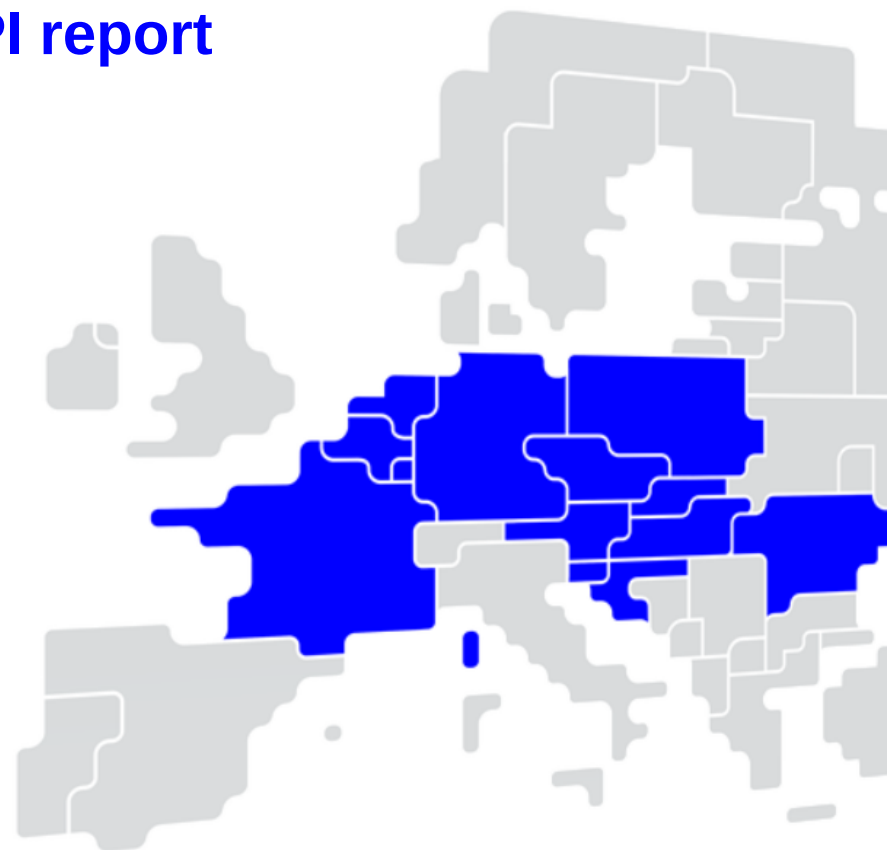




Core FB MC Operational KPI report

April 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

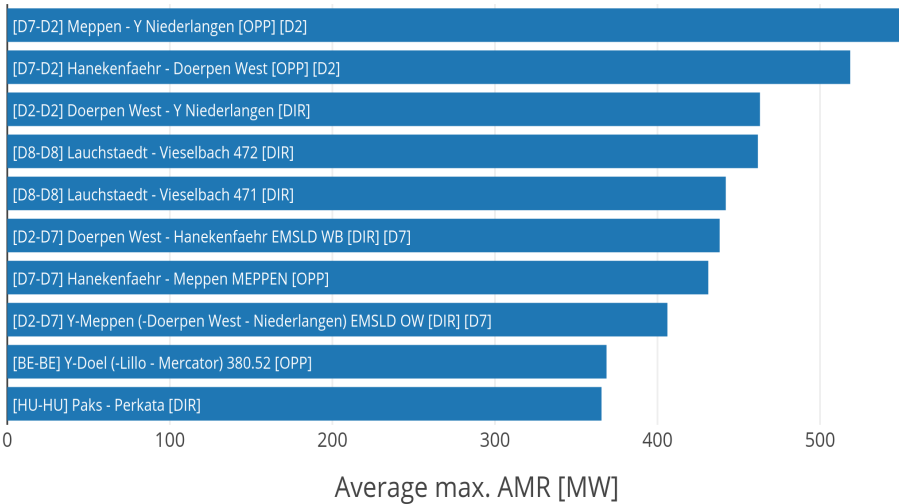
- KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode
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Market Impact Assessment

- KPI 11: Most often presolved CNEs (top 20)
- KPI 12: Most limiting CNEs (top 20)
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KPI 1: Average maximum AMR per CNE (Top 10)

CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	548.77	28.41%
[D7-D2] Hanekenfaehr - Doerpen West [OPP] [D2]	518.56	26.85%
[D2-D2] Doerpen West - Y Niederlangen [DIR]	463.04	23.98%
[D8-D8] Lauchstaedt - Vieselbach 472 [DIR]	461.75	18.51%
[D8-D8] Lauchstaedt - Vieselbach 471 [DIR]	442.00	15.83%
[D2-D7] Doerpen West - Hanekenfaehr EMSLD WB [DIR] [D7]	438.24	20.21%
[D7-D7] Hanekenfaehr - Meppen MEPPEN [OPP]	431.25	19.51%
[D2-D7] Y-Meppen (-Doerpen West - Niederlangen) EMSLD OW [DIR] [D7]	406.10	17.24%
[BE-BE] Y-Doel (-Lillo - Mercator) 380.52 [OPP]	368.64	24.45%
[HU-HU] Paks - Perkata [DIR]	365.55	26.39%

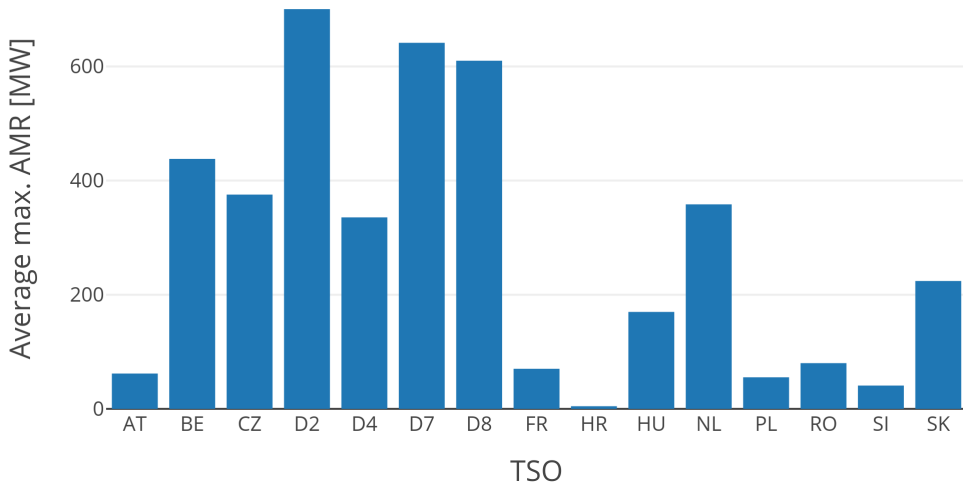


KPI 2: Average maximum AMR per TSO



TSO	Average maximum AMR per TSO
AT	61.88
BE	438.13
CZ	375.51
D2	700.49
D4	335.46
D7	641.48
D8	610.13
FR	70.22
HR	4.69
HU	169.95

TSO	Average maximum AMR per TSO
NL	358.41
PL	55.20
RO	80.16
SI	40.87
SK	224.05



KPI 3: Share of MTUs with intervention per TSO



Total BDs

30

Total MTUs

720

MTUs without IVA

0

Share of distinct MTUs without IVA

0%

MTUs with IVA

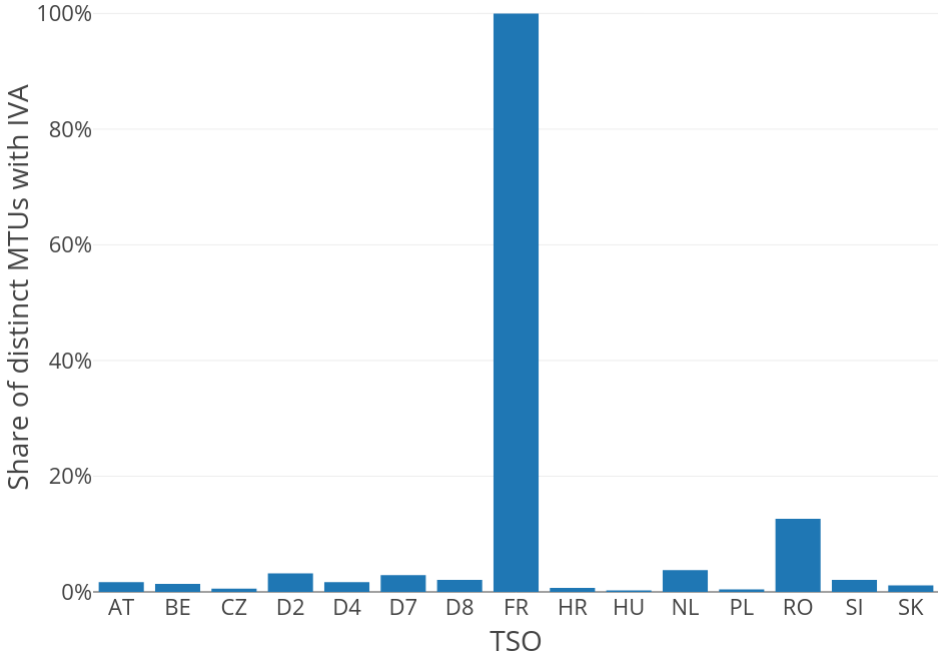
720

Share of distinct MTUs with IVA

100%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	1.67%	12
BE	1.39%	10
CZ	0.56%	4
D2	3.19%	23
D4	1.67%	12
D7	2.92%	21
D8	2.08%	15
FR	100.00%	720
HR	0.69%	5
HU	0.28%	2

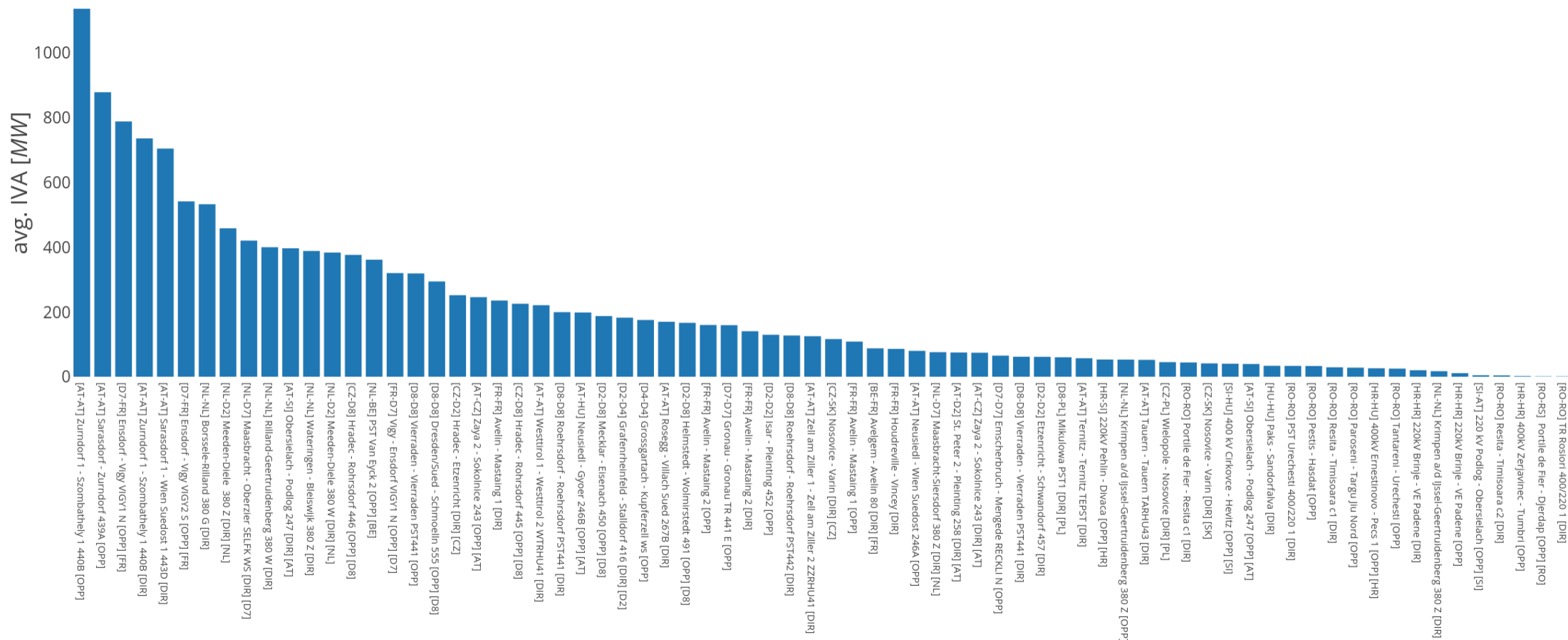
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
NL	3.75%	27
PL	0.42%	3
RO	12.64%	91
SI	2.08%	15
SK	1.11%	8



