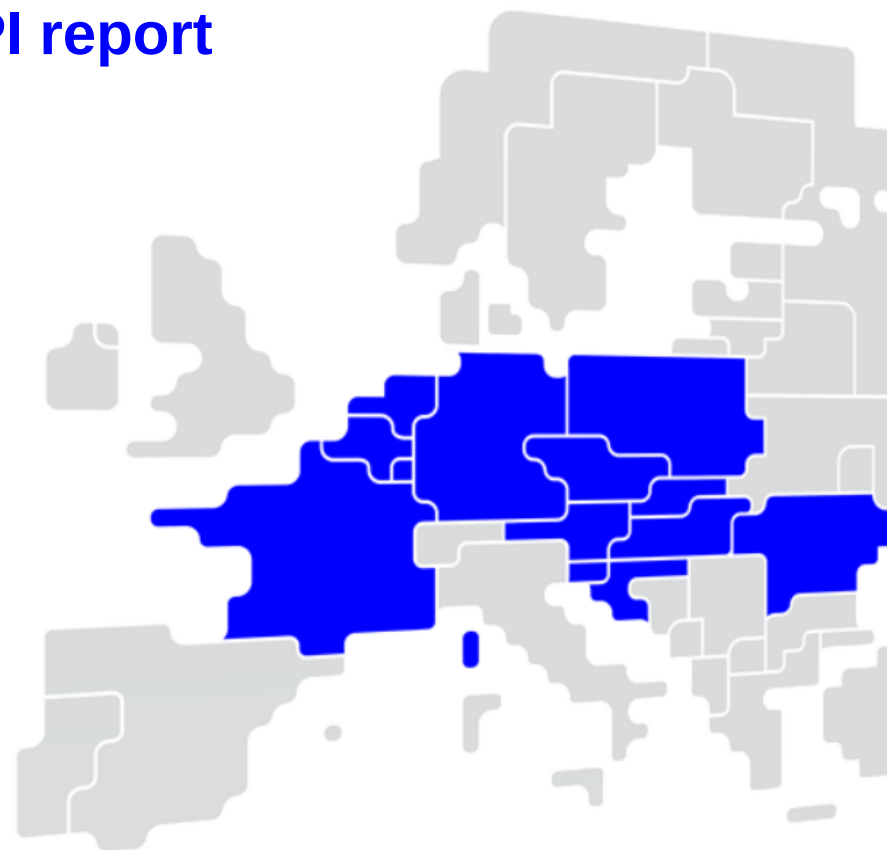




Core FB MC Operational KPI report

September 2024



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

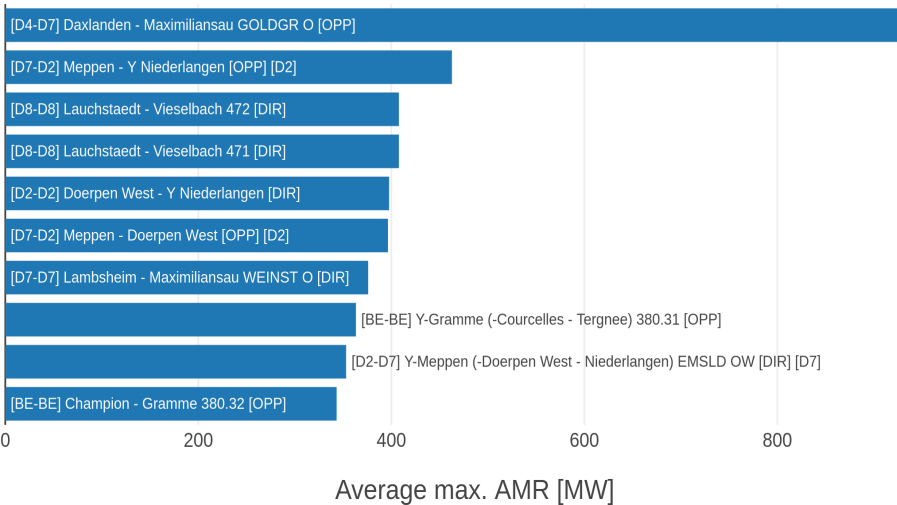
- KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode
- KPI 9: Most limiting CNEC per TSO (NRAO)
- KPI 10: Average variation of relative RAM before and after NRAO

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
[D4-D7] Daxlanden - Maximiliansau GOLDGR O [OPP]	924.29	0.48%
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	462.76	21.48%
[D8-D8] Lauchstaedt - Vieselbach 471 [DIR]	407.82	14.10%
[D8-D8] Lauchstaedt - Vieselbach 472 [DIR]	407.82	14.10%
[D2-D2] Doerpen West - Y Niederlangen [DIR]	397.67	17.62%
[D7-D2] Meppen - Doerpen West [OPP] [D2]	396.46	12.58%
[D7-D7] Lamsbheim - Maximiliansau WEINST O [DIR]	376.00	0.19%
[BE-BE] Y-Gramme (-Courcelles - Tergnee) 380.31 [OPP]	363.28	17.58%
[D2-D7] Y-Meppen (-Doerpen West - Niederlangen) EMSLD OW [DIR] [D7]	353.13	13.07%
[BE-BE] Champion - Gramme 380.32 [OPP]	343.30	20.03%

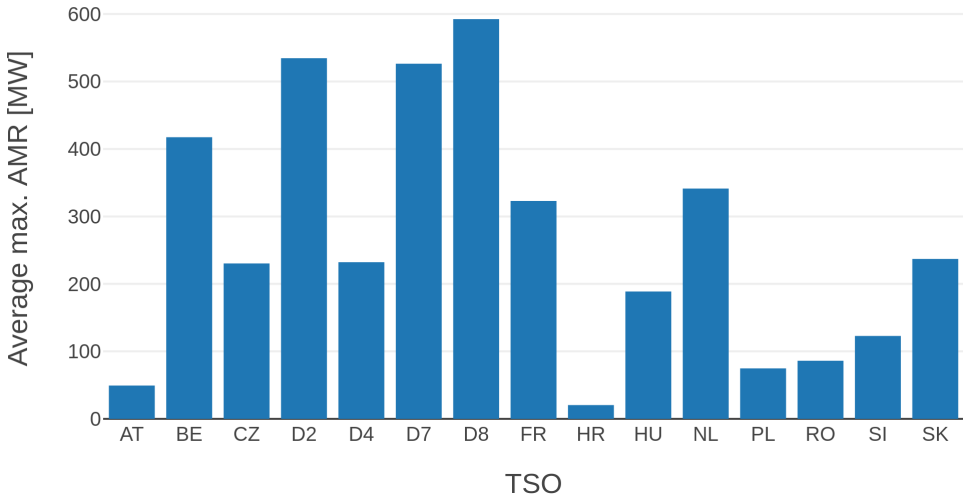


KPI 2: Average maximum AMR per TSO



TSO	Average maximum AMR per TSO
AT	49.33
BE	417.37
CZ	230.32
D2	534.58
D4	232.22
D7	526.23
D8	592.39
FR	322.92
HR	20.48
HU	188.68

TSO	Average maximum AMR per TSO
NL	341.22
PL	74.81
RO	86.14
SI	122.79
SK	237.06



KPI 3: Share of MTUs with intervention per TSO



Total BDs
30

Total MTUs
720

MTUs without IVA
111

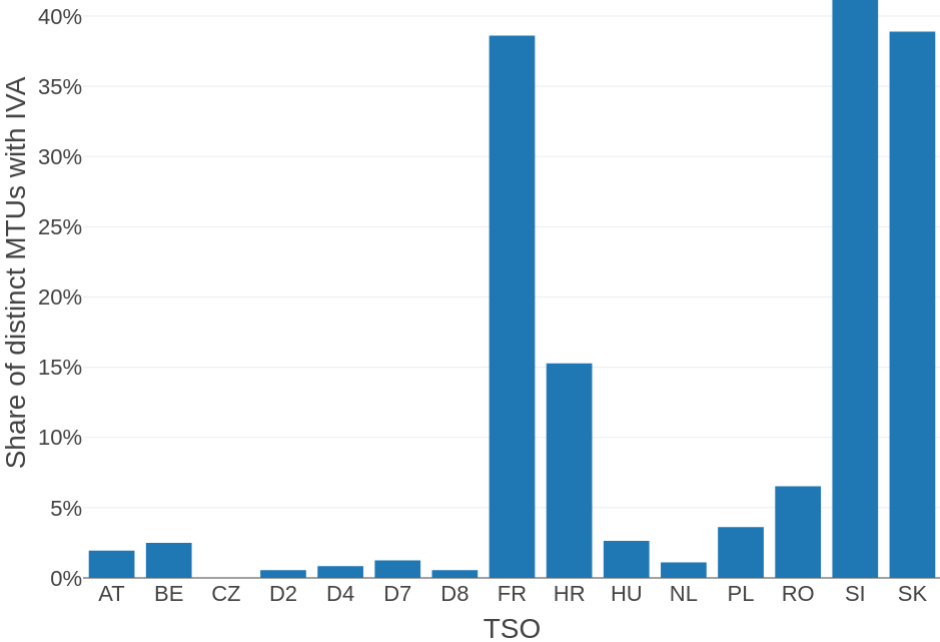
Share of distinct MTUs without IVA
15.42%

MTUs with IVA
609

Share of distinct MTUs with IVA
84.6%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	1.94%	14
BE	2.50%	18
CZ	0.00%	0
D2	0.56%	4
D4	0.83%	6
D7	1.25%	9
D8	0.56%	4
FR	38.61%	278
HR	15.28%	110
HU	2.64%	19

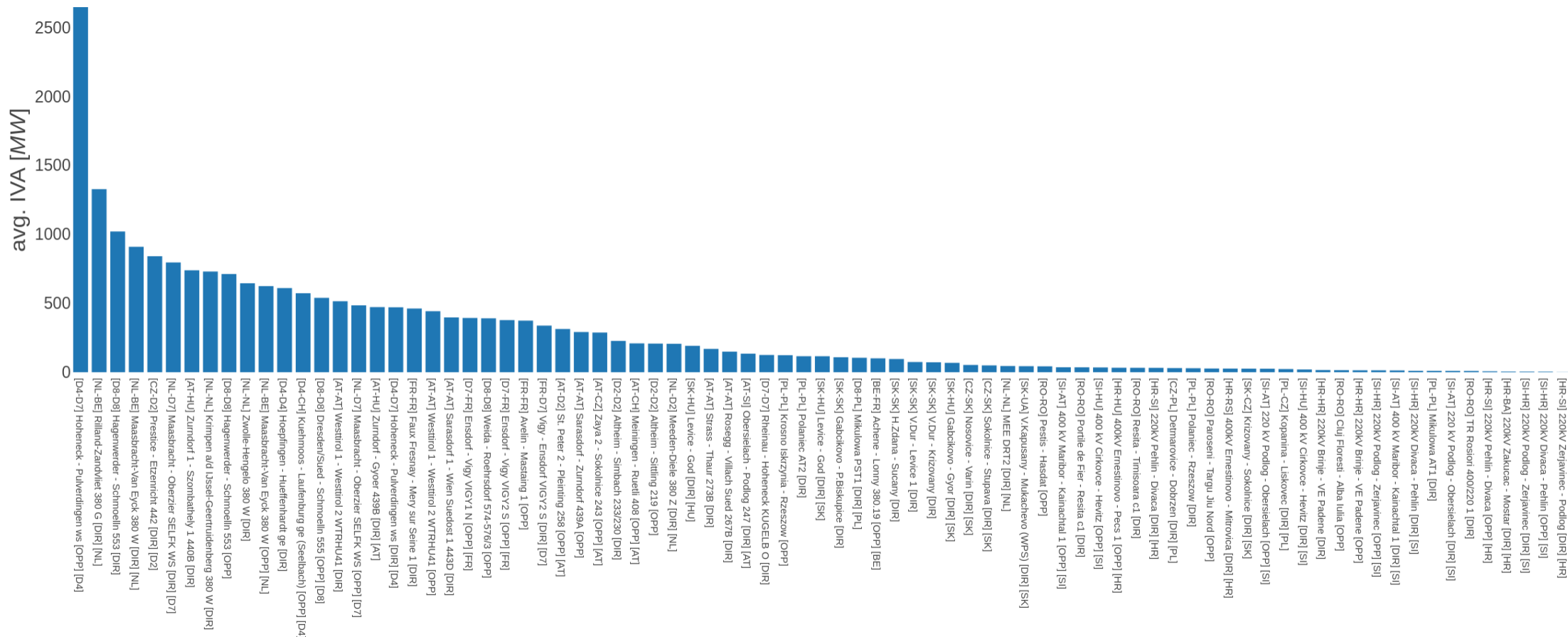
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
NL	1.11%	8
PL	3.61%	26
RO	6.53%	47
SI	41.25%	297
SK	38.89%	280



