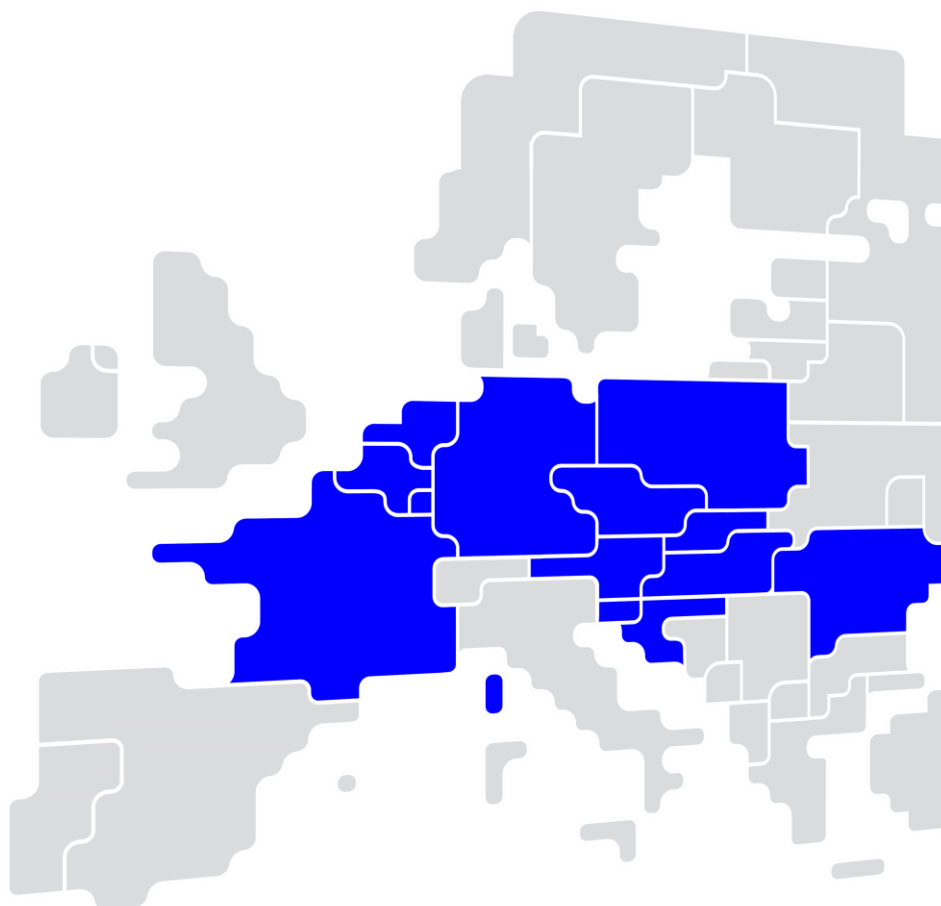
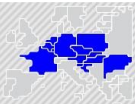




Core DA CC – Annual Report

2024





Executive Summary

This report provides a comprehensive overview of the Core Day-Ahead Capacity Calculation (Core DA CC) process for the year 2024, covering the period from January 1st to December 31st. It fulfills the reporting obligations outlined in the Core DA CCM and its amendments, as mandated by Articles 10, 13, 16, 26, and 28.

Key highlights

Remedial Actions (RA) Availability:

- Analysis of PSTs, topological RAs, and redispatch potential across D-2 and D-1 timeframes:
 - PSTs: Some TSOs provide more PSTs for D-2 than for D-1.
 - Topological RAs: FR provides significantly more Topological RAs for D-1 than for D-2.
 - Redispatch potential: AT provides significantly more RD units for D-2 than for D-1.

Efficiency of NRAO:

- The NRAO process contributed an estimated €57 million in Social Economic Welfare (SEW) benefits, though impacts varied across Market Time Units (MTUs).
- A comparison of the 2023 and 2024 NRAO analyses indicates that the NRAO step has a significant impact on the IVA step of the CC process—an effect that was not considered in the 2023 analysis.

Data Quality Indicators:

- Monthly DQI reports highlighted several high-impact incidents during the year, including a total of 25 MTUs where Default Flow-Based Parameters (DFP) had to be applied.

Stakeholder Feedback:

- Survey results indicate a decline in user satisfaction compared to previous years regarding the use of the JAO Core FB MC page and the JAO Publication Tool.

Aggregated operational KPIs

- KPI 4 highlights the strong influence of DFP application on the min and max Net Positions per BZ.
- KPI 5a and 5b reveal extensive use of virtual margins by the market, with values exceeding 150% of Fmax in certain cases.

Conclusions

This report demonstrates the overall successful implementation of the Core Day-Ahead Capacity Calculation (DA CC) methodology throughout 2024, delivering measurable benefits in both market efficiency and system security. While the process has matured significantly, the analysis also highlights areas where further improvements are needed. Additionally, the report identifies some critical operational situations that occurred during the year, offering valuable insights for future enhancements and risk mitigation.

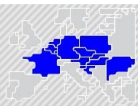
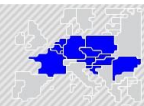


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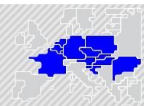
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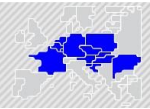
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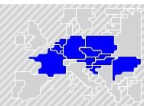


Glossary

AHC	Advanced Hybrid Coupling
AMR	Adjustment For Minimum RAM
ATC	Available Transfer Capacity
BCI	Base Case Improvement
BD	Business Day
CACM	The Guideline on Capacity Allocation and Congestion Management
CBCO	Critical Branch Critical Outage
CCC	Capacity Calculation Coordinator
CCct	Core Capacity Calculation Tool
CCR	Capacity Calculation Region
CGM	Common Grid Model
CNE	Critical Network Element
CNEC	Critical Network Element And Contingency
Core DA CCM	Core Day-Ahead Capacity Calculation Methodology
Core IG	Core Implementation Group
DA CSA	Day-Ahead Coordinated Security Analysis
DACF	Day-Ahead Congestion Forecast
DFP	Default Flow Base Parameters
DQI	Data Quality Indicator
ICS	Improved Coordinated Solution
IGM	Individual Grid Model
IVA	Individual Validation Adjustment
KPI	Key Performance Indicator
LTA	Long Term-Allocated Capacity
LTN	Long Term Nomination
MNEC	Monitored Network Element with a Contingency
MP	Market Party
MTU	Market Time Unit
NP	Net Position
NRA	National Regulatory Agency
NRAO	Non-Costly Remedial Action Optimiser
NTC	Net Transfer Capacity
PRA	Preventive Remedial Action
PST	Phase Shifting Transformer
PTDF	Power Transfer Distribution Factor
PTRs	Physical Transmission Rights
RA	Remedial Action



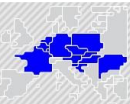
RAM	Remaining Available Margin
RDP	Redispatch Potential
REMIT	The Regulation on Wholesale Energy Market Integrity And Transparency
SDAC	Single Day-Ahead Coupling
SEW	Social Economic Welfare
SGM	Static Grid Model
SO GL	System Operation Guideline on Electricity Transmission
SP	Shadow Price
TF	Task Force
TSO	Transmission System Operator



TSOs in Core Region

Below you will find an overview of the Transmission System Operators (TSO) located in the Core region.

UCT TSO Country Code	TSO
AT	Austrian Power Grid (APG)
BE	Elia
CZ	CEPS
D2	TenneT TSO (TTG)
D4	TransnetBW (TBW)
D6	Creos
D7	Amprion
D8	50Hertz
FR	RTE
HR	HOPS
HU	MAVIR
NL	TenneT TSO BV
PL	PSE
RO	Transelectrica
SI	ELES
SK	SEPS



Introduction

According to the Core DA CCM and the Core DA CCM 1st amendment ([link](#)), the annual reporting obligations following the implementation of this methodology are as follows:

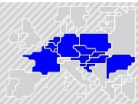
Art. 27(4): “The CCC, with the support of the Core TSOs where relevant, shall draft and publish an annual report satisfying the reporting obligations set in Articles 10, 13, 16, 26 and 28 of this methodology:

- (a) According to Article 10(6), the Core TSOs shall report to the CCC on systematic withholdings which were not essential to ensure operational security in real-time operation*
- (b) According to Article 13(5), the Core TSOs shall monitor the accuracy of non-Core exchanges in the CGM*
- (c) According to Article 16(7), the CCC shall monitor the efficiency of the NRAO*
- (d) According to Article 26(3), the CCC shall monitor and report on the quality of the data published on the dedicated online communication platform as referred to in Article 25, with supporting detailed analysis of a failure to achieve sufficient data quality standards by the concerned TSOs, where relevant*
- (e) According to Article 28(4), after the implementation of this methodology, the Core TSOs shall report on their continuous monitoring of the effects and performance of the application of this methodology*

Additionally, according to Article 26(4):

*“The Core TSOs shall commit to a minimum value for at least some of the indicators mentioned in paragraph 2, to be achieved by each TSO individually on average on a monthly basis. Should a TSO fail to fulfil at least one of the data quality requirements, this TSO shall provide to the CCC within one month following the failure to fulfil the data quality requirement, detailed reasons for the failure to fulfil data quality requirements, as well as an action plan to correct past failures and prevent future failures. No later than three months after the failure, this action plan shall be fully implemented and the issue resolved. **This information shall be published on the online communication platform and in the annual report**”.*

This report covers the period from Business Day 01.01.2024 to 31.12.2024. The report is structured as follows: 3 general chapters (*Glossary, TSOs in Core Region and Introduction*), 5 chapters dedicated to reporting obligations, and 4 annexes (one Annex related to Allocation and External Constraints, other Annex for the yearly overview of the monthly data quality indicator (DQI) breaches, the third one including the raw results from the survey conducted, and the final one showing additional figures on the NRAO study).



Availability of RA for the Day-Ahead Capacity Calculation

Reporting obligations from DA CCM

As per Article 10(6) of the Core DA CCM:

“In accordance with Article 25(4) of the CACM Regulation, a TSO may withhold only those RAs, which are needed to ensure operational security in real-time operation and for which no other (costly) RAs are available, or those offered to the day-ahead capacity calculation in other CCRs in which the concerned TSO also participates. The CCC shall monitor and report in the annual report on systematic withholdings, which were not essential to ensure operational security in real-time operation.”

Following previous alignments via Core IG call 20200122, the reporting requirement is fulfilled by assessing the RA potential offered in the Core DA CC process, namely PSTs, topological RAs and redispatch, as well as a comparison of RA potential offered in the D-2 (Core DA CC process) vs D-1 timeframes (DA CSA process).

RA potential

From the D-2 timeframe (the Core DA CC process, which is the subject of this report), Core TSOs are providing RA potential to the central tool separately for 2 process steps:

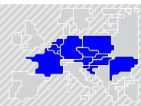
- NRAO: where non-costly (PSTs and topological RAs) RAs are provided
- Simple Coordinated Validation: where non-costly (PSTs and topological RAs) and costly (redispatch potential *RD*) RAs are provided

From the D-1 timeframe (the Legacy SA process in UCTE-DEF format, currently the Improved Coordinated Solution (*ICS*)), the RA potential (costly and non-costly RAs) provided by Core TSOs is retrieved for the purpose of this reporting point.

In the following subchapters, statistics and visualisations are presented with the D-2 data on RA potential, as well as comparisons of RA potential offered in the D-2 vs D-1 timeframes. A dedicated subchapter is provided for each type of RA (PSTs, topological RAs, redispatch potential).

The definitions of the above-mentioned RAs used in both timeframes are according to Art 22(1) of the *Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation* ([link](#)) (SO GL Regulation).

For any RA, a distinction is being made between being in Preventive (RA application can be considered regardless of base-case or considered contingency) or Curative (the RA application is associated only with a certain contingency or contingencies) mode.



RA potential – PSTs

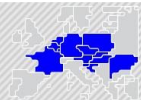
By changing the tap position of a PST, the active power flow on a certain network element or several network elements can be adjusted.

Count of PSTs by TSO, Mode (Preventive/Curative) and Process (D-2 vs D-1)

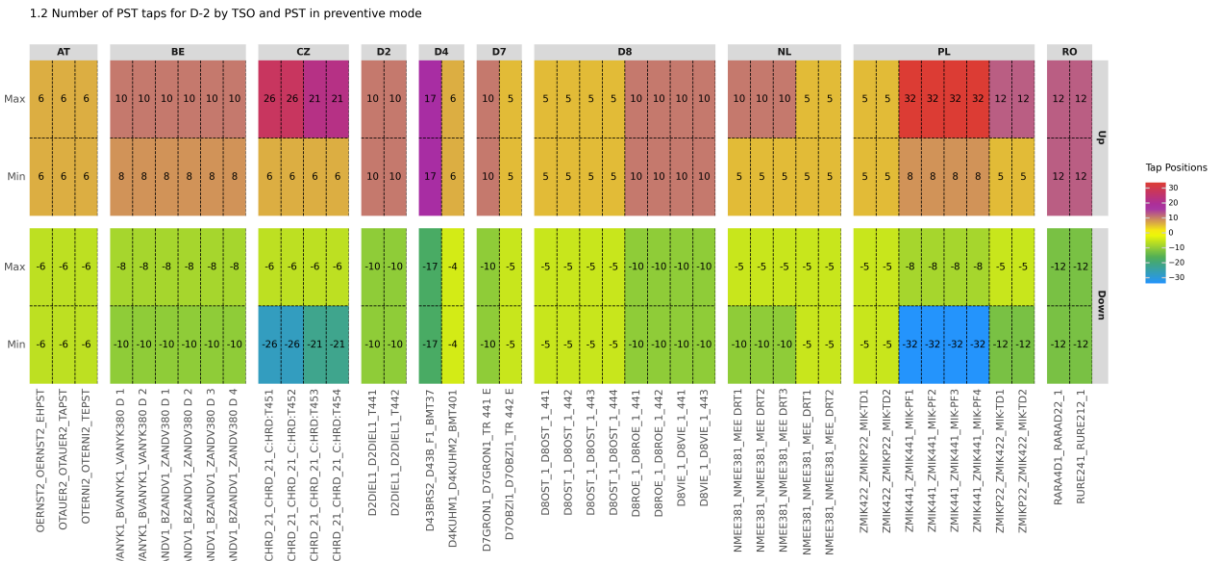


The figure above shows the cumulative number of PSTs that have been offered as RAs per TSO during the D-2 process and during the D-1 process in the reporting period. The top half of the figure shows the count of PSTs offered as preventive RAs and the bottom half shows the count of PSTs offered as curative RAs.

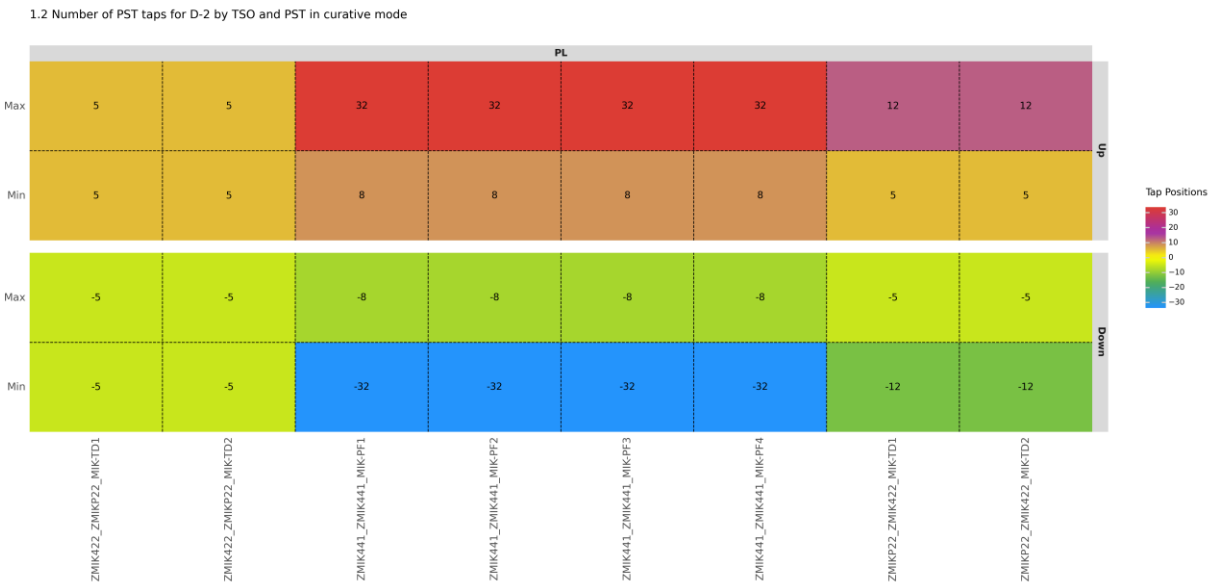
In the case of D-1 and D-2 data, the same PST can be provided for both preventive and curative measures for the same TS. In the figure, a distinct count of PSTs is considered for preventive and curative modes, even if the same PST is provided for both modes.



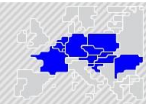
Number of PST taps provided for D-2, by TSO and PST



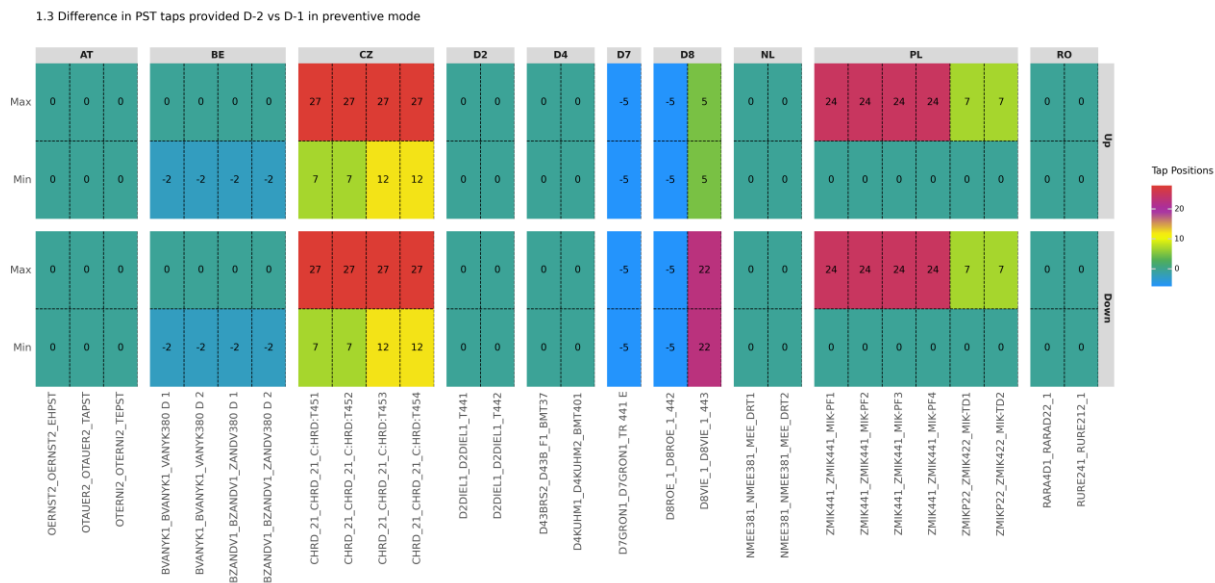
The figure above shows the number of PST taps provided by the TSOs for each PST for the D-2 process in preventive mode.



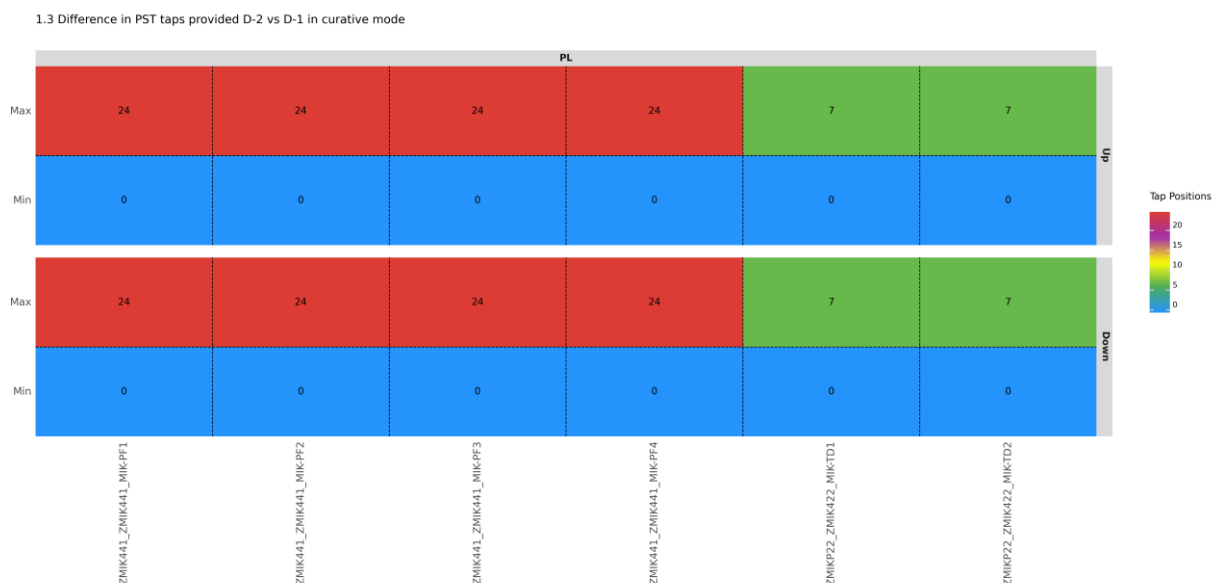
The figure above shows the number of PST taps provided by the TSOs for each PST for the D-2 process in curative mode.



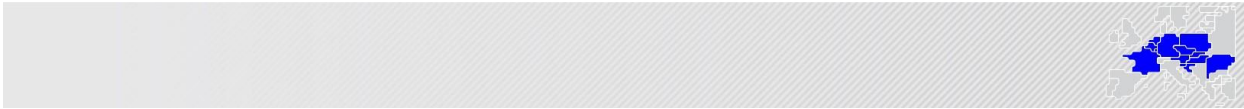
Difference in PST taps provided for D-2 vs D-1, by TSO and PST



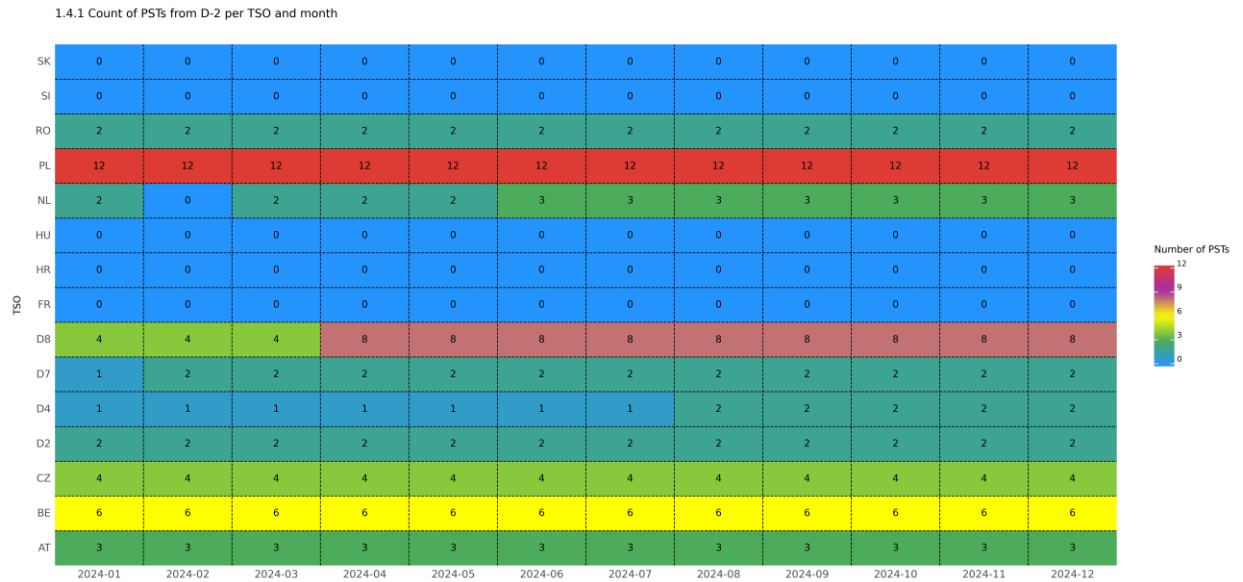
The figure above shows the difference in provided PST taps when comparing the D-2 process to the D-1 process. The figure is showing the number per TSO and the provided PST taps are compared for preventive mode. The higher the number of the difference, the more taps were offered in D-1 (compared to D-2). Negative values indicate that more taps were offered in D-2.



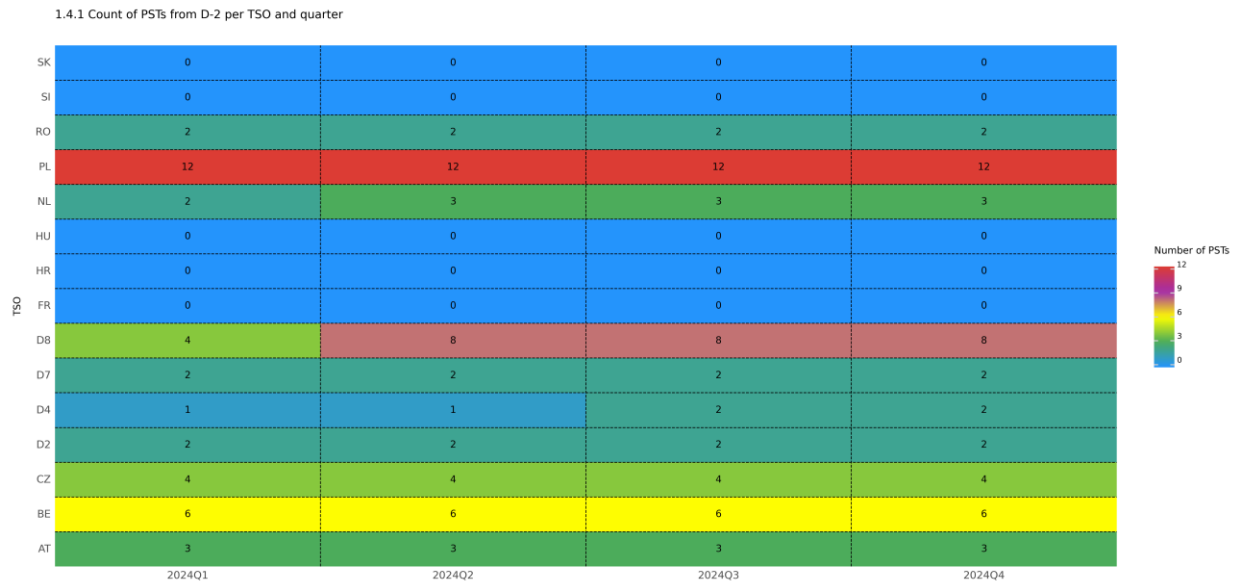
The figure above shows the difference in provided PST taps when comparing the D-2 process to the D-1 process. The figure is showing the number per TSO and the provided PST taps are compared for curative mode.



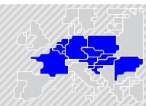
Timeseries indicators for PSTs



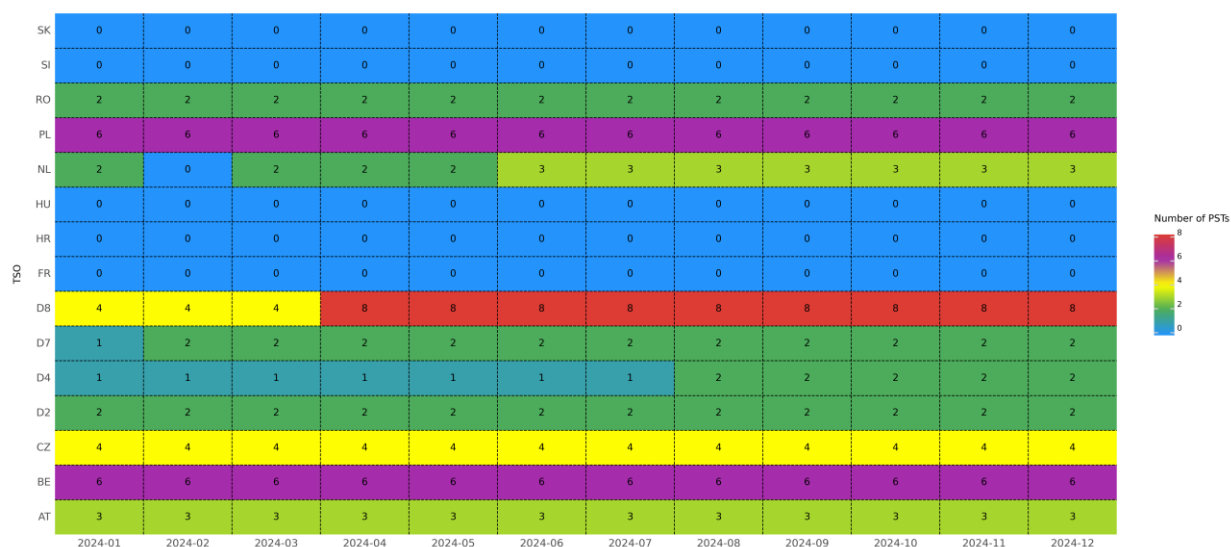
The figure above is showing the number of PSTs offered by each TSO during the D-2 process for each month in the period.



The figure above is showing the number of PSTs offered by each TSO during the D-2 process for each quarter in the period.

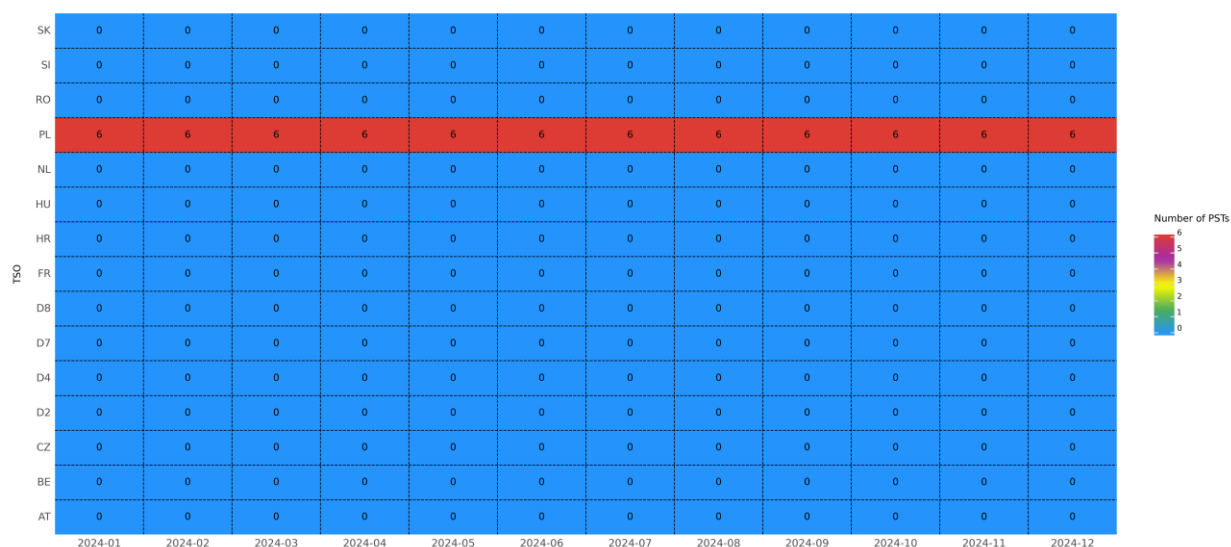


1.4.2 Count of PSTs from D-2 per TSO and month in preventive mode

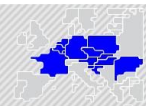


The figure above is showing the number of PSTs offered by each TSO during the D-2 process for each month in the period in preventive mode.

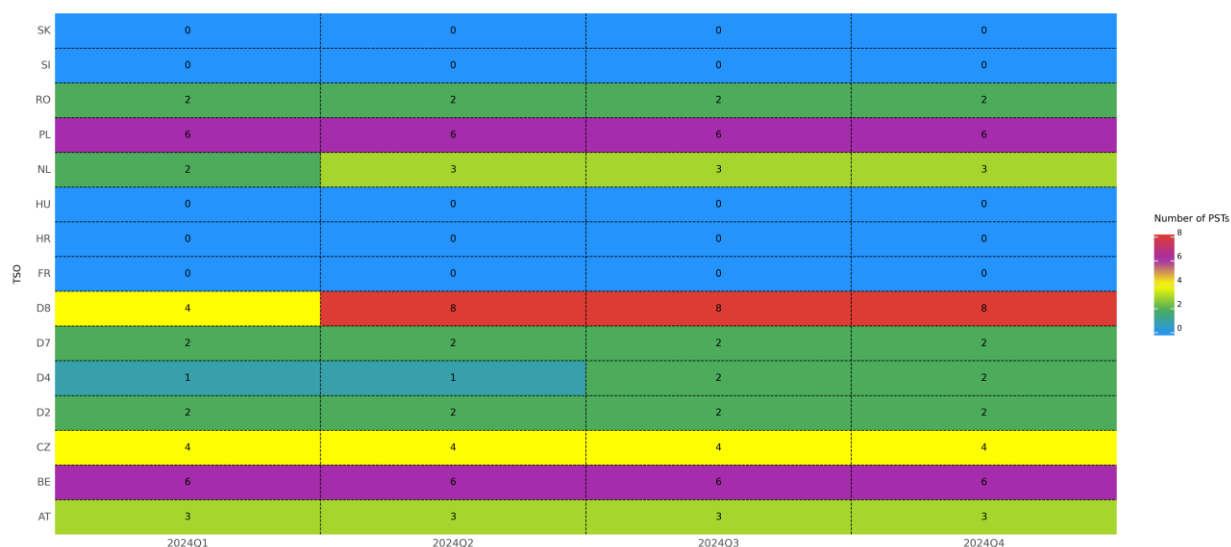
1.4.2 Count of PSTs from D-2 per TSO and month in curative mode



The figure above is showing the number of PSTs offered by each TSO during the D-2 process for each quarter in the period in preventive mode.

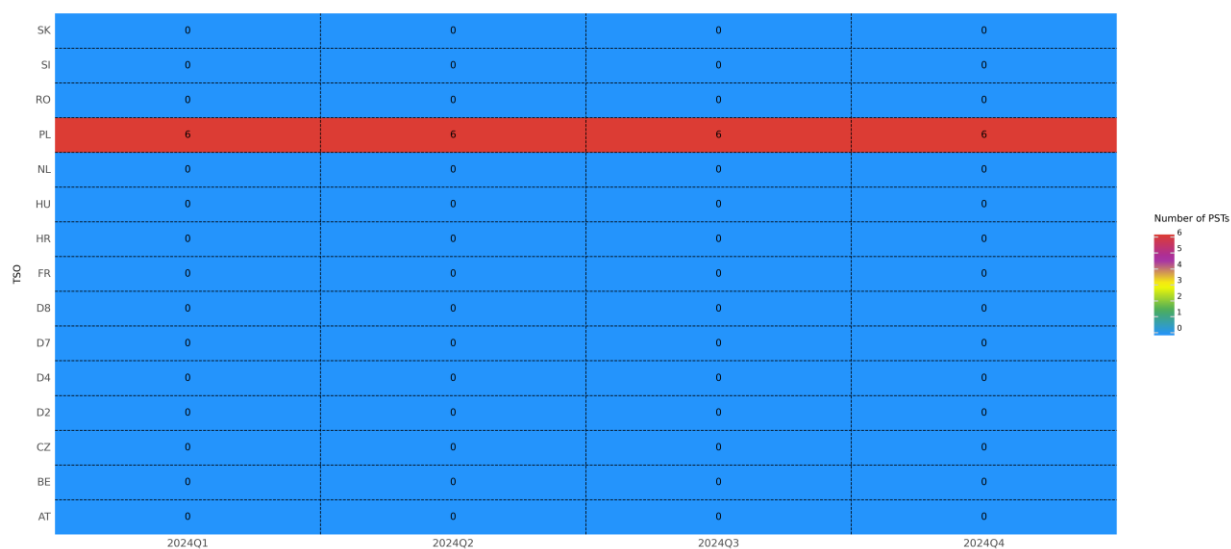


1.4.2 Count of PSTs from D-2 per TSO and quarter in preventive mode

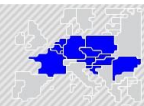


The figure above is showing the number of PSTs offered by each TSO during the D-2 process for each quarter in the period in curative mode.

1.4.2 Count of PSTs from D-2 per TSO and quarter in curative mode



The figure above is showing the number of PSTs offered by each TSO during the D-2 process for each quarter in the period in curative mode.

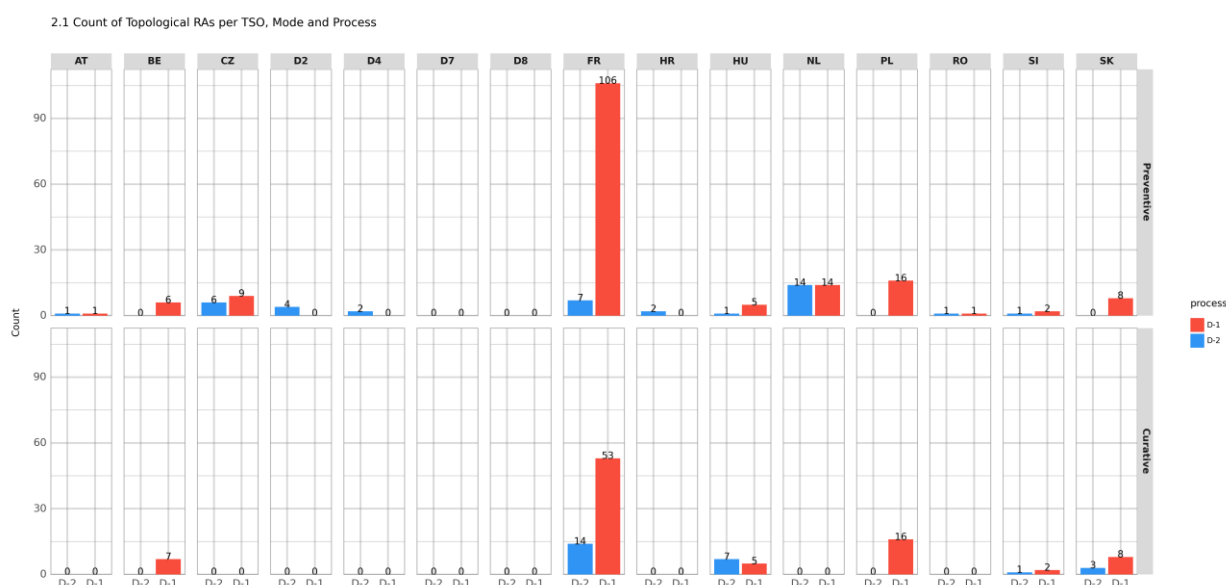


RA potential – Topological RAs

A topological RA is a change or subset of changes in the grid topology, with the result of impacting the active power flow on certain network element or several network elements. A non-exhaustive list of topological RAs include:

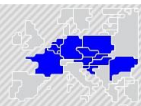
- 2-node operation in a substation voltage level (by opening the busbar coupler)
- Closing/opening of a circuit (line, transformer)
- Moving one line from one busbar to another (in the case of 2-node or 3-node operation)

Count of Topological RAs by TSO, Mode (Preventive/Curative) and Process (D-2 vs D-1)



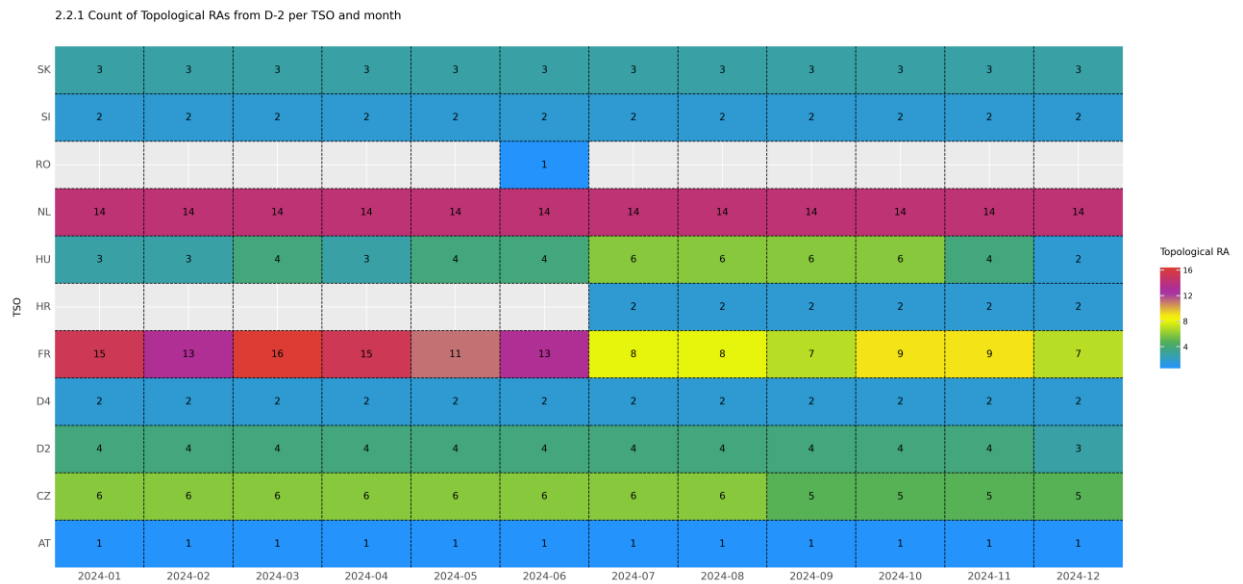
Shown in the figure above is an overview of the number of topological RAs provided by each Core TSO for D-2 and D-1 for the period.

In the case of D-1 and D-2 data, the same topological RA can be provided for both preventive and curative measures for the same TS. In the figure, a distinct count of PSTs is considered for preventive and curative modes, even if the same Topological RA is provided for both modes.

