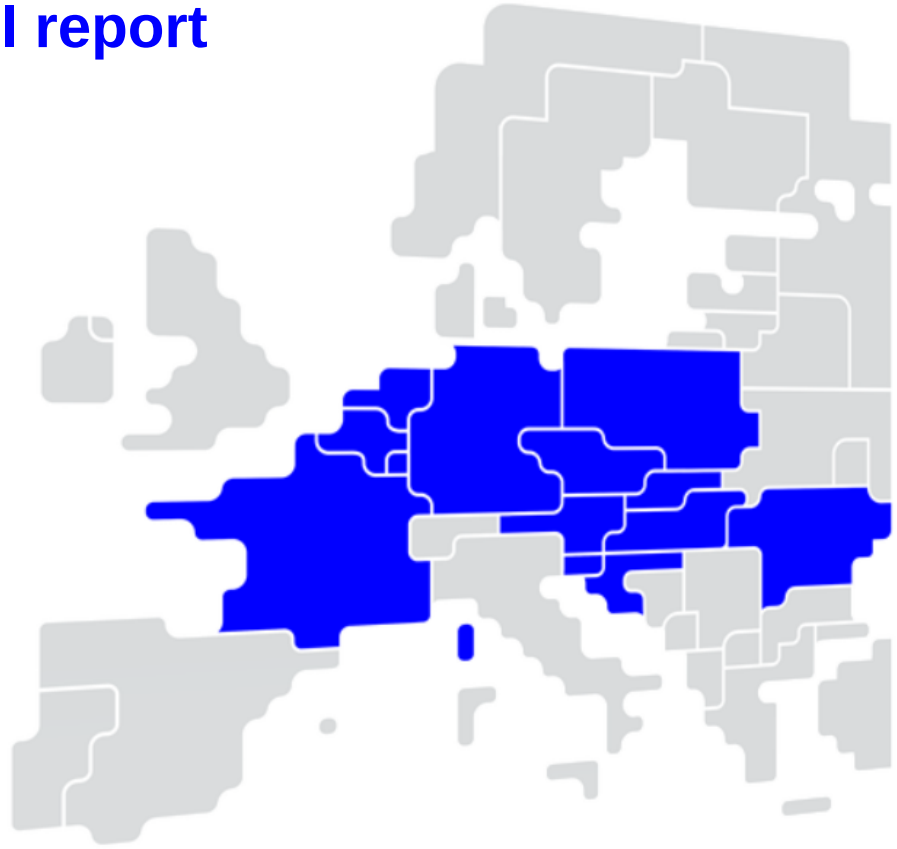
Core FB MC Operational KPI report

February 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

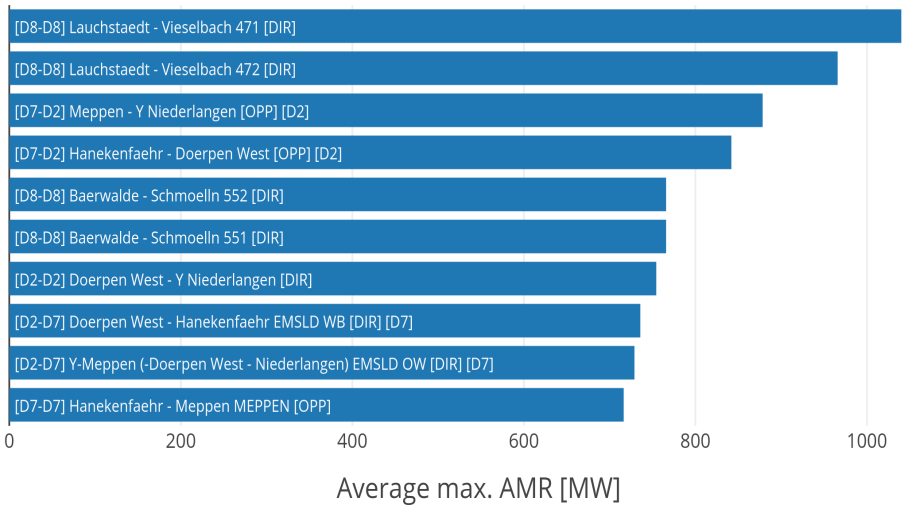
- KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode
- KPI 9: Most limiting CNEC per TSO (NRAO)
- KPI 10: Average variation of relative RAM before and after NRAO

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)

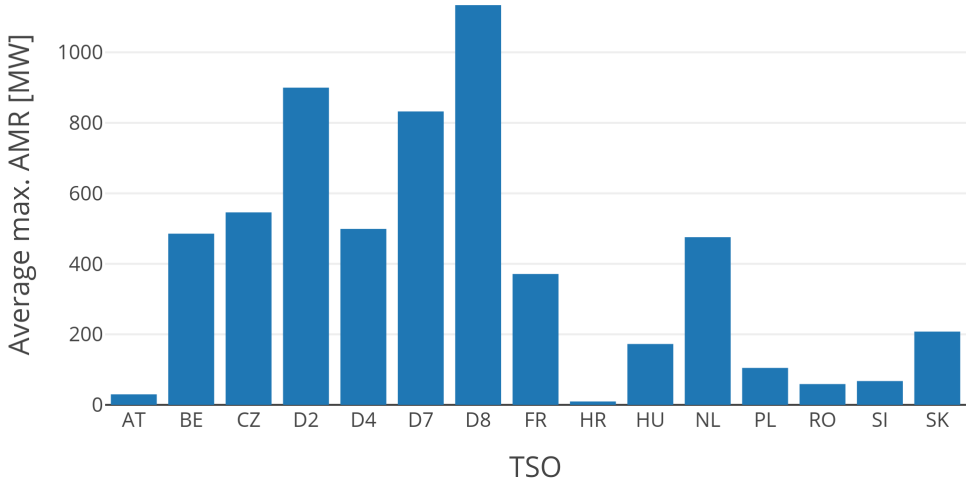
CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[D8-D8] Lauchstaedt - Vieselbach 471 [DIR]	1040.10	35.29%
[D8-D8] Lauchstaedt - Vieselbach 472 [DIR]	965.84	38.73%
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	878.38	44.15%
[D7-D2] Hanekenfaehr - Doerpen West [OPP] [D2]	841.93	42.32%
[D8-D8] Baerwalde - Schmoelln 551 [DIR]	765.81	30.71%
[D8-D8] Baerwalde - Schmoelln 552 [DIR]	765.81	30.71%
[D2-D2] Doerpen West - Y Niederlangen [DIR]	754.36	37.92%
[D2-D7] Doerpen West - Hanekenfaehr EMSLD WB [DIR] [D7]	735.75	32.61%
[D2-D7] Y-Meppen (-Doerpen West - Niederlangen) EMSLD OW [DIR] [D7]	728.93	30.94%
[D7-D7] Hanekenfaehr - Meppen MEPPEN [OPP]	716.35	31.39%



KPI 2: Average maximum AMR per TSO

TSO	Average maximum AMR per TSO
AT	29.96
BE	485.54
CZ	546.15
D2	899.97
D4	499.26
D7	832.56
D8	1134.11
FR	371.23
HR	9.67
HU	172.59

TSO	Average maximum AMR per TSO
NL	475.80
PL	104.89
RO	58.88
SI	67.53
SK	207.97

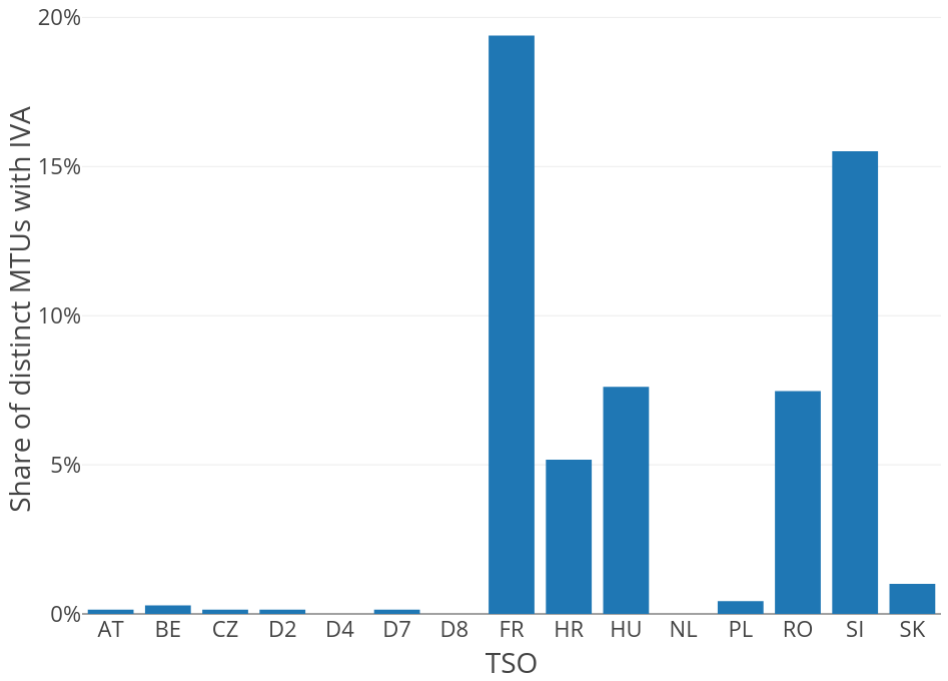


KPI 3: Share of MTUs with intervention per TSO

Total BDs	Total MTUs	MTUs without IVA	Share of distinct MTUs without IVA	MTUs with IVA	Share of distinct MTUs with IVA
29	696	401	57.6%	295	42.4%

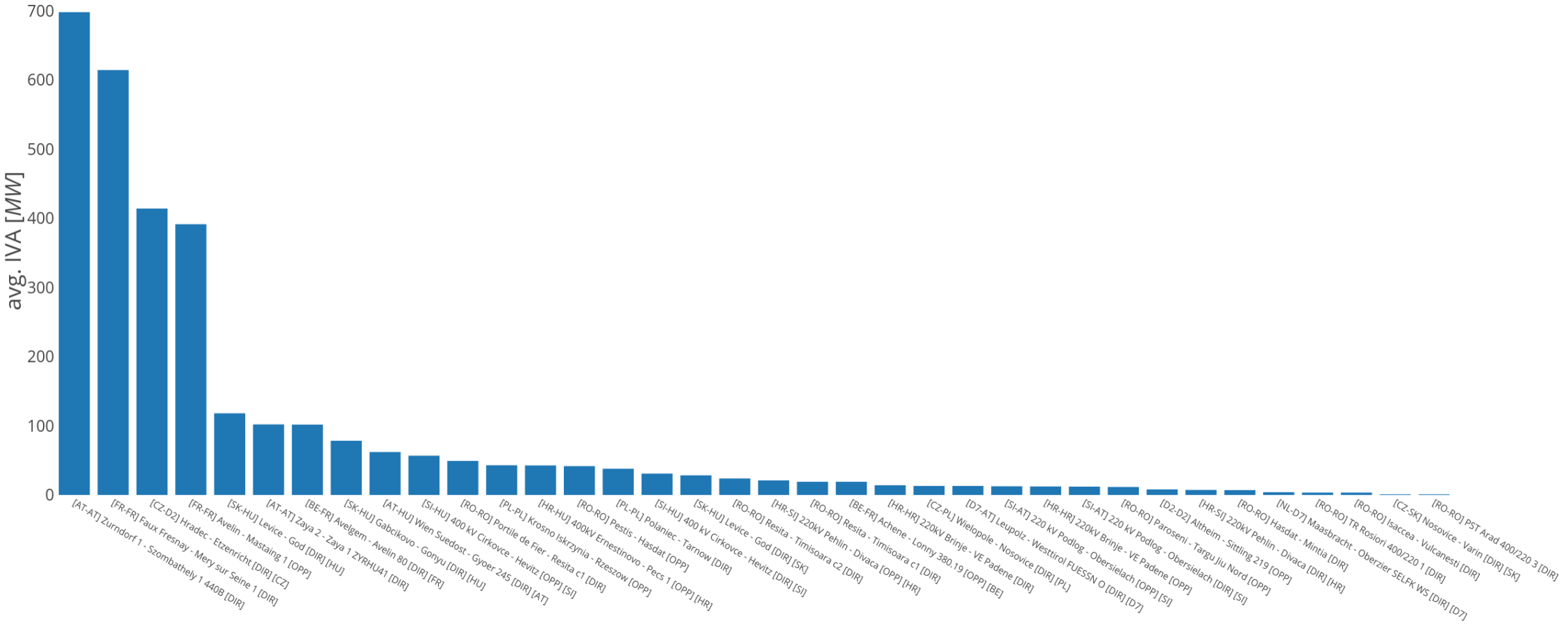
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	0.14%	1
BE	0.29%	2
CZ	0.14%	1
D2	0.14%	1
D4	0.00%	0
D7	0.14%	1
D8	0.00%	0
FR	19.40%	135
HR	5.17%	36
HU	7.61%	53

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
NL	0.00%	0
PL	0.43%	3
RO	7.47%	52
SI	15.52%	108
SK	1.01%	7



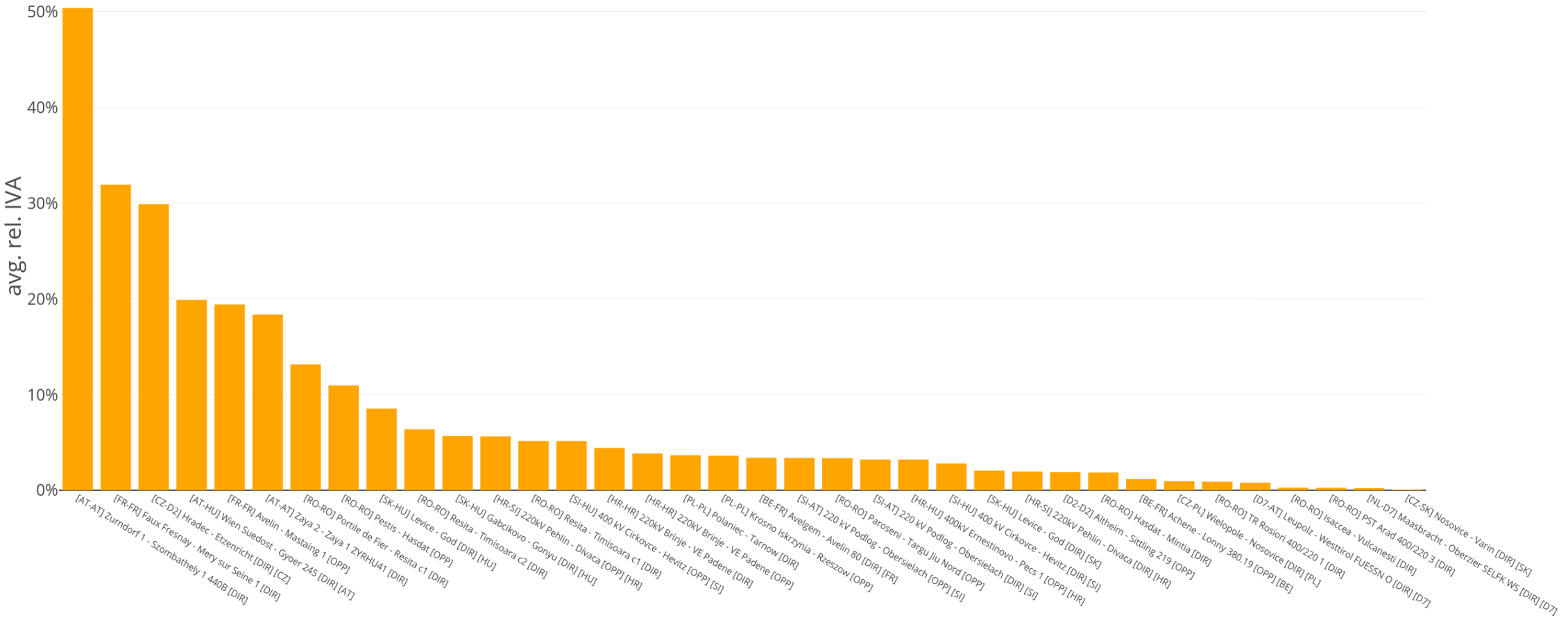
KPI 4a: Average IVA applied for each CNE affected by TSO intervention

