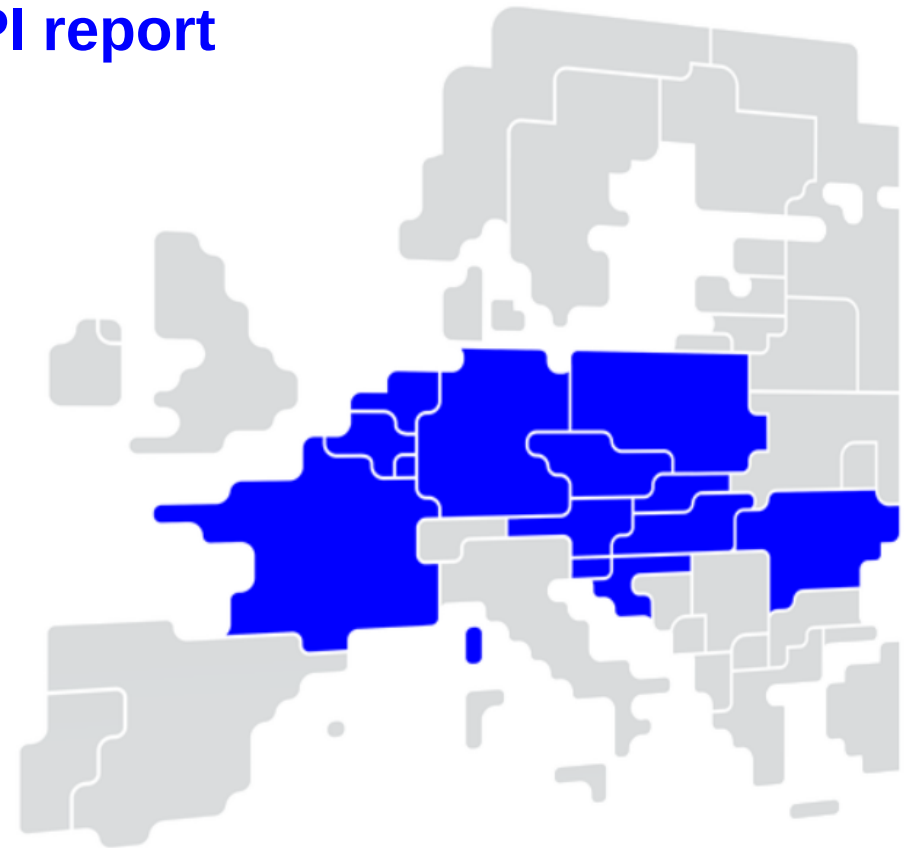


Core FB MC Operational KPI report

December 2023



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
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Non-costly Remedial Action Optimization Analysis

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

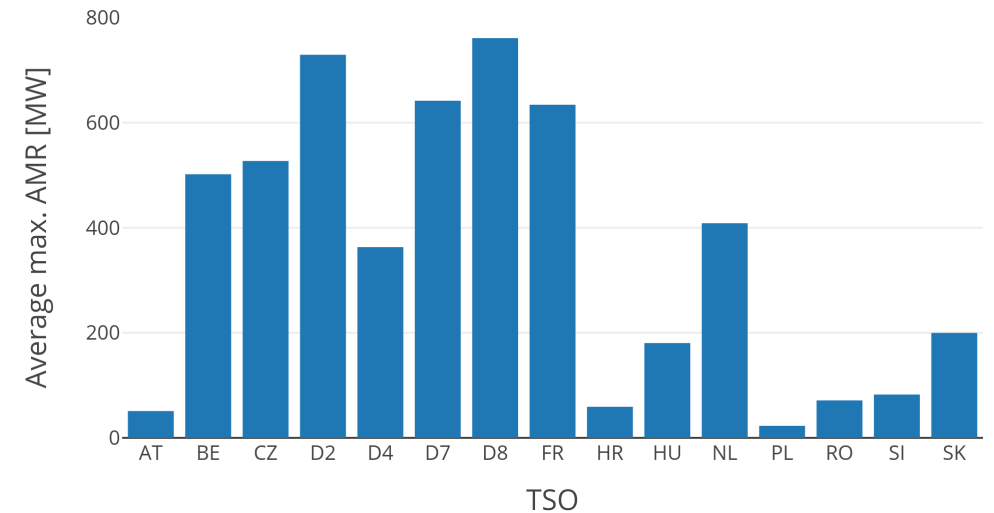
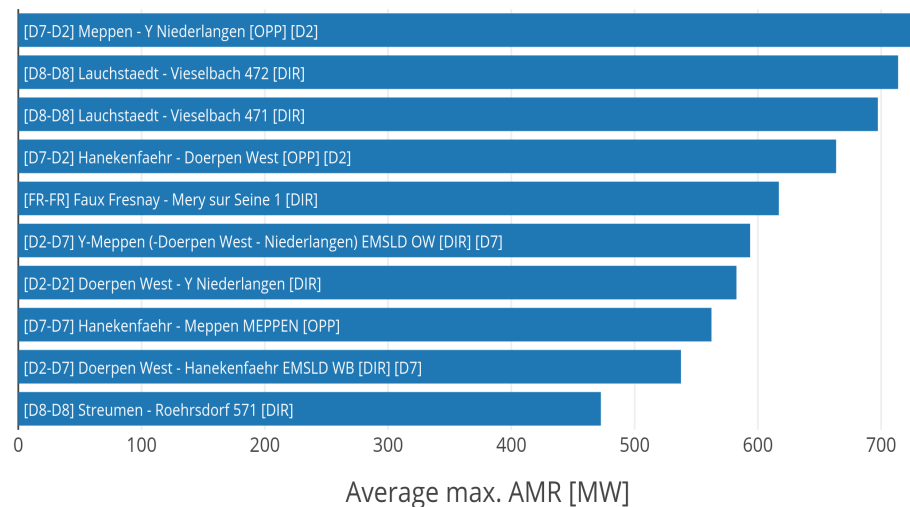
KPI 2: Average maximum AMR per TSO



CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	723.68	36.08%
[D8-D8] Lauchstaedt - Vieselbach 472 [DIR]	713.76	27.77%
[D8-D8] Lauchstaedt - Vieselbach 471 [DIR]	697.33	27.96%
[D7-D2] Hanekenfaehr - Doerpen West [OPP] [D2]	663.47	33.03%
[FR-FR] Faux Fresnay - Mery sur Seine 1 [DIR]	617.02	31.67%
[D2-D7] Y-Meppen (-Doerpen West - Niederlangen) EMSLD OW [DIR] [D7]	593.73	25.20%
[D2-D2] Doerpen West - Y Niederlangen [DIR]	582.62	29.03%
[D7-D7] Hanekenfaehr - Meppen MEPPEN [OPP]	562.34	23.93%
[D2-D7] Doerpen West - Hanekenfaehr EMSLD WB [DIR] [D7]	537.58	22.87%
[D8-D8] Streumen - Roehrsdorf 571 [DIR]	472.62	26.13%

TSO	Average maximum AMR per TSO
AT	50.91
BE	501.92
CZ	527.08
D2	729.17
D4	363.09
D7	641.64
D8	760.95
FR	634.03
HR	59.16
HU	180.44

TSO	Average maximum AMR per TSO
NL	408.65
PL	22.96
RO	71.38
SI	82.57
SK	199.76



KPI 3: Share of MTUs with intervention per TSO



Total BDs

31

Total MTUs

744

MTUs without IVA

162

Share of distinct MTUs without IVA

21.77%

MTUs with IVA

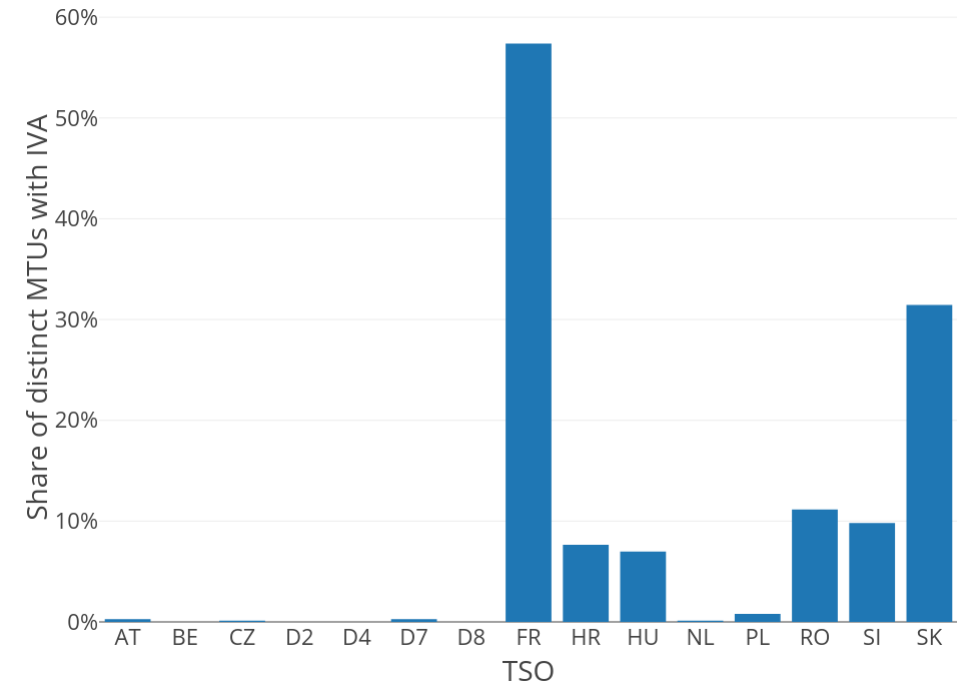
582

Share of distinct MTUs with IVA

78.2%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	0.27%	2
BE	0.00%	0
CZ	0.13%	1
D2	0.00%	0
D4	0.00%	0
D7	0.27%	2
D8	0.00%	0
FR	57.39%	427
HR	7.66%	57
HU	6.99%	52

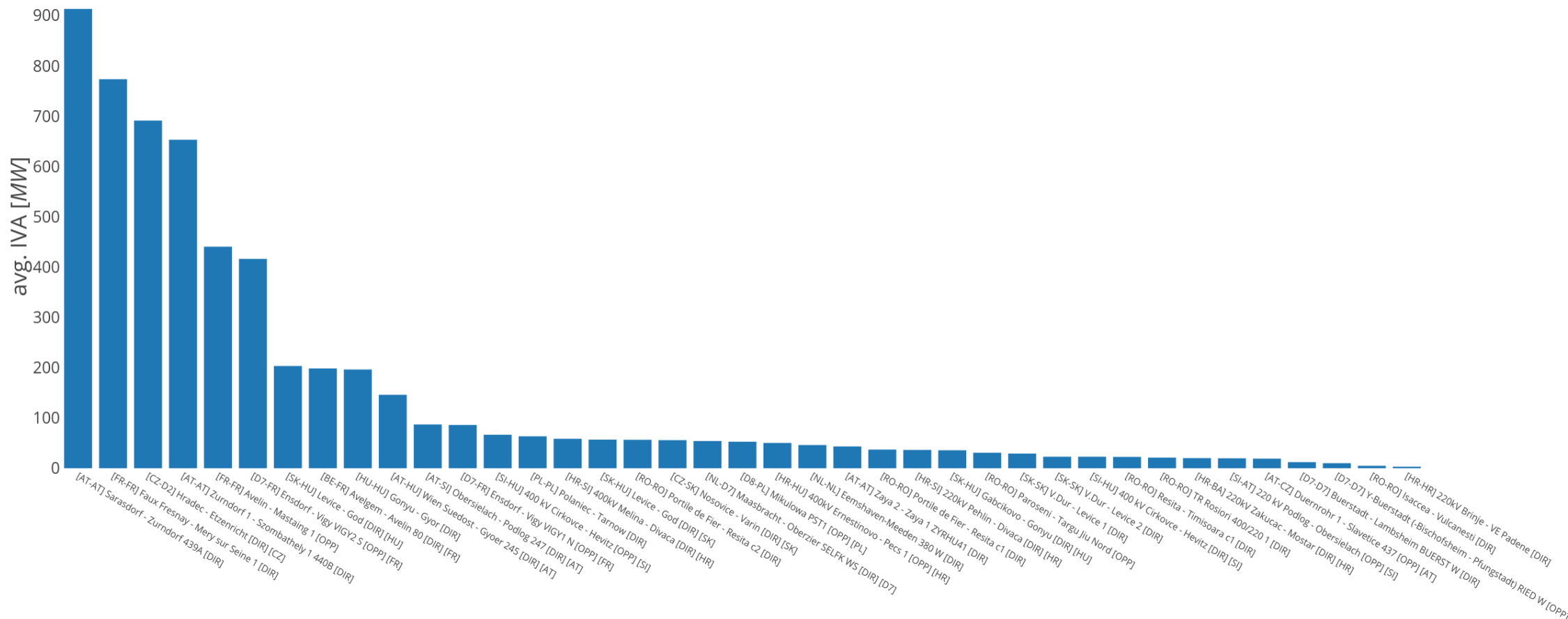
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
NL	0.13%	1
PL	0.81%	6
RO	11.16%	83
SI	9.81%	73
SK	31.45%	234



