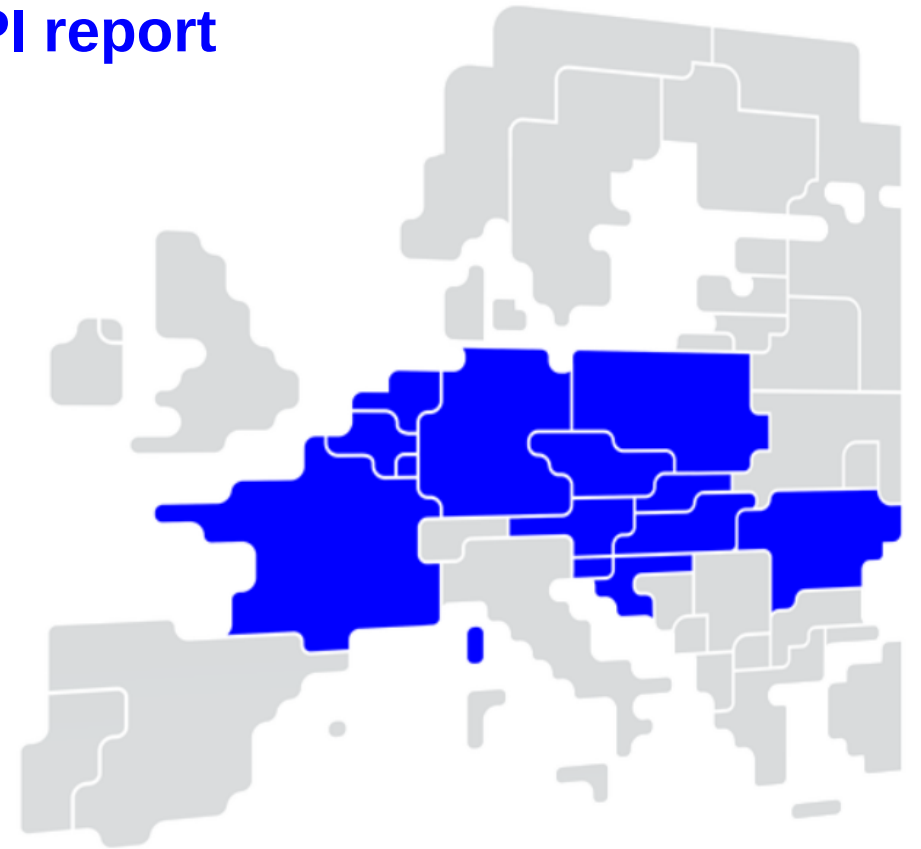


# Core FB MC Operational KPI report

June 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)

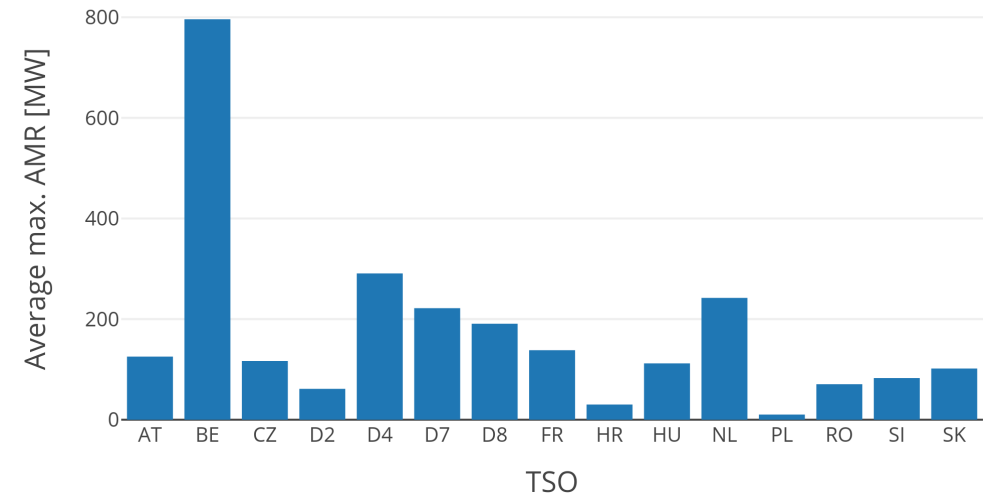
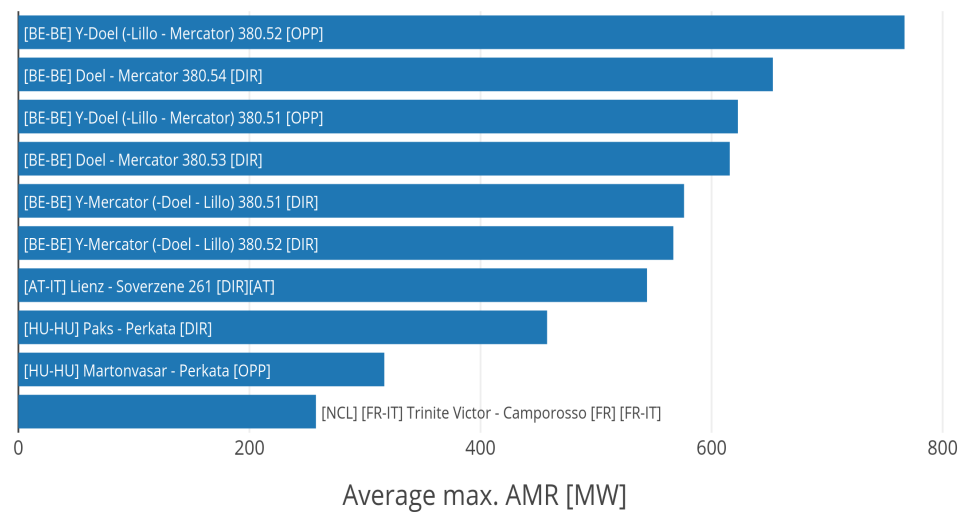
# KPI 2: Average maximum AMR per TSO



CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[BE-BE] Y-Doel (-Lillo - Mercator) 380.52 [OPP]	767.01	33.45%
[BE-BE] Doel - Mercator 380.54 [DIR]	653.04	30.78%
[BE-BE] Y-Doel (-Lillo - Mercator) 380.51 [OPP]	622.77	32.07%
[BE-BE] Doel - Mercator 380.53 [DIR]	615.74	29.01%
[BE-BE] Y-Mercator (-Doel - Lillo) 380.51 [DIR]	576.17	29.68%
[BE-BE] Y-Mercator (-Doel - Lillo) 380.52 [DIR]	566.89	24.20%
[AT-IT] Lienz - Soverzene 261 [DIR][AT]	544.10	160.89%
[HU-HU] Paks - Perkata [DIR]	457.62	24.23%
[HU-HU] Martonvasar - Perkata [OPP]	316.72	16.77%
[NCL] [FR-IT] Trinite Victor - Camporosso [FR] [FR-IT]	257.55	51.05%

TSO	Average maximum AMR per TSO
AT	125.53
BE	796.06
CZ	116.75
D2	61.38
D4	290.85
D7	221.69
D8	190.83
FR	138.28
HR	30.30
HU	112.00

TSO	Average maximum AMR per TSO
NL	242.21
PL	10.15
RO	70.68
SI	82.79
SK	101.84



# KPI 3: Share of MTUs with intervention per TSO



Total BDs

22

Total MTUs

528

MTUs without IVA

114

Share of distinct MTUs without IVA

21.59%

MTUs with IVA

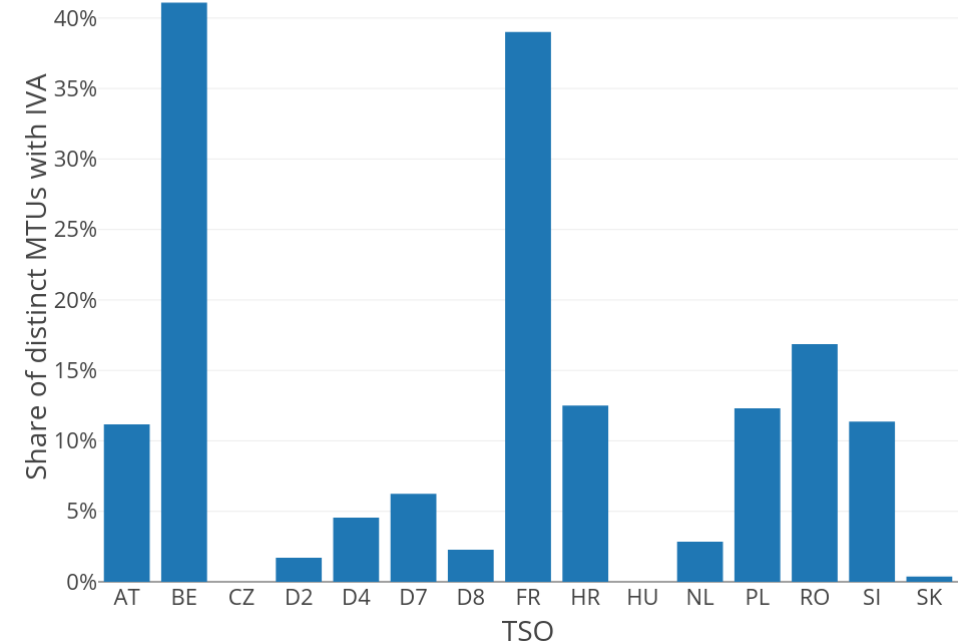
414

Share of distinct MTUs with IVA

78.4%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
SI	11.36%	60
CZ	0.00%	0
AT	11.17%	59
D7	6.25%	33
D8	2.27%	12
D2	1.70%	9
PL	12.31%	65
D4	4.55%	24
SK	0.38%	2
HU	0.00%	0

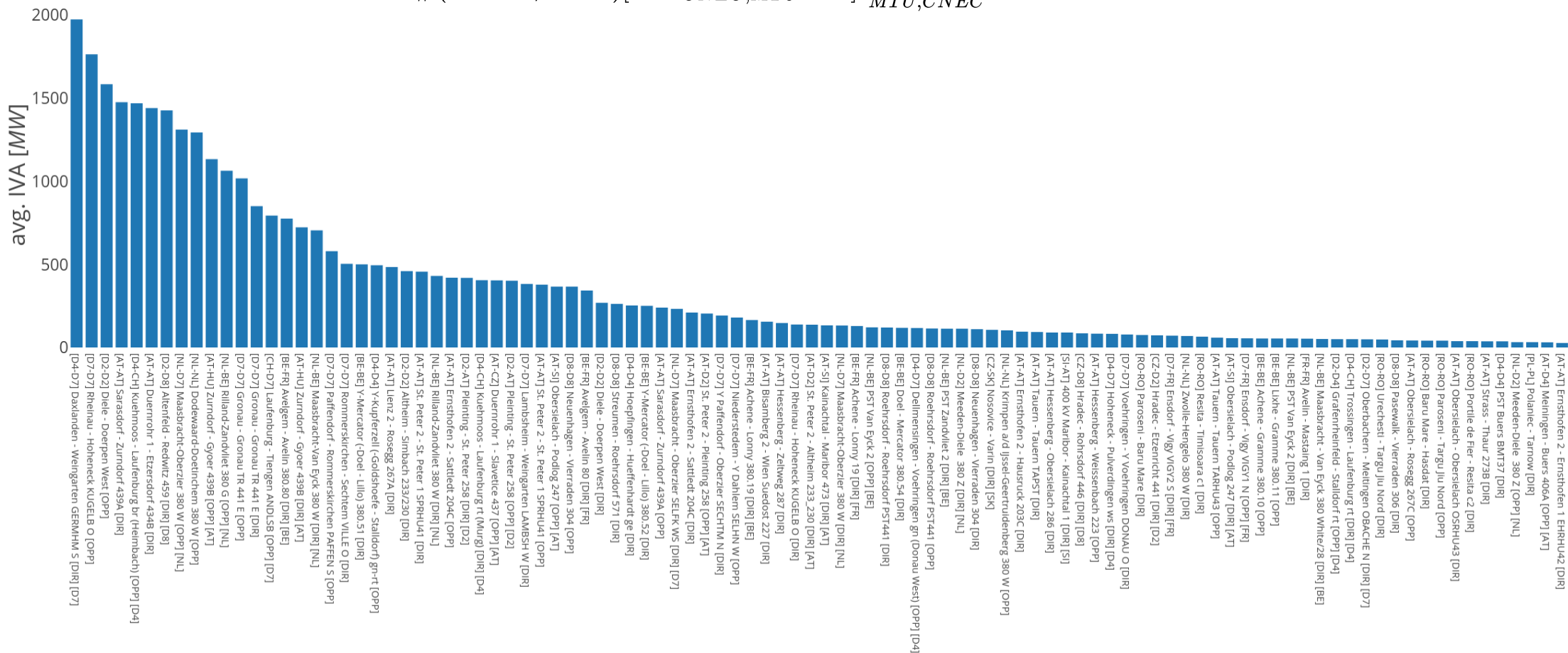
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
BE	41.10%	217
NL	2.84%	15
FR	39.02%	206
RO	16.86%	89
HR	12.50%	66



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



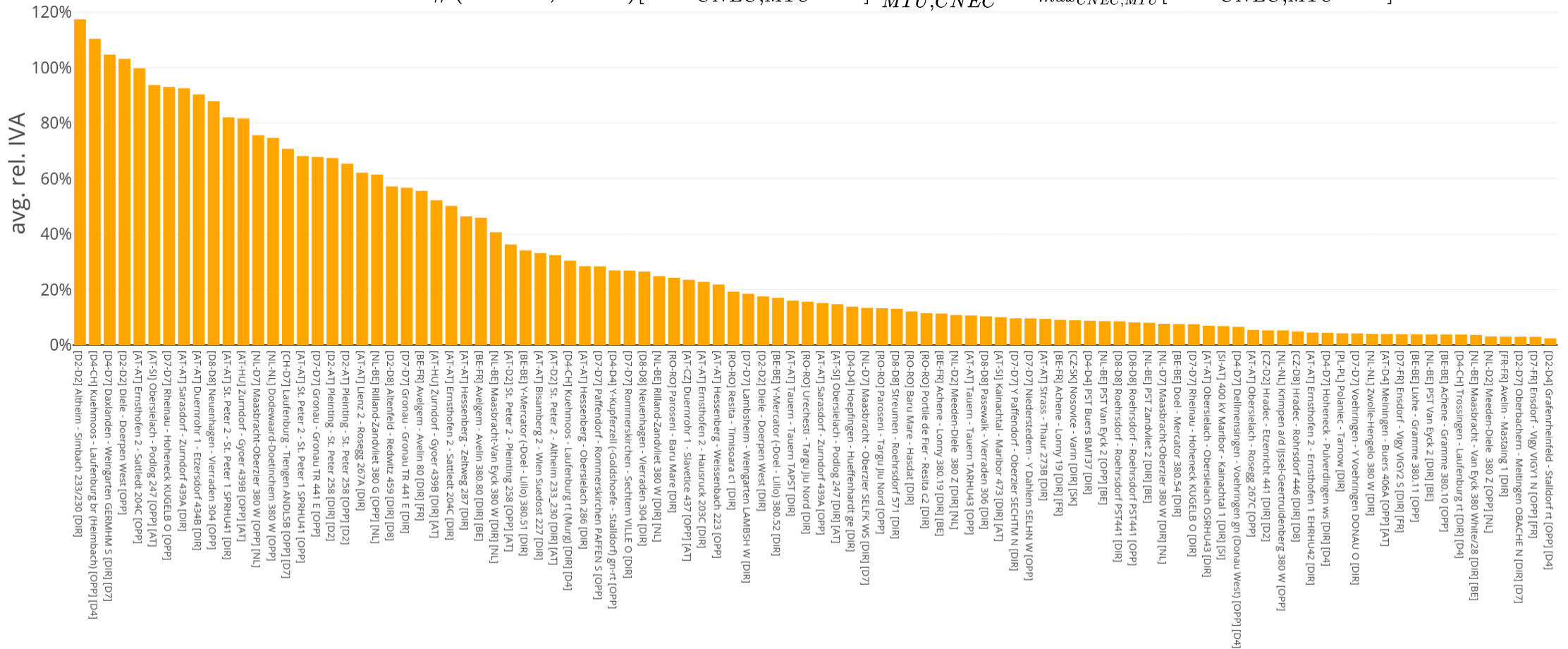
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



