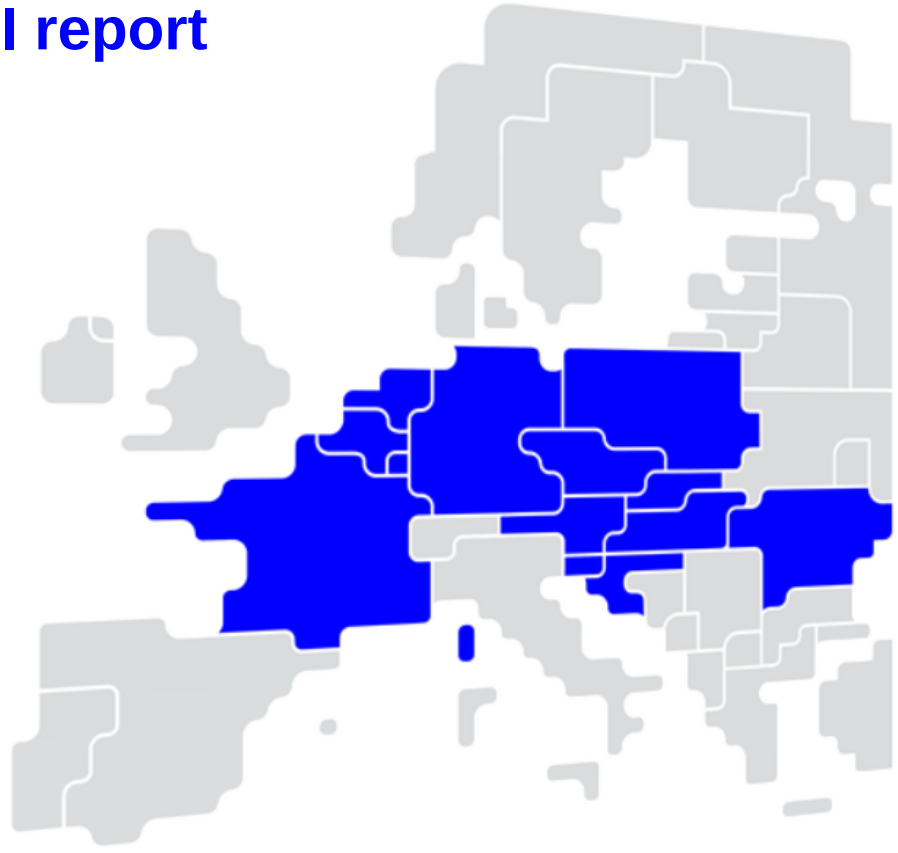
Core FB MC Operational KPI report

June 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
- KPI 6: Virtual margins at market balance for CORE TSOs
- KPI 7: Non-Core exchanges delta flow

Non-costly Remedial Action Optimization Analysis

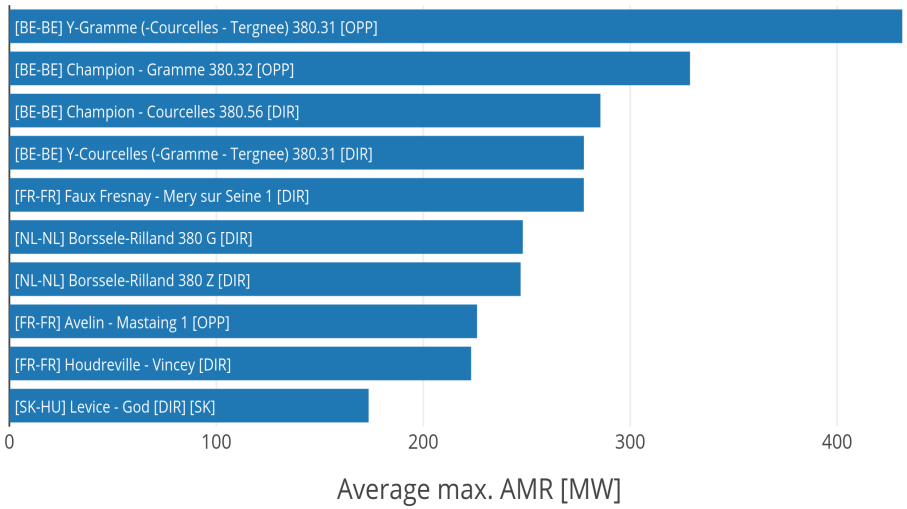
- KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode
- KPI 9: Most limiting CNEC per TSO (NRAO)
- KPI 10: Average variation of relative RAM before and after NRAO

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)

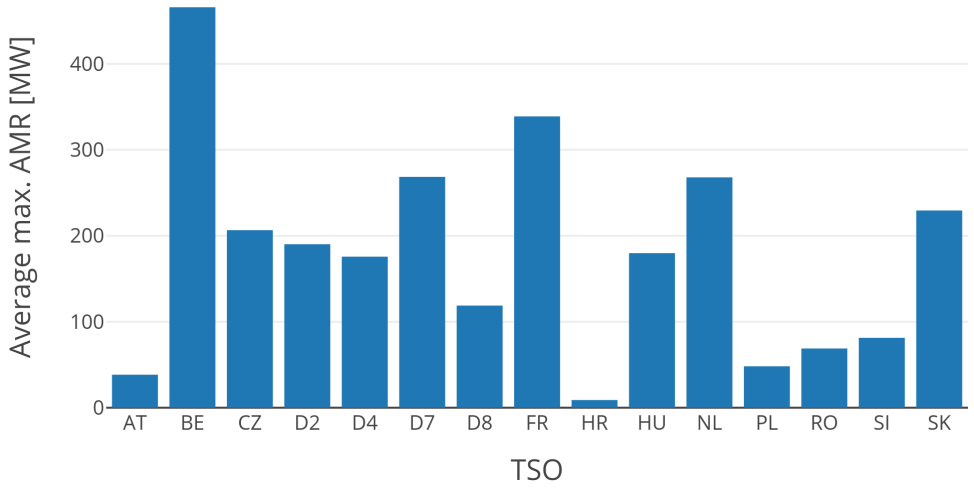
CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[BE-BE] Y-Gramme (-Courcelles - Tergnee) 380.31 [OPP]	431.47	29.51%
[BE-BE] Champion - Gramme 380.32 [OPP]	328.90	17.77%
[BE-BE] Champion - Courcelles 380.56 [DIR]	285.60	16.01%
[BE-BE] Y-Courcelles (-Gramme - Tergnee) 380.31 [DIR]	277.61	18.97%
[FR-FR] Faux Fresnay - Mery sur Seine 1 [DIR]	277.58	16.94%
[NL-NL] Borssele-Rilland 380 G [DIR]	248.10	5.48%
[NL-NL] Borssele-Rilland 380 Z [DIR]	247.03	5.46%
[FR-FR] Avelin - Mastaing 1 [OPP]	225.98	12.69%
[FR-FR] Houdreville - Vincey [DIR]	223.12	0.83%
[SK-HU] Levice - God [DIR] [SK]	173.58	12.52%



KPI 2: Average maximum AMR per TSO

TSO	Average maximum AMR per TSO
AT	38.43
BE	465.87
CZ	206.52
D2	190.15
D4	175.78
D7	268.57
D8	118.75
FR	338.88
HR	8.91
HU	179.86

TSO	Average maximum AMR per TSO
NL	268.04
PL	48.14
RO	68.81
SI	81.32
SK	229.44

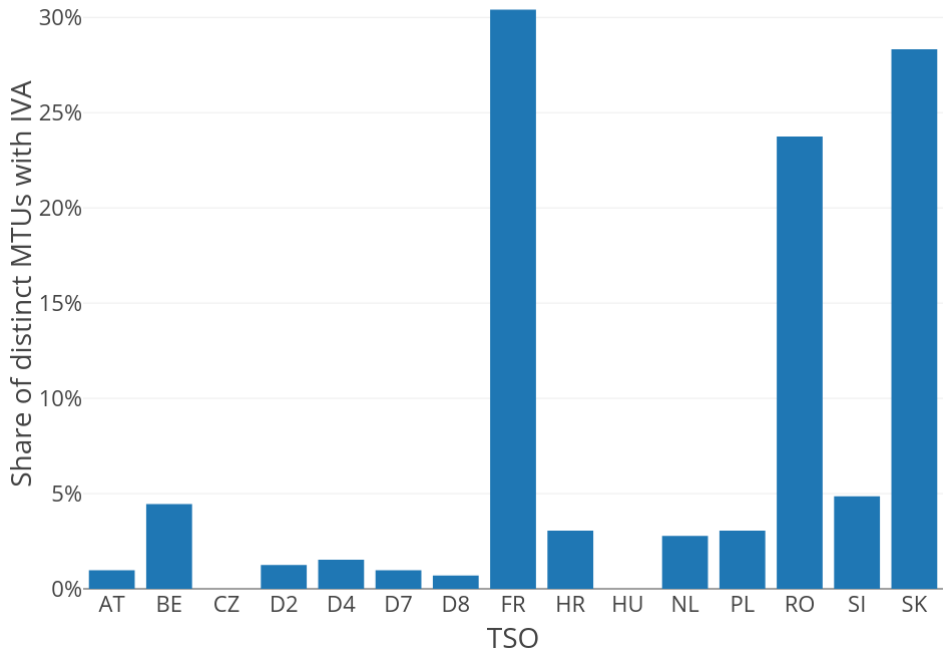


KPI 3: Share of MTUs with intervention per TSO

Total BDs	Total MTUs	MTUs without IVA	Share of distinct MTUs without IVA	MTUs with IVA	Share of distinct MTUs with IVA
30	720	222	30.83%	498	69.2%

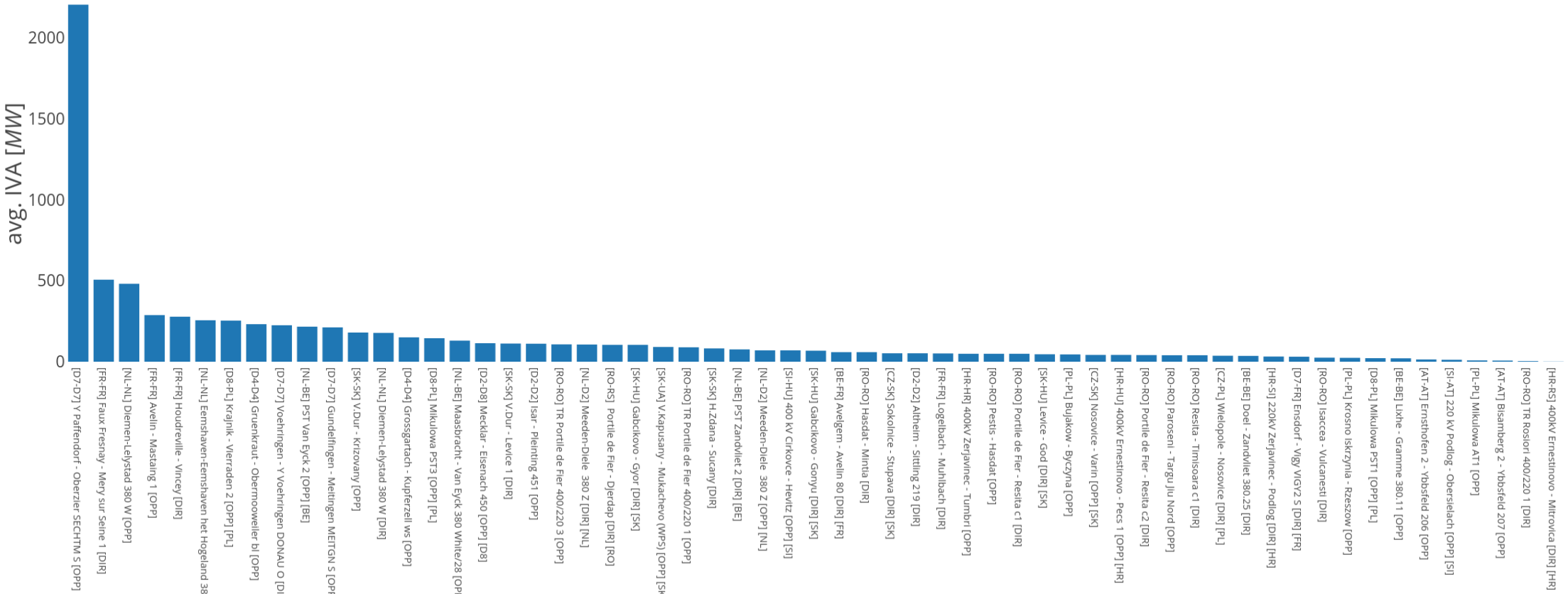
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	0.97%	7
BE	4.44%	32
CZ	0.00%	0
D2	1.25%	9
D4	1.53%	11
D7	0.97%	7
D8	0.69%	5
FR	30.42%	219
HR	3.06%	22
HU	0.00%	0

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
NL	2.78%	20
PL	3.06%	22
RO	23.75%	171
SI	4.86%	35
SK	28.33%	204



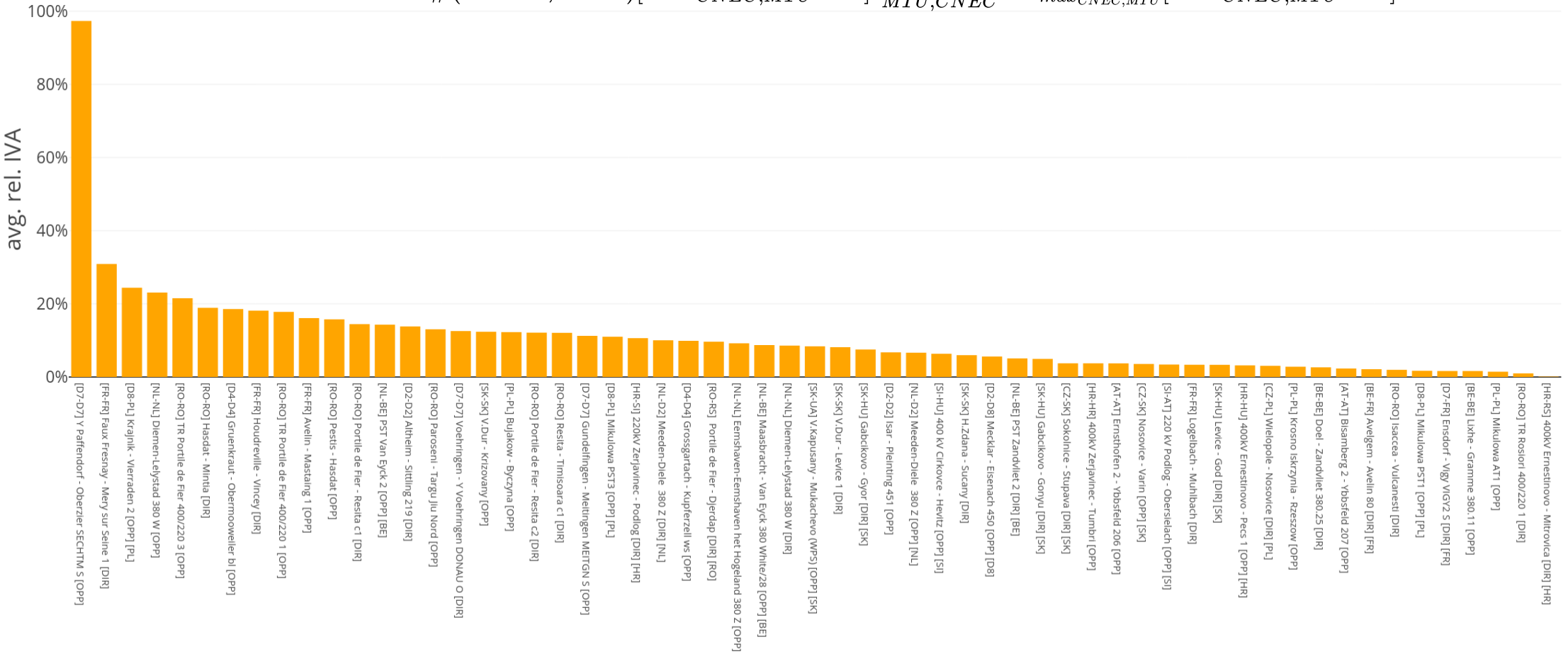
KPI 4a: Average IVA applied for each CNE affected by TSO intervention