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



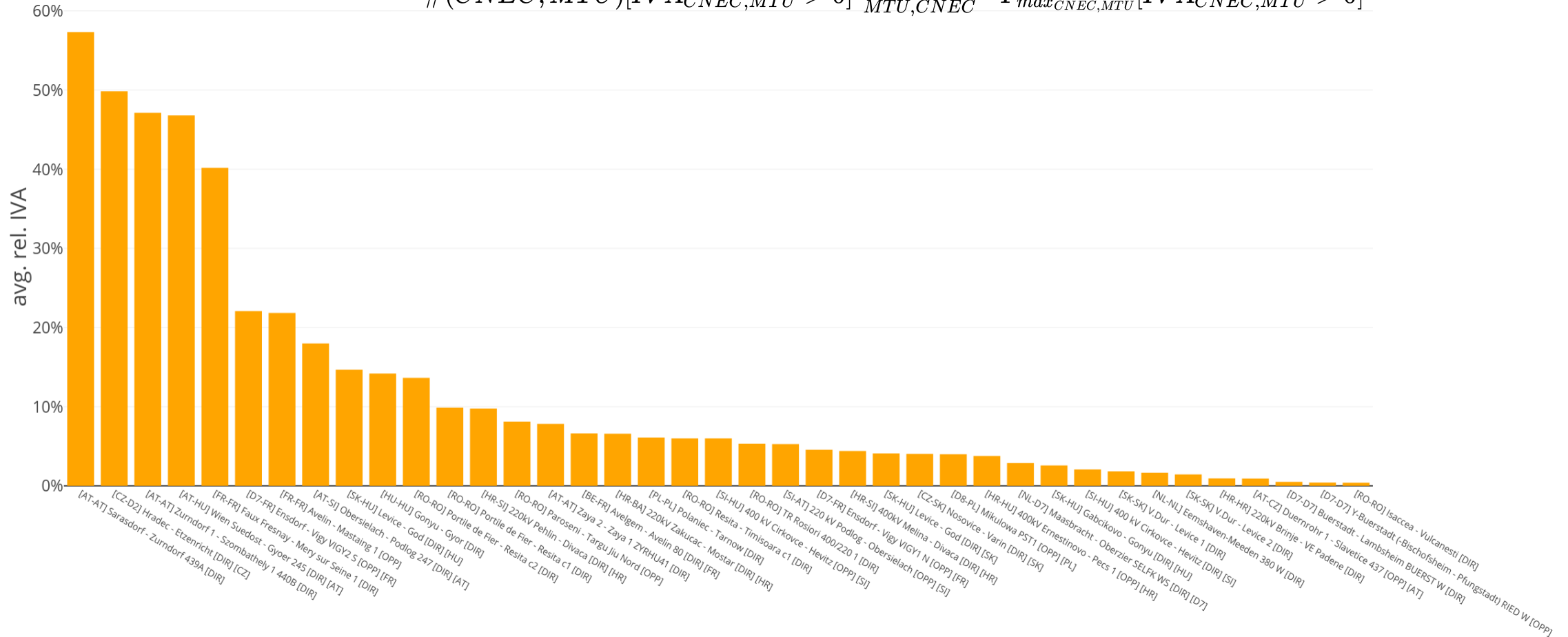
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



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



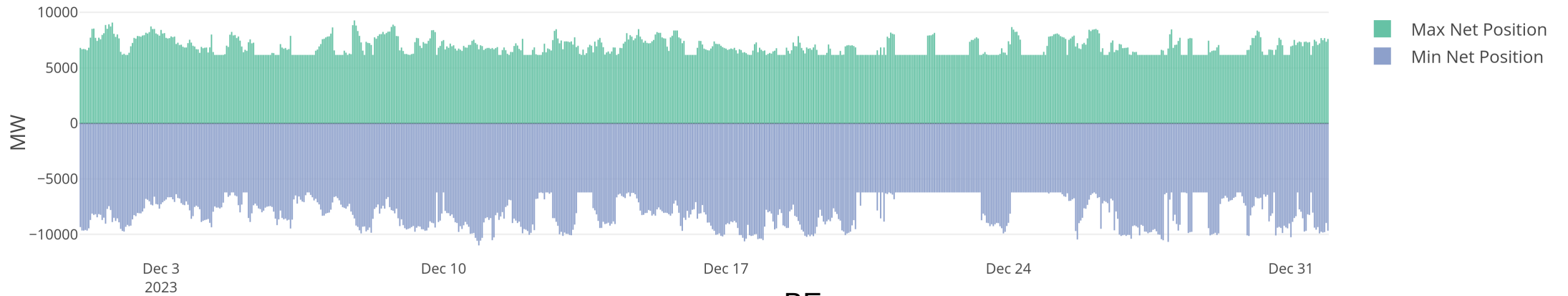
$$\text{avg. rel. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU) [IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} \frac{IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]}{F_{max CNEC, MTU} [IVA_{CNEC, MTU} > 0]}$$



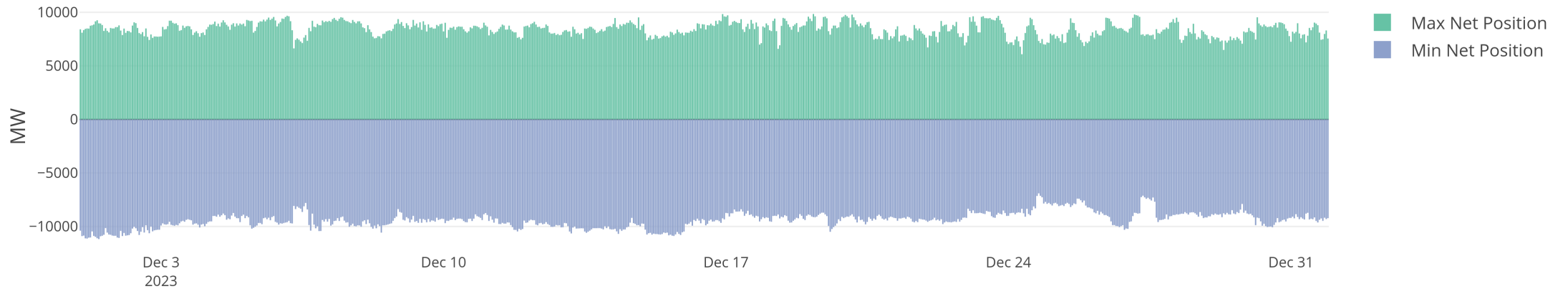
KPI 5: Min & max net positions per BZ hub



AT



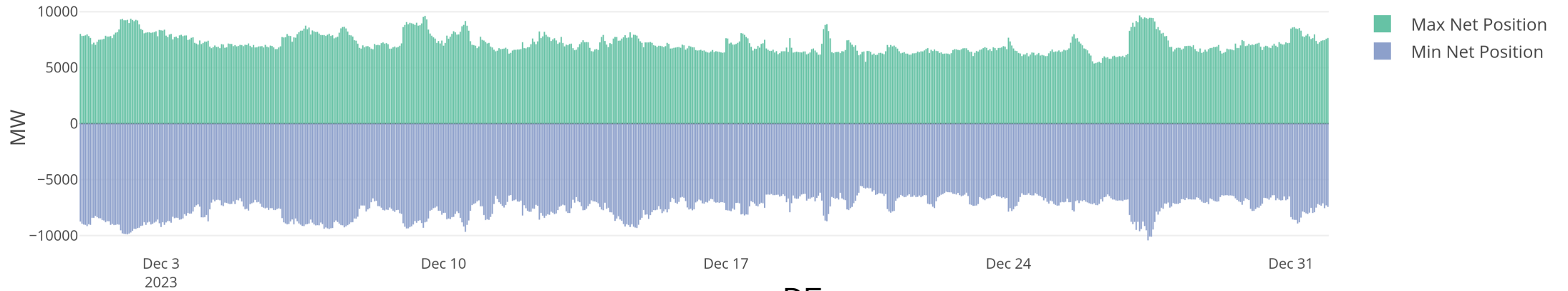
BE



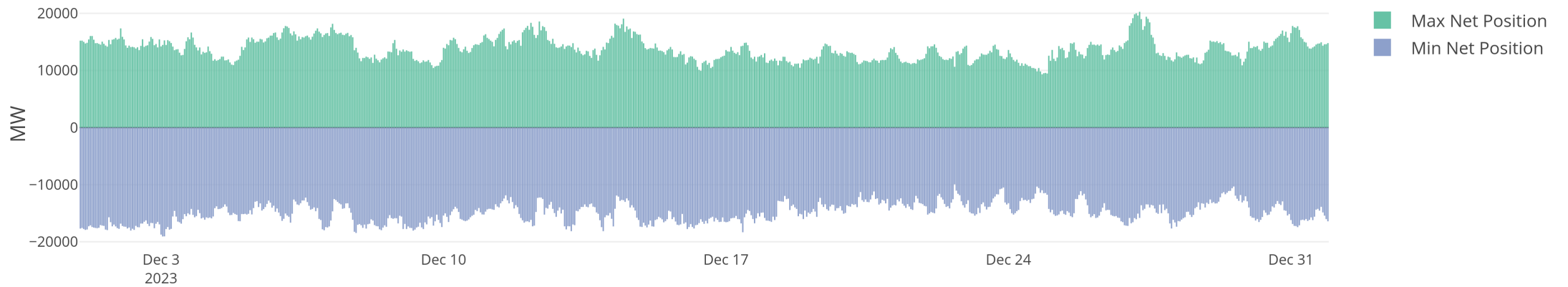
KPI 5: Min & max net positions per BZ hub



CZ



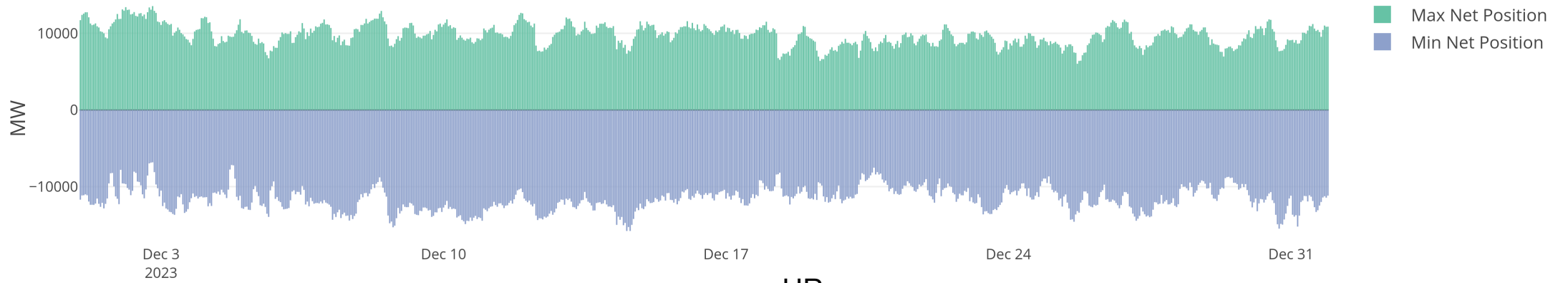
DE



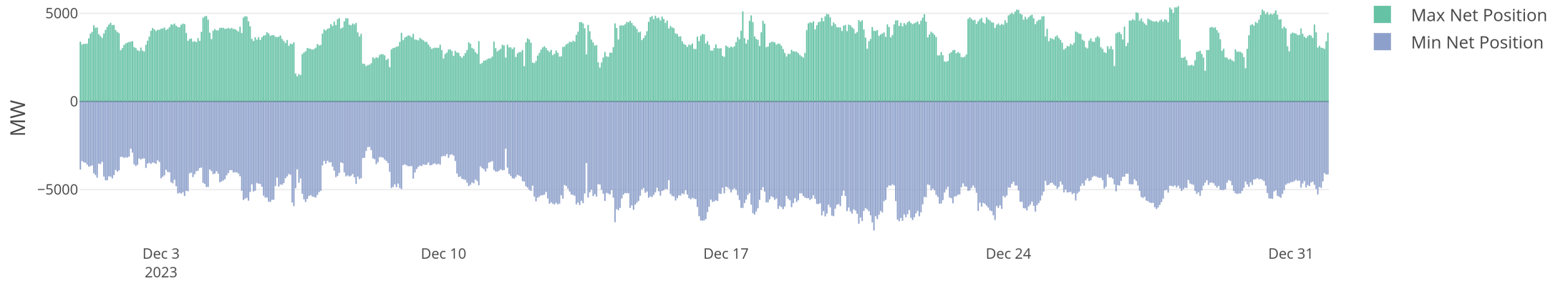
KPI 5: Min & max net positions per BZ hub



FR



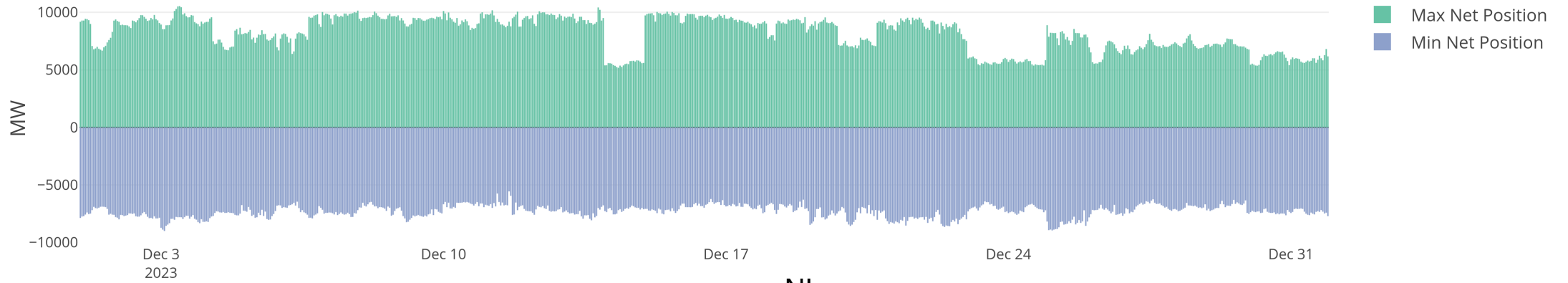
HR



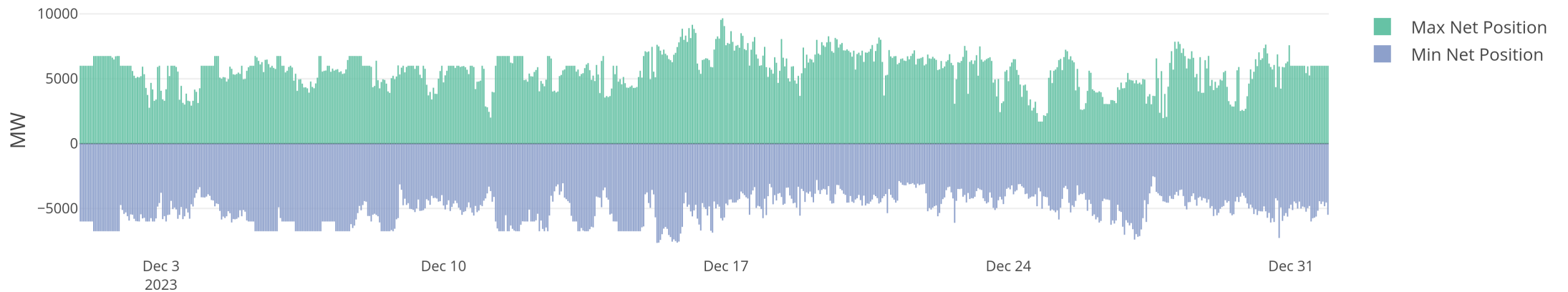
KPI 5: Min & max net positions per BZ hub



