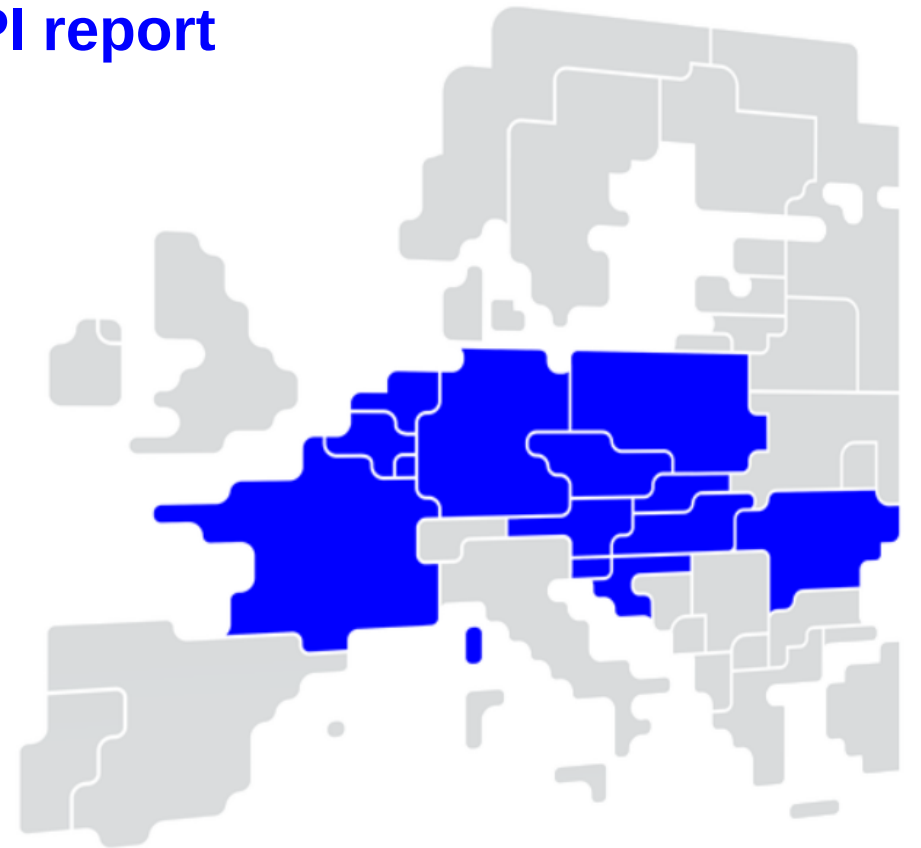




Core FB MC Operational KPI report

May 2025



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

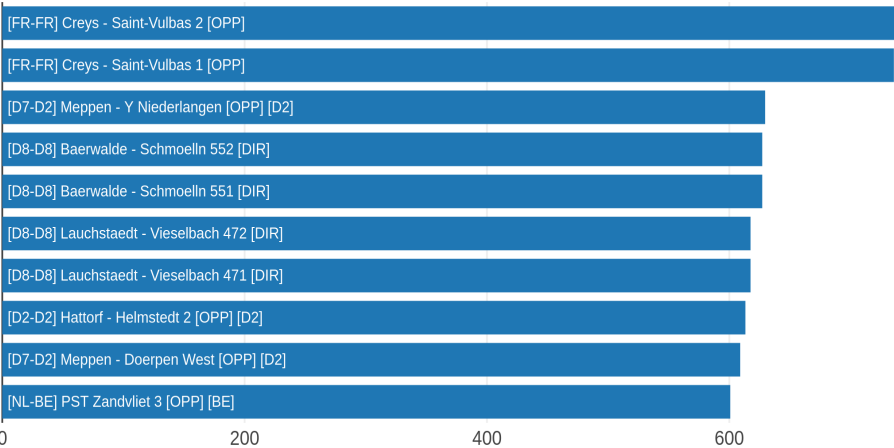
- KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode
- KPI 9: Most limiting CNEC per TSO (NRAO)
- KPI 10: Average variation of relative RAM before and after NRAO

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)
[FR-FR] Creys - Saint-Vulbas 2 [OPP]	736.16	34.26%	32.97%
[FR-FR] Creys - Saint-Vulbas 1 [OPP]	735.77	34.24%	32.95%
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	629.54	32.69%	18.28%
[D8-D8] Baerwalde - Schmoelln 551 [DIR]	627.15	25.15%	23.02%
[D8-D8] Baerwalde - Schmoelln 552 [DIR]	627.15	25.15%	23.02%
[D8-D8] Lauchstaedt - Vieselbach 471 [DIR]	617.49	24.76%	18.10%
[D8-D8] Lauchstaedt - Vieselbach 472 [DIR]	617.49	24.76%	18.10%
[D2-D2] Hattorf - Helmstedt 2 [OPP] [D2]	613.25	33.92%	26.26%
[D7-D2] Meppen - Doerpen West [OPP] [D2]	608.95	31.64%	18.03%
[NL-BE] PST Zandvliet 3 [OPP] [BE]	600.75	39.96%	0.21%



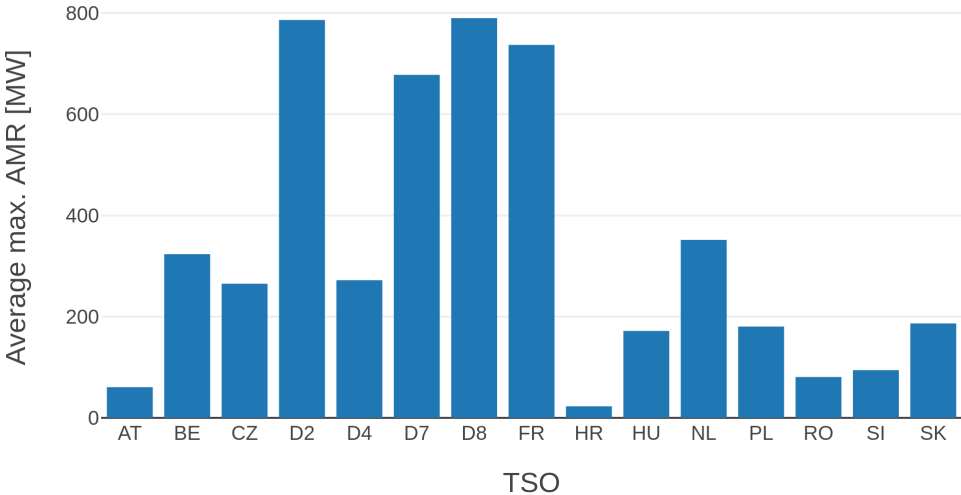
Average max. AMR [MW]

KPI 2: Average maximum AMR per TSO



TSO	Average maximum AMR per TSO
AT	60.74
BE	323.51
CZ	264.90
D2	786.18
D4	271.83
D7	677.72
D8	789.88
FR	736.82
HR	22.83
HU	171.81

TSO	Average maximum AMR per TSO
NL	351.62
PL	180.44
RO	80.77
SI	94.39
SK	186.69



KPI 3: Share of MTUs with intervention per TSO



Total BDs
30

Total MTUs
720

MTUs without IVA
393

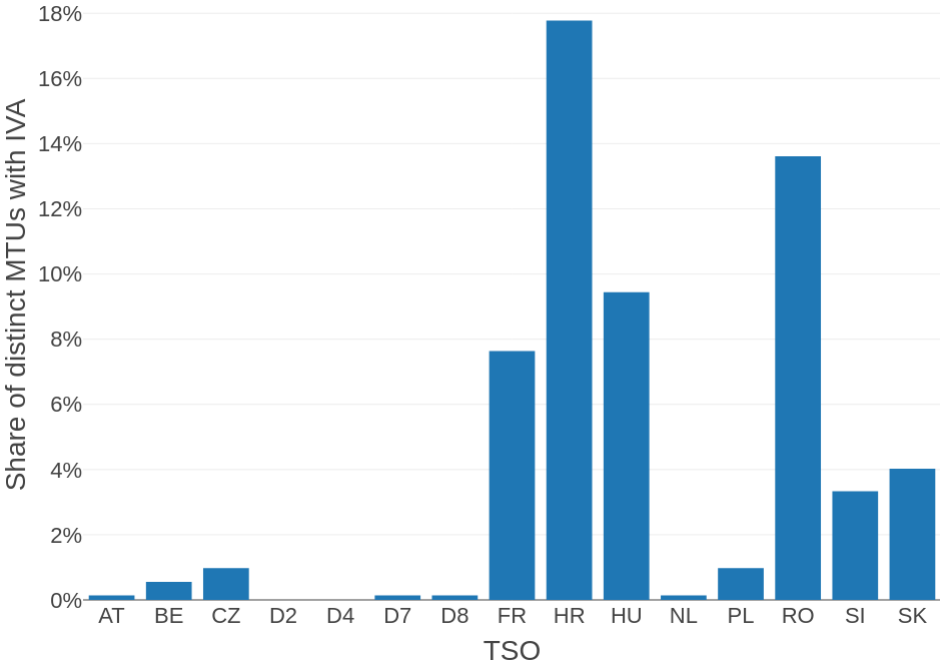
Share of distinct MTUs without IVA
54.6%

MTUs with IVA
327

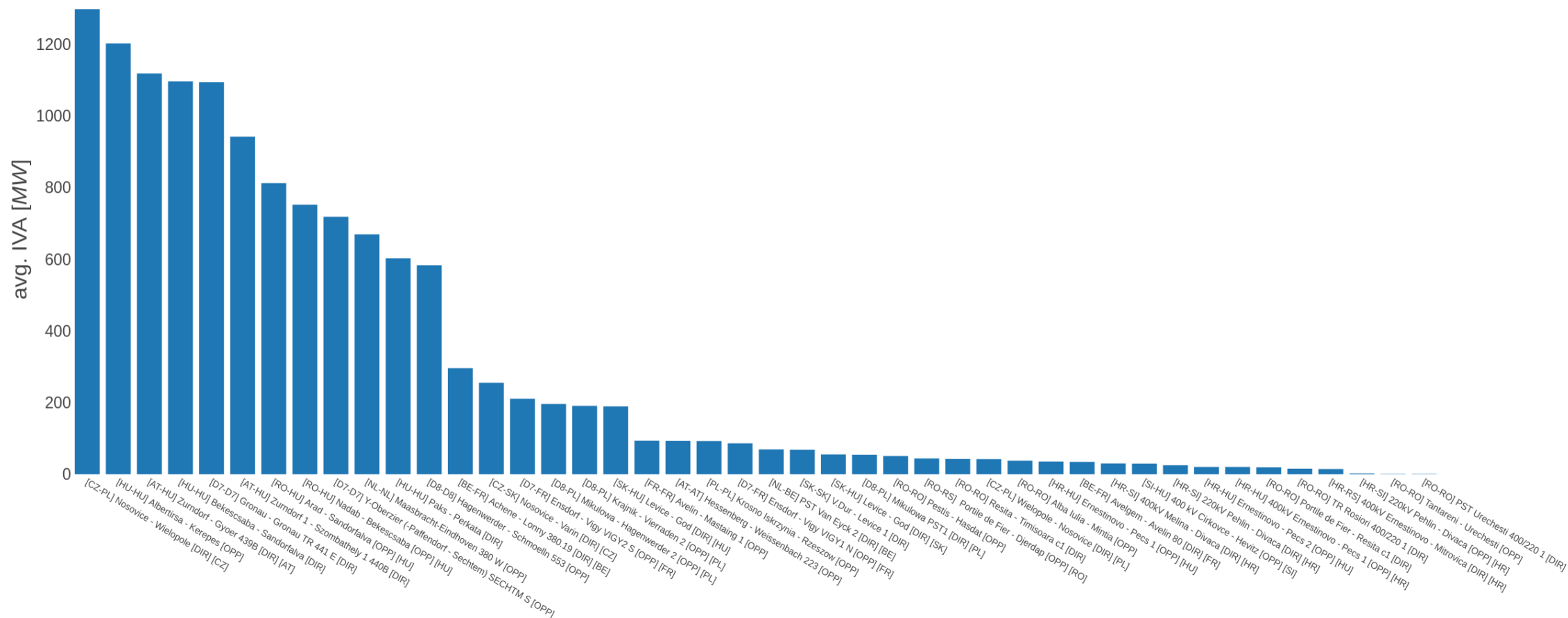
Share of distinct MTUs with IVA
45.4%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	0.14%	1
BE	0.56%	4
CZ	0.97%	7
D2	0.00%	0
D4	0.00%	0
D7	0.14%	1
D8	0.14%	1
FR	7.64%	55
HR	17.78%	128
HU	9.44%	68

