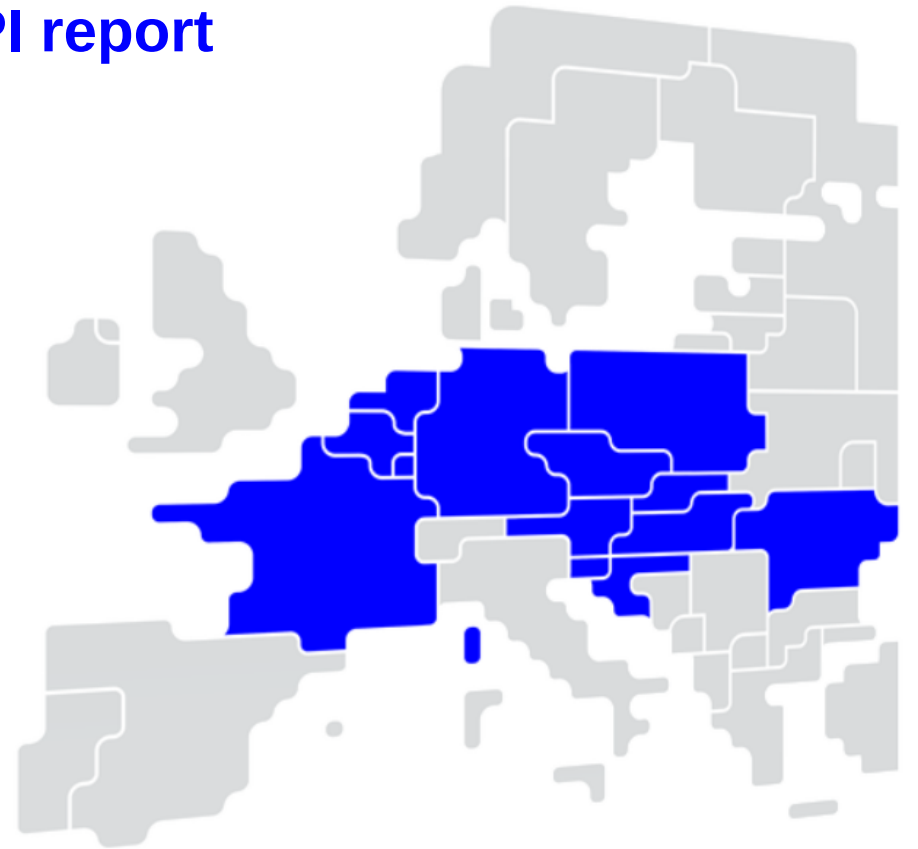


Core FB MC Operational KPI report

July 2022



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)

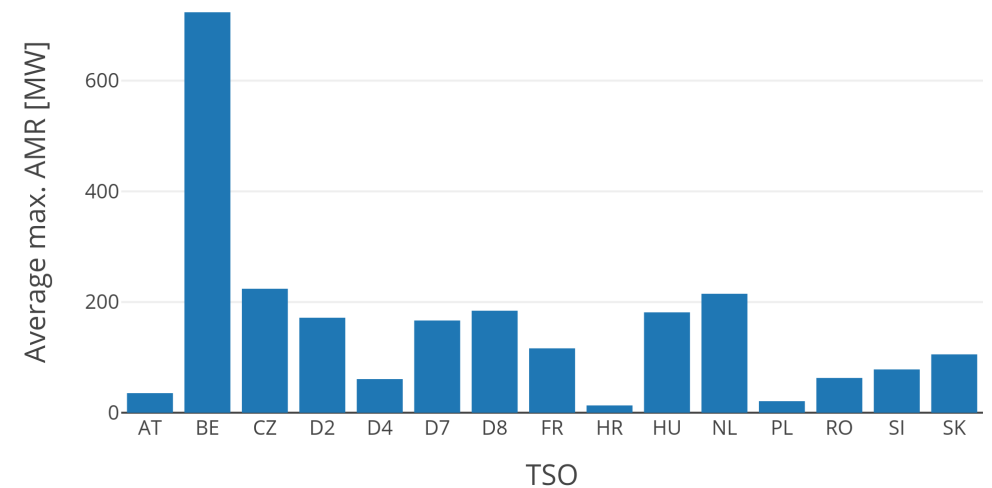
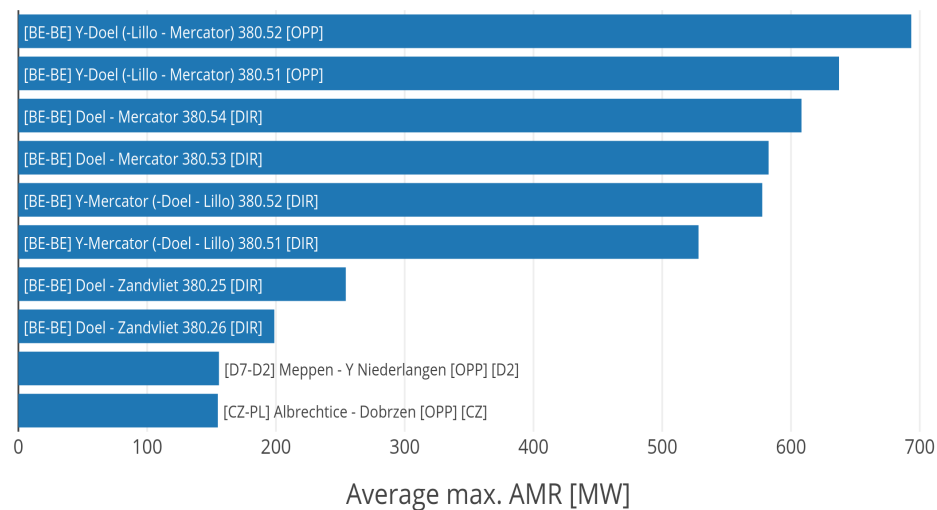
KPI 2: Average maximum AMR per TSO



CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[BE-BE] Y-Doel (-Lillo - Mercator) 380.52 [OPP]	693.40	48.67%
[BE-BE] Y-Doel (-Lillo - Mercator) 380.51 [OPP]	637.30	44.76%
[BE-BE] Doel - Mercator 380.54 [DIR]	608.15	39.25%
[BE-BE] Doel - Mercator 380.53 [DIR]	582.60	37.55%
[BE-BE] Y-Mercator (-Doel - Lillo) 380.52 [DIR]	577.67	40.74%
[BE-BE] Y-Mercator (-Doel - Lillo) 380.51 [DIR]	528.20	37.26%
[BE-BE] Doel - Zandvliet 380.25 [DIR]	254.25	17.31%
[BE-BE] Doel - Zandvliet 380.26 [DIR]	198.75	13.62%
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	155.76	7.73%
[CZ-PL] Albrechtice - Dobrzen [OPP] [CZ]	154.89	11.15%

TSO	Average maximum AMR per TSO
AT	35.31
BE	723.65
CZ	223.87
D2	171.66
D4	60.75
D7	166.62
D8	184.41
FR	116.22
HR	13.11
HU	181.30

TSO	Average maximum AMR per TSO
NL	214.87
PL	20.77
RO	62.77
SI	78.16
SK	105.36



KPI 3: Share of MTUs with intervention per TSO



Total BDs

31

Total MTUs

742

MTUs without IVA

125

Share of distinct MTUs without IVA

16.85%

MTUs with IVA

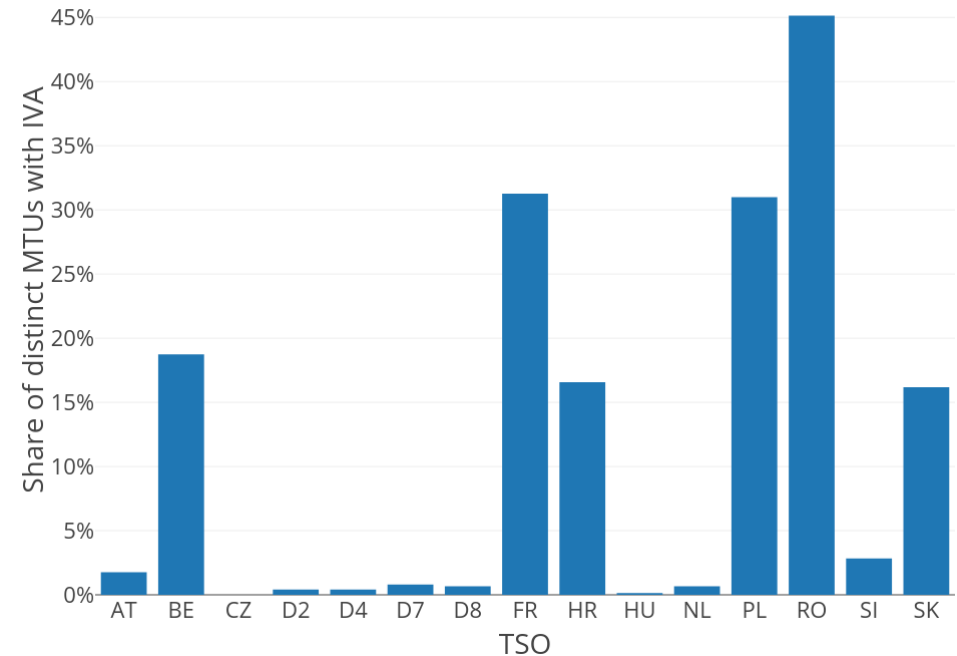
617

Share of distinct MTUs with IVA

83.2%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
SI	2.83%	21
CZ	0.00%	0
AT	1.75%	13
D7	0.81%	6
D8	0.67%	5
D2	0.40%	3
PL	31.00%	230
D4	0.40%	3
SK	16.17%	120
HU	0.13%	1

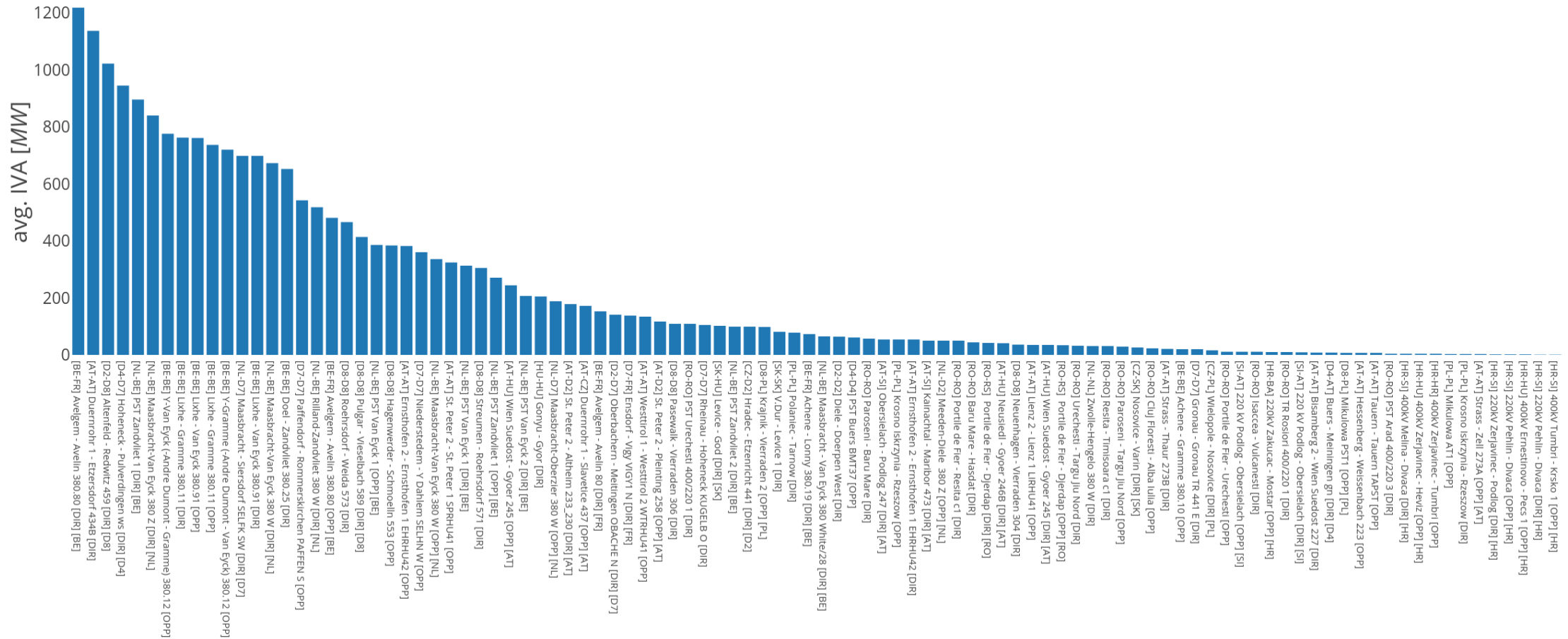
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
BE	18.73%	139
NL	0.67%	5
FR	31.27%	232
RO	45.15%	335
HR	16.58%	123