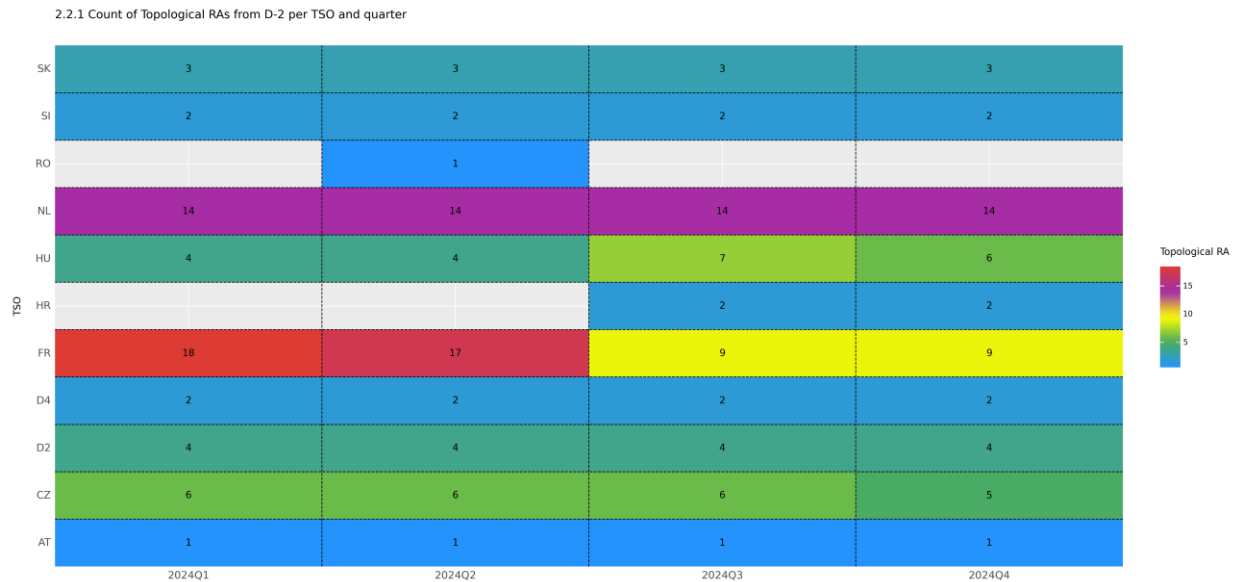


Timeseries indicators for Topological RAs

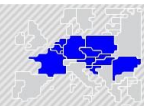
The following figures include both curative and preventive RAs. In case the same RA has been offered as curative and preventive, it is only counted once.



The figure above shows a monthly overview of the number of unique topological RAs provided by each Core TSO for the D-2 process. If the same remedial action is provided for multiple MTUs, it is only counted once.



The figure above shows a quarterly overview of the number of unique topological RAs provided by each CORE TSO for the D-2 process. If the same remedial action is provided for multiple months, it is only counted once in the quarterly overview.



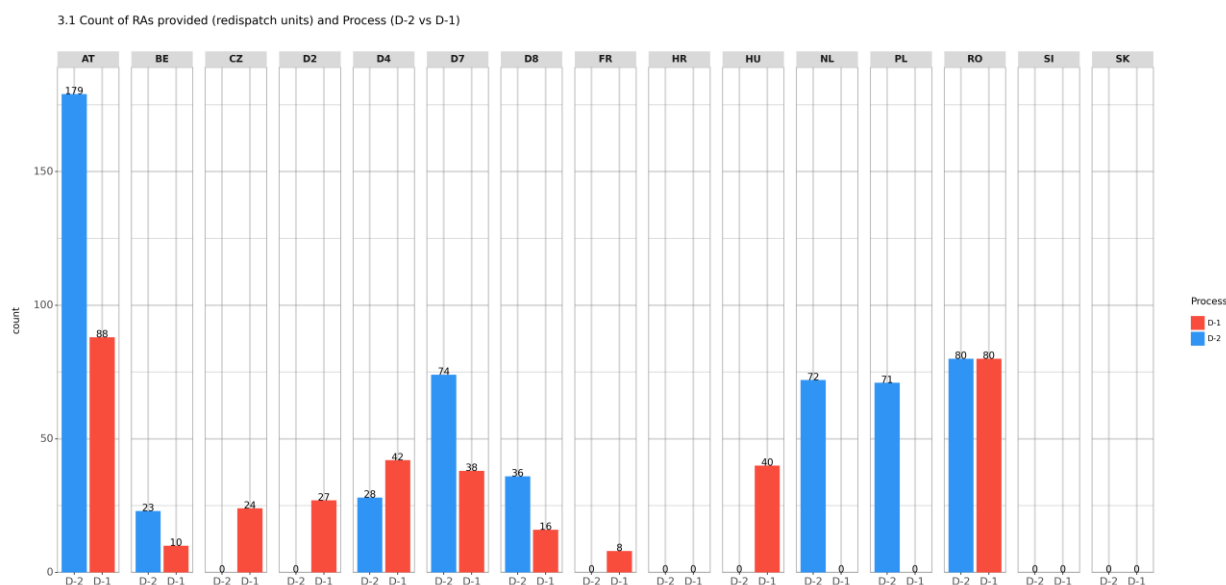
Note: For RTE a RA can be composed by several single actions (example: to perform to nodes in a substation you can use different combination of opening/closing circuit breakers). The figures above represent the number of single actions.

RA potential – Redispatch potential

Redispatch is a costly RA which consists of modifying (increasing or decreasing) the generation value of one or several generating or production units, with the aim of relieving an overload on certain network element or several network elements. Countertrading is not in the scope of this report.

The upward *RDP+* and downward *RDP-* redispatch potential of a generating unit is relative to the initial (before applying redispatch) operating point *P0*. *RDP+*, *RDP-* and *P0* are subject to the physical or technical restrictions of the generating unit, such as *Pmax* and *Pmin*. The total redispatch volume of a redispatching unit is a sum of *RDP+* and *RDP-*.

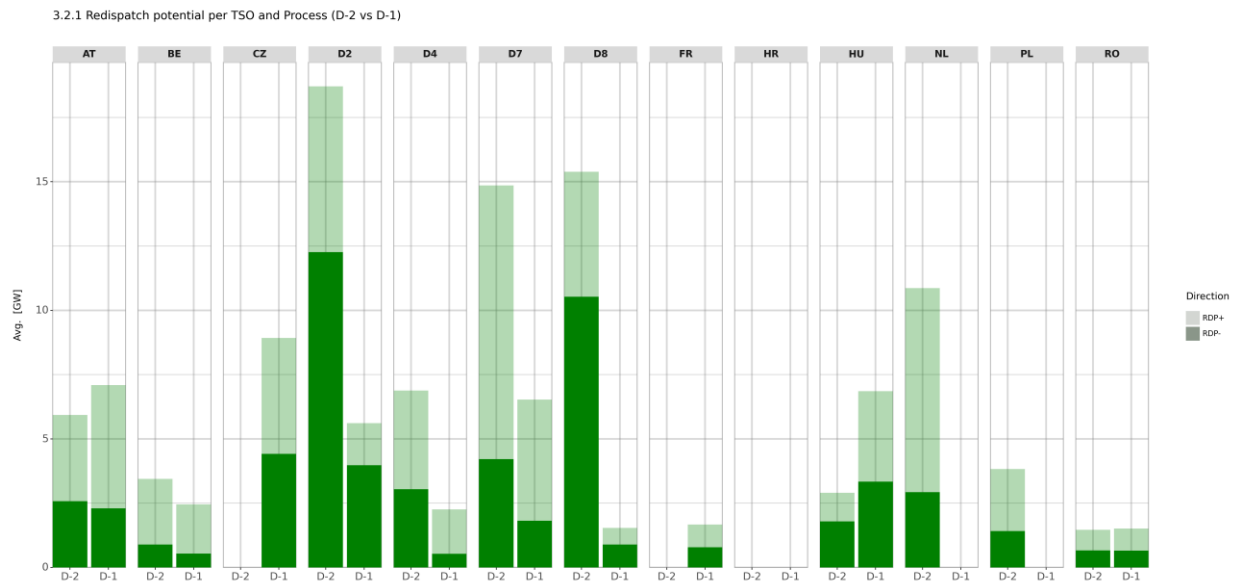
Count of RD units provided by TSO per Process (D-2 vs D-1)



The figure above shows the number of redispatch units provided by each TSO for the D-1 - and the D-2 process.

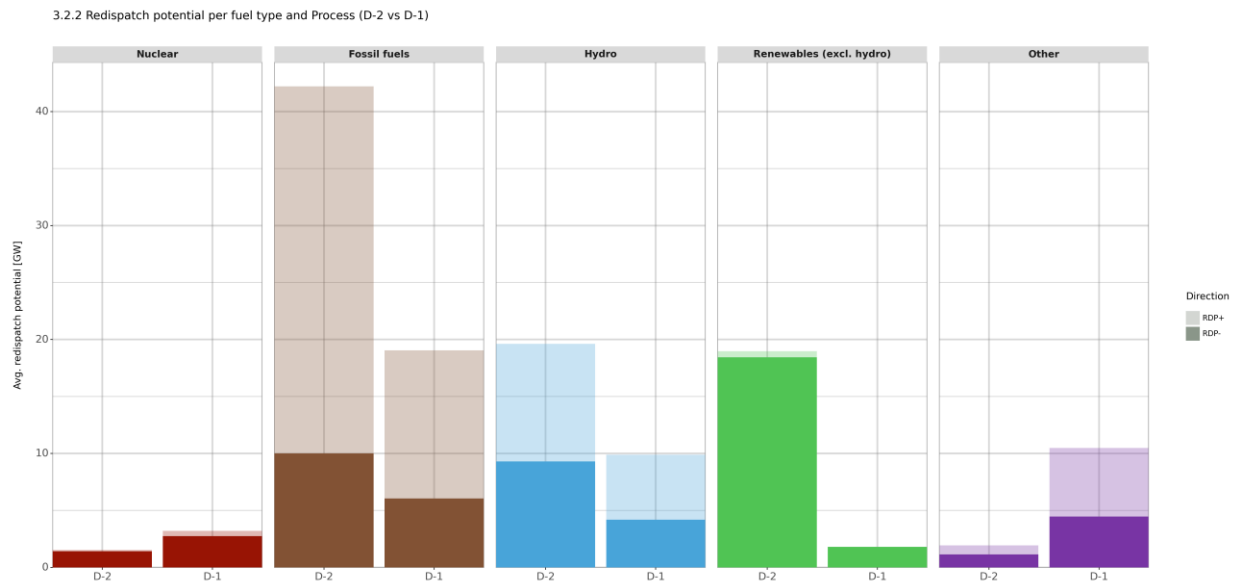


Redispatch volume by TSO, Fuel Type and Process (D-2 vs D-1)

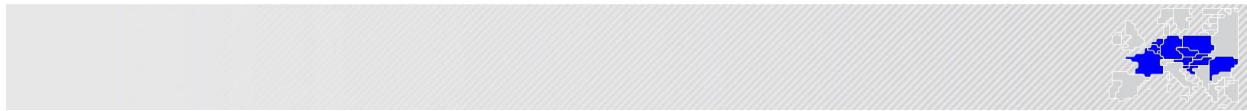


The figure above shows the cumulative redispatch potential per TSO for each process D-1 and D-2 for the year 2024. The transparent colour is showing the upward redispatch potential and the solid colour is showing the downward redispatch potential.

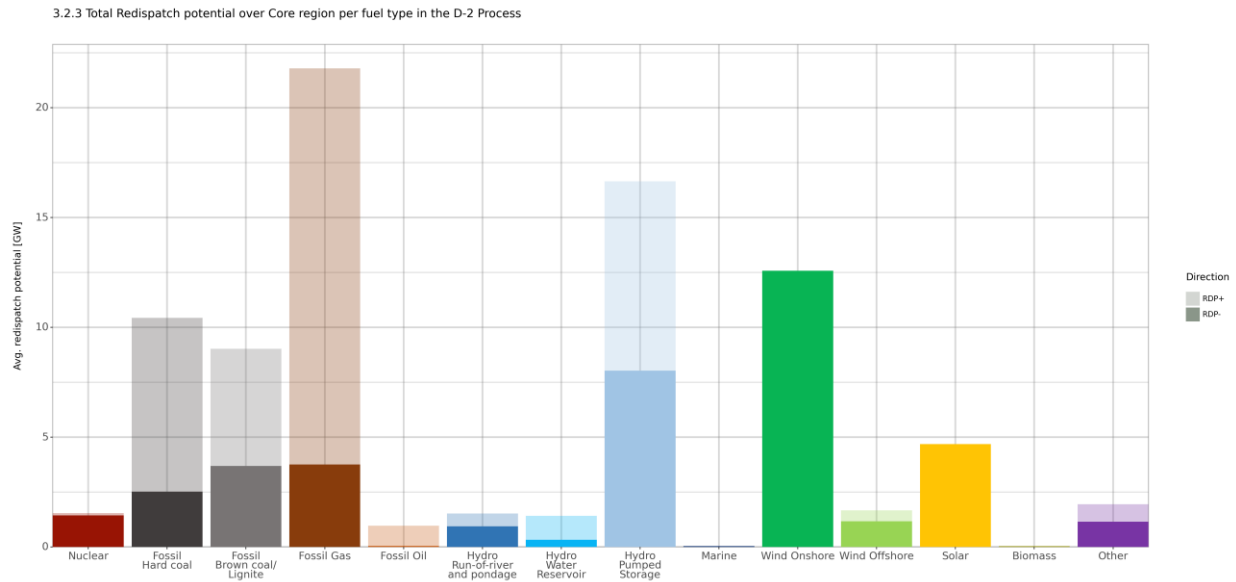
Redispatch potential per fuel type and Process (D-2 vs D-1)



The figure above shows the cumulative redispatch potential per fuel type for each process D-1 and D-2 for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

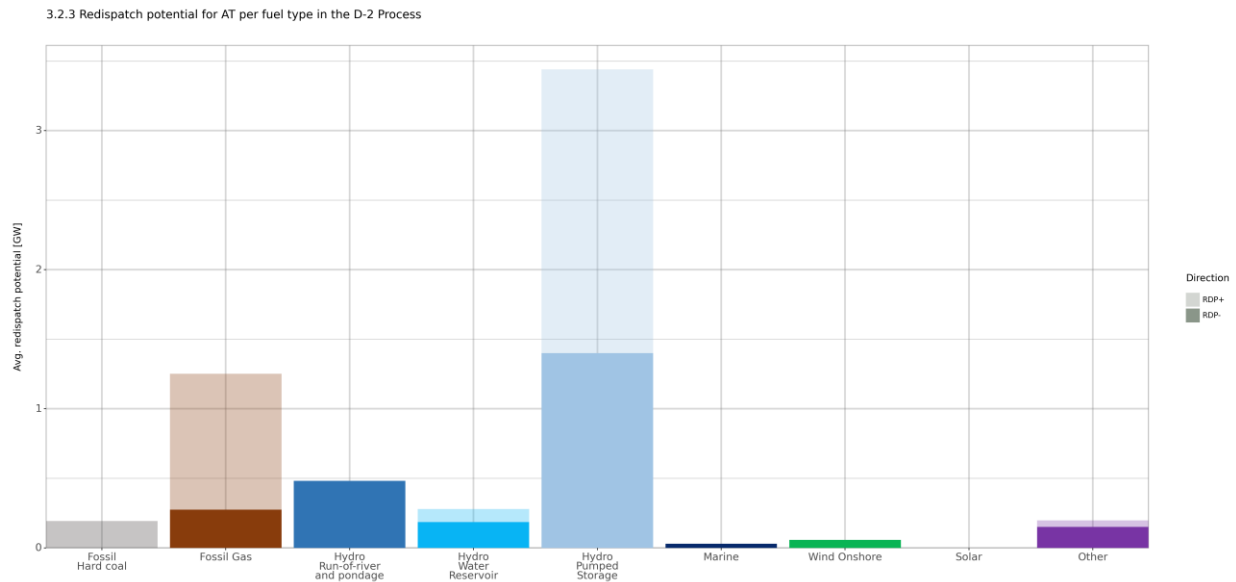


Total Redispatch potential over Core region per fuel type in the D-2 Process

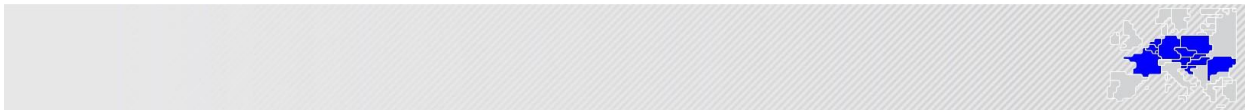


The figure above shows the total redispatch potential per fuel type for the D-2 process for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

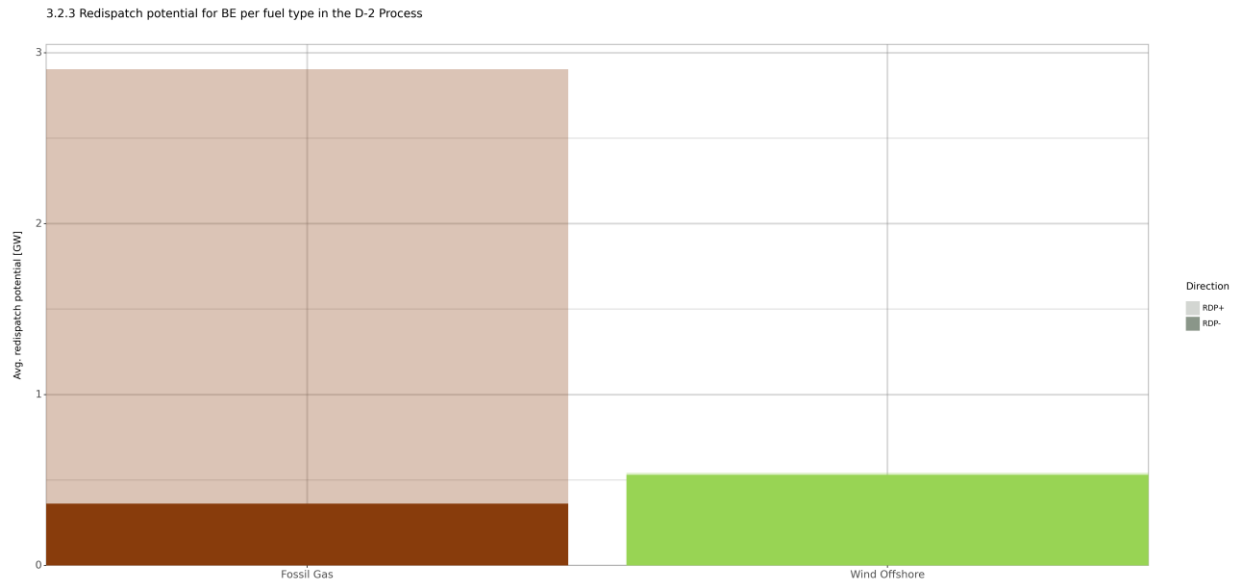
Redispatch potential for APG per fuel type in the D-2 Process



The figure above shows the redispatch potential per fuel type for the D-2 process for APG for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

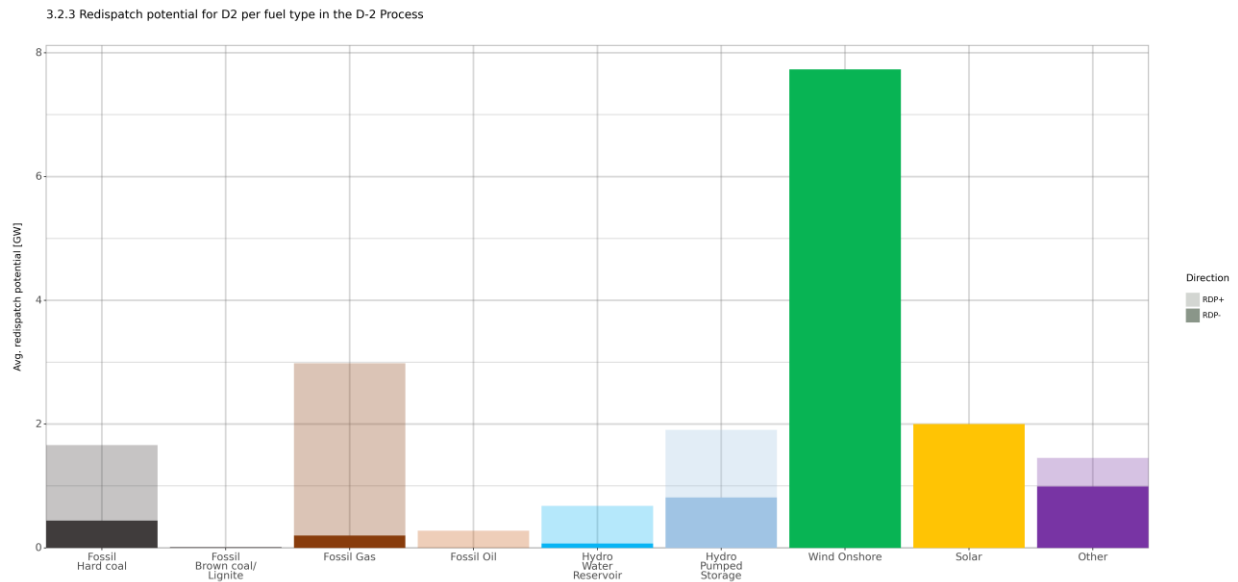


Redispatch potential for Elia per fuel type in the D-2 Process

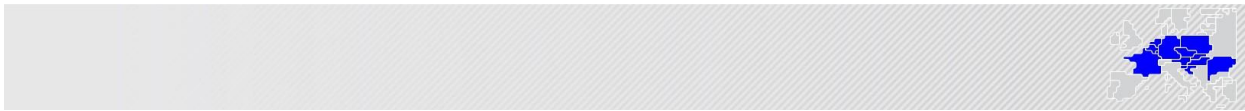


The figure above shows the redispatch potential per fuel type for the D-2 process for Elia for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

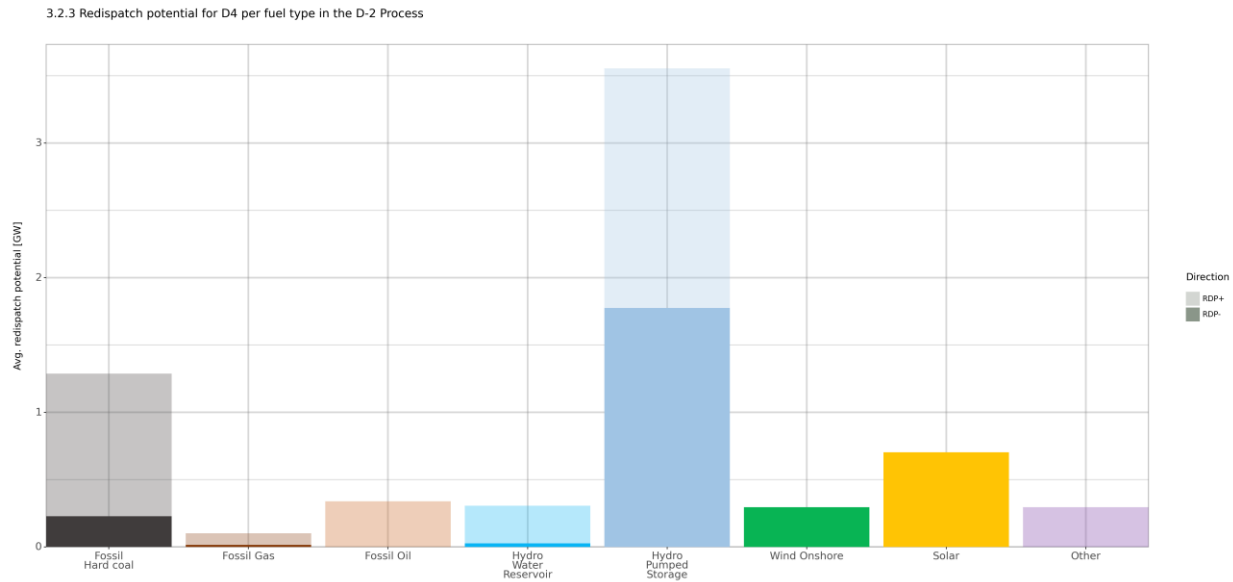
Redispatch potential for TenneT DE per fuel type in the D-2 Process



The figure above shows the redispatch potential per fuel type for the D-2 process for TenneT TSO GmbH for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

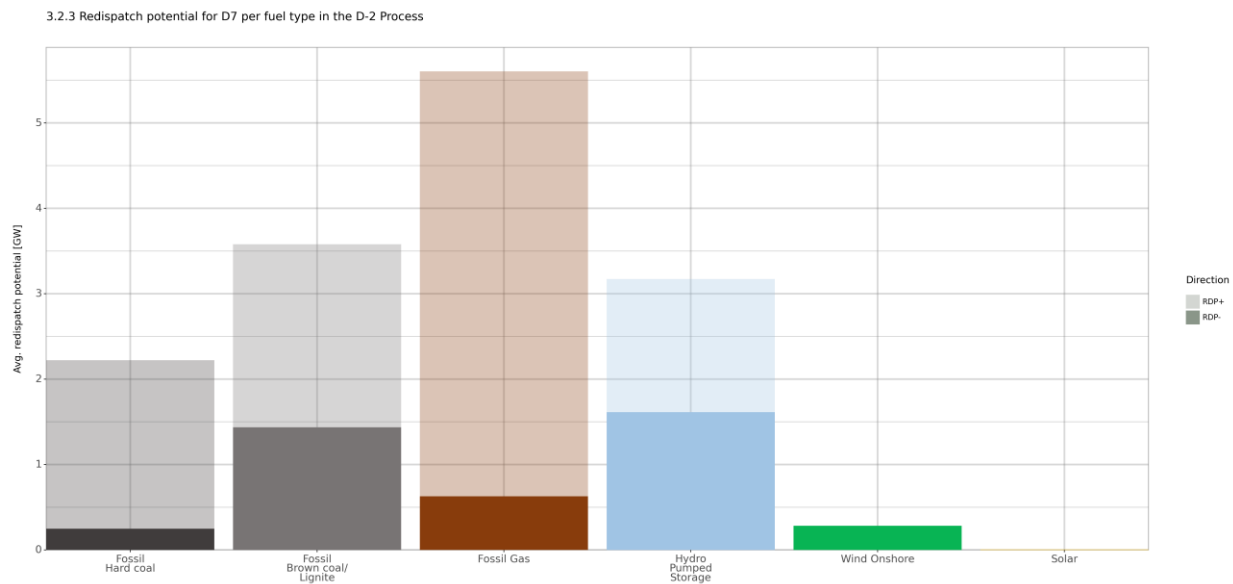


Redispatch potential for TransnetBW per fuel type in the D-2 Process

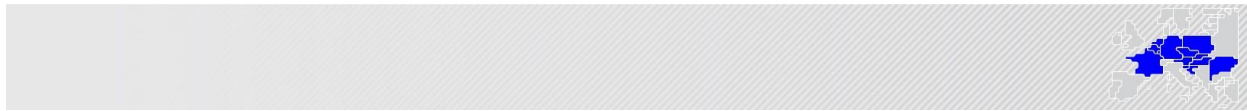


The figure above shows the redispatch potential per fuel type for the D-2 process for TransnetBW for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

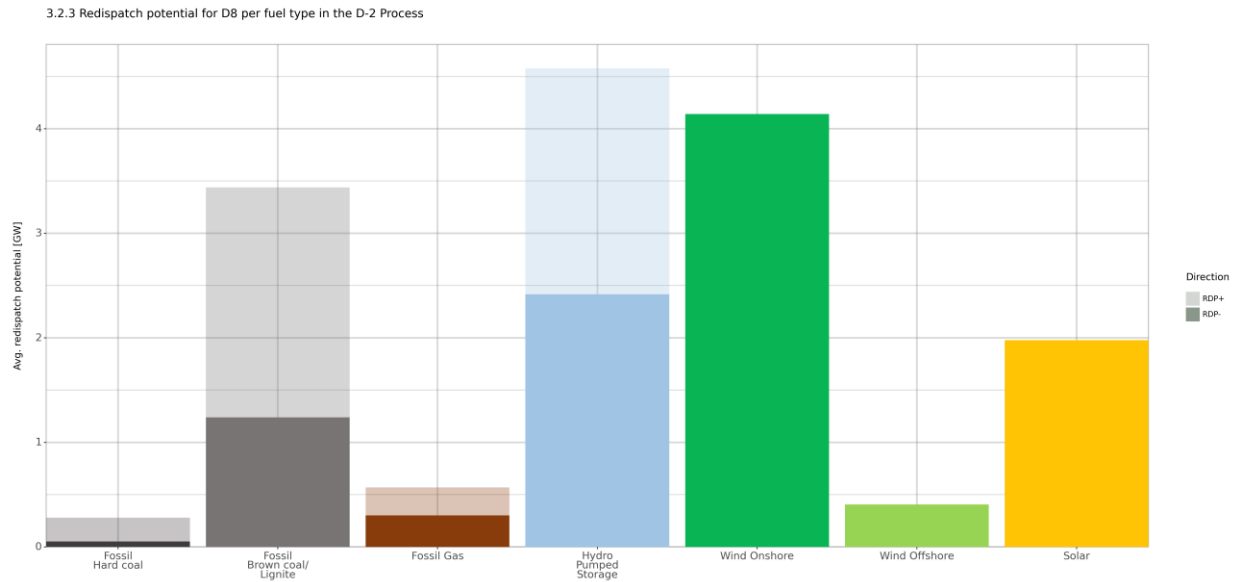
Redispatch potential for Amprion per fuel type in the D-2 Process



The figure above shows the redispatch potential per fuel type for the D-2 process for Amprion for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

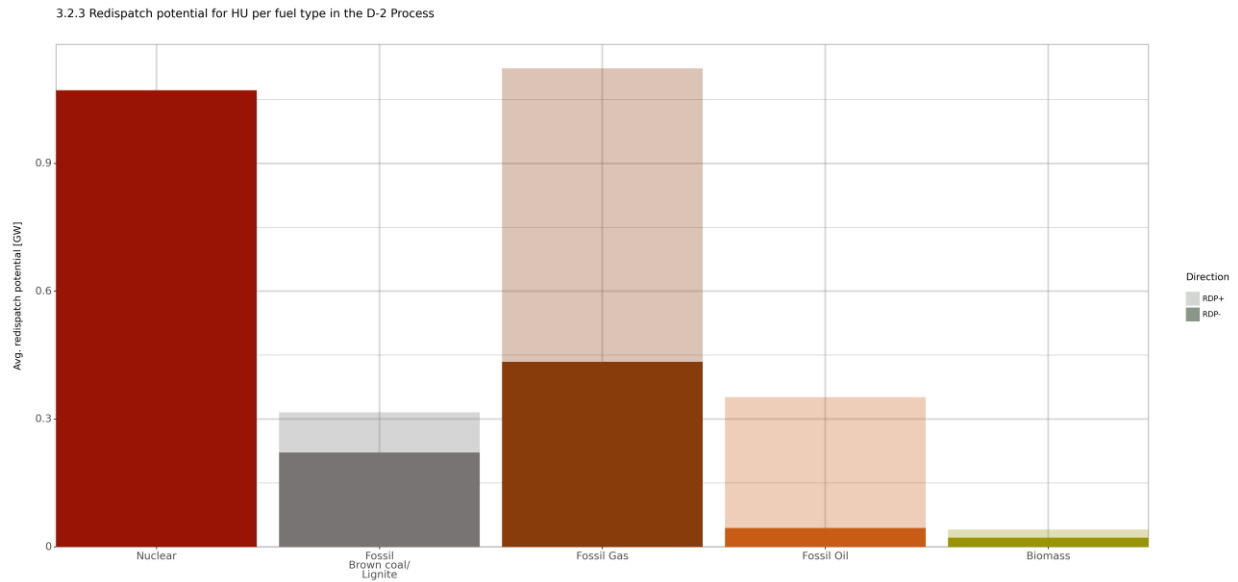


Redispatch potential for 50Hertz per fuel type in the D-2 Process

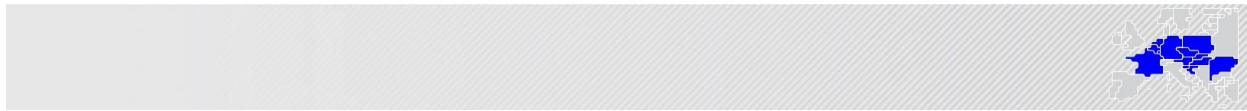


The figure above shows the redispatch potential per fuel type for the D-2 process for 50Hertz for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

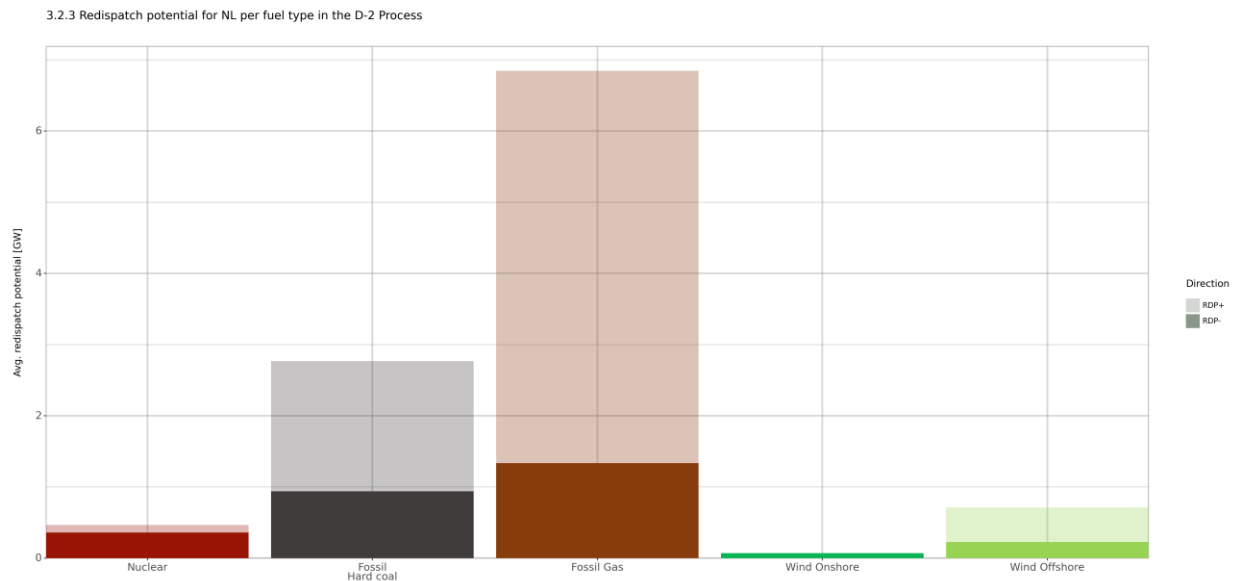
Redispatch potential for Mavir per fuel type in the D-2 Process



The figure above shows the redispatch potential per fuel type for the D-2 process for Mavir for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

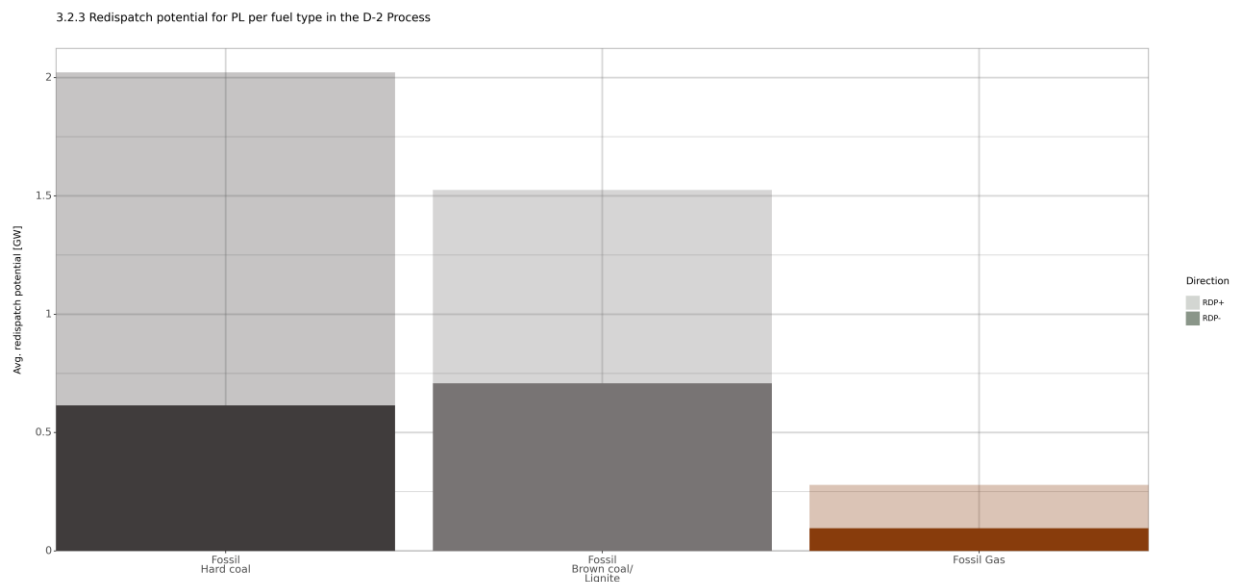


Redispatch potential for TenneT NL per fuel type in the D-2 Process

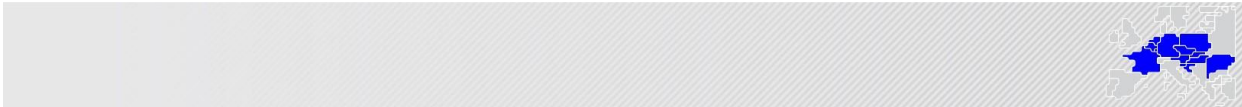


The figure above shows the redispatch potential per fuel type for the D-2 process for TenneT TSO B.V. for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

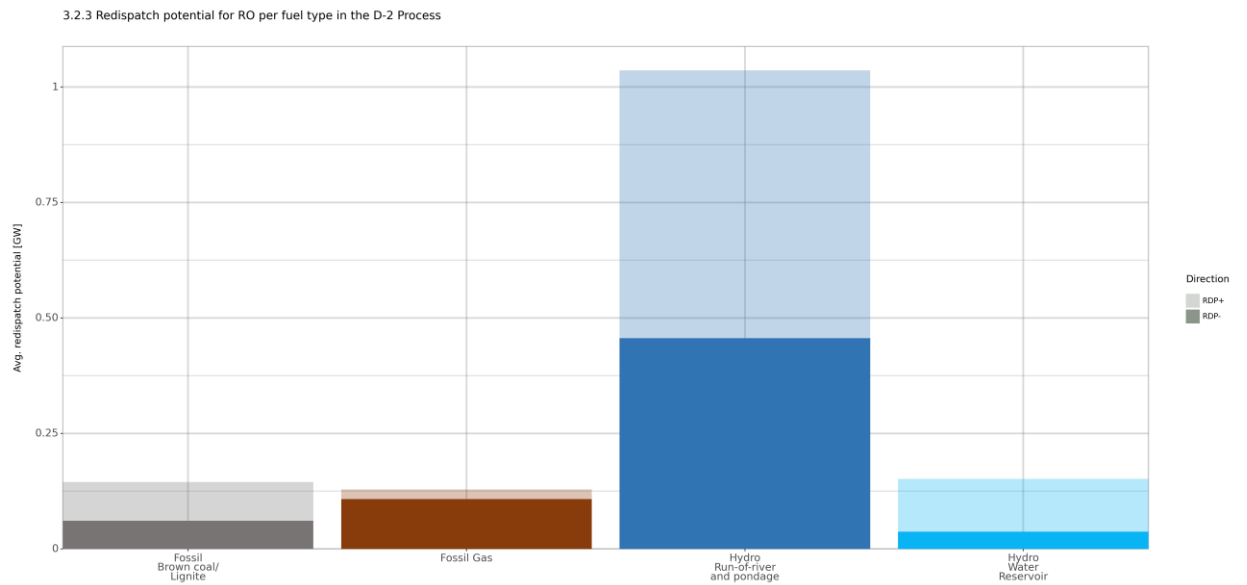
Redispatch potential for PSE per fuel type in the D-2 Process



The figure above shows the redispatch potential per fuel type for the D-2 process for PSE for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

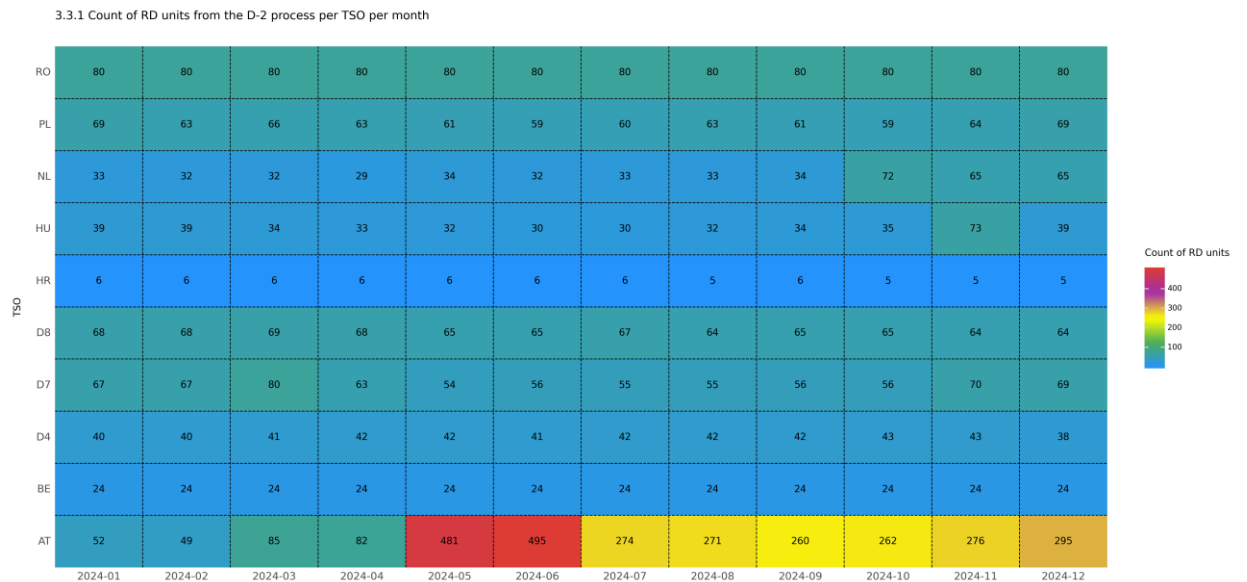


Redispatch potential for Transelectrica per fuel type in the D-2 Process

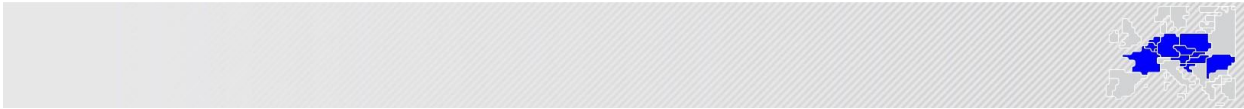


The figure above shows the redispatch potential per fuel type for the D-2 process for Transelectrica for the year 2024. The transparent colour is showing the upward redispatch potential and the complete colour is showing the downward redispatch potential.

