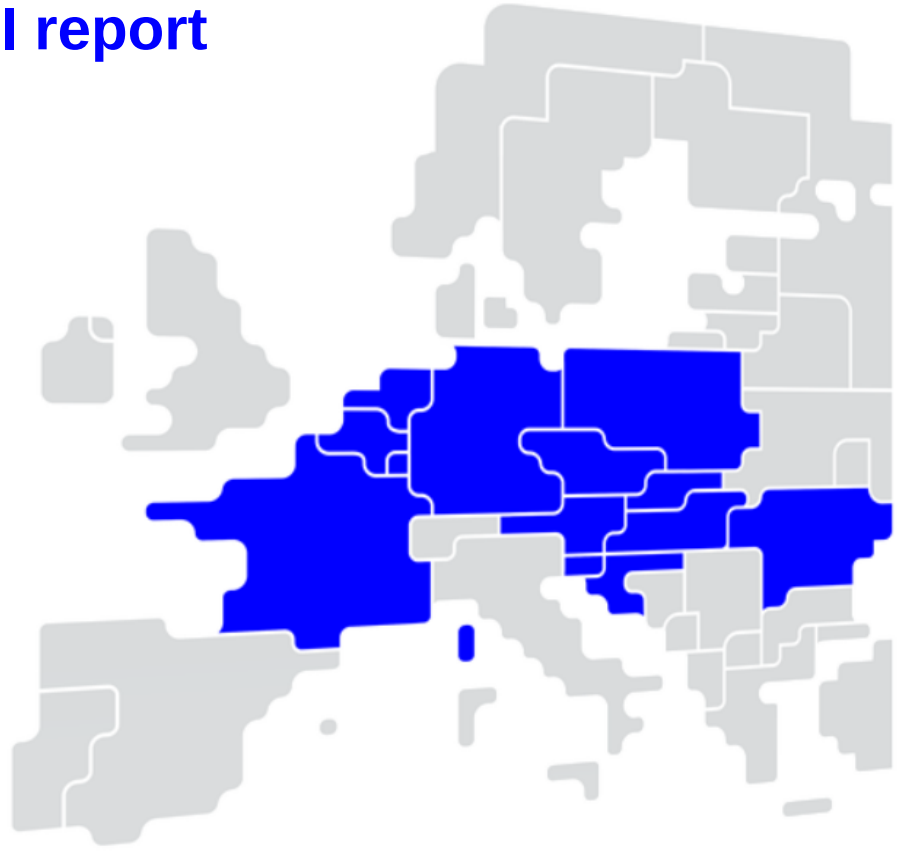
Core FB MC Operational KPI report

January 2023



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

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- KPI 11: Most often presolved CNEs (top 20)
- KPI 12: Most limiting CNEs (top 20)
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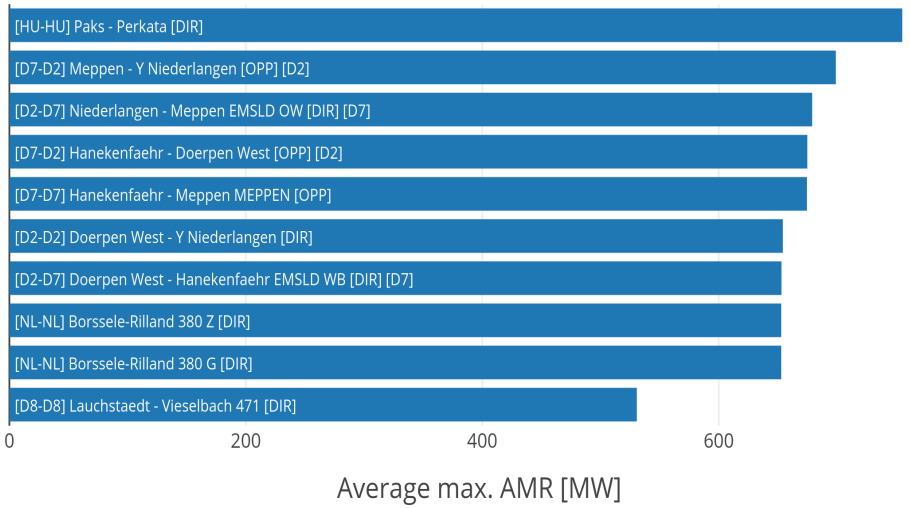
KPI 1: Average maximum AMR per CNE (Top 10)

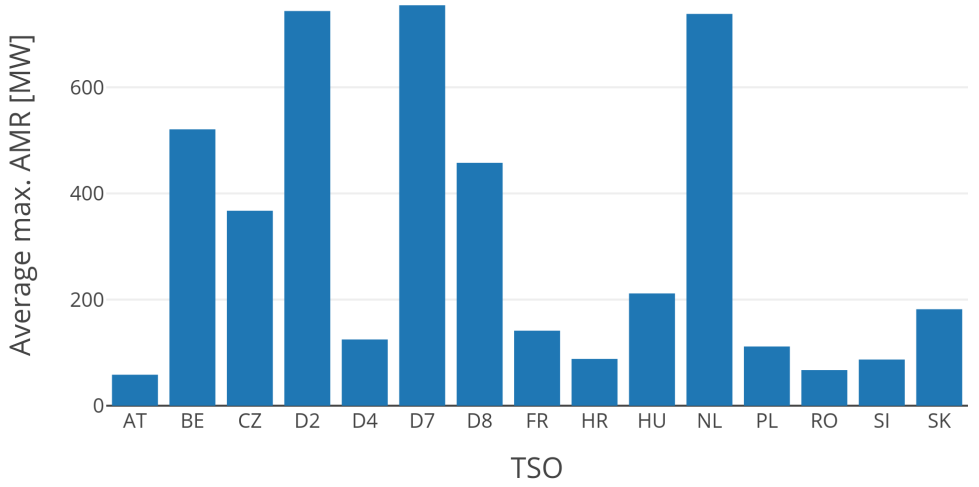
CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[HU-HU] Paks - Perkata [DIR]	755.25	0.29%
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	699.06	33.09%
[D2-D7] Niederlangen - Meppen EMSLD OW [DIR] [D7]	679.06	29.28%
[D7-D2] Hanekenfaehr - Doerpen West [OPP] [D2]	674.94	33.39%
[D7-D7] Hanekenfaehr - Meppen MEPPEN [OPP]	674.60	28.96%
[D2-D2] Doerpen West - Y Niederlangen [DIR]	654.23	30.87%
[D2-D7] Doerpen West - Hanekenfaehr EMSLD WB [DIR] [D7]	653.09	29.63%
[NL-NL] Borssele-Rilland 380 G [DIR]	652.87	25.14%
[NL-NL] Borssele-Rilland 380 Z [DIR]	652.87	25.14%
[D8-D8] Lauchstaedt - Vieselbach 471 [DIR]	530.72	9.98%



KPI 2: Average maximum AMR per TSO

TSO	Average maximum AMR per TSO
AT	58.43
BE	520.85
CZ	367.39
D2	743.79
D4	124.77
D7	754.65
D8	457.67
FR	141.48
HR	88.20
HU	211.67

TSO	Average maximum AMR per TSO
NL	738.33
PL	111.55
RO	67.19
SI	86.87
SK	181.79

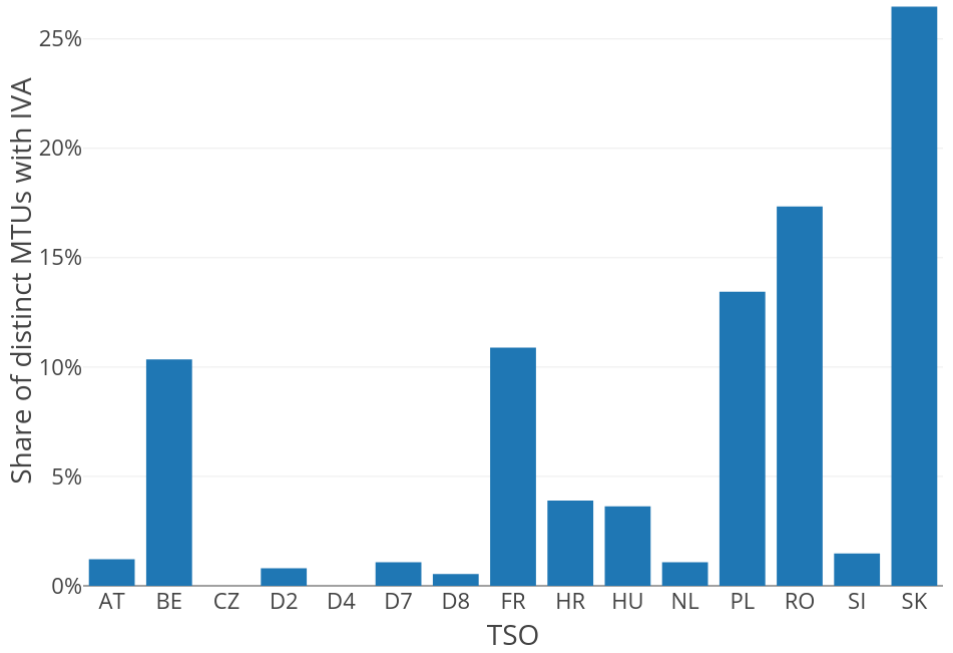


KPI 3: Share of MTUs with intervention per TSO

Total BDs	Total MTUs	MTUs without IVA	Share of distinct MTUs without IVA	MTUs with IVA	Share of distinct MTUs with IVA
31	744	289	38.8%	455	61.2%

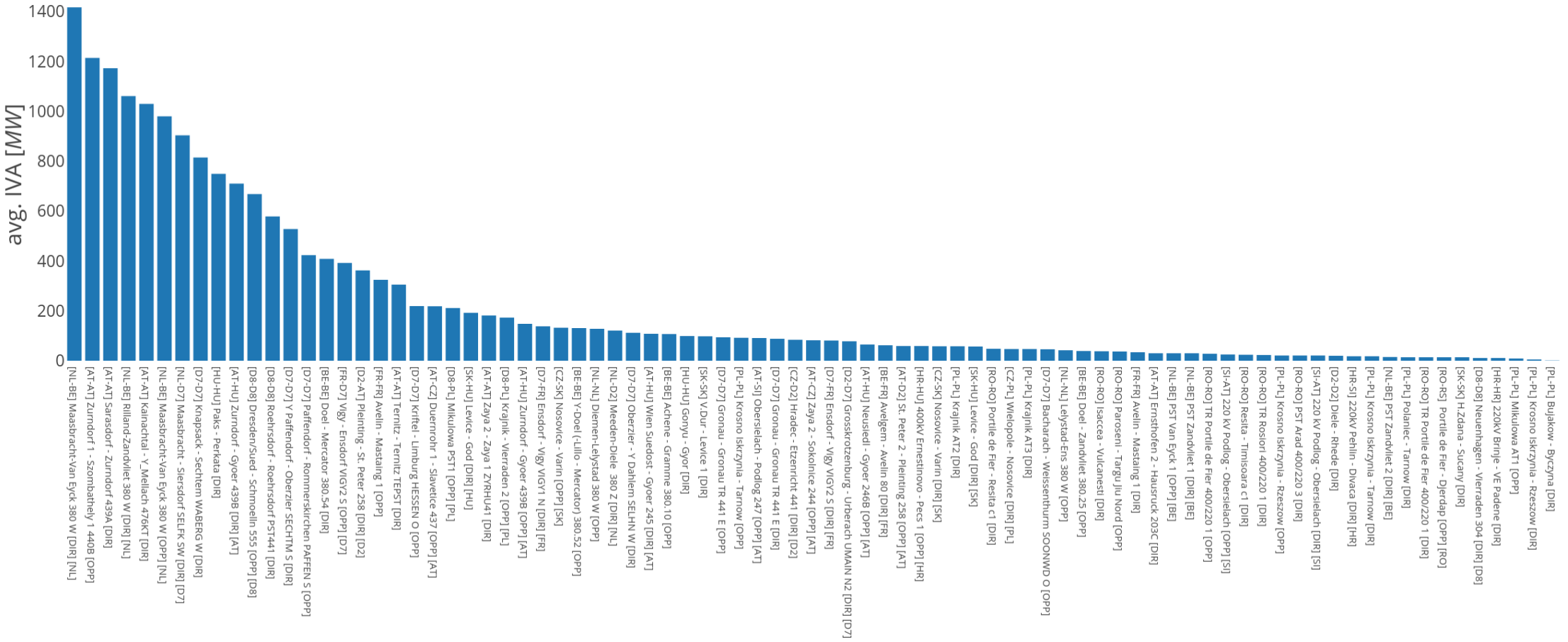
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	1.21%	9
BE	10.35%	77
CZ	0.00%	0
D2	0.81%	6
D4	0.00%	0
D7	1.08%	8
D8	0.54%	4
FR	10.89%	81
HR	3.90%	29
HU	3.63%	27

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
NL	1.08%	8
PL	13.44%	100
RO	17.34%	129
SI	1.48%	11
SK	26.48%	197



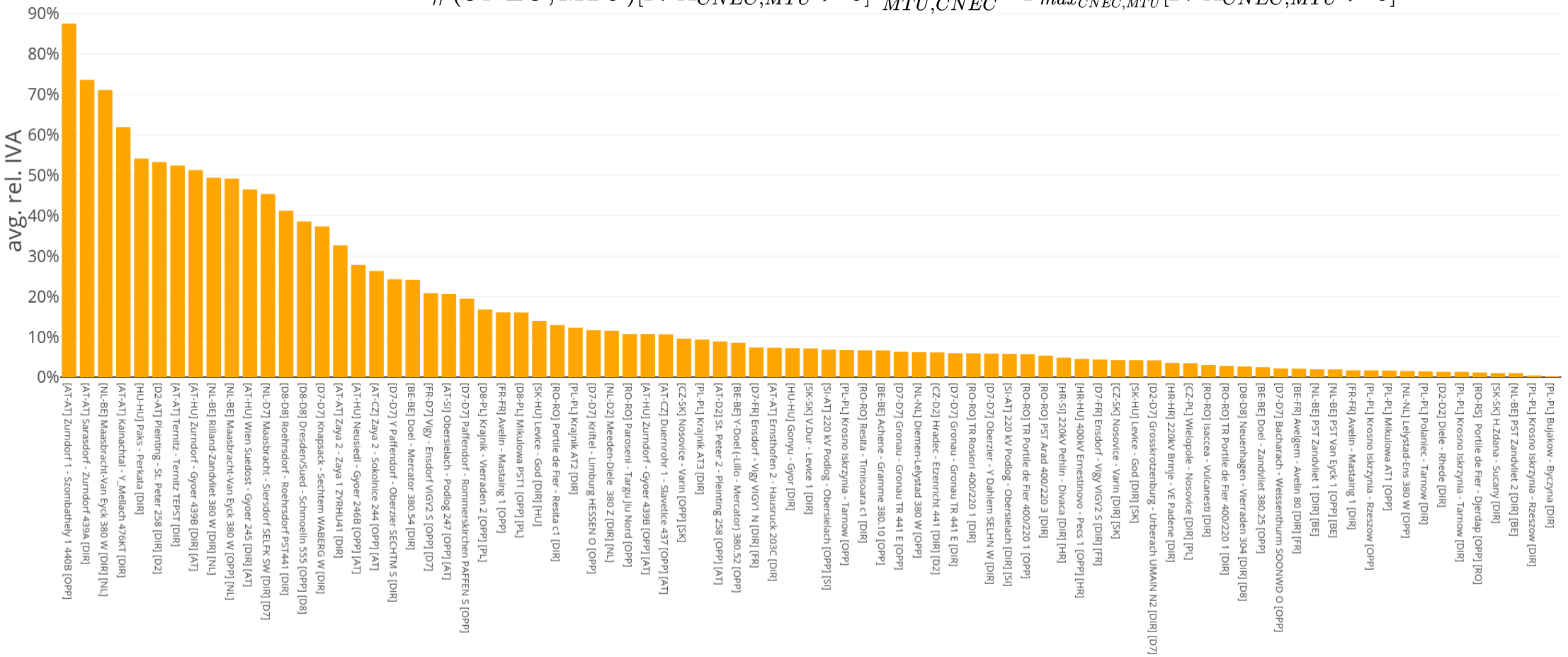
KPI 4a: Average IVA applied for each CNE affected by TSO intervention