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

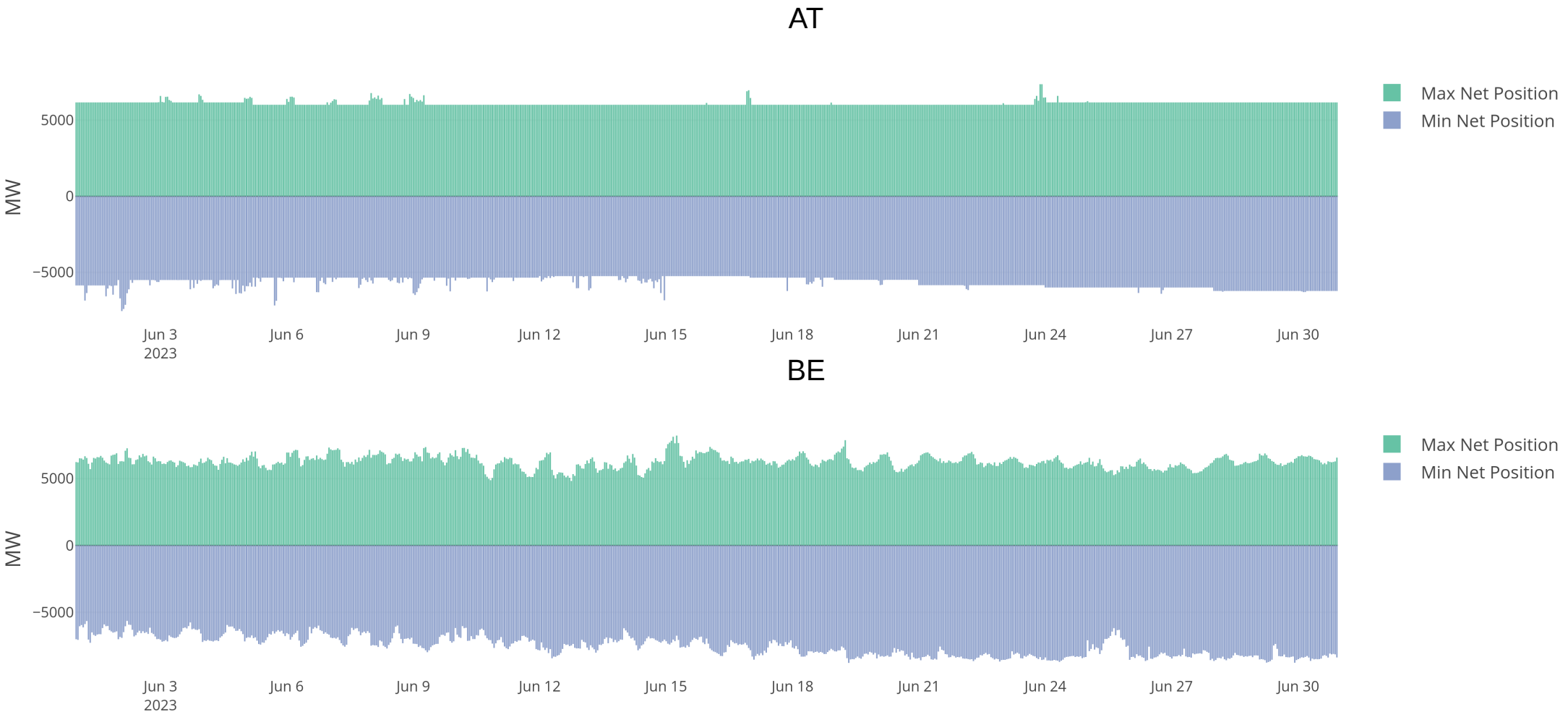


KPI 4b: Average relative IVA applied for each CNE affected by TSO intervention

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



KPI 5: Min & max net positions per BZ hub



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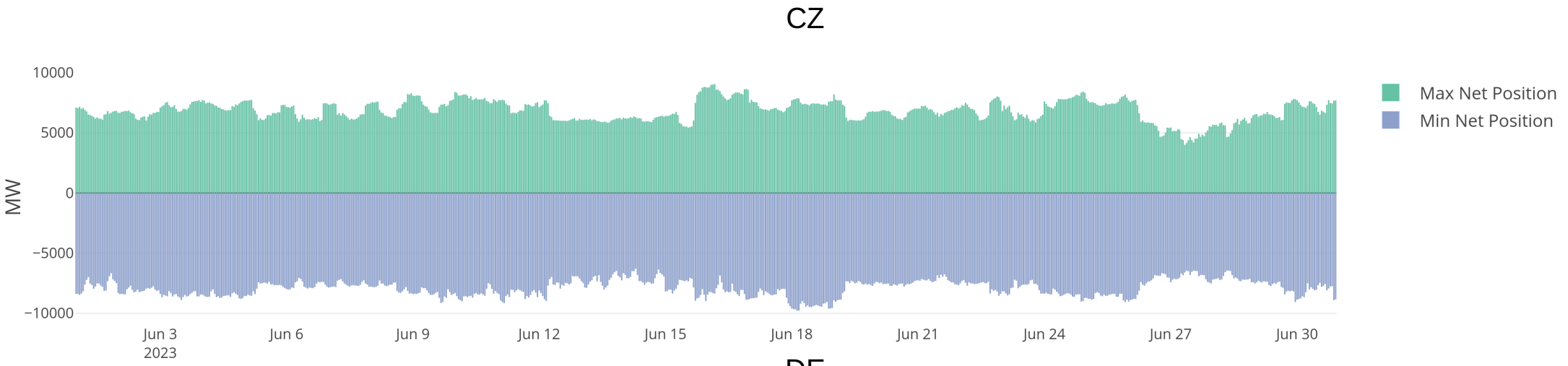
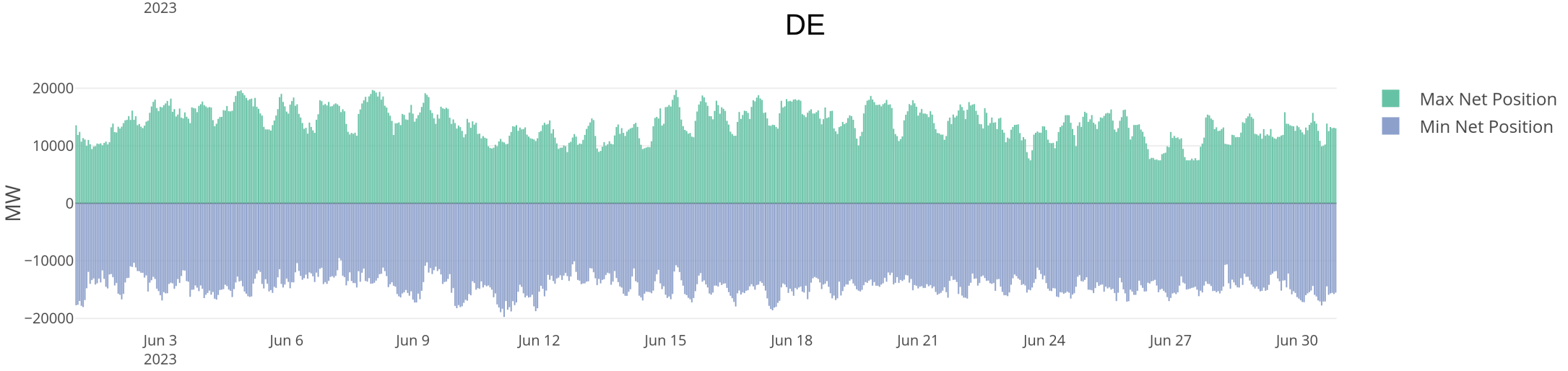
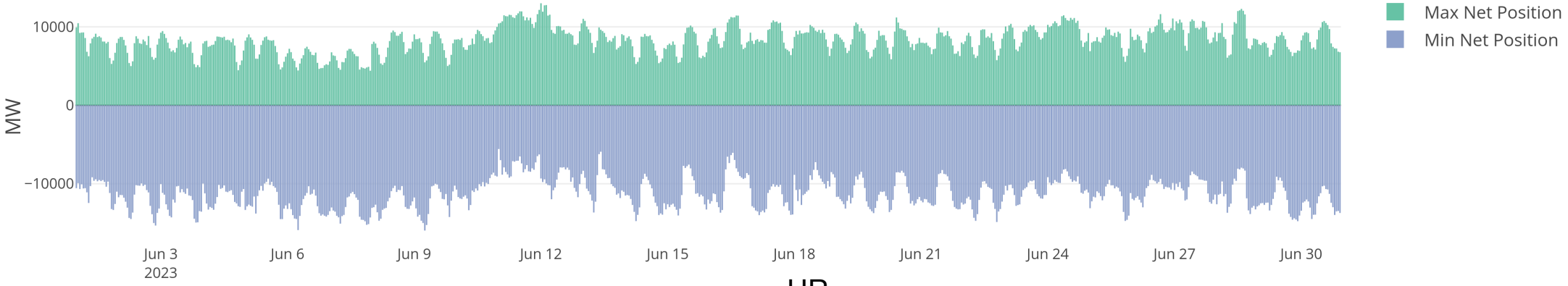