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



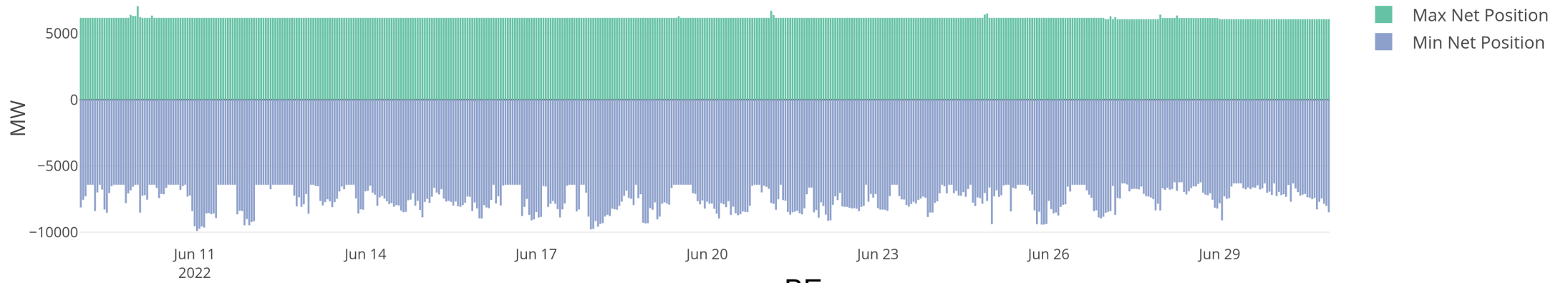
$$\text{avg. rel. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} \frac{IVA_{CNEC, MTU}[IVA_{CNEC, MTU} > 0]}{F_{max CNEC, MTU}[IVA_{CNEC, MTU} > 0]}$$



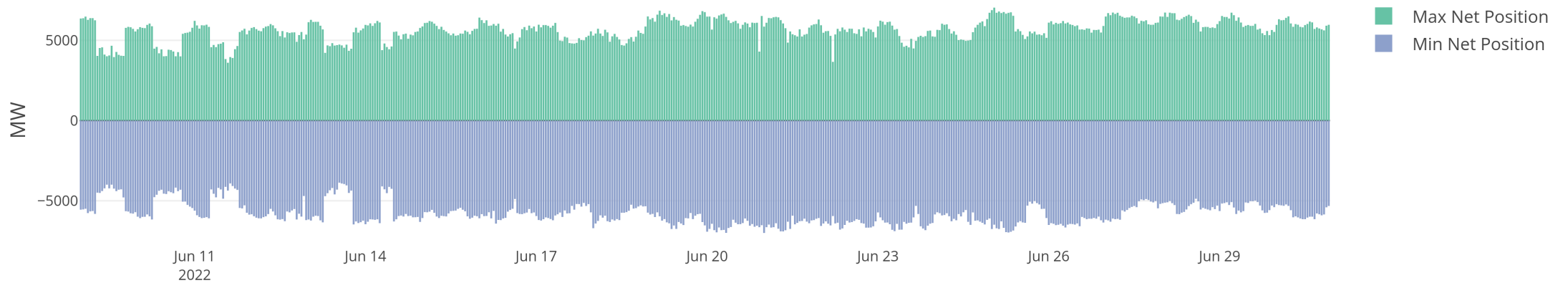
# KPI 5: Min & max net positions per BZ hub



AT



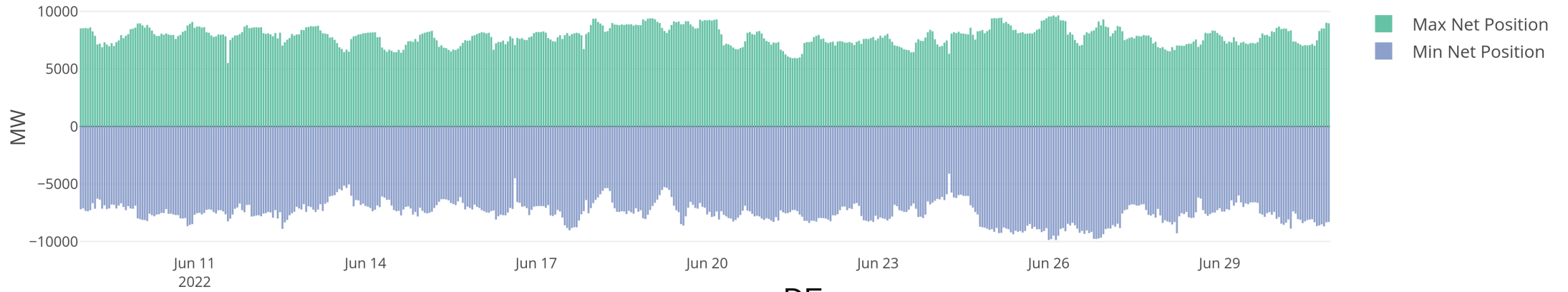
BE



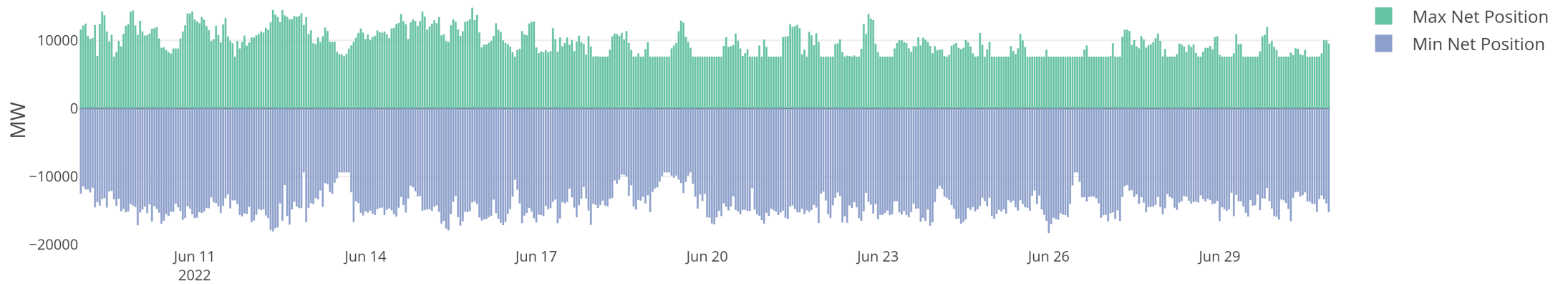
# KPI 5: Min & max net positions per BZ hub



CZ

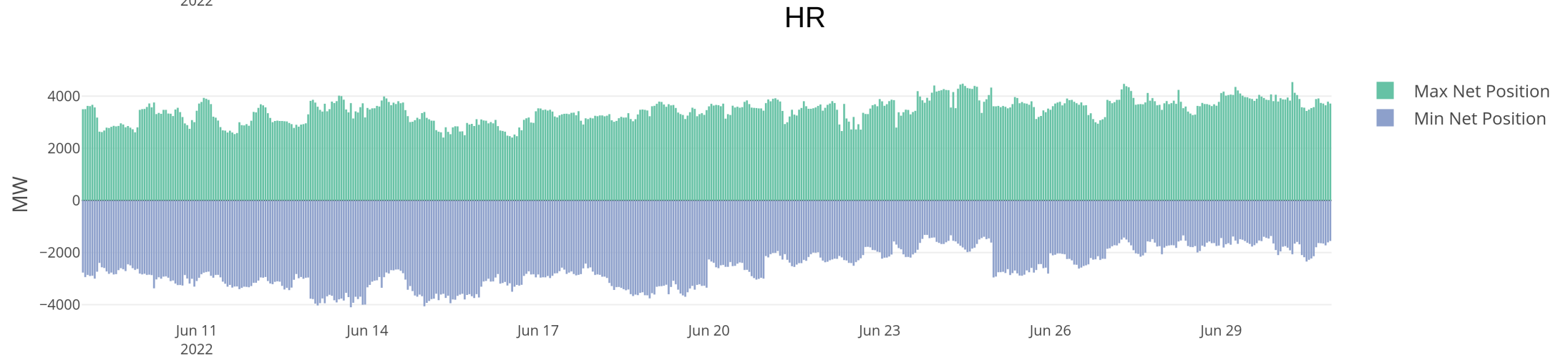
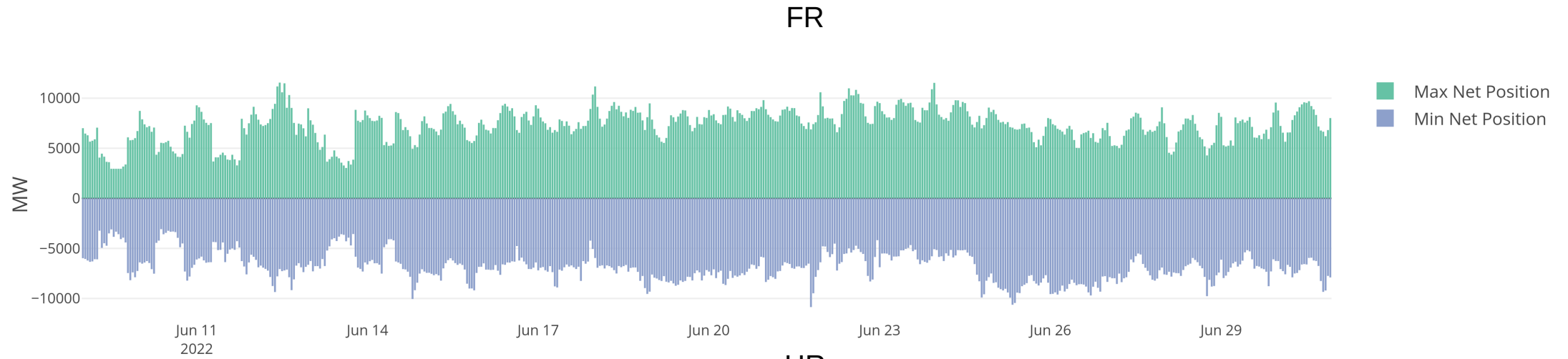


DE

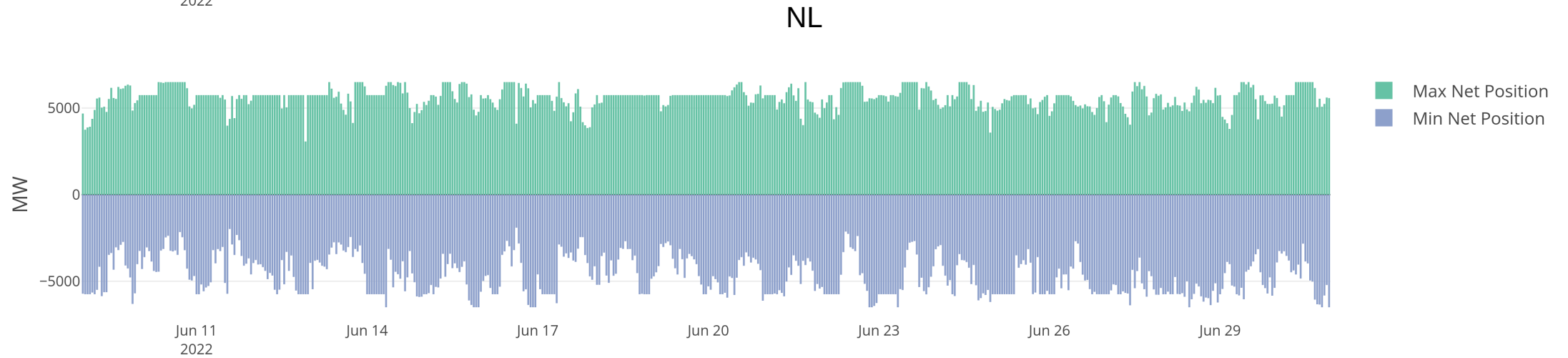
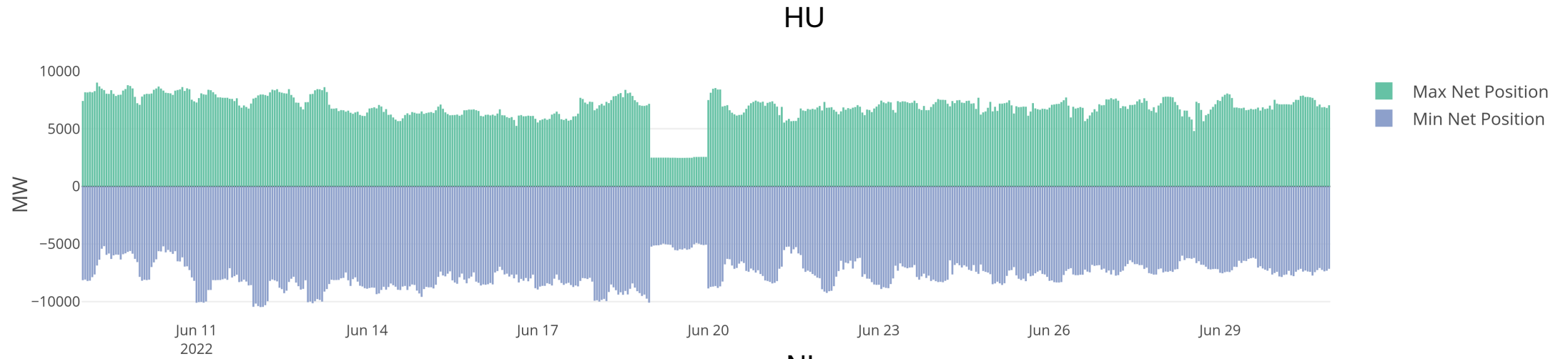