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

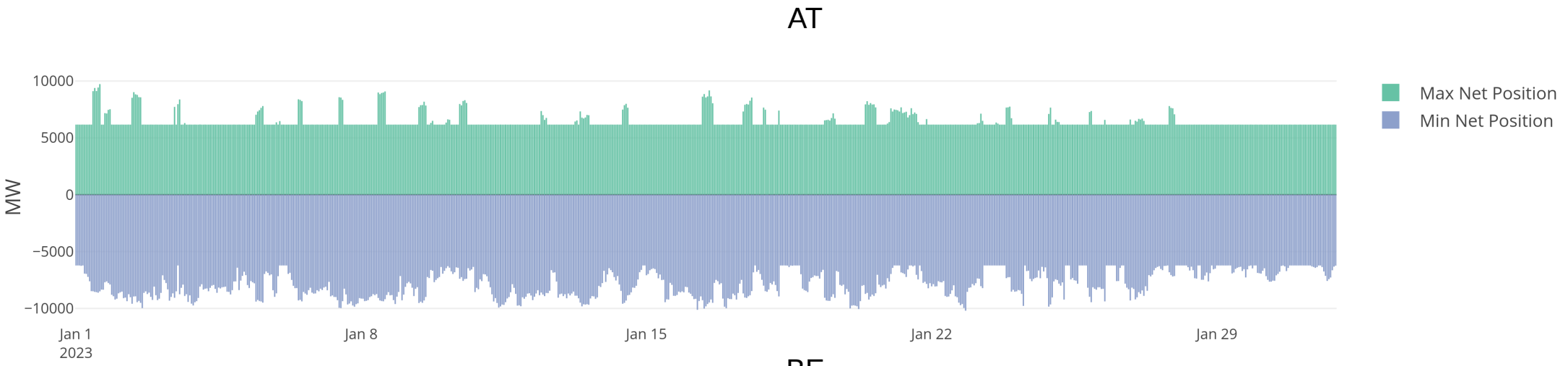


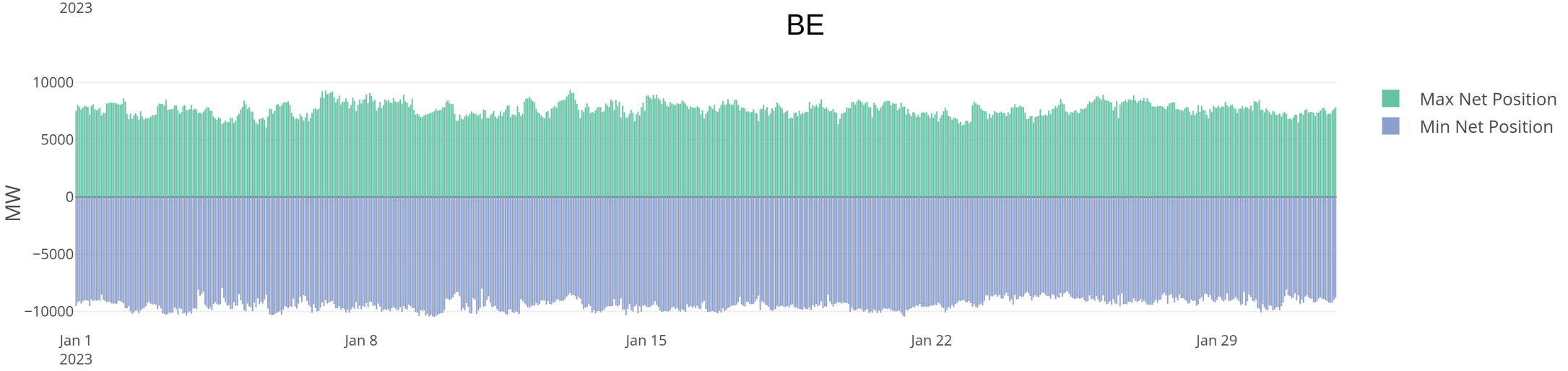
KPI 4b: Average relative IVA applied for each CNE affected by TSO intervention

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

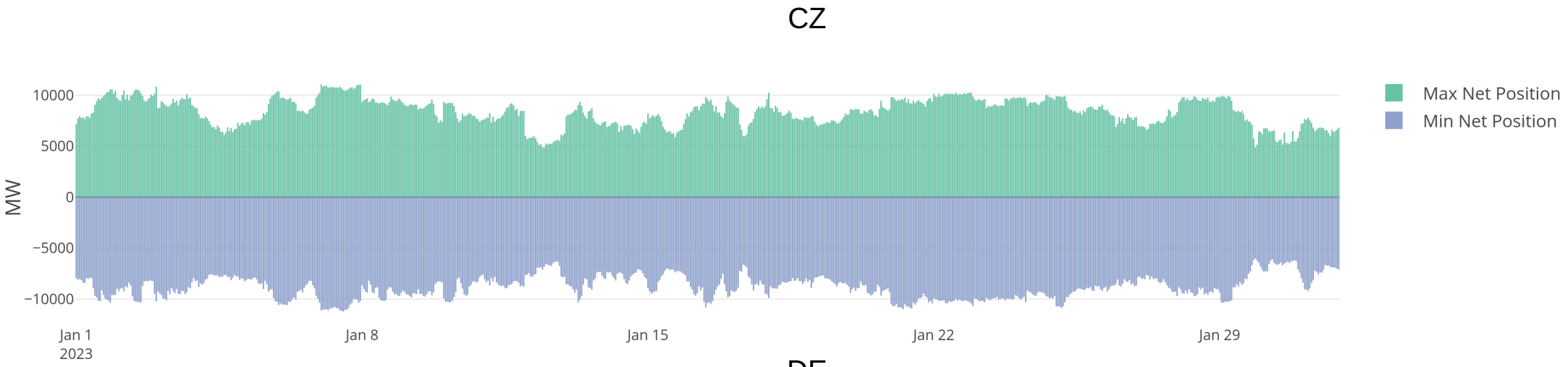


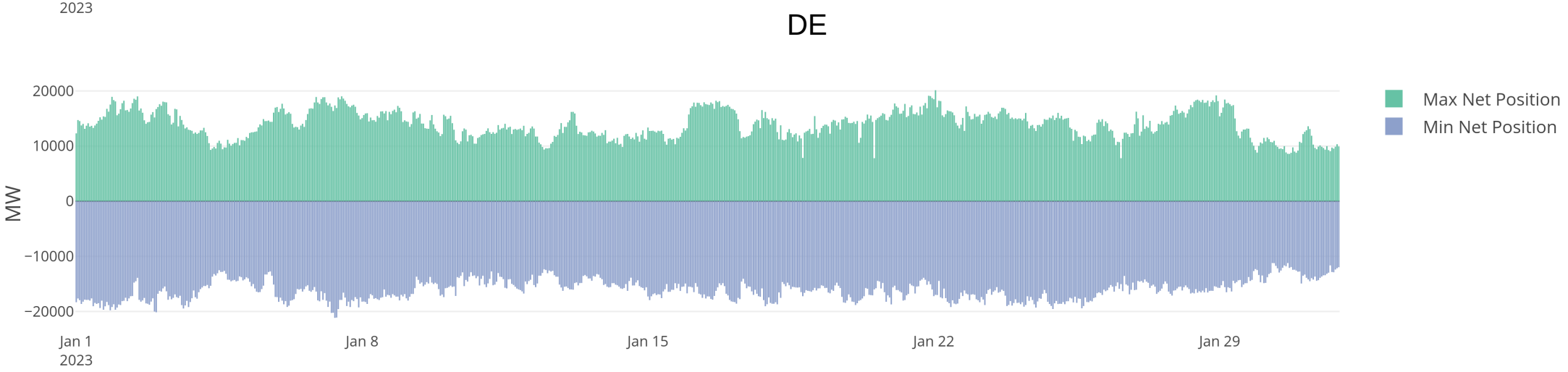
KPI 5: Min & max net positions per BZ hub





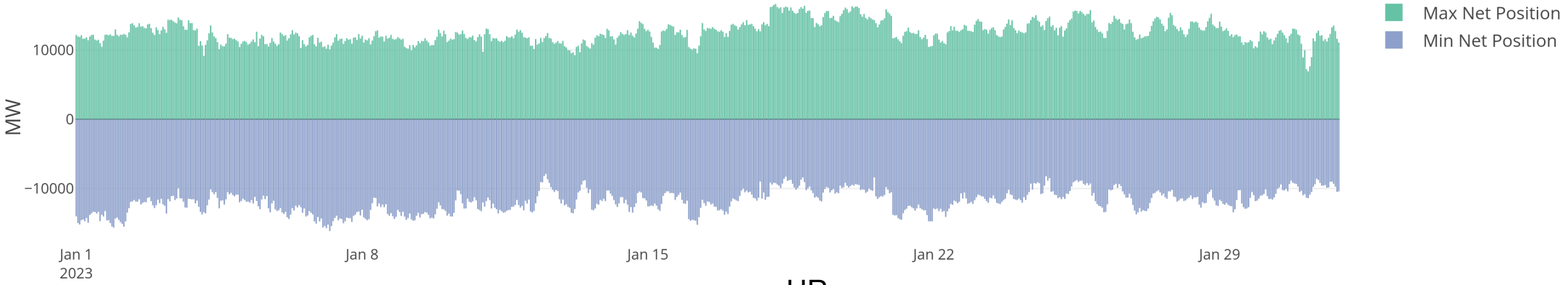
KPI 5: Min & max net positions per BZ hub



