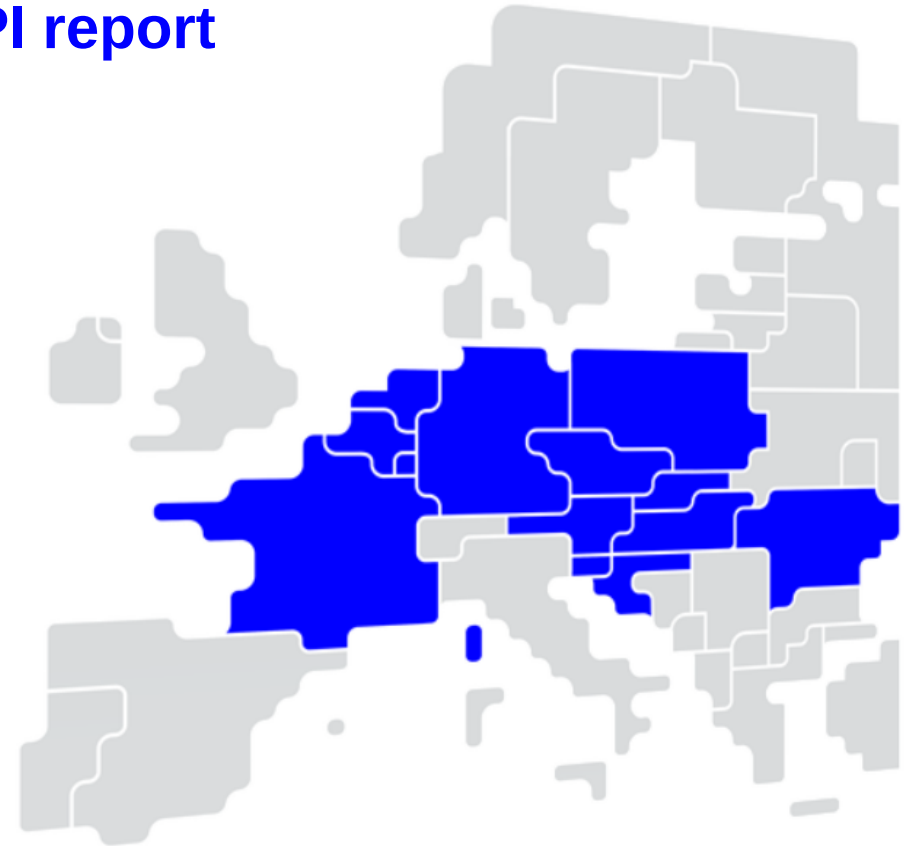


# Core FB MC Operational KPI report

May 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)

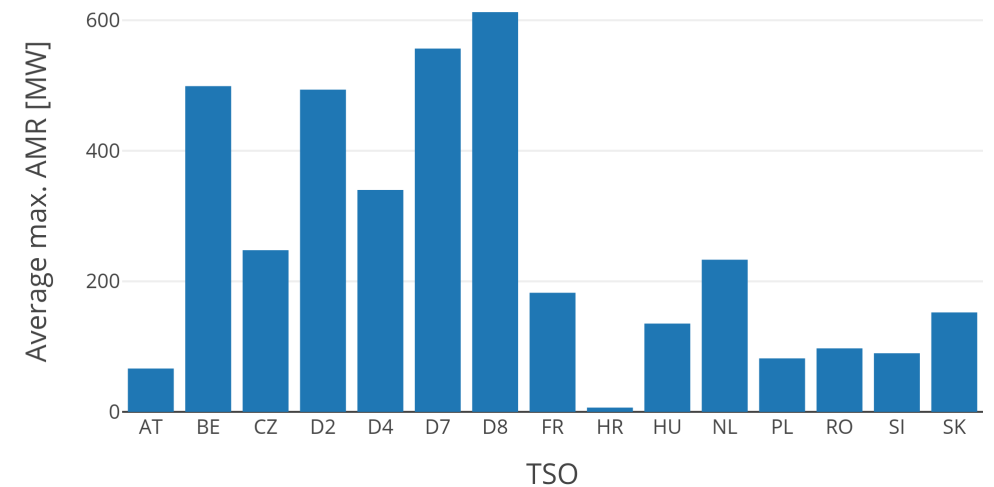
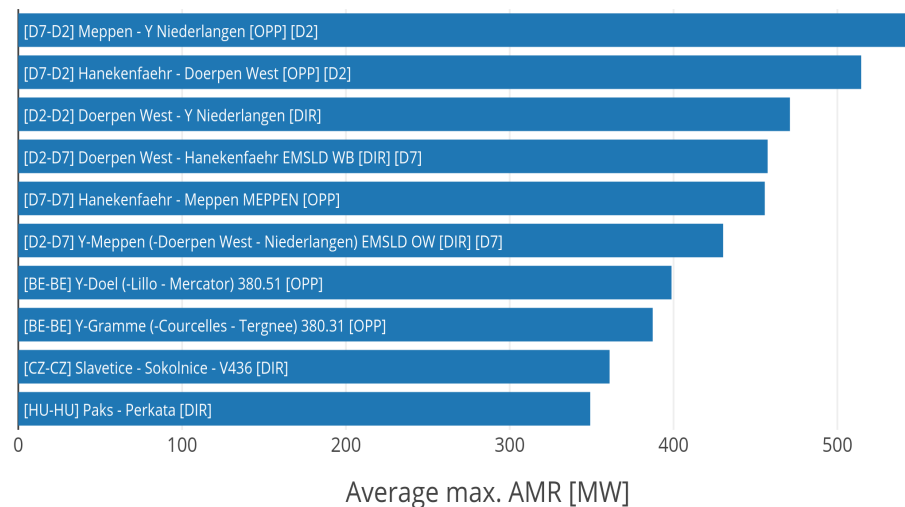
# KPI 2: Average maximum AMR per TSO



CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	544.54	28.88%
[D7-D2] Hanekenfaehr - Doerpen West [OPP] [D2]	514.54	27.67%
[D2-D2] Doerpen West - Y Niederlangen [DIR]	471.04	25.32%
[D2-D7] Doerpen West - Hanekenfaehr EMSLD WB [DIR] [D7]	457.44	21.87%
[D7-D7] Hanekenfaehr - Meppen MEPPEN [OPP]	455.69	21.45%
[D2-D7] Y-Meppen (-Doerpen West - Niederlangen) EMSLD OW [DIR] [D7]	430.26	17.85%
[BE-BE] Y-Doel (-Lillo - Mercator) 380.51 [OPP]	398.75	26.97%
[BE-BE] Y-Gramme (-Courcelles - Tergnee) 380.31 [OPP]	387.27	24.95%
[CZ-CZ] Slavetice - Sokolnice - V436 [DIR]	360.96	22.19%
[HU-HU] Paks - Perkata [DIR]	349.12	24.97%

TSO	Average maximum AMR per TSO
AT	66.45
BE	499.10
CZ	247.72
D2	493.75
D4	339.99
D7	556.59
D8	612.44
FR	182.40
HR	6.58
HU	135.25

TSO	Average maximum AMR per TSO
NL	233.08
PL	81.97
RO	97.35
SI	89.81
SK	152.36



# KPI 3: Share of MTUs with intervention per TSO



Total BDs

31

Total MTUs

737

MTUs without IVA

219

Share of distinct MTUs without IVA

29.72%

MTUs with IVA

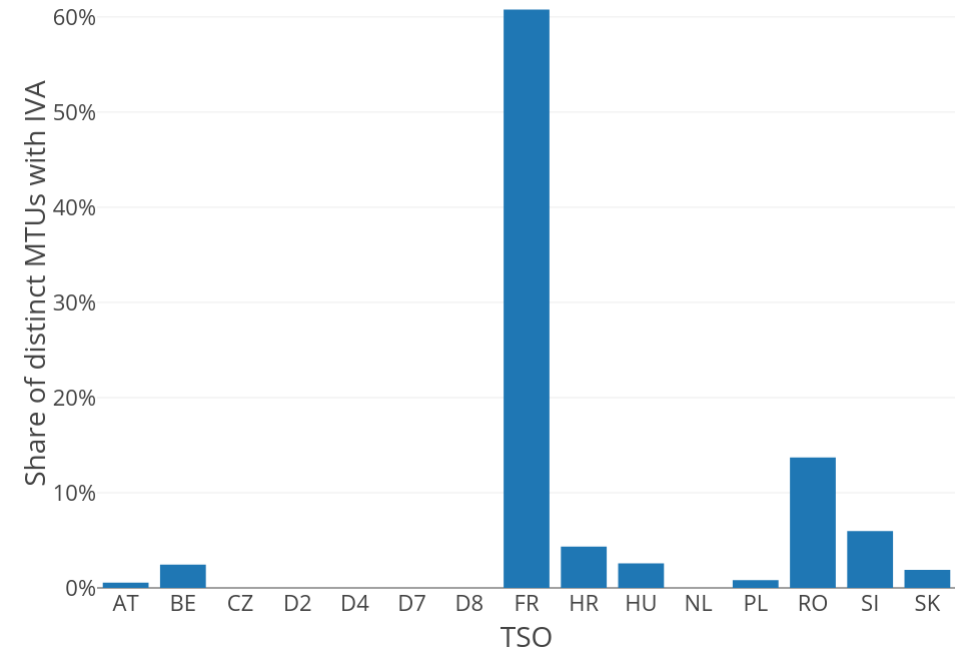
518

Share of distinct MTUs with IVA

70.3%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
AT	0.54%	4
BE	2.44%	18
CZ	0.00%	0
D2	0.00%	0
D4	0.00%	0
D7	0.00%	0
D8	0.00%	0
FR	60.79%	448
HR	4.34%	32
HU	2.58%	19

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
NL	0.00%	0
PL	0.81%	6
RO	13.70%	101
SI	5.97%	44
SK	1.90%	14