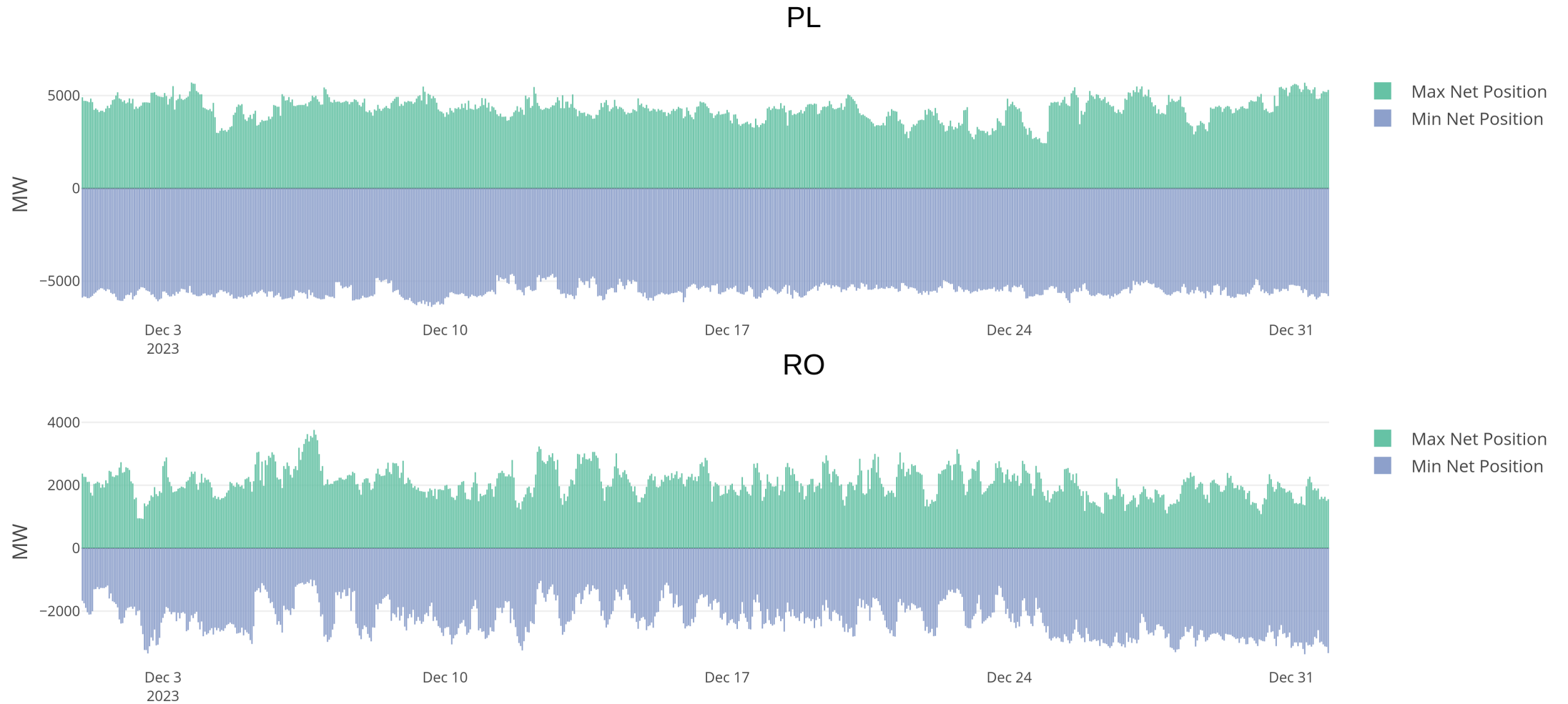
HU



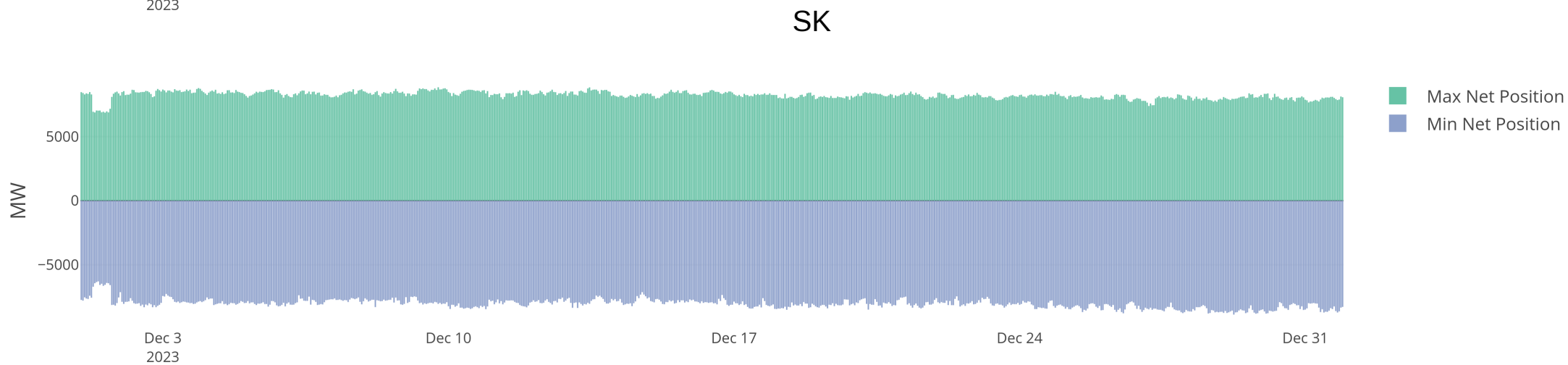
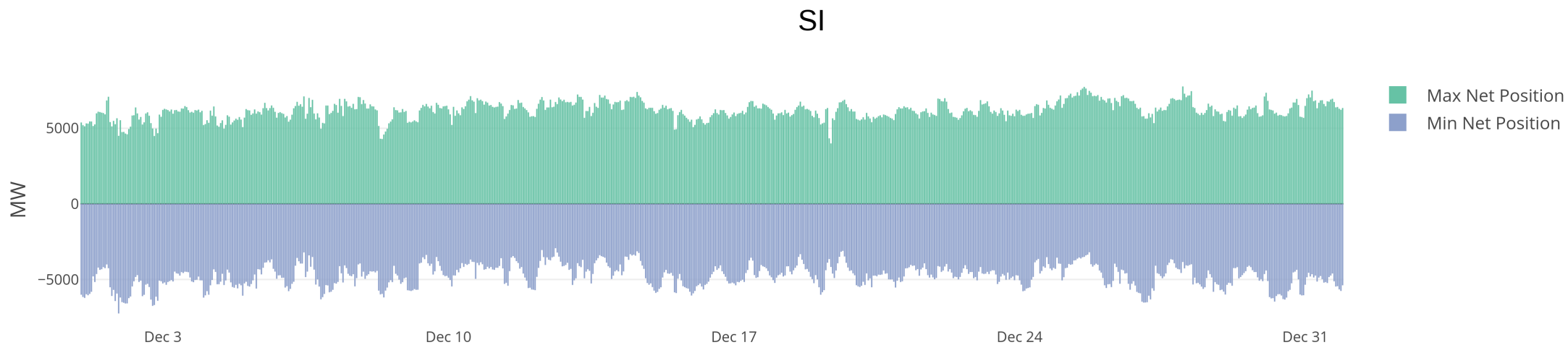
NL



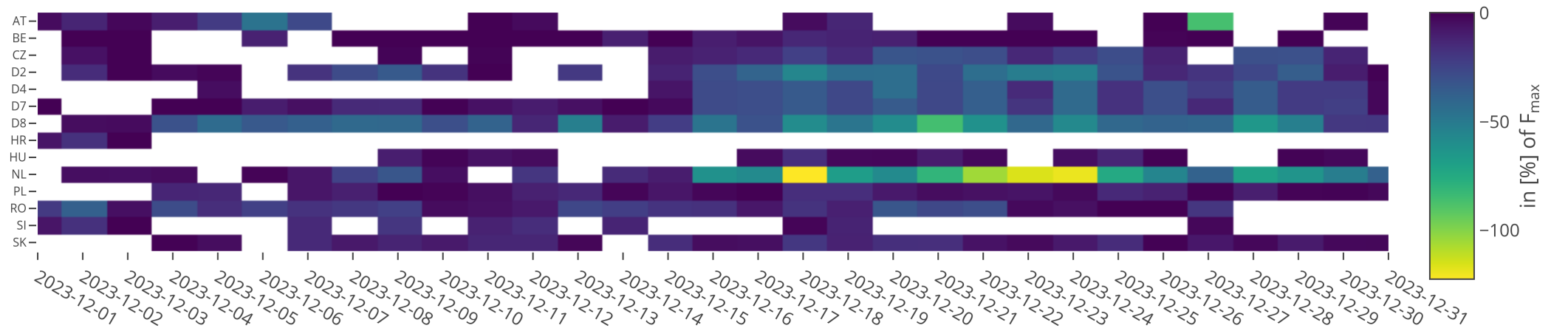
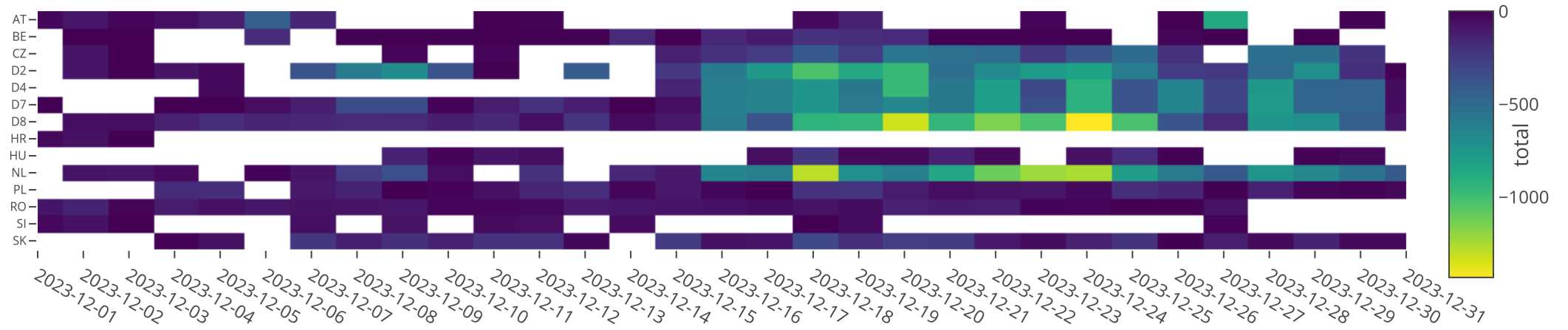
KPI 5: Min & max net positions per BZ hub



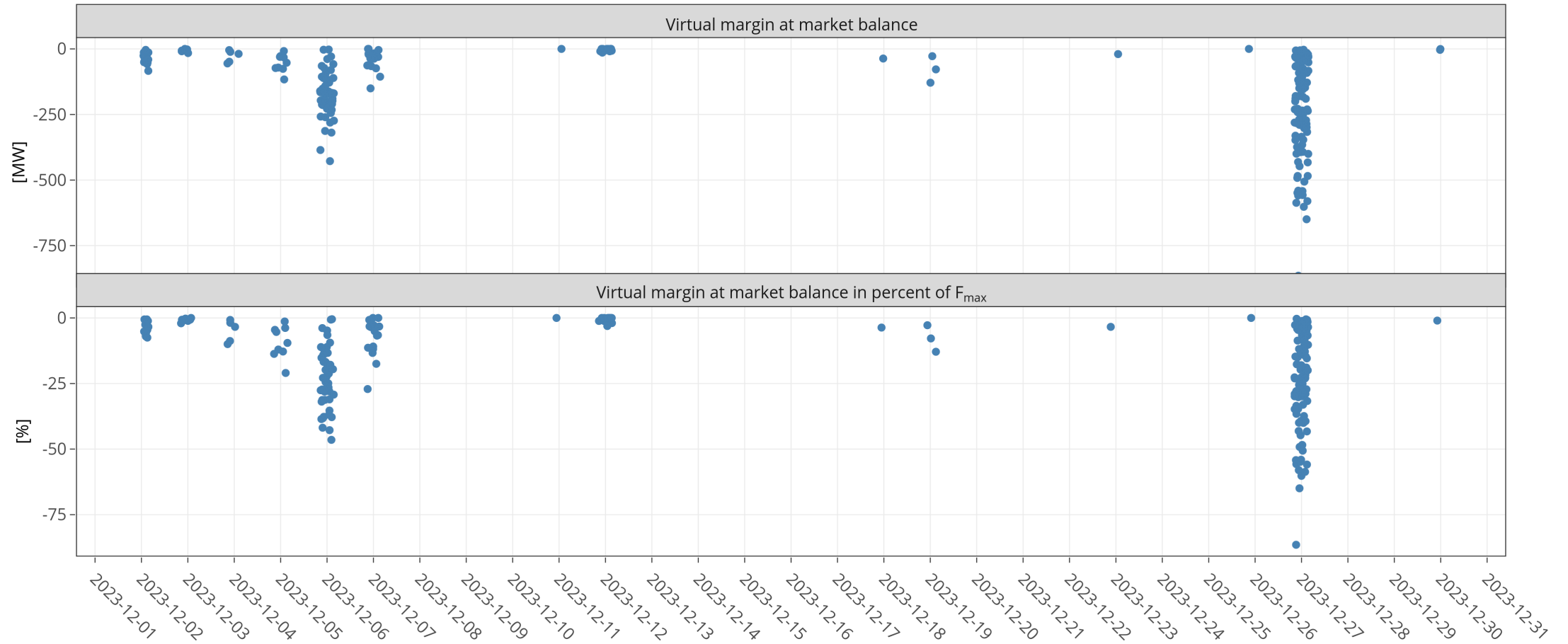
KPI 5: Min & max net positions per BZ hub



