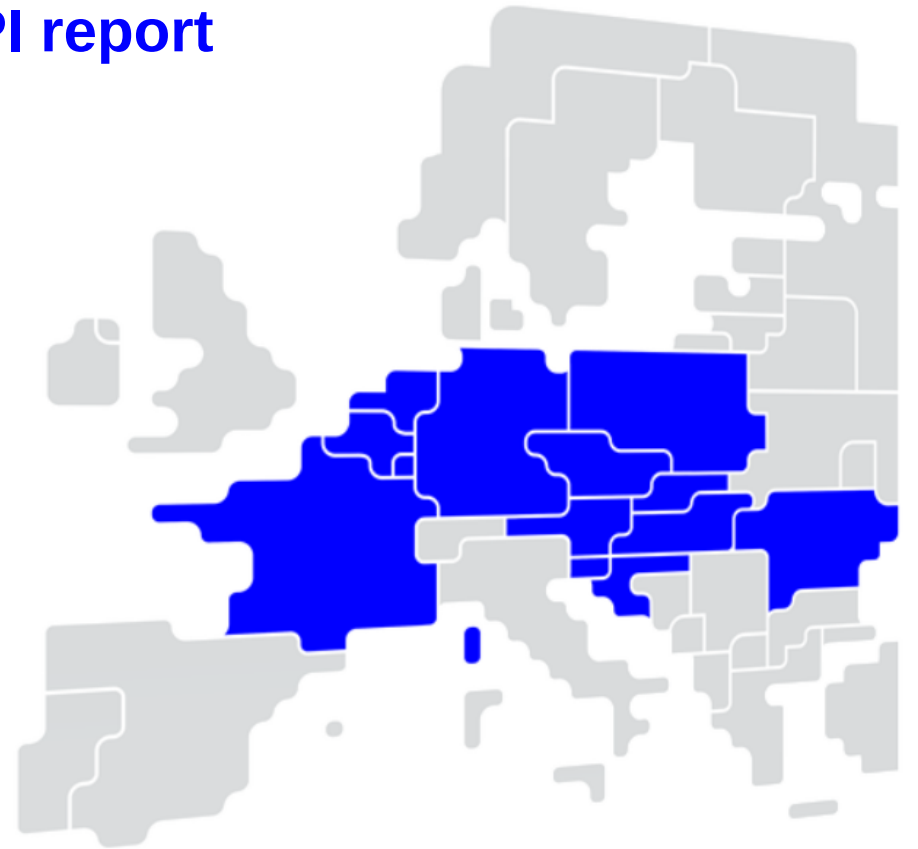


Core FB MC Operational KPI report

September 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)

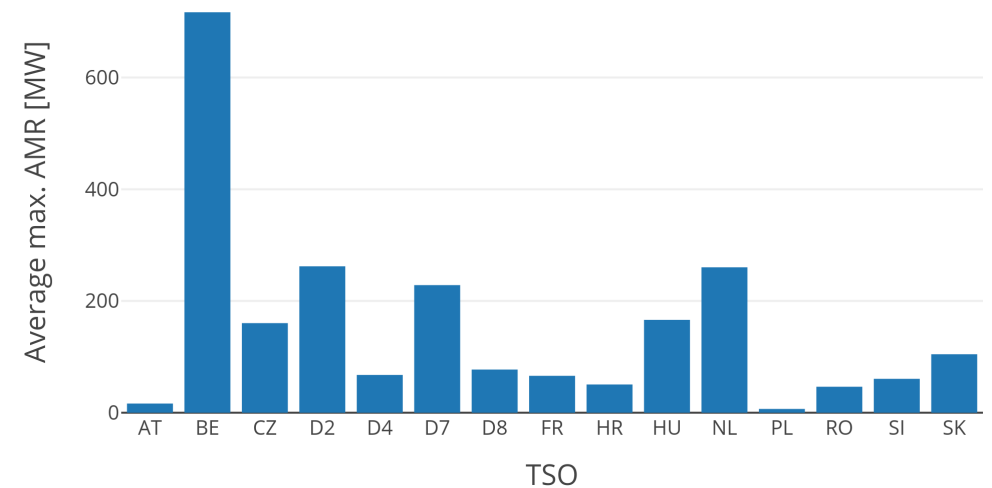
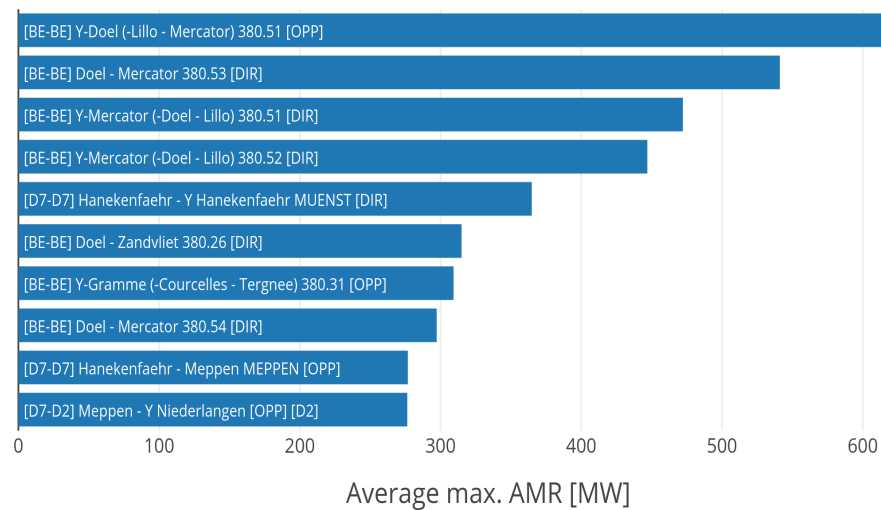
KPI 2: Average maximum AMR per TSO



CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[BE-BE] Y-Doel (-Lillo - Mercator) 380.51 [OPP]	634.49	43.70%
[BE-BE] Doel - Mercator 380.53 [DIR]	541.11	34.07%
[BE-BE] Y-Mercator (-Doel - Lillo) 380.51 [DIR]	472.19	32.51%
[BE-BE] Y-Mercator (-Doel - Lillo) 380.52 [DIR]	446.93	30.81%
[D7-D7] Hanekenfaehr - Y Hanekenfaehr MUENST [DIR]	364.81	0.79%
[BE-BE] Doel - Zandvliet 380.26 [DIR]	314.91	20.89%
[BE-BE] Y-Gramme (-Courcelles - Tergnee) 380.31 [OPP]	309.22	20.13%
[BE-BE] Doel - Mercator 380.54 [DIR]	297.24	18.68%
[D7-D7] Hanekenfaehr - Meppen MEPPEN [OPP]	276.76	9.50%
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	276.35	11.06%

TSO	Average maximum AMR per TSO
AT	16.47
BE	716.85
CZ	160.32
D2	262.16
D4	67.65
D7	228.40
D8	77.22
FR	66.01
HR	50.55
HU	166.28

TSO	Average maximum AMR per TSO
NL	260.29
PL	6.72
RO	46.45
SI	60.57
SK	104.67



KPI 3: Share of MTUs with intervention per TSO



Total BDs

30

Total MTUs

720

MTUs without IVA

253

Share of distinct MTUs without IVA

35.1%

MTUs with IVA

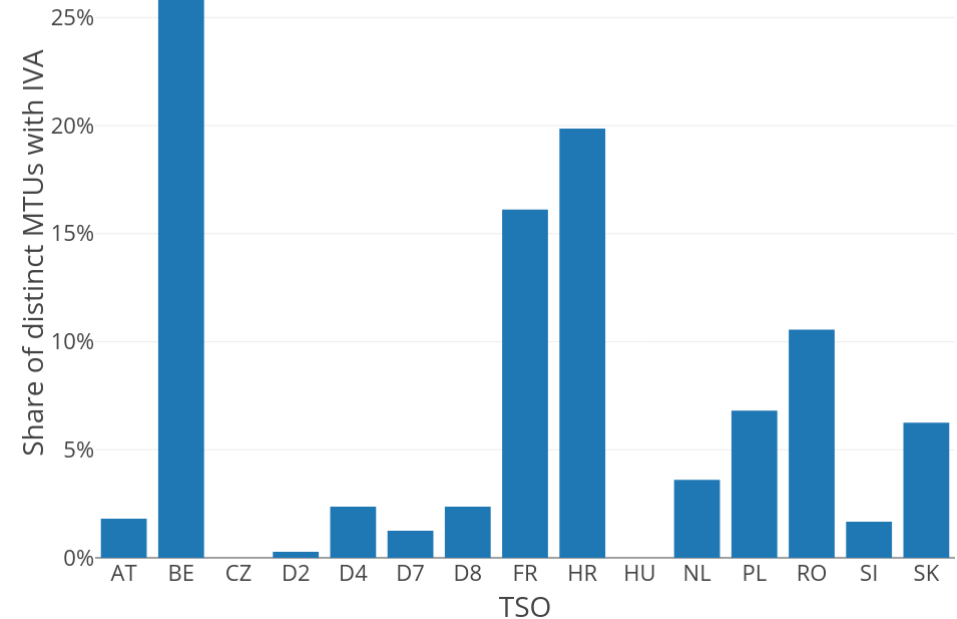
467

Share of distinct MTUs with IVA

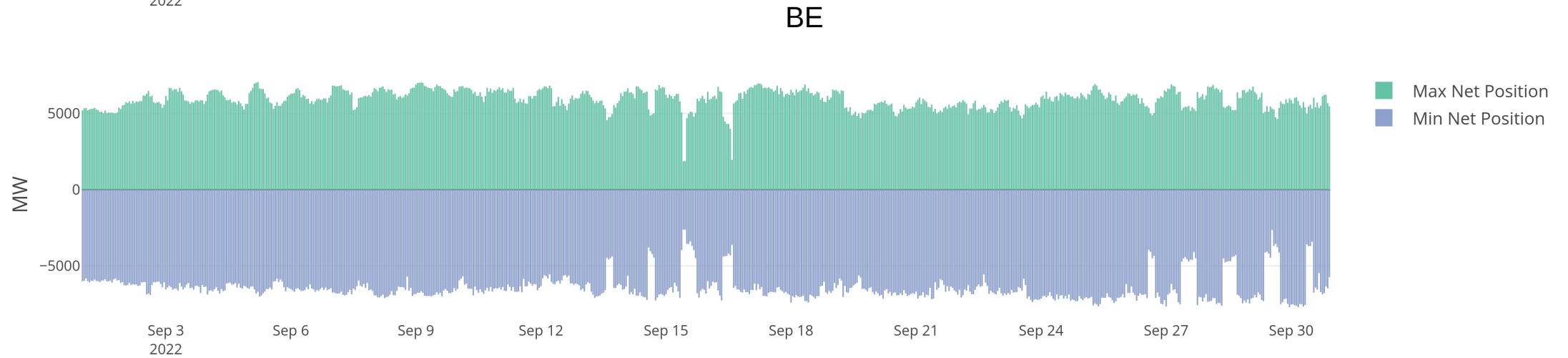
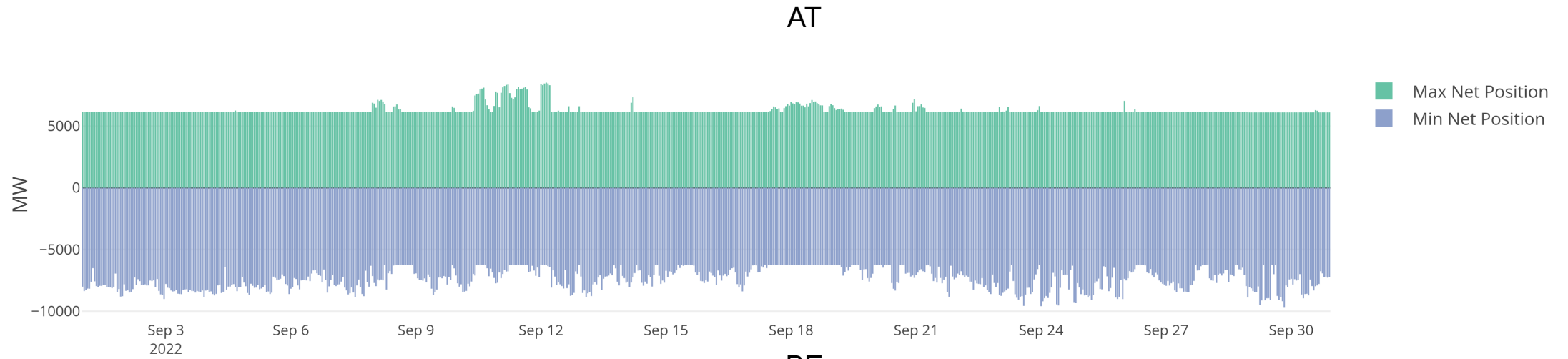
64.9%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
SI	1.67%	12
CZ	0.00%	0
AT	1.81%	13
D7	1.25%	9
D8	2.36%	17
D2	0.28%	2
PL	6.81%	49
D4	2.36%	17
SK	6.25%	45
HU	0.00%	0