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



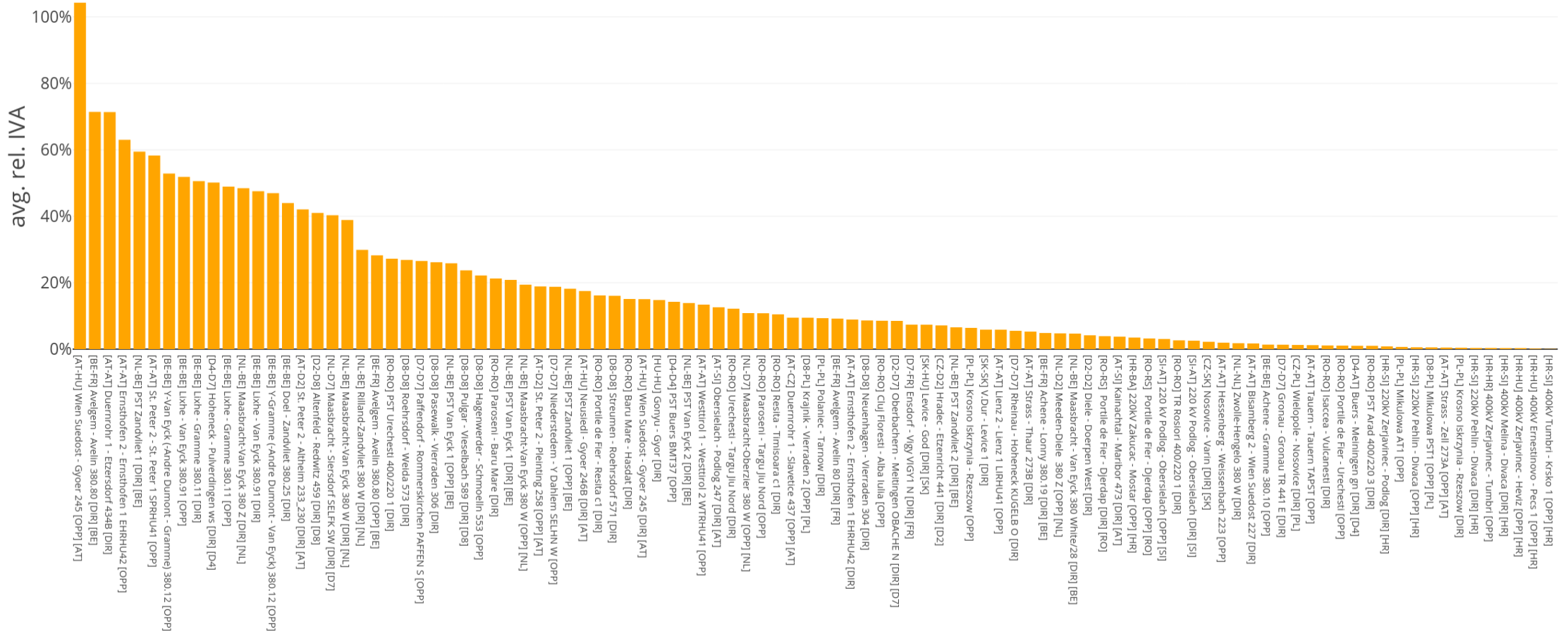
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



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



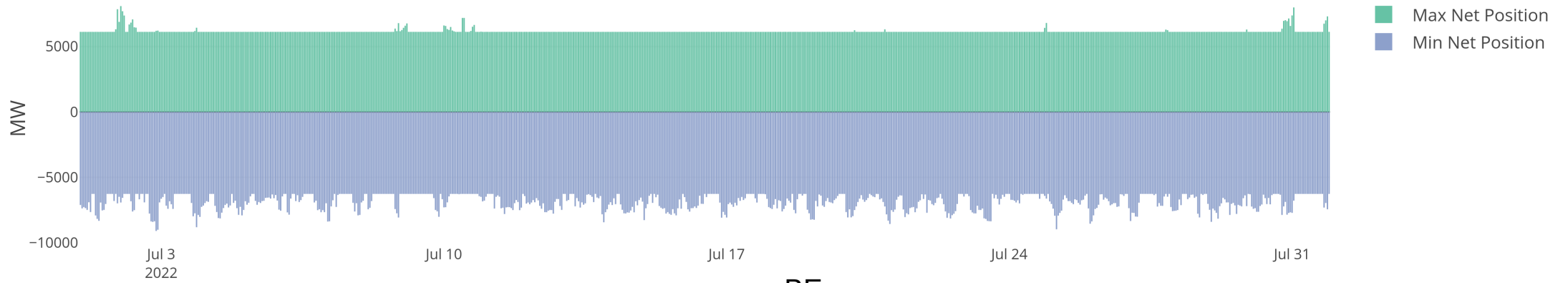
$$\text{avg. rel. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} \frac{IVA_{CNEC, MTU}[IVA_{CNEC, MTU} > 0]}{F_{max, CNEC, MTU}[IVA_{CNEC, MTU} > 0]}$$



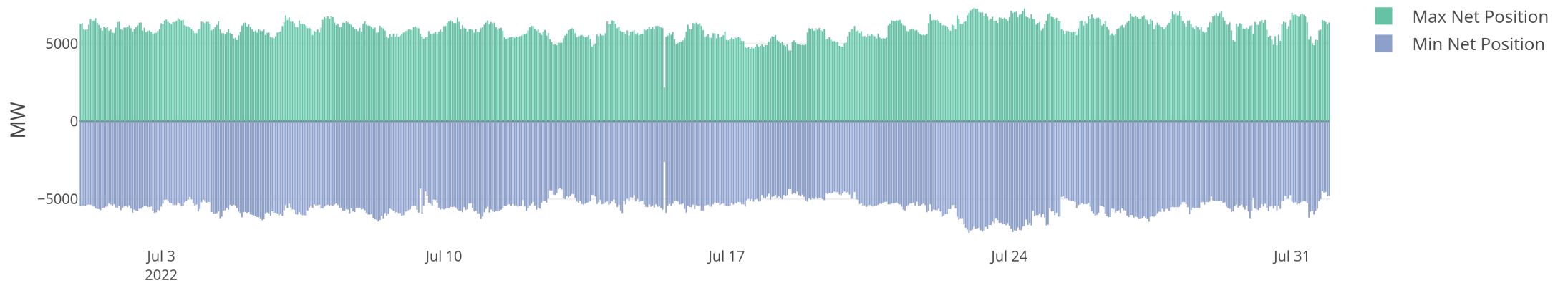
KPI 5: Min & max net positions per BZ hub



AT



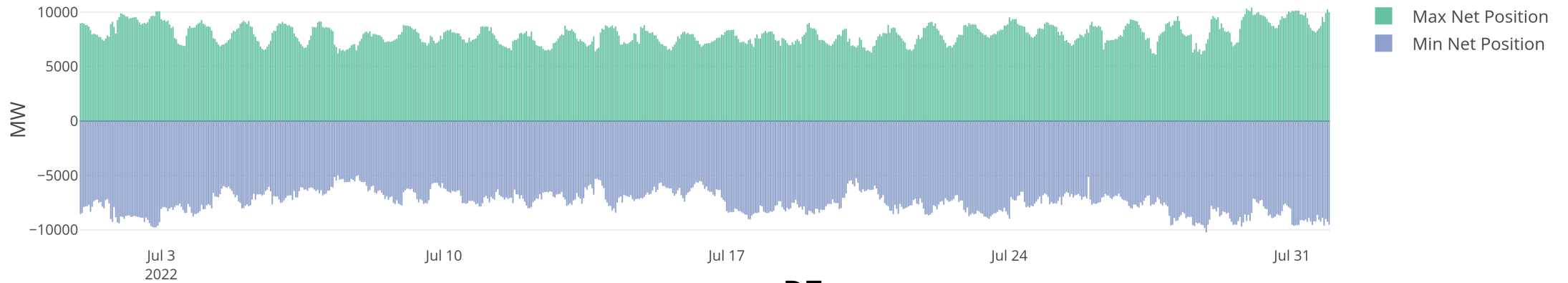
BE



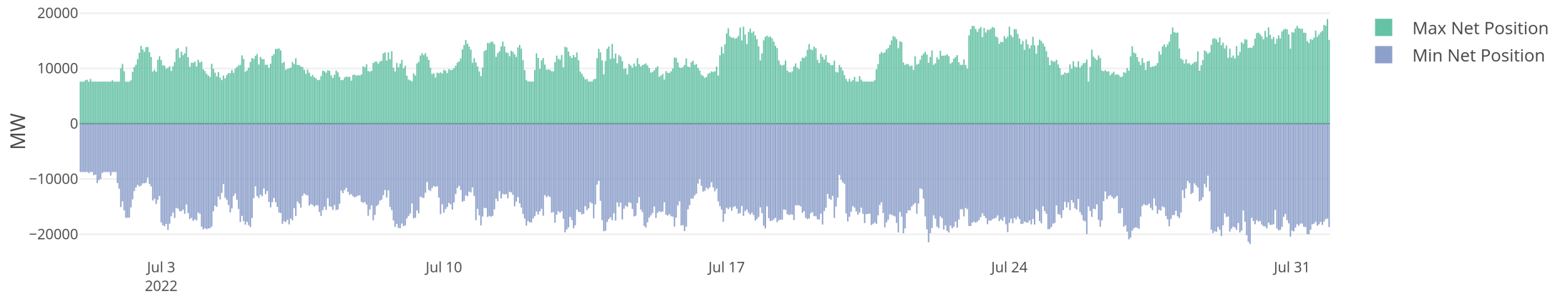
KPI 5: Min & max net positions per BZ hub



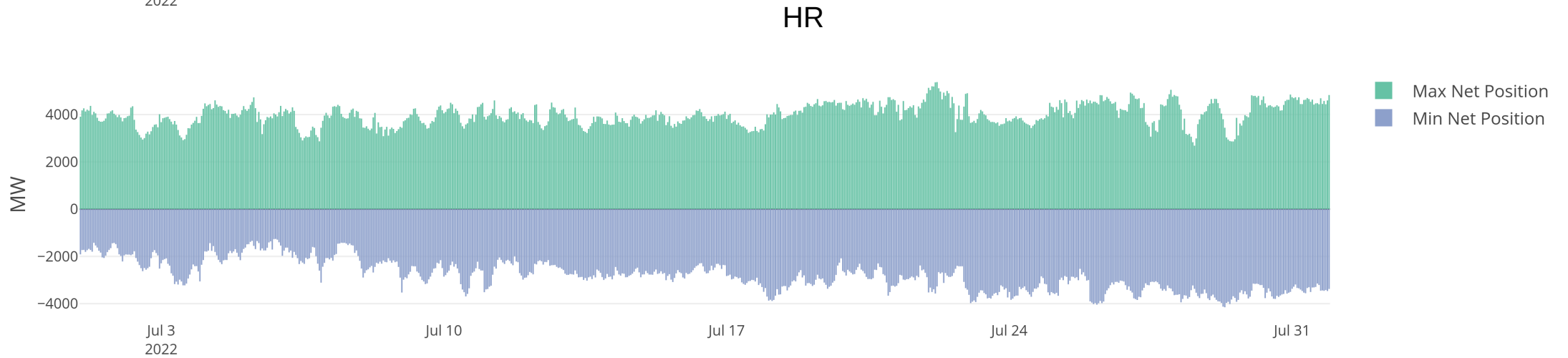
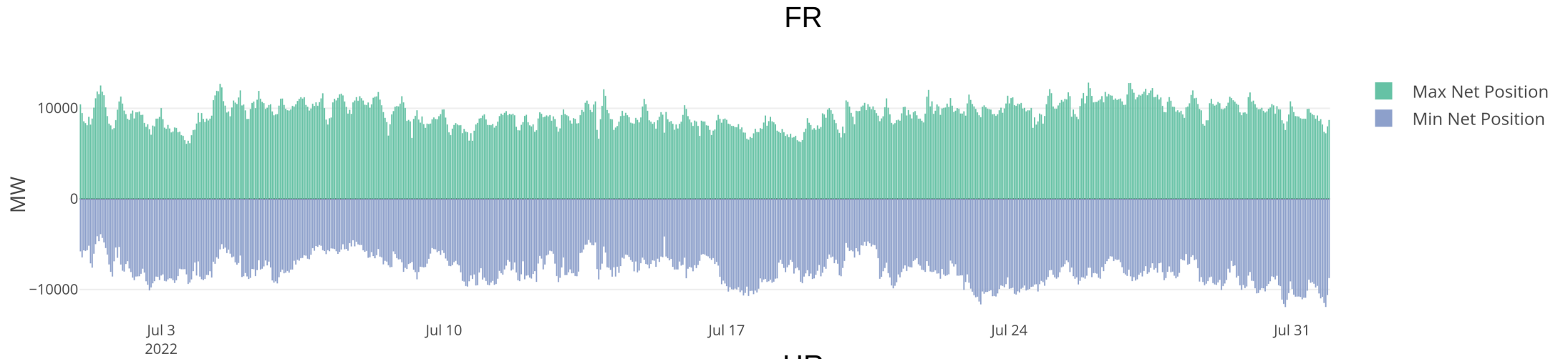
CZ



DE



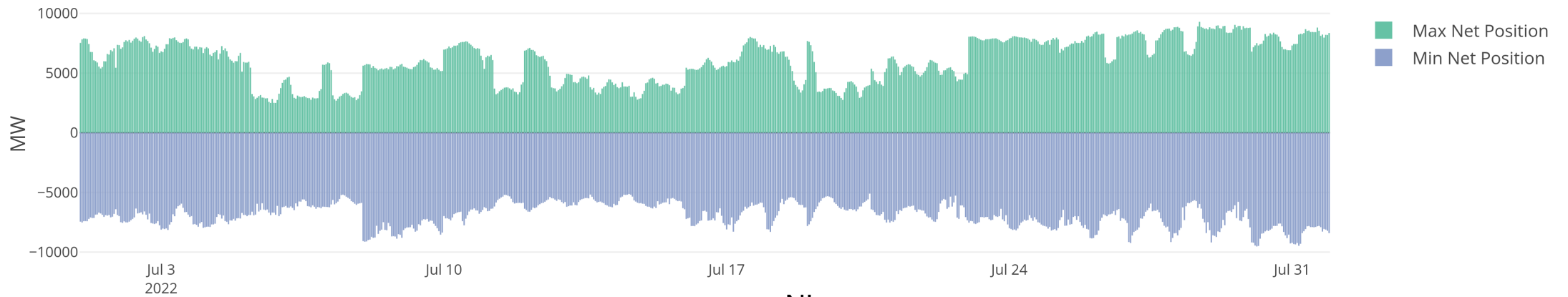
KPI 5: Min & max net positions per BZ hub