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



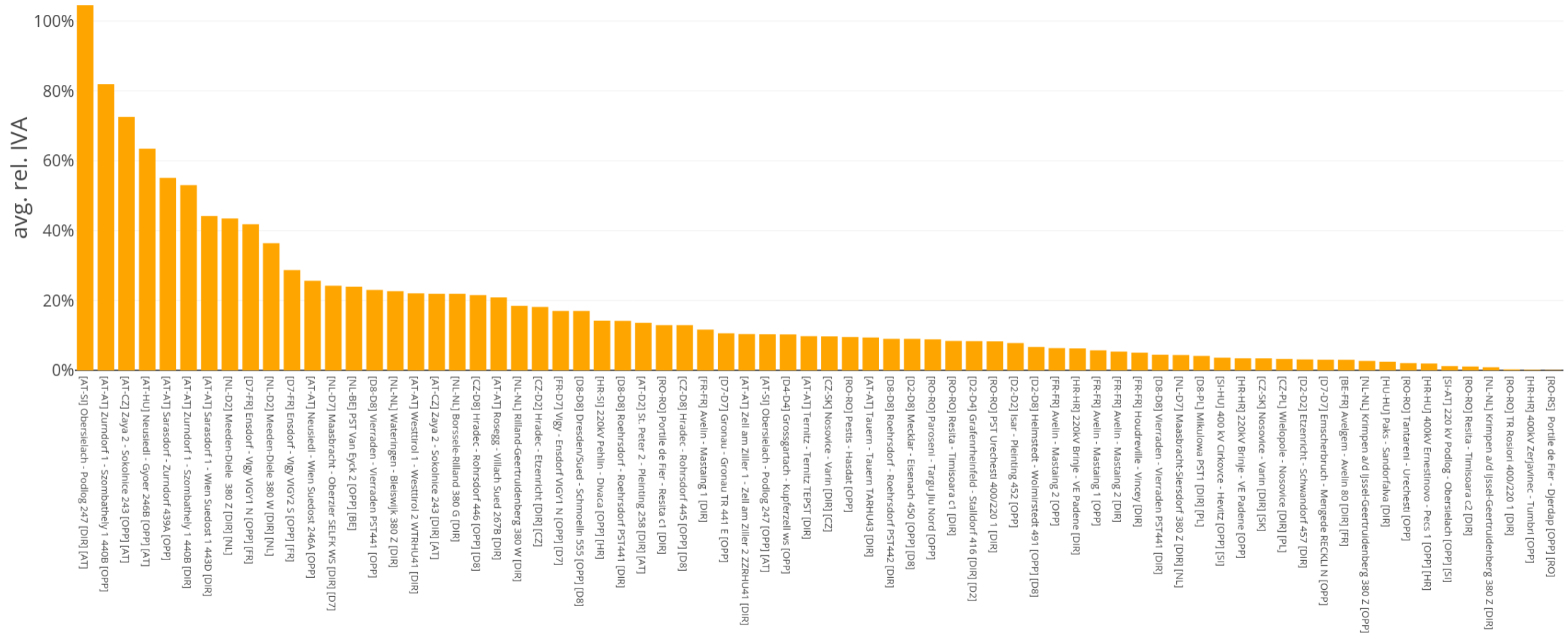
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



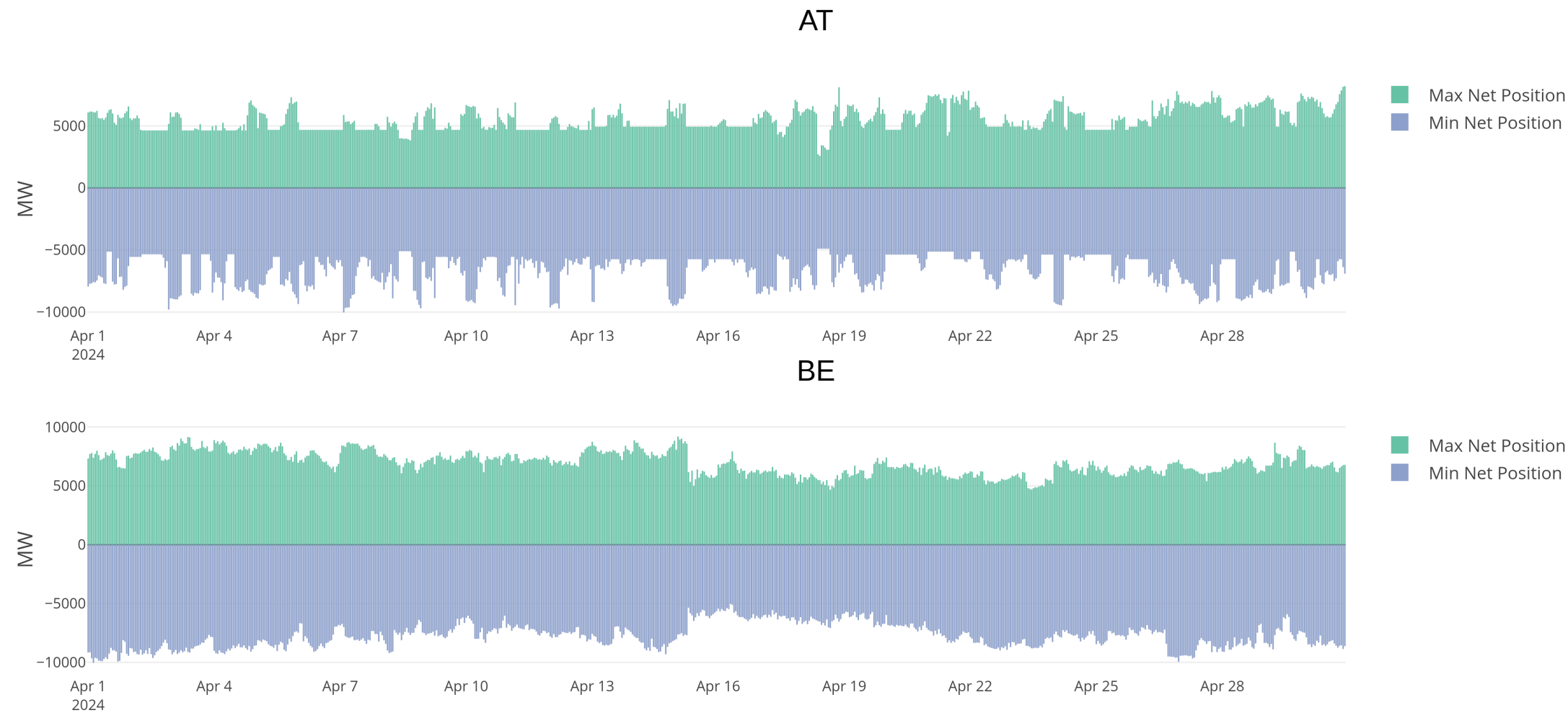
KPI 4b: Average relative IVA applied for each CNE affected by TSO intervention



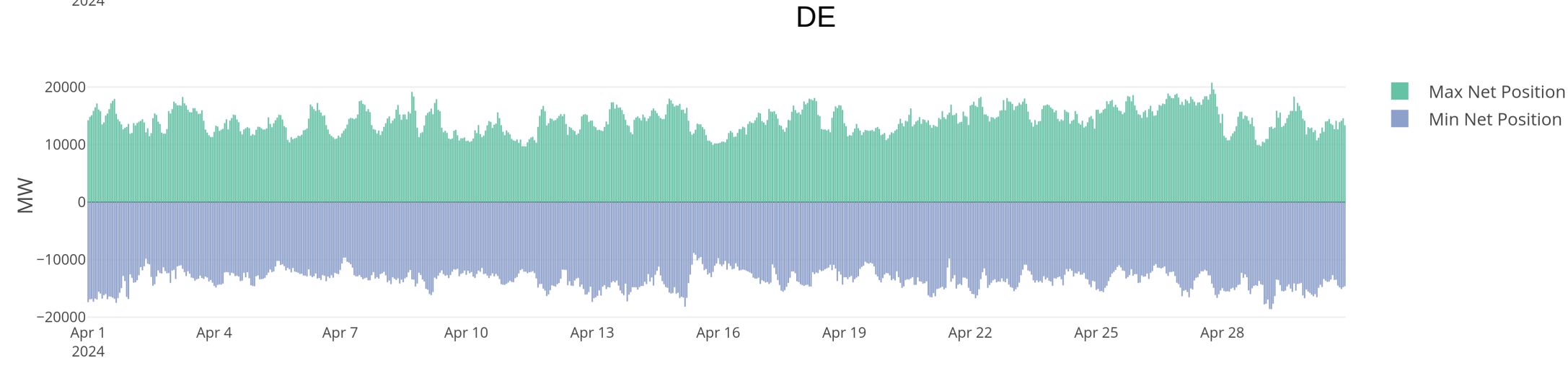
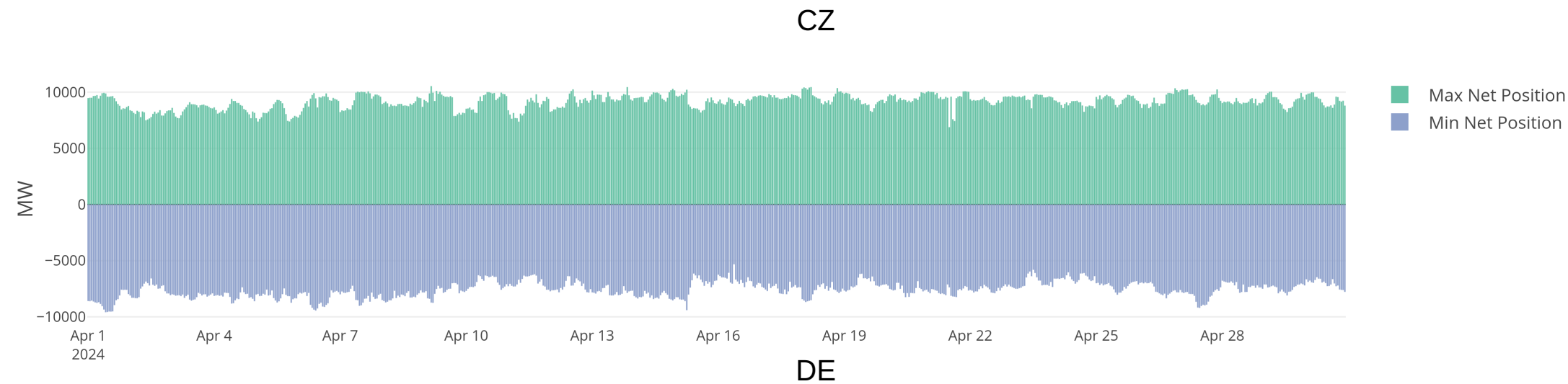
$$\text{avg. rel. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} \frac{IVA_{CNEC, MTU}[IVA_{CNEC, MTU} > 0]}{F_{max CNEC, MTU}[IVA_{CNEC, MTU} > 0]}$$



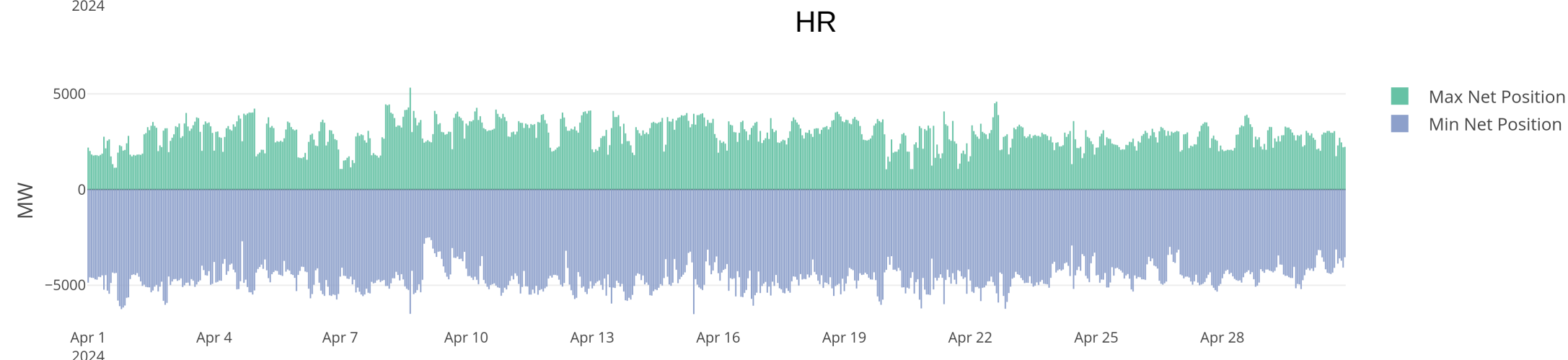
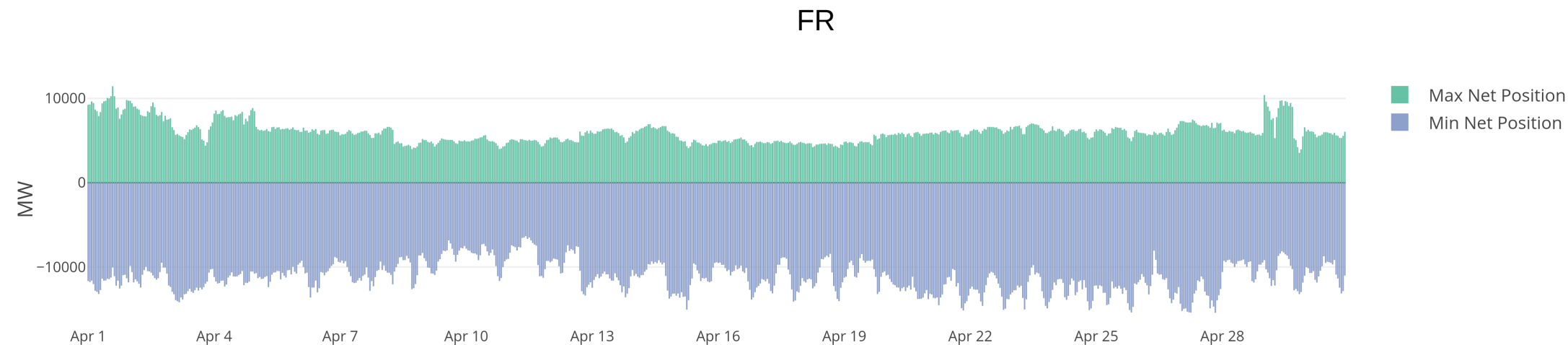
KPI 5: Min & max net positions per BZ hub