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
BE	26.81%	193
NL	3.61%	26
FR	16.11%	116
RO	10.56%	76
HR	19.86%	143



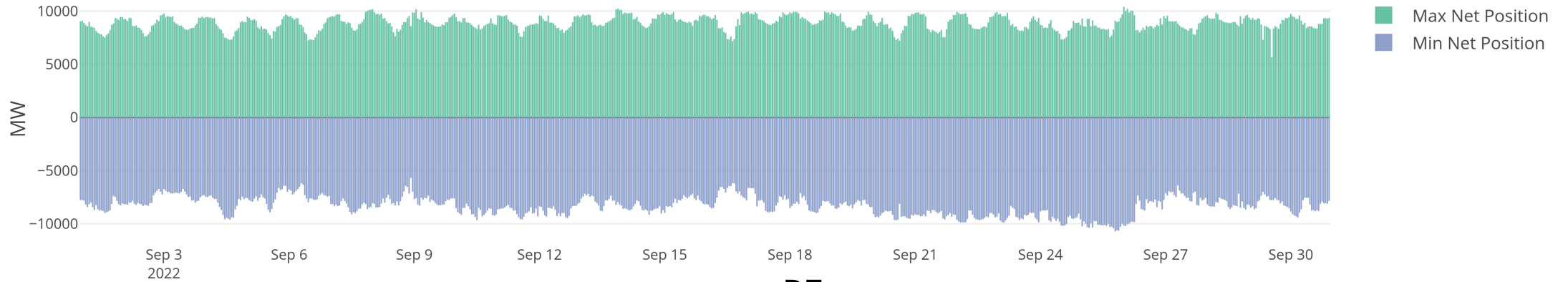
KPI 5: Min & max net positions per BZ hub



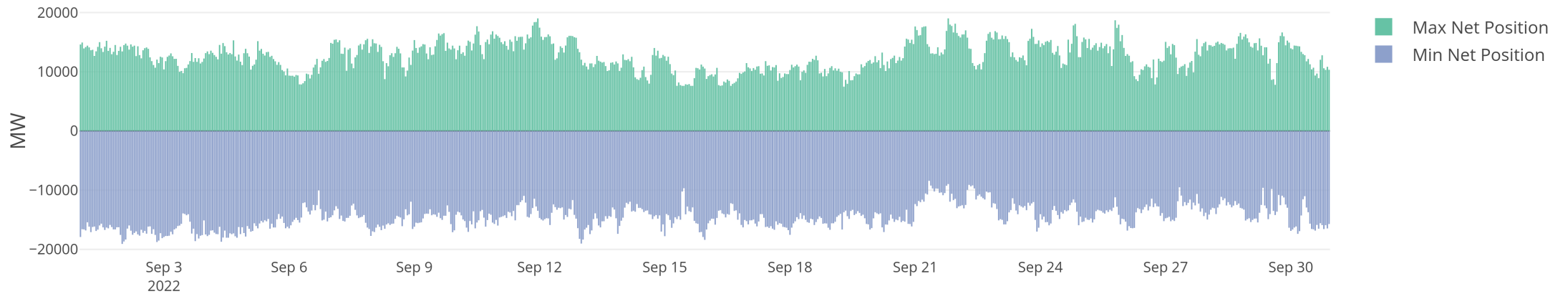
KPI 5: Min & max net positions per BZ hub



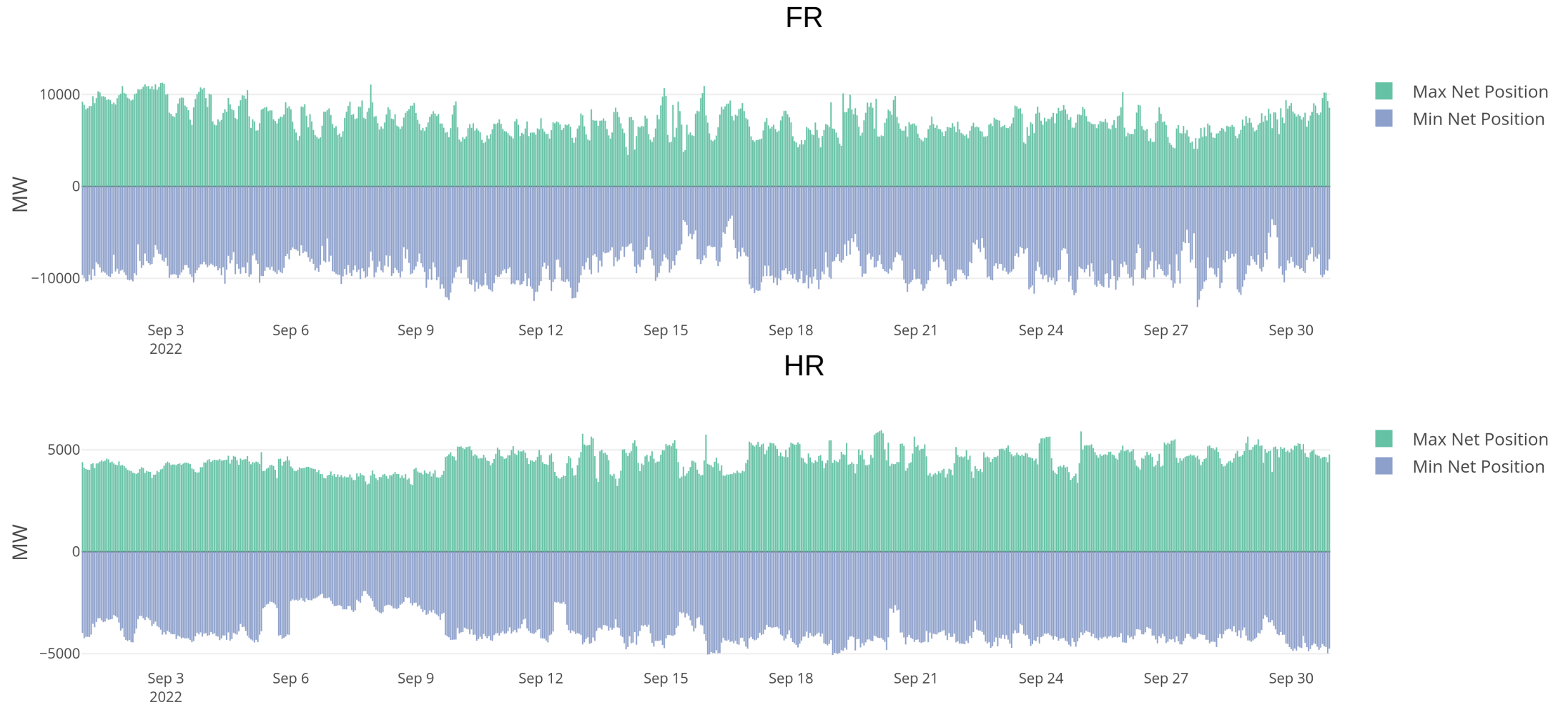
CZ



DE



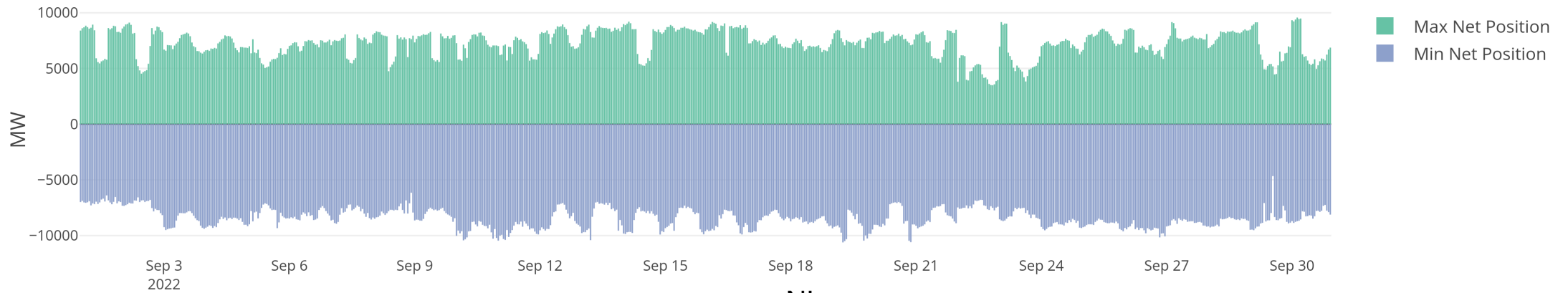
KPI 5: Min & max net positions per BZ hub



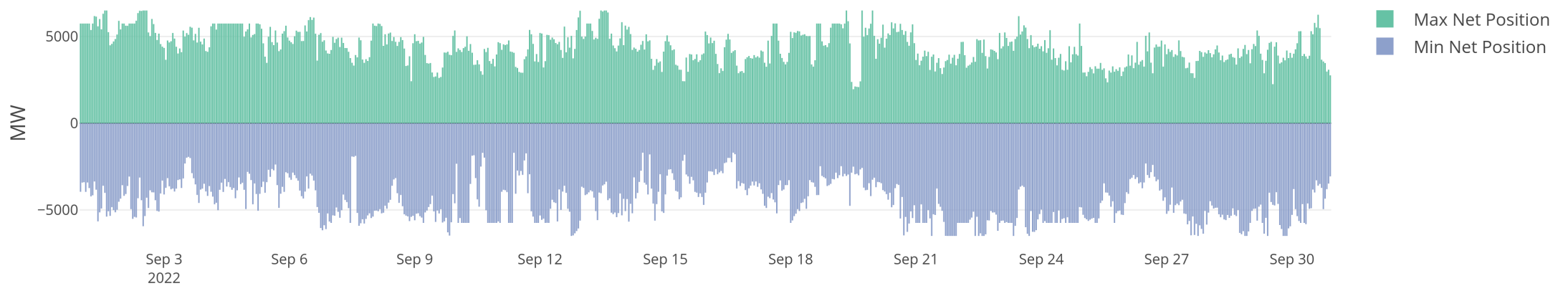
KPI 5: Min & max net positions per BZ hub