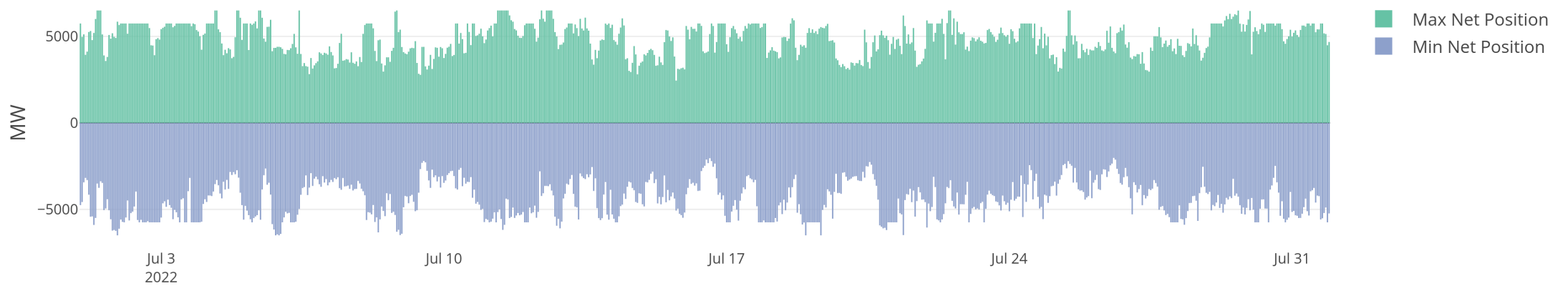
KPI 5: Min & max net positions per BZ hub



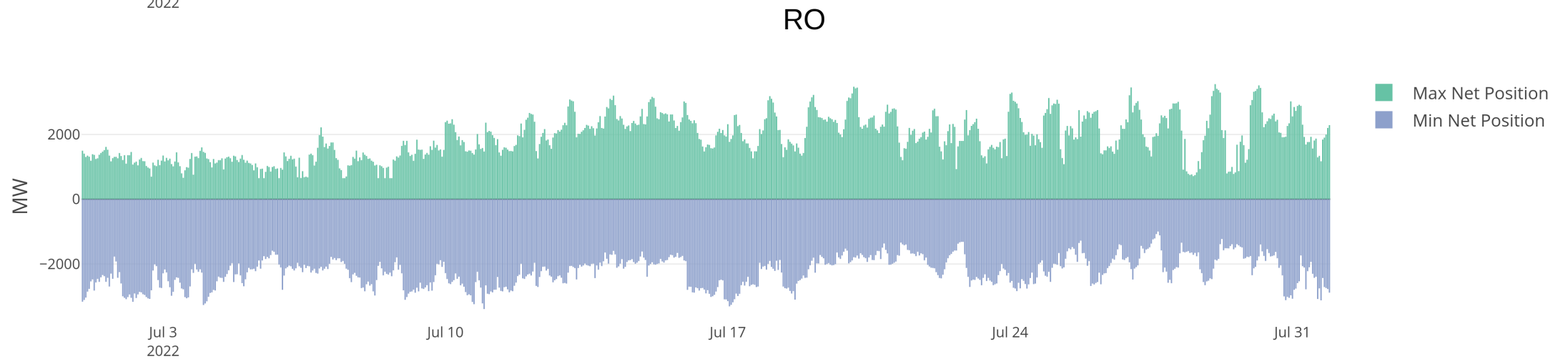
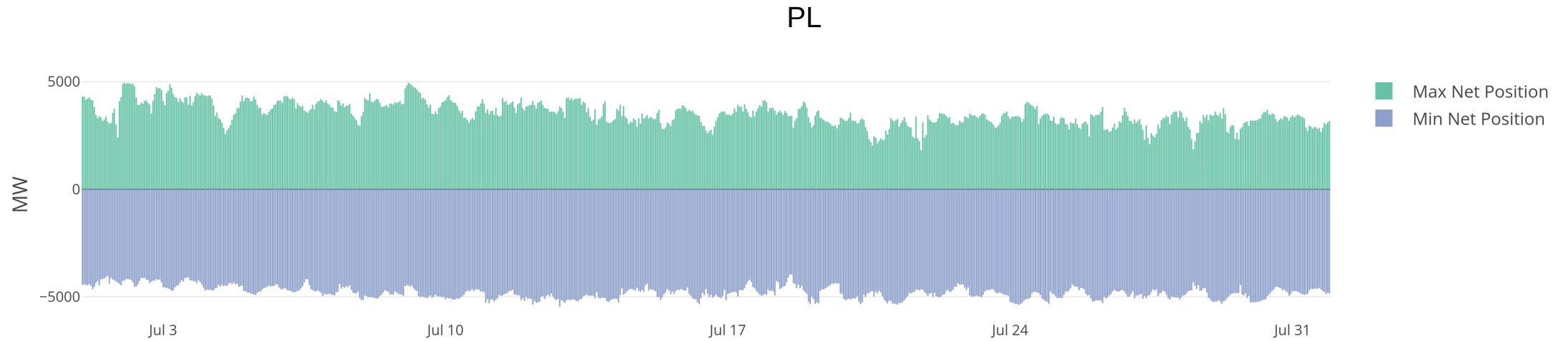
HU



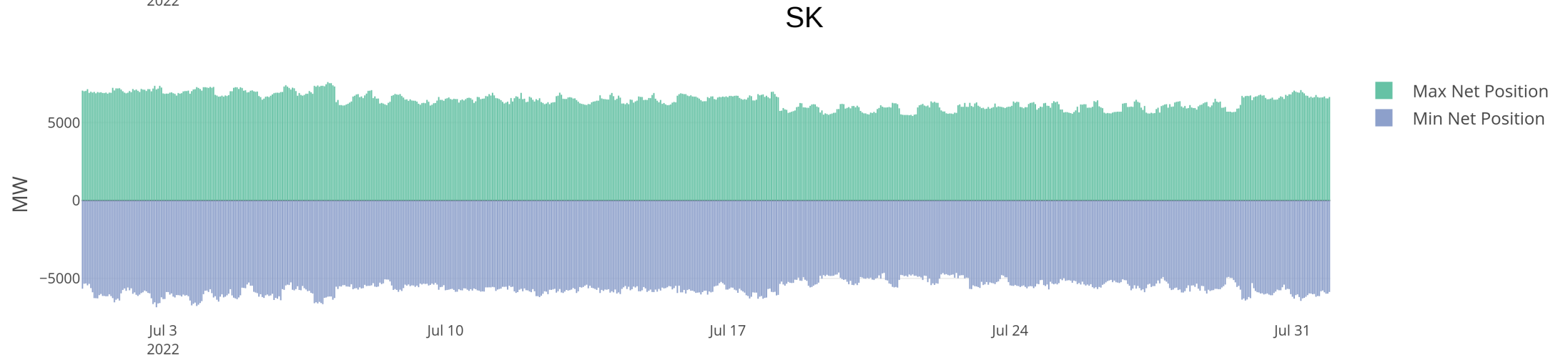
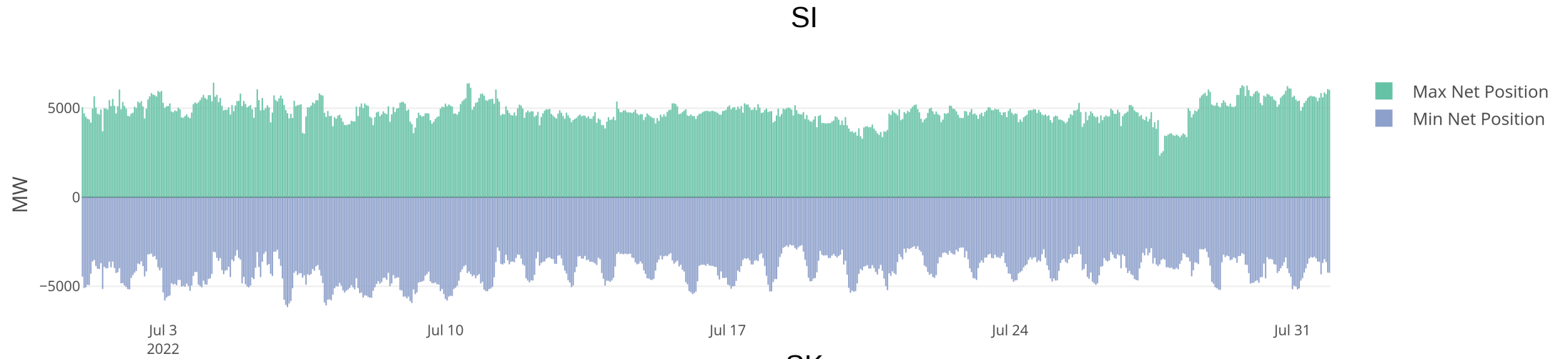
NL



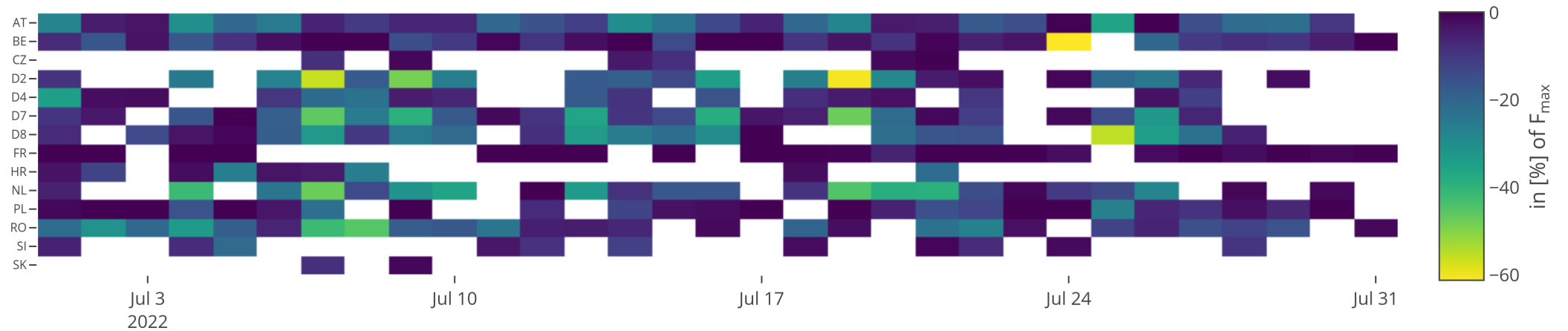
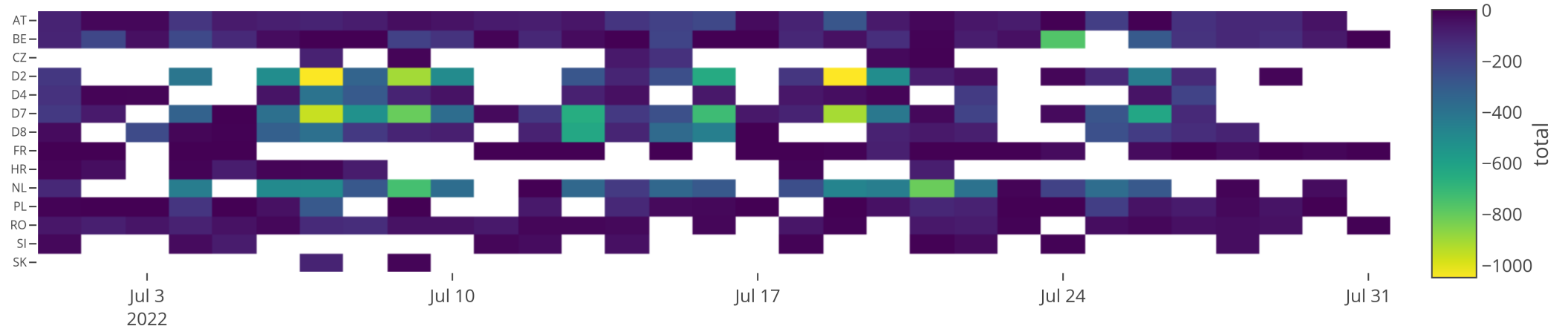
KPI 5: Min & max net positions per BZ hub



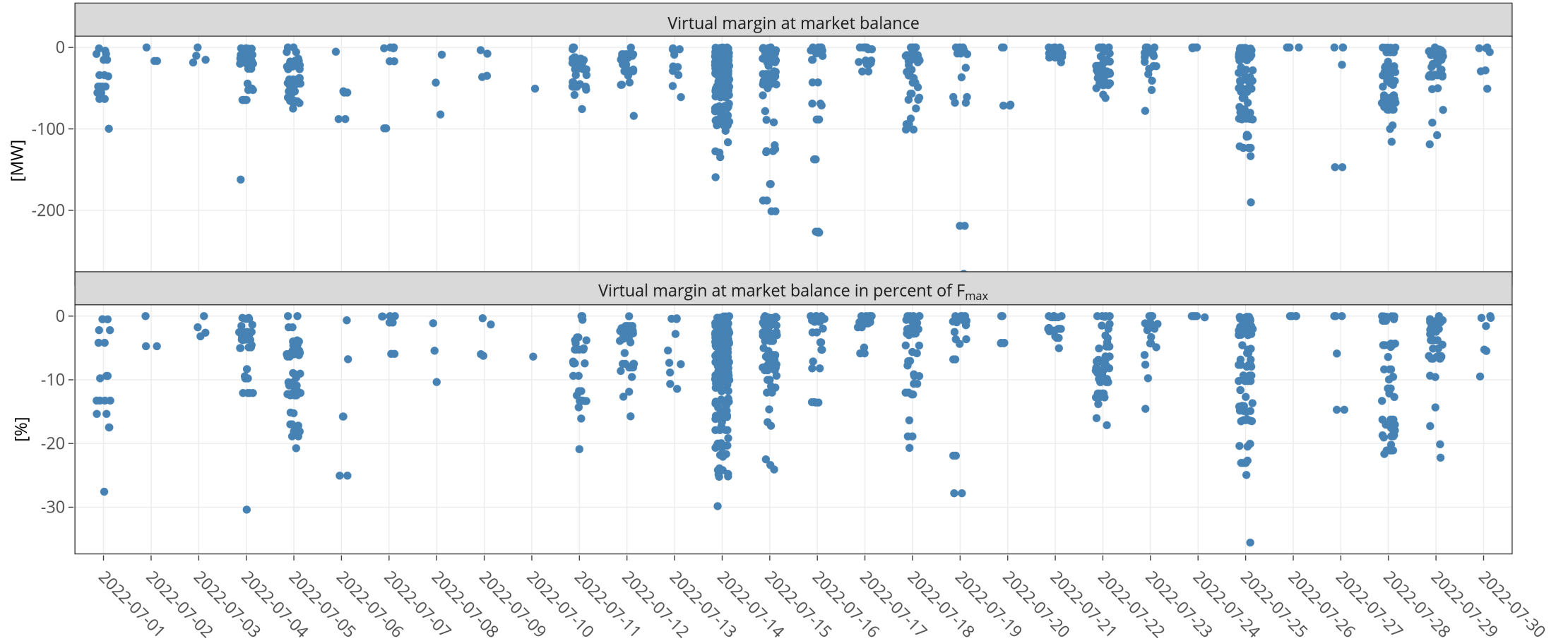
KPI 5: Min & max net positions per BZ hub