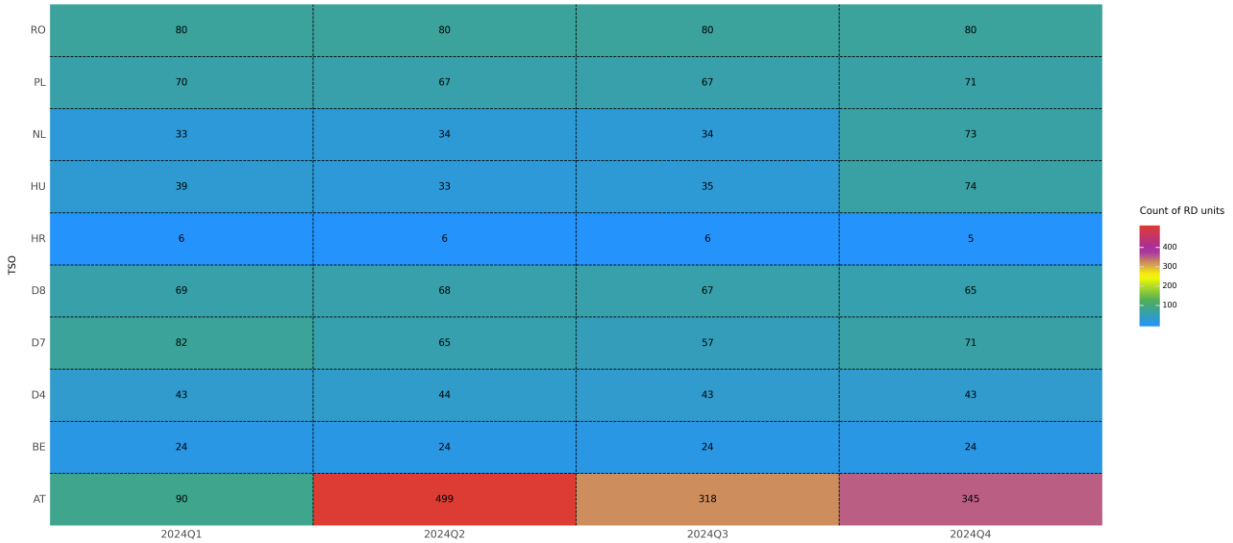
Timeseries indicators for Redispatch potential



The figure above shows the number of redispatch units provided by each TSO for the D-2 process per TSO during each month of the reporting period. This includes cases for which redispatch units; RD+ and RD- have zero values. The colour coding indicates the range in which the counted number belong.



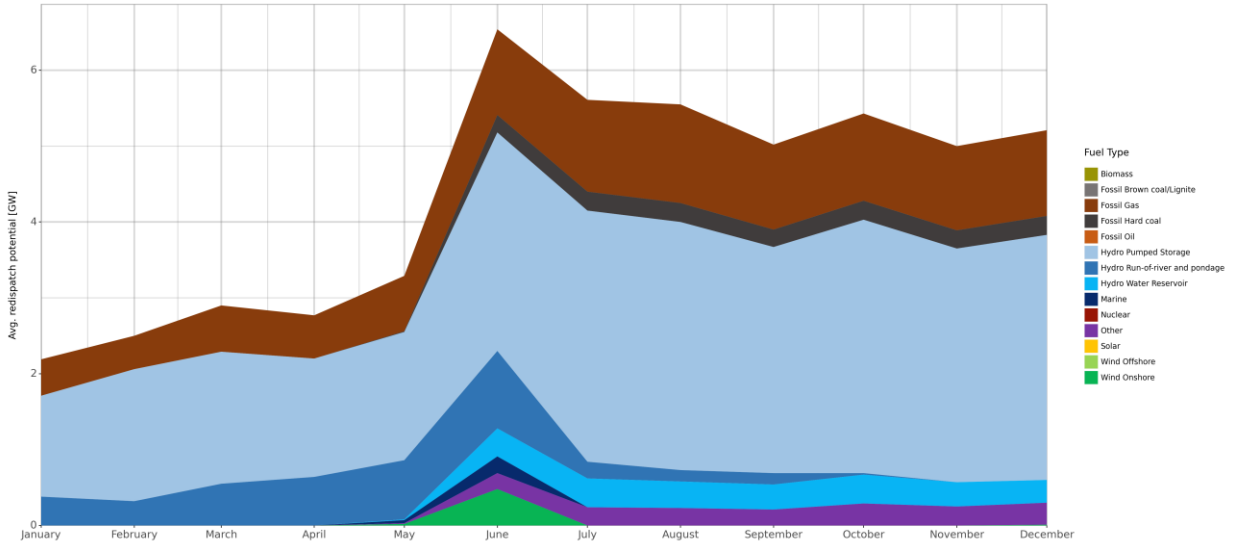
3.3.1 Count of RD units from the D-2 process per TSO per quarter



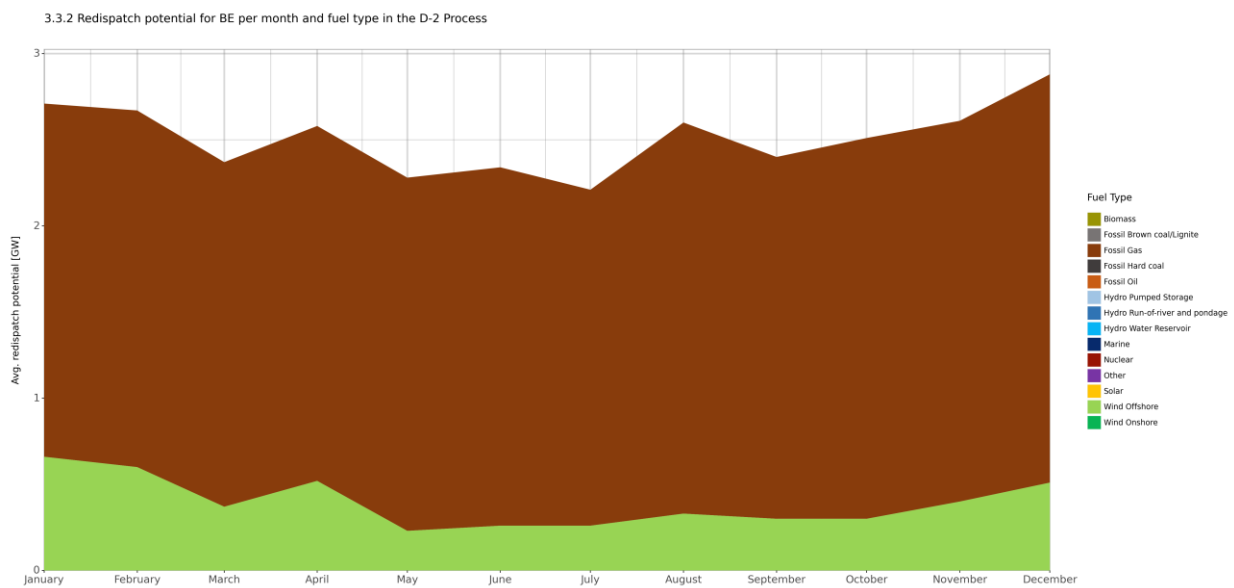
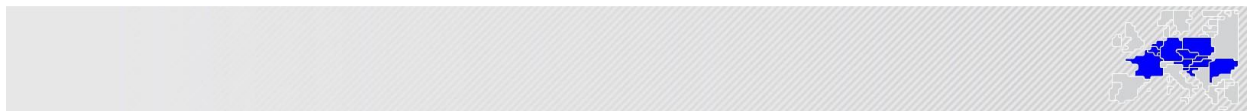
The figure above shows the average number of redispatch units provided by each TSO for the D-2 process per TSO during each quarter of the reporting period. This includes cases for which redispatch units; RD+ and RD- have zero values. The colour coding indicates the range in which the counted number belong.

TSOs Monthly Redispatch Potential in the D-2 Process

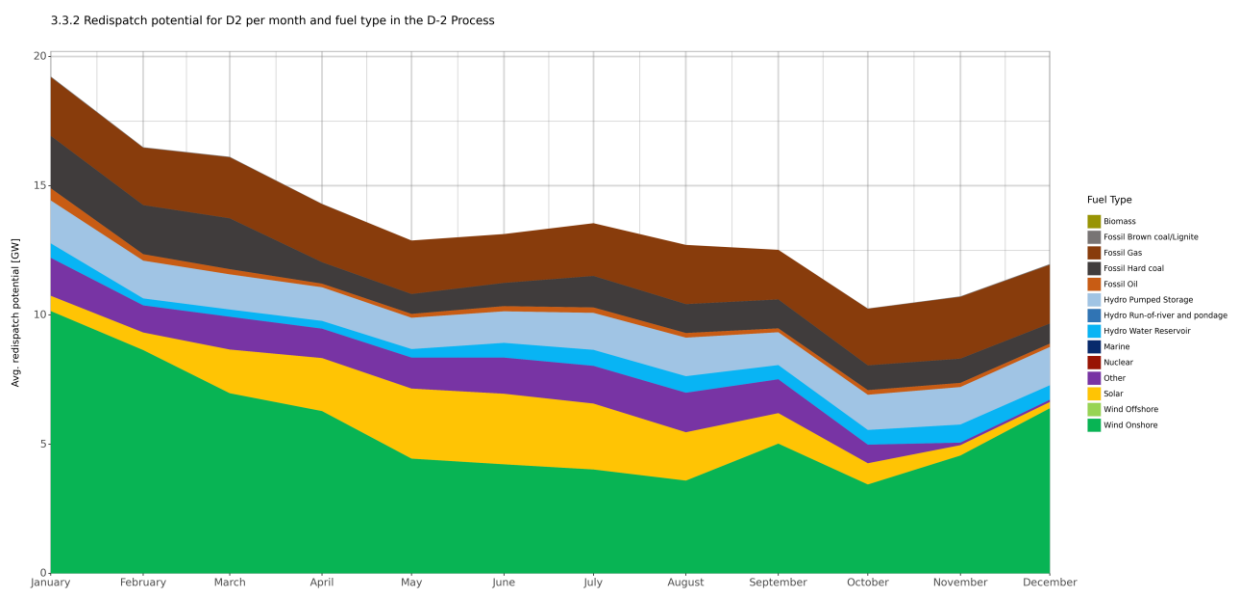
3.3.2 Redispatch potential for AT per month and fuel type in the D-2 Process



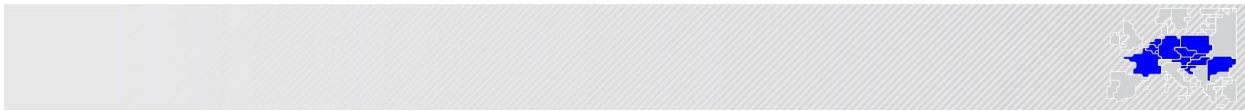
The figure above shows the monthly redispatch potential per fuel type for the D-2 process for APG.



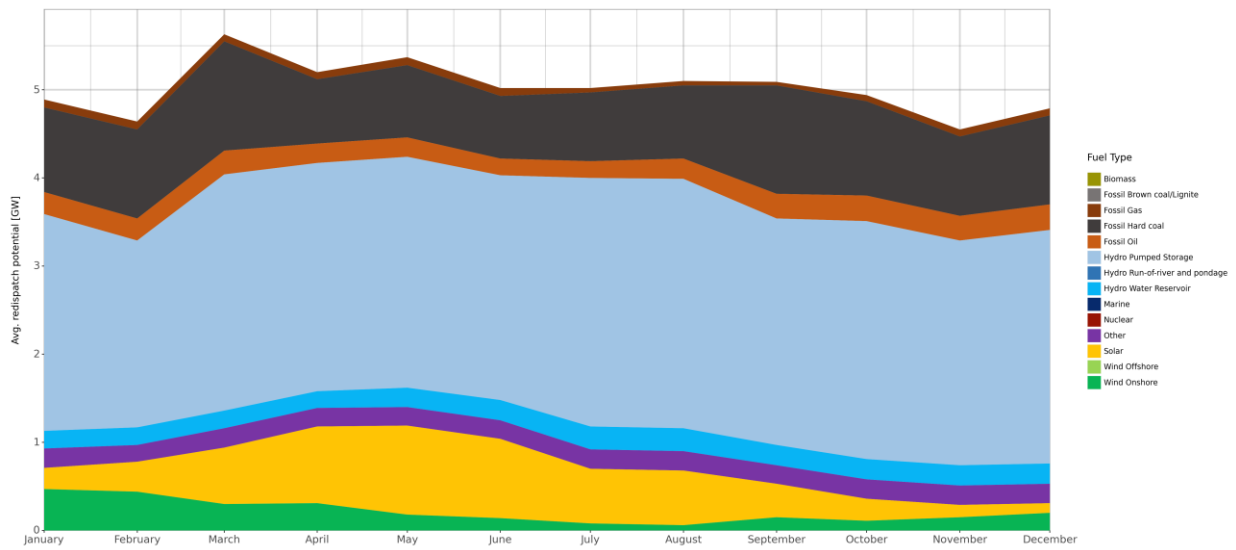
The figure above shows the monthly redispatch potential per fuel type for the D-2 process for Elia.



The figure above shows the monthly redispatch potential per fuel type for the D-2 process for TenneT TSO GmbH.

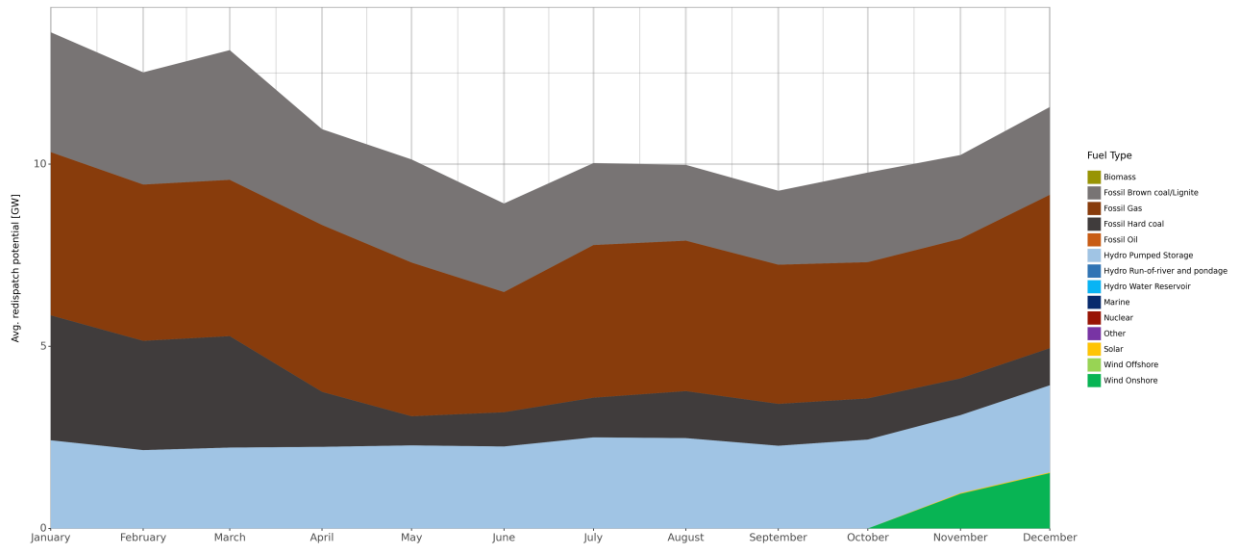


3.3.2 Redispatch potential for D4 per month and fuel type in the D-2 Process

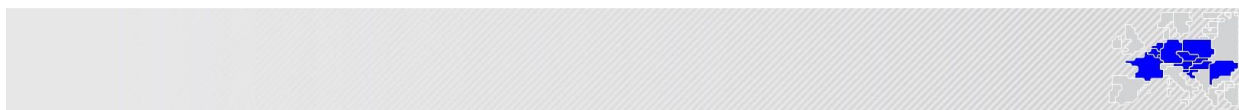


The figure above shows the monthly redispatch potential per fuel type for the D-2 process for TransnetBW.

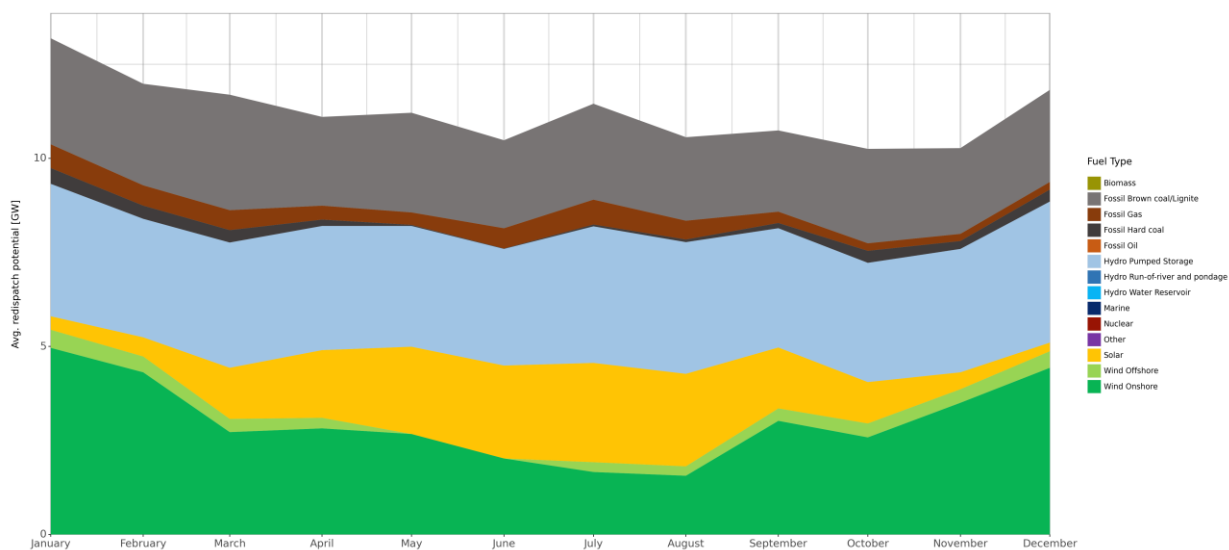
3.3.2 Redispatch potential for D7 per month and fuel type in the D-2 Process



The figure above shows the monthly redispatch potential per fuel type for the D-2 process for Amprion.

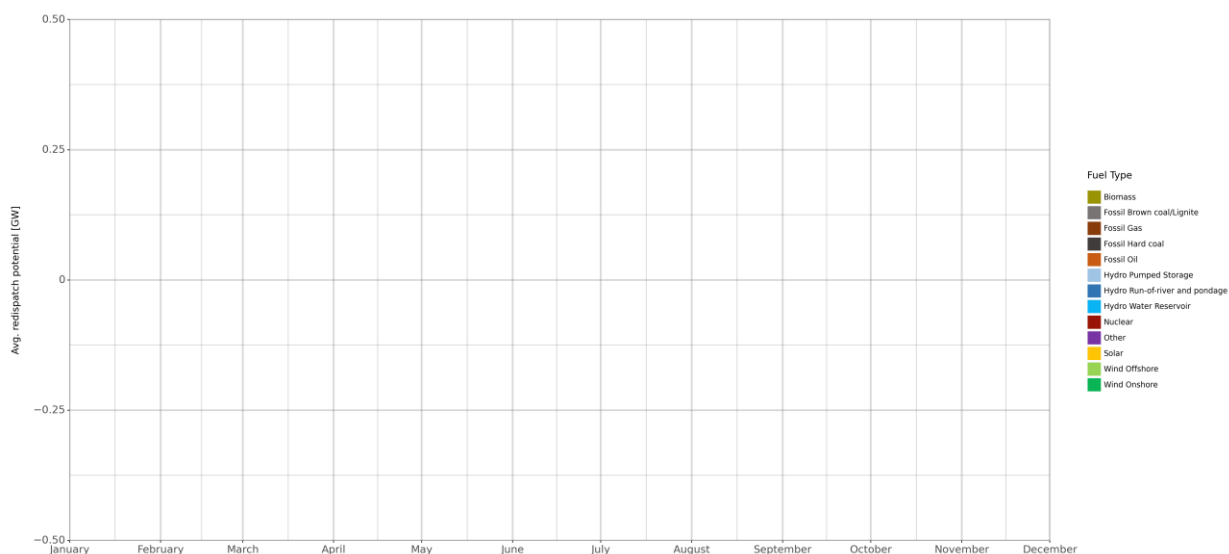


3.3.2 Redispatch potential for D8 per month and fuel type in the D-2 Process

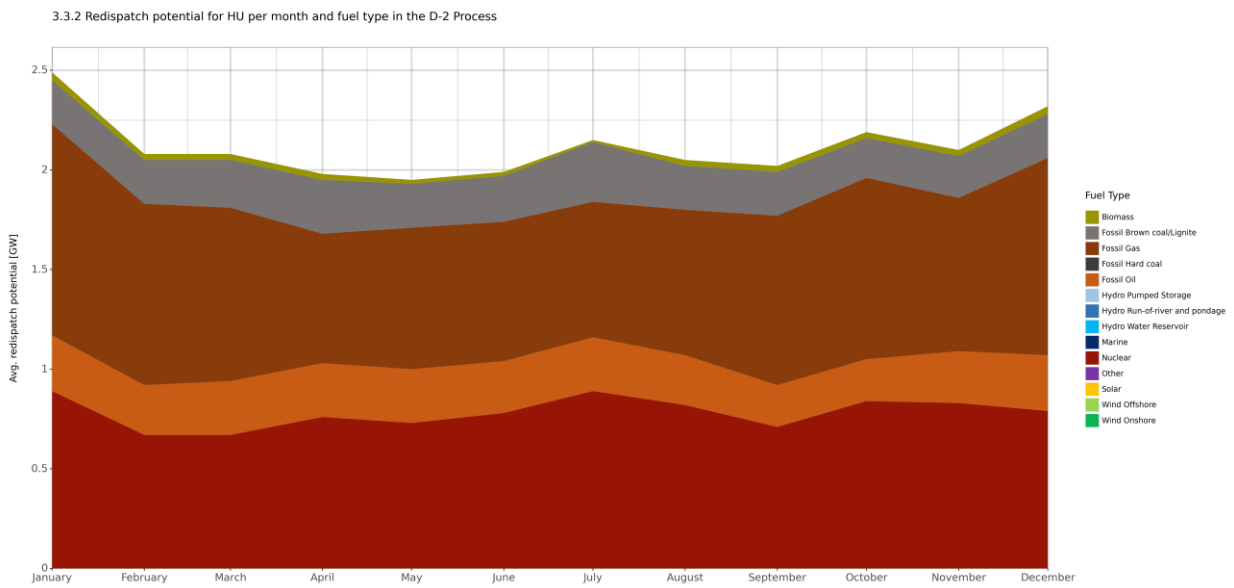
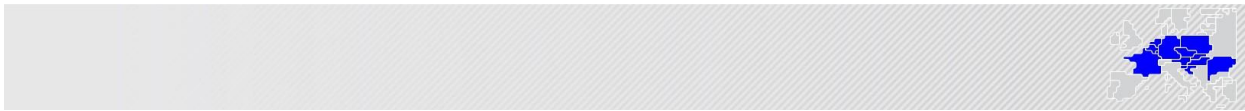


The figure above shows the monthly redispatch potential per fuel type for the D-2 process for 50 Hertz.

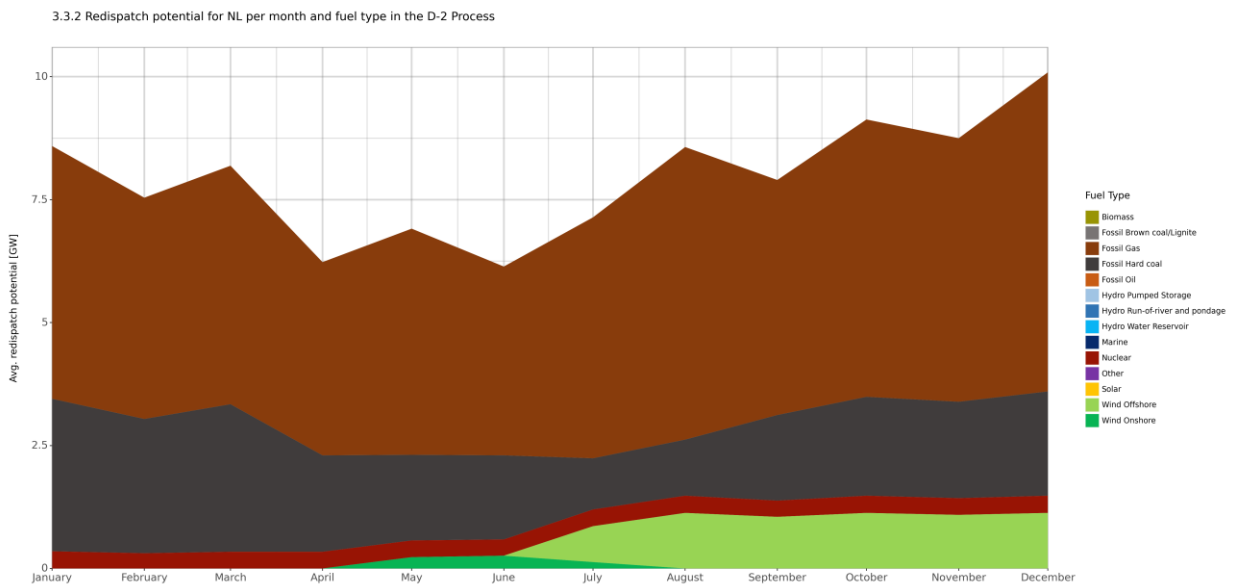
3.3.2 Redispatch potential for HR per month and fuel type in the D-2 Process



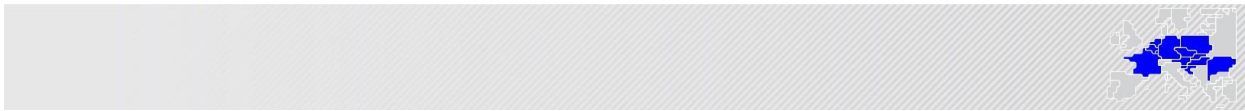
The figure above shows the monthly redispatch potential per fuel type for the D-2 process for HOPS. As HOPS delivered no redispatch potential for the provided units, no data is shown in the figure.



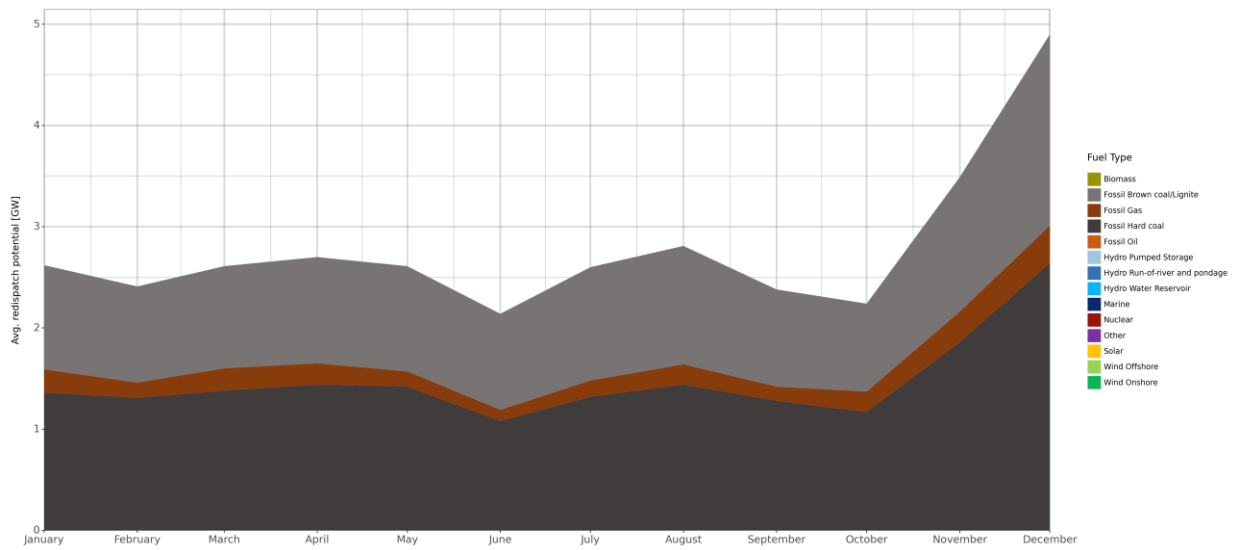
The figure above shows the monthly redispatch potential per fuel type for the D-2 process for Mavir.



The figure above shows the monthly redispatch potential per fuel type for the D-2 process for TenneT TSO B.V.

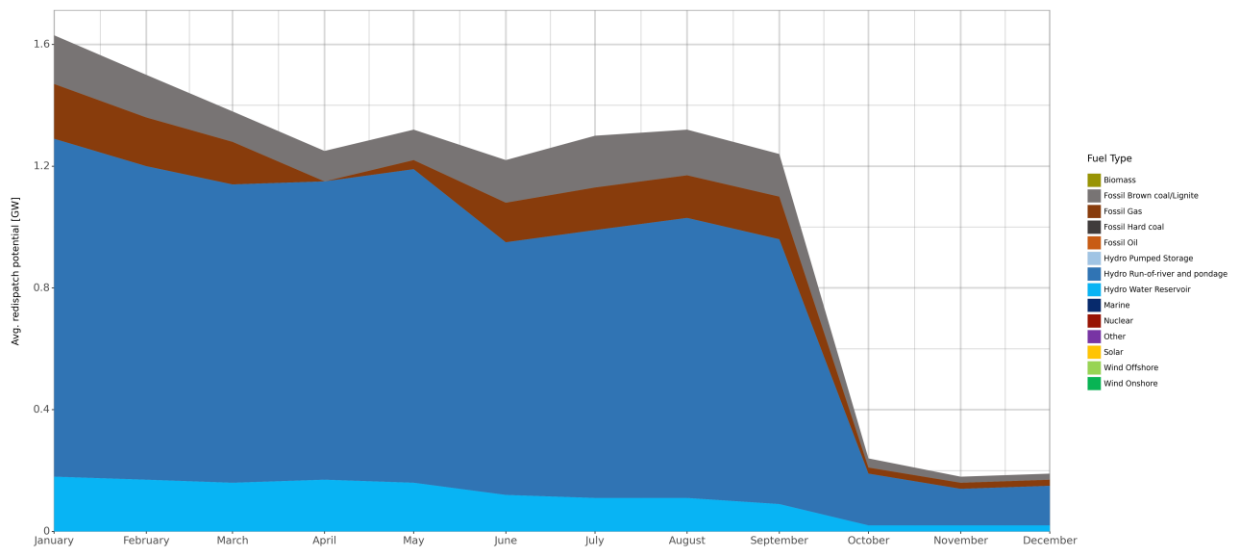


3.3.2 Redispatch potential for PL per month and fuel type in the D-2 Process

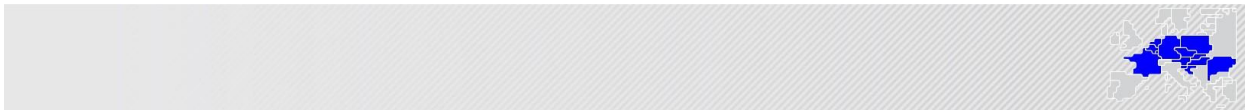


The figure above shows the monthly redispatch potential per fuel type for the D-2 process for PSE.

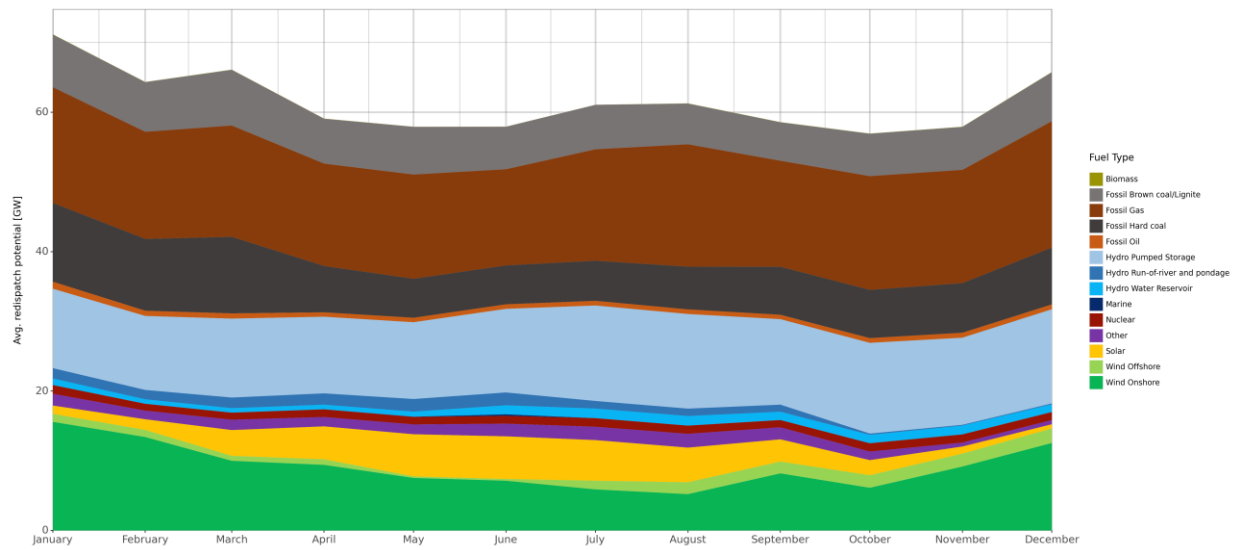
3.3.2 Redispatch potential for RO per month and fuel type in the D-2 Process



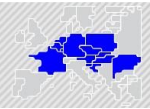
The figure above shows the monthly redispatch potential per fuel type for the D-2 process for Transelectrica.



3.3.2 Total Redispatch potential over Core region per month und fuel type in the D-2 Process



The figure above shows the monthly redispatch potential per fuel type for the D-2 process for the entire Core region.



Accuracy of non-Core Exchanges

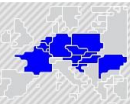
The obligation of Core TSOs to monitor and report on the accuracy of non-Core exchanges is outlined in this chapter, offering an overview of the DA CCM requirements and their fulfilment.

Reporting obligations from DA CCM

As per Article 13(5) of the Core DA CCM:

“Until the AHC is implemented, the Core TSOs shall monitor the accuracy of non-Core exchanges in the CGM. The Core TSOs shall report in the annual report to all Core regulatory authorities the accuracy of such forecasts.”

The reporting requirement is fulfilled by the KPI *Non-Core exchanges delta flow* from the Operational KPI reports, published on the JAO platform [\[LINK\]](#). Additionally, for an annual overview of this KPI, please also refer to the chapter **Aggregated operational KPIs** from this report.



Efficiency of NRAO

This chapter includes an overview of the reporting obligations outlined in the DA CCM. The chapter covers the analysis of the efficiency of NRAO, the presentation of results, justification by Core TSOs in case non-costly RAs were not provided. The chapter includes simulation results assessing the benefit of the Non-Costly Remedial Action Optimising process step. Additionally, it addresses the quality of data published, including summaries of data quality, as well as the output of a satisfaction survey regarding the use of JAO Core FB MC page and JAO Publication Tool by Market Participants.

Reporting obligations from DA CCM

As per Article 16(7) of the Core DA CCM:

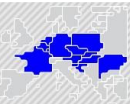
“Every year after the implementation of this methodology in accordance with Article 28(3), the CCC, in coordination with the Core TSOs, shall analyse the efficiency of the NRAO and present the results of this analysis in the annual report. This analysis shall contain an ex-post analysis on whether the NRAO effectively increased cross-zonal capacity in the most valuable market direction. The analysis shall focus on data from the last year of operation, and shall include at least the following information:

- (a) an assessment of the availability of non-costly RAs provided by the Core TSOs, including the average number of non-costly RAs provided by each Core TSO*
- (b) for the Core TSOs which did not provide non-costly RAs, a justification why they did not do so*
- (c) for each CNEC with non-zero shadow price: \overline{PTDF}_{init} , \overline{PTDF}_f , $F_{ref,init}$ and F_{nrao}*
- (d) an estimate of the market clearing point (and related market welfare) which may have occurred, should the NRAO not have taken place (but including other capacity calculation steps such as minRAM, LTA inclusion and an estimate of the validation phase)”*

And as per Article 16(8) of the Core DA CCM:

“Based on the conclusion of the analysis mentioned in the previous paragraph, the Core TSOs may propose changes to the NRAO by submitting to all Core regulatory authorities a proposal for amendment of this methodology in accordance with Article 9(13) of the CACM Regulation.”

Each of the reporting obligations from this Article corresponds to a dedicated subchapter in this report.



Article 16(7)(a)

This subchapter presents an overview of the total number of unique non-costly RAs offered by the Core TSOs for NRAO. If the same remedial action is provided for multiple MTUs, it is only counted once.

The table below contain the total cumulative number of unique non-costly RAs offered for NRAO by each of the Core TSOs during the reporting period.

Core TSO	Total number of unique non-costly RAs offered for NRAO
AT	4
BE	6
CZ	10
D2	6
D4	4
D7	2
D8	8
FR	24
HR	2
HU	8
NL	18
PL	12
RO	3
SI	2
SK	3

Article 16(7)(b)

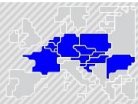
All Core TSOs provided non-costly RAs during the reporting period

Article 16(7)(c)

This reporting obligation requires the following parameters for each CNEC with non-zero shadow price:

$\overrightarrow{PTDF}_{init}$, \overrightarrow{PTDF}_f , $F_{ref,init}$ and $F_{nr ao}$

The data is provided separately in the file [2024 CNECs with non-zero shadow price.xlsx](#)



Estimated impact of NRAO – Article 16(7)(d)

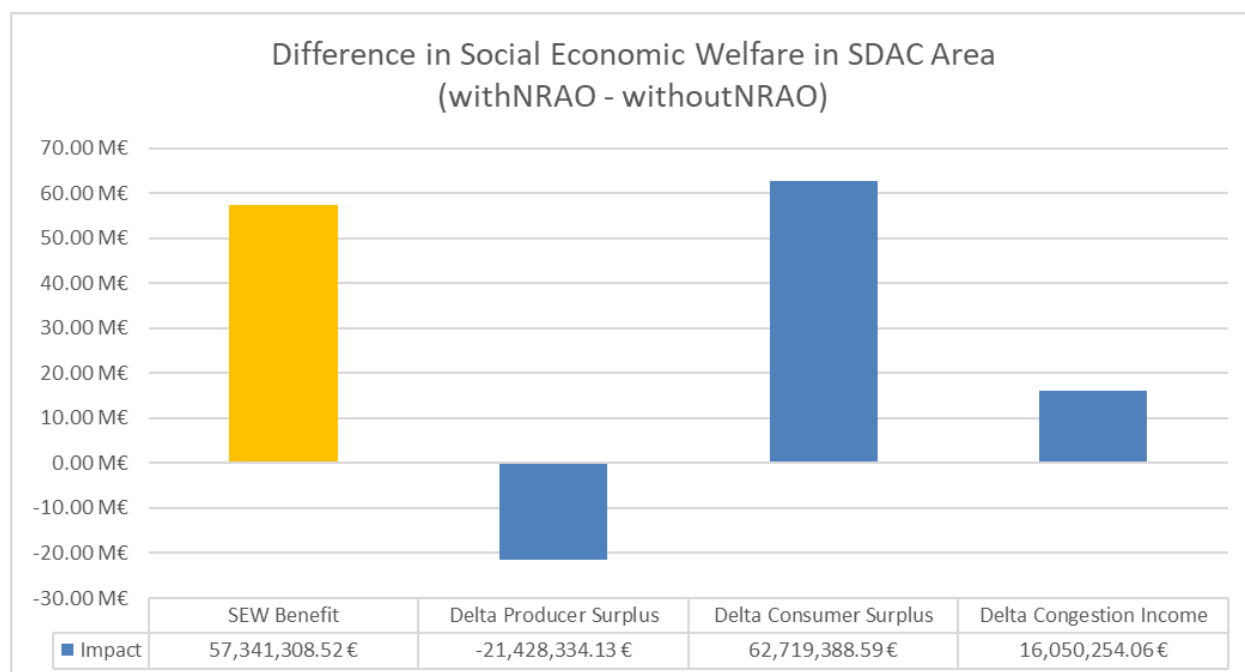
This subchapter presents the results of the study evaluating the effect of implementing the non-costly remedial action optimization (NRAO) on market coupling outcomes, with a particular focus on social welfare.

The study involved rerunning the capacity calculation process for the entire year of 2024 without including the NRAO step and comparing these results with the operational results that do include the NRAO step. Additionally, to further isolate the impact of NRAO, the IVA step has also been removed from both computations, resulting in the following two scenarios:

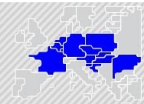
- CCCt Computation with NRAO + Without IVA
- CCCt Computation without NRAO + Without IVA

The final flow-based domain derived from the capacity calculation process was applied to simulate the day-ahead market coupling using the Simulation Facility, which houses the historical market and network data as well as the network topology. Notably, only the Core flow-based domain parameters were altered for the simulation, all other variables remained unchanged. The simulation was conducted using Simulation Facility version 4.36.0 and Euphemia 11.3 fix1.