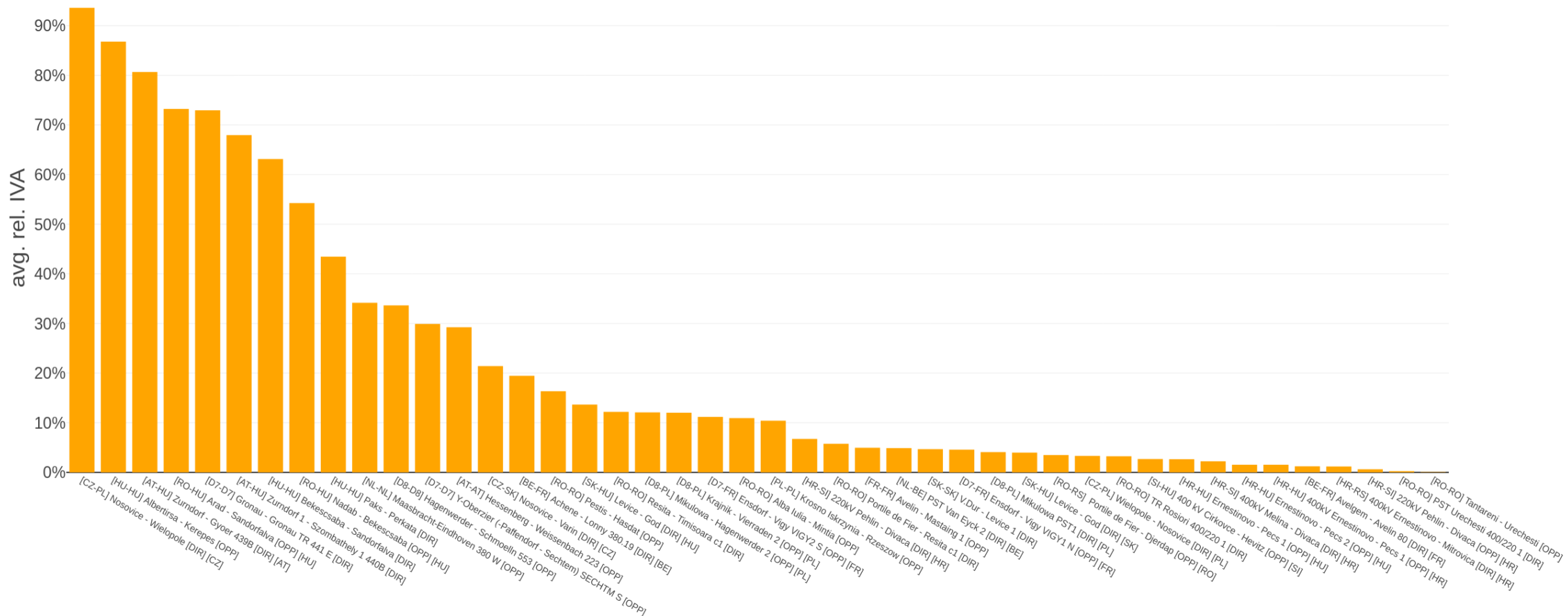
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
NL	0.14%	1
PL	0.97%	7
RO	13.61%	98
SI	3.33%	24
SK	4.03%	29



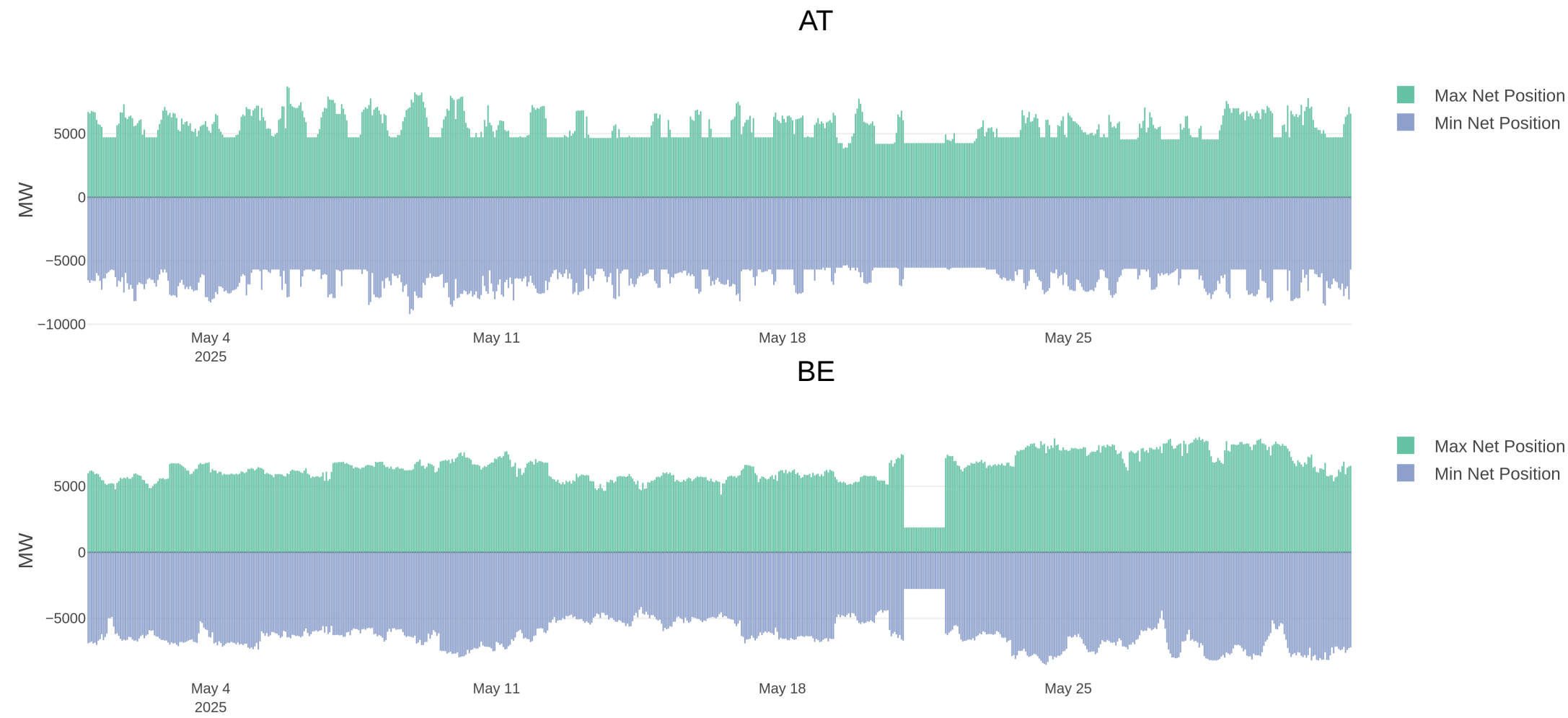
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



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



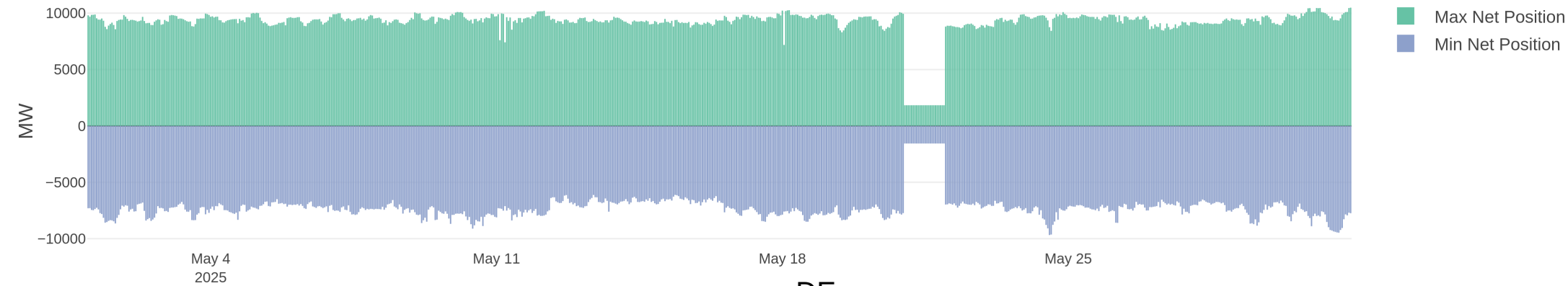
KPI 5: Min & max net positions per BZ hub



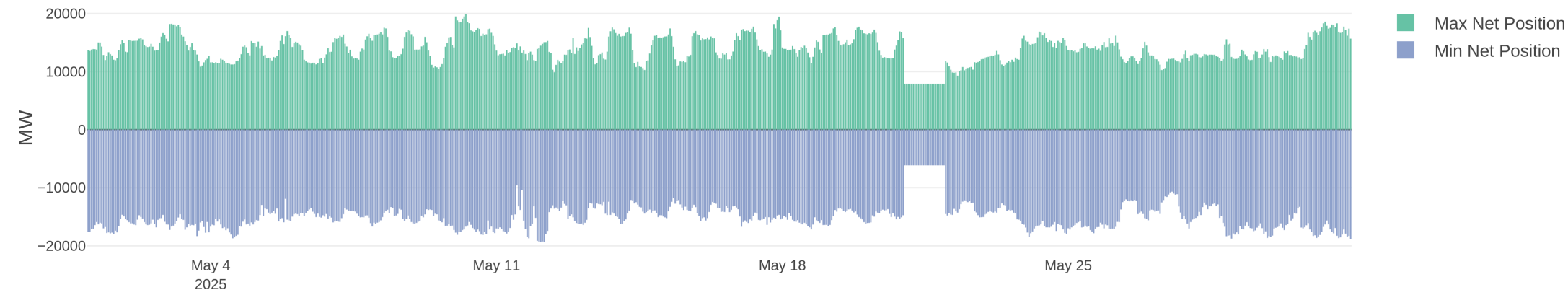
KPI 5: Min & max net positions per BZ hub