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



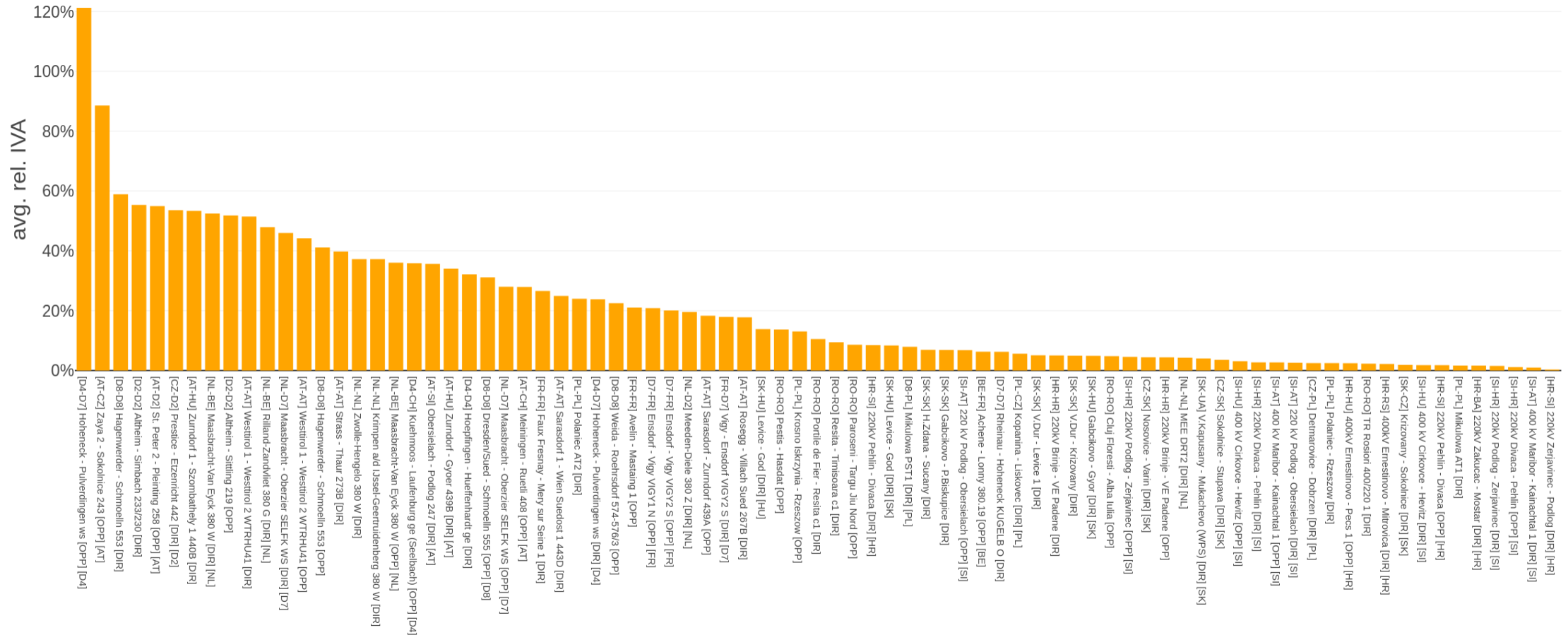
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



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



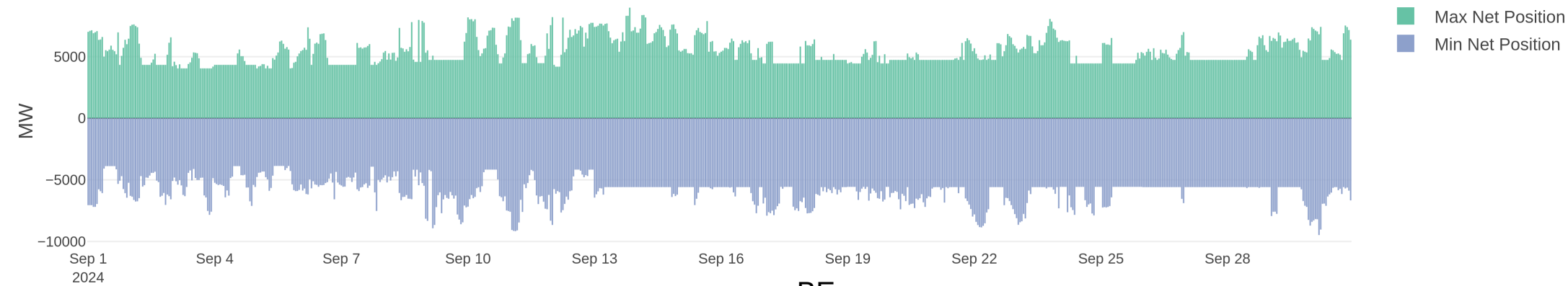
$$\text{avg. rel. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} \frac{IVA_{CNEC, MTU}[IVA_{CNEC, MTU} > 0]}{F_{maxCNEC, MTU}[IVA_{CNEC, MTU} > 0]}$$



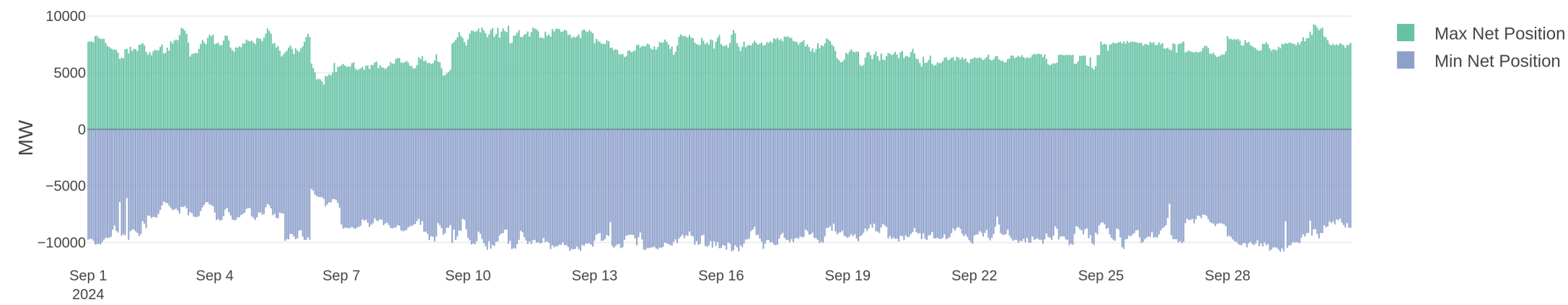
KPI 5: Min & max net positions per BZ hub



AT



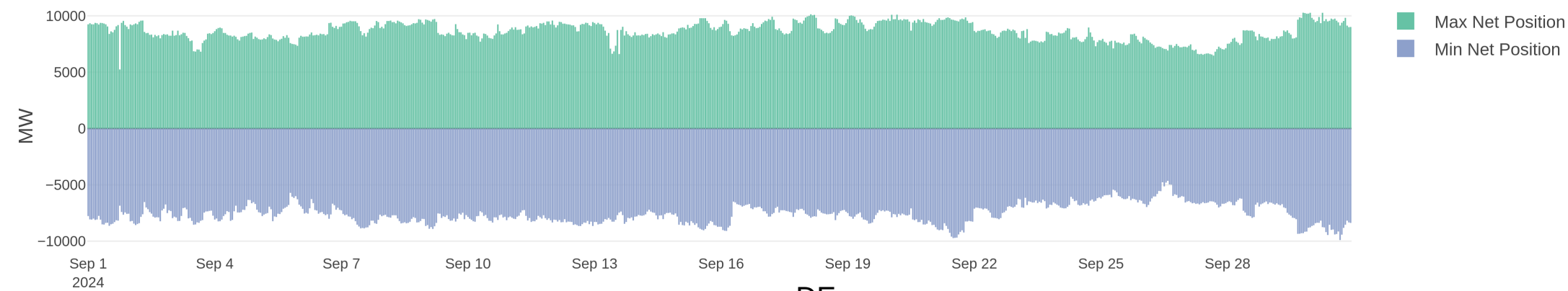
BE



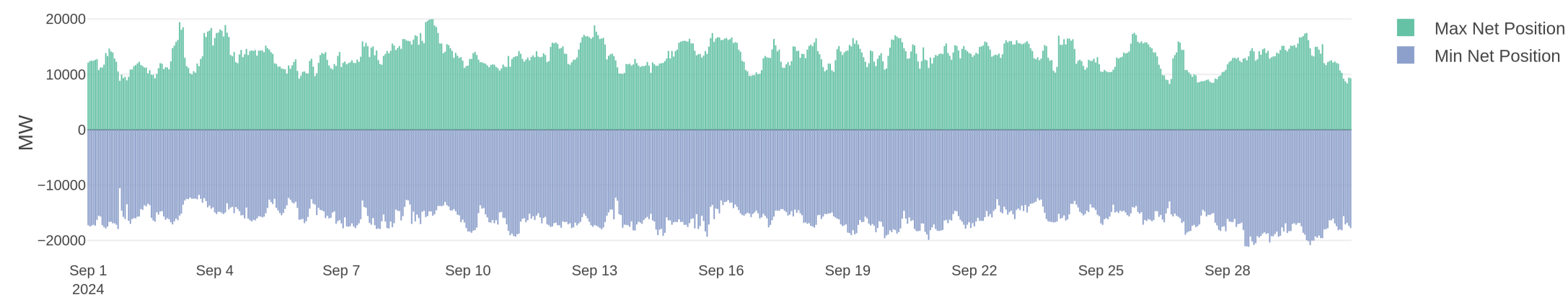
KPI 5: Min & max net positions per BZ hub



CZ



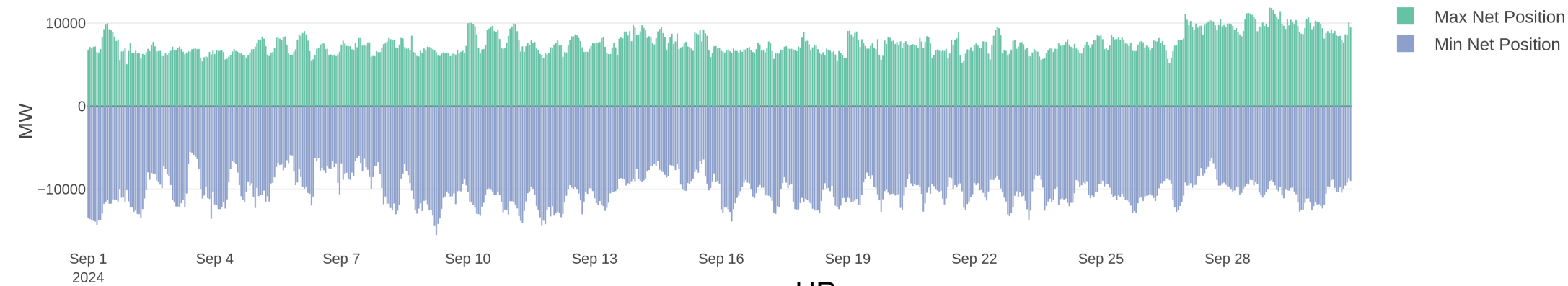
DE



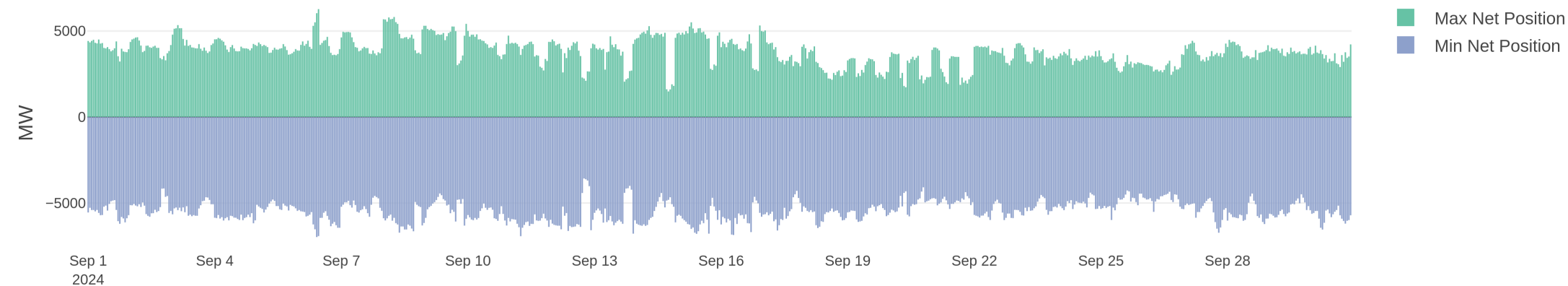
KPI 5: Min & max net positions per BZ hub



FR



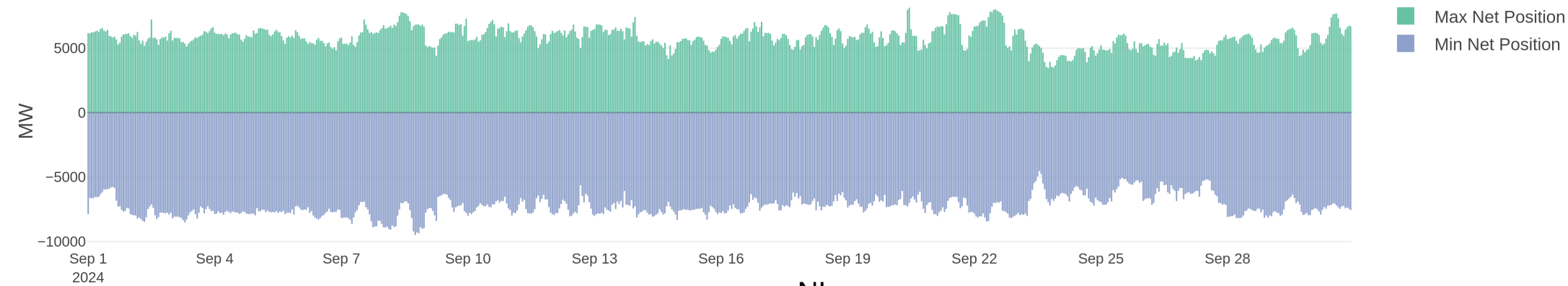
HR



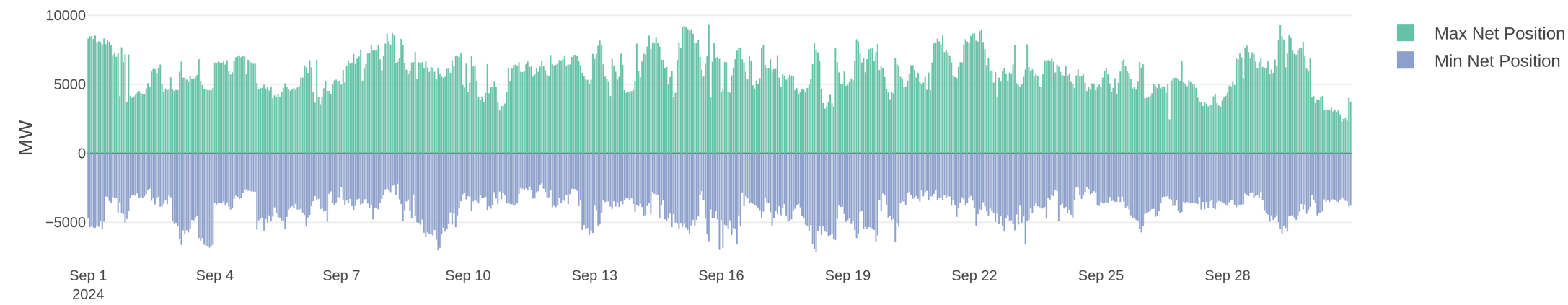
KPI 5: Min & max net positions per BZ hub