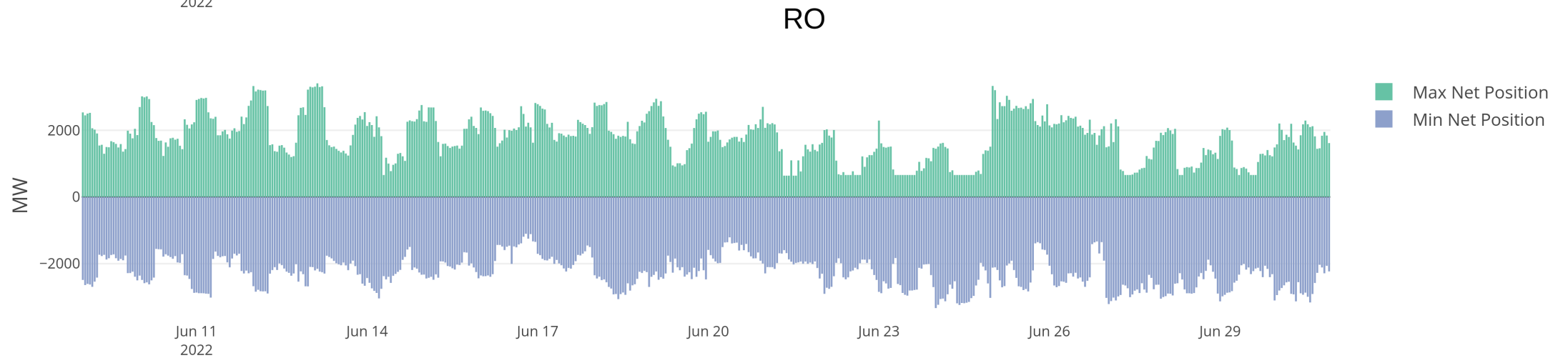
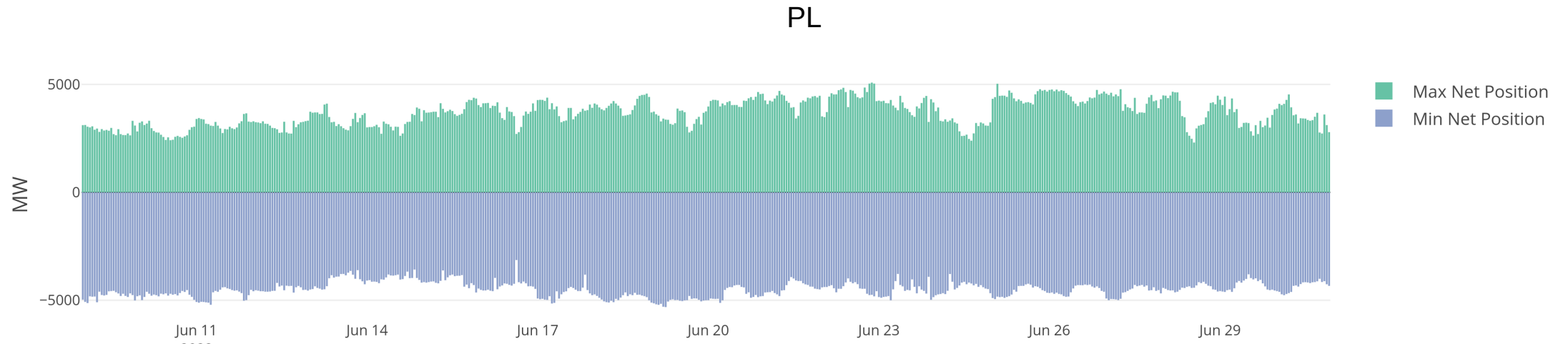
# KPI 5: Min & max net positions per BZ hub



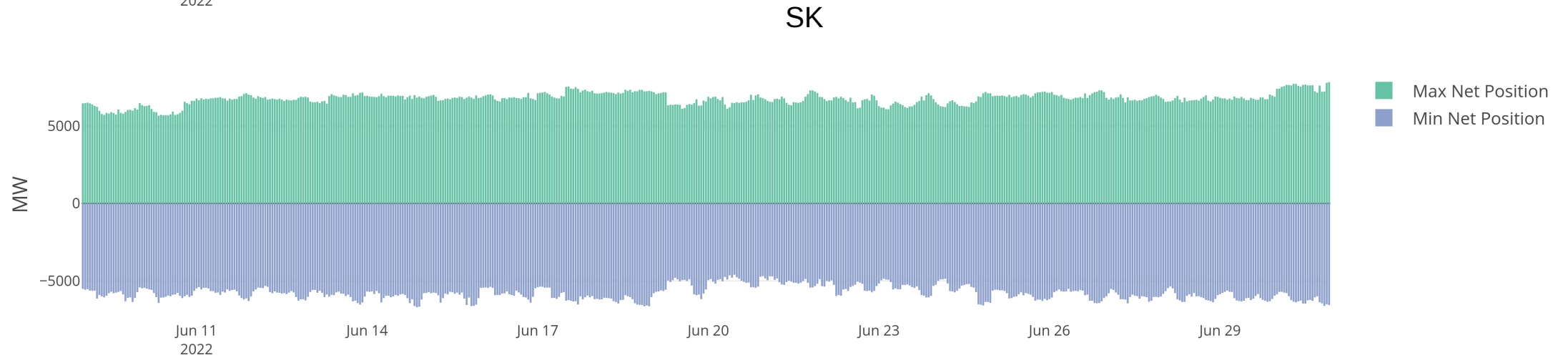
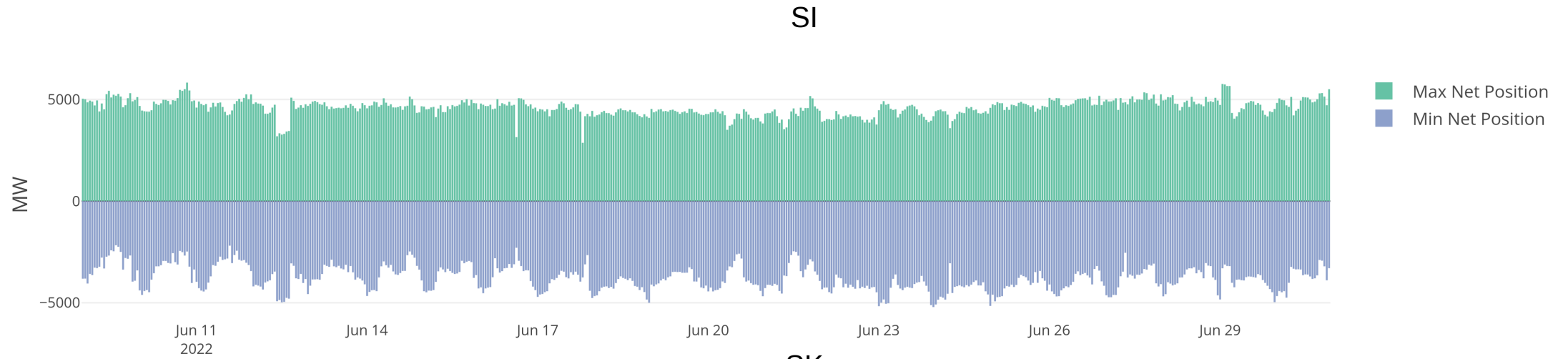
# KPI 5: Min & max net positions per BZ hub



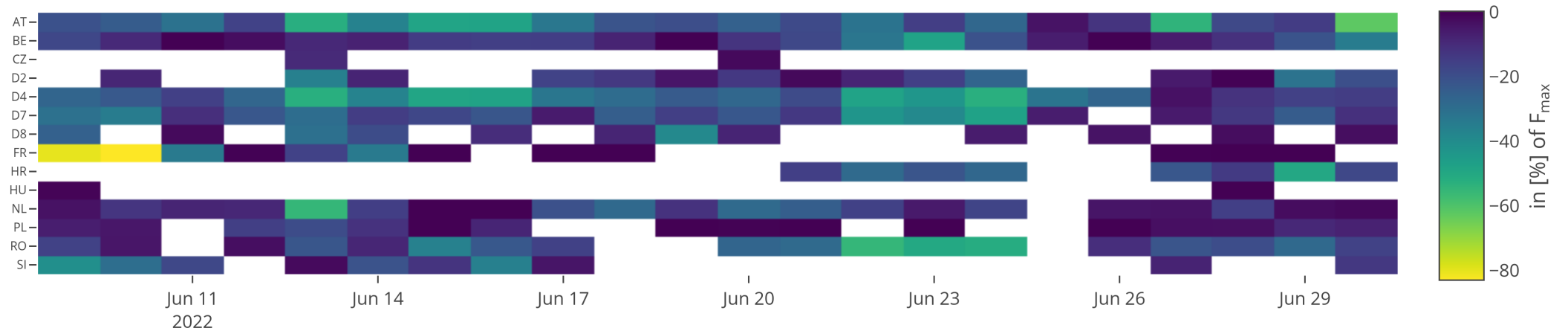
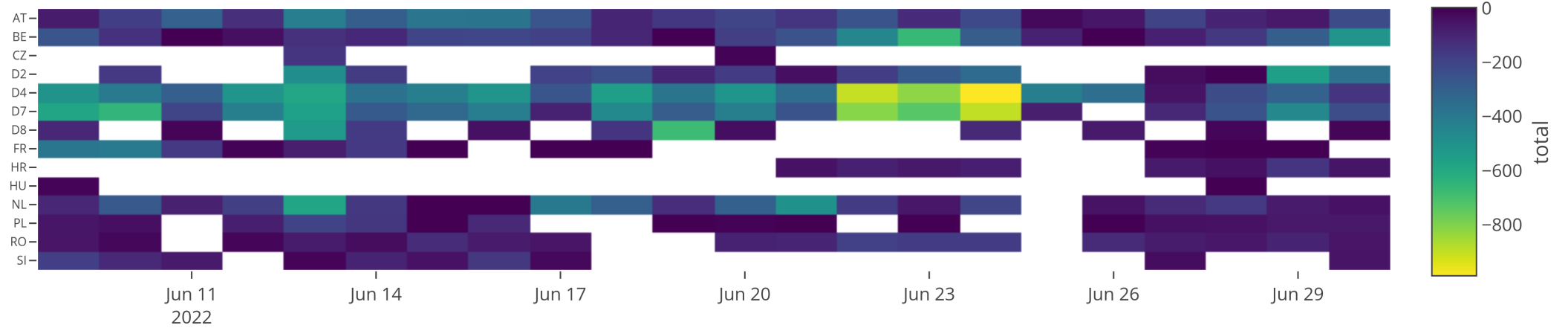
# KPI 5: Min & max net positions per BZ hub



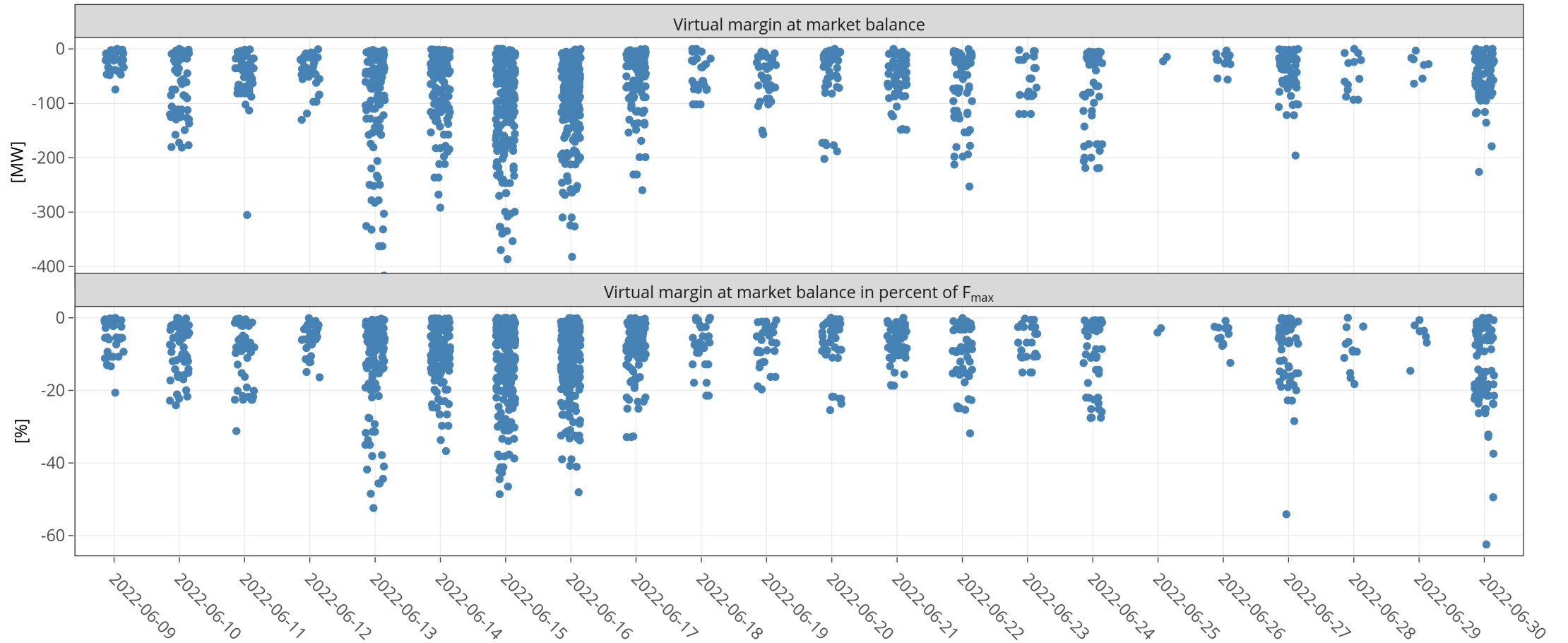
# KPI 5: Min & max net positions per BZ hub



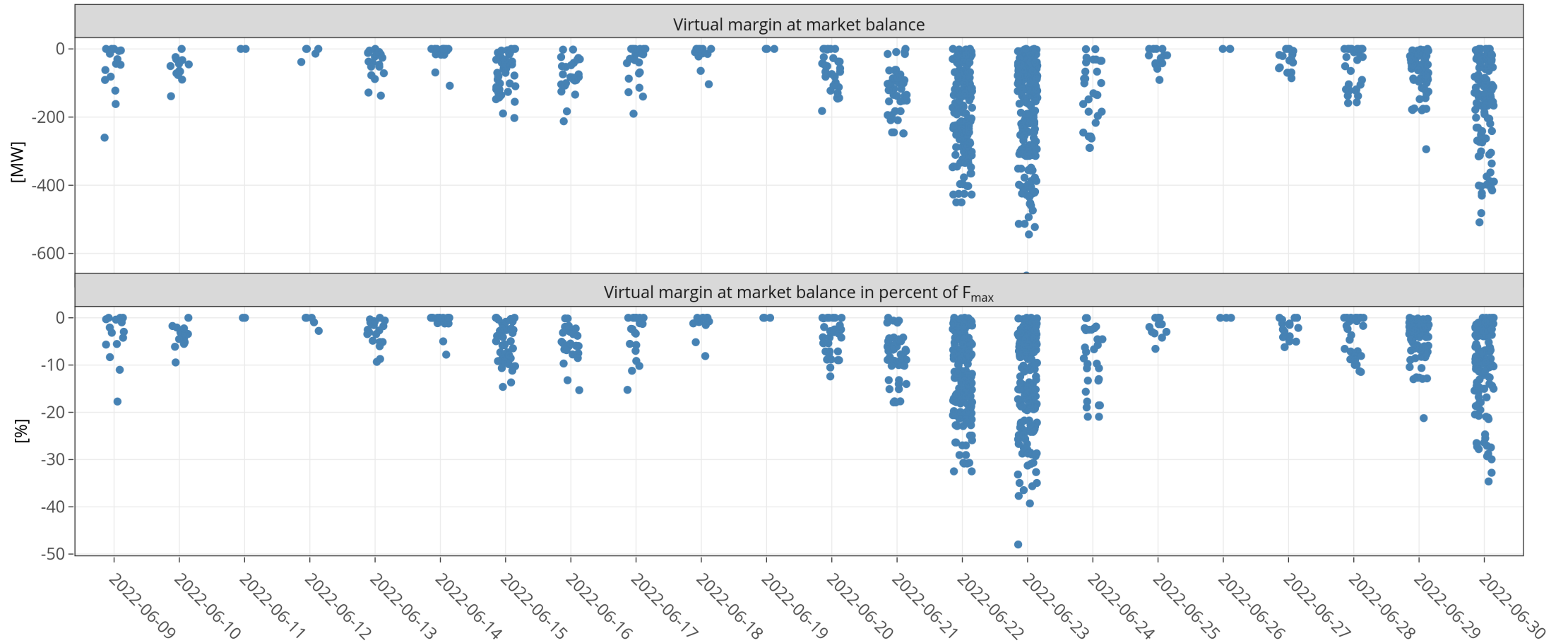
# KPI 6a: Highest virtual margins at market balance for CORE TSOs