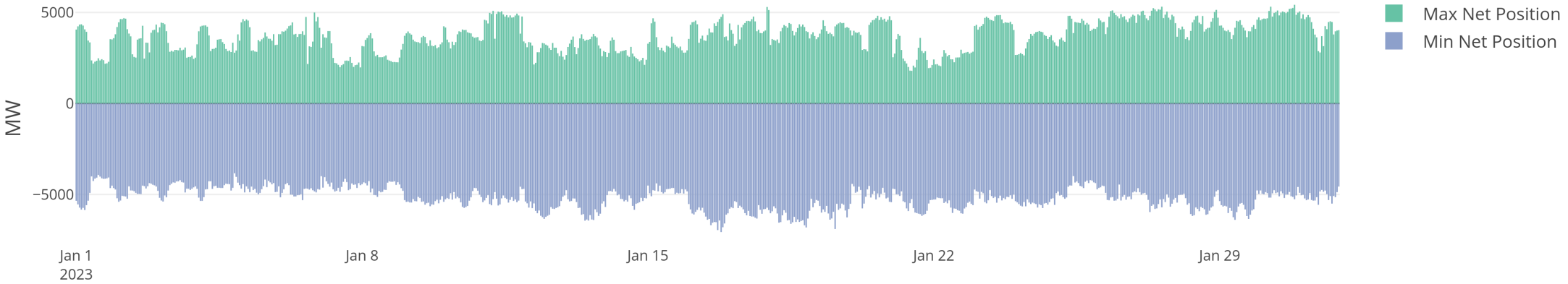


KPI 5: Min & max net positions per BZ hub

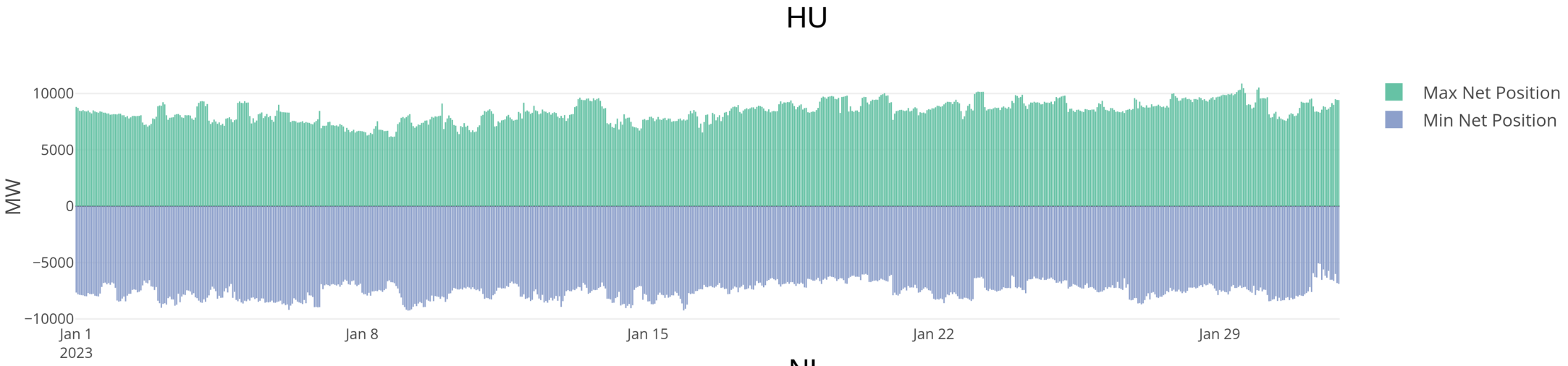
FR

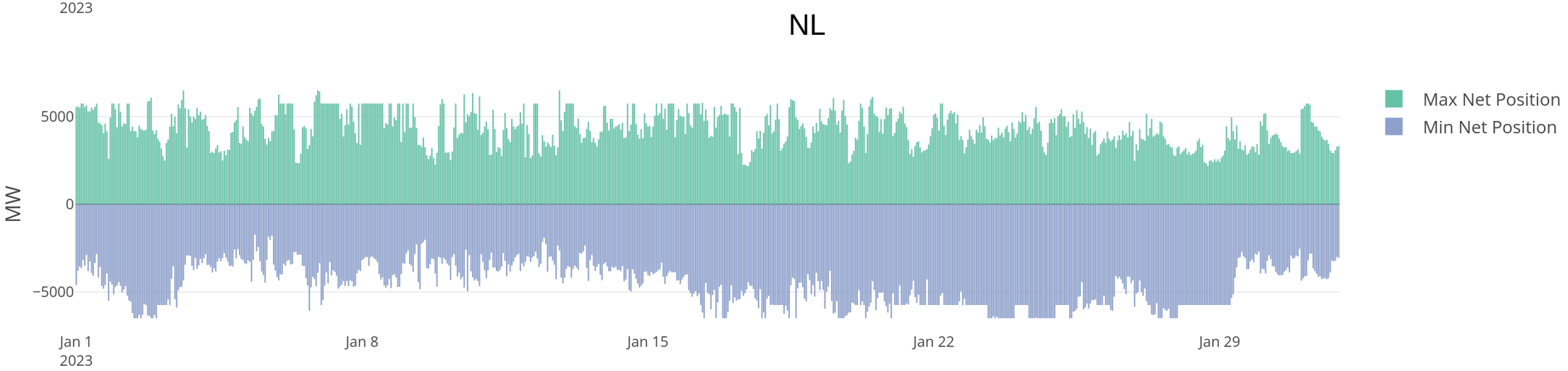


HR

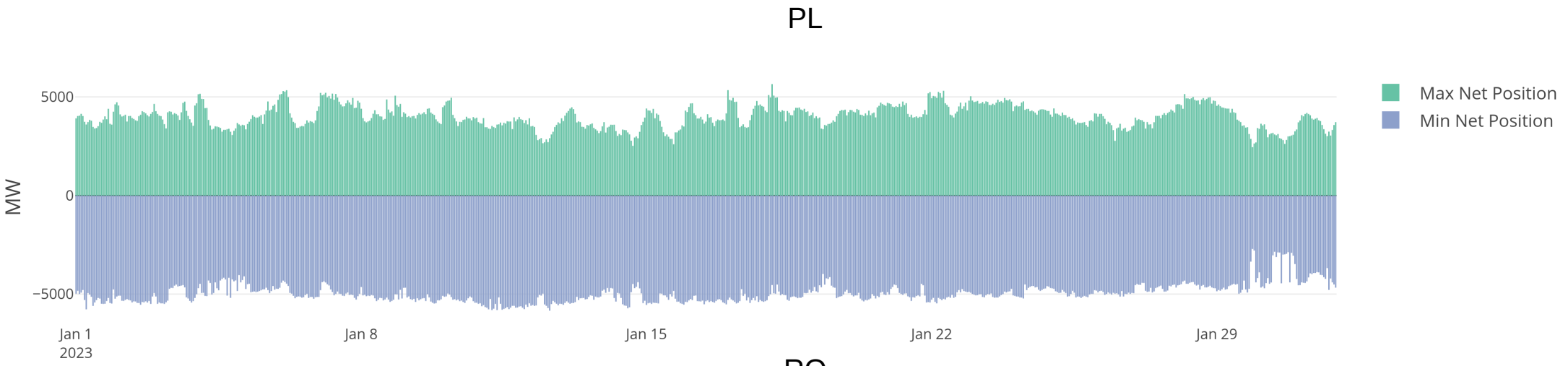


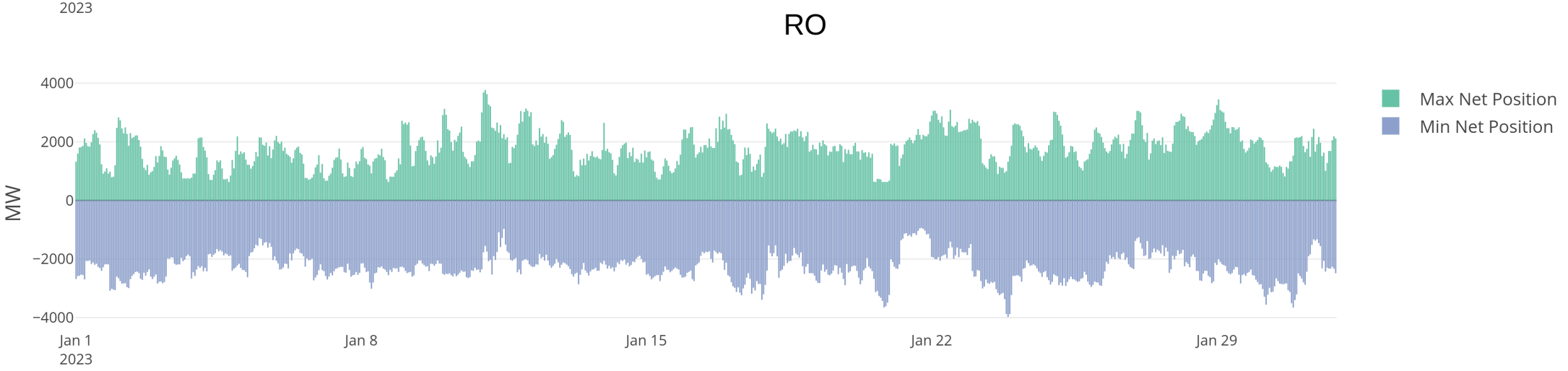
KPI 5: Min & max net positions per BZ hub



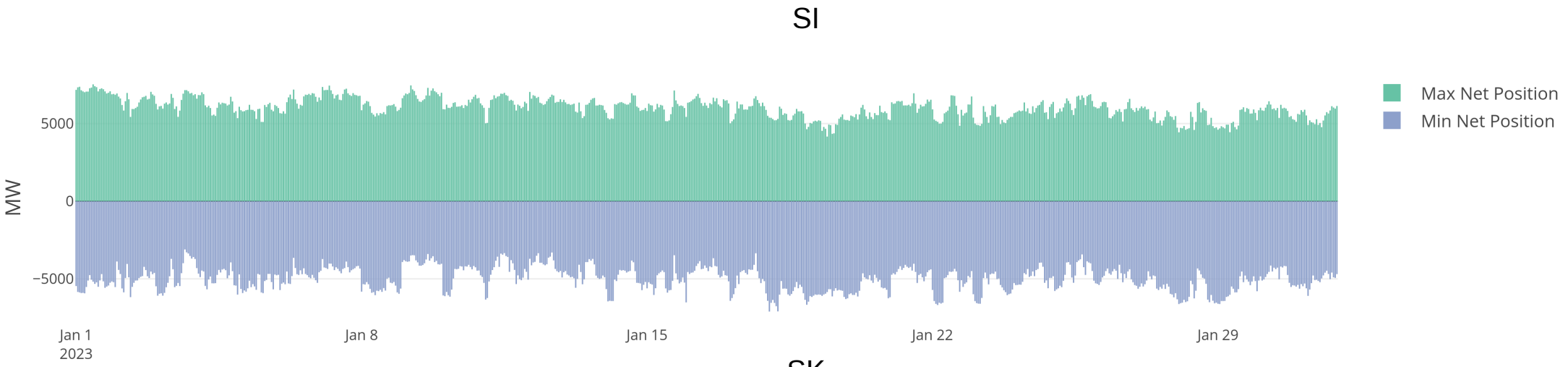


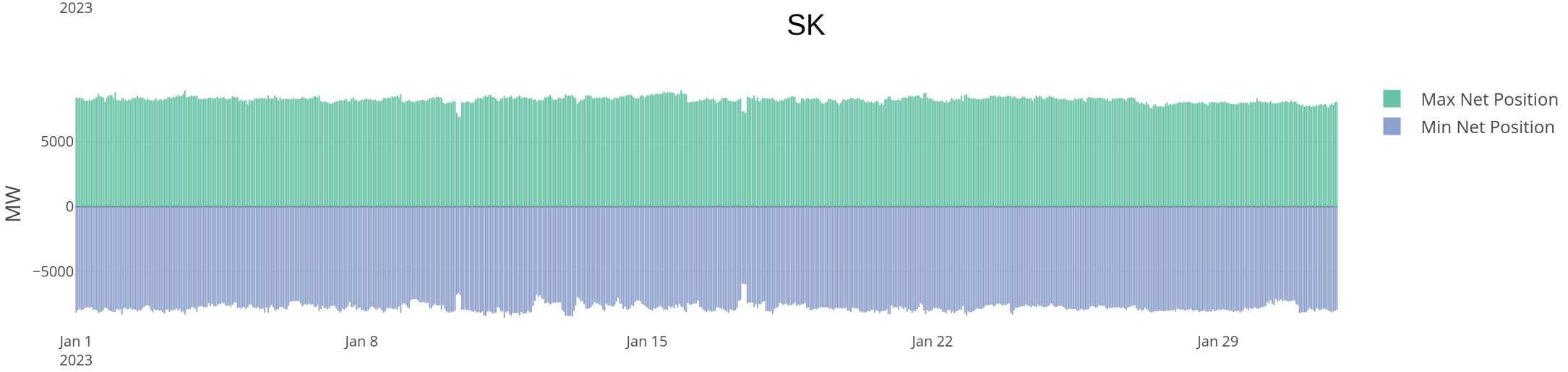
KPI 5: Min & max net positions per BZ hub



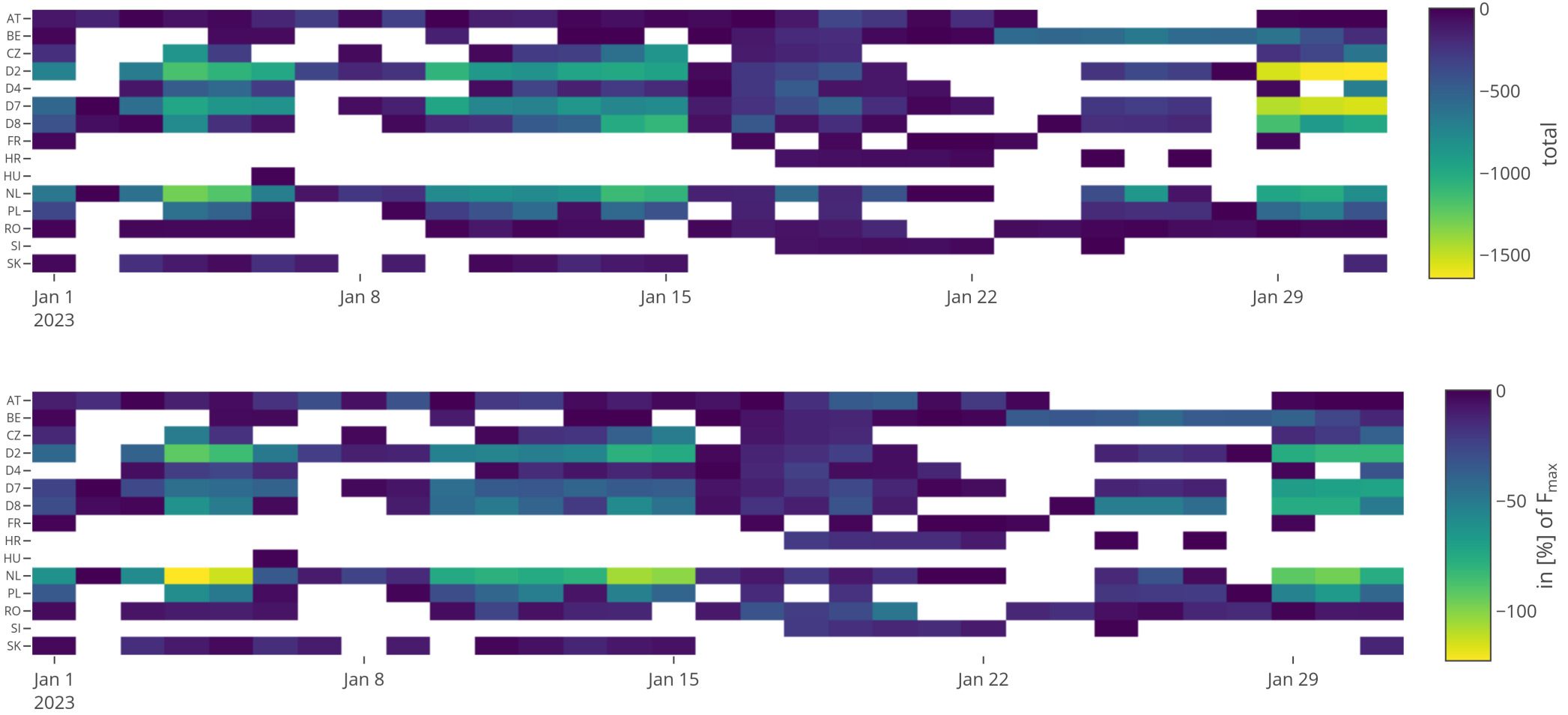


KPI 5: Min & max net positions per BZ hub

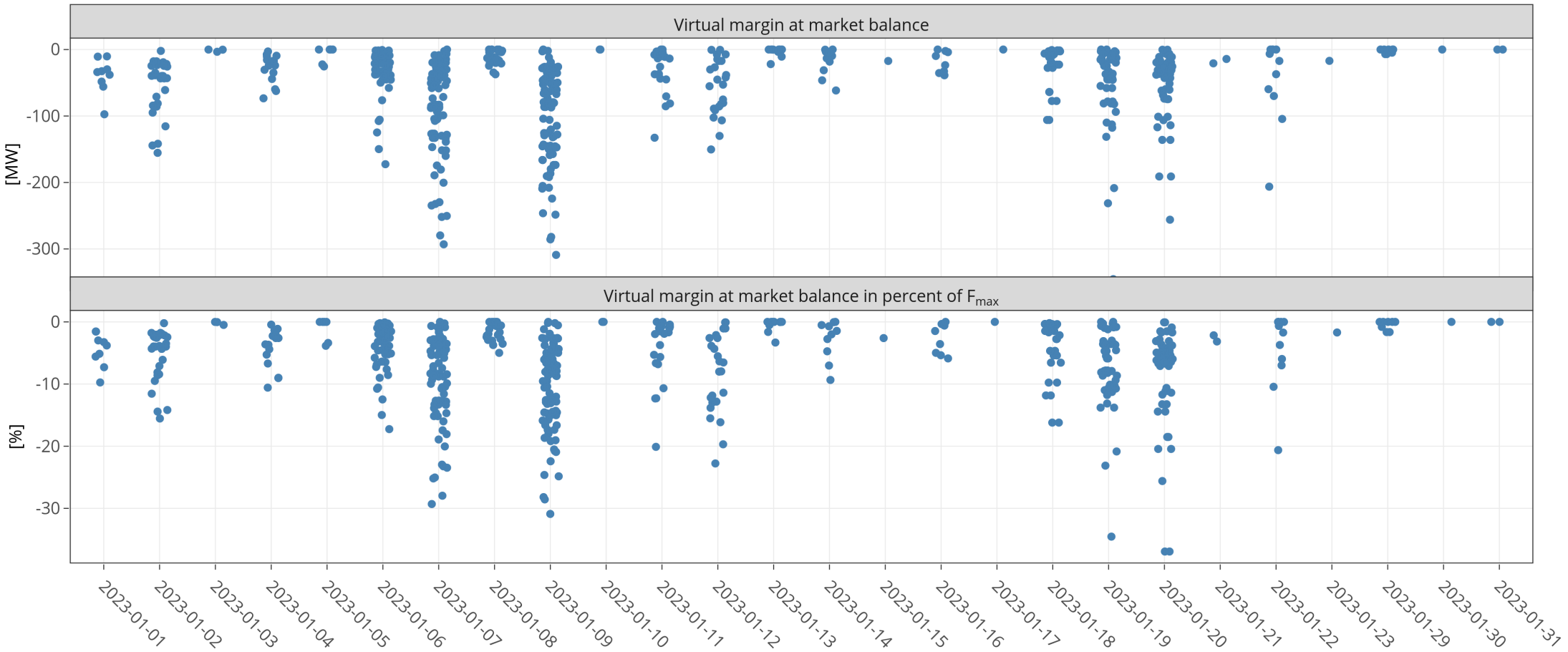




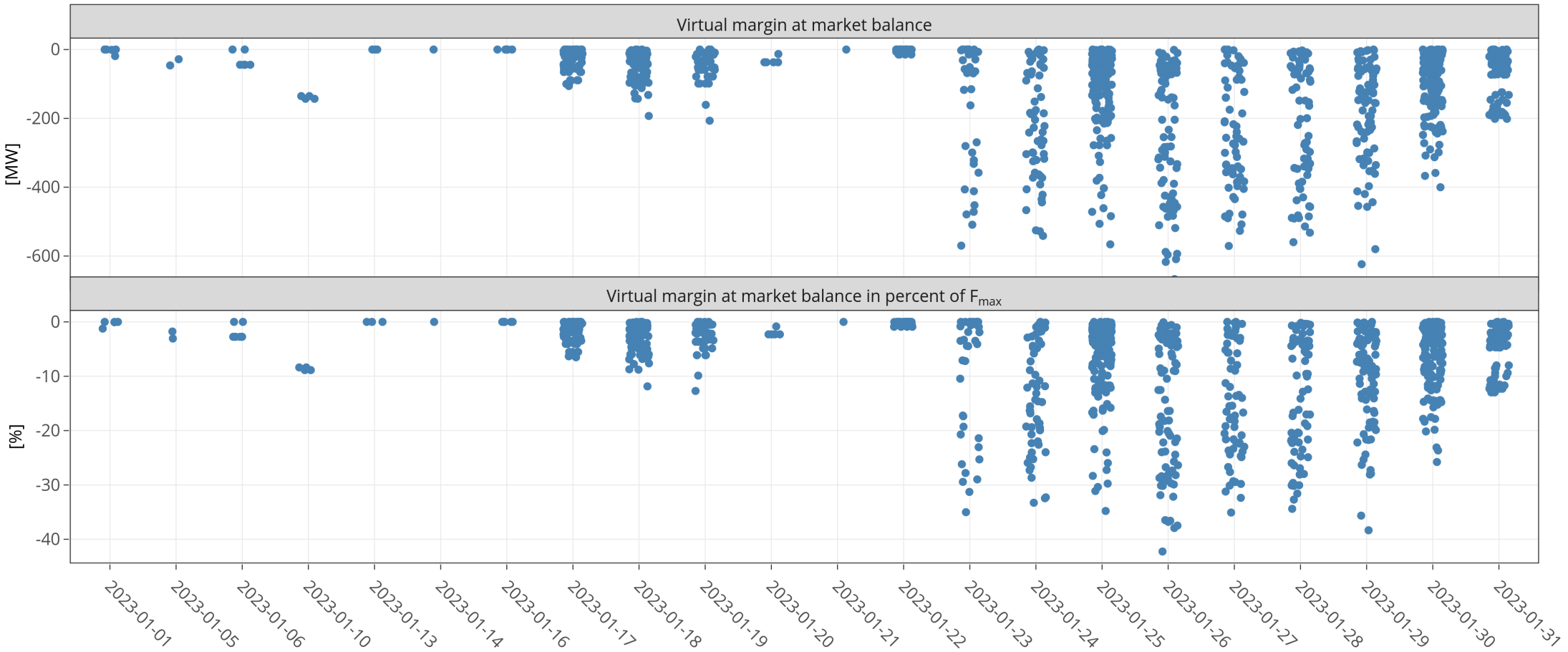
KPI 6a: Highest virtual margins at market balance for CORE TSOs