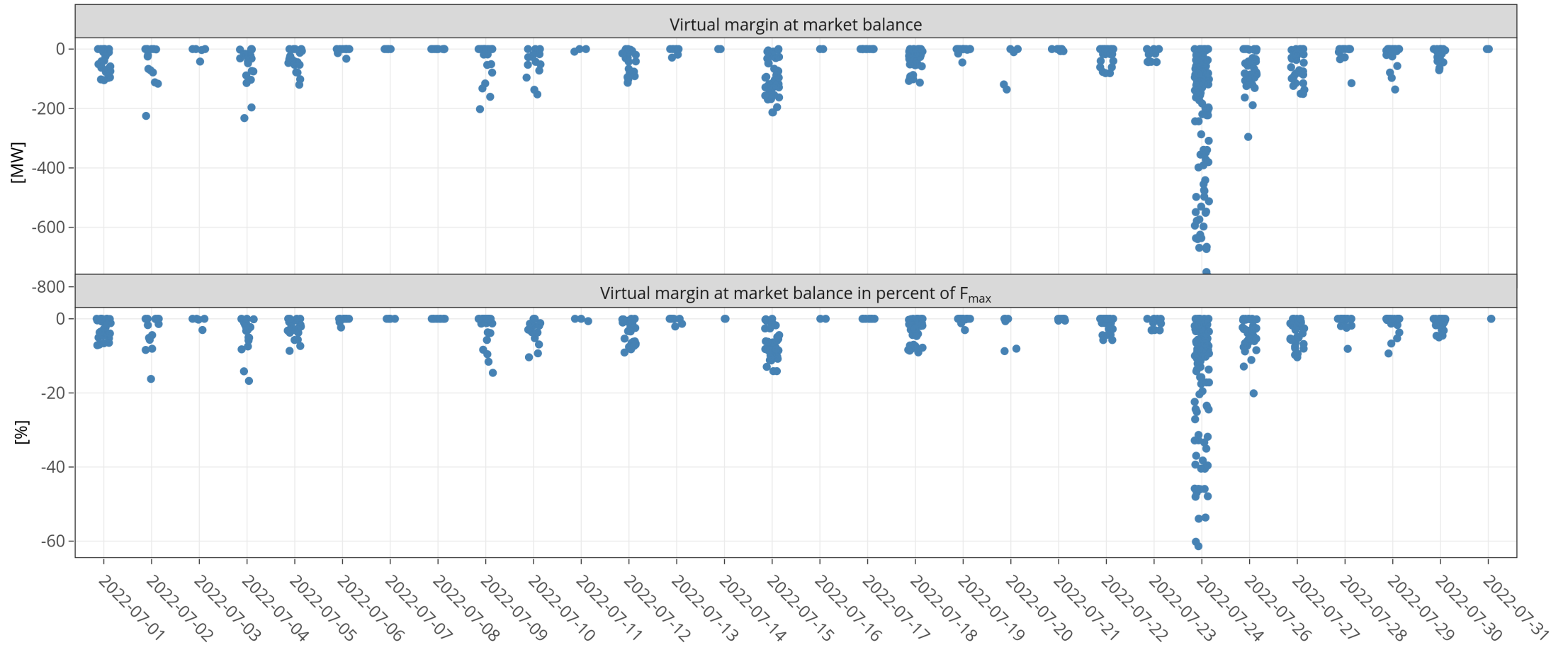
KPI 6a: Highest virtual margins at market balance for CORE TSOs



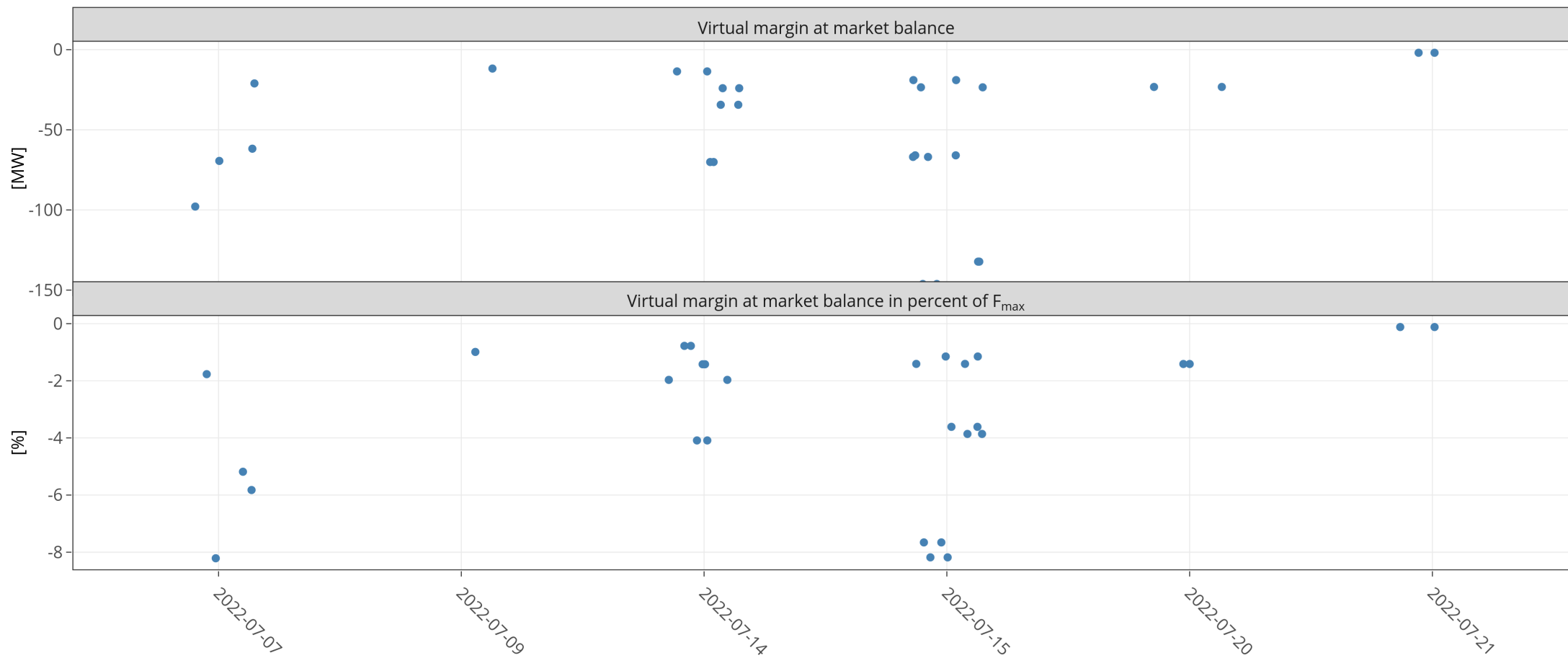
KPI 6b: Virtual margins at market balance AT



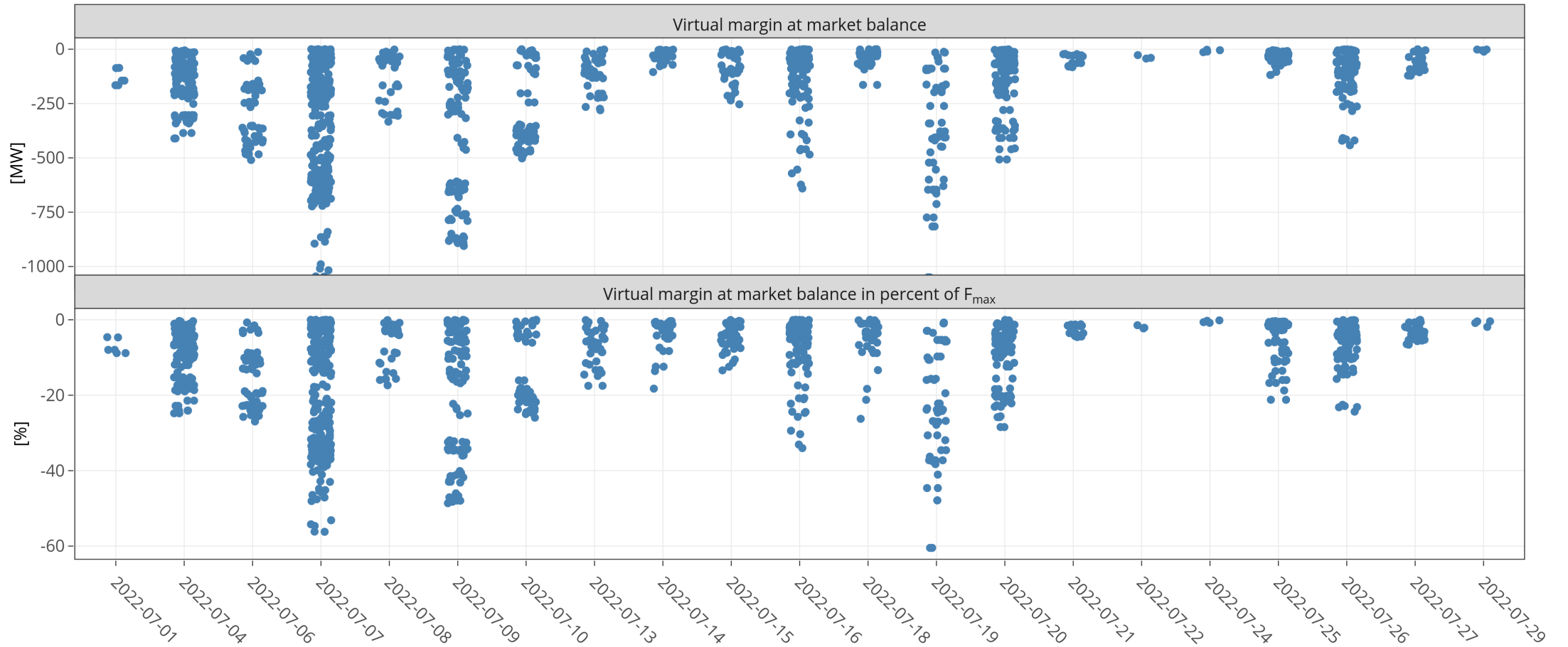
KPI 6b: Virtual margins at market balance BE



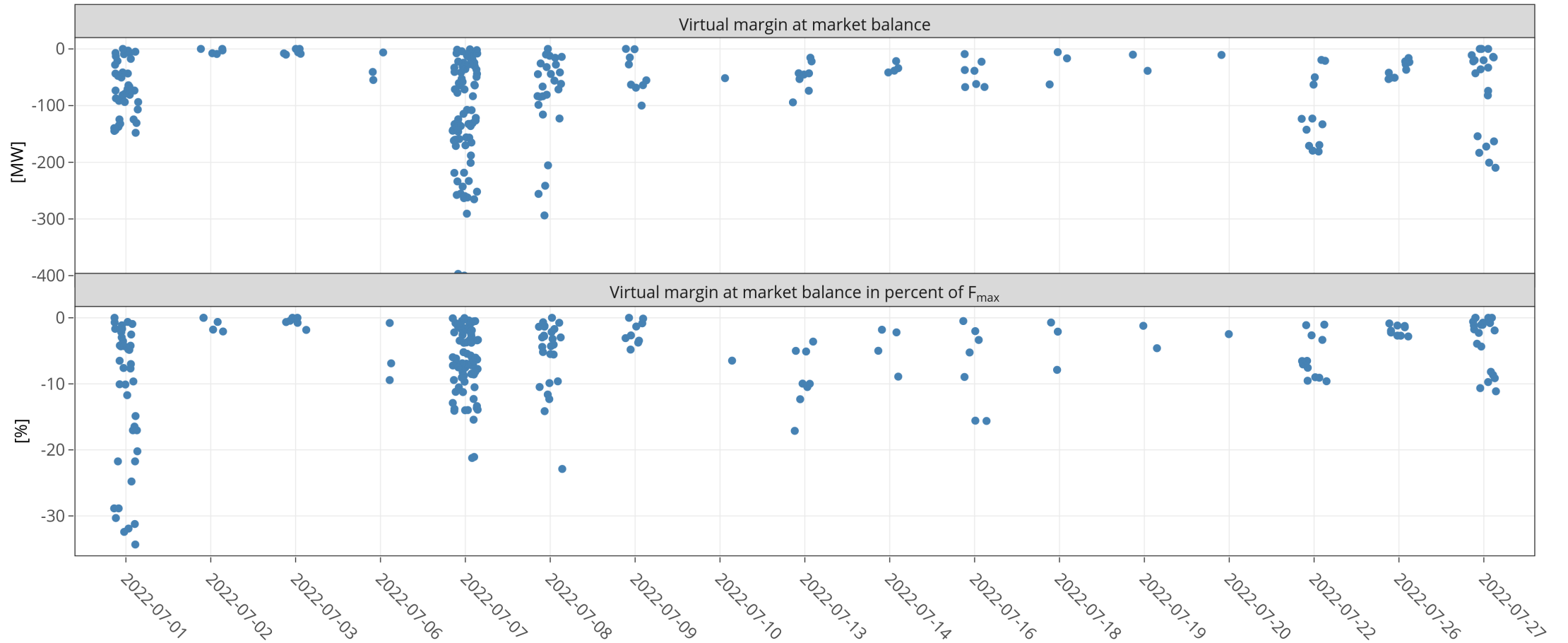
KPI 6b: Virtual margins at market balance CZ