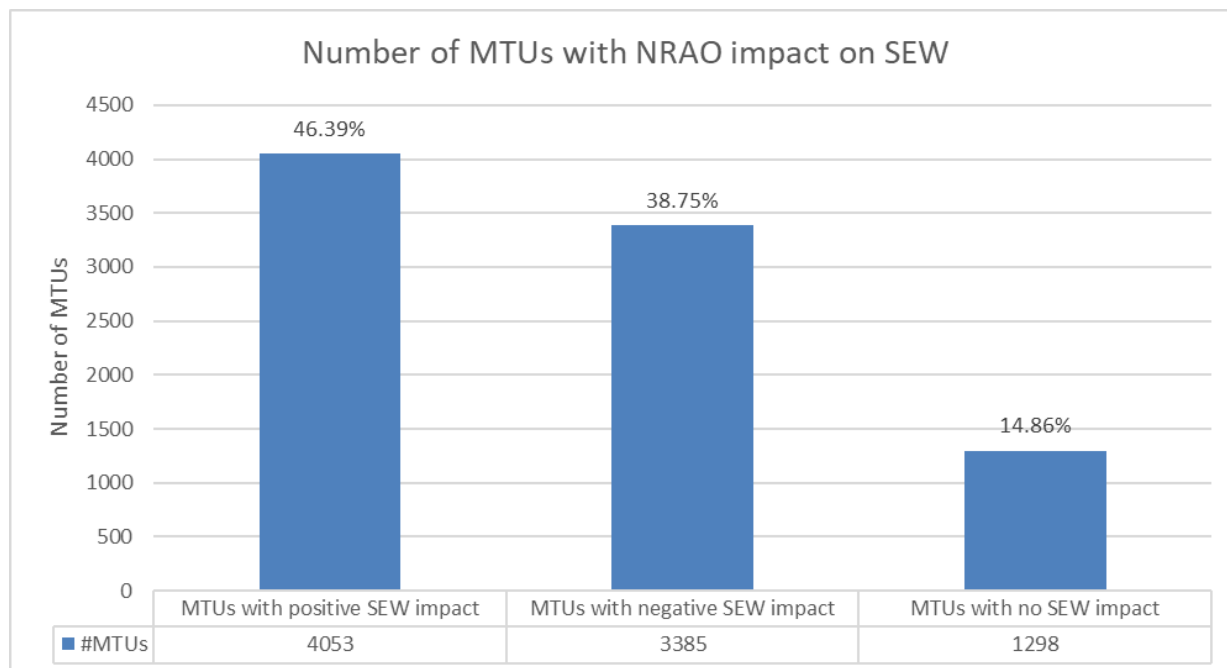
Both scenarios have been computed using the same Core Capacity Calculation tool and Simulation Facility configurations to minimize the impact of tool differences in the comparison analysis.



The graph above shows the added value of the NRAO step for the entire 2024. A positive value indicates a positive impact of NRAO. The yellow column “Social Economic Welfare” is the sum of the blue bars “Consumer Surplus”, “Producer Surplus”, and “Congestion Income”.



Analysing the results at a MTU level, the following results are obtained:

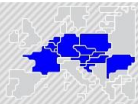


In the figure above, it can be observed that NRAO can have either a positive or negative impact on Social Economic Welfare. This behaviour can be explained by the fact that the market direction is unknown at the moment of the NRAO step, so, even though NRAO optimizes the domain in the most likely market direction, the market may ultimately move towards a completely different situation. Therefore, this behaviour underscores the importance of an accurate Net Position Forecast to properly optimize the Capacity Calculation process.

Additionally, looking at the most extreme MTUs in the analysed period, impacts of around 2M€ can be observed in both directions: positive impact and negative impact.

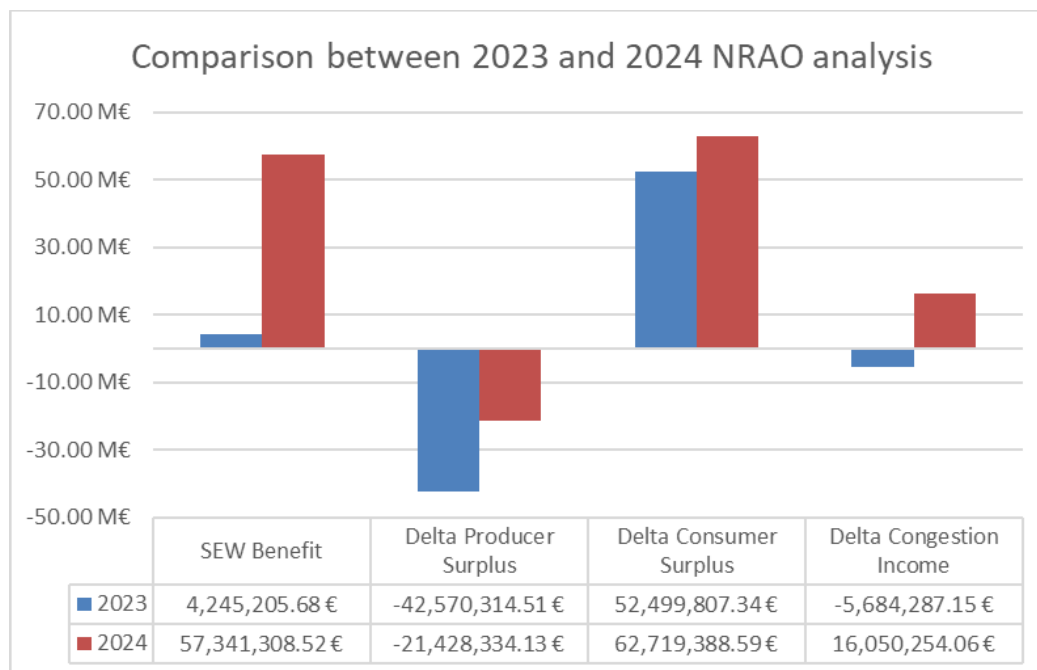
MTU with highest SEW impact	2,315,661 €
MTU with lowest SEW impact	-1,967,180 €

These numbers suggest that applying non-costly remedial actions could have a significant impact on the Social Economic Welfare on an MTU level. However, the impact can be positive or negative depending on the grid and market situation.



Comparison between 2023 and 2024 NRAO analysis

The only difference between 2023 and 2024 NRAO analysis has been the exclusion of IVA step from 2024 computations. However, the difference in the SEW results is quite relevant:

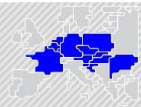


The difference in the results may be impacted by two factors:

- Improvement in NRAO outputs during the year 2024 with respect to 2023. (dependant on market situation, grid topology or other factors)
- The exclusion of the IVA step from the analysis.
 - In 2023 NRAO analysis, the same IVA values from production were considered for both scenarios: with and without NRAO. This simplification did not consider the fact that NRAO may have an impact on the IVA step, potentially modifying the reduction values needed.

The significant increase in SEW benefit suggests that both factors mentioned above have had an impact in the results. Therefore, it seems that NRAO does have an impact on IVA step that cannot be overlooked. Given the positive impact in SEW Benefit, it appears that market constraints were reduced.

However, with the current analysis it is not possible to quantify this impact as it is not possible to know which factor played a bigger role in the results' difference: NRAO performance improvement, or NRAO impact on IVA.



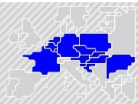
NRAO analysis summary

The analysis results show that NRAO had an impact of 57M€ on SEW during the year 2024, which showcases the potential of non-costly remedial action optimization.

However, looking at the results on MTU basis, both positive and negative SEW impacts can be observed. This occurs because there is certain degree of independence between increasing the domain in the direction of the minimum relative RAM (which is the objective function of NRAO) and increasing market capacities. This behaviour can be attributed to the market potentially moving towards a Clearing Point¹ that is not in the most likely market direction at the time of the NRAO process, but rather in an alternative direction.

Additionally, the comparison between the 2023 and 2024 results indicates that NRAO is closely linked to other steps in the CC process, such as the IVA. Therefore, it is essential to consider the potential impact of NRAO on these steps in order to accurately assess the overall process efficiency.

¹ The Market Clearing Point (MCP) refers to the price and net positions at which the electricity supply matches the demand. In the context of this report, the MCP is the outcome of the Single Day-Ahead Coupling (SDAC) process.



Observations from Operational Process

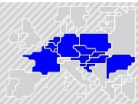
This subsection contains key observations from the operational process during 2023.

The following table display the monthly overview of the number and percentage of timestamps in which at least one RA was applied during the individual months of 2023.

Month	Number of timestamps with RAs applied	Share of timestamps with RAs applied [%]
Jan	699	94.0
Feb	659	94.7
Mar	672	90.4
Apr	632	87.8
May	590	79.3
Jun	238	33.1
Jul	325	43.7
Aug	655	88.0
Sep	546	75.8
Oct	459	61.6
Nov	534	74.2
Dec	459	61.7

- The chapter “Aggregated operational KPIs” contain several KPIs that provides insights to the performance of NRAO including KPI 9 (KPI 9: Average variation of relative RAM before and after NRAO

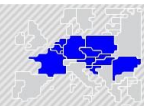
) which shows the average variation of relative RAM before and after NRAO and it is reflected in this figure that the NRAO tools are increasing the minimum relative RAM by applying non-costly remedial actions as defined in the objective function of the NRAO tools.



Individual Validation Adjustment Applied as Fallback

Following RAO and the intermediate FB computation, the individual validation takes place. The objective of the individual validation is, for each Core TSO, to conduct a separate analysis to determine if the cross-zonal capacity could potentially violate the operational security limits within its own control area. This allows TSOs apply IVA values to reduce RAM for its own CNECs as a part of the normal process. Individual Validation Adjustment values can also be applied as a fallback in individual validation in the event that TSO operator needs to deviate from the normal process due to reasons like failure of local validation. This section contains an overview of the number and percentage of timestamps in 2023 in which IVA was applied as fallback.

Month	Number of timestamps with IVA applied as fallback	Share of timestamps with IVA applied as fallback [%]
Jan	26	5.22
Feb	18	6.12
Mar	401	79.25
Apr	118	16.39
May	21	4.06
Jun	24	5.43
Jul	64	15.06
Aug	101	28.06
Sep	63	10.34
Oct	29	4.82
Nov	18	3.51
Dec	50	9.88



Quality of Data Published

Reporting obligations from DA CCM

As per Article 26(3) of the Core DA CCM:

“The CCC shall provide in the annual report at least the following:

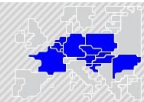
- (a) the summary of the quality of the data provided by each data provider*
- (b) the assessment of the ease-of-use of data retrieval (both manual and automated)*
- (c) the results of the satisfaction survey performed annually with stakeholders and all Core regulatory authorities*
- (d) suggestions for improving the quality of the provided data and/or the ease-of-use of data retrieval”*

The reporting obligation pursuant to Article 26(3)(a) has a dedicated first subchapter in this report; Articles 26(3)(b)-(d) are tackled jointly in second subchapter.

Article 26(3)(a)

This subchapter includes an annual summary of the quality of data covering the following:

- Annual overview of the information published in the Monthly DQI reports, including the following indicators:
 - Individual Grid Model (IGM) replacement
 - Spanning
 - Default Flow-Based Parameters (DFP)
 - NRAO was not applied
- Data completeness and timeliness on JAO monitoring tool.
- This section includes an annual overview, with monthly granularity, of total number of occurrences for which follow up actions were initiated due to a delay in the publication.



Annual overview of Monthly DQI reports

IGM replacement heatmap

This section contains the overview of results of the quality indicator “IGM replacement was performed” for each month of the year by each TSO.

The ambition level for this DQI is: IGM replacement was performed ≤ 24 MTUs/month. In case the ambition level was not reached, detailed information for particular MTUs is provided in the [Annex 2](#)

TSO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT	3	0	0	0	0	0	0	0	0	0	0	0
BE	0	0	0	0	24	0	0	0	0	0	0	0
CZ	0	0	0	10	8	0	0	0	0	1	0	0
D2	0	0	0	24	0	0	1	0	0	1	0	0
D4	0	0	0	0	0	0	0	0	0	0	0	0
D6	3	40	0	1	24	0	24	0	0	0	24	0
D7	0	0	0	0	0	0	0	0	0	0	0	3
D8	0	0	0	1	0	0	0	0	0	2	0	0
FR	0	0	2	0	0	0	0	0	0	5	0	4
HR	0	0	0	5	8	0	0	0	0	0	1	0
HU	0	0	24	48	0	0	48	0	0	0	0	0
NL	24	0	0	0	0	0	0	0	0	0	0	0
PL	0	0	0	0	0	0	0	0	0	0	0	0
RO	0	0	3	3	0	0	0	0	0	0	0	0
SI	0	0	0	25	96	0	0	24	0	1	0	0
SK	0	0	0	0	0	0	0	0	0	1	0	0



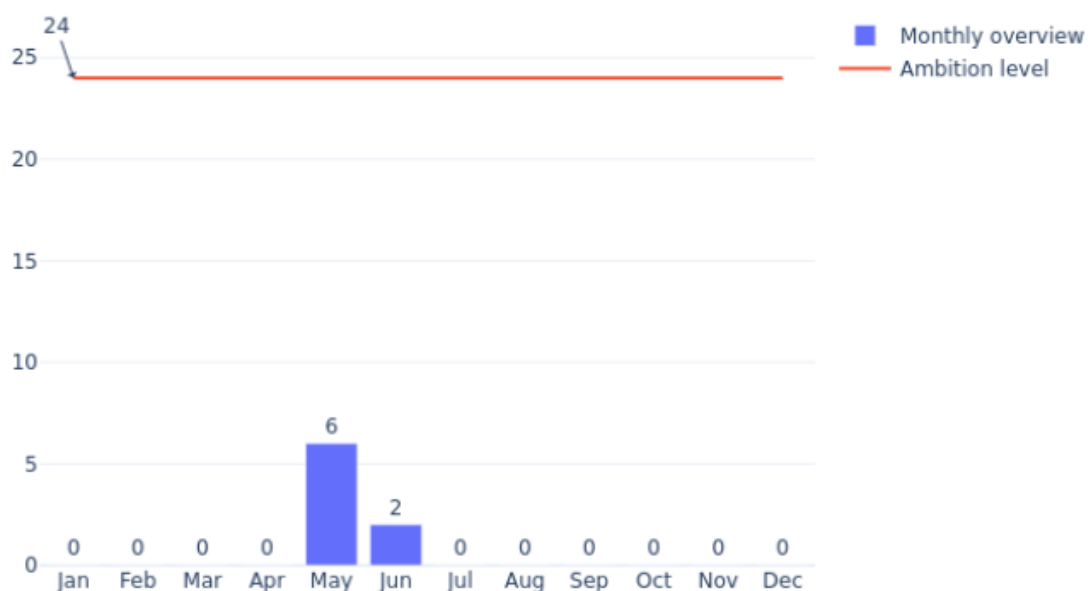
Spanning

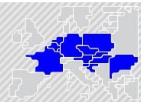
This section shows the results of the quality indicators “Spanning was applied” for each month of the year, for the Final FB computation.

Spanning is a fallback action that consists of calculating the capacity values for the missing timestamp(s) knowing the values of the neighbouring timestamps. This fallback assumes that the operational situation does not change excessively from one timestamp to another.

The ambition level for this DQI is: Spanning was applied ≤ 24 MTUs/month. In case the ambition level was not reached, detailed information for particular MTUs is provided in the [Annex 2](#)

Overview of the Spanning DQI in 2024





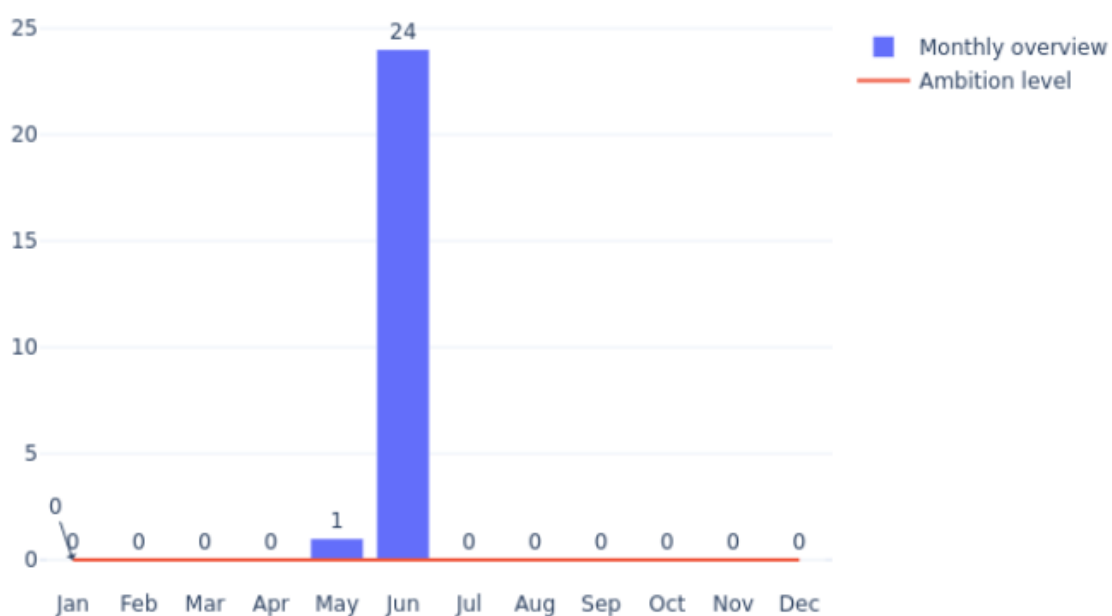
DFP

This section shows the results of the quality indicators “DFP was applied” for each month of the year, for the Final FB computation.

DFP is a fallback procedure that consists of replacing the capacity values of the missing timestamp(s) with default values.

The ambition level for this DQI is: DFP was applied = 0 MTUs/month. In case the ambition level was not reached, detailed information for particular MTUs is provided in the [Annex 2](#)

Overview of the DFP DQI in 2024





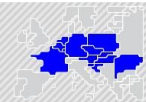
NRAO was not applied

This section contains the results of the quality indicator “NRAO was not applied” for each month of the year. For a particular MTU, NRAO is considered to not be applied if neither NRAO tool (TSCNET’s or CORESO’s) provided results. The expected number of MTUs is where NRAO was triggered (thus excluding spanned or DFP MTUs or occurrences where neither of the NRAOs were triggered, for example due to issues with CCCT).

The ambition level for this DQI is: NRAO was not applied ≤ 48 MTUs/month. In case the ambition level was not reached, detailed information for particular MTUs is provided in the [Annex 2](#)

Overview of the NRAO DQI in 2024

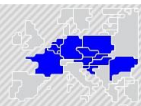




JAO Monitoring Tool Completeness and Timely Data Publication

This section includes an annual overview, with monthly granularity, of total number of occurrences for which follow up actions were initiated due to a delay in the publication.

ATCs on CORE external borders	0	4	1	1	1	3	0	2	1	0	1	2
Allocation Constraints	0	1	1	0	1	1	0	0	0	0	0	0
Alpha factor from MCP	0	0	0	0	0	0	0	1	0	1	0	0
Border Data Overview	0	0	0	0	0	0	0	2	0	0	0	0
Congestion Income	0	0	0	1	0	0	0	1	0	3	1	1
Core MarketGraphs	0	0	0	0	1	1	0	0	1	0	0	0
Core MarketView	1	0	1	1	1	1	0	0	1	1	0	0
Core max net positions and bilateral exchanges	0	0	0	0	1	1	0	0	1	0	0	0
D2CF	0	0	0	0	0	1	0	0	0	0	0	0
Final Bilateral Exchange Restrictions	0	0	0	0	1	1	0	0	1	0	0	0
Final Computation	1	0	1	1	1	1	0	0	0	1	0	0
Initial Computation (Virgin Domain)	0	1	1	1	1	3	1	3	3	6	0	2
Intraday ATC	0	0	1	1	0	6	2					
Intraday NTC	0	0	0	0	0	0	0					
LTA	0	0	0	0	0	0	0	0	0	0	0	0
LTN	0	0	0	0	0	0	0	2	0	0	0	0
Max Exchanges (MaxBex)	0	0	0	0	1	1	0	0	1	0	0	0
Max Net Positions	0	0	0	0	1	1	0	0	1	0	0	0
Net Position	0	0	0	0	0	0	0	1	0	1	0	0
Pre-Final Computation (Early Publication)	1	2	5	3	5	6	0	3	0	0	0	1
Price Spread	0	0	0	0	0	0	0	1	0	1	0	0
Reference Net Position	0	0	0	0	0	0	0	0	0	0	0	0
Refprog	0	0	0	0	0	1	0	0	0	0	0	0
Remedial Action Curative	0	6	0	1	1	1	0	0	0	1	0	0
Remedial Action Preventive	0	6	0	1	1	1	0	0	0	1	0	0
Scheduled Exchanges	0	0	0	0	0	1	0	1	0	1	0	0
Shadow Auction ATC	0	4	1	1	1	3	0	2	1	0	1	2
Shadow Prices	0	0	0	0	0	1	0	1	0	1	0	1
Spanning / DFP	0	0	0	0	1	1	0	0	0	0	0	0
Validation Reductions	0	0	0	0	1	1	0	0	0	0	1	0
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

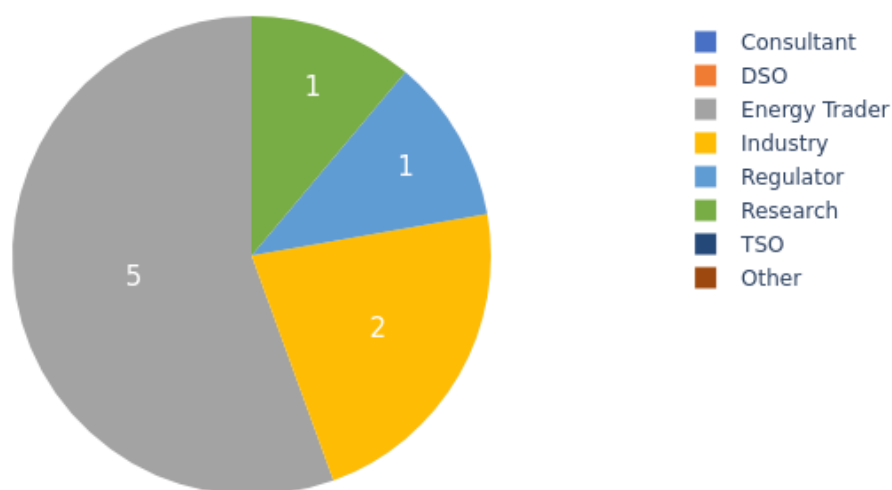


Article 26(3)(b)-(d)

This subchapter analyses the outputs of the satisfaction survey related to the use of JAO Core FB MC page & JAO Publication Tool by Market Participant for 2024. The survey ran for 1 month on the ENTSO-E and the feedback received was processed by the Reporting TF.

- 12 survey responses were obtained, out of which 3 were confidential so will be excluded from the figures below

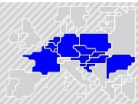
BREAKDOWN OF SURVEY RESPONSES, PER STAKEHOLDER CATEGORY



Observations on all functionalities covered by the survey – excluding the JAO Publication Tool pages:

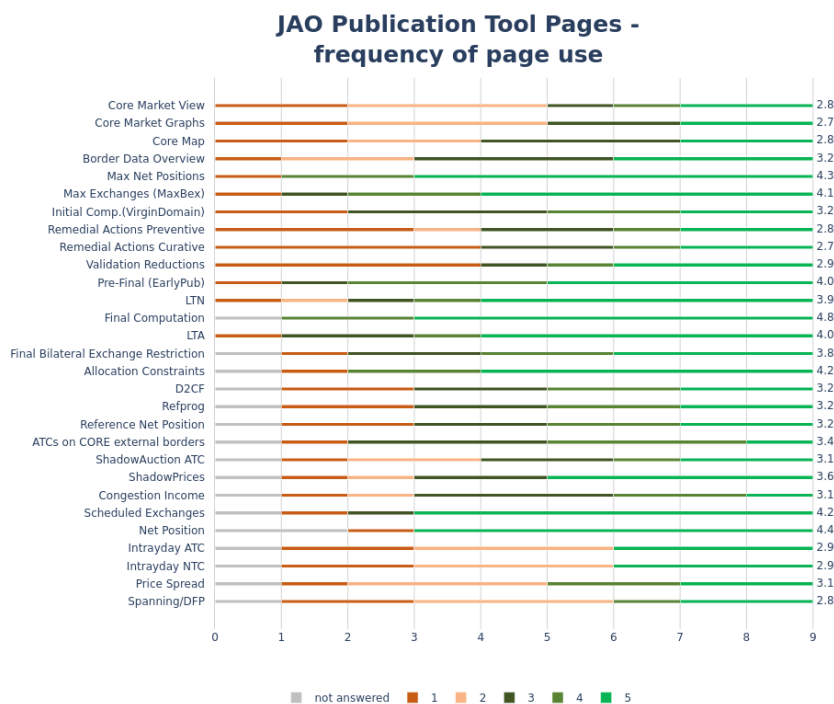
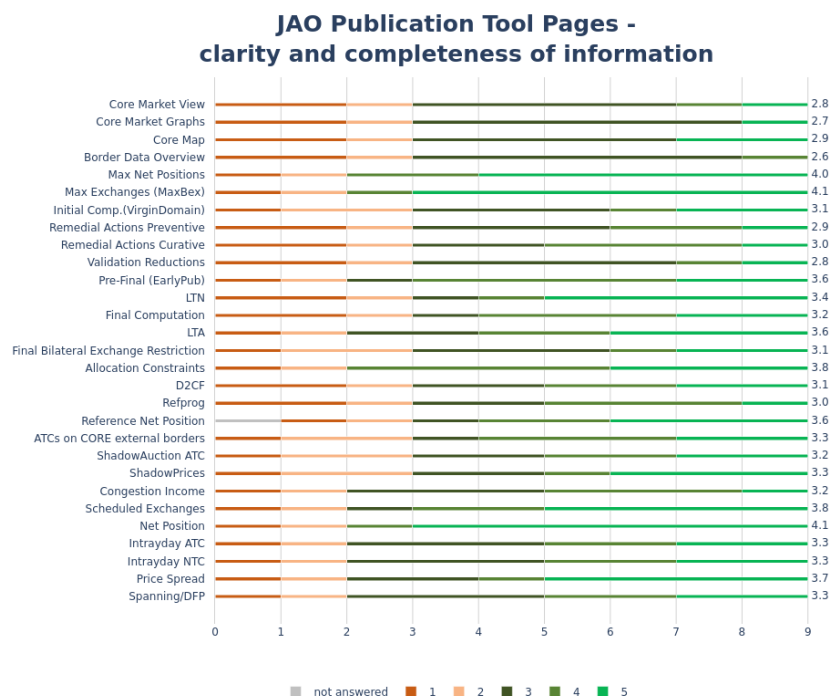
Frequency of use - functionality with highest rating	Frequency of use - functionality with lowest rating
Navigation, downloading the data & Monitoring Tool (3.0/5)	Monthly DQI reports (1.5/5)

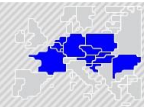
Clarity and completeness of information - functionality with highest rating	Clarity and completeness of information - functionality with lowest rating
Navigation, downloading the data (3.1/5)	Monthly DQI reports and Static Grid Model (1.8/5)



Observations on JAO Publication Tool pages:

- The most frequently used pages (>4/5) do not always have the best average ratings. Highly used pages with low ratings should be prioritized
 - Final Computation: Frequency of use: 4.8/5 – Clarity and completeness: 3.2/5
- The lowest average rating for clarity and completeness of information was 2.6/5 for “Border Data Overview” page
- The least frequently used page are “Core Market Graphs” and “Remedial Actions Curative” with an average rating of 2.7/5





Aggregated operational KPIs

Reporting obligations from DA CCM

As per Article 28(4) of the Core DA CCM:

*“During the internal and external parallel runs, the Core TSOs shall continuously monitor the effects and the performance of the application of this methodology. For this purpose, they shall develop, in coordination with the Core regulatory authorities, the Agency and stakeholders, the monitoring and performance criteria and report on the outcome of this monitoring on a quarterly basis in a quarterly report. **After the implementation of this methodology, the outcome of this monitoring shall be reported in the annual report**”.*

After the go-live of the Core DA CC process, Operational KPI reports are prepared on monthly resolution and published on the JAO platform [\[LINK\]](#).

Additionally, in this report the values for each KPI are aggregated over the whole year, with data slicing per quarter basis, in order to facilitate potential observation of trends throughout the year. The KPIs are grouped into five broad categories:

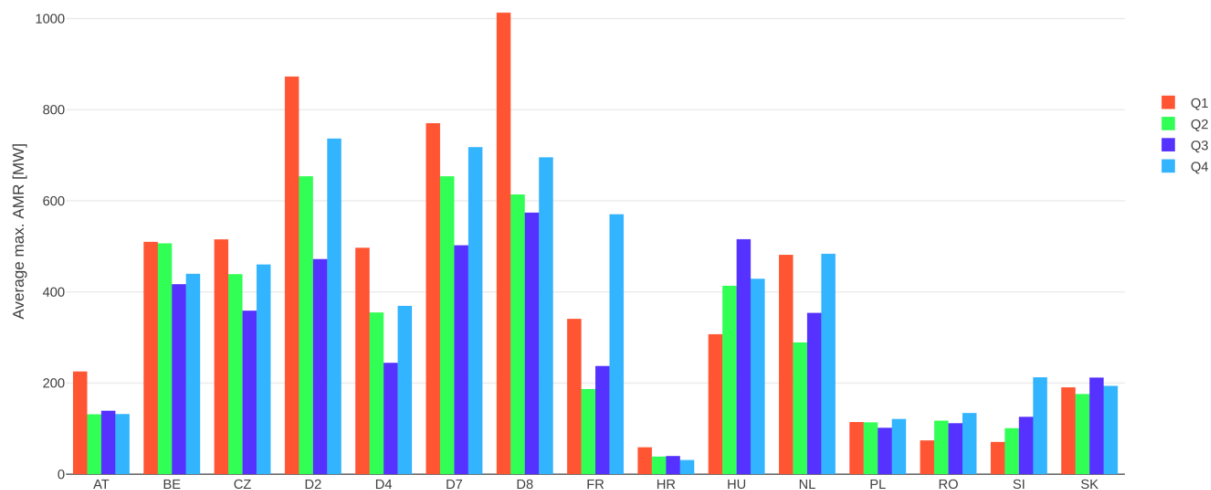
1. Adjustment for minimum RAM Inclusion
2. TSOs' adjustment after validation
3. Power system impact analysis
4. Non-costly remedial action optimisation analysis
5. Market impact assessment



KPI results

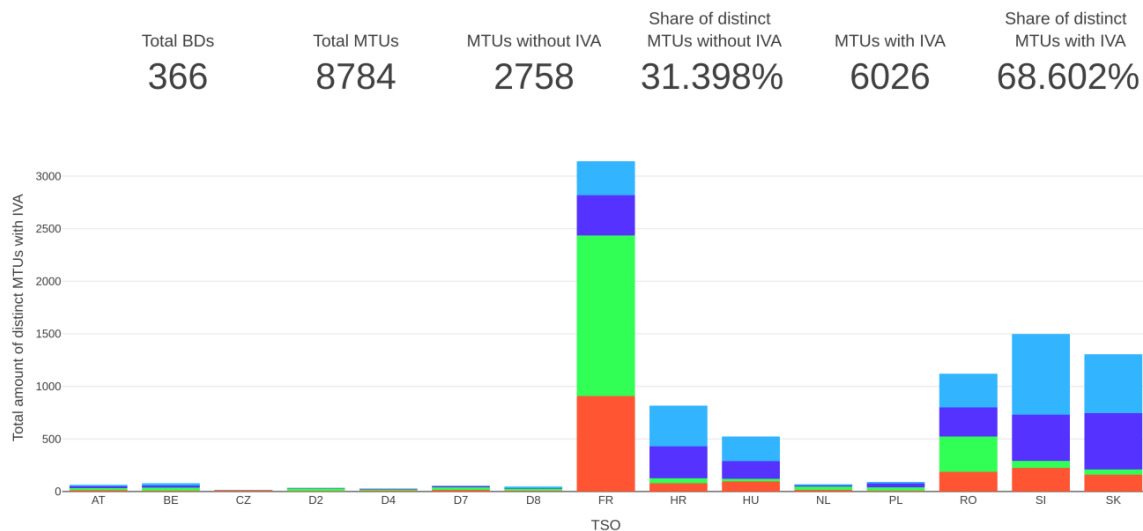
Adjustment for minimum RAM inclusion

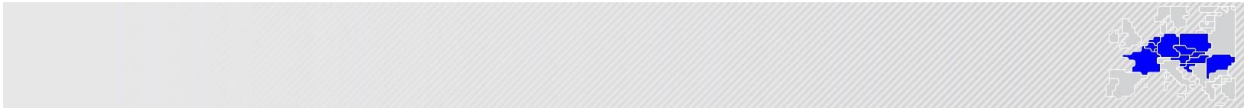
- KPI 1: Average maximum AMR per TSO



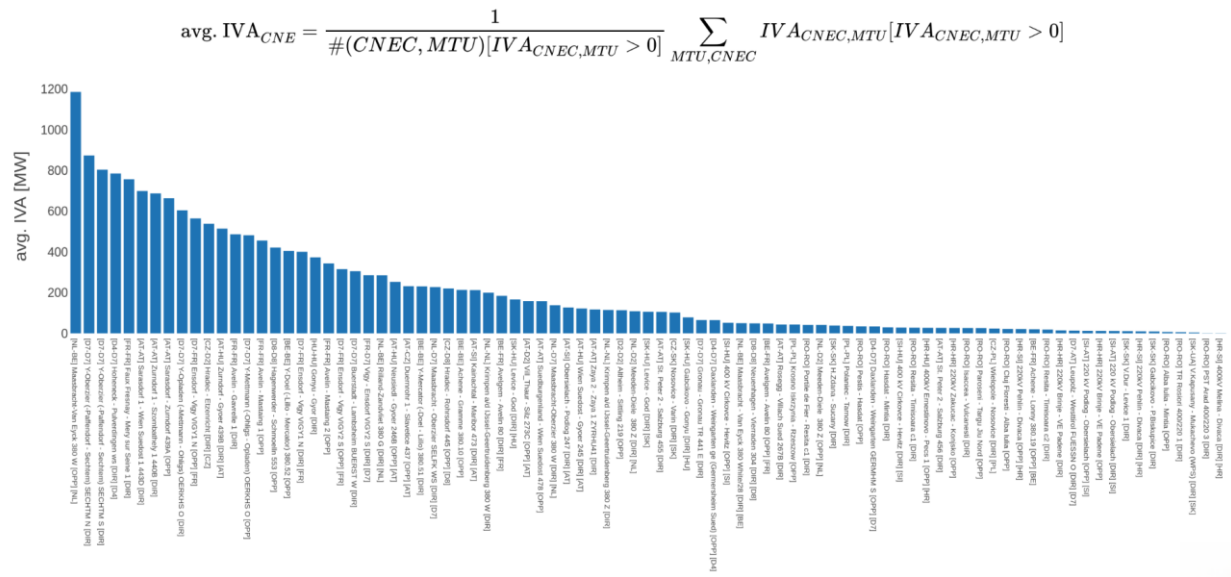
TSOs' adjustment after validation

- KPI 2: Total amount of MTUs with intervention per TSO

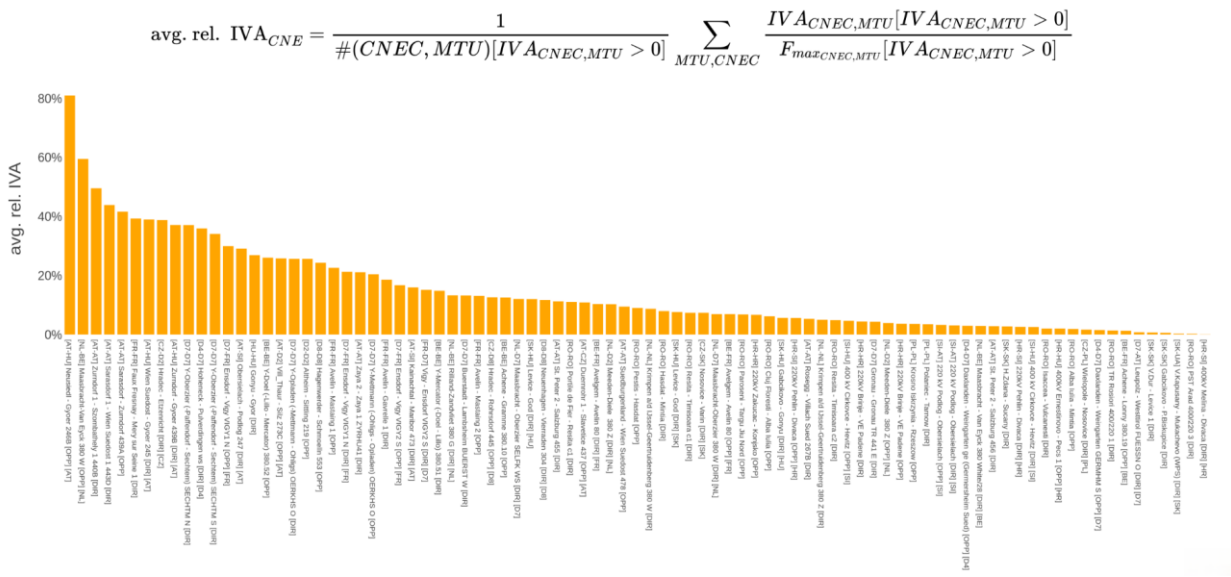




- KPI 2: Average IVA applied for each CNE affected by TSO intervention (Quarter 1)

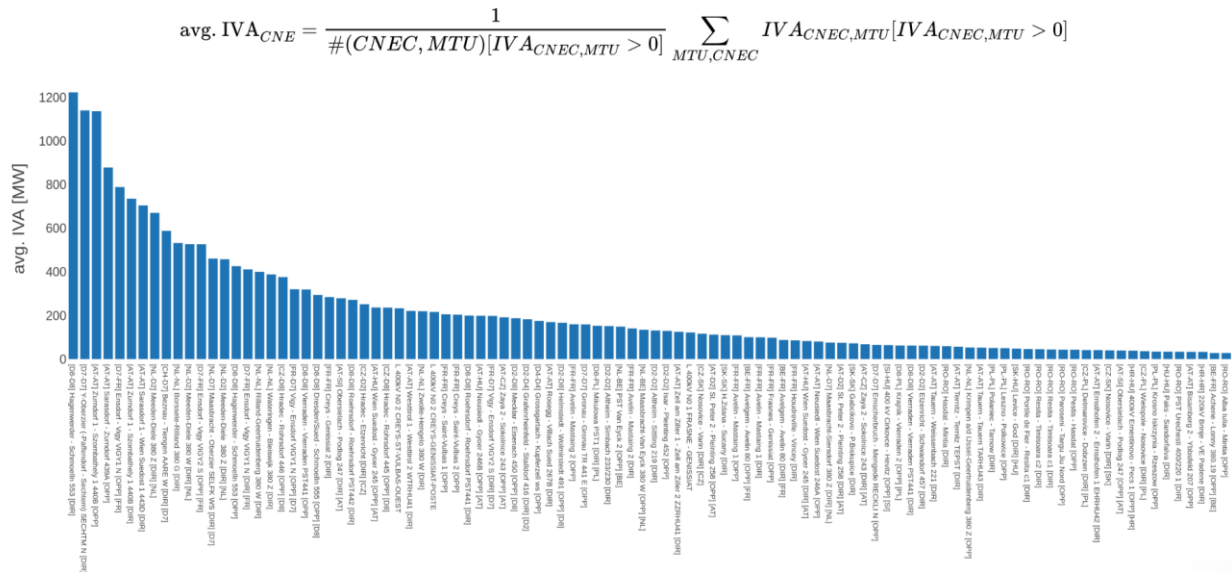


- KPI 2: Average relative IVA applied for each CNE affected by TSO intervention (Quarter 1)

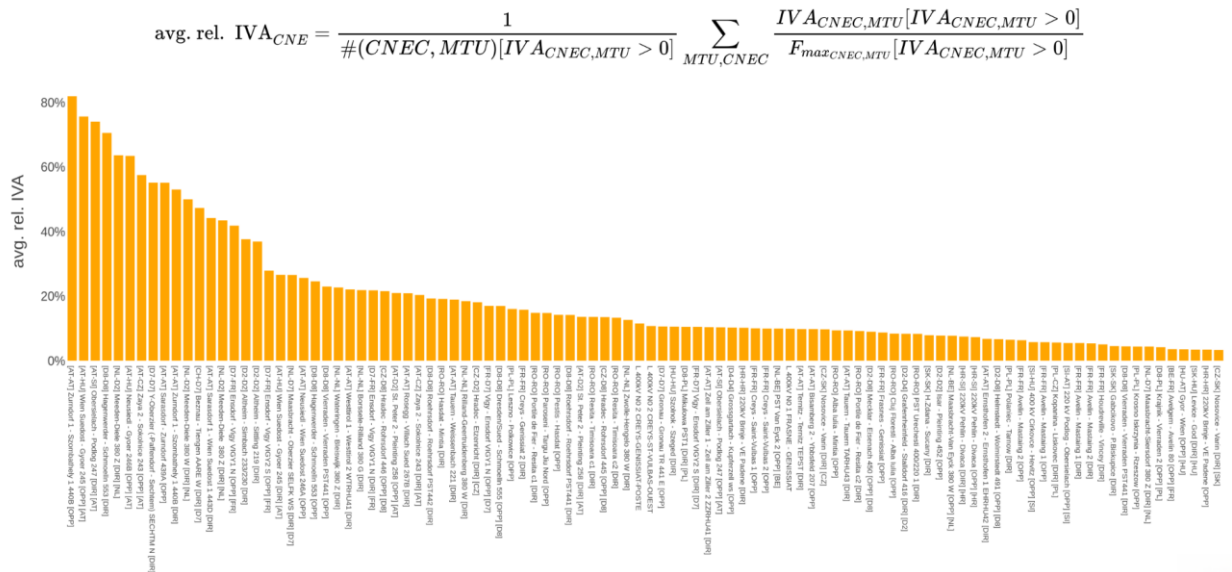




- KPI 2: Average IVA applied for each CNE affected by TSO intervention (Quarter 2)