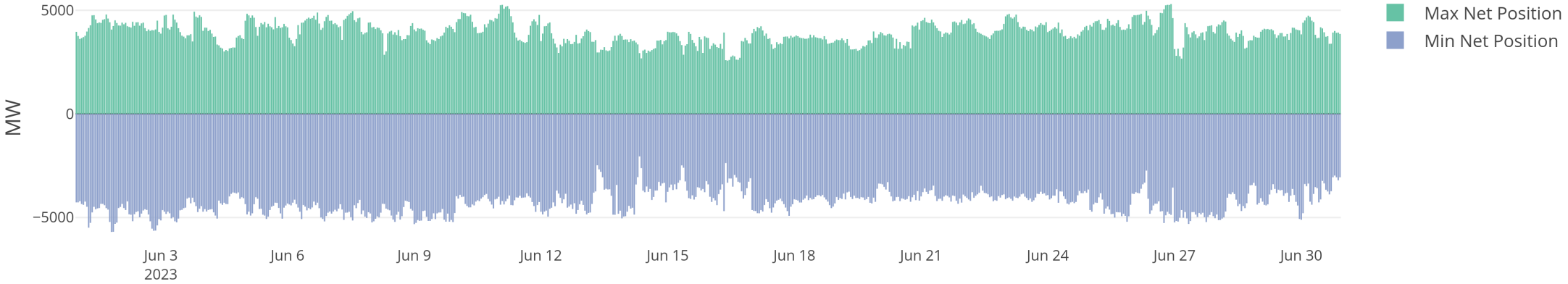


KPI 5: Min & max net positions per BZ hub

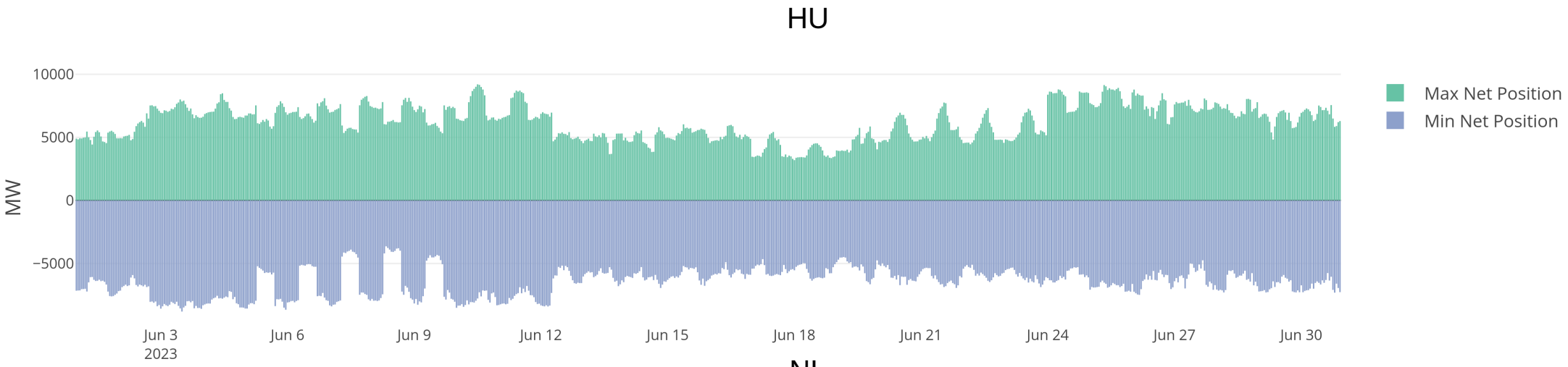
FR

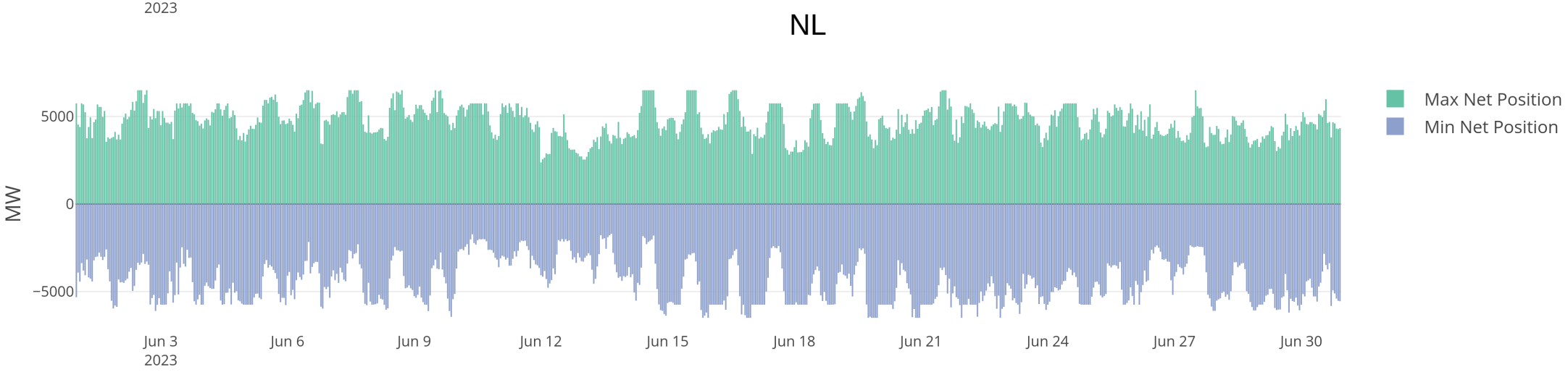


HR

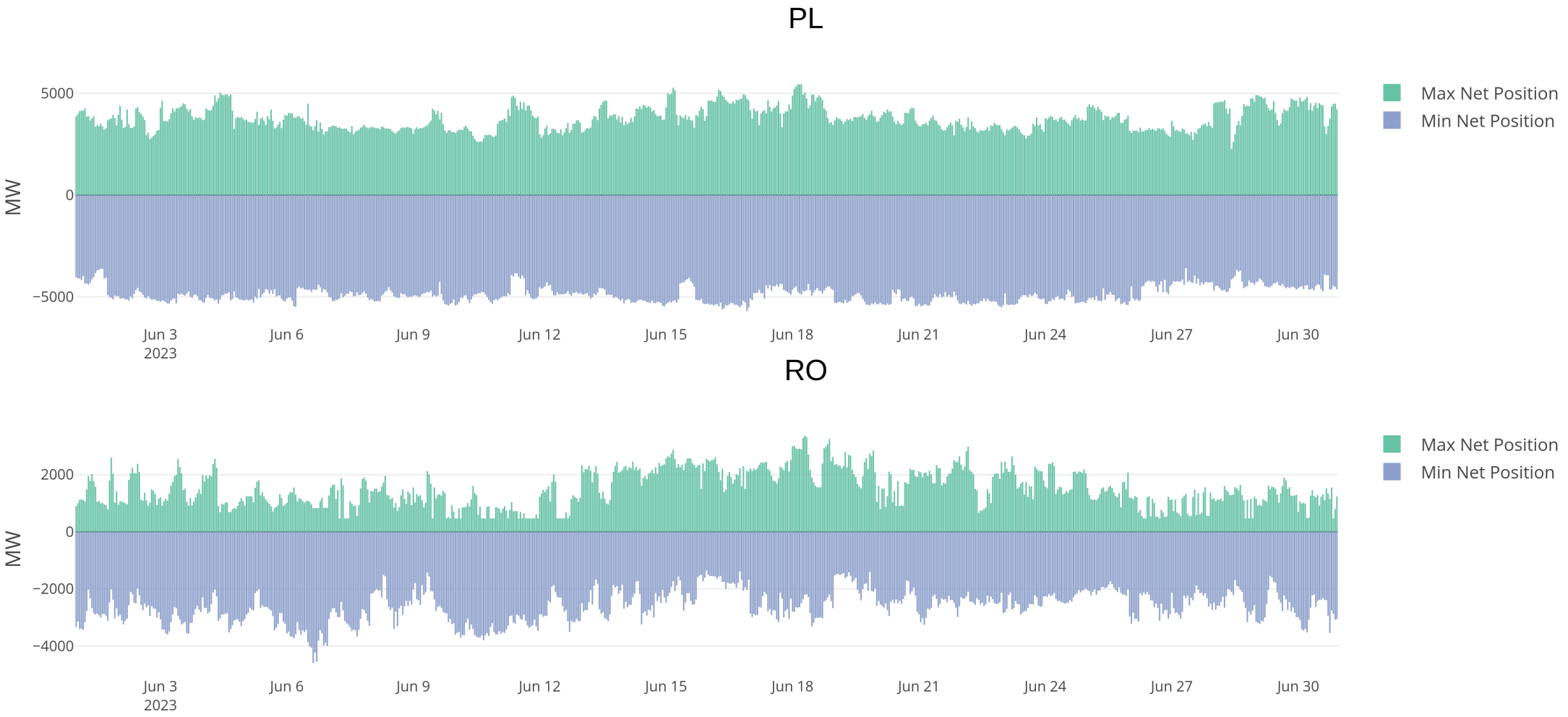


KPI 5: Min & max net positions per BZ hub

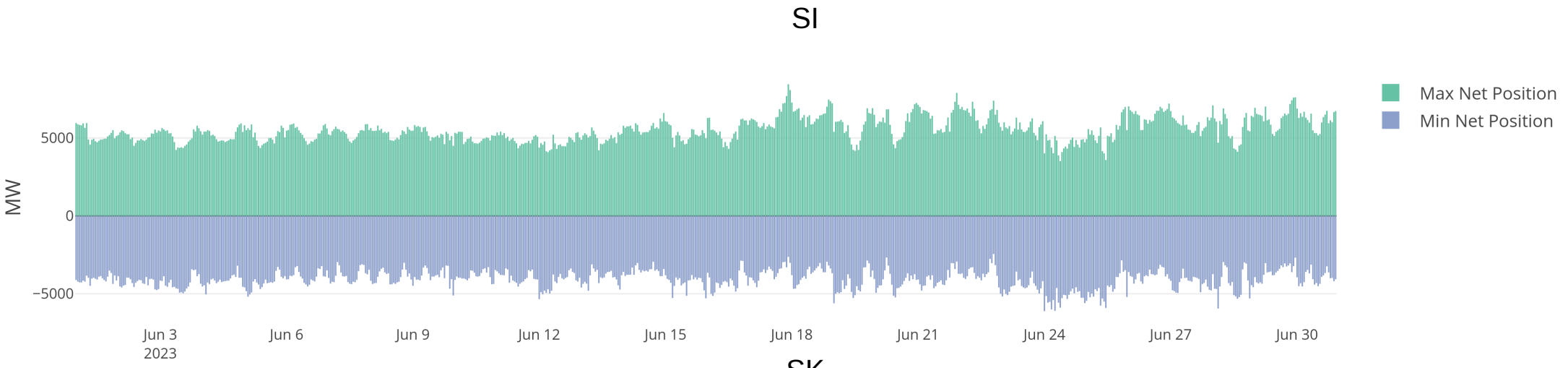


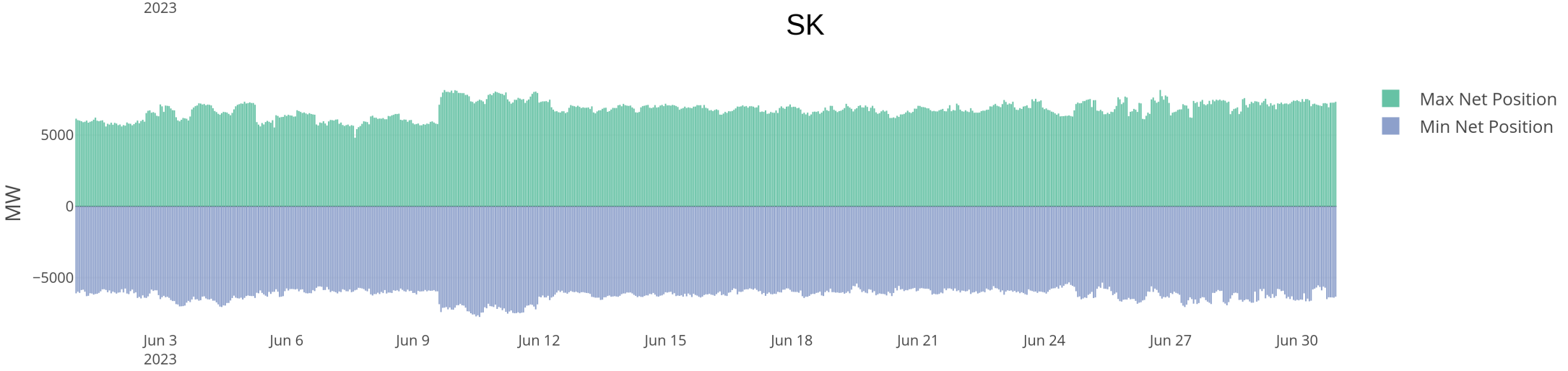


KPI 5: Min & max net positions per BZ hub

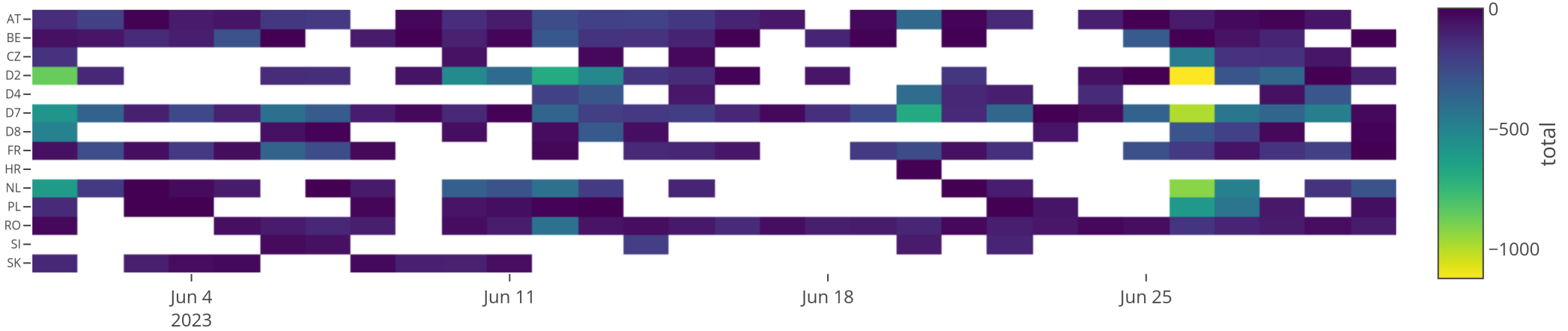


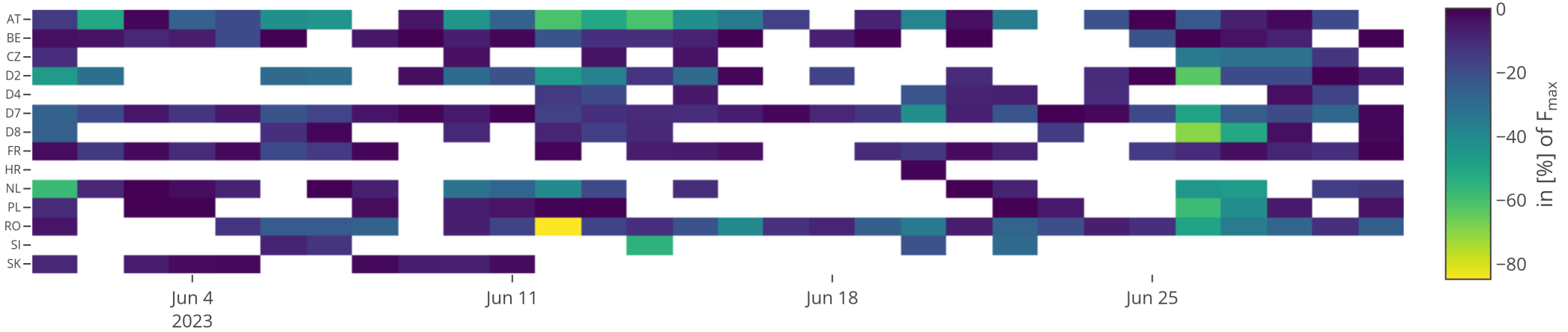
KPI 5: Min & max net positions per BZ hub