KPI 6b: Virtual margins at market balance D2



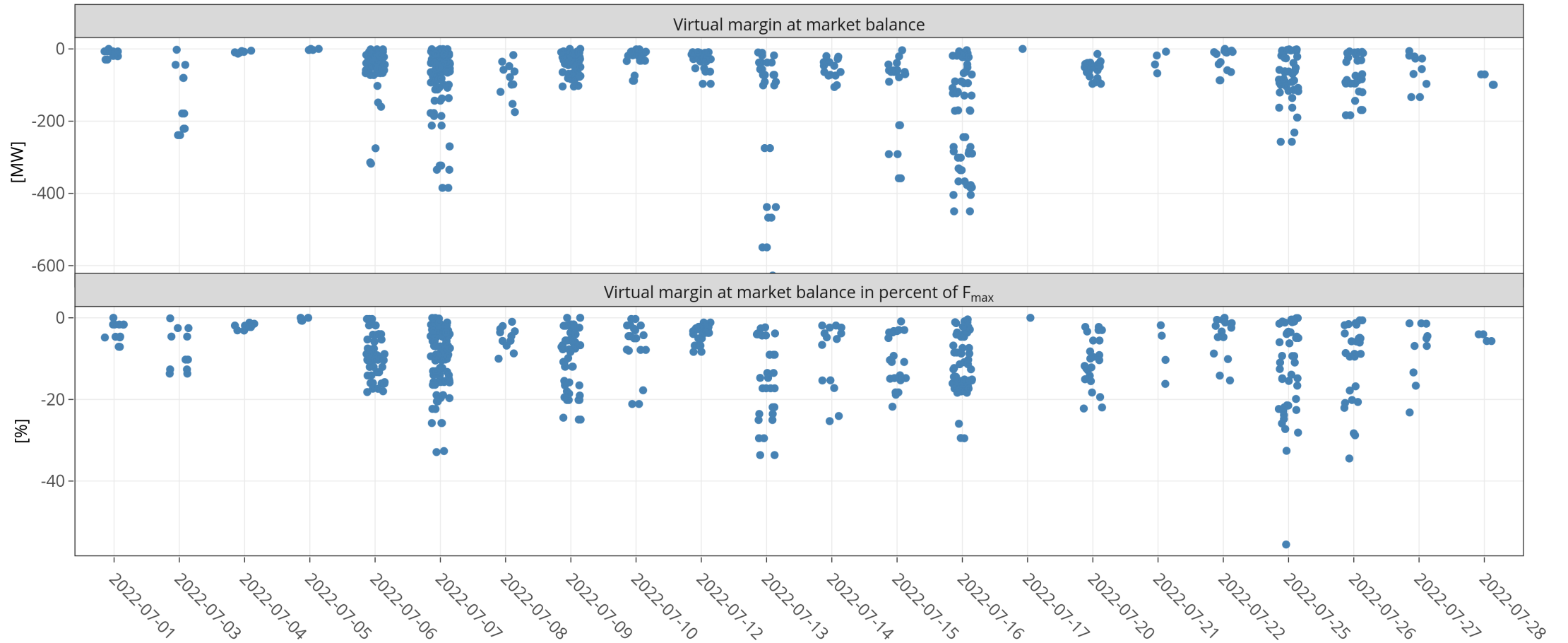
KPI 6b: Virtual margins at market balance D4



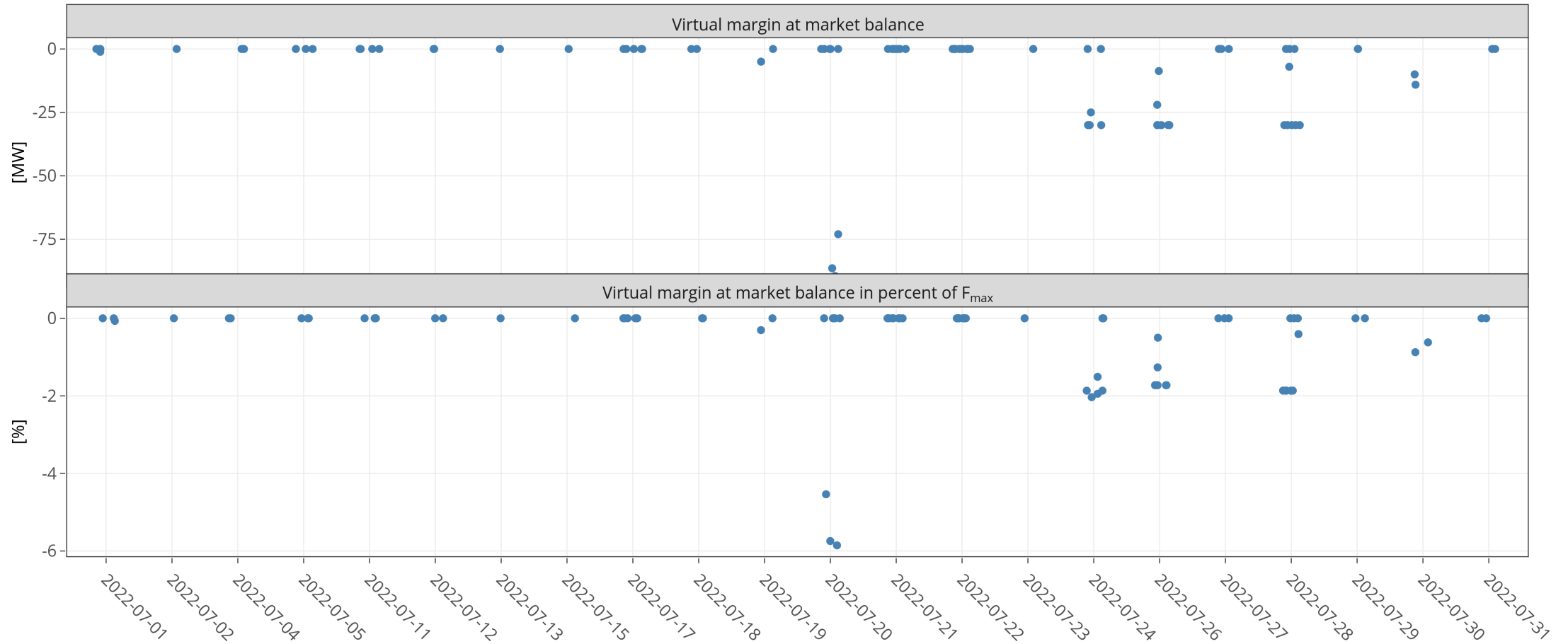
KPI 6b: Virtual margins at market balance D7



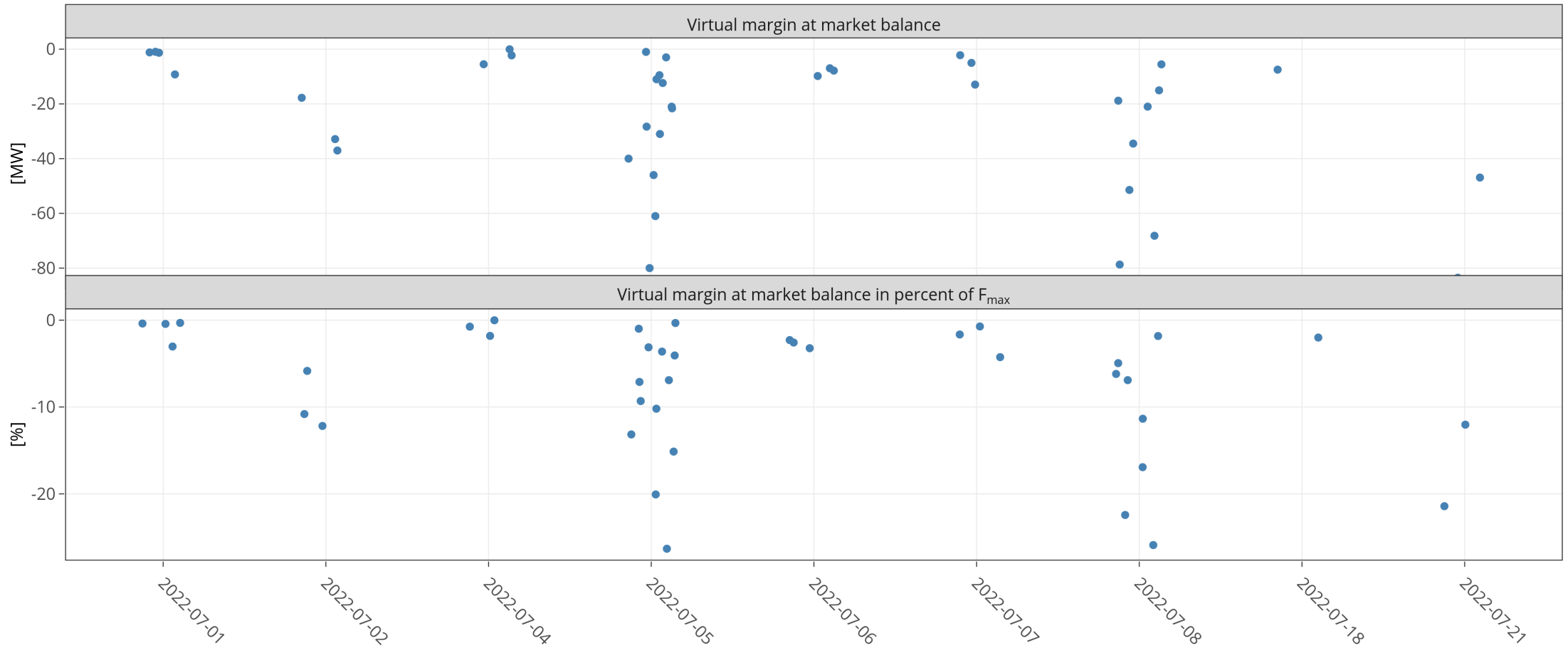
KPI 6b: Virtual margins at market balance D8



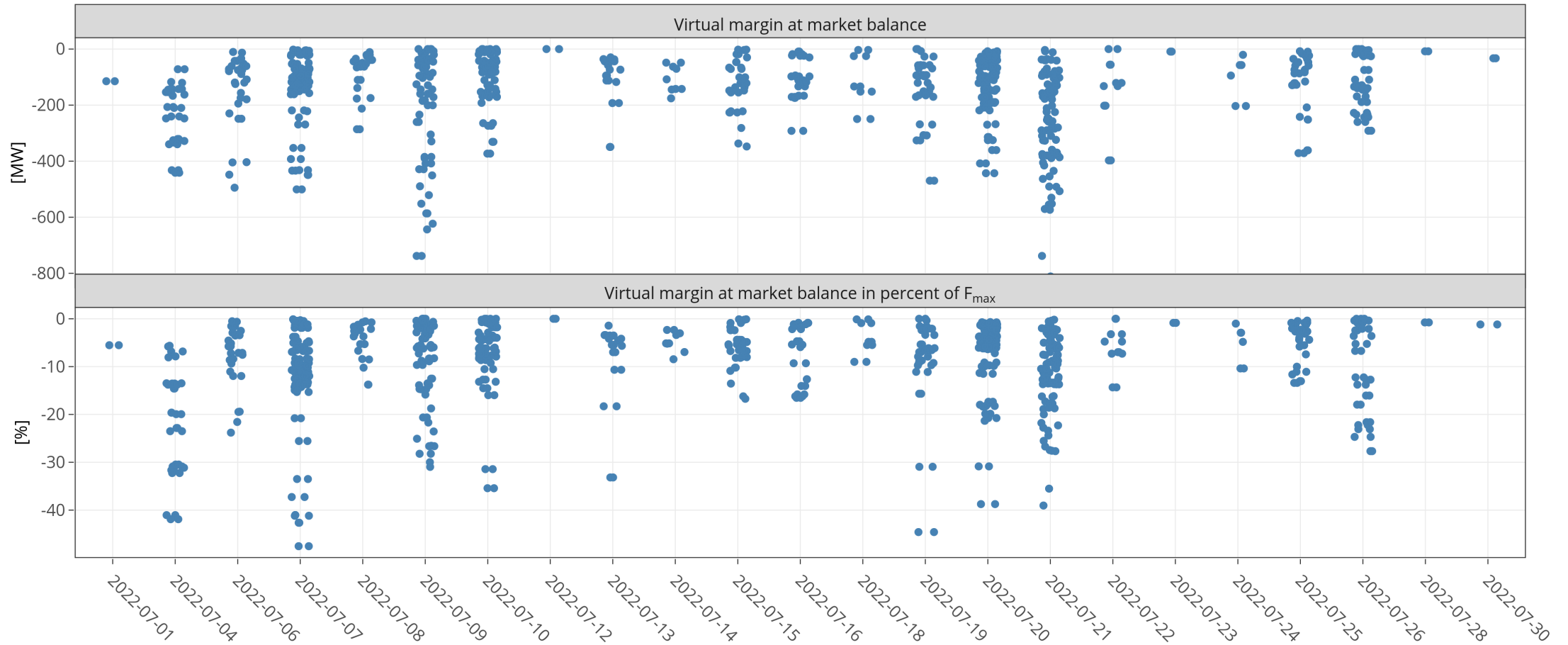
KPI 6b: Virtual margins at market balance FR