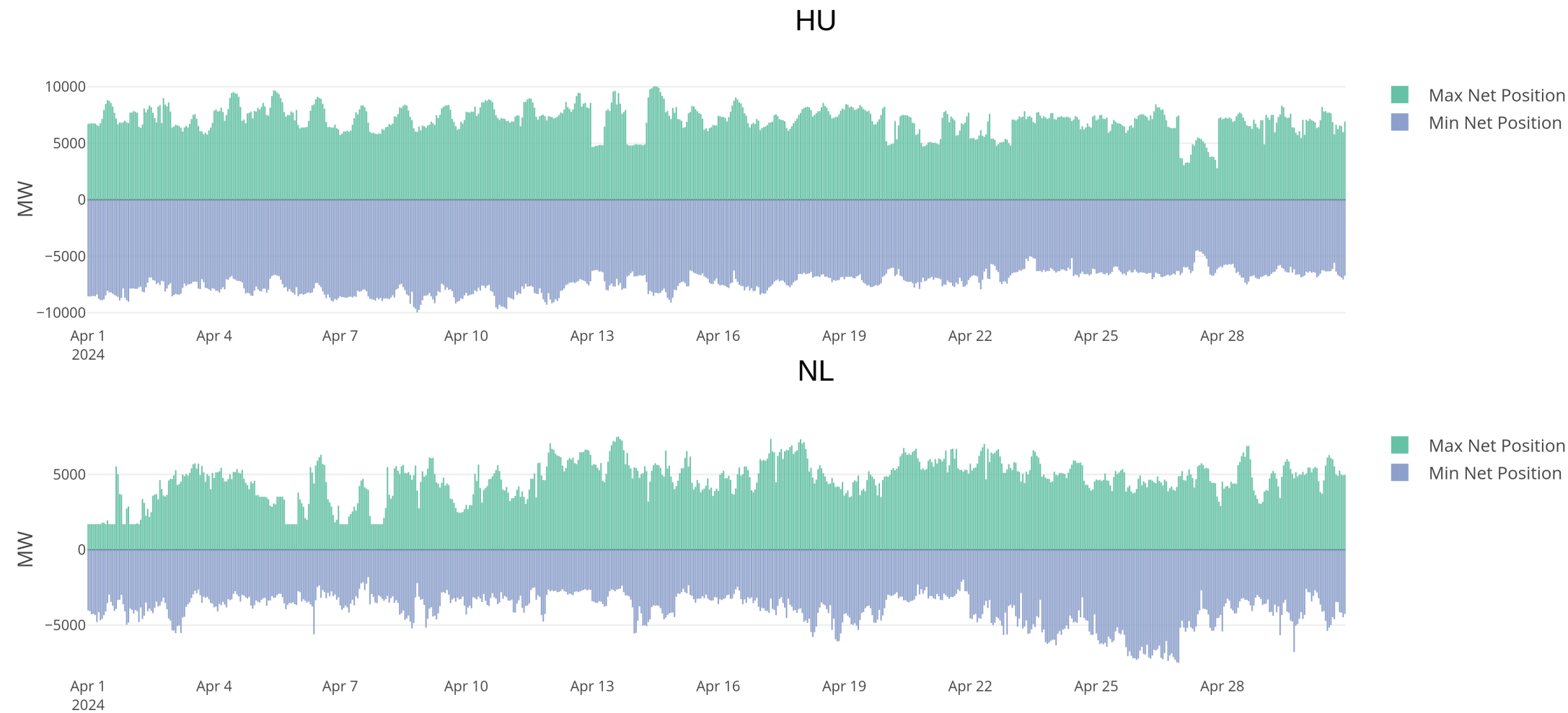
KPI 5: Min & max net positions per BZ hub



KPI 5: Min & max net positions per BZ hub



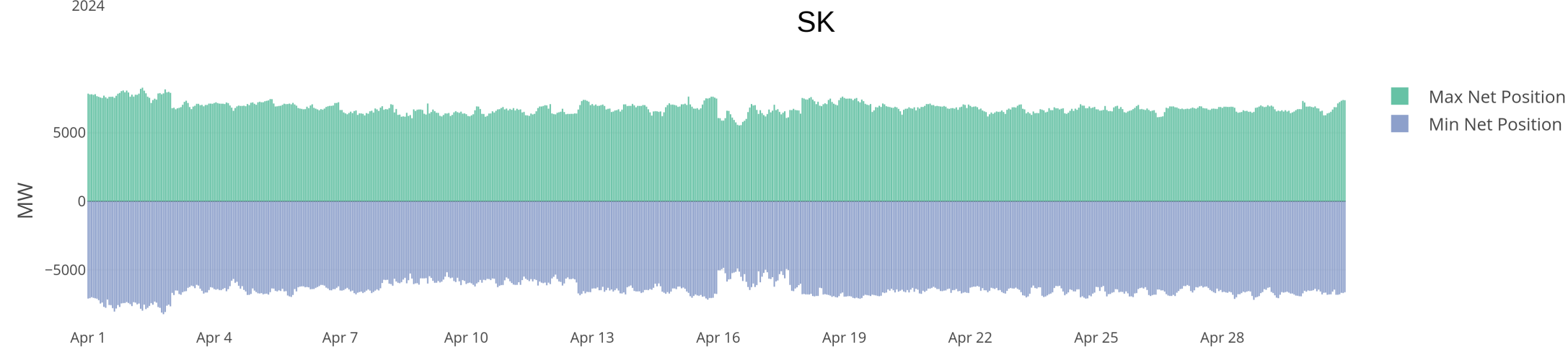
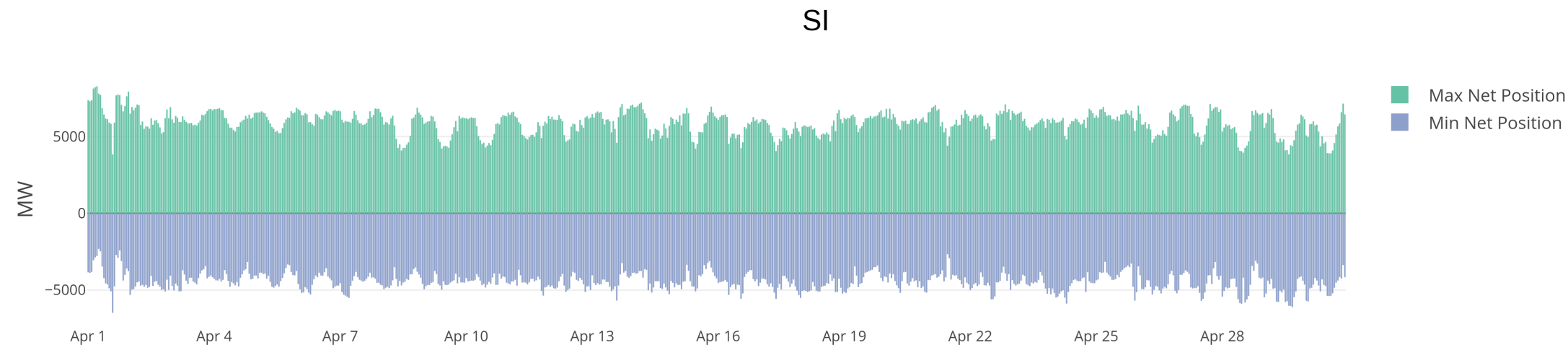
KPI 5: Min & max net positions per BZ hub



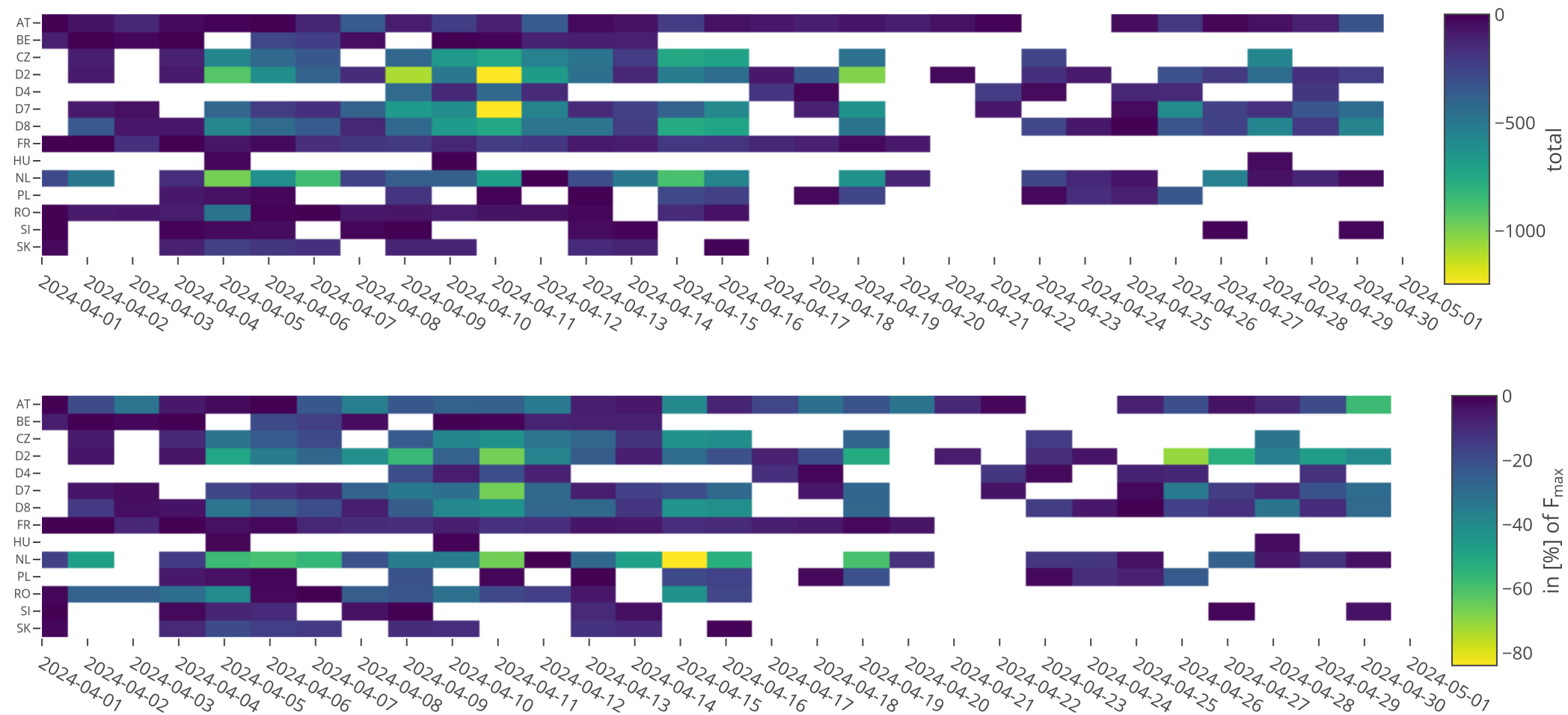
KPI 5: Min & max net positions per BZ hub



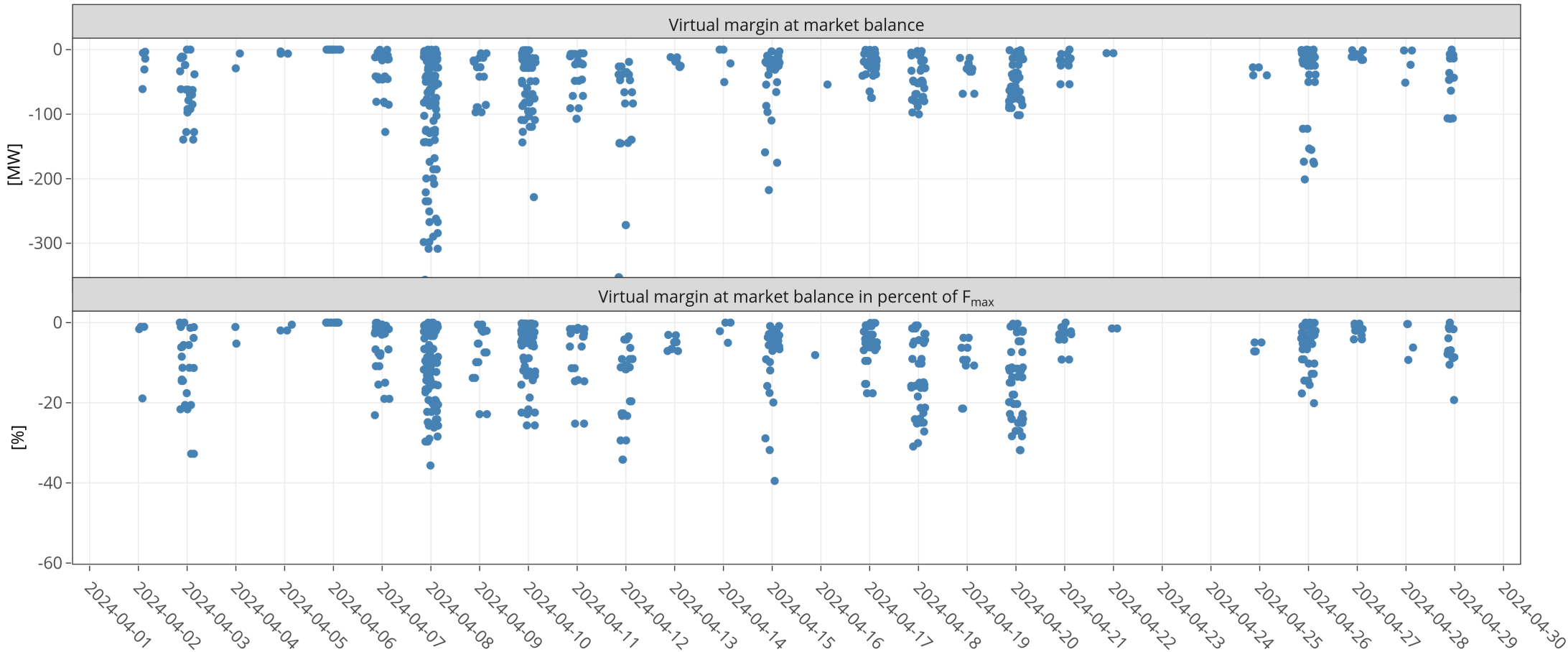
KPI 5: Min & max net positions per BZ hub



