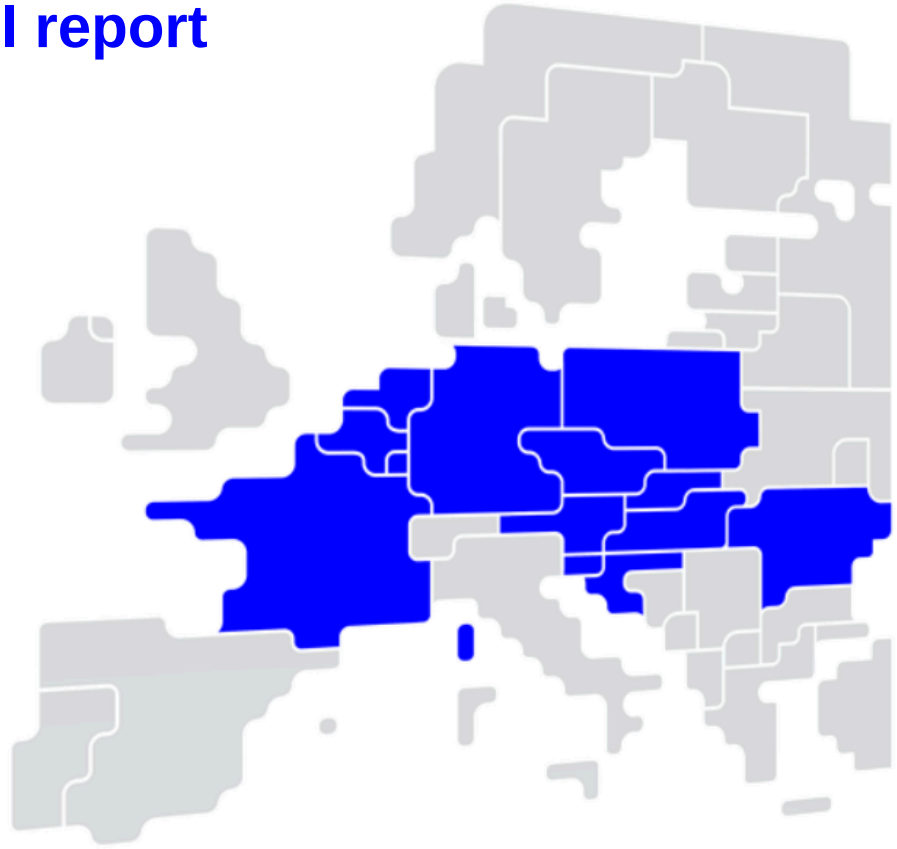
Core FB MC Operational KPI report

September 2026



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

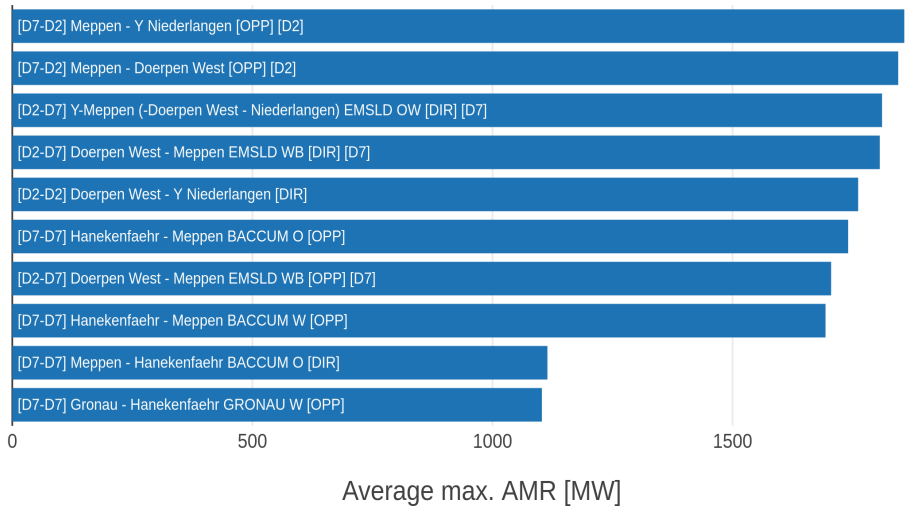
Market Impact Assessment

- 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)

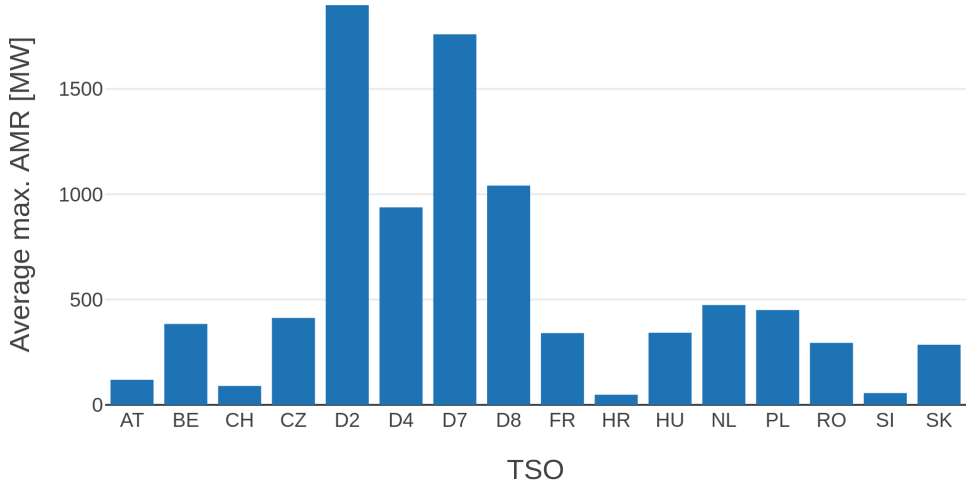
KPI 2: Average maximum AMR per TSO

CNE	Avg. Max. AMR (MW)	AMR/Fmax% (MTUs with AMR > 0 MW)	AMR/Fmax% (all MTUs)
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	1857.67	98.43%	88.58%
[D7-D2] Meppen - Doerpen West [OPP] [D2]	1844.91	97.75%	87.97%
[D2-D7] Y-Meppen (-Doerpen West - Niederlangen) EMSLD OW [DIR] [D7]	1811.24	72.62%	62.74%
[D2-D7] Doerpen West - Meppen EMSLD WB [DIR] [D7]	1806.58	72.44%	62.28%
[D2-D2] Doerpen West - Y Niederlangen [DIR]	1761.53	93.34%	83.61%
[D7-D7] Hanekenfaehr - Meppen BACCUM O [OPP]	1740.65	78.85%	68.88%
[D2-D7] Doerpen West - Meppen EMSLD WB [OPP] [D7]	1705.23	68.37%	58.31%
[D7-D7] Hanekenfaehr - Meppen BACCUM W [OPP]	1693.55	76.87%	66.73%
[D7-D7] Meppen - Hanekenfaehr BACCUM O [DIR]	1114.40	50.74%	31.08%
[D7-D7] Gronau - Hanekenfaehr GRONAU W [OPP]	1102.85	50.14%	39.28%



TSO	Average maximum AMR per TSO
AT	118.75
BE	384.01
CH	89.82
CZ	412.44
D2	1898.04
D4	937.94
D7	1759.68
D8	1041.10
FR	340.79
HR	48.04

TSO	Average maximum AMR per TSO
HU	342.35
NL	474.01
PL	449.87
RO	294.52
SI	56.12
SK	285.61

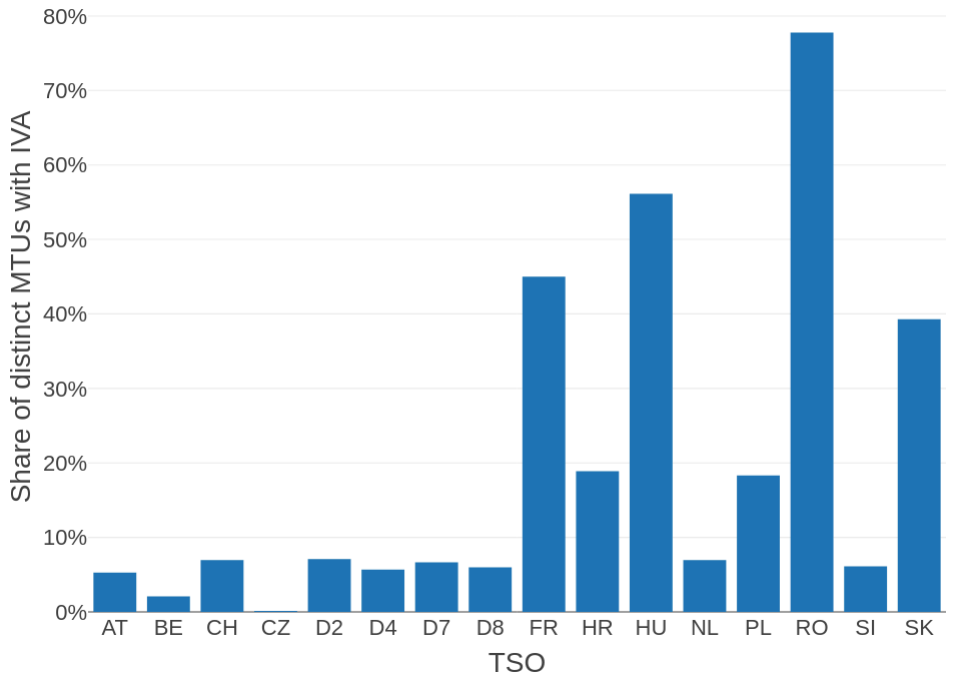


KPI 3: Share of MTUs with intervention per TSO

Total BDs	Total MTUs	MTUs without IVA	Share of distinct MTUs without IVA	MTUs with IVA	Share of distinct MTUs with IVA
30	720	35	4.86%	685	95.1%

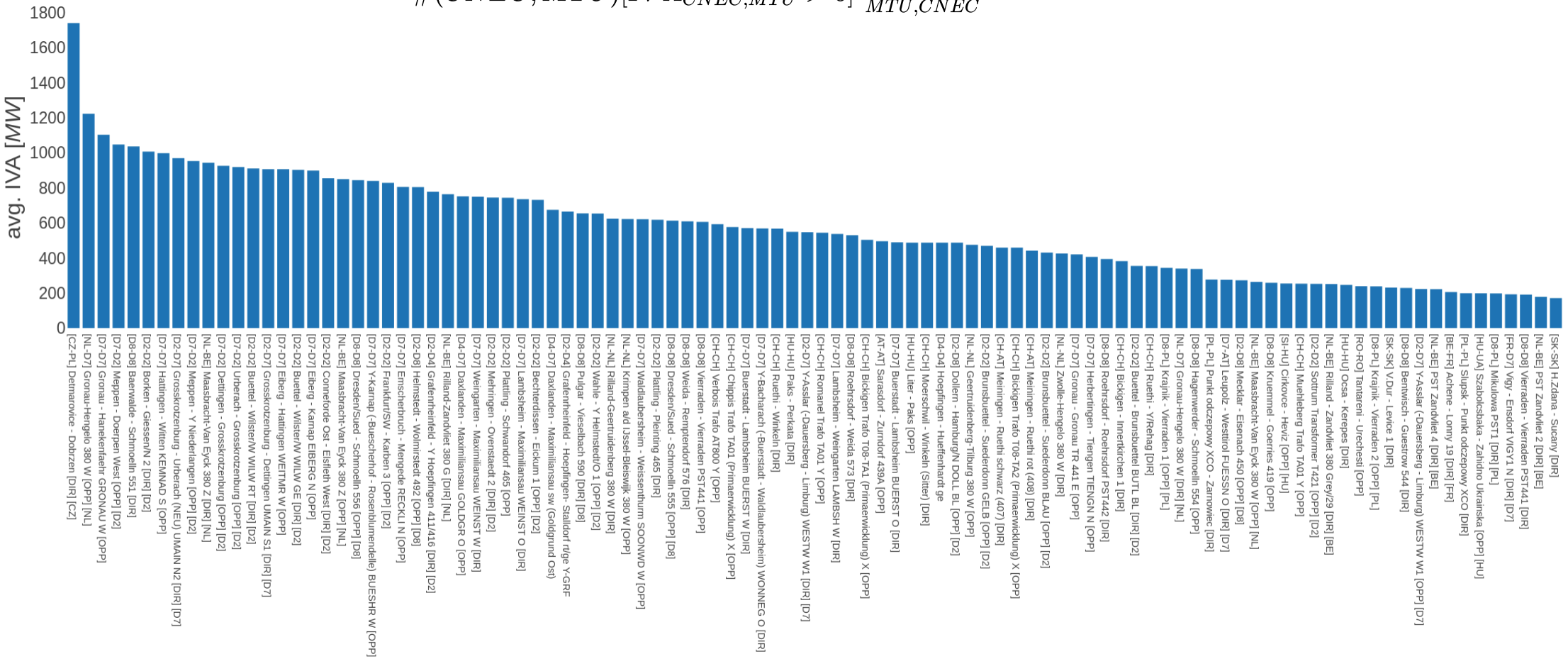
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	5.28%	38
BE	2.08%	15
CH	6.94%	50
CZ	0.14%	1
D2	7.08%	51
D4	5.69%	41
D7	6.67%	48
D8	5.97%	43
FR	45.00%	324
HR	18.89%	136

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
HU	56.11%	404
NL	6.94%	50
PL	18.33%	132
RO	77.78%	560
SI	6.11%	44
SK	39.31%	283



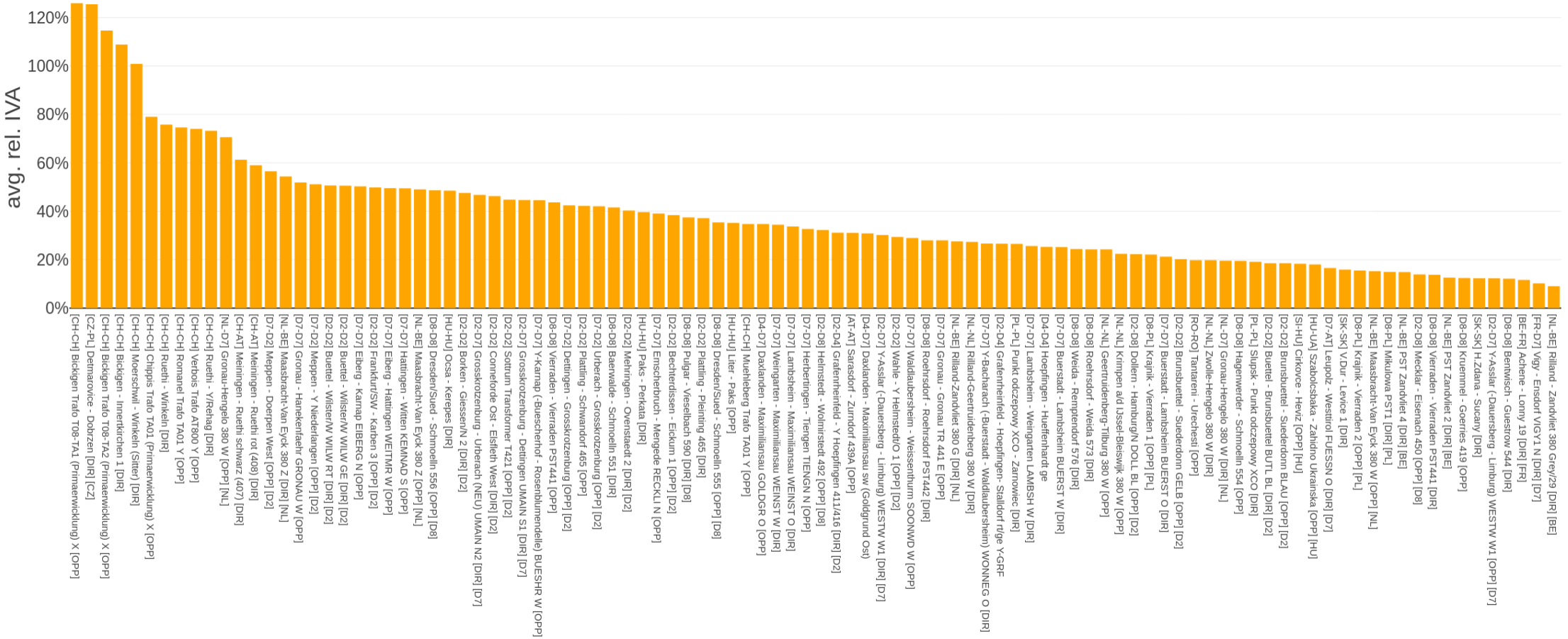
KPI 4a: Average IVA applied for each CNE affected by TSO intervention