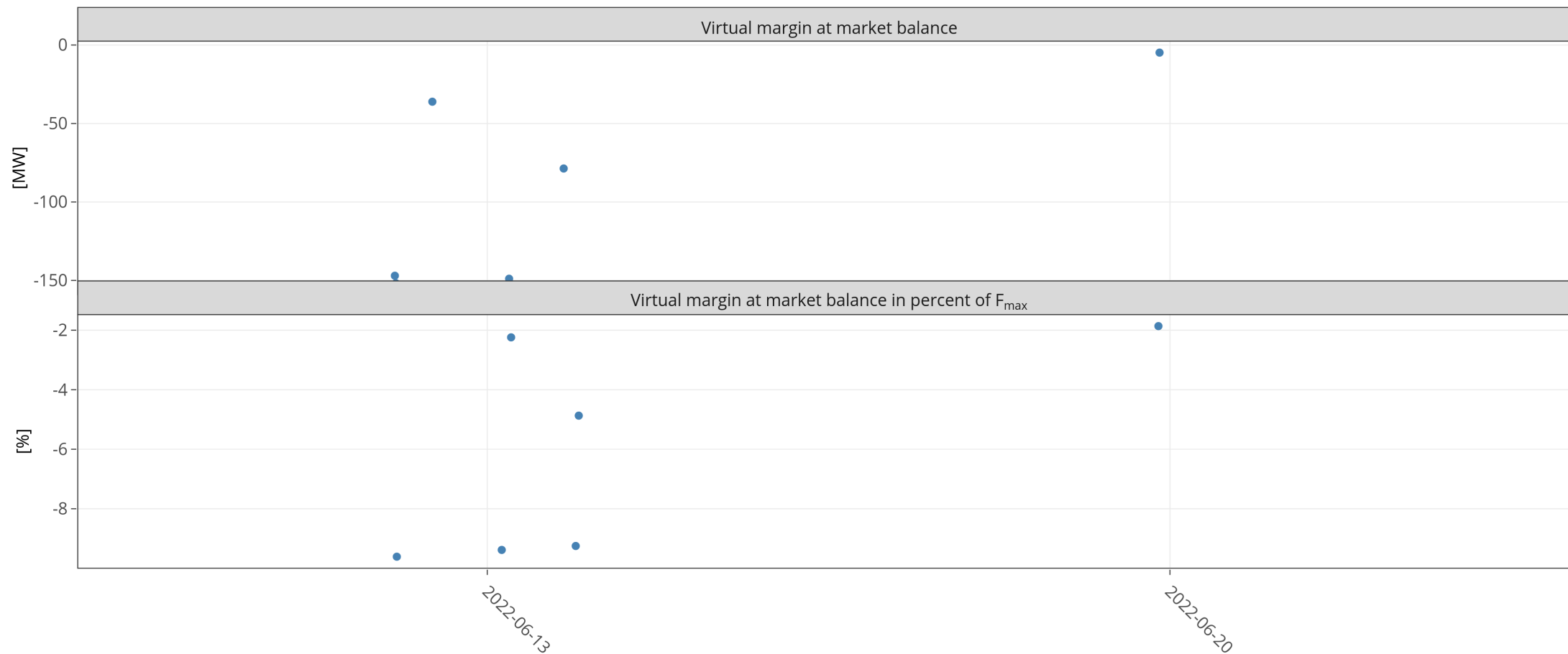
# KPI 6b: Virtual margins at market balance AT



# KPI 6b: Virtual margins at market balance BE

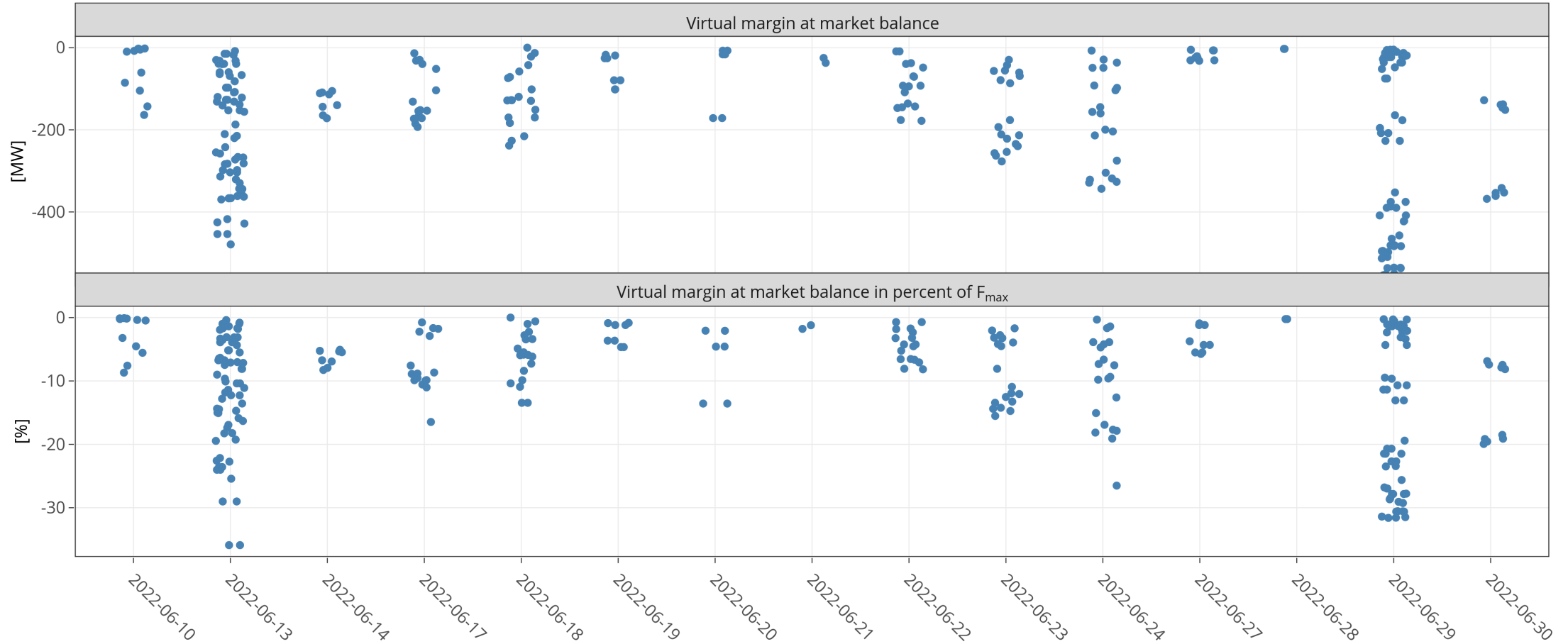


# KPI 6b: Virtual margins at market balance CZ

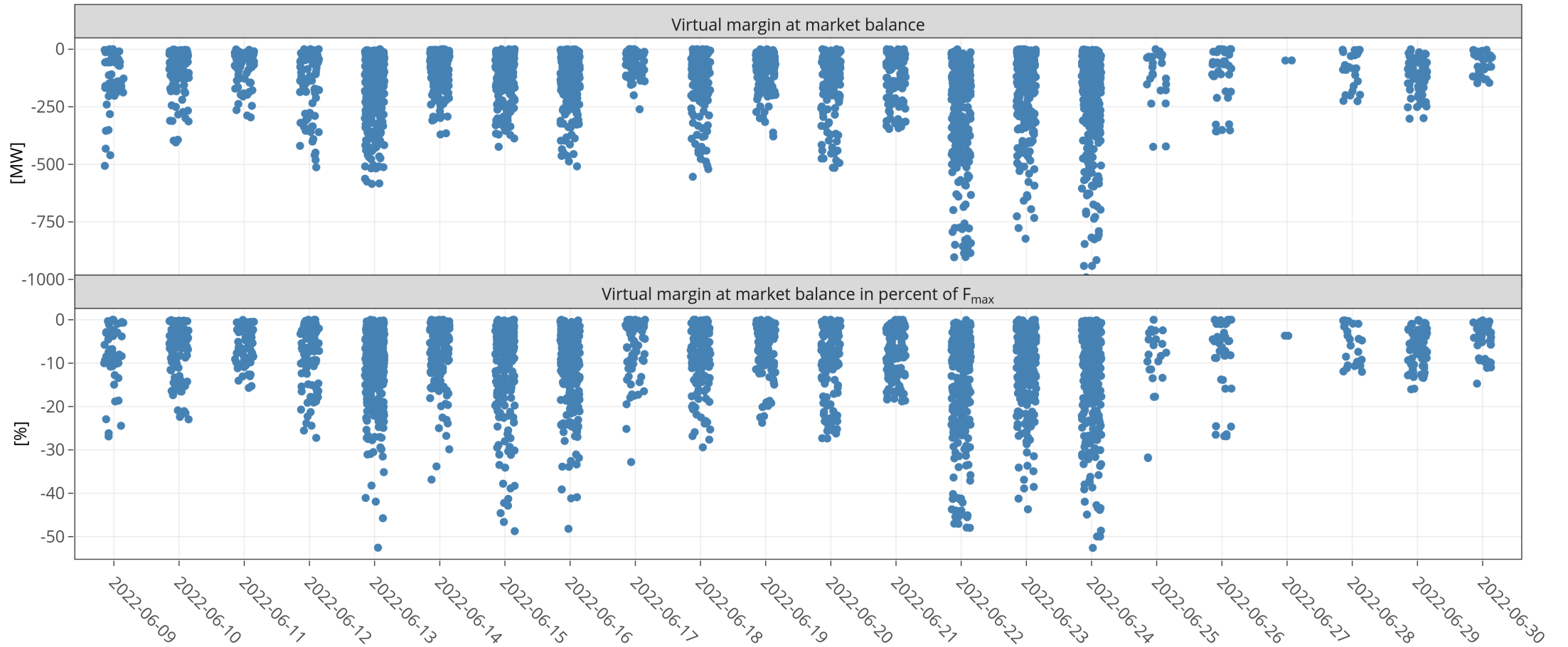




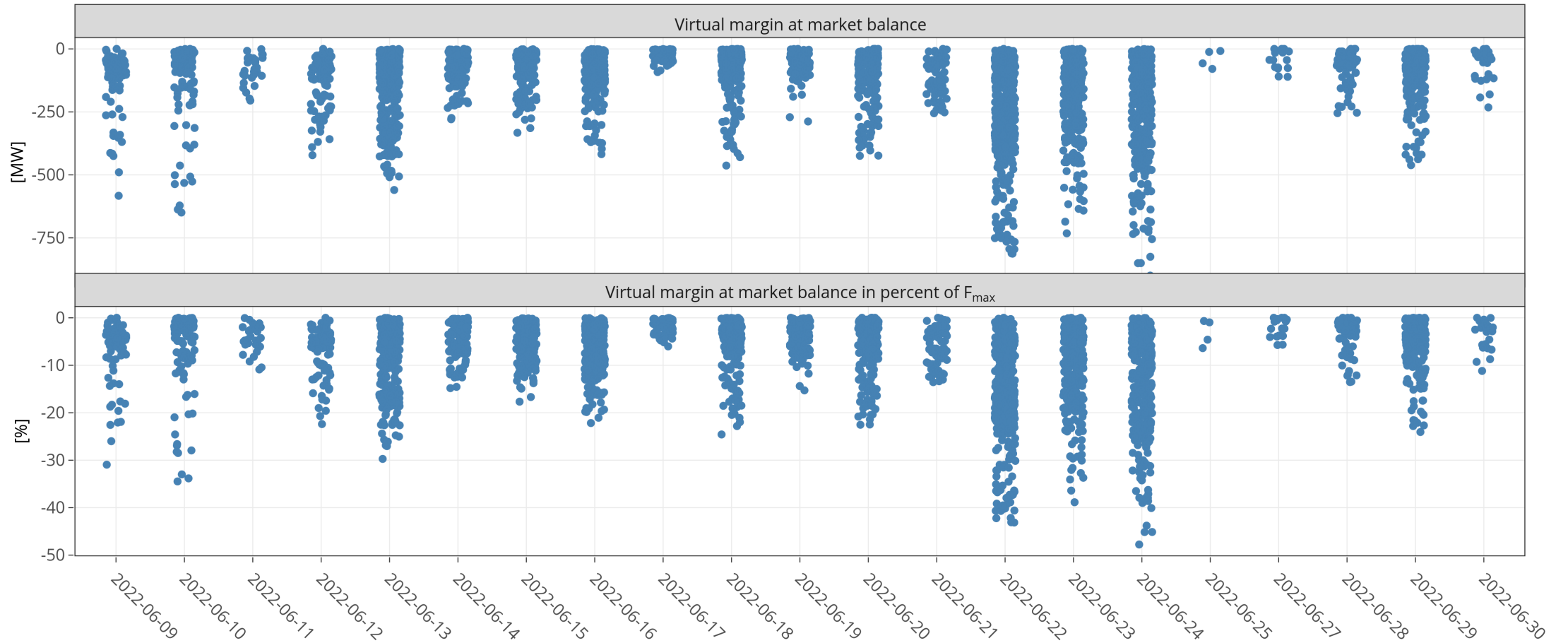
# KPI 6b: Virtual margins at market balance D2