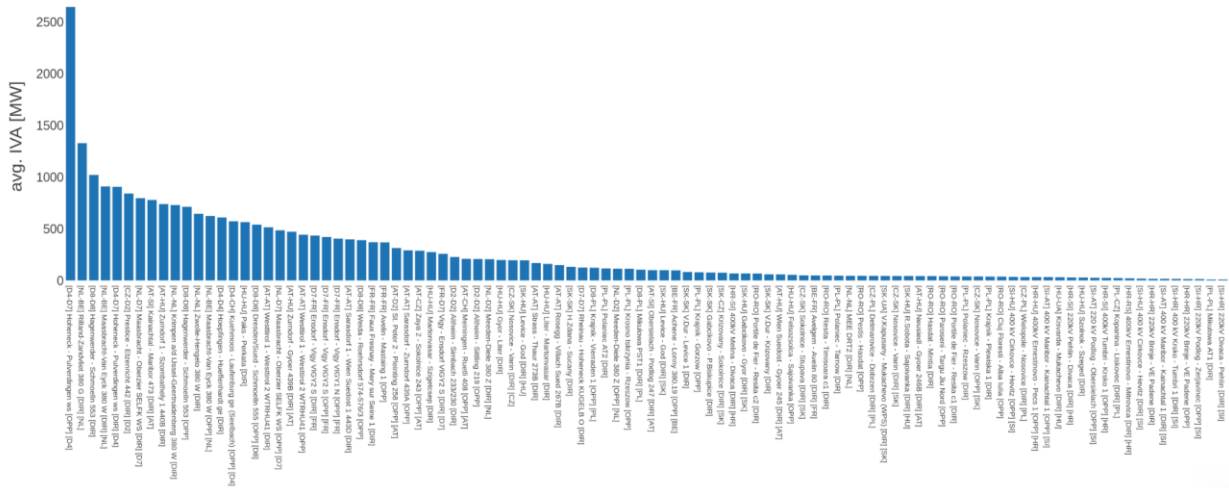
- KPI 2: Average relative IVA applied for each CNE affected by TSO intervention (Quarter 2)





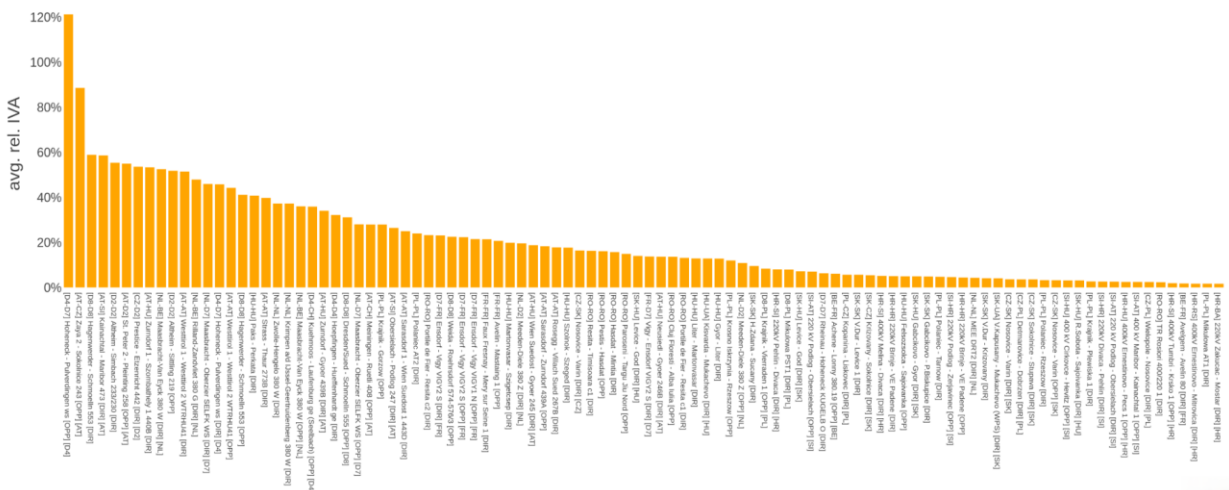
- KPI 2: Average IVA applied for each CNE affected by TSO intervention (Quarter 3)

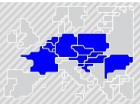
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



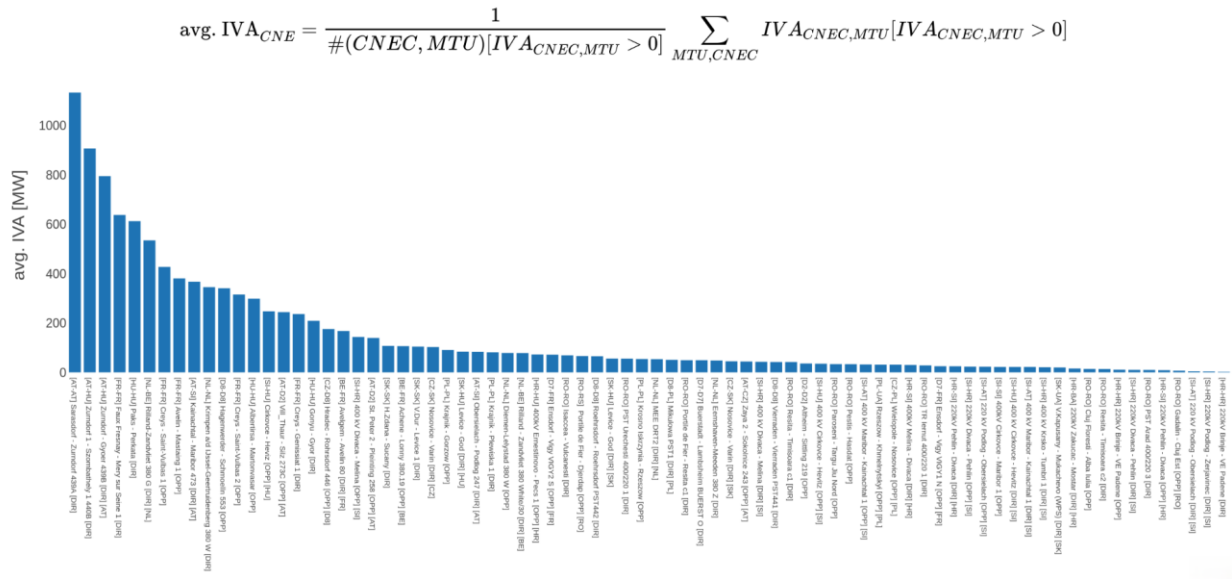
- KPI 2: Average relative IVA applied for each CNE affected by TSO intervention (Quarter 3)

$$\text{avg. rel. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} \frac{IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]}{F_{maxCNEC, MTU} [IVA_{CNEC, MTU} > 0]}$$

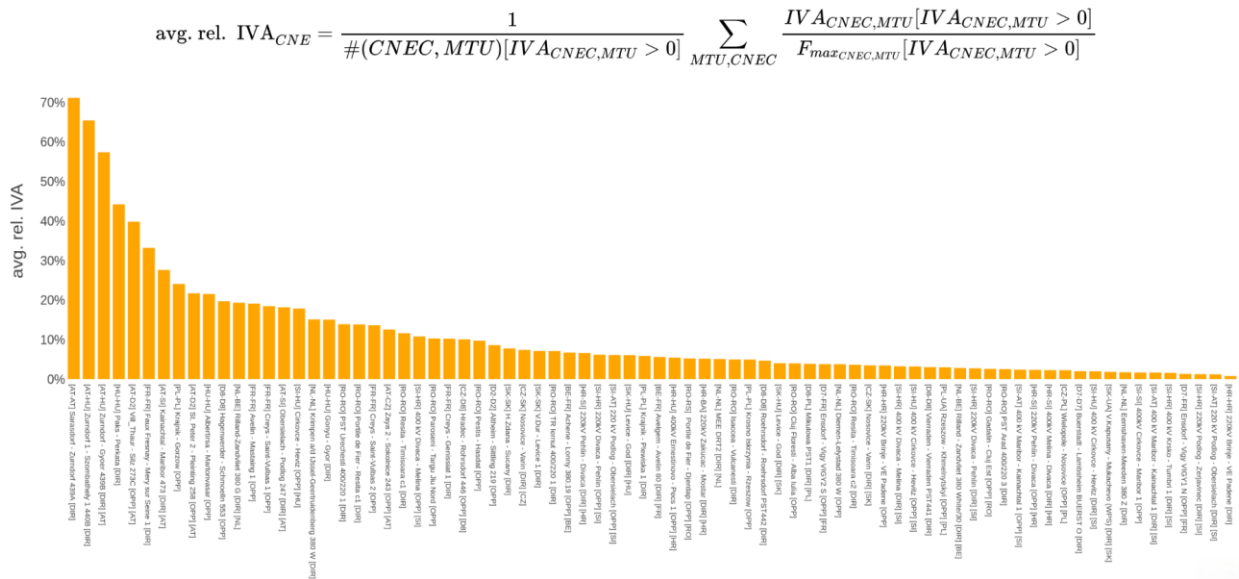


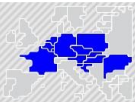


- KPI 2: Average IVA applied for each CNE affected by TSO intervention (Quarter 4)

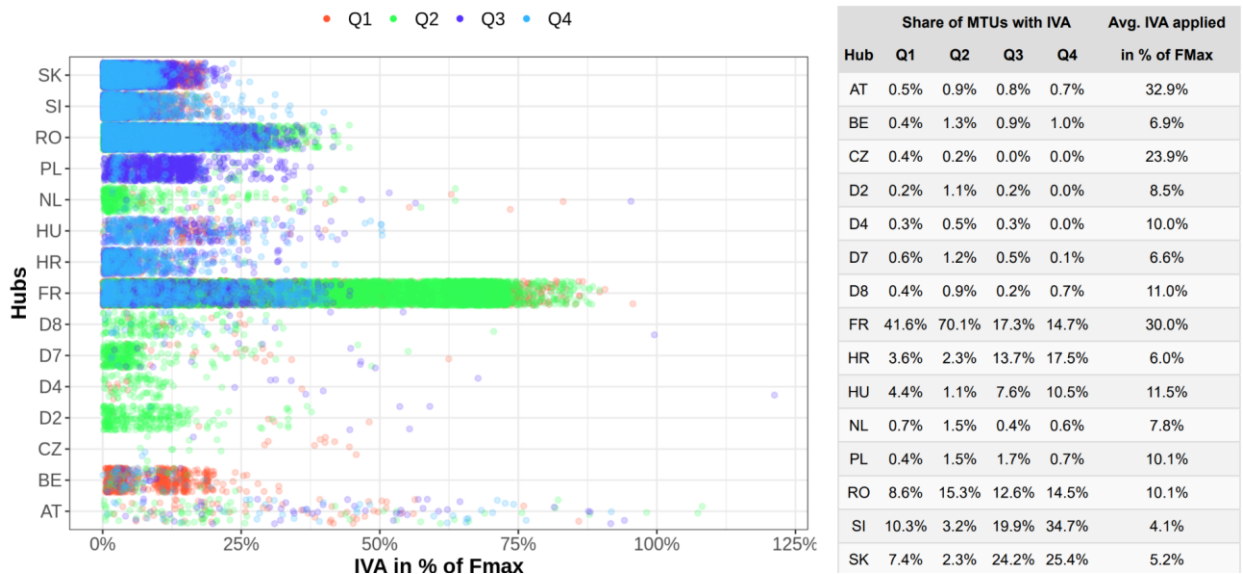


- KPI 2: Average relative IVA applied for each CNE affected by TSO intervention (Quarter 4)



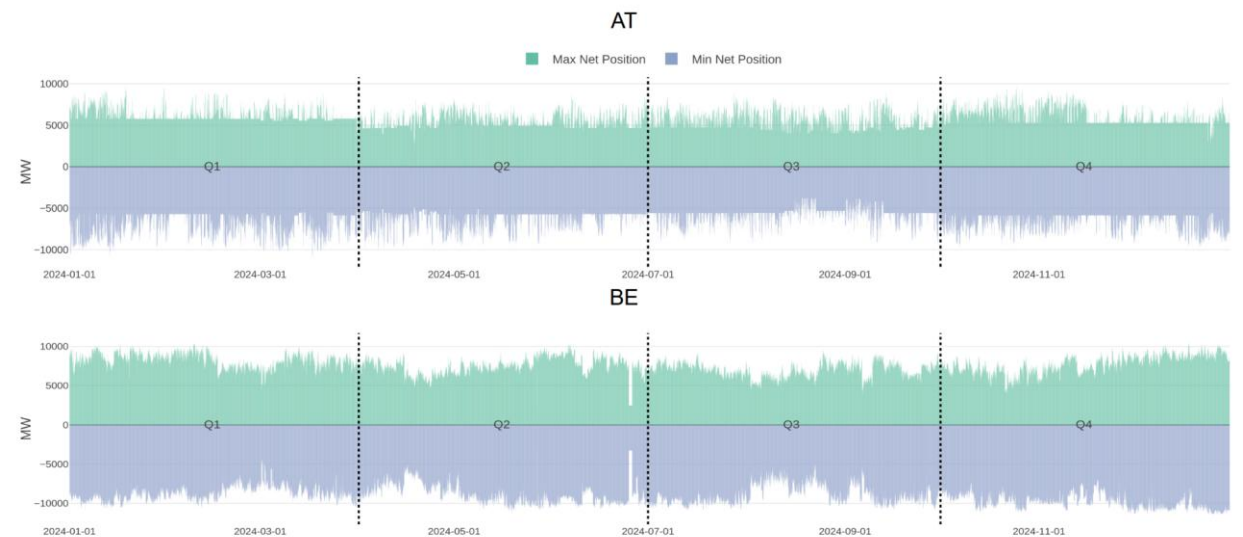


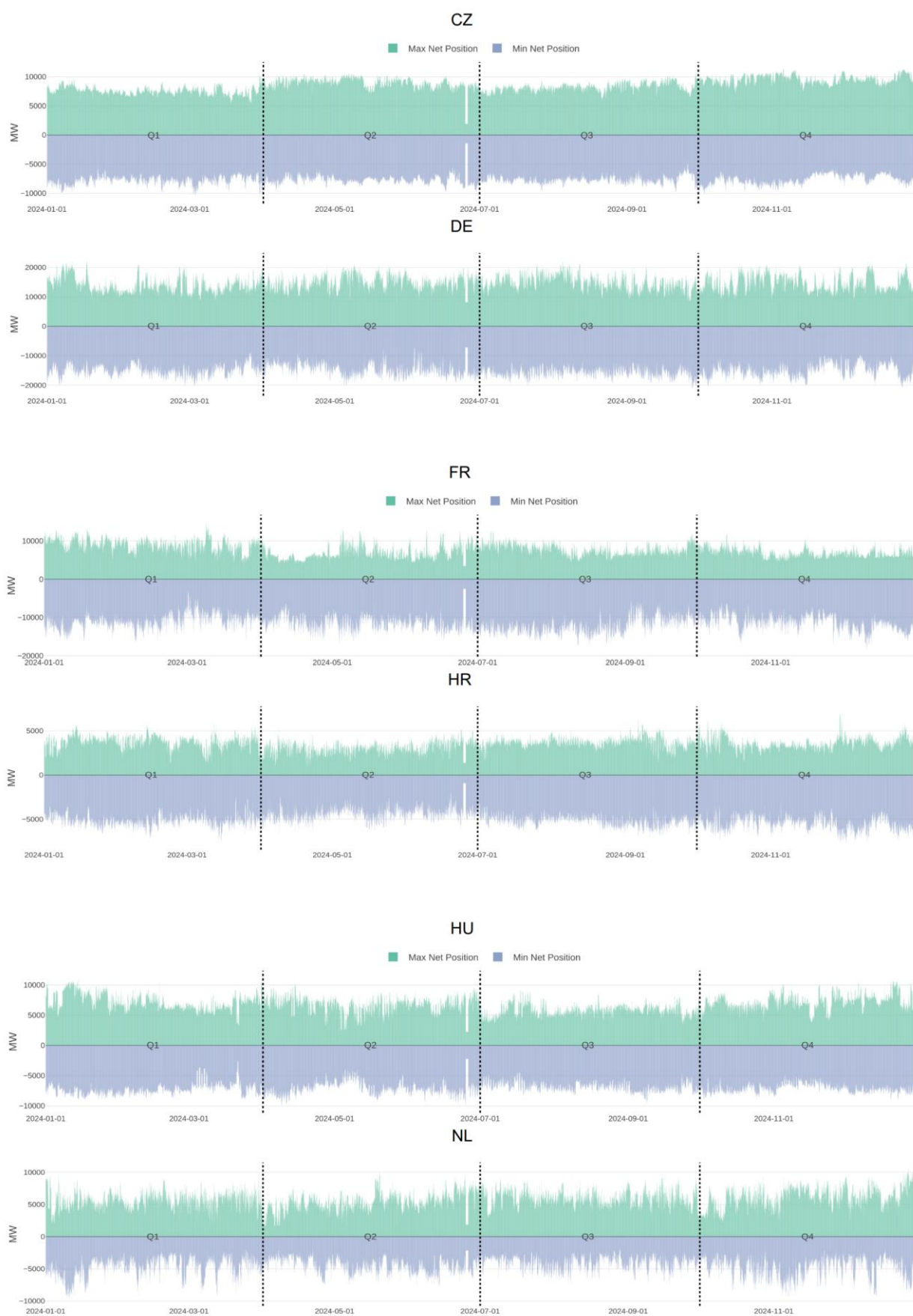
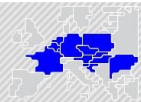
KPI 3: Total IVA applied per TSO

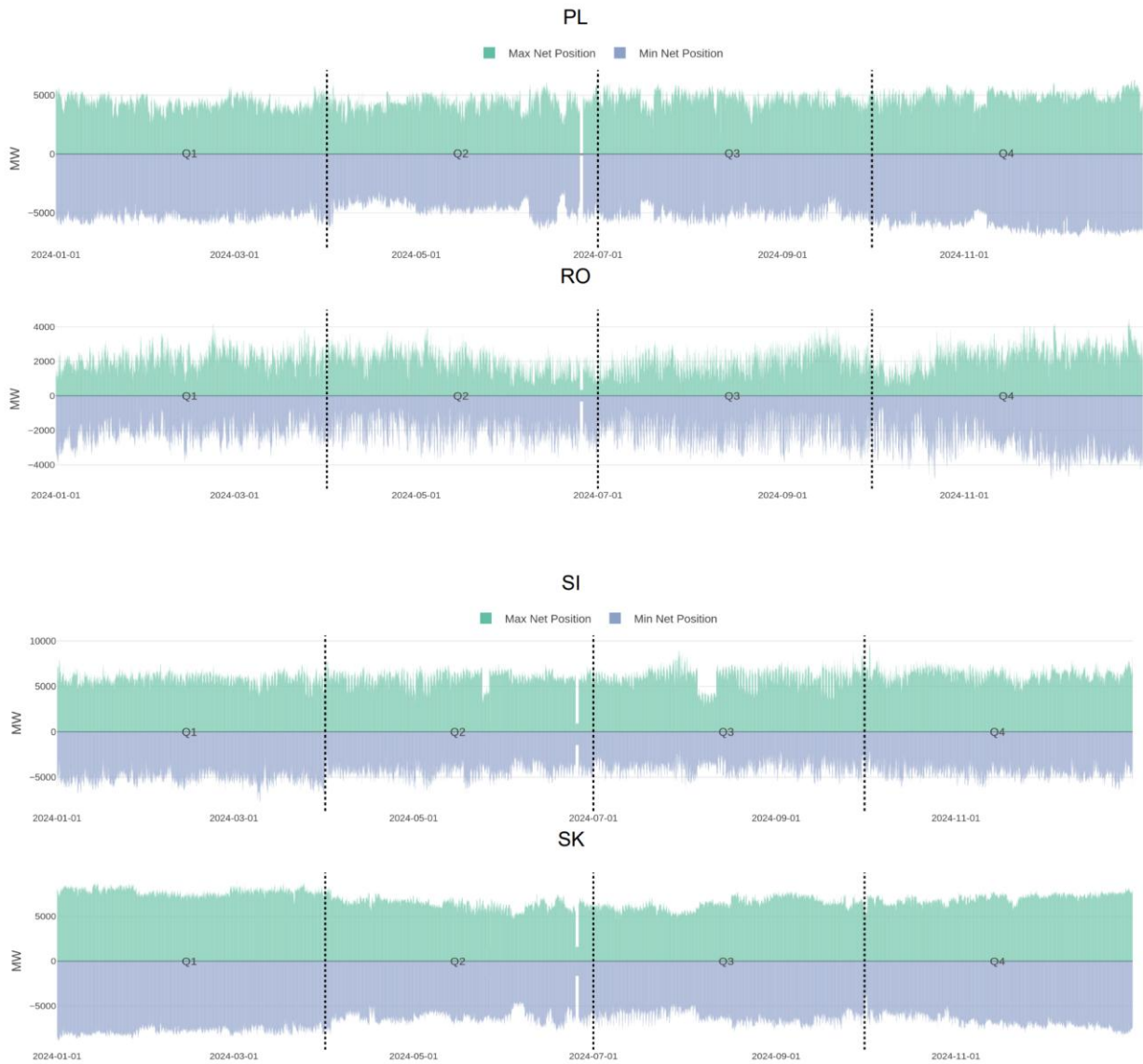
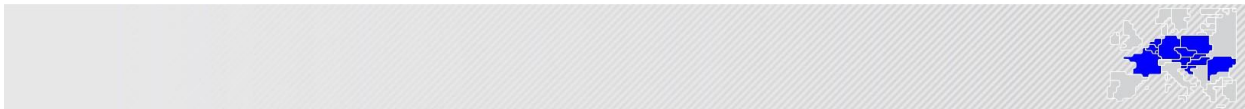


Power System Impact Analysis

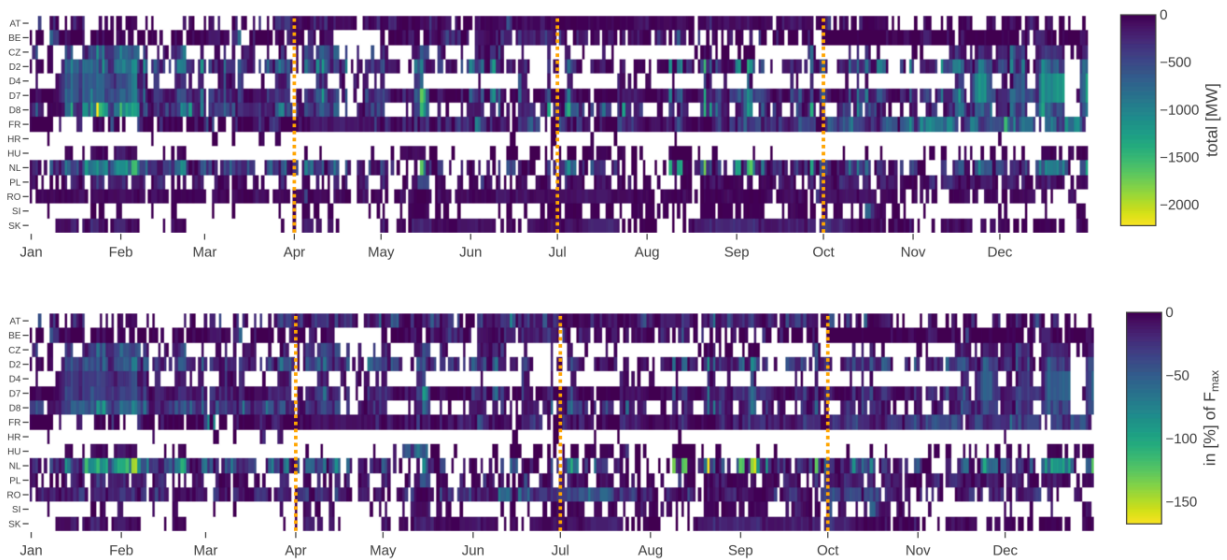
KPI 4: Min and max net positions per BZ hub

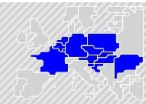




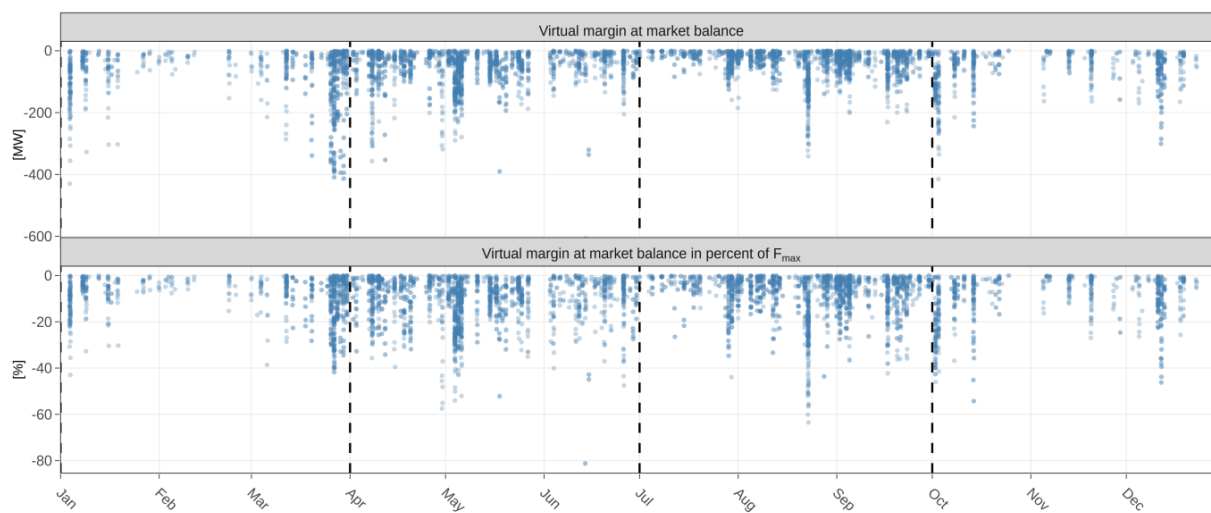


- KPI 5a: Highest virtual margins at market balance (all Core TSOs)

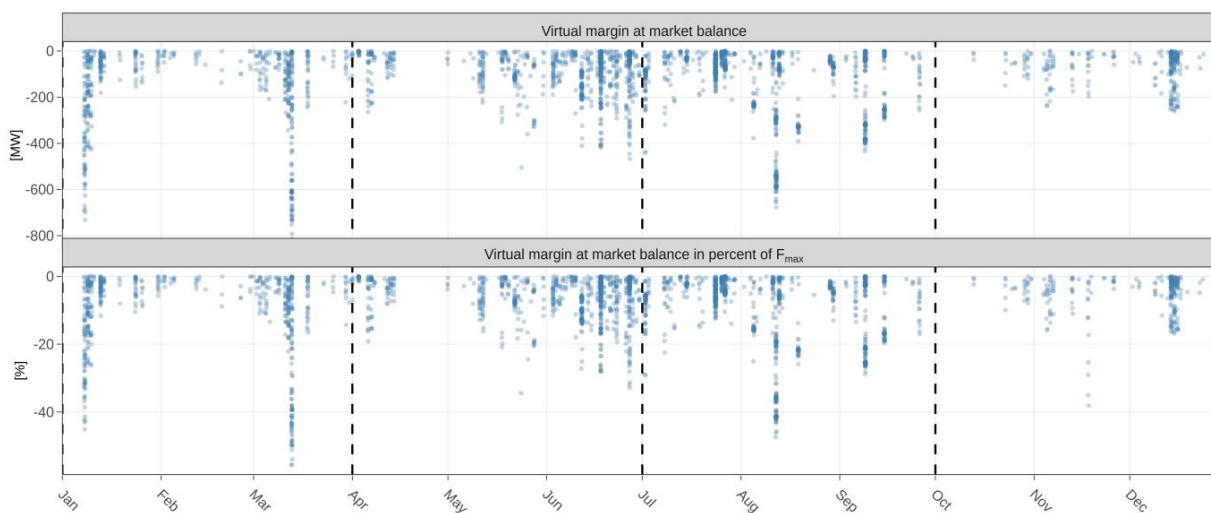




- KPI 5b: Virtual margins at market balance (AT)

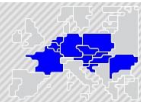


- KPI 5b: Virtual margins at market balance (BE)

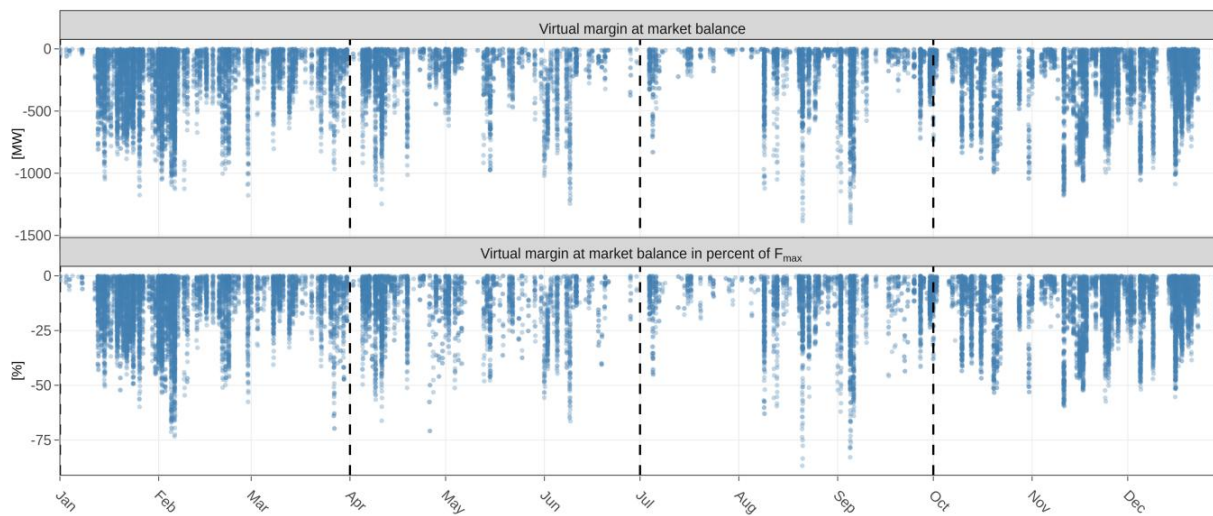


- KPI 5b: Virtual margins at market balance (CZ)

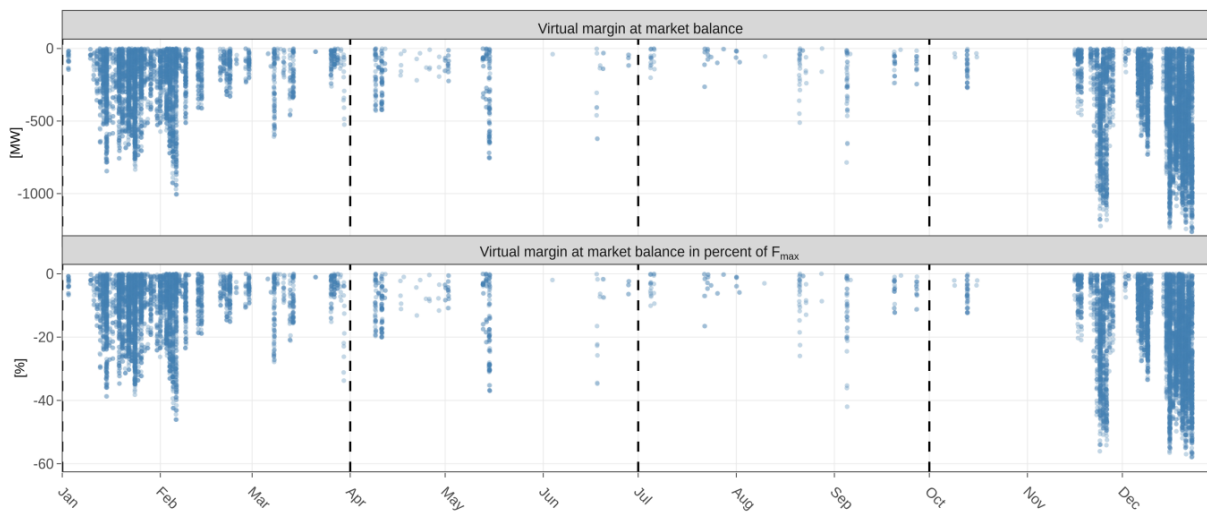




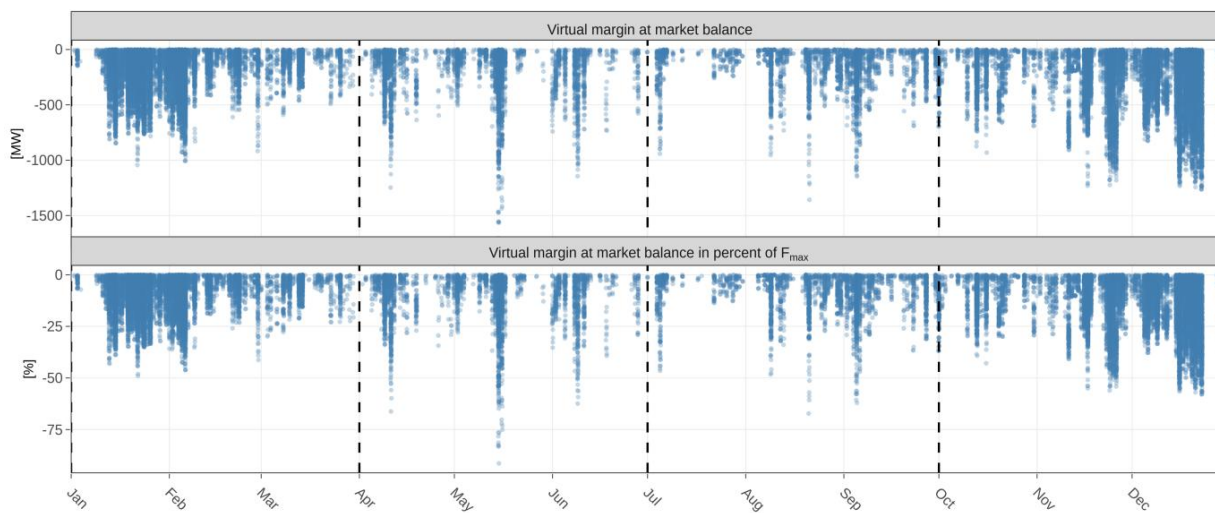
- KPI 5b: Virtual margins at market balance (D2)

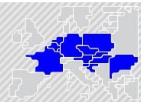


- KPI 5b: Virtual margins at market balance (D4)

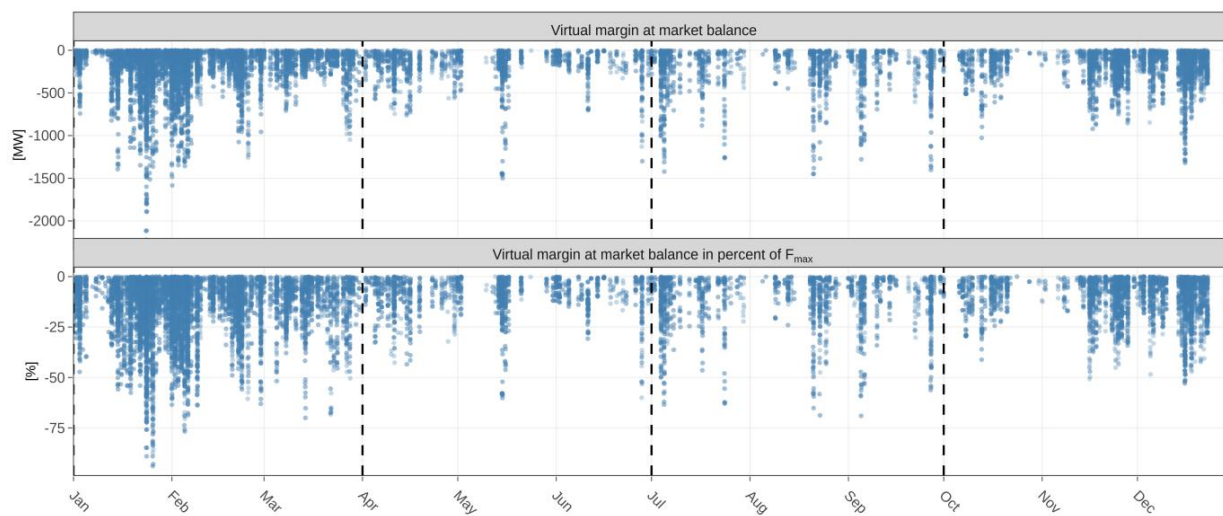


- KPI 5b: Virtual margins at market balance (D7)

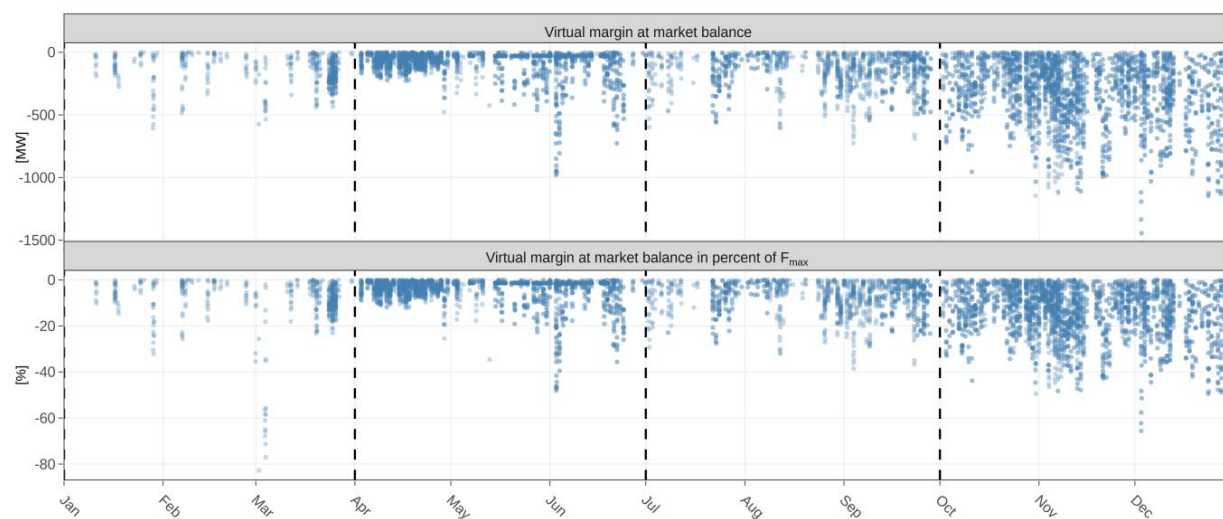




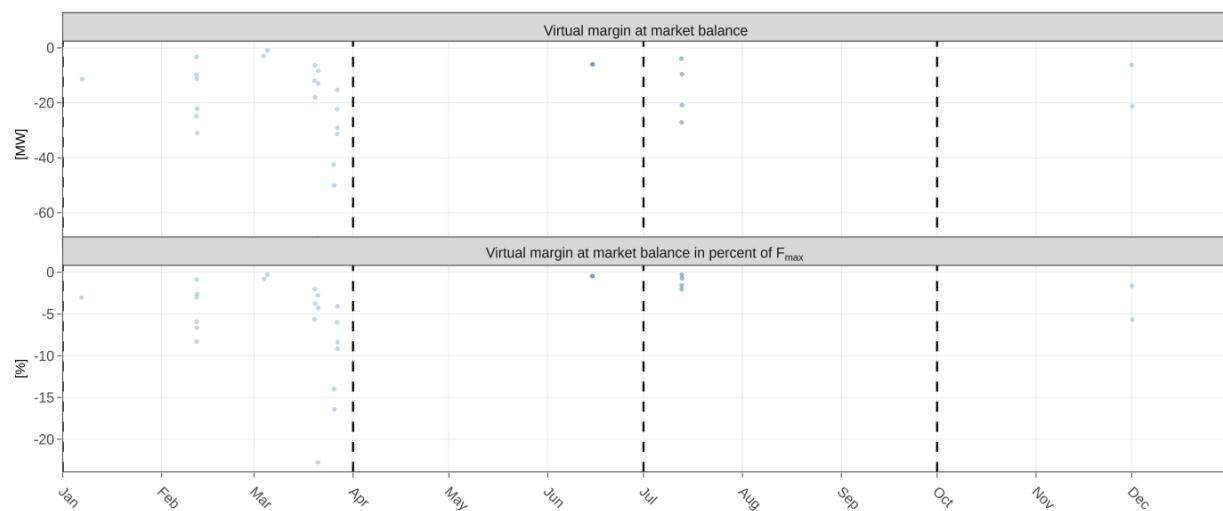
- KPI 5b: Virtual margins at market balance (D8)

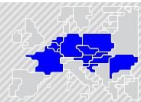


- KPI 5b: Virtual margins at market balance (FR)



KPI 5b: Virtual margins at market balance (HR)