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

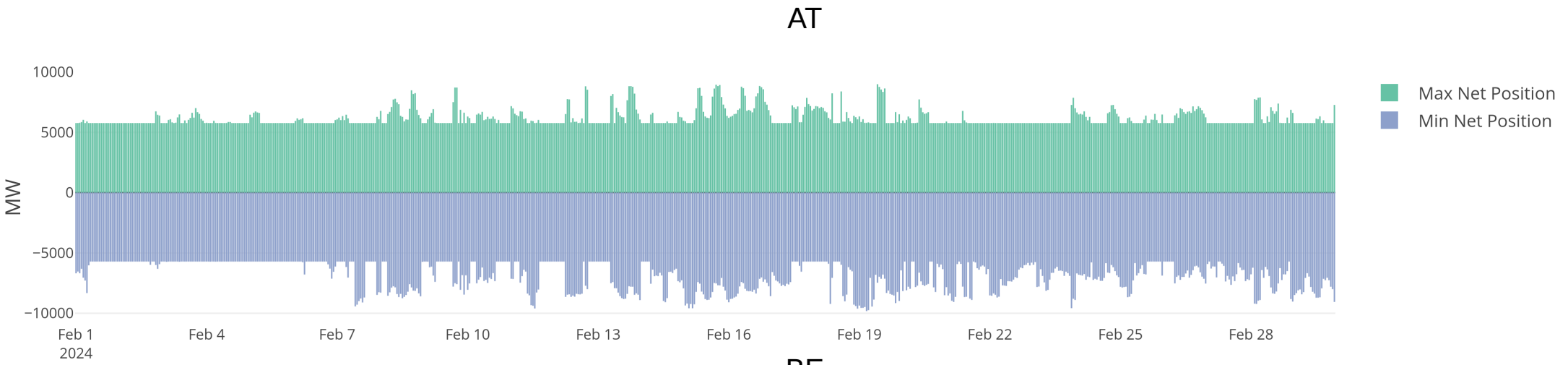


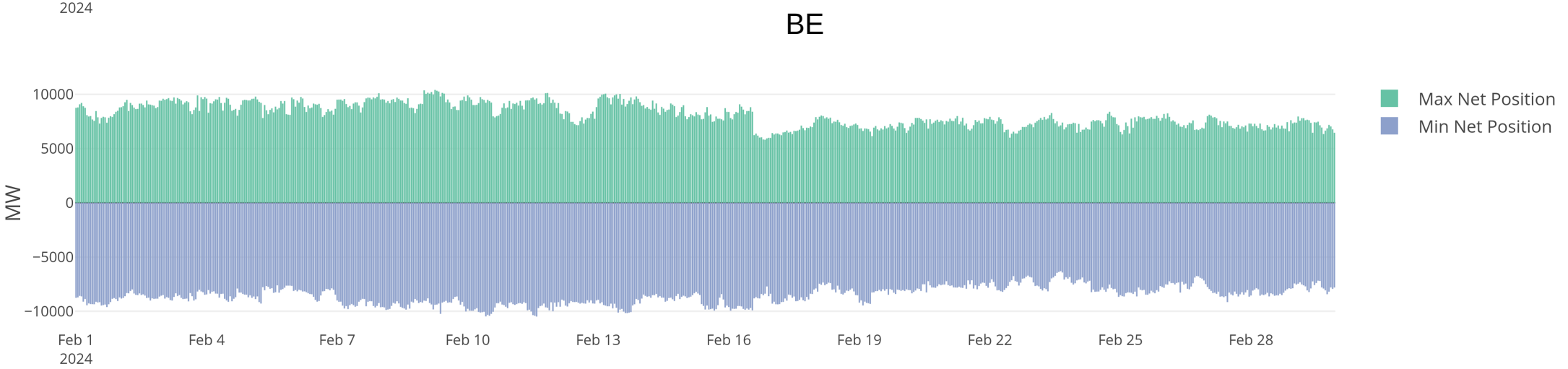
KPI 4b: Average relative IVA applied for each CNE affected by TSO intervention

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

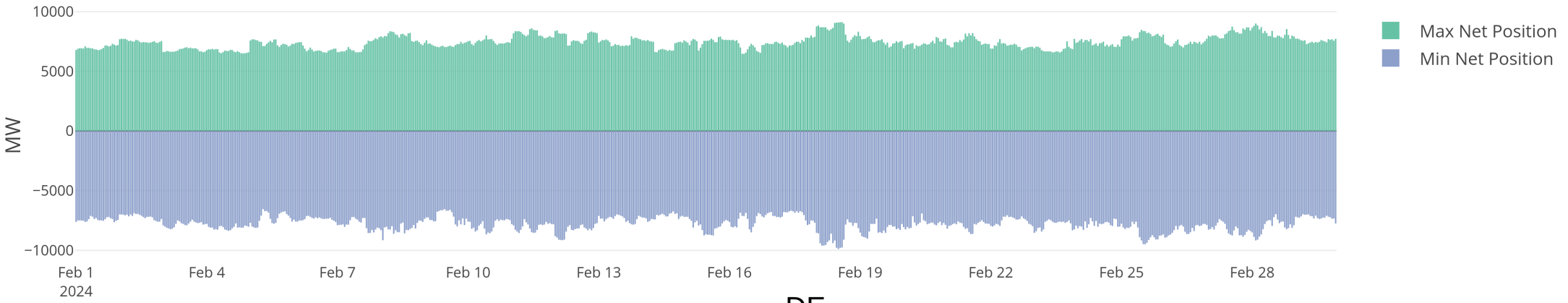


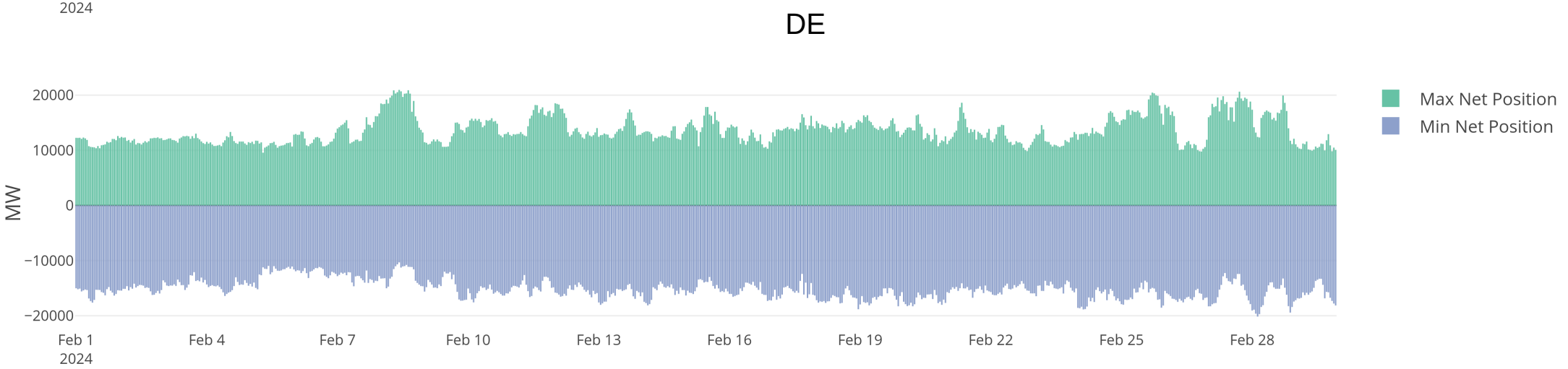
KPI 5: Min & max net positions per BZ hub



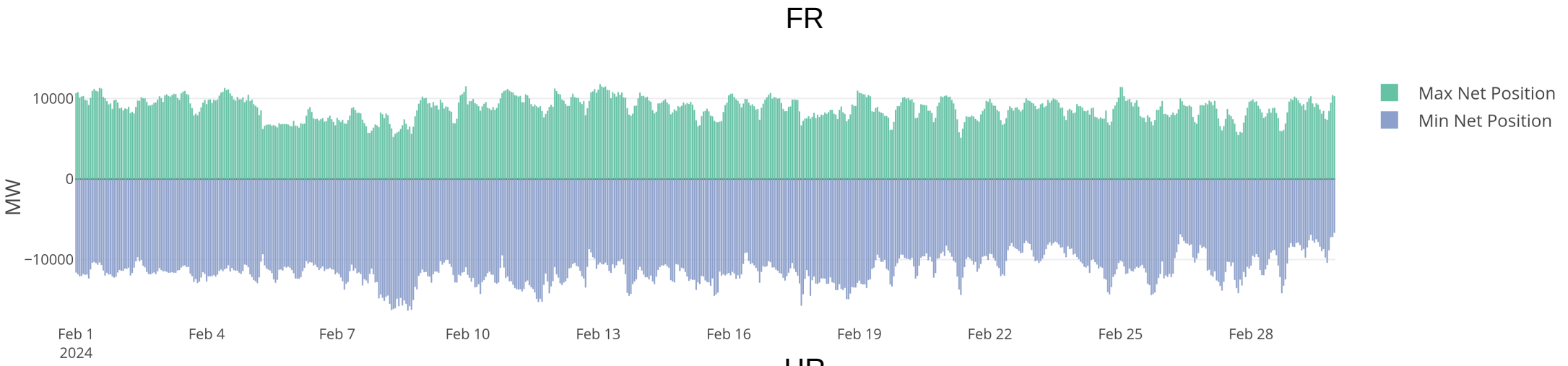


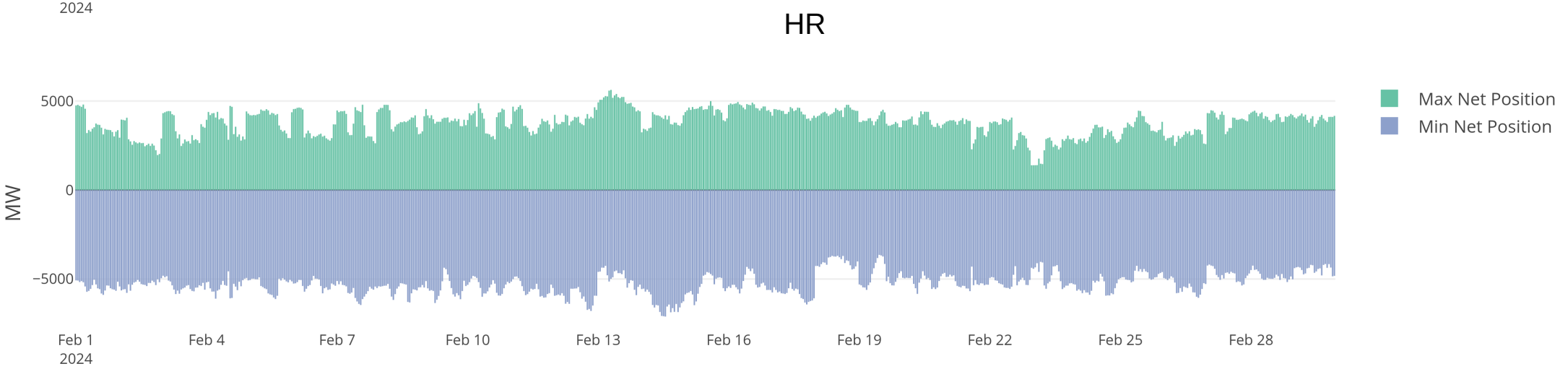
KPI 5: Min & max net positions per BZ hub



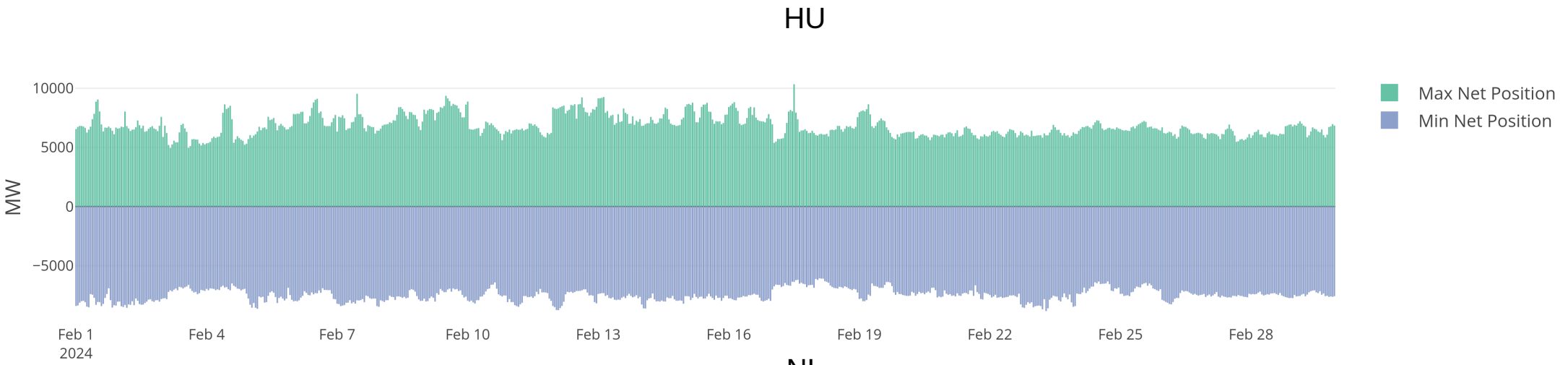


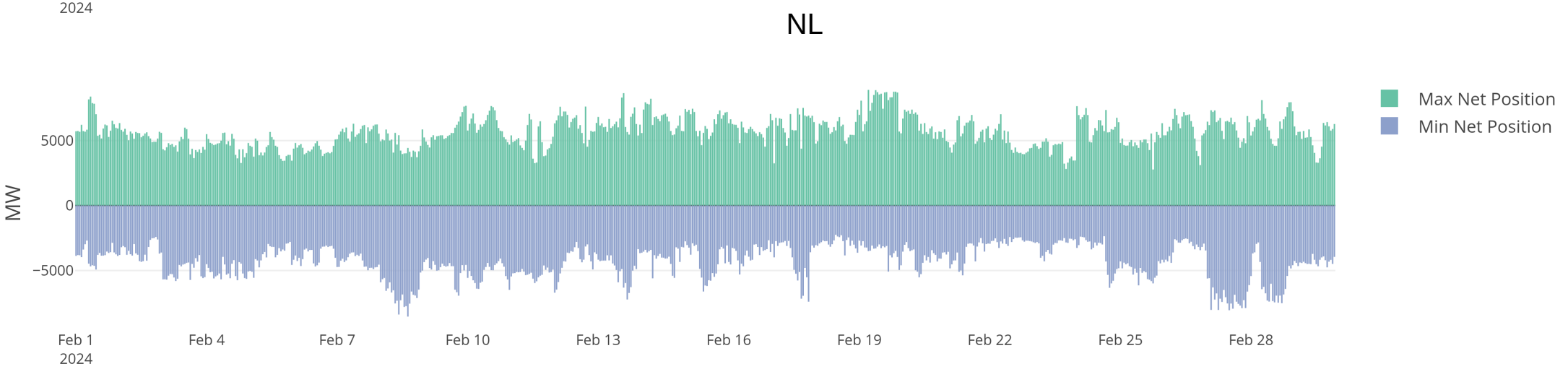
KPI 5: Min & max net positions per BZ hub