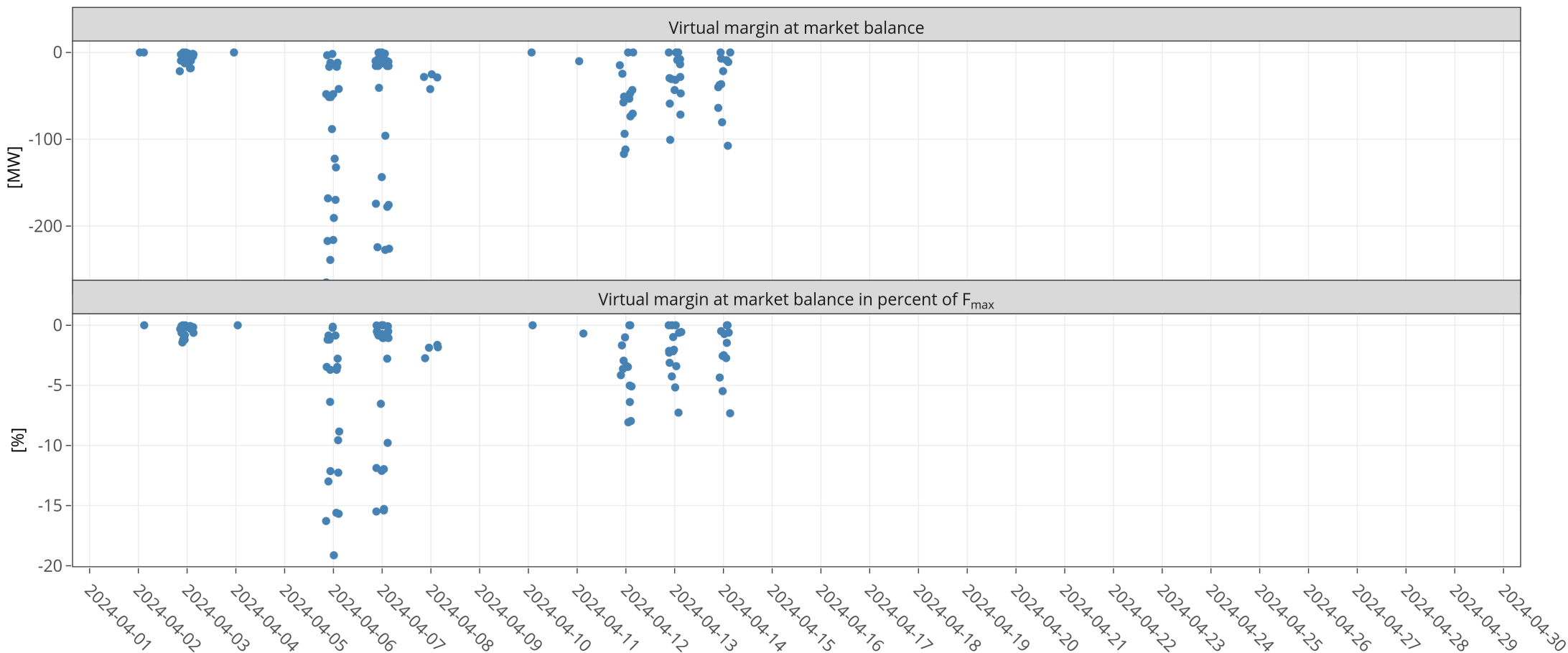
KPI 6a: Highest virtual margins at market balance for CORE TSOs



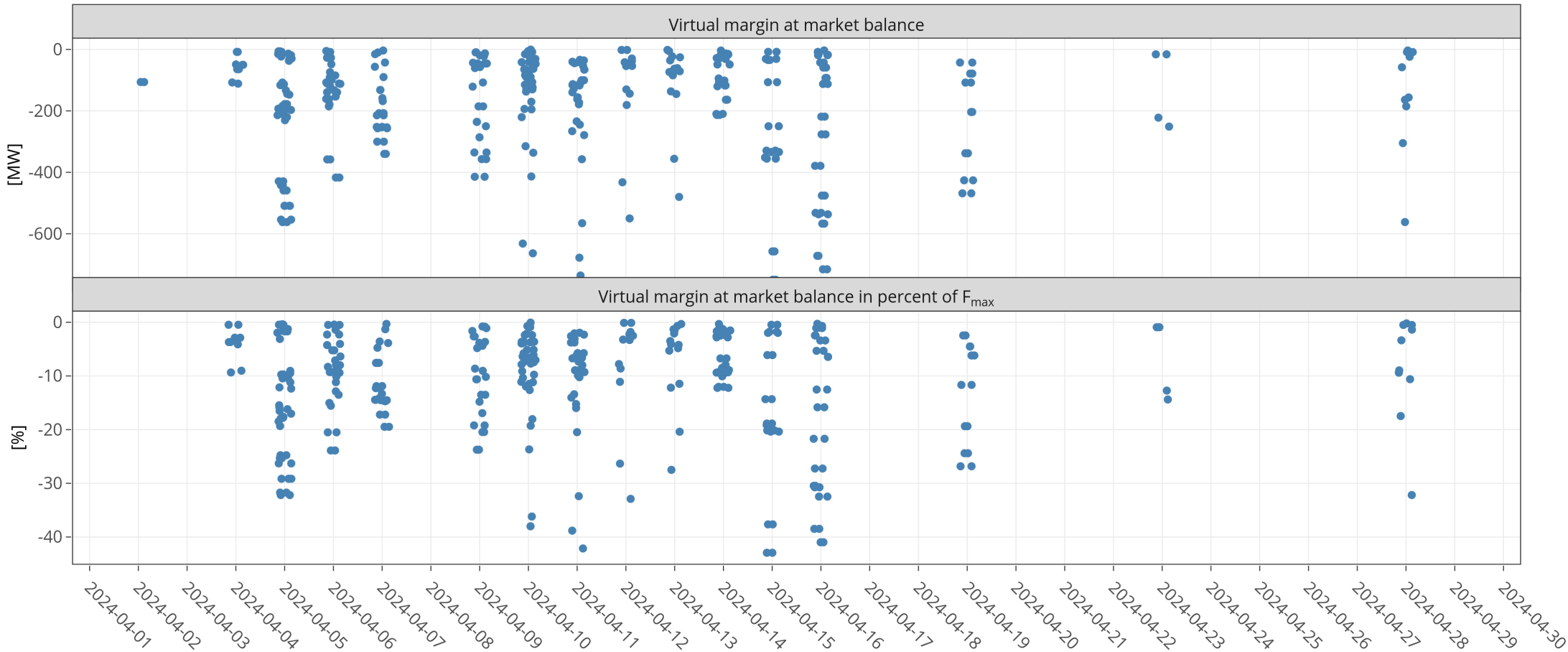
KPI 6b: Virtual margins at market balance AT



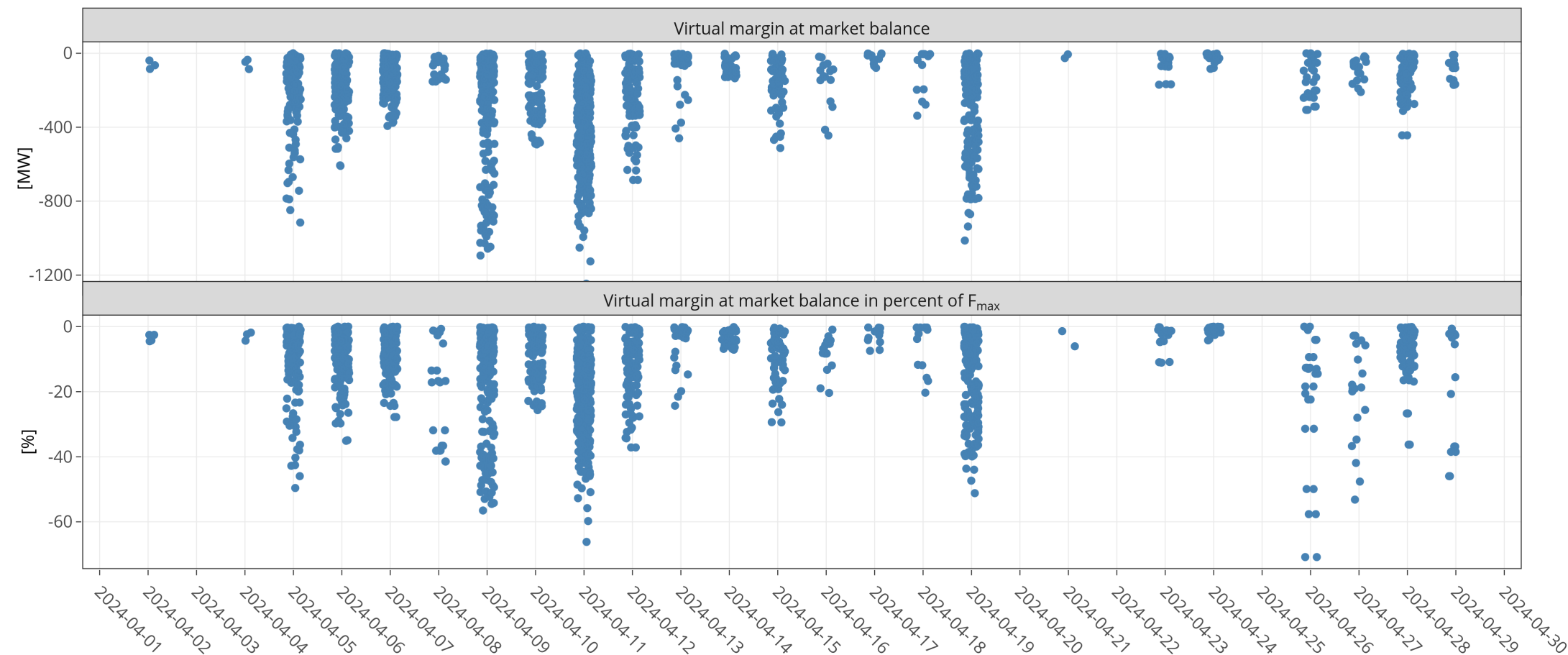
KPI 6b: Virtual margins at market balance BE