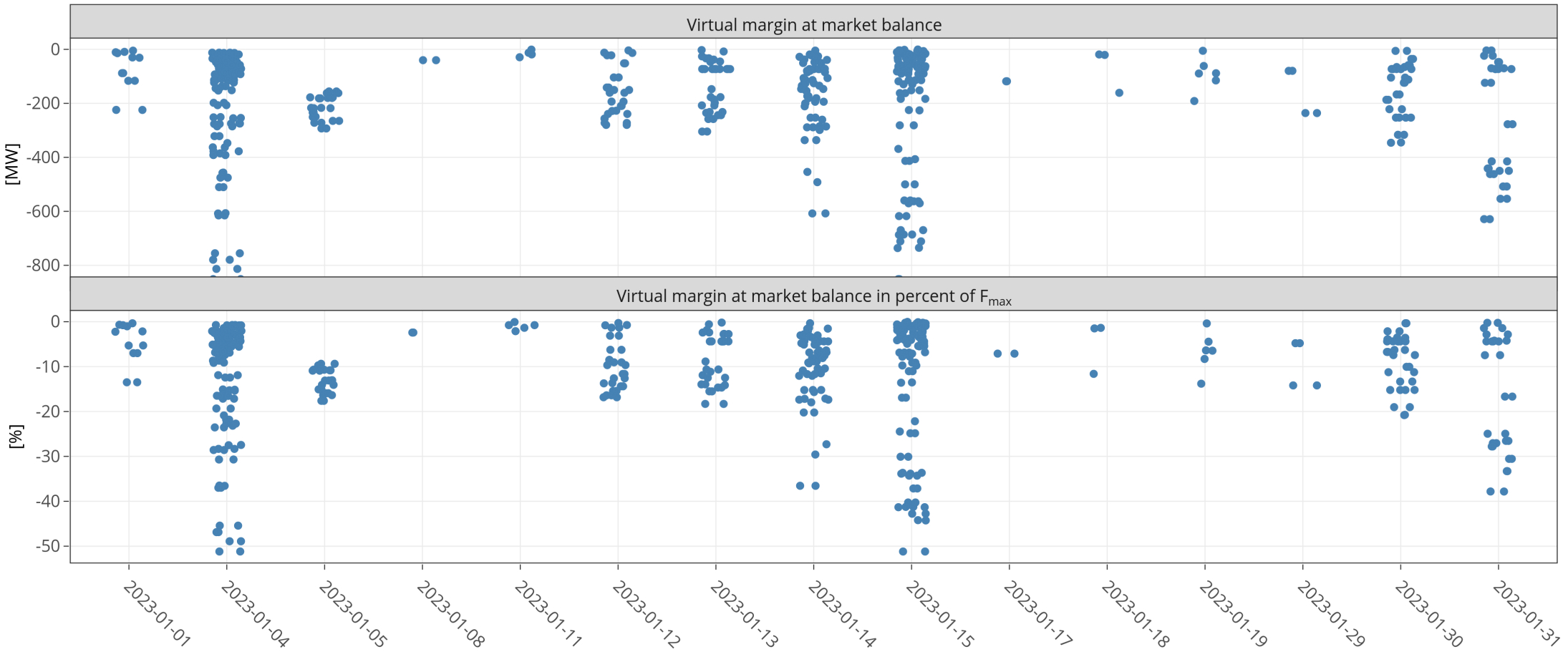
KPI 6b: Virtual margins at market balance AT



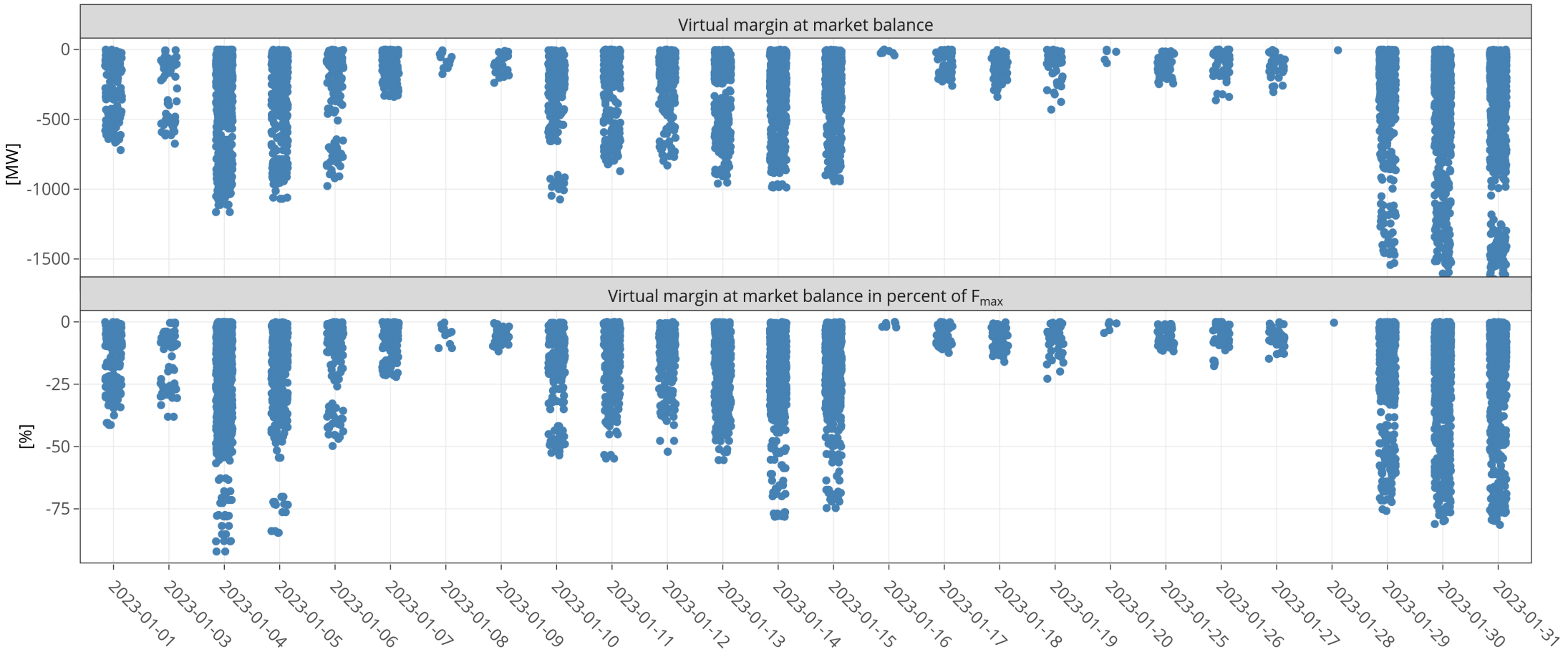
KPI 6b: Virtual margins at market balance BE



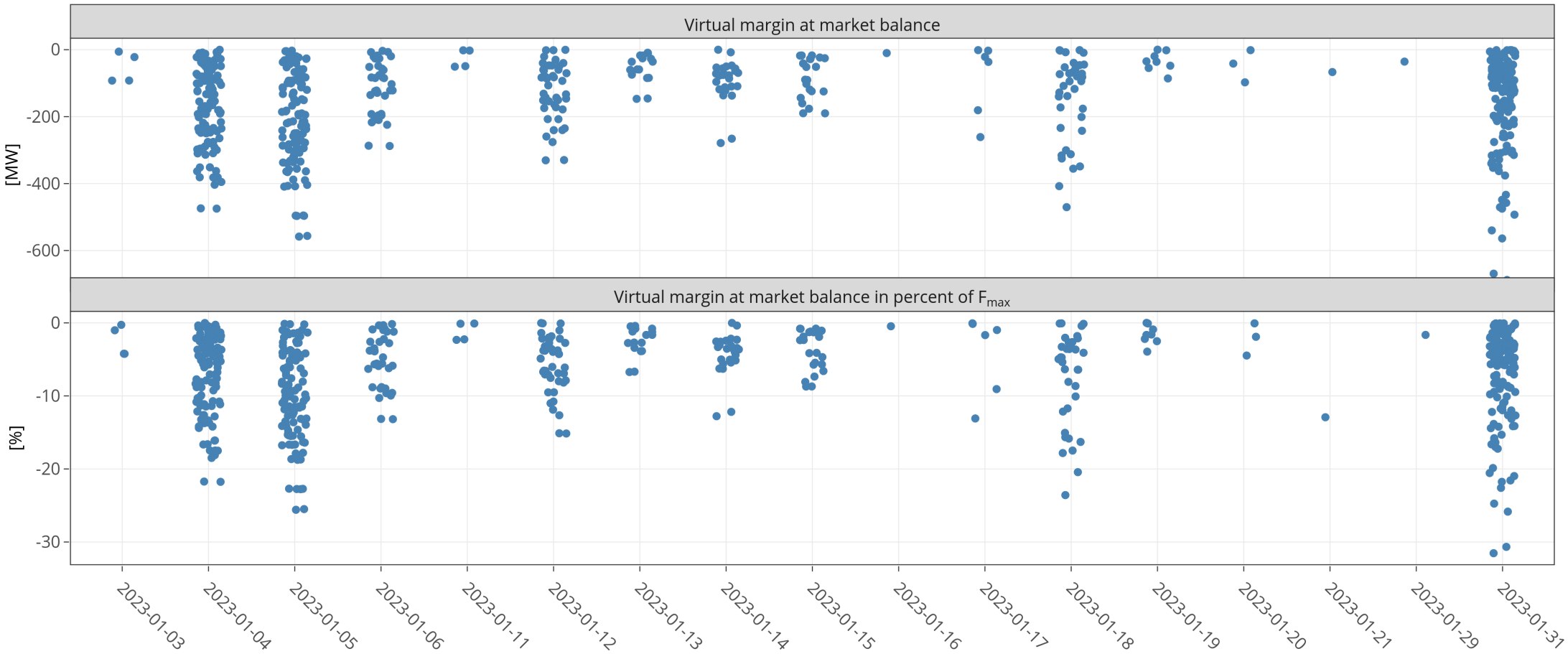
KPI 6b: Virtual margins at market balance CZ



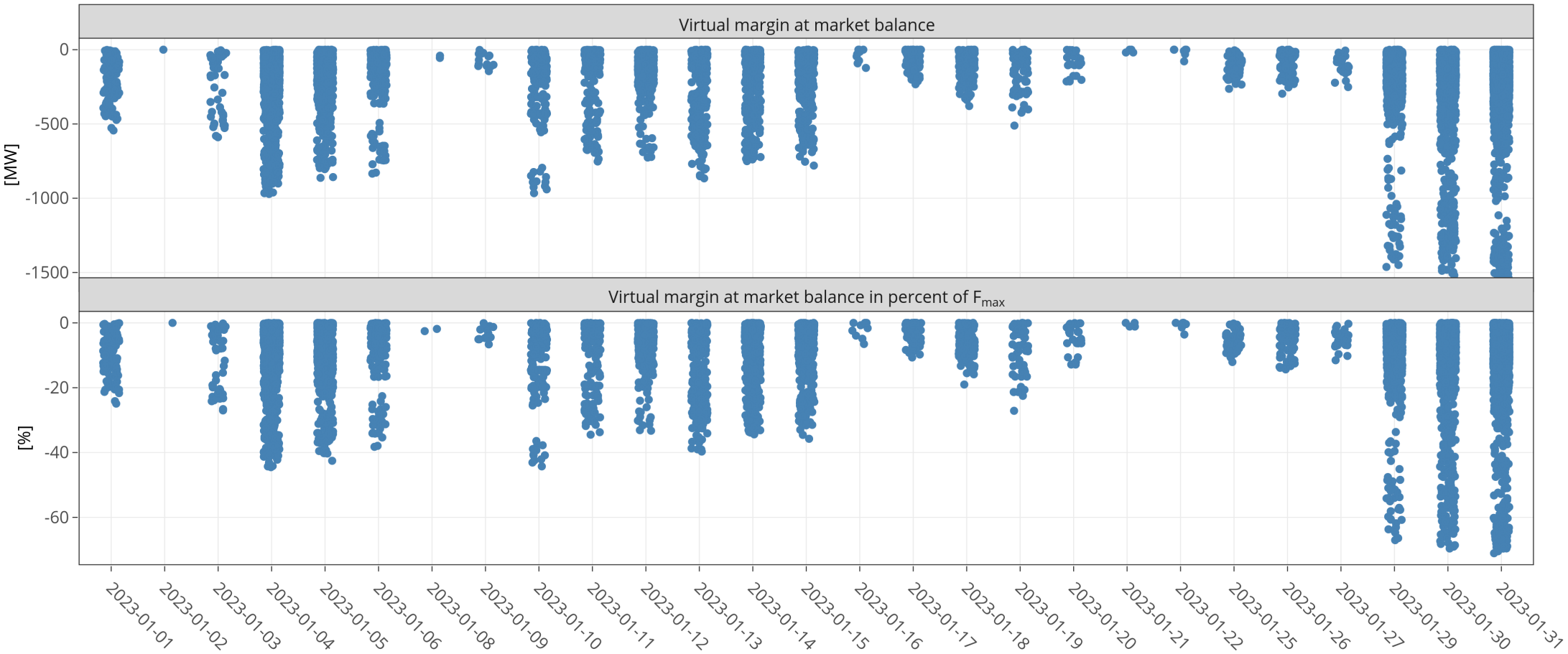
KPI 6b: Virtual margins at market balance D2