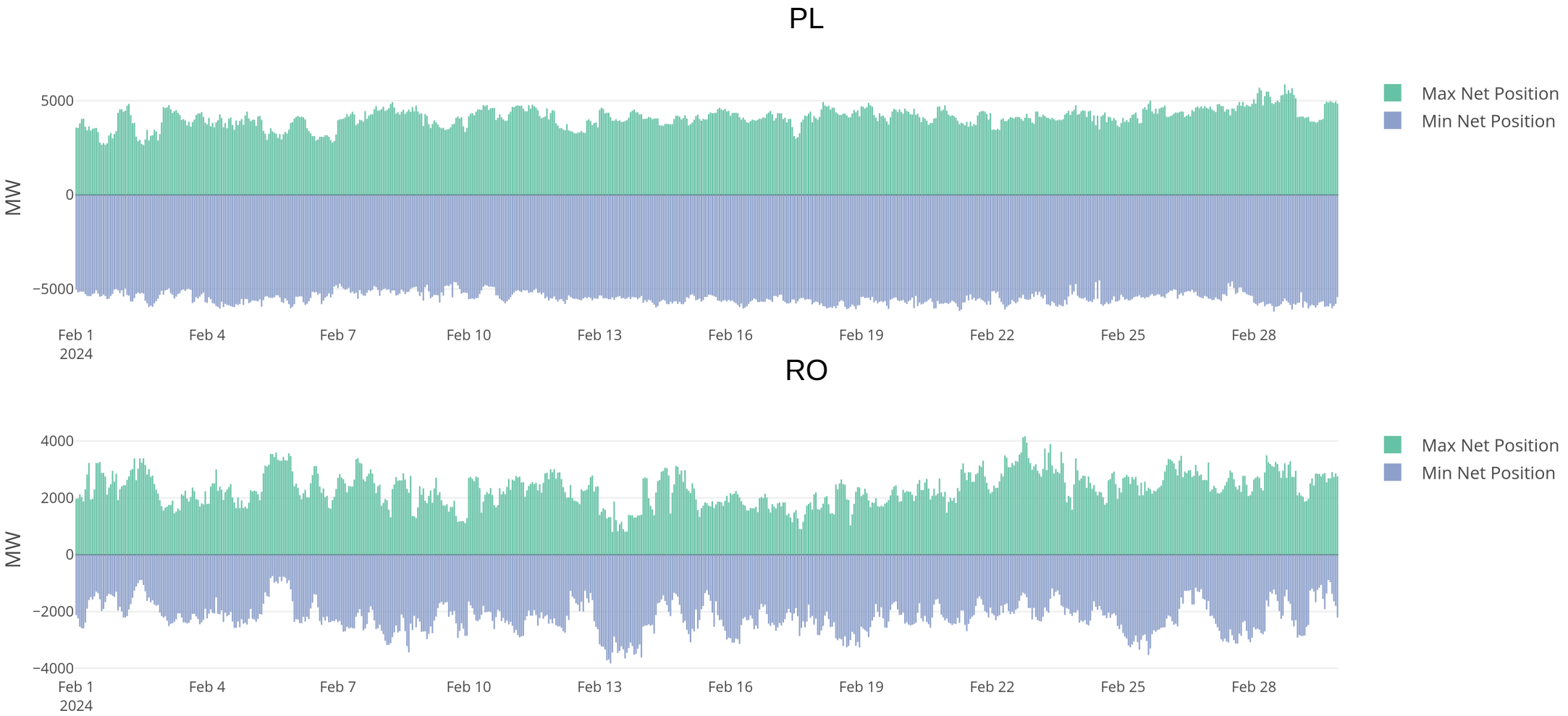


KPI 5: Min & max net positions per BZ hub

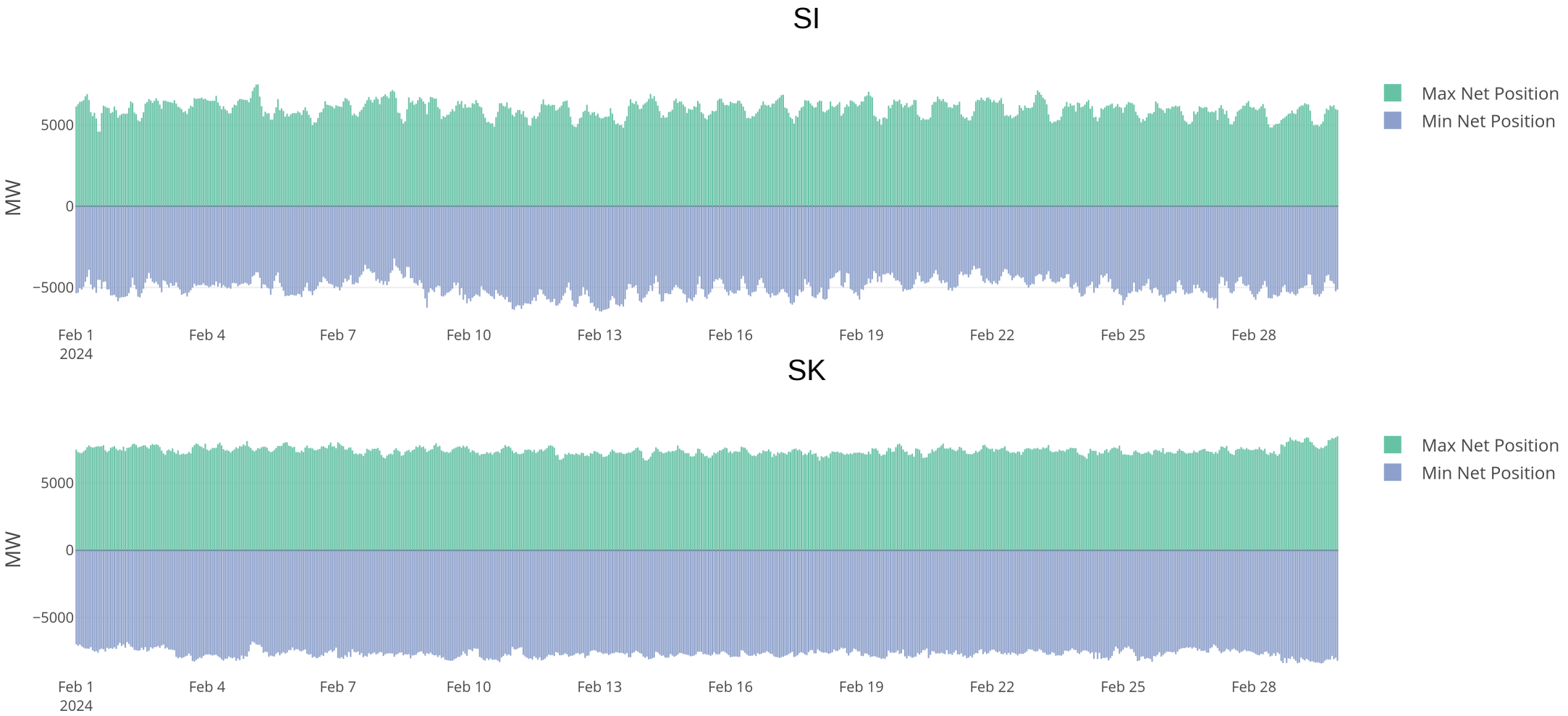




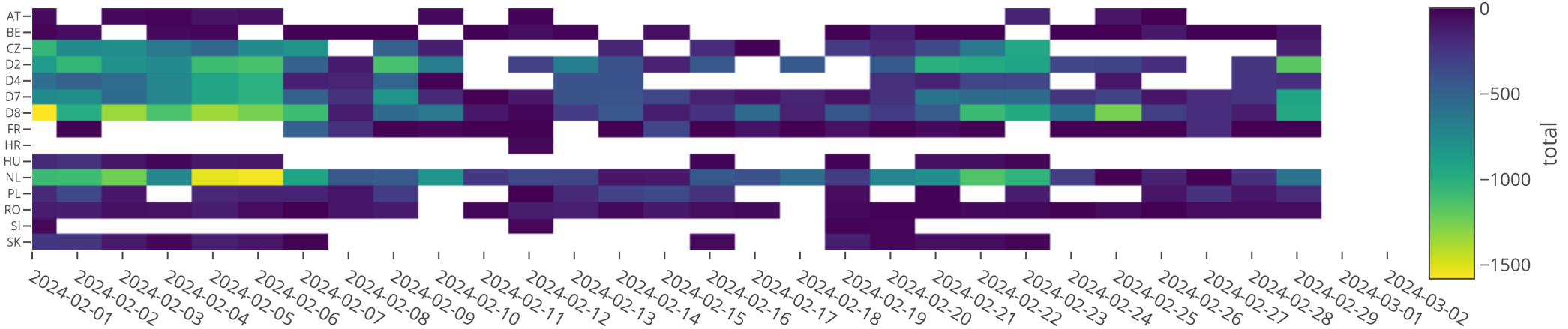
KPI 5: Min & max net positions per BZ hub