HU



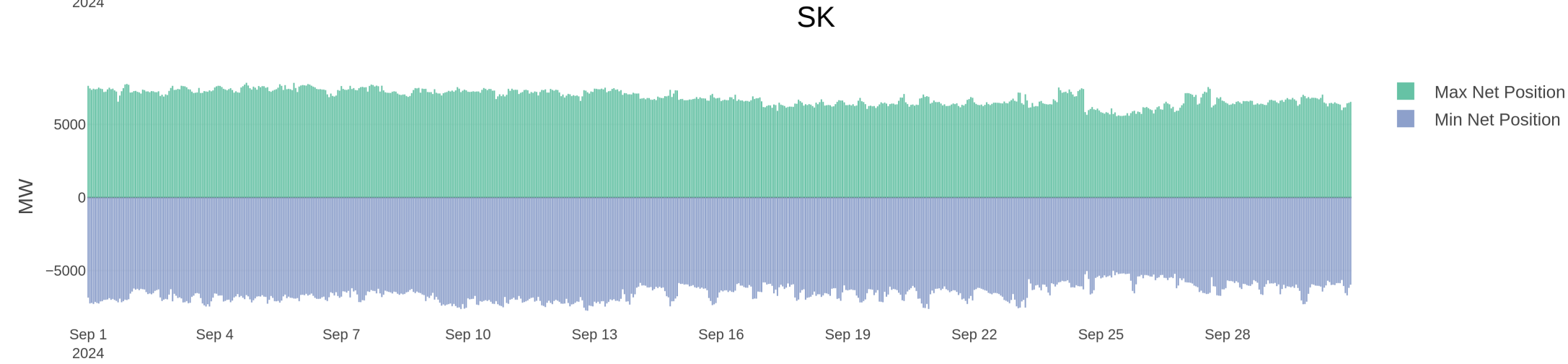
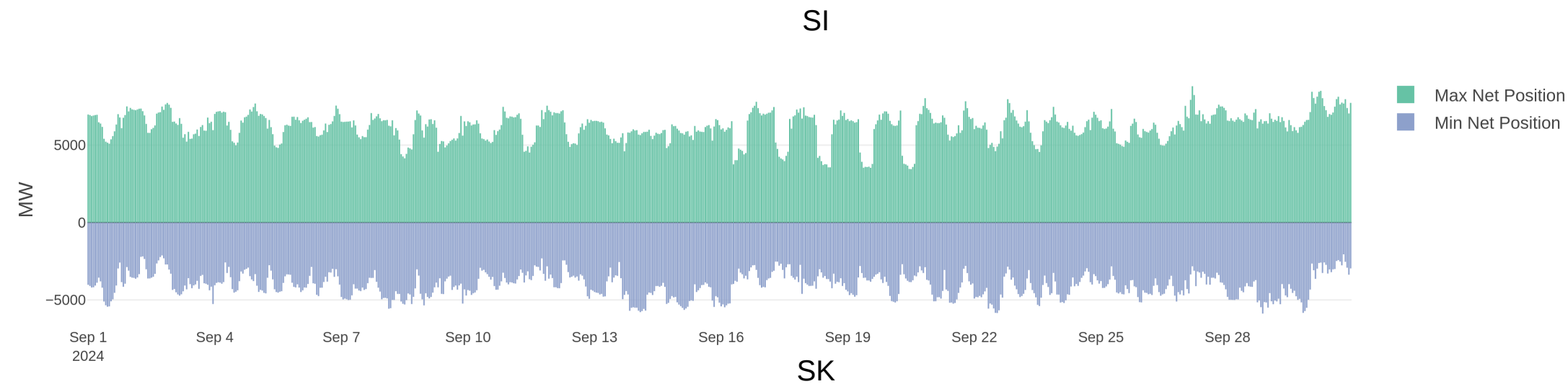
NL



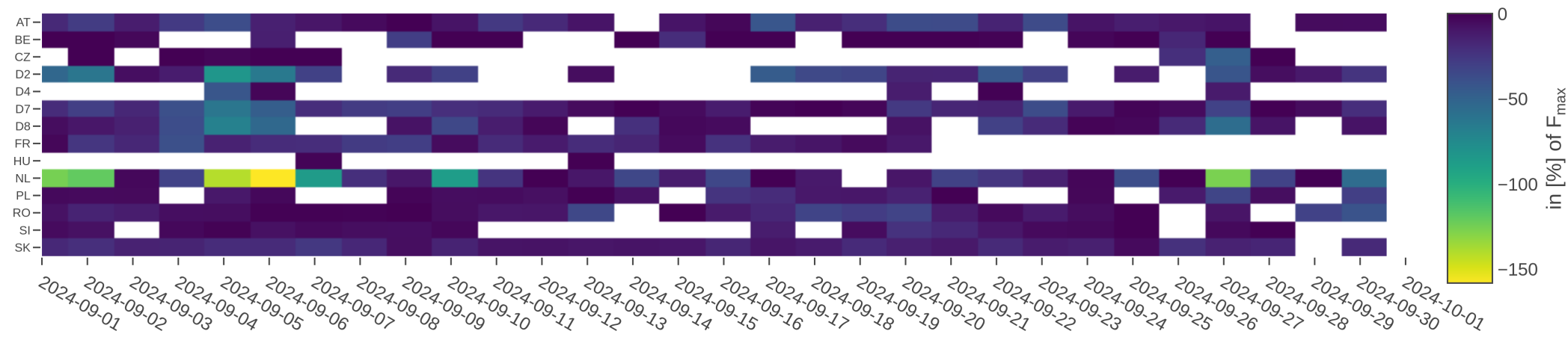
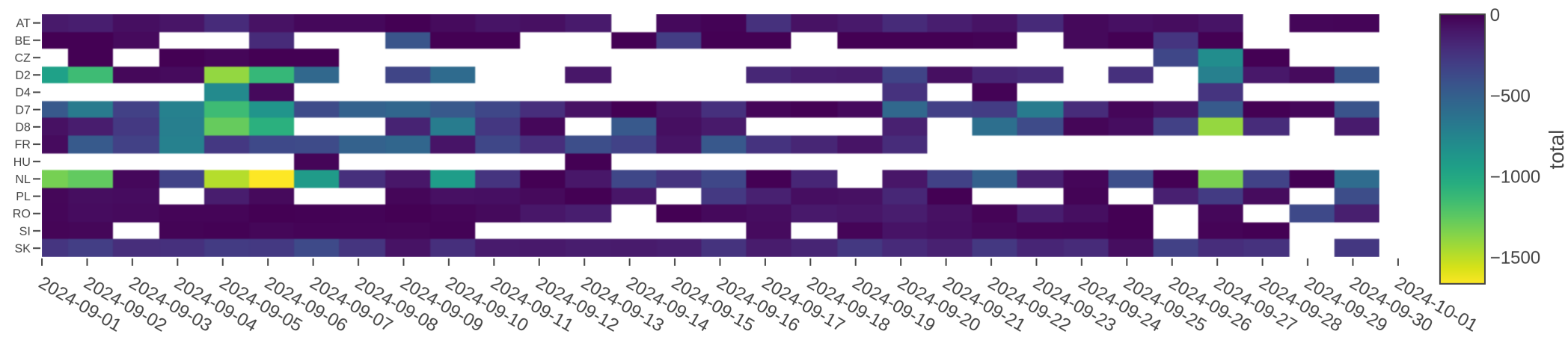
KPI 5: Min & max net positions per BZ hub



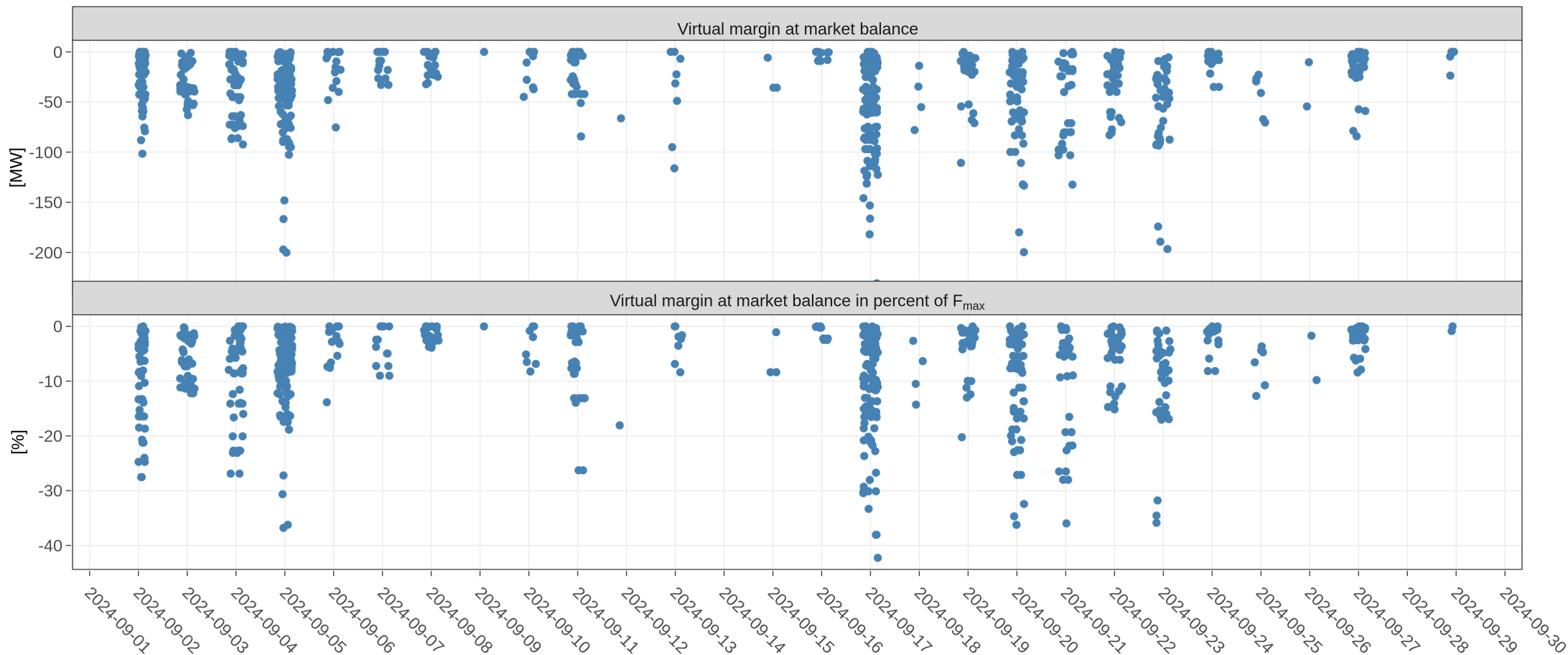
KPI 5: Min & max net positions per BZ hub



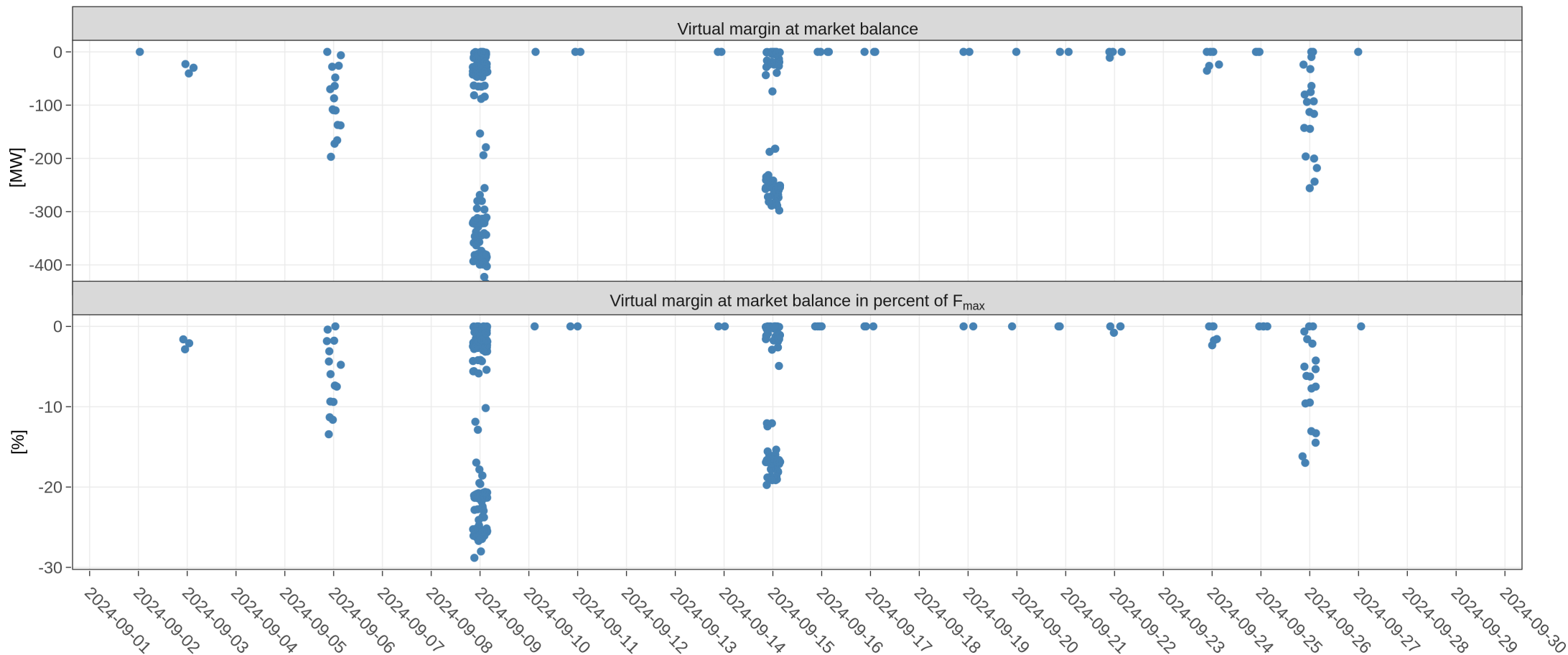
KPI 6a: Highest virtual margins at market balance for CORE TSOs



