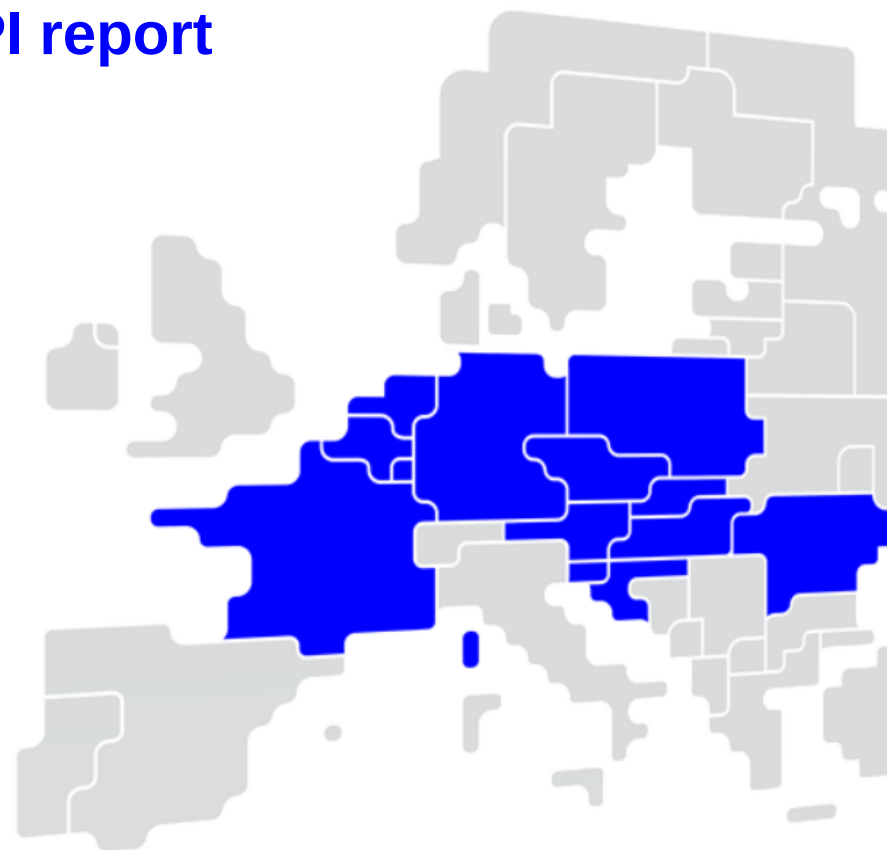




Core FB MC Operational KPI report

December 2024



Overview of Operational KPIs



Adjustment for minimum RAM Inclusion

- KPI 1: Average maximum AMR per CNE
- KPI 2: Average maximum AMR per TSO

TSOs' adjustment after validation

- KPI 3: Share of MTUs with intervention per TSO
- KPI 4: Average IVA applied for each CNE affected by TSO intervention

Power System Impact Analysis

- KPI 5: Min & max net positions per BZ hub
- KPI 6: Virtual margins at market balance for CORE TSOs
- KPI 7: Non-Core exchanges delta flow

Non-costly Remedial Action Optimization Analysis

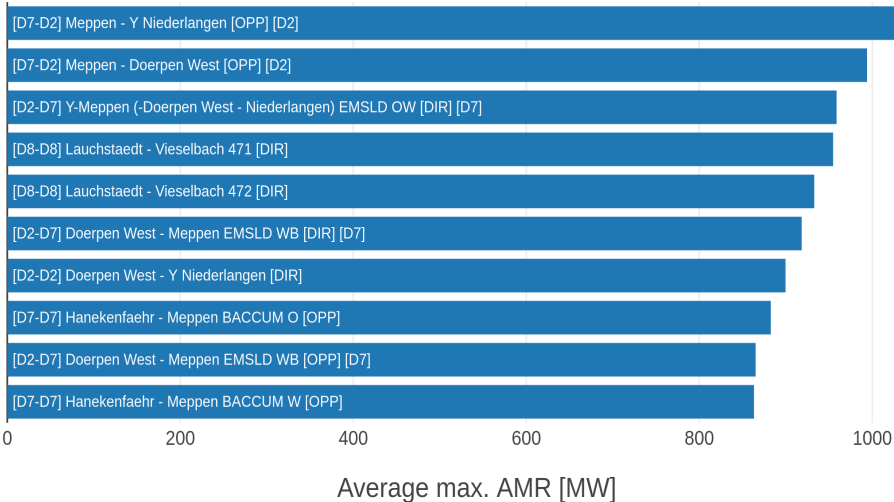
- KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode
- KPI 9: Most limiting CNEC per TSO (NRAO)
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Market Impact Assessment

- KPI 11: Most often presolved CNEs (top 20)
- KPI 12: Most limiting CNEs (top 20)
- KPI 13: Allocation Constraints

KPI 1: Average maximum AMR per CNE (Top 10)

CNE	Avg. Max. AMR (MW)	AMR/Fmax% (MTUs with AMR > 0 MW)	AMR/Fmax% (all MTUs)
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	1031.26	50.77%	38.48%
[D7-D2] Meppen - Doerpen West [OPP] [D2]	993.92	48.93%	36.43%
[D2-D7] Y-Meppen (-Doerpen West - Niederlangen) EMSLD OW [DIR] [D7]	958.73	40.69%	29.26%
[D8-D8] Lauchstaedt - Vieselbach 471 [DIR]	954.67	38.28%	23.62%
[D8-D8] Lauchstaedt - Vieselbach 472 [DIR]	932.90	37.41%	23.68%
[D2-D7] Doerpen West - Meppen EMSLD WB [DIR] [D7]	918.38	38.98%	27.56%
[D2-D2] Doerpen West - Y Niederlangen [DIR]	899.70	44.30%	32.86%
[D7-D7] Hanekenfaehr - Meppen BACCUM O [OPP]	882.66	36.30%	25.32%
[D2-D7] Doerpen West - Meppen EMSLD WB [OPP] [D7]	865.08	36.72%	25.61%
[D7-D7] Hanekenfaehr - Meppen BACCUM W [OPP]	863.23	35.81%	24.36%

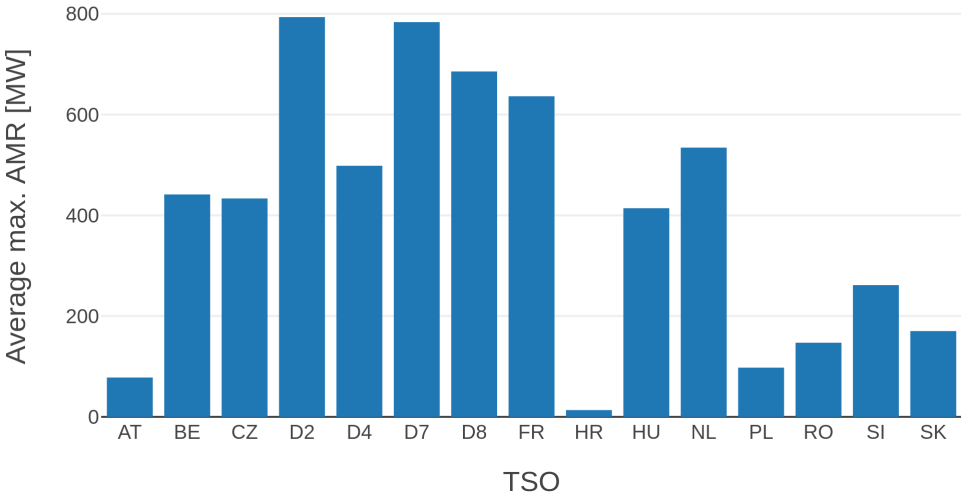


KPI 2: Average maximum AMR per TSO



TSO	Average maximum AMR per TSO
AT	78.04
BE	441.50
CZ	433.40
D2	793.45
D4	498.35
D7	783.54
D8	685.65
FR	636.29
HR	13.37
HU	414.07

TSO	Average maximum AMR per TSO
NL	534.32
PL	97.76
RO	147.28
SI	261.59
SK	170.36



KPI 3: Share of MTUs with intervention per TSO



Total BDs
31

Total MTUs
744

MTUs without IVA
238

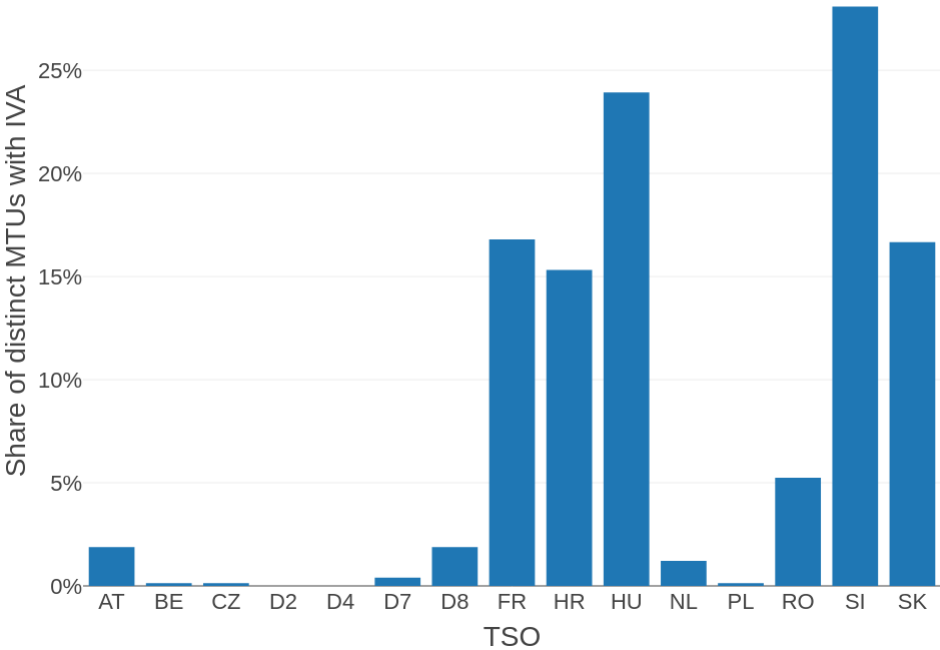
Share of distinct MTUs without IVA
31.99%

MTUs with IVA
506

Share of distinct MTUs with IVA
68%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	1.88%	14
BE	0.13%	1
CZ	0.13%	1
D2	0.00%	0
D4	0.00%	0
D7	0.40%	3
D8	1.88%	14
FR	16.80%	125
HR	15.32%	114
HU	23.92%	178

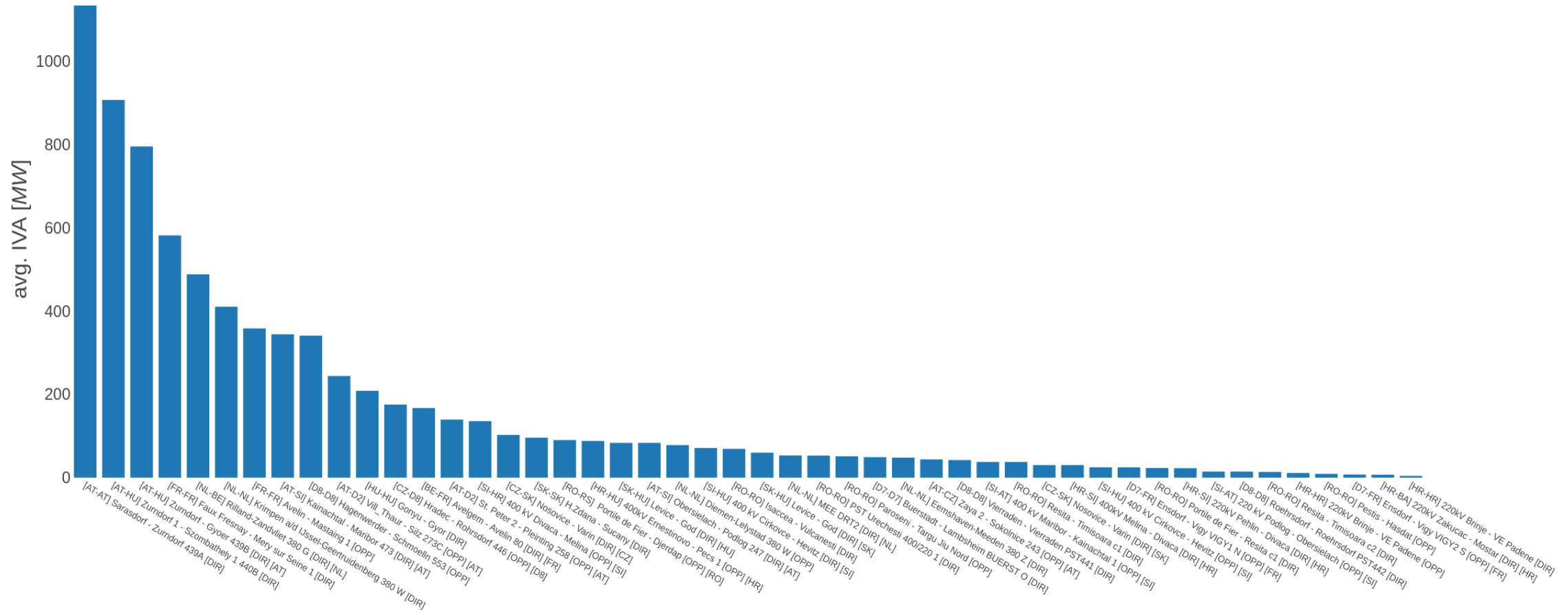
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
NL	1.21%	9
PL	0.13%	1
RO	5.24%	39
SI	28.09%	209
SK	16.67%	124