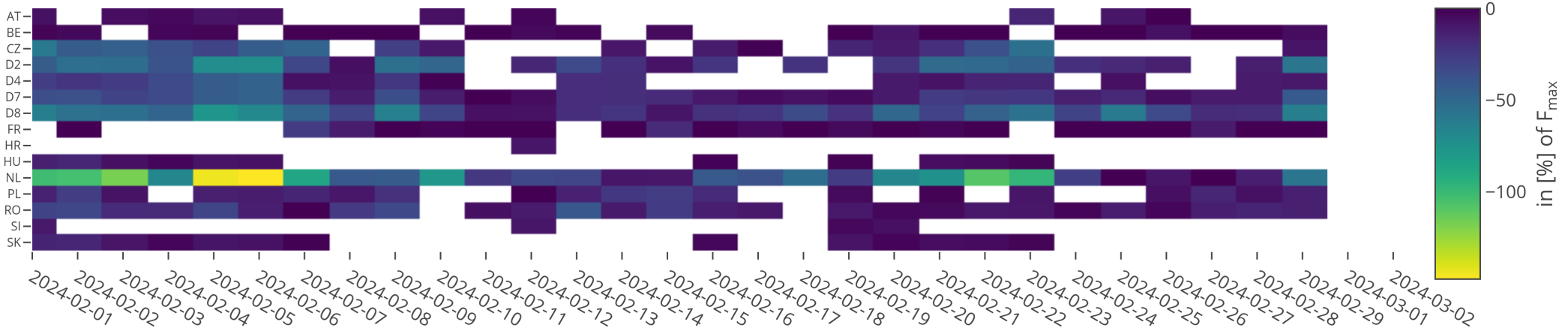


KPI 5: Min & max net positions per BZ hub

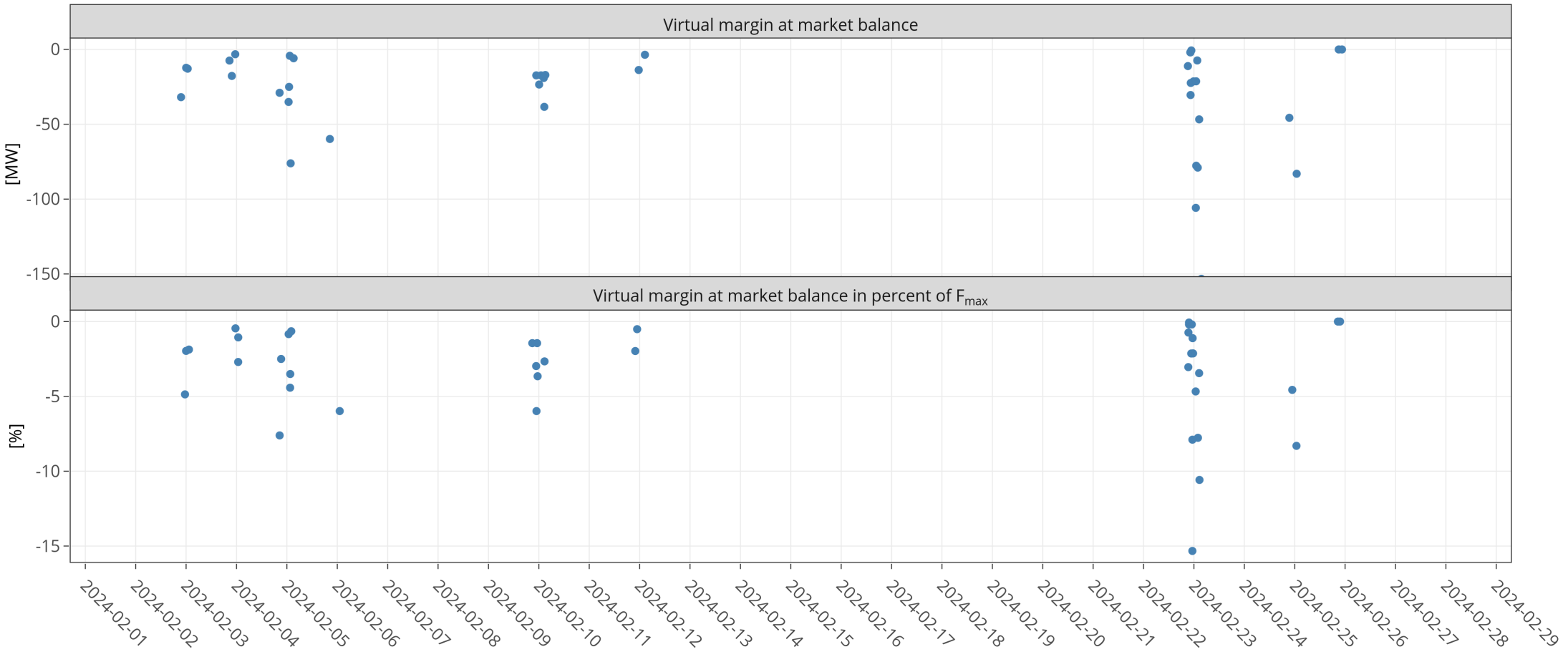


KPI 6a: Highest virtual margins at market balance for CORE TSOs

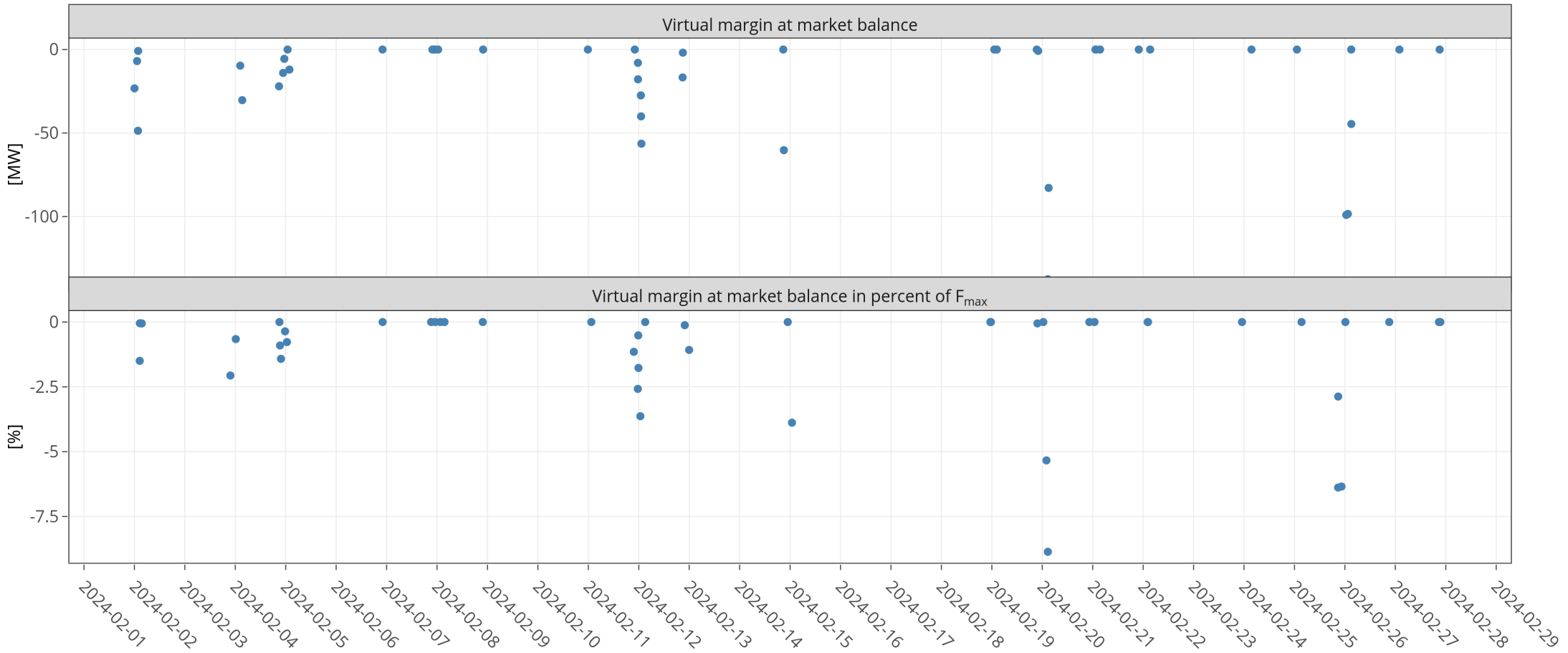




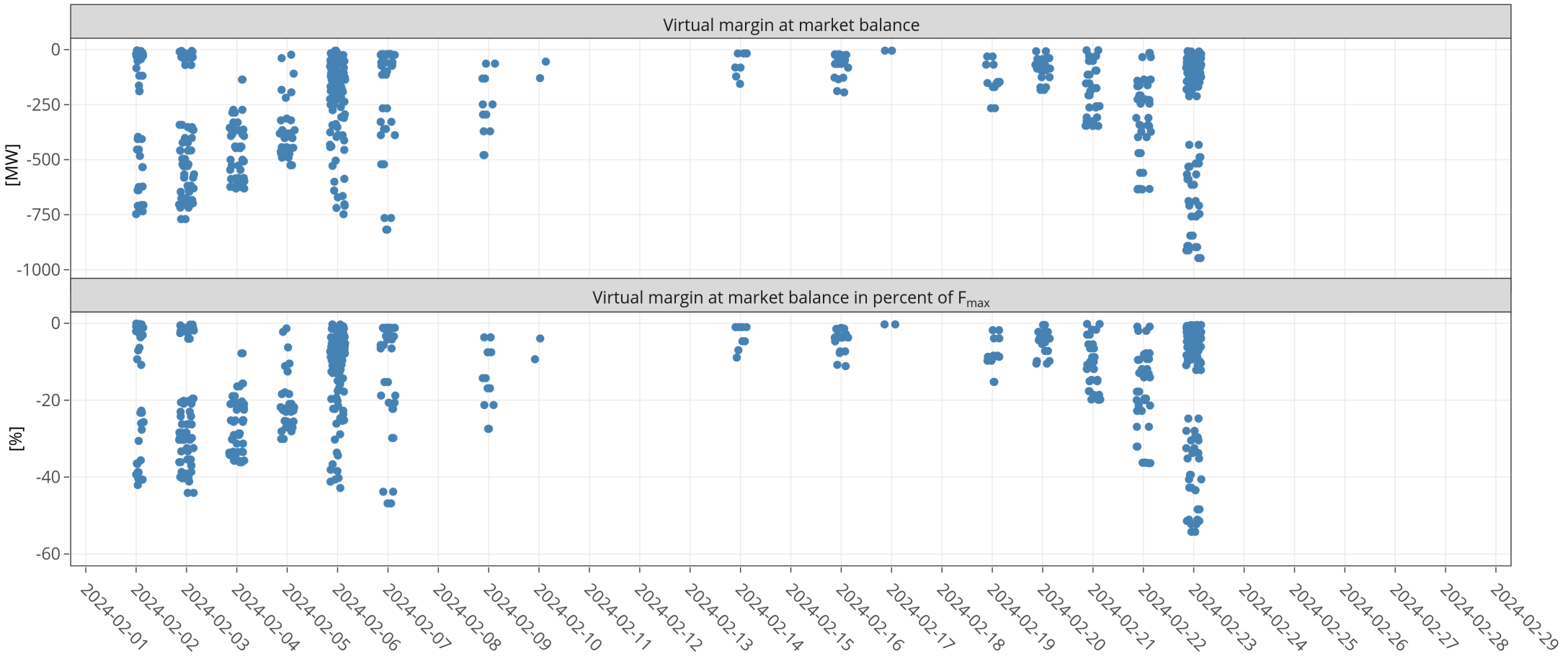
KPI 6b: Virtual margins at market balance AT



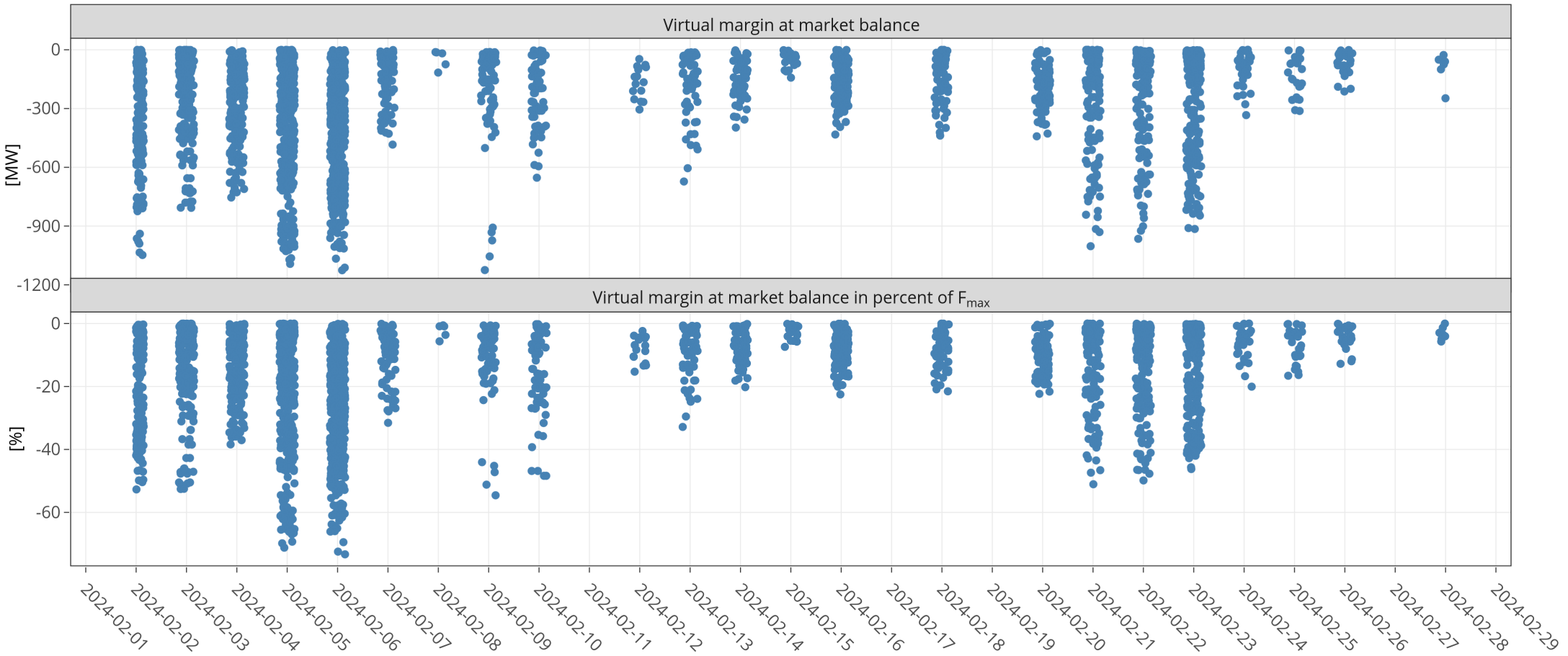
KPI 6b: Virtual margins at market balance BE



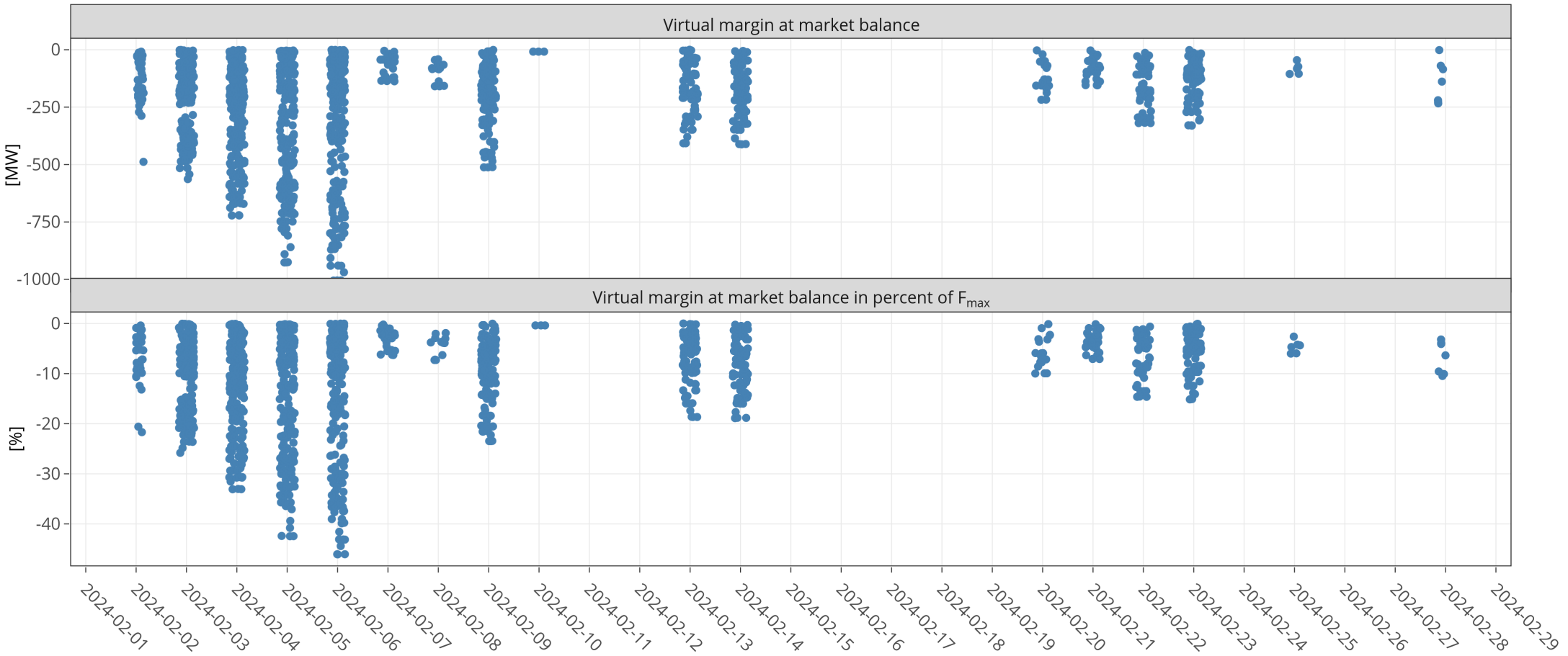
KPI 6b: Virtual margins at market balance CZ



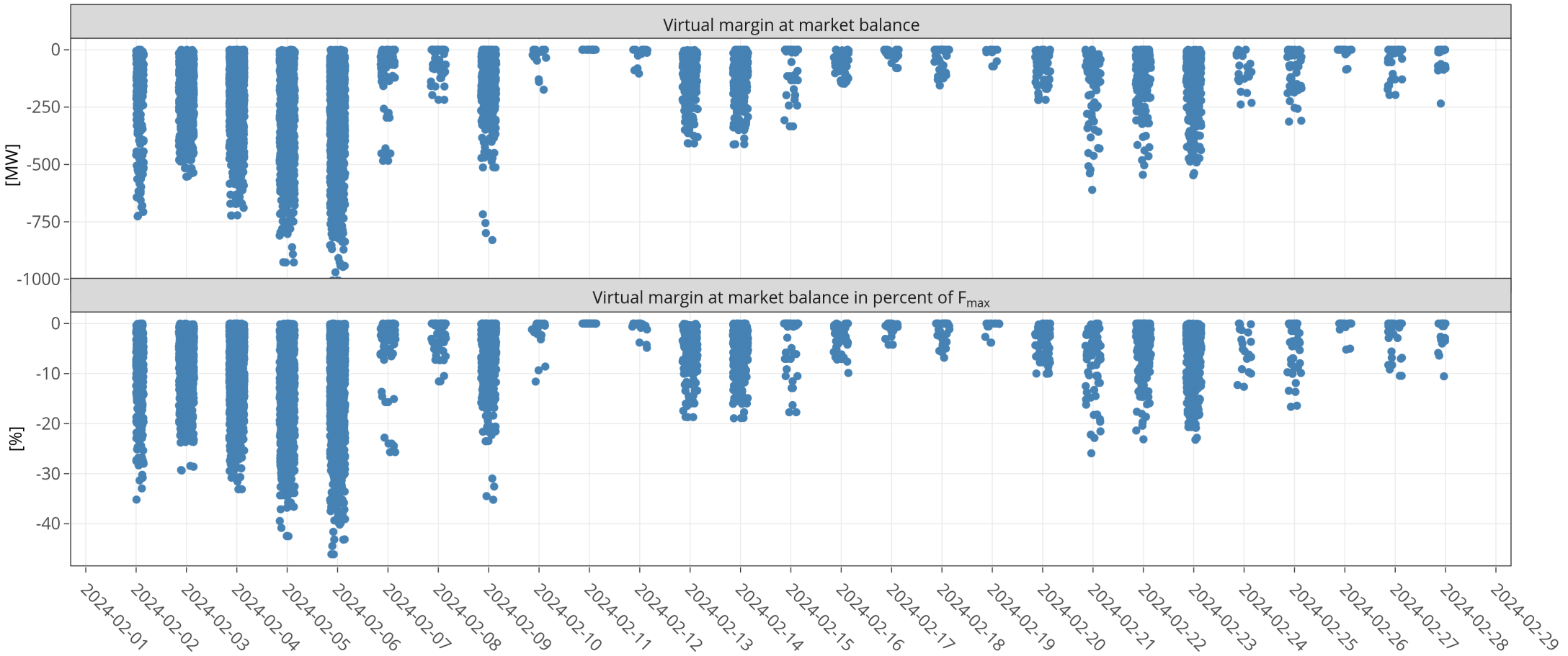
KPI 6b: Virtual margins at market balance D2