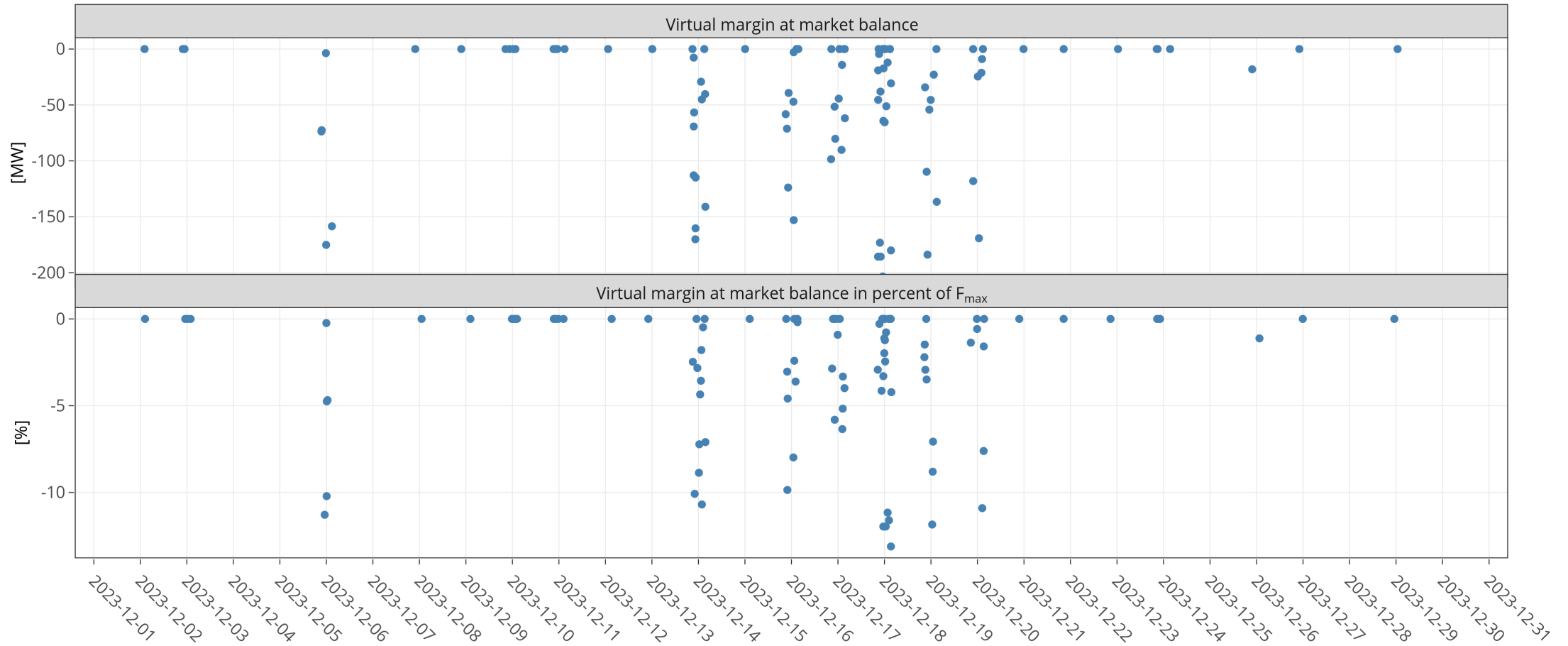
KPI 6a: Highest virtual margins at market balance for CORE TSOs



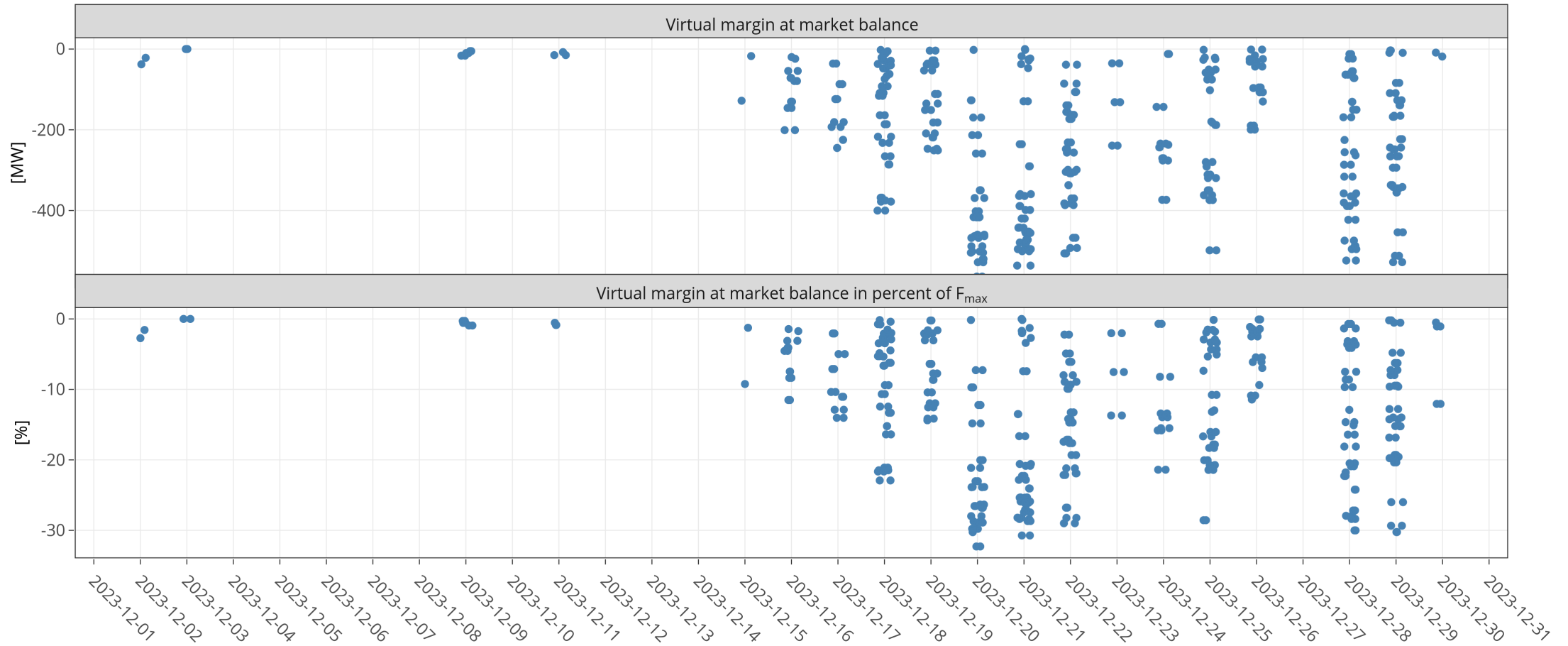
KPI 6b: Virtual margins at market balance AT



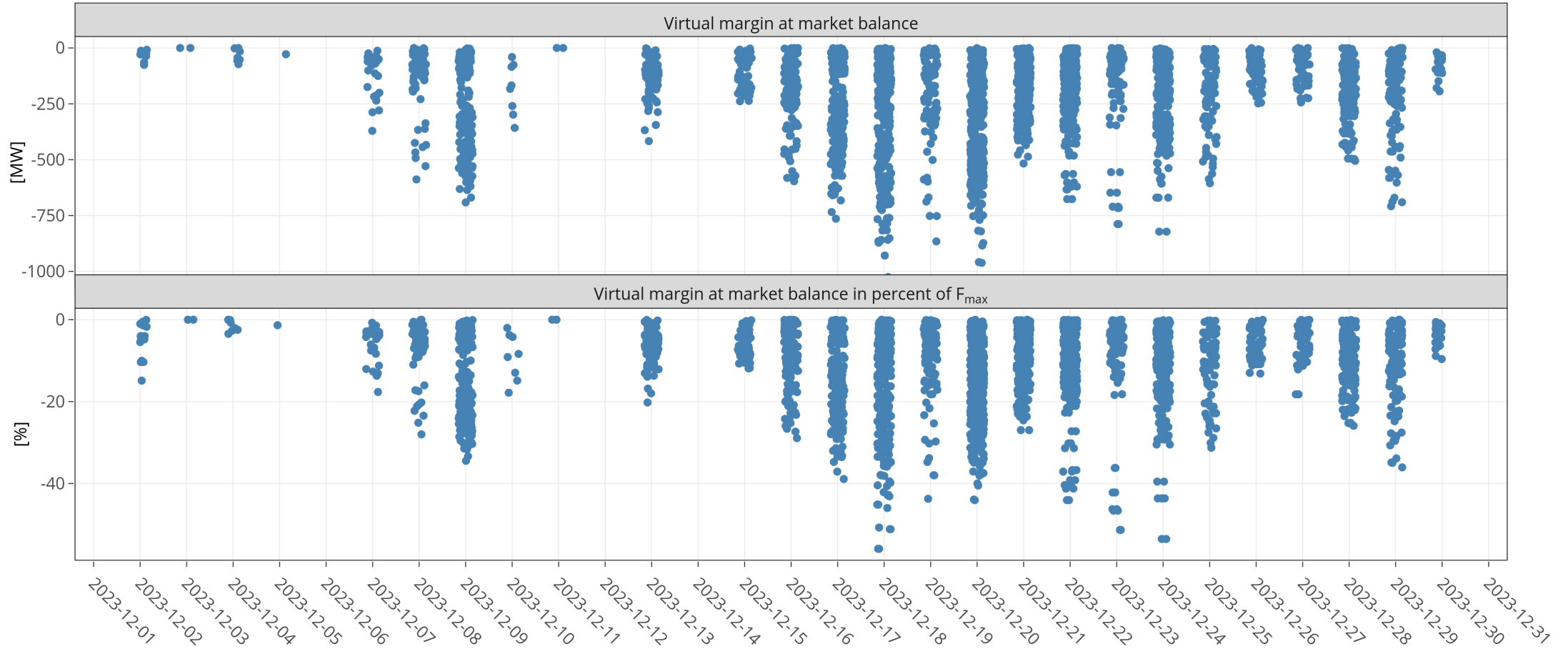
KPI 6b: Virtual margins at market balance BE



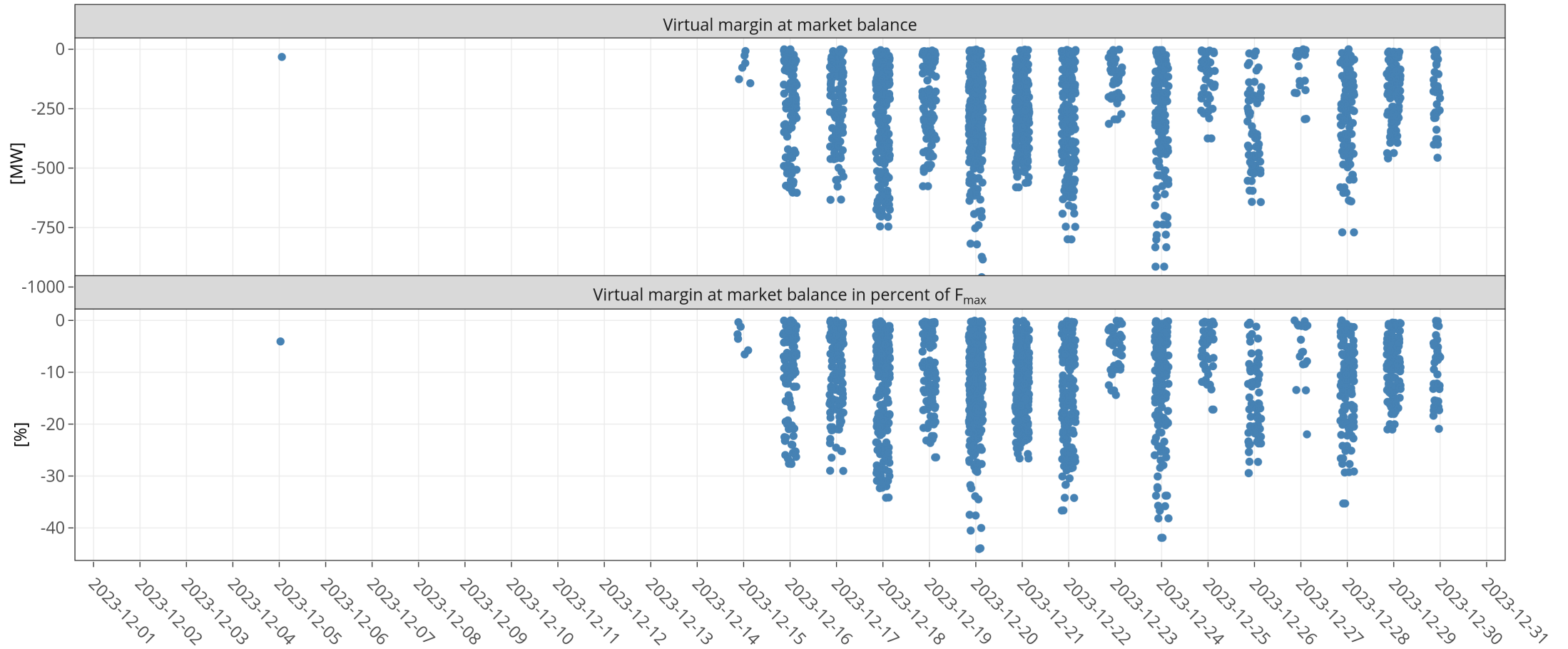
KPI 6b: Virtual margins at market balance CZ



KPI 6b: Virtual margins at market balance D2



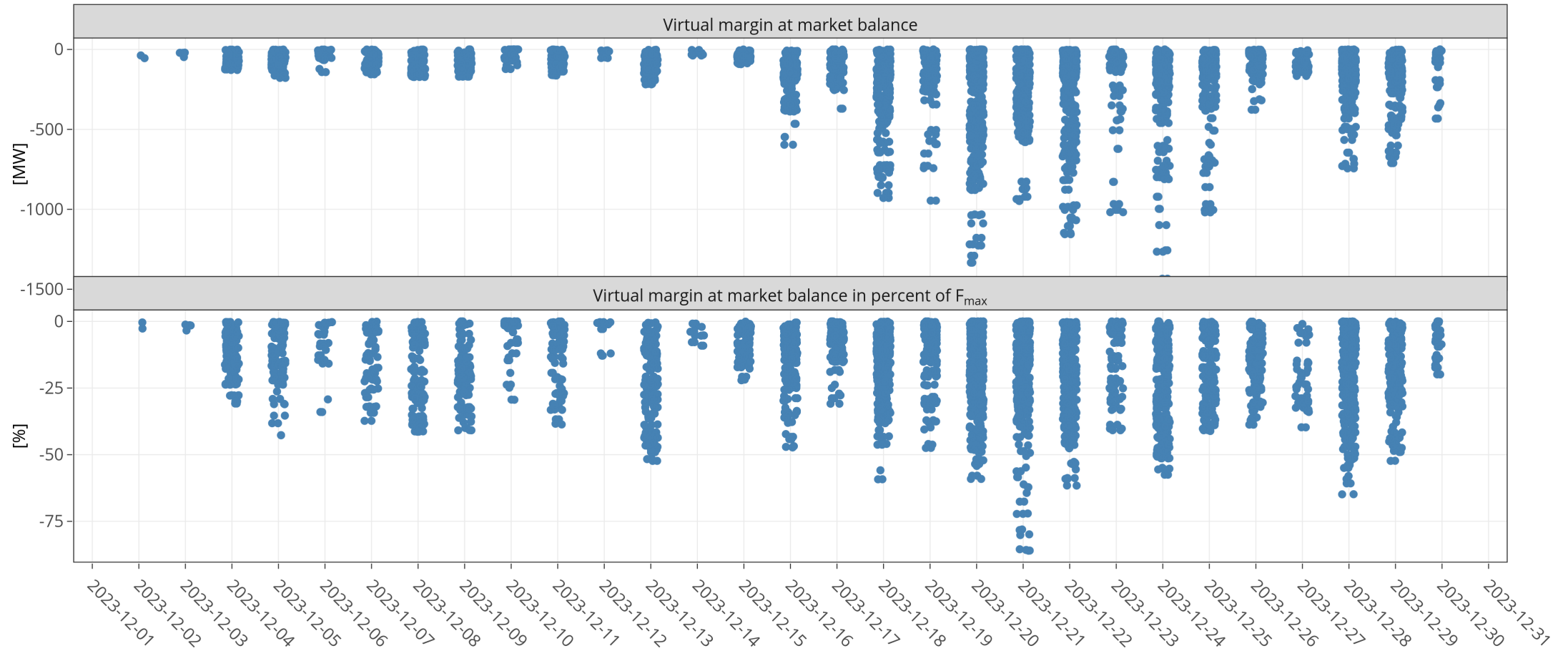
KPI 6b: Virtual margins at market balance D4