KPI 4a: Average IVA applied for each CNE affected by TSO intervention



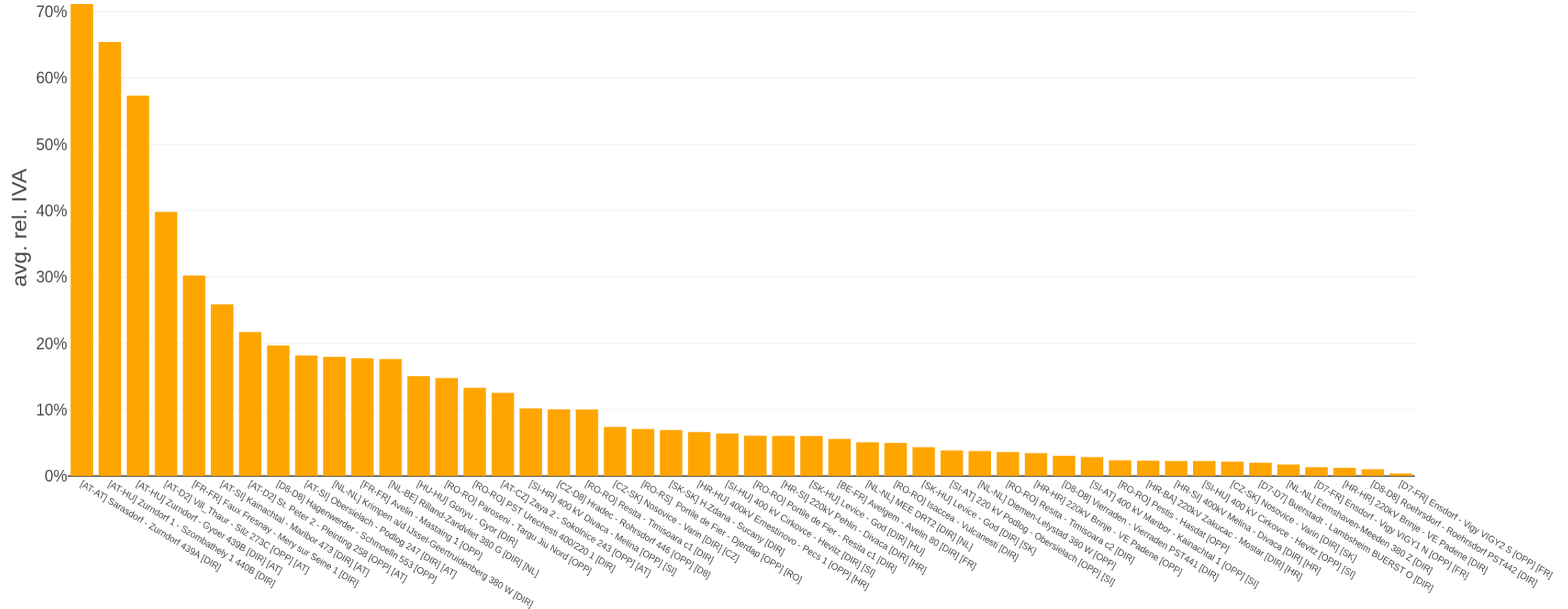
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



KPI 4b: Average relative IVA applied for each CNE affected by TSO intervention



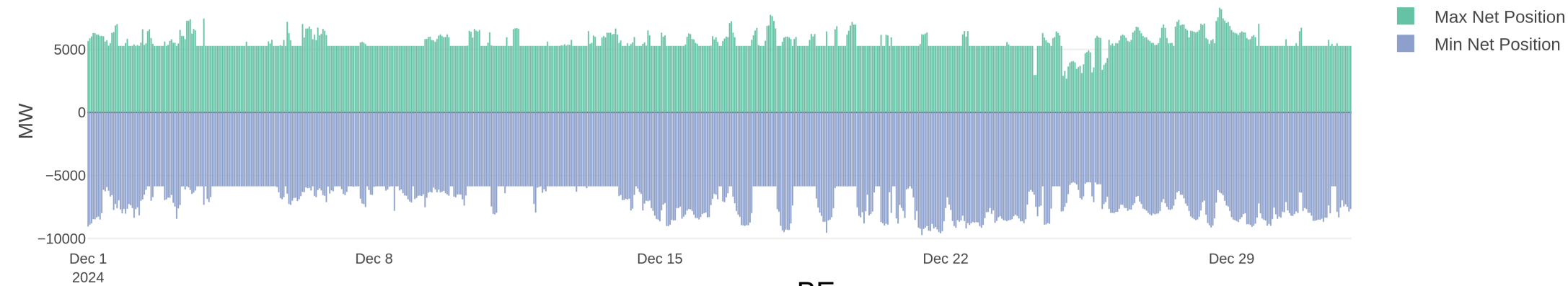
$$\text{avg. rel. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} \frac{IVA_{CNEC, MTU}[IVA_{CNEC, MTU} > 0]}{F_{maxCNEC, MTU}[IVA_{CNEC, MTU} > 0]}$$



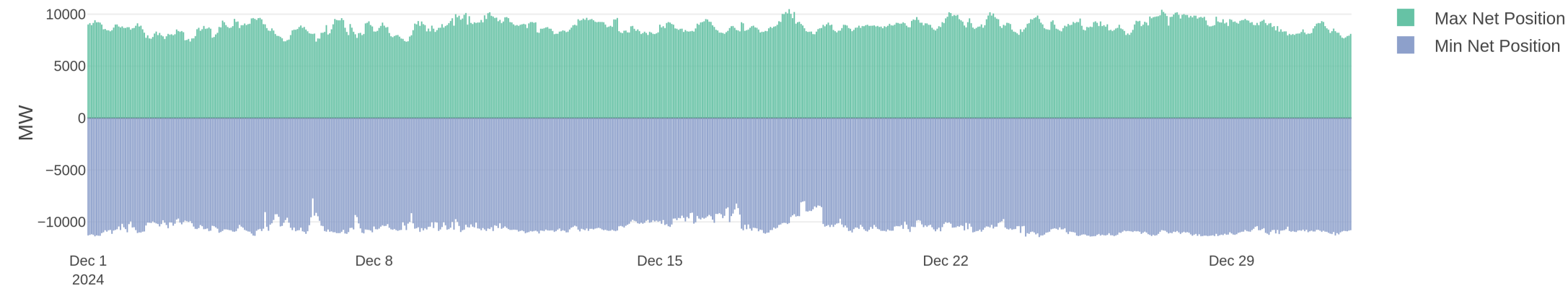
KPI 5: Min & max net positions per BZ hub



AT



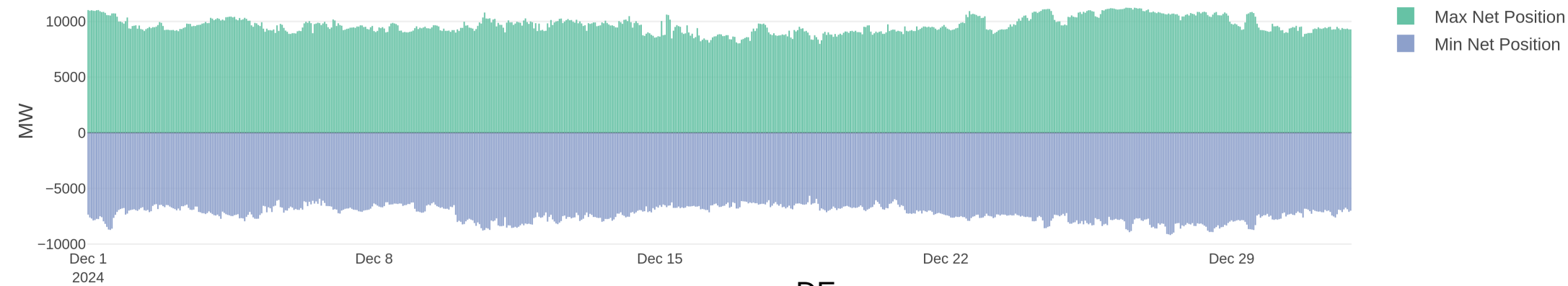
BE



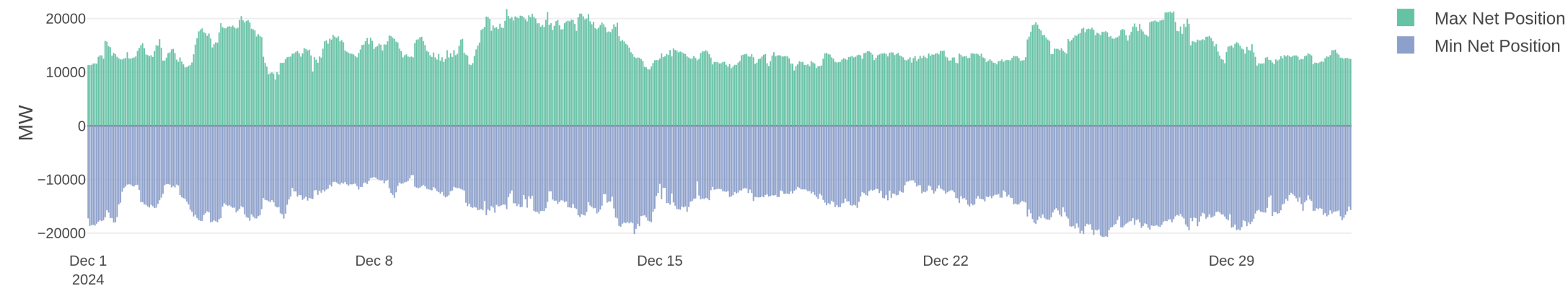
KPI 5: Min & max net positions per BZ hub



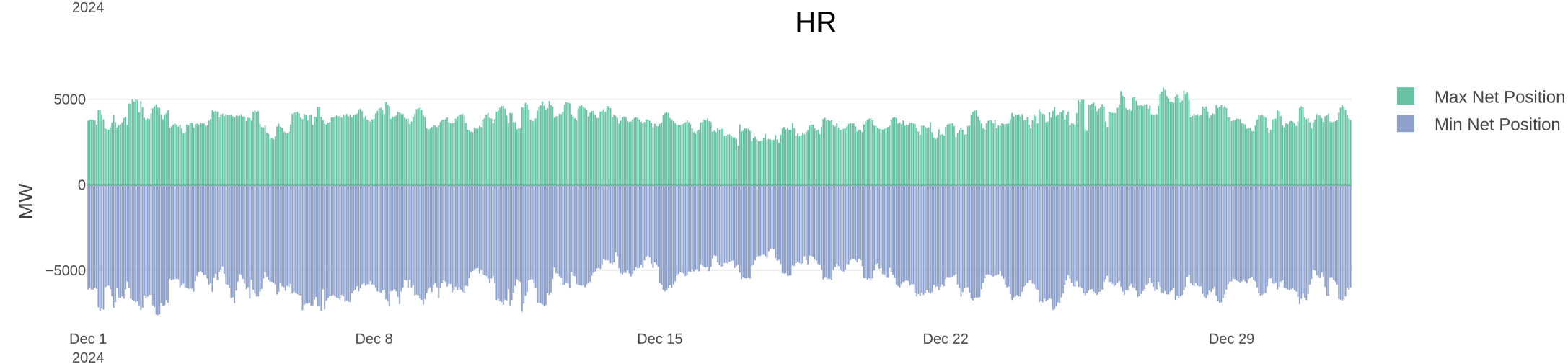
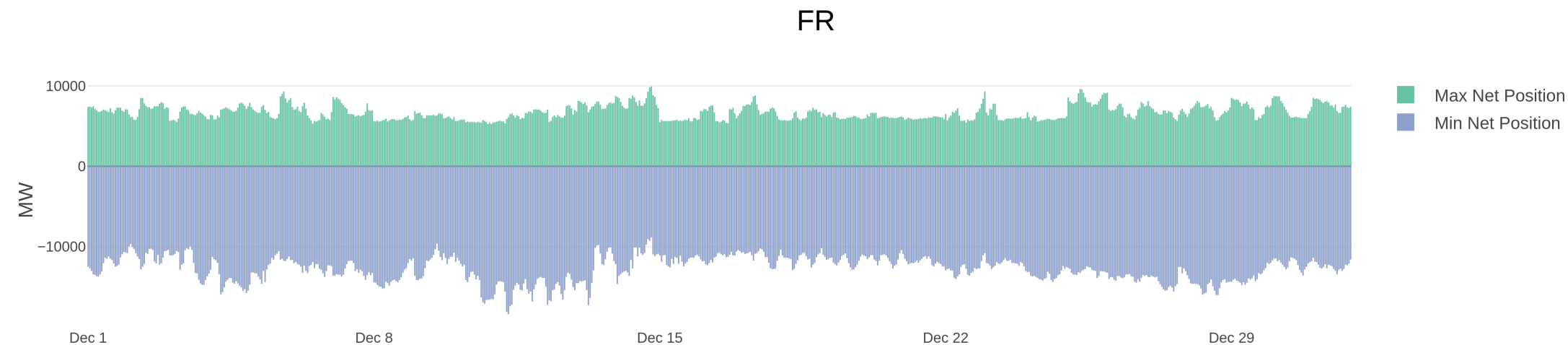
CZ



DE



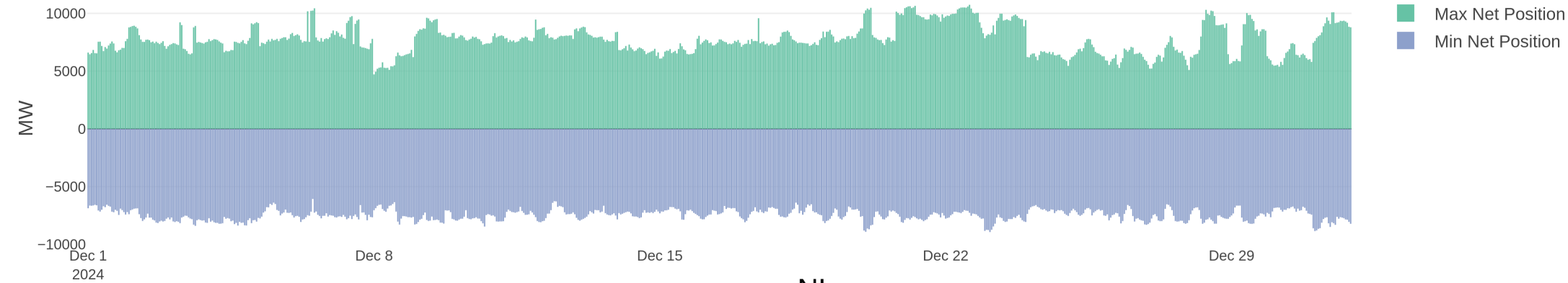
KPI 5: Min & max net positions per BZ hub