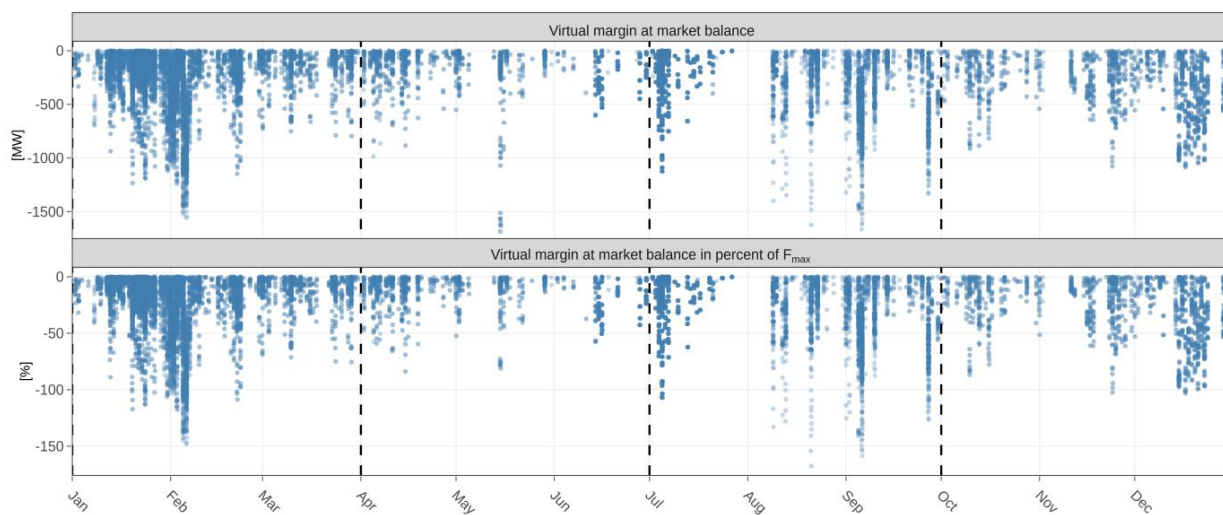




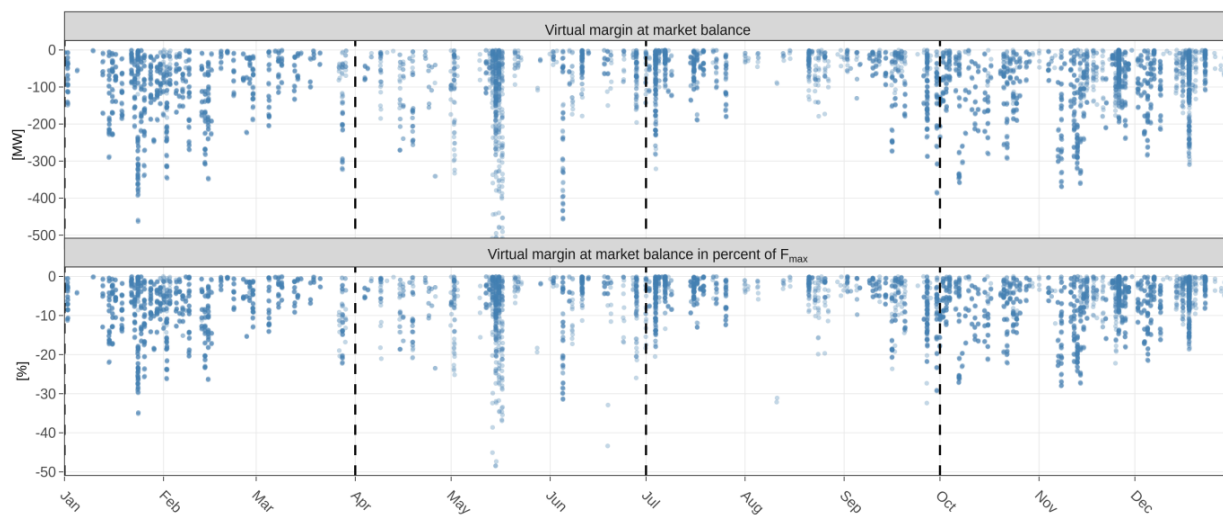
- KPI 5b: Virtual margins at market balance (HU)

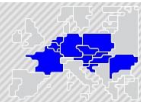


- KPI 5b: Virtual margins at market balance (NL)

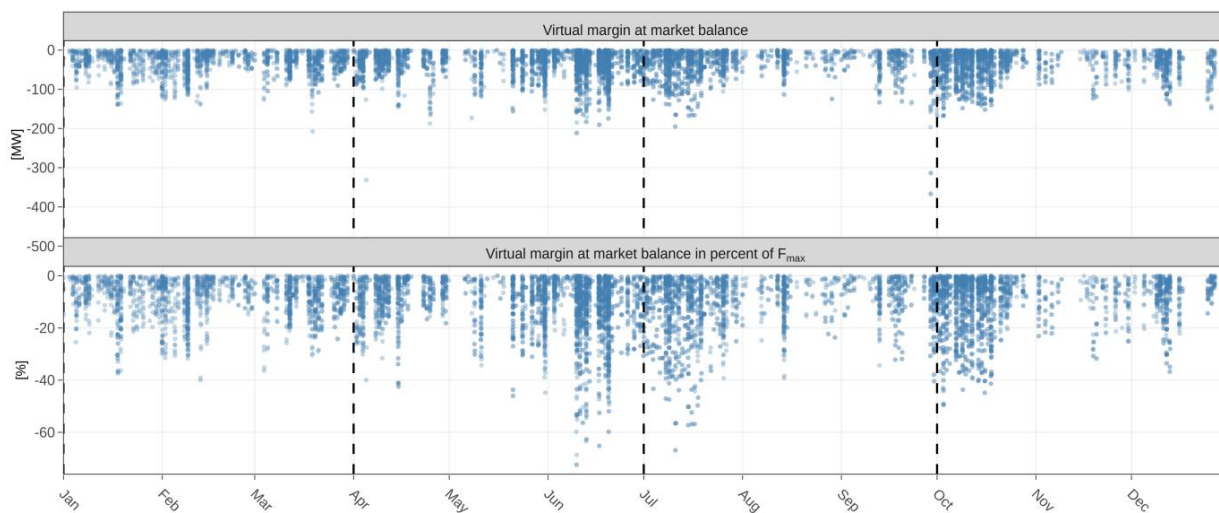


- KPI 5b: Virtual margins at market balance (PL)

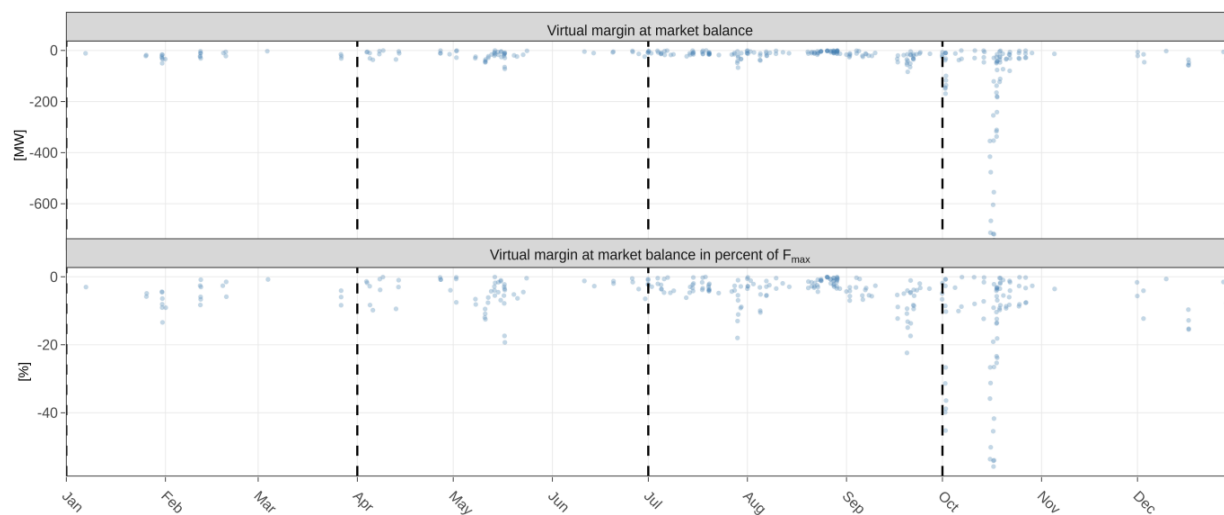




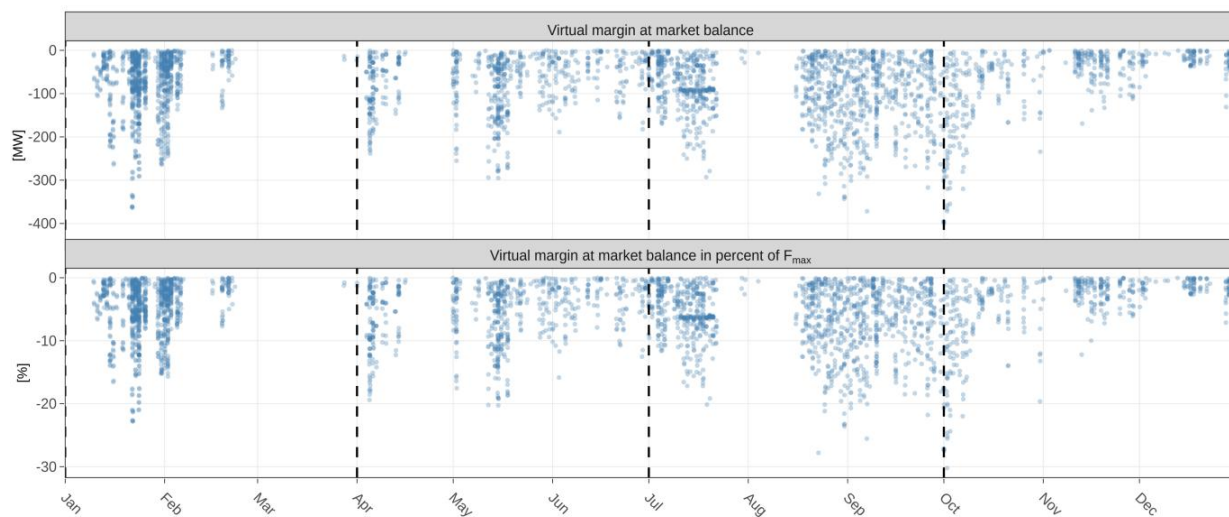
- KPI 5b: Virtual margins at market balance (RO)

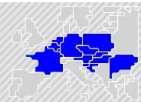


- KPI 5b: Virtual margins at market balance (SI)

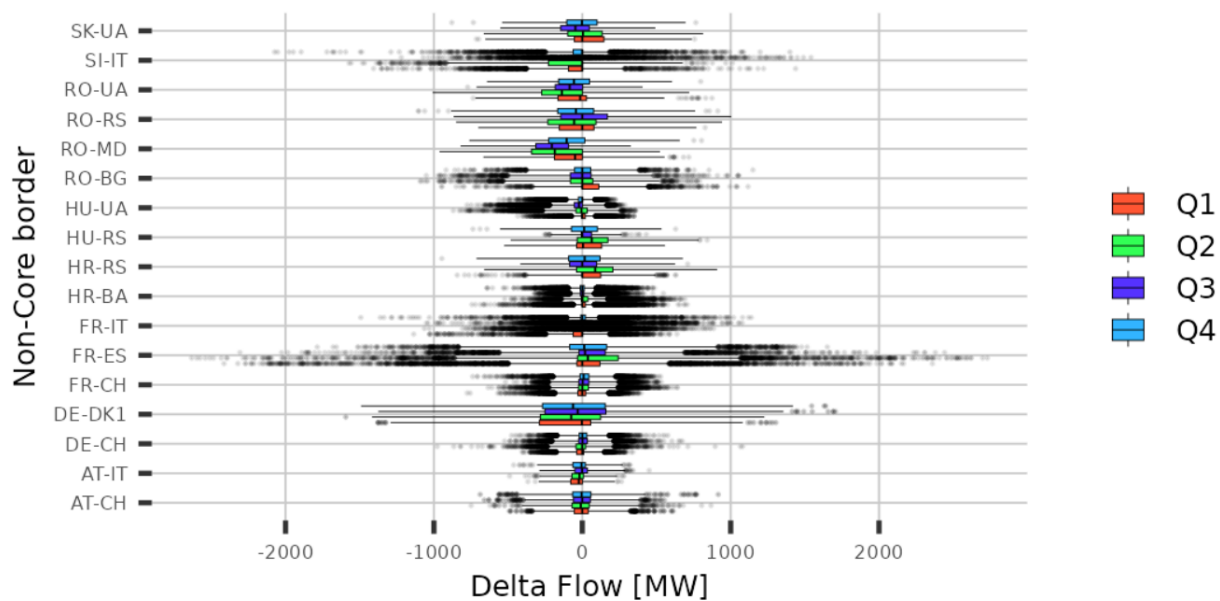


- KPI 5b: Virtual margins at market balance (SK)

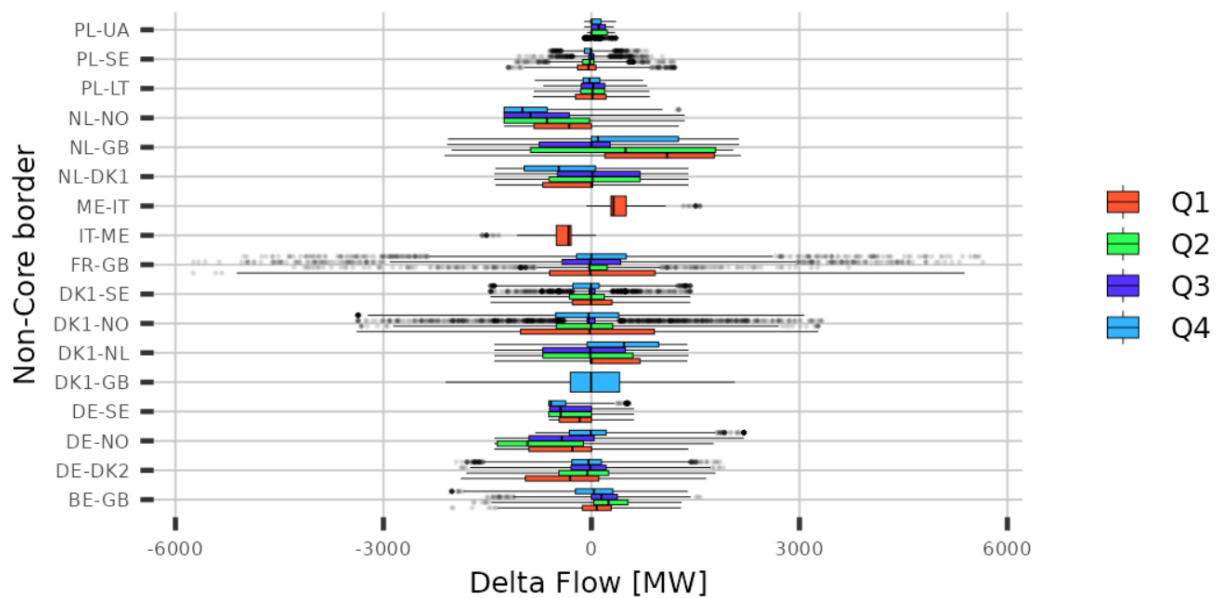


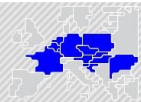


- KPI 6: Non-Core exchanges AC delta flow



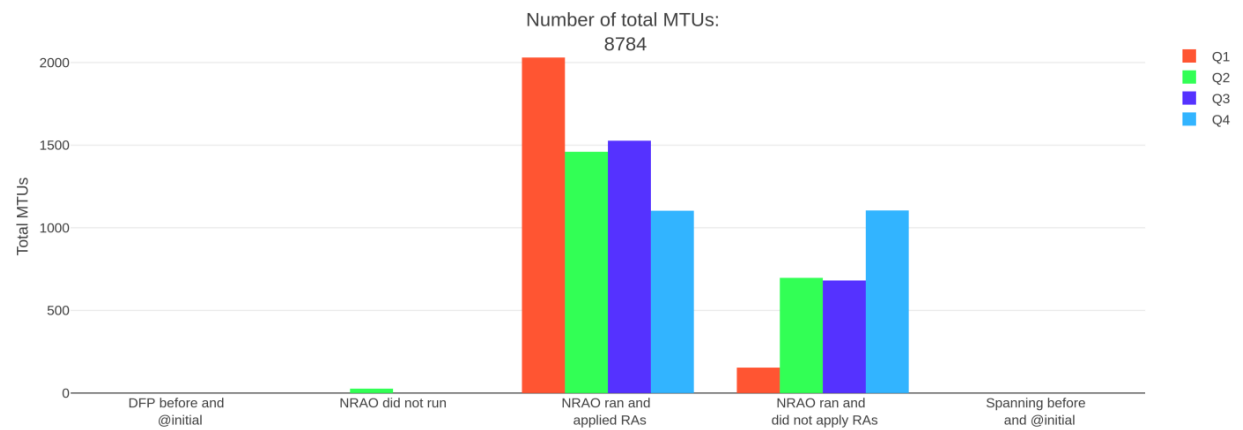
- KPI 6: Non-Core exchanges DC delta flow





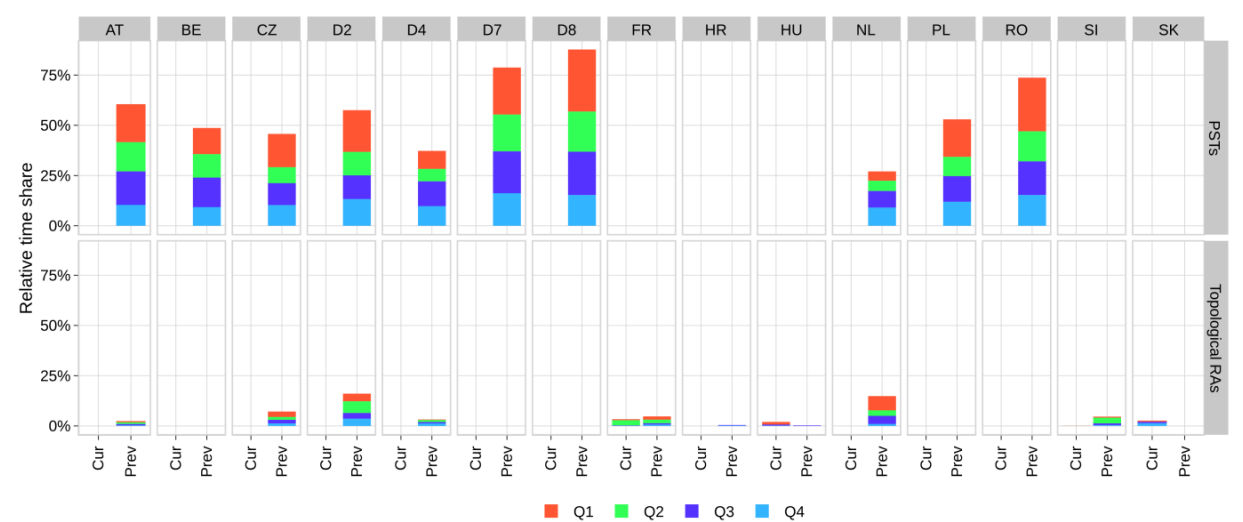
Non-costly Remedial Action Optimization Analysis

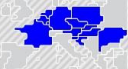
- KPI 7: NRAO – Applied Remedial Action



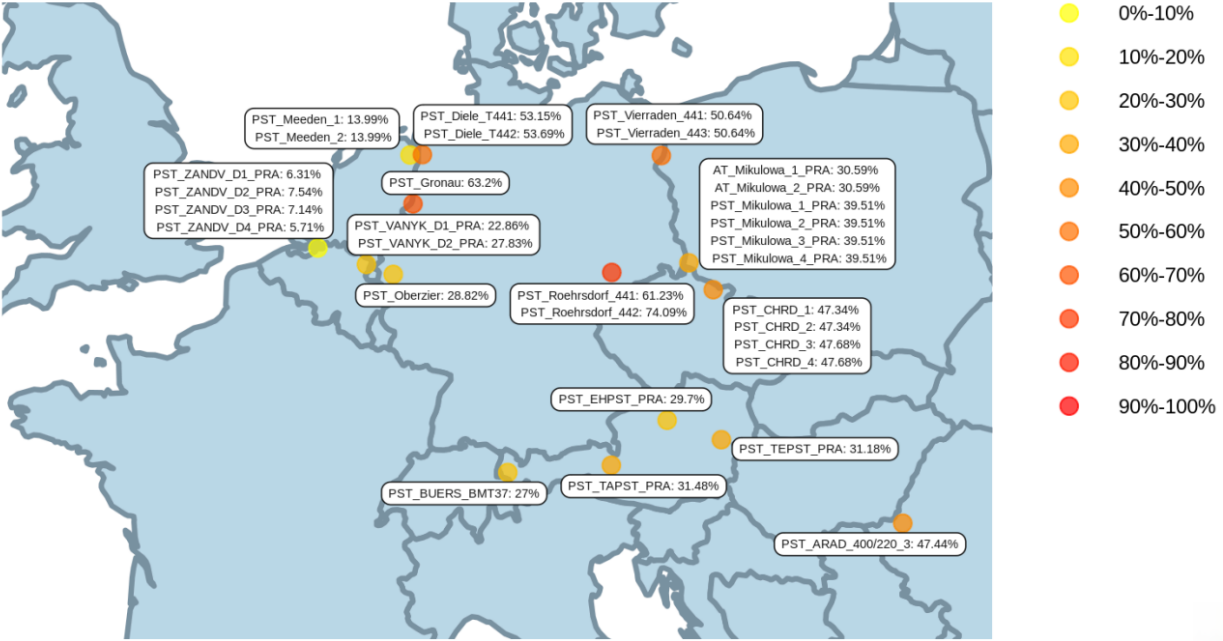
In the following plots, the relative time share relates to the hours labelled ‘NRAO ran and applied RAs’

- KPI 7: Relative time share of applied RAs by TSO, type and mode

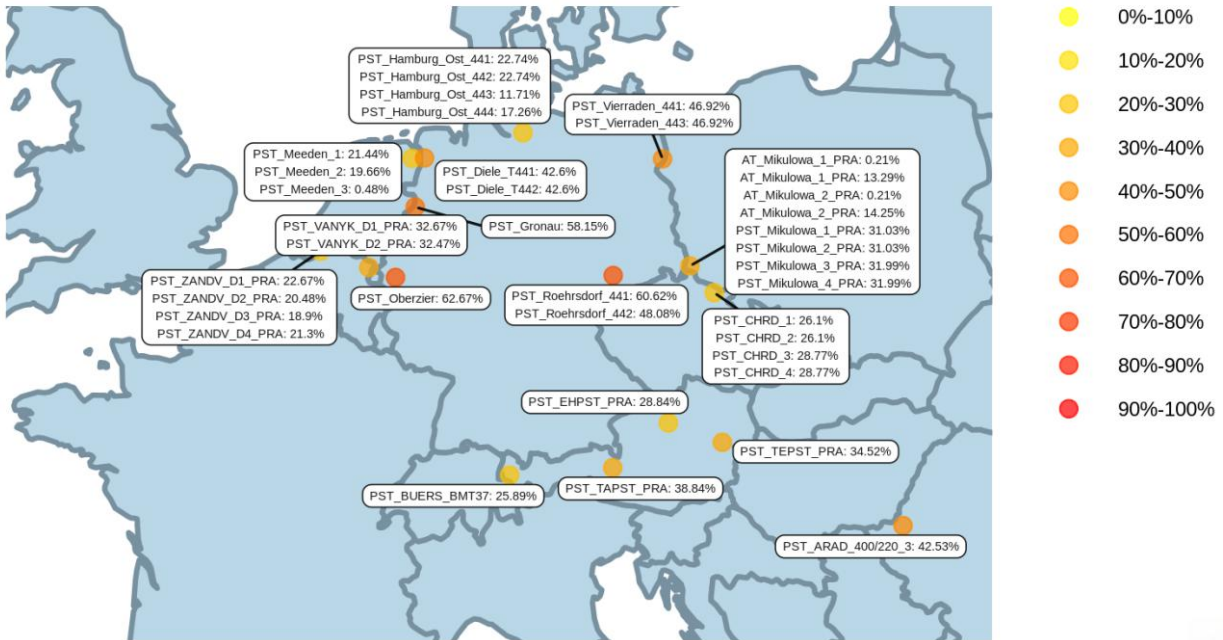


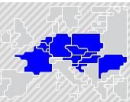


• KPI 7: Relative time share of applied PSTs in preventive mode (Quarter 1)

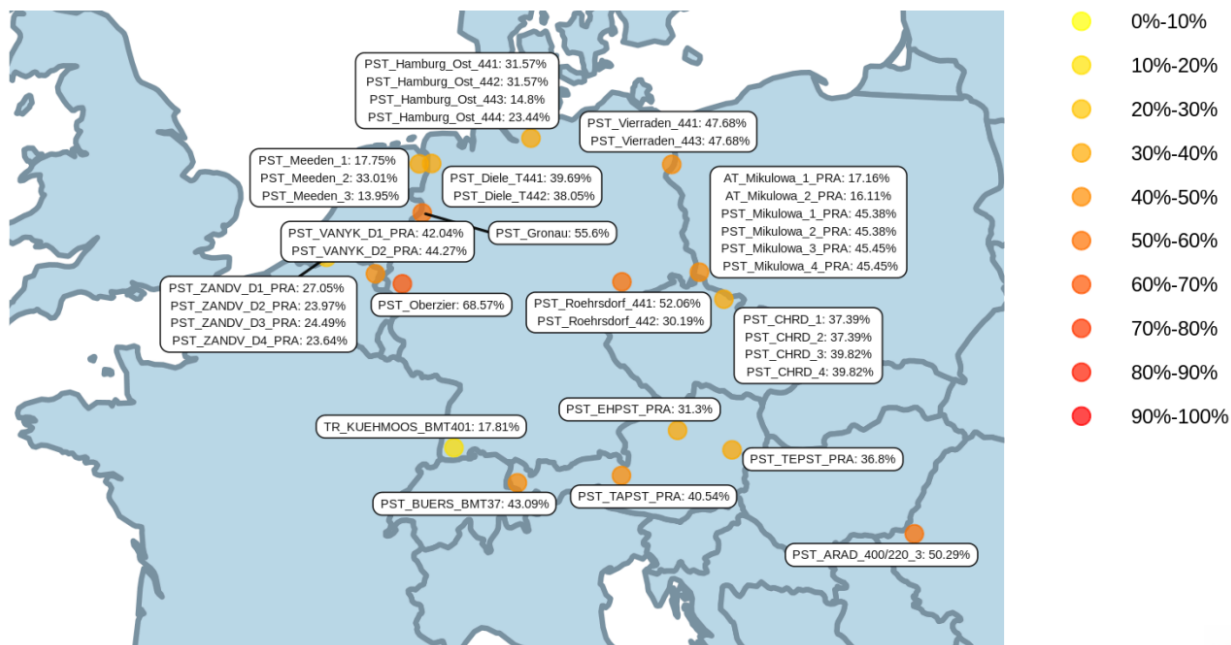


• KPI 7: Relative time share of applied PSTs in preventive mode (Quarter 2)

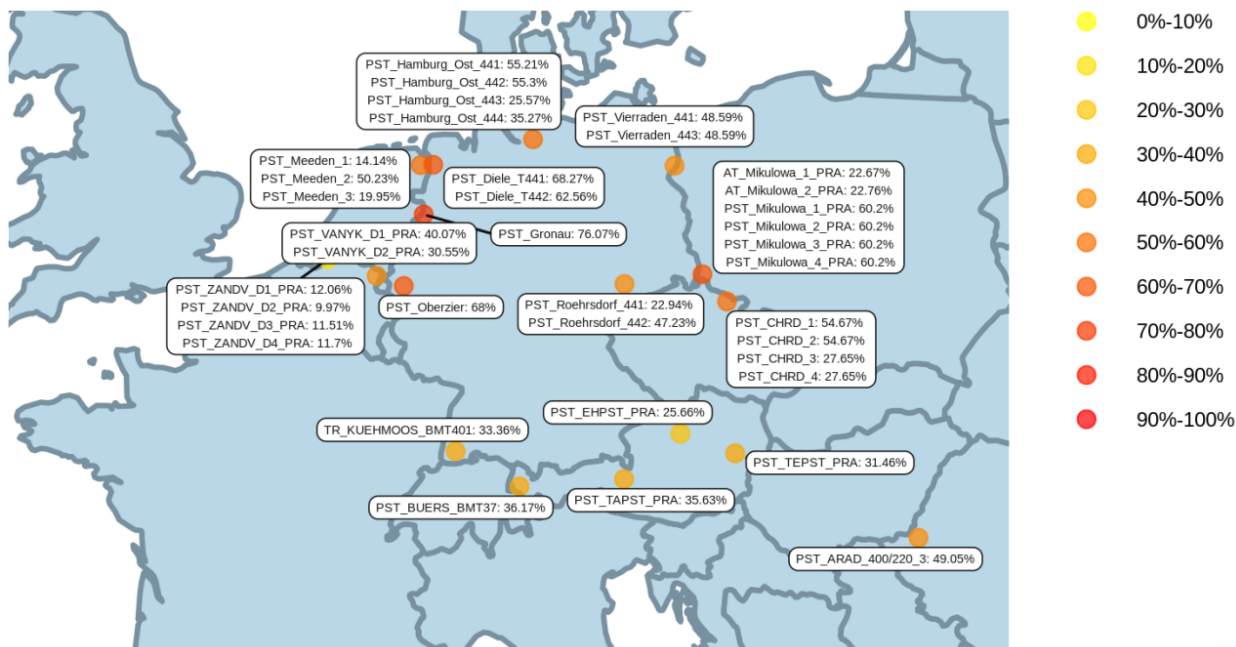


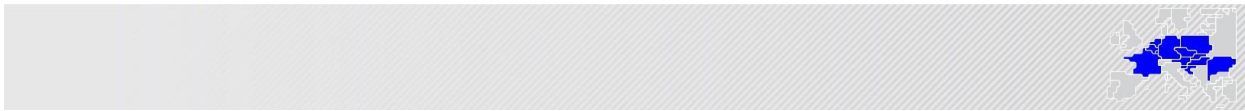


- KPI 7: Relative time share of applied PSTs in preventive mode (Quarter 3)



- KPI 7: Relative time share of applied PSTs in preventive mode (Quarter 4)



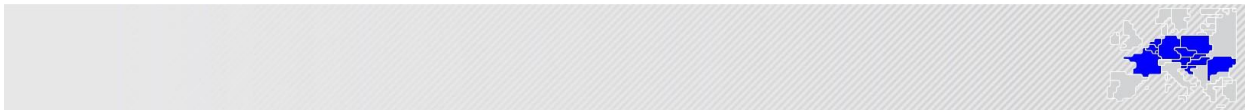


- KPI 7: Relative time share of applied PSTs in curative mode (Quarter 1)



- KPI 7: Relative time share of applied PSTs in curative mode (Quarter 2)



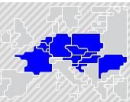


- KPI 7: Relative time share of applied PSTs in curative mode (Quarter 3)

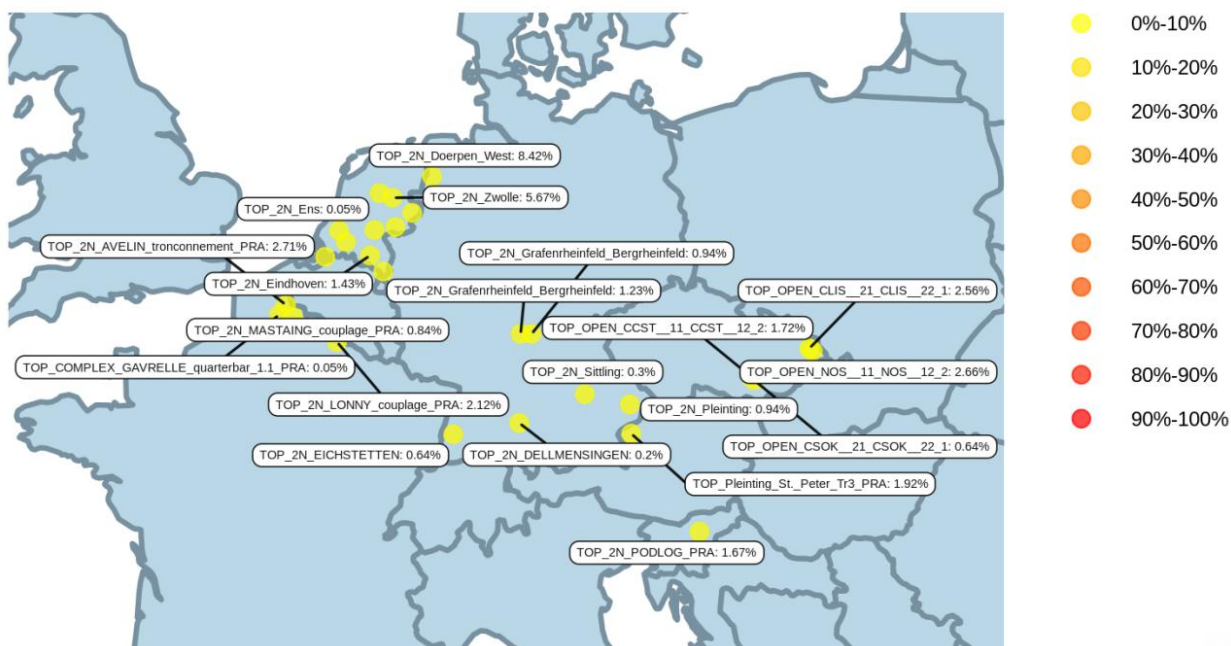


- KPI 7: Relative time share of applied PSTs in curative mode (Quarter 4)

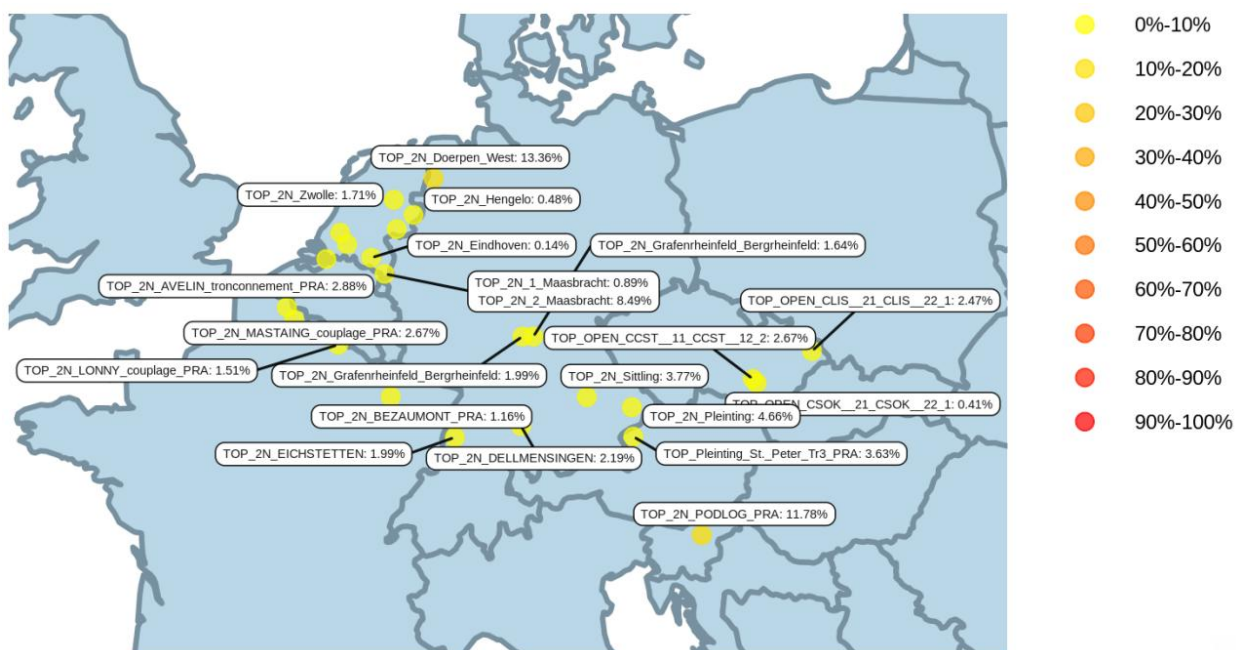


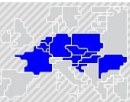


- KPI 7: Relative time share of topological RAs in preventive mode (Quarter 1)

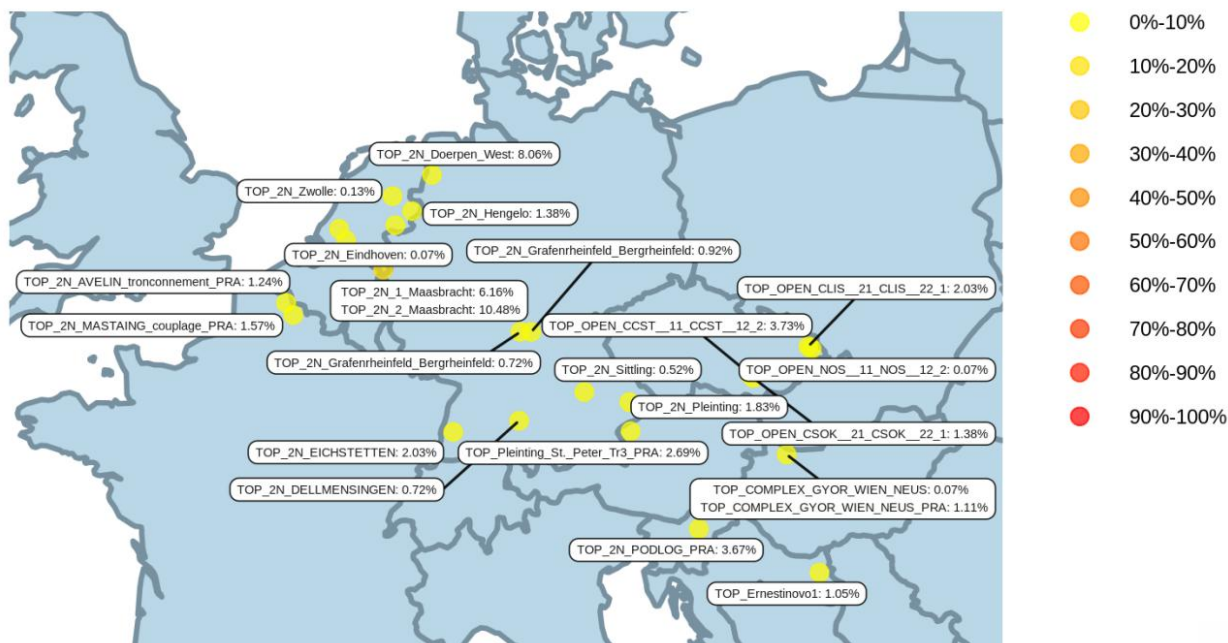


- KPI 7: Relative time share of topological RAs in preventive mode (Quarter 2)



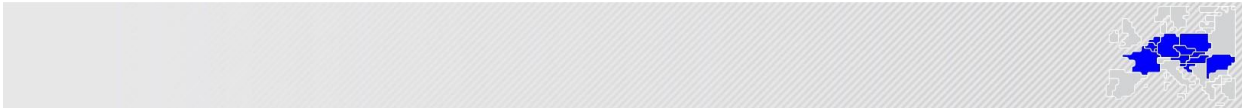


- KPI 7: Relative time share of topological RAs in preventive mode (Quarter 3)

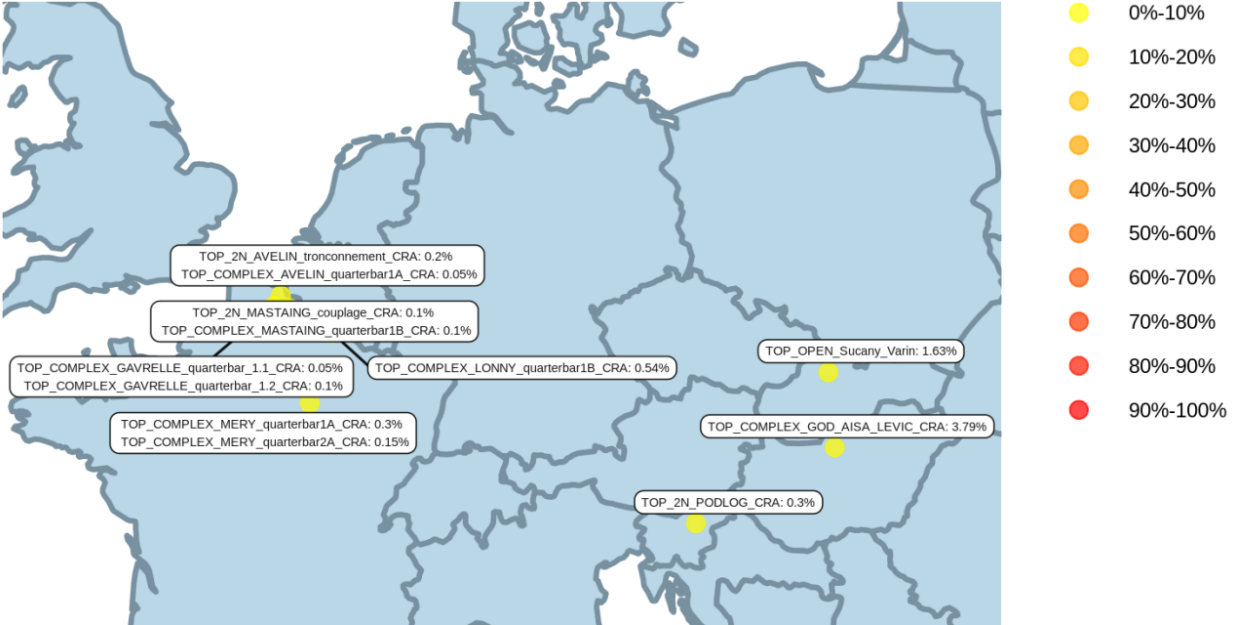


- KPI 7: Relative time share of topological RAs in preventive mode (Quarter 4)

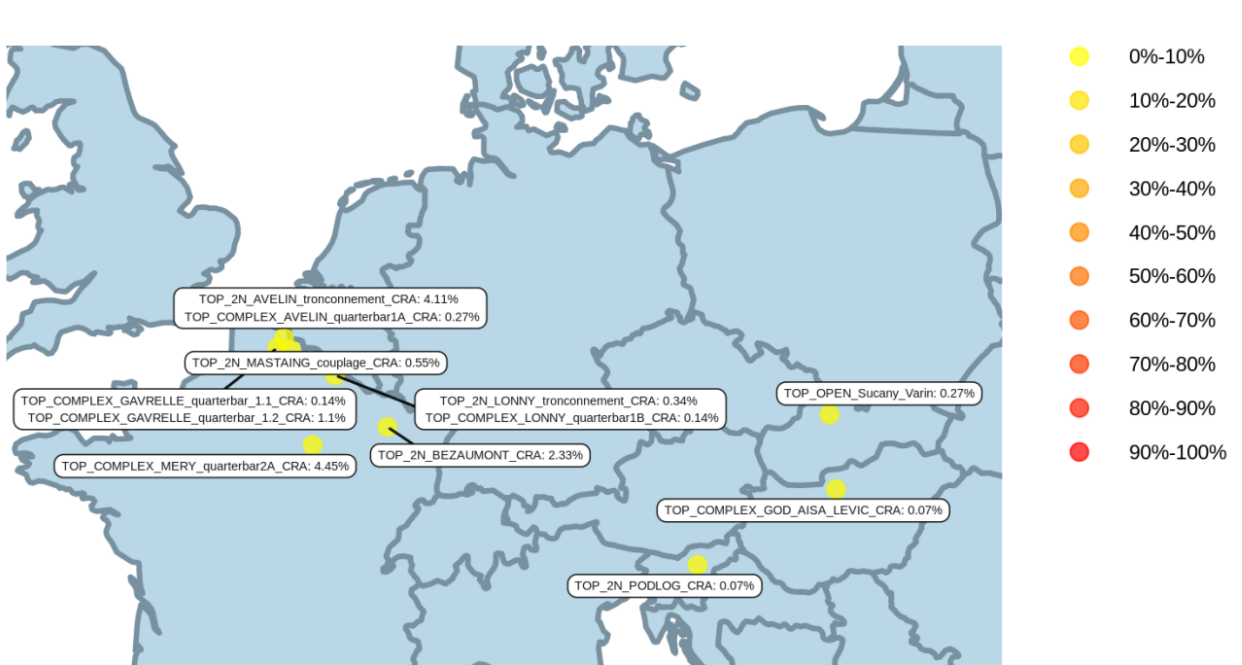


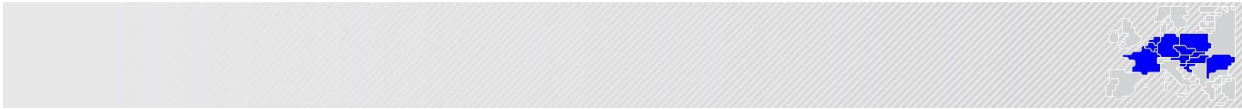


• KPI 7: Relative time share of topological RAs in curative mode (Quarter 1)



• KPI 7: Relative time share of topological RAs in curative mode (Quarter 2)





- KPI 7: Relative time share of topological RAs in curative mode (Quarter 3)

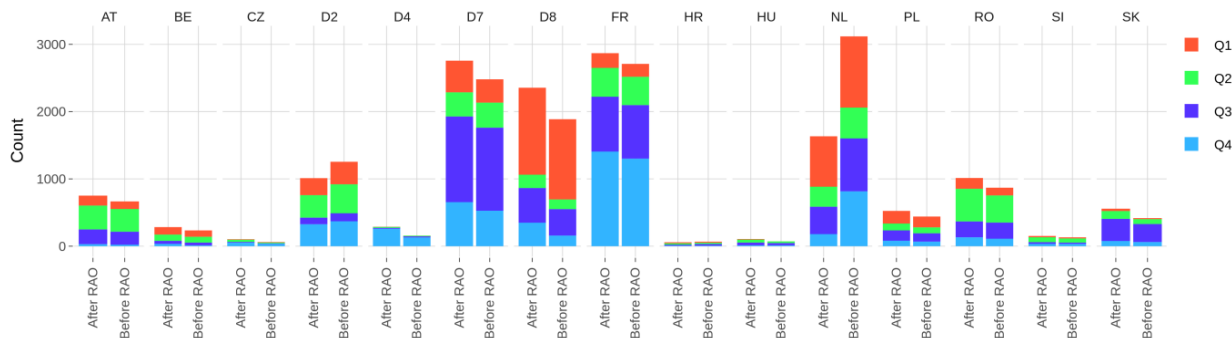


- KPI 7: Relative time share of topological RAs in curative mode (Quarter 4)



- KPI 8: Most limiting CNEC per TSO (NRAO)

The graph below shows the distribution of CNECs which are the most limiting from NRAO perspective, these are the CNECs with lowest relative RAM per MTU



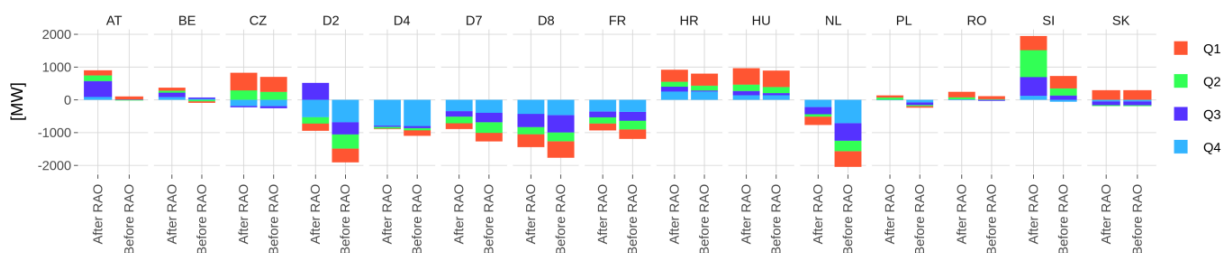
As expected, there is redistributing of the most limiting CNECs. This is because the application of Remedial Actions does not eliminate flows but re-routes, reducing the flows on some limiting CNECs and increasing the load on others, which at the end impacts also the RAM values.