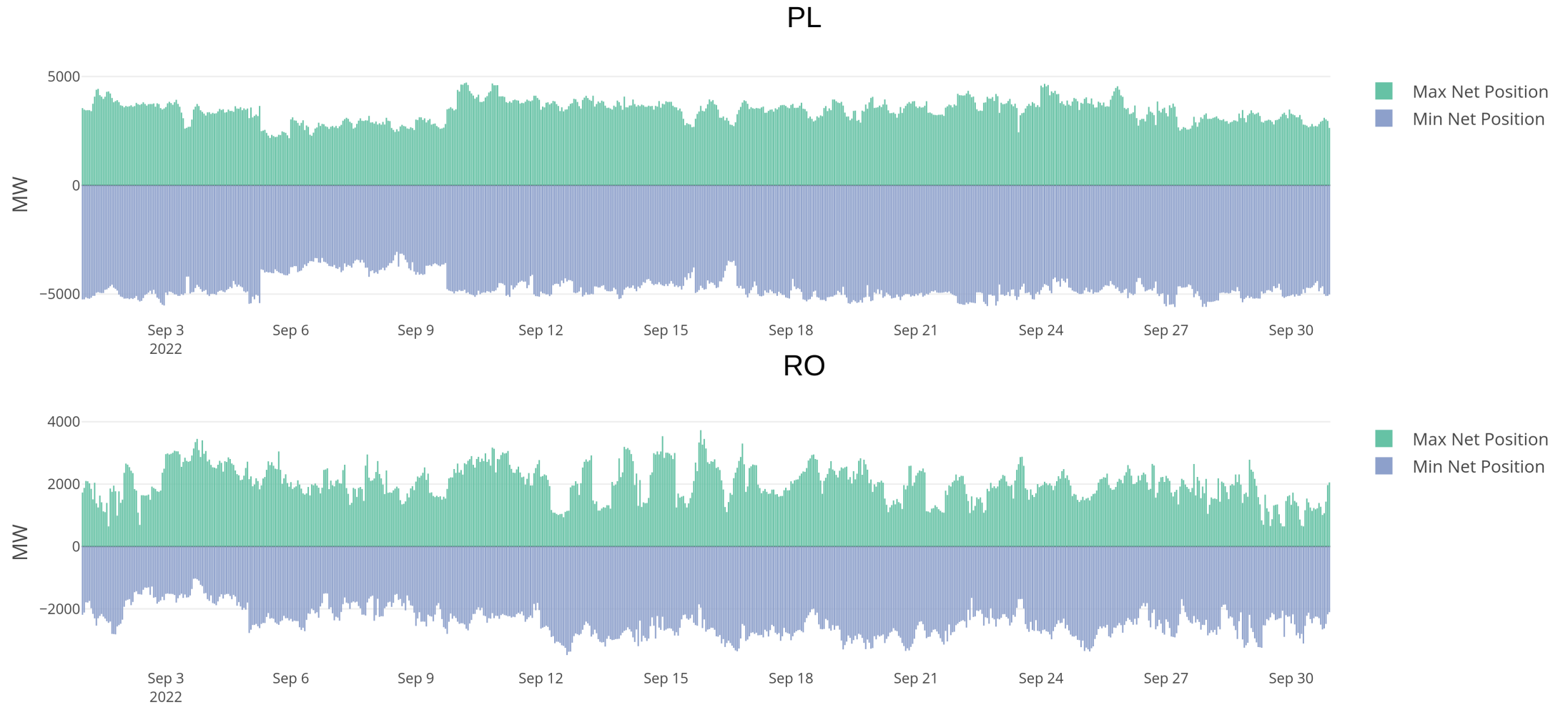
HU



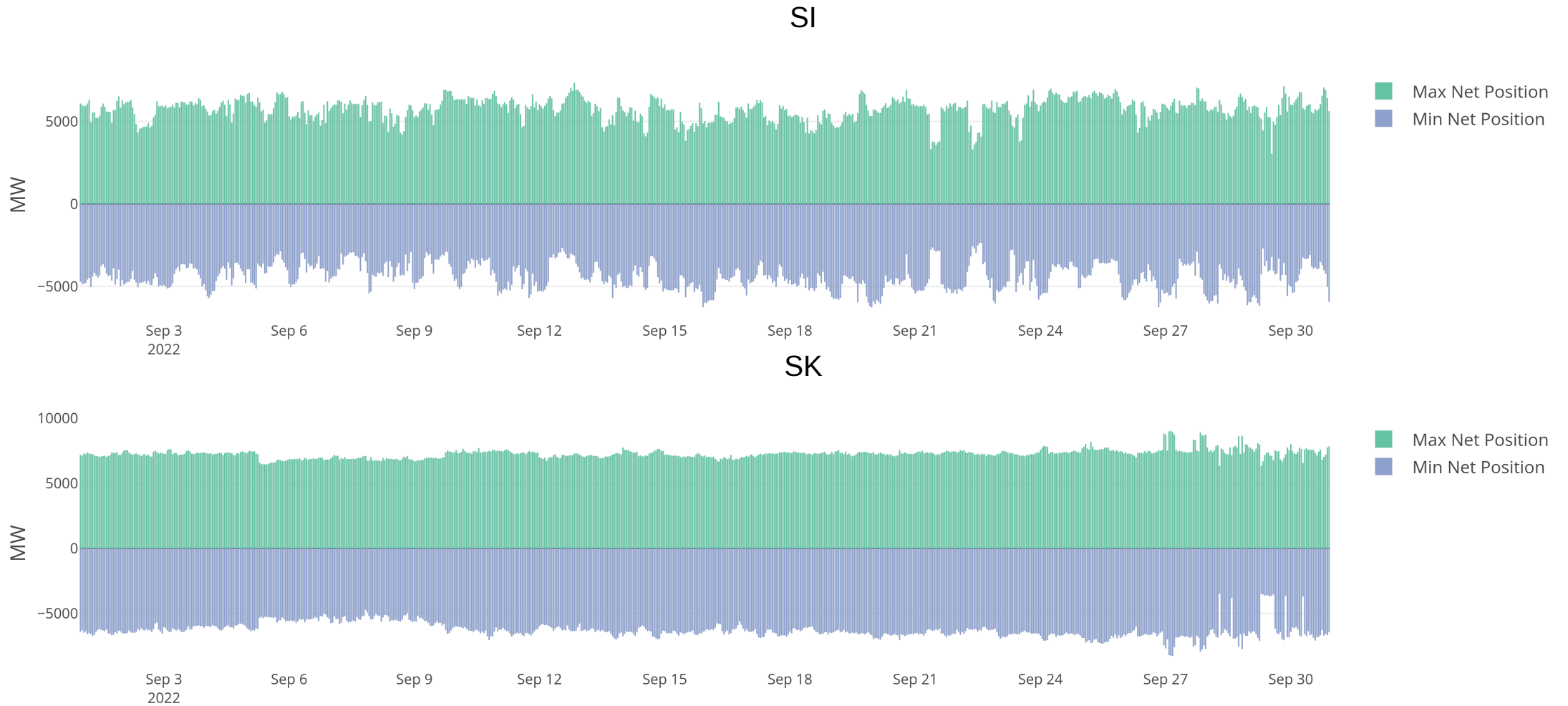
NL



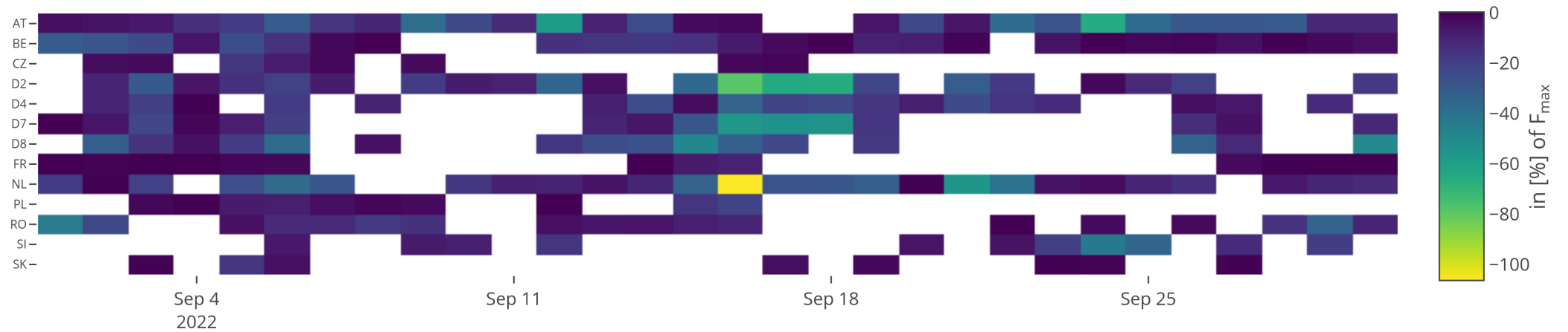
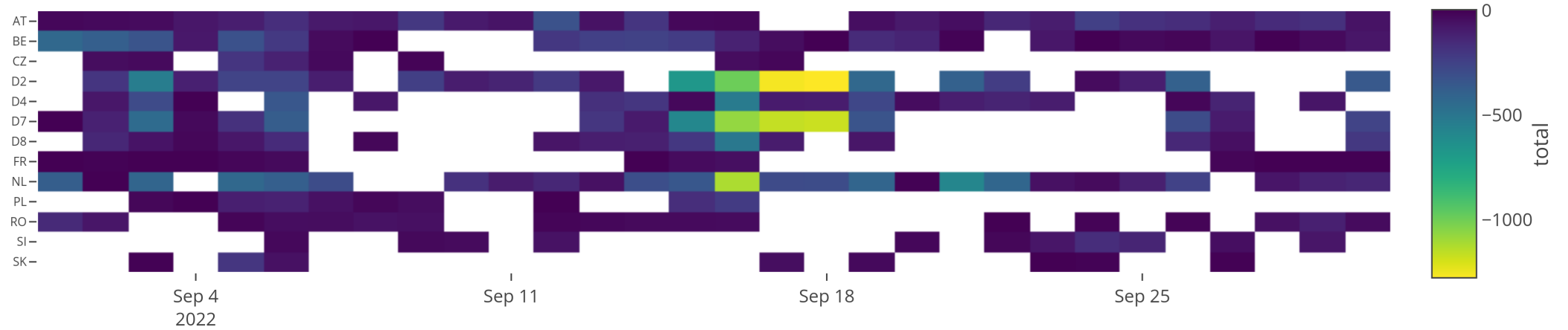
KPI 5: Min & max net positions per BZ hub



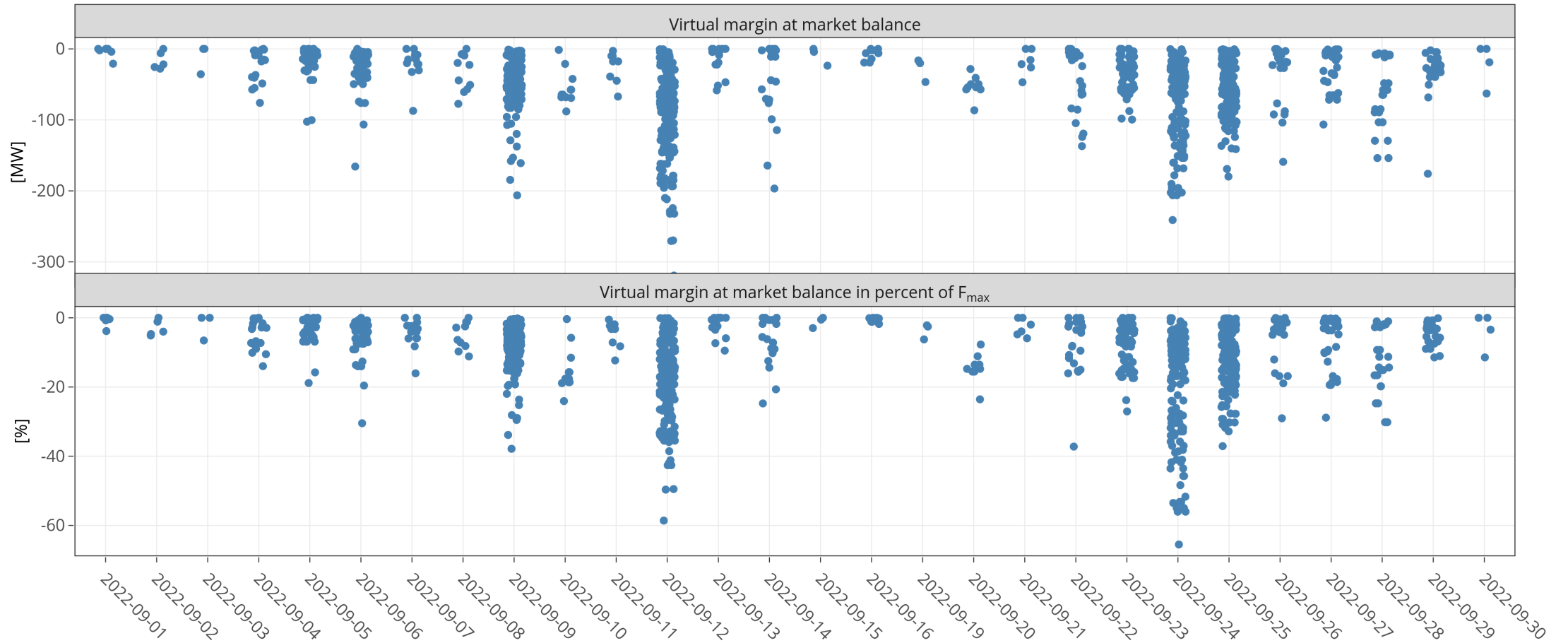
KPI 5: Min & max net positions per BZ hub