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

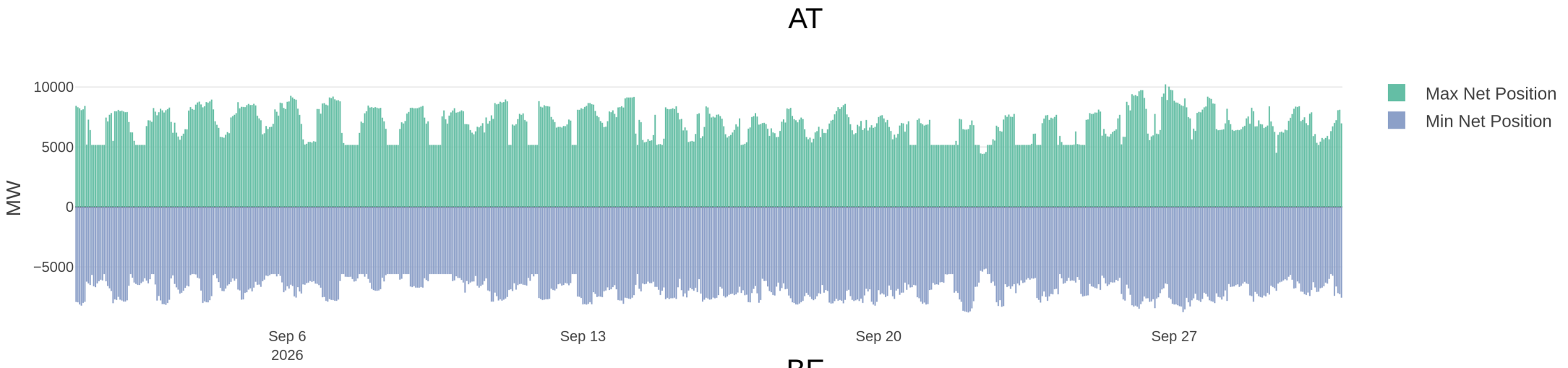


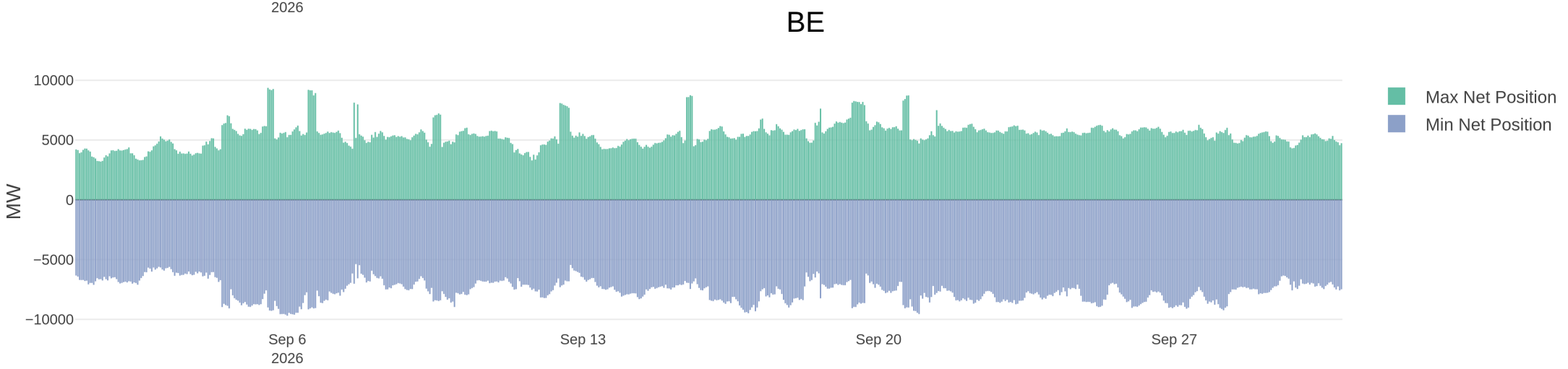
KPI 4b: Average relative IVA applied for each CNE affected by TSO intervention

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

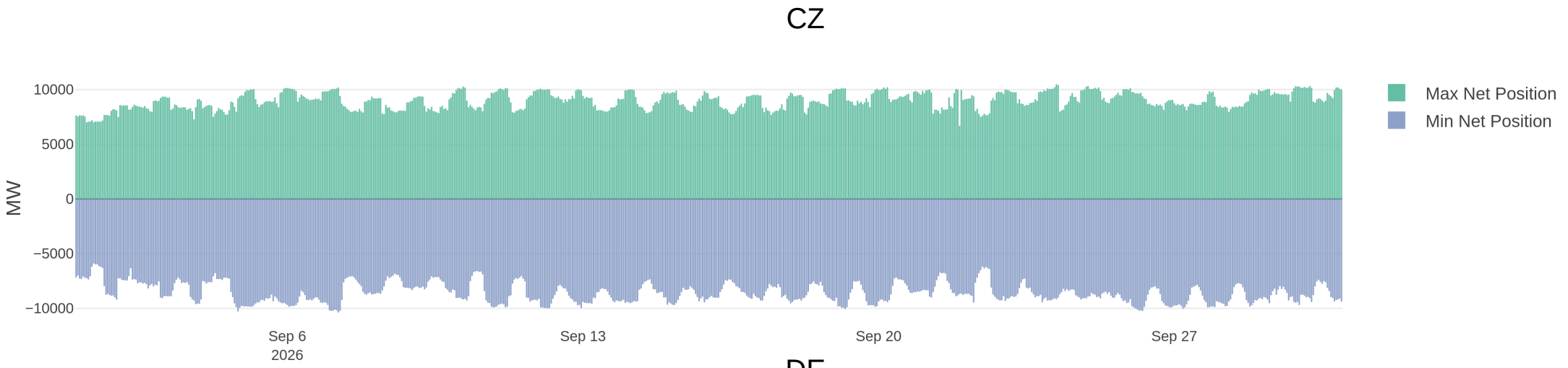


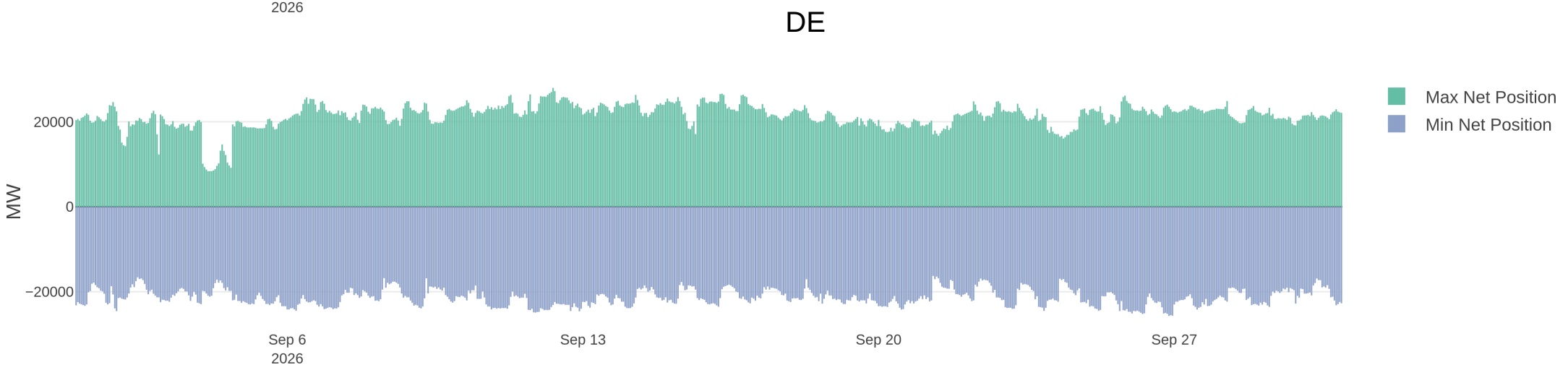
KPI 5: Min & max net positions per BZ hub



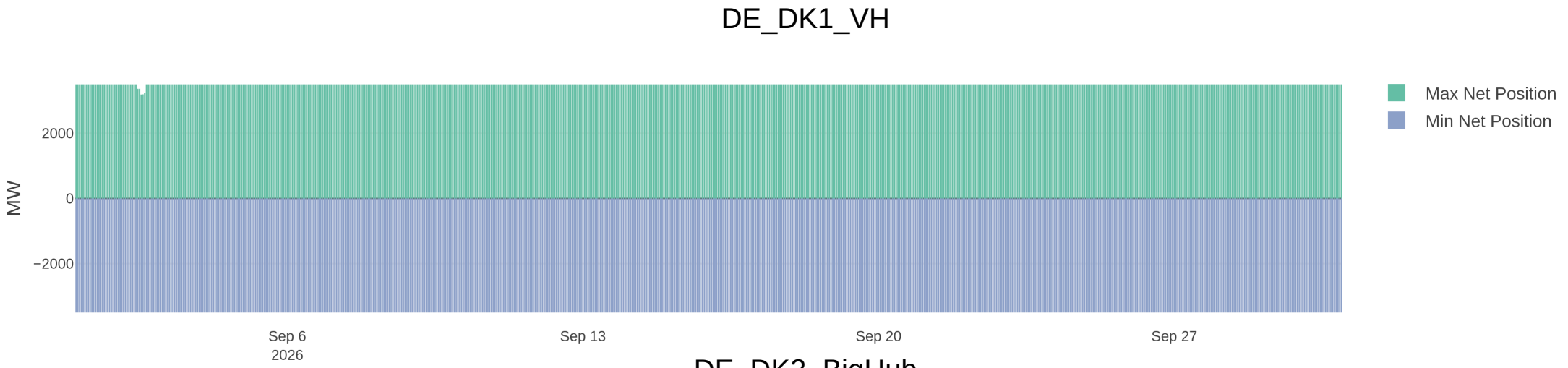


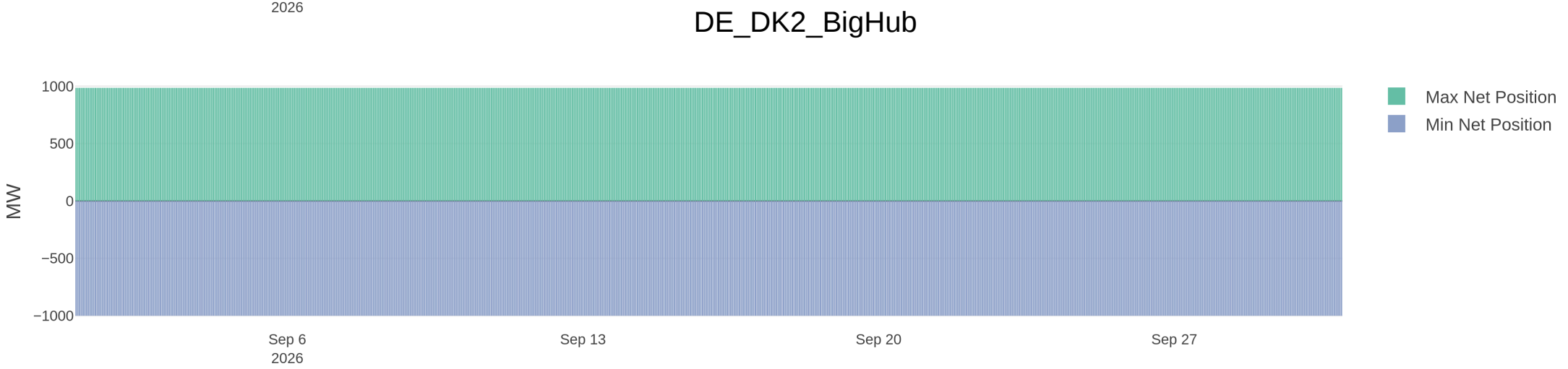
KPI 5: Min & max net positions per BZ hub



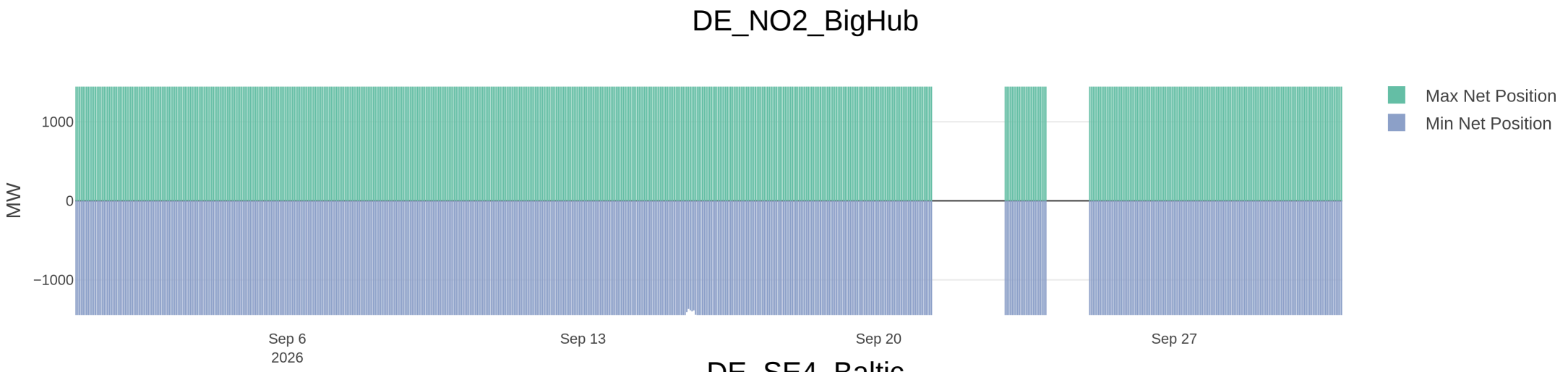


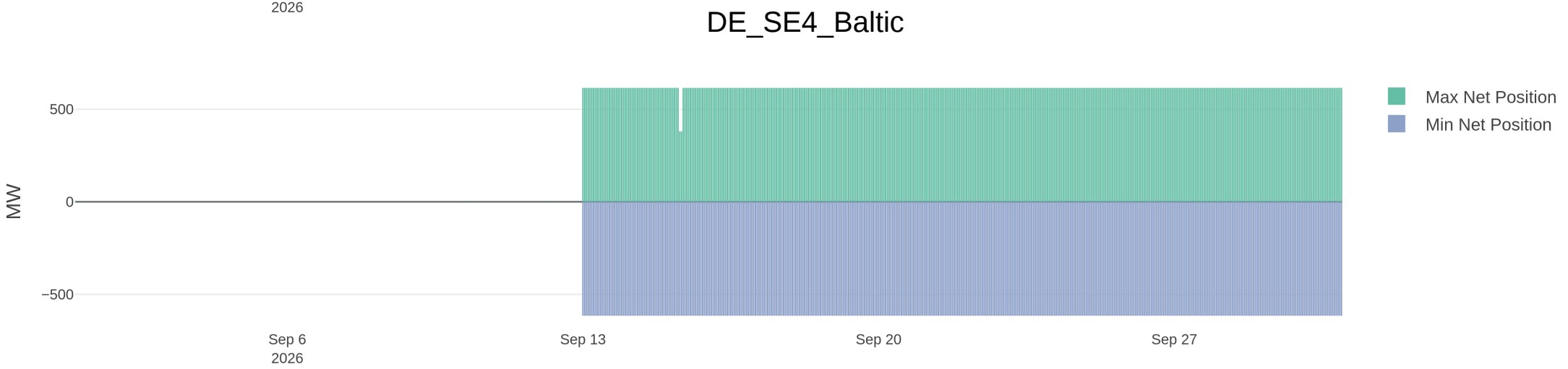
KPI 5: Min & max net positions per BZ hub