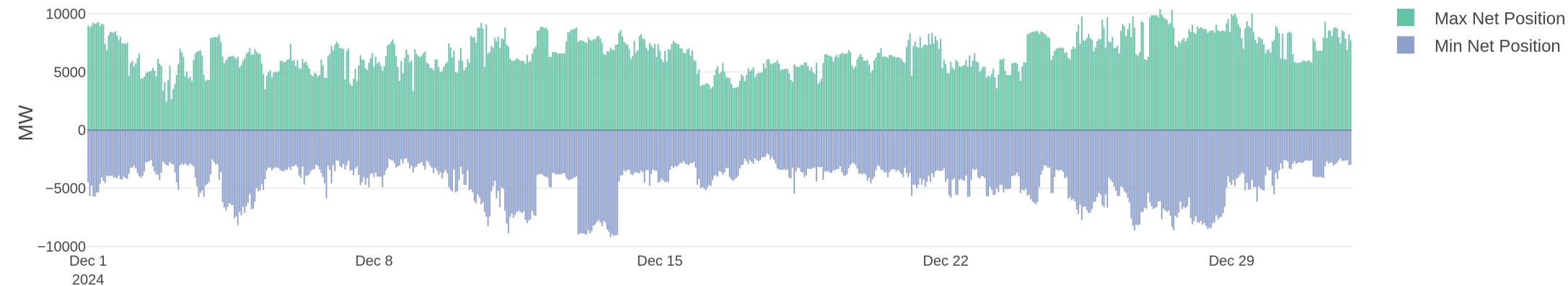
KPI 5: Min & max net positions per BZ hub



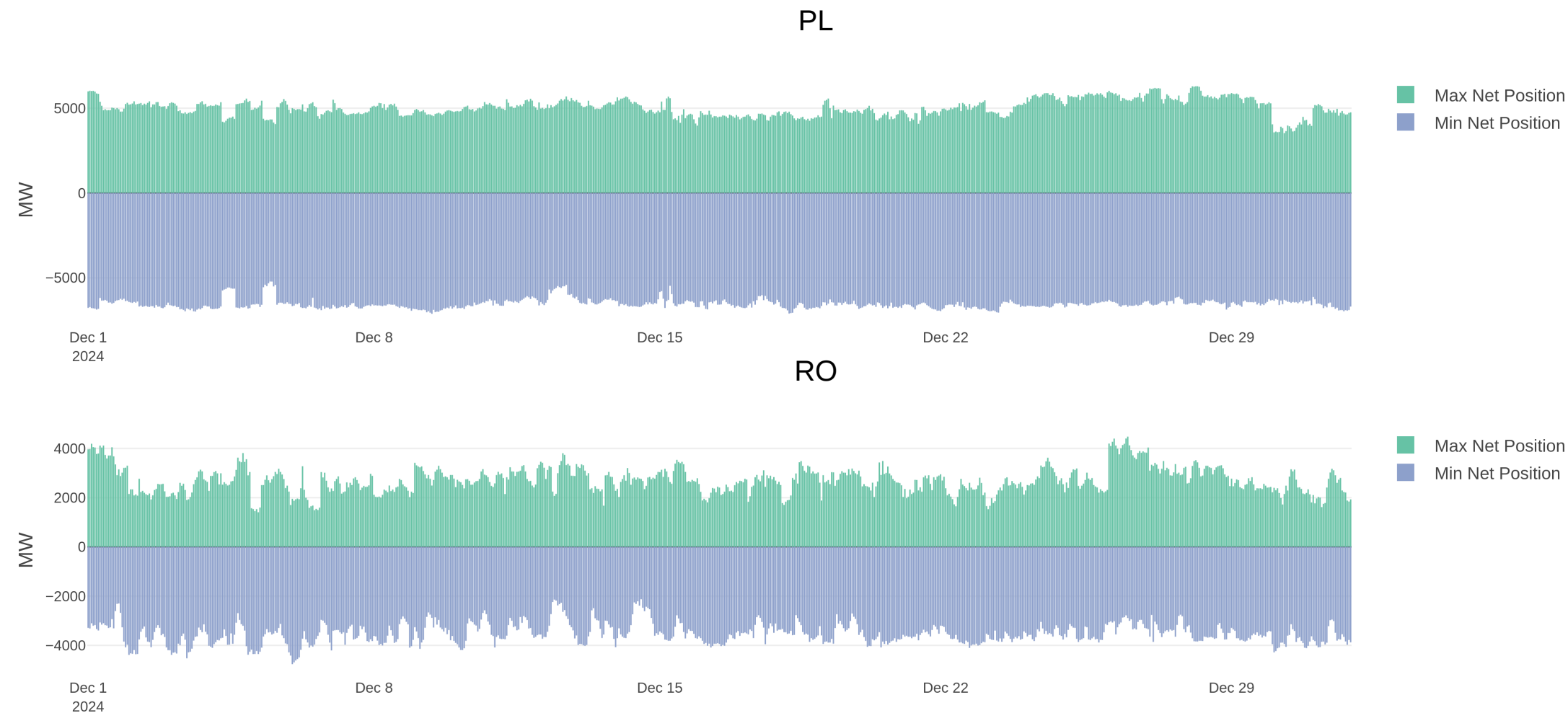
HU



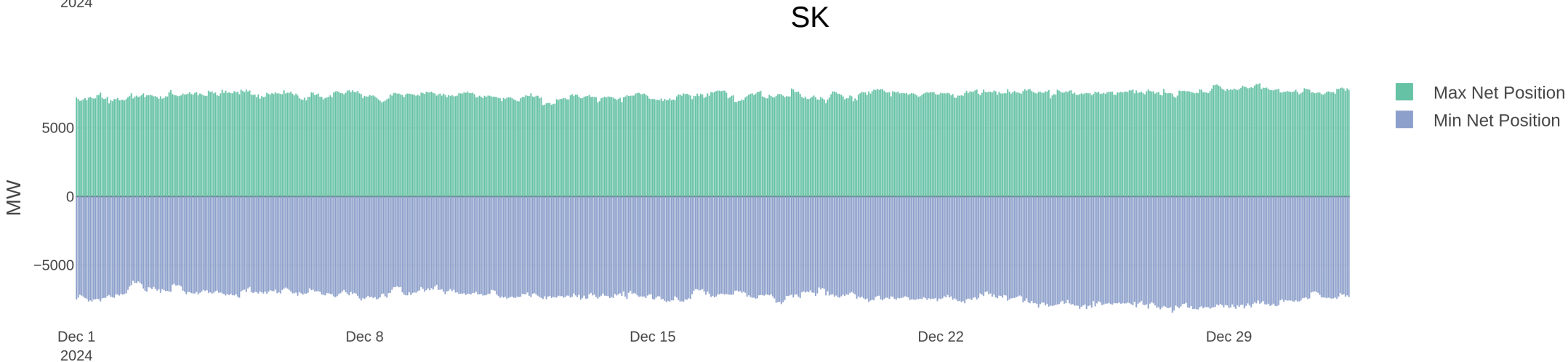
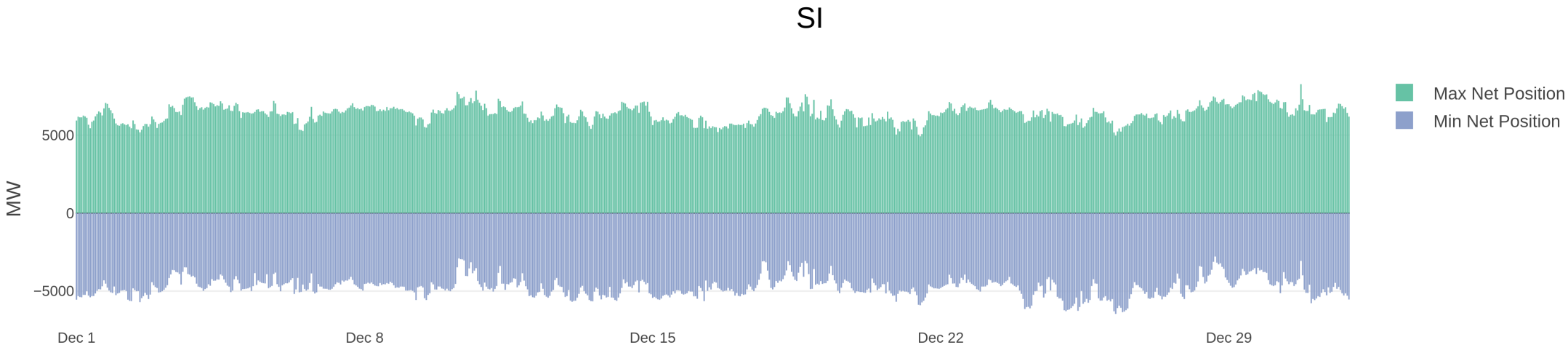
NL



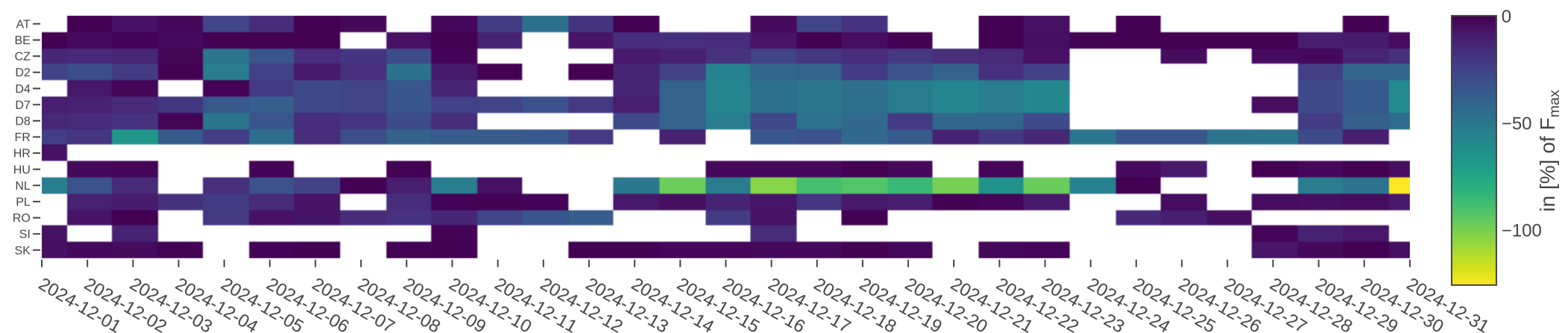
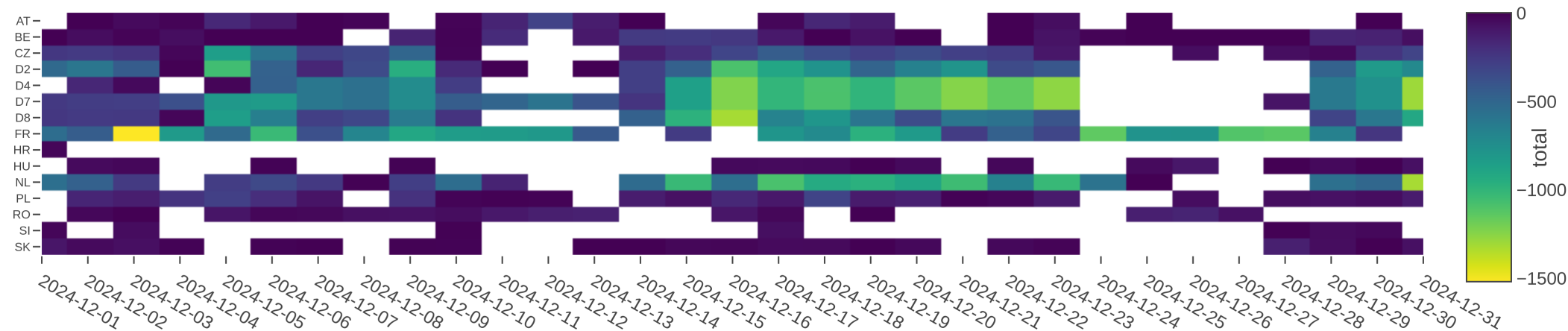
KPI 5: Min & max net positions per BZ hub



KPI 5: Min & max net positions per BZ hub



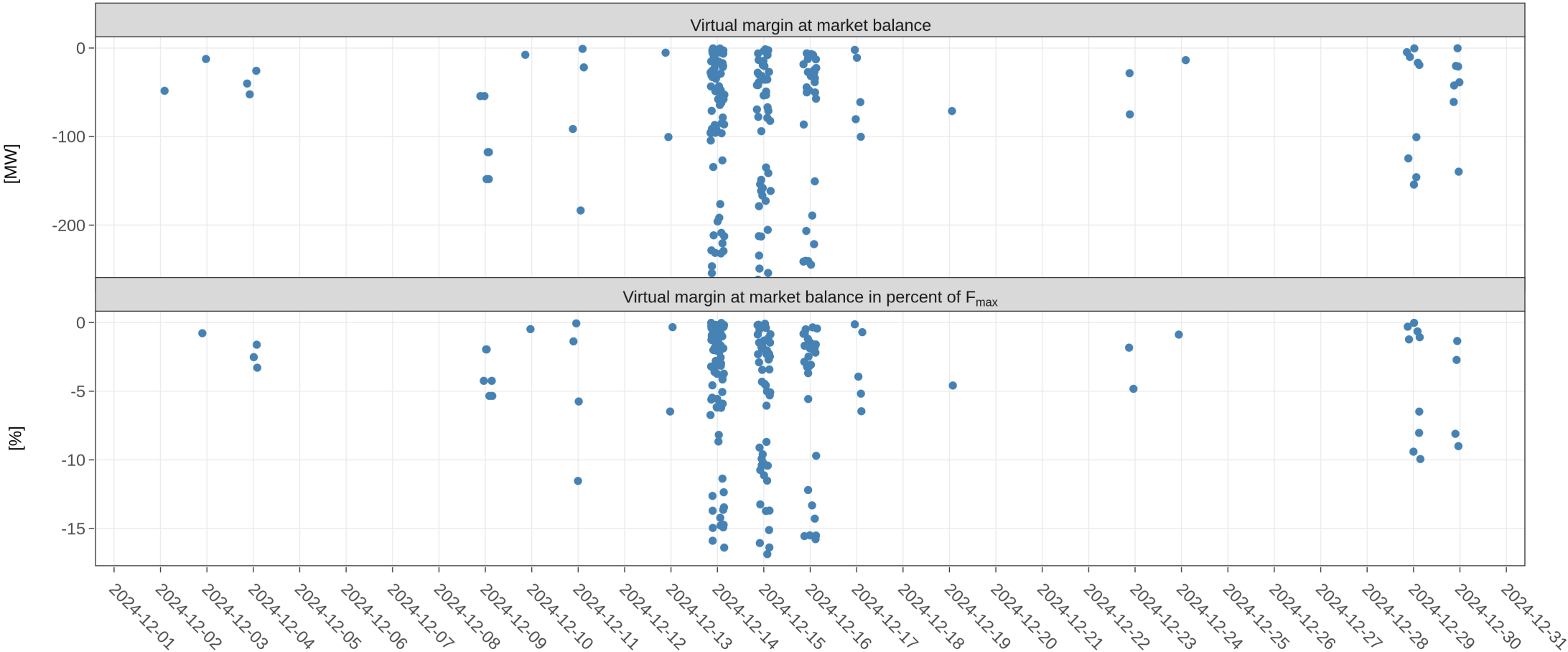
KPI 6a: Highest virtual margins at market balance for CORE TSOs