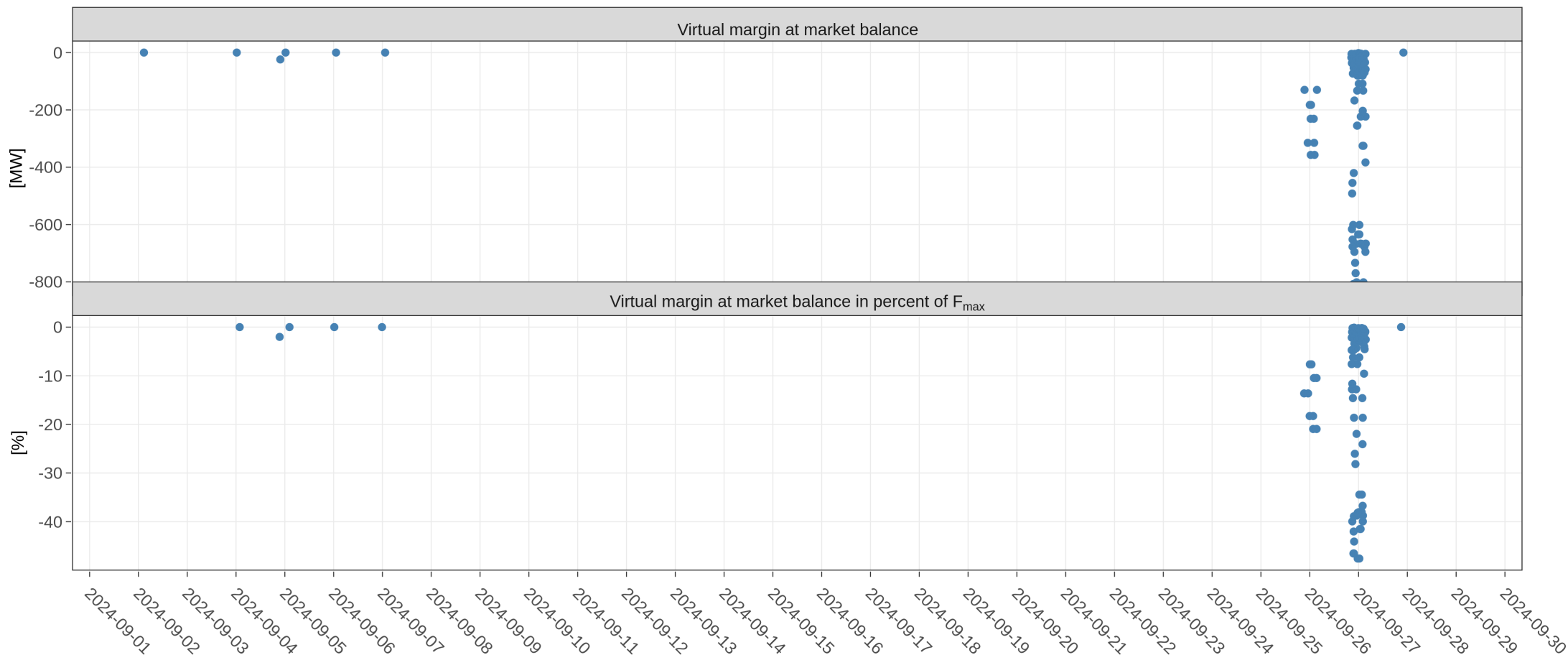
KPI 6b: Virtual margins at market balance AT



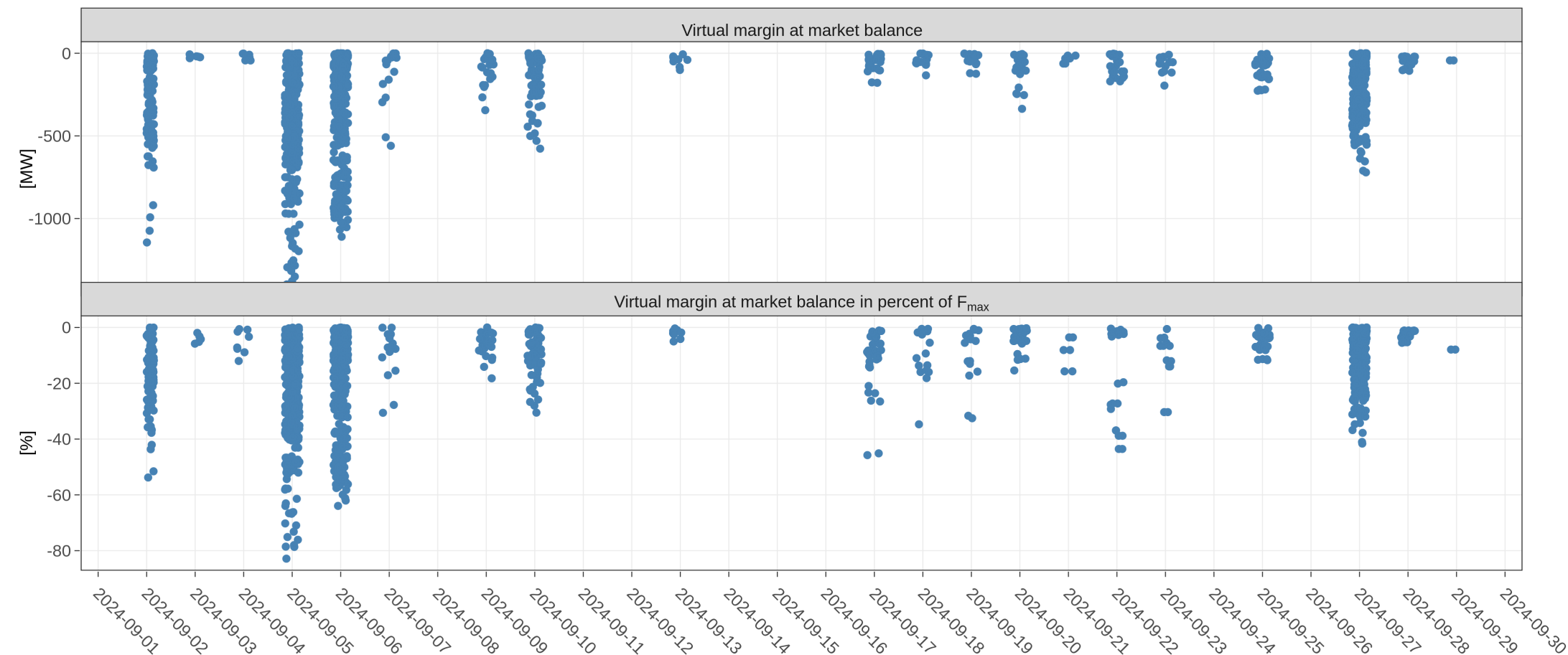
KPI 6b: Virtual margins at market balance BE



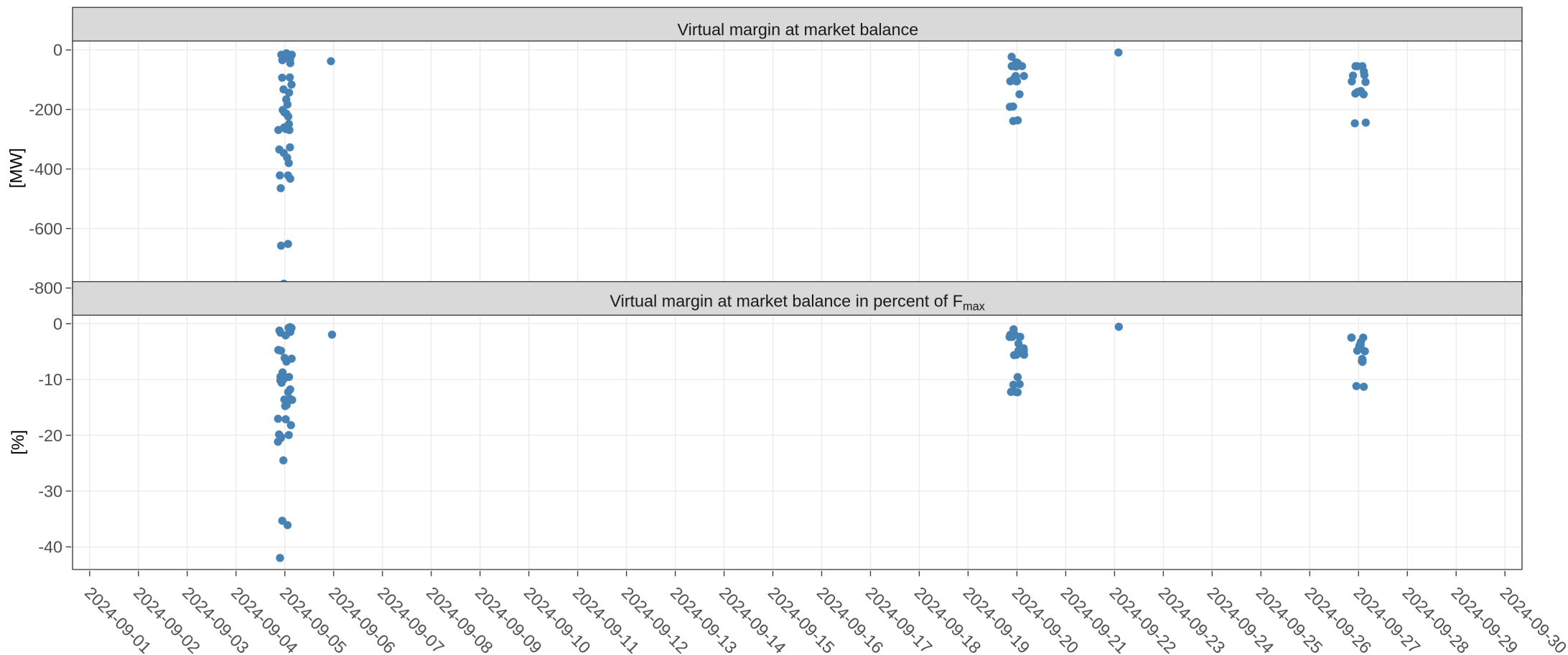
KPI 6b: Virtual margins at market balance CZ



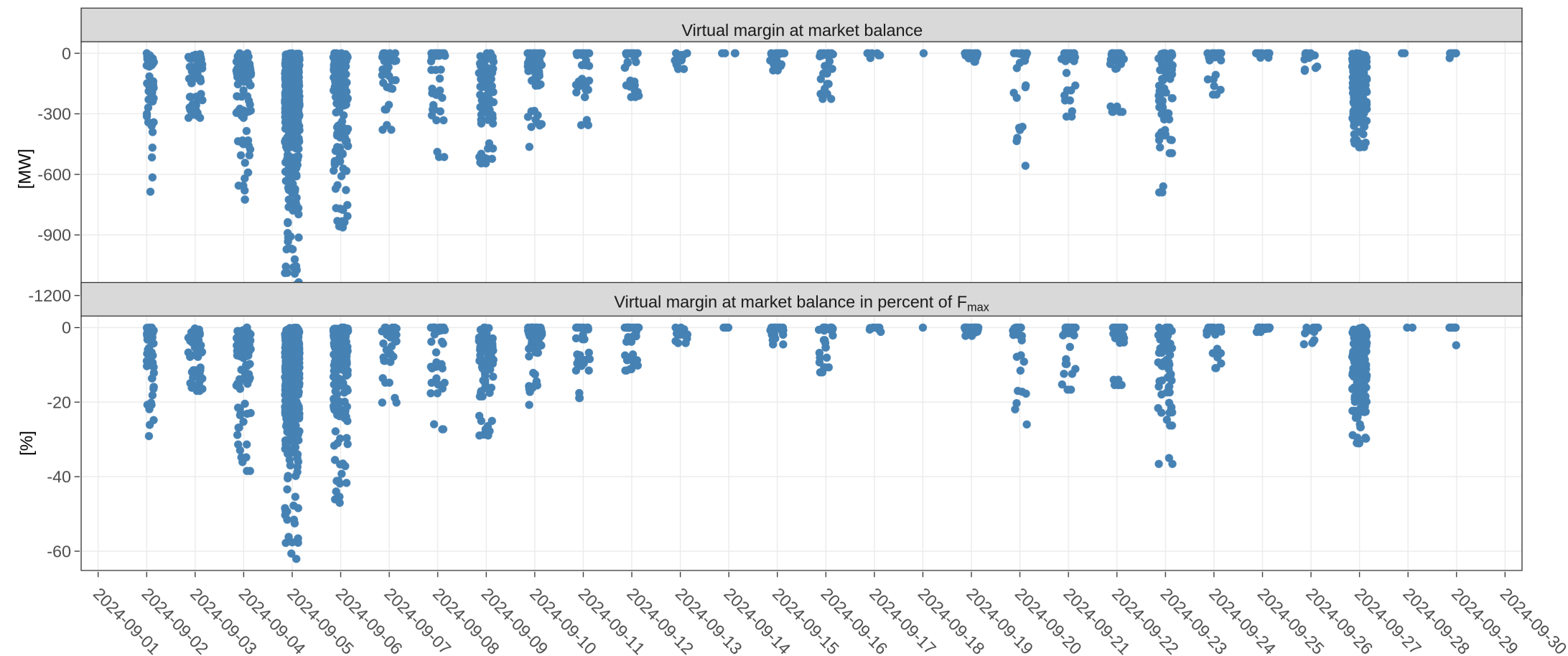
KPI 6b: Virtual margins at market balance D2