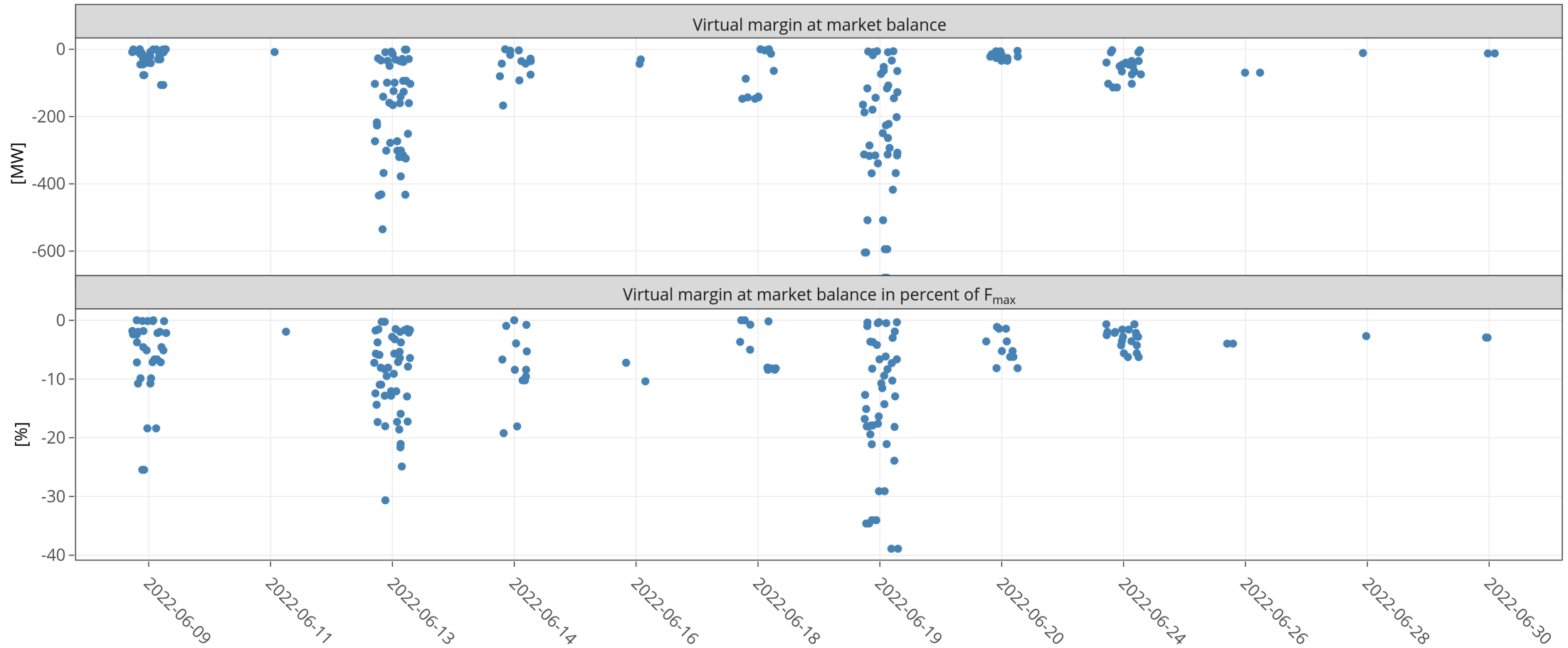
# KPI 6b: Virtual margins at market balance D4



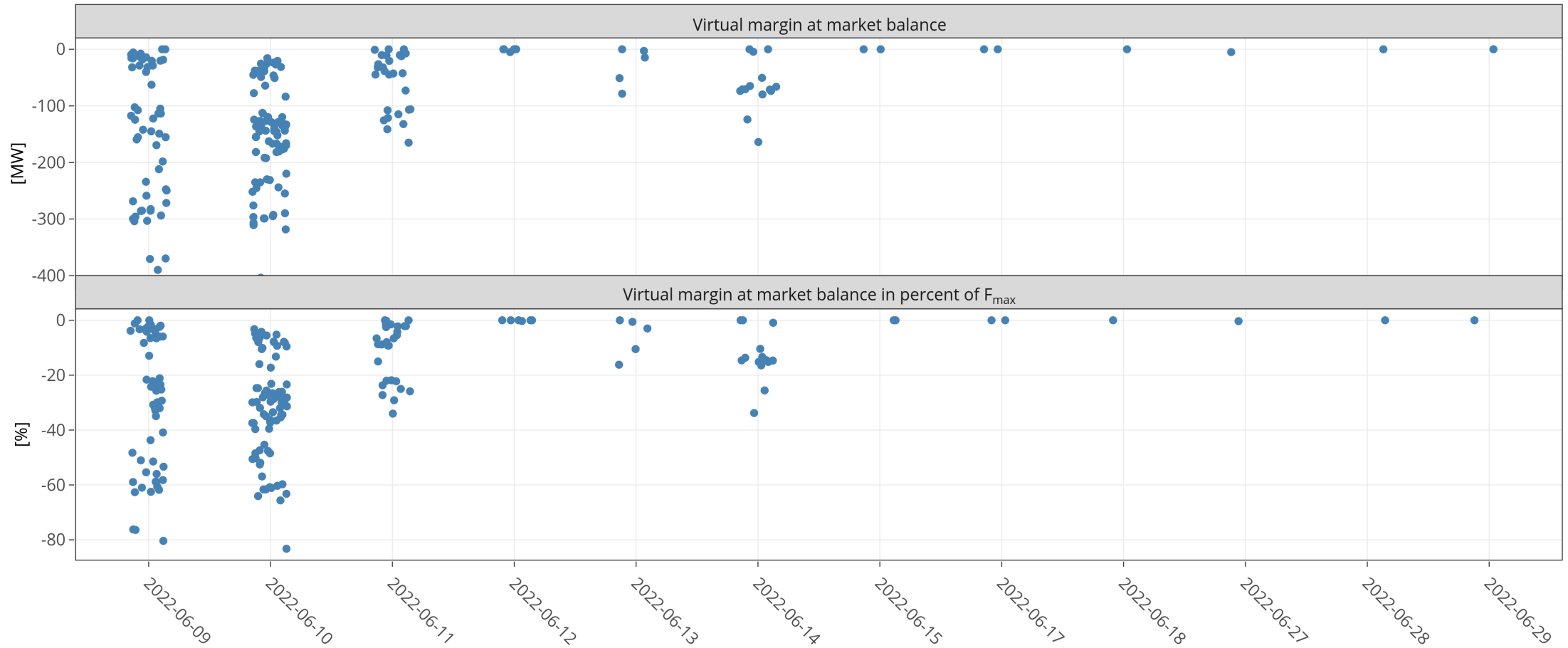
# KPI 6b: Virtual margins at market balance D7



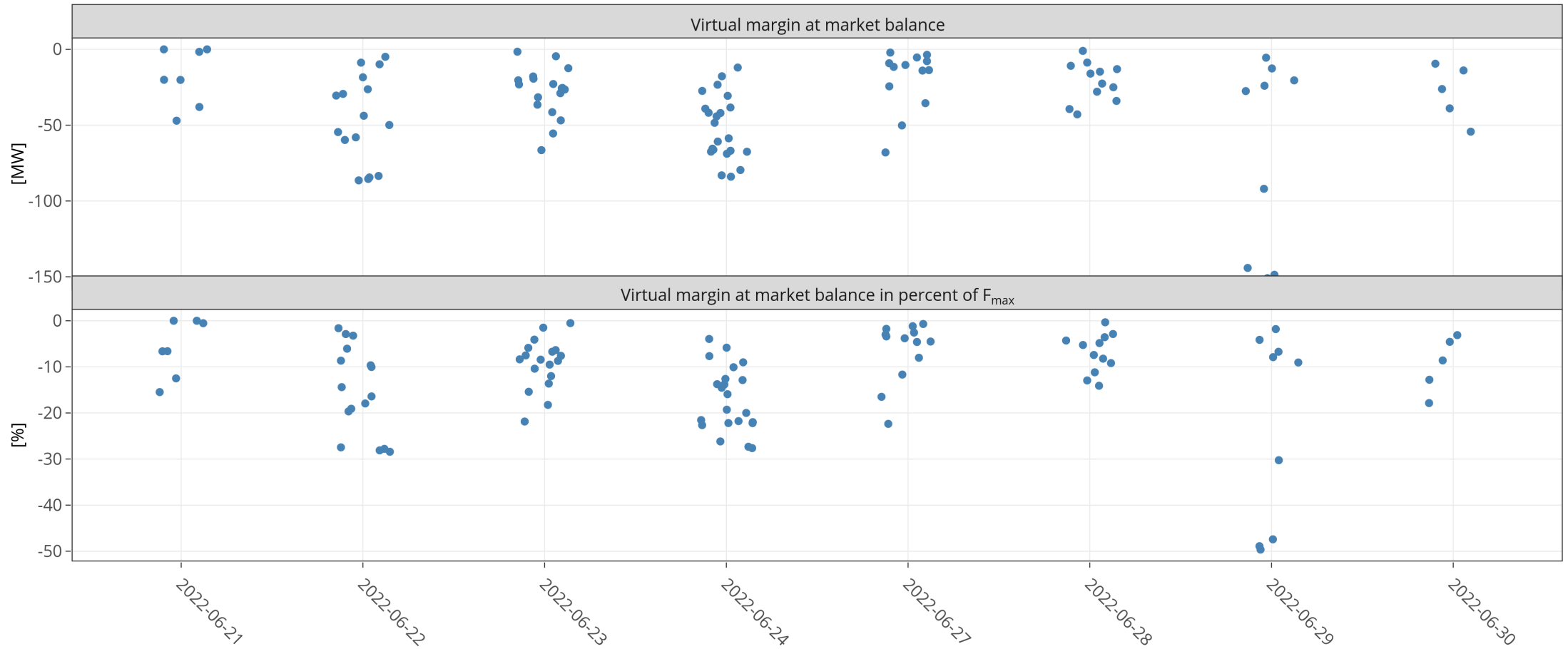
# KPI 6b: Virtual margins at market balance D8



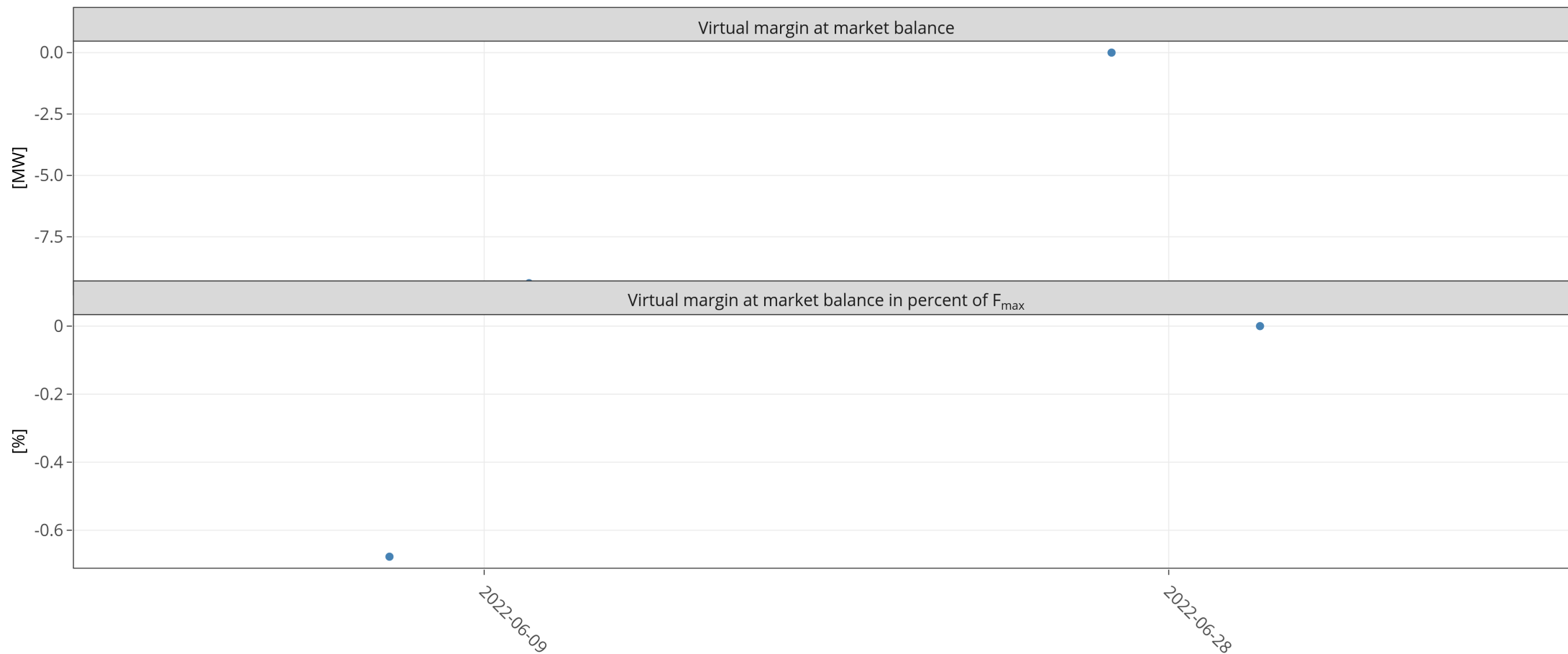
# KPI 6b: Virtual margins at market balance FR



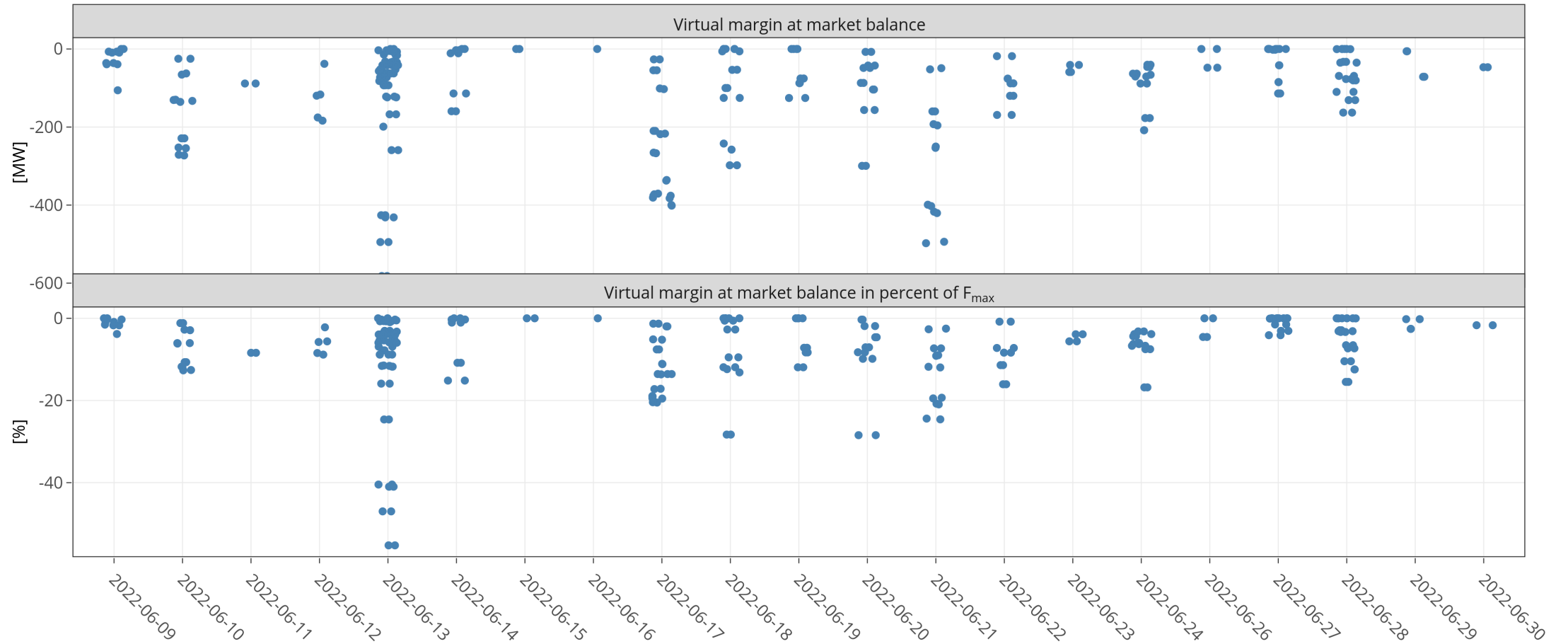
# KPI 6b: Virtual margins at market balance HR