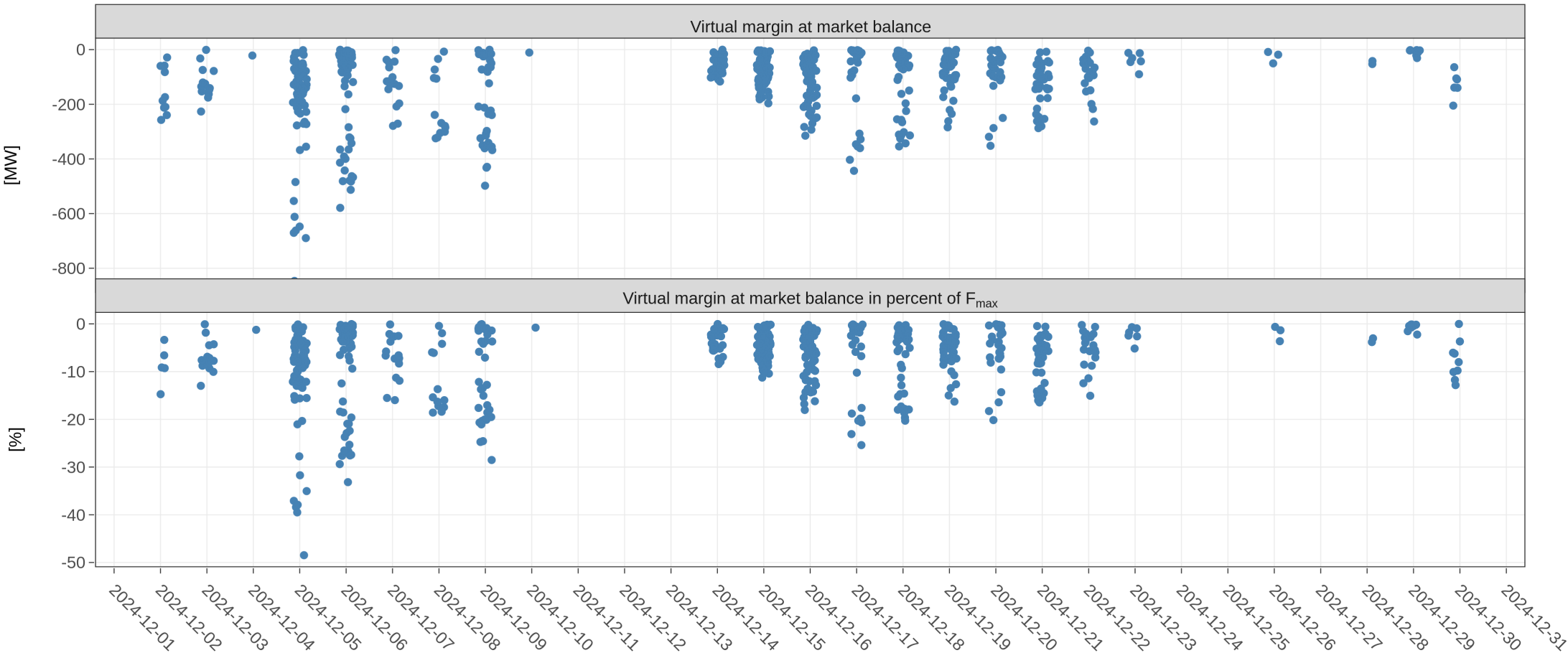
KPI 6b: Virtual margins at market balance AT



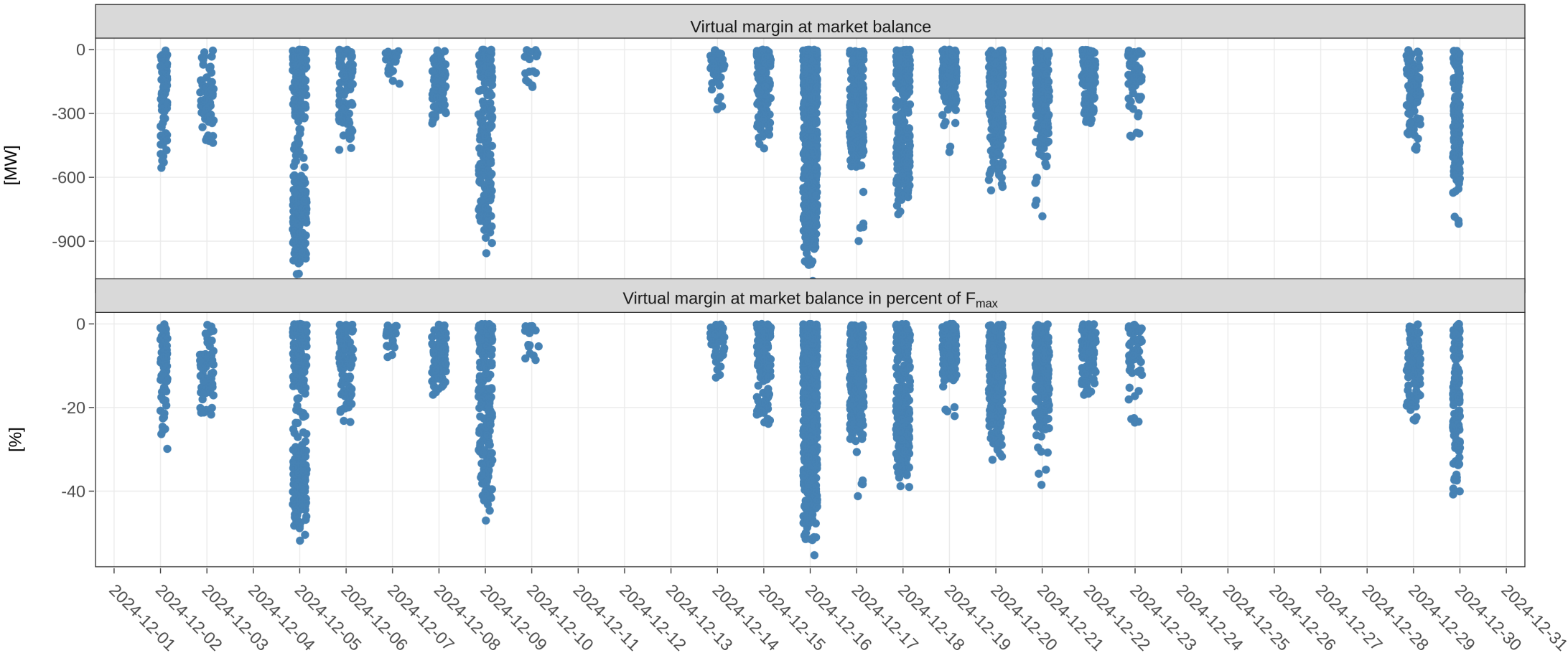
KPI 6b: Virtual margins at market balance BE



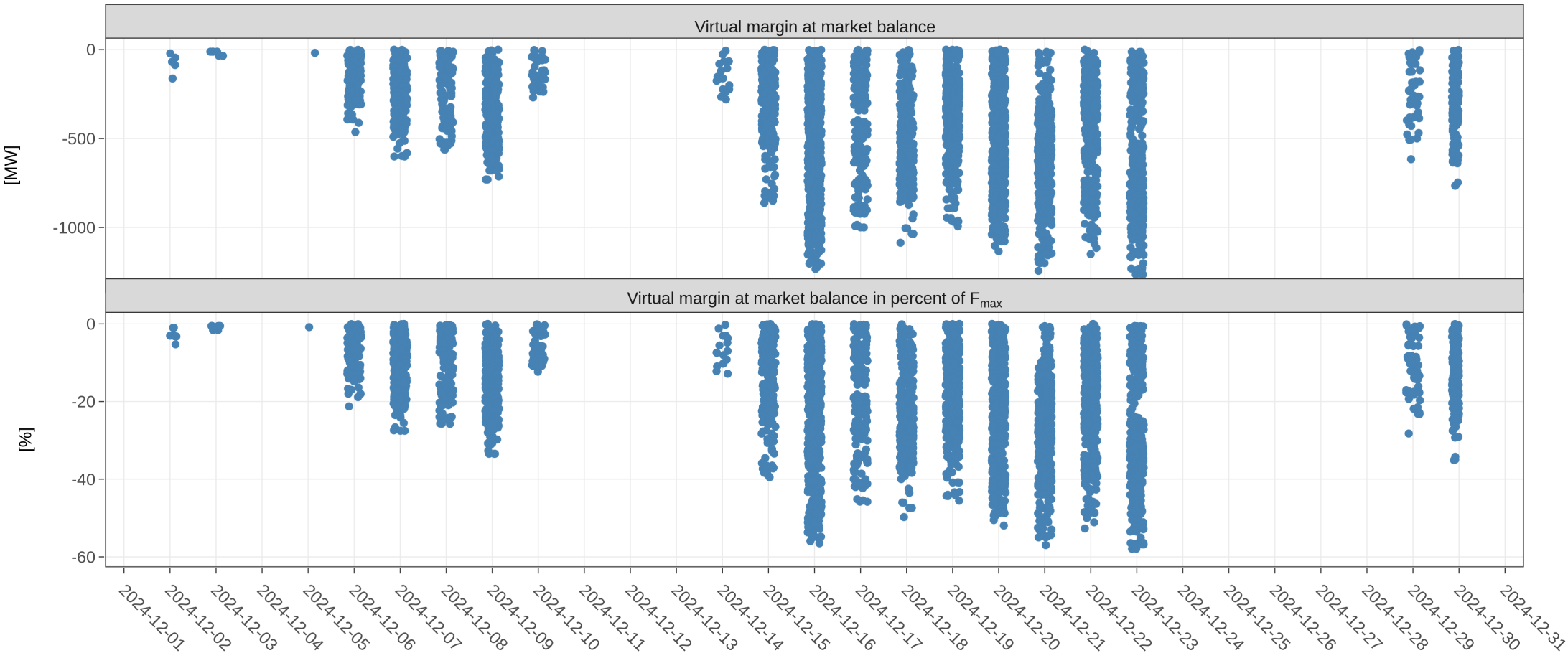
KPI 6b: Virtual margins at market balance CZ



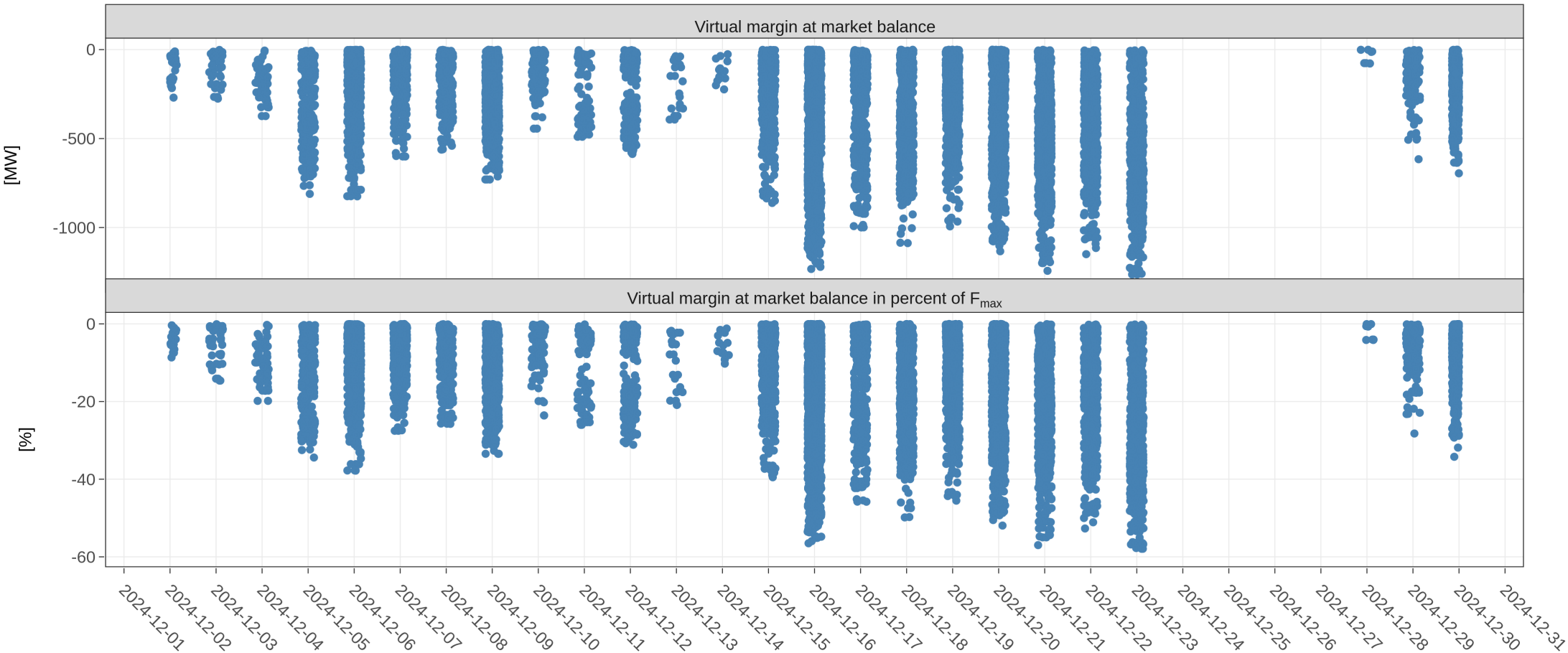
KPI 6b: Virtual margins at market balance D2