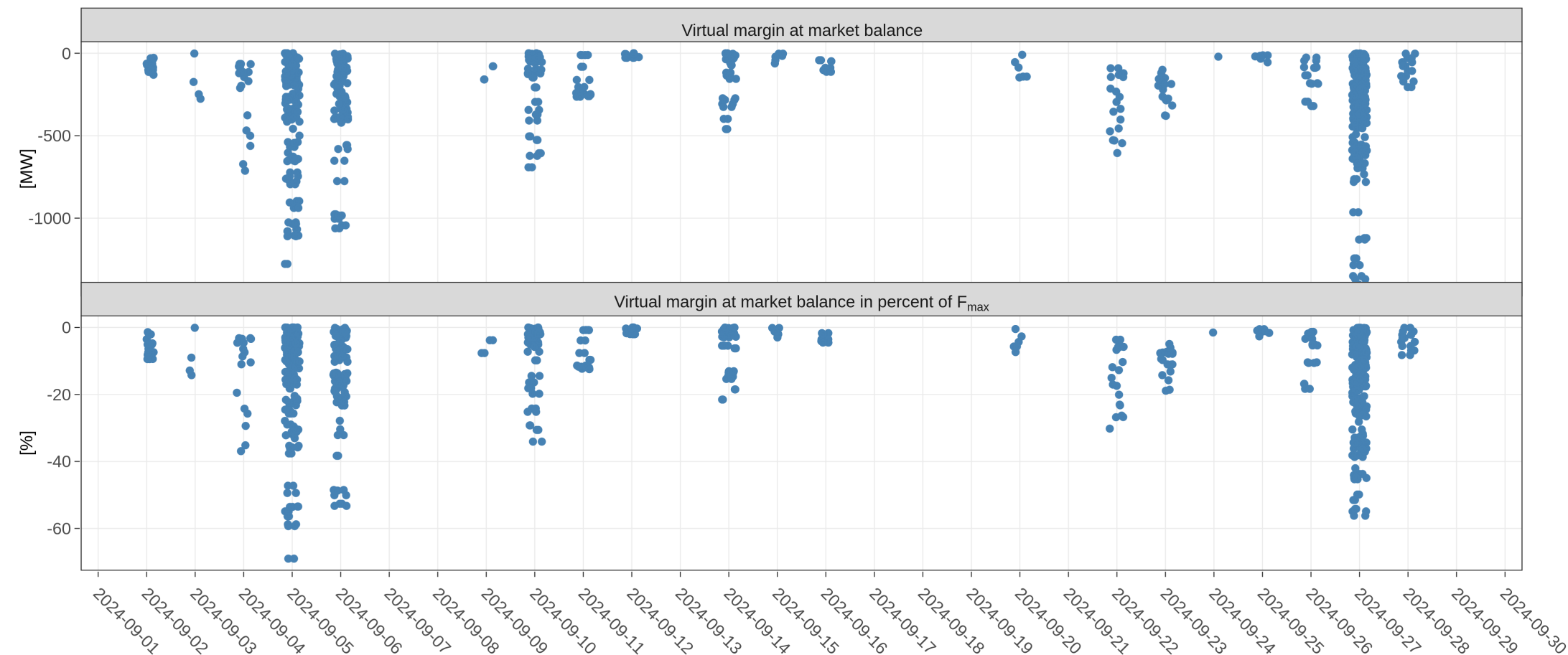
KPI 6b: Virtual margins at market balance D4



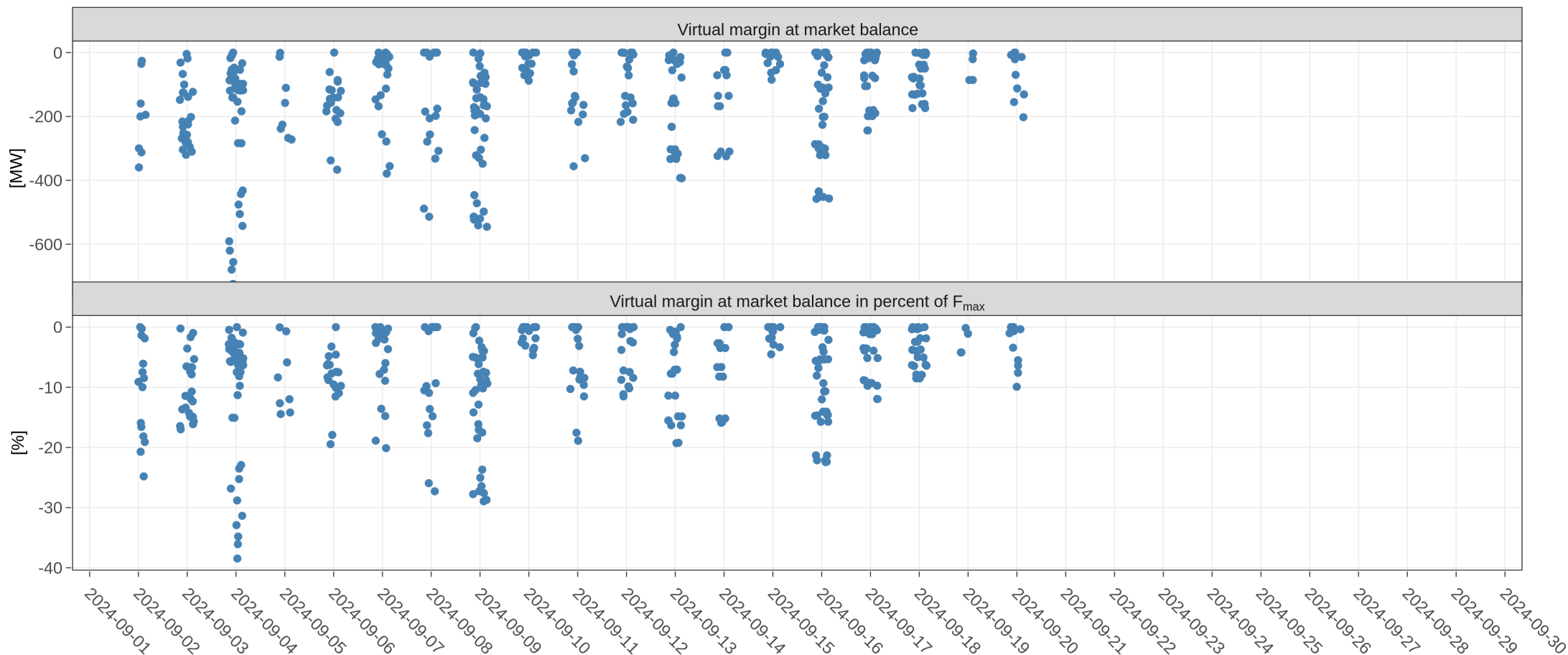
KPI 6b: Virtual margins at market balance D7



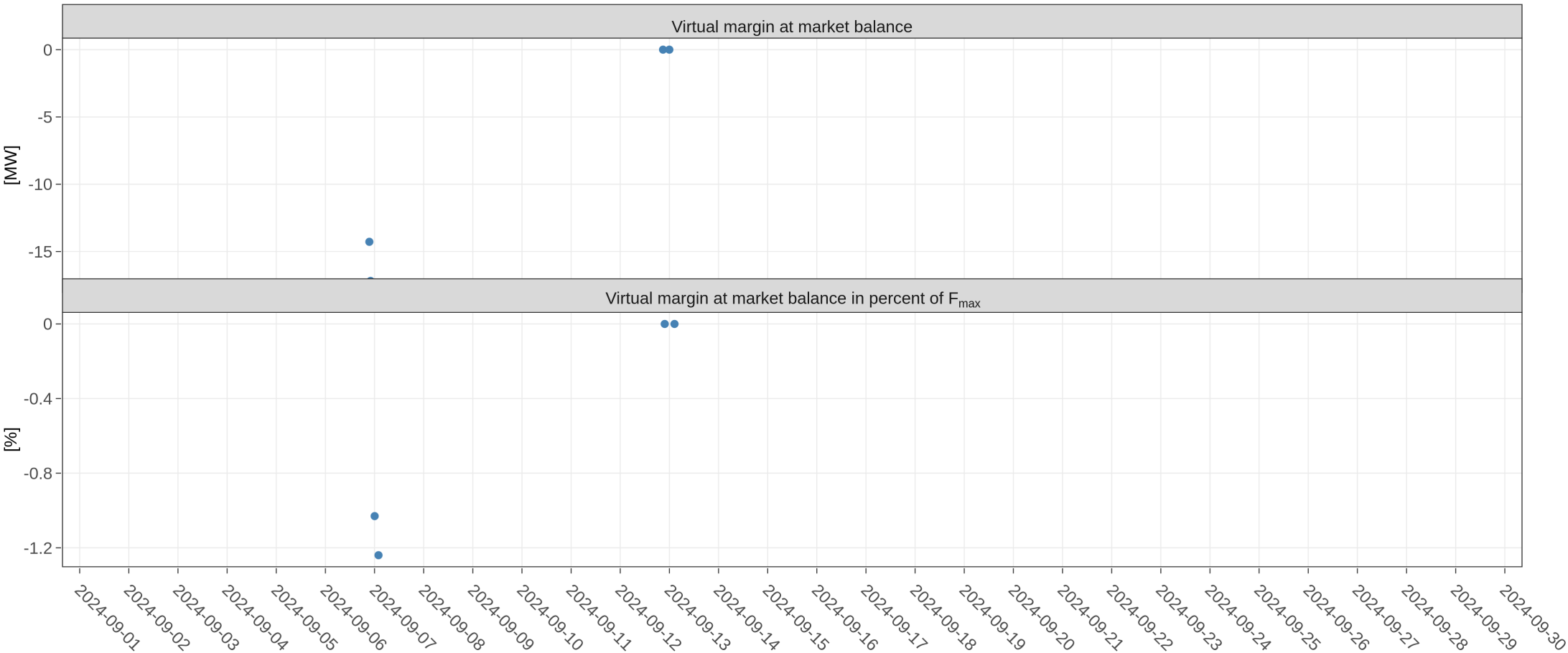
KPI 6b: Virtual margins at market balance D8



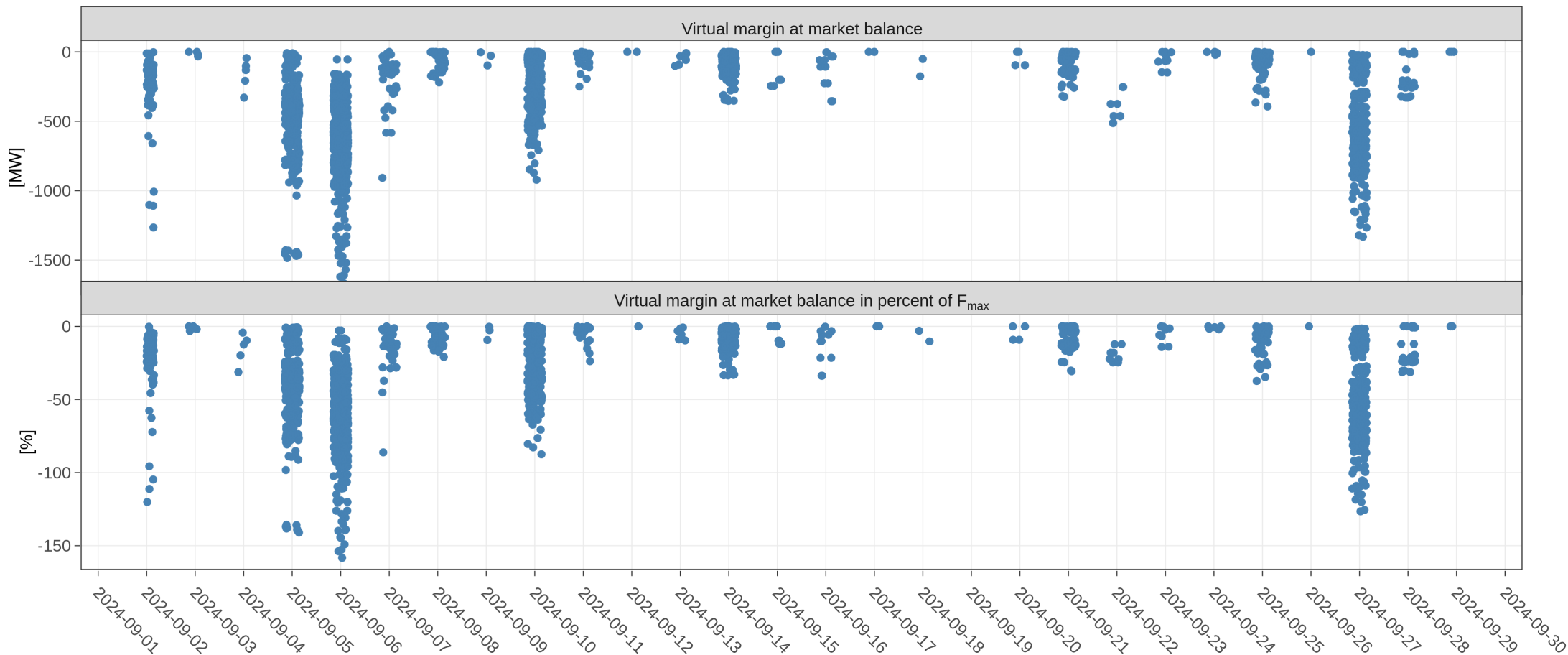
KPI 6b: Virtual margins at market balance FR