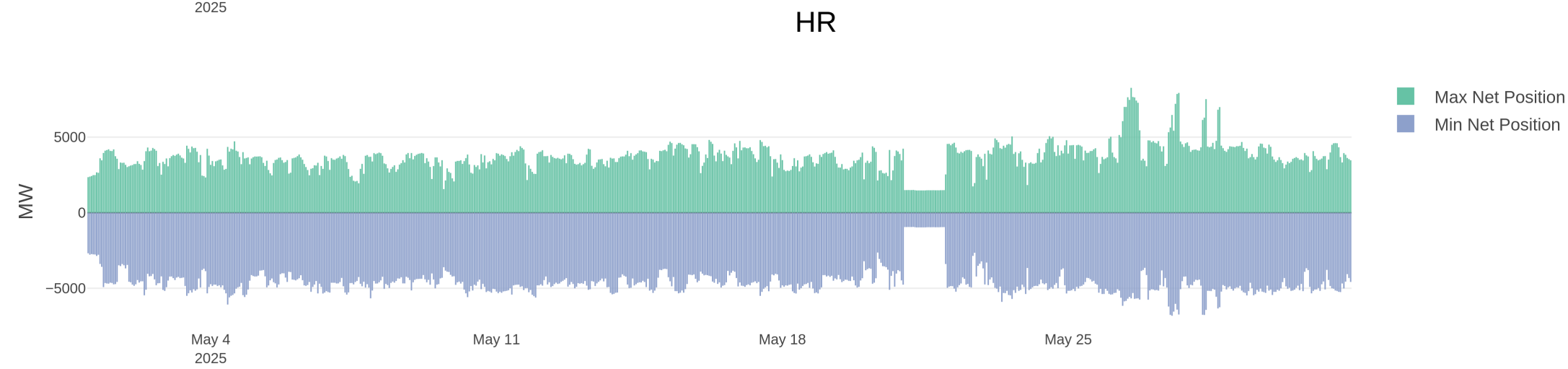
CZ



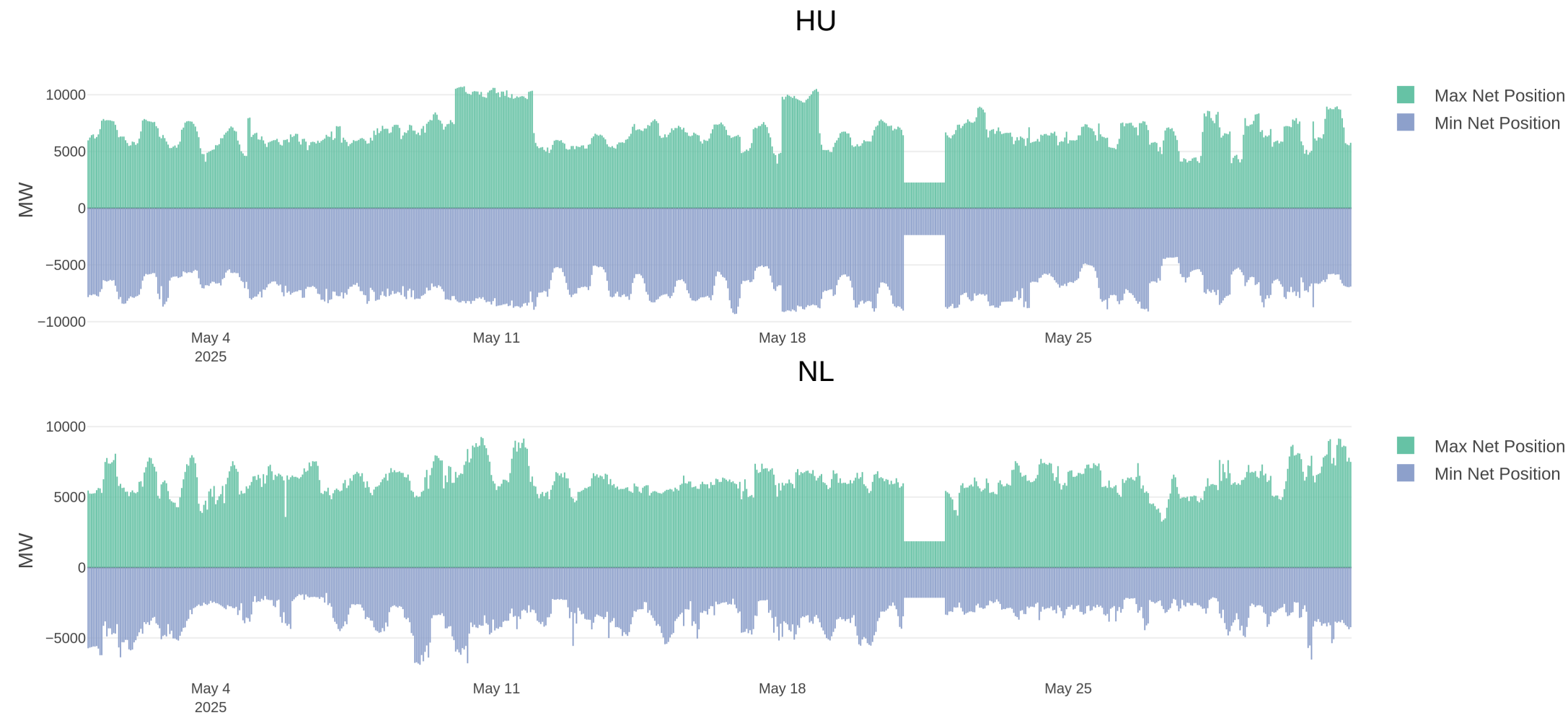
DE



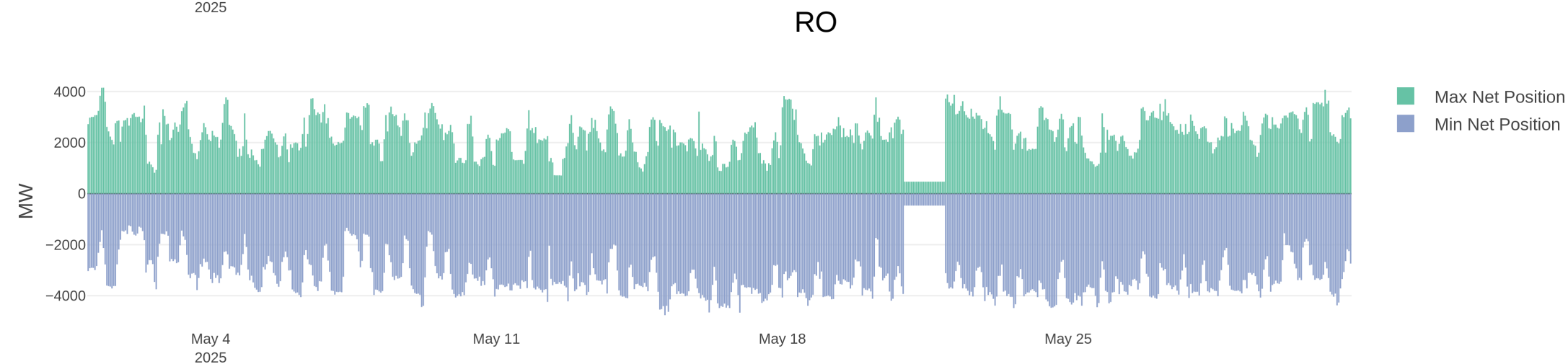
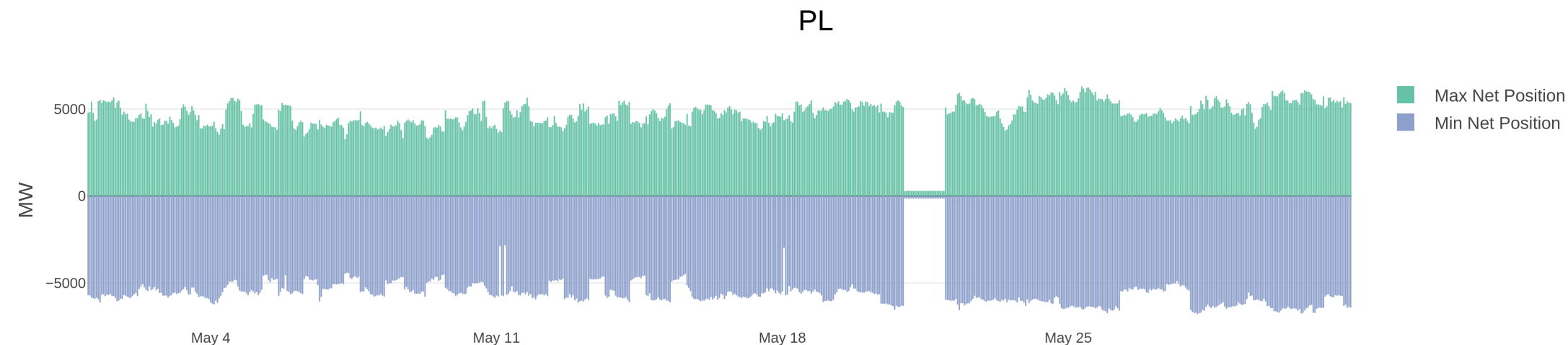
KPI 5: Min & max net positions per BZ hub



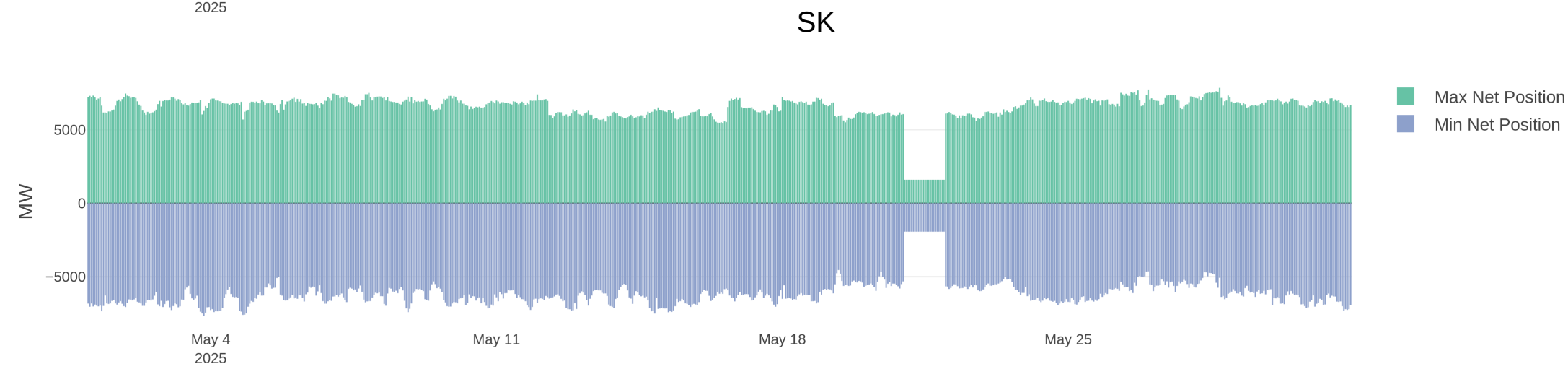
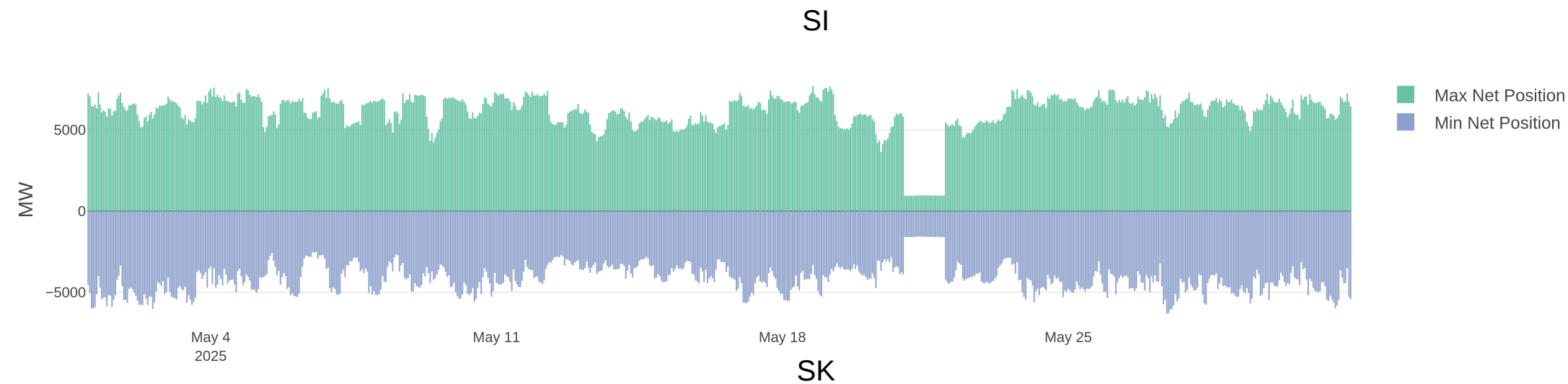
KPI 5: Min & max net positions per BZ hub



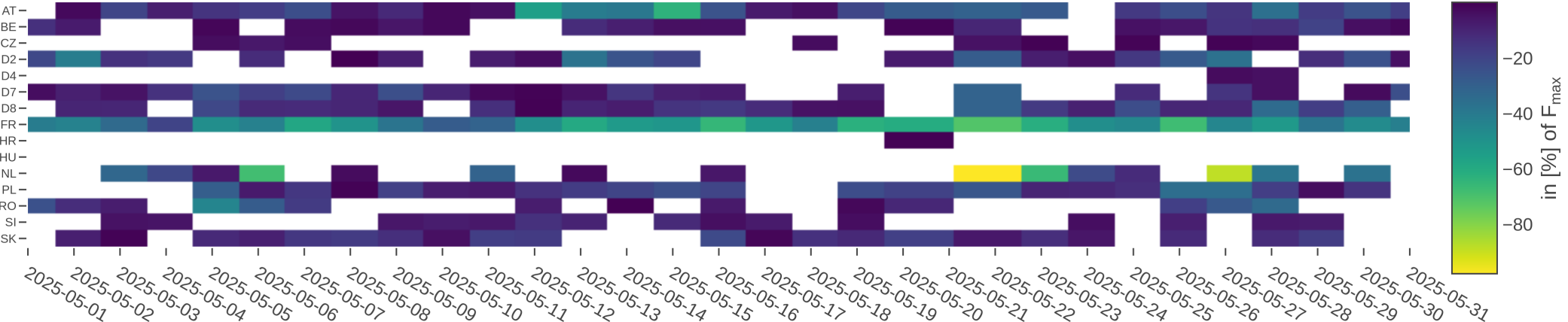
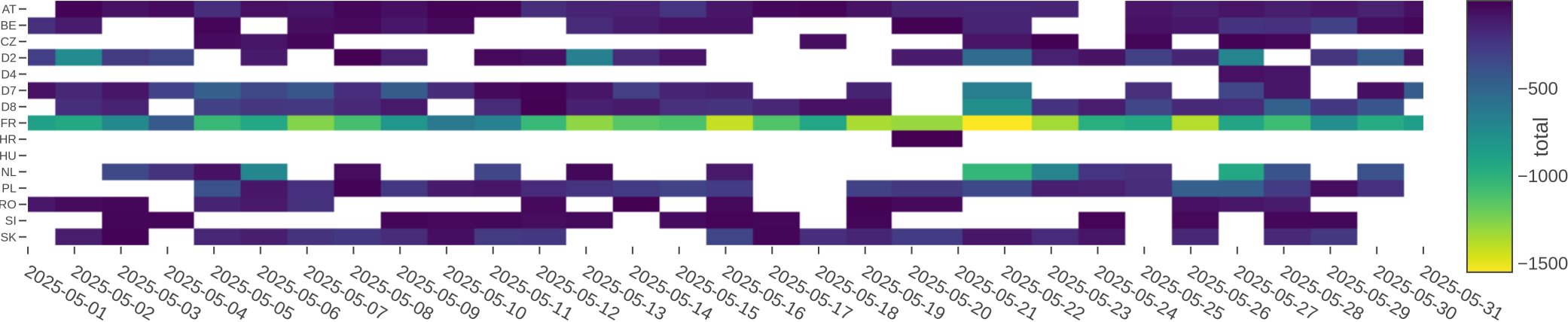
KPI 5: Min & max net positions per BZ hub



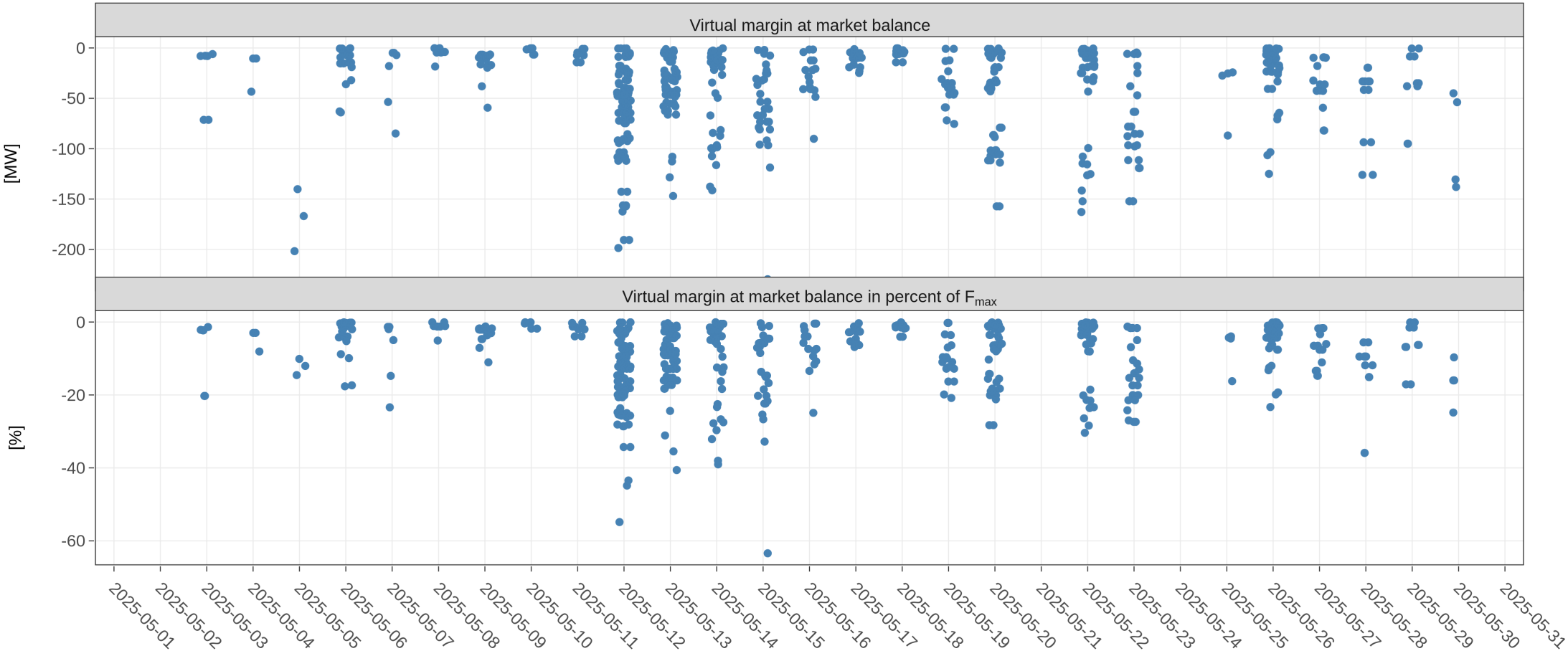
KPI 5: Min & max net positions per BZ hub