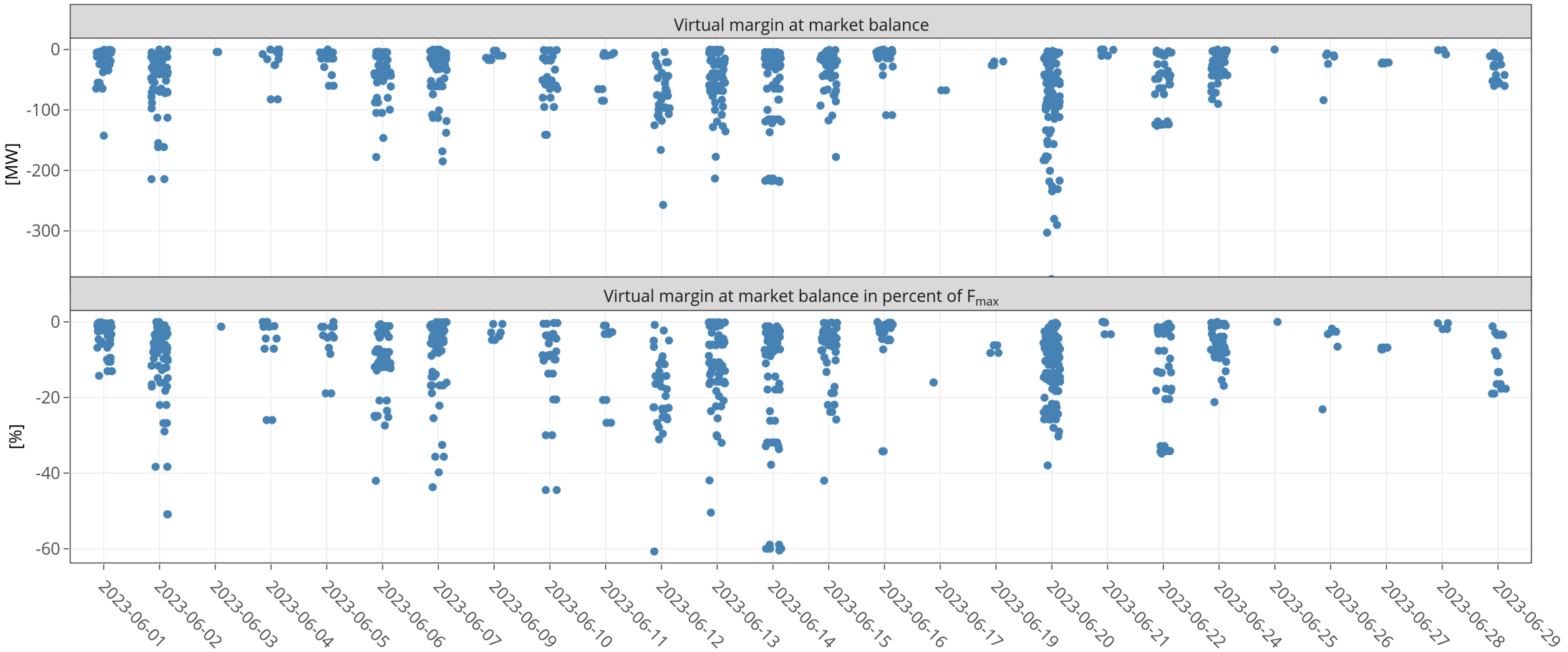


KPI 6a: Highest virtual margins at market balance for CORE TSOs

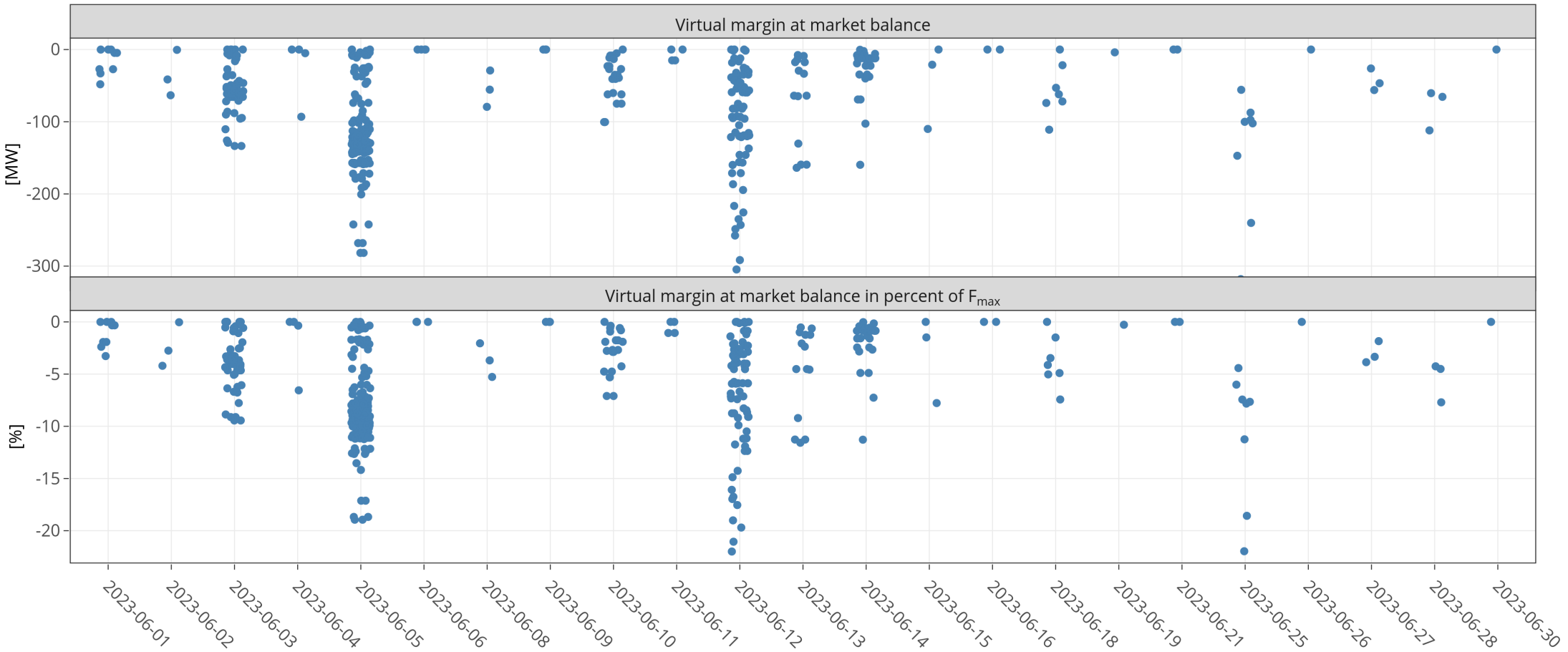




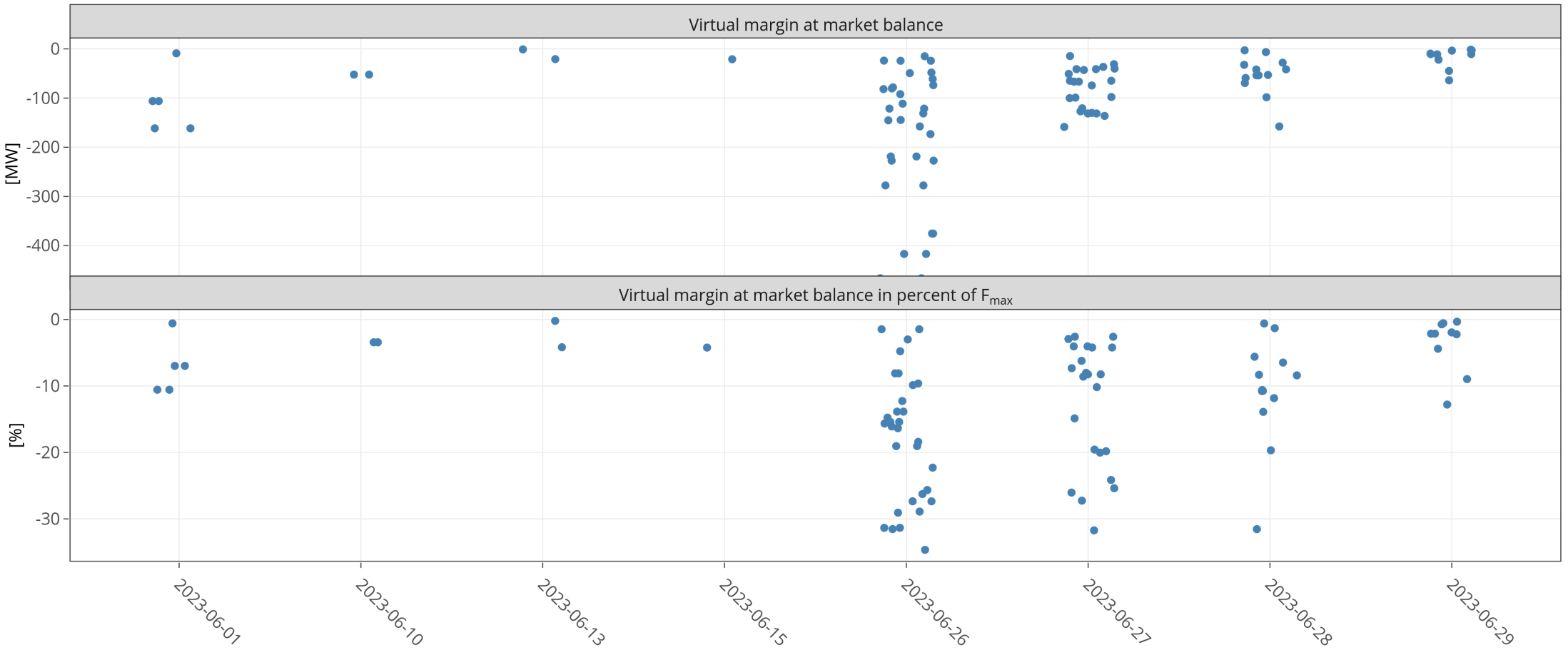
KPI 6b: Virtual margins at market balance AT



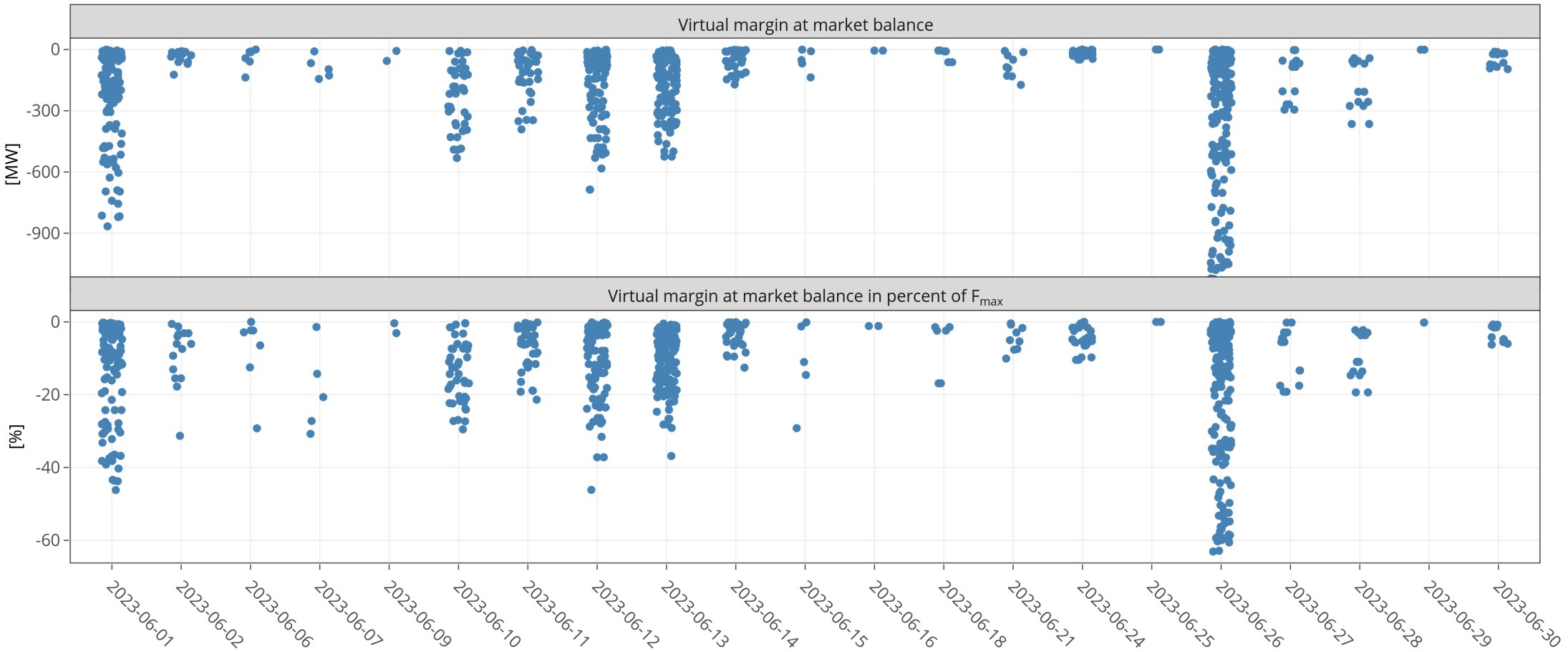
KPI 6b: Virtual margins at market balance BE



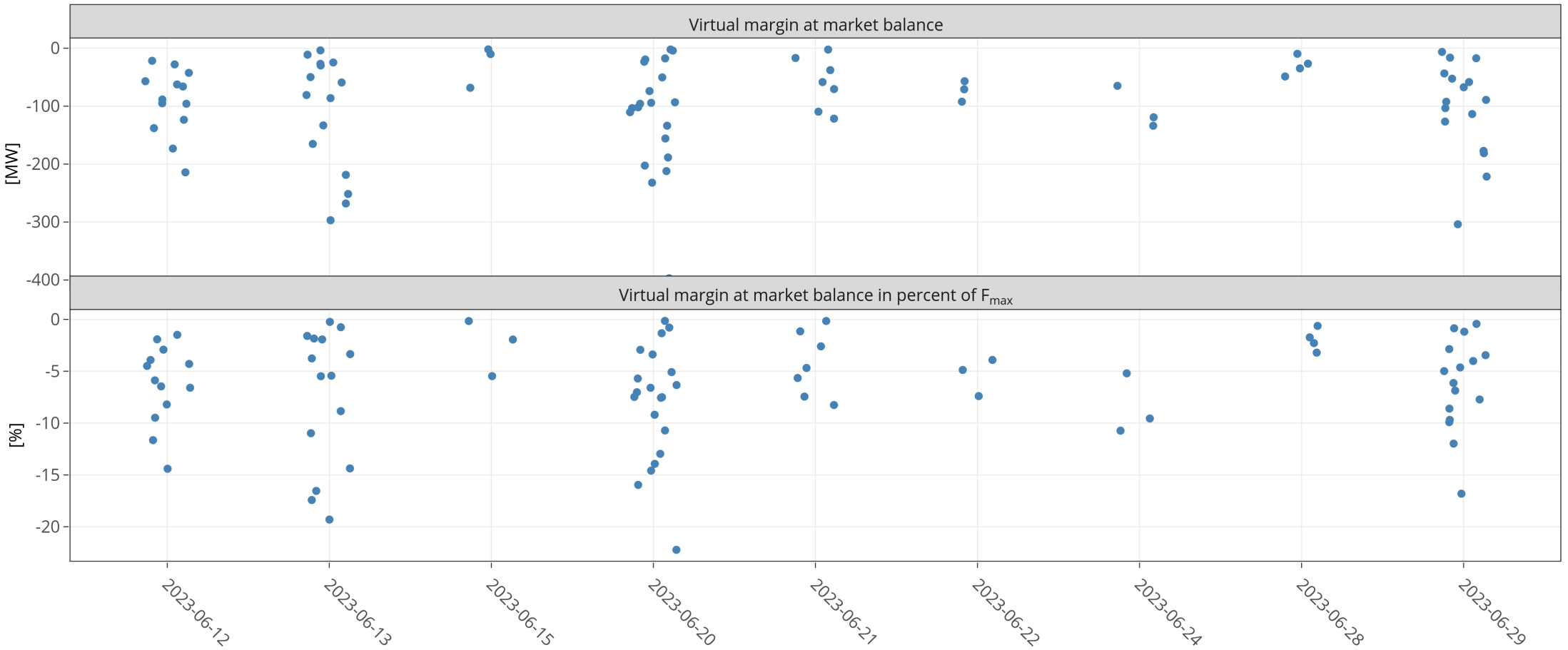
KPI 6b: Virtual margins at market balance CZ



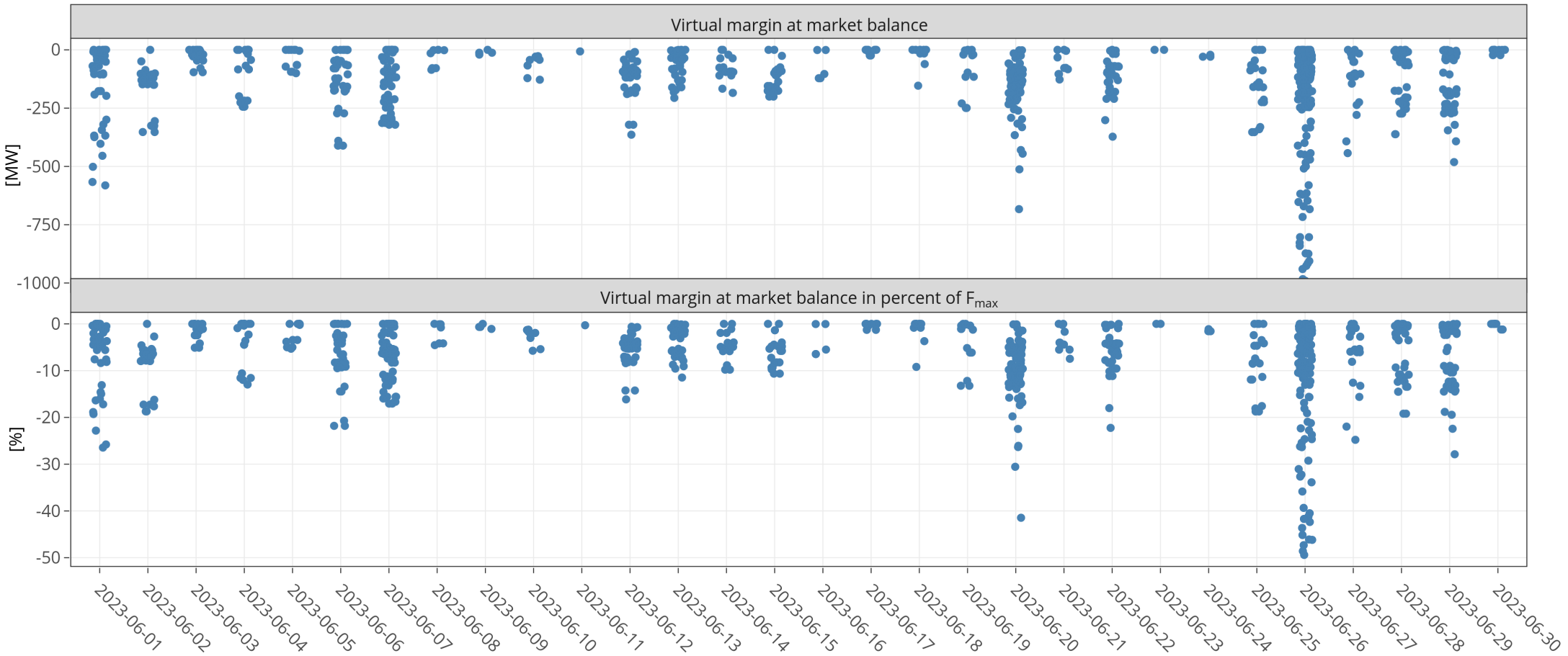
KPI 6b: Virtual margins at market balance D2