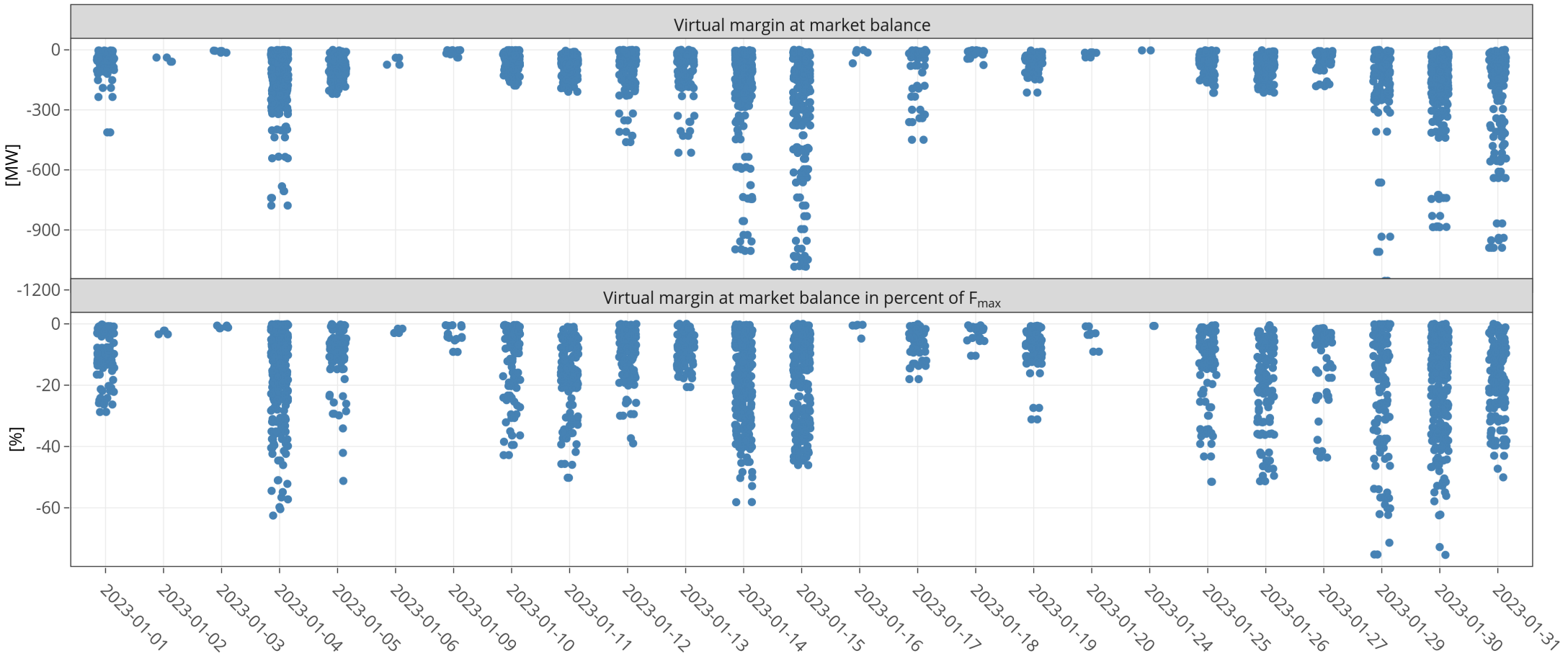
KPI 6b: Virtual margins at market balance D4



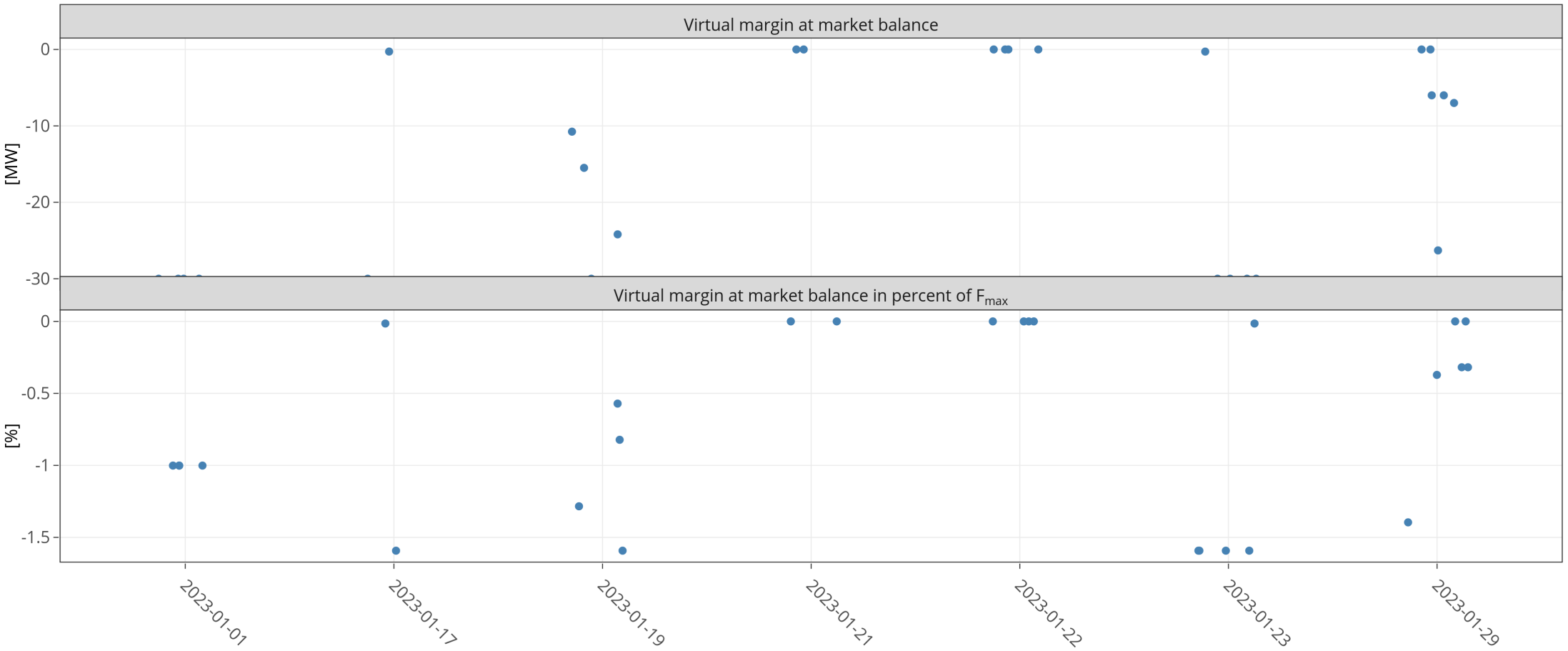
KPI 6b: Virtual margins at market balance D7



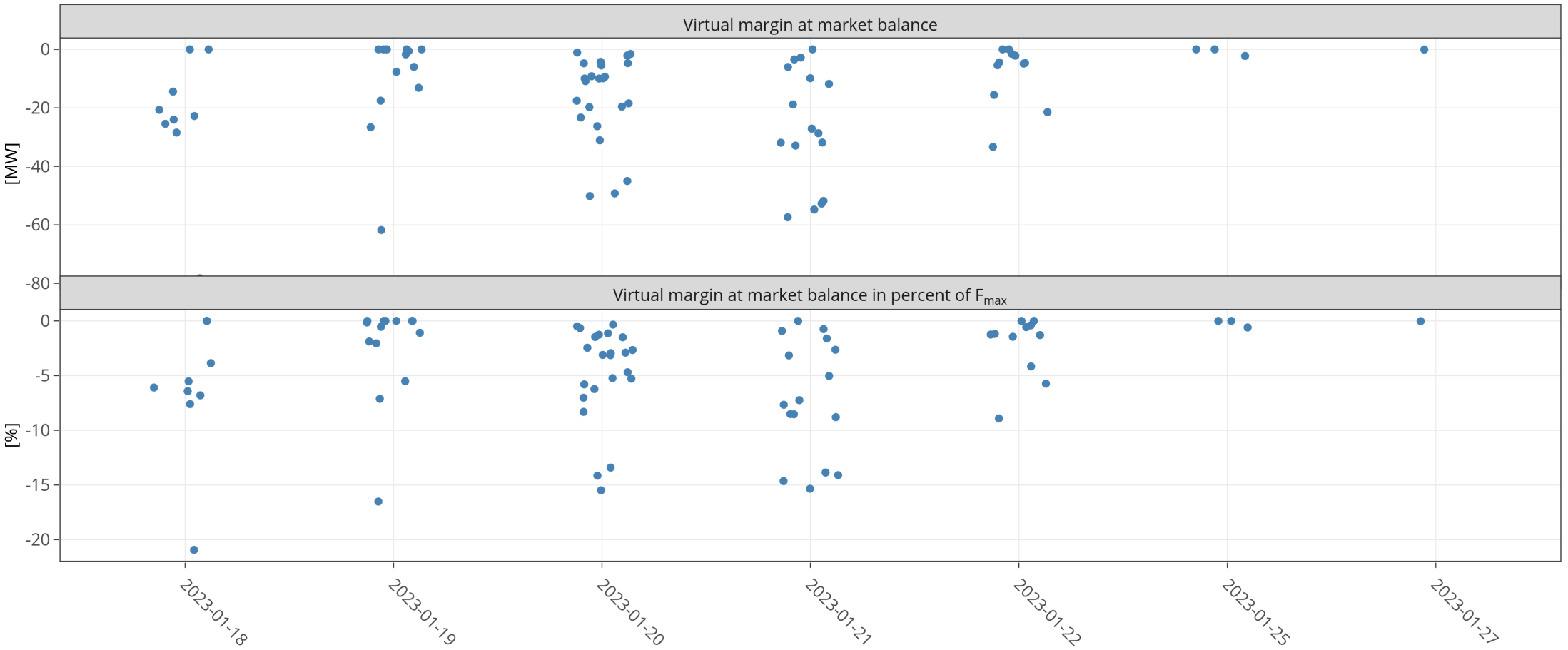
KPI 6b: Virtual margins at market balance D8



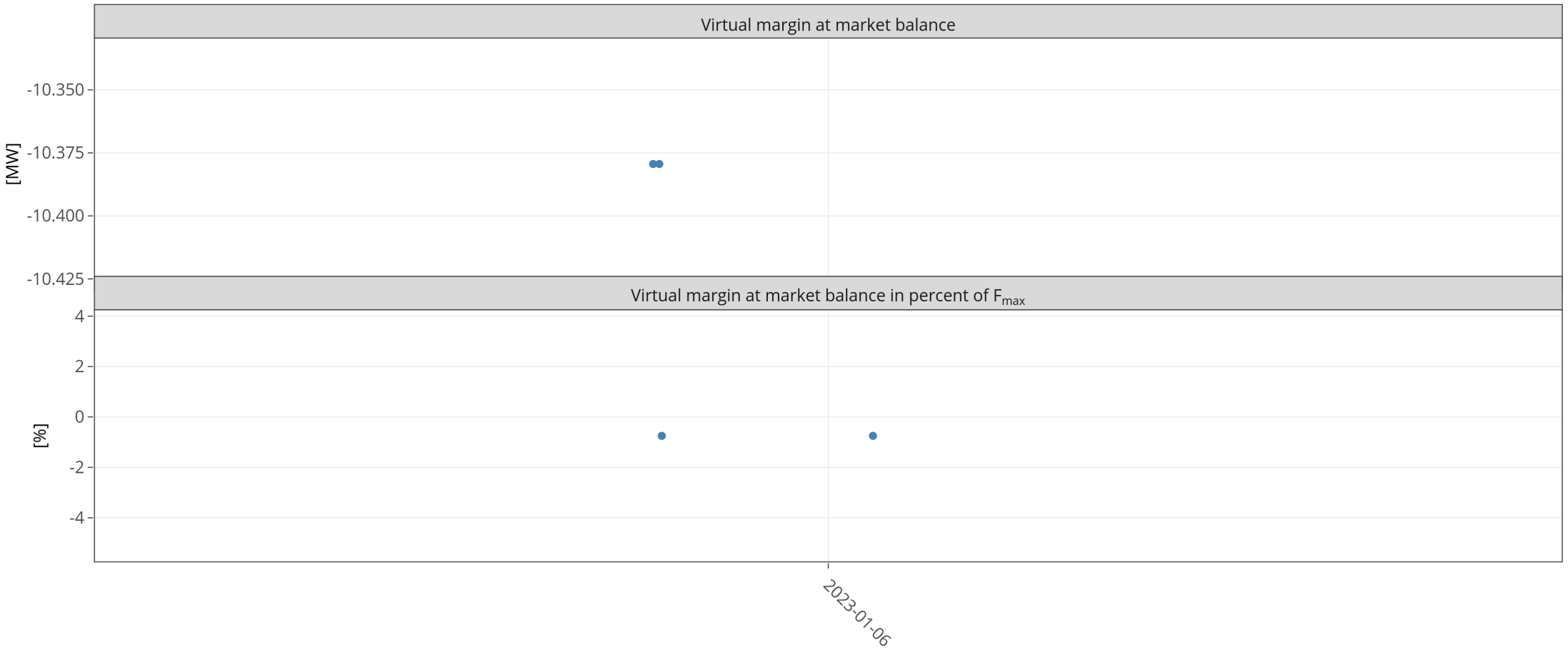
KPI 6b: Virtual margins at market balance FR