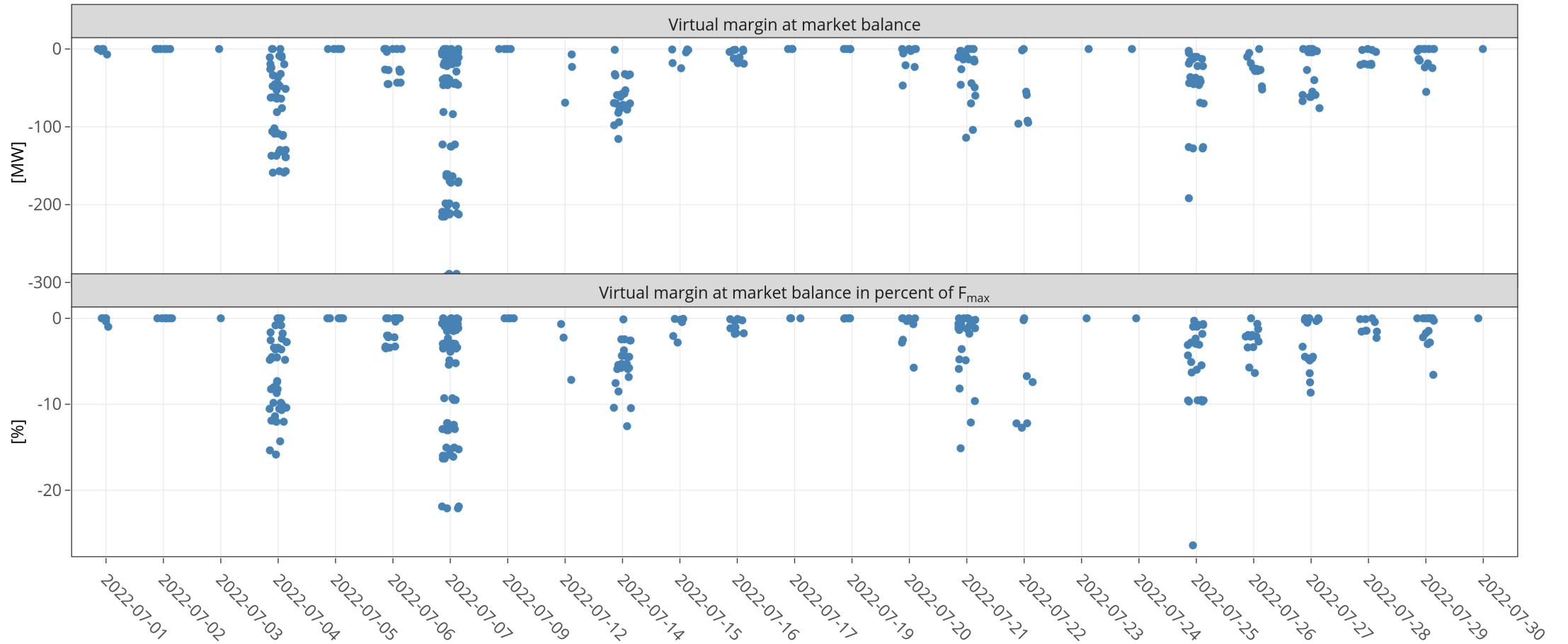
KPI 6b: Virtual margins at market balance HR



KPI 6b: Virtual margins at market balance NL



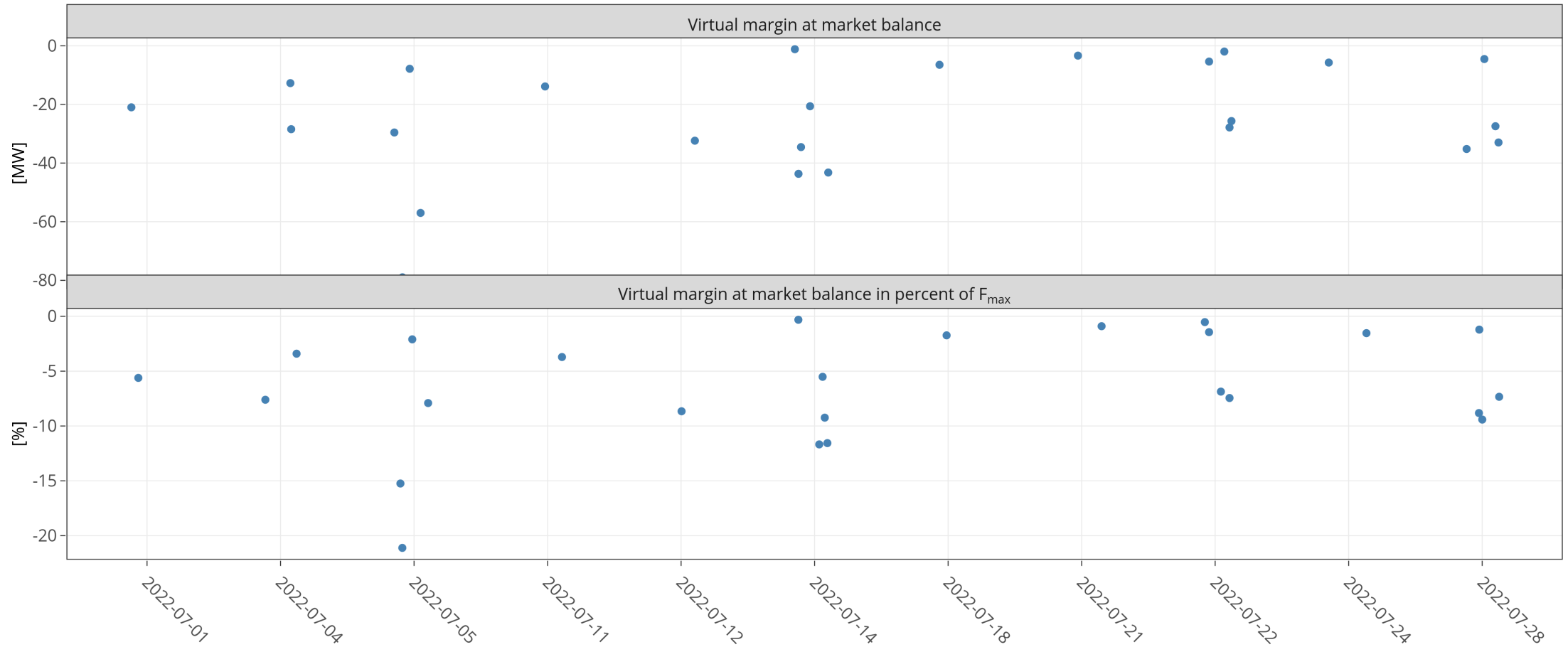
KPI 6b: Virtual margins at market balance PL



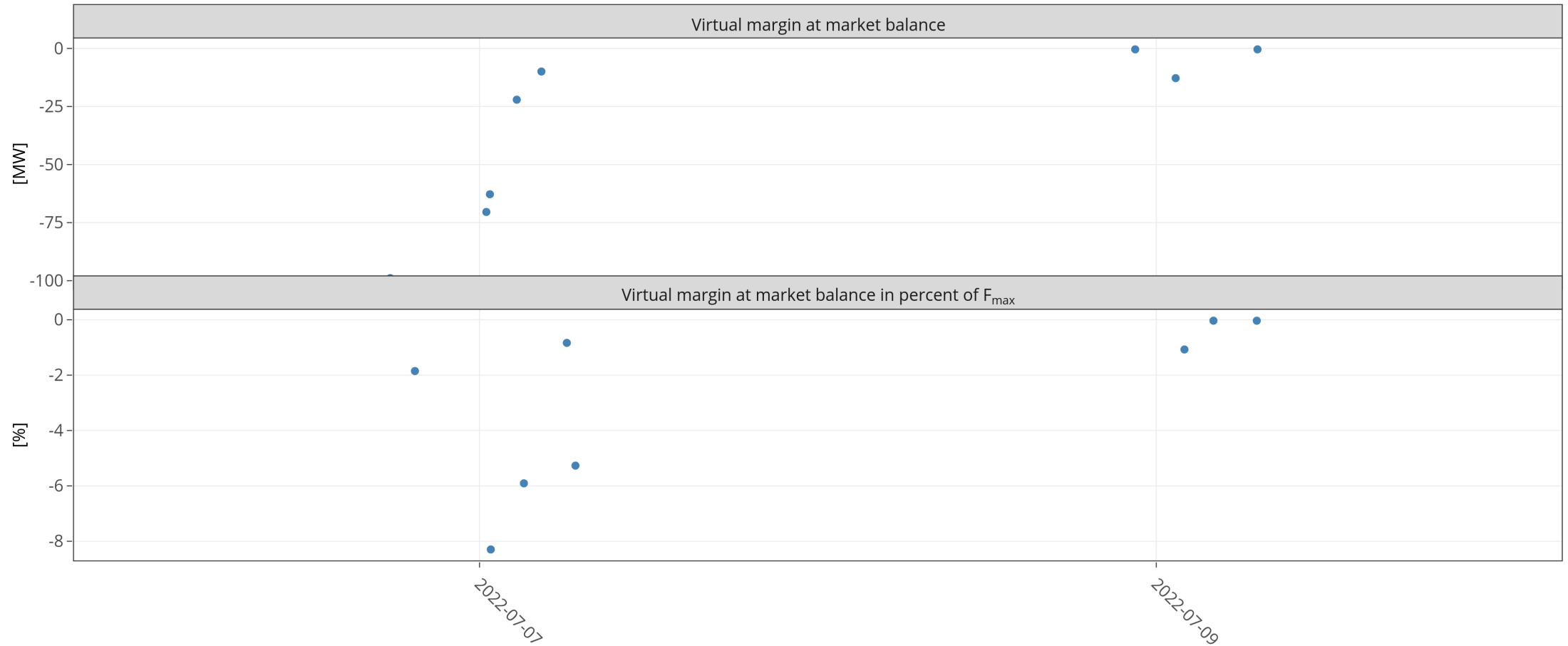
KPI 6b: Virtual margins at market balance RO



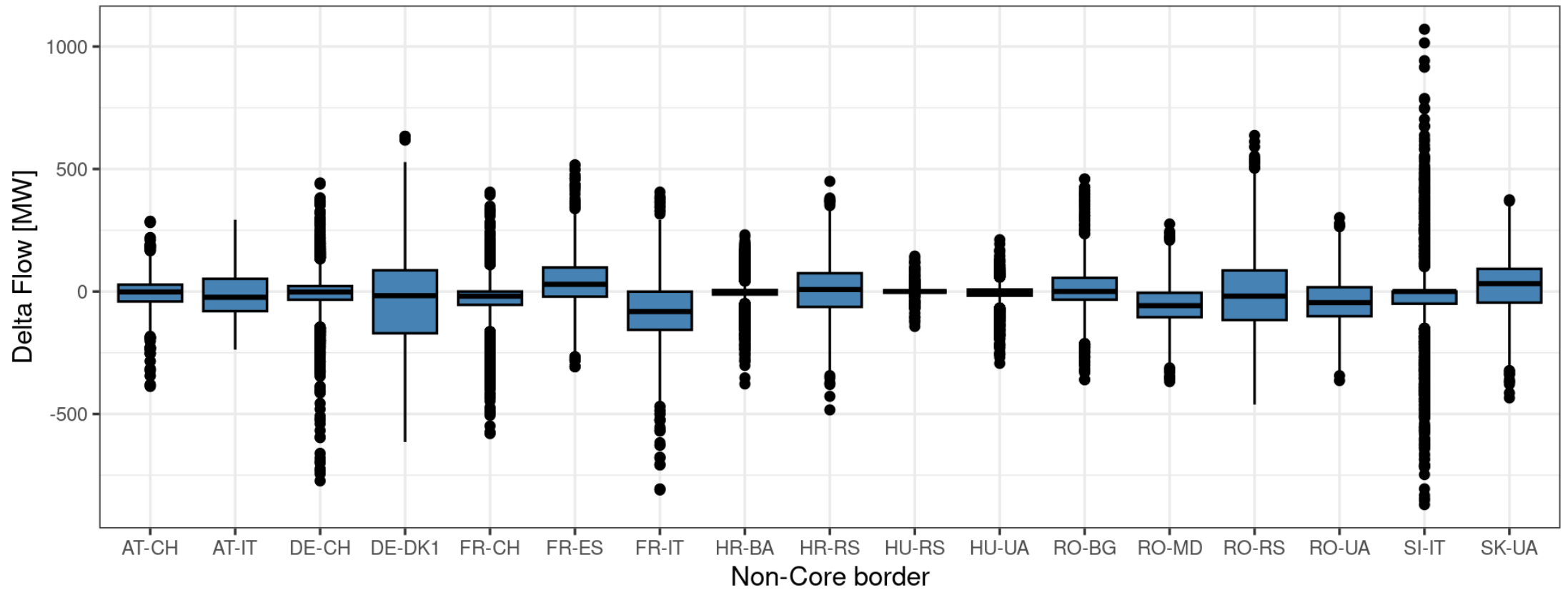
KPI 6b: Virtual margins at market balance SI