KPI 6b: Virtual margins at market balance CZ

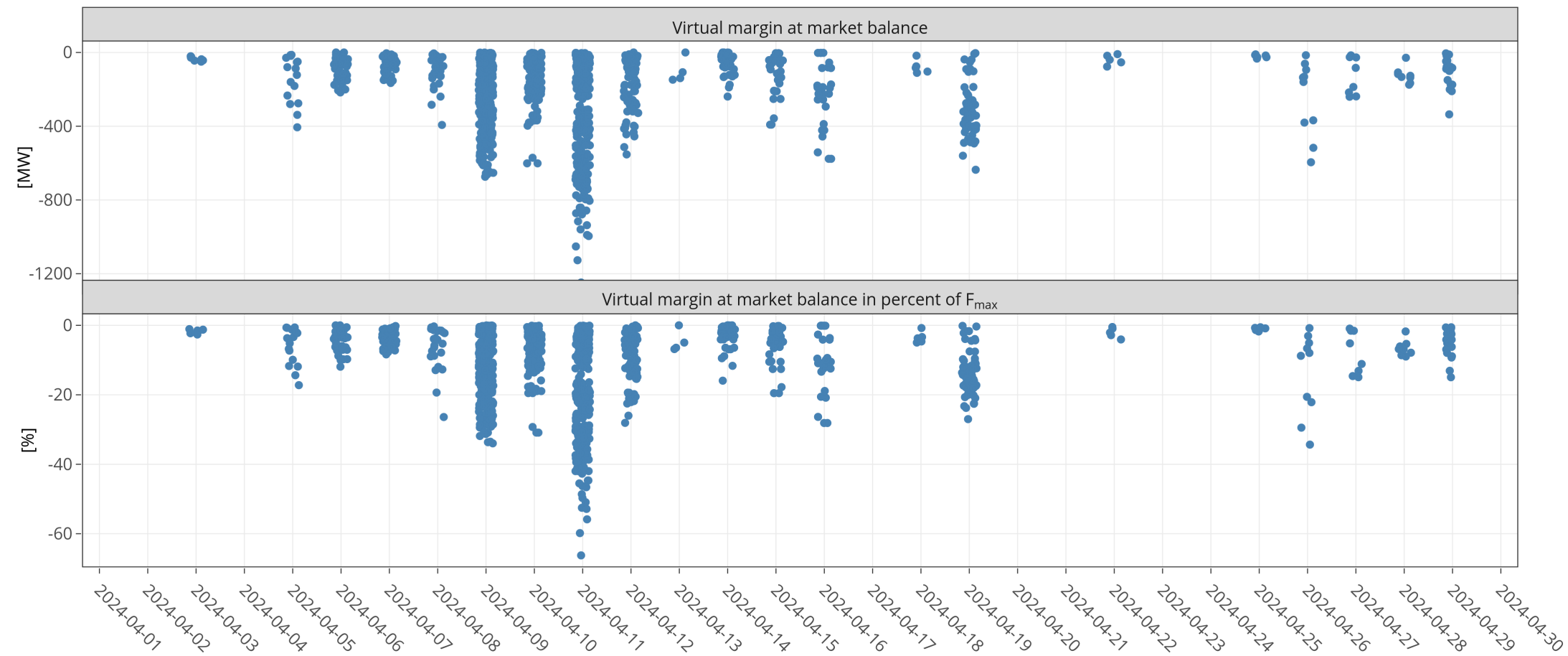


KPI 6b: Virtual margins at market balance D2

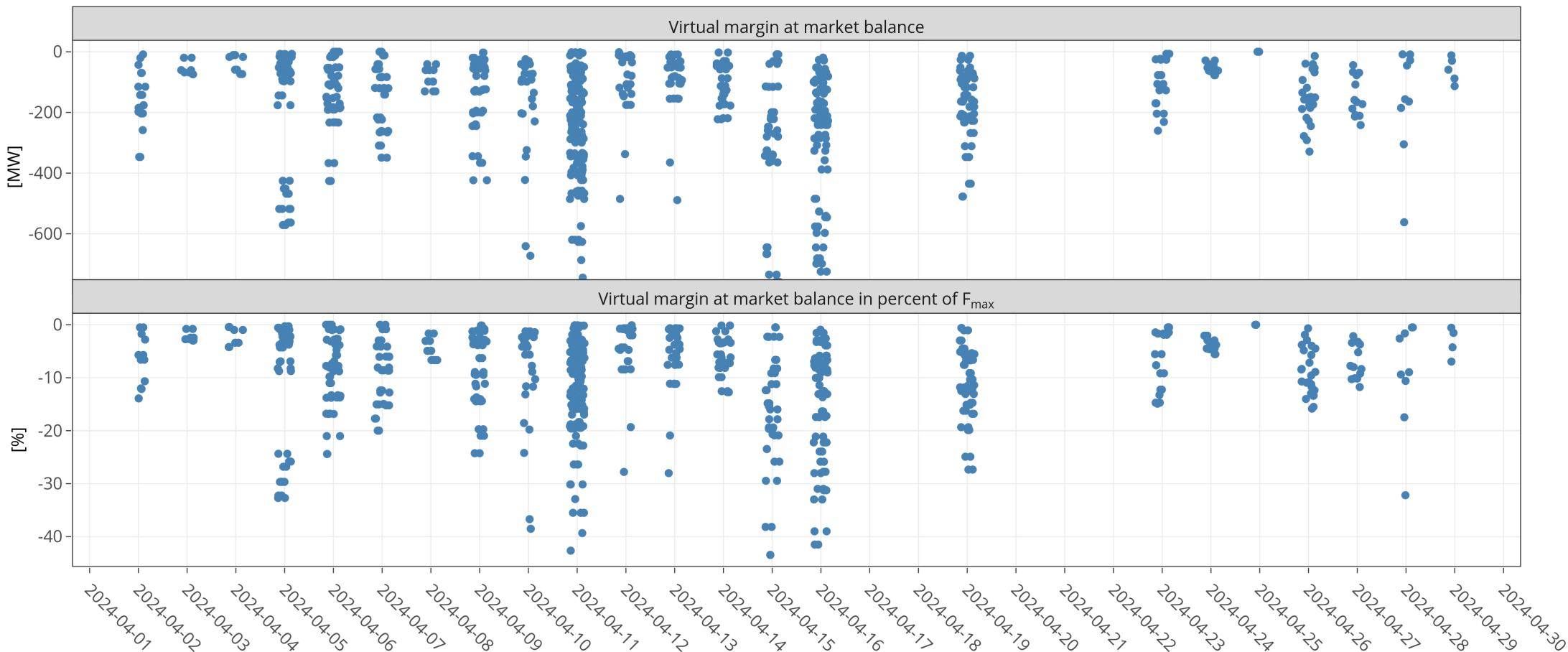




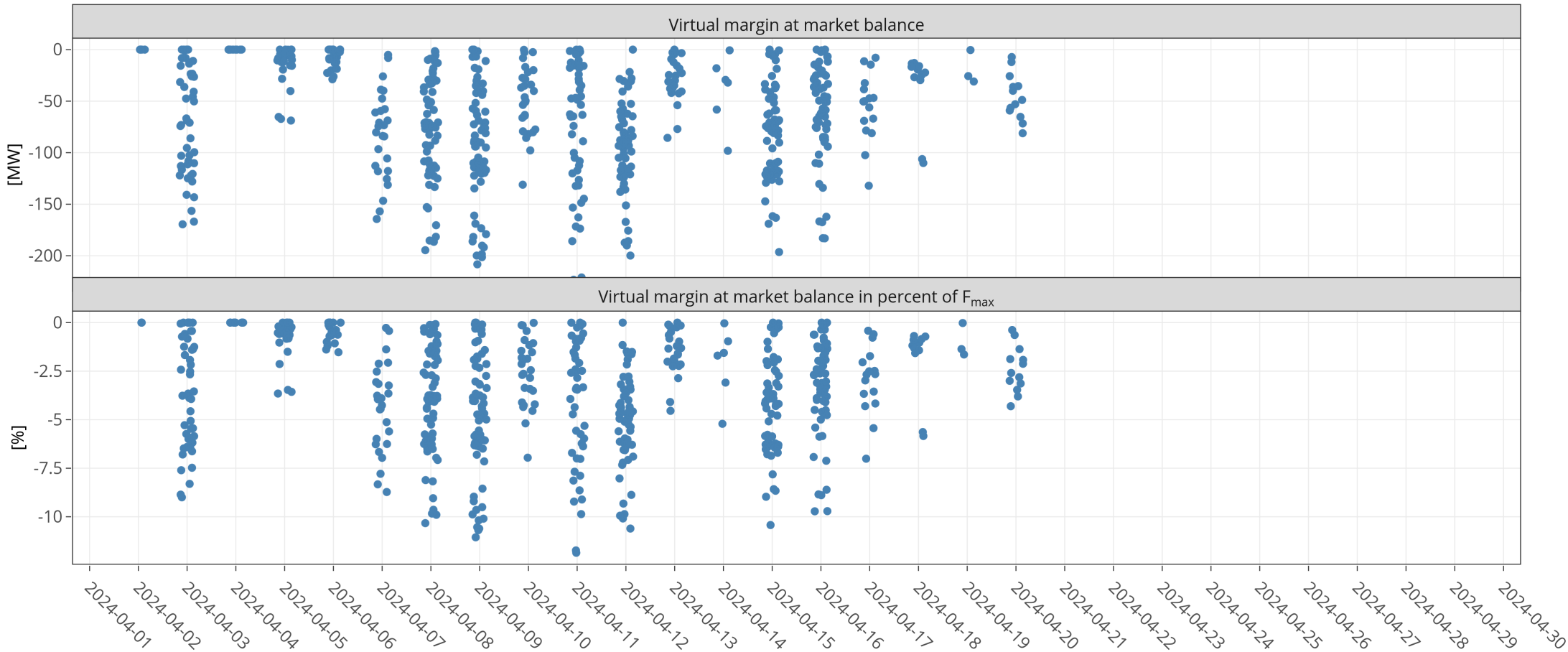
KPI 6b: Virtual margins at market balance D7



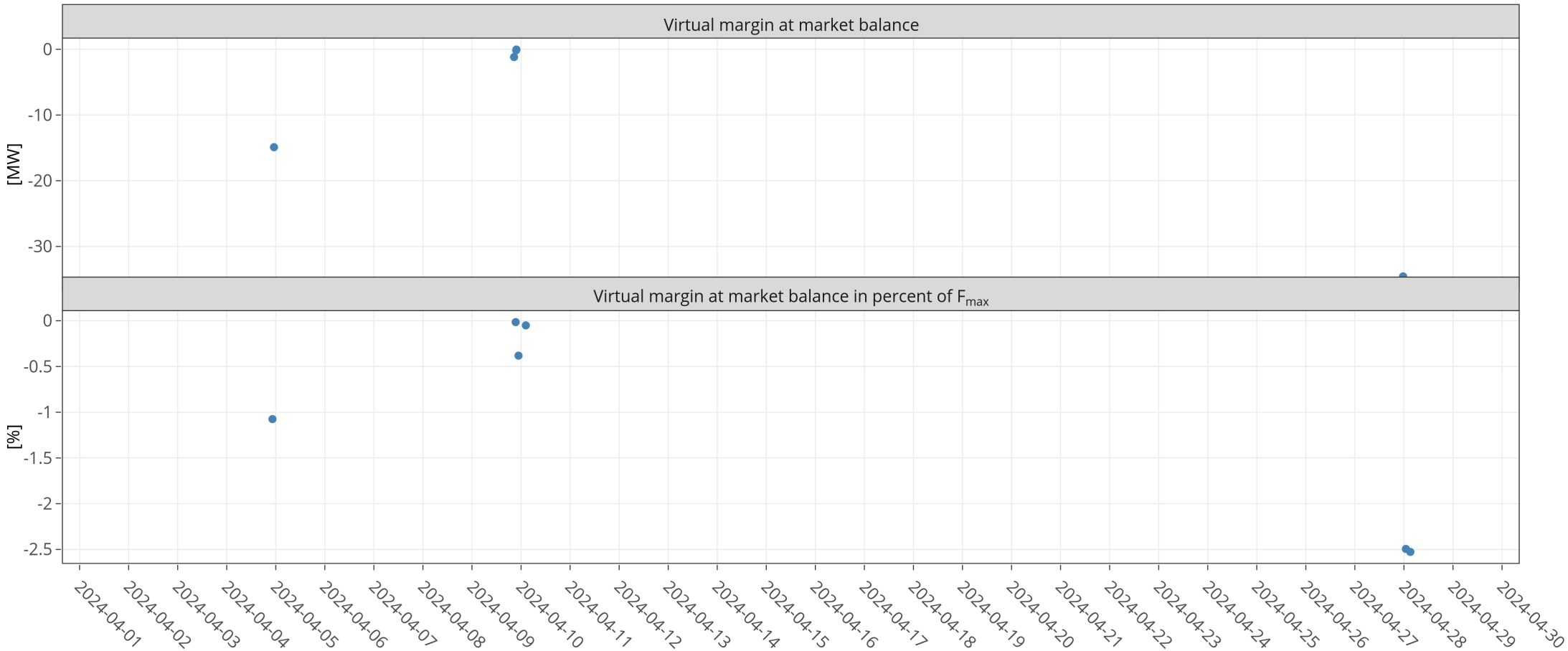
KPI 6b: Virtual margins at market balance D8



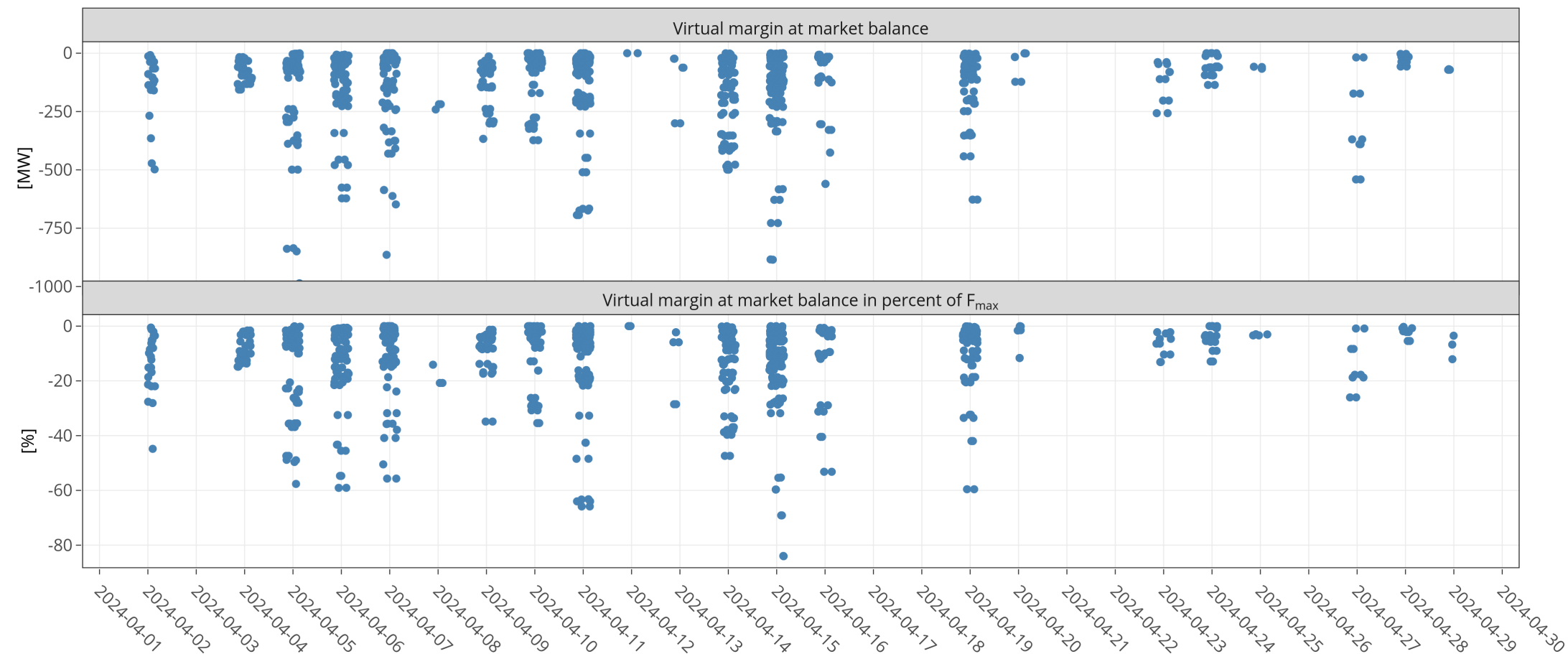
KPI 6b: Virtual margins at market balance FR



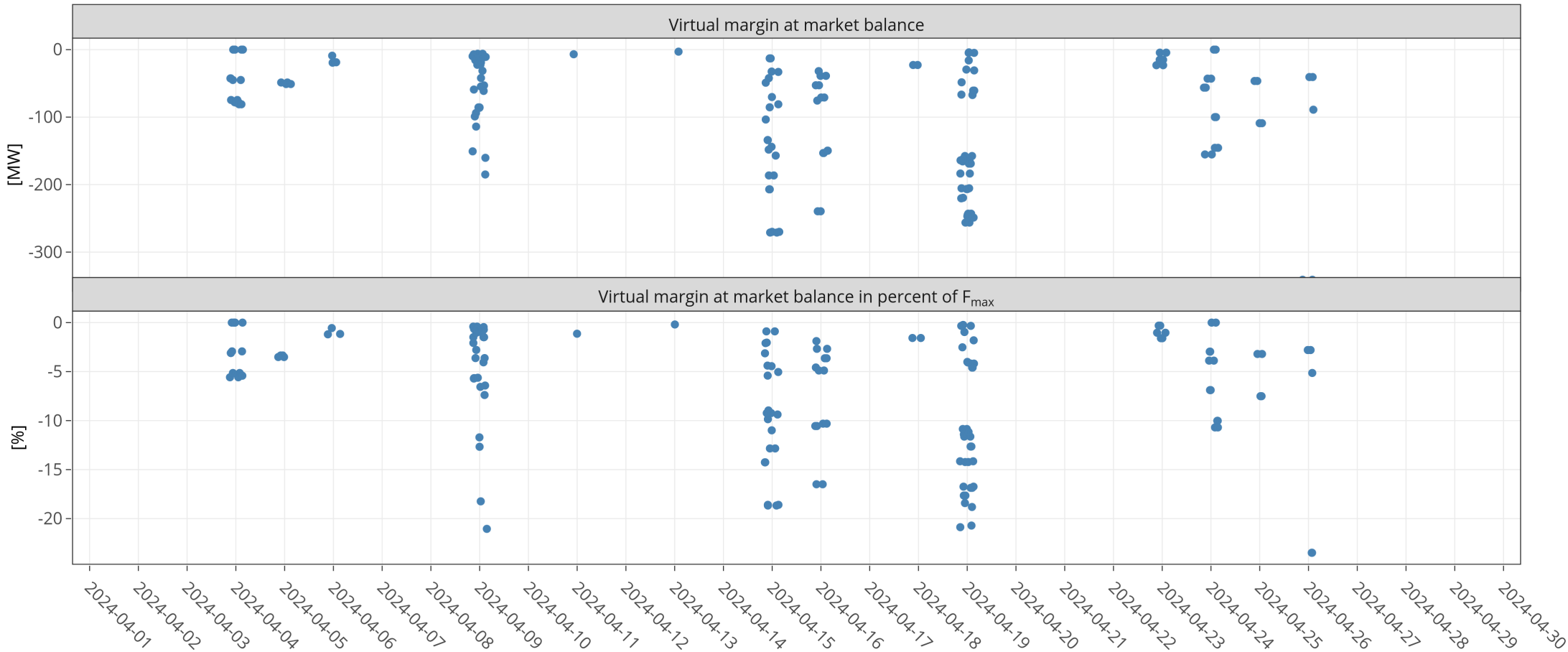
KPI 6b: Virtual margins at market balance HU