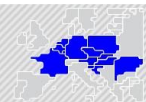
- KPI 9: Average variation of relative RAM before and after NRAO

The graph shows average values of relative RAM before and after NRAO, per TSO on the most limiting CNECs from NRAO perspective. Selected CNECs before RAO are the same as after RAO, and average computed for MTUs when was used further in the process

- Most limiting element from NRAO perspective is the one which has the lowest relative RAM per MTU
- To determine value of relative RAM, the following formula was used

$$RAM_{rel} = \begin{cases} \frac{RAM_{nrao}}{\sum_{(A,B) \in \text{neighbouring Core bidding zones pairs}} |PTDF_{A \rightarrow B, nrao}|}, & \text{if } RAM_{nrao} \geq 0 \\ RAM_{nrao}, & \text{if } RAM_{nrao} < 0 \end{cases}$$





Market Impact Assessment

- KPI 10: Most often pre-solved CNECs (top 20 in quarter 1)

CNE	Distinct hours CNE was presolved	Count of hours CNEC was presolved	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF	Max sum z2zPTDF
[CZ-SK] Sokolnice - Stupava [DIR] [CZ]	2183	2183	79.07%	64.79%	97.84%	0.3239	1.3062
[SK-SK] Gabčíkovo - P.Biskupice [DIR]	2182	2262	80.81%	59.87%	103.54%	0.2724	1.1785
[CZ-SK] Sokolnice - Krizovany [OPP] [CZ]	2180	2180	95.15%	75.90%	110.25%	0.3257	1.3406
[SI-HU] 400 kV Cirkovce - Heviltz [OPP] [SI]	2179	5138	74.91%	47.88%	111.18%	0.2387	1.0605
[RO-RO] TR Rosiori 400/220 1 [DIR]	2175	2200	38.86%	19.00%	81.50%	0.1447	0.2687
[HU-HU] Gonyu - Gyor [DIR]	2170	4004	74.90%	22.96%	117.47%	0.267	1.5221
[SI-HU] 400 kV Cirkovce - Heviltz [DIR] [SI]	2168	4457	105.46%	68.80%	138.50%	0.2387	1.0605
[SK-HU] Gabčíkovo - Gonyu [DIR] [HU]	2158	2162	81.67%	59.09%	110.53%	0.3019	1.0445
[CZ-SK] Liskovec - P. Bystrica [OPP] [CZ]	2156	2156	96.13%	71.08%	128.31%	0.0803	0.2797
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	2155	4224	43.61%	19.80%	118.90%	0.3248	1.4095
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	2143	2161	57.43%	28.07%	92.78%	0.1916	0.4902
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	2142	4022	109.31%	72.73%	155.35%	0.1916	0.4902
[AT-SI] Obersielach - Podlog 247 [OPP] [AT]	2089	3182	90.09%	20.73%	147.06%	0.1883	0.5639
[SK-HU] Levice - God [DIR] [HU]	2080	2550	66.17%	42.14%	80.66%	0.3182	1.1796
[CZ-D8] Hradec - Rohrsdorf 445 [OPP] [D8]	2078	2126	51.36%	20.16%	111.28%	0.3046	1.3356
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	2056	4580	92.42%	48.31%	137.74%	0.3555	0.8332
[CZ-D2] Hradec - Etzenricht 441 [DIR] [D2]	2055	2055	52.35%	35.79%	73.45%	0.2191	0.9329
[HU-HU] Gonyu - Gyor [OPP]	2038	2155	108.36%	66.14%	159.57%	0.2604	1.5221
[SK-SK] V.Dur - Levice 1 [DIR]	2025	2025	46.99%	37.18%	61.66%	0.2467	1.0529
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	2012	3663	55.23%	38.67%	89.54%	0.3351	1.1432

Note 1: The shown z2zPTDF values do not correspond to the maximum zone-to-zone PTDFs according to equation 5 of the Day-ahead CCM and hence are not the ones used for the CNEC Selection. The z2zPTDFs are calculated only between neighbouring BZs. See KPI reading guide on JAO.

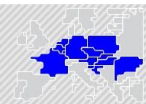
Note 2: RAM for Core exchanges can be higher than 100% due to the relieving effect of Fuaf: $RAM_Core = CEP_target - Fuaf$. So if Fuaf is very negative you can get above 100%.

- KPI 10: Most often pre-solved CNECs (top 20 in quarter 2)

CNE	Distinct hours CNE was presolved	Count of hours CNEC was presolved	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF	Max sum z2zPTDF
[HU-HU] Gonyu - Gyor [DIR]	2151	4446	73.59%	48.30%	109.68%	0.305	1.7725
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	2149	3965	112.99%	76.47%	175.94%	0.2875	0.7046
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	2145	2238	56.72%	15.24%	95.72%	0.2875	0.7046
[SI-HU] 400 kV Cirkovce - Heviltz [OPP] [SI]	2144	4261	79.15%	45.90%	108.84%	0.355	1.1613
[HU-HU] Gonyu - Gyor [OPP]	2144	2867	109.49%	70.40%	173.14%	0.305	1.7725
[SI-HU] 400 kV Cirkovce - Heviltz [DIR] [SI]	2121	4513	100.97%	71.15%	137.24%	0.355	1.1613
[CZ-SK] Liskovec - P. Bystrica [OPP] [CZ]	2114	2114	101.00%	68.73%	149.03%	0.1319	0.4804
[SK-SK] Gabčíkovo - P.Biskupice [DIR]	2099	2099	82.76%	64.87%	106.27%	0.3335	1.1811
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	2087	4032	63.16%	19.70%	145.60%	0.2899	1.3007
[CZ-SK] Sokolnice - Stupava [DIR] [CZ]	2057	2136	74.51%	61.54%	92.71%	0.3556	1.3746
[SK-HU] Gabčíkovo - Gonyu [DIR] [HU]	2046	2448	87.02%	62.12%	129.29%	0.3243	1.1283
[SK-HU] Gabčíkovo - Gonyu [OPP] [HU]	2036	4039	86.80%	60.25%	120.20%	0.3243	1.1283
[AT-D2] St. Peter 2 - Pleinting 258 [DIR] [AT]	2021	3553	60.88%	19.55%	139.48%	0.2097	0.8166
[CZ-SK] Liskovec - P. Bystrica [DIR] [CZ]	2007	2042	79.43%	50.58%	114.67%	0.1319	0.4804
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	1989	4108	69.77%	19.79%	170.80%	0.2547	0.8066
[SK-SK] V.Dur - Levice 1 [DIR]	1986	1986	45.98%	27.84%	68.45%	0.2338	0.9899
[RO-RO] TR Rosiori 400/220 1 [DIR]	1975	2051	48.59%	18.50%	88.00%	0.1815	0.388
[PL-CZ] Kopanina - Liskovec [DIR] [PL]	1959	2832	73.64%	41.56%	114.43%	0.1457	0.5183
[PL-CZ] Kopanina - Liskovec [OPP] [PL]	1932	2674	102.58%	55.26%	139.71%	0.1457	0.5183
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	1920	2854	57.51%	39.10%	88.70%	0.4302	1.5089

Note 1: The shown z2zPTDF values do not correspond to the maximum zone-to-zone PTDFs according to equation 5 of the Day-ahead CCM and hence are not the ones used for the CNEC Selection. The z2zPTDFs are calculated only between neighbouring BZs. See KPI reading guide on JAO.

Note 2: RAM for Core exchanges can be higher than 100% due to the relieving effect of Fuaf: $RAM_Core = CEP_target - Fuaf$. So if Fuaf is very negative you can get above 100%.



- KPI 10: Most often pre-solved CNECs (top 20 in quarter 3)

CNE	Distinct hours CNE was presolved	Count of hours CNEC was presolved	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF	Max sum z2zPTDF
[HU-HU] Gonyu - Gyor [DIR]	2207	4428	71.68%	52.89%	106.93%	0.347	1.6282
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	2195	2407	50.44%	0.00%	93.05%	0.2182	0.5396
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	2175	4007	120.56%	80.48%	215.78%	0.2182	0.5396
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	2161	2227	61.15%	10.51%	99.88%	0.3714	1.2857
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	2152	6007	67.91%	21.10%	146.56%	0.2471	0.7332
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	2134	2156	60.65%	23.90%	104.04%	0.2662	1.0272
[AT-SI] Obersielach - Podlog 247 [OPP] [AT]	2108	4494	103.87%	32.51%	212.26%	0.2471	0.7332
[SK-HU] Gabcikovo - Gonyu [OPP] [HU]	2095	3746	85.51%	62.84%	116.09%	0.3618	1.2613
[FR-D7] Vigy - Ensndorf VIGY2 S [DIR] [D7]	2078	2080	42.22%	19.85%	111.57%	0.2428	0.6702
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	2073	4669	73.42%	19.80%	171.70%	0.2984	1.3047
[RO-RO] TR Rosiori 400/220 1 [DIR]	2006	2008	40.85%	18.50%	100.75%	0.1564	0.2815
[SK-SK] Gabcikovo - P.Biskupice [DIR]	2000	2046	83.11%	67.59%	103.67%	0.3523	1.4184
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	1981	2587	61.06%	37.74%	102.84%	0.3481	1.2599
[BE-BE] Lixhe - Gramme 380.11 [OPP]	1966	2300	61.68%	47.50%	92.82%	0.2286	0.5341
[HR-HU] 400kV Ernestinovo - Pecs 1 [OPP] [HR]	1909	1909	66.95%	39.10%	93.31%	0.3009	0.975
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	1908	1908	63.13%	28.54%	91.88%	0.33	1.4214
[SK-HU] Gabcikovo - Gonyu [DIR] [HU]	1890	2317	88.71%	63.85%	123.02%	0.3618	1.2613
[CZ-D2] Prestice - Etzenricht 442 [DIR] [D2]	1847	3209	76.74%	35.37%	109.24%	0.2506	1.1365
[AT-D2] St. Peter 2 - Pleinting 258 [DIR] [AT]	1833	3000	84.14%	19.85%	166.36%	0.1803	0.6668
[CZ-SK] Liskovec - P. Bystica [OPP] [CZ]	1819	1820	99.95%	74.13%	144.79%	0.0921	0.334

Note 1: The shown z2zPTDF values do not correspond to the maximum zone-to-zone PTDFs according to equation 5 of the Day-ahead CCM and hence are not the ones used for the CNEC Selection. The z2zPTDFs are calculated only between neighbouring BZs. See KPI reading guide on JAO.

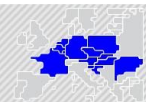
Note 2: RAM for Core exchanges can be higher than 100% due to the relieving effect of Fuaf: $RAM_Core = CEP_target - Fuaf$. So if Fuaf is very negative you can get above 100%.

- KPI 10: Most often pre-solved CNECs (top 20 in quarter 4)

CNE	Distinct hours CNE was presolved	Count of hours CNEC was presolved	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF	Max sum z2zPTDF
[CZ-SK] Nosovice - Varin [OPP] [CZ]	2209	2995	102.48%	72.48%	129.22%	0.339	1.3313
[HU-HU] Gonyu - Gyor [DIR]	2209	4530	72.46%	25.32%	108.87%	0.3028	1.5599
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	2208	2340	42.73%	0.00%	78.61%	0.2902	0.7156
[SI-HU] 400 kV Cirkovce - Hevitz [OPP] [SI]	2199	4386	83.97%	45.27%	112.98%	0.255	1.1143
[SI-HU] 400 kV Cirkovce - Hevitz [DIR] [SI]	2193	4376	96.04%	68.26%	134.72%	0.255	1.1143
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	2158	4058	128.09%	93.05%	202.14%	0.2902	0.7156
[CZ-SK] Nosovice - Varin [DIR] [CZ]	2145	3937	76.33%	51.17%	102.89%	0.339	1.3313
[HU-HU] Gonyu - Gyor [OPP]	2142	2494	112.11%	67.39%	177.20%	0.2886	1.5599
[AT-HU] Zumdorf - Gyoer 439B [DIR] [AT]	2137	5874	86.87%	18.98%	116.74%	0.4134	1.7036
[FR-D7] Vigy - Ensndorf VIGY2 S [DIR] [D7]	2129	2205	39.34%	19.90%	109.93%	0.2435	0.5979
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	2122	4883	54.02%	38.10%	86.94%	0.3697	1.2801
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	2108	2169	75.59%	29.96%	104.14%	0.2694	0.9191
[CZ-SK] Nosovice - Varin [OPP] [SK]	2106	4014	101.29%	72.73%	128.52%	0.3773	1.4363
[SK-SK] V.Dur - Levicoe 1 [DIR]	2105	2105	47.00%	19.59%	63.51%	0.3205	1.2169
[SI-HU] Cirkovce - Hevitz [OPP] [HU]	2095	2095	83.05%	42.93%	109.52%	0.2606	1.2018
[SK-SK] Gabcikovo - P.Biskupice [DIR]	2093	2166	82.98%	70.70%	104.49%	0.2949	1.0911
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	2090	2343	85.46%	19.85%	151.92%	0.1996	0.7654
[NL-NL] MEE DRT2 [DIR] [NL]	2089	2089	48.12%	19.96%	161.12%	0.3198	0.6983
[AT-SI] Obersielach - Podlog 247 [OPP] [AT]	2068	2885	97.07%	31.41%	209.75%	0.1833	0.5728
[HR-HU] 400kV Ernestinovo - Pecs 1 [OPP] [HR]	2064	2064	74.74%	48.20%	98.12%	0.3345	0.9304

Note 1: The shown z2zPTDF values do not correspond to the maximum zone-to-zone PTDFs according to equation 5 of the Day-ahead CCM and hence are not the ones used for the CNEC Selection. The z2zPTDFs are calculated only between neighbouring BZs. See KPI reading guide on JAO.

Note 2: RAM for Core exchanges can be higher than 100% due to the relieving effect of Fuaf: $RAM_Core = CEP_target - Fuaf$. So if Fuaf is very negative you can get above 100%.



- KPI 11: Most limiting CNECs (top 20 in quarter 1)

CNE	Distinct hours CNE has shadow price	Count of hours CNECs have shadow price	Max shadow price [€/MW]	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF
[FR-D7] Vigy - Ensford VIGY2 S [DIR] [D7]	425	425	287.32	39.65%	19.90%	71.82%	0.2231
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	396	396	517.97	25.94%	19.94%	92.12%	0.2933
[RO-RO] TR Rosiori 400/220 1 [DIR]	348	348	971.54	28.56%	19.00%	70.00%	0.1447
[D7-FR] Ensford - Vigy VIGY1 N [OPP] [FR]	315	319	359.85	33.72%	0.00%	72.13%	0.237
[CZ-D8] Hradec - Rohrsdorf 445 [OPP] [D8]	282	282	345.24	45.44%	20.16%	64.83%	0.3022
[D8-D8] Neuenhagen - Vierraden 304 [DIR] [D8]	267	267	807	45.38%	19.90%	68.11%	0.1071
[D8-PL] Mikulowa PST1 [OPP] [PL]	265	265	240.22	48.34%	37.12%	68.18%	0.3393
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	141	142	163.81	84.42%	54.39%	107.92%	0.353
[NL-BE] Rilland-Zandvliet 380 G [DIR] [NL]	134	134	184.57	61.49%	40.08%	100.09%	0.567
[D8-PL] Mikulowa PST1 [DIR] [PL]	132	132	171.63	52.01%	43.03%	70.87%	0.4393
[SK-HU] Levice - God [DIR] [HU]	123	123	415.92	59.58%	42.14%	73.74%	0.2684
[NL-NL] Krimpen a/d IJssel-Geertruidenberg 380 W [DIR]	115	115	467.16	32.93%	19.95%	74.98%	0.4601
[RO-RO] Resita - Timisoara c1 [DIR]	111	111	877.38	31.03%	20.05%	56.68%	0.147
[D8-D8] Pasewalk - Vierraden 306 [DIR]	109	109	785.1	42.94%	29.26%	63.31%	0.1111
[NL-D2] Meeden-Diele 380 W [OPP] [NL]	70	70	298.41	24.37%	19.94%	54.80%	0.2711
[NL-D2] Meeden-Diele 380 Z [DIR] [NL]	69	69	175.58	52.36%	19.94%	105.98%	0.236
[SK-SK] V.Dur - Levice 1 [DIR]	66	66	454.84	43.02%	37.64%	61.61%	0.2036
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	53	53	313.86	47.97%	34.12%	67.33%	0.3456
[D2-D2] Altheim - Sittling 219 [OPP]	45	45	498.93	75.93%	37.30%	95.36%	0.0708
[SI-AT] 220 kV Podlog - Obersielach [OPP] [SI]	45	45	139.72	77.76%	60.16%	130.21%	0.1524

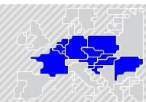
Note 1: The RAM values (expressed as % of Fmax) should not be interpreted as "the capacities offered by the Core TSOs to the market coupling". Indeed, since the introduction of Ext LTA inclusion Euphemie performs an optimization where it takes a portion of the FB domain and a portion of the LTA domain to maximize welfare. The RAM value shown in this KPI report correspond to the "portion of the FB domain" resulting from this optimization

Example:

- RAM = 500MW
- Portion of FB Domain = 40%
- RAM offered by Core TSOs = 500 MWh/0.4 = 1250MW

- KPI 11: Most limiting CNECs (top 20 in quarter 2)

CNE	Distinct hours CNE has shadow price	Count of hours CNECs have shadow price	Max shadow price [€/MW]	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	680	686	1432.29	57.50%	19.79%	114.55%	0.2547
[D7-FR] Ensford - Vigy VIGY1 N [OPP] [FR]	579	618	450.4	22.08%	9.24%	69.11%	0.2198
[FR-FR] Creys - Saint-Vulbas 2 [OPP]	313	313	1032.69	24.73%	19.99%	43.02%	0.143
[FR-D7] Vigy - Ensford VIGY2 S [DIR] [D7]	309	410	795.34	43.23%	19.96%	71.97%	0.2516
[SK-SK] V.Dur - Levice 1 [DIR]	217	217	1560.98	39.41%	27.84%	50.24%	0.214
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	215	215	262.56	82.99%	52.40%	104.81%	0.3487
[RO-RO] TR Rosiori 400/220 1 [DIR]	198	198	936.76	39.72%	20.00%	77.75%	0.1361
[D8-PL] Mikulowa PST1 [DIR] [PL]	191	191	489.3	53.05%	27.55%	72.18%	0.4886
[FR-D7] Vigy - Ensford VIGY1 N [DIR] [D7]	189	205	701.99	43.43%	19.96%	73.67%	0.2261
[FR-FR] Frasnies - Genissiat [OPP]	161	161	1879.82	35.06%	20.02%	58.79%	0.0925
[D8-D8] Vierraden - Vierraden PST441 [DIR]	150	150	632.3	48.87%	37.81%	68.61%	0.4092
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	138	138	854.97	28.93%	19.94%	63.34%	0.2442
L 400kV NO 2 CREYS-ST-VULBAS-OUEST	127	127	808.55	25.21%	20.02%	38.02%	0.1238
[NL-NL] Krimpen a/d IJssel-Geertruidenberg 380 W [DIR]	107	107	130.19	72.07%	22.63%	113.02%	0.5811
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	106	106	207.95	51.19%	40.87%	71.86%	0.4061
[HU-HU] Szolnok - Szeged [DIR]	101	101	1789.32	44.22%	15.85%	90.85%	0.1147
[BE-FR] Avelgem - Avelin 80 [OPP] [FR]	100	100	257.79	66.67%	51.66%	89.12%	0.4764
[AT-D2] St. Peter 2 - Pleinting 258 [DIR] [AT]	96	99	425.97	42.33%	19.74%	101.10%	0.1619
[FR-FR] Avelin - Mastaling 1 [DIR]	87	87	421.18	76.48%	42.14%	100.16%	0.2855
[CZ-D8] Hradec - Rohrsdorf 445 [OPP] [D8]	81	81	191.35	47.09%	24.68%	67.01%	0.3655



- KPI 11: Most limiting CNECs (top 20 in quarter 3)

CNE	Distinct hours CNE has shadow price	Count of hours CNECs have shadow price	Max shadow price [€/MW]	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF
[FR-D7] Vigy - Enseldorf VIGY2 S [DIR] [D7]	1341	1341	2147.85	35.71%	19.85%	89.81%	0.2428
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	529	538	5535.11	56.26%	21.37%	119.83%	0.247
[SK-SK] V.Dur - Levice 1 [DIR]	475	475	4757.99	35.79%	15.81%	50.65%	0.1994
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	287	287	645.76	48.54%	23.90%	80.79%	0.2662
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	263	264	2012.83	43.70%	20.00%	87.04%	0.1584
[RO-RO] TR Rosiori 400/220 1 [DIR]	256	256	4938.81	37.66%	19.00%	80.00%	0.1526
[D8-PL] Mikulowa PST1 [DIR] [PL]	200	200	831.71	49.96%	19.02%	67.29%	0.4271
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	188	190	758.89	57.44%	26.86%	85.80%	0.347
[D8-D8] Vierraden - Vierraden PST441 [DIR]	145	145	833.01	43.19%	30.88%	62.99%	0.3061
[FR-FR] Creys - Saint-Vulbas 2 [OPP]	140	140	749.58	33.92%	19.99%	52.52%	0.1444
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	138	138	228.76	31.99%	19.94%	77.68%	0.2922
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	130	134	292.59	85.53%	39.96%	116.95%	0.3101
[CZ-SK] Nosovice - Varin [DIR] [CZ]	114	114	334.17	70.29%	54.95%	90.86%	0.3865
[D2-D2] Altheim - Simbach 234/230 [DIR]	113	113	1042.33	53.73%	23.74%	77.40%	0.1122
[D2-D2] Altheim - Simbach 233/230 [DIR]	92	92	3228.4	49.17%	20.11%	84.51%	0.096
[AT-AT] Neusiedl - Wien Suedost 246A [OPP]	87	87	15434.44	58.34%	40.71%	76.60%	0.0791
[D7-D7] Y-Oberzier (-Paffendorf - Sechtem) SECHTM N [OPP]	82	82	178.85	50.41%	23.53%	74.38%	0.6402
[NL-NL] MEE DRT2 [DIR] [NL]	68	68	253.48	35.28%	19.96%	83.37%	0.2612
[D7-D7] Gronau - Gronau TR 441 E [DIR]	65	65	220.01	55.72%	35.00%	98.00%	0.3041
[AT-AT] Tauern - Weissenbach 221 [DIR]	64	64	2103.04	46.75%	20.13%	77.99%	0.1054

- KPI 11: Most limiting CNECs (top 20 in quarter 4)

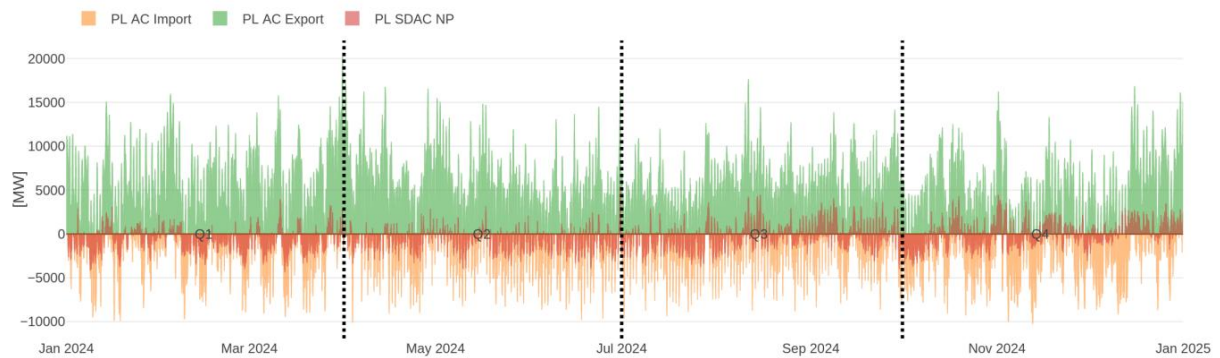
CNE	Distinct hours CNE has shadow price	Count of hours CNECs have shadow price	Max shadow price [€/MW]	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF
[FR-D7] Vigy - Enseldorf VIGY2 S [DIR] [D7]	616	619	1512.78	30.43%	19.90%	77.44%	0.2362
[NL-NL] MEE DRT2 [DIR] [NL]	433	433	495.02	24.26%	19.96%	74.71%	0.3072
[D8-D8] Roehrsdorf - Roehrsdorf PST442 [DIR]	428	428	797.66	40.78%	19.93%	62.70%	0.2751
[CZ-SK] Nosovice - Varin [DIR] [CZ]	379	382	545.56	70.08%	52.81%	88.31%	0.3366
[FR-FR] Creys - Saint-Vulbas 2 [OPP]	322	322	720.41	25.32%	19.98%	44.95%	0.1505
[D8-PL] Mikulowa PST1 [DIR] [PL]	302	302	706	47.30%	35.15%	74.70%	0.3791
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	253	254	442.38	48.88%	39.54%	64.21%	0.335
[FR-FR] Creys - Genissiat 1 [DIR]	180	180	467.34	27.27%	19.98%	44.44%	0.1795
[SK-SK] V.Dur - Levice 1 [DIR]	176	176	2429.63	44.37%	19.59%	55.03%	0.3159
[SK-HU] Levice - God [DIR] [HU]	162	162	451.92	58.65%	47.04%	71.57%	0.3196
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	154	154	1759.85	77.47%	20.13%	143.94%	0.185
[CZ-SK] Nosovice - Varin [DIR] [SK]	145	145	643.49	62.63%	49.49%	83.12%	0.3952
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	132	134	205.61	93.74%	71.42%	123.45%	0.2824
[D8-D8] Vierraden - Vierraden PST441 [DIR]	131	131	499.91	42.84%	29.15%	66.67%	0.2868
[CZ-D8] Hradec - Rohrsdorf 446 [OPP] [D8]	123	123	371.91	39.35%	19.93%	57.16%	0.3409
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	119	119	762.7	61.29%	29.96%	83.00%	0.2338
[NL-NL] Krimpen a/d IJssel-Geertruidenberg 380 W [DIR]	112	112	563.27	45.38%	27.58%	96.59%	0.4503
[RO-RO] PST Arad 400/220 3 [DIR]	81	81	3494.61	59.58%	22.25%	90.75%	0.2063
[NL-D7] Maasbracht - Oberzier SELFK WS [DIR] [D7]	59	59	49.82	43.90%	27.60%	83.23%	0.2685
[D2-NL] Diele - Meeden SCHWARZ [OPP] [D2]	55	55	522.01	61.89%	43.30%	87.64%	0.3484



- KPI 12: Allocation constraints (Poland)

	# MTUs
AC was limiting MC	3205
AC < 0 MW	1046
AC = 0 MW	2028
AC > 0 MW	131

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1776.97	4618.41
Min.	-10213.00	0.00
Max.	0.00	20354.00



Annex 1: Effectiveness of Allocation Constraints and Alternative Solutions to address the underlying operational security limits

Introduction

According to Article 7(3)(b)(i) and (ii) of the DA CCM, as well as the agreement with Core NRAs in Core IG call 20200415, the Core TSOs that use external or allocation constraints need to provide to the CCC as an annex in the annual report the following information:

Expected inputs to be provided by concerned Core TSOs	Condition on which input is expected from concerned Core TSOs
Effectiveness of the allocation constraint in preventing the violation of the underlying operational security limits	Concerned Core TSO uses external- or allocation constraints
Alternative solutions to address the underlying operational security limits	External- or allocation constraint of concerned Core TSO had a non-zero shadow price in more than 0.1% of hours in any of the quarters of the analysed year

This annex contains the required information described above for each concerned Core TSO for which the respective conditions for input provision for the analysed year are met.

PSE

Effectiveness of allocation constraint

PSE may use an external constraint to limit the import and export of the Polish bidding zone.

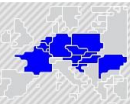
Technical and legal justification

Capacity allocation constraints are a legally prescribed means, defined by Capacity Allocation and Congestion Management Regulation (Art. 23(3) and art. 21(1)(a)(ii) CACM).

These constraints limit the global net position of Polish zone and reflect the ability of Polish generators to increase generation (potential constraints in export direction) or decrease generation (potential constraints in import direction) subject to technical characteristics of individual generating units as well as the necessity to maintain minimum generation reserves required in the Polish power system to ensure secure operation.

Rationale behind implementation of allocation constraints on PSE side

Implementation of allocation constraints as applied by PSE is related to the fact that under the conditions of the integrated scheduling-based market model applied in Poland (also called central dispatching model) the responsibility of the Polish TSO on system balance is significantly extended comparing to such responsibility of TSOs in so-called self-dispatch market models. Central dispatching is one of the two dispatching models authorized by EU Commission Regulation 2017/2195. In self-dispatch markets,

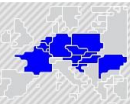


balance responsible parties (BRPs) are themselves supposed to take care about their generating reserves and load following, while TSO ensures them just for dealing with contingencies in the timeframe of up to one hour ahead. In a central dispatching model, it is the TSO who dispatches generating units taking into account their: operational constraints, transmission constraints and reserve capacity requirements, with the aim to balance national generation, demand and cross-border exchanges while ensuring secure operation of the transmission system. When TSO is preparing generation dispatch plans for the operational day, energy and reserves in the central dispatching model are ensured simultaneously (inherent feature of central dispatching systems with accordance to EU Commission Regulation 2017/2195). Results of the wholesale market together with the results of the balancing capacity reserves market serve as a basis for the generation dispatch performed under integrated scheduling process.

In central dispatching systems, the above process is realised within an Integrated Scheduling Process (ISP) run as a single optimisation problem called security constrained unit commitment (SCUC – where generation units are being dispatch on and off) and economic dispatch (SCED – where generation output for all dispatched generation units is determined). Integrated Scheduling Process starts in the late afternoon of D-1, already well after the day-ahead capacity calculation and SDAC, and continues iteratively by recalculating the future dispatch plans for each particular hour of day D until its real-time execution (new recalculation at least every hour). Within aforementioned integrated scheduling process, generation units connected to the transmission grid are dispatched by PSE with the aim to respect power purchase agreements concluded between market participants on the wholesale market, while minimizing overall costs of dispatch adjustments and balancing energy activation to cover the residual demand (being the part of end users demand not covered by commercial contracts). When doing so, PSE is obliged to respect power system operating conditions, as well as the technical characteristics of generation units both on the level of individual generation units and on the level of power plants. Unit capabilities, considering their inter-temporal limitations (ramping rates), are also considered in this process.

According to the national legislation, PSE is legally obliged ensure availability of sufficient level of generating reserves for the whole Polish power system in order to safeguard its secure operation in case of contingency, as well as in case of insufficient and ineffective balancing activities performed by market participants in Poland. However, if balancing service providers (generating units) would already sold too much energy in the day-ahead market in form of high exports, they may not be able to provide sufficient upward reserve capacity within the integrated scheduling process as required by national legislation. This conclusion equally applies for the case when market participants import significant amount of energy, as it could result in balancing service providers being unable to provide downward regulation capabilities due to not securing enough generation levels in the day-ahead market. The strength of the imbalance settlement pricing is also important in this process, together with the maturity and the ability market participants to maintain balanced portfolios under objectively high RES and demand uncertainties and underdeveloped intra-day markets.

This leads to implementation of allocation constraints, being the necessary means to ensure operational security of Polish power system in terms of securing generating capacities for upward or downward regulation, as well as in order to cover the national imbalances in the direction of shortage (i.e. cover the residual demand) and surplus (i.e. manage and regulate down the surplus of power during periods of oversupply). Excluding such a solution and depriving TSOs under central dispatching systems from the usage of allocation constraints to set appropriate limits to how much electricity can be imported or exported by the system as a whole may lead to insufficient balancing capacity reserves, making the provisions of Electricity Balancing Guideline void, and making it impossible or at least much more difficult to comply with System Operation Guideline.



The impact of allocation constraints is analysed and described in Quarterly and Annual Core Reports. The reports show that the largest social welfare impact concerns Poland (order of magnitude higher than for other Core countries), resulting in a loss of social welfare in Poland due to application of allocation constraints. However, as demonstrated in the reports time after time, this apparent loss of social welfare in Poland avoids much higher welfare losses when secure operation of the Polish power system is threatened and extraordinary measures must be applied to mitigate this threat (e.g. demand curtailment or RES curtailment).

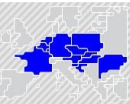
It needs to be highlighted that despite implementation of explicit balancing capacity procurement in Poland as per 14 June 2024, and despite maintaining the use of Allocation Constraints, PSE still has to apply remedial measures at large scale in order to ensure equilibrium between demand and supply in the Polish power system. These measures are mostly the non-market-based curtailment of RES (in case of energy surplus) and emergency exchanges with neighbouring TSOs (in case of energy surplus or shortage). Both aforementioned measures have severe negative consequences, such as difficulties for TSO and DSO dispatching teams to manage hundreds of operational commands issued to dispersed RES facilities in very short time, difficulties of RES facility owners to respond to dispatching commands issued with short notice, as well as depletion of operational reserves of neighbouring TSOs when asked for emergency exchanges, reducing overall European power system resilience. In many instances of time, neighbouring TSOs are unable to provide the requested support.

Balancing market reform executed on 14 June 2024 has significantly improved market price signals, so that balancing responsible parties are better reacting to dynamically changing power system situation. Nonetheless, the observed levels of balancing energy that needs to be activated by PSE under ISP is still very high, often exceeding the procured balancing capacity. This implies that the new improved balancing market prices are still unable to convey sufficient incentives for market participants to improve generation and demand planning as BRPs still do not balance their portfolios earlier on more attractive day-ahead and intraday markets. Moreover, new balancing capacity reserves procurement process is still immature and suffers from lack of liquidity, low supply and low competition. Both aforementioned items are a subject of intensive analysis on PSE side with the aim to prepare improvements and increase effectiveness of price signals.

The reason why allocation constraints can't be expressed by maximum admissible power flow

This limitation cannot be efficiently expressed by translating it into transfer capacities of critical network elements offered to the market. If this limit was to be reflected in cross-zonal capacities offered by PSE in the form of an appropriate adjustment of cross-zonal capacities, this would imply that PSE would need to guess the most likely market direction (imports and/or exports on particular interconnectors) and accordingly reduce the cross-zonal capacities in these directions. In the flow-based approach, this would need to be done on each CNEC in a form of reductions of the RAM. However, from the point of view of market participants, due to the inherent uncertainties of market results, such an approach is burdened with the risk of suboptimal splitting of allocation constraints onto individual interconnections – overestimated on one interconnection and underestimated on the other, or vice versa. Also, such reductions of the RAM would limit cross-zonal exchanges for all bidding zone borders having impact on Polish CNECs (i.e. transit flows), whereas the allocation constraint has an impact only on the import or export of the Polish bidding zone, while the trading of other bidding zones is unaffected.

Determination of allocation constraints in Poland



Allocation constraints are applied in day-ahead allocation process, with values determined day before energy delivery, per each Market Time Unit (MTU) individually based on expected generation adequacy analysis for this MTU as well as power system operation conditions and technical characteristics of generation units both on the level of individual generation units and on the level of power plants. Allocation constraints are determined for the whole Polish power system, meaning that they are applicable simultaneously for all CCRs in which PSE has at least one bidding zone border.

When determining the allocation constraints, PSE takes into account the most recent information on the technical characteristics of generation units, forecasted power system load as well as minimum reserve margins required in the whole Polish power system to ensure secure operation and forward import/export contracts that need to be respected from previous capacity allocation time frames.

Allocation constraints are bidirectional, with independent values for each MTU, and separately for directions of import to Poland and export from Poland.

For each MTU, the constraints are calculated according to the below equations:

$$EXPORT_{constraint} = P_{CD} - (P_{NA} + P_{ER}) + P_{NCD} - (P_L + P_{UPres}) \quad (1)$$

$$IMPORT_{constraint} = P_L - P_{DOWNres} - P_{CDmin} - P_{NCD} \quad (2)$$

Where:

P_{CD}	Sum of available generating capacities of centrally dispatched units as declared by generators ²
P_{CDmin}	Sum of technical minima of available centrally dispatched generating units
P_{NCD}	Sum of schedules of generating units that are not centrally dispatched, as provided by generators (for wind farms: forecasted by PSE)
P_{NA}	Generation not available due to grid constraints (both planned outage and/or anticipated congestions)
P_{ER}	Generation unavailability's adjustment resulting from issues not declared by generators, forecasted by PSE due to exceptional circumstances (e.g. cooling conditions or prolonged overhauls)
P_L	Demand forecasted by PSE
P_{UPres}	Minimum reserve for upward regulation
$P_{DOWNres}$	Minimum reserve for downward regulation

Equation (1) stems from requirement for system operators to maintain upward reserves to cover part of forecasted load with accordance to Polish grid codes. These reserves are a critical aspect of ensuring system reliability and stability, particularly in balancing supply and demand during unexpected events such as generation outages or sudden demand spikes. During periods of high energy demand combined with limited additional capacity from renewable sources, it becomes challenging to maintain adequate upward reserves. In such scenarios, the only viable solution to address the balancing challenge is to set the export capacity to zero.

² Note that generating units which are kept out of the market on the basis of strategic reserve contracts with the TSO are not taken into account in this calculation.

Equation (2) refers to the need of securing the capacity that can be quickly reduced to balance supply and demand when there is an excess of power in the grid e.g. in case of loss of significant load.

For illustrative purposes, the process of practical determination of allocation constraints in the framework of the day-ahead capacity calculation is illustrated below in Figures 1 and 2. The figures illustrate how a forecast of the Polish power balance for each MTU of the delivery day is developed by PSE in the morning of D-1 in order to determine reserves in generating capacities available for potential exports and imports, respectively, for the day-ahead market.

Allocation constraint in export direction zone Polish interconnections in export direction. Allocation constraint in import direction limits import to Polish zone.