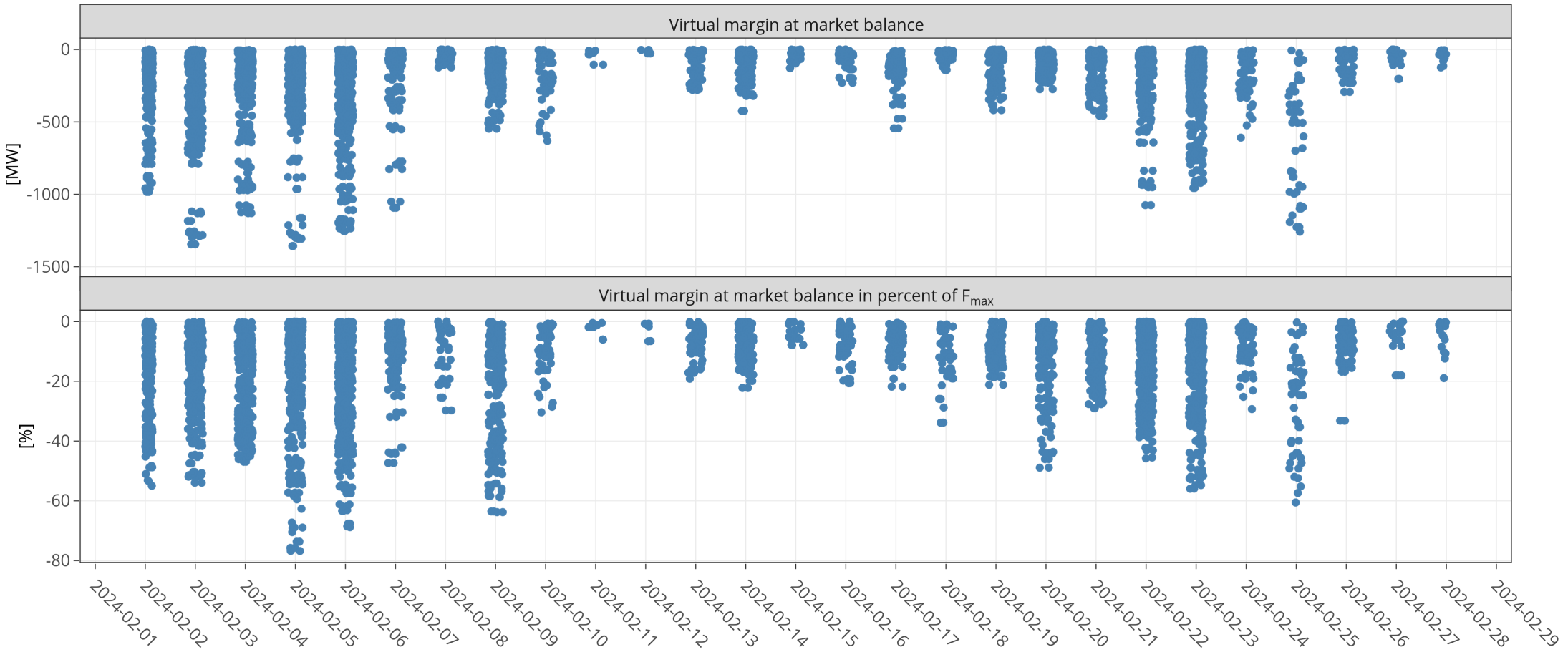
KPI 6b: Virtual margins at market balance D4



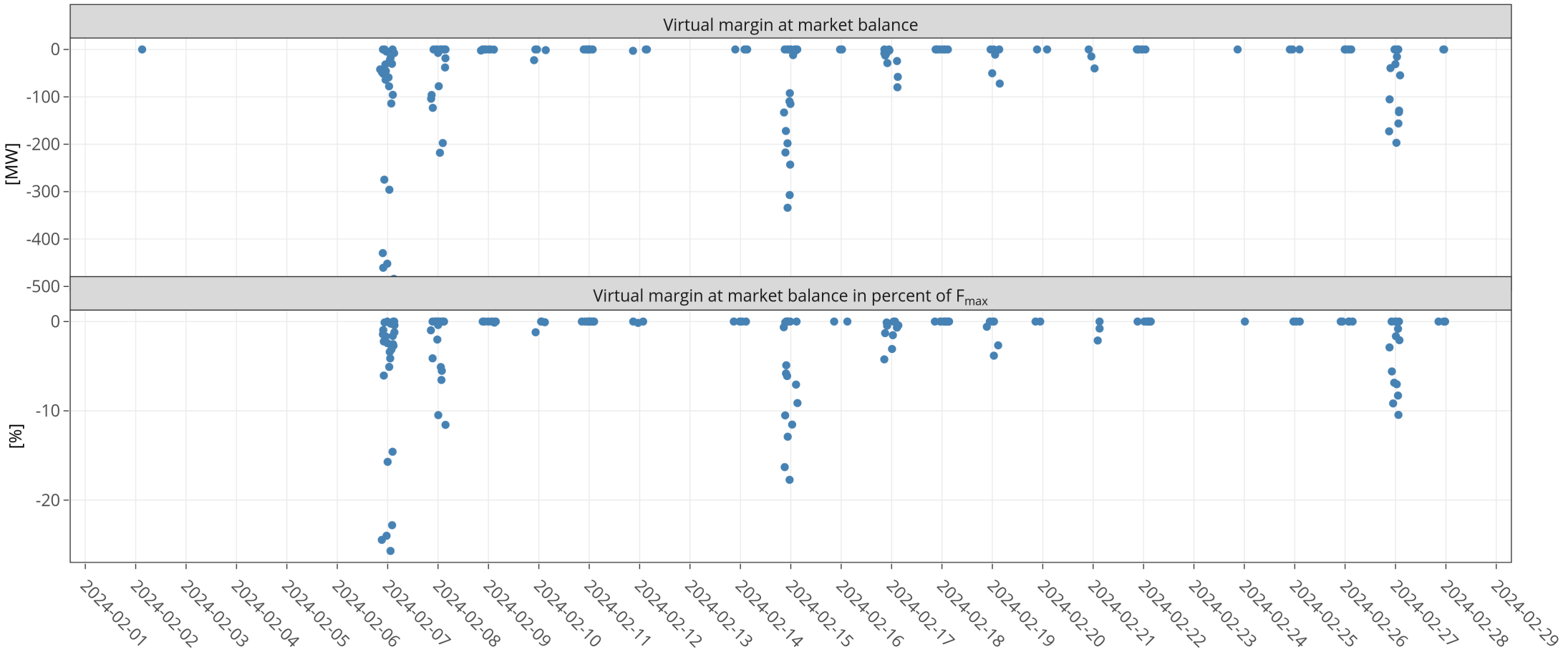
KPI 6b: Virtual margins at market balance D7



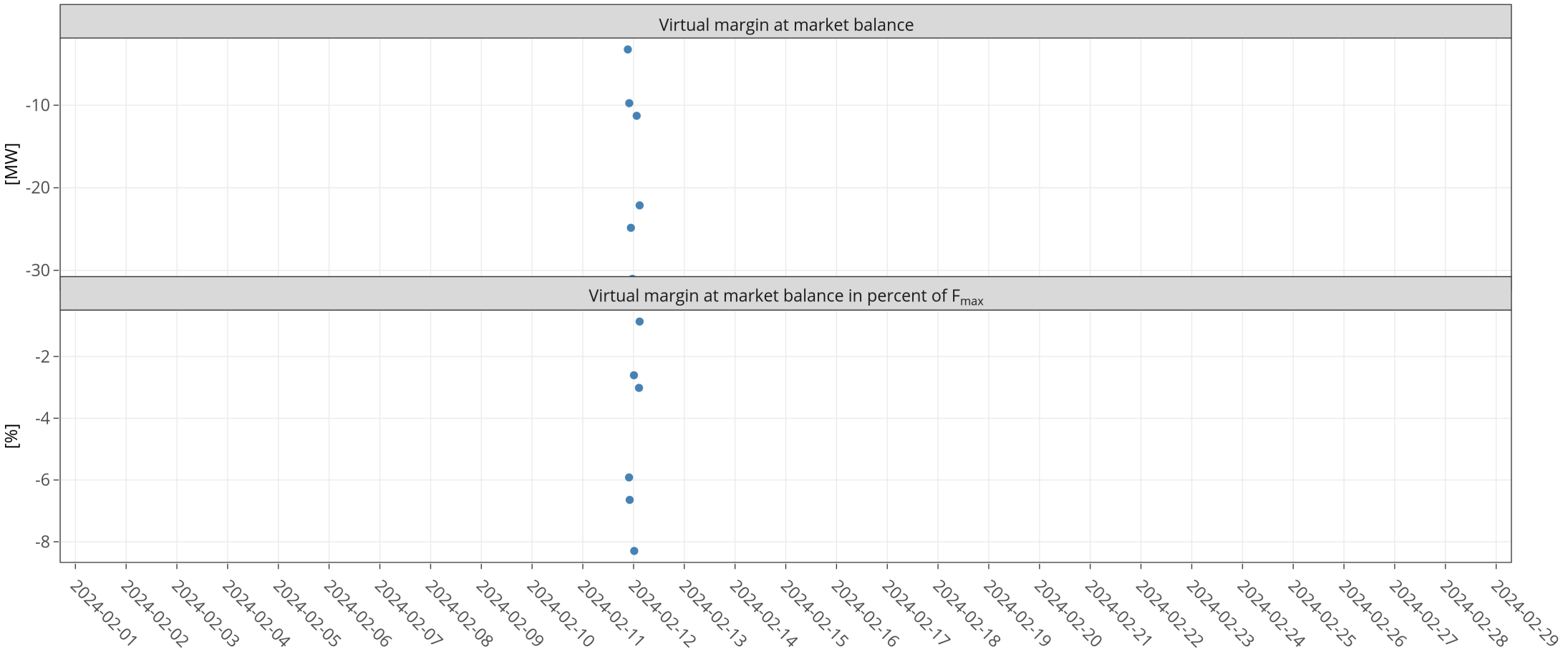
KPI 6b: Virtual margins at market balance D8



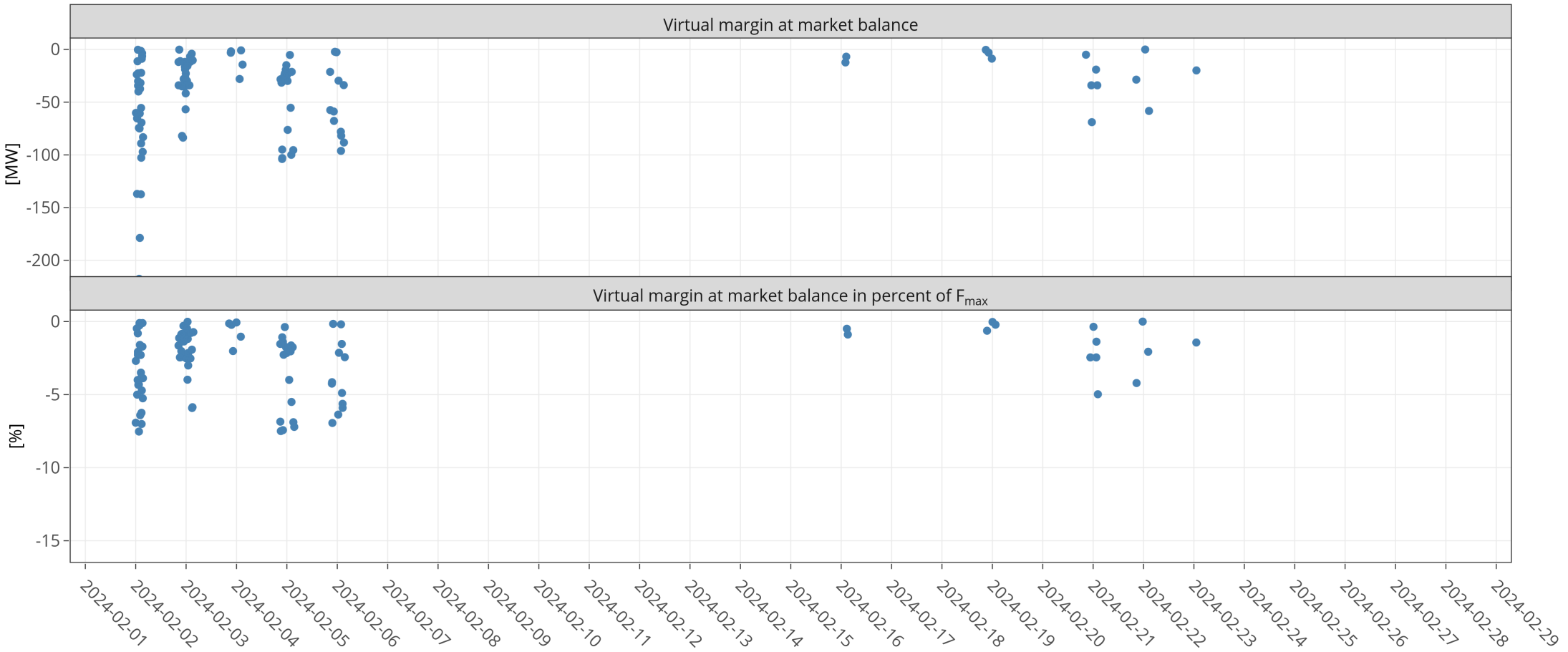
KPI 6b: Virtual margins at market balance FR