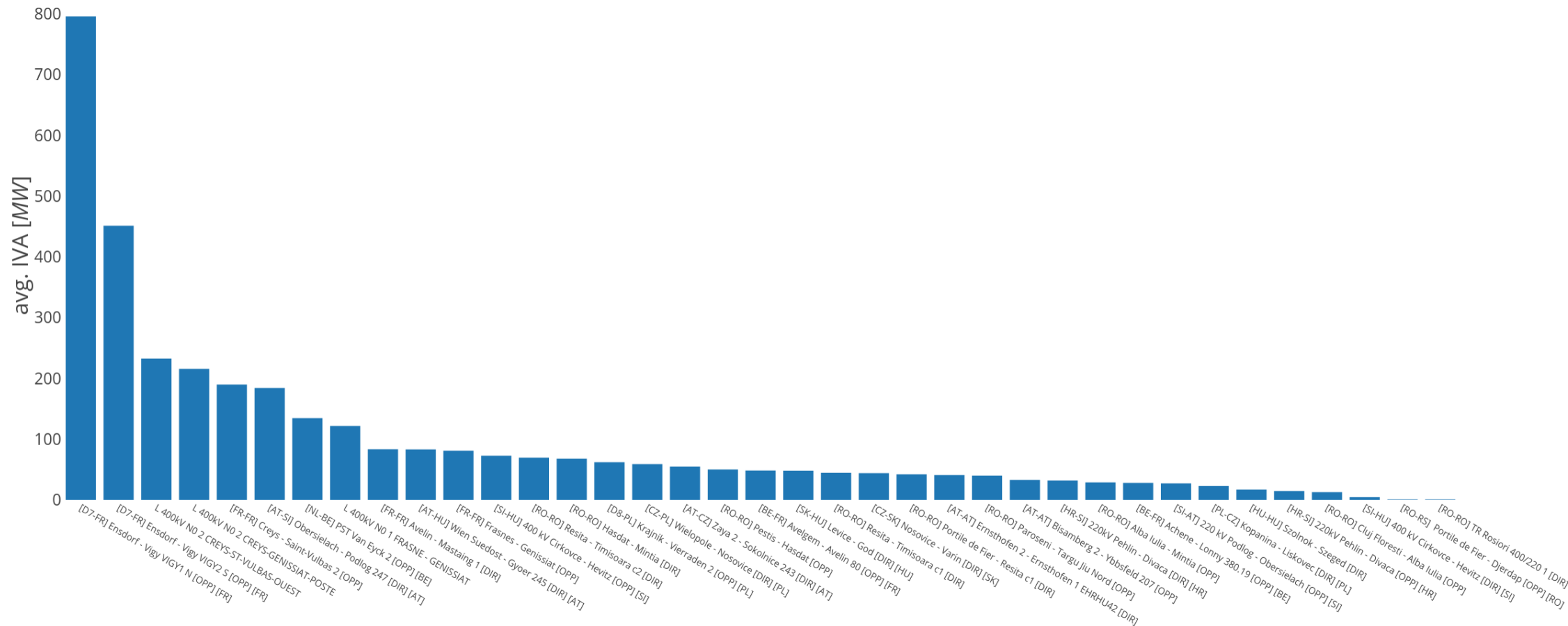




# KPI 4a: Average IVA applied for each CNE affected by TSO intervention



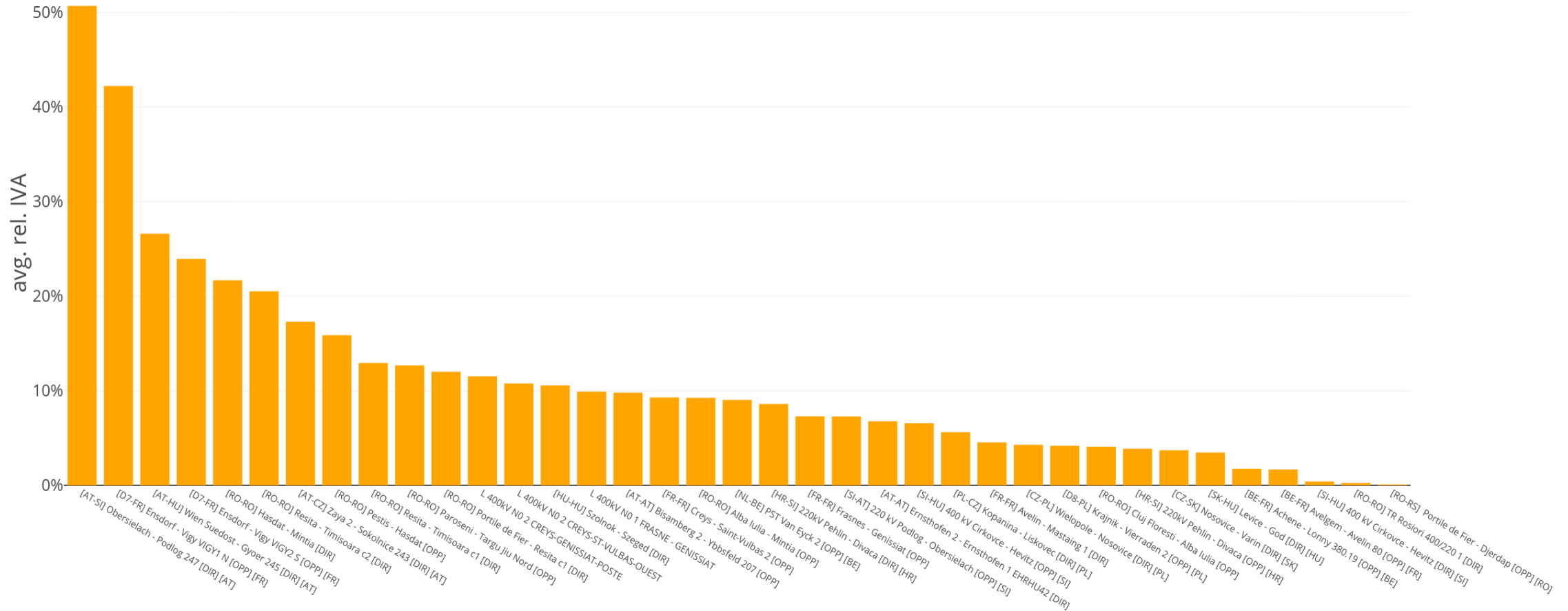
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



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



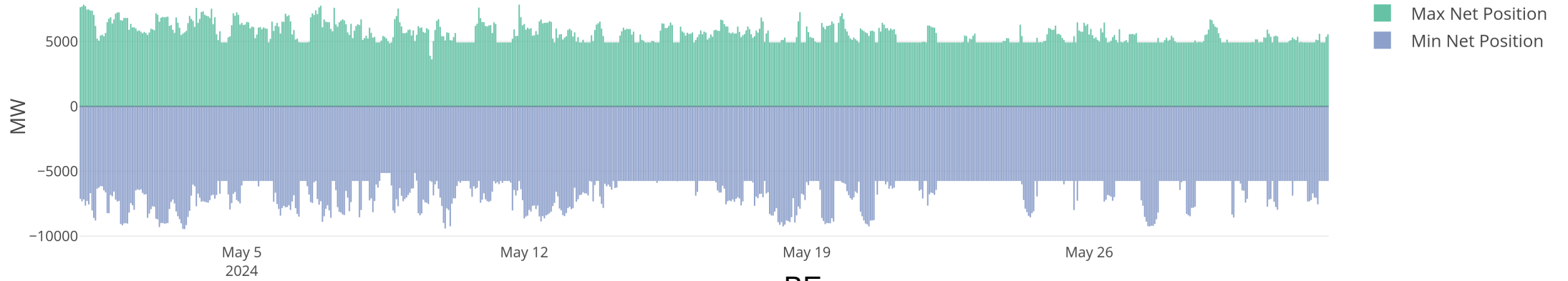
$$\text{avg. rel. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} \frac{IVA_{CNEC, MTU}[IVA_{CNEC, MTU} > 0]}{F_{maxCNEC, MTU}[IVA_{CNEC, MTU} > 0]}$$



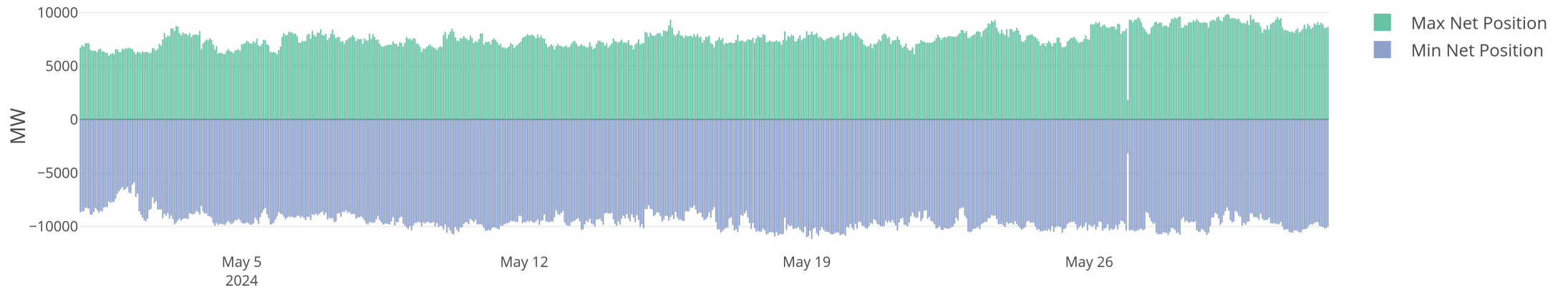
# KPI 5: Min & max net positions per BZ hub