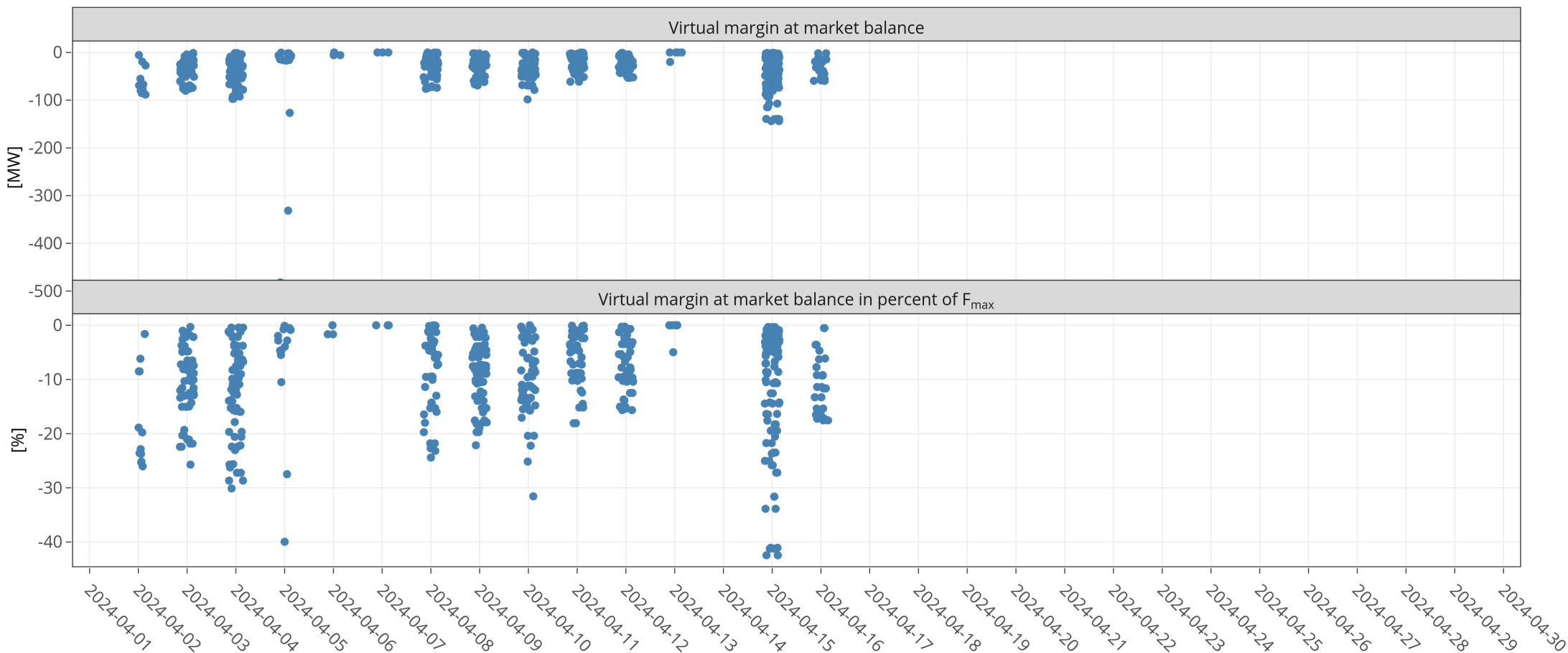
KPI 6b: Virtual margins at market balance NL



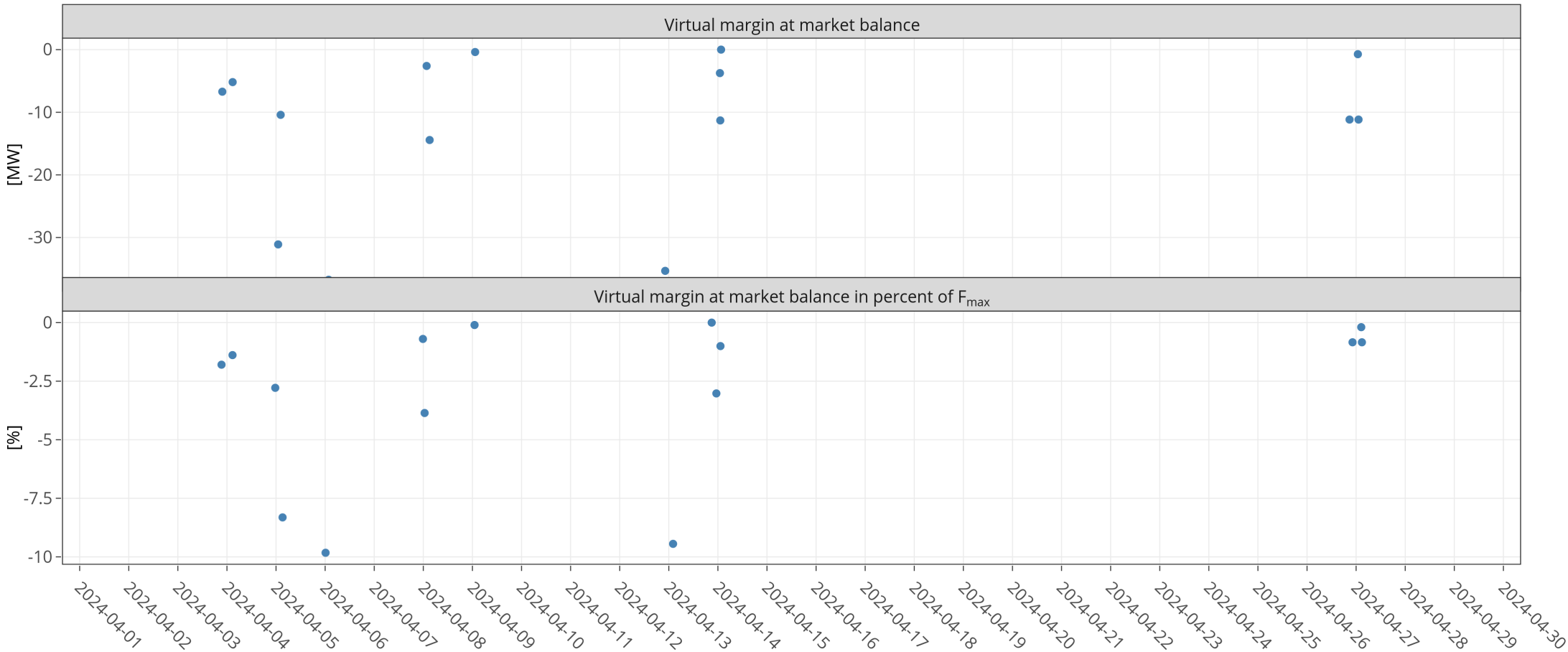
KPI 6b: Virtual margins at market balance PL



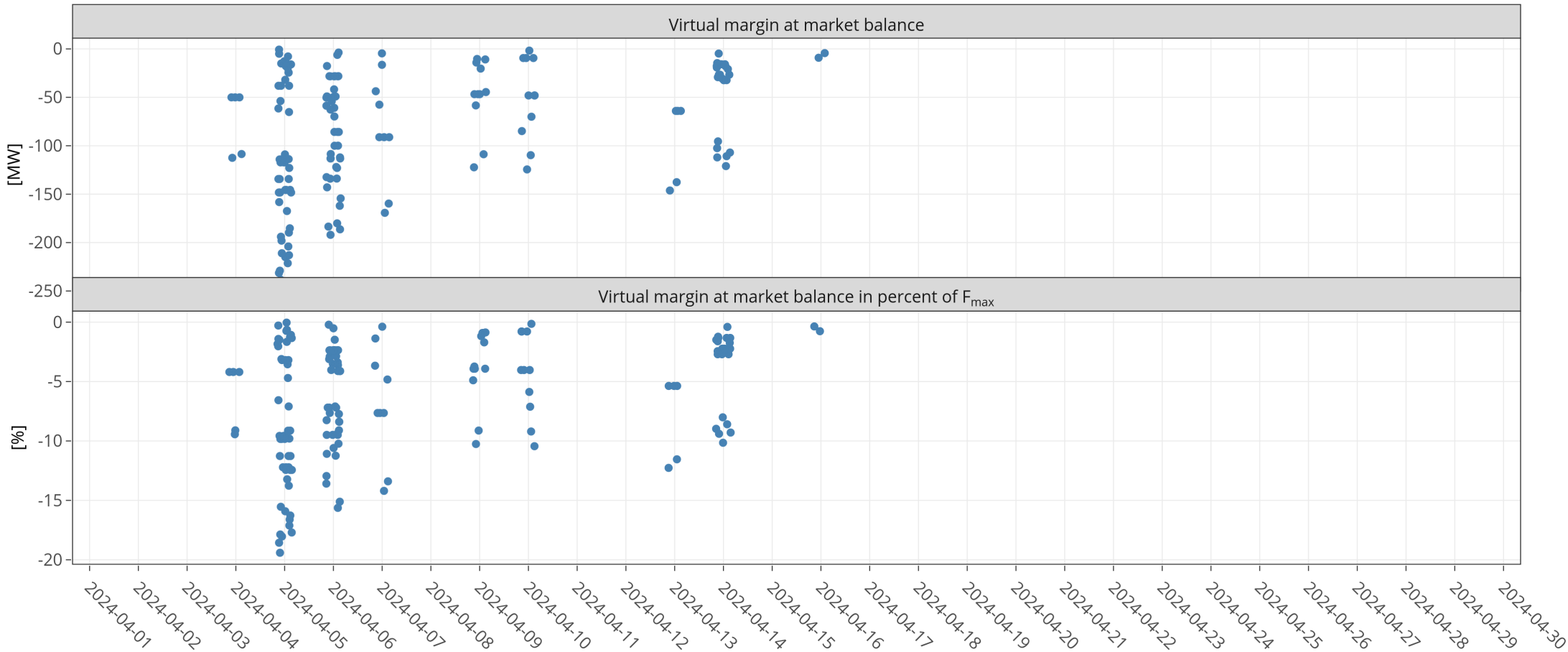
KPI 6b: Virtual margins at market balance RO



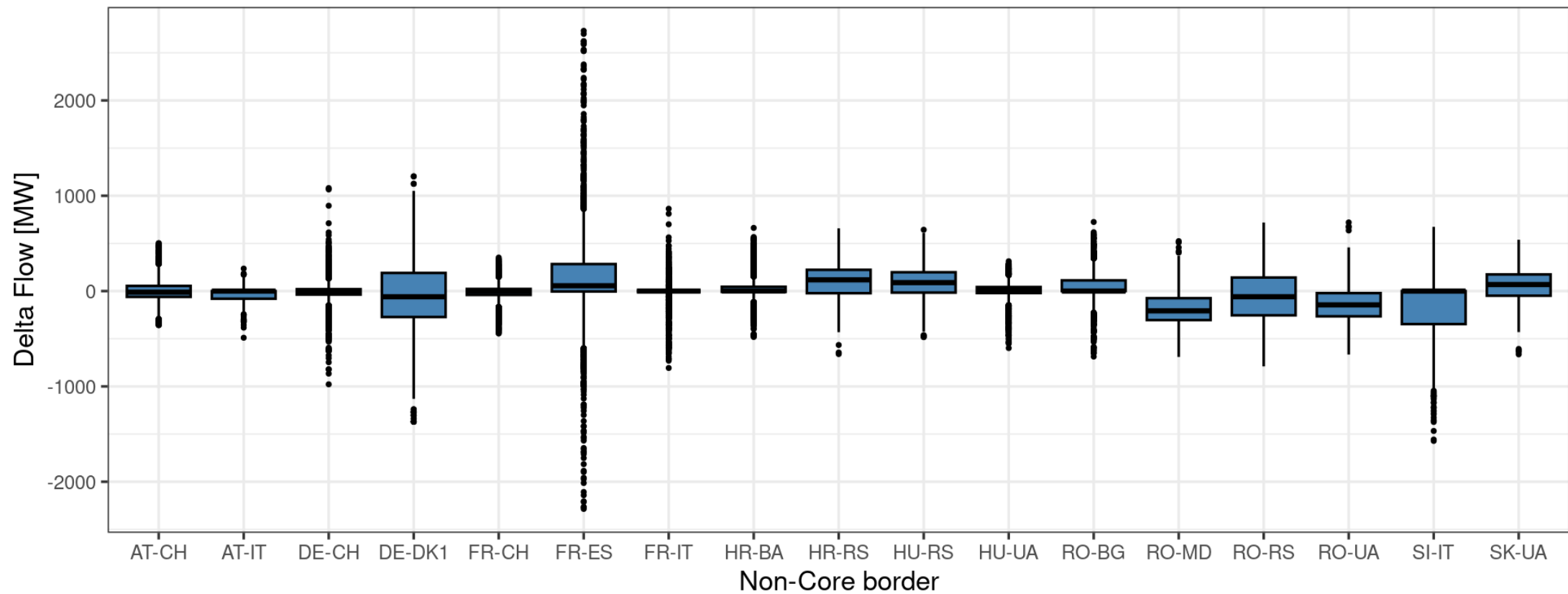
KPI 6b: Virtual margins at market balance SI