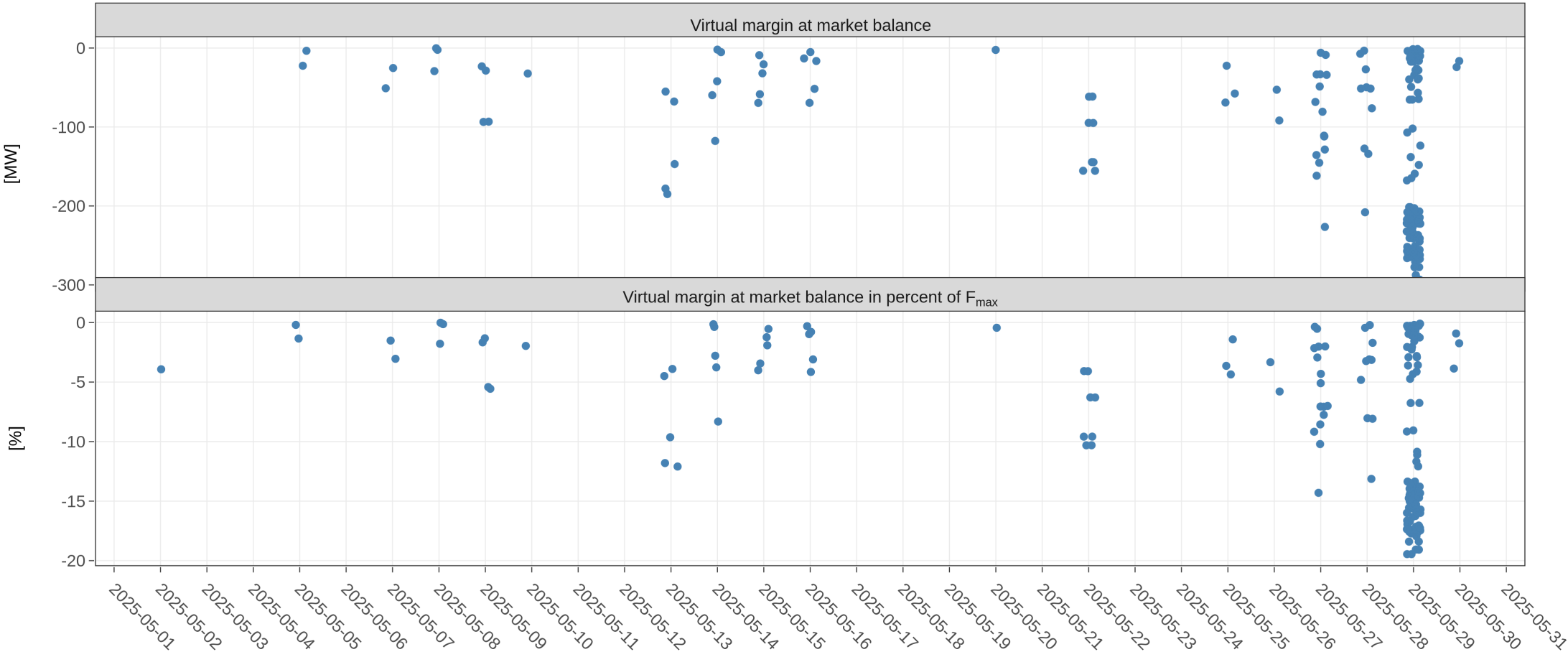
KPI 6a: Highest virtual margins at market balance for CORE TSOs



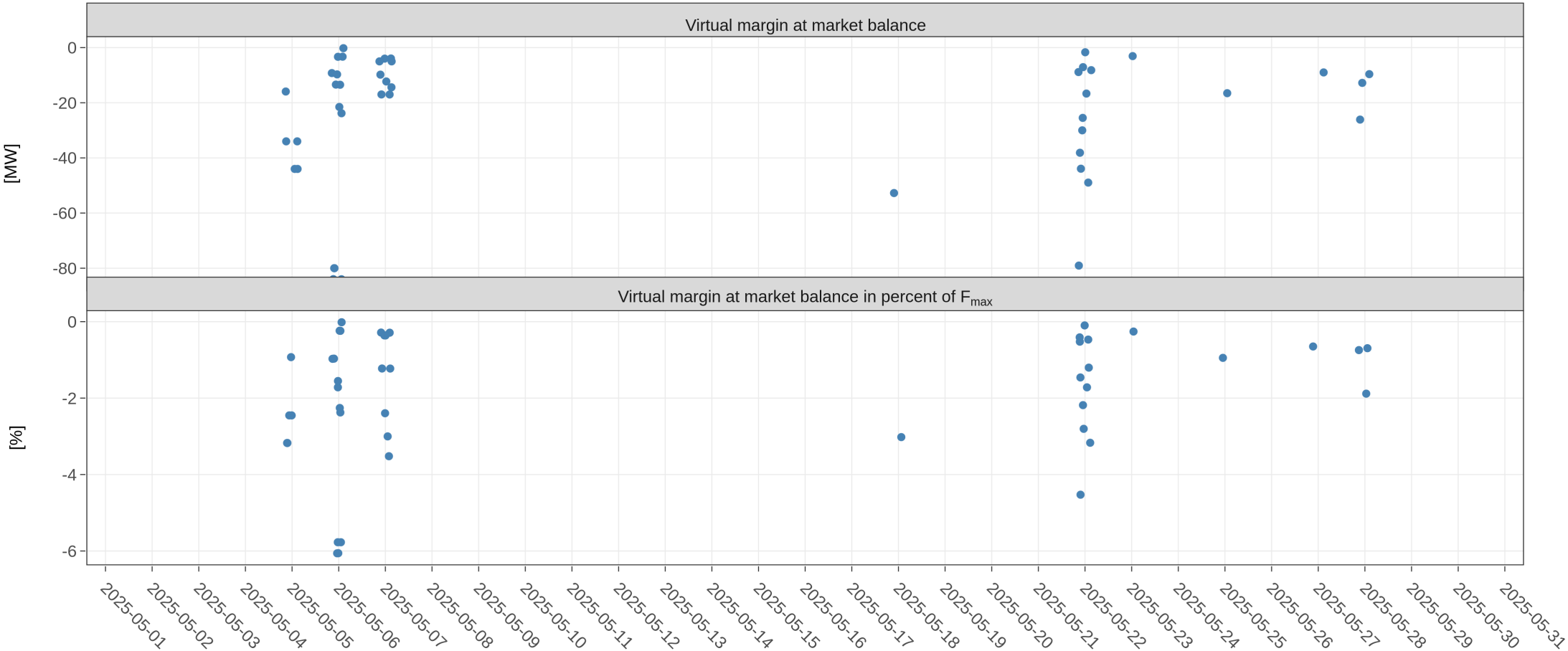
KPI 6b: Virtual margins at market balance AT



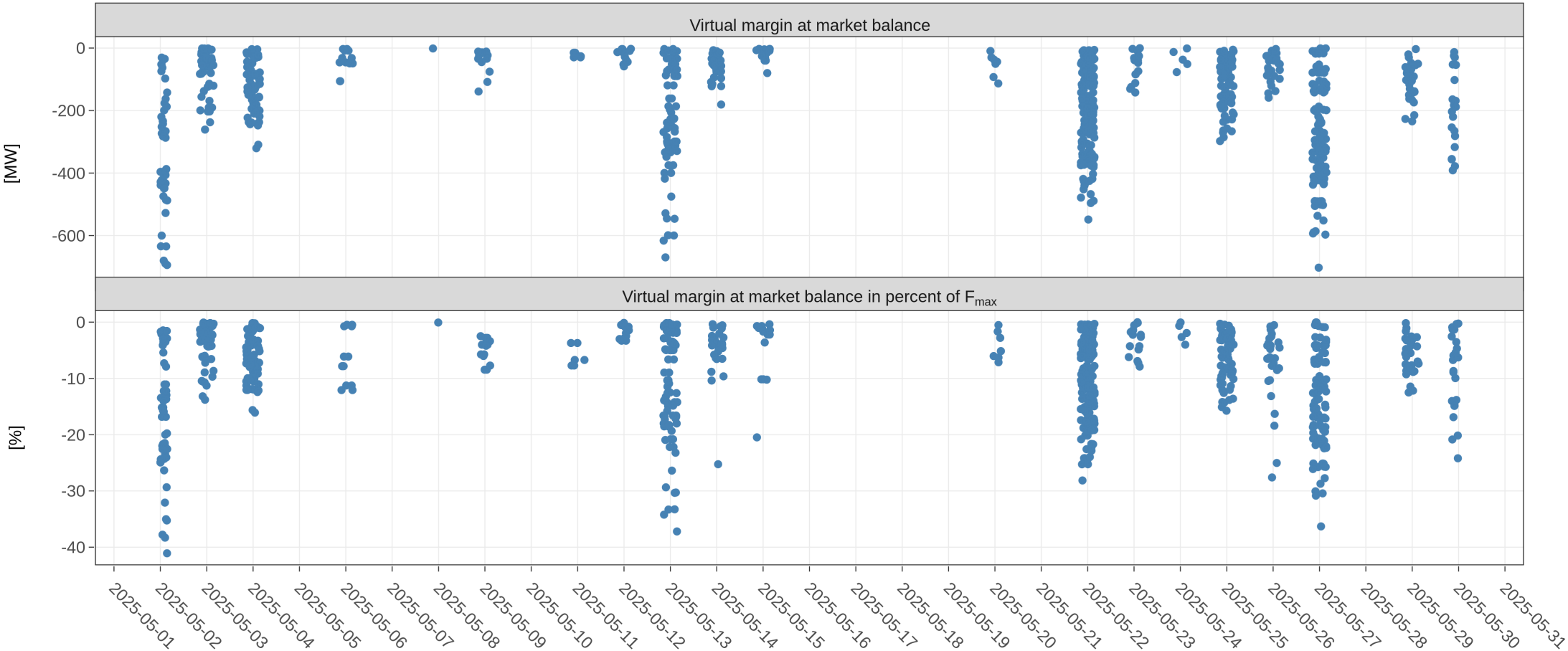
KPI 6b: Virtual margins at market balance BE



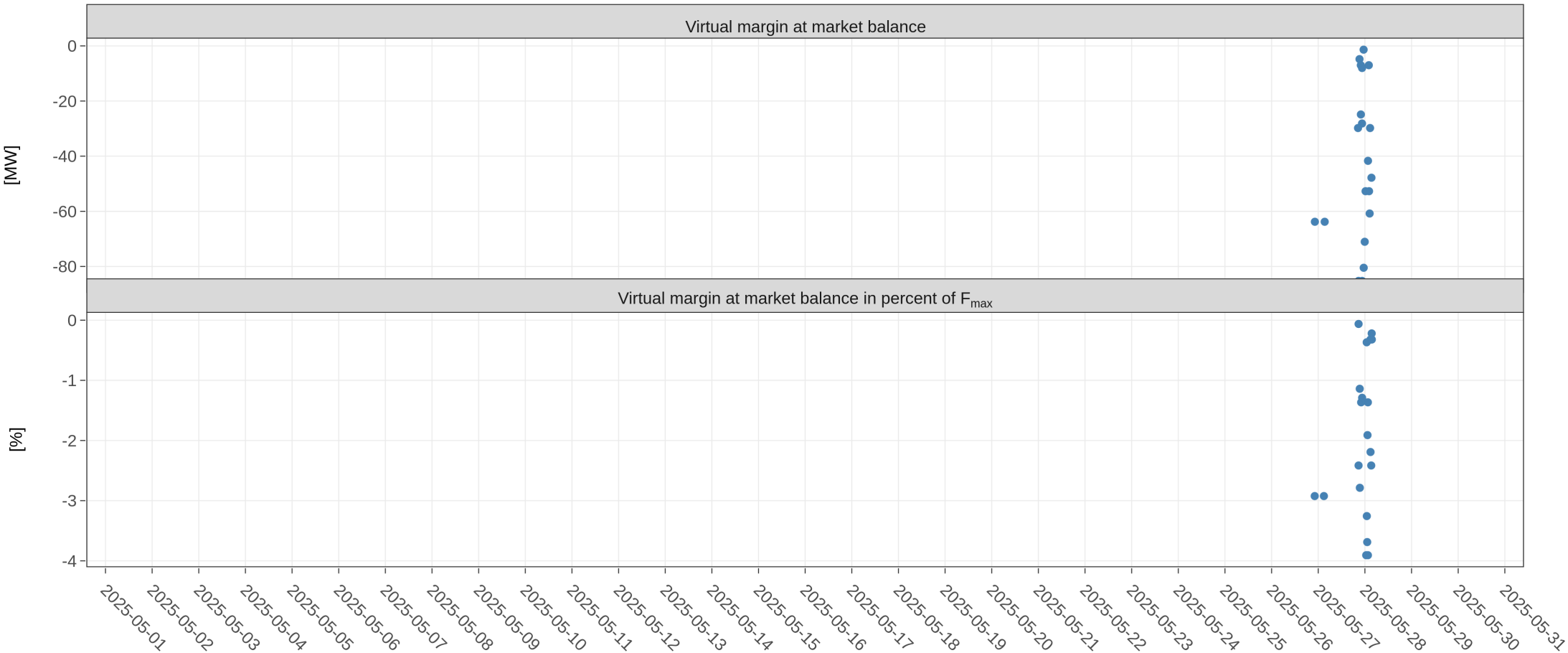
KPI 6b: Virtual margins at market balance CZ