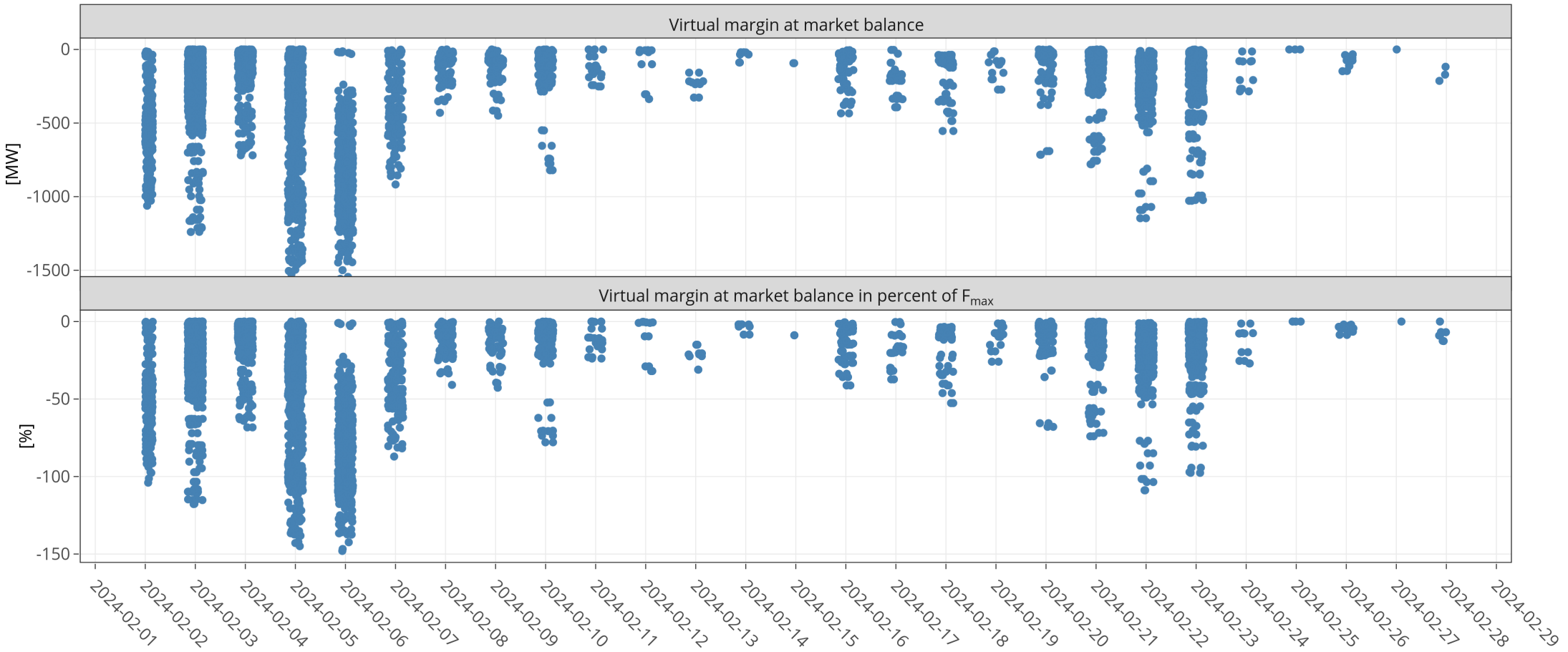
KPI 6b: Virtual margins at market balance HR



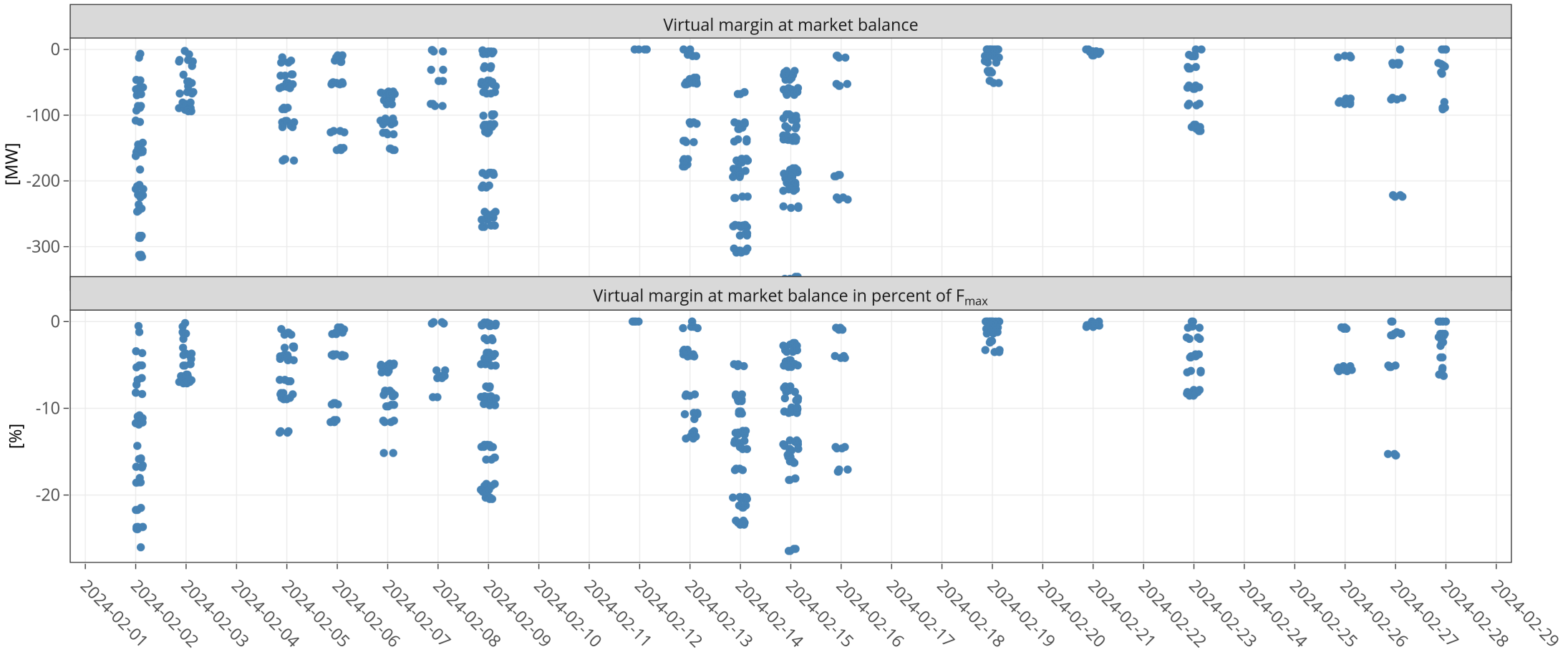
KPI 6b: Virtual margins at market balance HU



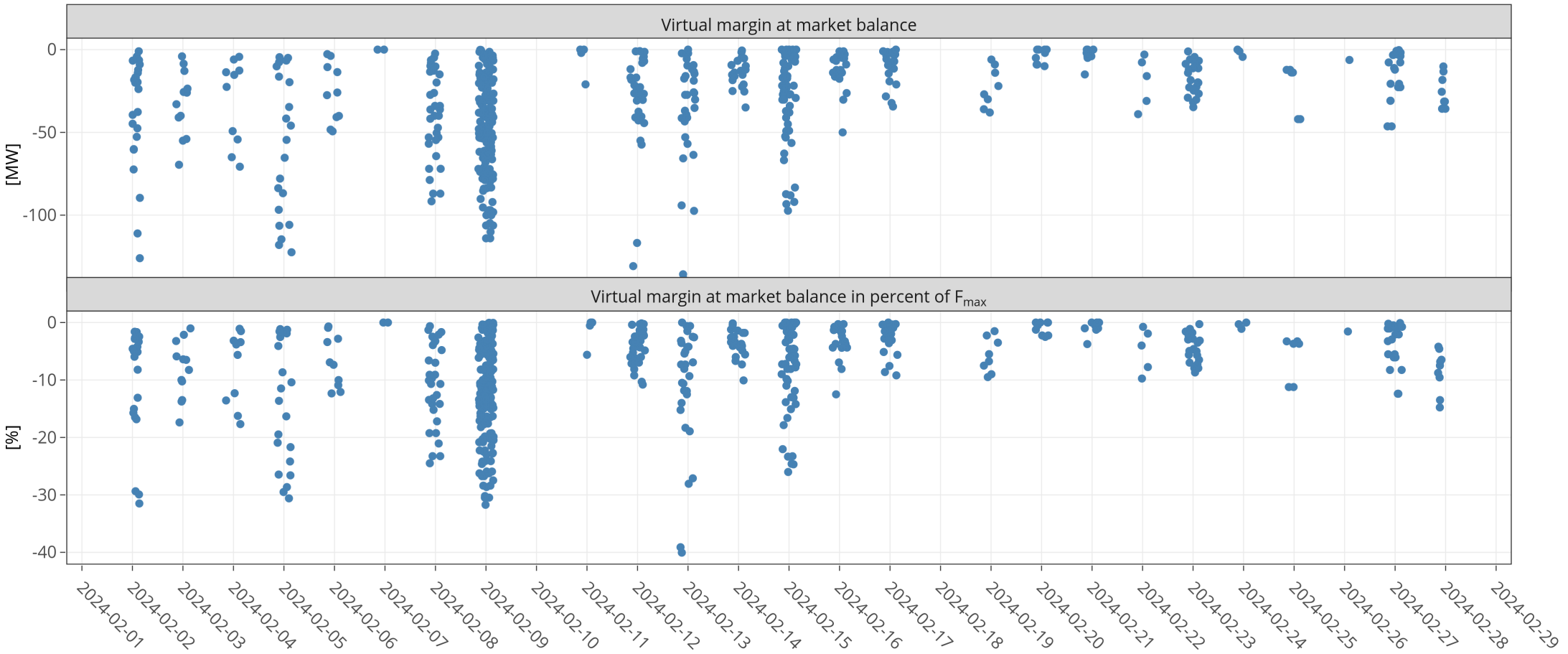
KPI 6b: Virtual margins at market balance NL



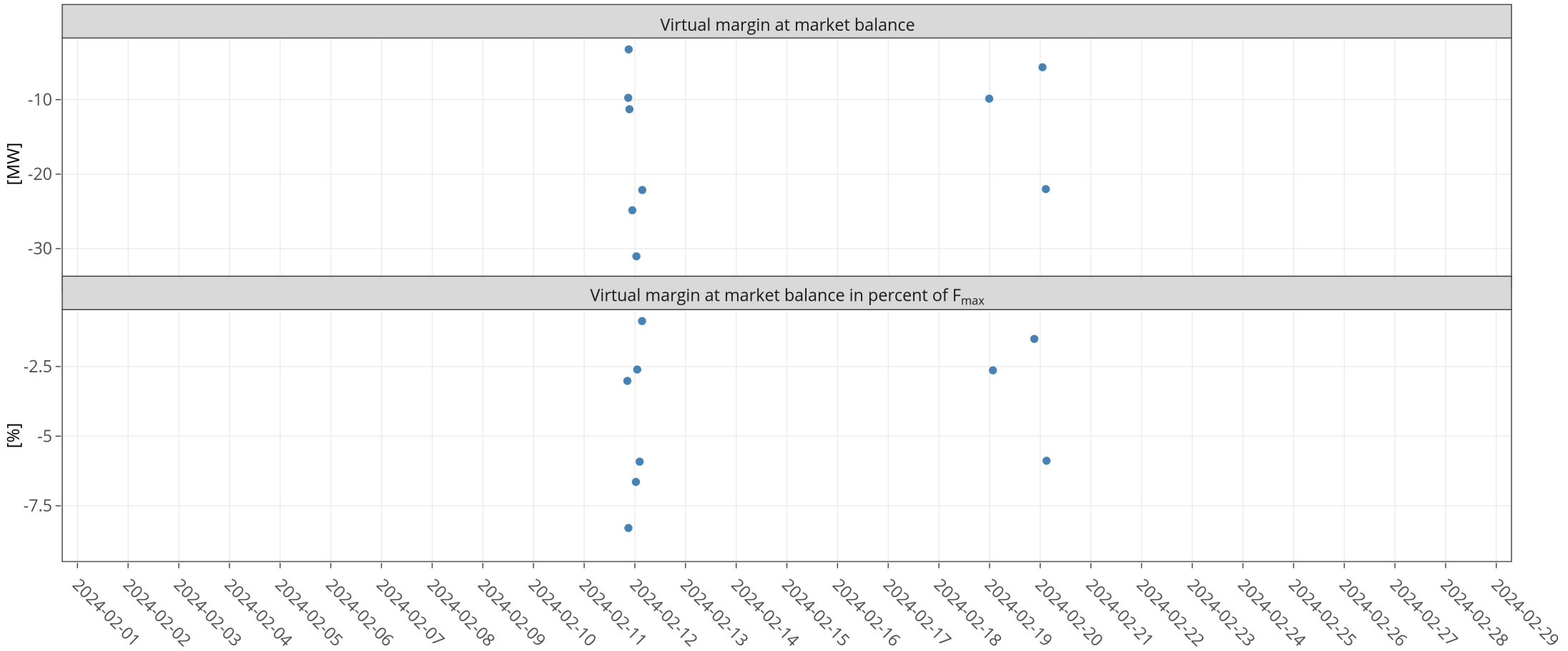
KPI 6b: Virtual margins at market balance PL



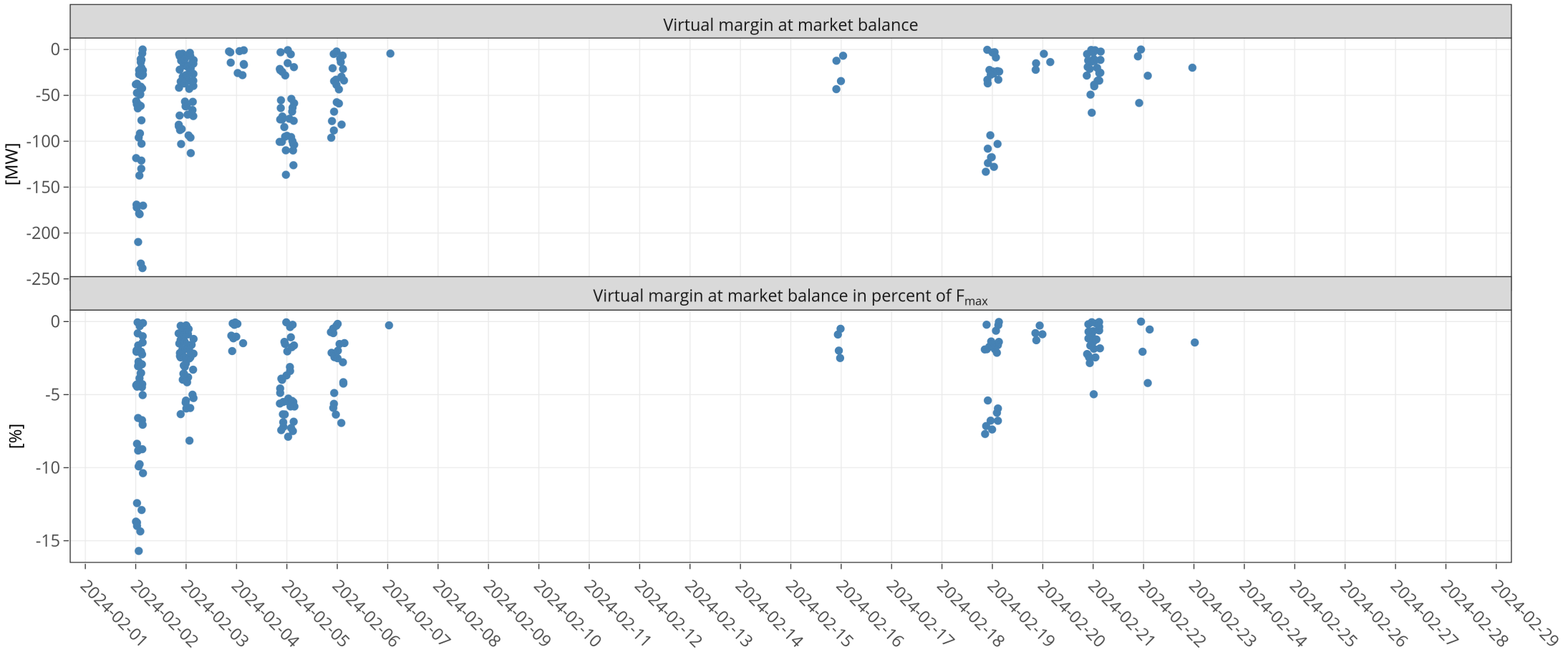
KPI 6b: Virtual margins at market balance RO