AT



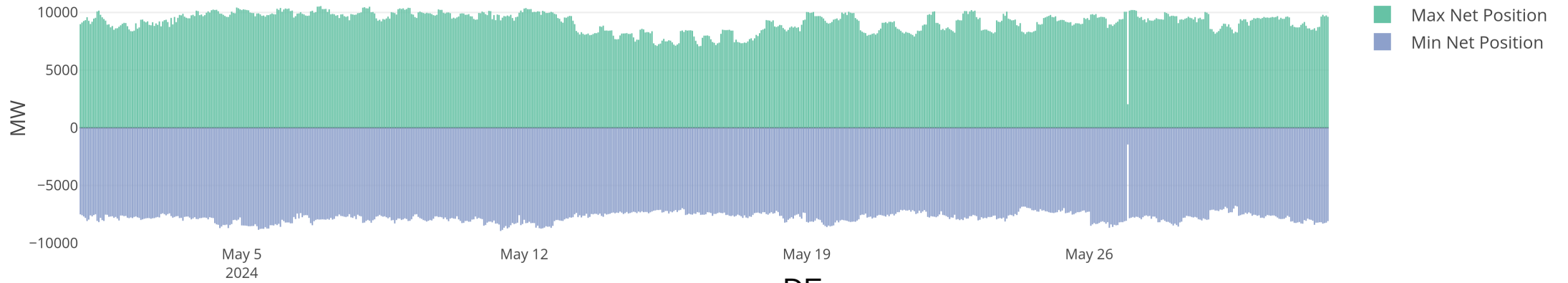
BE



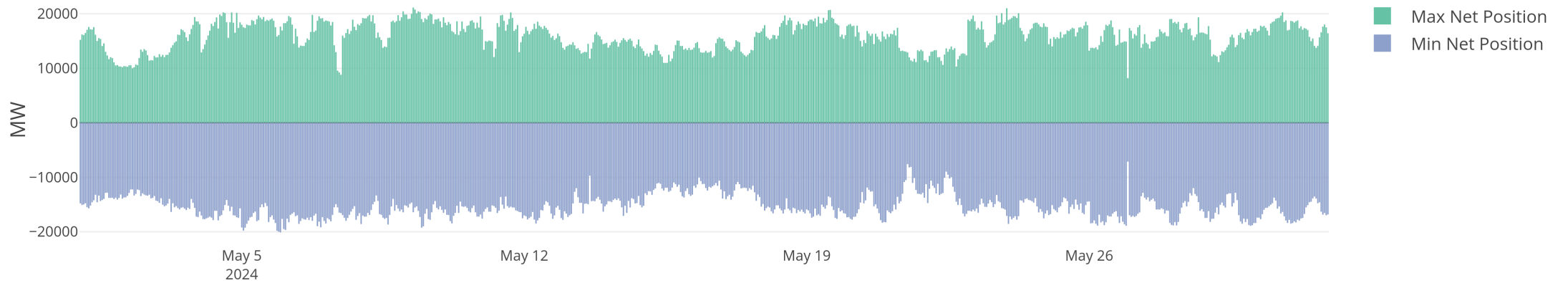
# KPI 5: Min & max net positions per BZ hub



CZ



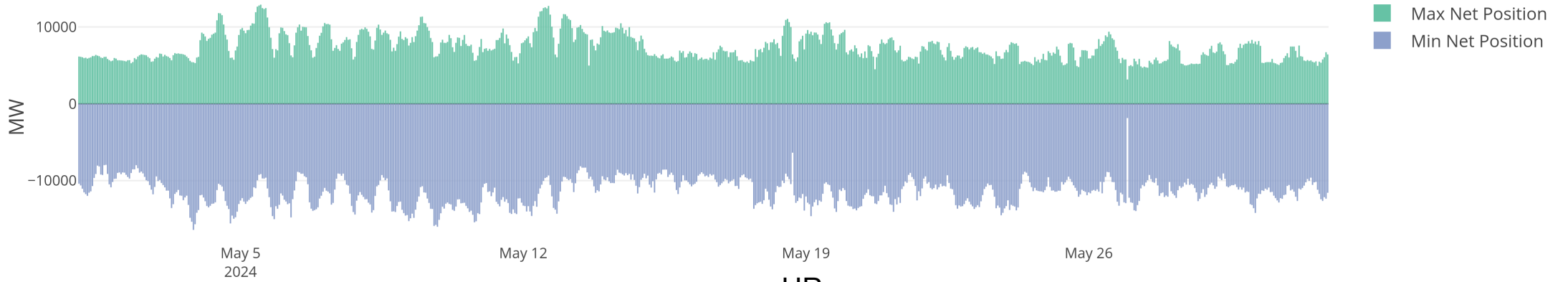
DE



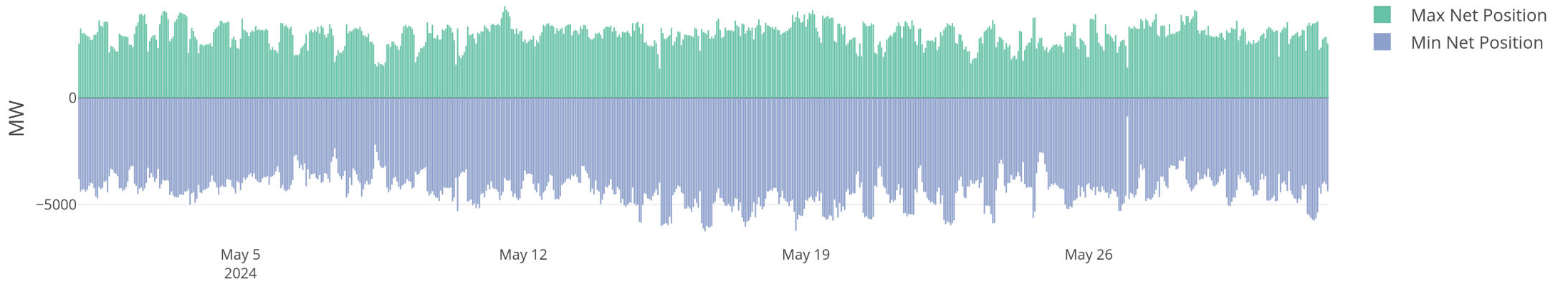
# KPI 5: Min & max net positions per BZ hub



FR



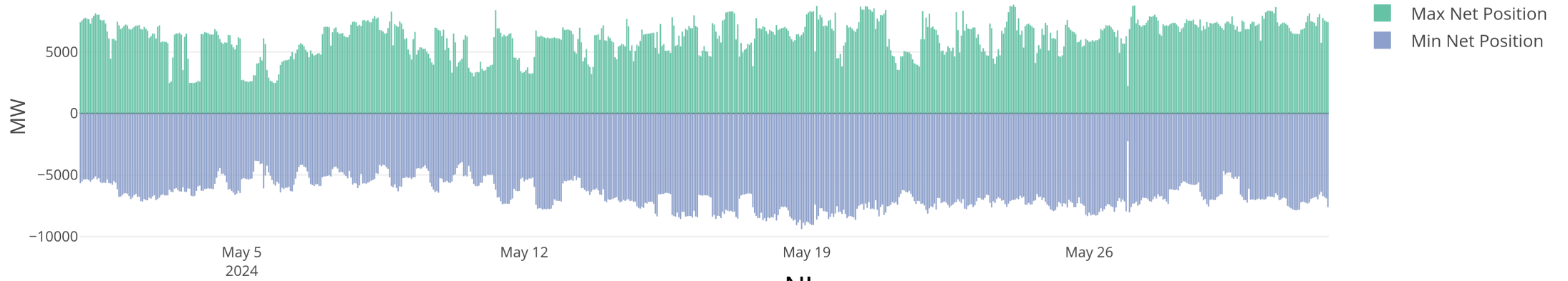
HR



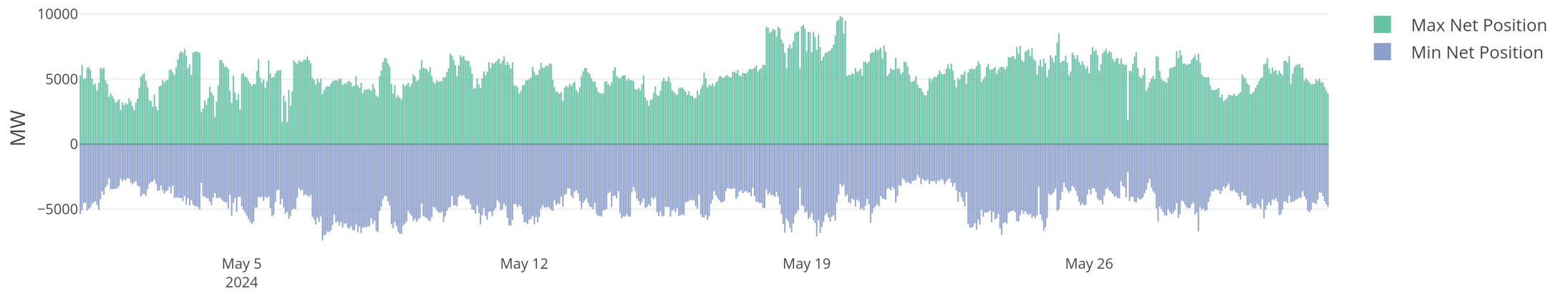
# KPI 5: Min & max net positions per BZ hub