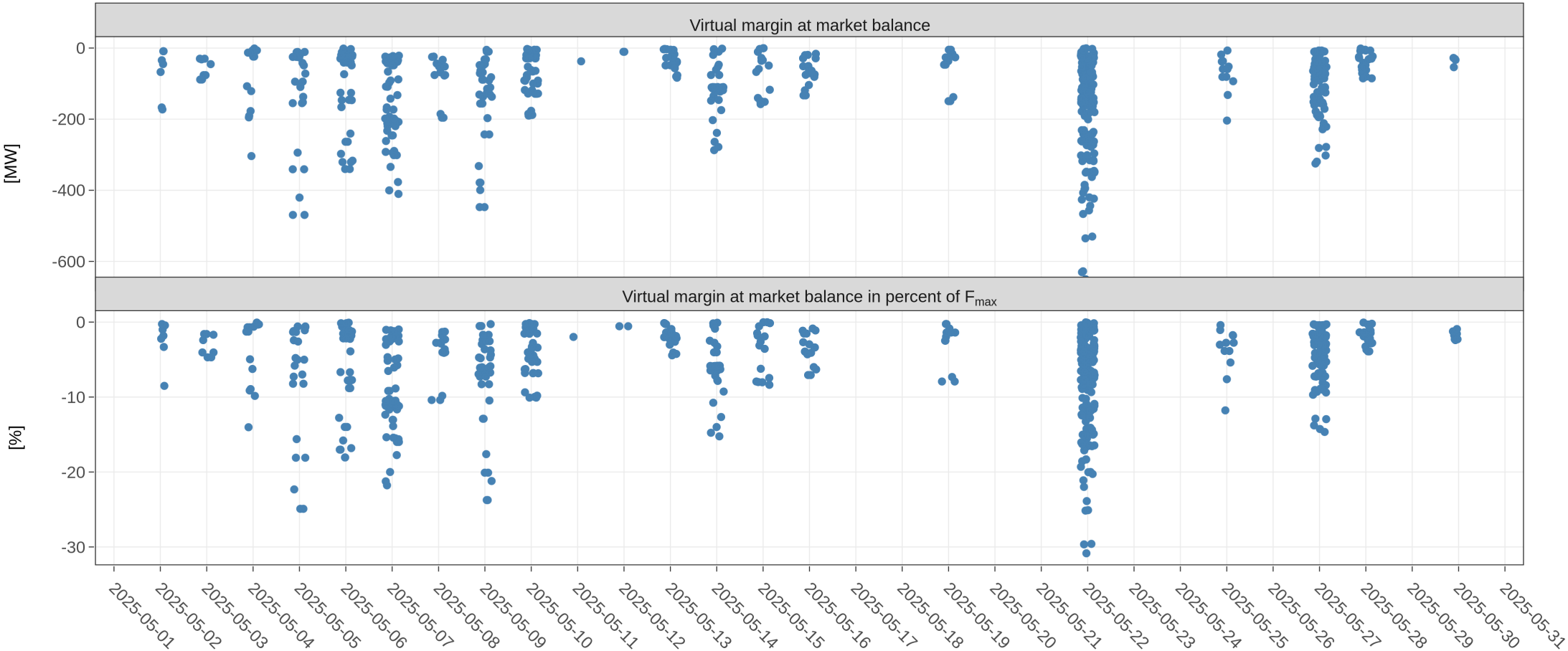
KPI 6b: Virtual margins at market balance D2



KPI 6b: Virtual margins at market balance D4



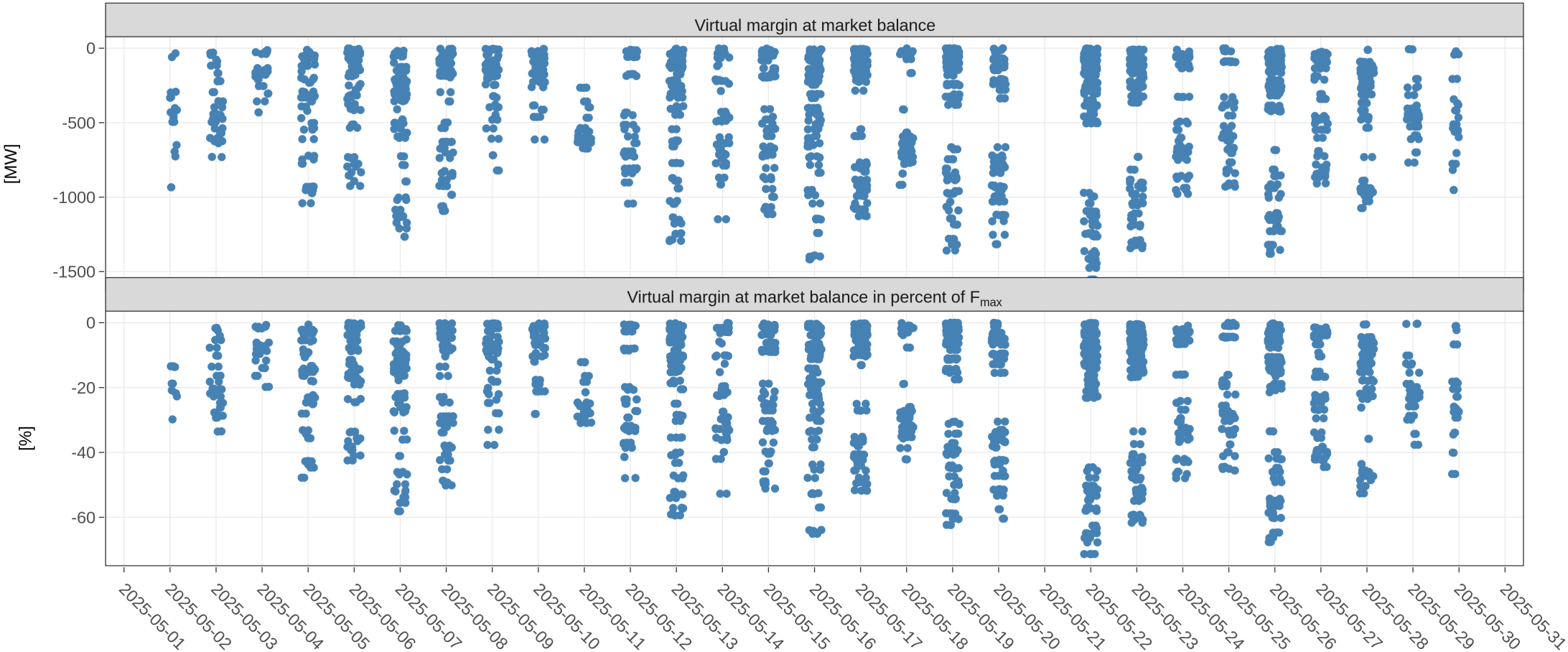
KPI 6b: Virtual margins at market balance D7



KPI 6b: Virtual margins at market balance D8



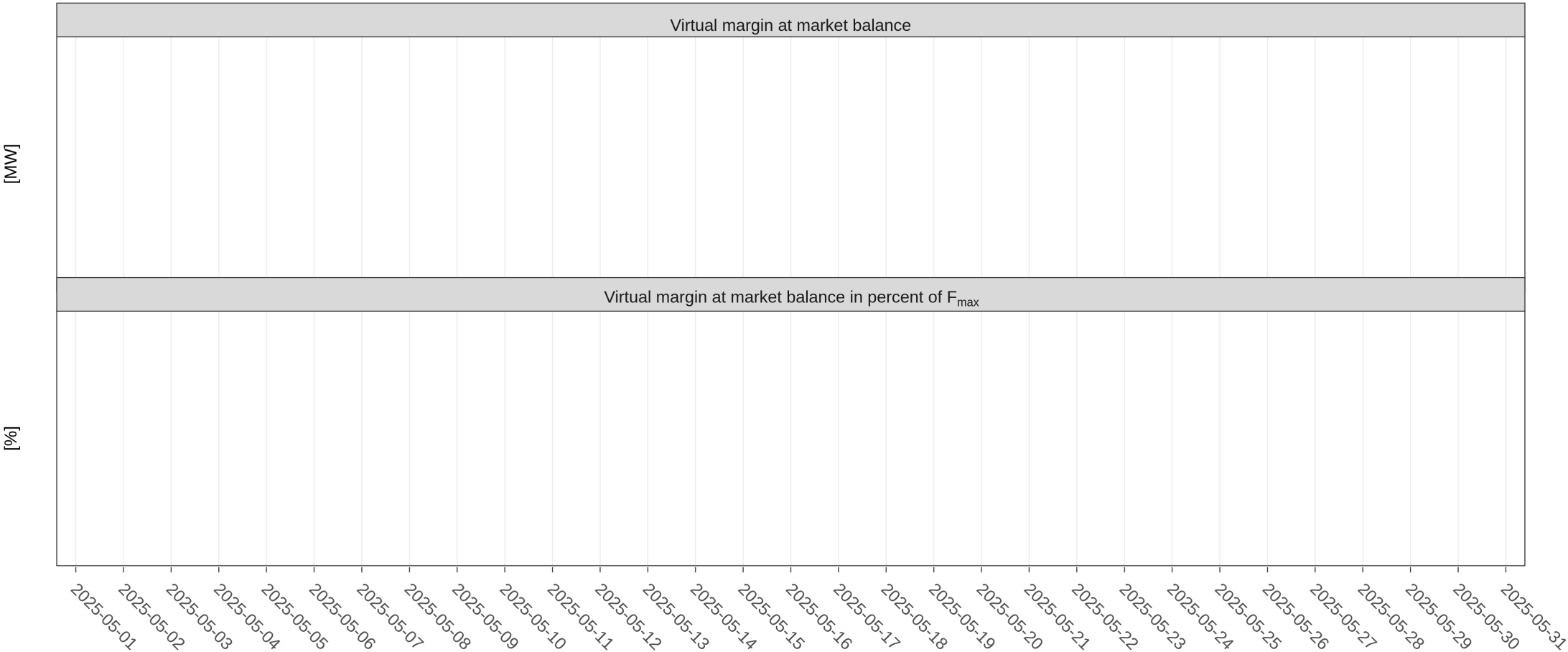
KPI 6b: Virtual margins at market balance FR



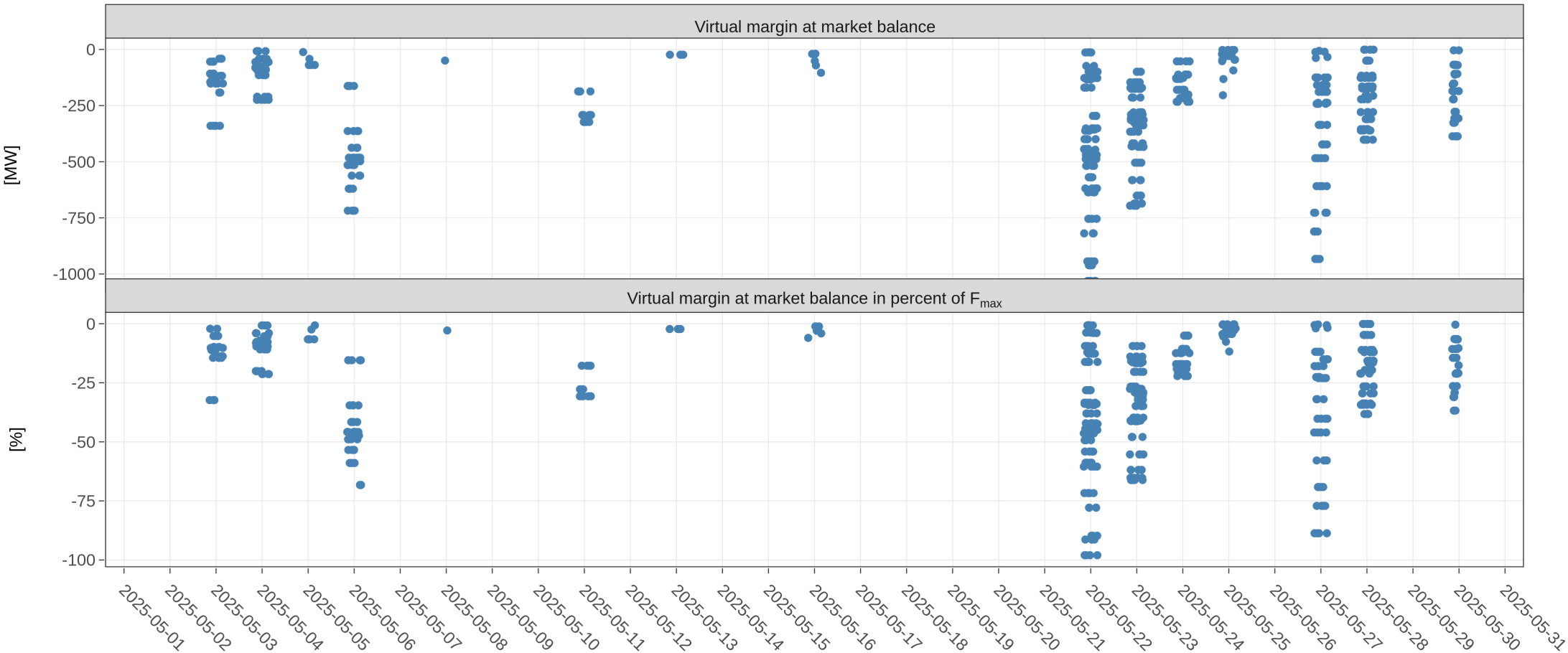
KPI 6b: Virtual margins at market balance HR