# KPI 6b: Virtual margins at market balance HU

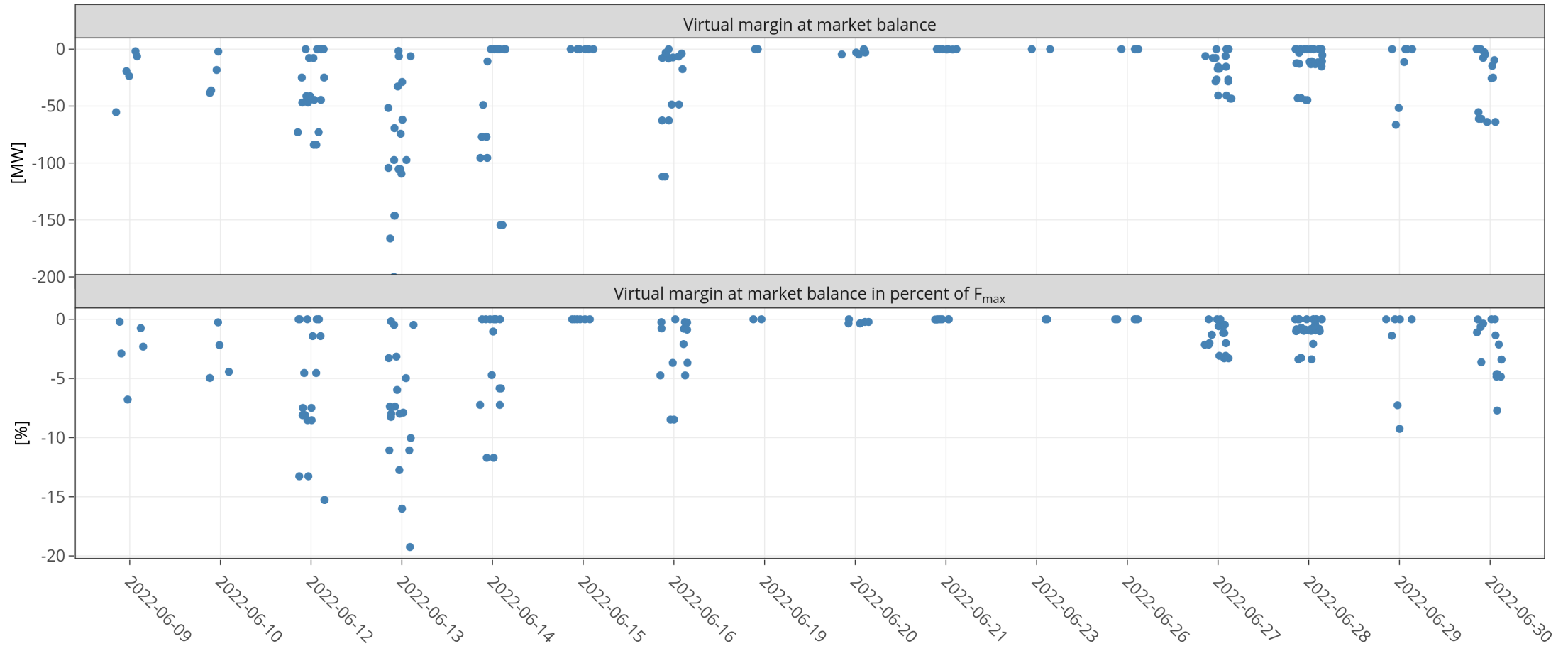


# KPI 6b: Virtual margins at market balance NL

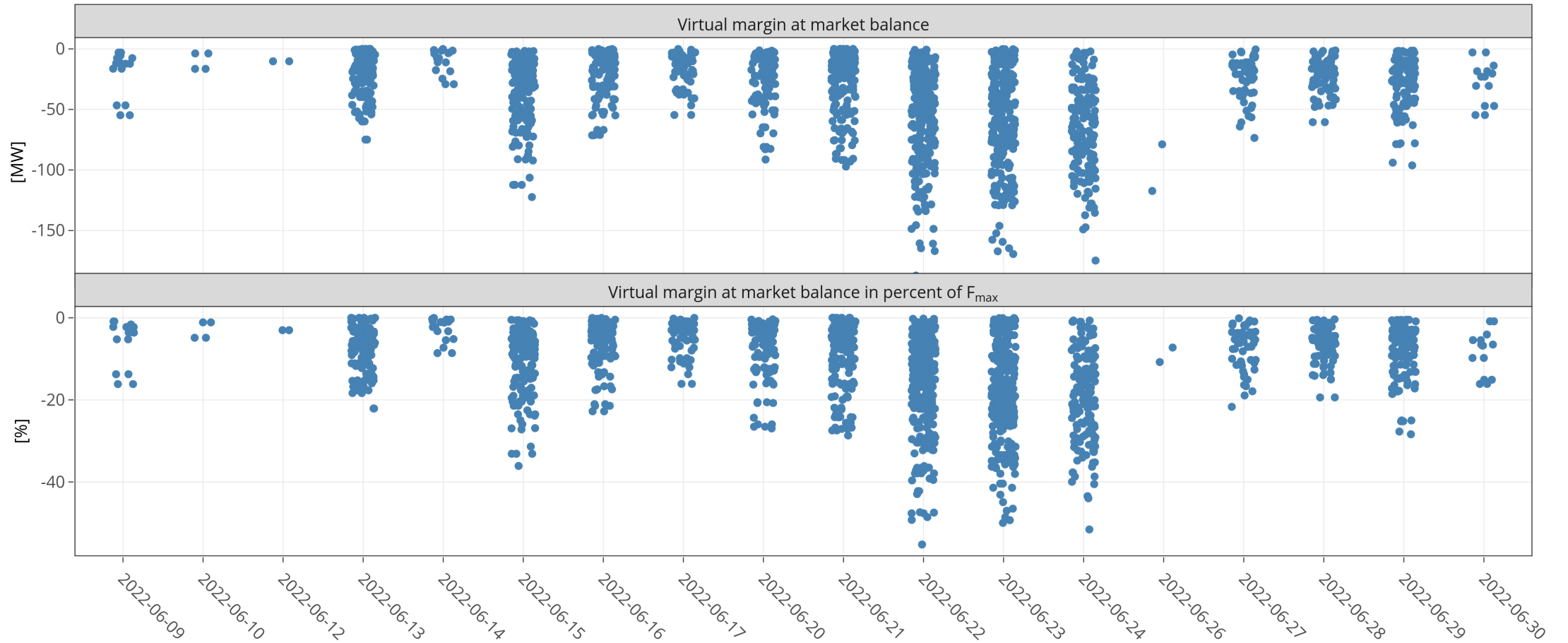




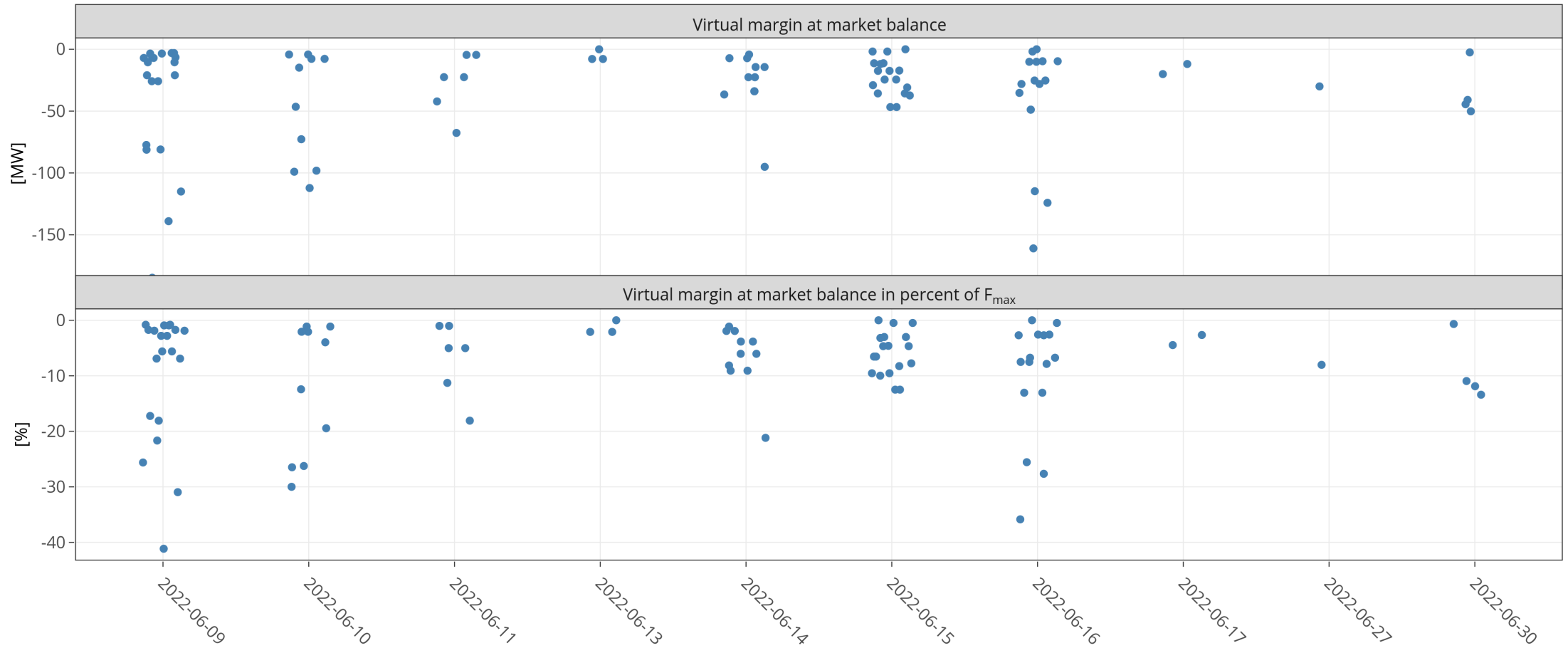
# KPI 6b: Virtual margins at market balance PL



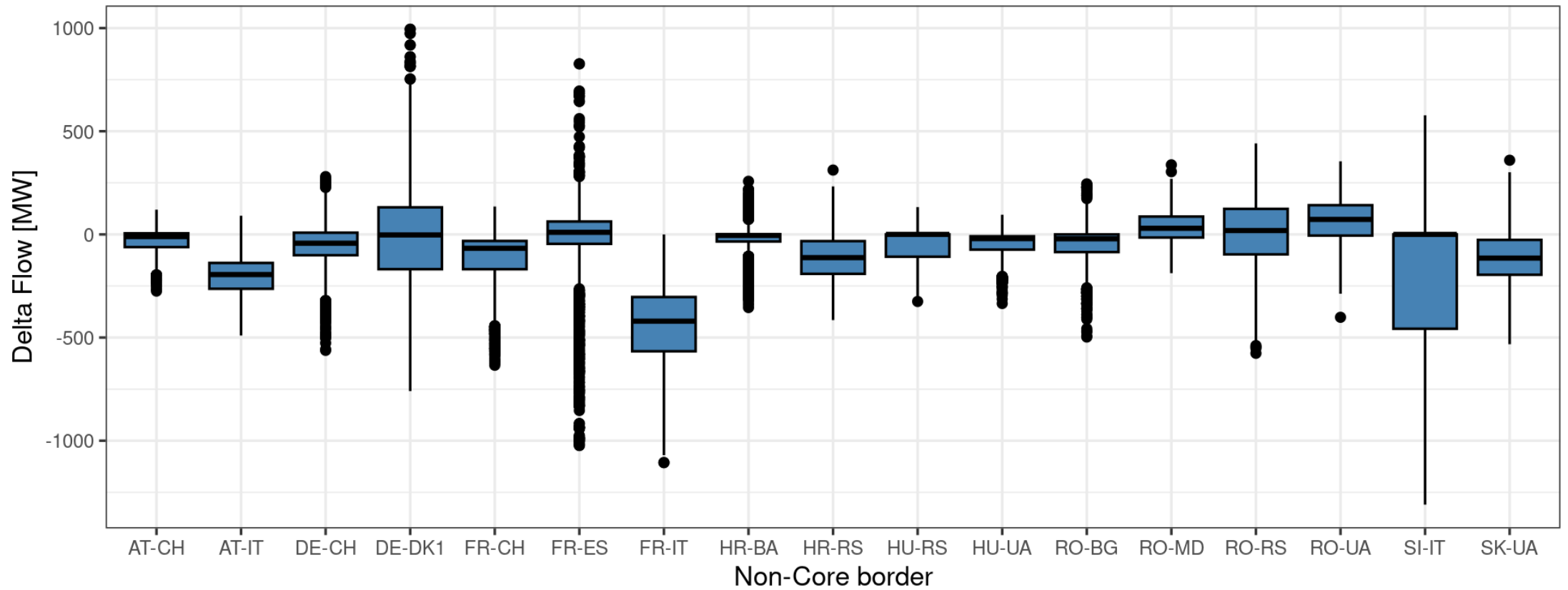
# KPI 6b: Virtual margins at market balance RO



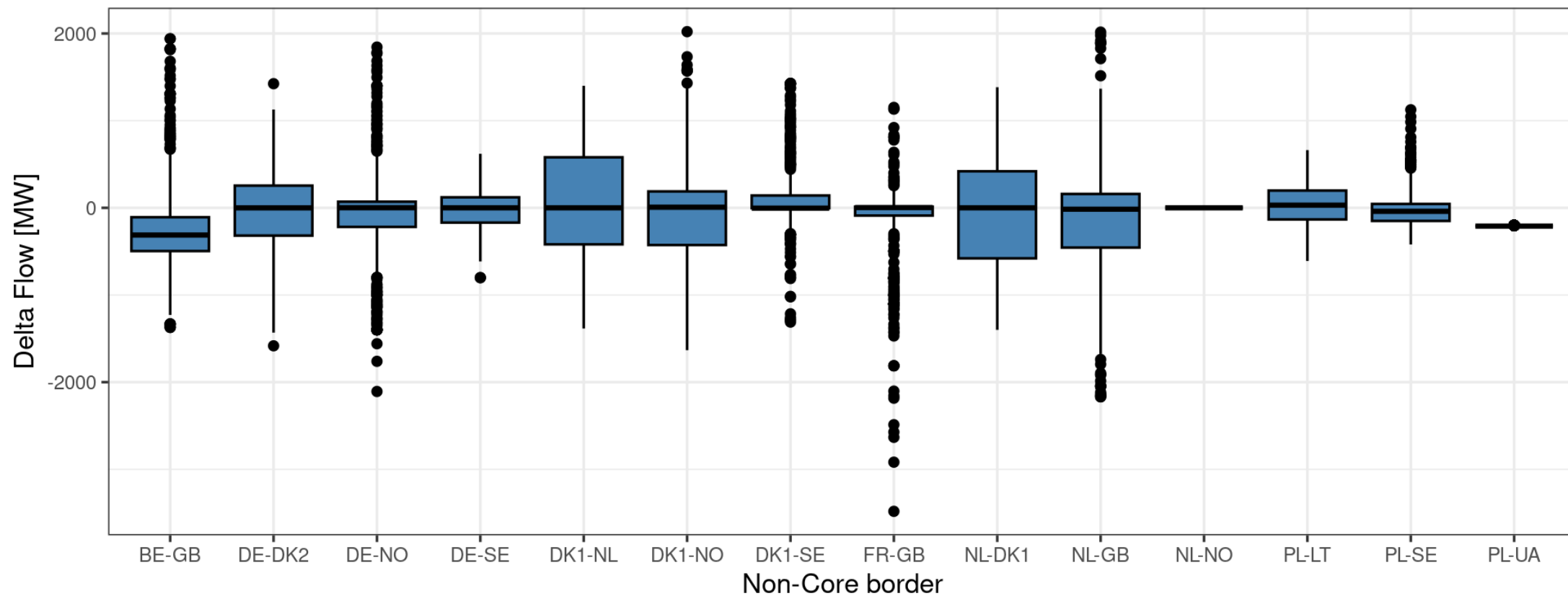
# KPI 6b: Virtual margins at market balance SI