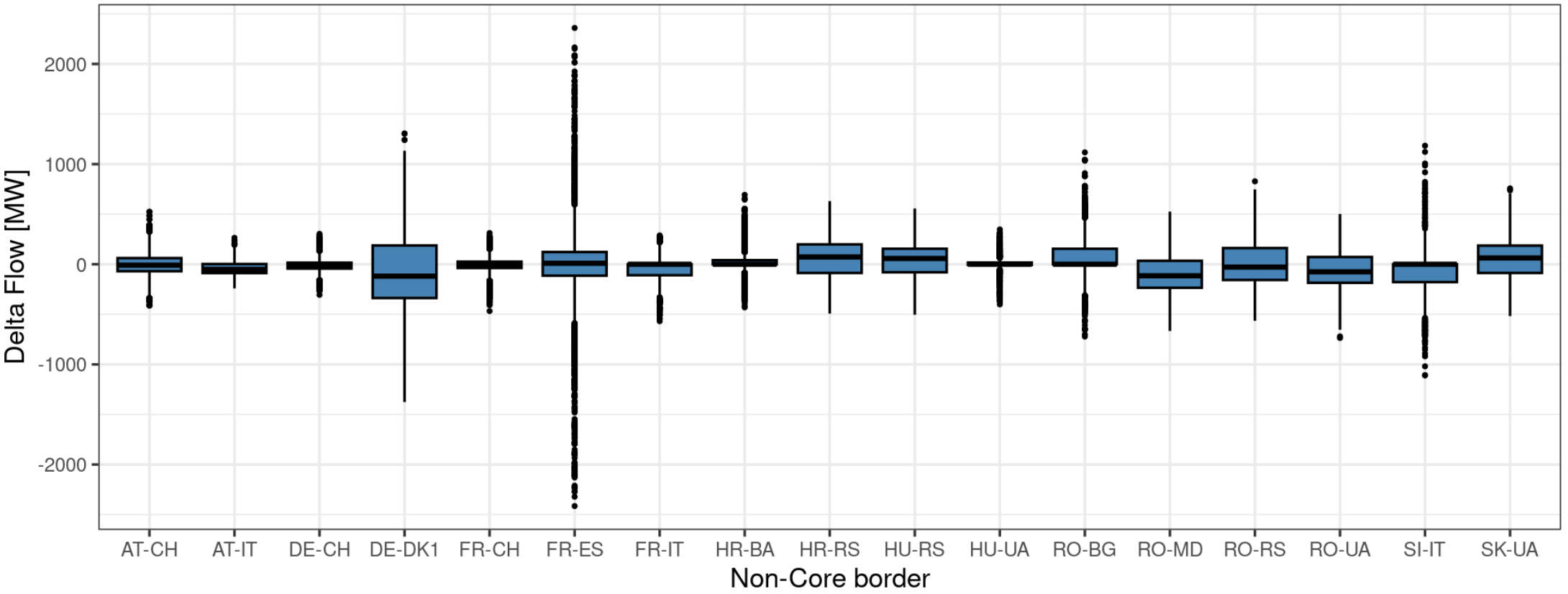
KPI 6b: Virtual margins at market balance SI



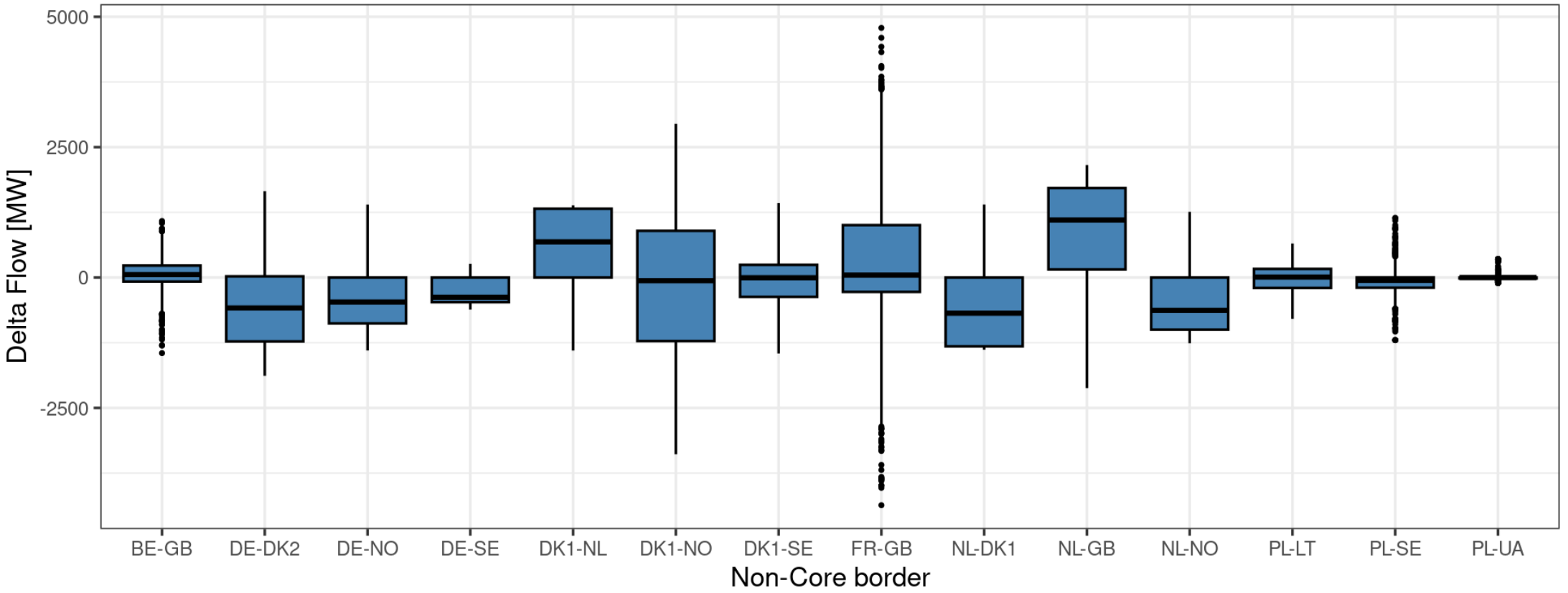
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow

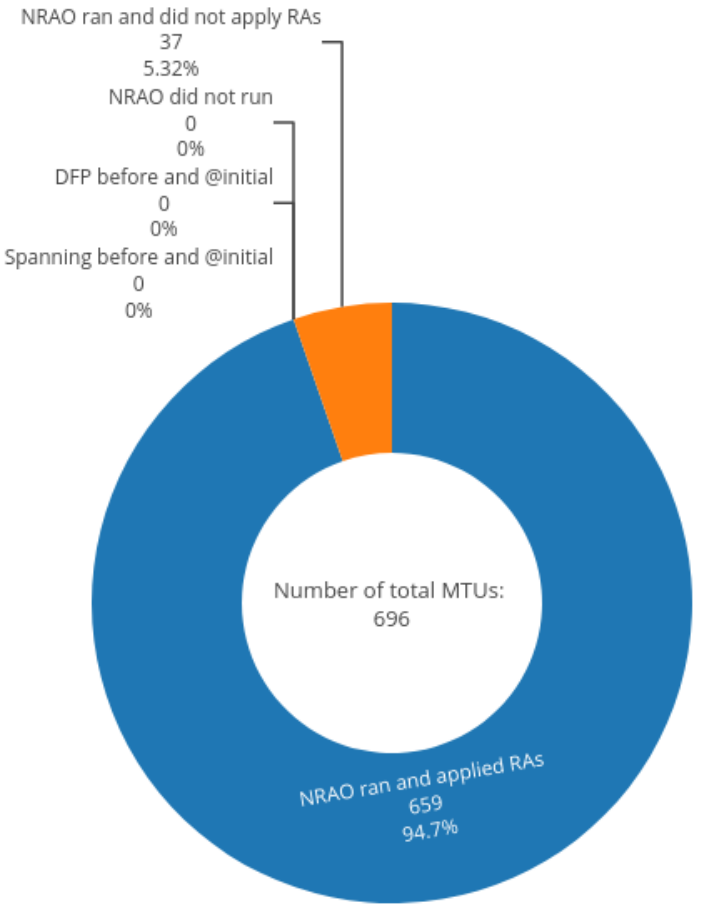


KPI 7: Non-Core exchanges DC delta flow

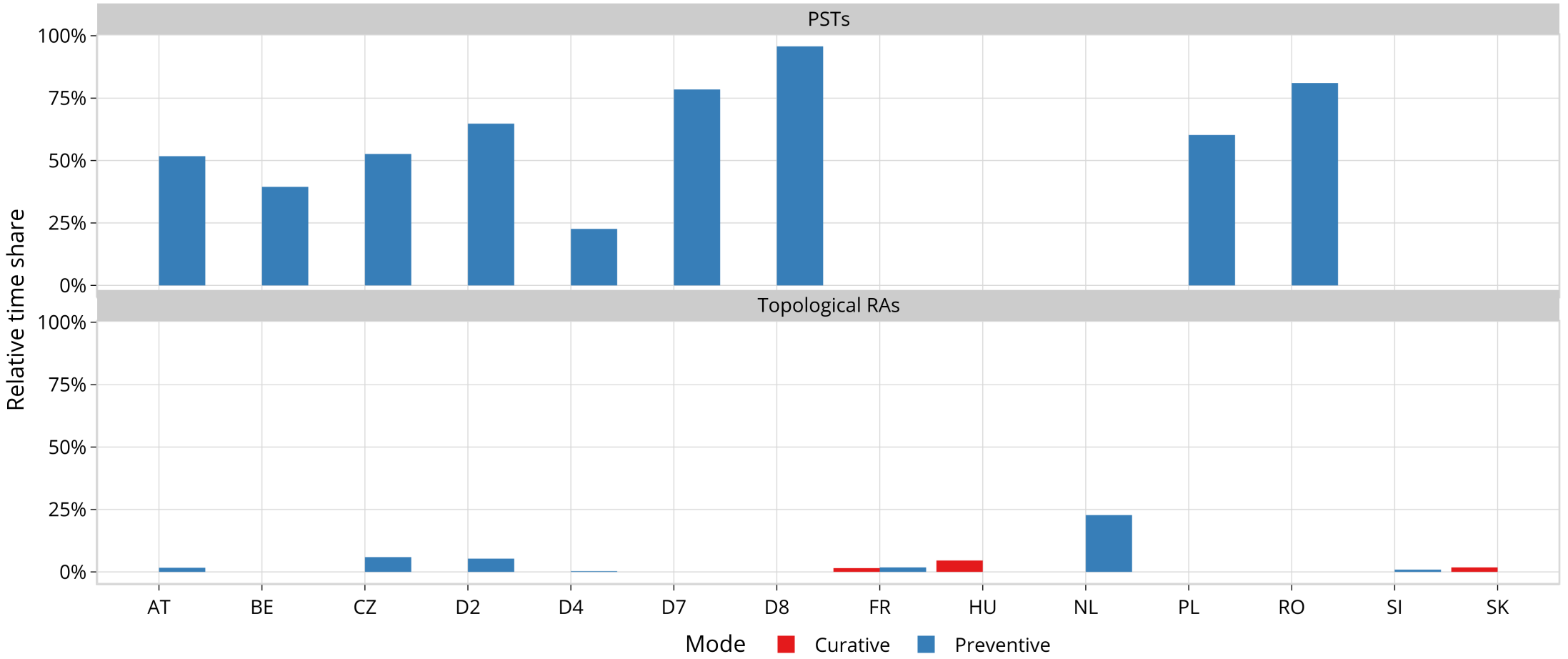


KPI 8: NRAO – Applied Remedial Action

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

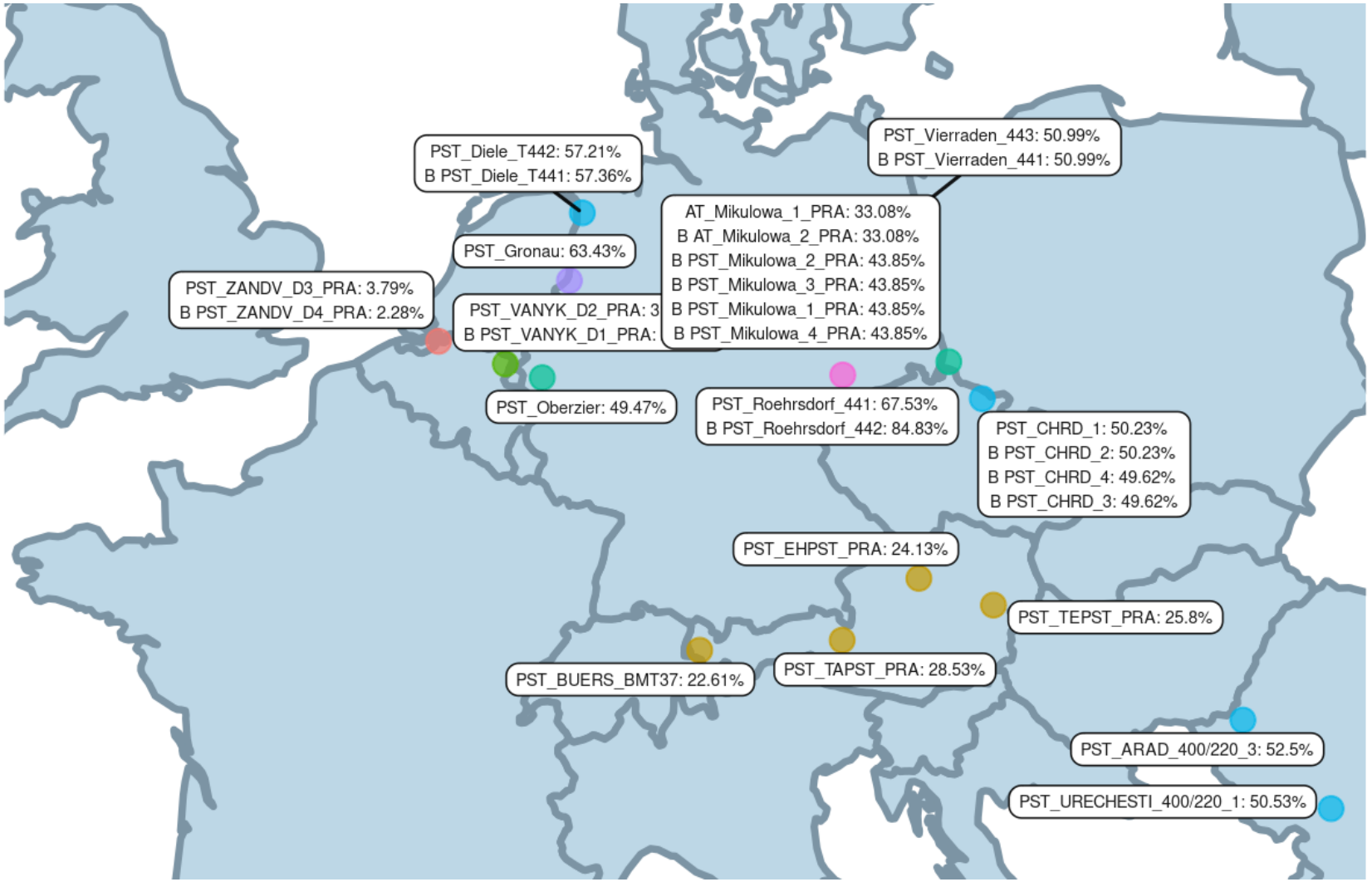


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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