KPI 6b: Virtual margins at market balance HR

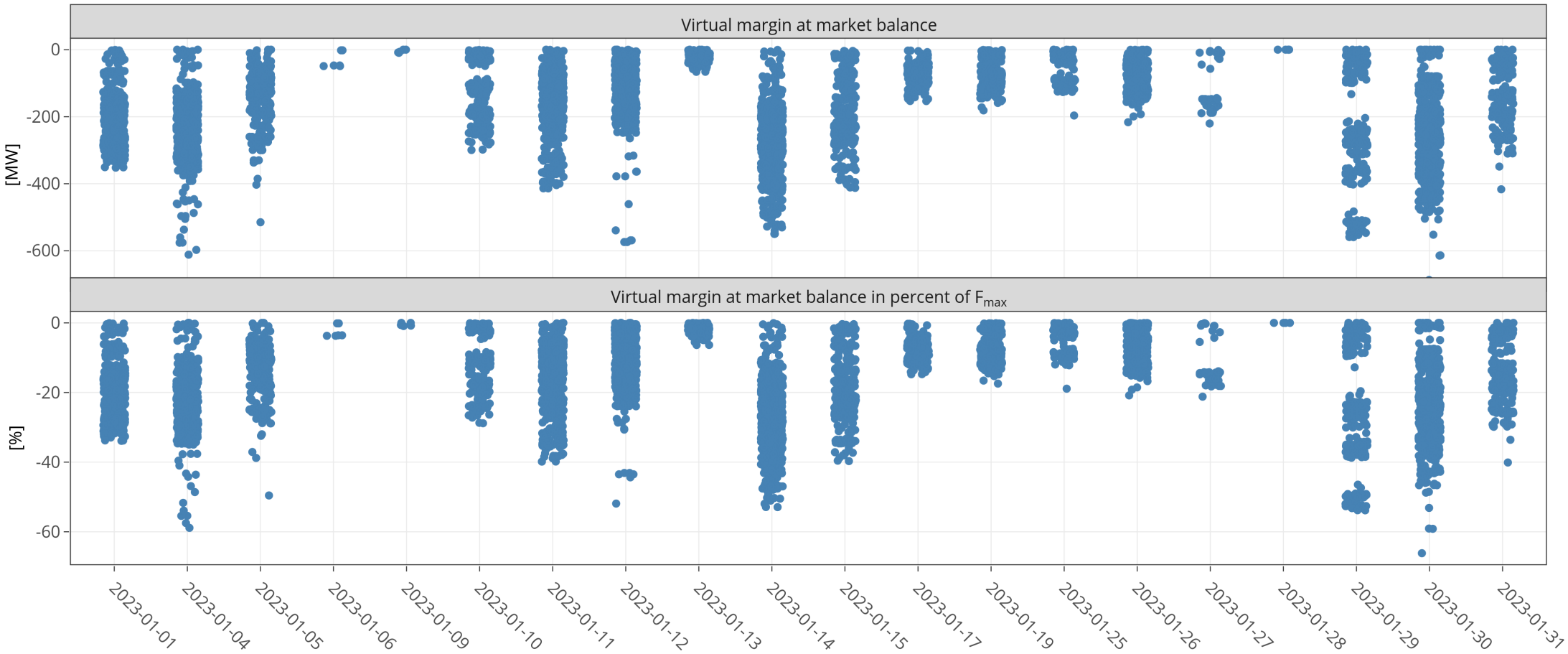


KPI 6b: Virtual margins at market balance HU

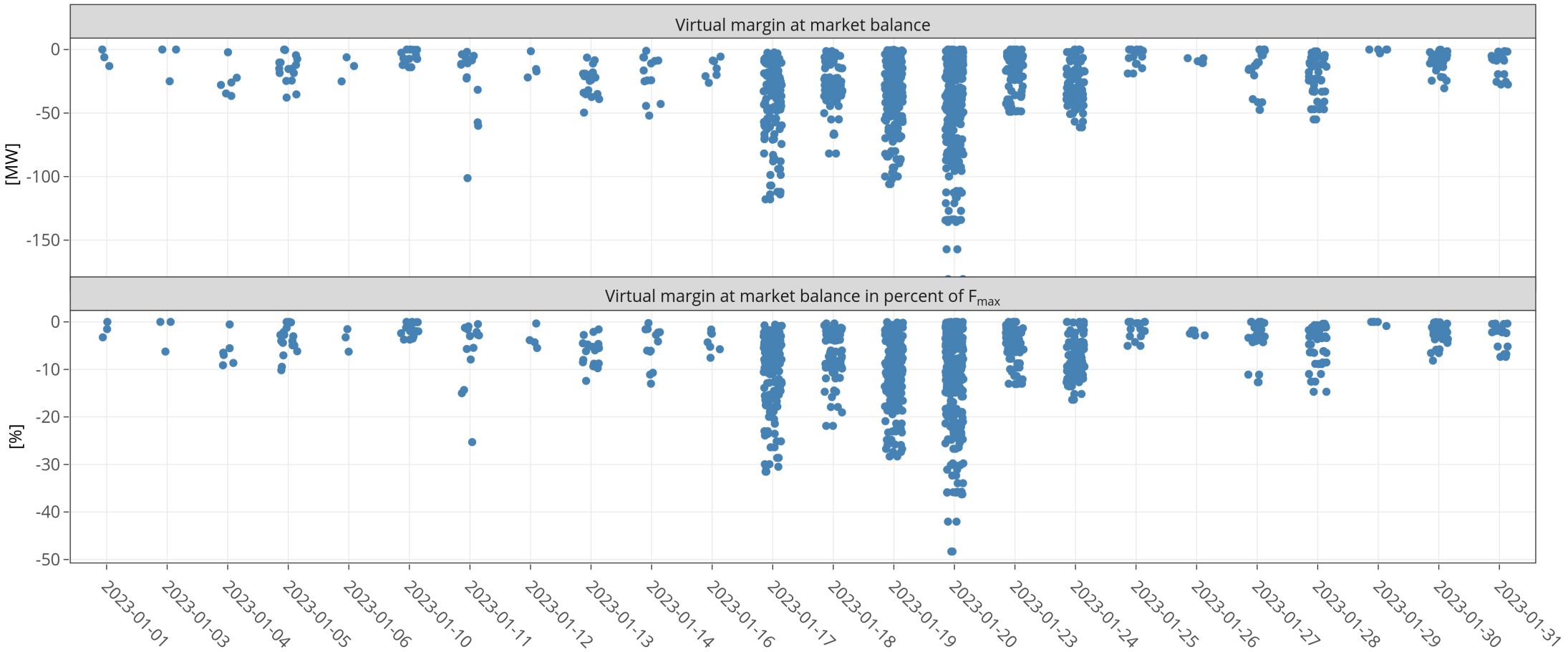


KPI 6b: Virtual margins at market balance NL

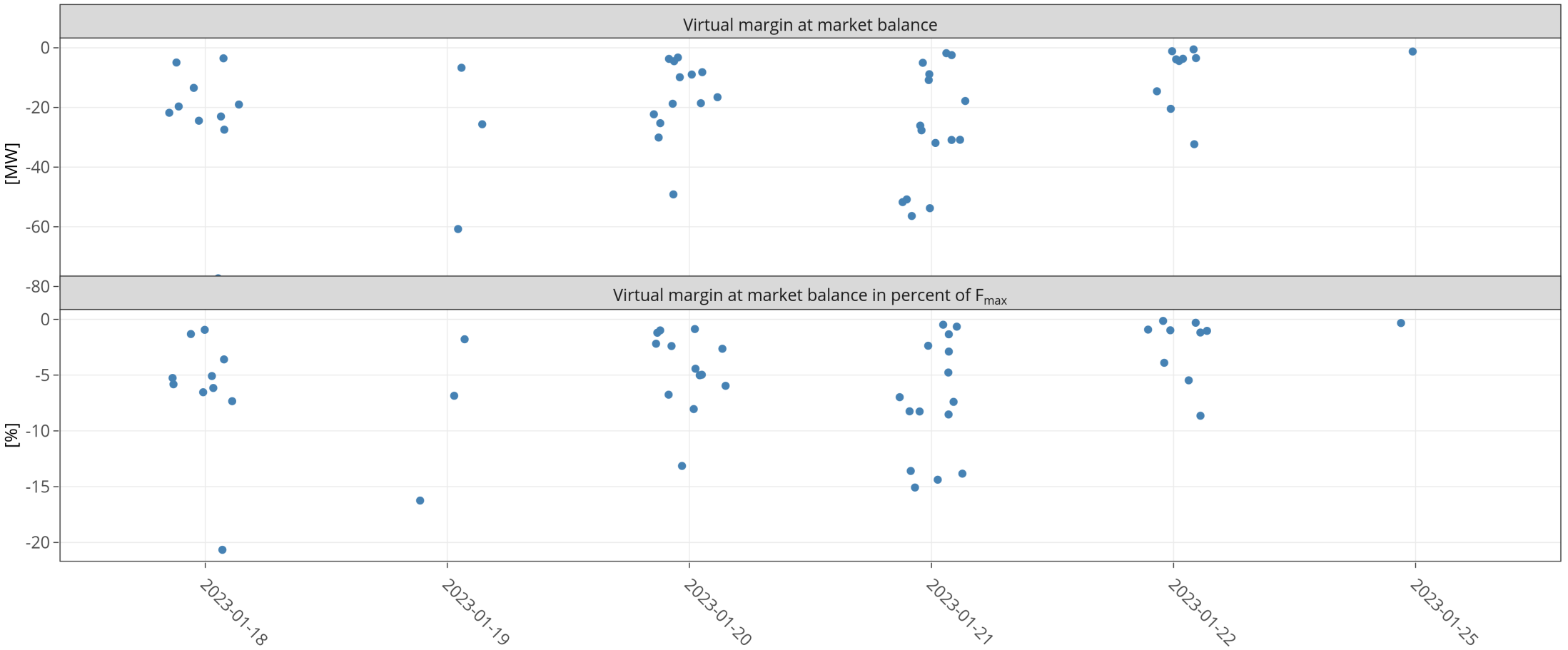
KPI 6b: Virtual margins at market balance PL



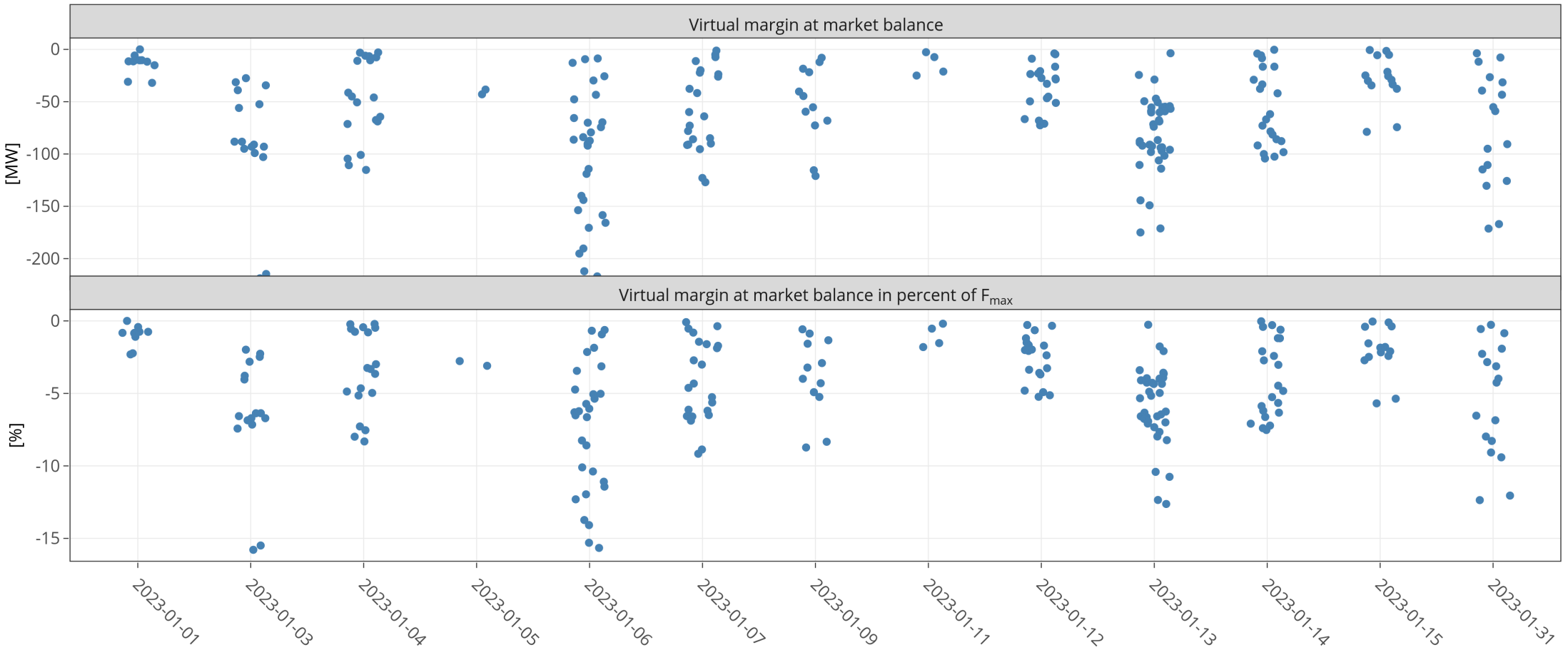
KPI 6b: Virtual margins at market balance RO



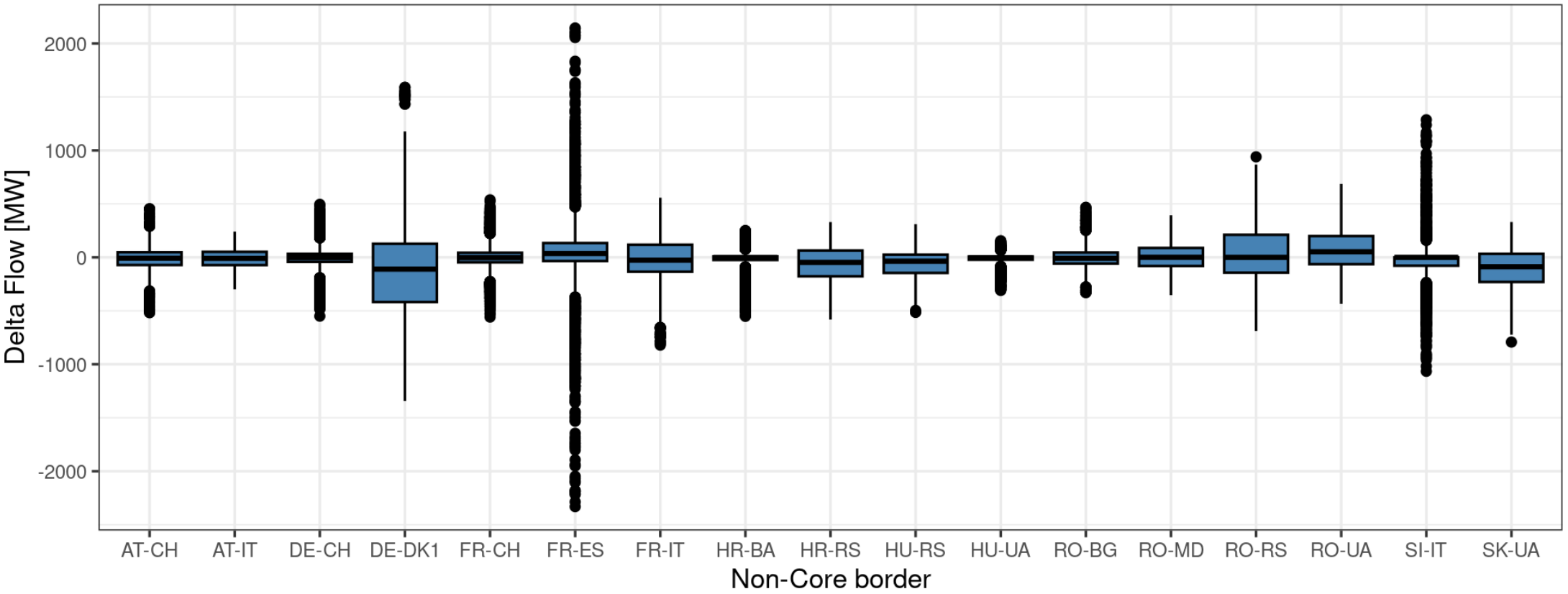
KPI 6b: Virtual margins at market balance SI



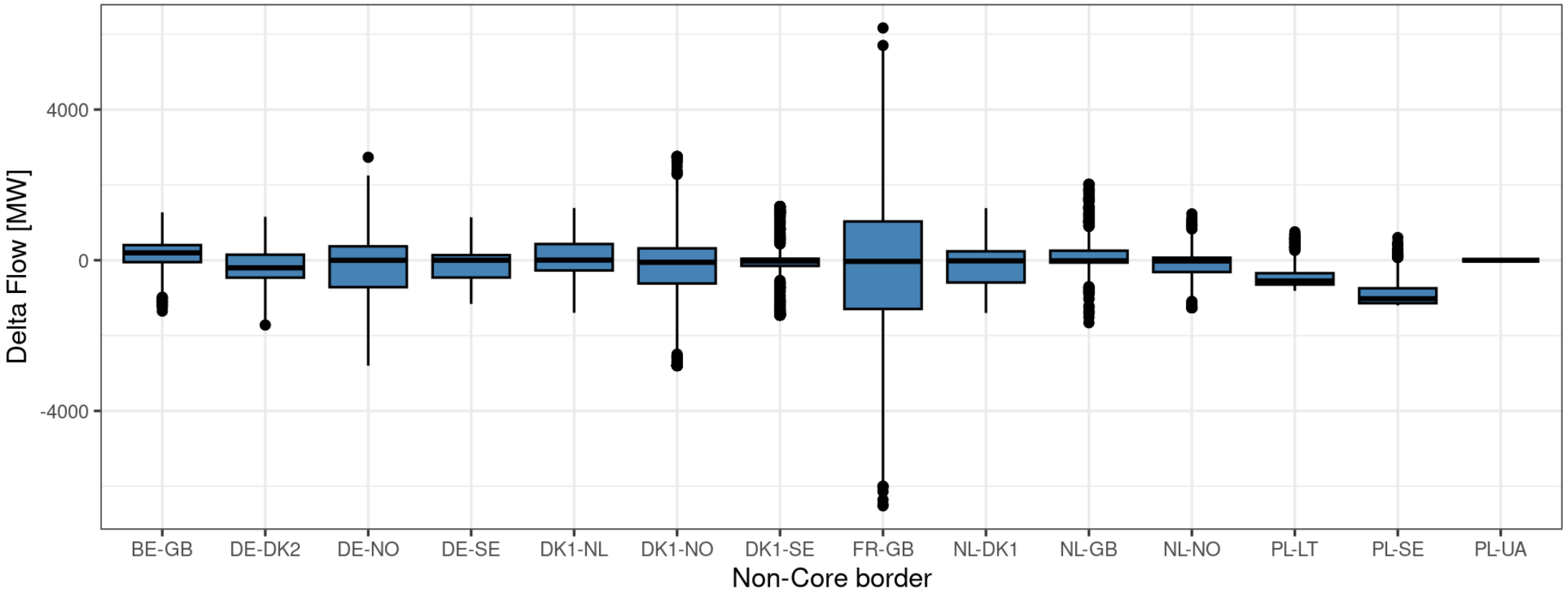
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow