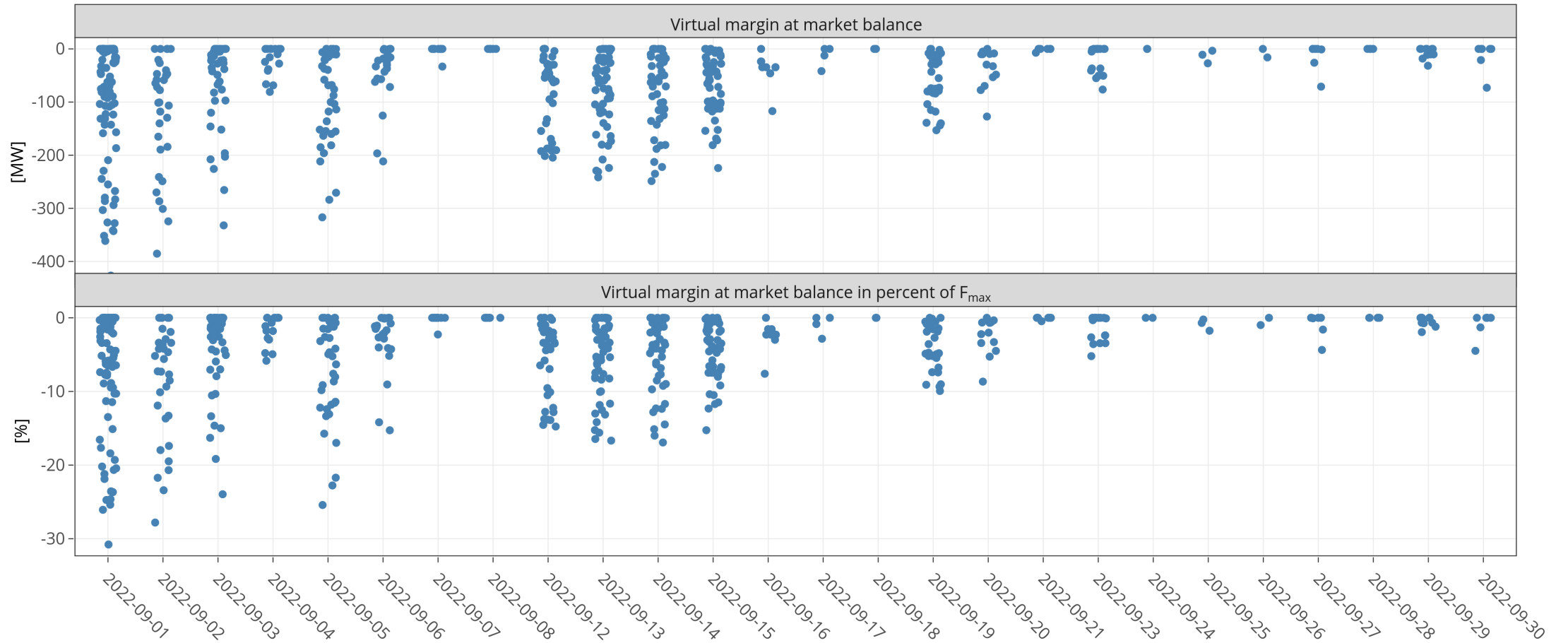
KPI 6a: Highest virtual margins at market balance for CORE TSOs



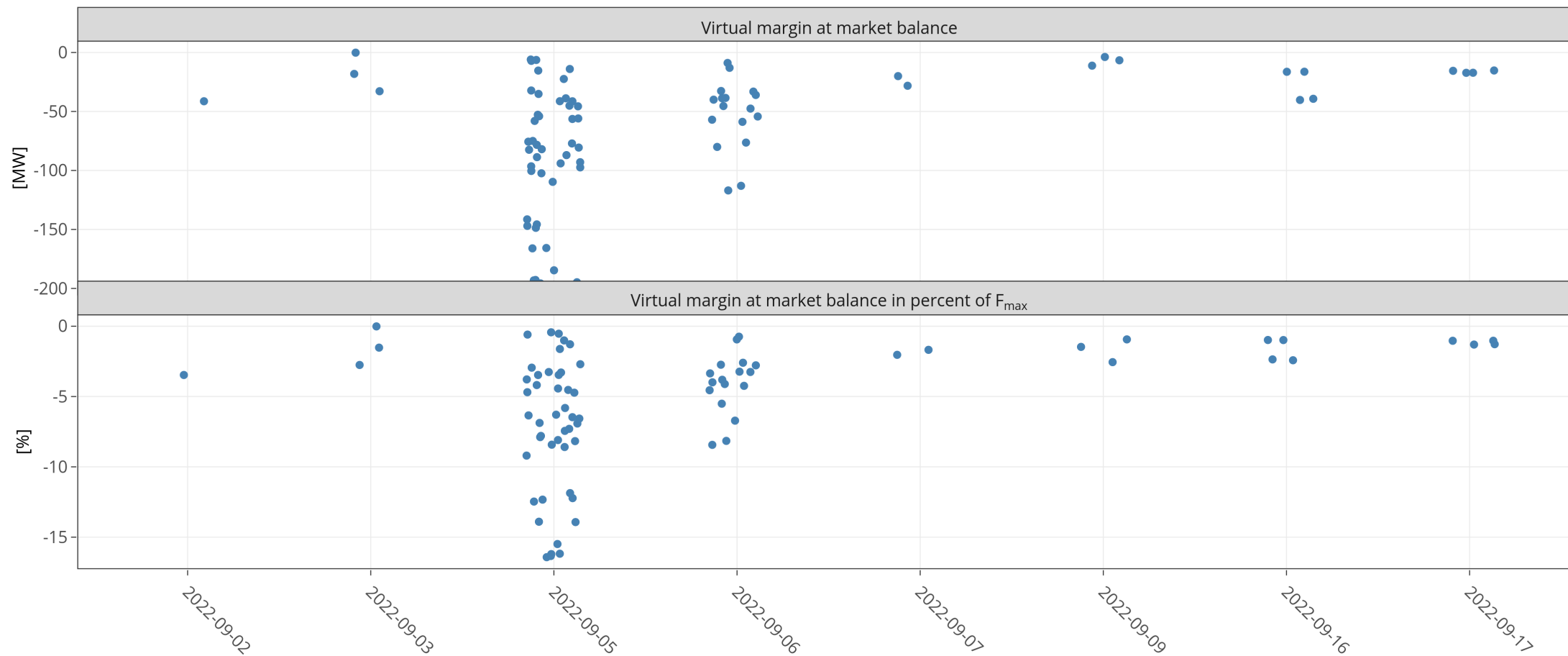
KPI 6b: Virtual margins at market balance AT



KPI 6b: Virtual margins at market balance BE



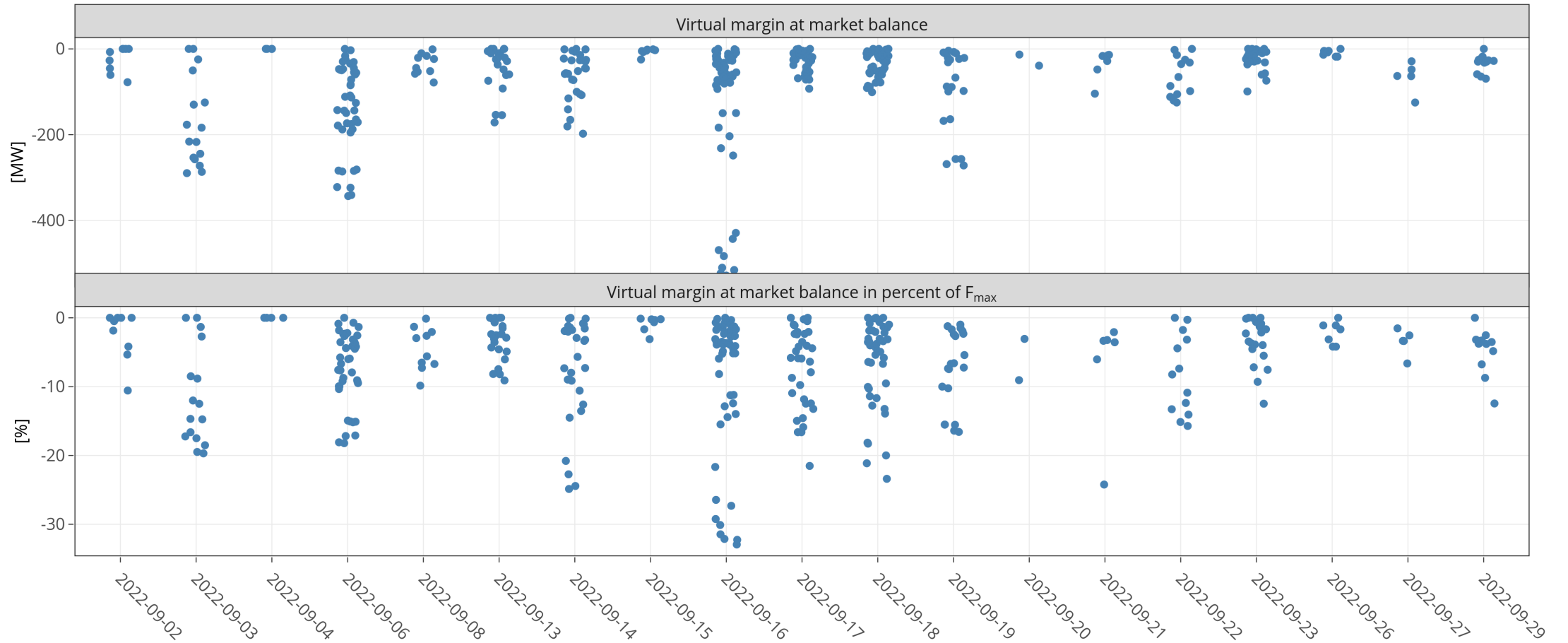
KPI 6b: Virtual margins at market balance CZ



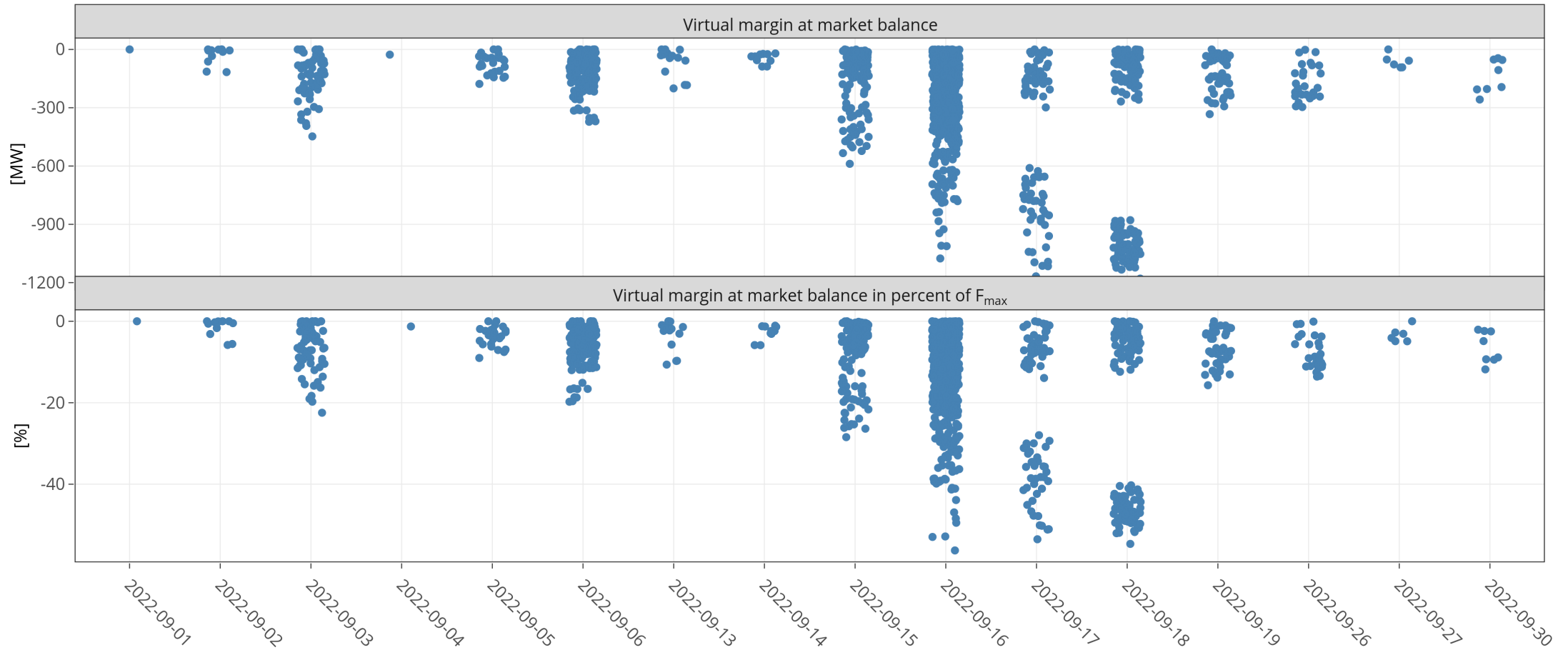
KPI 6b: Virtual margins at market balance D2