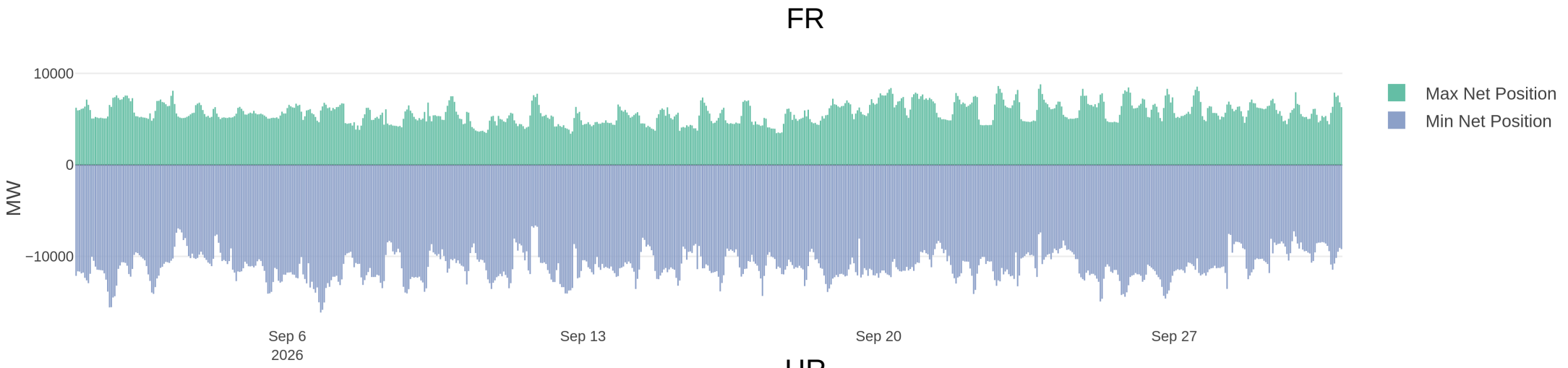


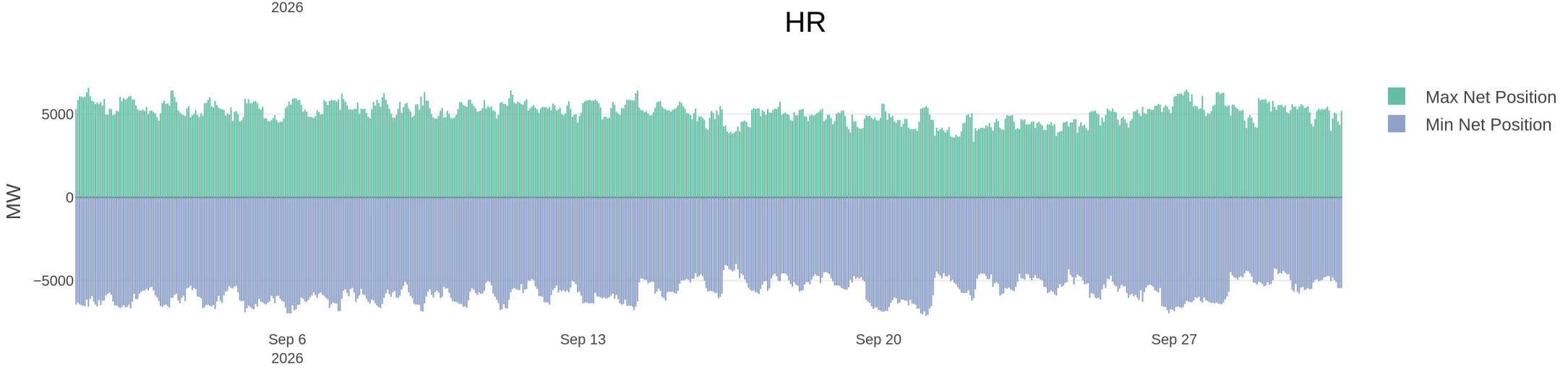
KPI 5: Min & max net positions per BZ hub