KPI 6b: Virtual margins at market balance HU



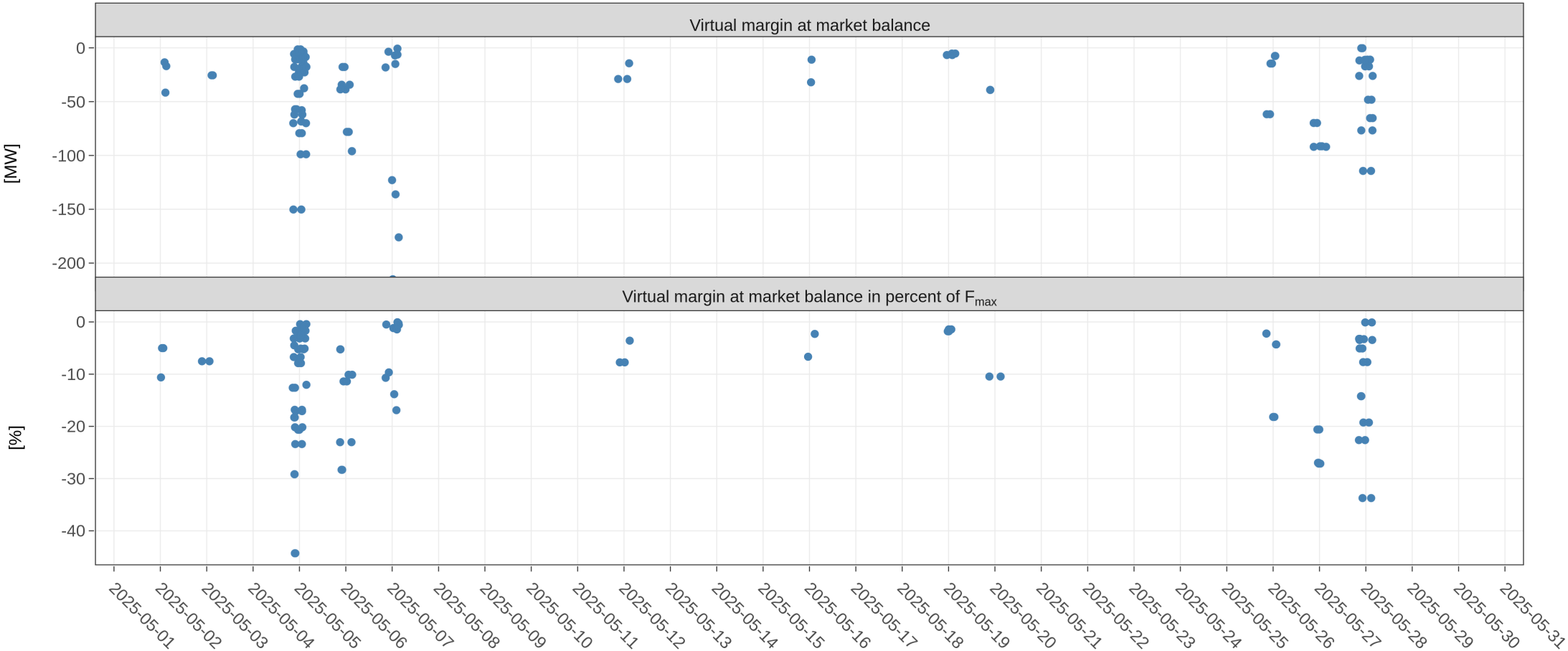
KPI 6b: Virtual margins at market balance NL



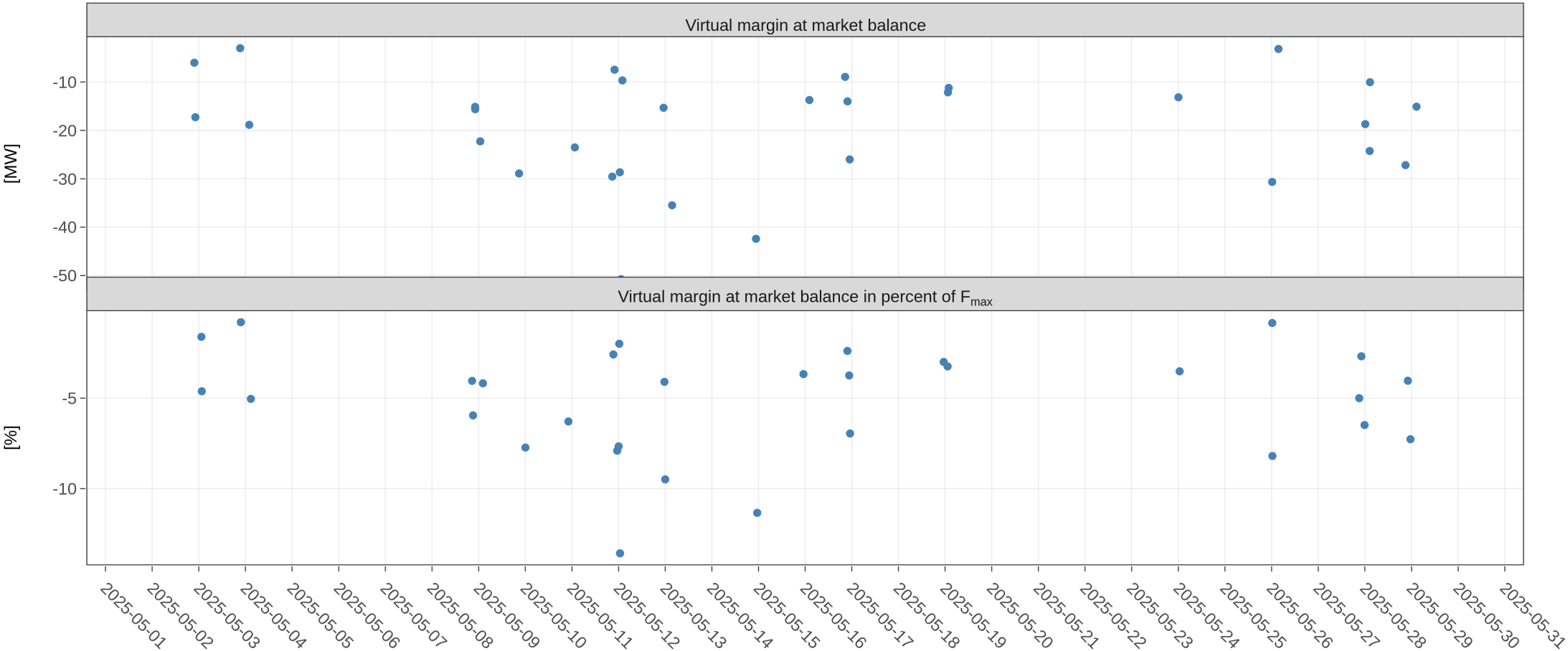
KPI 6b: Virtual margins at market balance PL



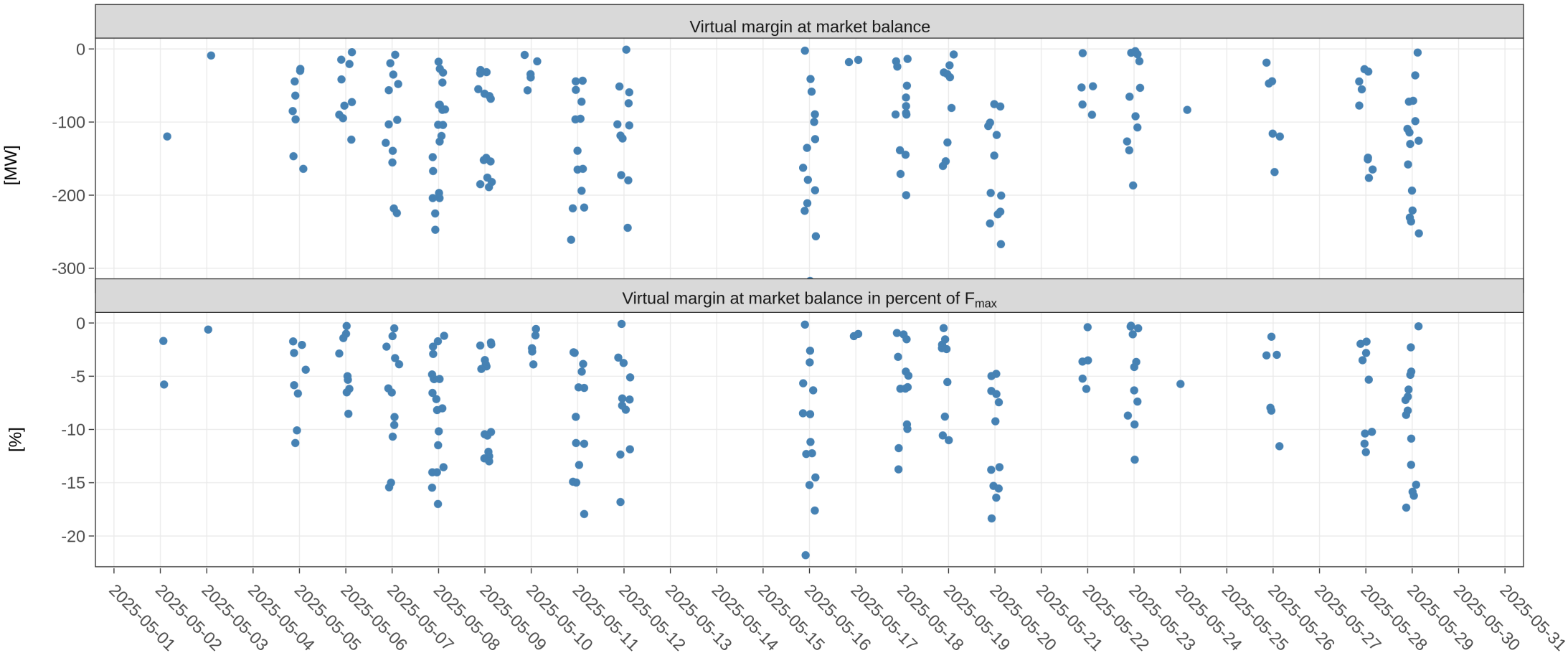
KPI 6b: Virtual margins at market balance RO



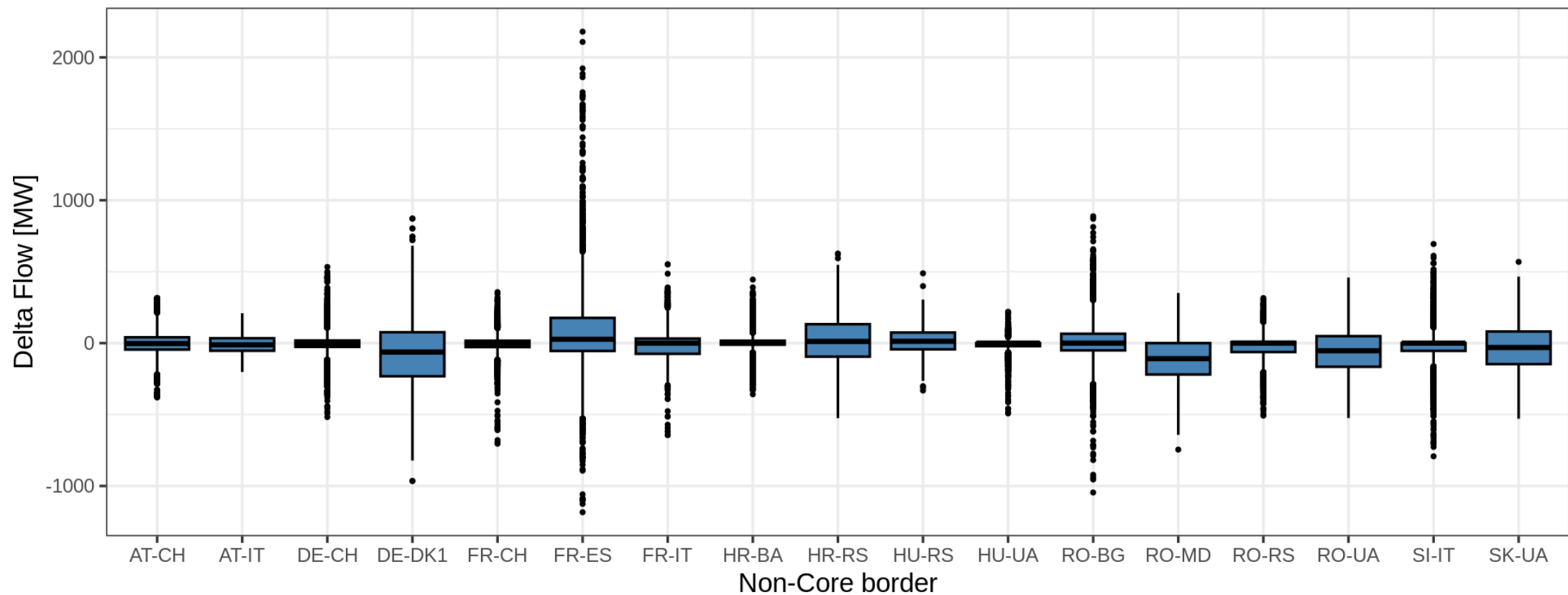
KPI 6b: Virtual margins at market balance SI