KPI 6b: Virtual margins at market balance D4



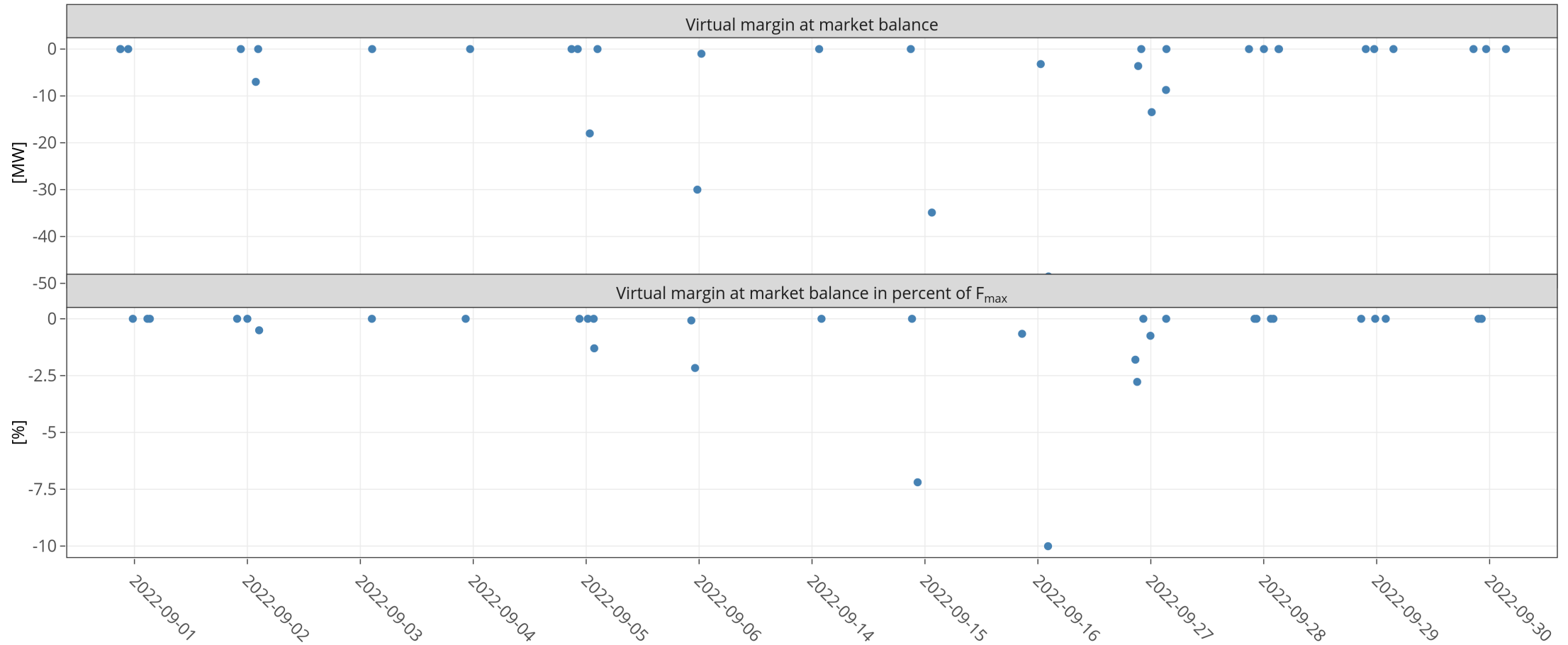
KPI 6b: Virtual margins at market balance D7



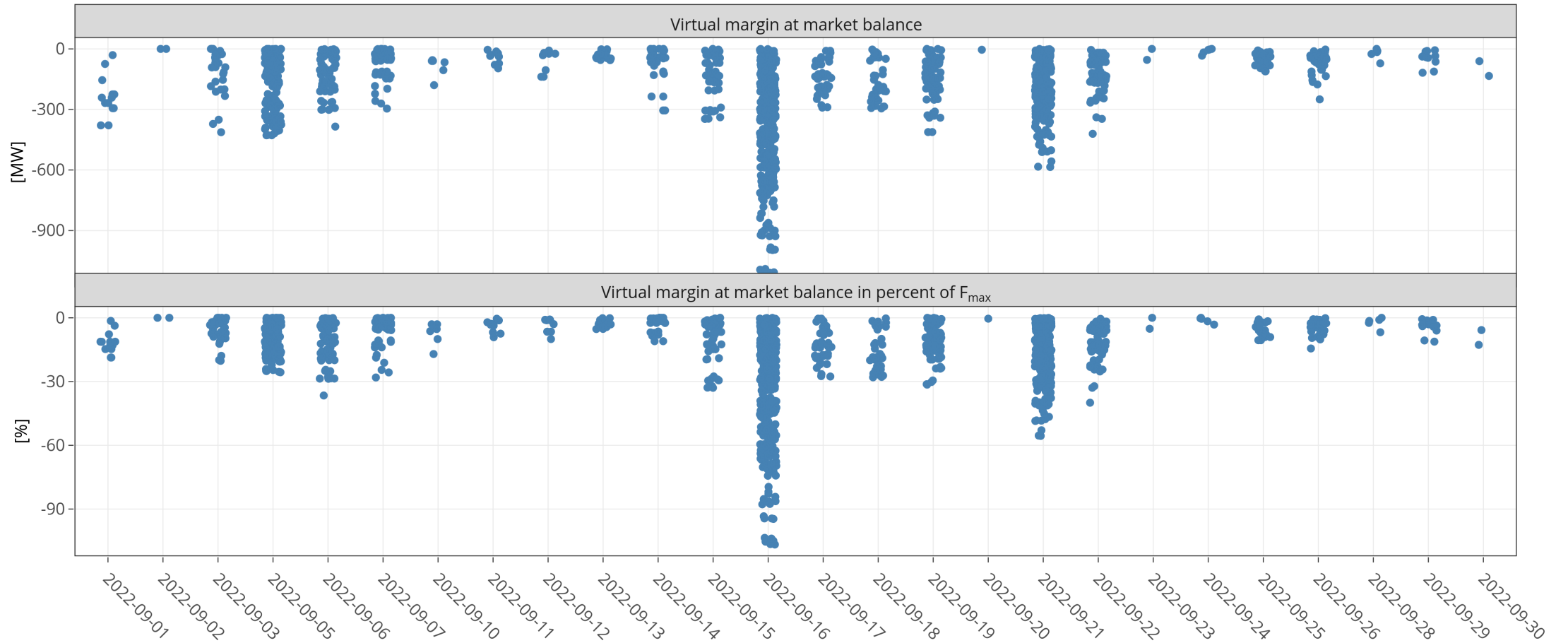
KPI 6b: Virtual margins at market balance D8



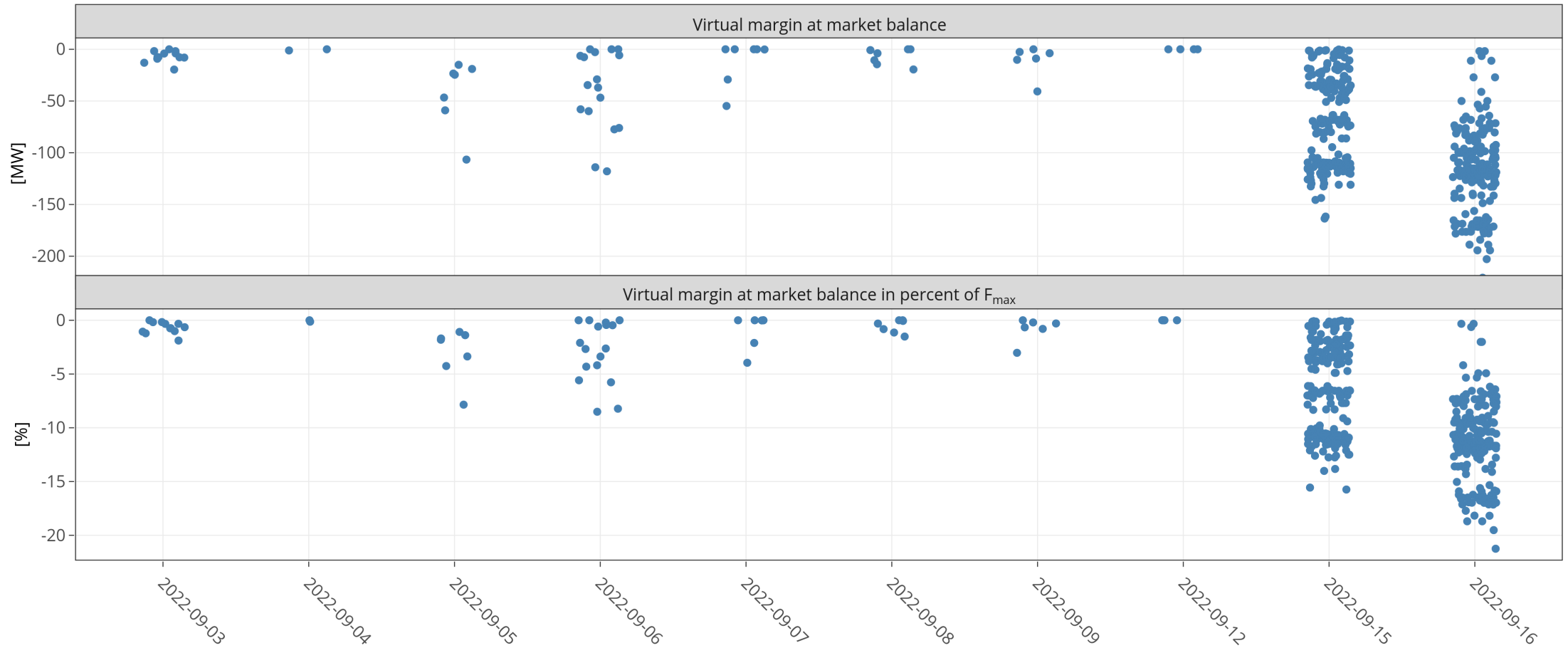
KPI 6b: Virtual margins at market balance FR



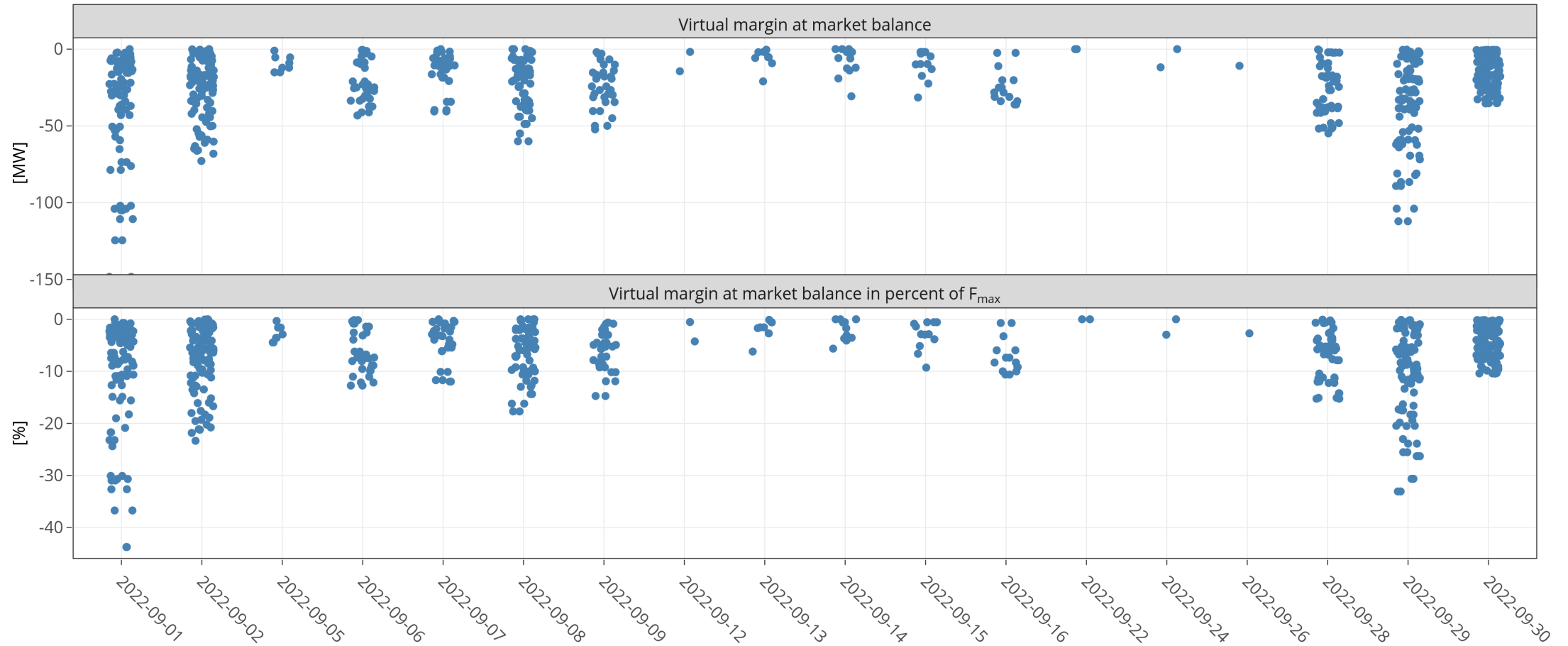
KPI 6b: Virtual margins at market balance NL