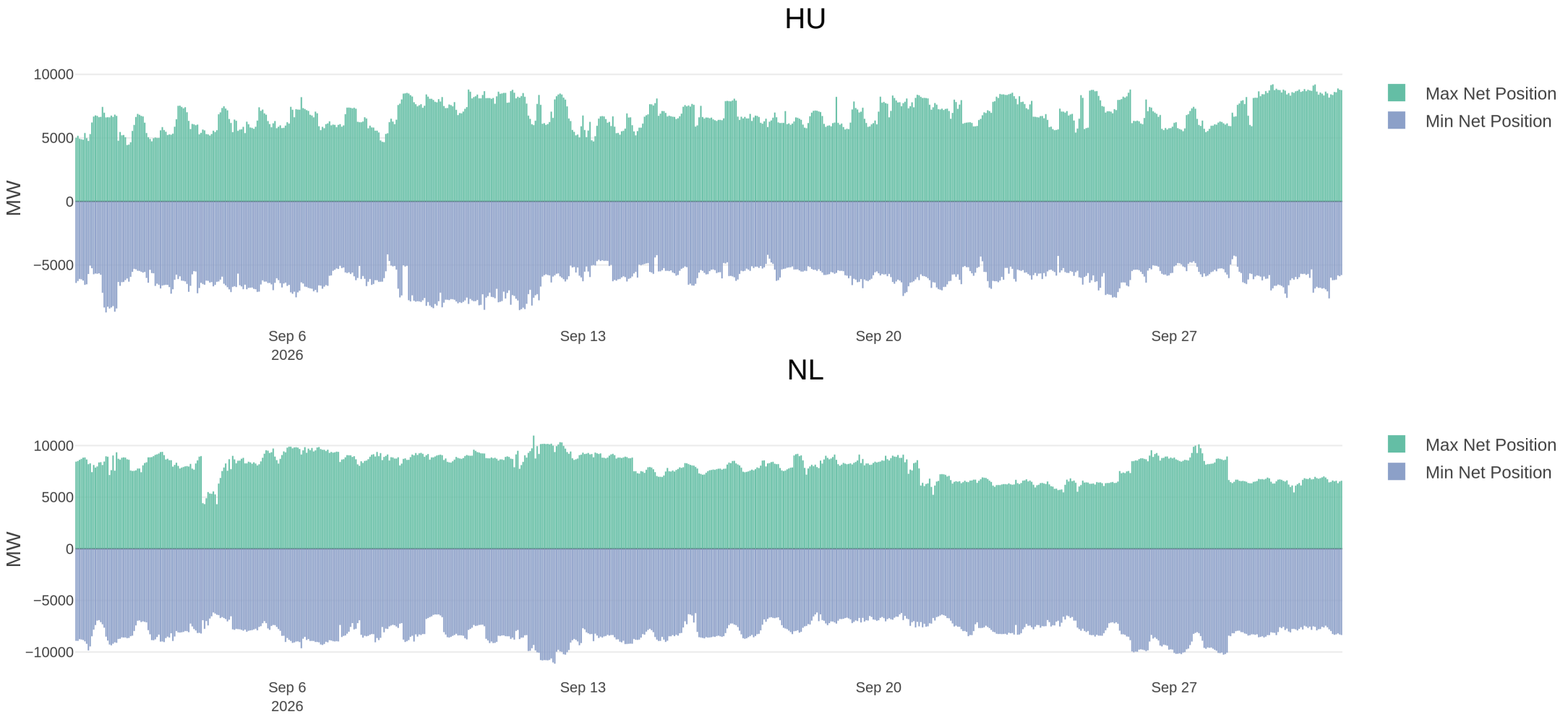


KPI 5: Min & max net positions per BZ hub

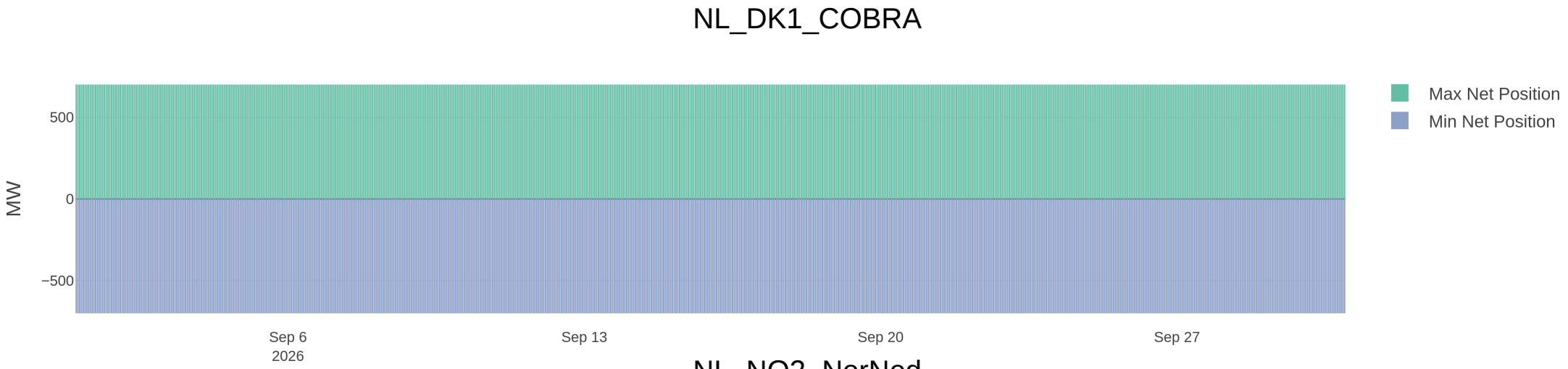


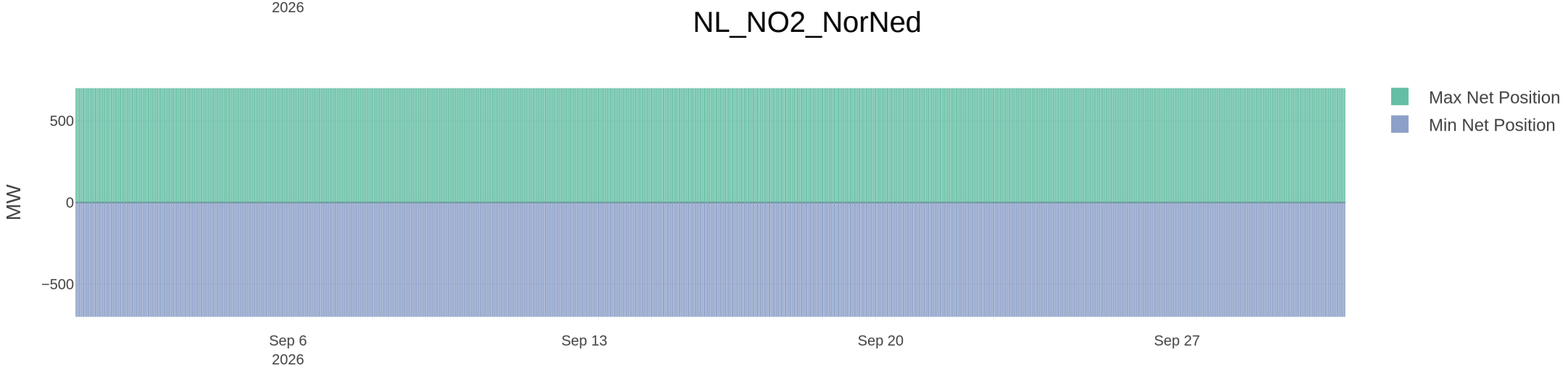


KPI 5: Min & max net positions per BZ hub

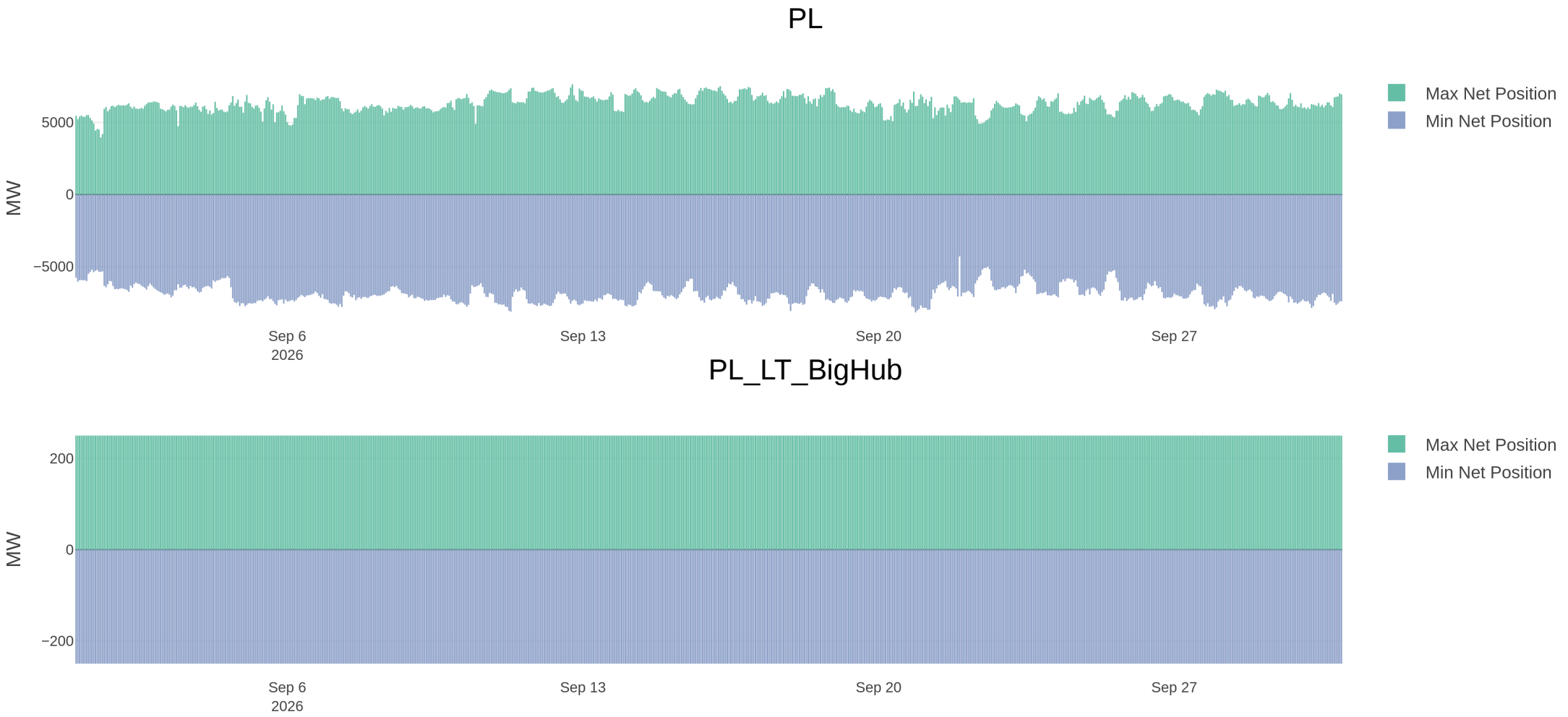


KPI 5: Min & max net positions per BZ hub

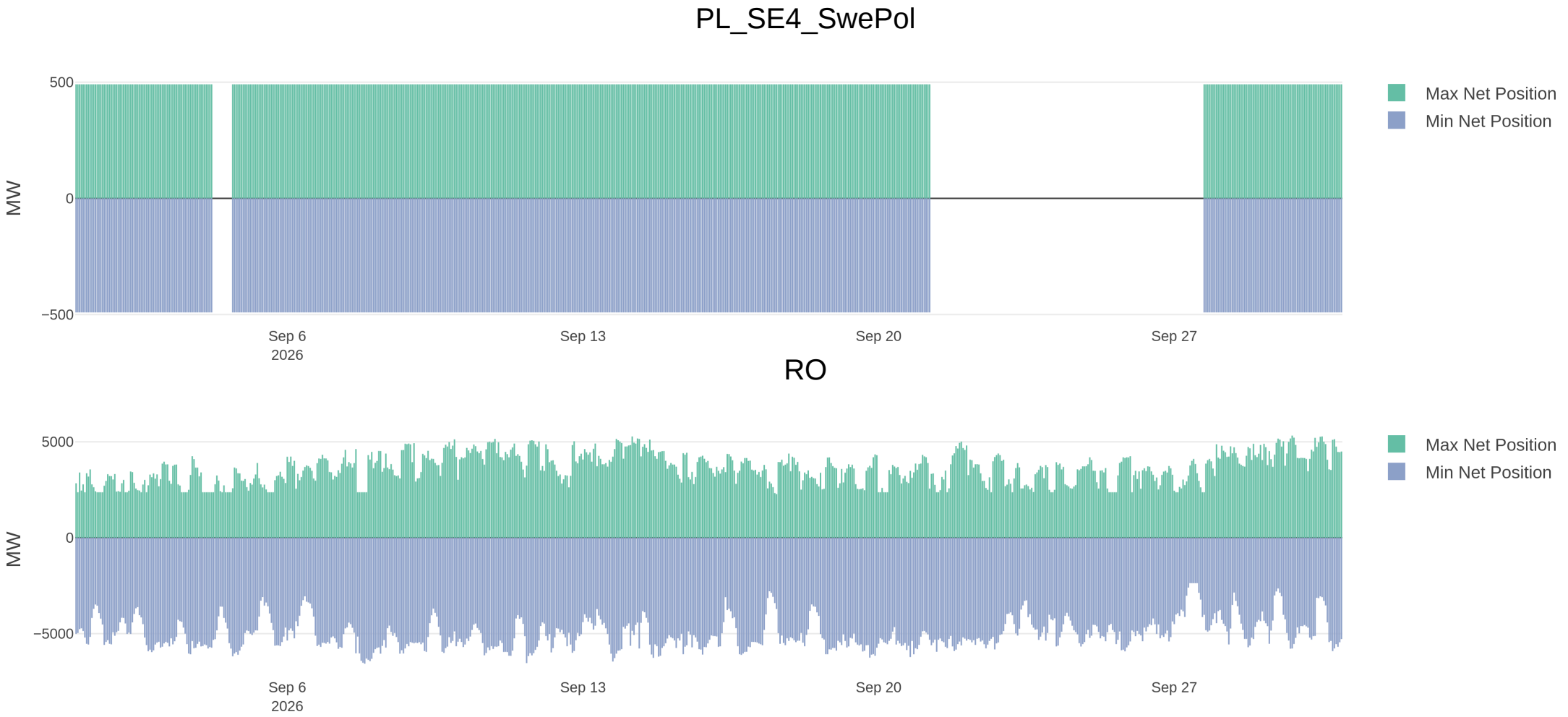




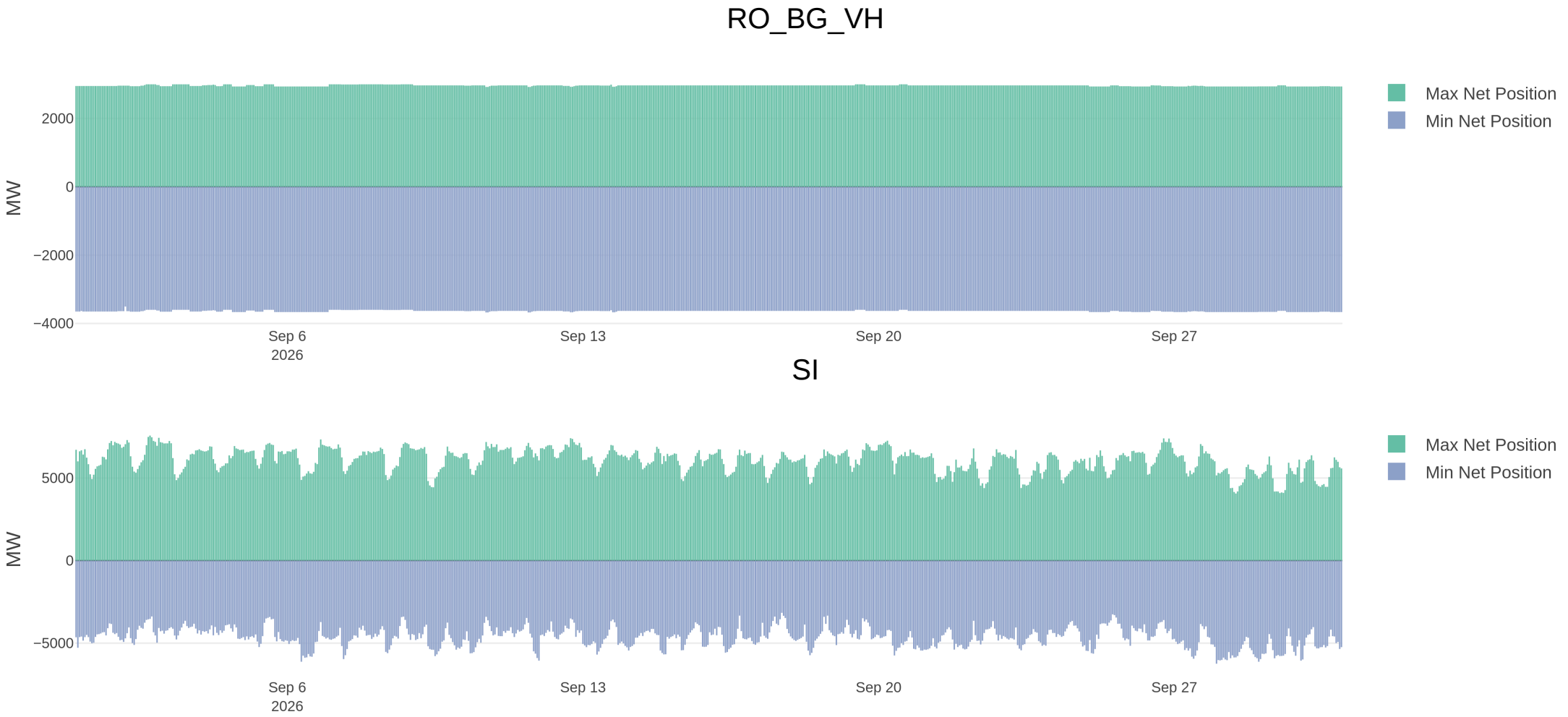
KPI 5: Min & max net positions per BZ hub



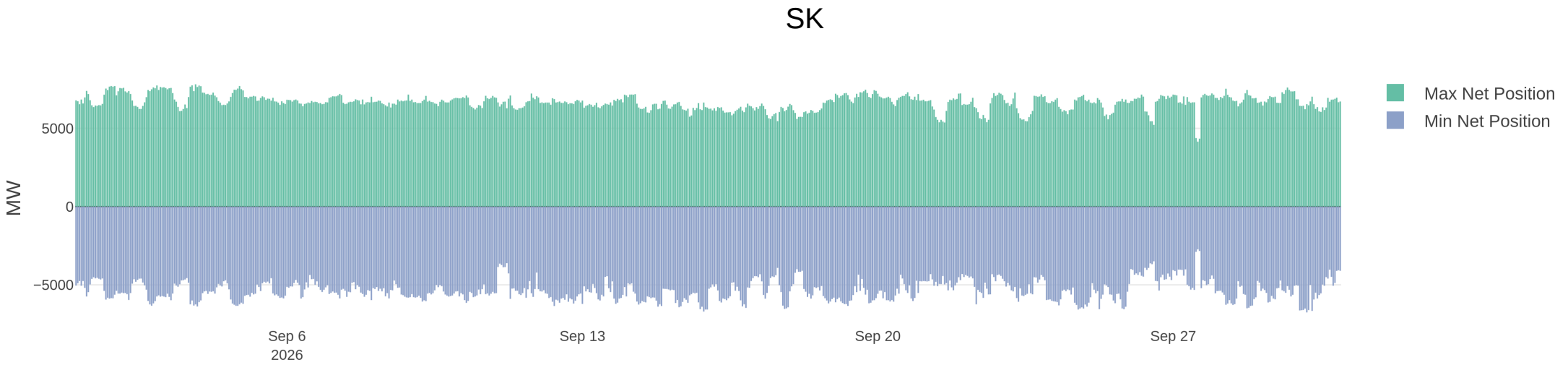
KPI 5: Min & max net positions per BZ hub



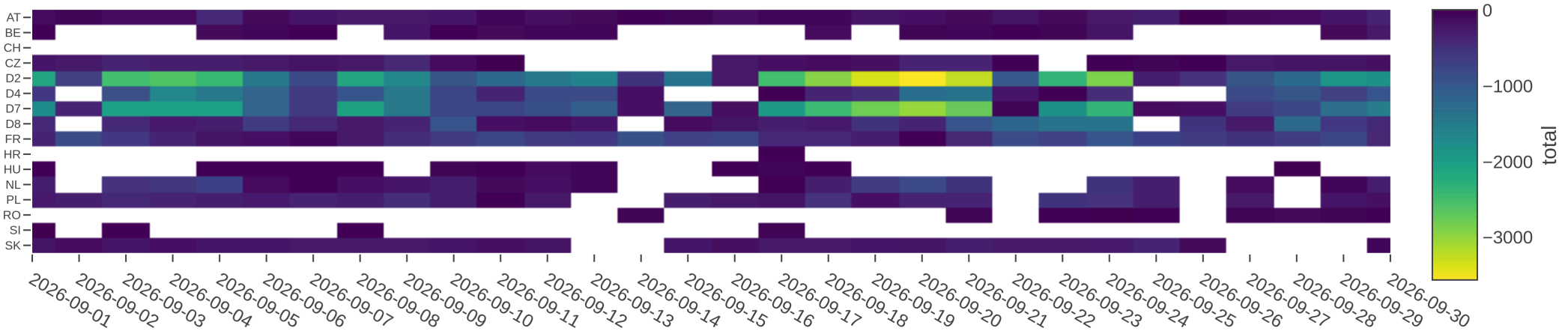
KPI 5: Min & max net positions per BZ hub

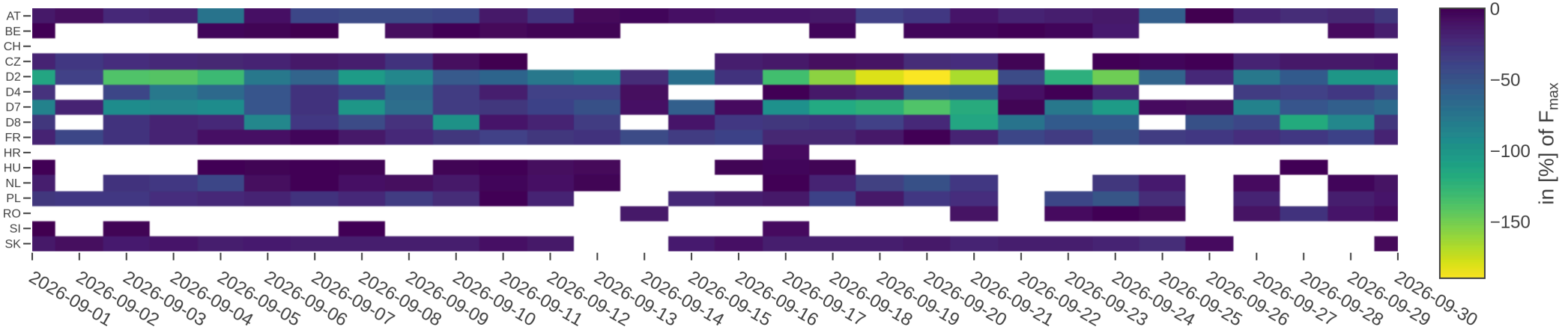


KPI 5: Min & max net positions per BZ hub



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





KPI 6b: Virtual margins at market balance AT



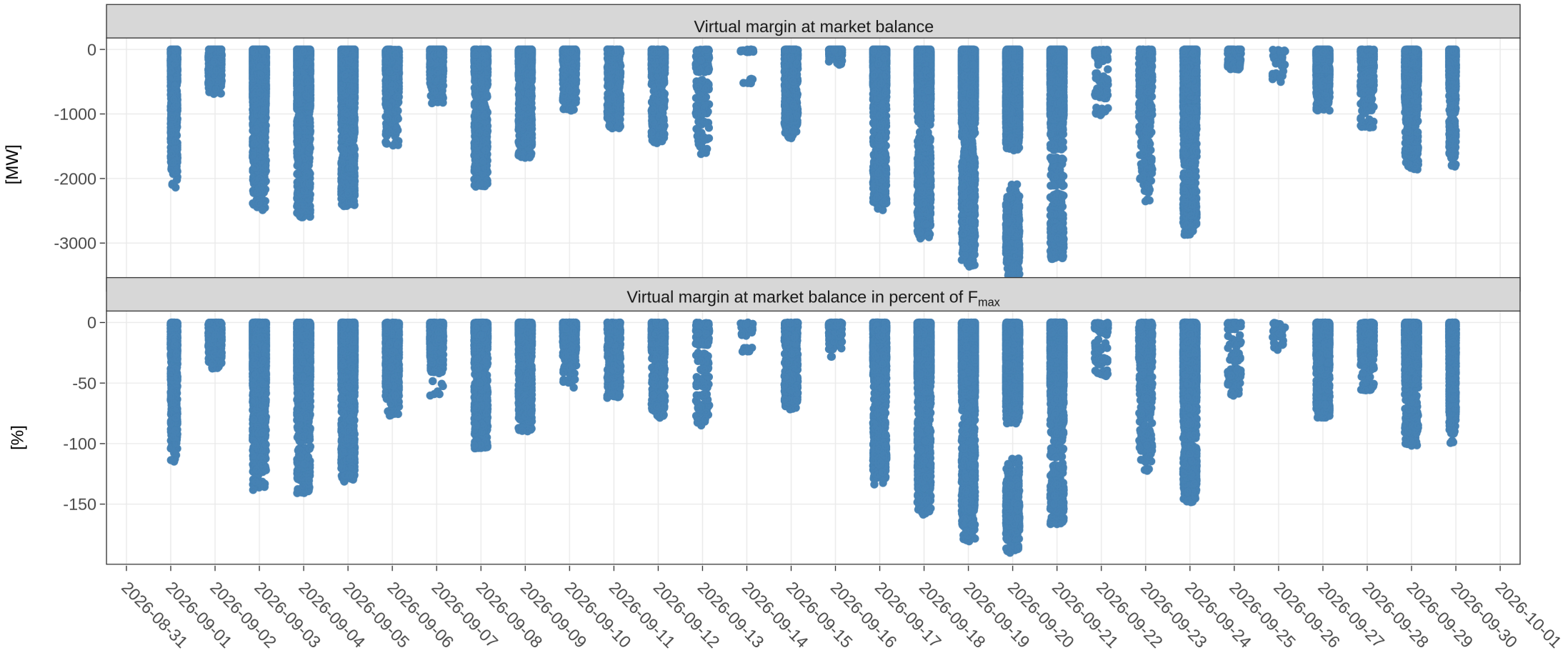
KPI 6b: Virtual margins at market balance BE