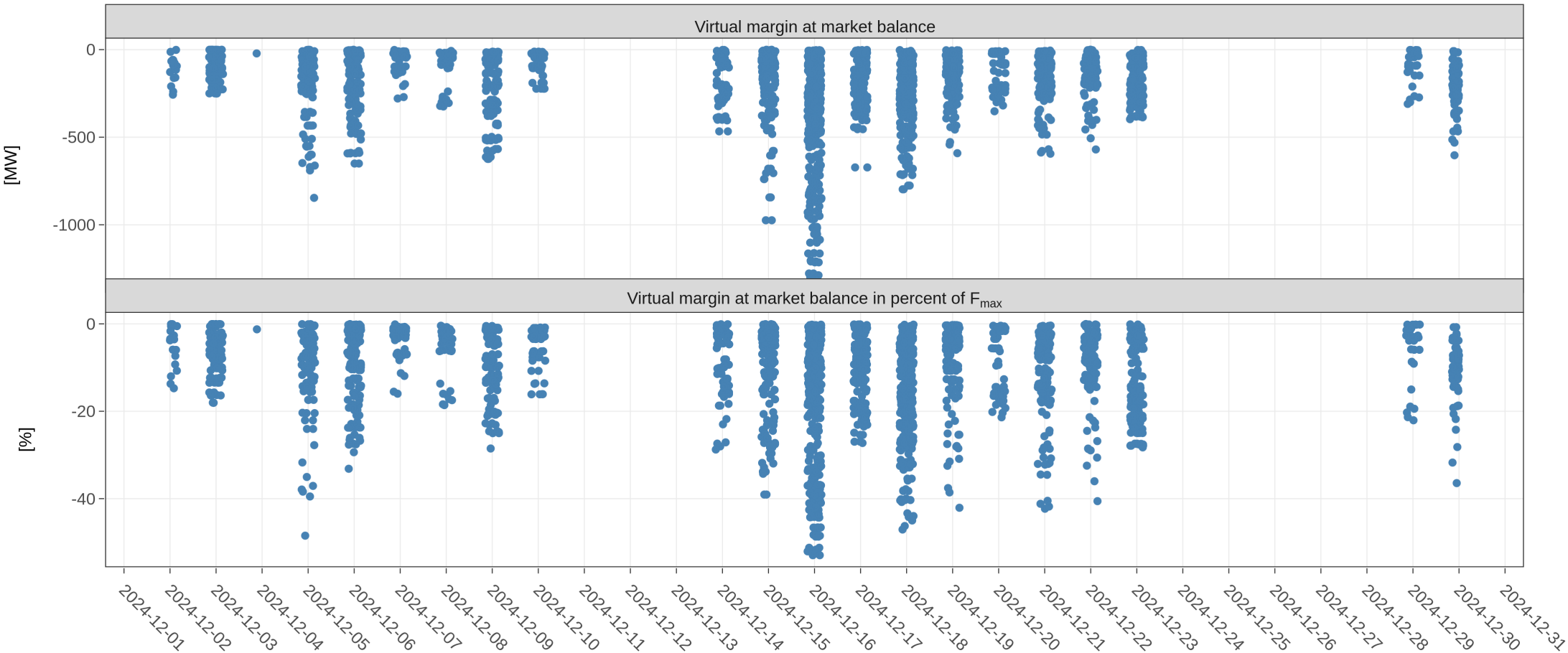
KPI 6b: Virtual margins at market balance D4



KPI 6b: Virtual margins at market balance D7



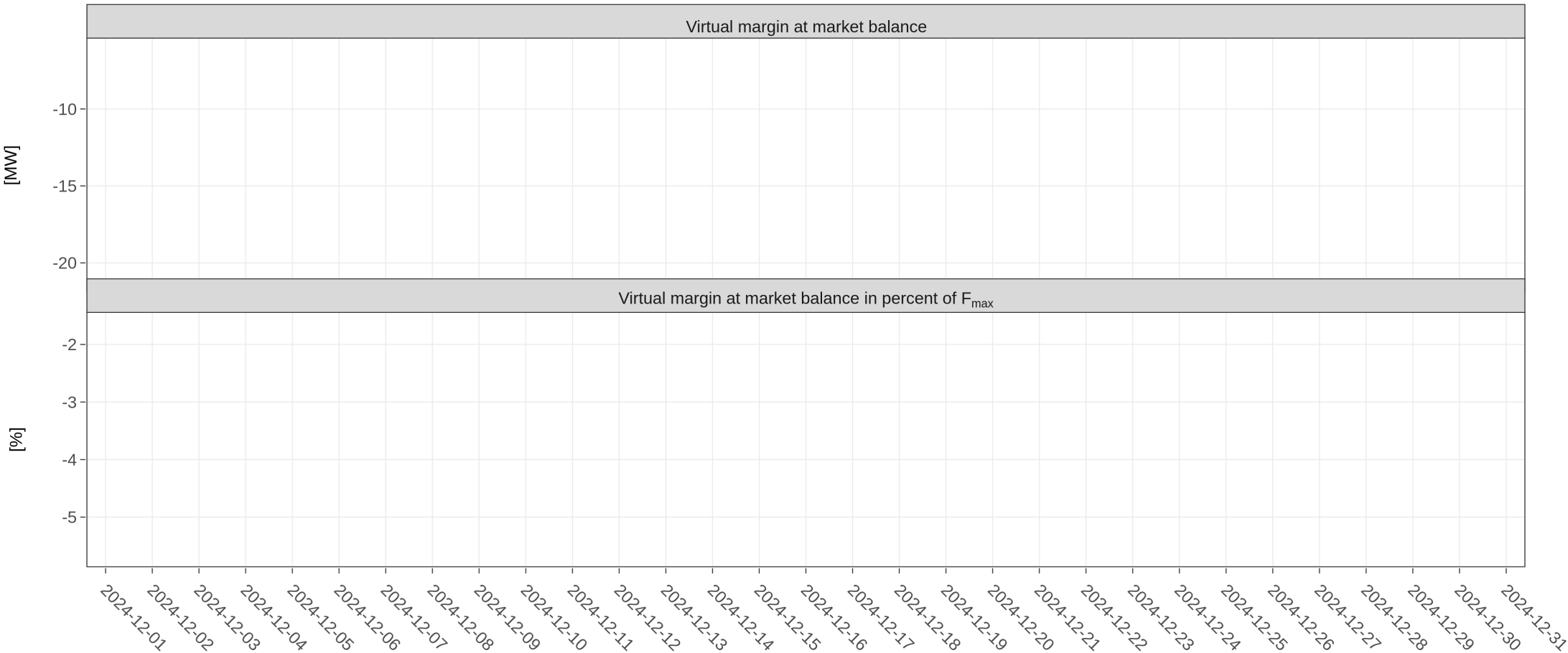
KPI 6b: Virtual margins at market balance D8



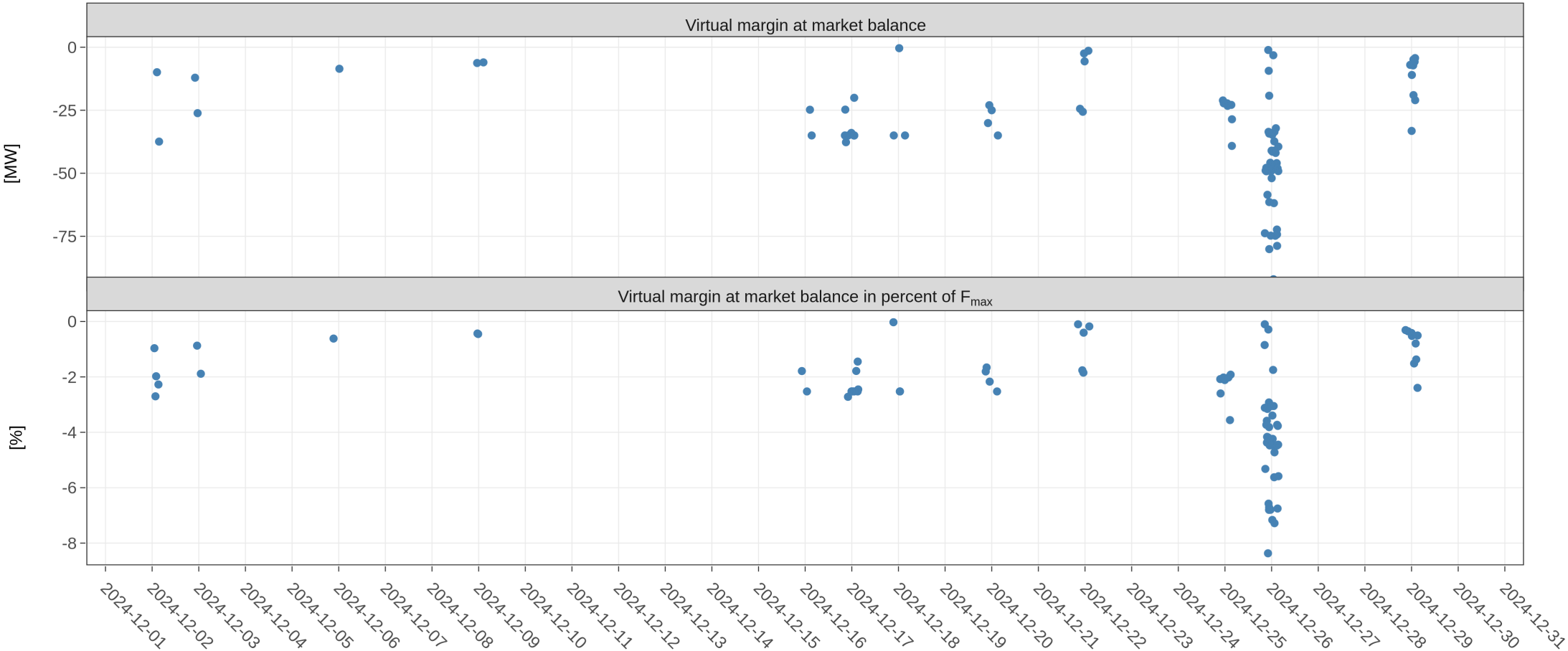
KPI 6b: Virtual margins at market balance FR



KPI 6b: Virtual margins at market balance HR



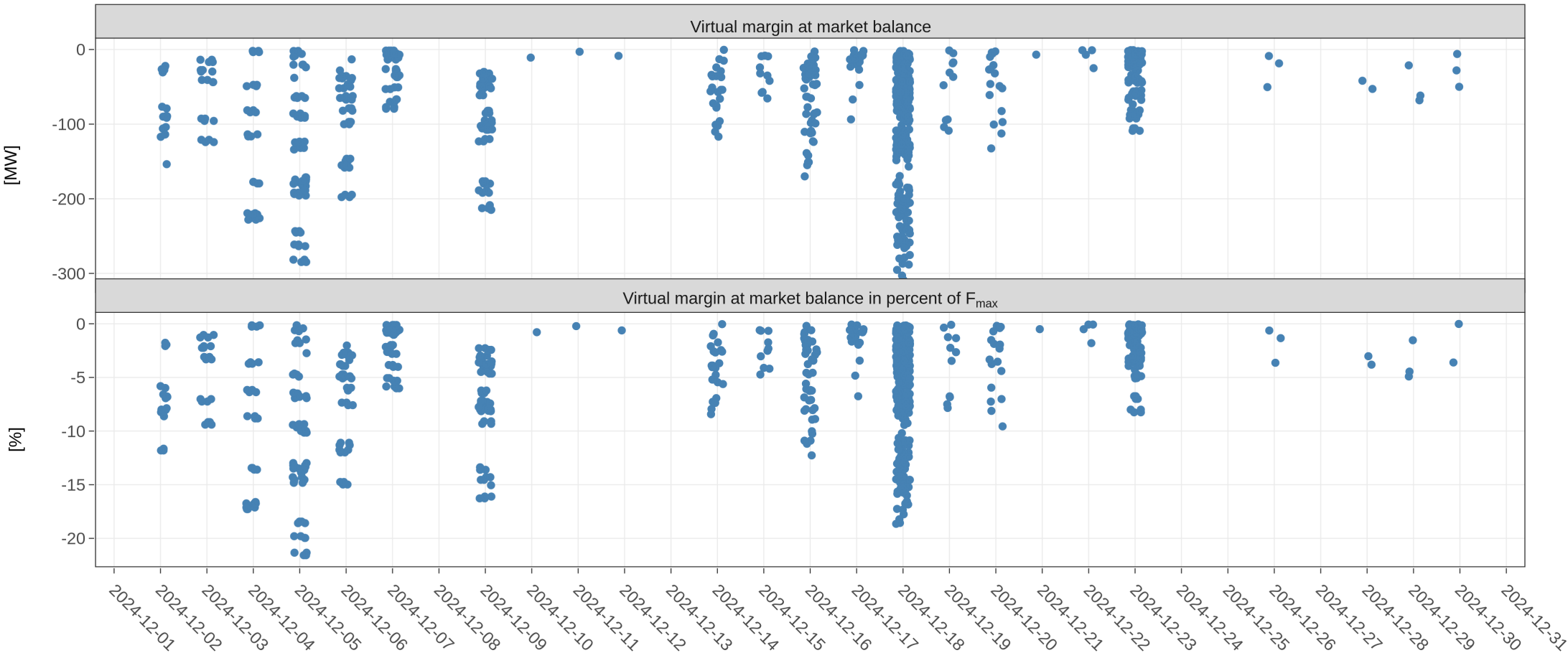
KPI 6b: Virtual margins at market balance HU