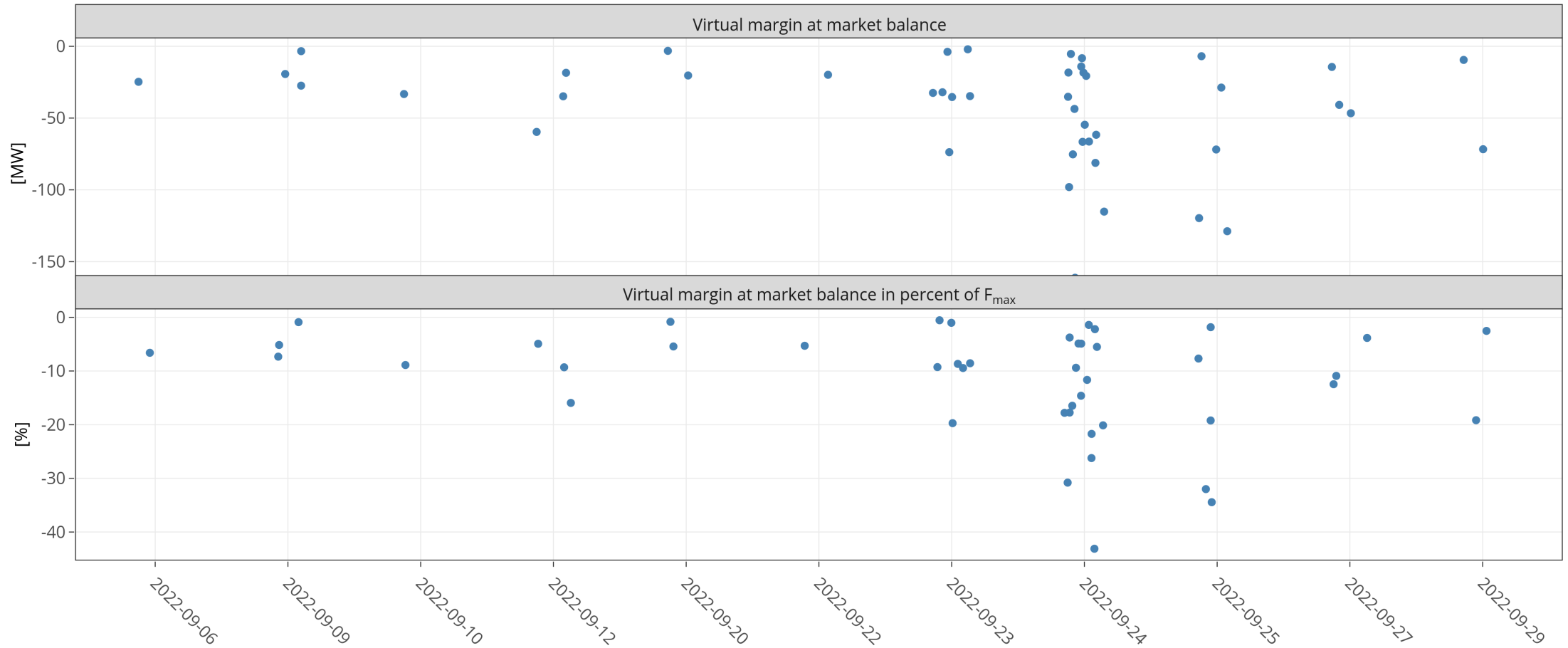
KPI 6b: Virtual margins at market balance PL



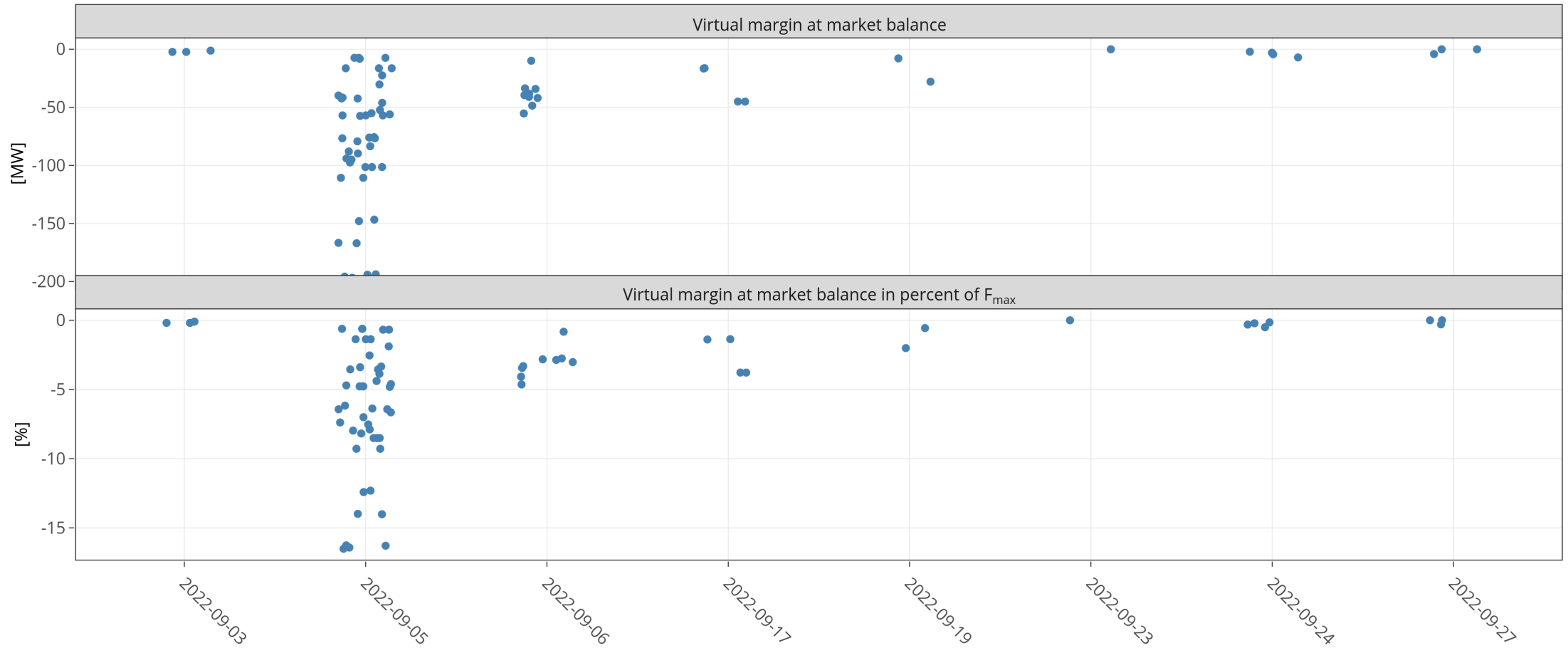
KPI 6b: Virtual margins at market balance RO



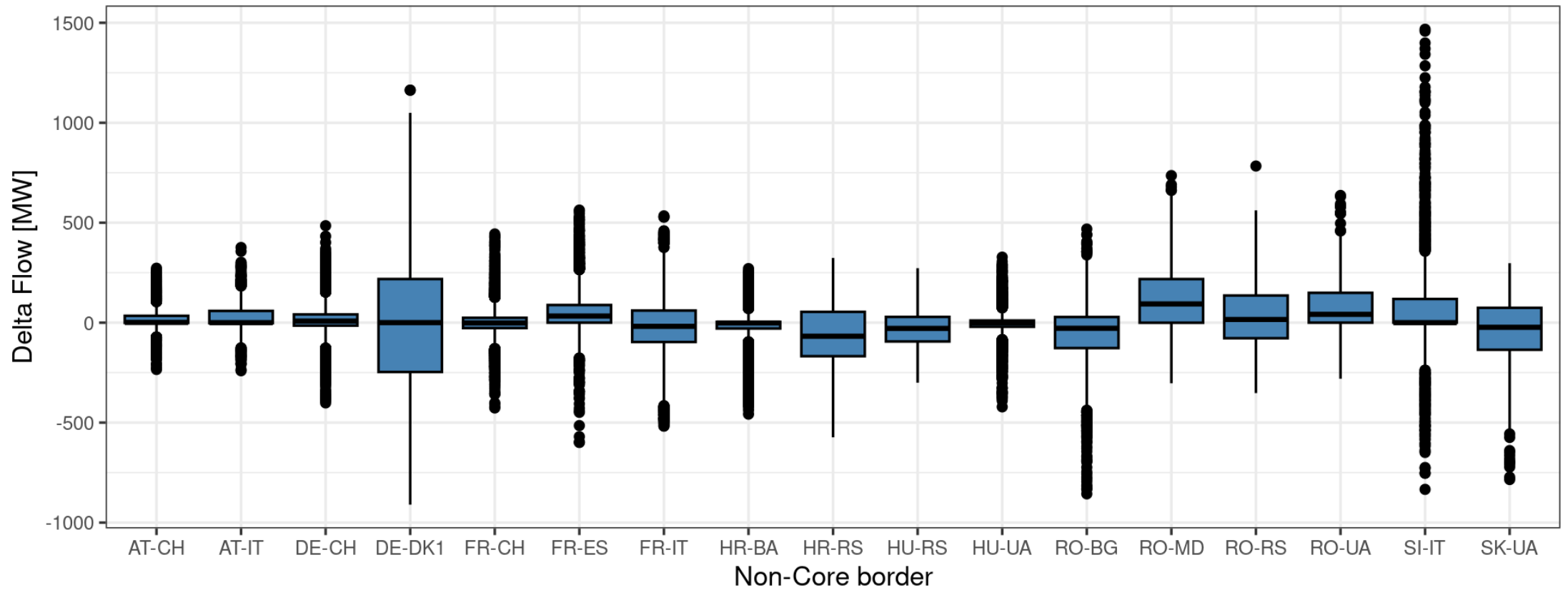
KPI 6b: Virtual margins at market balance SI



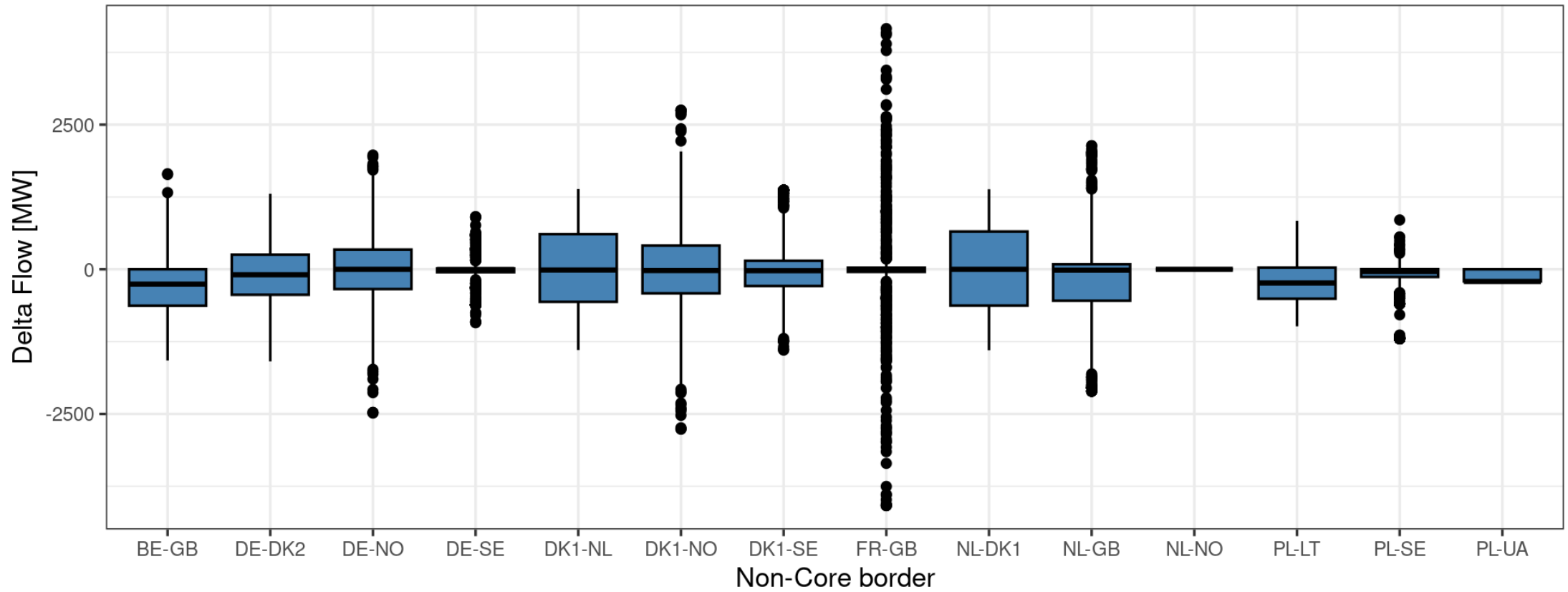
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow