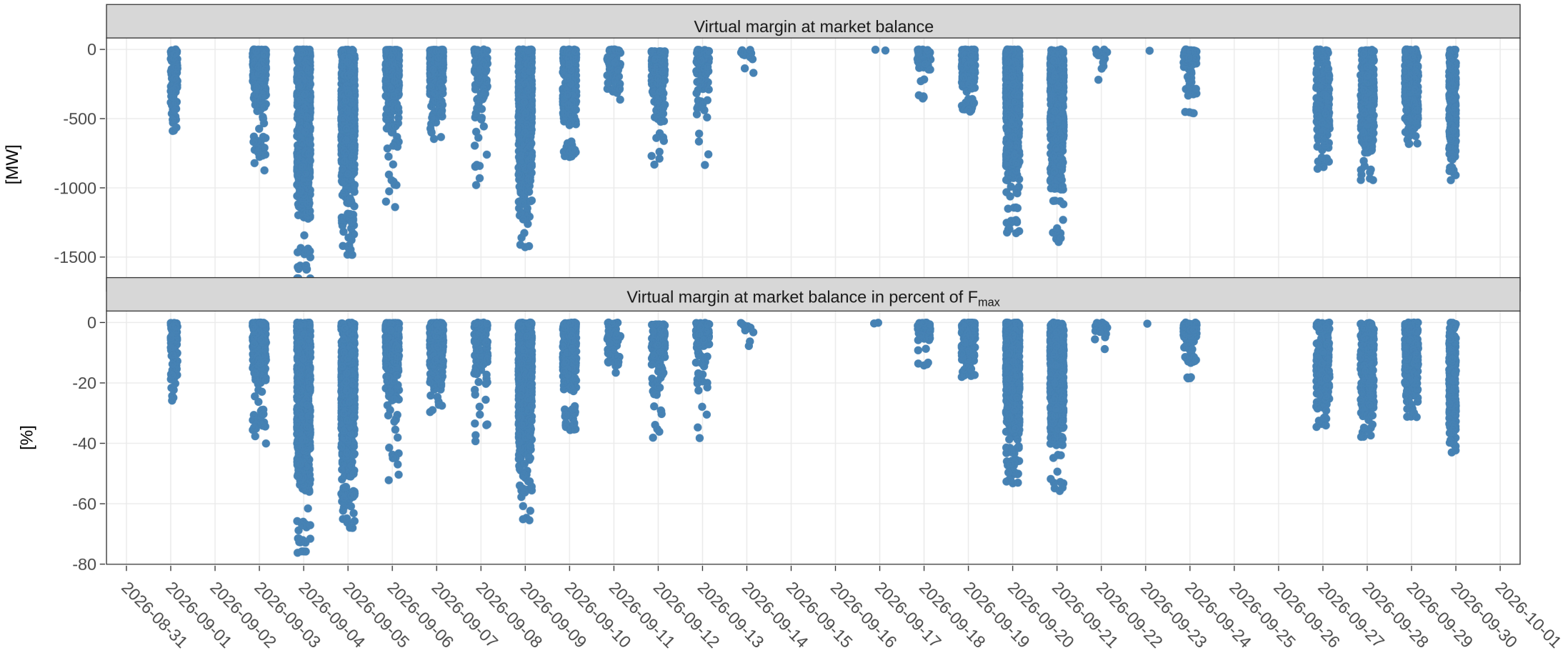
KPI 6b: Virtual margins at market balance CZ



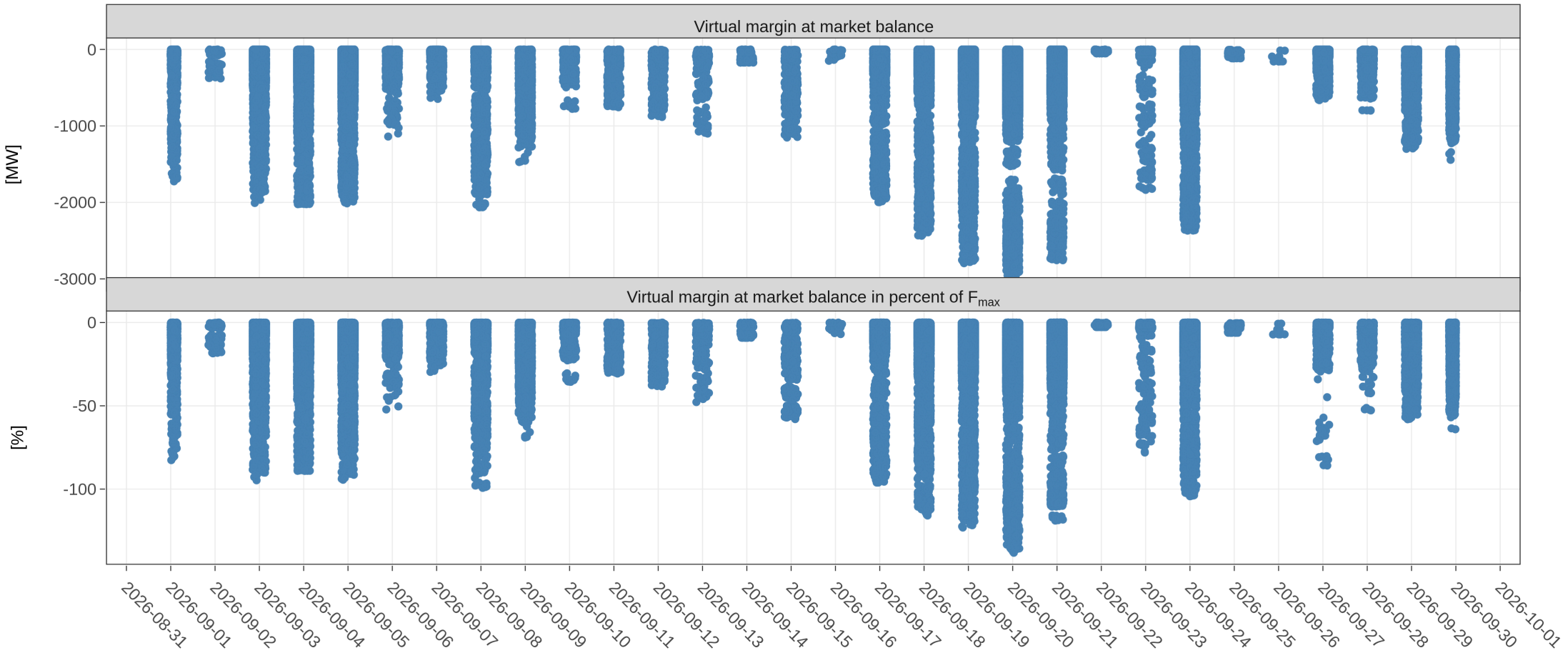
KPI 6b: Virtual margins at market balance D2



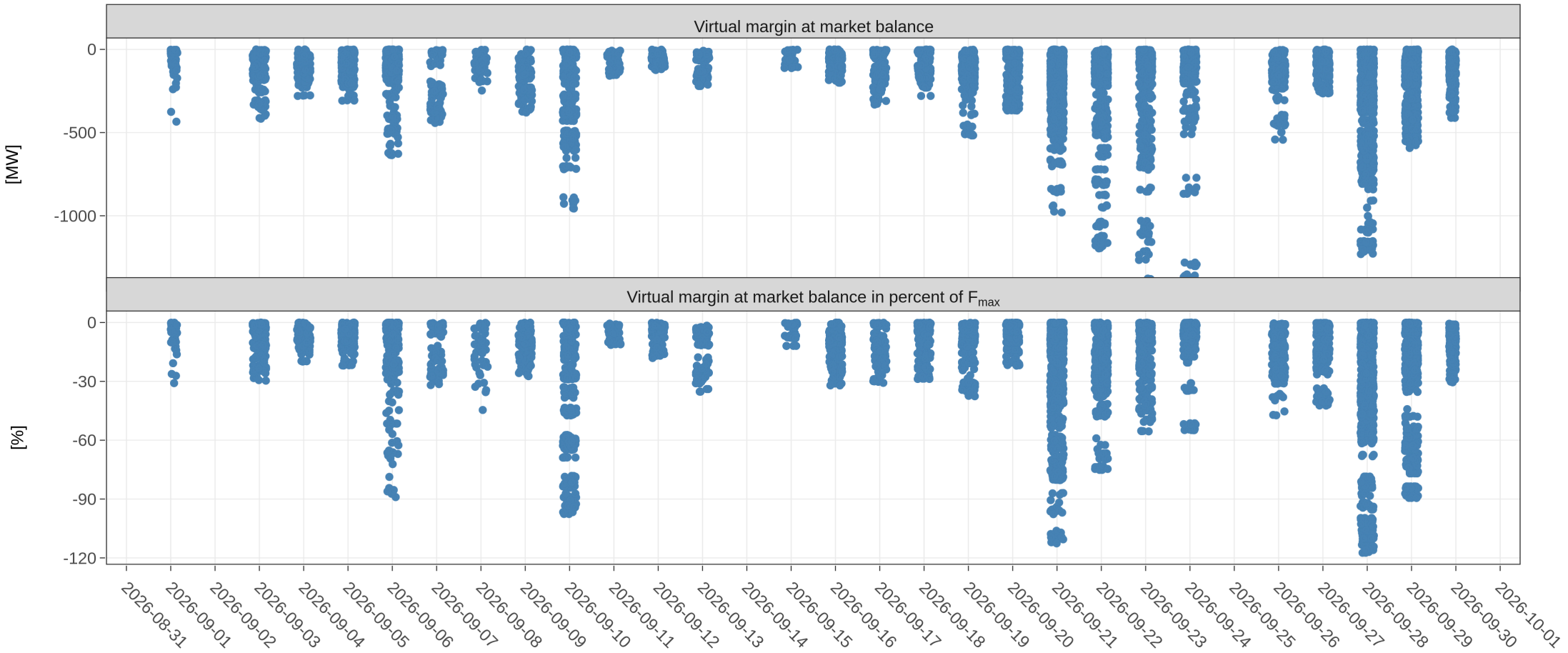
KPI 6b: Virtual margins at market balance D4



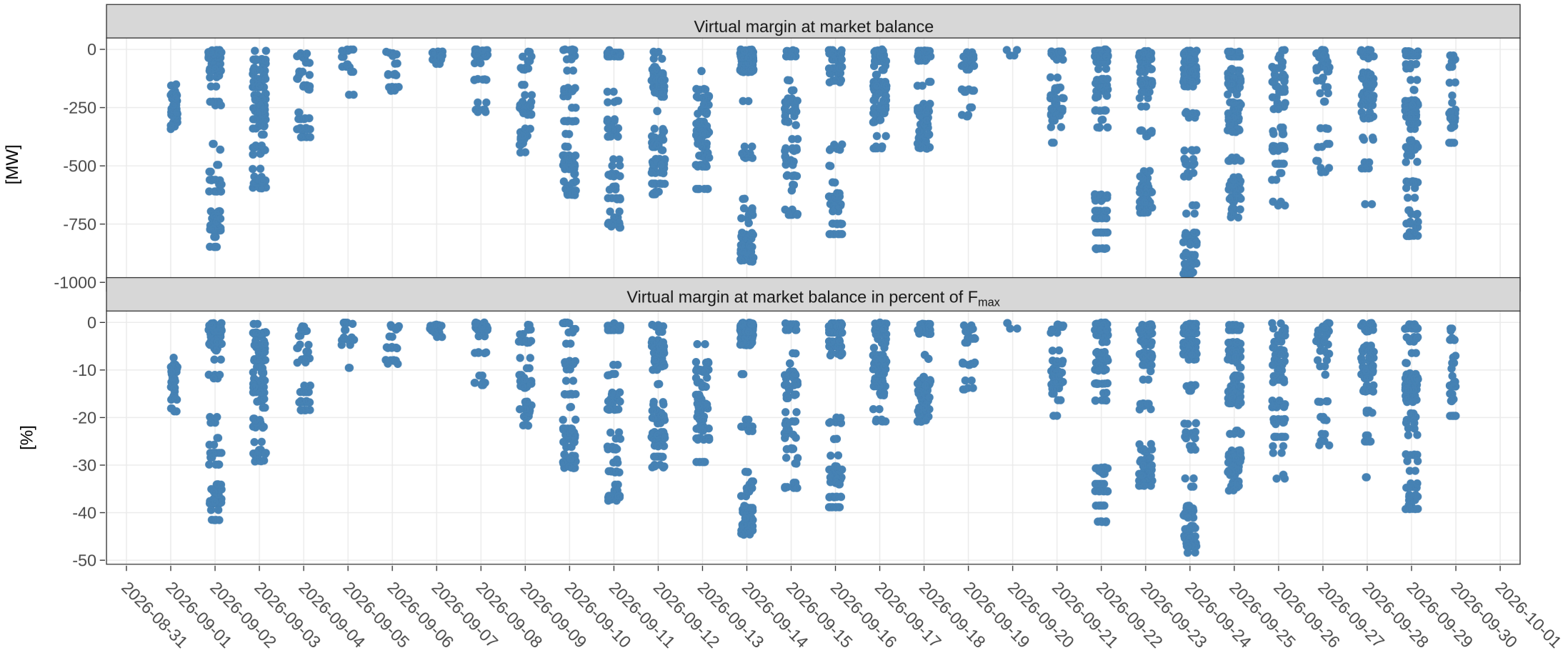
KPI 6b: Virtual margins at market balance D7



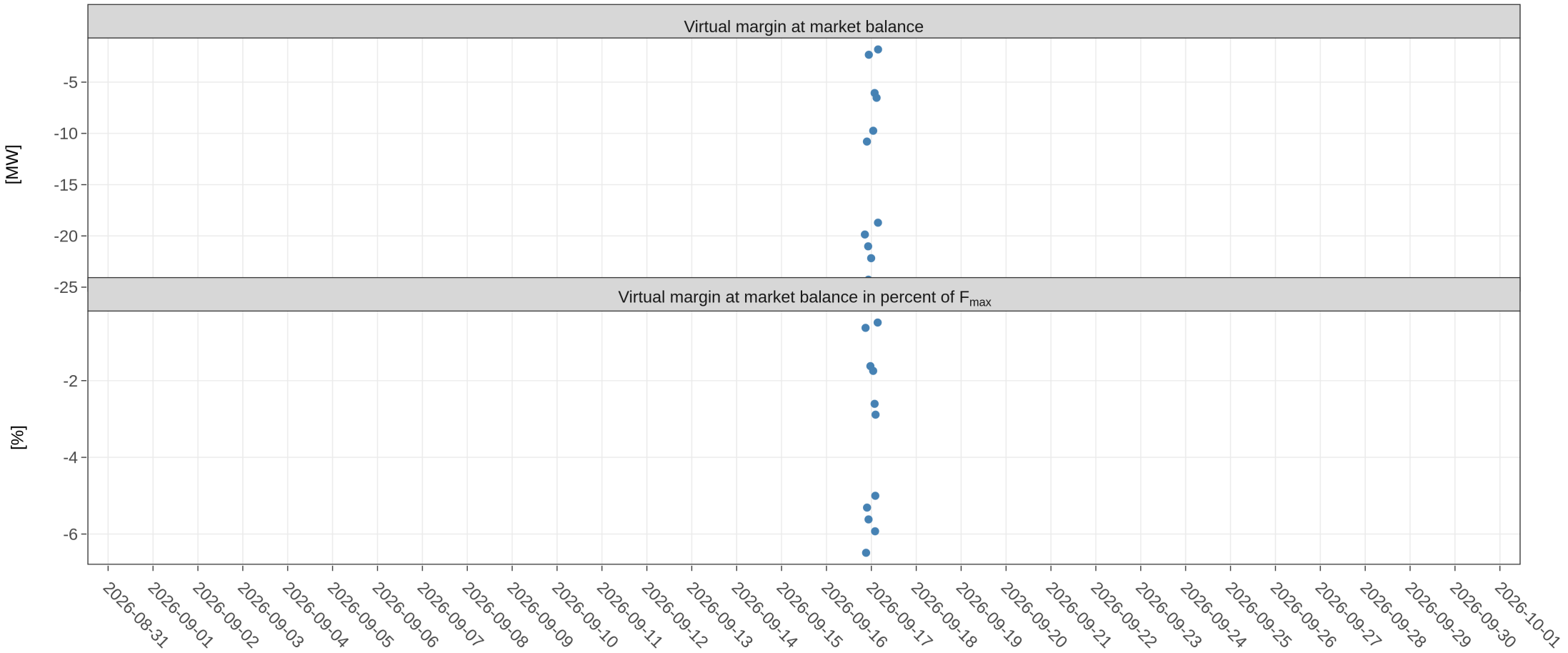
KPI 6b: Virtual margins at market balance D8