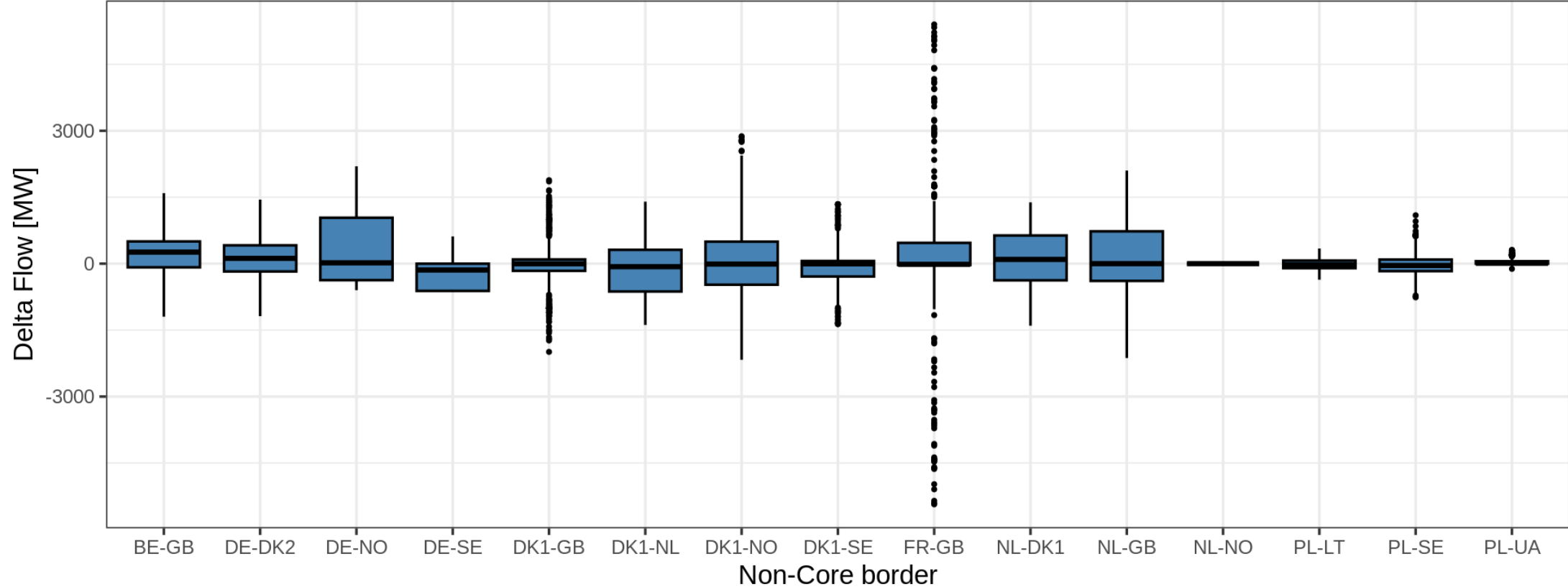
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow



KPI 7: Non-Core exchanges DC delta flow



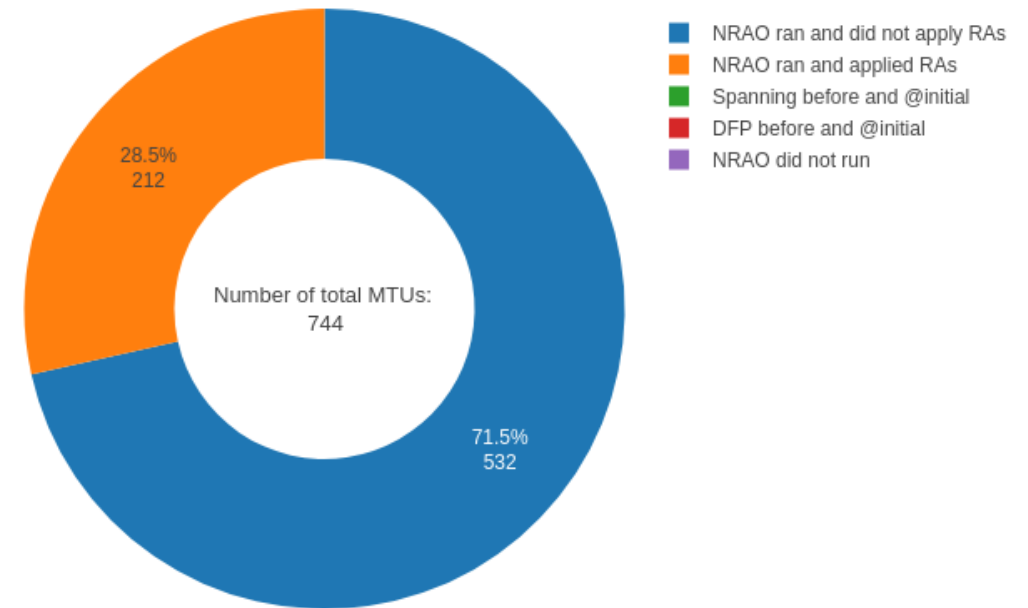
KPI 8: NRAO – Applied Remedial Action



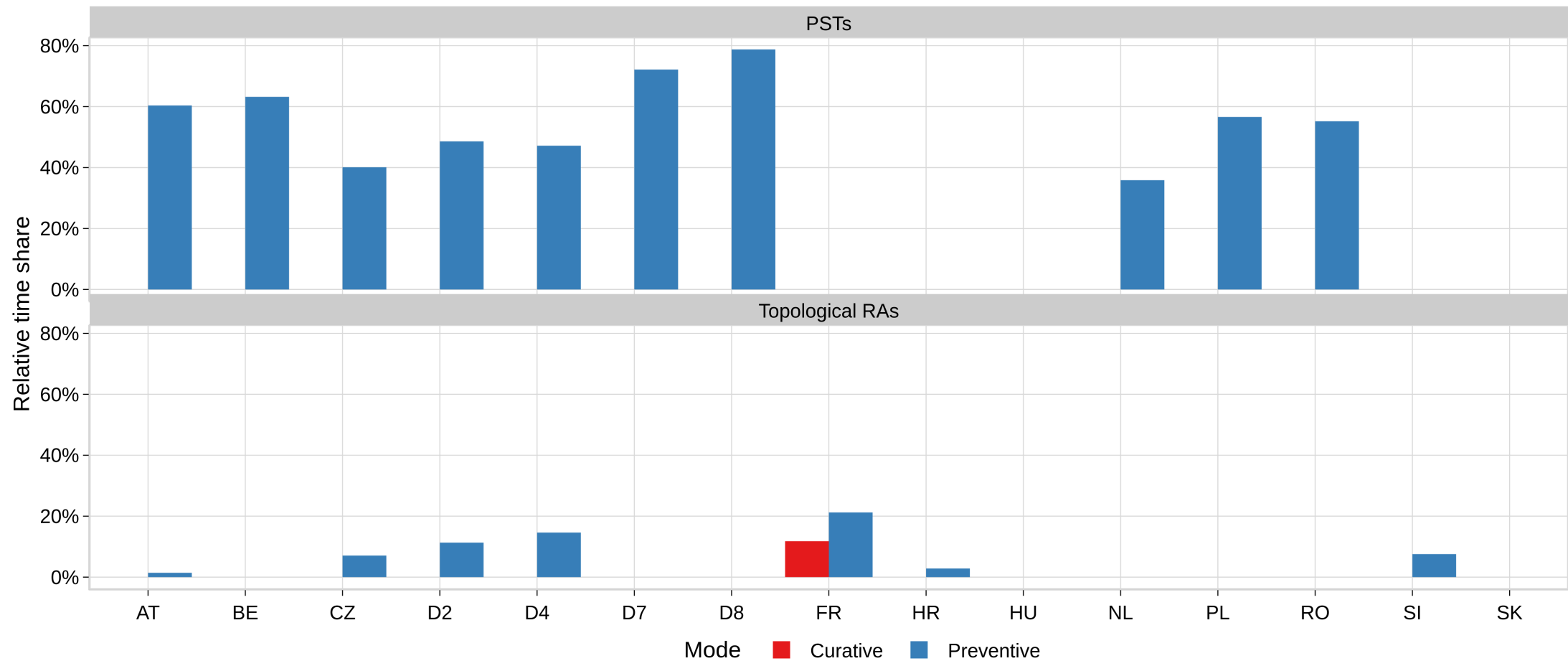
In the following plots, the relative time share relates to the hours labeled 'NRAO Ran and Applied RAs'.

Total MTUs: 744 hours

Category	Hours (%)
NRAO ran and did not apply RAs	532 hours (71.5%)
NRAO ran and applied RAs	212 hours (28.5%)
Spanning before and @initial	0 hours (0%)
DFP before and @initial	0 hours (0%)
NRAO did not run	0 hours (0%)

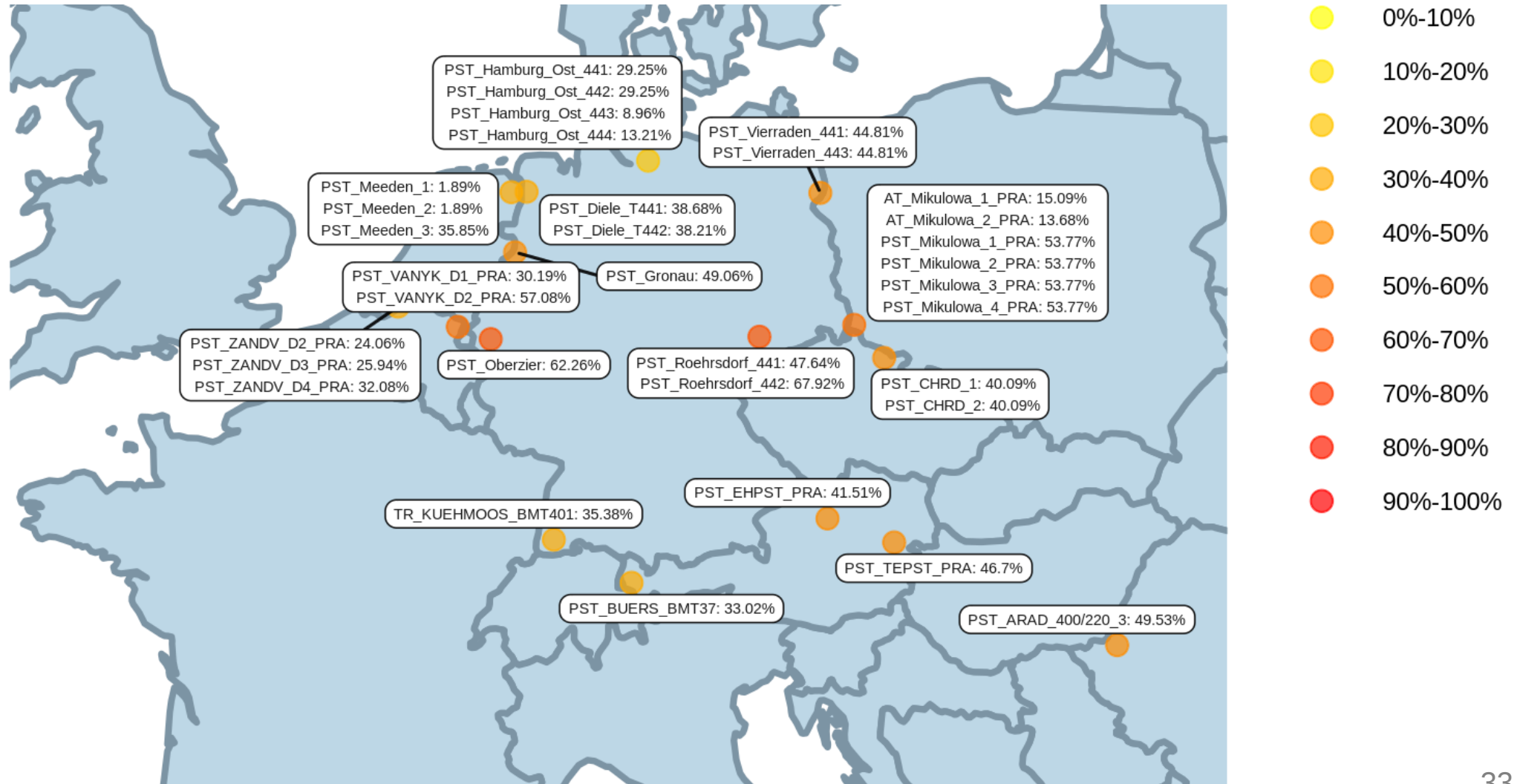


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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