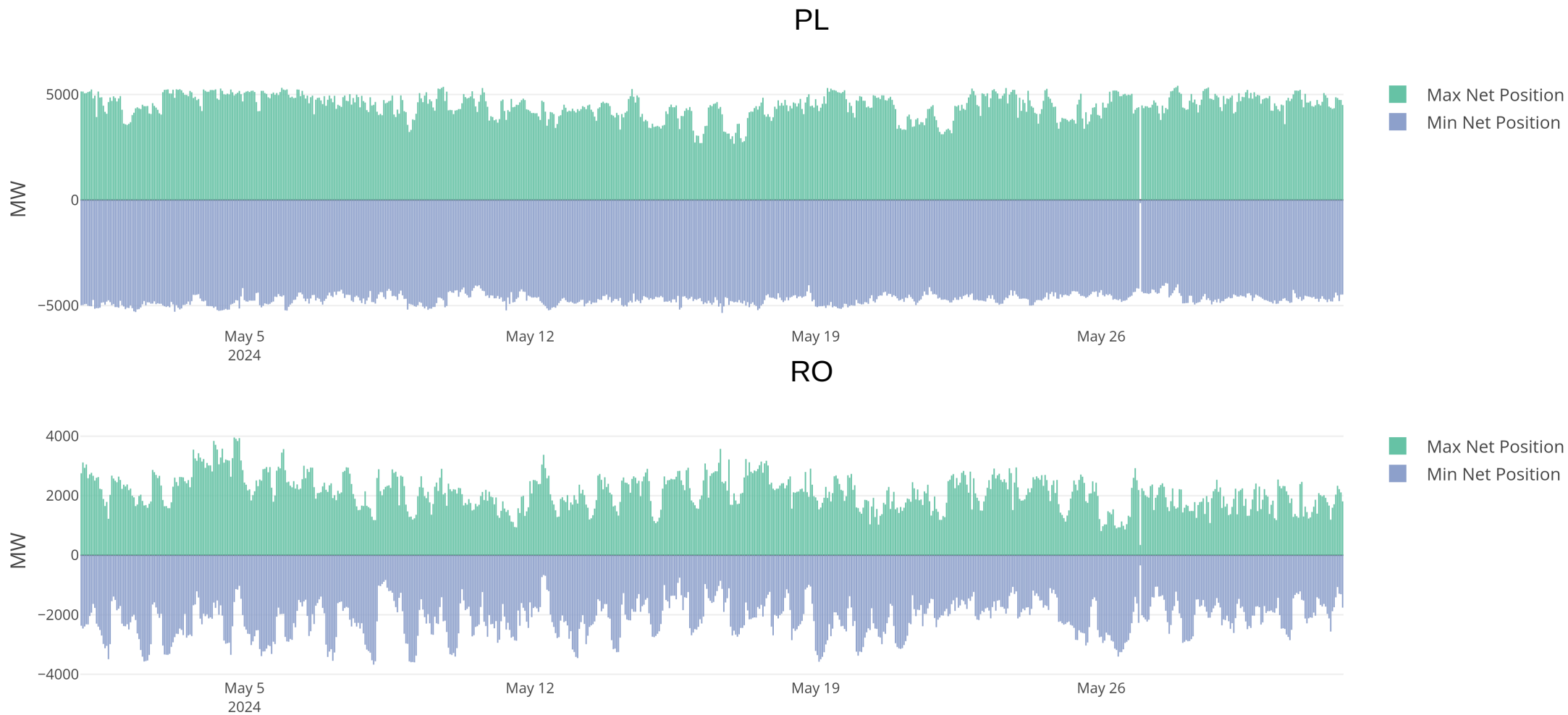
## HU



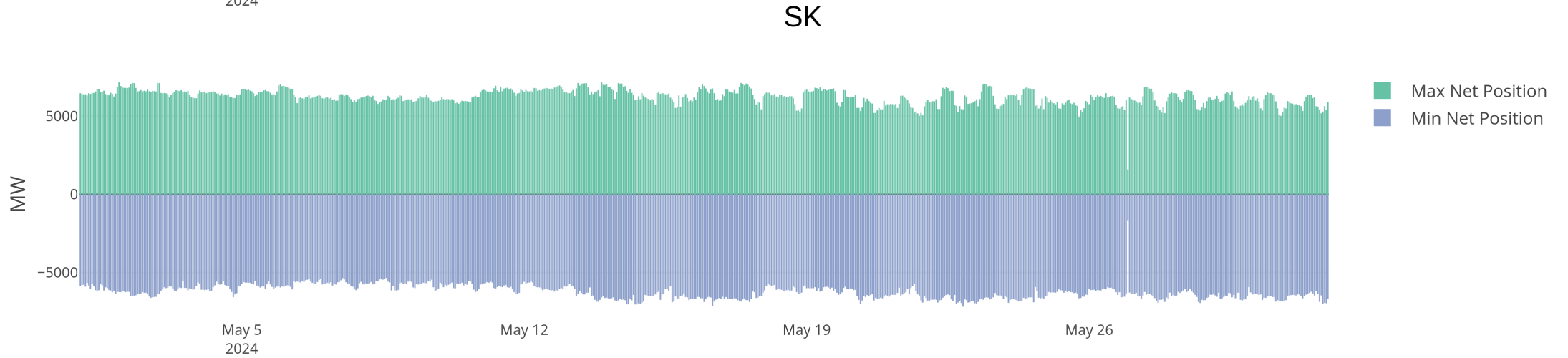
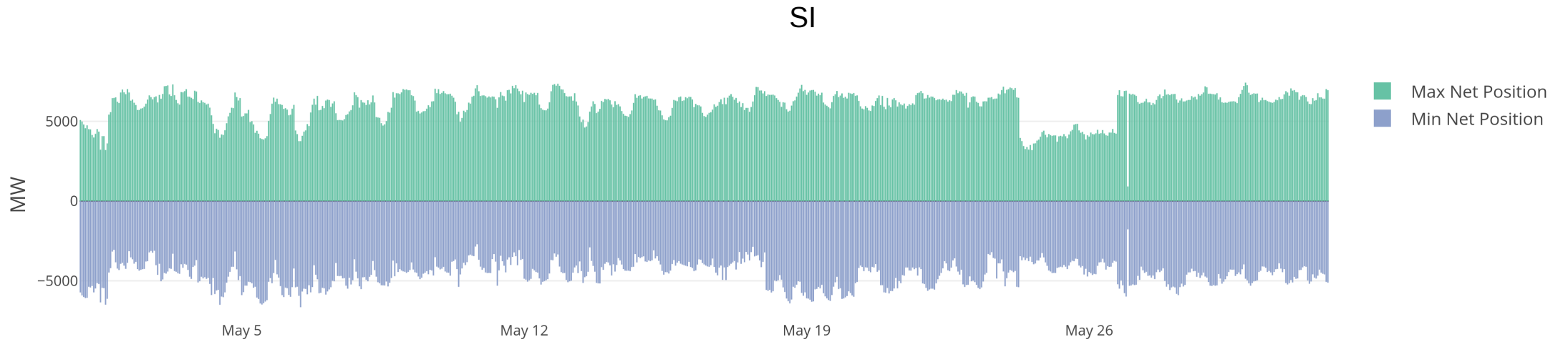
## NL



# KPI 5: Min & max net positions per BZ hub

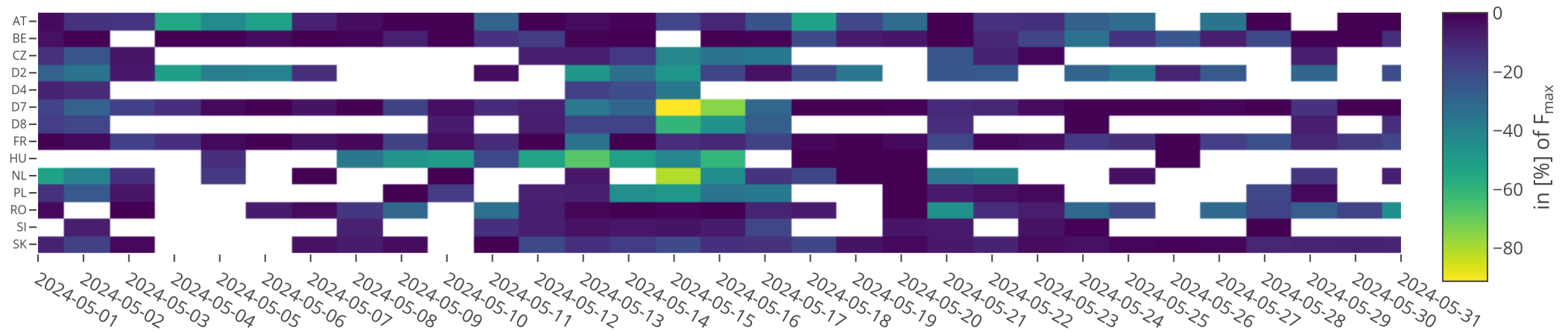
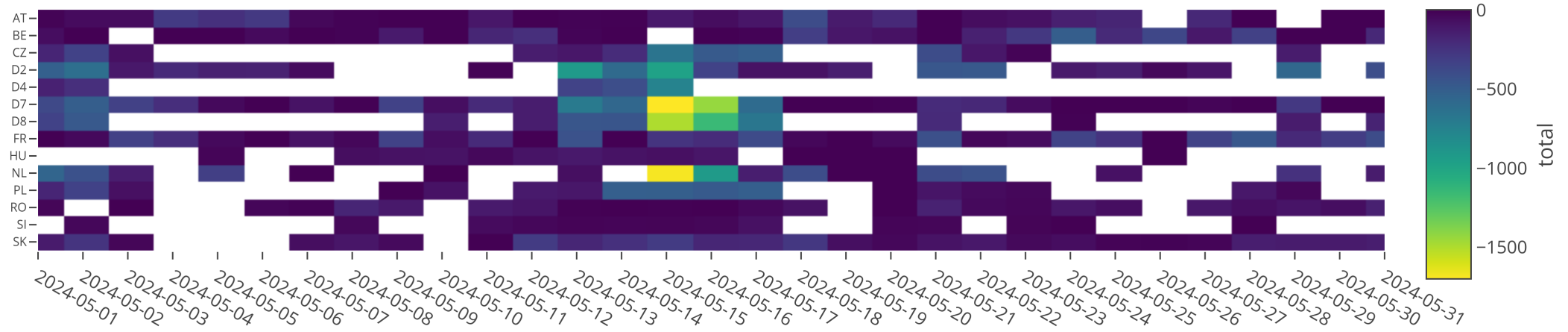