# KPI 7: Non-Core exchanges AC delta flow



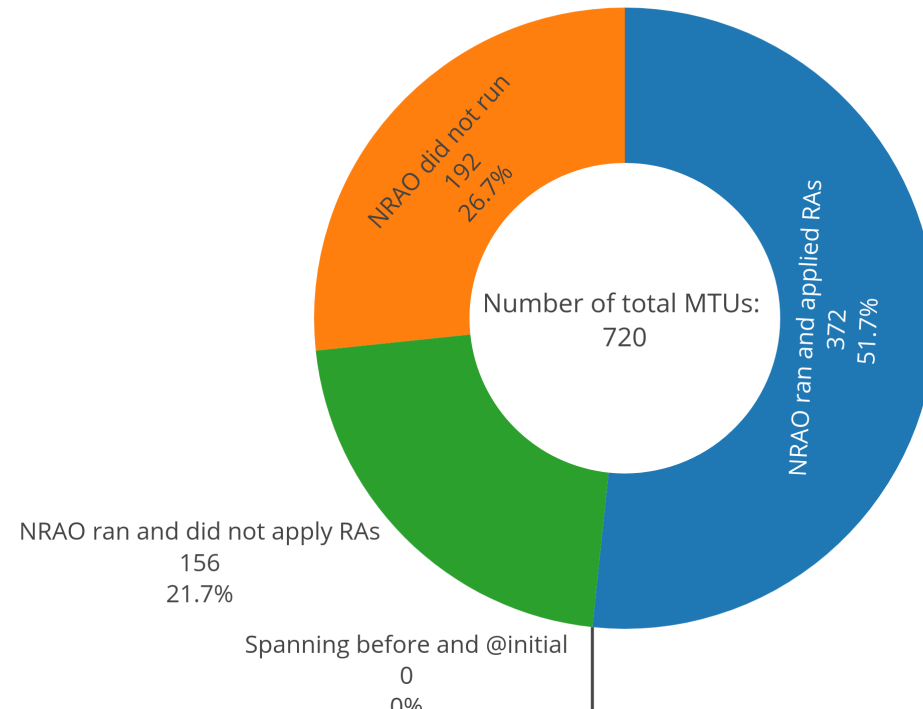
# KPI 7: Non-Core exchanges DC delta flow



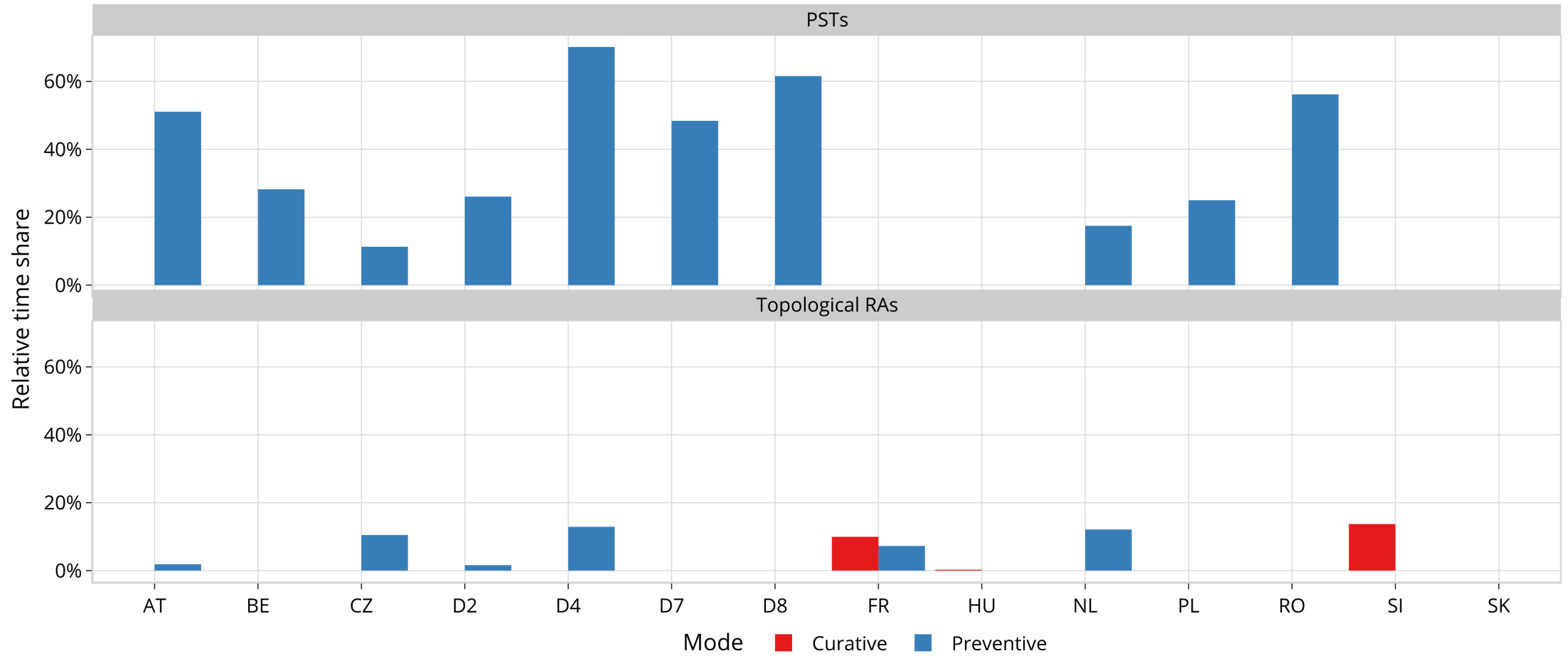
# KPI 8: NRAO – Applied Remedial Action



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

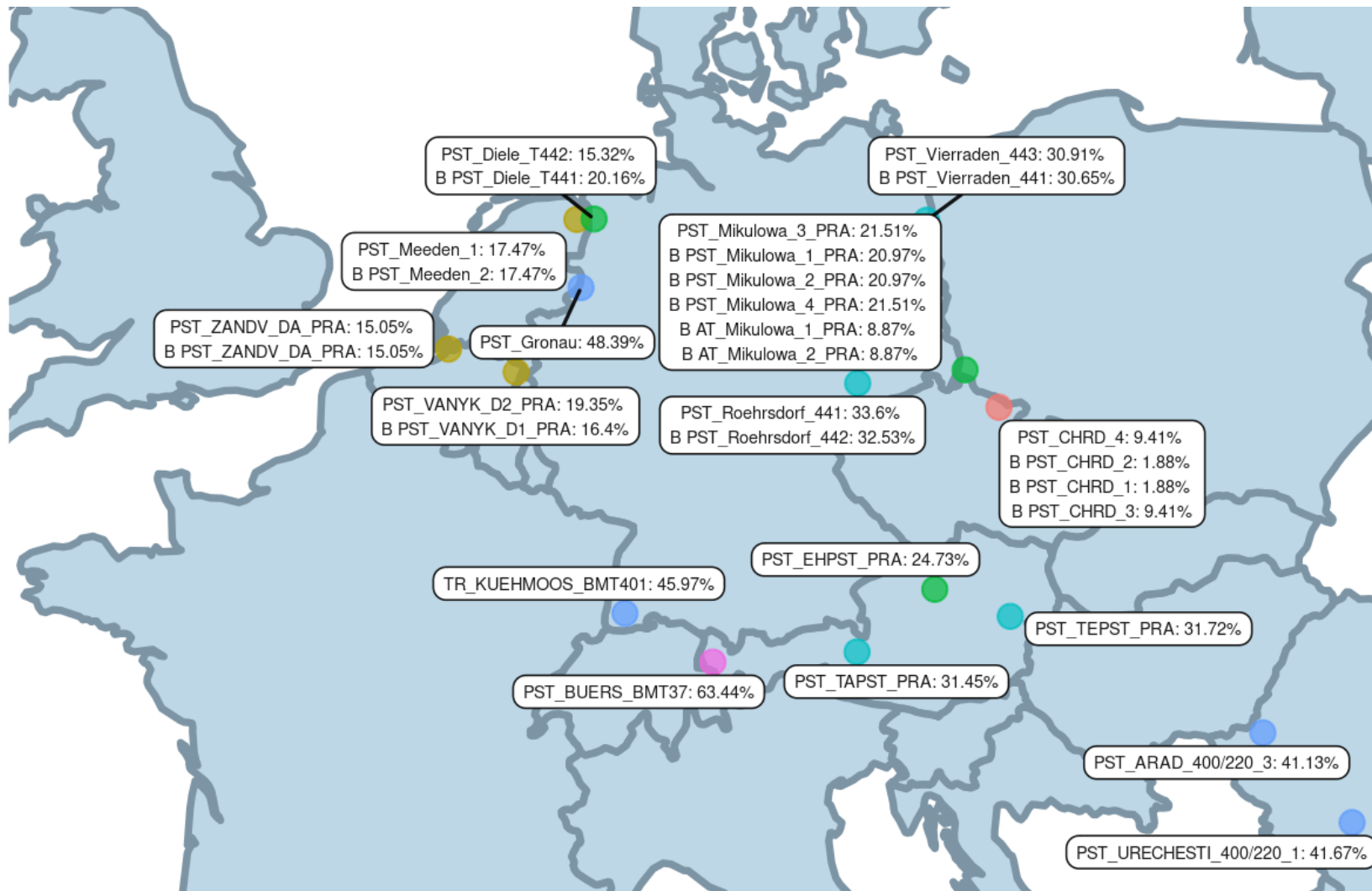


# KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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

## Relative Time Share of Applied PSTs in Preventive Mode



Relative Time Share [%]

- 0%-10%
- 10%-20%
- 20%-30%
- 30%-40%
- 40%-50%
- 60%-70%



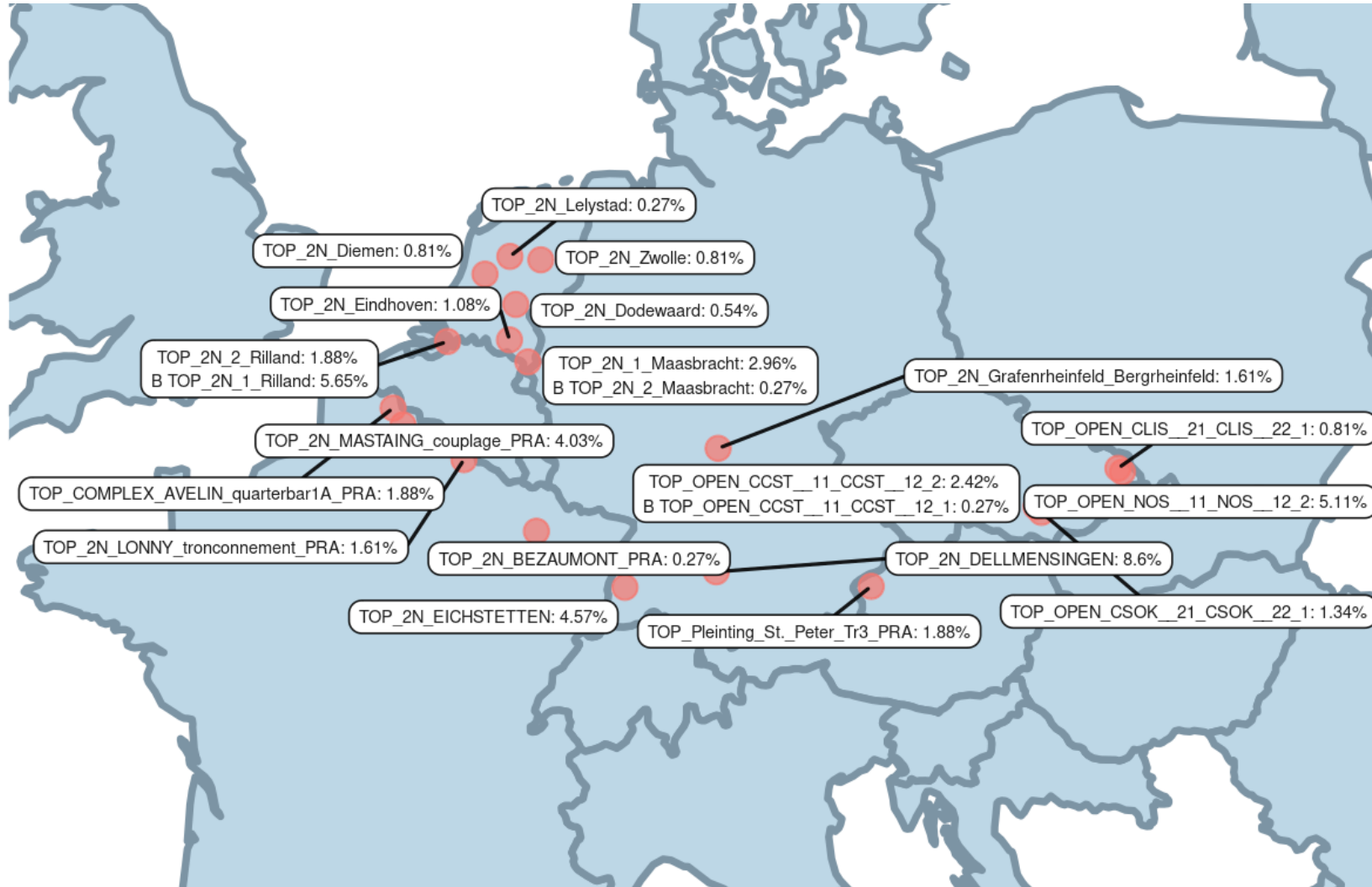
# KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