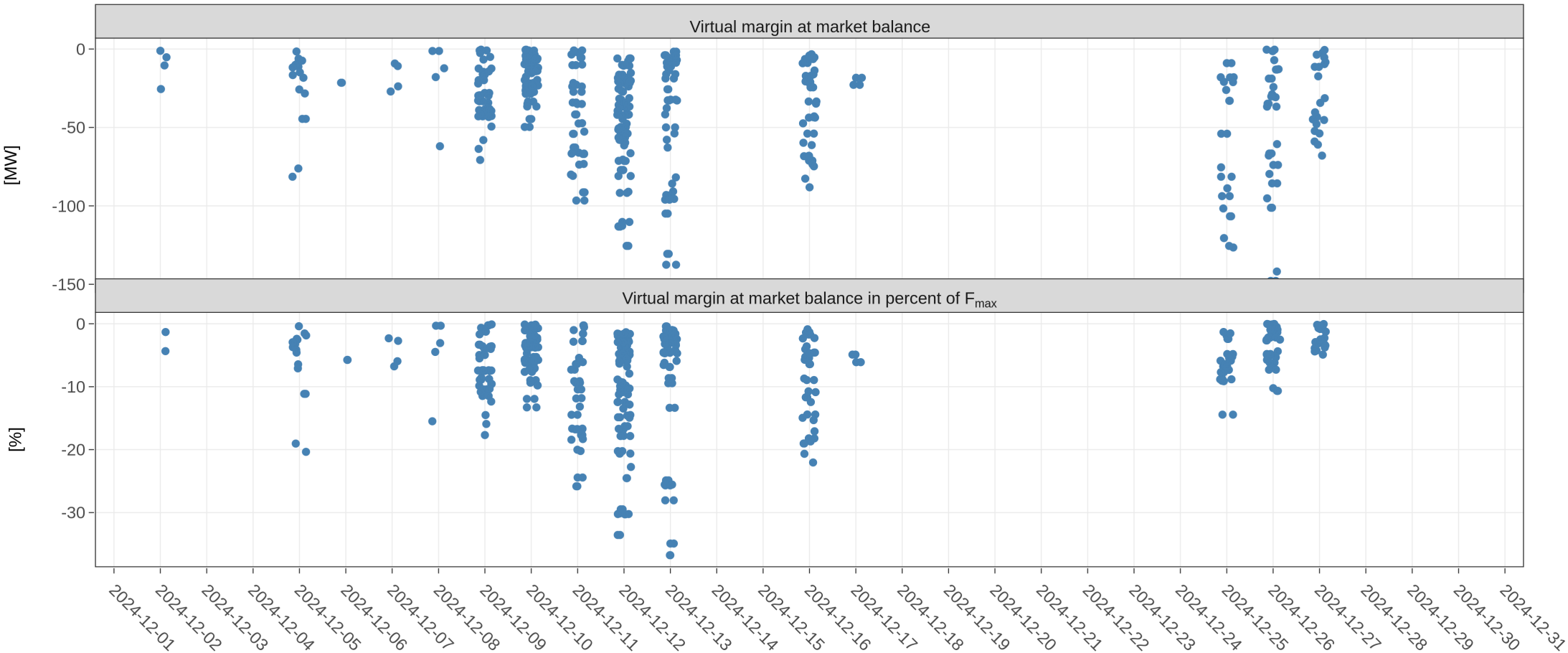
KPI 6b: Virtual margins at market balance NL



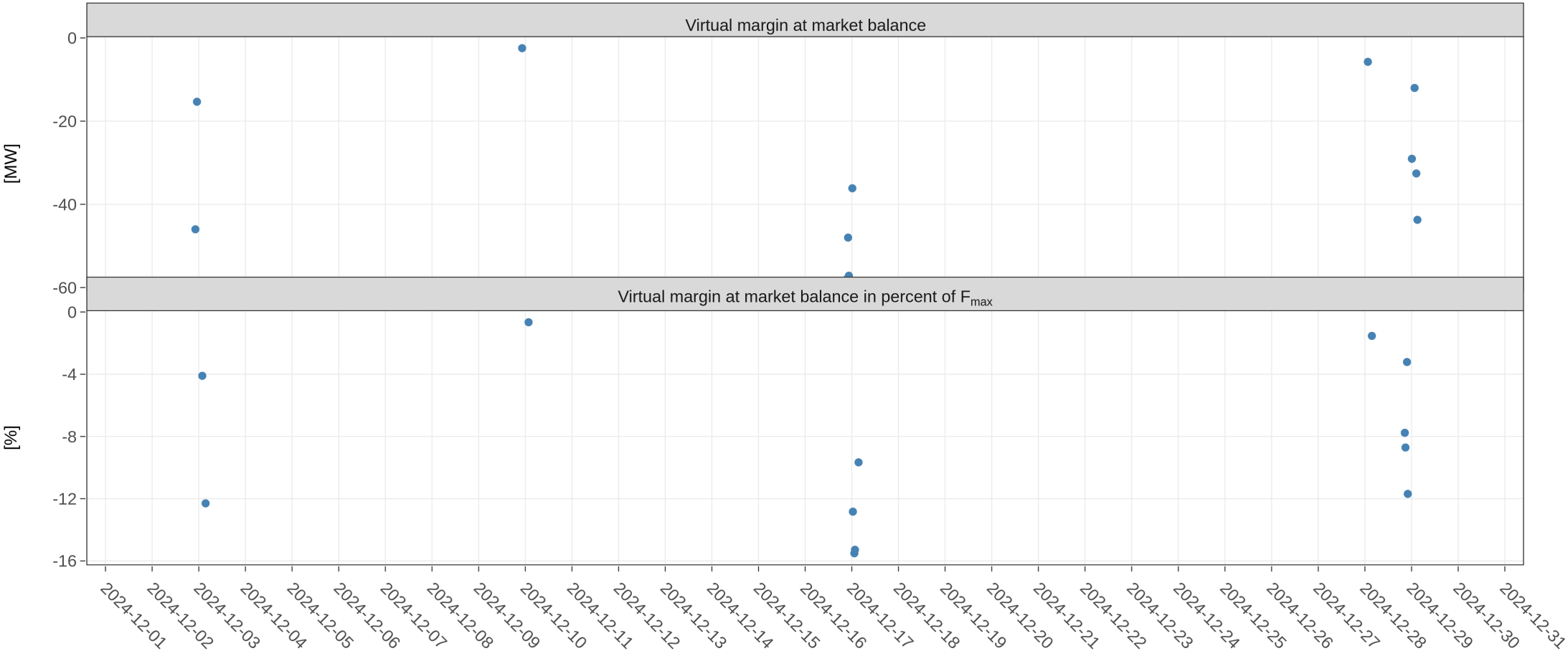
KPI 6b: Virtual margins at market balance PL



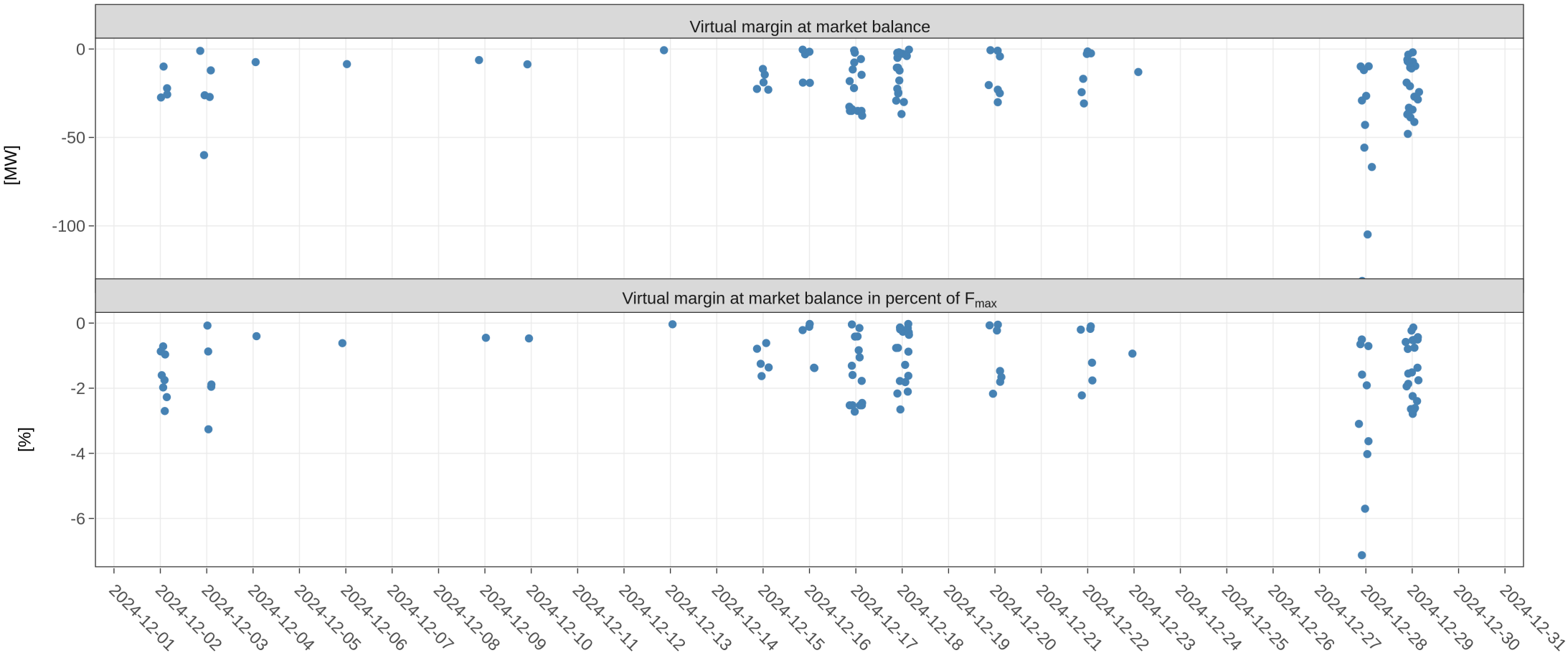
KPI 6b: Virtual margins at market balance RO



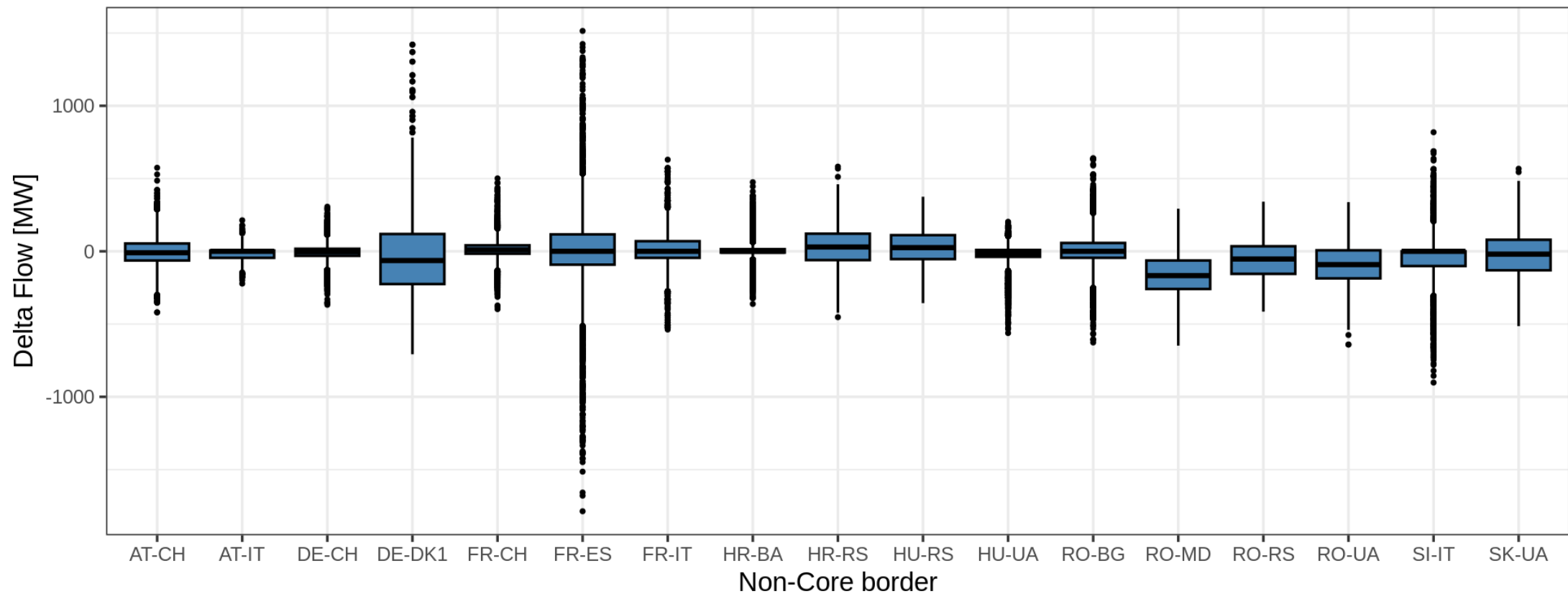
KPI 6b: Virtual margins at market balance SI



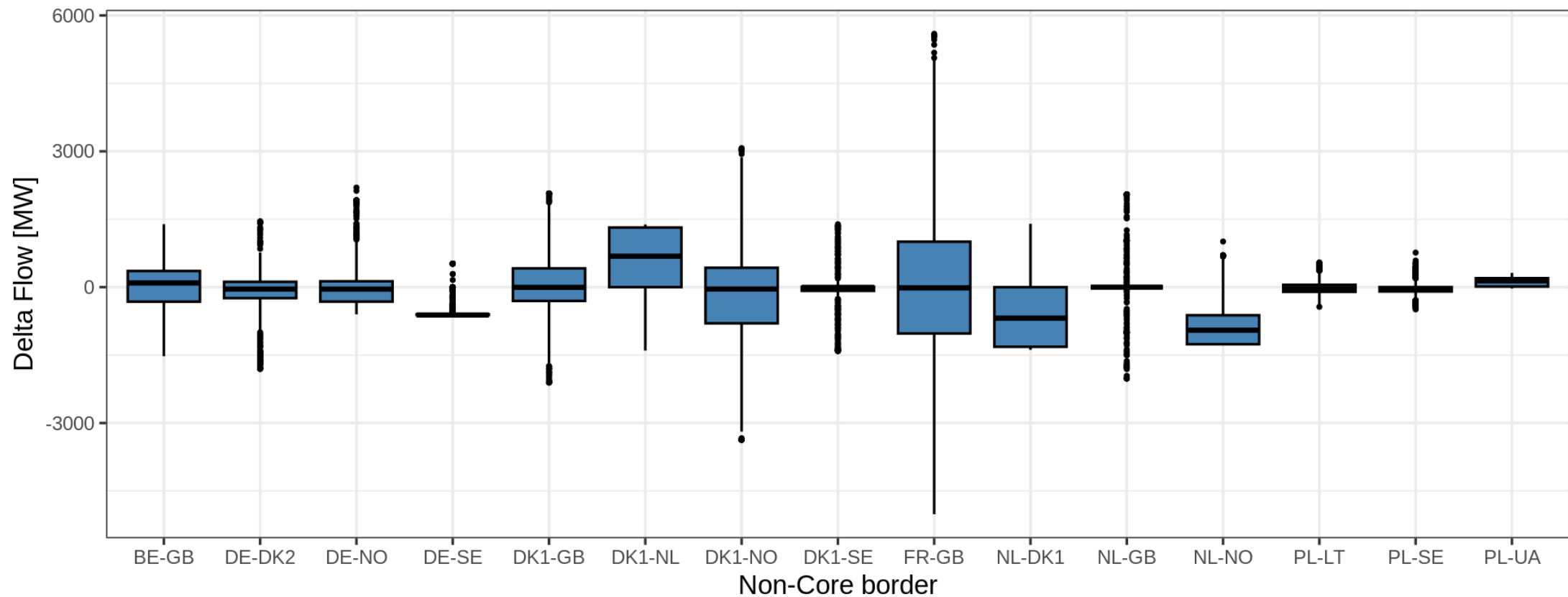
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow



KPI 7: Non-Core exchanges DC delta flow



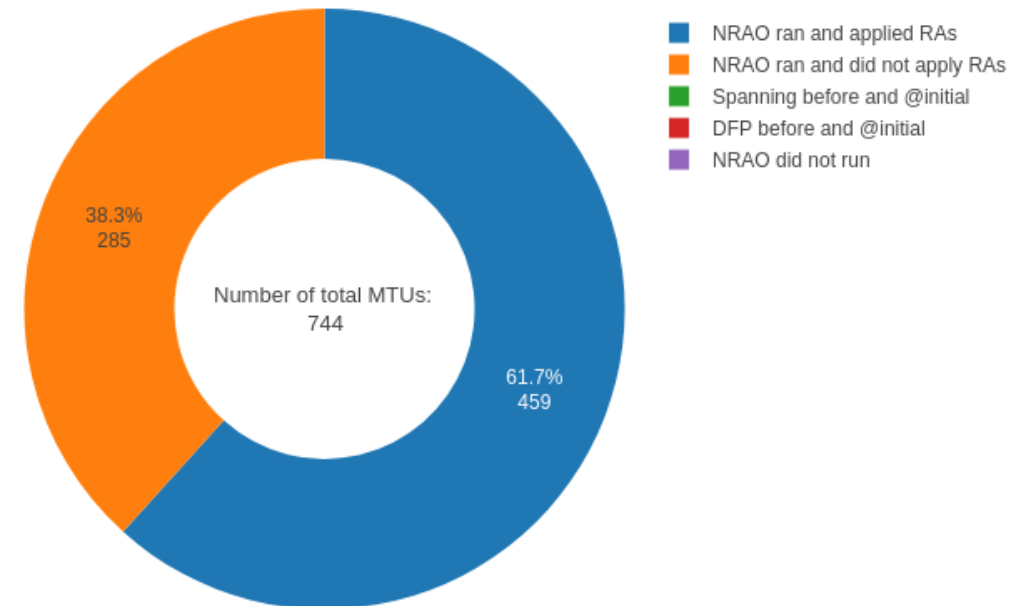
KPI 8: NRAO – Applied Remedial Action



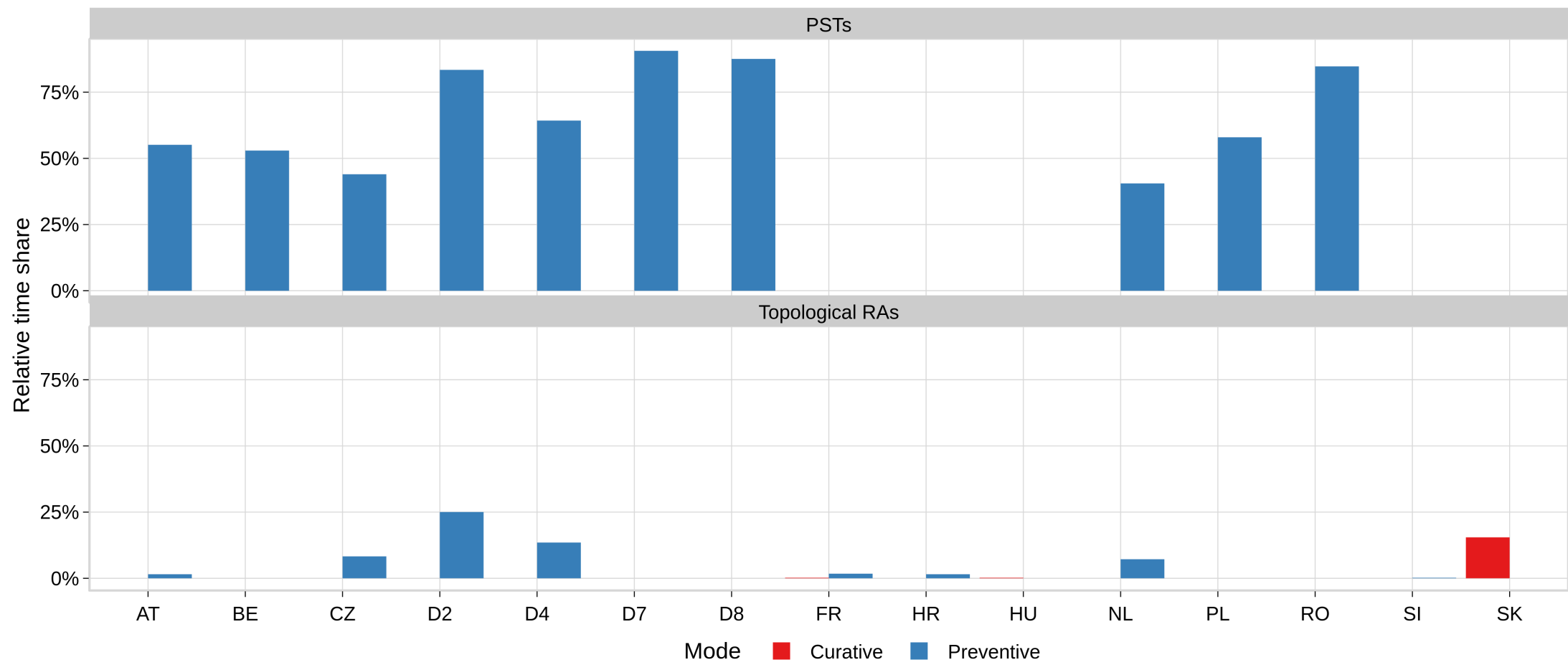
In the following plots, the relative time share relates to the hours labeled 'NRAO Ran and Applied RAs'.

Total MTUs: 744 hours

Category	Hours (%)
NRAO ran and applied RAs	459 hours (61.7%)
NRAO ran and did not apply RAs	285 hours (38.3%)
Spanning before and @initial	0 hours (0%)
DFP before and @initial	0 hours (0%)
NRAO did not run	0 hours (0%)

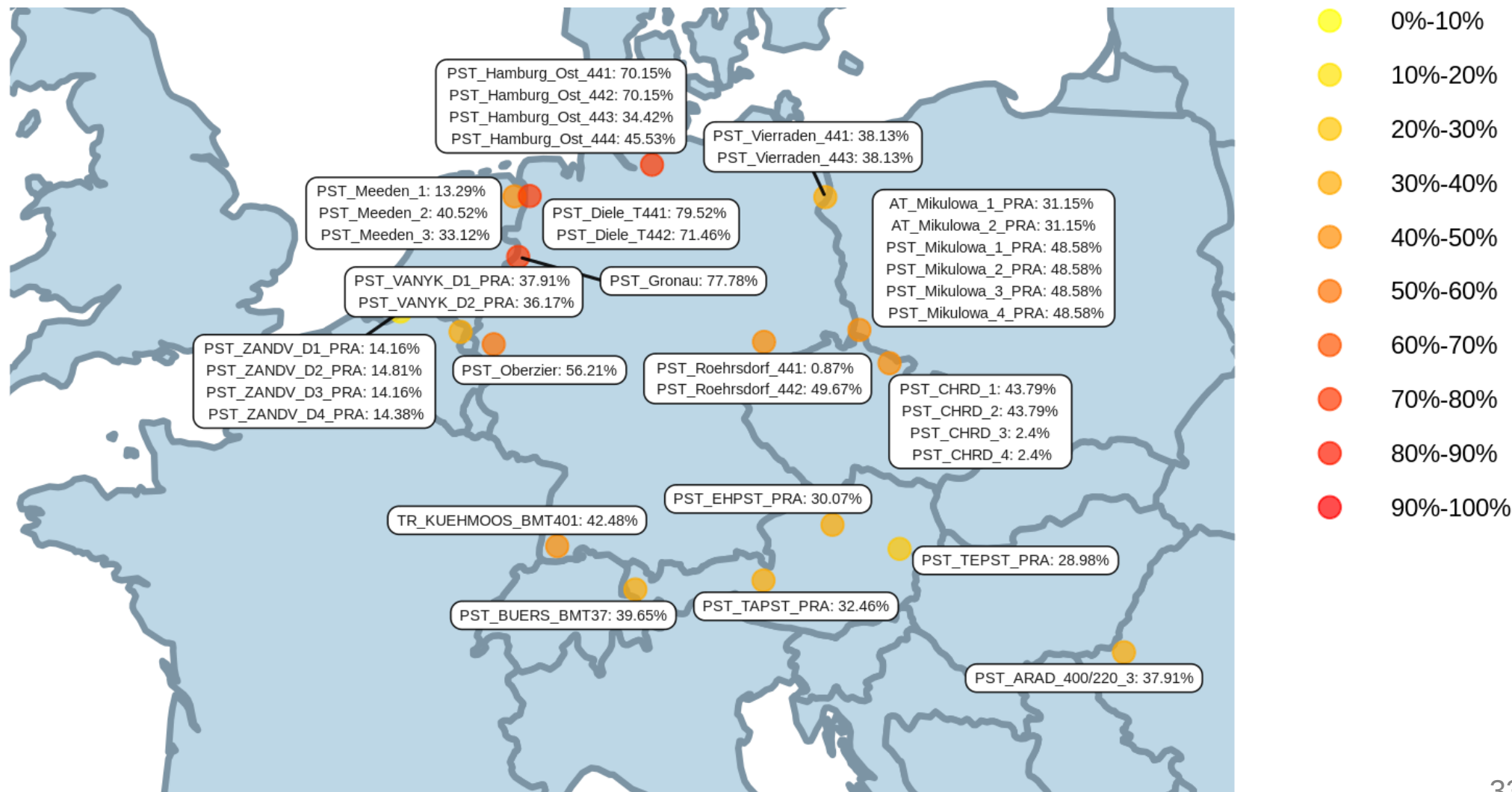


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied PSTs in Preventive Mode



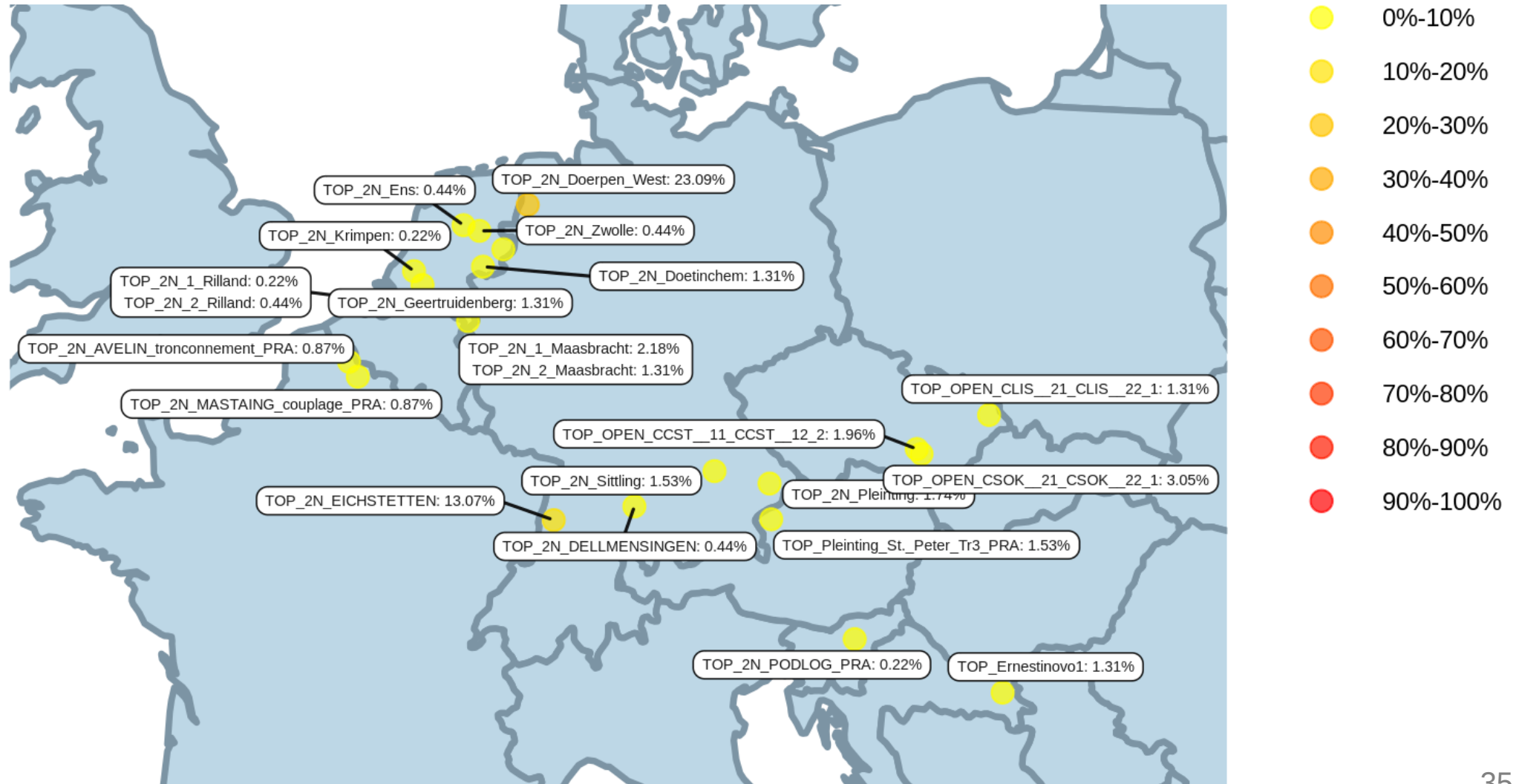
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied PSTs in Curative Mode