# KPI 5: Min & max net positions per BZ hub

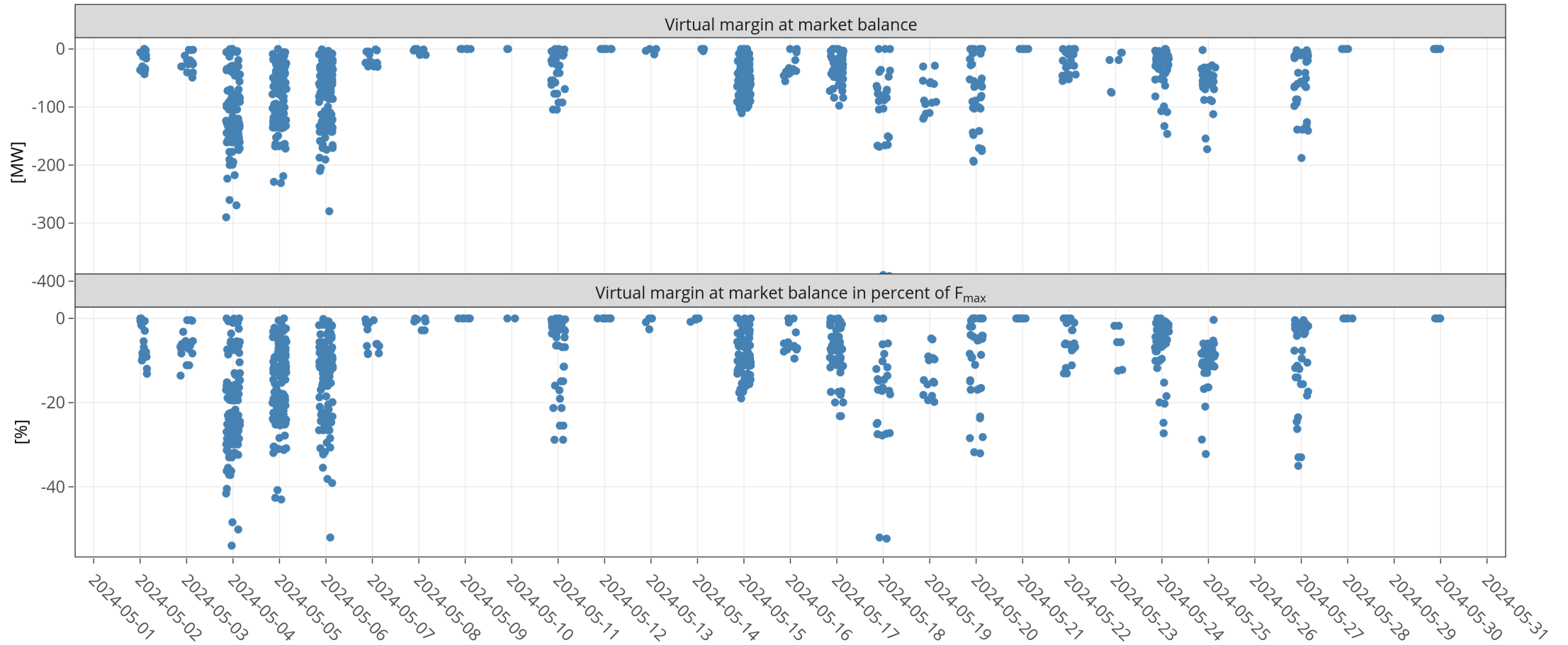




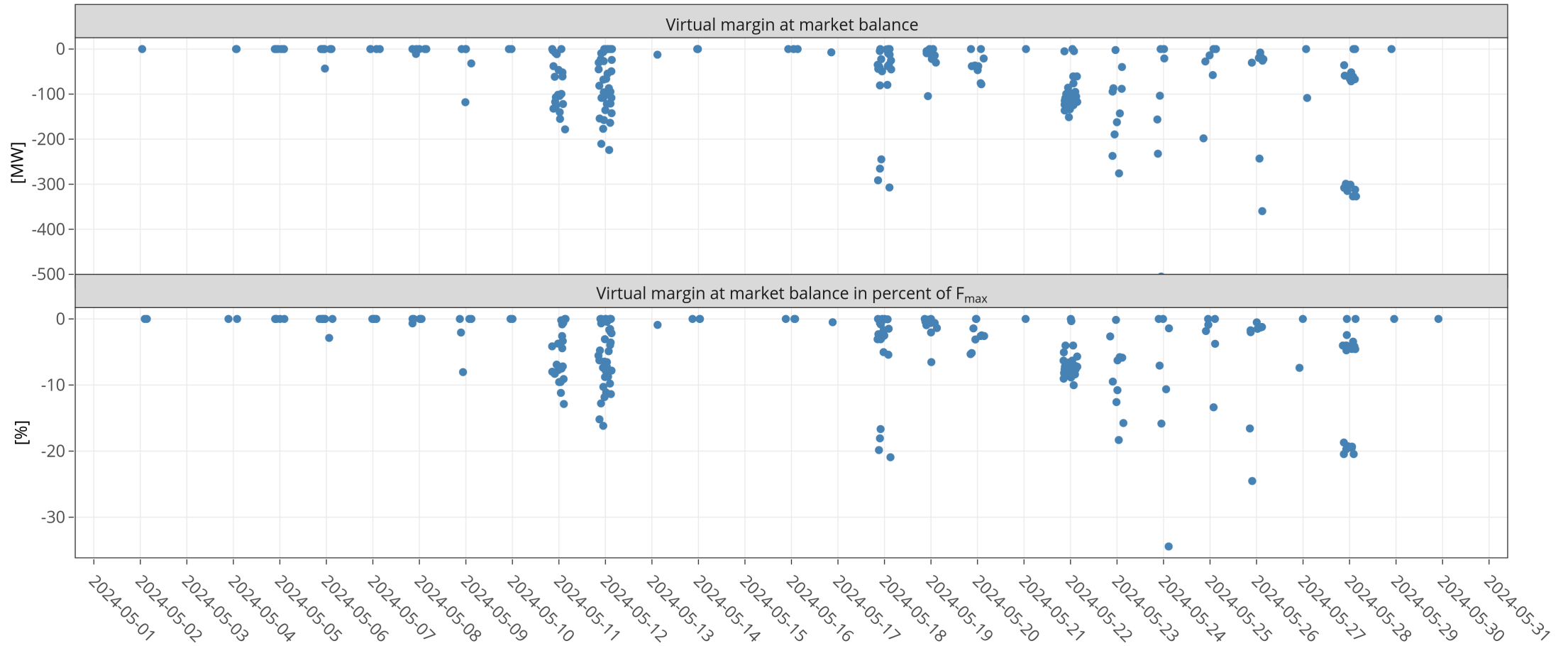
# KPI 6a: Highest virtual margins at market balance for CORE TSOs



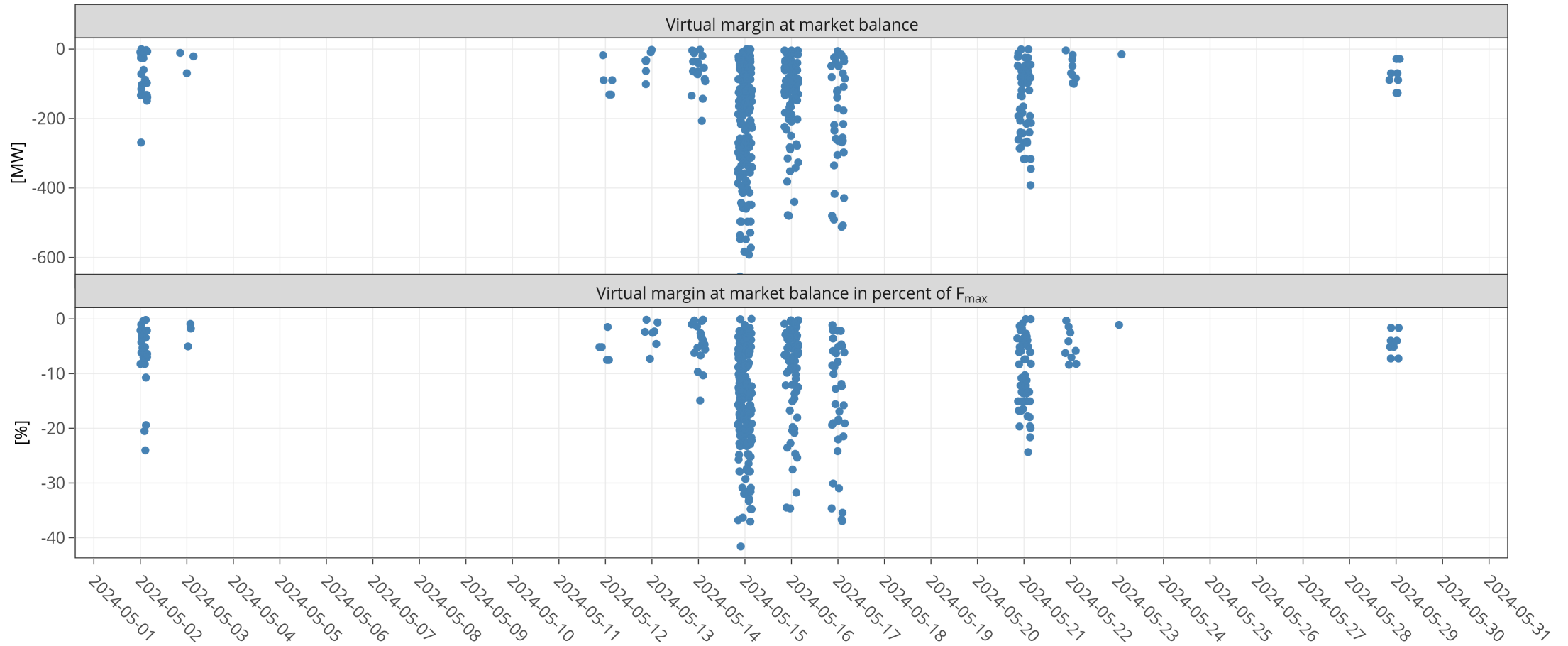
# KPI 6b: Virtual margins at market balance AT