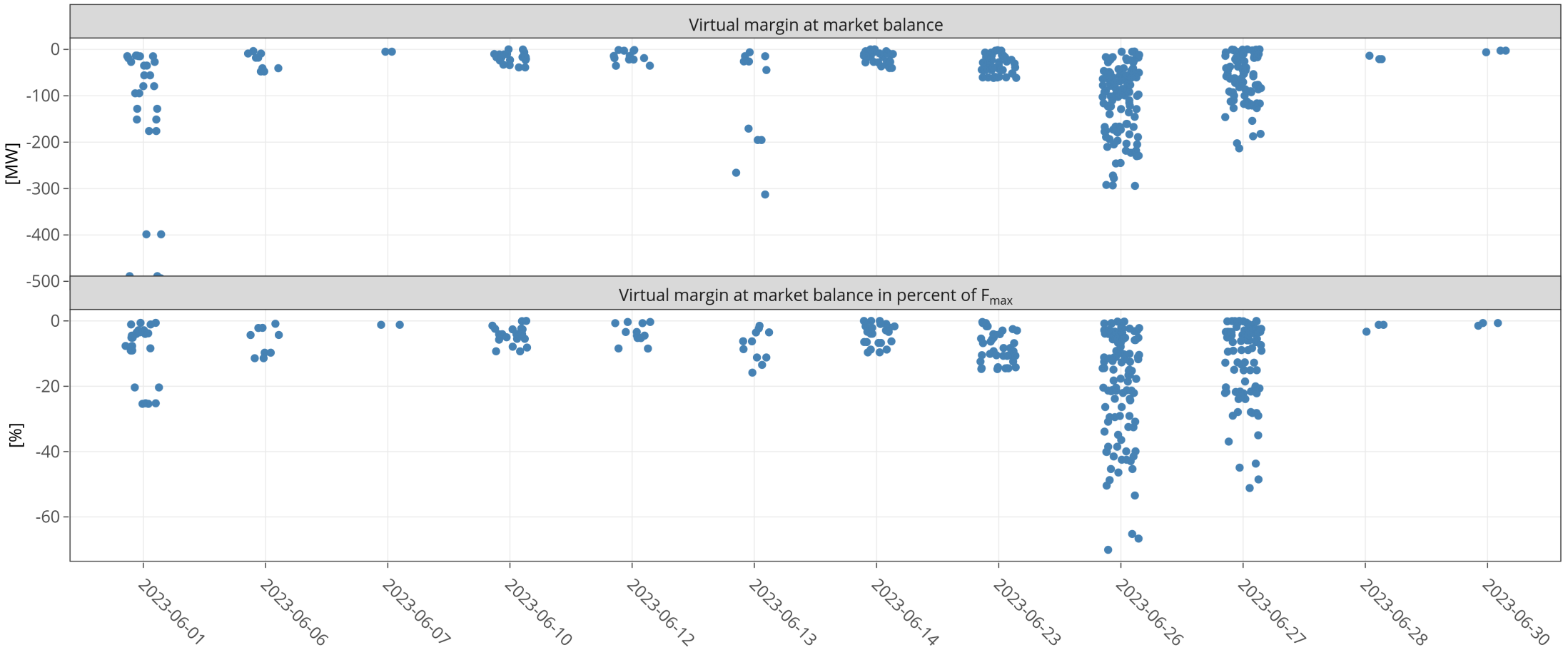
KPI 6b: Virtual margins at market balance D4



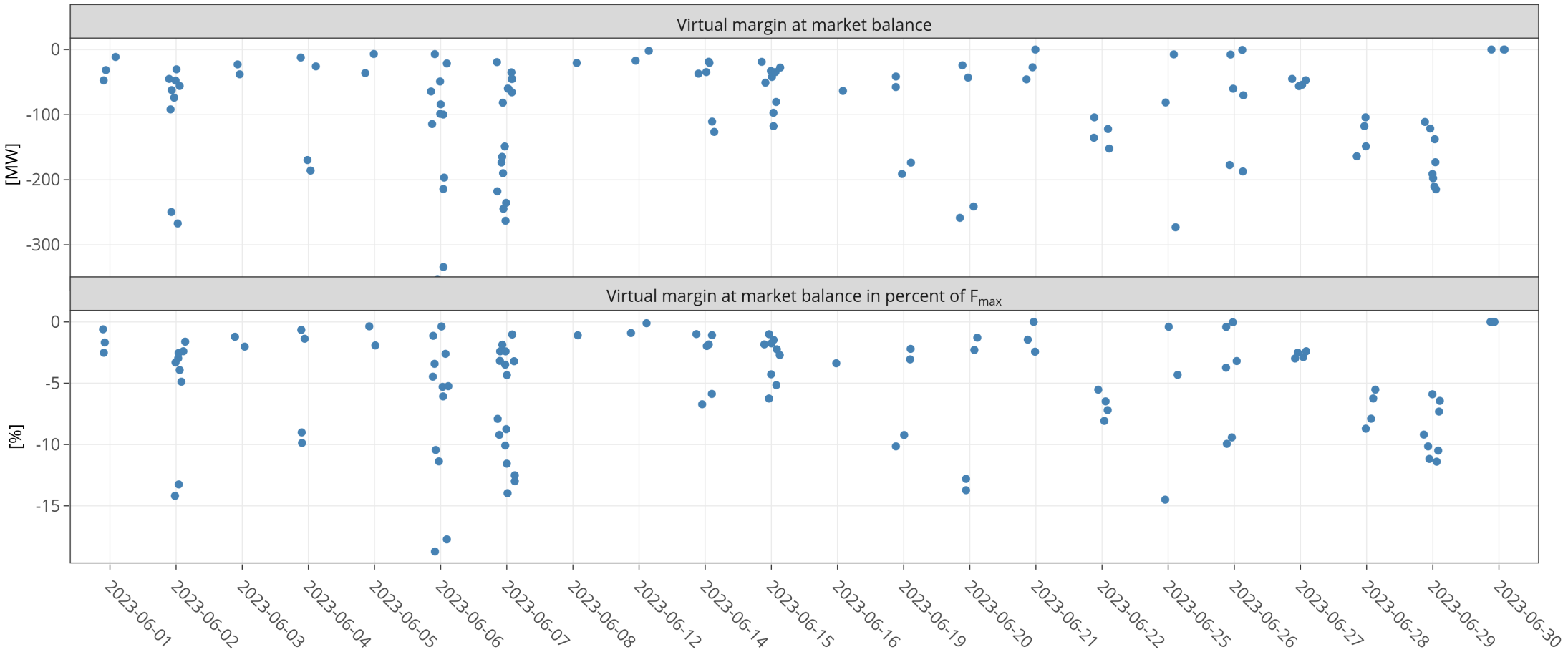
KPI 6b: Virtual margins at market balance D7