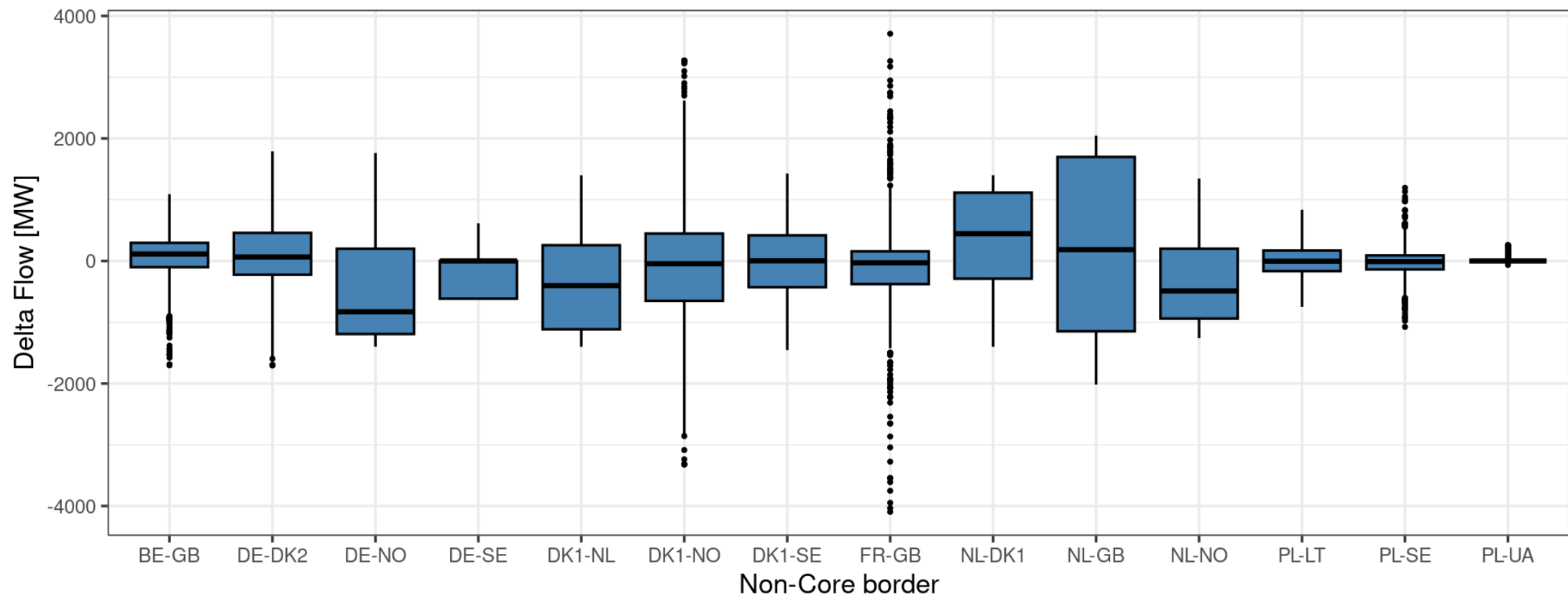
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow



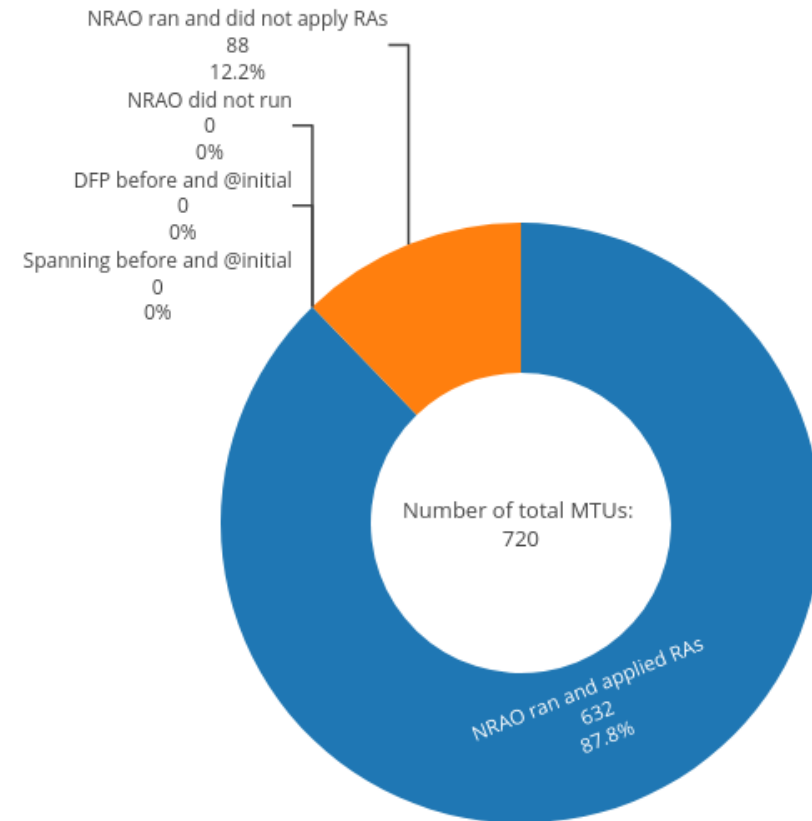
KPI 7: Non-Core exchanges DC delta flow



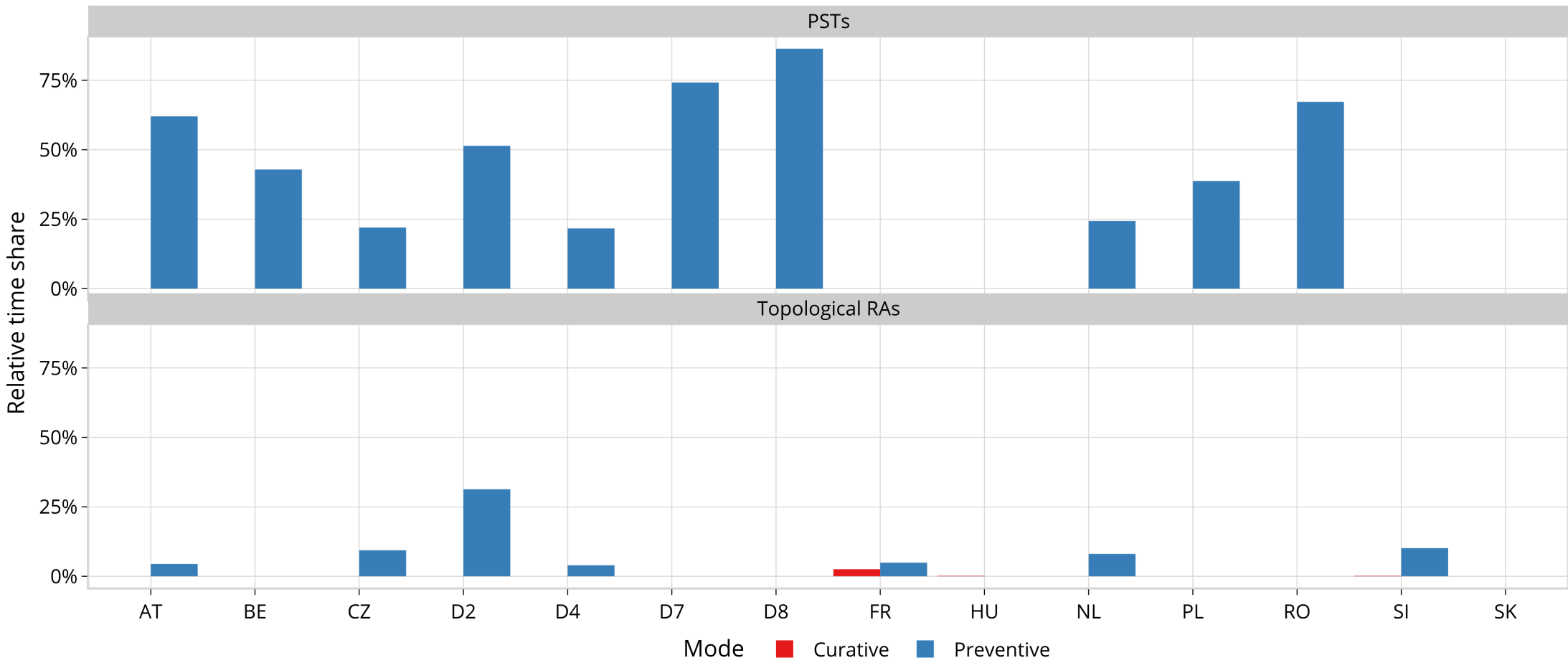
KPI 8: NRAO – Applied Remedial Action



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

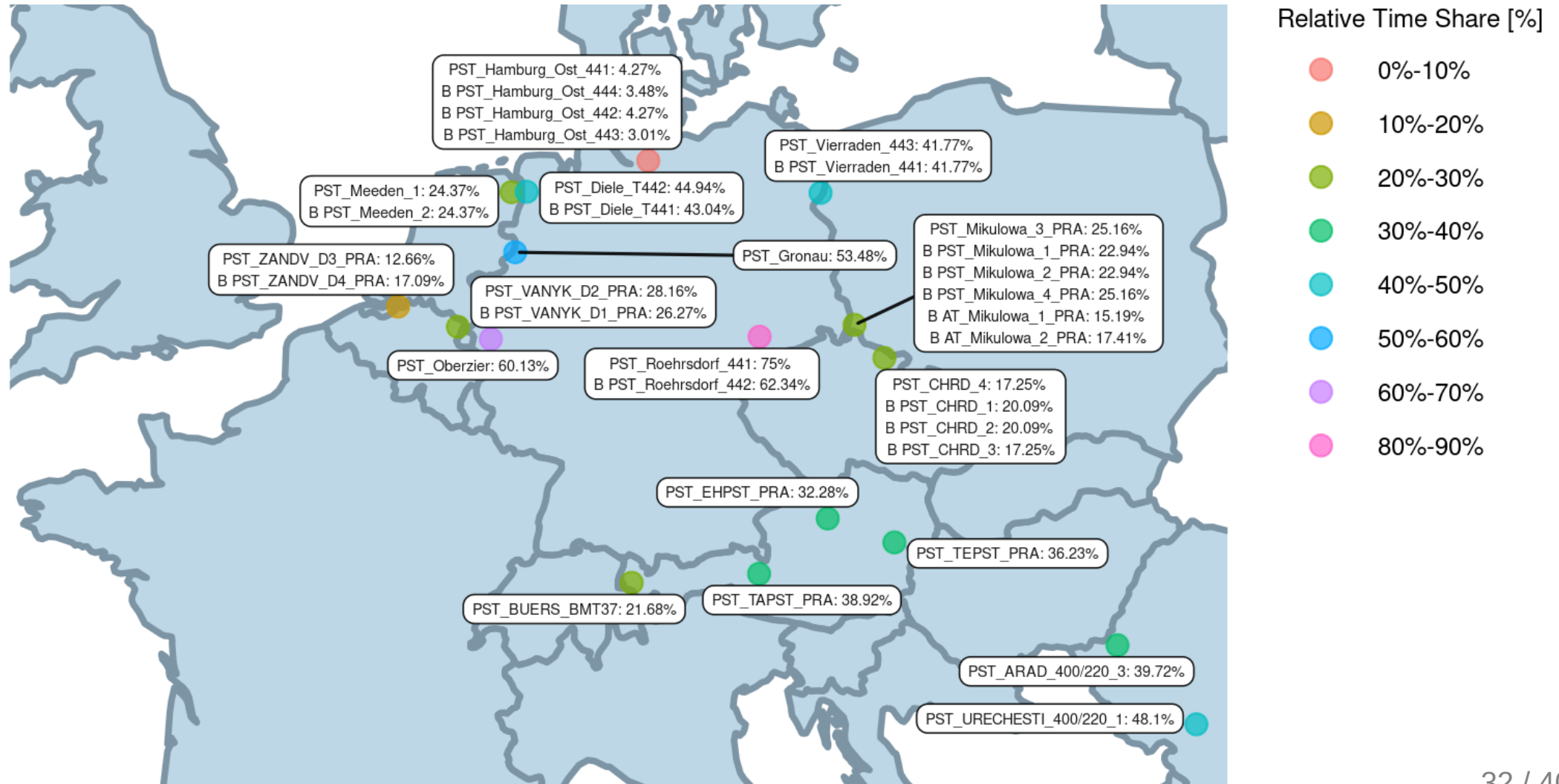


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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

Relative Time Share of Applied PSTs in Preventive Mode



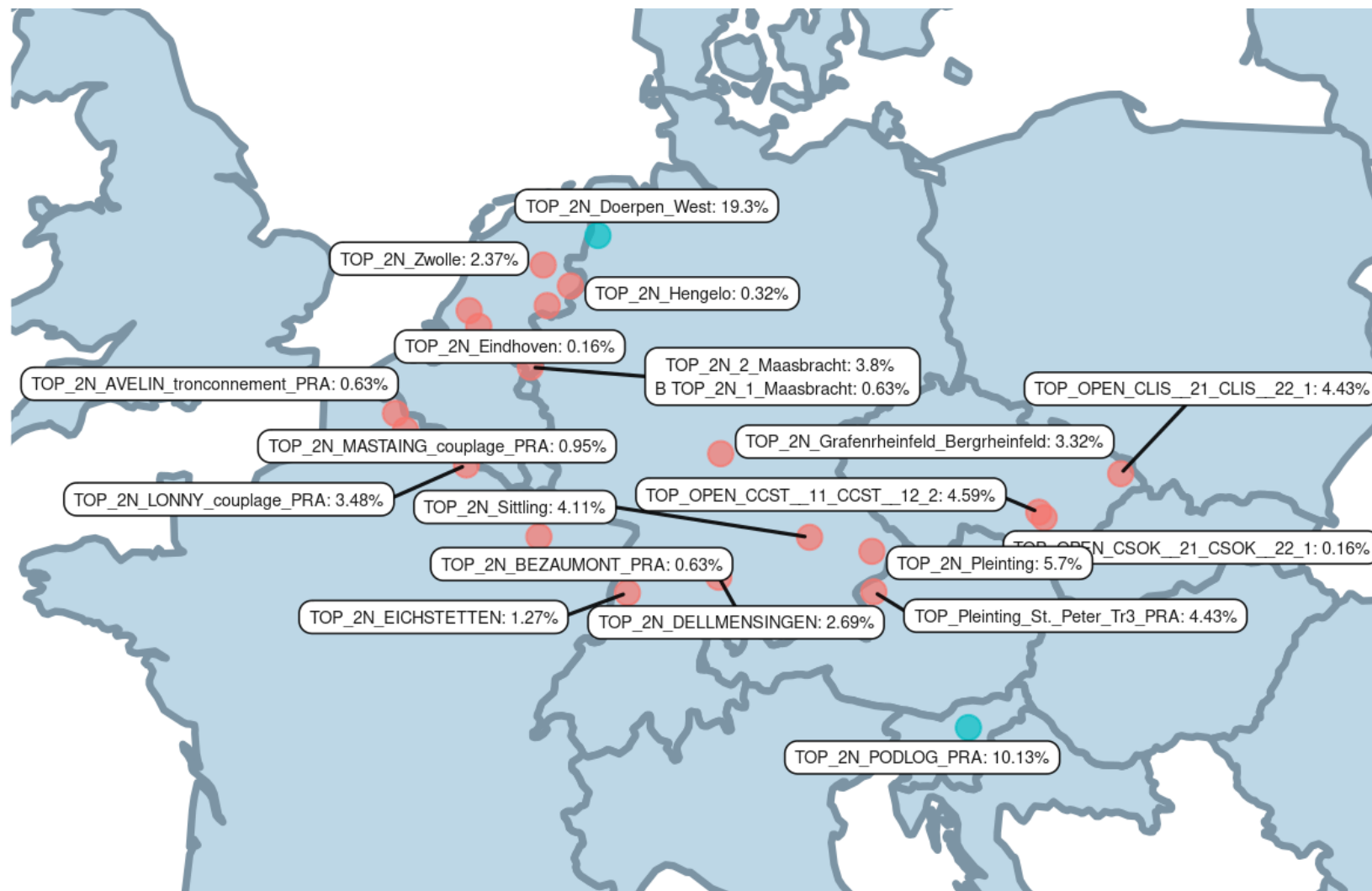
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied PSTs in Curative Mode