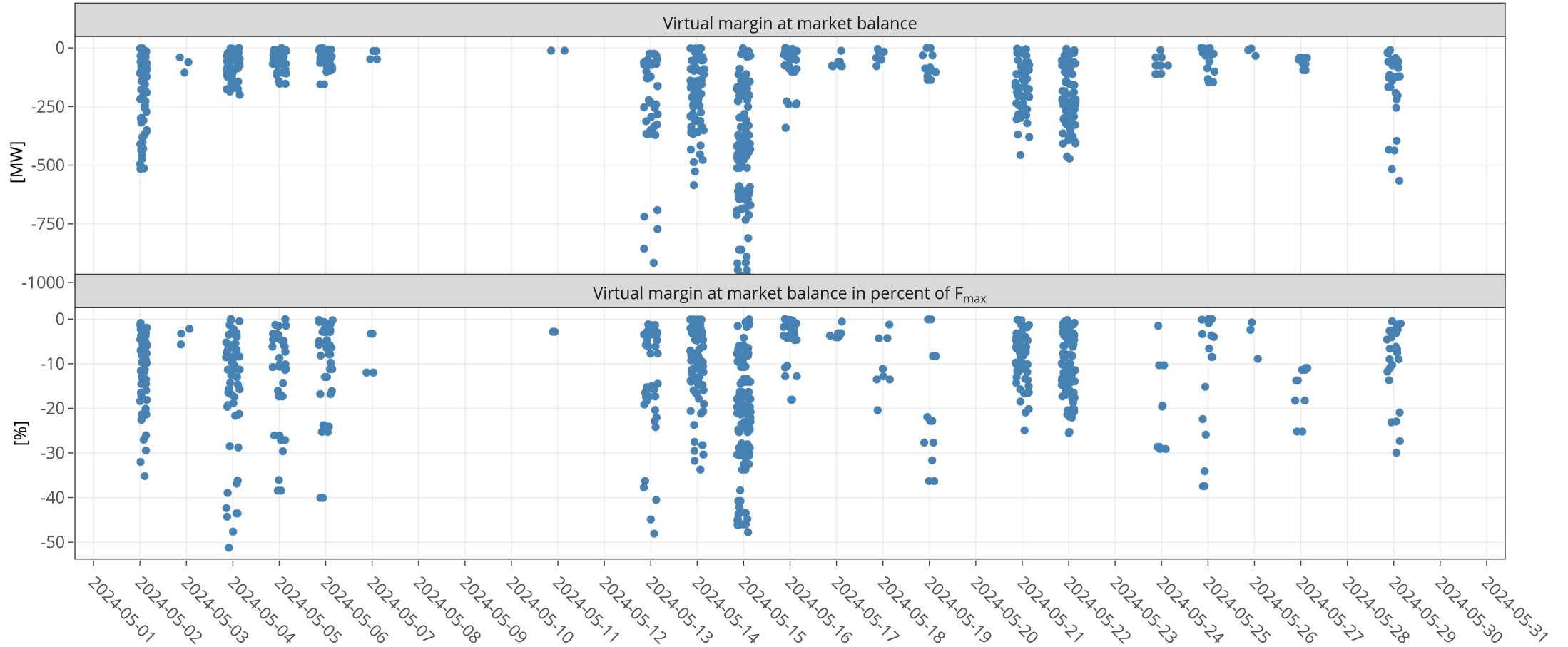
# KPI 6b: Virtual margins at market balance BE



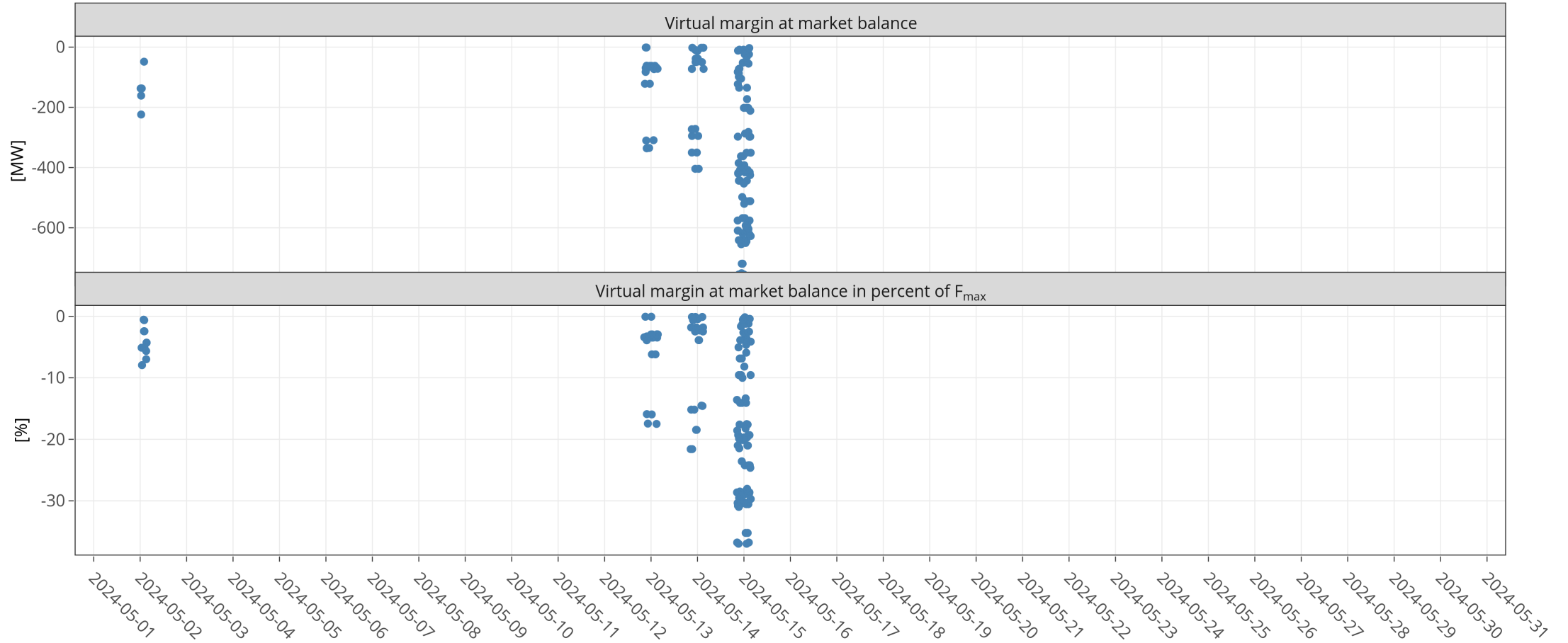
# KPI 6b: Virtual margins at market balance CZ



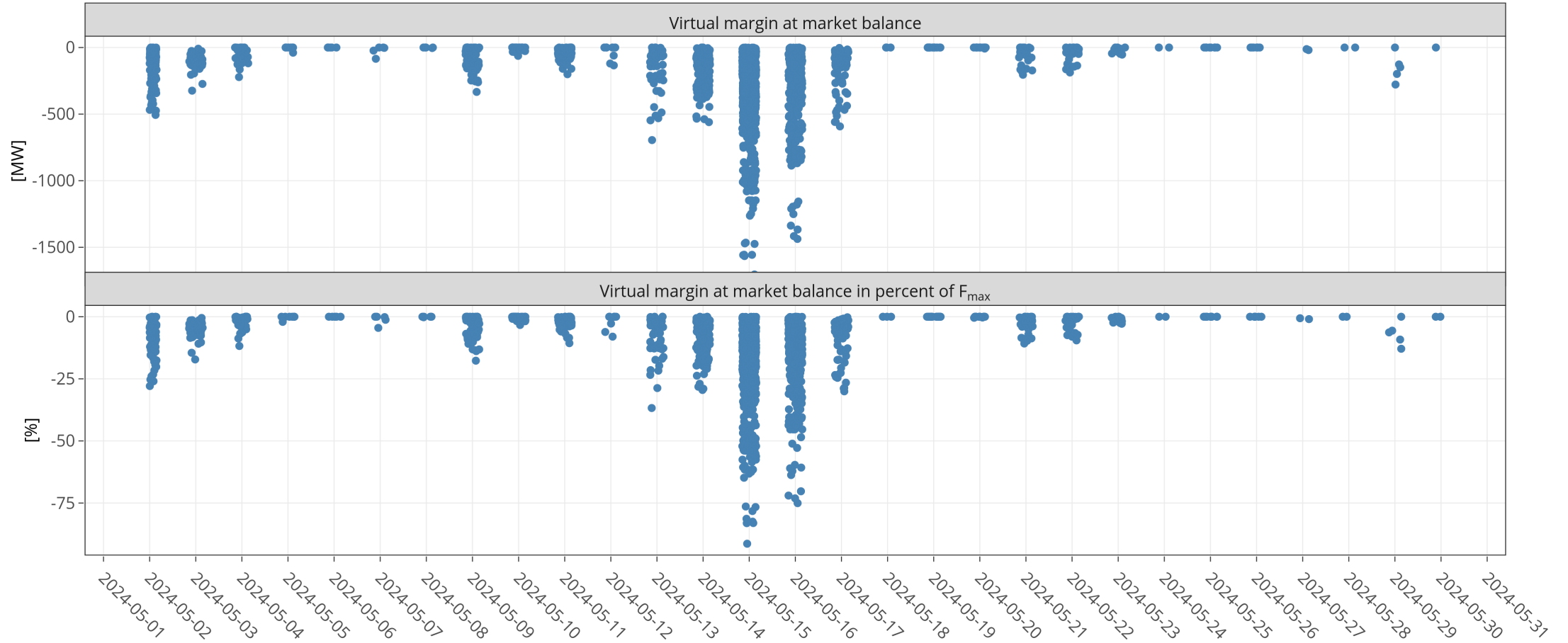
# KPI 6b: Virtual margins at market balance D2