KPI 6b: Virtual margins at market balance D8

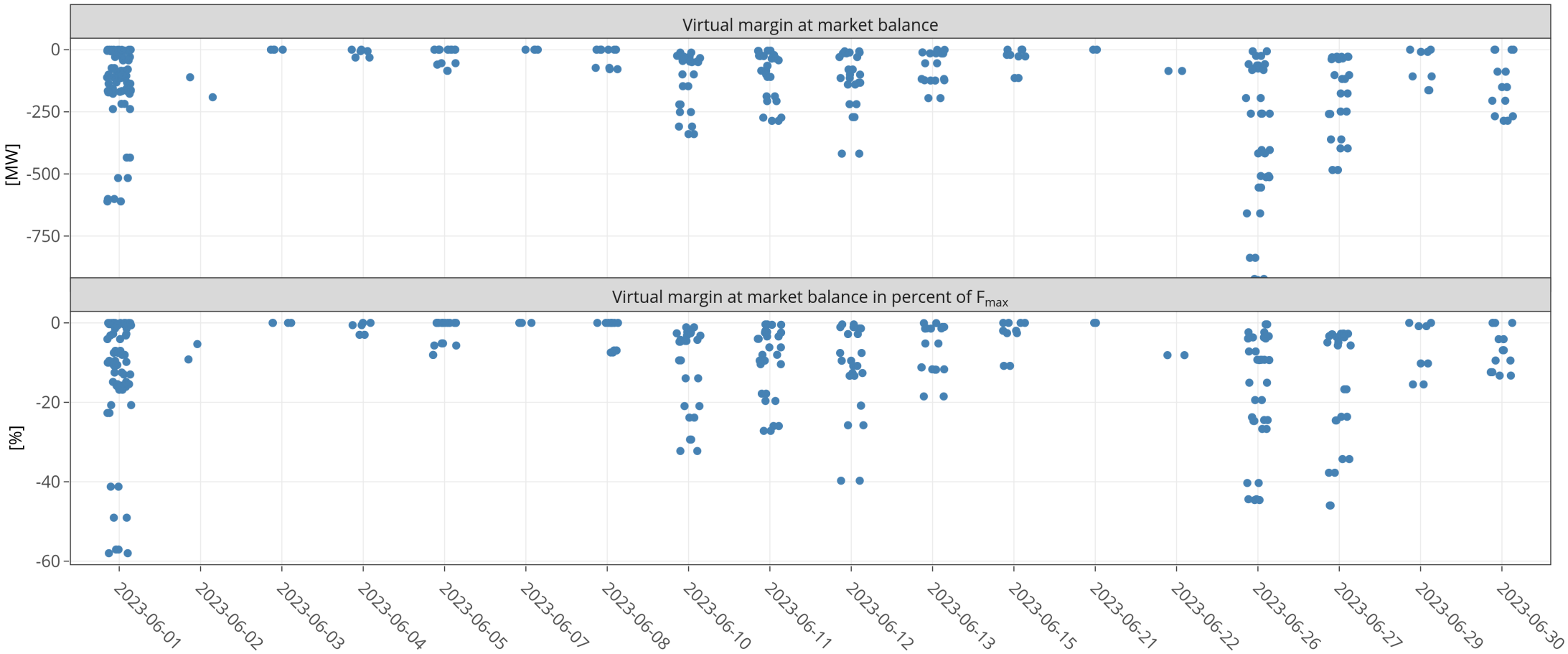


KPI 6b: Virtual margins at market balance FR

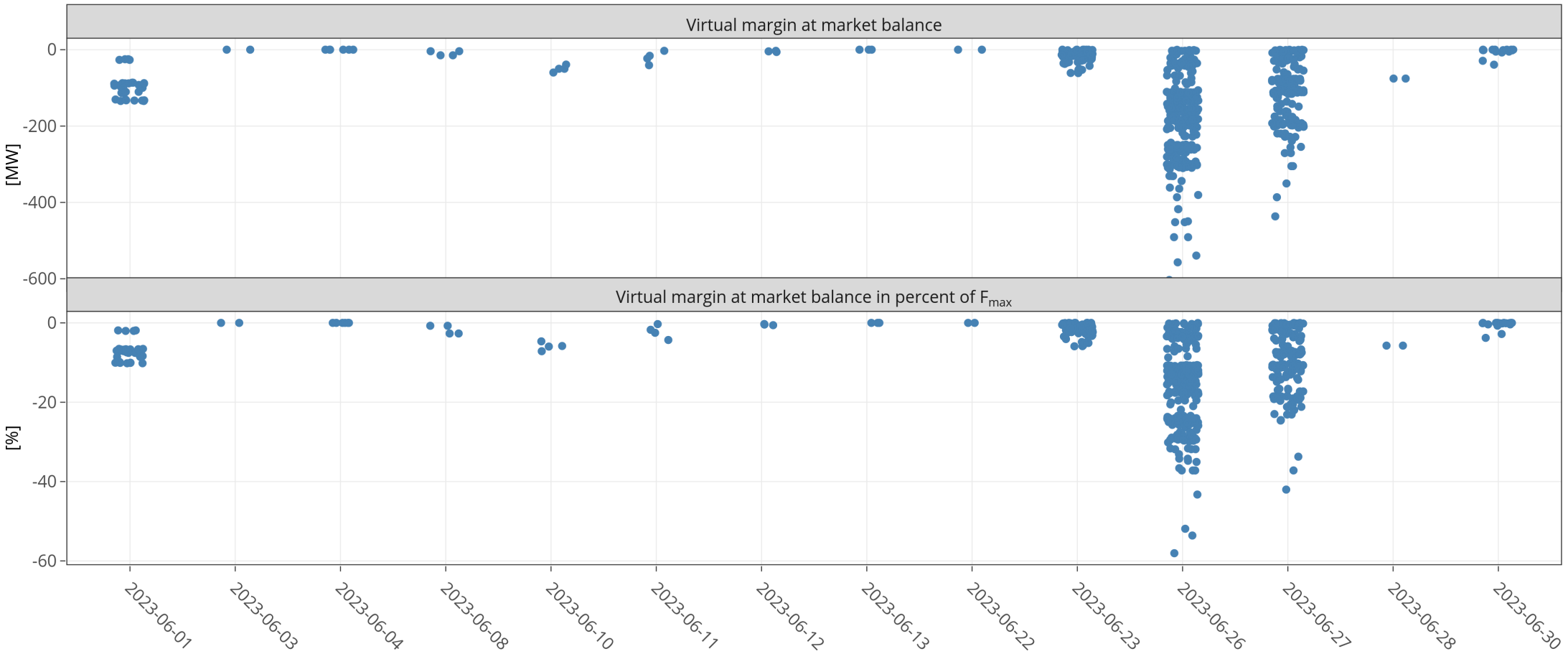


KPI 6b: Virtual margins at market balance HR

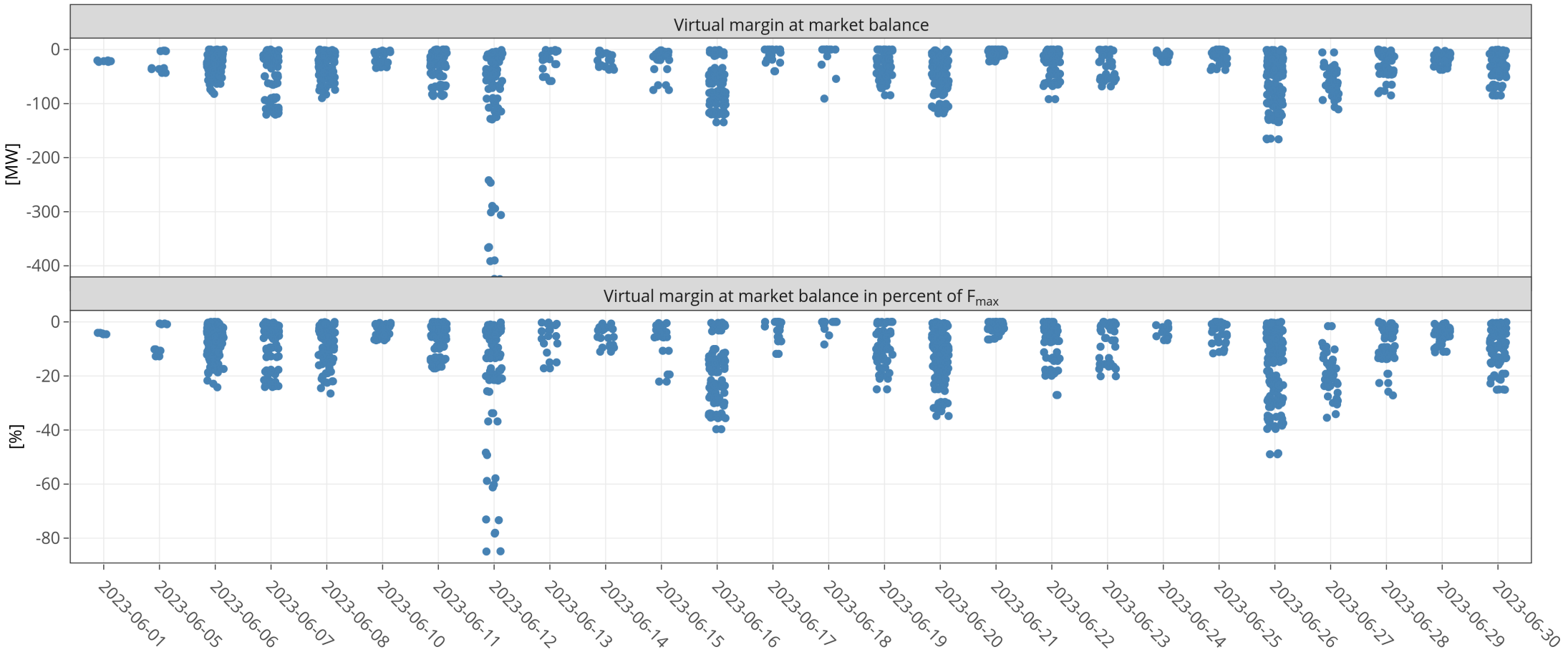
KPI 6b: Virtual margins at market balance NL



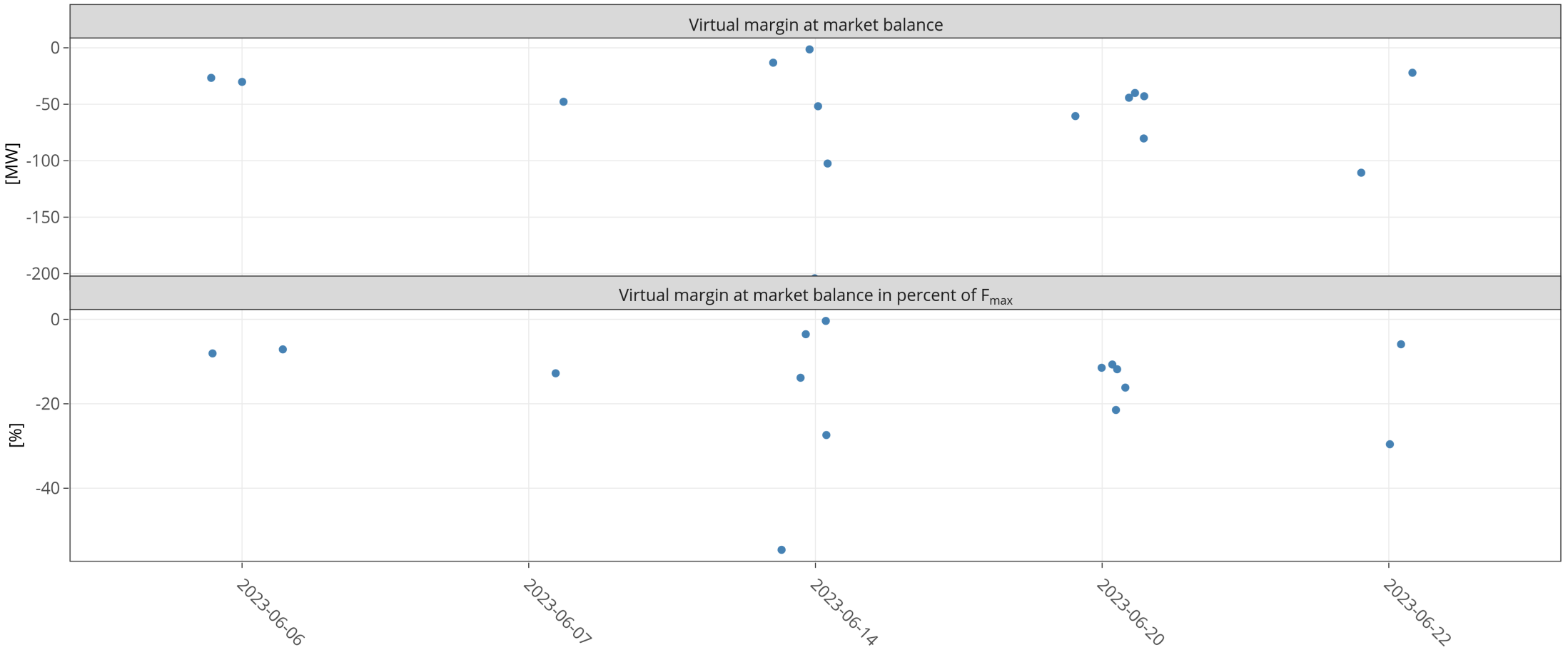
KPI 6b: Virtual margins at market balance PL



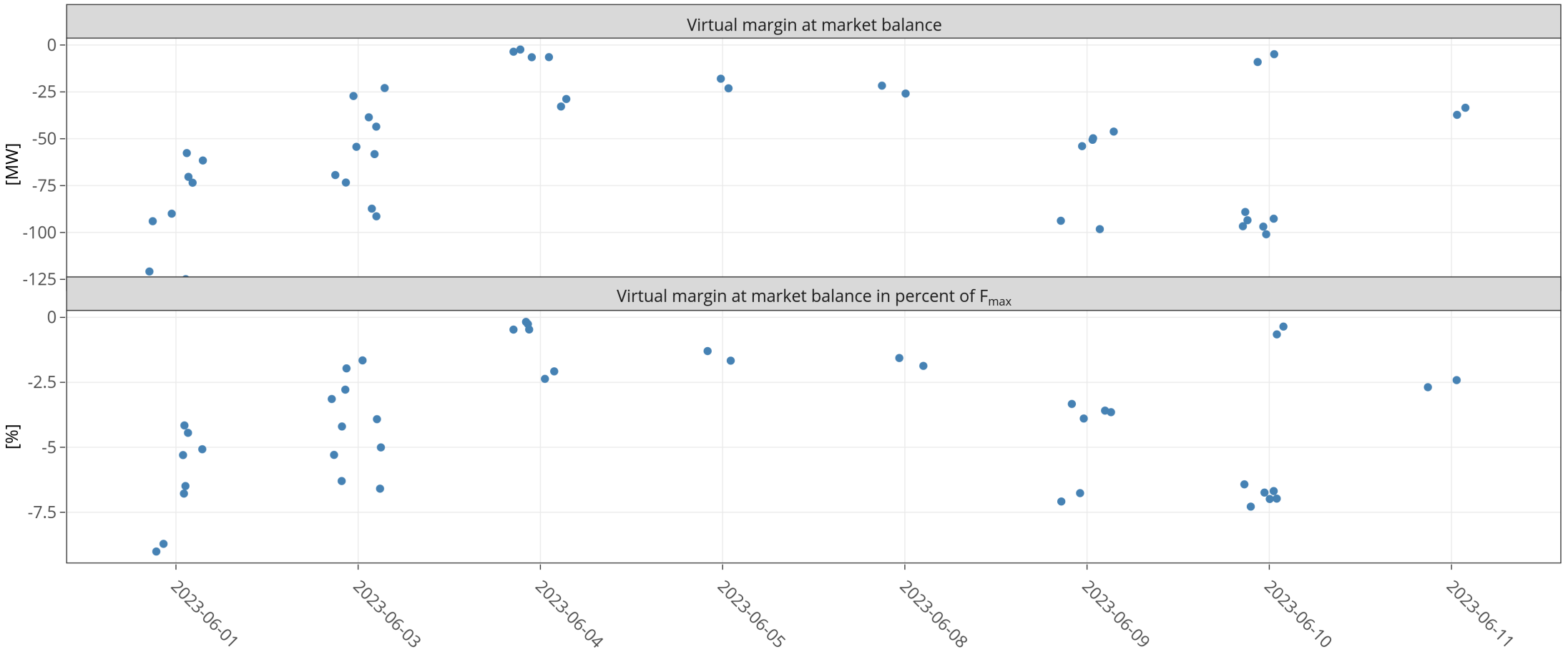
KPI 6b: Virtual margins at market balance RO



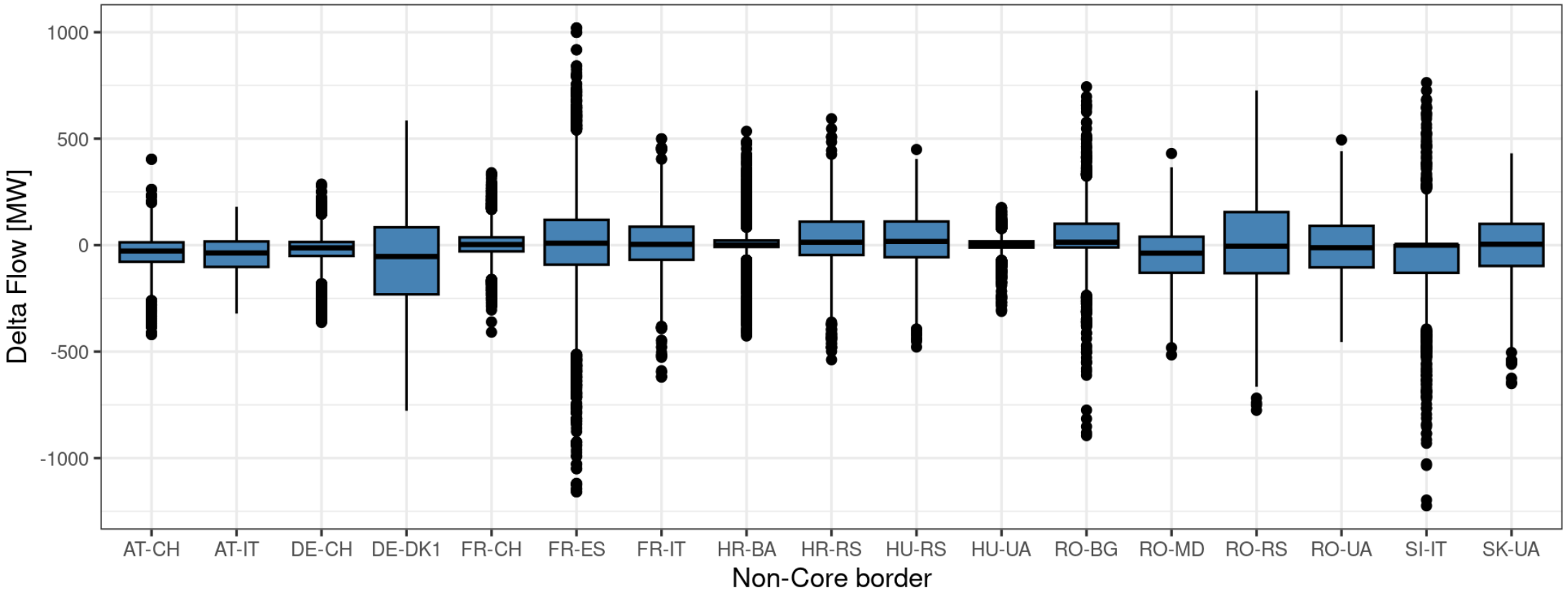
KPI 6b: Virtual margins at market balance SI



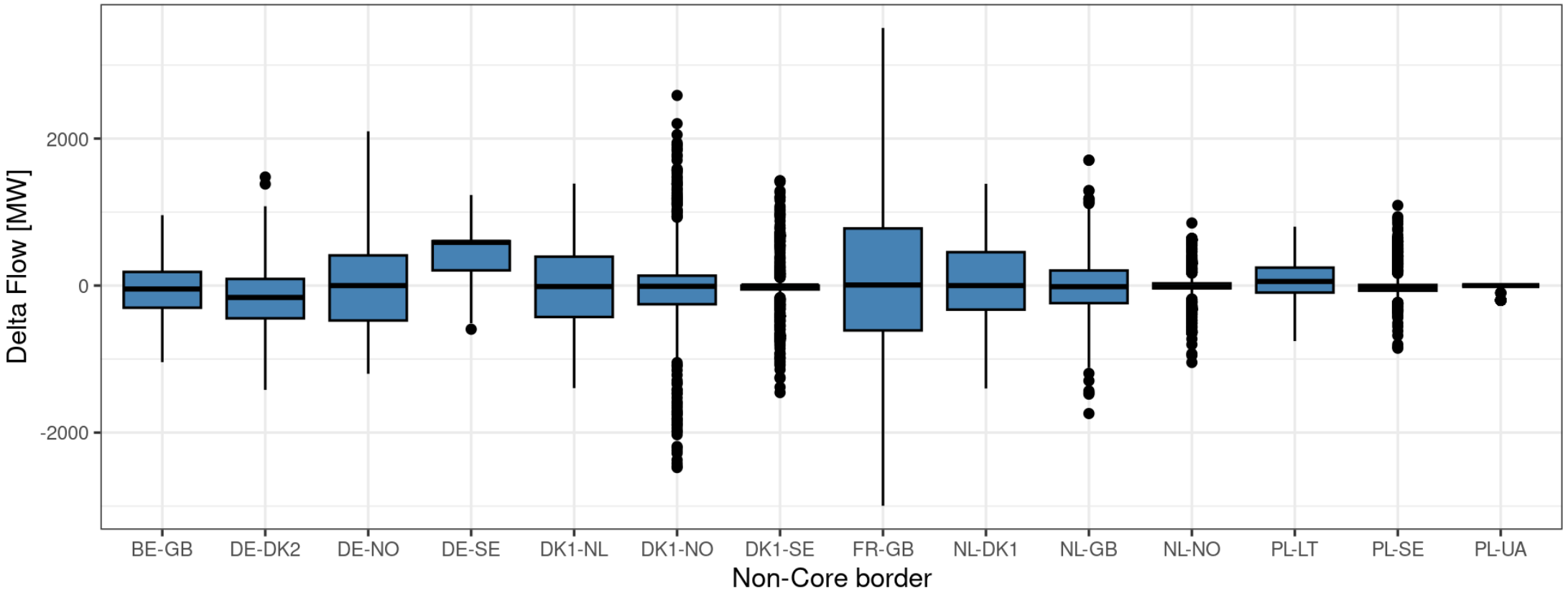
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow