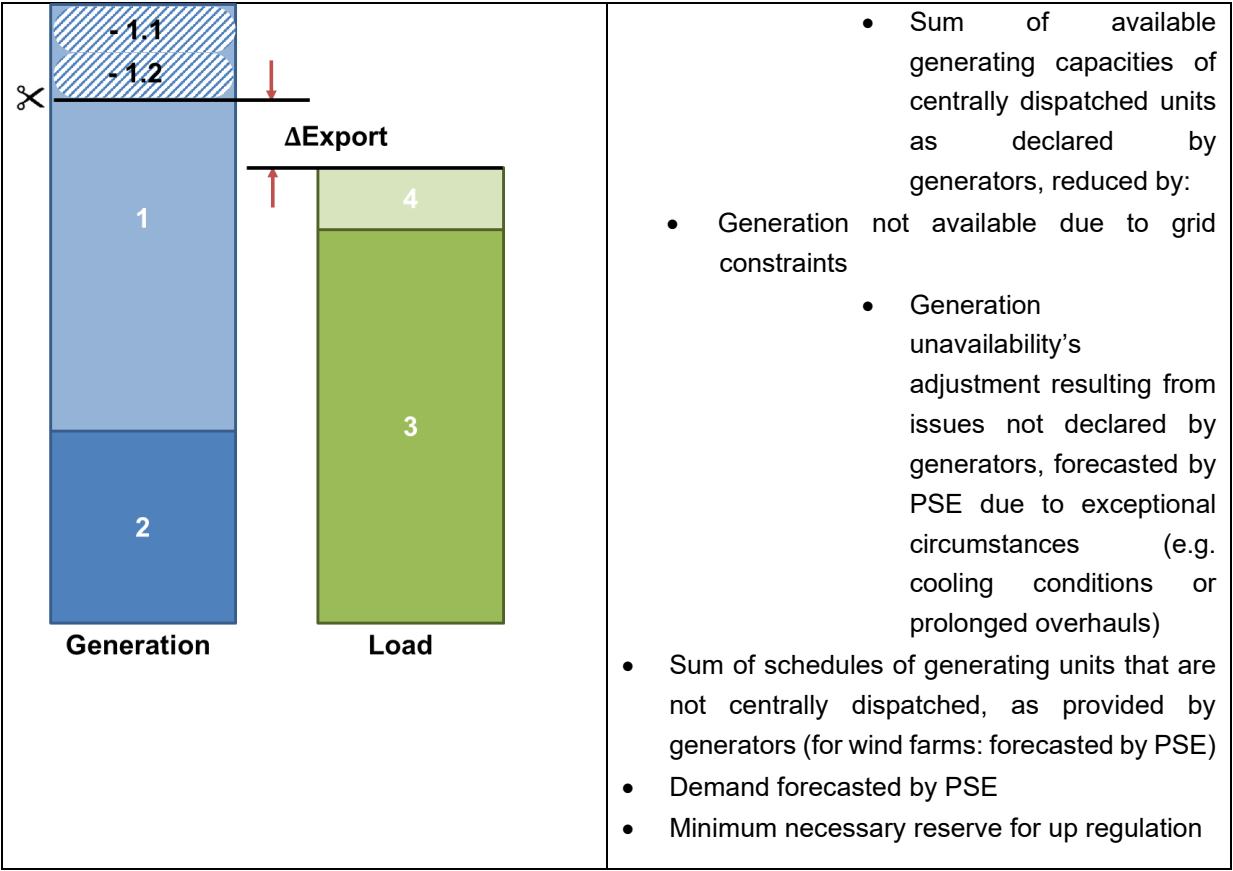


Figure 1: Determination of external constraints in export direction (generating capacities available for potential exports) in the framework of the day-ahead capacity calculation.

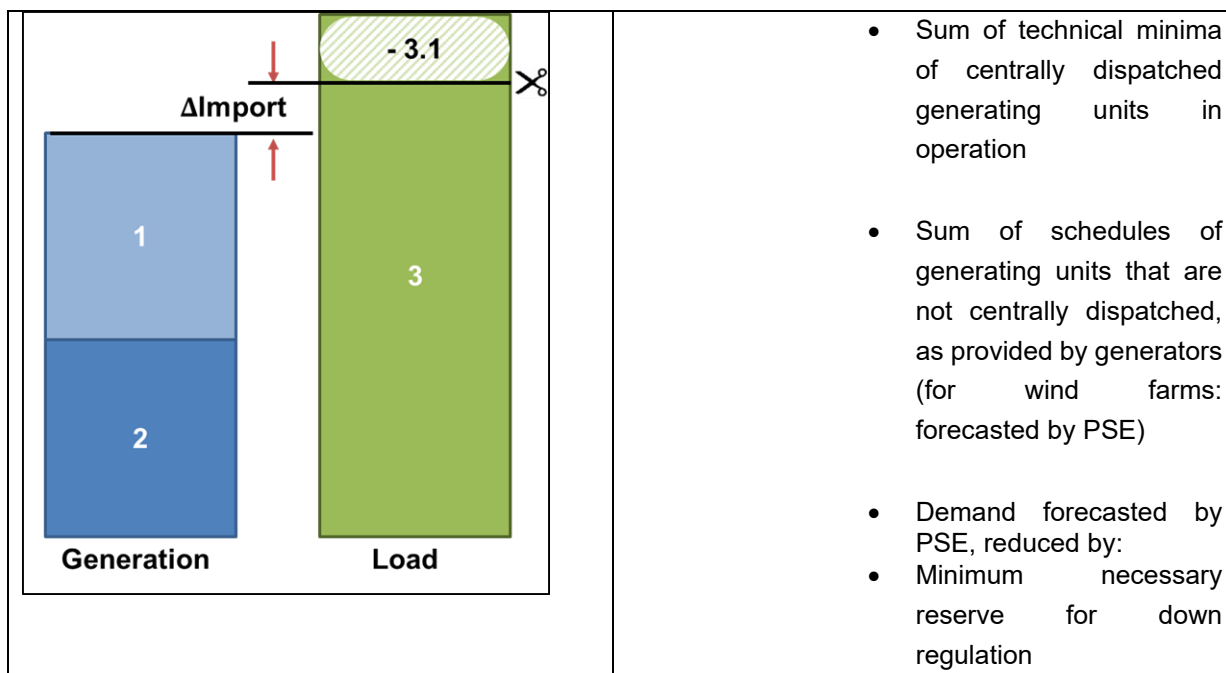


Figure 2: Determination of external constraints in import direction (reserves in generating capacities available for potential imports) in the framework of the day-ahead capacity calculation.

Frequency of re-assessment

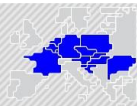
External constraints are determined in a continuous process based on the most recent information, for each capacity allocation time frame, from forward till day-ahead and intra-day. In case of day-ahead process, these are calculated in the morning of D-1, resulting in independent values for each DA CC MTU, and separately for directions of import to Poland and export from Poland.

Time periods for which external constraints are applied

As described above, external constraints are determined in a continuous process for each capacity allocation timeframe, so they are applicable for all DA CC MTUs of the respective allocation day.

Alternative solutions to address the underlying operational security limits

Please find more information separately in the file [Impact of Polish Allocation Constraints in 2024 - PSE.pdf](#), which contains an analysis of Polish Allocation Constraints prepared by PSE (comparison of historical data and simulations with no Allocation Constraint).



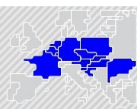
Annex 2: Detailed reasons for Data Quality Indicators Breaches and Action Plans

Introduction

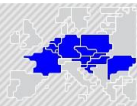
According to Article 26(d) of the DA CCM, the Core TSOs that did not fulfil the ambition levels of the defined Data Quality Indicators (DQI) need to provide to the CCC the detailed reasons for the failure as well as action plans to correct past failures and prevent future failures. This information shall be included in the annual report.

Data quality Indicators breaches for 2023 and action plans overview

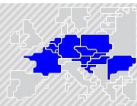
Party	BD	DQI breach category	MTUs with DQI breach	Cause	Mitigation	Corrective Action	Corrective action live since
Creos	11/01/2024	IGM Replacement	3	Wrong HEO settings on new element	correction of HEO settings	The problem was solved by adjusting those HEO settings, parameters	12/01/2024
Creos	26/02/2024	IGM Replacement	2	Problem not tangible	As no direct tangible root cause , further observations of tool behaviour	N/A	04/03/2024
Creos	27/02/2024	IGM Replacement	12	Wrong HEO settings on new element	correction of HEO settings	The problem was solved by adjusting those HEO settings, parameters	04/03/2024
Creos	28/02/2024	IGM Replacement	10	Wrong HEO settings on new element	correction of HEO settings	The problem was solved by adjusting those HEO settings, parameters	04/03/2024
Creos	29/02/2024	IGM Replacement	16	Wrong HEO settings on new element	correction of HEO settings	The problem was solved by adjusting those HEO settings, parameters	04/03/2024
MAVIR	05/04/2024	IGM Replacement	1 to 24	Tool failure with providing IGM	Investigated by the IT department to restart the process	Replacement of IGM sending as local backup	15/04/2024



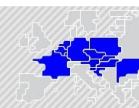
MAVIR	09/04/2024	IGM Replacement	1 to 24	Tool failure with providing IGM	Investigated by the IT department to restart the process	Replacement of IGM sending as local backup	15/04/2024
Creos	29/05/2024	IGM Replacement	24	Migration of D2CF Server by Amprion	Add old server path for the storage of the generated IGM's (D2CF)	The problem was that the generated D2CF were only stored on the new server. After discussion we figured out that the files should be stored on the new server and also remain to be stored on the old server ! It revealed that Coreso only retrieves the files (D2CF) from the old server.	30/05/2024
ELES	01/05/2024	IGM Replacement	24	No generation in Eles grid have caused issues with the combination of the provided GSK. The merging server requires at least one generation node if Generation block is present in GSK (even if there is a quality check that check the generation units)	New developement needed on Eles GSK tooling. Currently we provide static GSK, however, a dynamic GSK is needed.	Replacement of IGMs. On Eles side, we started a developement of a more complex GSK tool that yould provide the dynamic GSK. The tool is to be put into production around end of july (could be later due to holiday season).	Not yet
ELES	02/05/2024	IGM Replacement	24	No generation in Eles grid have caused issues with the combination of the provided GSK. The merging server requires at least one generation node if	New developement needed on Eles GSK tooling. Currently we provide static GSK, however, a dynamic GSK is needed.	Replacement of IGMs. On Eles side, we started a developement of a more complex GSK tool that yould provide the dynamic GSK. The tool is to be put into production around end of july	Not yet



				Generation block is present in GSK (even if there is a quality check that check the generation units)		(could be later due to holiday season).	
ELES	04/05/2024	IGM Replacement	24	No generation in Eles grid have caused issues with the combination of the provided GSK. The merging server requires at least one generation node if Generation block is present in GSK (even if there is a quality check that check the generation units)	New developement needed on Eles GSK tooling. Currently we provide static GSK, however, a dynamic GSK is needed.	Replacement of IGMs. On Eles side, we started a developement of a more complex GSK tool that would provide the dynamic GSK. The tool is to be put into production around end of july (could be later due to holiday season).	Not yet
ELES	05/05/2024	IGM Replacement	24	No generation in Eles grid have caused issues with the combination of the provided GSK. The merging server requires at least one generation node if Generation block is present in GSK (even if there is a quality check that check the generation units)	New developement needed on Eles GSK tooling. Currently we provide static GSK, however, a dynamic GSK is needed.	Replacement of IGMs. On Eles side, we started a developement of a more complex GSK tool that would provide the dynamic GSK. The tool is to be put into production around end of july (could be later due to holiday season).	Not yet
MAVIR	11/07/2024	IGM Replacement	1 to 24	Tool failure with providing IGM	Investigated by the IT department to restart the process	Replacement of IGM sending as local backup	21/07/2024

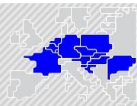


MAVIR	12/07/2024	IGM Replacement	1 to 24	Tool failure with providing IGM	Investigated by the IT department to restart the process	Replacement of IGM sending as local backup	21/07/2024
Creos	29/07/2024	IGM Replacement	24	Tool failure which provides the IGM's	Investigation by IT department. Restart of Tool	N/A	28/07/2024
TSCNET	11/02/2024	NRAO results were not applied	1 to 24	Partial start of GROM services after OS update on environment	N/A	Manual start of GROM components was replaced by automatic start. Monitoring system extended to cover start of the application.	21/02/2024
TSCNET	26/05/2024	DFP	24	Unrealistic results that would force TSOs to apply validations that could distort the market	N/A	N/A	N/A
CORESO	25/06/2024	DFP	1 to 24	Unavailability of CGMs due to a failure of the merging tool	N/A	Replacement of firewall in the Datacentre	04/07/2024

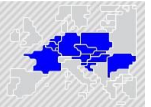


Annex 3: Quality of data published - Raw survey results

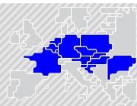
Survey Question	Answer 1	Answer 2	Answer 3	Answer 4	Answer 5	Answer 6	Answer 7	Answer 8	Answer 9
Which category of stakeholders do you belong to? - category of stakeholder	Regulator	Research	Energy Trader	Energy Trader	Energy Trader	Energy Trader	Industry	Industry	Energy Trader
If in the previous question you indicated "Other", please specify - Views									
Would you like your answer to remain anonymous? - I would like my answer to remain anonymous.	No	No	Yes	Yes	Yes	Yes	No	No	No
I want my answer to remain confidential - If you tick this box, we will not publish your answer to this consultation - Confidentiality	No	No	No	No	No	No	No	No	No
How often do you use the following tools and pages? - d - Publication Tool Handbook	4	2	3	4	4	2	5	5	5
How often do you use the following tools and pages? - d - Monitoring Tool	2	2	2	5	2	2	5	2	5
How often do you use the following tools and pages? - d - Core Market View	2	1	2	4	2	3	5	1	5



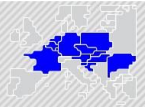
How often do you use the following tools and pages? - d - Core Market Graphs	2	1	2	3	2	3	5	1	5
How often do you use the following tools and pages? - d - Core Map	2	1	2	3	3	3	5	1	5
How often do you use the following tools and pages? - d - Border Data View	2	1	2	3	3	3	5	5	5
How often do you use the following tools and pages? - d - Max Net Positions	5	1	5	4	4	5	5	5	5
How often do you use the following tools and pages? - d - Max Echanges (MaxBex)	5	1	5	4	3	4	5	5	5
How often do you use the following tools and pages? - d - Initial Comp (VirginDomain)	3	1	1	4	4	3	5	3	5
How often do you use the following tools and pages? - d - Remedial Actions Preventive	4	1	1	3	1	3	5	2	5
How often do you use the following tools and pages?	4	1	1	3	1	3	5	1	5



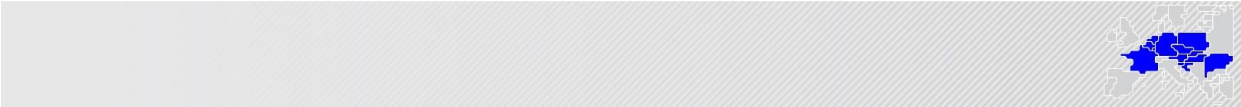
- d - Remedial Actions Curative									
How often do you use the following tools and pages?	5	1	1	3	1	4	5	1	5
- d - Validation Reductions									
How often do you use the following tools and pages?	3	1	4	5	4	5	5	4	5
- d - Pre-Final (EarlyPub)									
How often do you use the following tools and pages?	3	1	4	5	2	5	5	5	5
- d - LTN									
How often do you use the following tools and pages?	5		4	5	4	5	5	5	5
- d - Final Computation									
How often do you use the following tools and pages?	5	1	4	5	3	3	5	5	5
- d - LTA									
How often do you use the following tools and pages?	4	1	4	3		3	5	5	5
- d - Final Bilateral Exchange Restrictions									
How often do you use the following tools and pages?	4	1	4	5		5	5	5	5
- d - Allocation Constraints									



How often do you use the following tools and pages? - d - D2CF	4	1	1	3	3	5	4	5
How often do you use the following tools and pages? - d - Refprog	4	1	1	3	3	5	4	5
How often do you use the following tools and pages? - d - Reference Net Position	4	1	1	3	3	5	4	5
How often do you use the following tools and pages? - d - ATCs on CORE external borders	4	1	4	3	3	5	3	4
How often do you use the following tools and pages? - d - ShadowAuction ATC	4	1	2	3	2	5	3	5
How often do you use the following tools and pages? - d - ShadowPrices	5	1	5	3	2	5	3	5
How often do you use the following tools and pages? - d - Congestion Income	4	1	3	3	2	5	3	4
How often do you use the following tools and pages?	5	1	5	3	5	5	5	5



- d - Scheduled Exchanges									
How often do you use the following tools and pages?	5	1	5	5		5	5		5
- d - Net Position									
How often do you use the following tools and pages?	5	1	2	2		1	5	2	5
- d - Intraday ATC									
How often do you use the following tools and pages?	5	1	2	2		1	5	2	5
- d - Intraday NTC									
How often do you use the following tools and pages?	4	1	2	2		2	5	4	5
- d - Price Spread									
How often do you use the following tools and pages?	4	1	1	2		2	5	2	5
- d - Spanning/DFP									
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?	4	2	5	2	1	4	3	2	3
- e - Publication Tool Handbook									



How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?

- e - Monitoring Tool

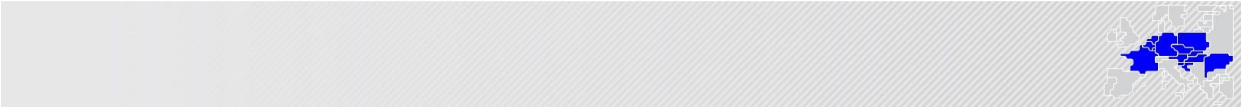
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?

- e - Core Market View

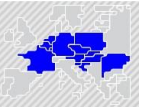
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?

- e - Core Market Graphs

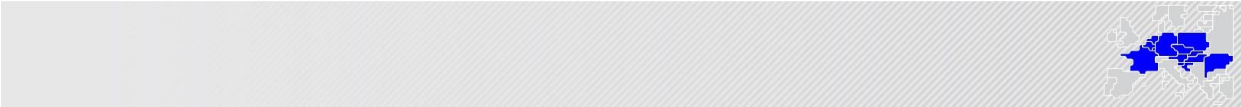
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being



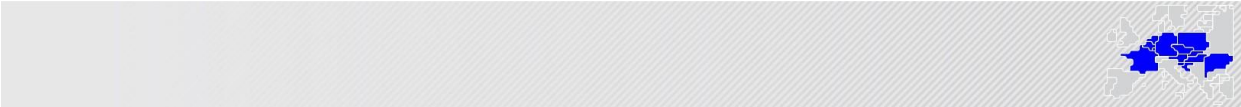
very clear? - e - Core Map									
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Border Data Overview	3	2	3	3	1	3	4	1	3
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Max Net Positions	4	2	5	5	1	5	5	5	4
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Max Exchanges (MaxBex)	4	2	5	5	1	5	5	5	5



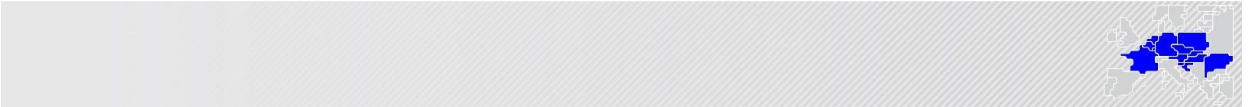
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Initial Comp.(VirginDomain)	4	2	3	2	1	3	5	5	3
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Remedial Actions Preventive	4	2	3	1	1	3	4	5	3
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Remedial Actions Curative	4	2	3	1	1	3	4	5	4
How would you rate the clarity and completeness of the information included of the following tools and	4	2	3	1	1	3	3	5	3



pages, with 1 being not clear at all and 5 being very clear? - e - Validation Reductions									
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Pre-Final (EarlyPub)	4	2	3	4	1	5	4	5	4
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - LTN	4	2	3	1	1	5	5	5	5
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Final Computation	4	2	3	1	1	5	4	5	4



How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - LTA	4	2	3	4	1	3	5	5	5
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Final Bilateral Exchange Restrictions	4	2	3	2	1	3	5	5	3
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Allocation Constraints	4	2	4	4	1	4	5	5	5
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not	4	2	3	1	1	3	5	5	4



clear at all and 5 being
very clear?

- e - D2CF

How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?

4

2

3

1

1

3

4

5

4

- e - Refprog

How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?

4

2

4

1

3

5

5

5

- e - Reference Net
Position

How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?

4

2

4

2

1

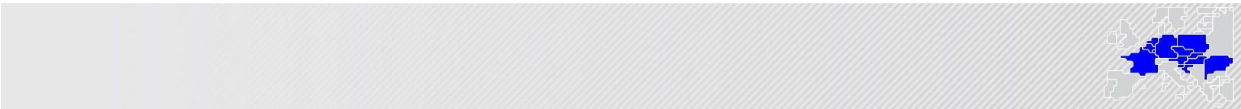
3

4

5

5

- e - ATCs on CORE external borders



How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?

- e - ShadowAuction ATC

4	2	3	2	1	3	4	5	5
---	---	---	---	---	---	---	---	---

How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?

- e - ShadowPrices

4	2	3	2	1	3	5	5	5
---	---	---	---	---	---	---	---	---

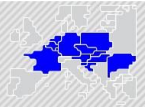
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear?

- e - Congestion Income

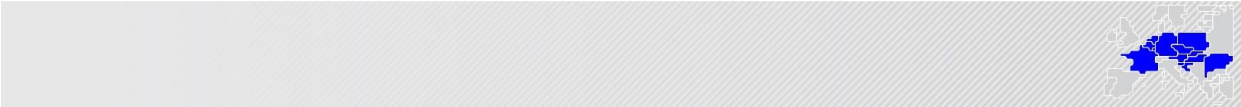
4	2	3	3	1	4	4	5	3
---	---	---	---	---	---	---	---	---

How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being

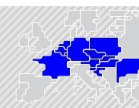
4	2	3	4	1	5	5	5	5
---	---	---	---	---	---	---	---	---



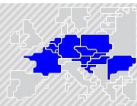
very clear? - e - Scheduled Exchanges									
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Net Position	4	2	5	5	1	5	5	5	5
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Intraday ATC	4	2	3	3	1	3	4	5	5
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Intraday NTC	4	2	3	3	1	3	4	5	5
How would you rate the clarity and completeness of the information included of the following tools and	4	2	3	3	1	5	5	5	5



pages, with 1 being not clear at all and 5 being very clear? - e - Price Spread										
How would you rate the clarity and completeness of the information included of the following tools and pages, with 1 being not clear at all and 5 being very clear? - e - Spanning/DFP	4	2	3	3	1	3	4	5	5	



Your feedback on the tools and pages - Any feedback on highlighting good practices or examples?	Clearer communication when there is an issue.	EDF welcomes this annual survey about the quality of the provided data and the easy-of-use of data retrieval on the JAO platform. Nevertheless, we observe little change compared to last year's situation.	Communication from JAO regarding developments and initiatives in regards to the publication handbook is hard to find.	The more recent releases considered some of our past remarks. Market participants, as primary users of the tool, are thankful JAO took their feedback into consideration.
		EDF would like to share some observations regarding the data available on the JAO platform: • Sometime data are indicated as published but the corresponding fields are empty • EDF observes differences between data published on the different publication tools	Publication time section of the documentation is sometimes unclear with times i see the data reported in the interface / api Perhaps more definitions/links to learn external knowledge regarding the information published within the handbook.	The Monitoring tool serves as a useful means to efficiently monitor the available data. We need to be able to rely on this published data. Core market graphs: the option to zoom (located in the top right

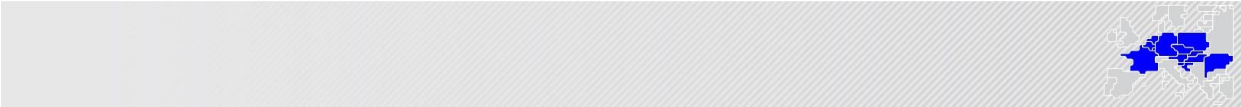


of JAO and the same data published on ENTSO-E platform. Differences have been detected regarding final ATC for SIDC and the ATC for IDA2 from ENTSO-E.

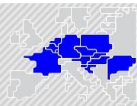
corner) and select zones of interest is a useful feature.

Pre-Final (EarlyPub): timeline of publication should be respected as it is not always the case. Also there is a strong need for communication when the process is late.

Final computation: timeline of publication should be respected as it is not always the case. Also there is a strong need for communication



when the
process is late.



Your feedback on the tools and pages - Any comments or suggestions for improvement?

Make sure to provide exact definitions on the homepage

Provide examples of all data and how you can use it

Publish a new manual specifically for day ahead trading and how you can use the results to analyse the market

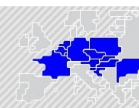
Clearer indication of what lines are causing restrictions

EDF would like to share some suggestions regarding:

- Publication tool handbook: the inclusion of long-term allocation should be clarified. Indeed, the definition of the proposed indicators could be more described.
- Regarding data that are input for calculation processes: these data are published as soon as the result of the calculation process is available. EDF regrets that the input data are not published sooner.
- The warning regarding the final bilateral exchanges could

Monitoring tool: It appears that there are still some issues with the monitoring tool, such as cases where the status remains "Expected" even though the data is already present, or where the status shows "Received" but part of data is missing. Moreover, there is a mismatch between the time zones published under the Deadline and Date Received column, the first being in CET and the latter in UTC.

Proposed



be more visible
on the
dedicated JAO
page.

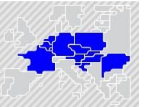
- LTA section: a publication of the LTA after each monthly auction results is needed.

- Curtailments: a dedicated section for curtailments, including the non-CORE borders is needed.

improvements:

Report (as in the handbook) the expected time of publication for each item.

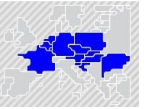
Moreover, adding more information in the "Follow up action initiated" column would be helpful to understand the actions taken on the reported issues. For instance, including details about the type of issue (simple delay, IT failure,...) and whether there is active work ongoing to solve the issue. These improvements would enhance the usability of the monitoring



tool and help users to effectively track the status of the items.

Core market view: it would be useful to give a short description of what the “tests” do directly on the page (currently users must refer to the handbook)

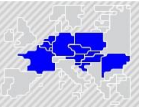
Core market graphs: An interactive graph would be a valuable addition to the current display format. Users could benefit from features such as the ability (directly from the graph) to select or deselect borders, zoom



in and out, and dynamically view values by hovering the mouse over the lines. Being able to directly save the charts would also be welcomed.

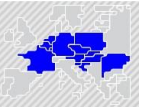
Max net positions: the explanation of how Max Net Positions are obtained could be improved, particularly in terms of providing a high-level overview of the calculation.

MaxBex: The explanation of how these are obtained could be improved, particularly in



terms of
providing a
high-level
overview of the
calculation.

Initial
Comp.(VirginDo
main): we
understand that
the Initial
Comp. is based
on the
 F_{ref_init} and
that F-ref does
not exist at this
point because it
is a product of
the NRAO
phase
performed later
in the process.
However, a
column F-ref is
shown in the
publication tool
(values= f_{ref_in}
it) but this is
not reported in
the handbook
under section
5.7. Would be
useful to clarify



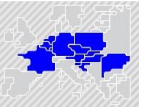
this aspect.

Remedial
Actions

Preventive:
replace the
term“Paramete
rs” in the right-
hand side
section by a
term that
reflects more
adequately
what the
numerical
values
“baseline” &
“after NRAO”
refer to.

Remedial
Actions

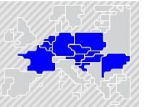
Curative: as of
today, it seems
only the CNEC
& cRA#1 names
are given, both
baseline &
NRAO columns
remain empty.
Difficult to find
any useability
of this page



with the limited amount of information available.

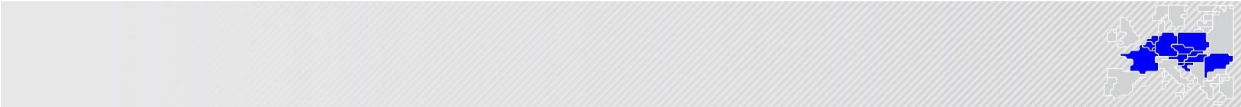
Validation
Reductions:
TSOs seem not to use all the fields in a standardized way, sometimes the information is all contained in the justification column, sometimes in the extra NP columns. The handbook is also not up to date and does not include a description of all the columns of this page.

Pre-Final
(EarlyPub): the calculation of



minRAM_target
_Core% is
difficult to
comprehend,
and the values
displayed still
haven't been
fixed. A clearer
explanation is
needed,
particularly
regarding the
relationship
between R_amr
and
minRAM_target
_Core.
Furthermore,
the labeling
"R_amr" and
"minRAM for
Core target" is
confusing, and
a better naming
structure would
be preferable.

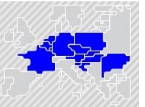
LTN: the
explanation of
LTN could be
clearer. It is our
understanding
that LTN refers



to long-term capacity that has been physically nominated, and this is currently only applicable to HR-SI: it may be useful to detail further the fact that only borders with PTRs are shown.

Final computation: we propose two modifications to the PTDF
Final Computation:

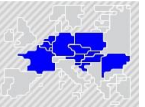
Add a new column indicating if the CNEC (Critical Network Element Constraint) meets the maxz2z threshold of 5% (boolean or checkmark).



This provides better transparency to MPs and NRAs and helps understand which CNECs have been retained despite not meeting the threshold.

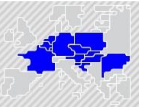
Introduce another column to classify whether the element is a CNEC (Critical Network Element Constraint) and MNEC (Monitored Network Element Constraint) elements. This will facilitate the filtering by MPs.

LTA: it could be very useful to add a graph



view.

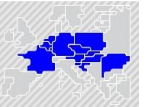
Final Bilateral
Exchange
Restrictions: as
indicated in the
publication
handbook, if
the DA CC fails,
the default FB
parameters are
utilized. In such
a case, the
description
suggests the
values may not
always
correspond to
the standard
LTN-adjusted
LTAs of normal
operation days.
It would be
advantageous
to include a
message stating
whether DFP is
in force directly
on this page. It
would be very
important to
add a
“curtailment”



section.

ATCs on CORE
external
borders: it
could be very
useful to add a
graph view.

Shadow prices:
we would
welcome
adding in the
handbook a
description of
the precise
formula used to
compute the
 $\max_{Z \geq 0} \sum_{i \in I} p_i x_i$
displayed on
this page (since
the official CCM
formula has
been amended
a few times it is
not always clear
to use whether
the actual
formula behind
this column has
also evolved

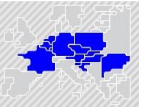


over time).

Scheduled exchanges: it could be very useful to add a graph view.

Net position: it could be very useful to add a graph view.

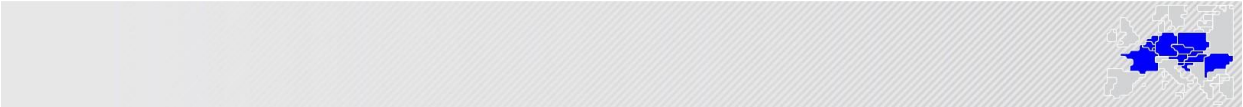
Intraday NTC: on some days, the Intraday NTC was not published, which then implied the need for market participants to perform manual calculation from Intraday ATC and Scheduled exchanges. . It



could be very
useful to add a
graph view.

Price spread: it
could be very
useful to add a
graph view.

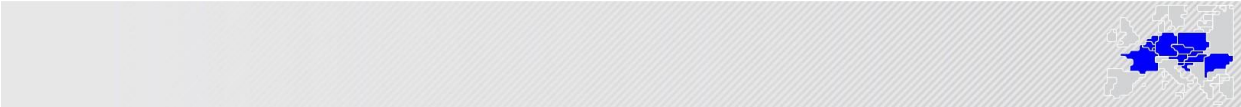
Spanning/DFP:
It would be
helpful to
include
additional
information in
the publication
handbook
about what the
Default FB
Parameters
entail (or a link
to the
associated
documentation)
. In addition,
when DFP is
applied, the
“synthetic”
PTDFs based on
OMW max
import/export



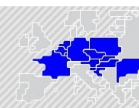
are not reported for all computations (initial/pre-final/final). One such example is on BD

Two items, namely Active FB Constraints and Active LTA Constraints are referenced in the Handbook but are not (yet?) published on the API.

How often do you use the following functionalities from the JAO Publication Tool on	1	2	3	3	3	3	5	3	5
---	---	---	---	---	---	---	---	---	---



a scale from 1 to 5? - vies - Navigation & Downloading of data									
How often do you use the following functionalities from the JAO Publication Tool on a scale from 1 to 5? - vies - API	5	5	5	3	5	5	5	5	5
How would you rate the ease-of-use of the following functionalities from the JAO Publication Tool on a scale from 1 to 5, with 1 being not clear at all and 5 being very clear? - k - Navigation & Downloading of data	2	2	4	3	2	3	5	3	3
How would you rate the ease-of-use of the following functionalities from the JAO Publication Tool on a scale from 1 to 5, with 1 being not clear at all and 5 being very clear? - k - API	4	3	5	3	2	5	5	5	5



Your Feedback - Any feedback on highlighting good practices or examples for the navigation, downloading of data or the API?

EDF would like to mention that in general the API works well, and the handbook gives enough information about it. However, there are few things that we would like to add:

1. A notification about any change in the API could be published and informed to the users in advance. As an example, the threshold on the number of API calls per second was implemented without prior information.
2. The API guide could be kept up to date with such information that could impact

Are final publications/virgin domains cached when manually downloading via the interface?

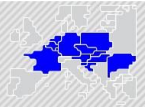
We noticed that for downloading ptdf relevant data, its much faster to download via the interface.

Additionally, when ptdfs are being uploaded, why does the API seem to struggle? I have noticed multiple times that between 9:50 - 10:05 (leading up to the publication of final pubs) the API as a whole is very slow.

I love how structured the schema is for API responses.

The addition of filters for in-page navigation & data download is also appreciated.

The option to test the API queries directly on the webpage is a very useful feature.

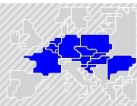


data extraction
or causes any
changes in the
way data is
delivered

(example: the
threshold on
number of calls).

3. The response
from API could
contain

PublishTime
value to help the
users know at
what time the
data got
updated/publish
ed on the API.

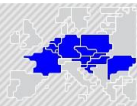


Your Feedback - Any comments or suggestions for improvement of the navigation, downloading of data or the API?

- The need for visibility on the future development of the API is essential: call signature, authentication, if necessary, ...
- The need for clarity between the operational functions and the ones that are at a development stage (as an example, in parallel run).
- On the navigation pages several days can be downloaded but the file is divided per day. A unique file with all data could be useful.

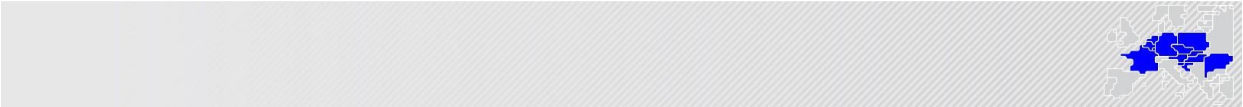
We believe that it would be beneficial to emphasize the "CWE-timezone" even further, despite it already being displayed above the hour selection bar on the left. This is particularly important given that the API operates on UTC.

Additionally, a dedicated tab or link towards the relevant parameters/datasets published on the main JAO website (Ramr DA & ID, SGM ...) which are not currently easily accessible, would be beneficial for users.



Currently, accessing the API tester at <https://publicationtool.jao.eu/core/api> requires either manually changing the url or using the link in the publication handbook, which can be inconvenient. It would be helpful to have an additional tab labeled "API" in the publication tool for easy access to these examples.

We would like to point out that, since 2 or 3 months, retrieving data via API queries has become difficult due to frequent server errors and this has impacted



operational processes. While the TSOs work on a fix, we would like to propose the following improvements to the API.

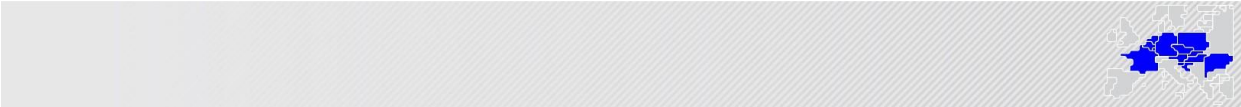
Clearer error messages and codes, as the currently used 500: Internal error message is too cryptic.

Best practices to be shared by the platform owners on how to use the API more effectively (e.g. Query size, amount of concurrent connection etc.).

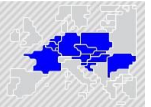
How often do you use the following publications a scale	4	2	1	3	1	3	4	1	5
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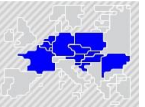
from 1 to 5? - m - Static Grid Model									
How often do you use the following publications a scale from 1 to 5? - m - Operational KPI reports	4	3	1	1	1	2	1	1	
How often do you use the following publications a scale from 1 to 5? - m - Monthly DQI reports	3	3	1	1	1	1	1	1	
How often do you use the following publications a scale from 1 to 5? - m - Quarterly reports	4	3	1	1	1	1	1	1	
How often do you use the following publications a scale from 1 to 5? - m - Annual reports	4	4	1	1	1	1	1	1	
How would you rate the clarity and completeness of the information included in the publication, with 1 being not clear at all and 5 being very clear? - I - Static Grid Model	5	2	1	1	1	2	3	1	3
How would you rate the clarity and completeness of the information included in the publication, with 1	4	2	1	3	1	2	1	1	



being not clear at all and 5 being very clear? - I - Operational KPI reports								
How would you rate the clarity and completeness of the information included in the publication, with 1 being not clear at all and 5 being very clear? - I - Monthly DQI reports	3	2	1	3	1	2	1	1
How would you rate the clarity and completeness of the information included in the publication, with 1 being not clear at all and 5 being very clear? - I - Quarterly reports	4	2	1	3	1	2	1	1
How would you rate the clarity and completeness of the information included in the publication, with 1 being not clear at all and 5 being very clear? - I - Annual reports	4	2	1	3	1	2	1	1



<p>Your Feedback</p> <ul style="list-style-type: none">- Any feedback on highlighting good practices or examples for any of the publications?	<p>EDF regrets that the accurate localisation of the nodes is not available on the JAO platform. These data are essential to simulate the complete network.</p>	<p>Dont use them.</p>	<p>Static Grid Model: the addition of the changelog has been very welcomed by market participants.</p>
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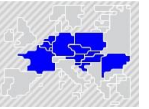


Your Feedback

- Any comments or suggestions for improvement for any of the publications?

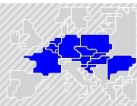
Static Grid Model: not solely related to this page, but ensuring consistency in element names across publications (SGM, CNE names, KPI reports, intermediate ID domains, etc...) is key to provide optimal traceability.

Operational KPIs reports: the page does not seem of use anymore (last ppt from 11/2022), KPIs are rather reported monthly in the DQI reports below. Could be useful to highlight if MPs should follow

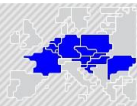


this page at all.

Monthly and Quarterly DQI reports: it would be preferable if the attachments section were located at the top of the page rather than requiring the user to scroll down.



What general feedback or suggestions do you have for improving the data published on JAO webpages? - Views	<p>All data inputs for Euphemia need to be published in anonymous form. Currently, it is just not possible to verify all calculations as not all input data is freely available.</p> <p>We need an open-source implementation of all used source code and all input data. The current situation is less than satisfactory and needs to be changed.</p>	<p>Overall, the data published by Jao is of good quality, with some inconsistencies due to the heterogeneity of TSO.</p> <p>Below some suggestions on what is published, and what is not:</p> <p>Data published by Jao:</p> <ul style="list-style-type: none">• Occasionally substation names are wrong (e.g. “Sreys” instead of “Creys”, “genissiat instead of “Genissiat Poste”)• The grid map HTML looks very old and should be upgraded (on the same pattern as the remark on more info on nodes)	<p>Overall the API is amazing on a day to day basis, though uncovering more than what the API provides and understanding is behaviour is a bit tricky at times.</p>	<p>Market participants would like to thank JAO & the TSOs for the recent improvements to the publication tool and its handbook, as well as for giving users the opportunity to provide their feedback.</p> <p>Going forward, we would welcome the addition of new tabs/links on the webpage to connect with external documents or pages (SGM, API tester, intraday files, etc) which facilitates the access. For the PTDF, it would also bring clarity to</p>
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- Filtering on the website could be made more precise
- The explicit names are often not consistent, e.g., the same line is called Wien SudOst – Gyor by Apg but Wien – Gyor by Mavir.

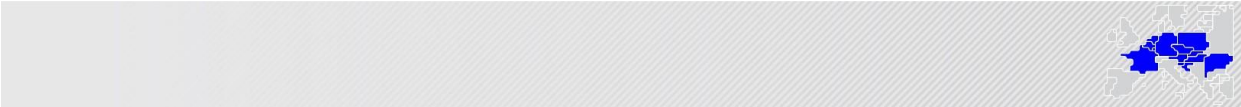
Data not published by Jao :

- We need the full grid (including the CNEs that fall below the 5% threshold) every day, at least for the FINAL_PUBLICATION
- Before regions Core and Italy-North are merged, the operation of the FR-IT DC cable needs to be clarified

highlight which elements are true CNECs and which are not, and whether the 5% threshold is reached.

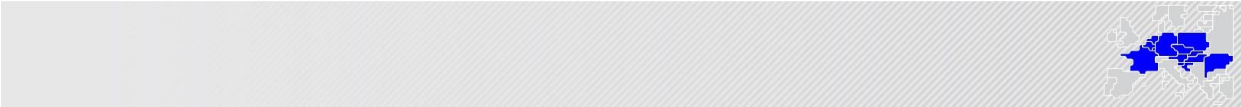
We also proposed above some minor improvements of the handbook.

It is important that all data are published on time and respect public deadlines. Also, before published, all data should be complete.



- The GSK methodology needs to be revised for a grid with less and less thermal.

What general feedback or suggestions do you have for improving the	The survey should be less formal (20+ points which	All good.	None
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format of this survey? - Views	same question) and allow more individual feedback.
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