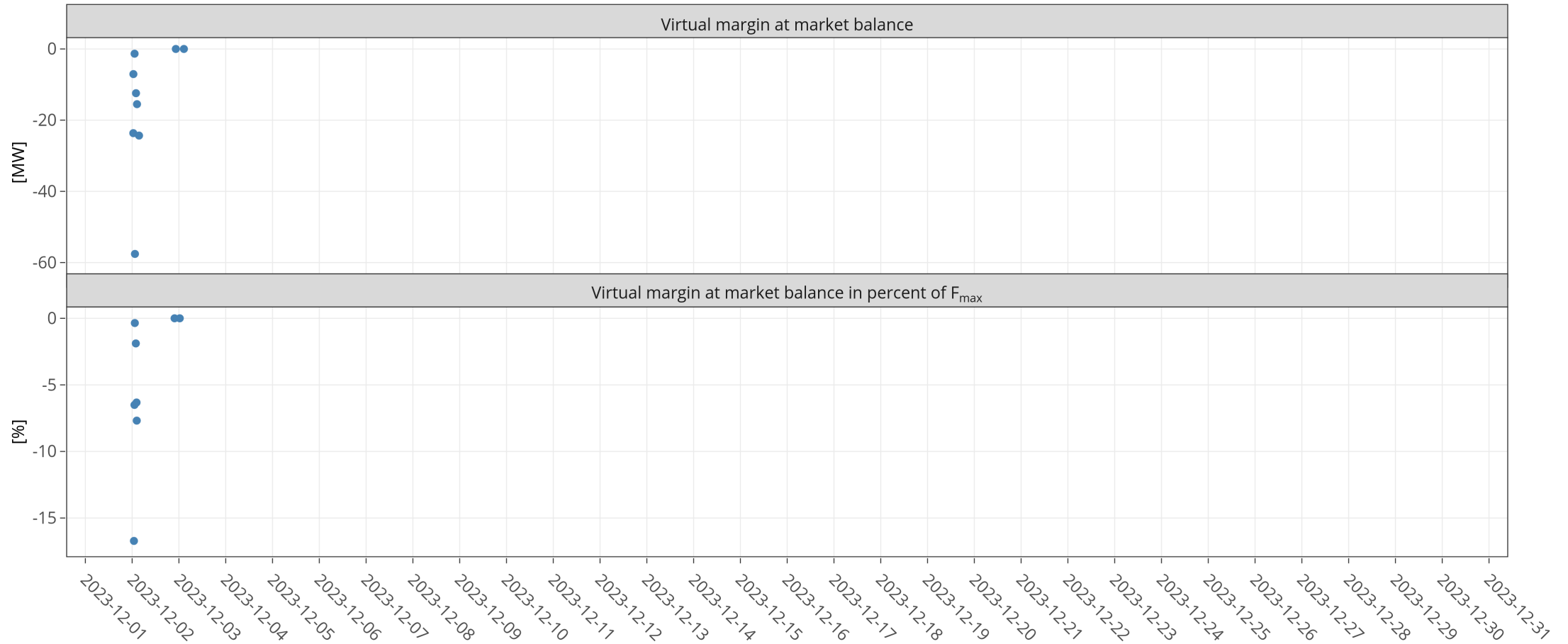
KPI 6b: Virtual margins at market balance D7



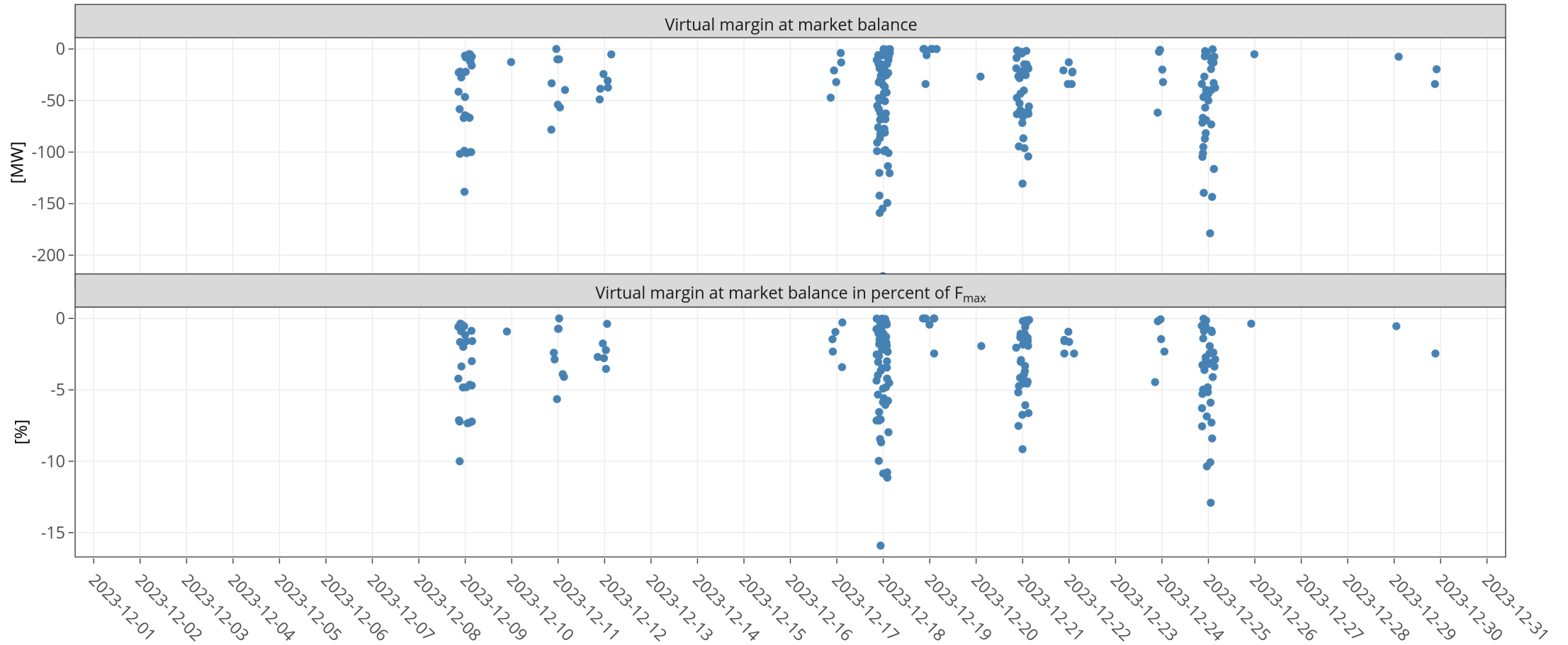
KPI 6b: Virtual margins at market balance D8



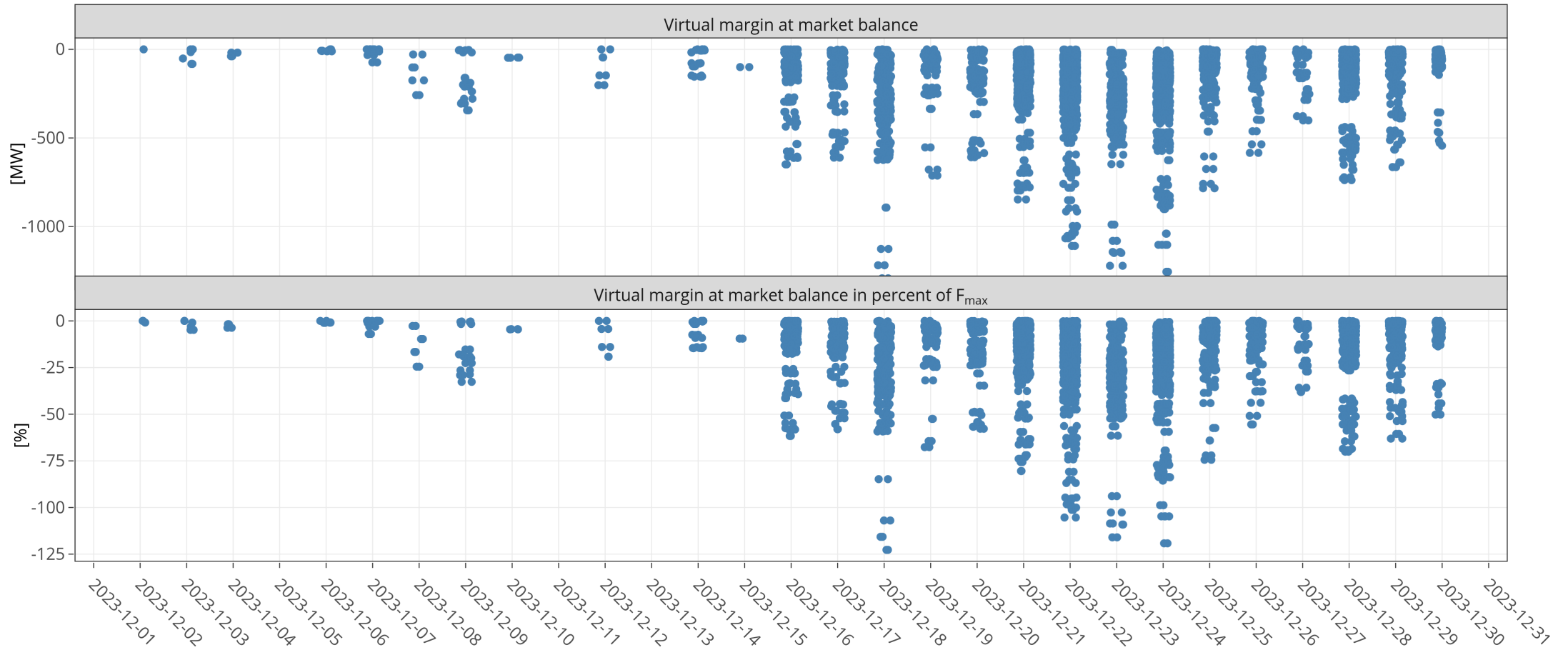
KPI 6b: Virtual margins at market balance HR



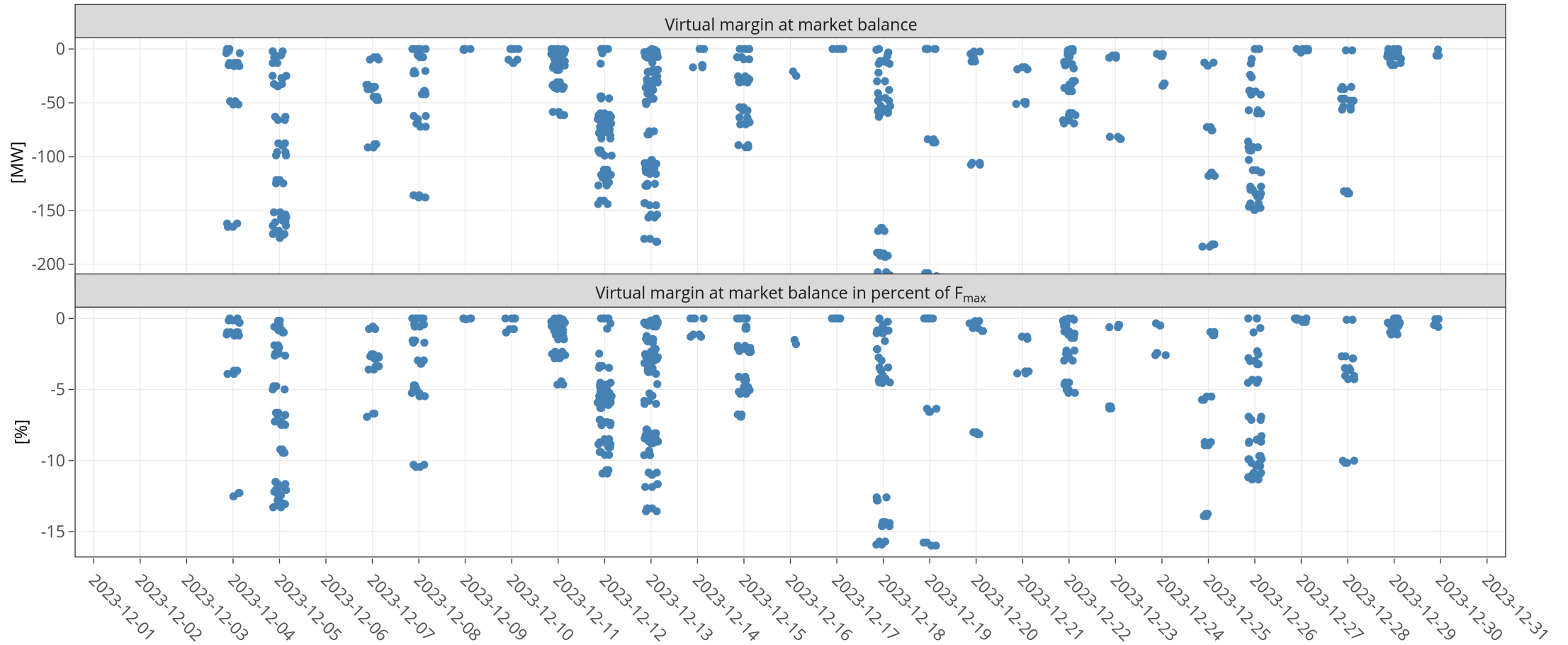
KPI 6b: Virtual margins at market balance HU