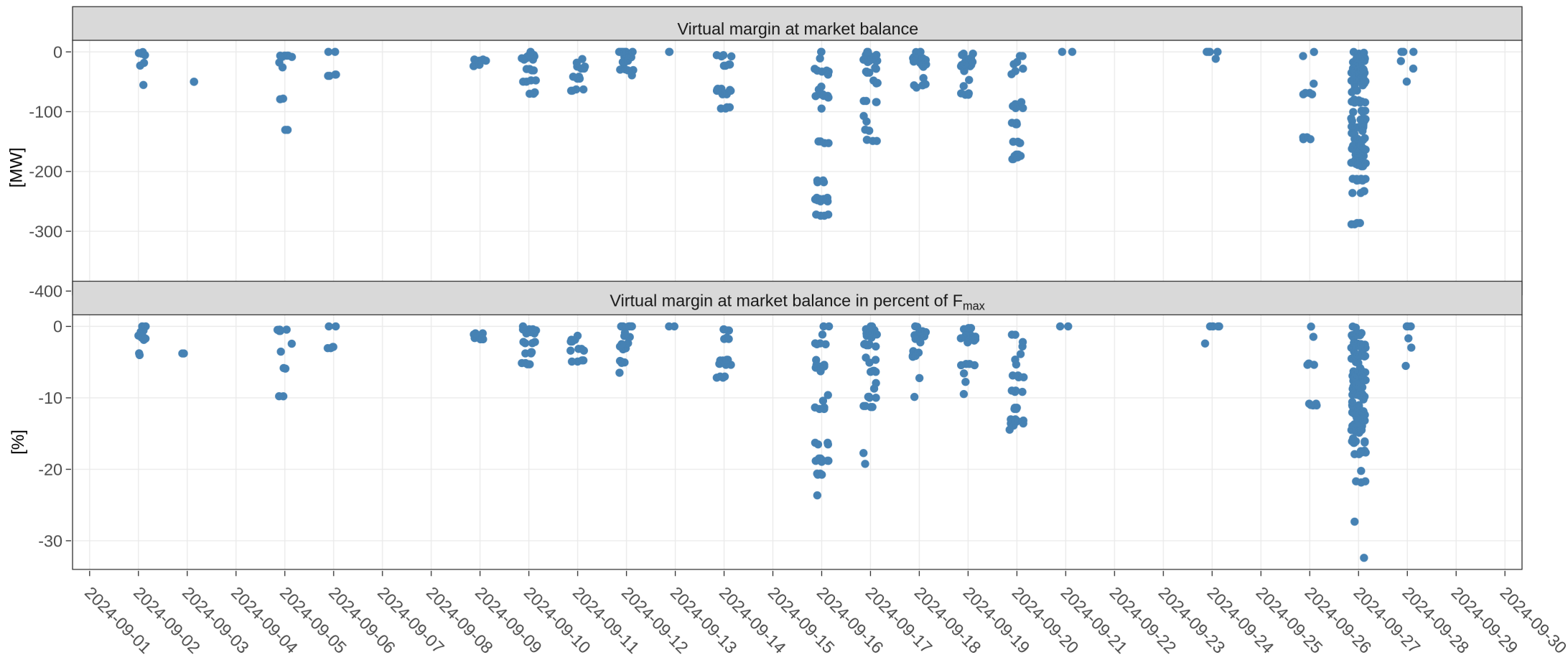
KPI 6b: Virtual margins at market balance HU



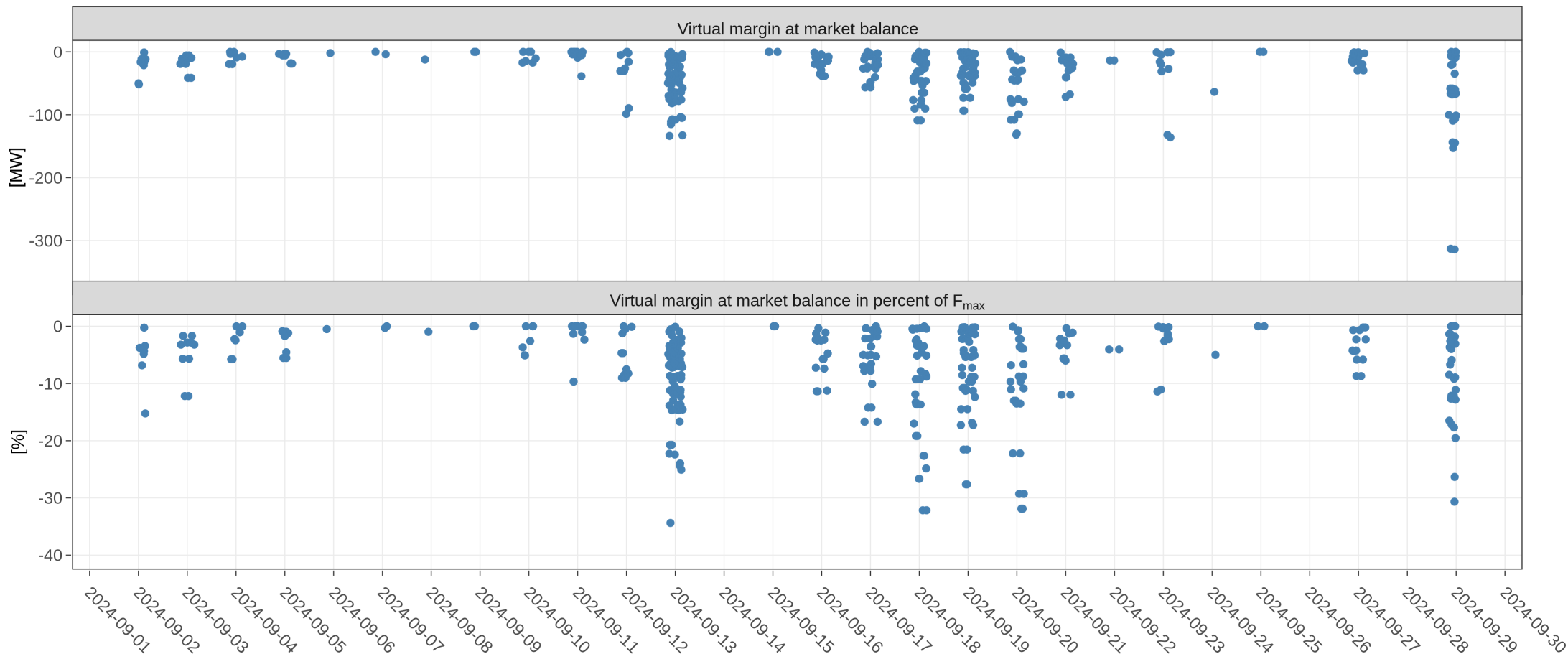
KPI 6b: Virtual margins at market balance NL



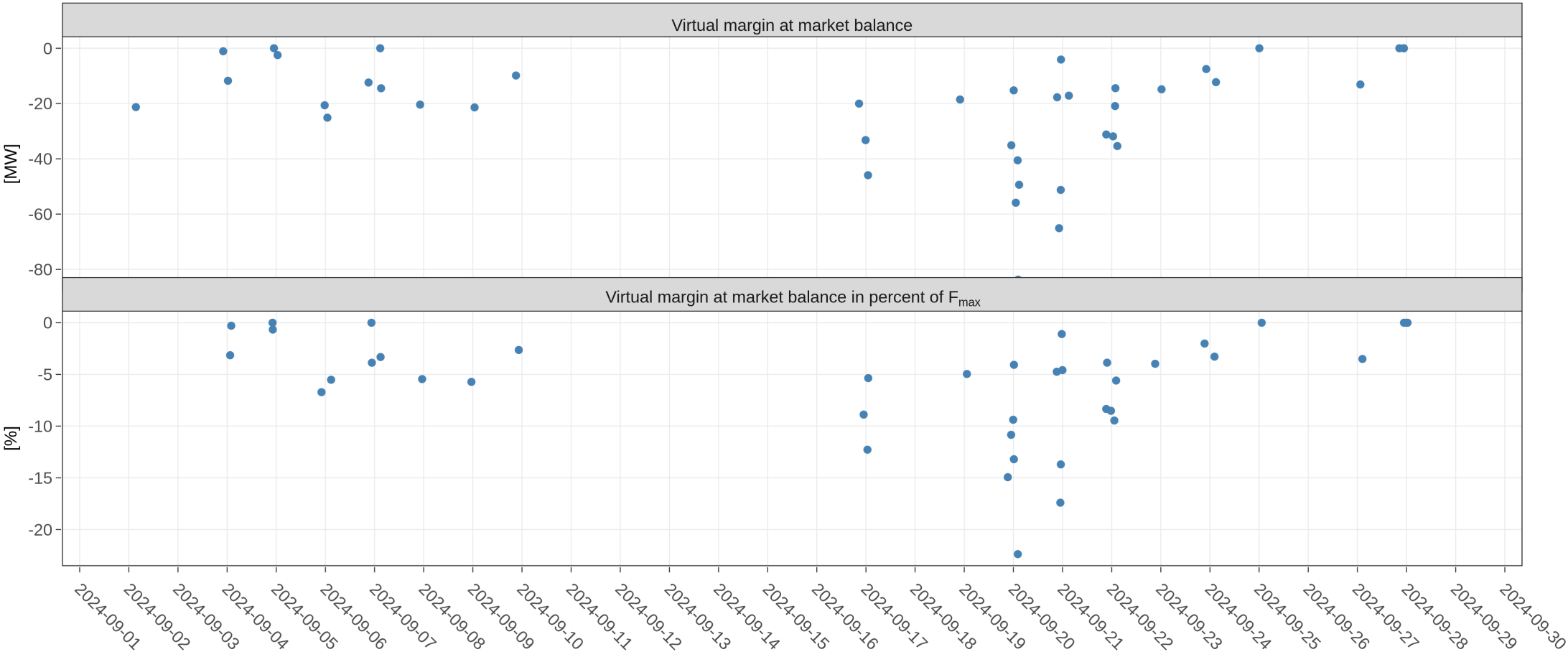
KPI 6b: Virtual margins at market balance PL



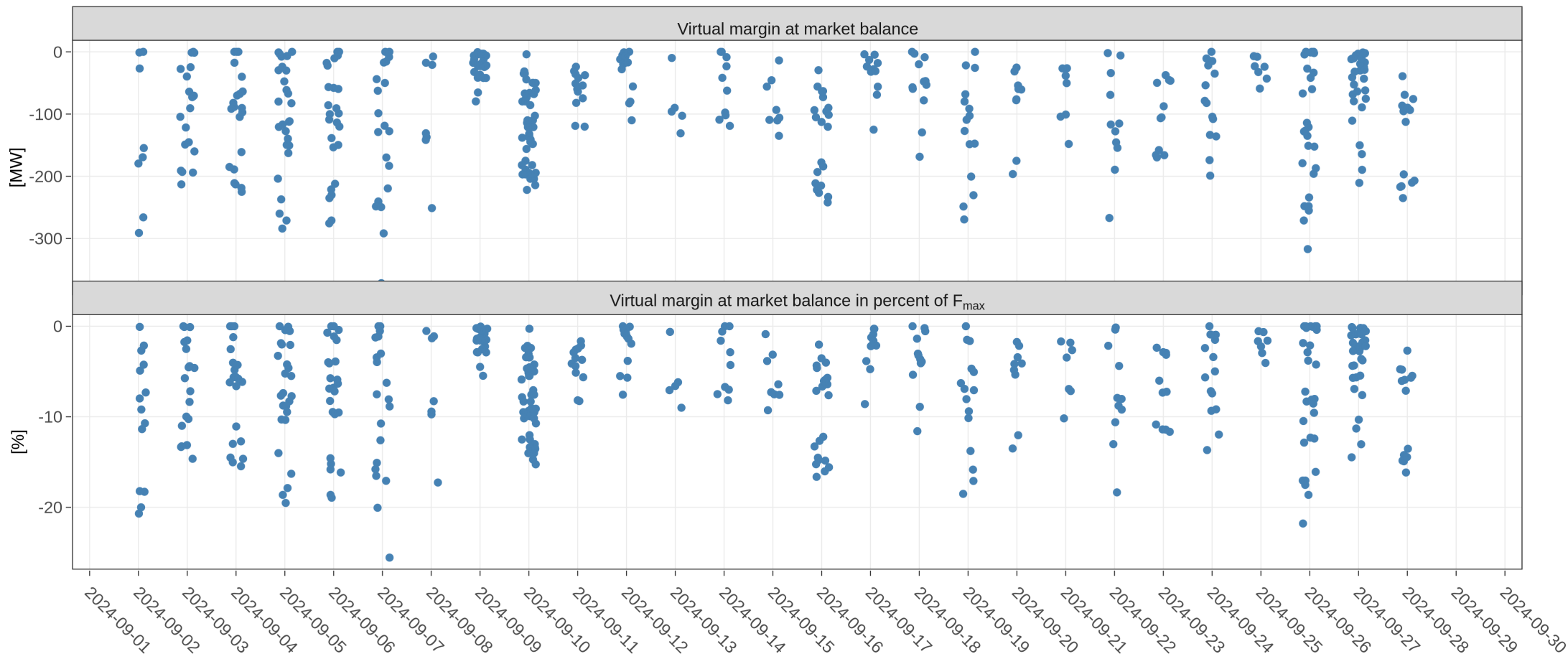
KPI 6b: Virtual margins at market balance RO