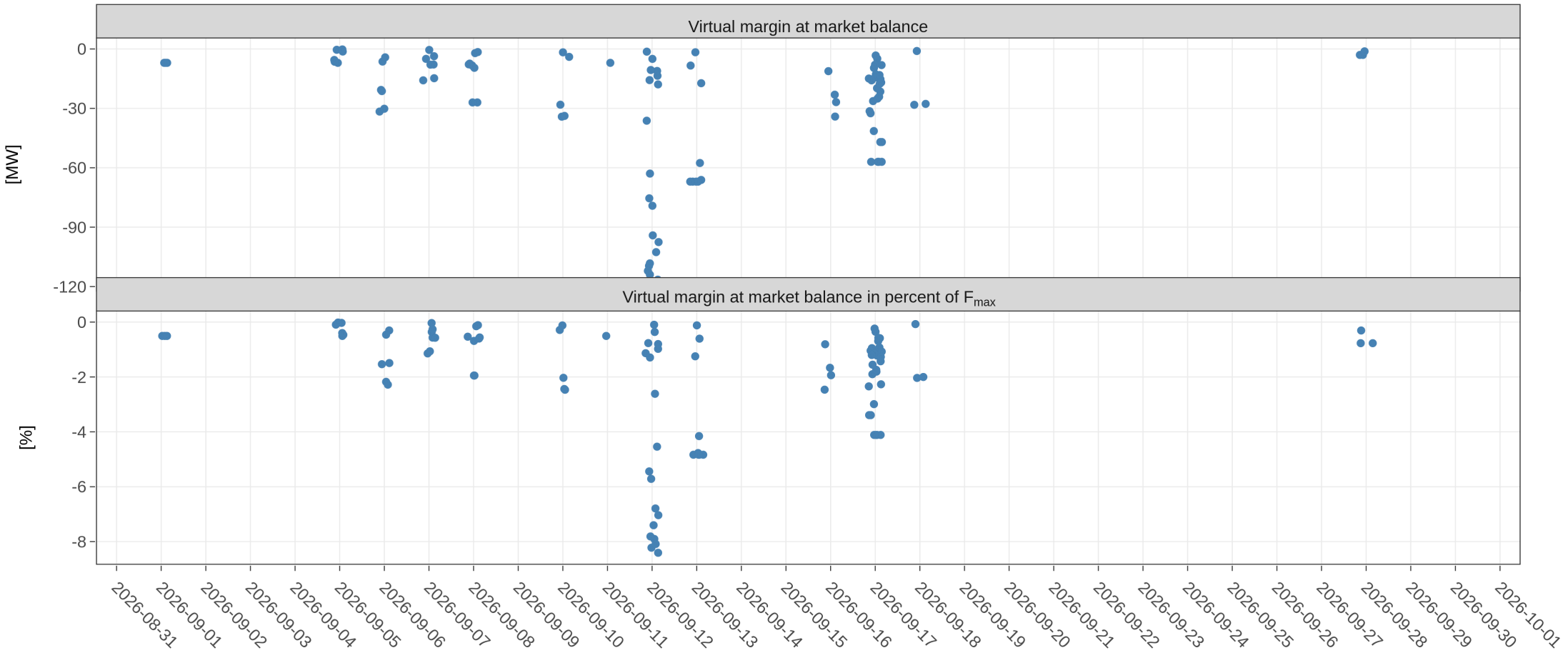
KPI 6b: Virtual margins at market balance FR



KPI 6b: Virtual margins at market balance HR



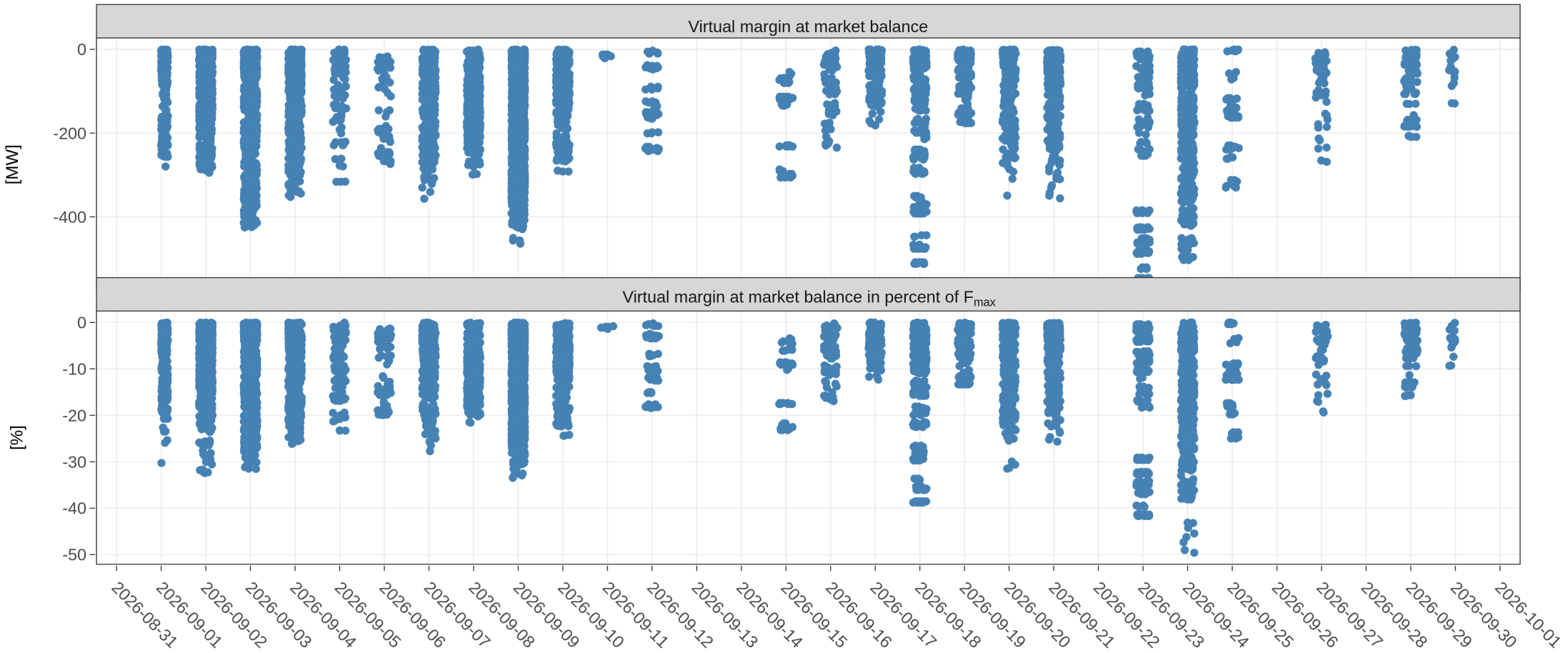
KPI 6b: Virtual margins at market balance HU



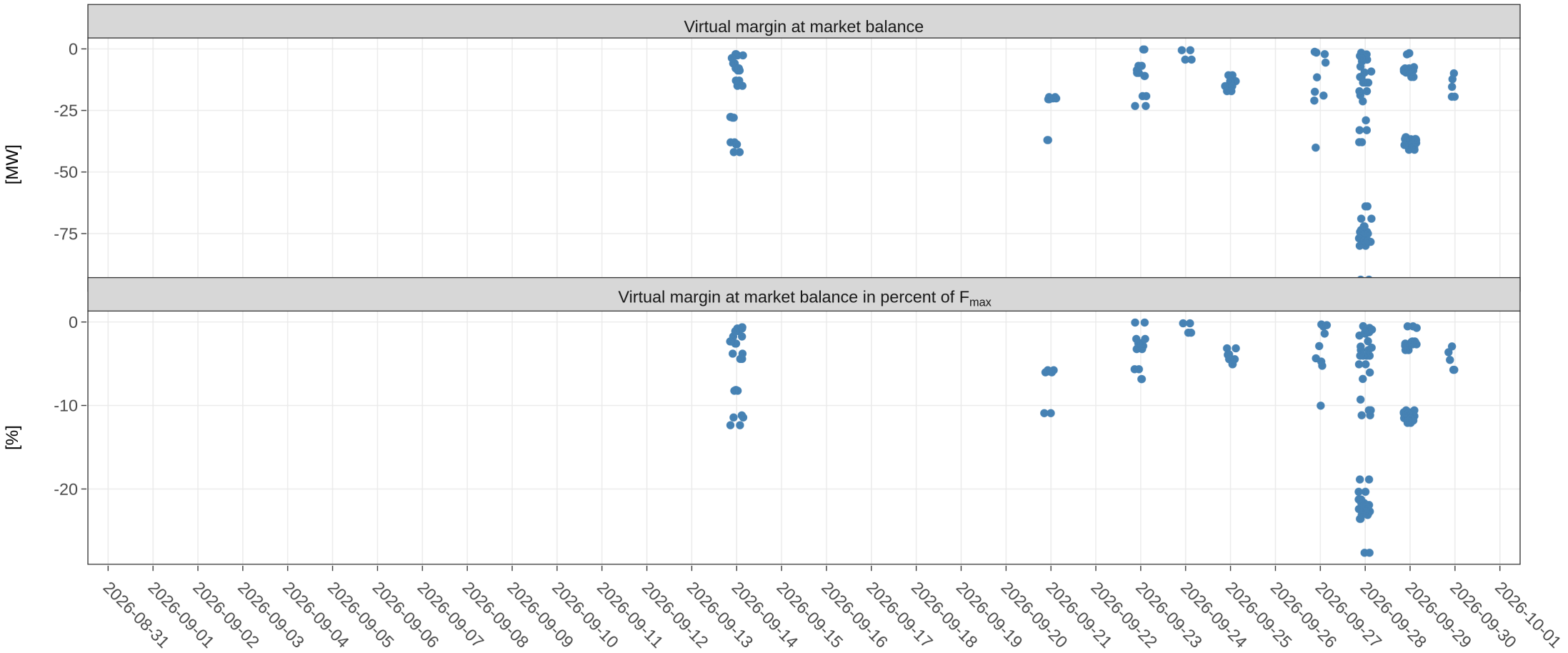
KPI 6b: Virtual margins at market balance NL



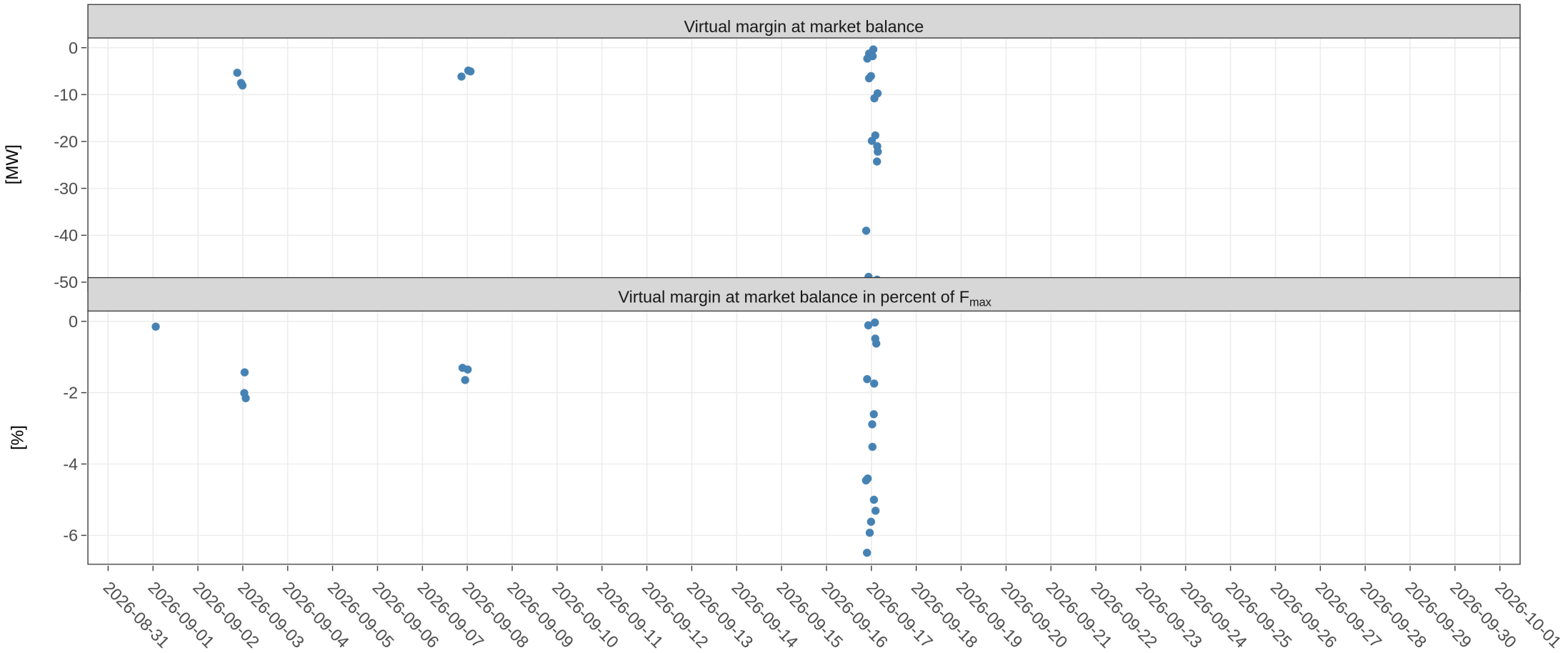
KPI 6b: Virtual margins at market balance PL



KPI 6b: Virtual margins at market balance RO



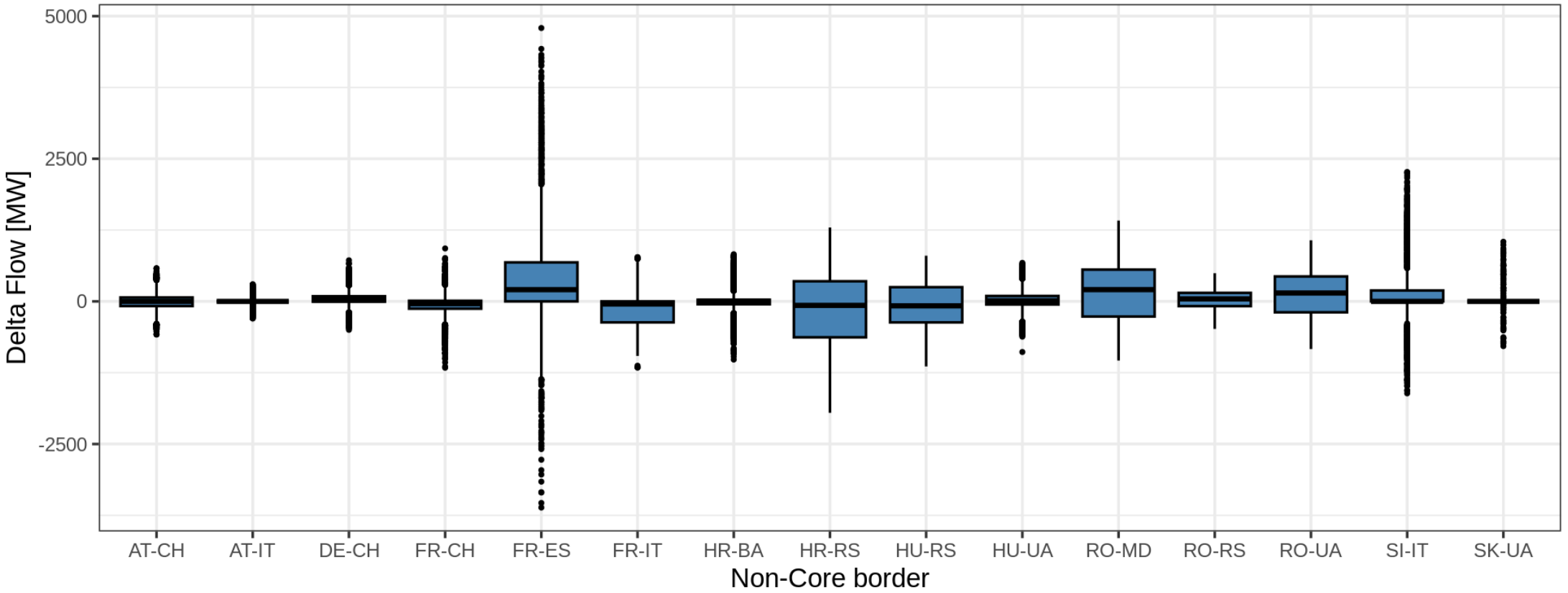
KPI 6b: Virtual margins at market balance SI