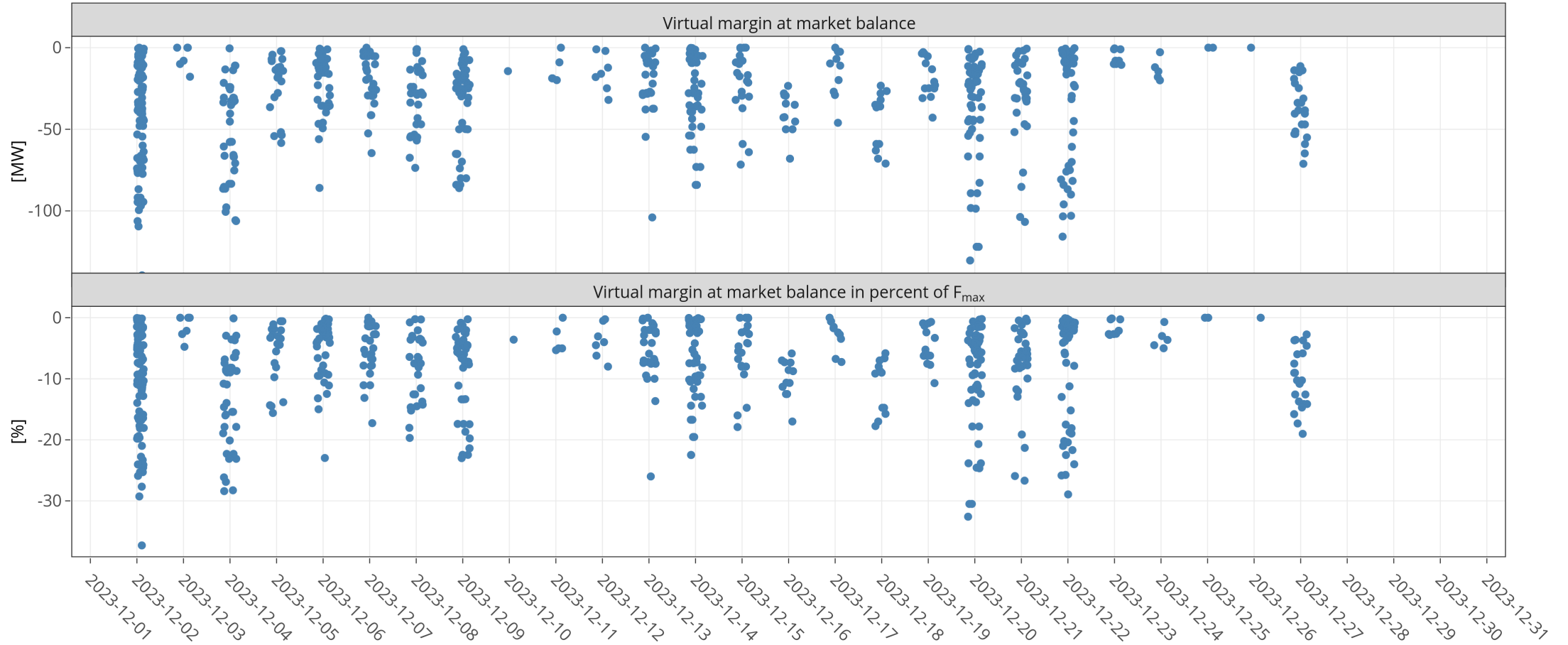
KPI 6b: Virtual margins at market balance NL



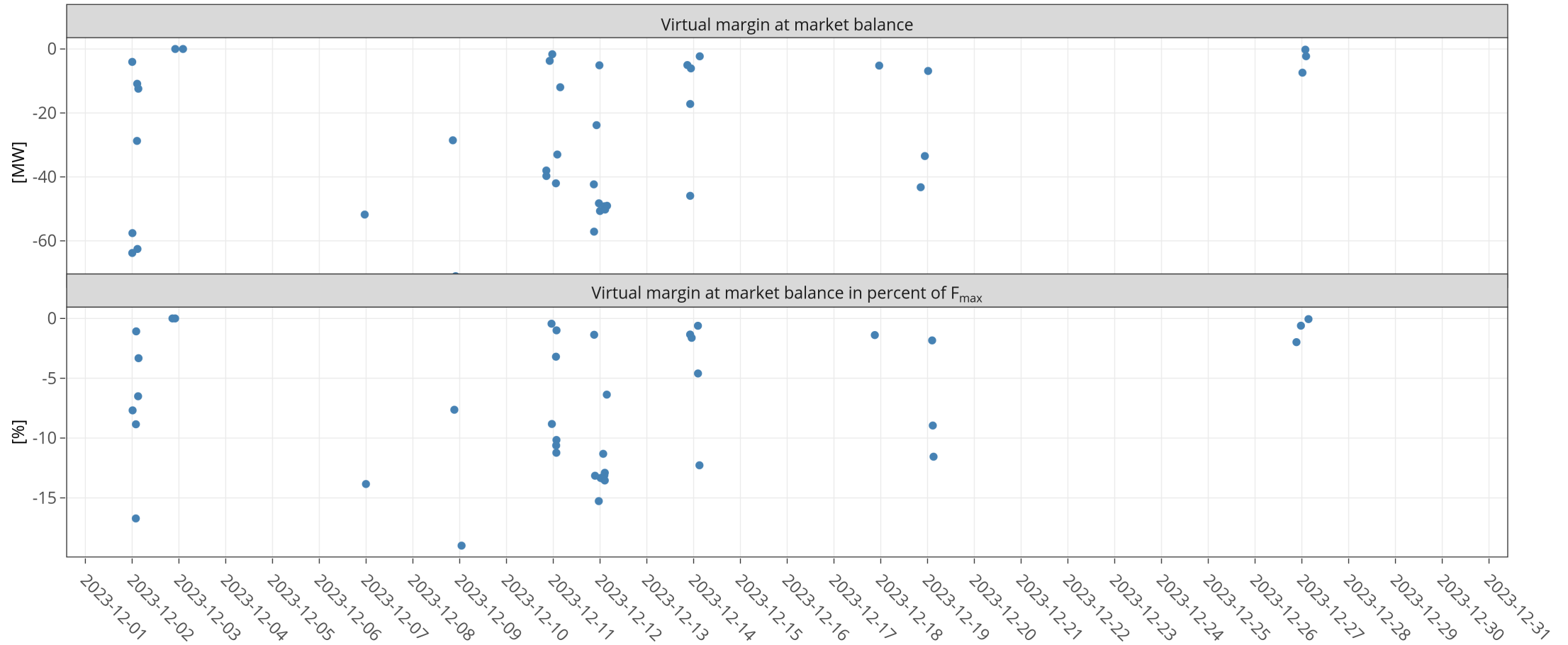
KPI 6b: Virtual margins at market balance PL



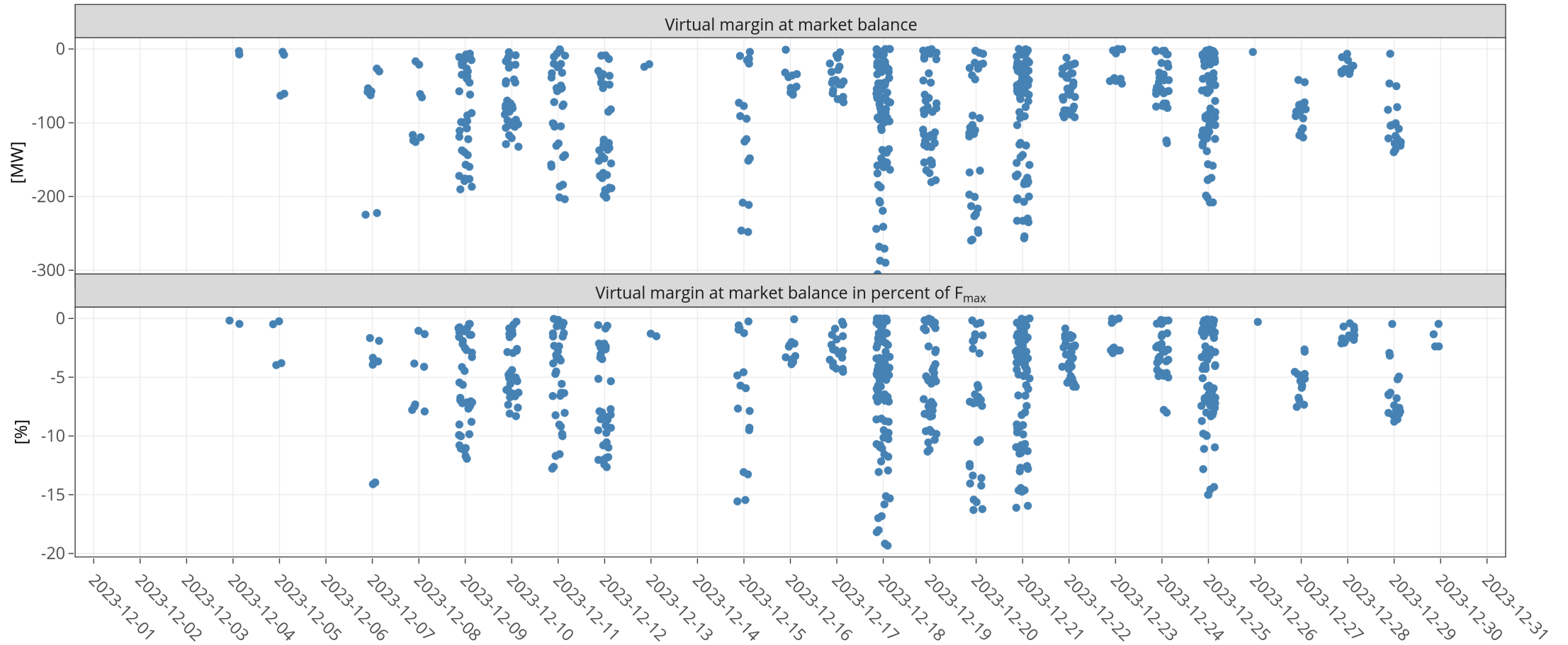
KPI 6b: Virtual margins at market balance RO



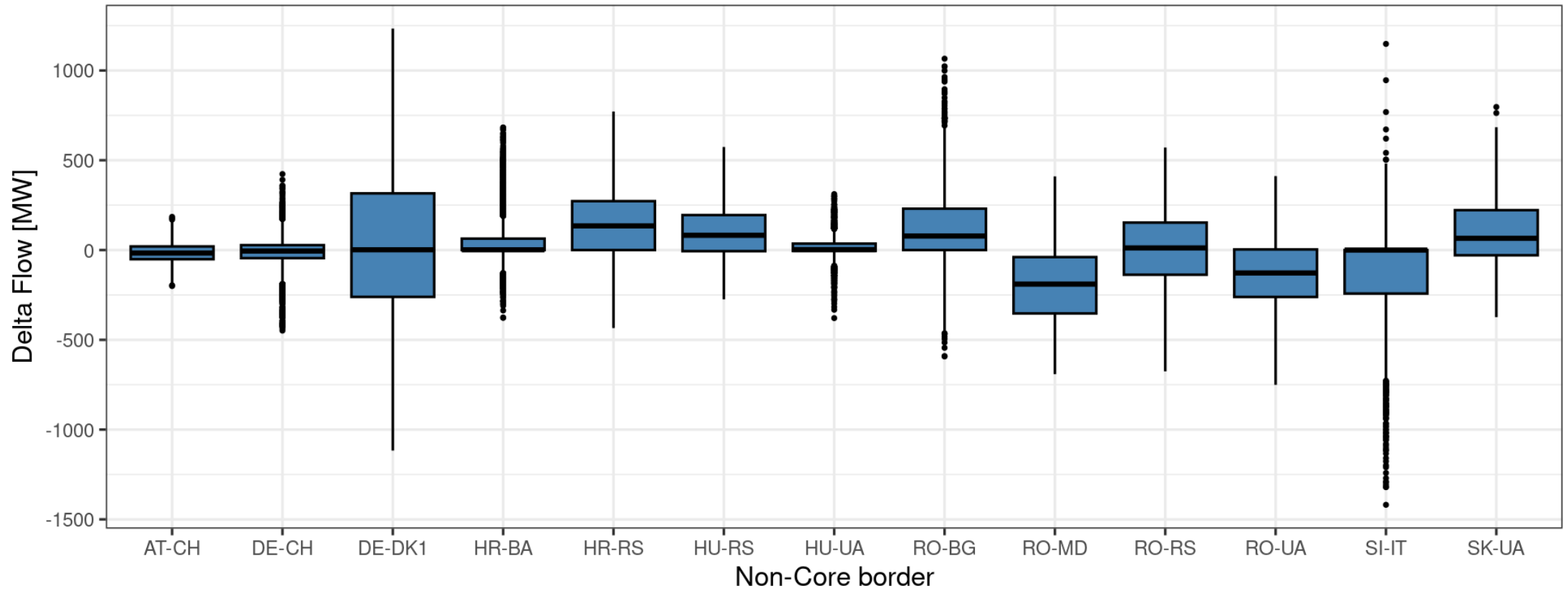
KPI 6b: Virtual margins at market balance SI