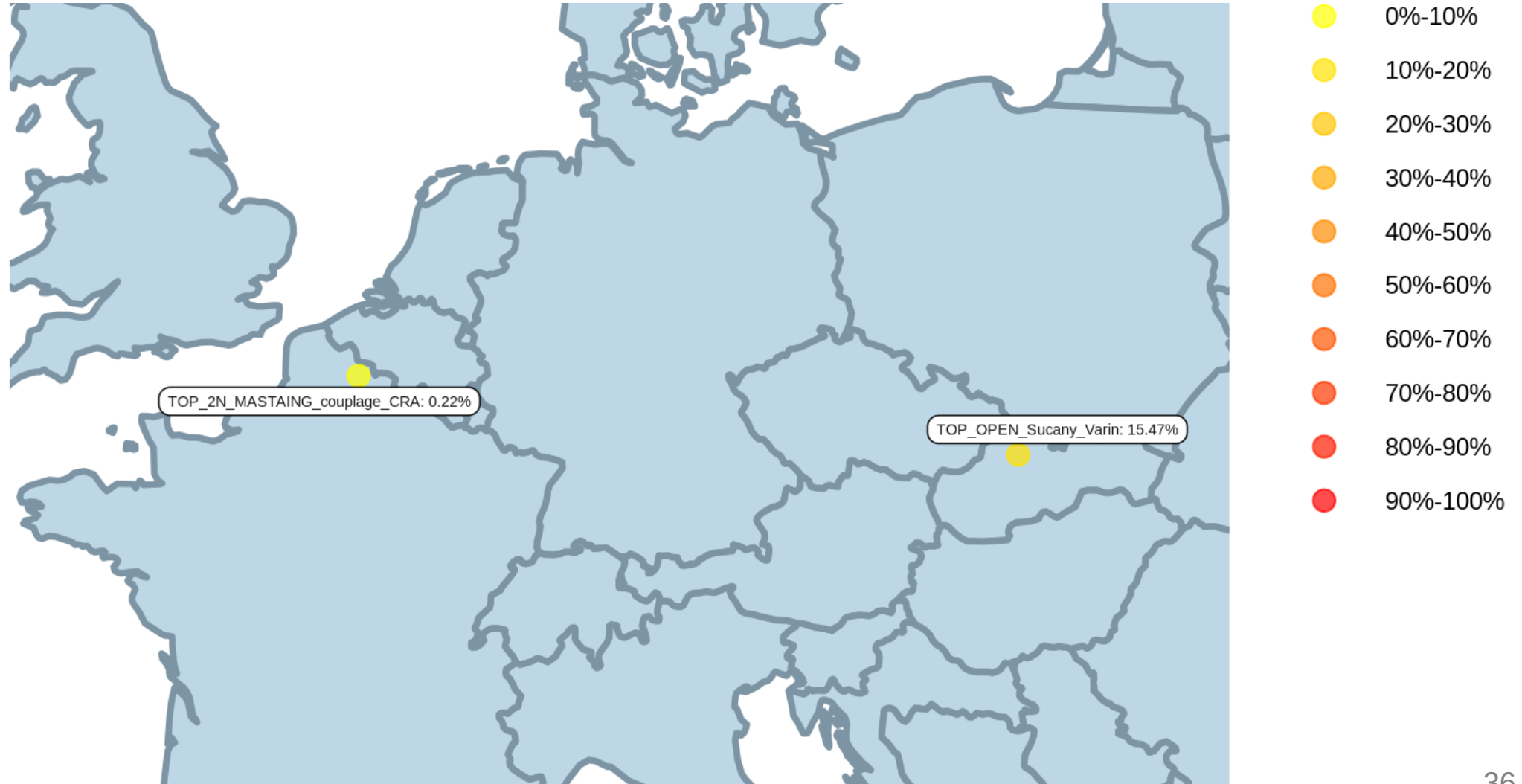
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied Topological RAs in Preventive Mode



KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

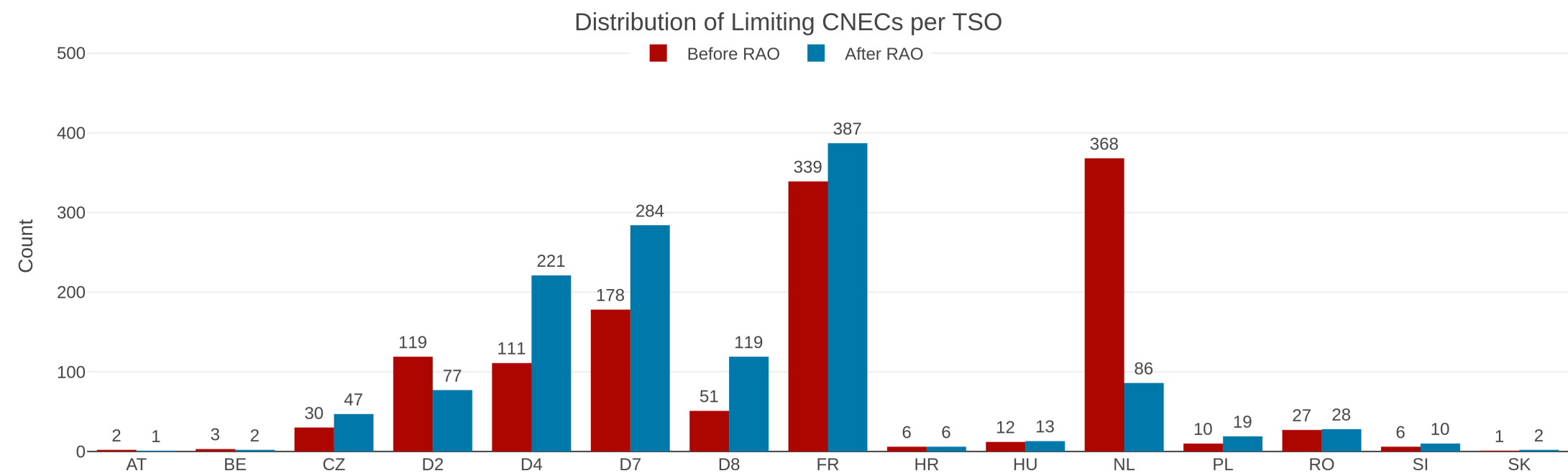
Relative Time Share of Applied Topological RAs in Curative Mode



KPI 9: 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.

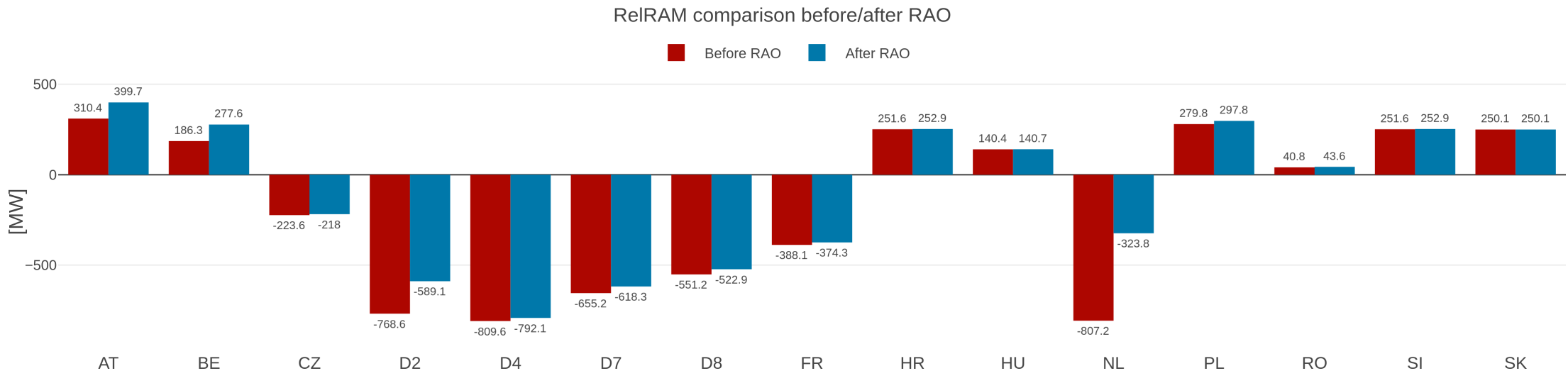
KPI 10: Average variation of relative RAM before and after NRAO



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

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



KPI 11: Most often presolved CNEs (top 20)



CNE	Distinct hours CNE was presolved	Count of presolved CNECs	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF	Max sum z2zPTDF
[HU-HU] Gonyu - Gyor [DIR]	744	1718	71.57%	25.32%	95.31%	0.2351	1.3314
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	744	778	40.69%	13.10%	78.61%	0.1876	0.4418
[SK-SK] Gabcikovo - P.Biskupice [DIR]	744	744	83.80%	71.65%	104.49%	0.2885	1.0234
[CZ-SK] Nosovice - Varin [OPP] [CZ]	744	884	103.17%	84.63%	129.22%	0.328	1.3021
[CZ-SK] Nosovice - Varin [OPP] [SK]	744	1526	101.72%	81.89%	125.61%	0.3106	1.2264
[SI-HU] 400 kV Cirkovce - Hevitz [OPP] [SI]	744	1485	83.46%	60.96%	104.78%	0.1993	0.9818
[CZ-SK] Nosovice - Varin [DIR] [SK]	744	1674	75.73%	53.03%	98.05%	0.3106	1.2264
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	744	1871	52.90%	38.10%	76.12%	0.3486	1.1916
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	743	1481	128.21%	94.65%	172.99%	0.1876	0.4417
[SK-SK] V.Dur - Levice 1 [DIR]	743	743	45.87%	36.32%	61.72%	0.2058	0.8143
[SI-HU] 400 kV Cirkovce - Hevitz [DIR] [SI]	743	1486	96.66%	74.93%	124.89%	0.1993	0.9818
[CZ-SK] Nosovice - Varin [DIR] [CZ]	742	1556	75.70%	52.81%	95.31%	0.328	1.3021
[SI-HU] Cirkovce - Heviz [OPP] [HU]	741	741	82.85%	62.99%	104.69%	0.2265	1.1404
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	741	741	74.98%	54.52%	96.57%	0.227	0.7738
[HR-HU] 400kV Ernestinovo - Pecs 1 [OPP] [HR]	737	737	73.11%	49.62%	97.59%	0.2506	0.7818
[SI-HR] 400 kV Divaca - Melina [OPP] [SI]	734	734	36.53%	4.36%	90.38%	0.1417	0.6912
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	727	757	37.94%	19.90%	75.96%	0.2164	0.5566
[HU-HU] Gonyu - Gyor [OPP]	727	728	118.57%	84.63%	157.14%	0.2112	1.3314
[AT-HU] Zurndorf - Gyoer 439B [DIR] [AT]	725	2000	86.32%	18.98%	116.74%	0.4134	1.7036
[NL-NL] MEE DRT2 [DIR] [NL]	724	724	40.92%	19.96%	148.19%	0.3198	0.6983

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 12: Most limiting CNEs (top 20)



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
[CZ-SK] Nosovice - Varin [DIR] [CZ]	299	302	545.56	70.17%	52.81%	87.95%	0.328
[D8-D8] Roehrsdorf - Roehrsdorf PST442 [DIR]	225	225	797.66	41.25%	26.41%	54.80%	0.2751
[NL-NL] MEE DRT2 [DIR] [NL]	159	159	455.8	21.06%	19.96%	74.43%	0.3072
[FR-FR] Creys - Saint-Vulbas 2 [OPP]	127	127	605.05	22.81%	19.98%	34.44%	0.1483
[CZ-D8] Hradec - Rohrsdorf 446 [OPP] [D8]	119	119	371.91	39.00%	19.93%	57.16%	0.3409
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	118	118	363.94	48.70%	42.50%	59.96%	0.3172
[FR-D7] Vigy - Enseldorf VIGY2 S [DIR] [D7]	92	93	989.04	22.11%	19.90%	37.00%	0.2146
[SK-HU] Levice - God [DIR] [HU]	92	92	377.61	56.28%	47.40%	66.16%	0.2476
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	78	78	542.01	85.61%	35.61%	143.94%	0.185
[D8-D8] Vierraden - Vierraden PST441 [DIR]	77	77	358.73	42.16%	29.15%	56.49%	0.2636
[D8-PL] Mikulowa PST1 [DIR] [PL]	51	51	396.22	46.63%	38.41%	63.41%	0.3526
[NL-NL] Krimpen a/d IJssel-Geertruidenberg 380 W [DIR]	47	47	563.27	45.33%	30.01%	85.21%	0.4079
[SK-SK] V.Dur - Levice 1 [DIR]	39	39	469.33	41.01%	36.32%	44.64%	0.186
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	37	37	762.7	64.24%	54.52%	75.44%	0.2187
[D2-D2] Altheim - Sittling 219 [OPP]	34	34	1155.88	69.36%	33.25%	104.83%	0.1016
[NL-D7] Maasbracht - Oberzier SELFK WS [DIR] [D7]	32	32	49.82	43.89%	27.60%	59.45%	0.2685
[D7-D7] Buerstadt - Lamsheim BUERST W [DIR]	32	32	616.35	46.80%	39.49%	57.70%	0.1408
[D4-D7] Daxlanden - Maximiliansau sw (Goldgrund Ost)	28	28	993.7	20.80%	20.03%	26.40%	0.1146
[D7-D7] Gronau - Gronau TR 441 E [DIR]	24	24	905.23	52.11%	32.33%	77.80%	0.2162
[NL-BE] Rilland-Zandvliet 380 G [DIR] [NL]	23	23	141.1	57.54%	46.45%	68.82%	0.5157

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 Euphemia 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 = $500\text{MW}/0.4 = 1250\text{MW}$

KPI 13 : Allocation Constraints - Poland



	# MTUs
AC was limiting MC	155
AC < 0 MW	16
AC = 0 MW	93
AC > 0 MW	46

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-2114.02	5379.72
Min.	-9117.00	0.00
Max.	0.00	16815.00