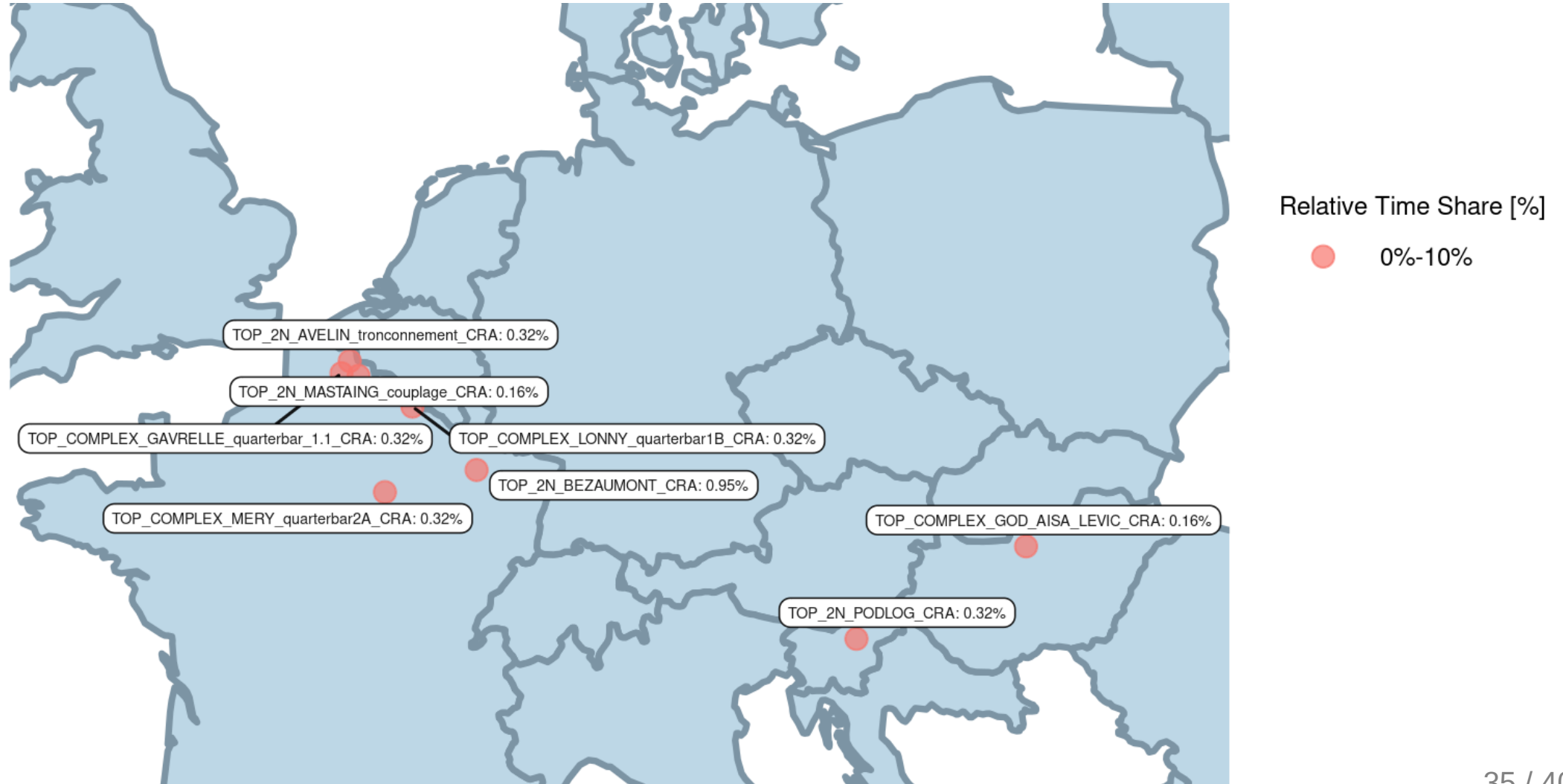
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied Topological RAs in Preventive Mode



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

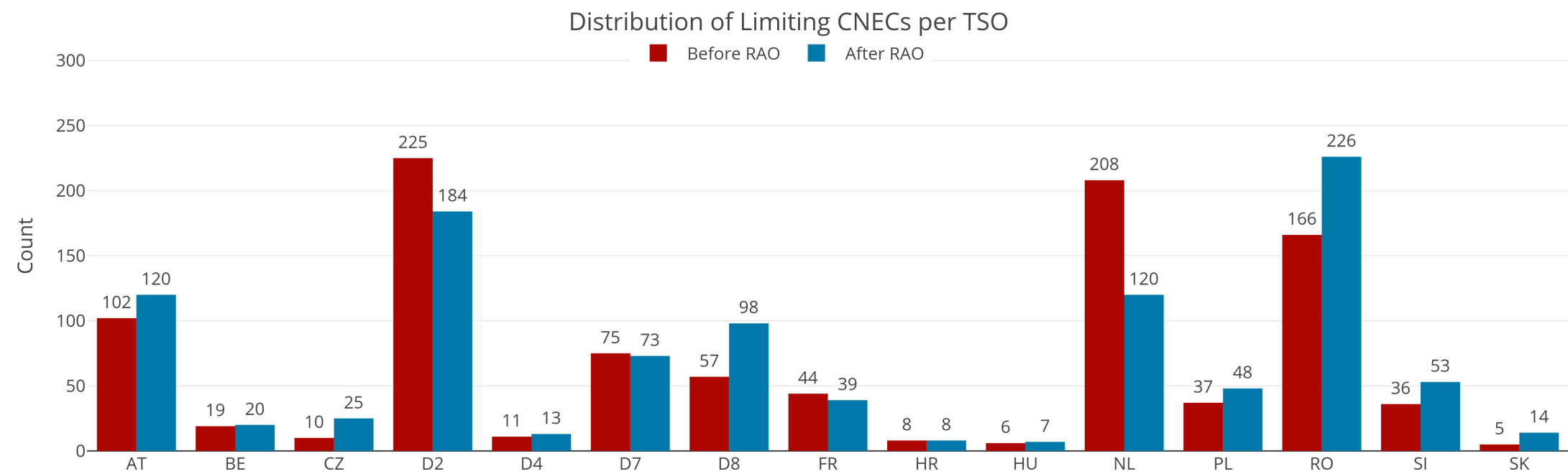
Relative Time Share of Applied Topological RAs in Curative Mode



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

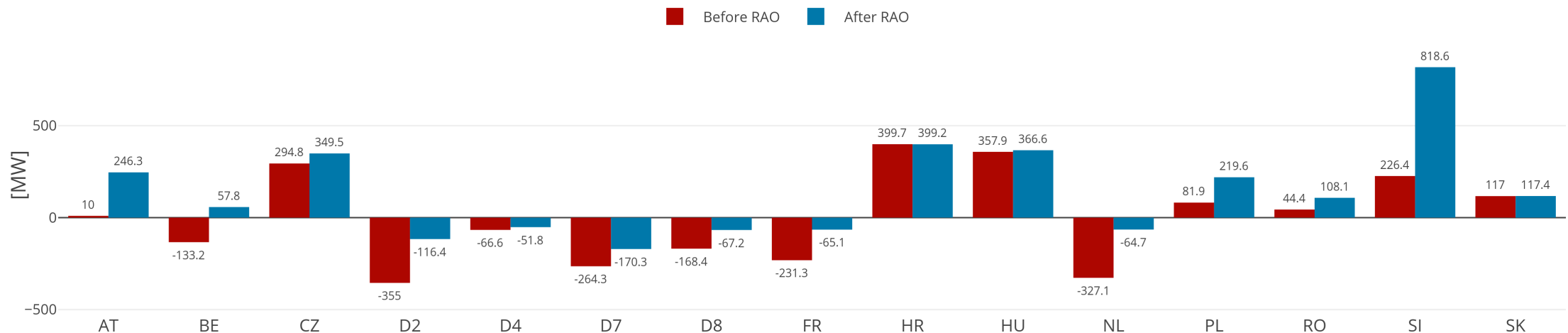


The graph shows average values of relative RAM before and after NRAO, per TSO on the most limiting CNECs from NRAO perspective. Selected CNECs before RAO are the same as after RAO, and average computed for MTUs when was used further in the process.

- 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

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

RelRAM comparison before/after RAO



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
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	720	732	52.76%	18.98%	88.77%	0.2282	0.5436
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	720	1295	115.75%	76.47%	171.66%	0.2282	0.5436
[HU-HU] Gonyu - Gyor [DIR]	720	1441	77.32%	59.35%	109.53%	0.2923	1.5048
[SI-HU] 400 kV Cirkovce - Hevitz [OPP] [SI]	718	1417	79.98%	57.35%	107.03%	0.2033	0.9766
[CZ-SK] Sokolnice - Stupava [DIR] [CZ]	717	717	74.87%	64.86%	92.71%	0.32	1.299
[SK-HU] Levice - God [DIR] [HU]	716	718	67.88%	60.68%	77.06%	0.2558	0.9088
[RO-RO] TR Rosiori 400/220 1 [DIR]	715	777	48.67%	20.00%	80.75%	0.1508	0.318
[HU-HU] Gonyu - Gyor [OPP]	715	950	104.53%	71.48%	147.51%	0.2923	1.5048
[SK-SK] Gabcikovo - P.Biskupice [DIR]	715	715	86.37%	65.19%	106.27%	0.3335	1.1745
[SK-HU] Gabcikovo - Gonyu [OPP] [HU]	707	1249	86.47%	64.79%	115.30%	0.2873	0.976
[SI-HU] 400 kV Cirkovce - Hevitz [DIR] [SI]	703	1382	99.99%	72.95%	130.39%	0.2033	0.9766
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	702	1117	60.64%	40.74%	86.94%	0.41	1.4756
[CZ-SK] Liskovec - P. Bystrica [OPP] [CZ]	702	702	99.63%	69.88%	149.03%	0.1237	0.4417
[SI-HU] Cirkovce - Heviz [OPP] [HU]	699	699	79.06%	56.42%	108.59%	0.2826	1.1932
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	696	1195	53.64%	20.00%	145.60%	0.2409	1.079
[SK-HU] Gabcikovo - Gonyu [DIR] [HU]	696	770	88.80%	68.11%	116.88%	0.2873	0.976
[CZ-SK] Liskovec - P. Bystrica [DIR] [CZ]	690	719	81.71%	57.92%	113.51%	0.1237	0.4417
[SK-UA] V.Kapusany - Mukachevo (WPS) [OPP] [SK]	678	678	87.47%	69.90%	120.12%	0.2526	0.8455
[SK-SK] V.Dur - Levice 1 [DIR]	677	677	49.03%	38.34%	62.01%	0.2303	0.9505
[D7-FR] Ens Dorf - Vigy VIGY1 N [OPP] [FR]	672	1920	22.36%	7.27%	79.83%	0.2217	0.587

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
[D7-FR] Ensdorf - Vigy VIGY1 N [OPP] [FR]	524	562	450.4	22.28%	9.24%	69.11%	0.2198
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	112	113	1343.36	65.90%	19.79%	114.55%	0.1709
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	94	94	262.56	81.71%	52.40%	104.81%	0.3487
[NL-NL] Krimpen a/d IJssel-Geertruidenberg 380 W [DIR]	89	89	130.19	73.15%	22.63%	113.02%	0.5811
[D8-D8] Vierraden - Vierraden PST441 [DIR]	77	77	256.45	49.07%	37.81%	68.61%	0.4092
[RO-RO] TR Rosiori 400/220 1 [DIR]	70	70	324.4	38.18%	20.00%	67.00%	0.1361
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	68	68	321.66	29.55%	19.94%	62.11%	0.2442
[D8-PL] Mikulowa PST1 [DIR] [PL]	62	62	181.81	53.62%	37.26%	71.49%	0.43
[CZ-D8] Hradec - Rohrsdorf 445 [OPP] [D8]	57	57	191.35	48.07%	24.68%	67.01%	0.3655
[HU-HU] Gonyu - Gyor [DIR]	54	54	9.67	76.15%	64.04%	99.57%	0.2414
[RO-RO] Resita - Timisoara c1 [DIR]	50	50	1043.23	38.26%	19.76%	65.51%	0.1167
[RO-RO] Paroseni - Targu Jiu Nord [OPP]	49	50	1017.59	31.00%	18.73%	61.54%	0.0938
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	40	40	208.06	87.99%	33.82%	125.82%	0.1617
[CZ-SK] Nosovice - Varin [DIR] [CZ]	40	40	247.77	73.05%	65.10%	97.32%	0.4209
[CZ-SK] Nosovice - Varin [DIR] [SK]	38	38	21.27	81.32%	64.60%	97.82%	0.4254
[NL-NL] Zwolle-Hengelo 380 W [DIR]	35	35	302.99	41.93%	19.98%	59.58%	0.1771
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	33	33	15.4	57.43%	39.84%	74.60%	0.1901
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	33	33	12.64	128.62%	107.49%	163.37%	0.2282
[NL-D2] Meeden-Diele 380 Z [DIR] [NL]	33	33	186.71	87.94%	43.87%	134.38%	0.2698
[D7-FR] Ensdorf - Vigy VIGY2 S [OPP] [FR]	31	32	251.38	18.90%	3.29%	36.20%	0.2316

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 = 400mW/0.4 = 1250MW

KPI 13 : Allocation Constraints - Poland



	# MTUs
AC was limiting MC	436
AC < 0 MW	90
AC = 0 MW	337
AC > 0 MW	9

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1504.73	5349.06
Min.	-10073.00	0.00
Max.	0.00	17099.00