## Relative Time Share of Applied PSTs in Curative Mode



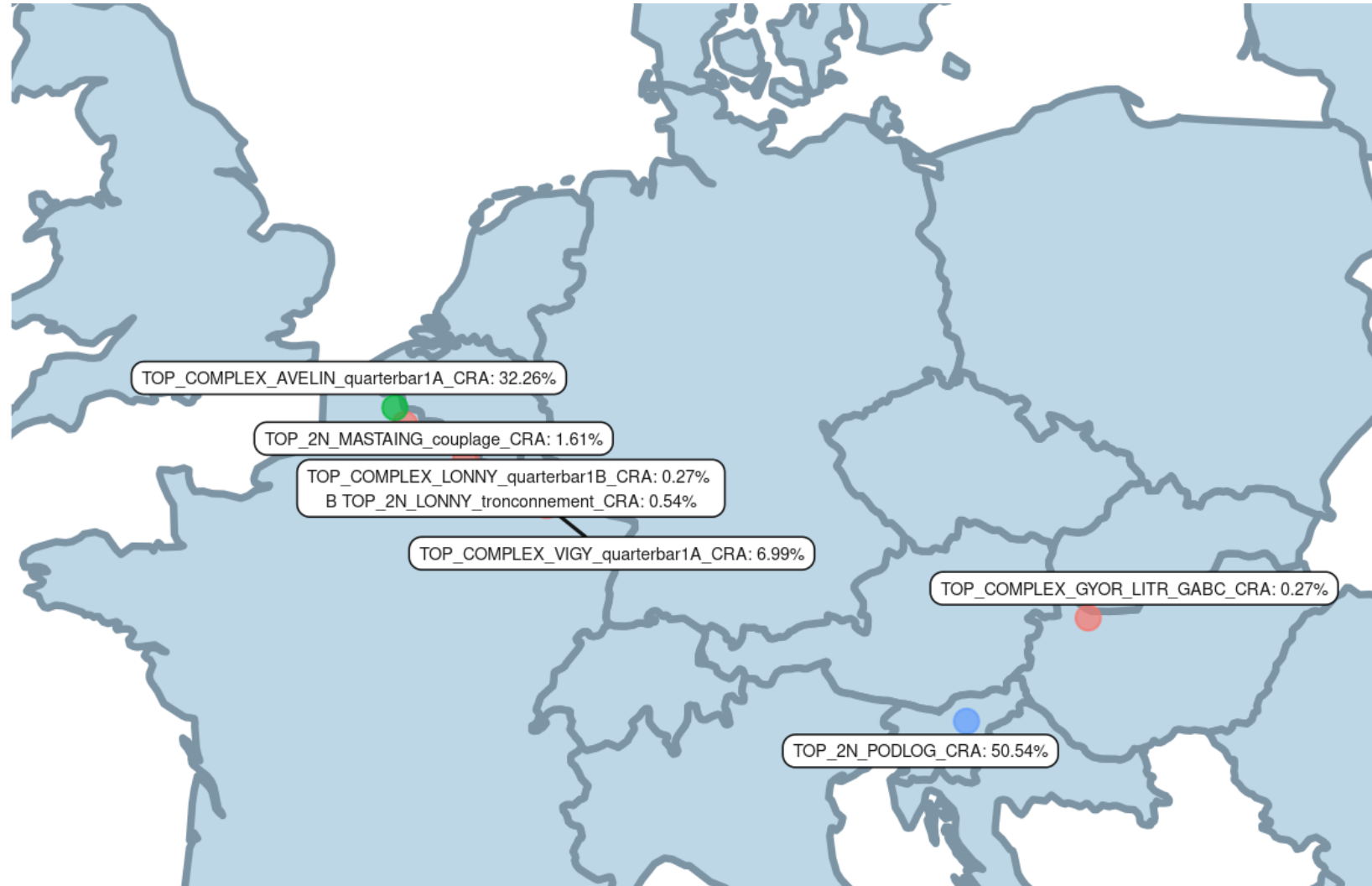
# KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

## 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

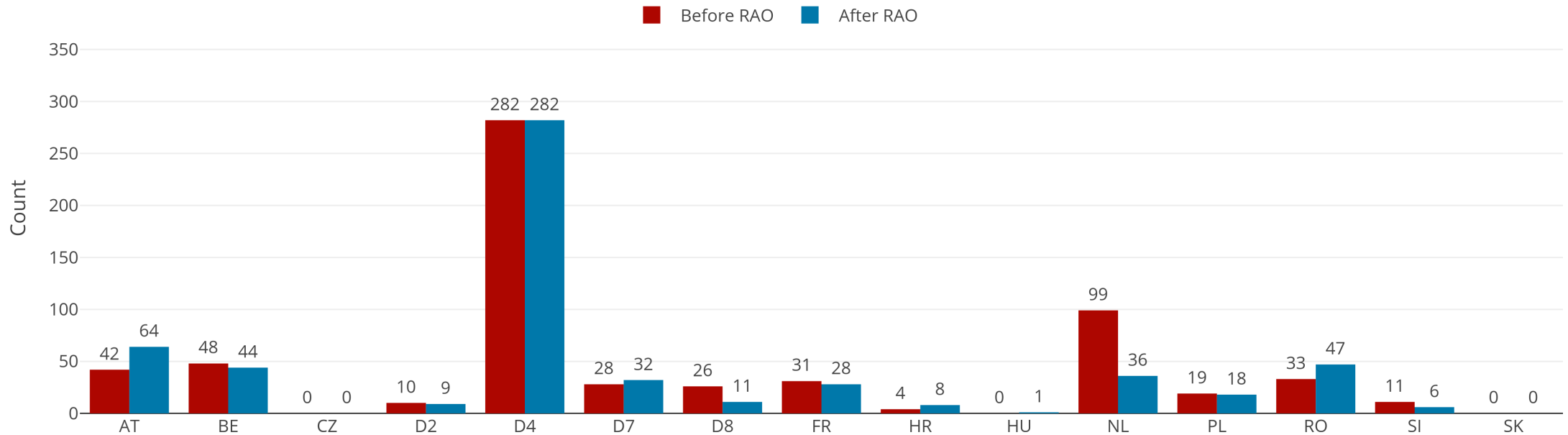


# KPI 9: Most limiting CNEC per TSO (NRAO)



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

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.

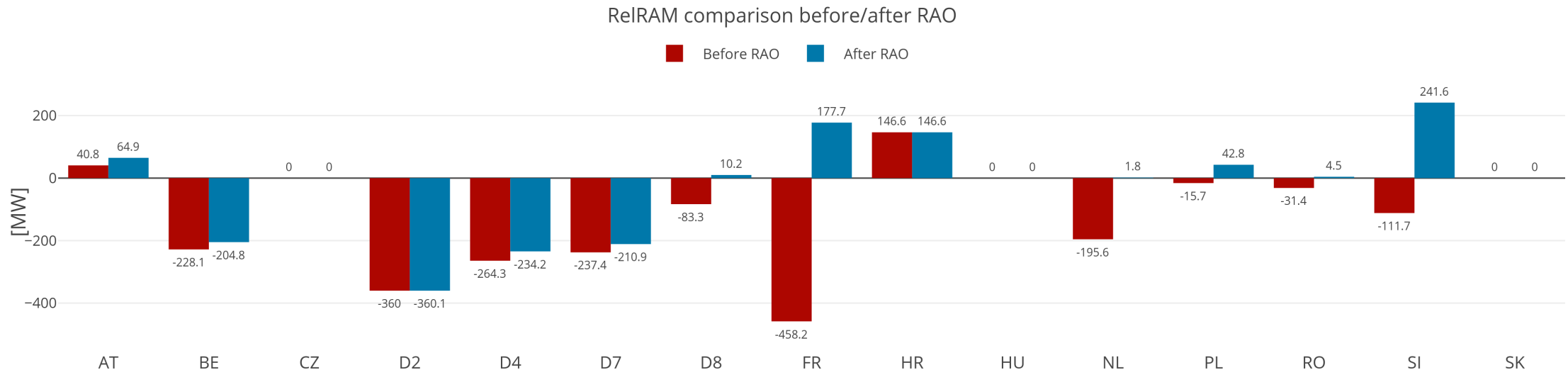
# KPI 10: Average variation of relative RAM before and after NRAO



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
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	528	528	88.34%	53.58%	119.58%	0.2739	1.0769
[SK-UA] V.Kapusany - Mukachevo (WPS) [OPP] [SK]	528	718	88.26%	58.73%	126.56%	0.2739	1.0769
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	528	1053	88.26%	56.42%	128.34%	0.2169	0.5382
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	528	531	83.65%	51.87%	122.46%	0.2169	0.5382
[NL-D7] Maasbracht - Oberzier SELFK WS [DIR] [D7]	521	2712	72.72%	8.89%	107.97%	0.3158	0.682
[HR-BA] 220kV Zakucac - Mostar [OPP] [HR]	510	510	51.25%	0.00%	142.11%	0.1339	0.4281
[SK-SK] Gabcikovo - P.Biskupice [DIR]	507	507	82.70%	66.27%	97.41%	0.2797	1.3168
[SK-HU] Gabcikovo - Gonyu [OPP] [HU]	506	978	78.24%	58.70%	102.53%	0.2935	1.0094
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	499	646	60.05%	41.30%	84.00%	0.3349	1.1848
[RO-RO] TR Rosiori 400/220 1 [DIR]	498	498	51.01%	24.75%	86.00%	0.1304	0.2203
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	497	641	96.31%	30.90%	144.38%	0.1599	0.6179
[RO-RS] Portile de Fier - Djerdap [OPP] [RO]	496	524	77.73%	23.07%	111.40%	0.504	0.7006
[CZ-SK] Liskovec - P. Bystrica [DIR] [CZ]	489	489	73.24%	57.92%	98.46%	0.0837	0.2941
[NL-BE] PST Van Eyck 2 [DIR] [BE]	487	1016	87.94%	54.42%	117.95%	0.3732	0.8452
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	484	484	56.28%	27.66%	92.84%	0.3508	1.2209
[SI-HR] 220kV Podlog - Zerjavinec [DIR] [SI]	469	835	79.53%	15.13%	112.83%	0.1157	0.4362
[NL-BE] PST Van Eyck 2 [OPP] [BE]	468	1315	78.75%	29.96%	111.80%	0.3578	0.8085
[PL-PL] Krosno Iskrzynia - Rzeszow [DIR]	466	466	123.32%	87.06%	154.00%	0.3508	1.2209
[NL-BE] PST Zandvliet 2 [DIR] [BE]	462	462	85.43%	51.17%	123.67%	0.3713	0.8409
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	454	460	73.28%	21.58%	101.20%	0.3506	1.4369

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
[D4-D7] Hoheneck - Pulverdingen ws [DIR] [D4]	137	146	2206.22	19.78%	16.99%	29.30%	0.1072
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	121	121	853.52	49.54%	27.66%	76.79%	0.3508
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	81	82	432.69	19.31%	1.10%	52.21%	0.2292
[BE-FR] Avelgem - Avelin 80 [DIR] [FR]	78	78	561.41	79.36%	18.97%	142.68%	0.3964
[HR-BA] 220kV Zakucac - Mostar [OPP] [HR]	73	73	1320.06	8.26%	0.00%	31.91%	0.1339
[D4-CH] Kuehmoos - Laufenburg br (Heimbach) [DIR] [D4]	60	60	760.23	36.59%	19.32%	74.06%	0.1675
[NL-D7] Maasbracht - Oberzier SELFK WS [DIR] [D7]	56	63	923.2	67.45%	8.89%	95.61%	0.3322
[NL-D7] Maasbracht-Oberzier 380 W [DIR] [NL]	42	42	105.1	48.44%	19.91%	75.48%	0.6082
[RO-RO] Paroseni - Targu Jiu Nord [OPP]	42	43	1959.44	22.31%	0.00%	48.08%	0.0989
[NL-D2] Meeden-Diele 380 Z [DIR] [NL]	41	41	1050.66	63.71%	27.83%	116.33%	0.2724
[AT-CH] Meiningen - Ruetli 408 [DIR] [AT]	41	41	1183.75	18.91%	14.84%	23.13%	0.0862
[AT-D4] Meiningen - Buers 406A [OPP] [AT]	41	43	2485.91	18.83%	5.16%	19.62%	0.0679
[D8-PL] Mikulowa PST3 [OPP] [PL]	39	39	354.17	41.67%	19.24%	86.29%	0.3992
[D4-CH] Trossingen - Laufenburg rt [DIR] [D4]	36	36	1746.08	20.24%	19.25%	28.50%	0.0687
[SI-AT] 220 kV Podlog - Obersielach [OPP] [SI]	35	37	362.02	19.15%	0.27%	53.74%	0.2709
[D7-D7] Buerstadt - Lamsheim BUERST W [DIR]	32	32	740.94	29.64%	19.43%	47.36%	0.171
[D8-D8] Pasewalk - Vierraden 306 [DIR]	30	30	1676.74	26.02%	19.18%	36.69%	0.1049
[NL-BE] PST Zandvliet 2 [DIR] [BE]	28	28	320.61	80.08%	57.60%	94.63%	0.3493
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	25	26	738.07	76.60%	55.24%	106.93%	0.129
[D8-PL] Mikulowa PST1 [OPP] [PL]	24	24	299.08	31.94%	22.05%	48.56%	0.3499

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
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AC was Limiting MC 0

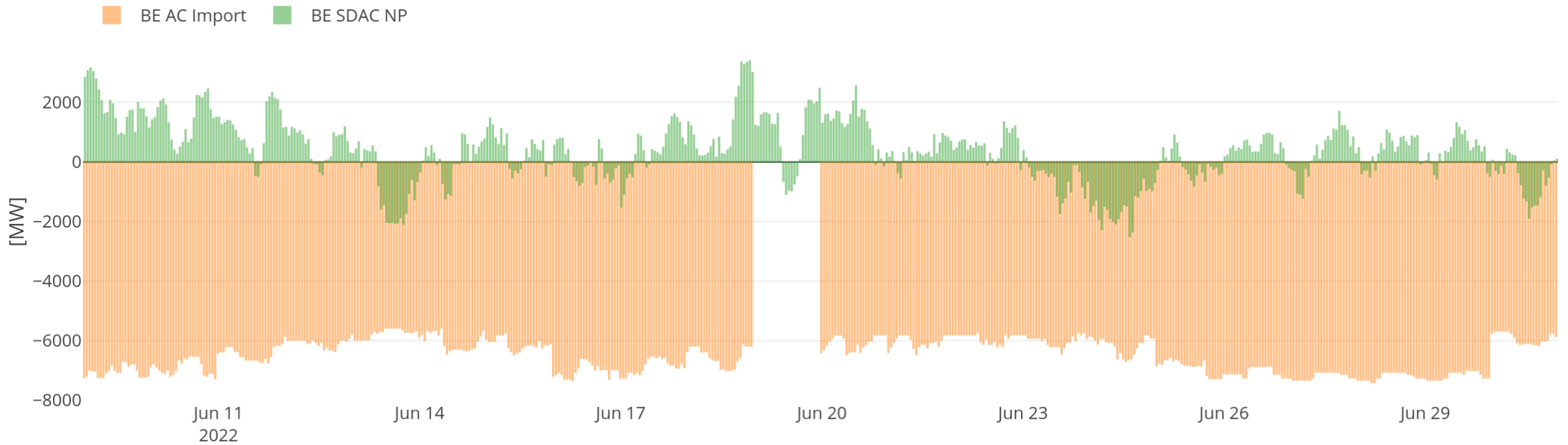
	BE AC Import [MW]
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Avg. -6485.24

Min. -7402.00

Max. -5572.00

Belgium only uses import allocation constraints





# KPI 13b: Allocation Constraints - Poland



	# MTUs
AC was limiting MC	315
AC < 0 MW	2
AC = 0 MW	210
AC > 0 MW	103

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-3161.45	720.91
Min.	-8009.00	0.00
Max.	0.00	4542.00