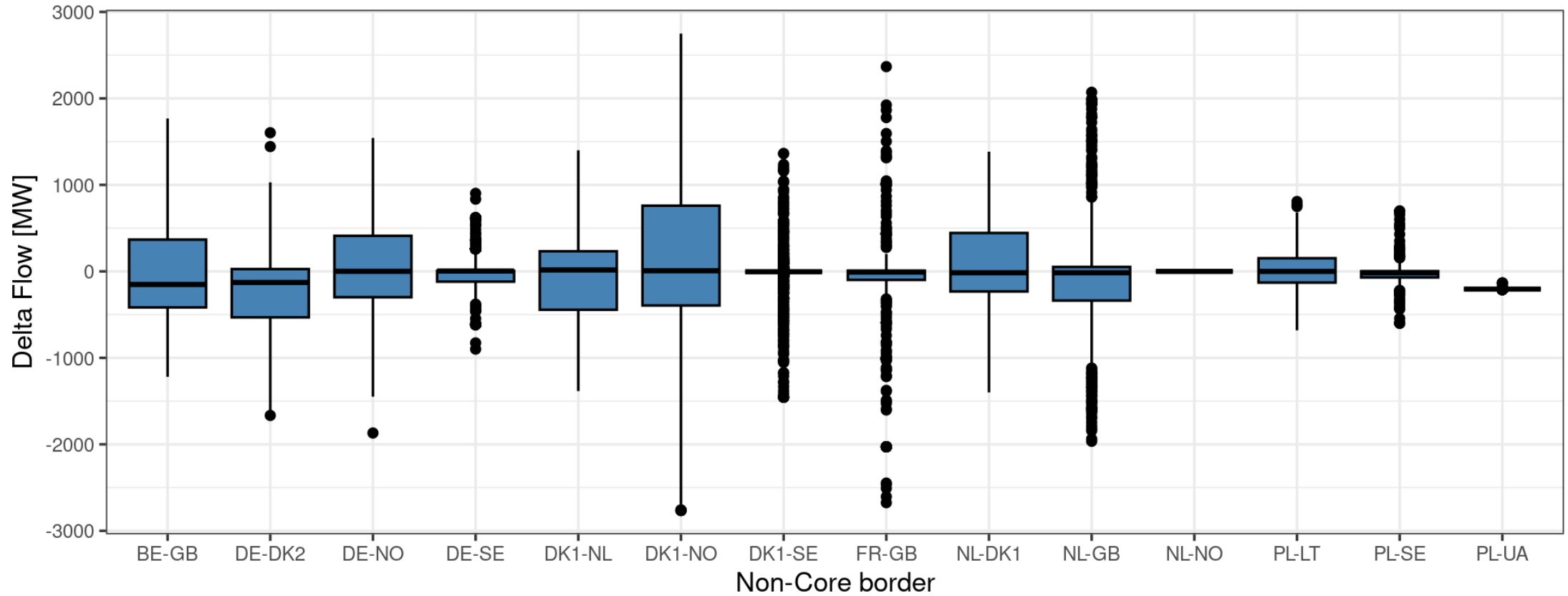
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow



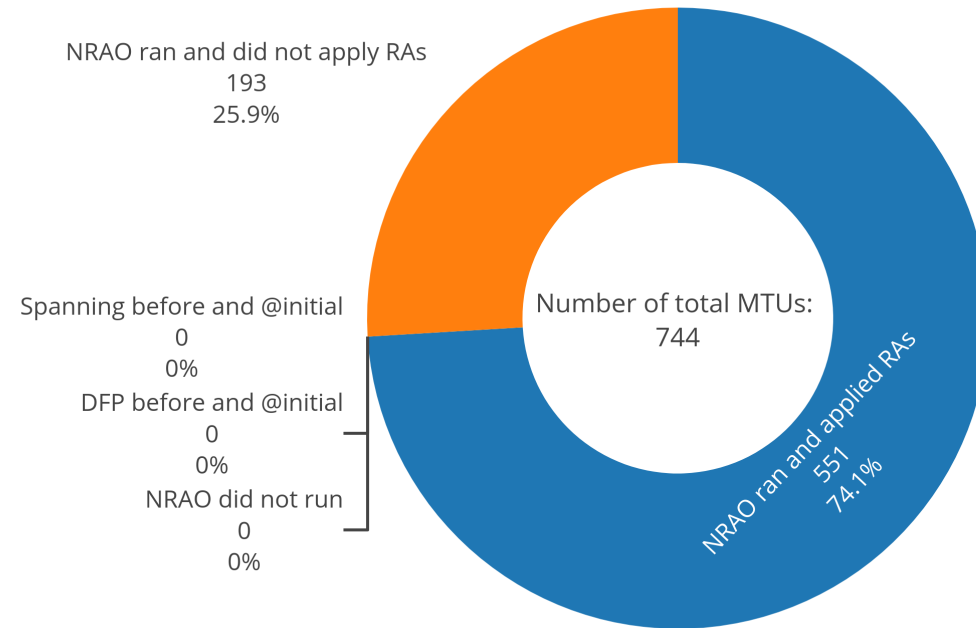
KPI 7: Non-Core exchanges DC delta flow



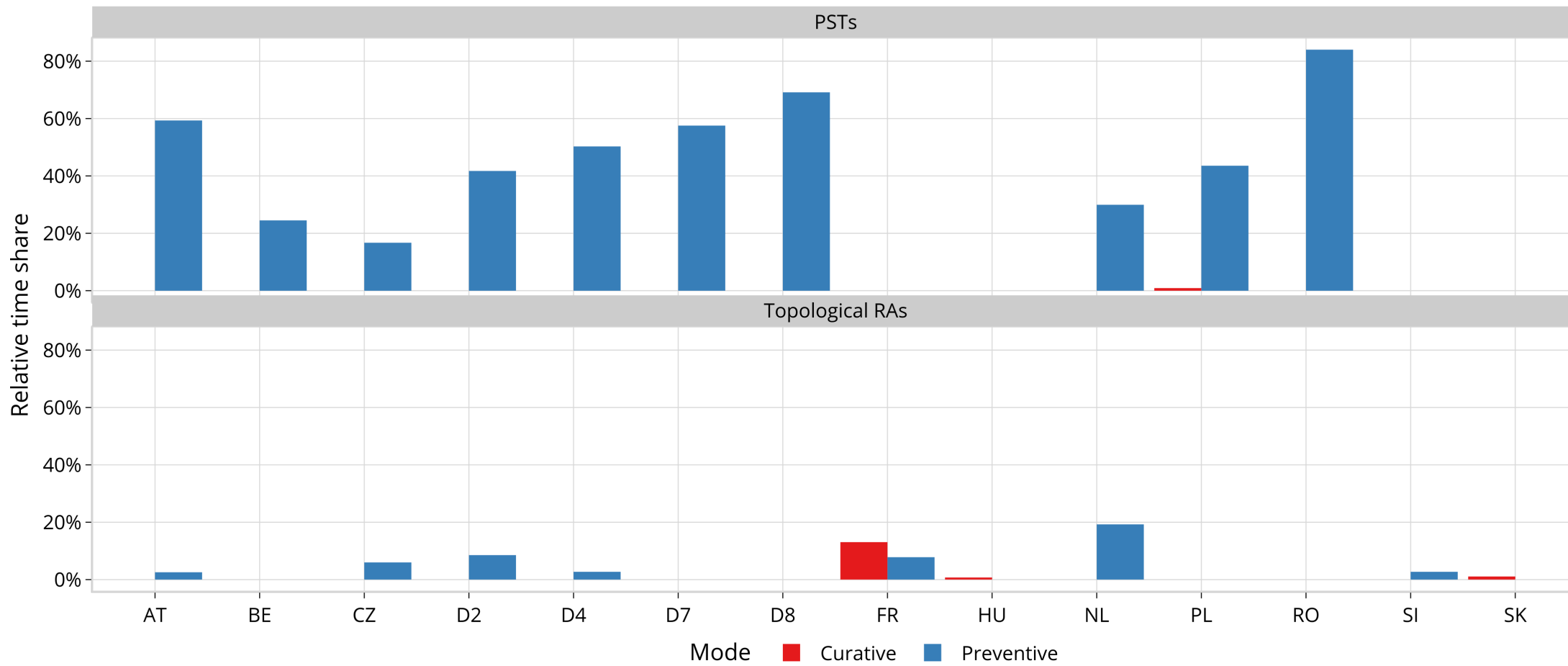
KPI 8: NRAO – Applied Remedial Action



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

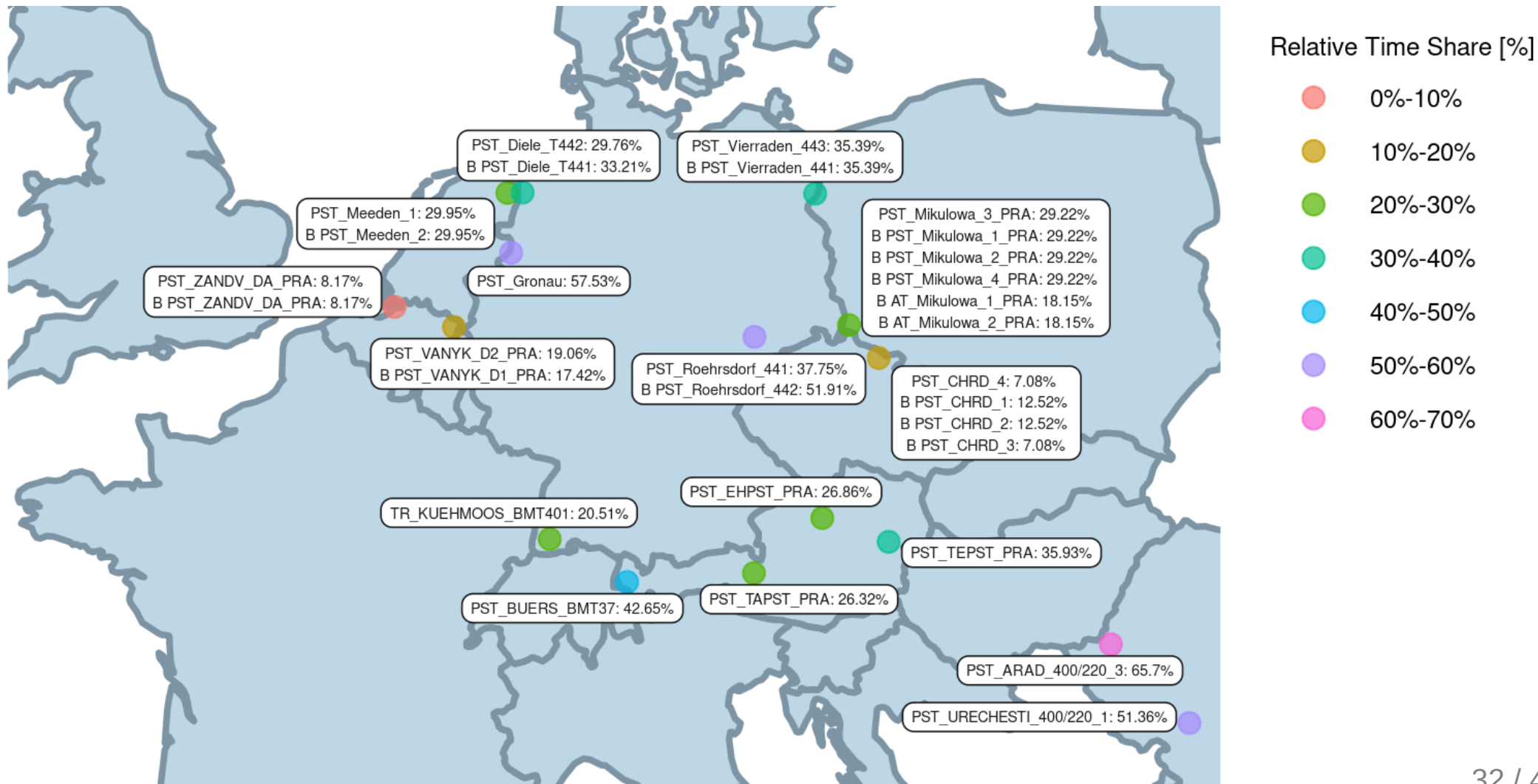


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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



Relative Time Share [%]

● 0%-10%

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

Relative Time Share of Applied Topological RAs in Preventive Mode

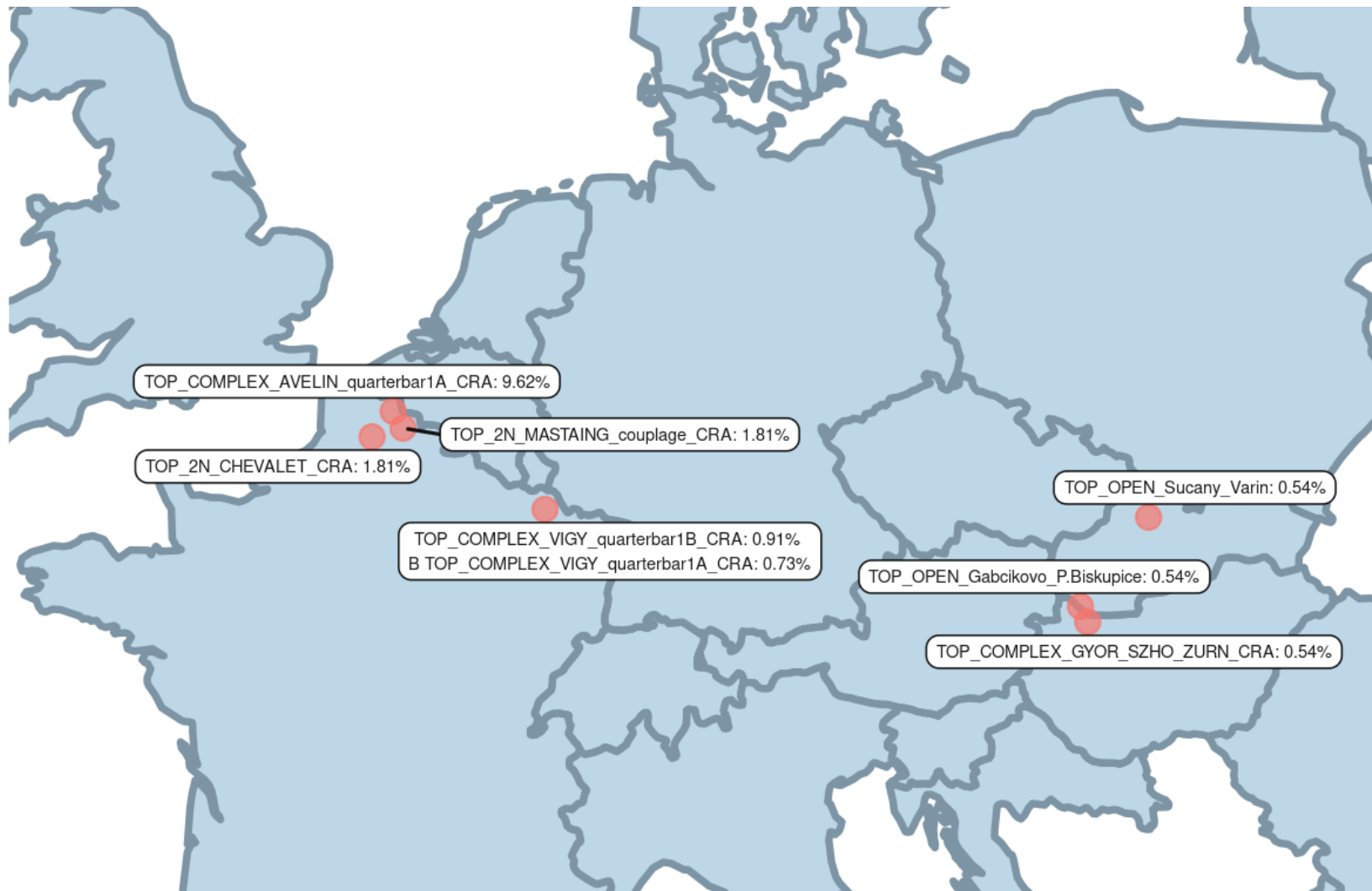


Relative Time Share [%]