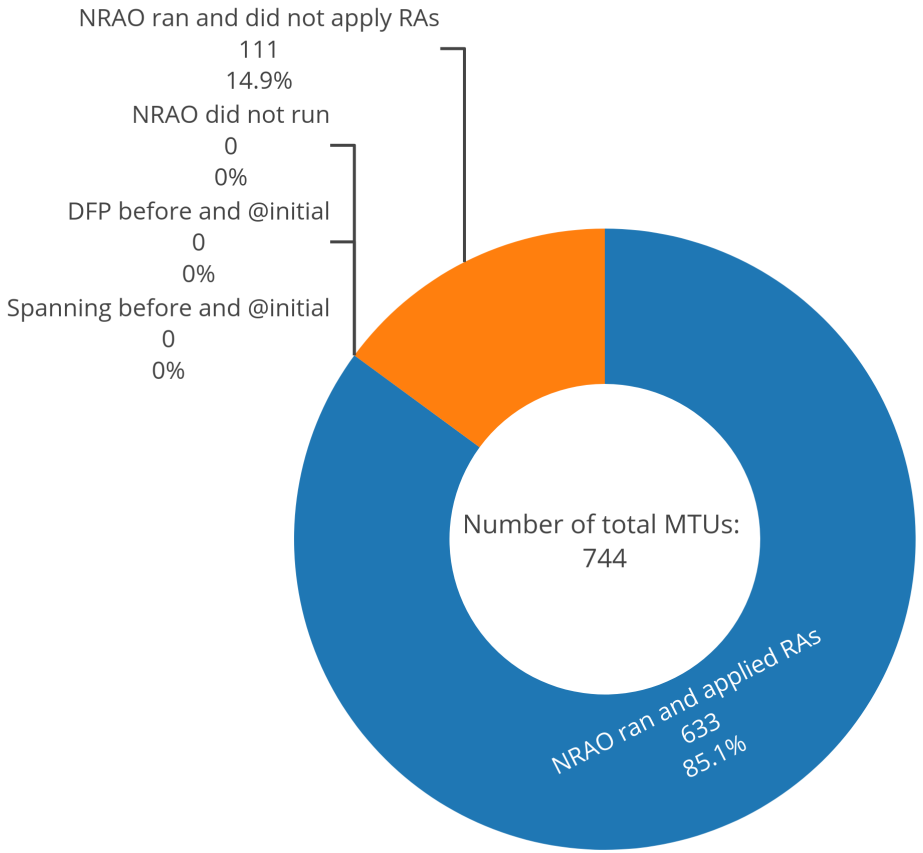


KPI 7: Non-Core exchanges DC delta flow

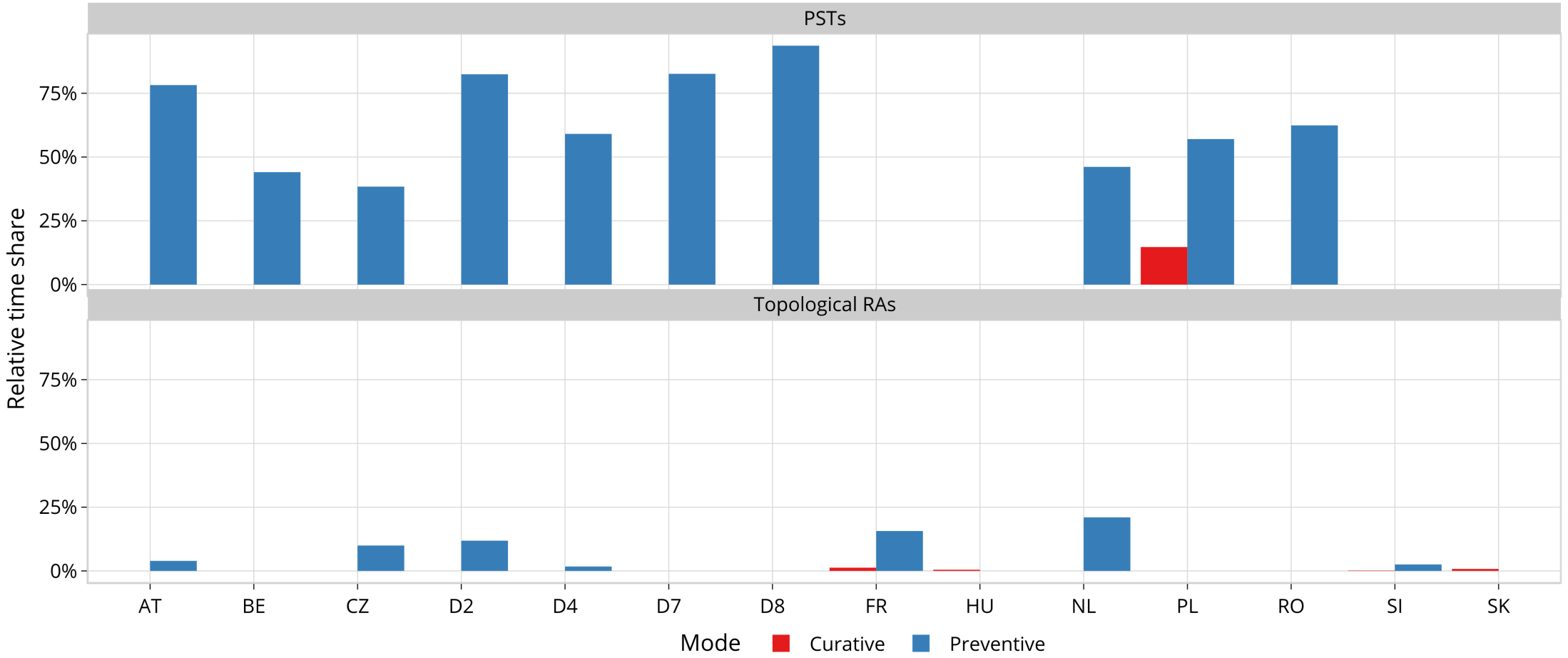


KPI 8: NRAO – Applied Remedial Action

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

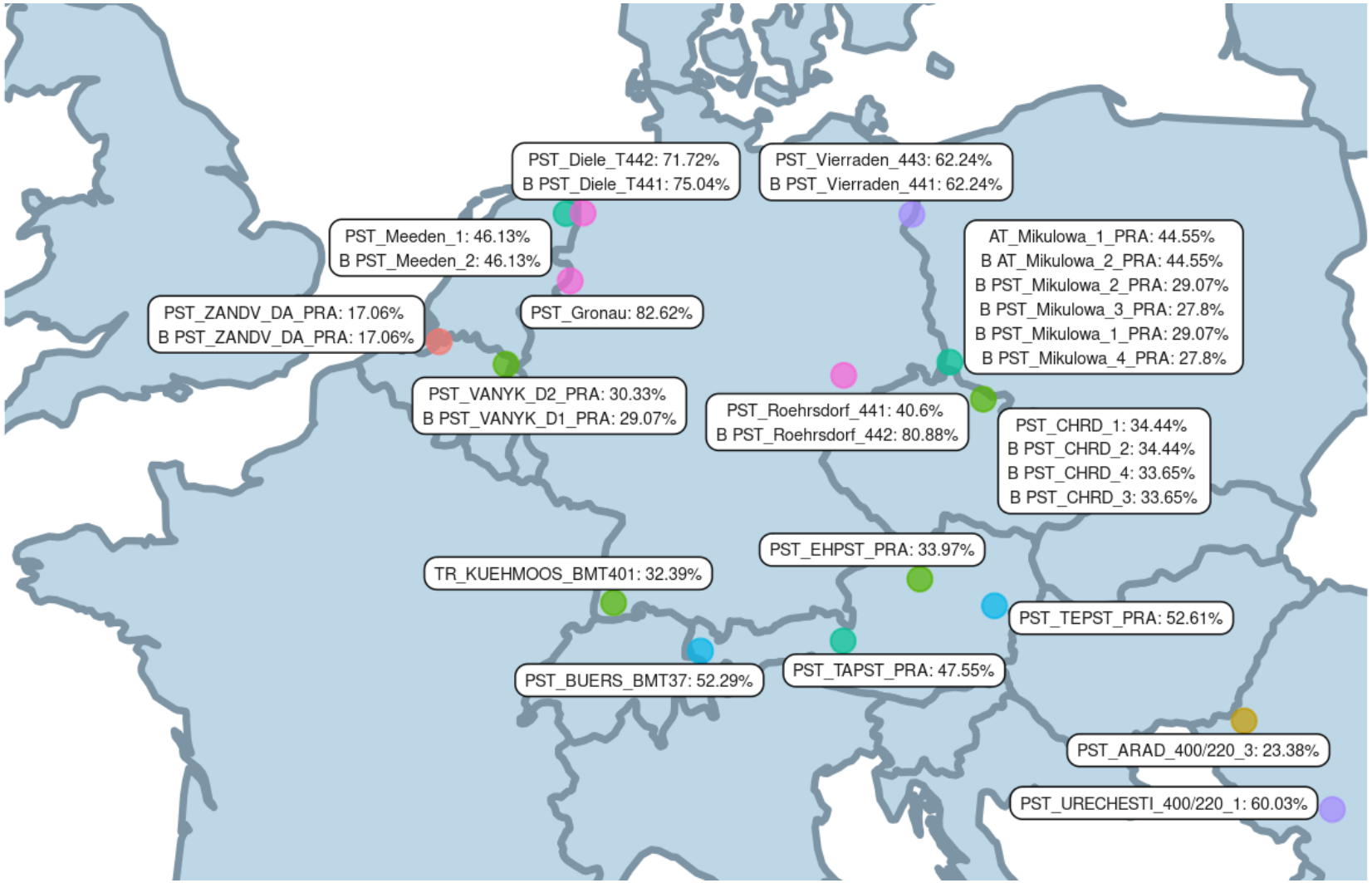


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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

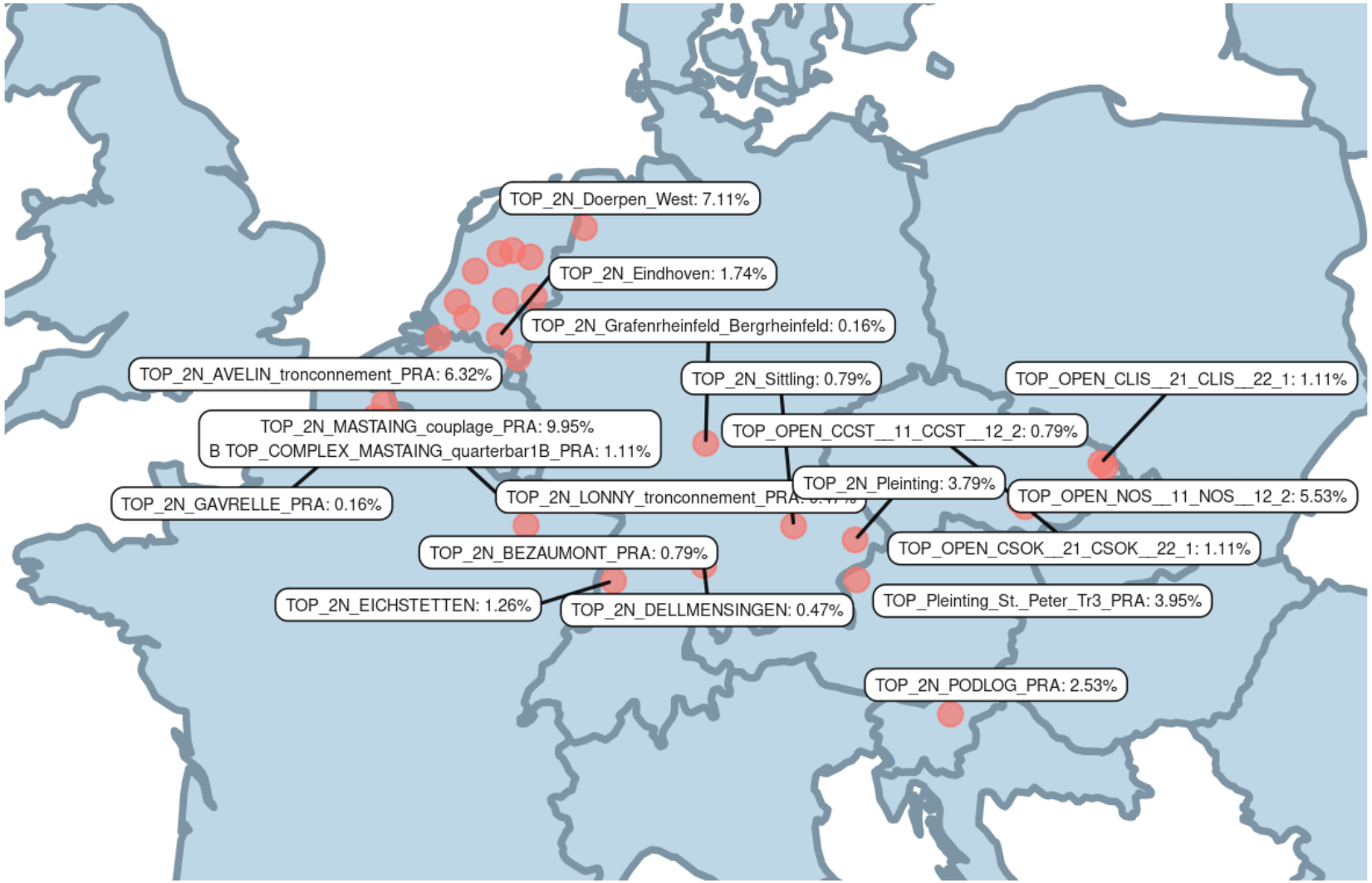
Relative Time Share of Applied PSTs in Curative Mode

Relative Time Share [%]