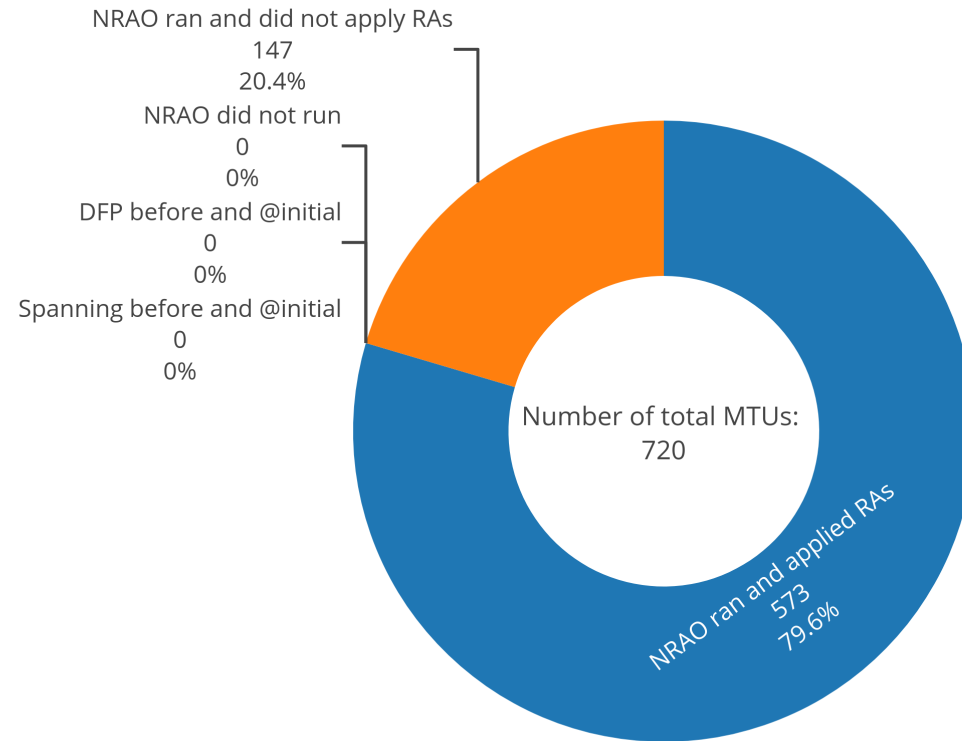
KPI 7: Non-Core exchanges DC delta flow



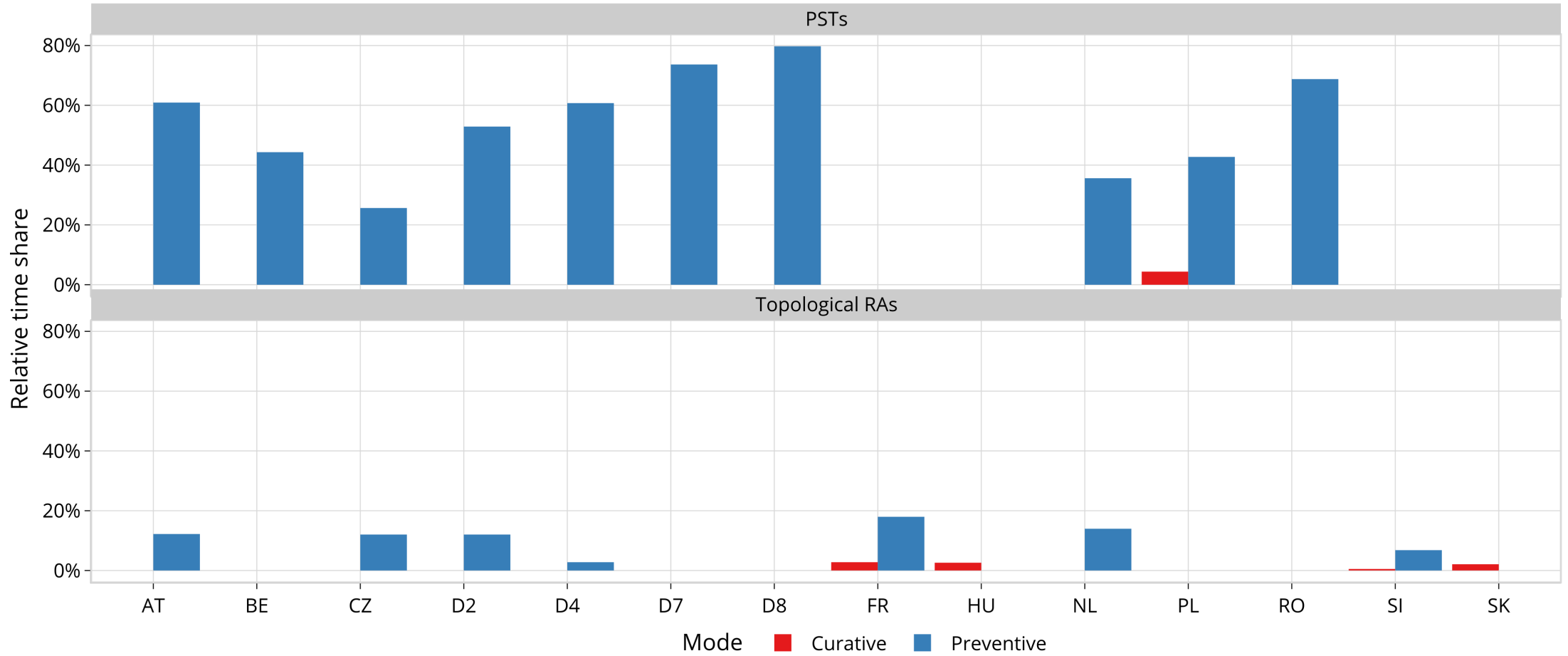
KPI 8: NRAO – Applied Remedial Action



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

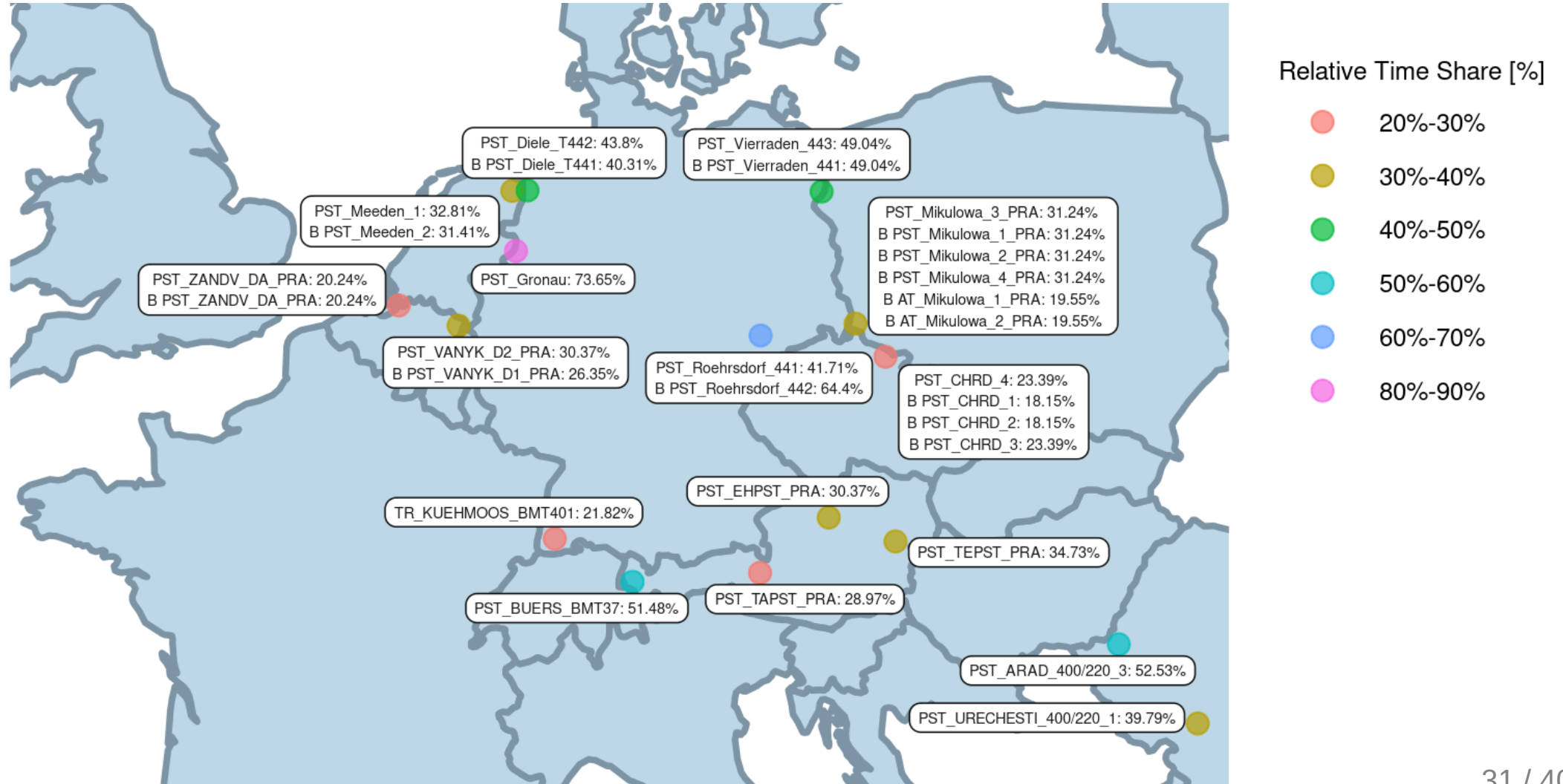


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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

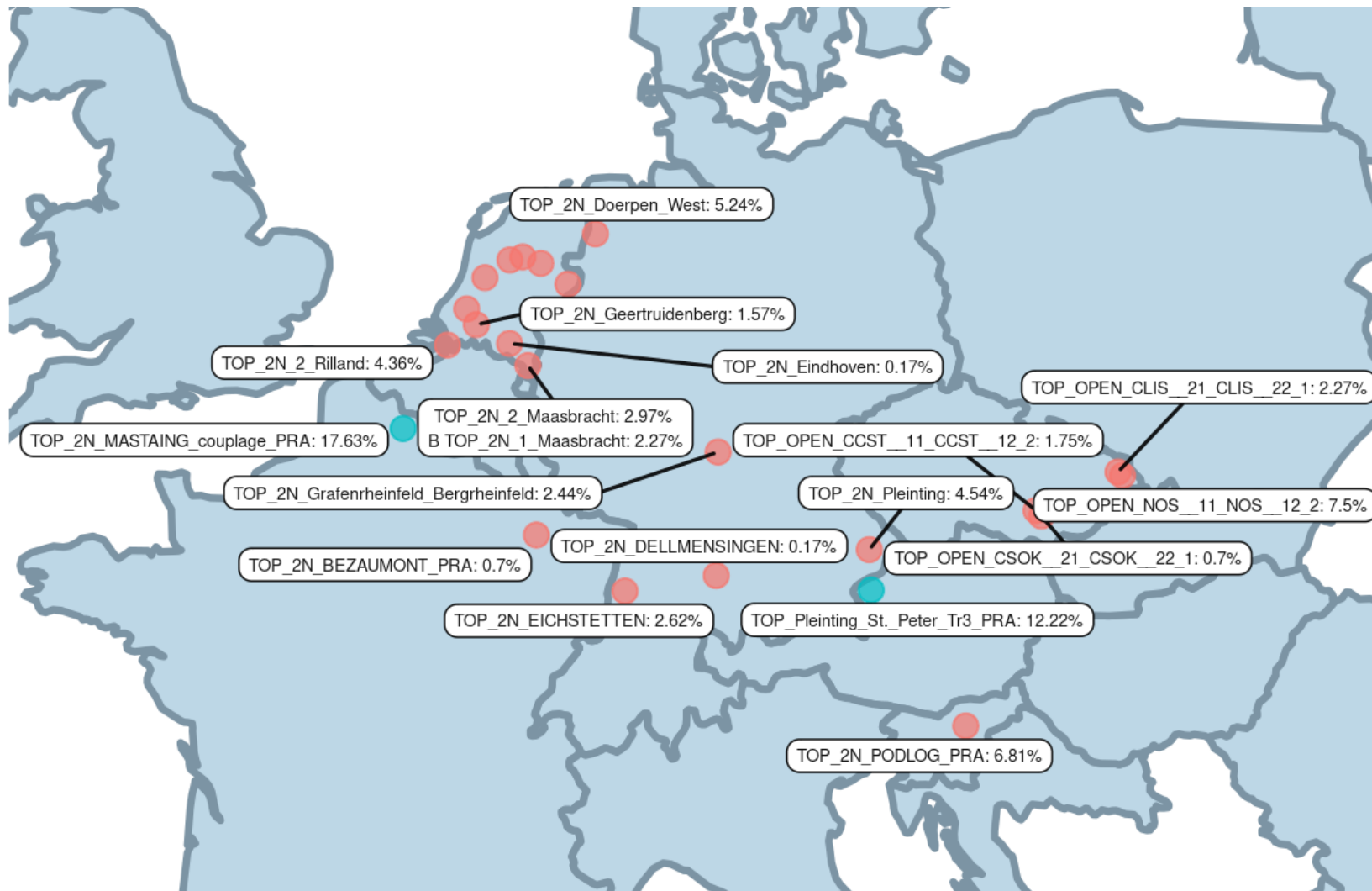


Relative Time Share [%]