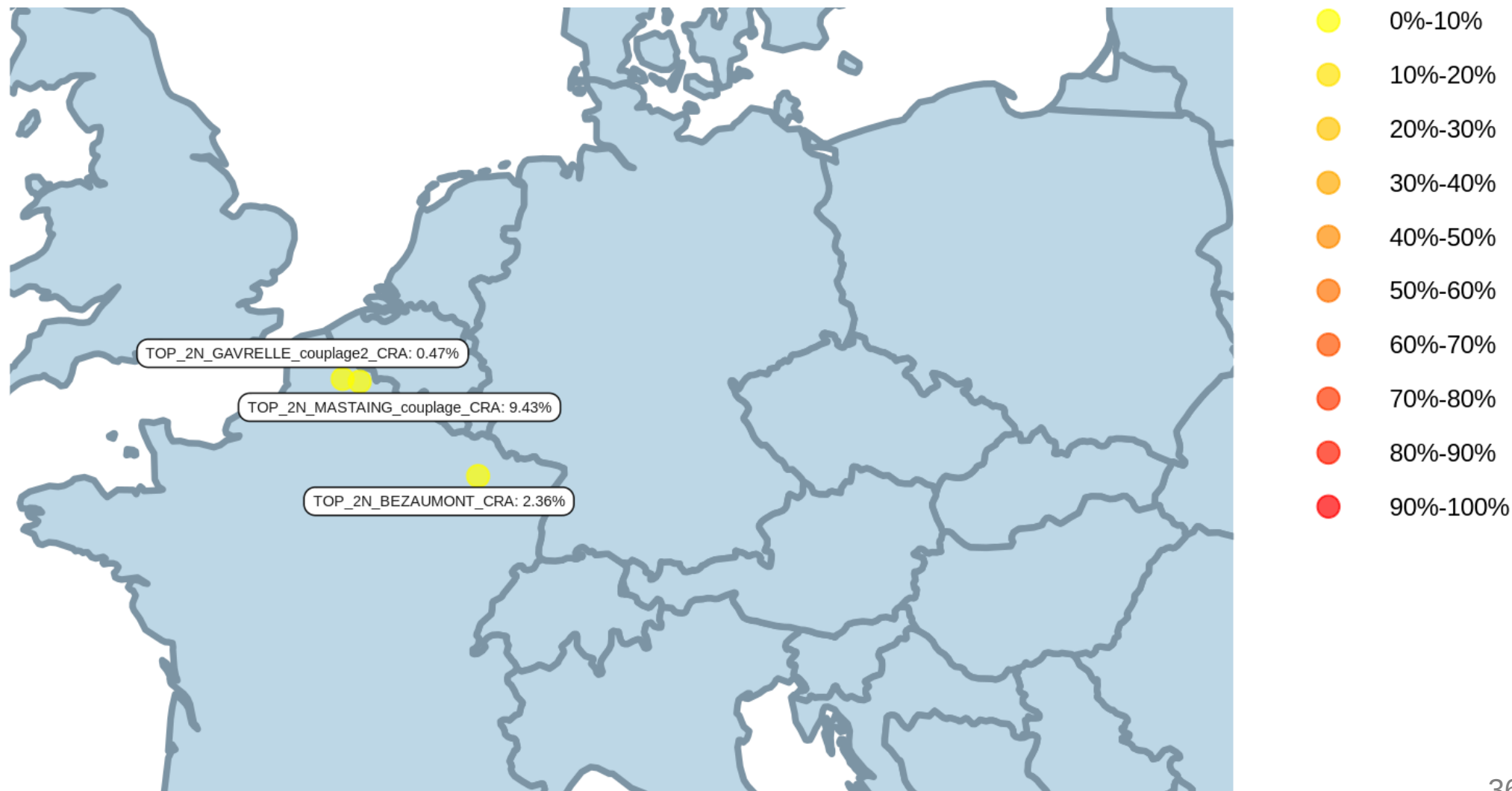
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied Topological RAs in Preventive Mode



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

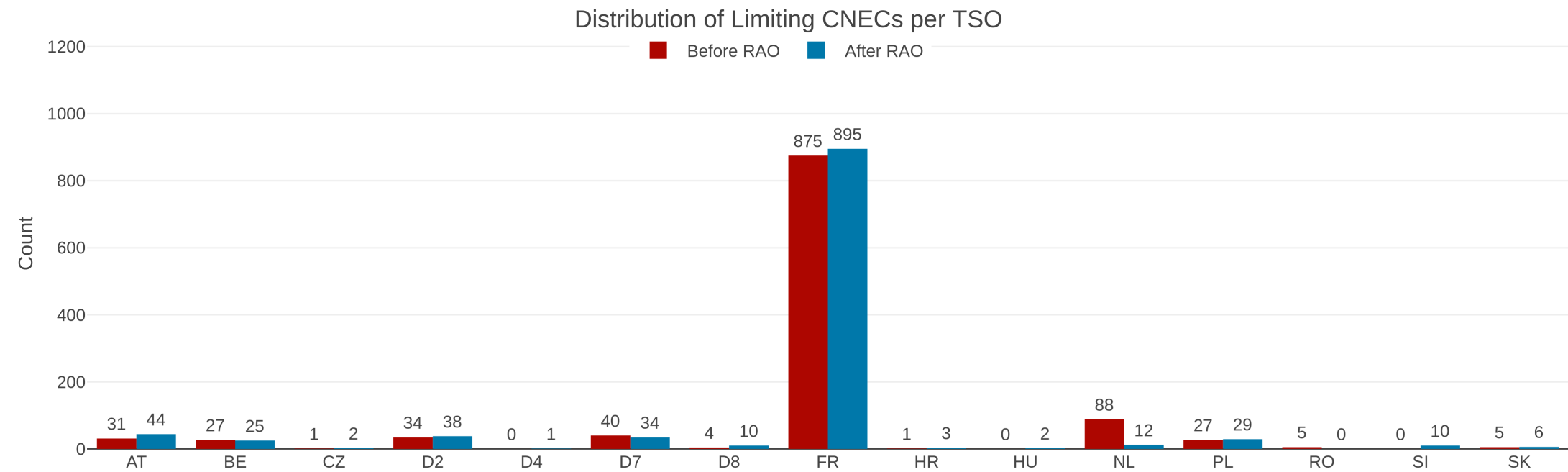
Relative Time Share of Applied Topological RAs in Curative Mode



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.

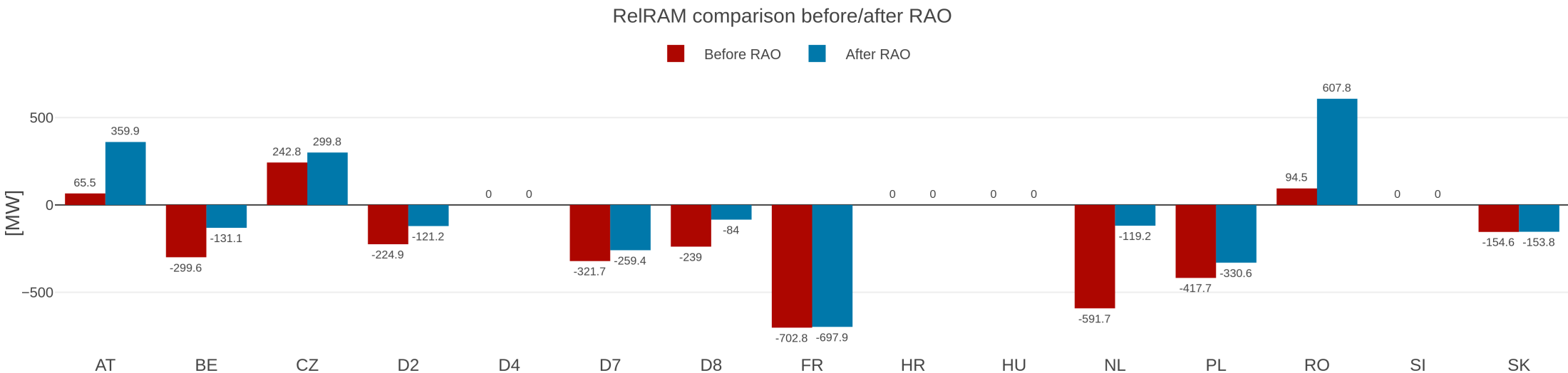
KPI 10: Average variation of relative RAM before and after NRAO



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
[CZ-SK] Nosovice - Varin [DIR] [CZ]	720	1172	80.59%	33.72%	107.30%	0.3263	1.2718
[CZ-SK] Nosovice - Varin [OPP] [CZ]	720	1034	99.04%	72.73%	123.32%	0.3263	1.2718
[HU-HU] Gonyu - Gyor [DIR]	720	1379	74.52%	56.42%	119.84%	0.3638	1.4756
[HU-HU] Gonyu - Gyor [OPP]	719	1214	108.82%	67.97%	149.06%	0.3638	1.4756
[CZ-SK] Nosovice - Varin [OPP] [SK]	718	1866	97.19%	73.57%	122.06%	0.338	1.2768
[SI-HU] 400 kV Cirkovce - Hevitz [DIR] [SI]	718	1424	102.77%	76.28%	141.93%	0.3682	1.3486
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	717	3058	63.75%	50.83%	95.53%	0.3664	1.3491
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	716	745	80.39%	38.79%	107.44%	0.25	0.8917
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	713	713	61.45%	37.49%	94.27%	0.273	1.1087
[SI-HU] 400 kV Cirkovce - Hevitz [OPP] [SI]	711	1390	77.35%	50.32%	103.70%	0.3682	1.3486
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	707	1608	51.94%	21.49%	117.40%	0.2593	0.7918
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	704	1498	67.82%	19.80%	123.70%	0.2142	0.9699
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	699	699	66.86%	48.58%	95.04%	0.2865	0.9929
[SK-UA] V.Kapusany - Mukachevo (WPS) [OPP] [SK]	695	806	98.62%	73.16%	136.67%	0.25	0.8916
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	695	1359	111.48%	82.35%	165.78%	0.2229	0.5097
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	695	779	62.27%	15.24%	90.91%	0.2229	0.5097
[AT-HU] Zurndorf - Gyoer 439B [DIR] [AT]	694	1783	92.11%	19.41%	121.36%	0.3582	1.5071
[NL-NL] MEE DRT3 [DIR] [NL]	693	693	48.83%	19.96%	134.13%	0.3028	0.6742
[HR-SI] 400kV Tumbri - Krsko 1 [OPP] [HR]	684	684	78.54%	53.61%	87.44%	0.3375	0.8117
[SK-HU] Gabcikovo - Gonyu [DIR] [HU]	673	1259	89.53%	62.77%	130.16%	0.3952	1.4142

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
[FR-FR] Creys - Saint-Vulbas 2 [OPP]	412	412	1083.93	20.87%	19.97%	43.39%	0.1749
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	320	320	287.75	60.78%	19.95%	99.86%	0.3909
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	258	259	958.17	40.23%	21.76%	93.09%	0.2582
[FR-FR] Creys - Saint-Vulbas 1 [OPP]	114	114	790.58	20.45%	19.97%	42.92%	0.1727
[SK-SK] V.Dur - Levice 1 [DIR]	103	103	725.85	44.33%	35.19%	52.30%	0.2102
[FR-D7] Vigy - Ens Dorf VIGY2 S [DIR] [D7]	94	94	726.6	22.96%	19.90%	52.92%	0.2138
[D8-PL] Mikulowa PST1 [DIR] [PL]	83	83	424.91	51.96%	42.27%	67.95%	0.3969
[NL-NL] MEE DRT3 [DIR] [NL]	62	62	172.15	24.49%	19.96%	89.92%	0.3028
[D8-D8] Roehrsdorf - Roehrsdorf PST442 [DIR]	41	41	204.7	53.18%	43.84%	64.84%	0.277
[D7-D7] Gronau - Gronau TR 441 E [DIR]	34	34	176.22	73.59%	20.07%	92.13%	0.2889
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	31	31	271.37	65.89%	36.57%	90.11%	0.137
[RO-RO] PST Arad 400/220 3 [DIR]	28	28	1031.72	73.48%	57.50%	86.00%	0.1242
[HR-RS] 400kV Ernestinovo - Mitrovica [DIR] [HR]	27	27	799.76	61.17%	57.63%	66.50%	0.2902
[AT-AT] St. Peter 2 - St. Peter 1 SPRHU42 [DIR]	26	26	675.97	42.66%	19.96%	64.57%	0.0955
[AT-AT] St. Peter 2 - St. Peter 1 SPRHU41 [DIR]	25	25	420.3	36.44%	19.78%	62.23%	0.0916
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	25	25	574.24	63.18%	38.79%	81.80%	0.245
[D8-D8] Vierraden - Vierraden PST441 [DIR]	24	24	464.84	51.77%	46.32%	55.77%	0.288
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	21	22	123.8	59.29%	55.63%	65.08%	0.3597
[FR-D7] Vigy - Ens Dorf VIGY1 N [DIR] [D7]	19	22	746.91	22.51%	19.90%	29.67%	0.2208
[NL-BE] PST Zandvliet 4 [DIR] [BE]	17	17	90.24	84.61%	72.81%	97.53%	0.4426

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 = 500MW/0.4 = 1250MW

KPI 13 : Allocation Constraints - Poland



	# MTUs
AC was limiting MC	287
AC < 0 MW	85
AC = 0 MW	202
AC > 0 MW	0

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1280.68	5596.06
Min.	-9555.00	0.00
Max.	0.00	15758.00