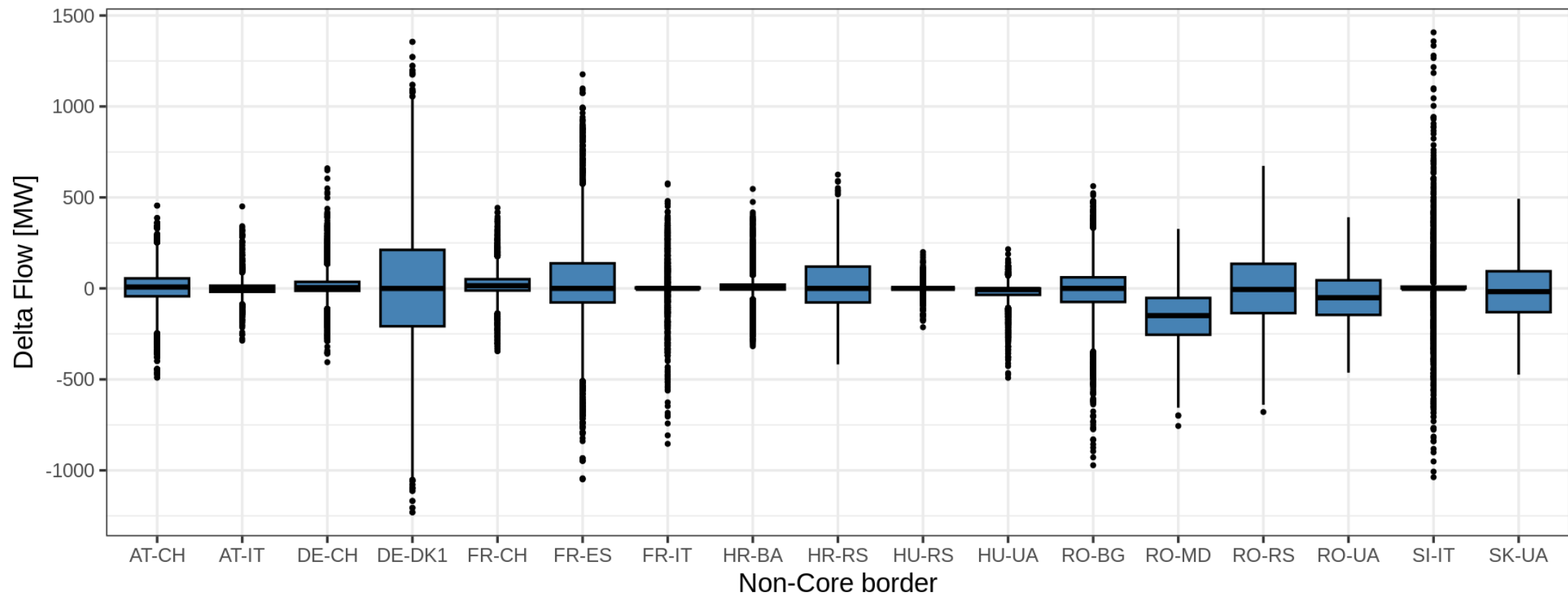
KPI 6b: Virtual margins at market balance SI



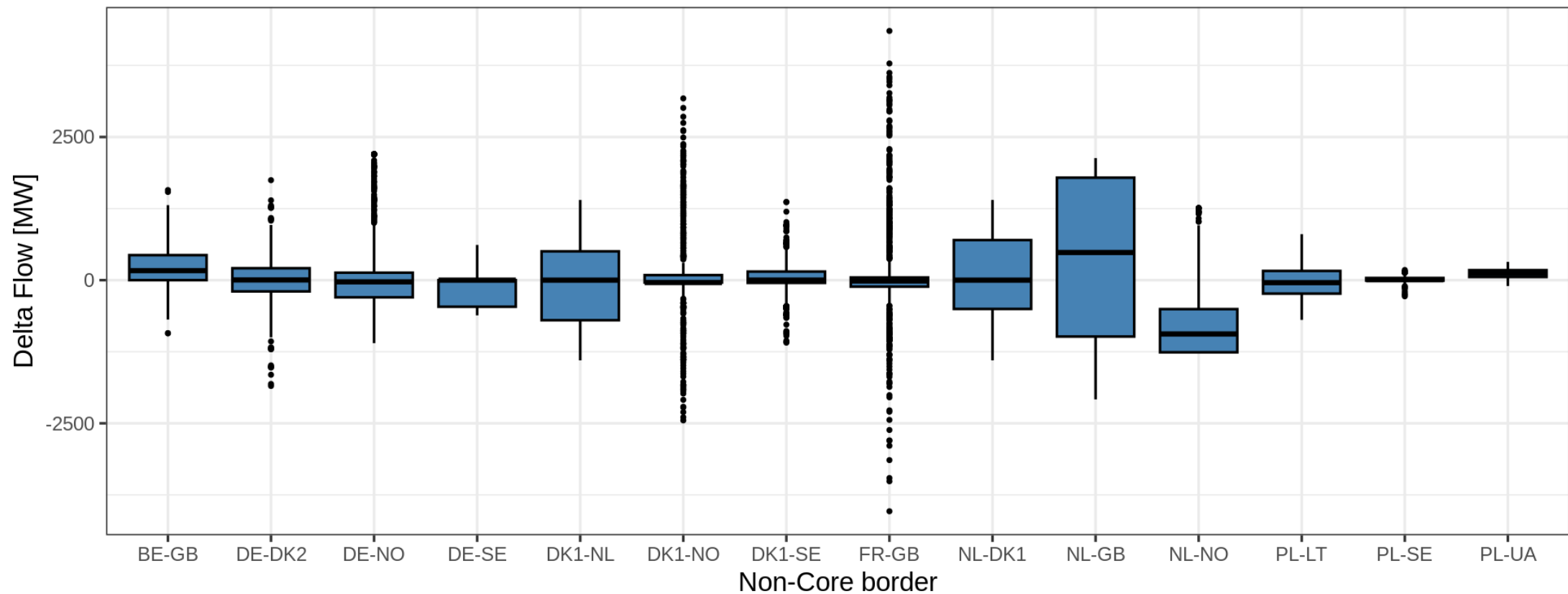
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow



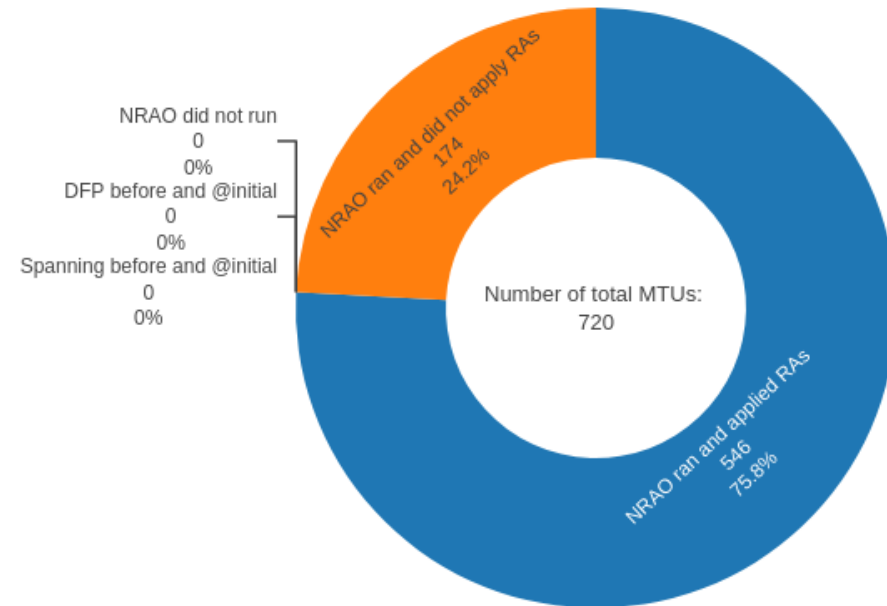
KPI 7: Non-Core exchanges DC delta flow



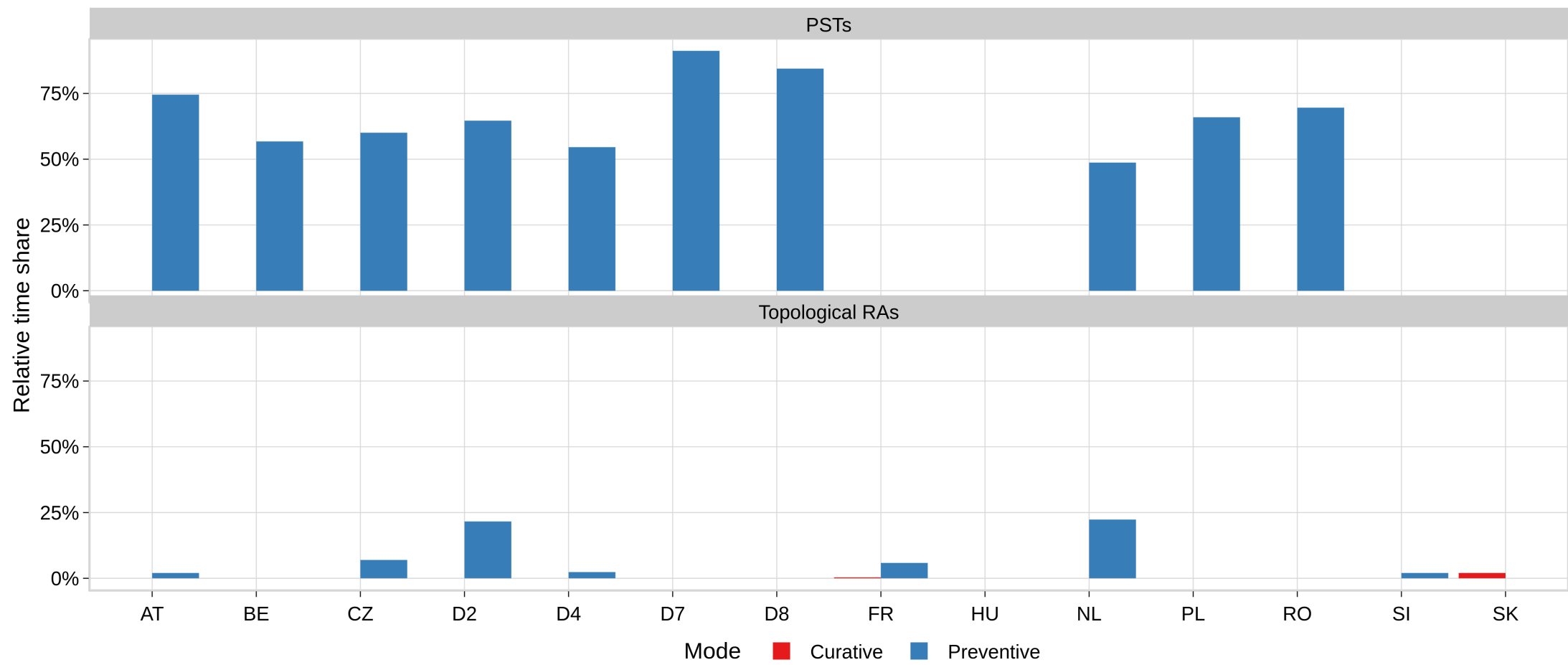
KPI 8: NRAO – Applied Remedial Action



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

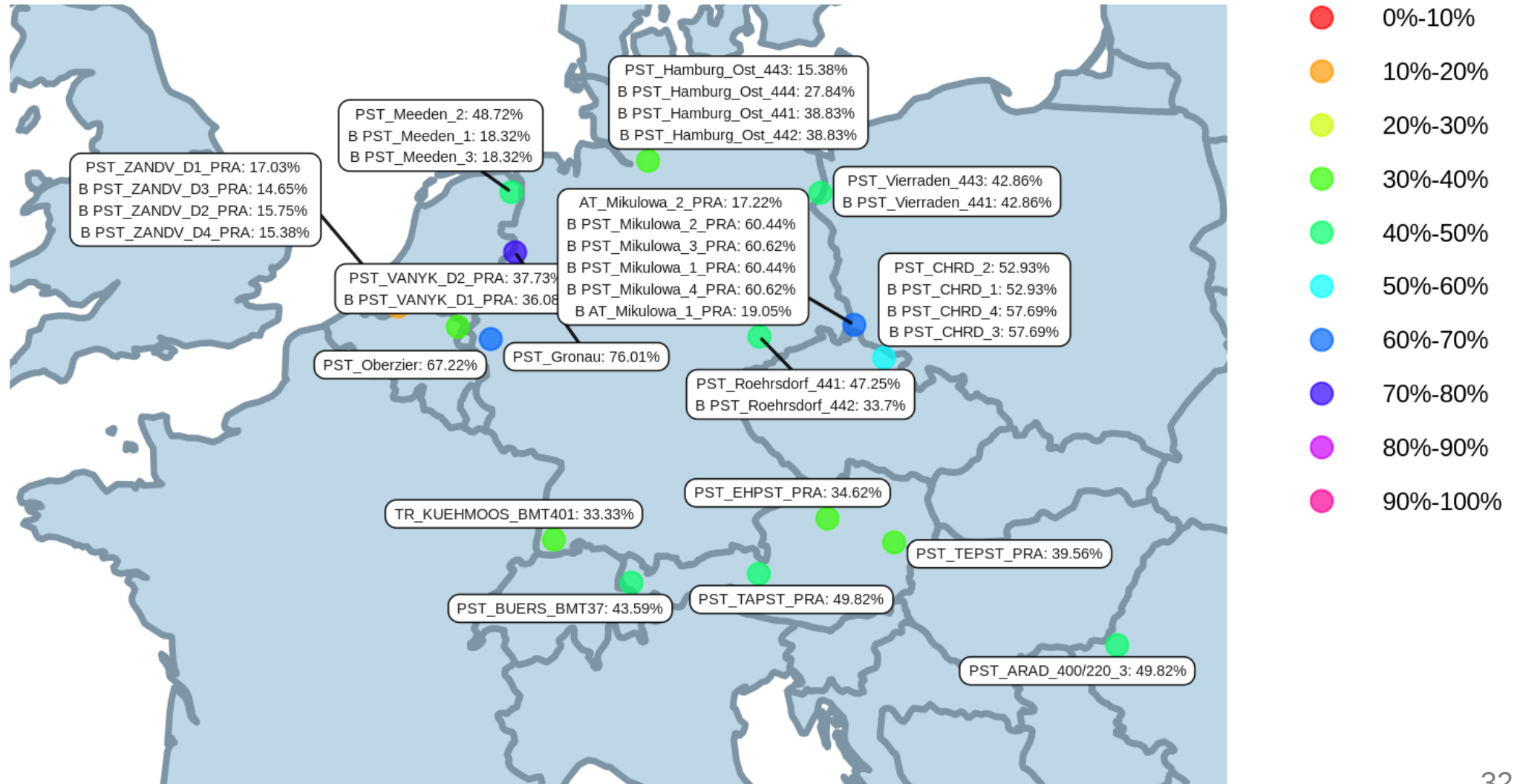


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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