● 0%-10%

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

Relative Time Share of Applied Topological RAs in Curative Mode

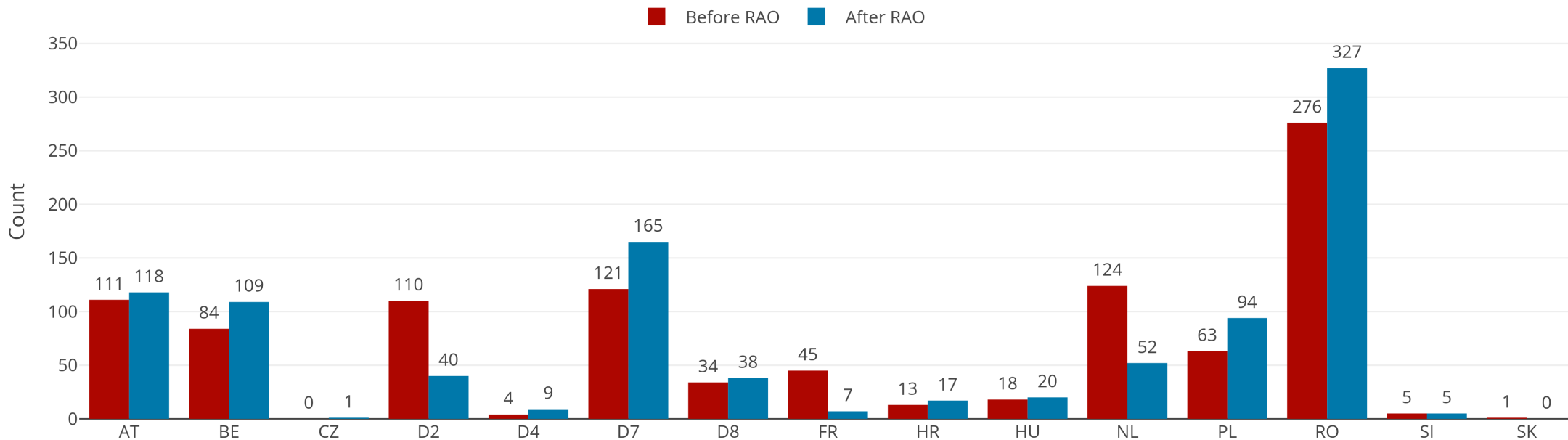


KPI 9: Most limiting CNEC per TSO (NRAO)



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.

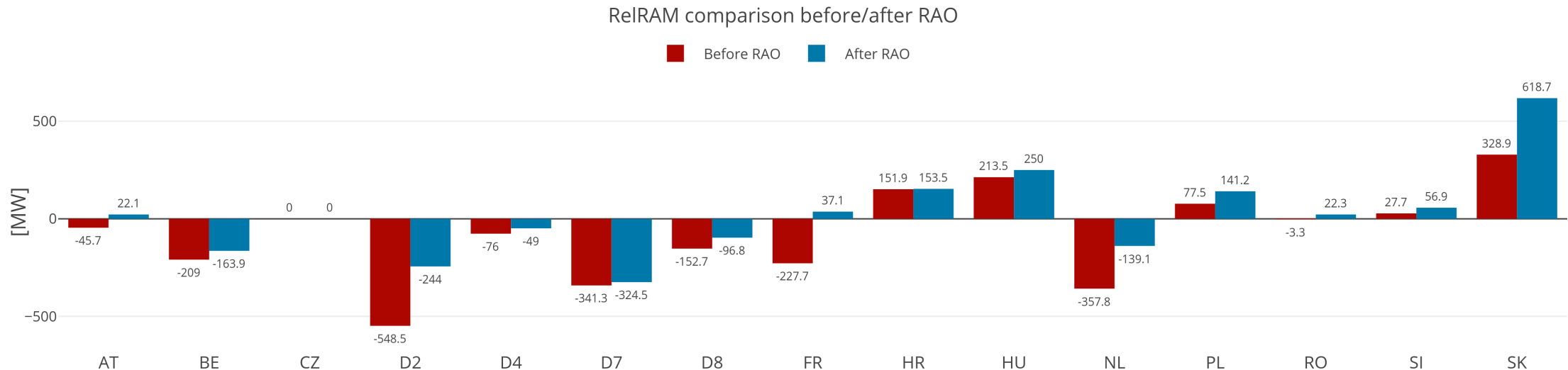
KPI 10: Average variation of relative RAM before and after NRAO



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
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	742	775	94.91%	53.21%	138.24%	0.2463	0.6052
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	742	742	86.41%	54.87%	117.65%	0.2492	1.0068
[HU-HU] Gonyu - Gyor [DIR]	742	1752	60.32%	37.47%	83.61%	0.2807	1.5069
[CZ-SK] Sokolnice - Senice [OPP] [CZ]	742	742	102.23%	76.87%	130.95%	0.0973	0.371
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	742	1455	79.77%	41.98%	127.01%	0.2463	0.6052
[SK-HU] Gabcikovo - Gonyu [OPP] [HU]	741	1407	89.36%	63.03%	112.78%	0.3633	1.2748
[SK-HU] Gabcikovo - Gonyu [DIR] [HU]	740	1034	83.81%	67.29%	131.48%	0.3633	1.2748
[SK-UA] V.Kapusany - Mukachevo (WPS) [OPP] [SK]	739	746	93.75%	62.50%	125.28%	0.2492	1.0068
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	739	1009	52.72%	23.60%	80.41%	0.3377	1.1796
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	735	749	48.21%	11.44%	81.63%	0.3789	1.3321
[PL-PL] Krosno Iskrzynia - Rzeszow [DIR]	726	738	132.17%	98.41%	177.25%	0.3789	1.3321
[CZ-SK] Nosovice - Varin [OPP] [SK]	726	1549	106.23%	76.85%	134.90%	0.3407	1.2849
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	725	1804	44.99%	10.50%	117.51%	0.2282	0.7719
[RO-RS] Portile de Fier - Djerdap [OPP] [RO]	715	821	73.24%	26.75%	141.27%	0.3676	0.7181
[RO-RO] TR Rosiori 400/220 1 [DIR]	705	705	42.10%	19.25%	84.00%	0.1437	0.2477
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	697	741	82.81%	20.00%	157.62%	0.1585	0.5958
[CZ-SK] Sokolnice - Senice [DIR] [CZ]	696	696	77.53%	62.24%	105.10%	0.0973	0.371
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	689	689	63.64%	35.00%	91.64%	0.35	1.4125
[NL-BE] PST Van Eyck 2 [DIR] [BE]	674	1051	74.51%	22.15%	112.72%	0.4357	0.9705
[AT-SI] Obersielach - Podlog 247 [OPP] [AT]	673	1294	122.65%	54.14%	202.49%	0.2282	0.7719

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 CNEs with shadow price	Max shadow price [€/MW]	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF
[D7-D7] Buerstadt - Lamsheim BUERST W [DIR]	267	291	2166.22	28.48%	19.08%	61.92%	0.1922
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	226	226	2488.62	38.93%	13.84%	65.38%	0.3761
[BE-FR] Avelgem - Avelin 80 [DIR] [FR]	209	209	1327.68	76.49%	43.81%	109.08%	0.4472
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	113	113	2333.63	65.70%	20.19%	103.00%	0.1541
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	84	85	1145.16	23.37%	10.77%	63.13%	0.1934
[D8-D8] Pasewalk - Vierraden 306 [DIR]	76	76	7001.41	22.16%	19.66%	40.29%	0.0967
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	69	69	2156.15	25.24%	19.75%	63.06%	0.2738
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	64	64	613.3	54.90%	36.36%	74.58%	0.35
[BE-FR] Avelgem - Avelin 380.80 [DIR] [BE]	54	54	804.7	74.98%	26.20%	109.47%	0.4482
[D8-PL] Mikulowa PST1 [OPP] [PL]	53	53	1453.92	32.75%	23.48%	53.33%	0.3119
[BE-BE] Achene - Gramme 380.10 [OPP]	45	45	1524.07	67.08%	43.56%	96.62%	0.34
[RO-RO] Paroseni - Targu Jiu Nord [OPP]	41	41	6320.41	28.16%	5.20%	44.61%	0.0875
[D4-D4] PST Buers BMT37 [OPP]	40	41	3108.23	56.39%	19.49%	81.44%	0.1013
[HR-BA] 220kV Zakucac - Mostar [OPP] [HR]	37	37	2237.42	10.63%	2.30%	25.00%	0.1206
[D2-D7] Grosskrotzenburg - Urberach UMAIN N2 [DIR] [D7]	36	36	2510.38	22.13%	19.53%	27.07%	0.0756
[NL-BE] PST Van Eyck 2 [DIR] [BE]	34	34	371.58	69.58%	55.79%	87.84%	0.4174
[NL-BE] PST Zandvliet 1 [DIR] [BE]	29	34	722.37	79.64%	58.55%	93.36%	0.4728
[D7-D7] Niederstedem - Y Dahlem SELHN W [OPP]	26	26	1079.65	27.42%	2.55%	40.96%	0.1155
[PL-PL] Polaniec - Tarnow [DIR]	25	25	2500.06	12.38%	0.00%	37.47%	0.2068
[RO-RO] Baru Mare - Hasdat [DIR]	24	24	4865.16	25.88%	0.00%	48.97%	0.0814

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 13a: Allocation Constraints - Belgium



MTUs

AC was Limiting MC

0

BE AC Import [MW]

Avg.

-6072.73

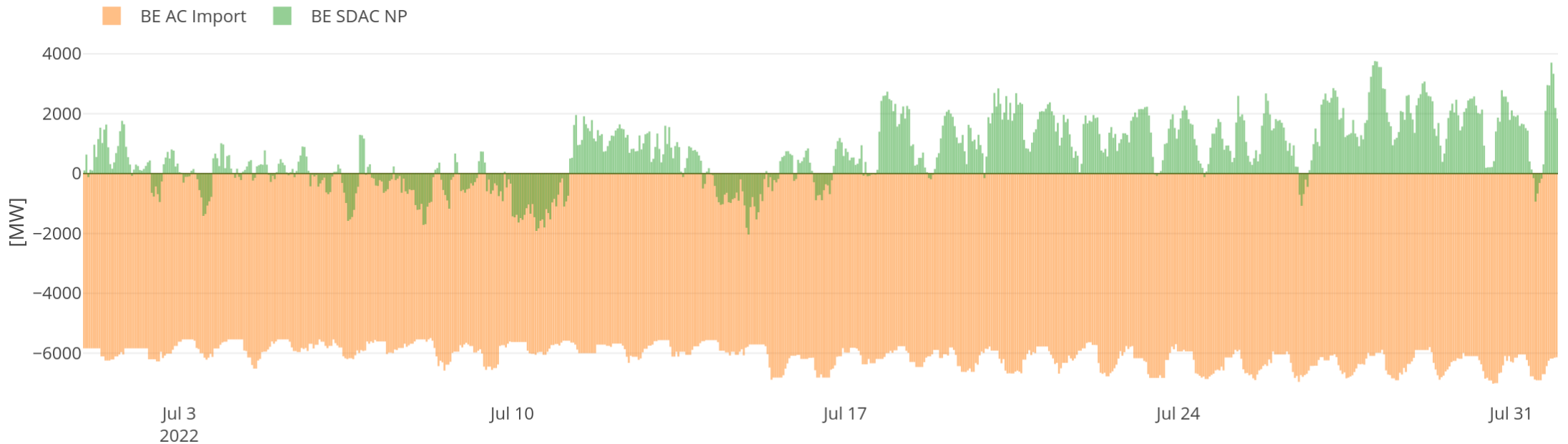
Min.

-6993.00

Max.

-5473.00

Belgium only uses import allocation constraints



KPI 13b: Allocation Constraints - Poland



	# MTUs
AC was limiting MC	508
AC < 0 MW	18
AC = 0 MW	421
AC > 0 MW	69

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-3005.11	115.09
Min.	-7958.00	0.00
Max.	0.00	2772.00