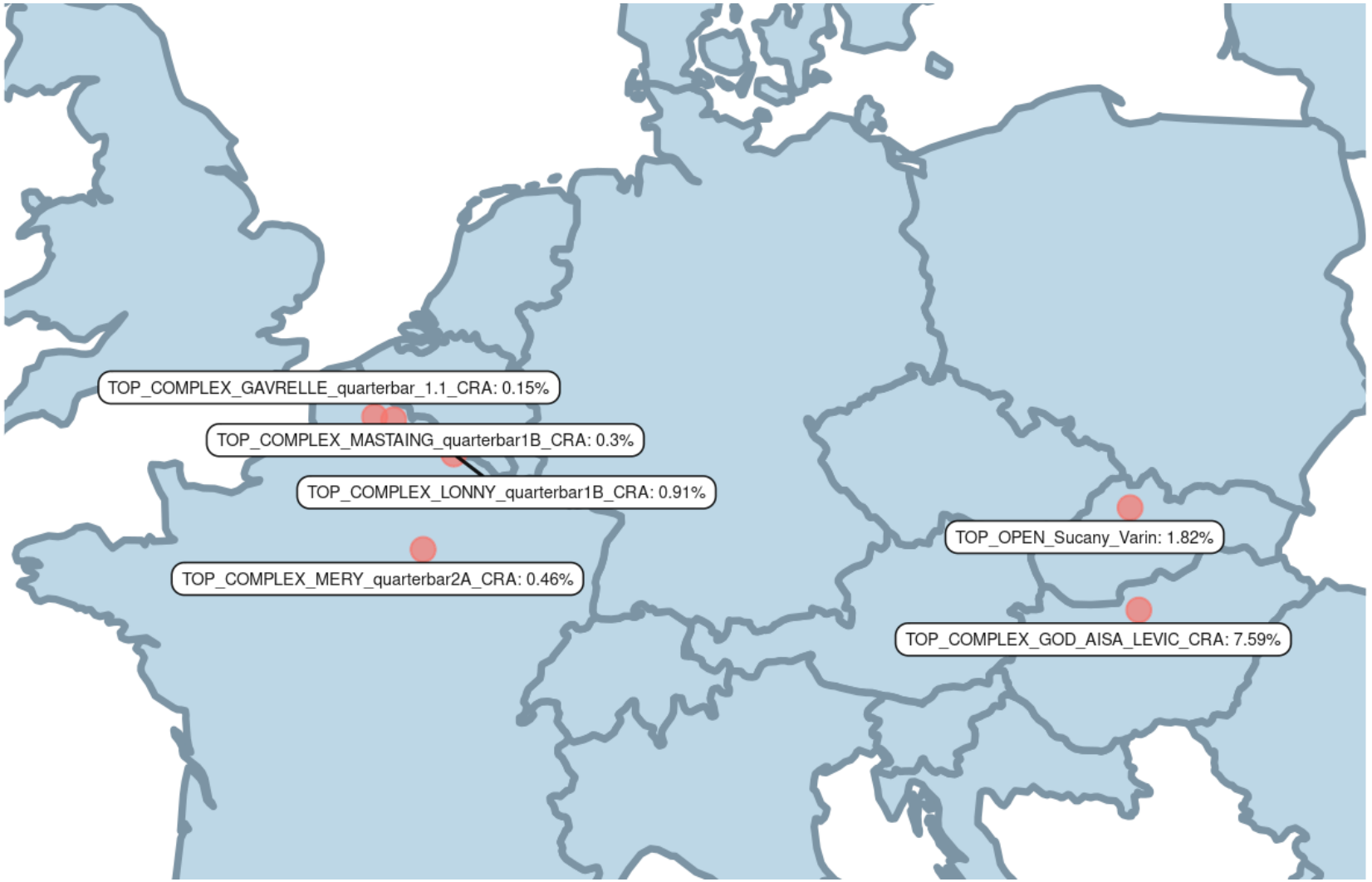
Relative Time Share of Applied PSTs in Curative Mode

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

Relative Time Share of Applied Topological RAs in Preventive Mode

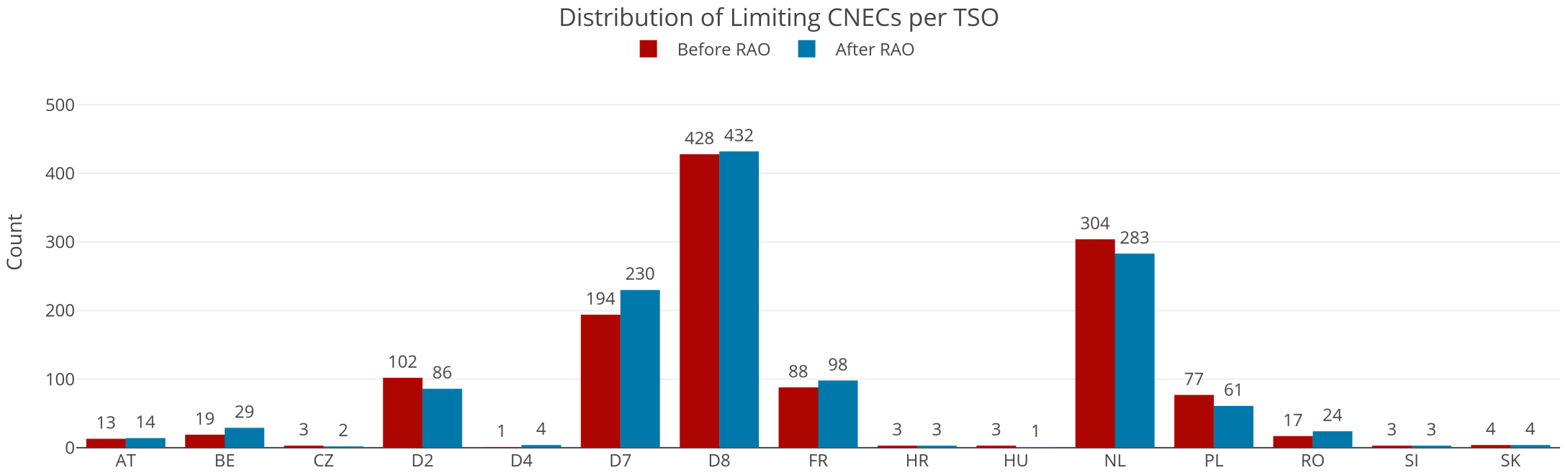
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

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



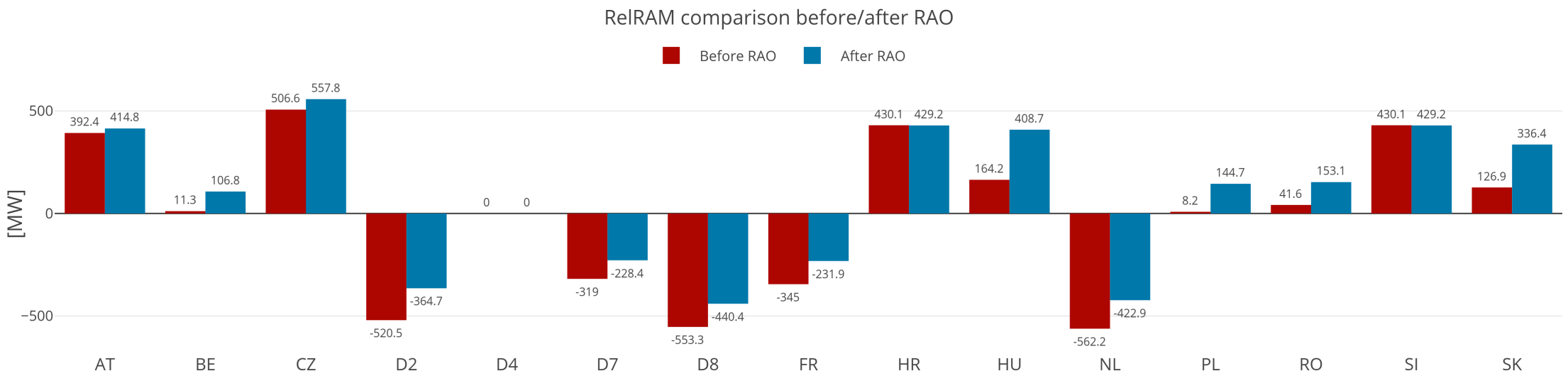
As expected, there is redistributing of the most limiting CNECs. This is because the application of Remedial Actions does not eliminate flows but re-routes, reducing the flows on some limiting CNECs and increasing the load on others, which at the end impacts also the RAM values.

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
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	696	697	55.11%	28.07%	92.78%	0.1714	0.4181
[SK-HU] Gabcikovo - Gonyu [OPP] [HU]	696	1170	93.12%	68.61%	123.52%	0.3019	1.0445
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	696	697	44.32%	19.90%	77.49%	0.2181	0.5782
[RO-RO] TR Rosiori 400/220 1 [DIR]	696	713	37.12%	19.25%	80.75%	0.1237	0.2471
[CZ-SK] Sokolnice - Stupava [DIR] [CZ]	696	696	77.12%	66.23%	97.84%	0.2981	1.2294
[SI-HU] 400 kV Cirkovce - Hevitz [OPP] [SI]	696	1872	71.82%	47.88%	92.88%	0.2244	1.0605
[SK-SK] Gabcikovo - P.Biskupice [DIR]	696	776	82.14%	70.38%	101.20%	0.2724	1.1785
[SK-HU] Gabcikovo - Gonyu [DIR] [HU]	696	698	77.21%	59.09%	103.90%	0.3019	1.0445
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	695	1381	109.09%	75.13%	155.35%	0.1714	0.4181
[SI-HU] 400 kV Cirkovce - Hevitz [DIR] [SI]	695	1560	108.86%	87.11%	138.50%	0.2244	1.0605
[SK-HU] Levice - God [DIR] [HU]	694	869	65.56%	44.59%	78.50%	0.2691	0.9114
[CZ-SK] Sokolnice - Krizovany [OPP] [CZ]	694	694	96.74%	75.90%	107.58%	0.2998	1.2513
[HU-HU] Gonyu - Gyor [DIR]	693	1461	73.93%	62.96%	94.22%	0.2484	1.2504
[AT-SI] Obersielach - Podlog 247 [OPP] [AT]	690	911	93.22%	50.41%	134.19%	0.1755	0.5294
[SK-SK] V.Dur - Levice 1 [DIR]	688	688	46.60%	37.18%	56.12%	0.1895	0.8532
[CZ-SK] Liskovec - P. Bystrica [OPP] [CZ]	688	688	95.63%	71.38%	126.15%	0.0743	0.257
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	686	1428	45.18%	19.80%	118.90%	0.2664	1.1775
[CZ-D2] Hradec - Etzenricht 441 [DIR] [D2]	681	681	52.34%	43.72%	67.60%	0.2191	0.9329
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	678	1276	89.27%	48.31%	116.90%	0.3217	0.7796
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	672	919	34.99%	19.94%	184.52%	0.2933	0.6705

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]	246	246	287.32	37.01%	19.90%	65.50%	0.2155
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	148	148	417.95	27.19%	19.94%	92.12%	0.2933
[CZ-D8] Hradec - Rohrsdorf 445 [OPP] [D8]	140	140	345.24	45.06%	33.16%	52.86%	0.2861
[RO-RO] TR Rosiori 400/220 1 [DIR]	123	123	656.44	26.44%	19.25%	42.50%	0.1138
[D8-D8] Neuenhagen - Vierraden 304 [DIR] [D8]	102	102	517.99	42.67%	26.14%	60.43%	0.1032
[D8-PL] Mikulowa PST1 [DIR] [PL]	87	87	171.63	50.80%	43.03%	63.15%	0.3413
[NL-BE] Rilland-Zandvliet 380 G [DIR] [NL]	57	57	184.57	58.83%	50.00%	71.00%	0.567
[SK-HU] Levice - God [DIR] [HU]	52	52	290.48	59.13%	44.59%	68.04%	0.2684
[D8-PL] Mikulowa PST1 [OPP] [PL]	52	52	126.53	47.75%	41.59%	65.98%	0.3393
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	47	47	163.81	78.75%	54.39%	102.52%	0.3211
[NL-D2] Meeden-Diele 380 W [OPP] [NL]	42	42	298.41	23.05%	19.94%	44.82%	0.2656
[PL-PL] Krosno Iskrzynia - Rzeszow [OPP]	38	38	263.7	47.30%	34.12%	58.94%	0.3456
[D8-D8] Pasewalk - Vierraden 306 [DIR]	35	35	785.1	38.03%	29.26%	44.12%	0.0802
[NL-D7] Maasbracht - Oberzier SELFK WS [DIR] [D7]	23	23	21.67	47.52%	19.96%	81.10%	0.2624
[RO-RO] Resita - Timisoara c1 [DIR]	21	21	552.51	33.82%	20.05%	49.20%	0.147
[D8-D8] Roehrsdorf - Roehrsdorf PST441 [DIR]	19	19	195.44	45.07%	41.35%	48.33%	0.2342
[D7-D7] Buerstadt - Lambsheim BUERST W [DIR]	17	17	85.08	48.80%	45.20%	52.13%	0.1509
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	15	16	195.48	27.49%	19.90%	57.90%	0.1829
[SI-AT] 220 kV Podlog - Obersielach [OPP] [SI]	15	15	50.75	74.33%	64.71%	83.16%	0.1418
[SK-SK] V.Dur - Levice 1 [DIR]	12	12	202.99	42.07%	37.64%	46.13%	0.1861

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 13 : Allocation Constraints - Poland

	# MTUs
AC was limiting MC	339
AC < 0 MW	130
AC = 0 MW	207
AC > 0 MW	2

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1730.57	5295.65
Min.	-9698.00	0.00
Max.	0.00	15917.00