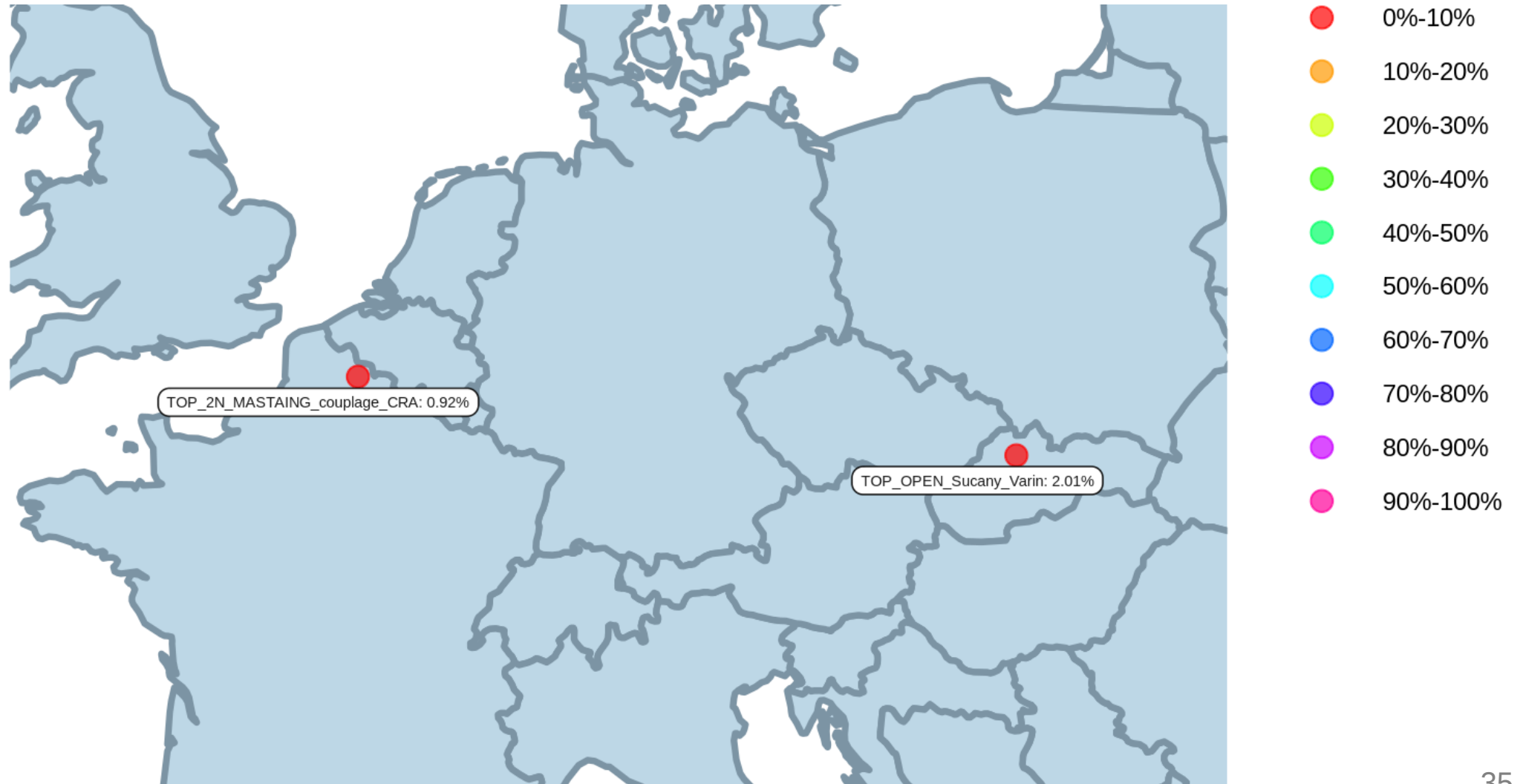
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied Topological RAs in Preventive Mode



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

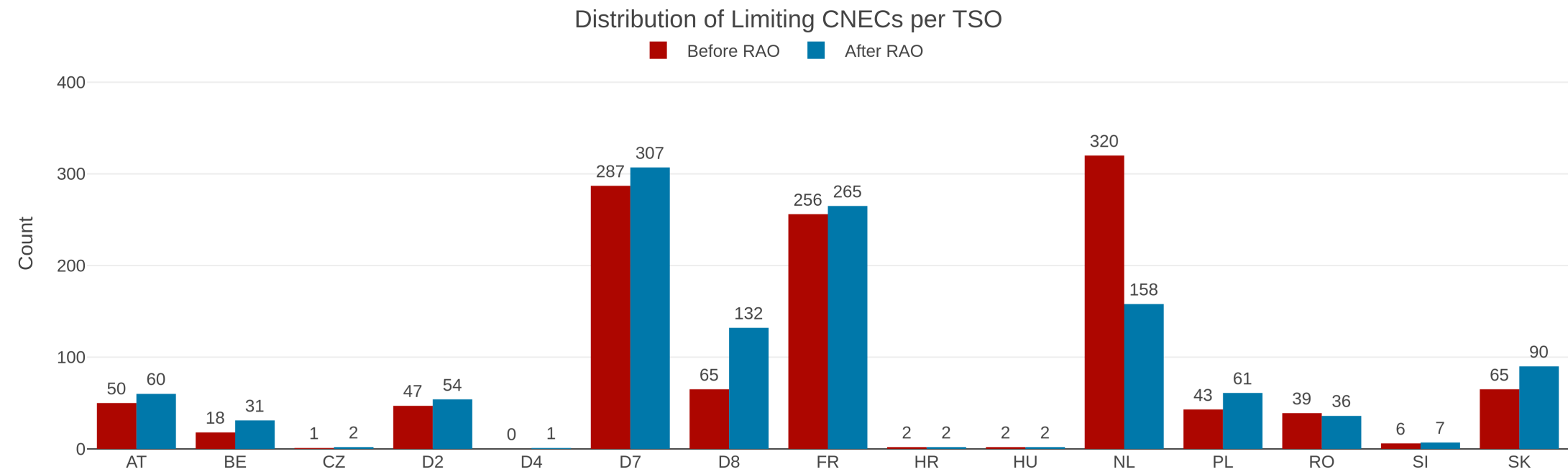
Relative Time Share of Applied Topological RAs in Curative Mode



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.

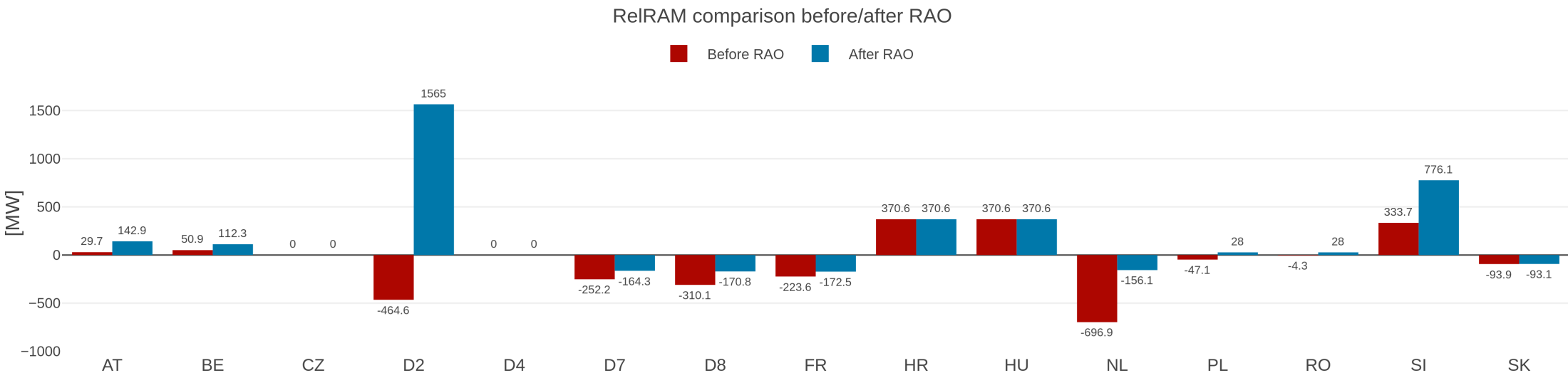
KPI 10: Average variation of relative RAM before and after NRAO



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

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



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
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	720	726	59.14%	10.51%	87.49%	0.3578	1.2451
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	720	720	64.58%	32.26%	99.63%	0.2394	0.9207
[HU-HU] Gonyu - Gyor [DIR]	719	1641	73.08%	55.12%	106.93%	0.347	1.4831
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	714	716	40.97%	19.85%	107.38%	0.2428	0.6491
[SK-SK] V.Dur - Levice 1 [DIR]	712	734	40.60%	19.52%	53.88%	0.2016	0.8799
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	710	2017	64.10%	21.10%	137.70%	0.2471	0.7332
[CZ-SK] Sokolnice - Stupava [DIR] [CZ]	710	710	77.27%	64.29%	94.66%	0.3363	1.4877
[SI-HU] 400 kV Cirkovce - Hevitz [DIR] [SI]	710	1406	101.59%	78.81%	140.76%	0.2667	1.1686
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	707	717	49.44%	8.56%	88.24%	0.1872	0.4651
[SK-SK] Gabcikovo - P.Biskupice [DIR]	707	753	85.16%	67.59%	102.97%	0.3502	1.4184
[SI-HU] 400 kV Cirkovce - Hevitz [OPP] [SI]	706	1384	78.80%	49.32%	101.17%	0.2667	1.1686
[CZ-SK] Liskovec - P. Bystrica [OPP] [CZ]	700	701	103.25%	74.13%	144.79%	0.0862	0.3064
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	697	1308	117.38%	80.48%	174.33%	0.1872	0.4651
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	692	2403	94.98%	39.96%	135.33%	0.3106	0.6962
[AT-SI] Obersielach - Podlog 247 [OPP] [AT]	689	1396	105.79%	33.61%	212.26%	0.2471	0.7332
[CZ-SK] Sokolnice - Krizovany [OPP] [CZ]	686	693	98.13%	80.16%	118.76%	0.3275	1.4874
[SI-HU] Cirkovce - Heviz [OPP] [HU]	681	681	77.94%	52.81%	99.57%	0.2906	1.368
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	678	1358	62.68%	19.80%	152.60%	0.2429	1.0851
[CZ-SK] Liskovec - P. Bystrica [DIR] [CZ]	644	659	76.47%	57.53%	108.49%	0.0862	0.3064
[SI-HU] Cirkovce - Heviz [DIR] [HU]	643	643	102.20%	80.38%	135.93%	0.2906	1.368

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 - Ensndorf VIGY2 S [DIR] [D7]	448	448	2147.85	33.12%	19.85%	89.81%	0.2428
[SK-SK] V.Dur - Levice 1 [DIR]	144	144	3656.21	35.78%	19.52%	45.29%	0.1985
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	127	127	5535.11	46.58%	21.37%	105.69%	0.247
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	117	118	2012.83	41.31%	20.00%	87.04%	0.1523
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	114	118	292.59	86.28%	39.96%	116.95%	0.3101
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	102	102	228.76	30.96%	19.94%	77.68%	0.2922
[FR-FR] Creys - Saint-Vulbas 2 [OPP]	93	93	749.58	33.82%	21.17%	52.52%	0.1444
[D8-PL] Mikulowa PST1 [DIR] [PL]	78	78	522.39	47.44%	19.02%	66.74%	0.4271
[RO-RO] TR Rosiori 400/220 1 [DIR]	70	70	815.11	34.83%	19.00%	59.75%	0.1362
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	69	69	645.76	50.54%	32.26%	73.25%	0.2253
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	47	47	325.31	54.52%	26.86%	73.81%	0.347
[NL-NL] MEE DRT2 [DIR] [NL]	45	45	253.48	36.61%	19.96%	83.37%	0.2584
[PL-PL] Mikulowa AT1 [DIR]	41	41	879.83	38.83%	29.75%	52.07%	0.1991
[D8-D8] Vierraden - Vierraden PST441 [DIR]	32	32	833.01	39.96%	30.88%	56.78%	0.296
[D2-D2] Altheim - Simbach 233/230 [DIR]	32	32	1312.59	45.18%	20.11%	77.92%	0.096
[CZ-SK] Nosovice - Varin [DIR] [CZ]	23	23	324.18	66.96%	54.95%	83.31%	0.3222
[AT-D2] St. Peter 2 - Pleinting 258 [DIR] [AT]	19	19	392.6	49.06%	25.73%	87.04%	0.1599
[FR-FR] Creys - Saint-Vulbas 1 [OPP]	16	16	610.29	32.89%	19.99%	51.74%	0.1409
[NL-D2] Meeden-Diele 380 Z [DIR] [NL]	15	15	1260.75	67.99%	39.70%	96.68%	0.2486
[AT-HU] Zurndorf - Gyoer 439B [DIR] [AT]	14	14	339.1	49.06%	18.54%	69.62%	0.273

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 13 : Allocation Constraints - Poland



	# MTUs
AC was limiting MC	154
AC < 0 MW	54
AC = 0 MW	99
AC > 0 MW	1

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1316.81	5039.57
Min.	-8601.00	0.00
Max.	0.00	14111.00