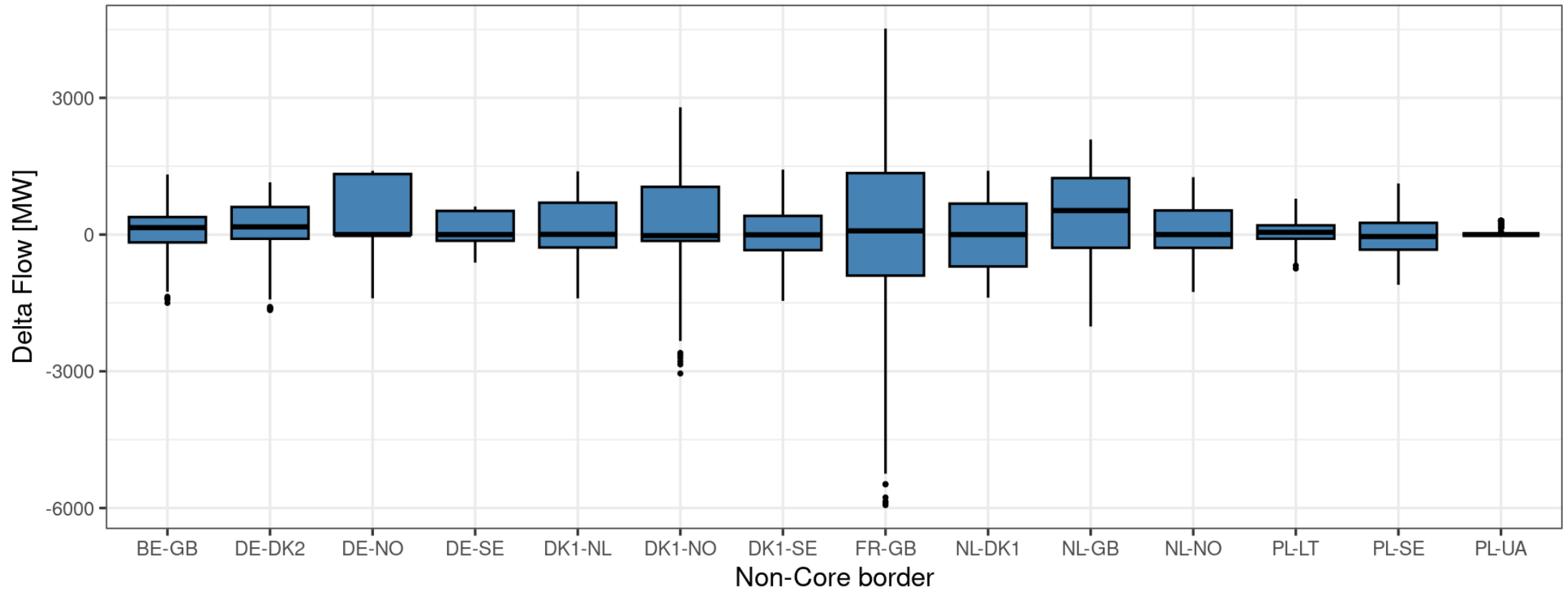
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow



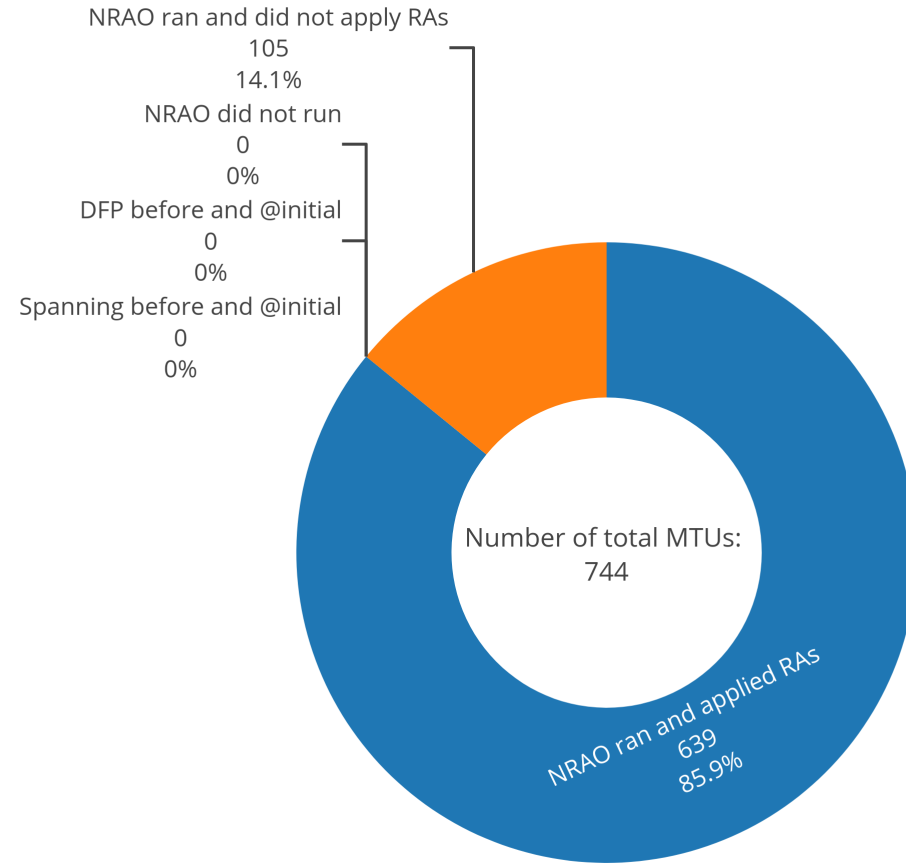
KPI 7: Non-Core exchanges DC delta flow



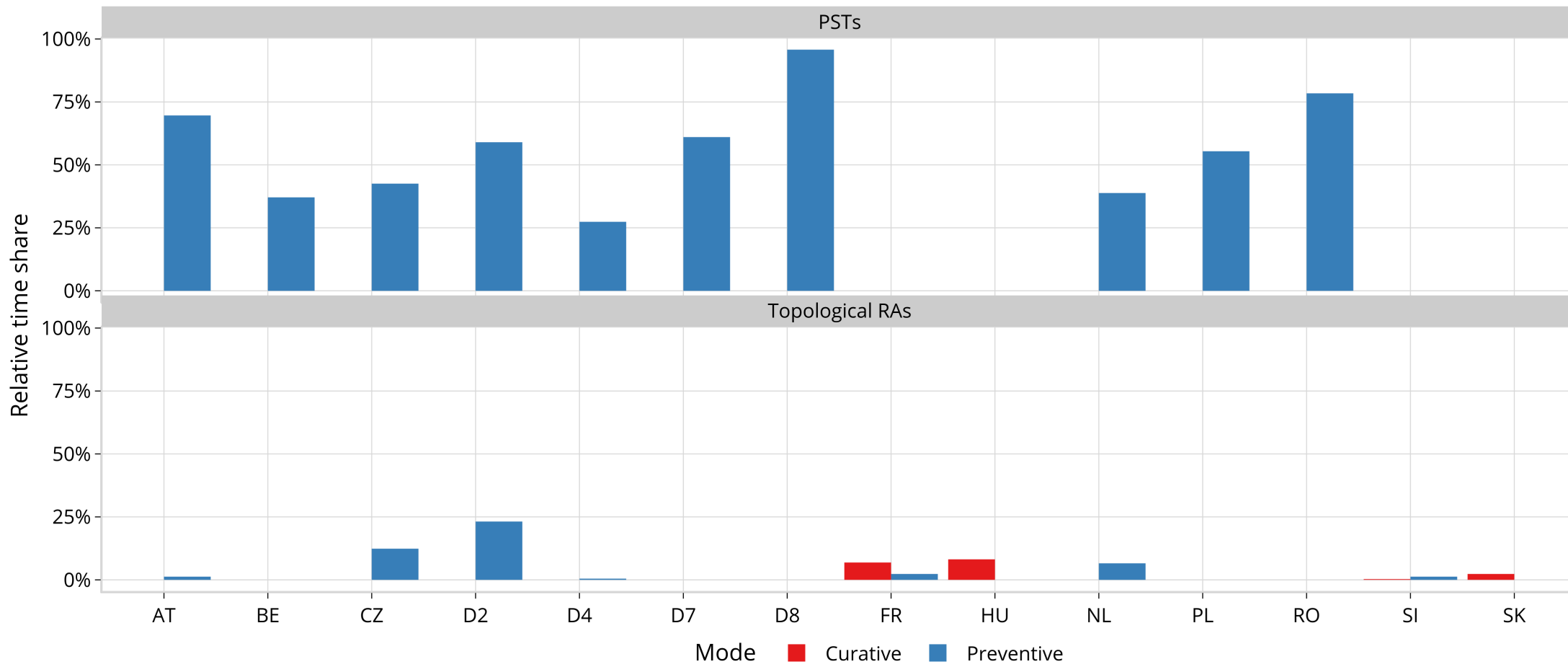
KPI 8: NRAO – Applied Remedial Action



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

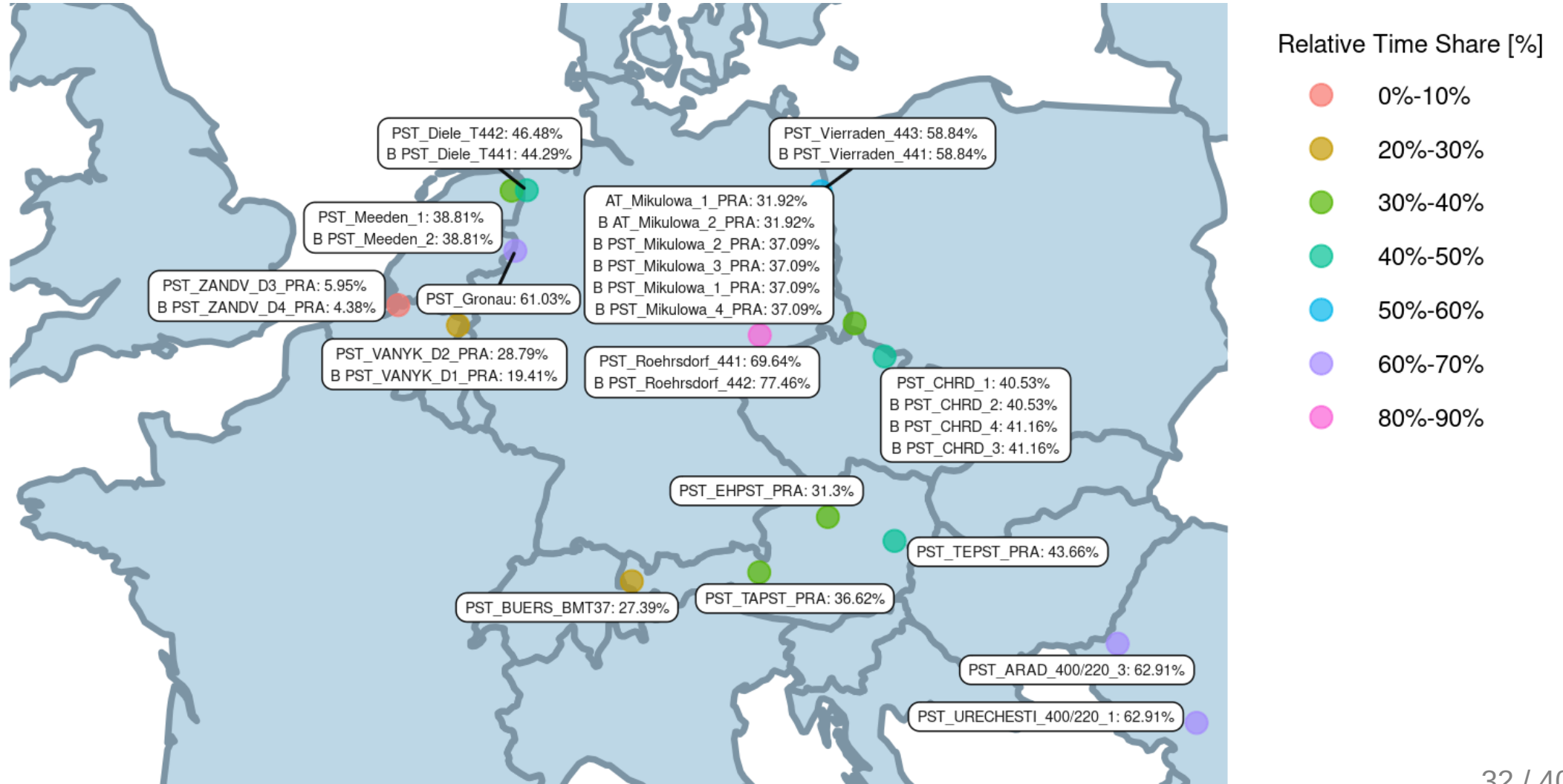


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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

Relative Time Share of Applied PSTs in Preventive Mode



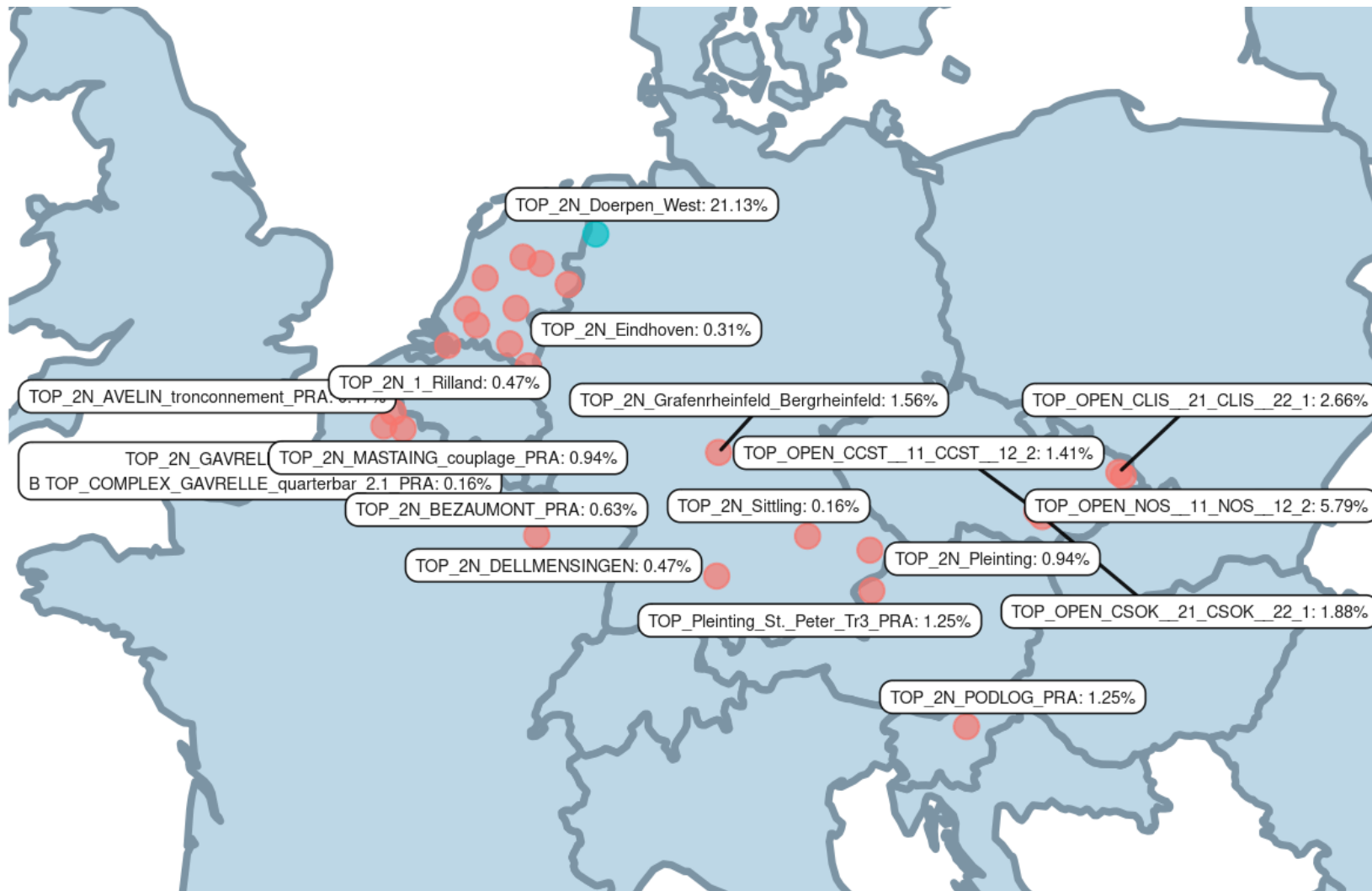
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