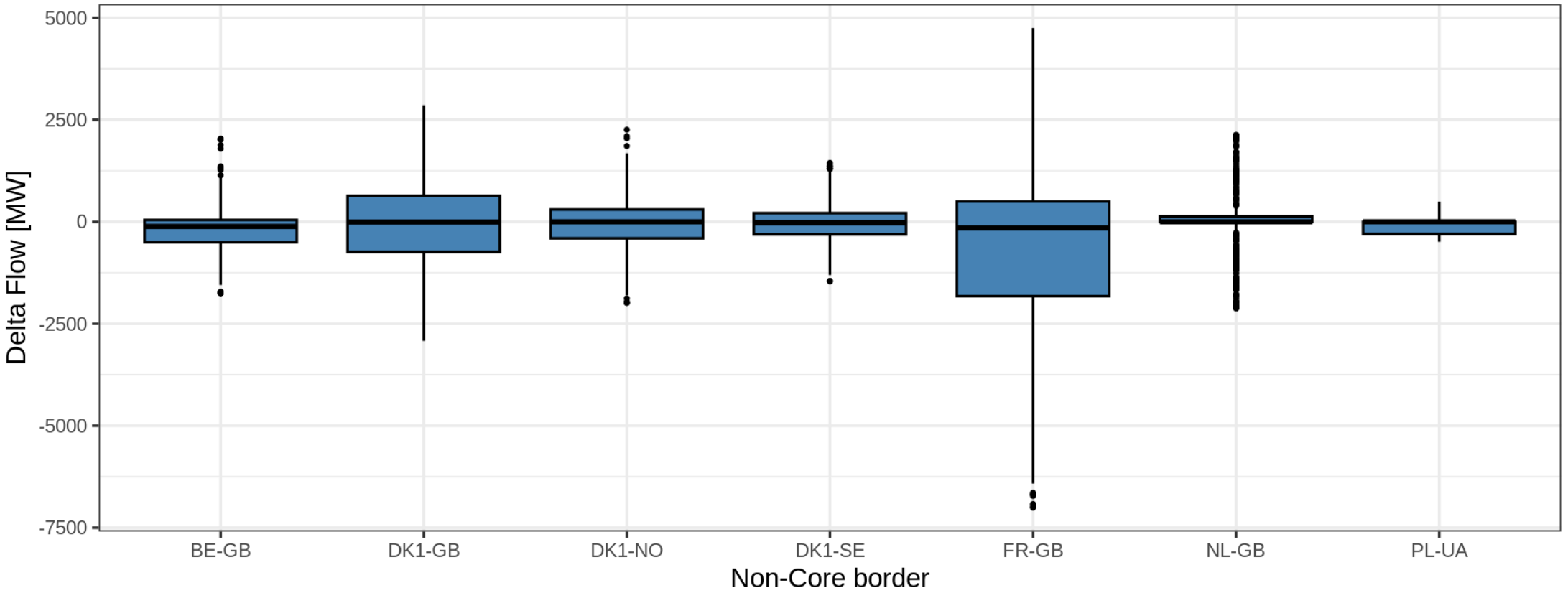
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow



KPI 7: Non-Core exchanges DC delta flow

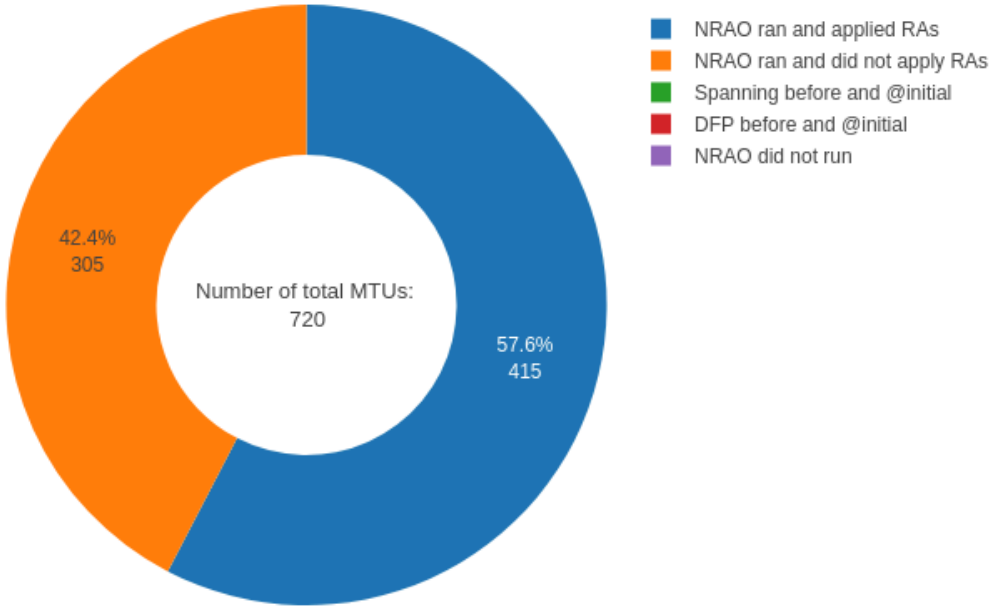


KPI 8: NRAO – Applied Remedial Action

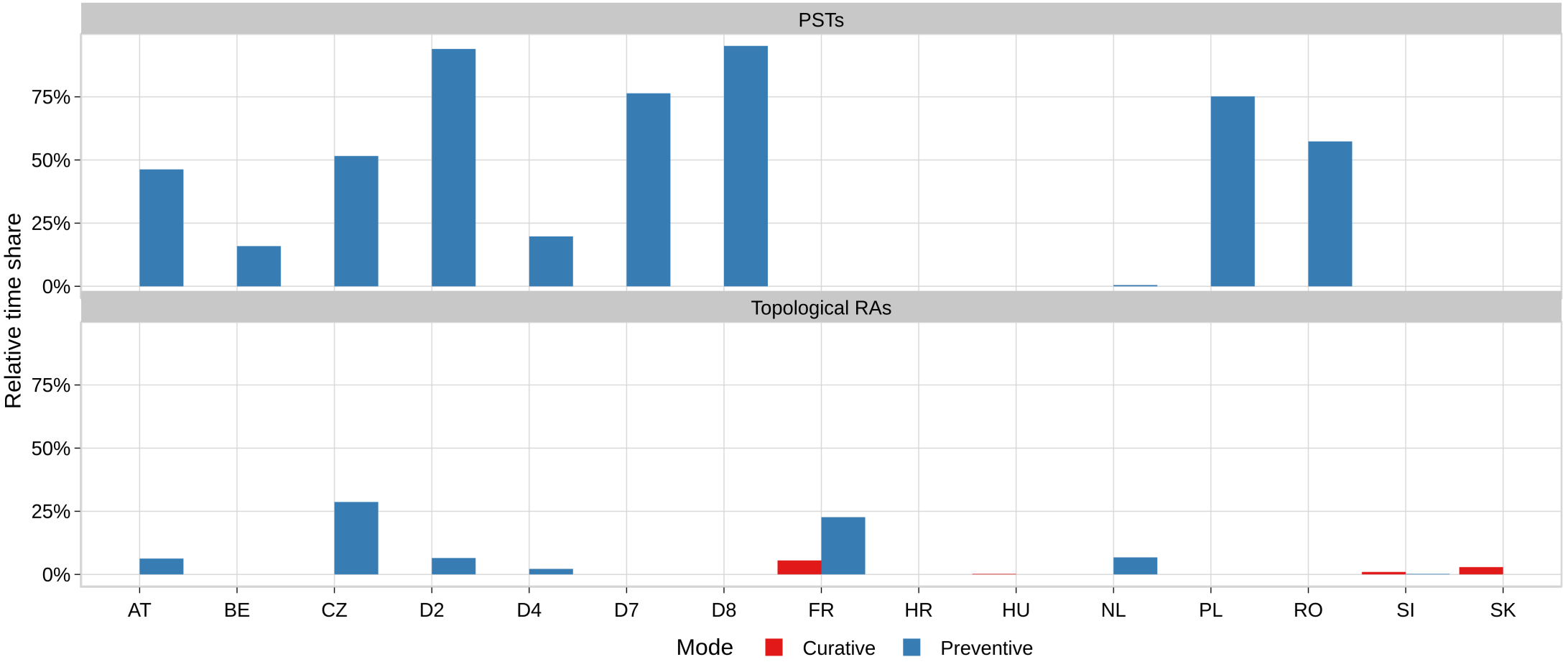
In the following plots, the relative time share relates to the hours labeled ‘NRAO Ran and Applied RAs’.

Total MTUs: 720 hours

Category	Hours (%)
NRAO ran and applied RAs	415 hours (57.6%)
NRAO ran and did not apply RAs	305 hours (42.4%)
Spanning before and @initial	0 hours (0%)
DFP before and @initial	0 hours (0%)
NRAO did not run	0 hours (0%)

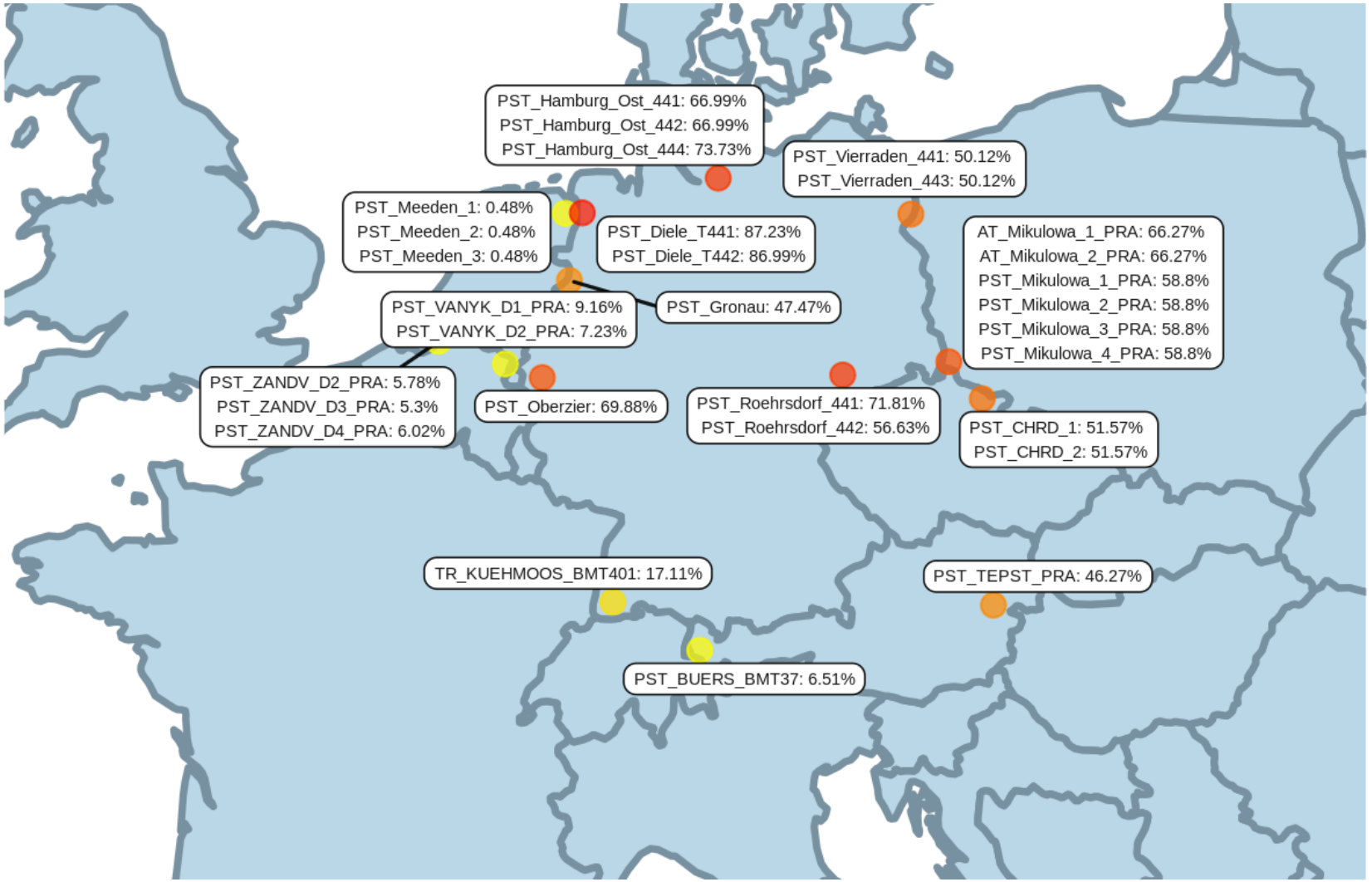


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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

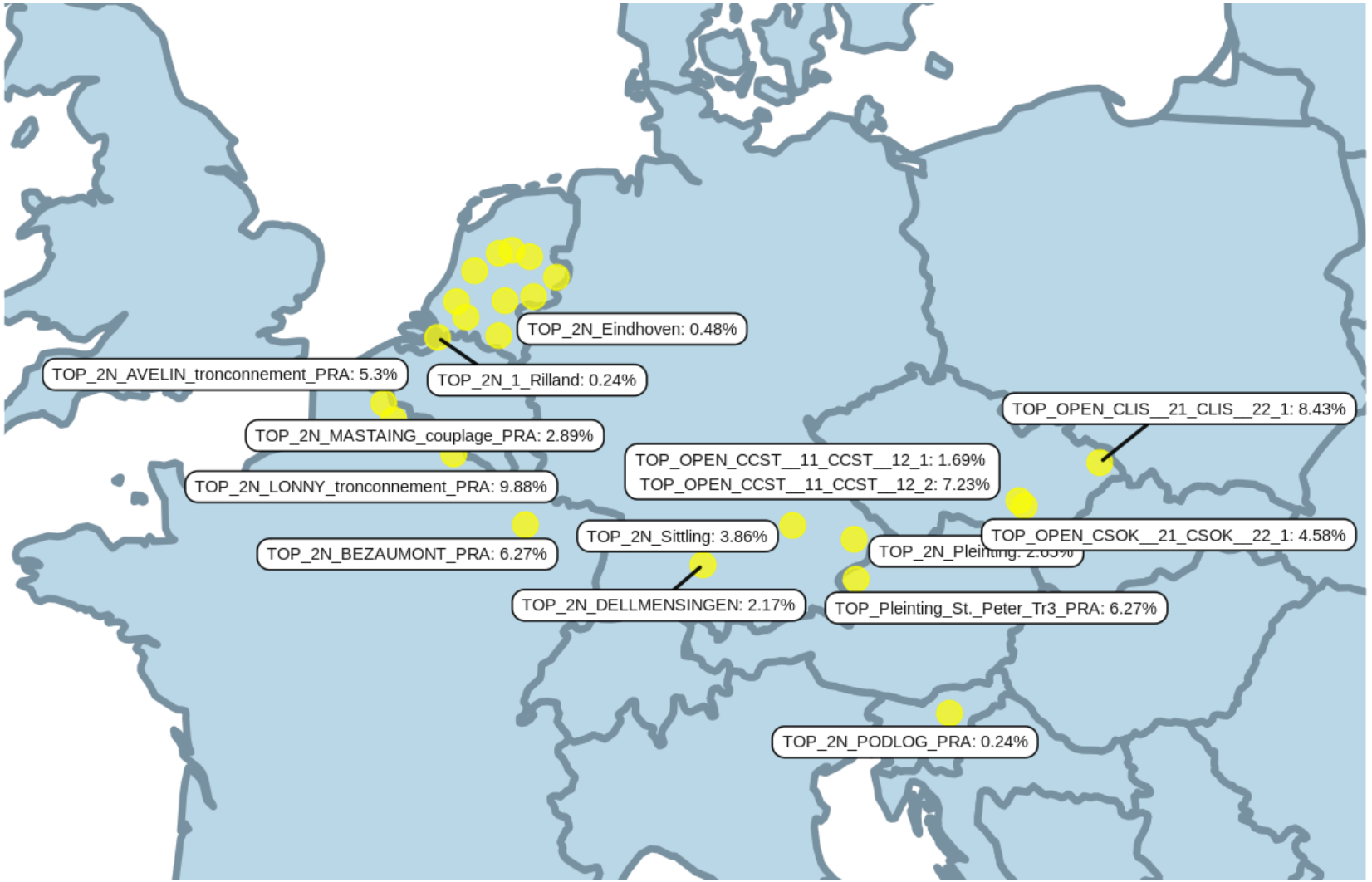
Relative Time Share of Applied PSTs in Curative Mode