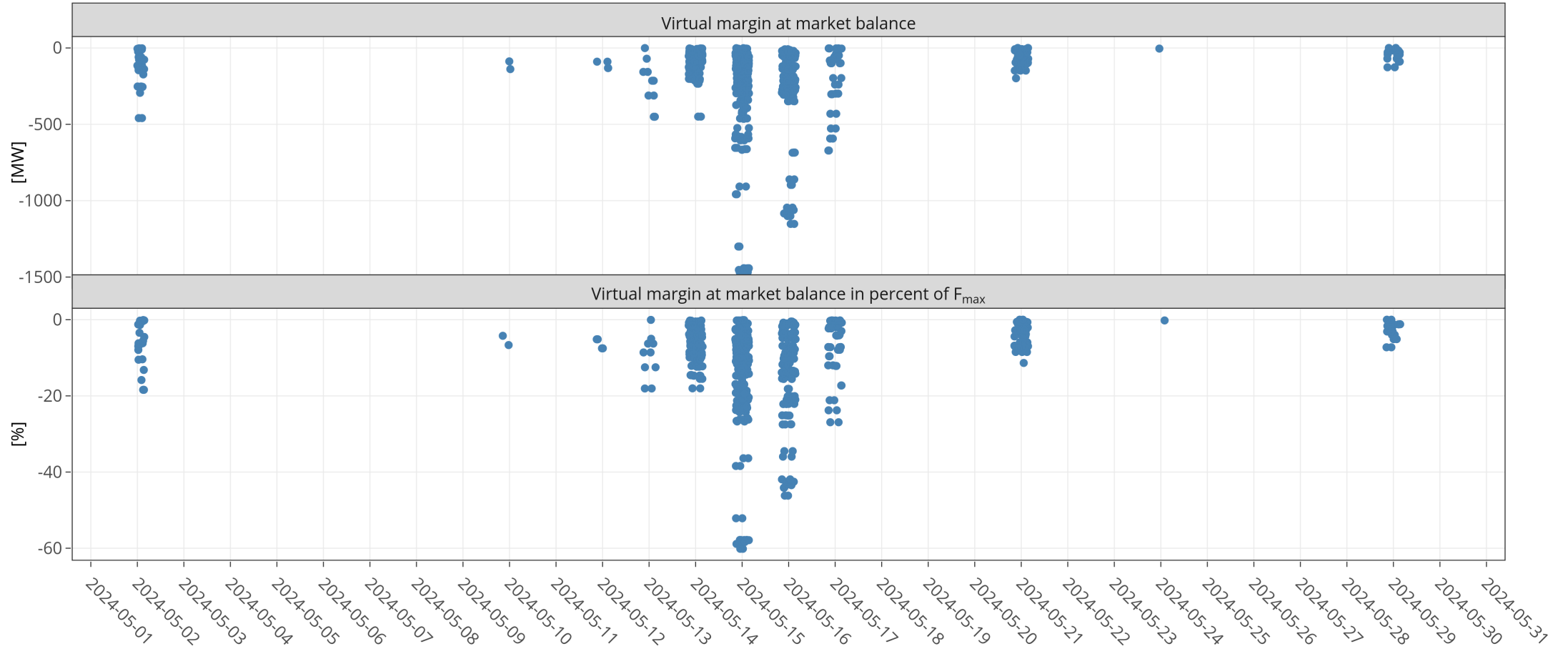
# KPI 6b: Virtual margins at market balance D4