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

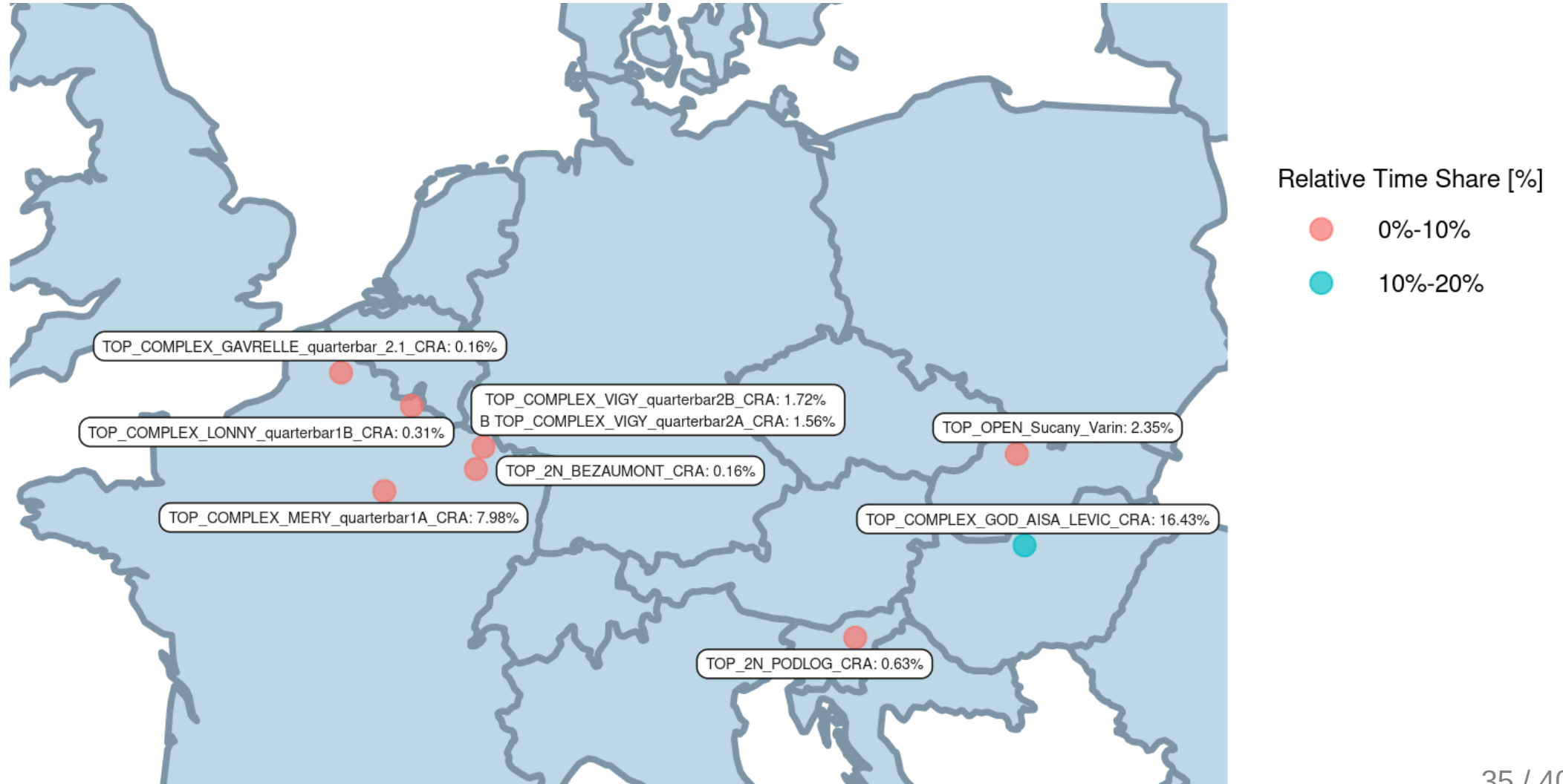


Relative Time Share [%]

- 0%-10%
- 20%-30%

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

Relative Time Share of Applied Topological RAs in Curative Mode

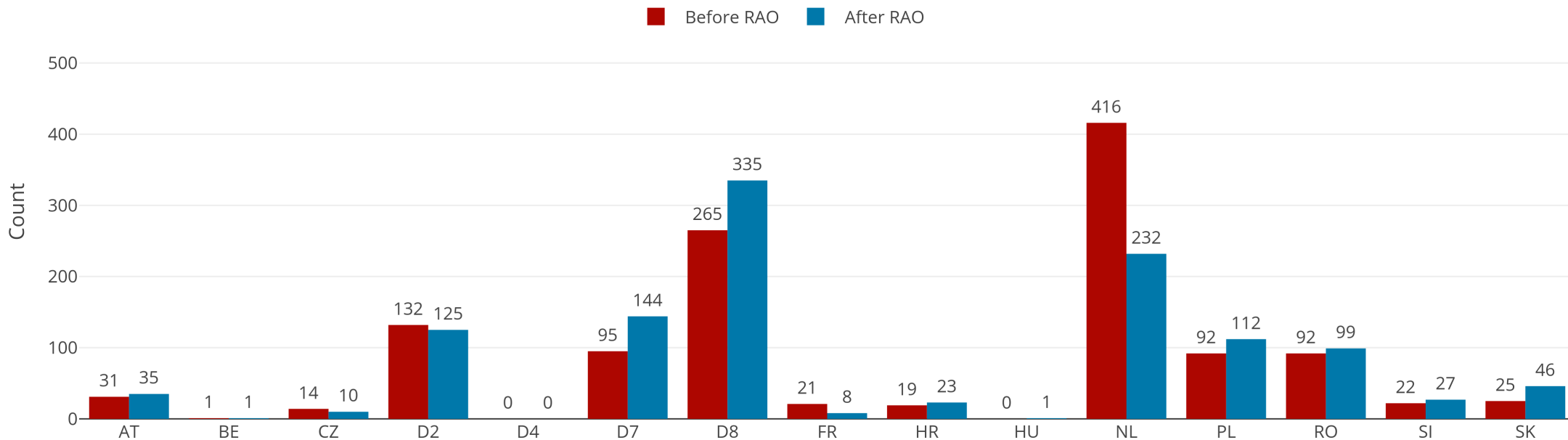


KPI 9: Most limiting CNEC per TSO (NRAO)



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

Distribution of Limiting CNECs per TSO



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.

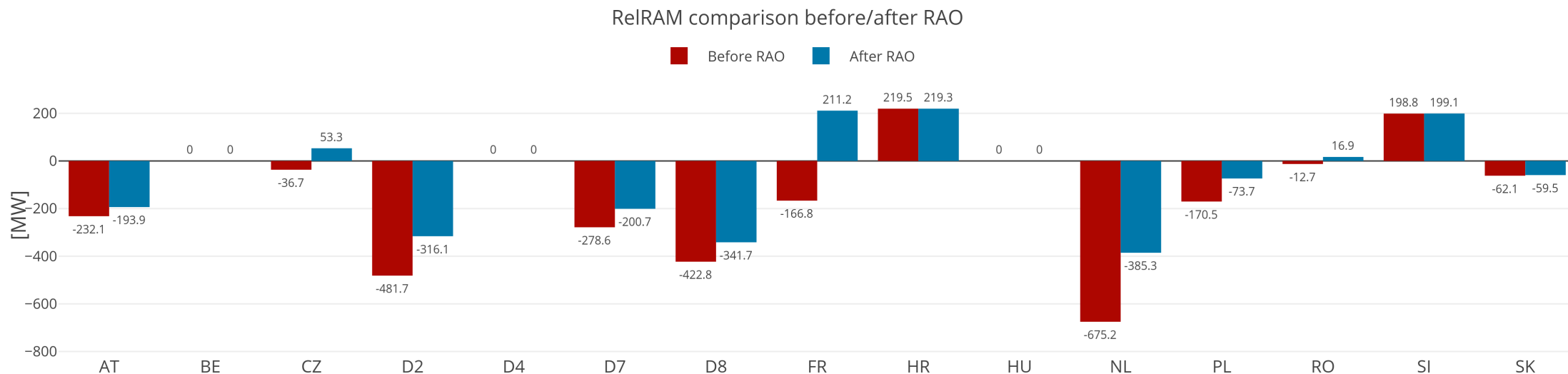
KPI 10: Average variation of relative RAM before and after NRAO



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
[RO-RO] TR Rosiori 400/220 1 [DIR]	744	744	42.83%	19.00%	87.50%	0.1402	0.2456
[CZ-SK] Sokolnice - Krizovany [OPP] [CZ]	744	744	94.87%	70.27%	111.04%	0.3199	1.2996
[SK-UA] V.Kapusany - Mukachevo (WPS) [OPP] [SK]	738	738	98.77%	64.14%	130.32%	0.2362	0.8367
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	736	971	69.05%	25.27%	127.89%	0.2005	0.6025
[SK-SK] Gabcikovo - P.Biskupice [DIR]	735	745	81.65%	65.89%	99.24%	0.2947	1.0178
[HU-HU] Gonyu - Gyor [DIR]	734	1431	73.27%	47.87%	97.76%	0.2346	1.2843
[CZ-SK] Sokolnice - Stupava [DIR] [CZ]	733	733	78.89%	63.71%	103.54%	0.288	1.1578
[CZ-D2] Hradec - Etzenricht 441 [DIR] [D2]	732	732	45.49%	36.00%	69.62%	0.1808	0.762
[HU-HU] Gonyu - Gyor [OPP]	732	733	116.08%	82.31%	151.19%	0.2174	1.2843
[SK-HU] Gabcikovo - Gonyu [DIR] [HU]	731	731	77.61%	57.83%	106.50%	0.2555	0.8592
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	729	729	56.19%	1.60%	99.73%	0.1938	0.4672
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	729	1160	114.84%	79.95%	180.75%	0.1938	0.4672
[SK-SK] H.Zdana - Sucany [DIR]	726	726	74.77%	67.39%	89.90%	0.1404	0.6872
[HU-AT] Gyor - Zurndorf [OPP] [HU]	713	1370	85.14%	58.12%	109.53%	0.2984	1.3282
[CZ-SK] Nosovice - Varin [DIR] [SK]	711	2441	71.81%	51.30%	99.93%	0.3261	1.2117
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	702	702	47.35%	33.84%	76.77%	0.2941	1.0152
[CZ-SK] Nosovice - Varin [OPP] [SK]	702	2611	112.06%	80.16%	137.45%	0.3261	1.2117
[SK-SK] V.Dur - Krizovany [DIR]	695	695	82.54%	54.64%	100.21%	0.2551	0.9351
[NL-D7] Maasbracht - Oberzier SELFK WS [DIR] [D7]	689	734	60.67%	20.01%	106.10%	0.3855	0.8769
[AT-SI] Obersielach - Podlog 247 [OPP] [AT]	678	721	105.72%	50.83%	161.66%	0.2005	0.6025

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 CNECs with shadow price	Max shadow price [€/MW]	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	207	207	459.76	29.45%	19.94%	85.09%	0.2433
[D8-PL] Mikulowa PST1 [OPP] [PL]	163	163	270.22	41.31%	29.32%	61.29%	0.346
[SK-SK] V.Dur - Levice 1 [DIR]	157	157	878.05	42.09%	36.35%	51.29%	0.2027
[D8-D8] Neuenhagen - Vierraden 304 [DIR] [D8]	144	144	852.62	34.38%	22.78%	50.36%	0.1006
[RO-RO] TR Rosiori 400/220 1 [DIR]	136	136	696.64	31.92%	19.00%	57.25%	0.1395
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	108	108	238.66	45.12%	19.85%	66.77%	0.2299
[CZ-D8] Hradec - Rohrsdorf 445 [OPP] [D8]	92	92	292.03	37.42%	28.52%	59.79%	0.2867
[FR-D7] Vigy - Ensdorf VIGY1 N [DIR] [D7]	64	64	315.33	51.91%	32.64%	77.44%	0.2192
[SK-HU] Levice - God [DIR] [HU]	50	50	501.35	51.07%	37.69%	67.00%	0.235
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	42	42	235.31	44.00%	36.80%	54.91%	0.2822
[FR-FR] Faux Fresnay - Mery sur Seine 1 [DIR]	41	41	85.03	21.47%	20.05%	29.51%	0.108
[D8-D8] Pasewalk - Vierraden 306 [DIR]	38	38	770.77	33.60%	24.46%	45.08%	0.1098
[RO-RO] Resita - Timisoara c1 [DIR]	32	32	1109.63	22.23%	20.32%	35.56%	0.0989
[NL-D2] Meeden-Diele 380 Z [DIR] [NL]	28	28	390.39	35.67%	19.94%	88.98%	0.2557
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	27	27	566.39	69.10%	54.01%	85.03%	0.1911
[PL-PL] Mikulowa AT1 [DIR]	27	27	245.14	45.14%	29.09%	61.64%	0.1547
[SK-HU] Levice - God [DIR] [SK]	24	24	239.52	57.51%	49.42%	65.87%	0.2311
[D7-D7] Y-Buerstadt (-Bischofsheim - Pfungstadt) RIED W [OPP]	20	20	317.28	34.80%	31.45%	38.58%	0.1052
[RO-RO] Portile de Fier - Resita c1 [DIR]	19	19	1161.85	23.91%	20.32%	31.28%	0.0814
[D7-D7] Y-Mittelbexbach (-Lambsheim - Otterbach) KAILAU N [OPP]	18	18	188.68	26.03%	21.40%	35.24%	0.1057

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 = $400\text{mW}/0.4 = 1250\text{MW}$

KPI 13 : Allocation Constraints - Poland



	# MTUs
AC was limiting MC	174
AC < 0 MW	44
AC = 0 MW	123
AC > 0 MW	7

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1663.12	5372.31
Min.	-9203.00	0.00
Max.	0.00	17629.00