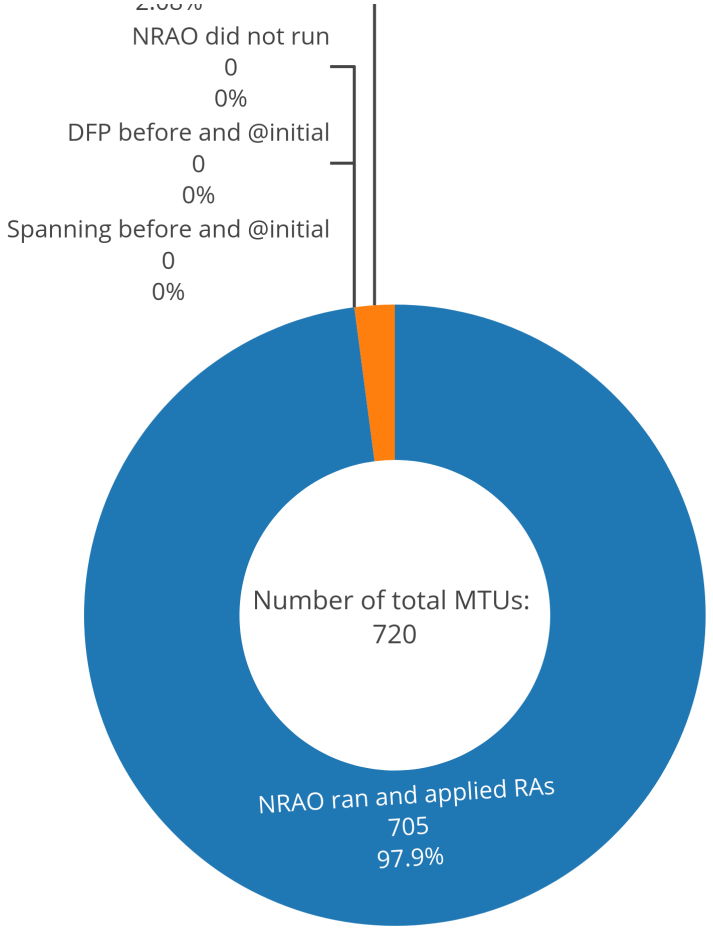


KPI 7: Non-Core exchanges DC delta flow

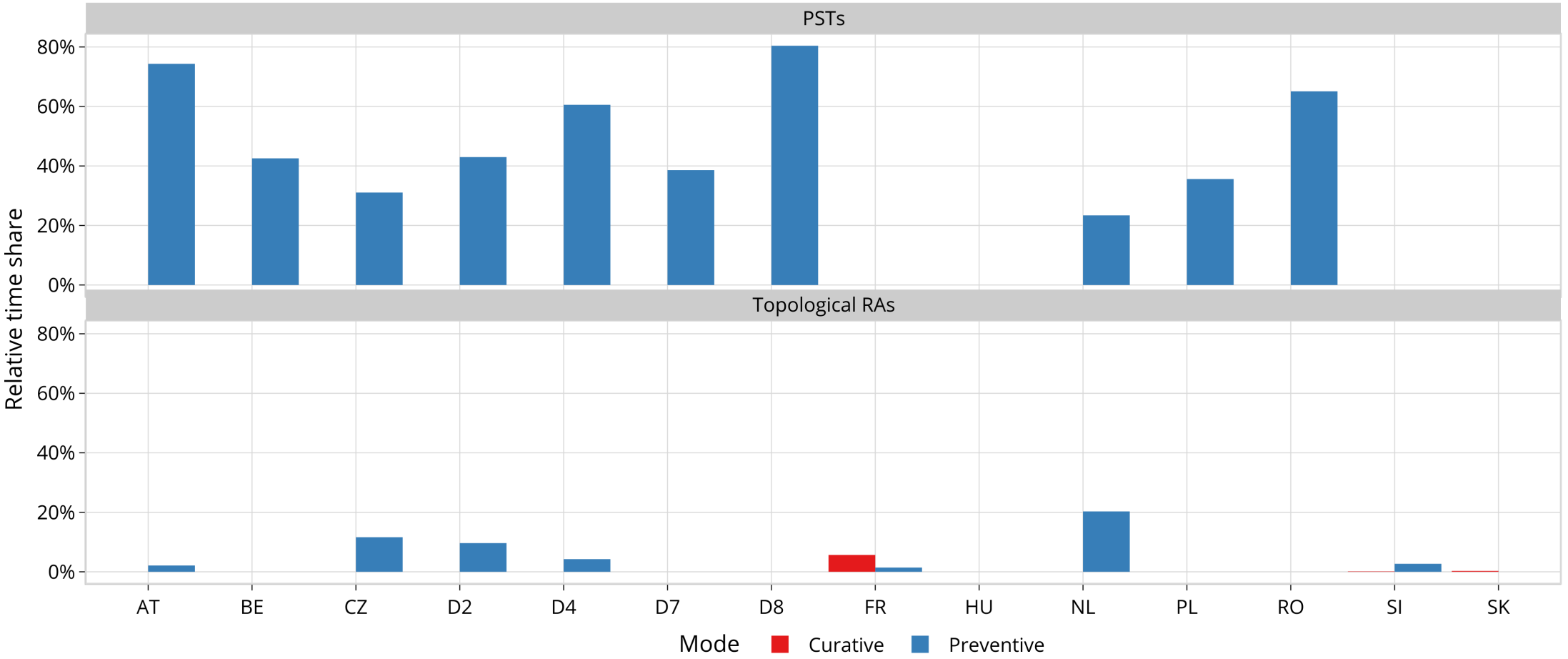


KPI 8: NRAO – Applied Remedial Action

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

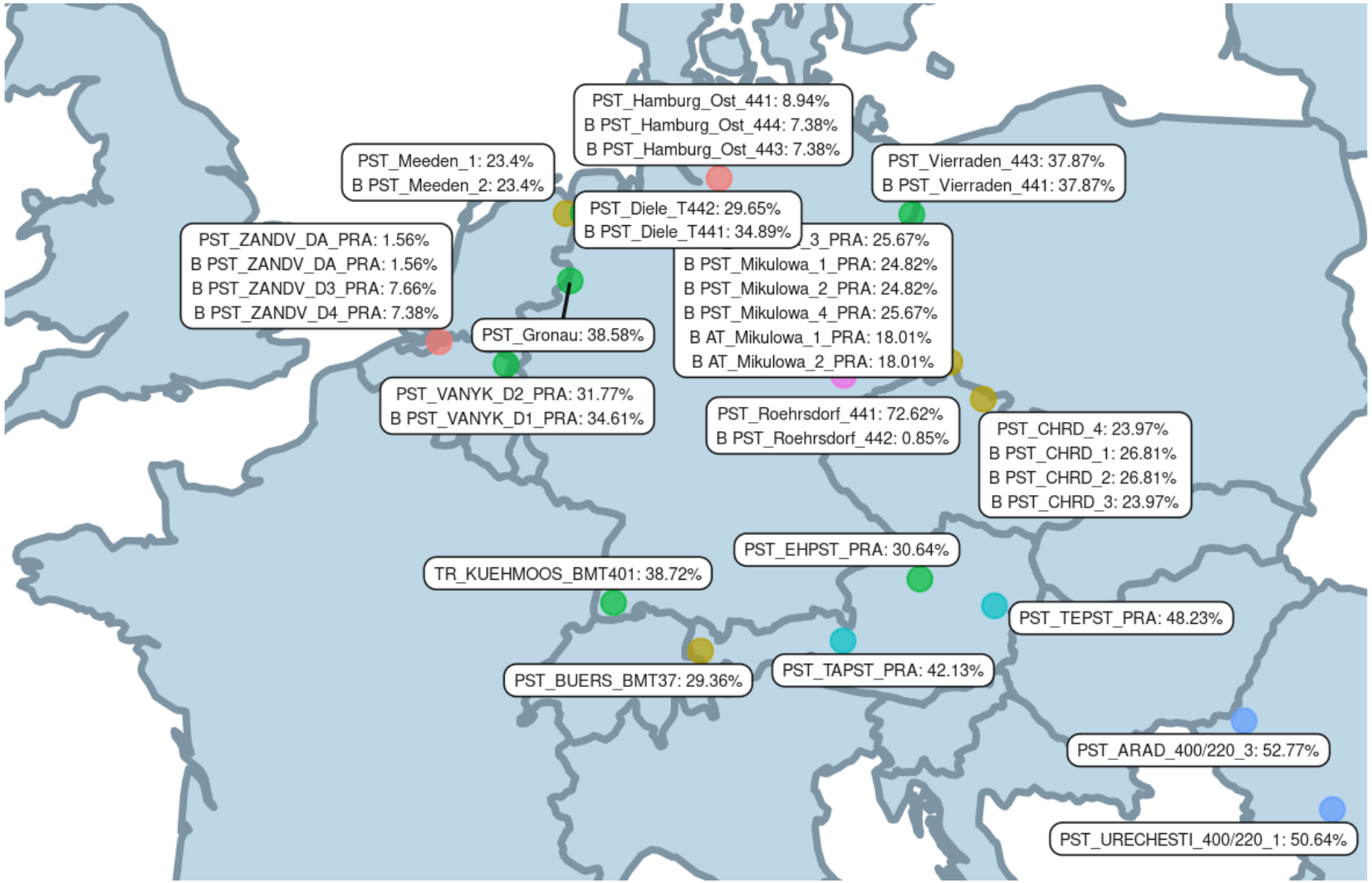


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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