- 0%-10%
- 10%-20%
- 20%-30%
- 30%-40%
- 40%-50%
- 50%-60%
- 60%-70%
- 70%-80%
- 80%-90%
- 90%-100%

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

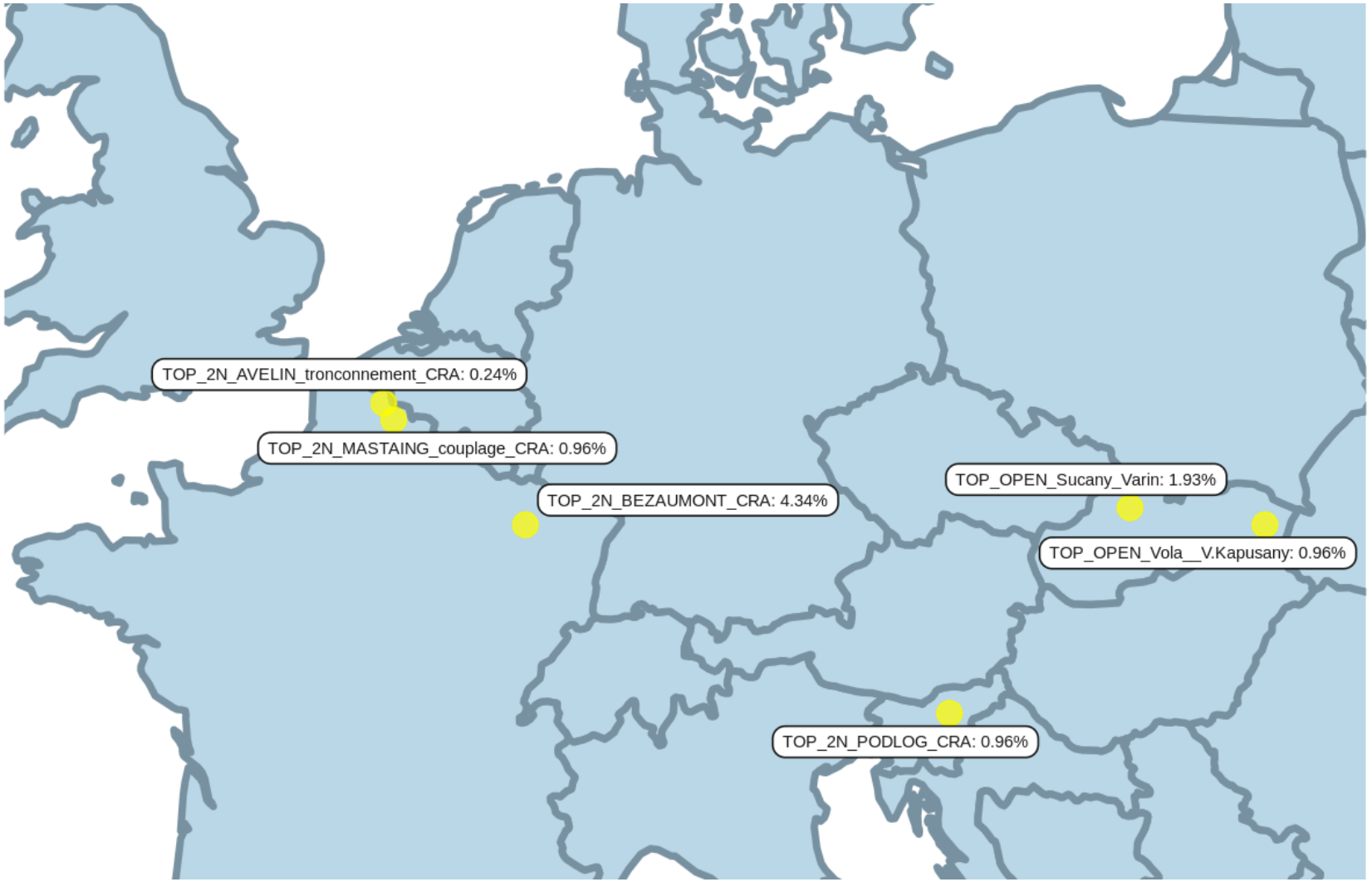
Relative Time Share of Applied Topological RAs in Preventive Mode





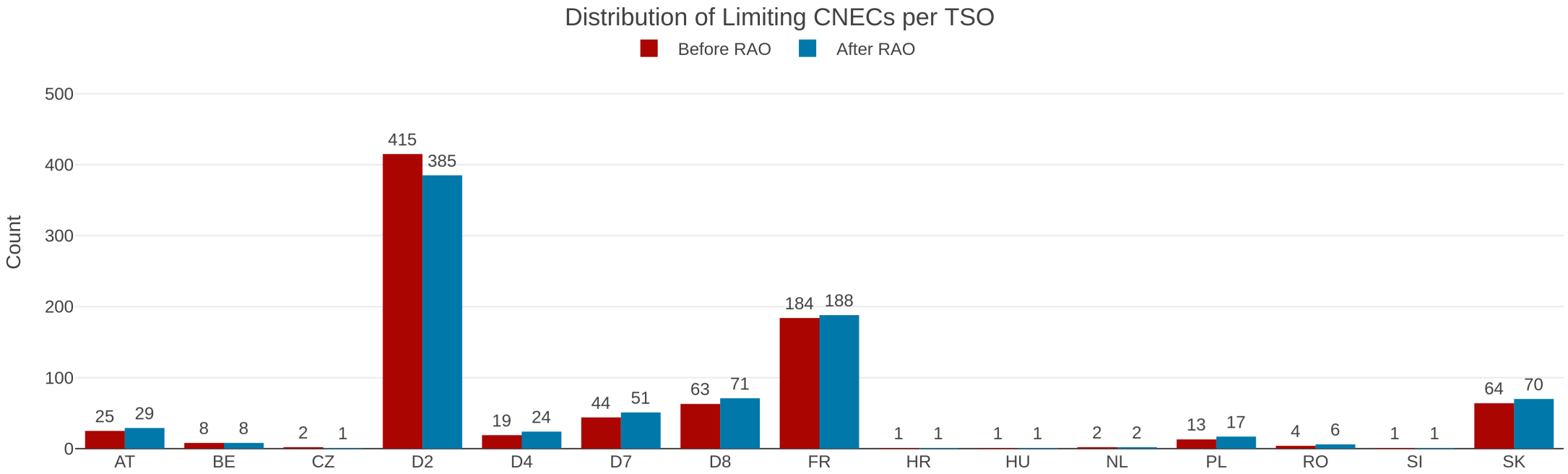
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

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



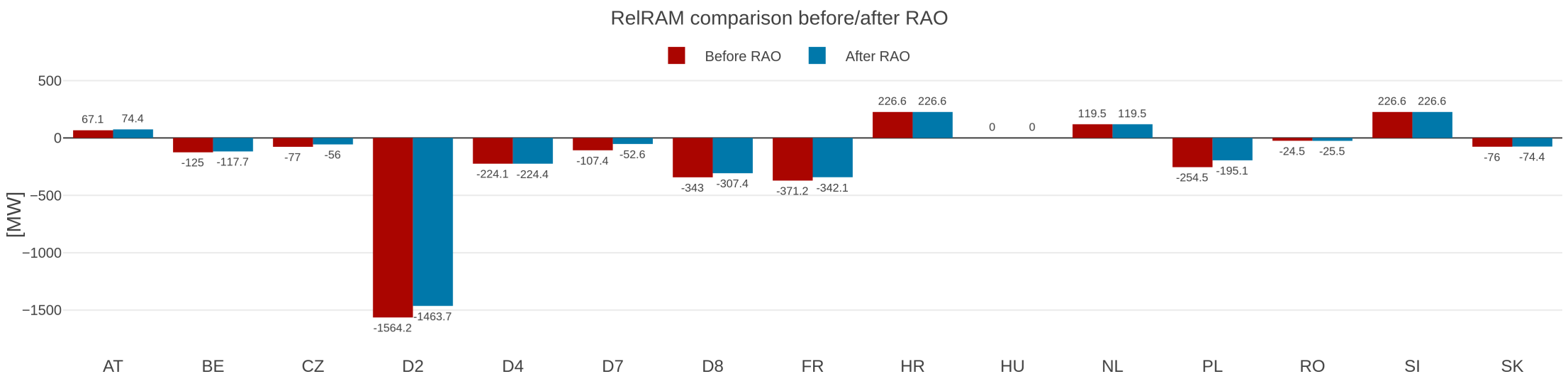
As expected, there is redistributing of the most limiting CNECs. This is because the application of Remedial Actions does not eliminate flows but re-routes, reducing the flows on some limiting CNECs and increasing the load on others, which at the end impacts also the RAM values.

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

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



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
[SI-HU] Cirkovce - Heviz [OPP] [HU]	720	791	74.74%	39.18%	94.52%	0.3121	1.5857
[SI-HU] 400 kV Cirkovce - Hevitz [DIR] [SI]	720	1436	106.85%	89.00%	127.86%	0.2532	1.3024
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	720	1370	105.55%	70.32%	147.86%	0.2483	0.6701
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	720	720	51.44%	20.33%	80.46%	0.3507	1.563
[SI-HU] 400 kV Cirkovce - Hevitz [OPP] [SI]	719	1448	74.27%	57.62%	90.98%	0.2532	1.3024
[CZ-SK] Nosovice - Varin [OPP] [CZ]	719	1549	104.06%	72.65%	134.56%	0.3903	1.7408
[D8-PL] Mikulowa PST1 [DIR] [PL]	719	719	65.67%	34.62%	91.74%	0.3434	1.6268
[SK-SK] V.Dur - Levice 1 [DIR]	718	834	60.66%	29.14%	80.96%	0.4014	1.754
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	718	786	66.29%	43.47%	78.30%	0.3598	1.3211
[SI-HU] Cirkovce - Heviz [DIR] [HU]	713	772	105.68%	85.43%	126.91%	0.3121	1.5857
[SK-SK] V.Dur - Krizovany [DIR]	707	754	92.00%	52.33%	120.82%	0.3534	1.3551
[PL-PL] Krosno Iskrzynia - Rzeszow [DIR]	704	733	119.43%	102.22%	143.30%	0.3598	1.3211
[D2-D2] Sottrum Transformer T421 [DIR] [D2]	703	1223	73.91%	24.38%	114.06%	0.1547	0.464
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	695	703	68.68%	36.90%	109.89%	0.2483	0.6701
[HU-HU] Paks - Sandorfalva [DIR]	693	1252	68.84%	53.75%	88.53%	0.2537	0.81
[CZ-SK] Nosovice - Varin [DIR] [CZ]	691	1227	72.36%	55.37%	104.70%	0.3903	1.7408
[D8-PL] Mikulowa PST1 [OPP] [PL]	684	684	122.92%	88.26%	166.67%	0.3434	1.6268
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	682	1201	73.92%	27.32%	125.68%	0.1419	0.4967
[BE-BE] Lixhe - Gramme 380.11 [OPP]	681	2244	65.34%	43.32%	98.53%	0.2869	0.6575
[D8-D8] Roehrsdorf - Roehrsdorf PST442 [DIR]	681	681	64.49%	19.93%	103.70%	0.2888	1.348

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 hours CNECs have shadow price	Max shadow price [€/MW]	Avg RAM/Fmax	Min RAM/Fmax	Max RAM/Fmax	Max z2zPTDF
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	212	212	529.98	45.58%	21.32%	74.34%	0.3424
[FR-FR] Creys - Saint-Vulbas 2 [OPP]	155	155	958.41	25.56%	19.99%	49.68%	0.2129
[SK-SK] V.Dur - Levice 1 [DIR]	141	141	641.38	47.42%	29.14%	67.56%	0.3525
[D2-D2] Sottrum Transformer T421 [DIR] [D2]	136	137	778.28	71.05%	41.46%	92.35%	0.1547
[D2-D2] Altheim - Simbach 233/230 [DIR]	116	116	1889.37	68.81%	38.42%	125.40%	0.1395
[NL-D7] Gronau-Hengelo 380 W [DIR] [NL]	103	106	1090.89	28.41%	20.05%	60.25%	0.2733
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	98	104	1040.12	64.05%	27.32%	99.18%	0.1356
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	94	97	639.4	81.34%	38.17%	131.74%	0.4153
[SK-HU] Levice - God [DIR] [HU]	88	88	500.82	51.39%	35.43%	61.04%	0.3432
[CZ-SK] Nosovice - Varin [DIR] [CZ]	86	87	689.75	66.36%	55.37%	81.38%	0.3903
[BE-BE] Lixhe - Gramme 380.11 [DIR]	70	73	171.56	111.67%	79.36%	139.36%	0.6666
[D8-PL] Mikulowa PST1 [DIR] [PL]	70	70	563.41	58.32%	34.62%	75.30%	0.3431
[D2-D2] Altheim - Sittling 219 [OPP]	66	66	1804.83	58.78%	35.03%	79.95%	0.0882
[D7-D7] Gronau - Gronau TR 441 E [DIR]	63	63	939.07	67.04%	49.80%	117.47%	0.3598
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	61	61	1223.56	56.52%	20.22%	88.83%	0.155
[BE-BE] Doel - Zandvliet 380.25 [OPP]	55	55	598.64	79.70%	47.47%	93.70%	0.3574
[BE-BE] Achene - Gramme 380.10 [DIR]	45	47	481.79	90.58%	40.29%	130.97%	0.3725
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	40	44	307.13	59.57%	45.45%	65.87%	0.3703
[NL-BE] PST Zandvliet 4 [DIR] [BE]	40	40	443.25	50.03%	20.03%	94.35%	0.4354
[D2-D2] Altheim - Sittling 220 [OPP]	39	39	1760.21	59.63%	34.02%	72.94%	0.0772

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 = 500MW/0.4 = 1250MW

KPI 13 : Allocation Constraints - Poland

	# MTUs
AC was limiting MC	868
AC < 0 MW	140
AC = 0 MW	449
AC > 0 MW	279

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-2111.94	1917.88
Min.	-10207.00	0.00
Max.	0.00	8988.00