80%-90%

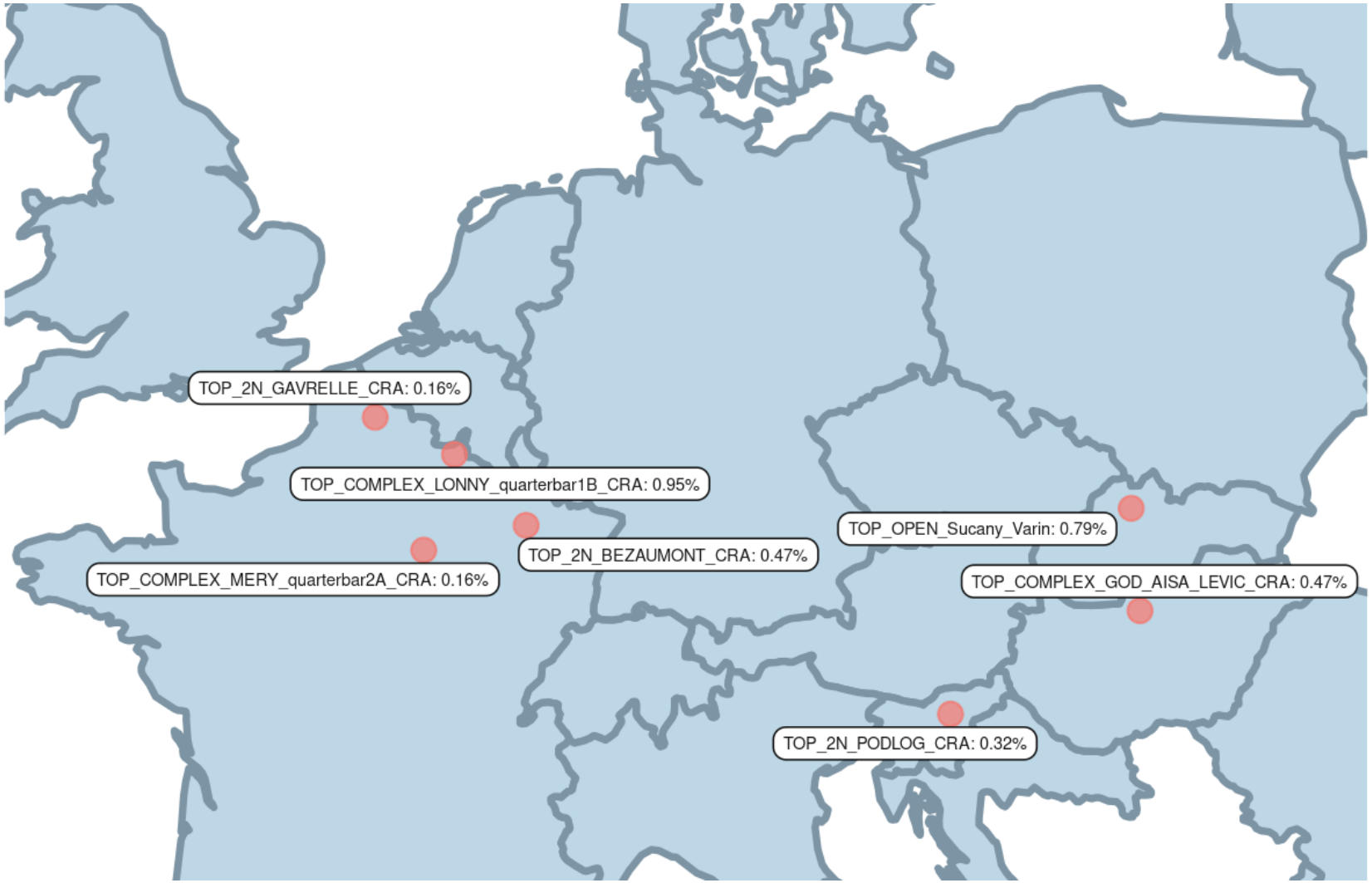
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

Relative Time Share of Applied Topological RAs in Preventive Mode



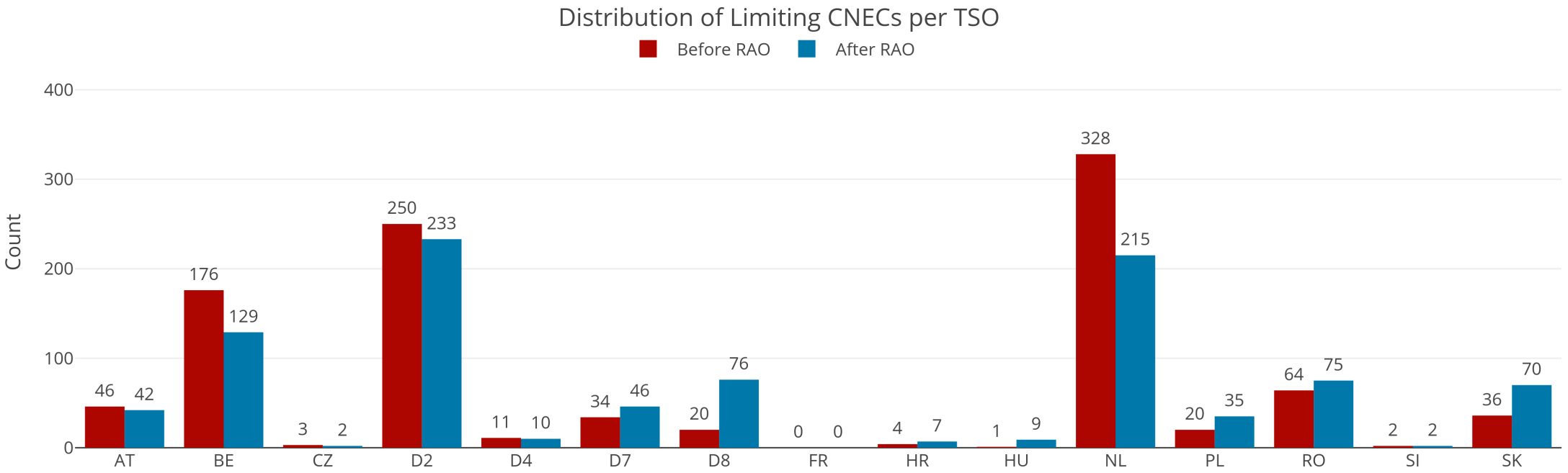
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

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



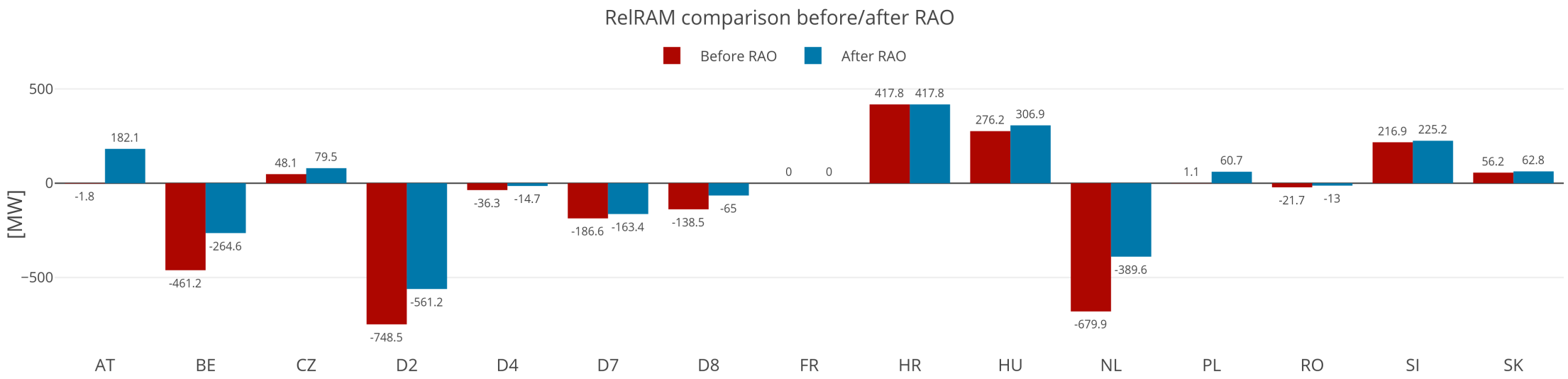
As expected, there is redistributing of the most limiting CNECs. This is because the application of Remedial Actions does not eliminate flows but re-routes, reducing the flows on some limiting CNECs and increasing the load on others, which at the end impacts also the RAM values.

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]	744	744	69.64%	50.36%	102.62%	0.2128	1.0644
[SK-SK] V.Dur - Levice 1 [DIR]	744	744	45.40%	22.80%	65.95%	0.198	0.7908
[HU-HU] Gonyu - Gyor [DIR]	744	1331	73.92%	50.76%	105.85%	0.2442	1.3571
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	744	918	118.05%	82.09%	181.02%	0.1994	0.5309
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	744	751	58.30%	21.39%	98.13%	0.1994	0.5309
[SK-HU] Gabcikovo - Gonyu [OPP] [HU]	739	1104	87.29%	67.44%	118.27%	0.2828	0.9616
[SK-SK] Gabcikovo - P.Biskupice [DIR]	739	739	89.81%	70.44%	111.84%	0.2924	1.0118
[SI-HU] Cirkovce - Heviz [DIR] [HU]	739	739	109.46%	73.56%	148.47%	0.2128	1.0644
[SK-HU] Gabcikovo - Gonyu [DIR] [HU]	735	737	86.57%	63.25%	110.47%	0.2828	0.9616
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	735	749	54.21%	22.51%	87.16%	0.3251	1.1409
[HR-HU] 400kV Ernestinovo - Pecs 1 [OPP] [HR]	735	735	67.13%	40.30%	111.73%	0.2607	0.8382
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	734	798	69.87%	25.00%	105.52%	0.2184	0.597
[SK-CZ] Krizovany - Sokolnice [OPP] [SK]	733	733	95.04%	71.43%	109.96%	0.3055	1.2137
[RO-RO] TR Rosiori 400/220 1 [DIR]	731	731	39.70%	7.75%	98.25%	0.1169	0.1969
[CZ-SK] Nosovice - Varin [OPP] [SK]	724	1878	104.40%	75.40%	137.45%	0.331	1.2586
[SK-HU] R.Sobota - Sajoivanka [DIR] [HU]	722	722	76.45%	55.96%	107.58%	0.248	0.8191
[CZ-SK] Nosovice - Varin [DIR] [SK]	722	2340	78.66%	53.68%	107.29%	0.331	1.2529
[CZ-D2] Hradec - Etzenricht 441 [DIR] [D2]	721	721	53.57%	30.16%	104.69%	0.2184	0.9411
[HU-HU] Gonyu - Gyor [OPP]	721	721	107.49%	74.22%	145.56%	0.2084	1.357
[SK-UA] V.Kapusany - Mukachevo (WPS) [DIR] [SK]	719	719	81.23%	45.41%	128.72%	0.2372	0.8634

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
[AT-D2] St. Peter 2 - Pleinting 258 [OPP] [AT]	171	171	1246.47	85.37%	58.64%	113.56%	0.1317
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	154	154	1459.62	27.44%	19.94%	105.13%	0.2564
[D8-PL] Krajnik - Vierraden 2 [OPP] [PL]	152	152	1513.57	17.43%	0.00%	39.85%	0.2426
[BE-BE] Doel - Zandvliet 380.25 [OPP]	130	131	434.48	40.50%	20.04%	61.89%	0.4515
[RO-RO] Resita - Timisoara c1 [DIR]	102	102	2191.34	22.51%	6.42%	50.00%	0.1063
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	100	100	1132.58	51.05%	21.39%	83.16%	0.1867
[NL-BE] PST Zandvliet 1 [DIR] [BE]	91	91	340.21	47.85%	26.21%	77.08%	0.3852
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	90	90	688.82	40.98%	22.51%	60.82%	0.3226
[SK-SK] V.Dur - Levice 1 [DIR]	88	88	1184.26	40.70%	22.80%	53.32%	0.1935
[D7-D7] Buerstadt - Lambsheim BUERST W [DIR]	83	83	907.7	43.73%	32.58%	63.66%	0.1417
[BE-FR] Achene - Lonny 380.19 [DIR] [BE]	67	67	350.43	60.26%	46.47%	78.12%	0.2297
[RO-RO] TR Rosiori 400/220 1 [DIR]	64	64	1299.05	25.06%	7.75%	37.25%	0.1074
[NL-NL] Diemen-Lelystad 380 W [OPP]	62	62	430.06	22.93%	19.97%	47.35%	0.3084
[CZ-D8] Hradec - Rohrsdorf 446 [OPP] [D8]	56	56	426.24	39.61%	32.25%	52.63%	0.2746
[D7-D7] Y Paffendorf - Oberzier SECHTM S [DIR]	55	55	204.7	71.18%	51.05%	98.85%	0.4864
[D8-PL] Mikulowa PST1 [OPP] [PL]	54	54	484.47	44.35%	27.35%	74.62%	0.3787
[PL-PL] Krosno Iskrzynia - Tarnow [OPP]	40	40	611.45	46.96%	25.11%	79.29%	0.369
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	40	40	76.44	60.62%	49.84%	75.53%	0.1909
[RO-RO] TR Portile de Fier 400/220 1 [OPP]	39	39	585.8	37.98%	0.00%	80.40%	0.1637
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	38	38	173.69	51.46%	26.17%	81.70%	0.1551

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:

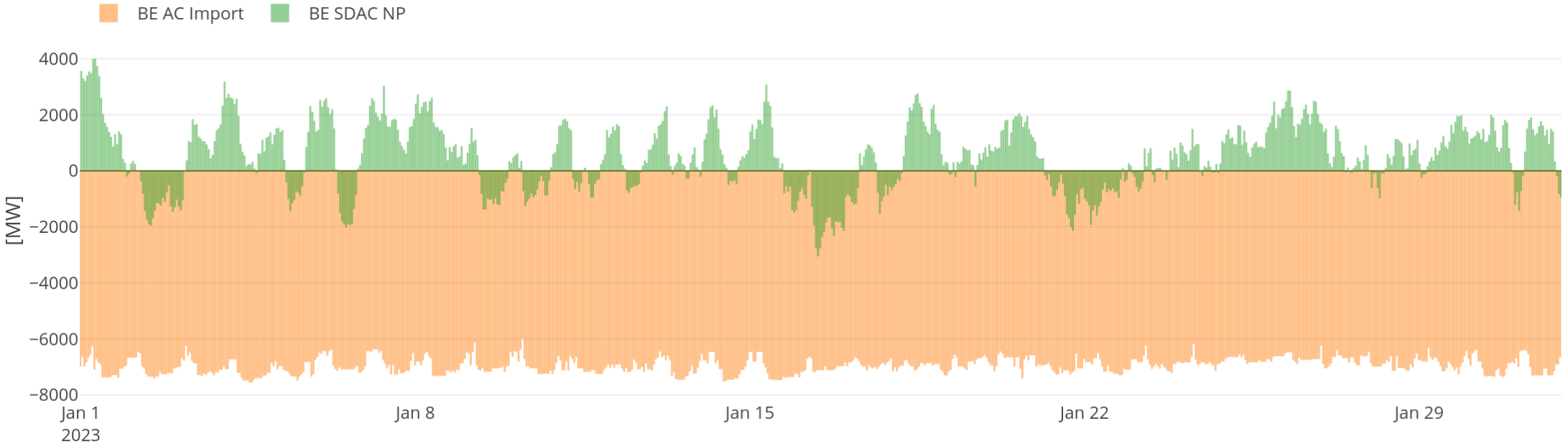
- RAM = 500MW
- Portion of FB Domain = 40%
- RAM offered by Core TSOs = 400mW/0.4 = 1250MW

KPI 13a: Allocation Constraints - Belgium

	# MTUs
AC was Limiting MC	0

	BE AC Import [MW]
Avg.	-6927.63
Min.	-7540.00
Max.	-5983.00

Belgium only uses import allocation contraints



KPI 13b: Allocation Constraints - Poland

	# MTUs
AC was limiting MC	336
AC < 0 MW	41
AC = 0 MW	246
AC > 0 MW	49

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1929.19	1346.28
Min.	-8123.00	0.00
Max.	0.00	10247.00