Relative Time Share of Applied PSTs in Preventive Mode

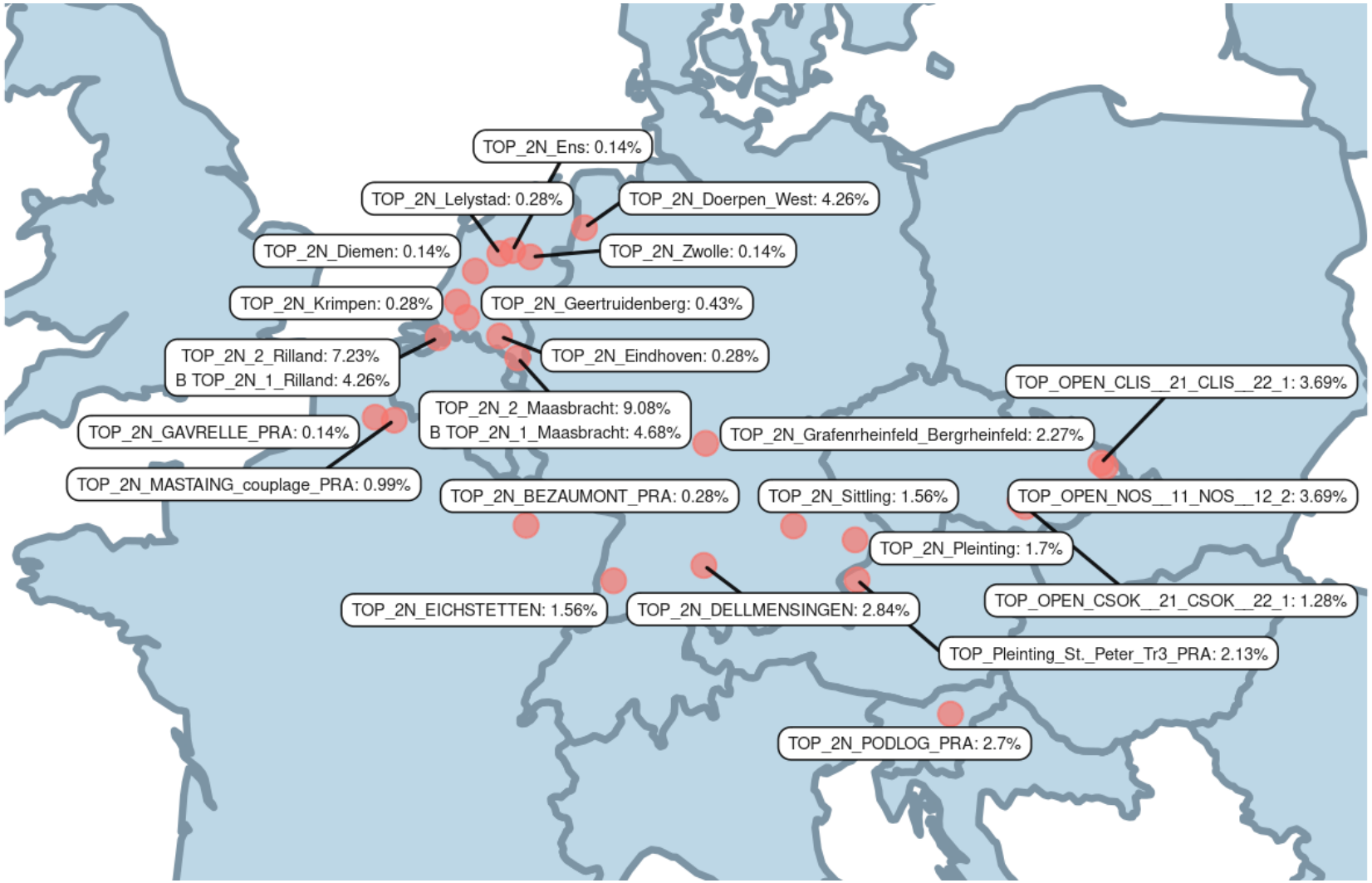


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied PSTs in Curative Mode

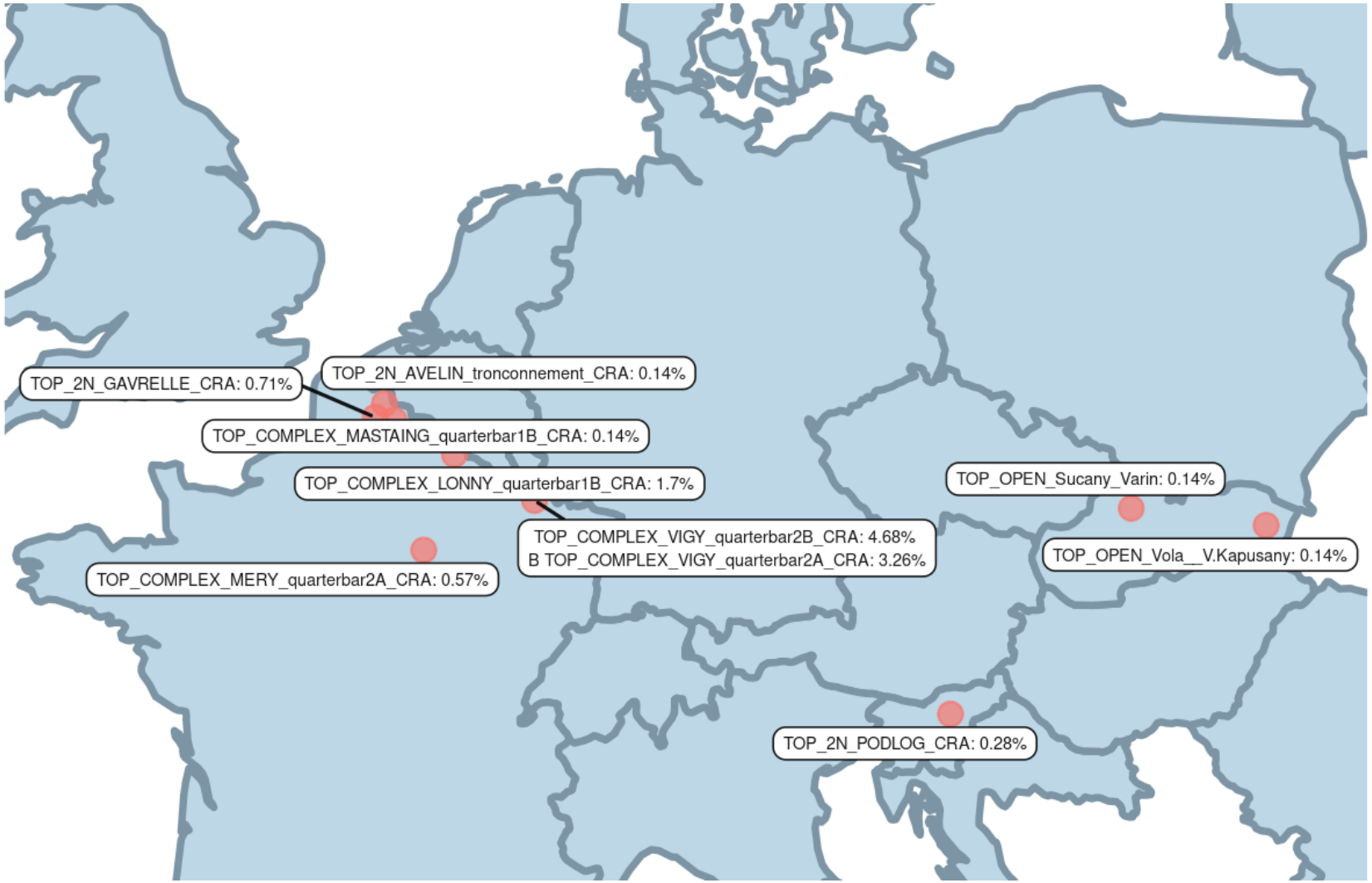
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied Topological RAs in Preventive Mode



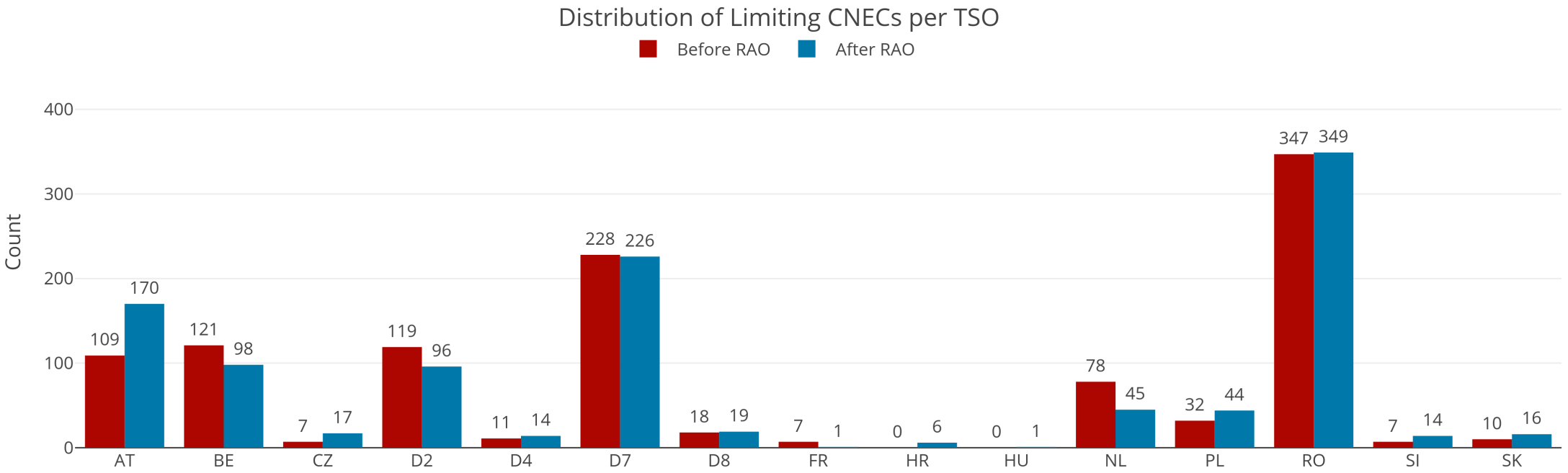
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

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



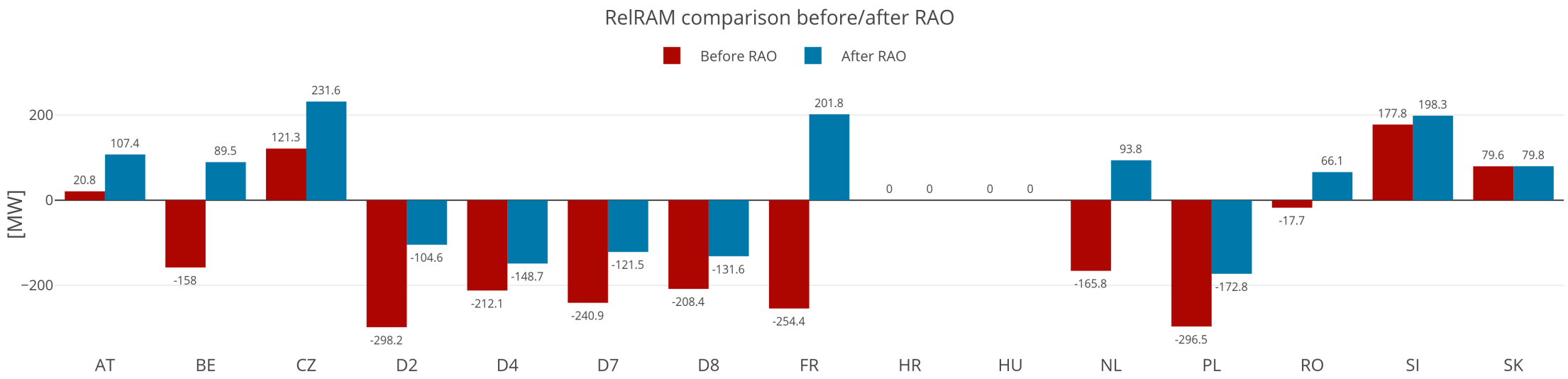
As expected, there is redistributing of the most limiting CNECs. This is because the application of Remedial Actions does not eliminate flows but re-routes, reducing the flows on some limiting CNECs and increasing the load on others, which at the end impacts also the RAM values.

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

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



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
[SK-UA] V.Kapusany - Mukachevo (WPS) [OPP] [SK]	720	1780	84.85%	51.01%	122.06%	0.2513	0.9201
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	720	748	91.83%	58.09%	137.41%	0.2513	0.9201
[SK-SK] Gabcikovo - P.Biskupice [DIR]	720	720	91.62%	74.68%	124.30%	0.3527	1.4377
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	713	713	70.71%	41.44%	106.15%	0.2008	0.4869
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	711	711	62.29%	37.09%	86.62%	0.3159	1.0961
[CZ-SK] Nosovice - Varin [OPP] [SK]	710	2377	101.86%	69.63%	145.89%	0.3701	1.3408
[CZ-SK] Sokolnice - Stupava [DIR] [SK]	707	772	76.78%	60.17%	100.07%	0.3657	1.5319
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	706	1003	104.55%	73.80%	138.77%	0.2008	0.4869
[SK-SK] V.Dur - Levice 1 [DIR]	705	705	46.82%	26.12%	71.72%	0.2284	0.9672
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	704	1934	52.30%	20.99%	137.57%	0.2606	0.9
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	703	705	49.85%	19.85%	101.17%	0.2527	0.7356
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	698	1230	58.85%	20.00%	139.80%	0.2425	1.0986
[HU-HU] Gonyu - Gyor [OPP]	696	1030	111.52%	68.59%	148.16%	0.4417	1.7439
[HU-HU] Gonyu - Gyor [DIR]	688	1365	75.16%	58.63%	107.00%	0.4417	1.7439
[NL-BE] PST Zandvliet 2 [DIR] [BE]	677	1441	80.57%	43.70%	125.20%	0.4616	1.0757
[SK-HU] Gabcikovo - Gonyu [OPP] [HU]	672	1346	89.62%	64.62%	144.69%	0.4246	1.6421
[SK-HU] Gabcikovo - Gonyu [DIR] [HU]	669	1055	91.16%	56.46%	135.74%	0.4246	1.6421
[PL-PL] Mikulowa AT1 [OPP]	666	666	77.15%	44.91%	133.45%	0.1866	0.6605
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	662	662	62.81%	32.95%	88.70%	0.3255	1.1463
[CZ-SK] Nosovice - Varin [DIR] [SK]	662	1978	77.24%	59.82%	106.96%	0.3701	1.3408

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
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	215	215	223.26	37.14%	19.85%	82.54%	0.2498
[RO-RO] Resita - Timisoara c1 [DIR]	107	107	1996.53	22.25%	0.00%	53.69%	0.109
[NL-D2] Meeden-Diele 380 Z [DIR] [NL]	68	68	214.25	75.31%	34.28%	132.29%	0.276
[NL-BE] PST Zandvliet 2 [DIR] [BE]	60	61	278.46	65.36%	44.60%	85.72%	0.3926
[D8-PL] Mikulowa PST3 [OPP] [PL]	47	47	118.49	32.84%	2.95%	49.32%	0.4406
[D8-PL] Mikulowa PST1 [OPP] [PL]	39	39	152.28	54.44%	27.05%	87.50%	0.424
[RO-RO] Pestis - Hasdat [OPP]	37	37	482.71	15.97%	0.00%	28.85%	0.115
[RO-RO] Portile de Fier - Resita c1 [DIR]	33	33	1346.14	26.29%	0.00%	50.74%	0.101
[D7-D7] Gronau - Gronau TR 441 E [DIR]	28	28	180.41	49.14%	23.07%	75.13%	0.192
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	26	27	163.05	41.61%	21.55%	88.95%	0.2545
[D8-D8] Pasewalk - Vierraden 306 [DIR]	22	22	443.66	33.74%	26.86%	40.29%	0.0708
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	18	18	179.77	26.60%	20.04%	42.17%	0.2569
[RO-RO] TR Portile de Fier 400/220 1 [OPP]	17	17	195.58	17.53%	0.00%	50.80%	0.1974
[SI-HU] Cirkovce - Heviz [OPP] [HU]	16	16	12.4	73.59%	61.37%	82.67%	0.2075
[BE-BE] Doel - Zandvliet 380.25 [OPP]	15	15	135.27	80.08%	57.98%	99.78%	0.408
[AT-D2] St. Peter 2 - Altheim 233_230 [OPP] [AT]	14	14	174.68	52.26%	21.28%	104.26%	0.1571
[RO-RO] Hasdat - Mintia [DIR]	13	13	345.88	9.71%	0.00%	28.21%	0.1155
[BE-BE] Doel - Zandvliet 380.25 [DIR]	13	13	18.23	56.22%	42.39%	80.95%	0.3947
[AT-D2] St. Peter 2 - Altheim 233_230 [DIR] [AT]	13	13	116.39	68.96%	20.09%	98.11%	0.1433
[RO-RS] Portile de Fier - Djerdap [DIR] [RO]	13	13	129.74	46.53%	19.12%	90.26%	0.357

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:

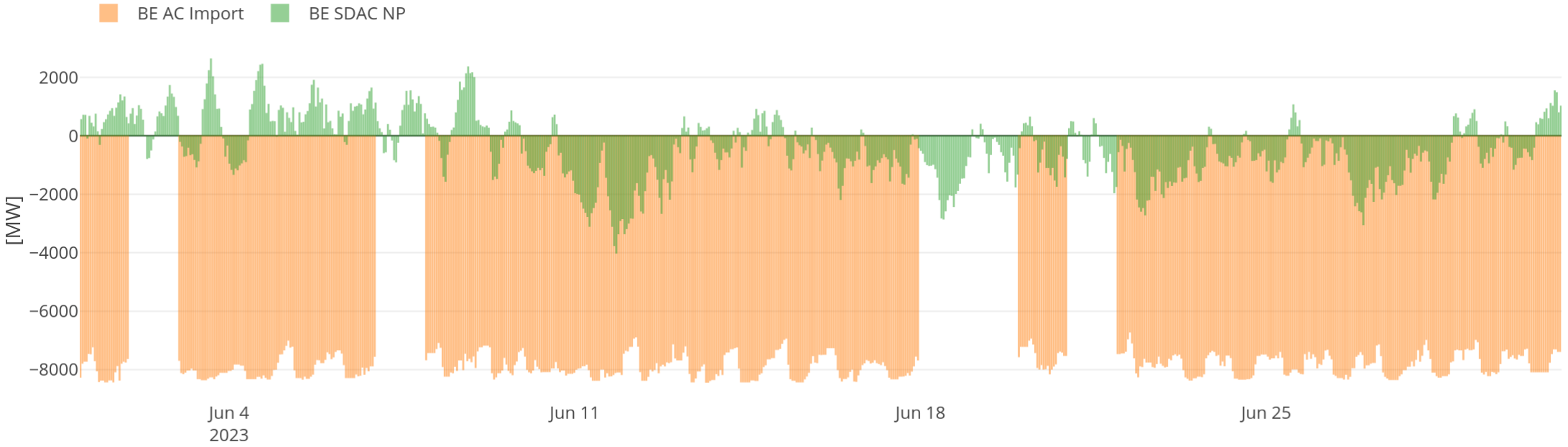
- RAM = 500MW
- Portion of FB Domain = 40%
- RAM offered by Core TSOs = 400mW/0.4 = 1250MW

KPI 13a: Allocation Constraints - Belgium

	# MTUs
AC was Limiting MC	0

	BE AC Import [MW]
Avg.	-7848.29
Min.	-8427.00
Max.	-6710.00

Belgium only uses import allocation contraints



KPI 13b: Allocation Constraints - Poland

	# MTUs
AC was limiting MC	504
AC < 0 MW	317
AC = 0 MW	186
AC > 0 MW	1

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1458.22	2383.83
Min.	-8604.00	0.00
Max.	0.00	8062.00