● 10%-20%

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%
- 10%-20%

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

Relative Time Share of Applied Topological RAs in Curative Mode

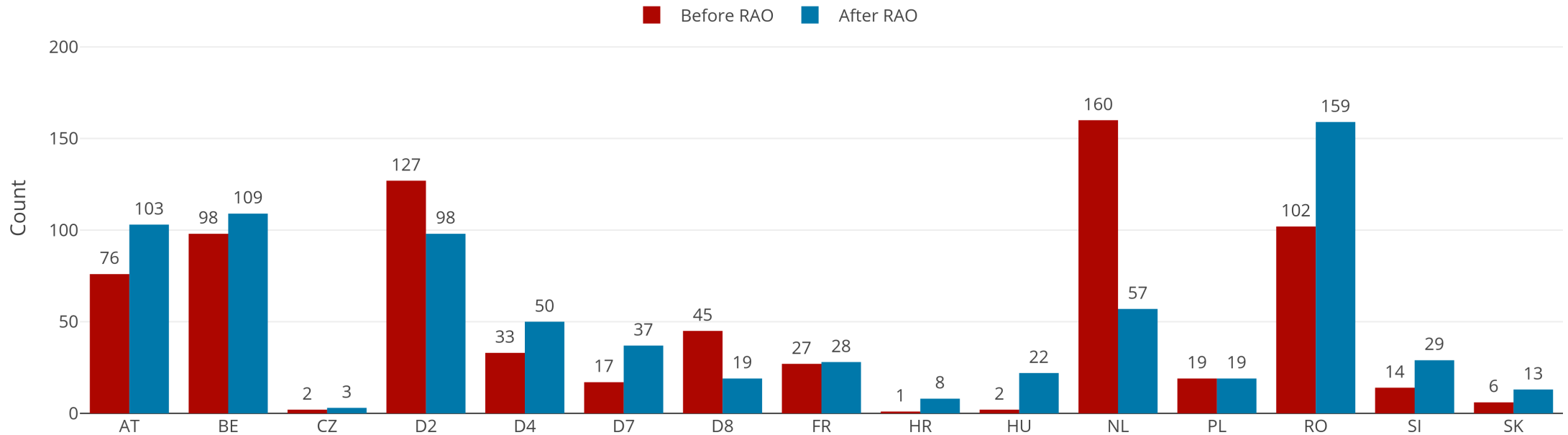


KPI 9: Most limiting CNEC per TSO (NRAO)



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.

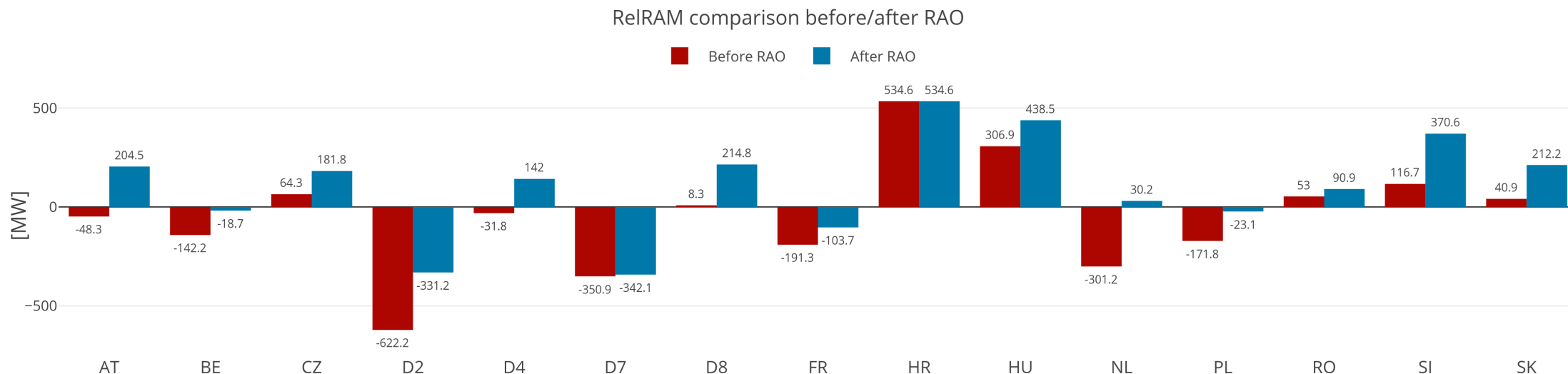
KPI 10: Average variation of relative RAM before and after NRAO



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) [OPP] [SK]	720	720	81.87%	54.60%	106.43%	0.2339	0.8889
[HU-HU] Gonyu - Gyor [DIR]	720	1584	64.69%	48.52%	85.70%	0.2983	1.3638
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	720	721	87.21%	42.25%	141.98%	0.2624	0.6384
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	720	1199	89.18%	38.24%	137.97%	0.2624	0.6384
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	715	715	69.62%	33.53%	90.10%	0.2968	1.2008
[SI-HU] Cirkovce - Heviz [OPP] [HU]	714	736	64.67%	46.48%	90.97%	0.2089	1.0435
[CZ-SK] Nosovice - Varin [OPP] [SK]	711	2309	102.83%	76.01%	146.39%	0.4695	1.7166
[SK-SK] Gabcikovo - P.Biskupice [DIR]	709	709	91.17%	70.13%	106.46%	0.2995	1.0581
[SK-HU] Gabcikovo - Gonyu [OPP] [HU]	709	1311	82.71%	61.44%	110.54%	0.3306	1.1583
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	708	1341	57.82%	19.89%	86.22%	0.5082	1.7605
[CZ-SK] Nosovice - Varin [DIR] [SK]	706	2442	76.78%	41.28%	103.86%	0.4695	1.7166
[SK-HU] Gabcikovo - Gonyu [DIR] [HU]	697	722	88.43%	69.53%	116.90%	0.3306	1.1583
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	687	775	67.78%	19.15%	132.39%	0.1475	0.5569
[SI-HU] Cirkovce - Heviz [DIR] [HU]	683	687	112.01%	85.20%	132.31%	0.2089	1.0435
[NL-BE] PST Zandvliet 1 [DIR] [BE]	675	676	76.56%	19.83%	114.63%	0.4246	0.9495
[PL-PL] Mikulowa AT1 [OPP]	670	670	81.41%	43.09%	146.73%	0.1818	0.6278
[HU-HU] Gyor - Oroszlany [DIR]	661	1289	73.37%	53.59%	101.03%	0.0878	0.3476
[NL-BE] PST Van Eyck 2 [DIR] [BE]	661	1371	96.99%	31.50%	127.72%	0.4037	0.9089
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	660	660	97.52%	73.71%	131.34%	0.2339	0.8889
[RO-RS] Portile de Fier - Djerdap [OPP] [RO]	656	657	79.89%	24.54%	139.80%	0.3956	0.5758

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
[BE-BE] Achene - Gramme 380.10 [OPP]	198	198	896.44	81.88%	19.88%	115.78%	0.3735
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	128	128	3067.33	43.57%	19.15%	109.59%	0.144
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	124	127	1288.04	36.69%	14.95%	102.45%	0.3433
[D8-D8] Pasewalk - Vierraden 306 [DIR]	113	113	5376.9	23.91%	19.66%	44.60%	0.1136
[D4-D4] PST Buers BMT37 [OPP]	100	100	5843.97	42.64%	17.72%	83.06%	0.0639
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	74	74	1011.97	36.89%	19.89%	64.14%	0.5082
[RO-RO] Paroseni - Targu Jiu Nord [OPP]	60	61	4661.03	28.23%	0.00%	53.85%	0.1018
[NL-D2] Meeden-Diele 380 W [OPP] [NL]	55	55	769.23	26.61%	19.75%	63.34%	0.2865
[D7-D7] Buerstadt - Lambsheim BUERST W [DIR]	53	53	2588.56	42.08%	19.86%	64.76%	0.168
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	48	48	509.22	24.82%	19.85%	73.03%	0.2761
[BE-FR] Avelgem - Mastaing 79 [DIR] [FR]	42	42	1800.06	93.91%	43.51%	127.42%	0.2834
[D4-CH] Trossingen - Laufenburg rt [DIR] [D4]	38	38	3980.24	30.35%	19.62%	42.41%	0.0902
[BE-FR] Achene - Lonny 380.19 [DIR] [BE]	34	34	1180.4	72.36%	19.87%	91.78%	0.3727
[D4-CH] Kuehmoos - Laufenburg br (Heimbach) [DIR] [D4]	32	32	2439.23	27.26%	13.98%	37.97%	0.0581
[AT-D4] Meiningen - Buers 406A [OPP] [AT]	29	30	2968.02	26.65%	19.25%	46.79%	0.0896
[CZ-SK] Nosovice - Varin [DIR] [SK]	25	25	859.17	64.89%	41.28%	79.78%	0.4586
[BE-FR] Achene - Lonny 19 [DIR] [FR]	24	24	714.45	74.65%	66.52%	96.64%	0.3306
[RO-RO] Resita - Timisoara c1 [DIR]	24	24	3616.06	30.94%	19.17%	38.94%	0.1098
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	23	23	832.99	59.65%	41.33%	83.99%	0.2894
[NL-D2] Meeden-Diele 380 Z [DIR] [NL]	22	22	600.86	25.98%	20.04%	54.80%	0.2686

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

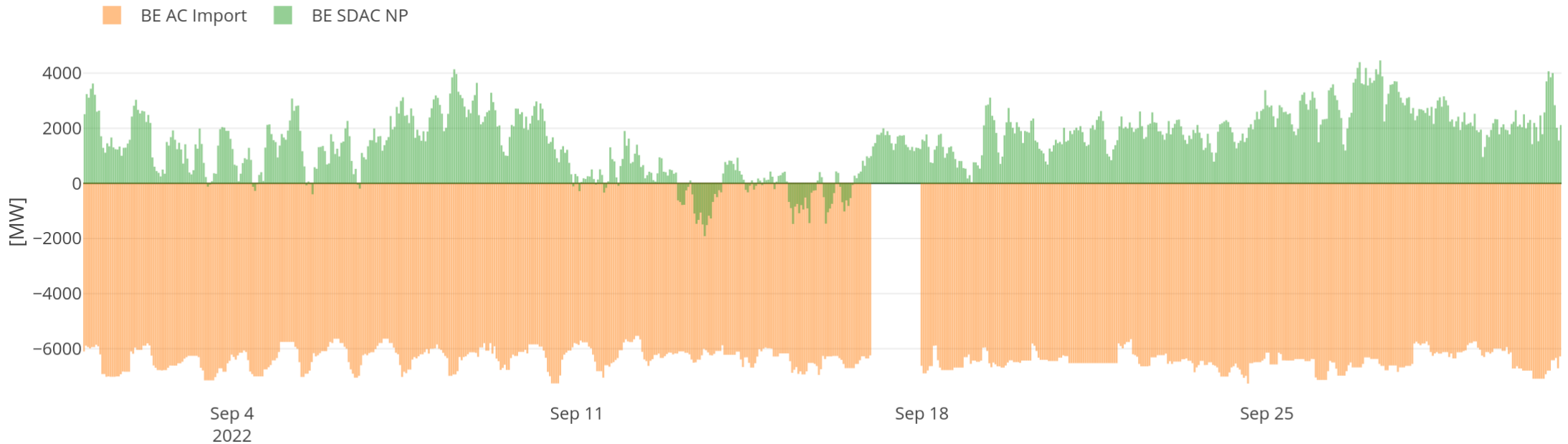
	BE AC Import [MW]
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Avg. -6370.98

Min. -7239.00

Max. -5512.00

Belgium only uses import allocation constraints



KPI 13b: Allocation Constraints - Poland



	# MTUs
AC was limiting MC	691
AC < 0 MW	6
AC = 0 MW	595
AC > 0 MW	90

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-3193.2	113.31
Min.	-8535.0	0.00
Max.	0.0	2940.00