# KPI 6b: Virtual margins at market balance D7

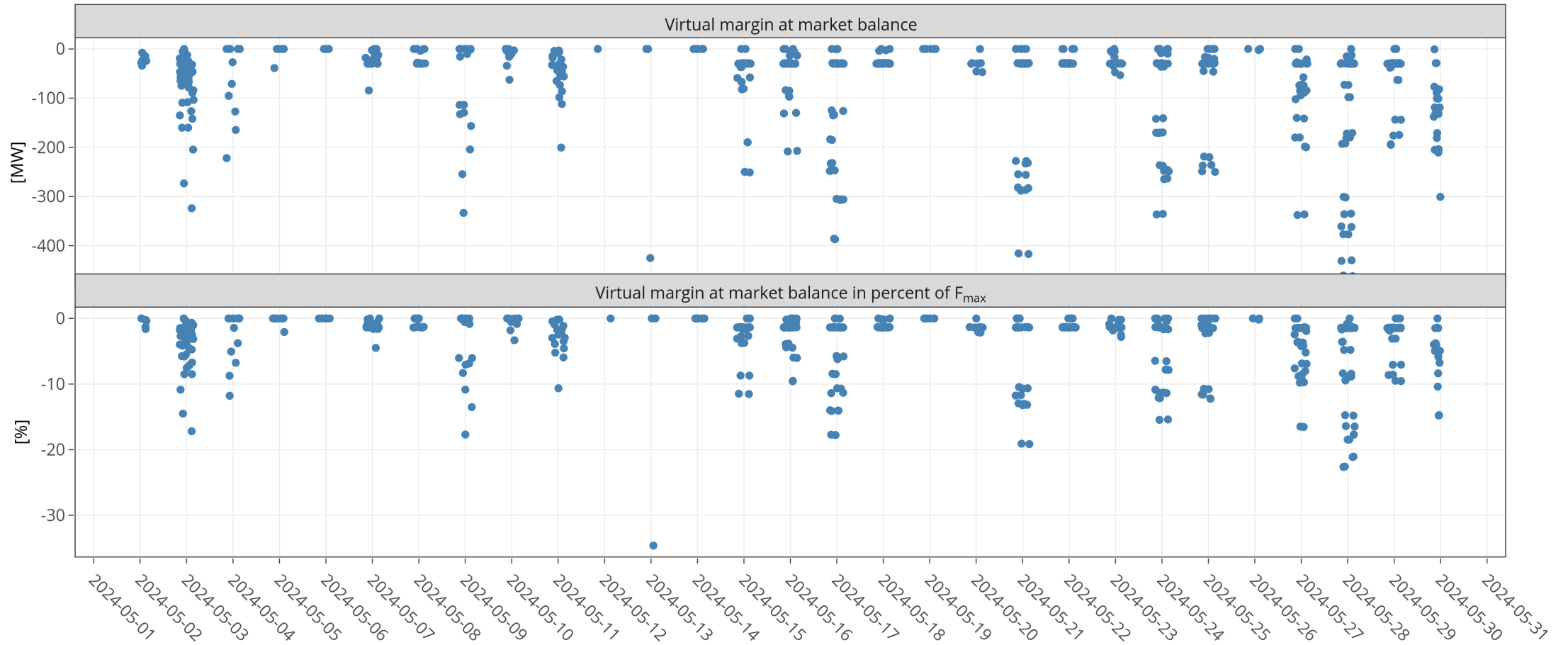


# KPI 6b: Virtual margins at market balance D8

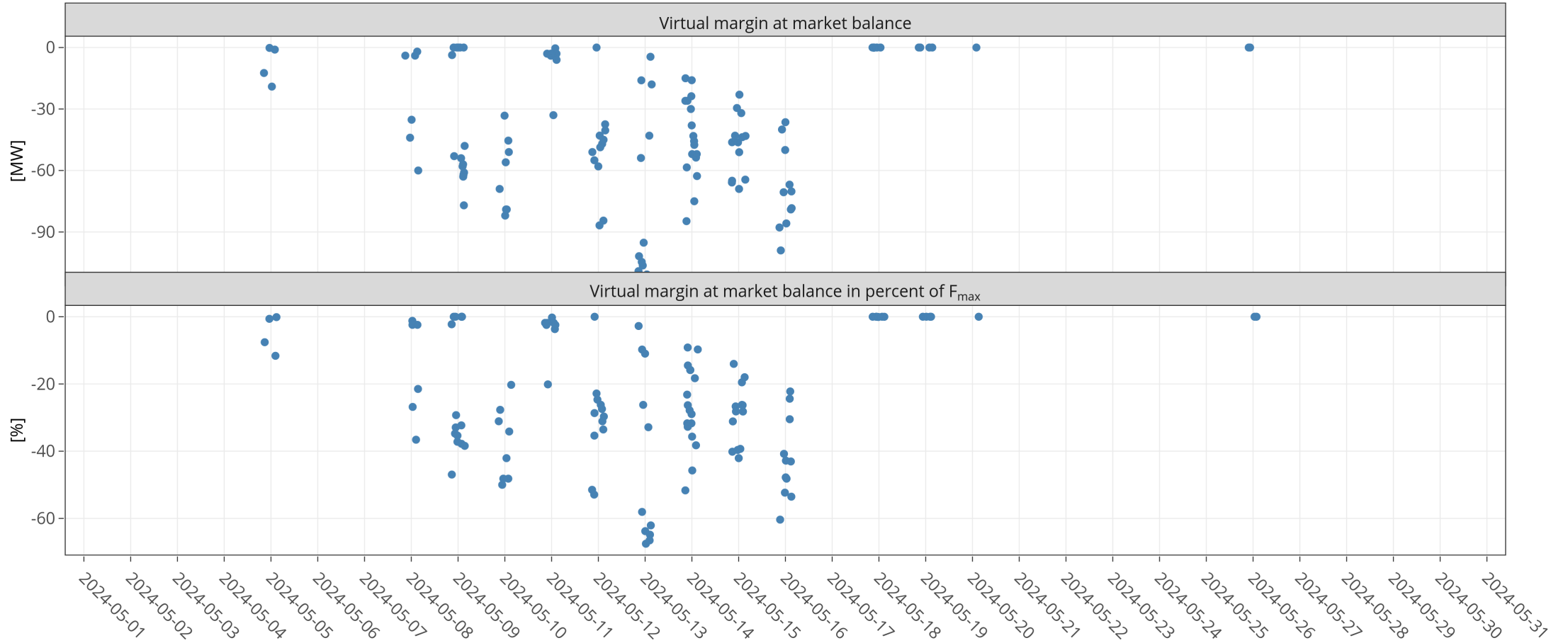




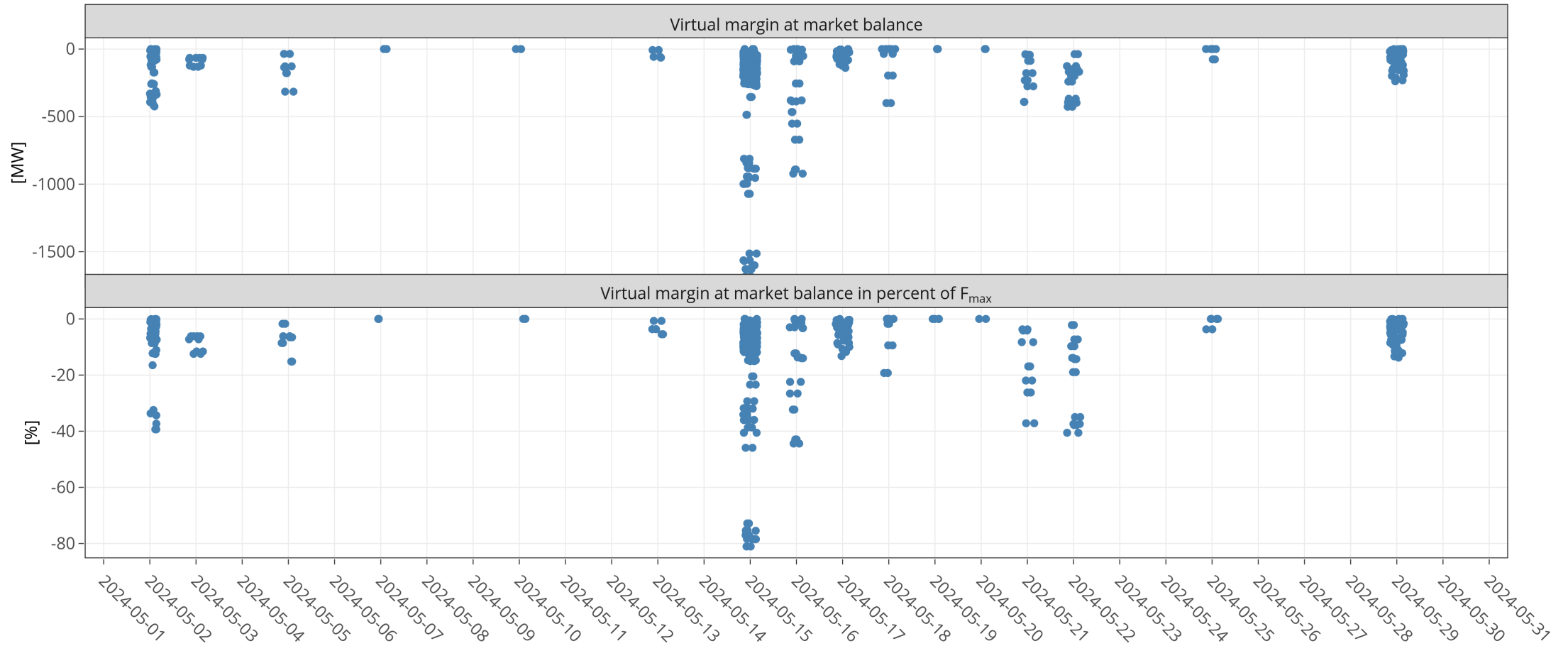
# KPI 6b: Virtual margins at market balance FR



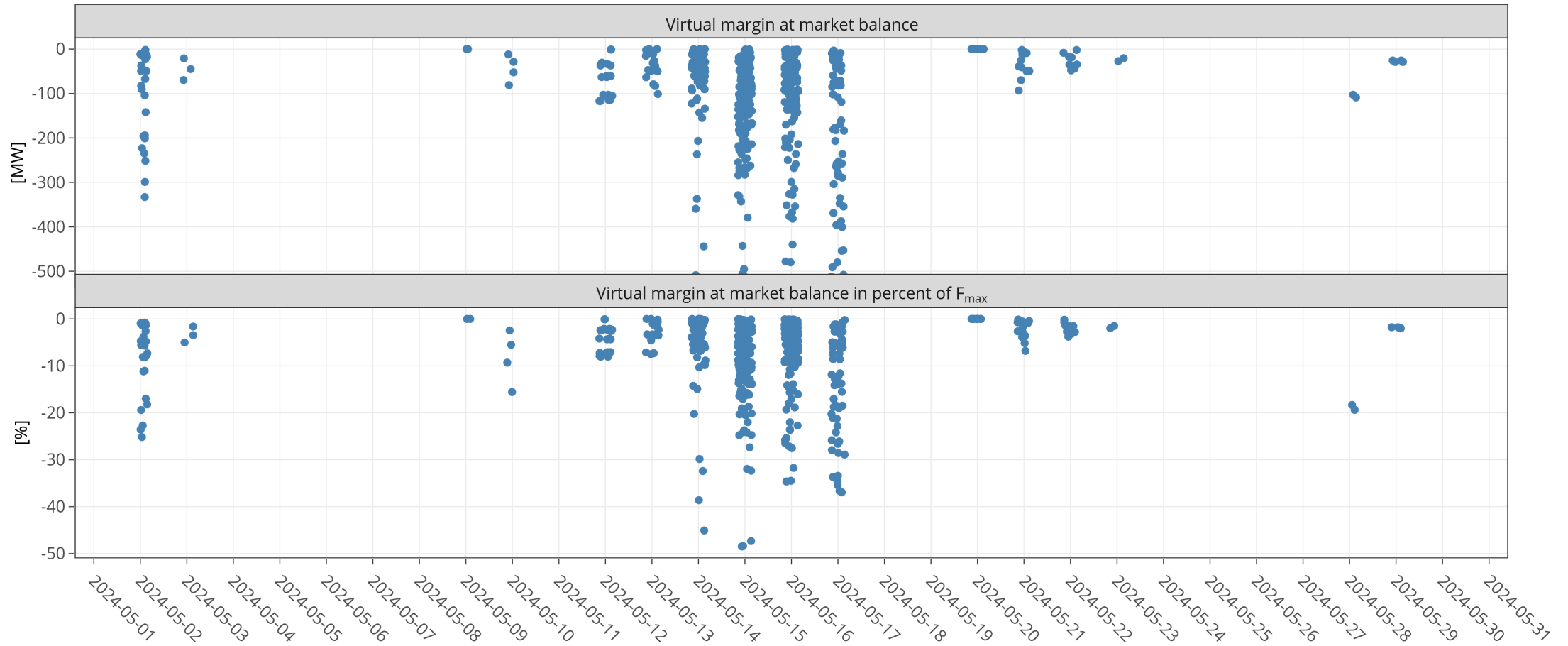
# KPI 6b: Virtual margins at market balance HU



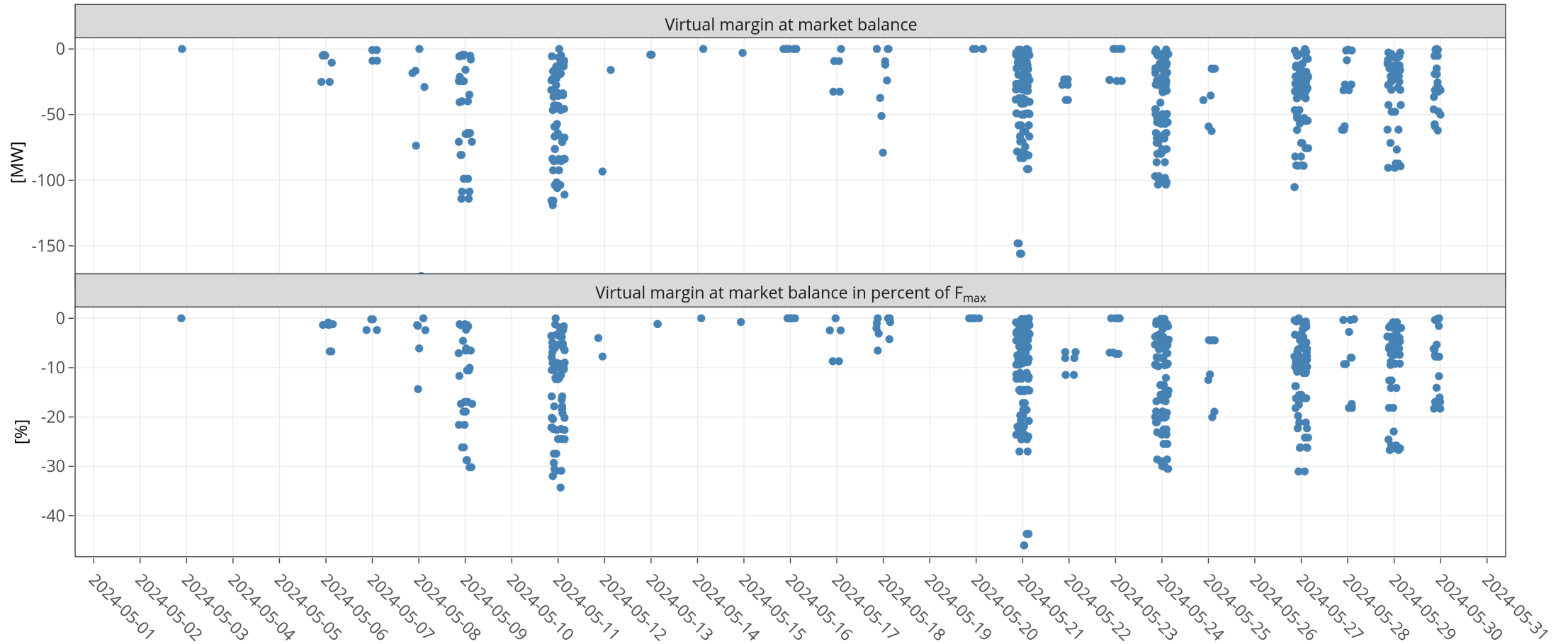
# KPI 6b: Virtual margins at market balance NL



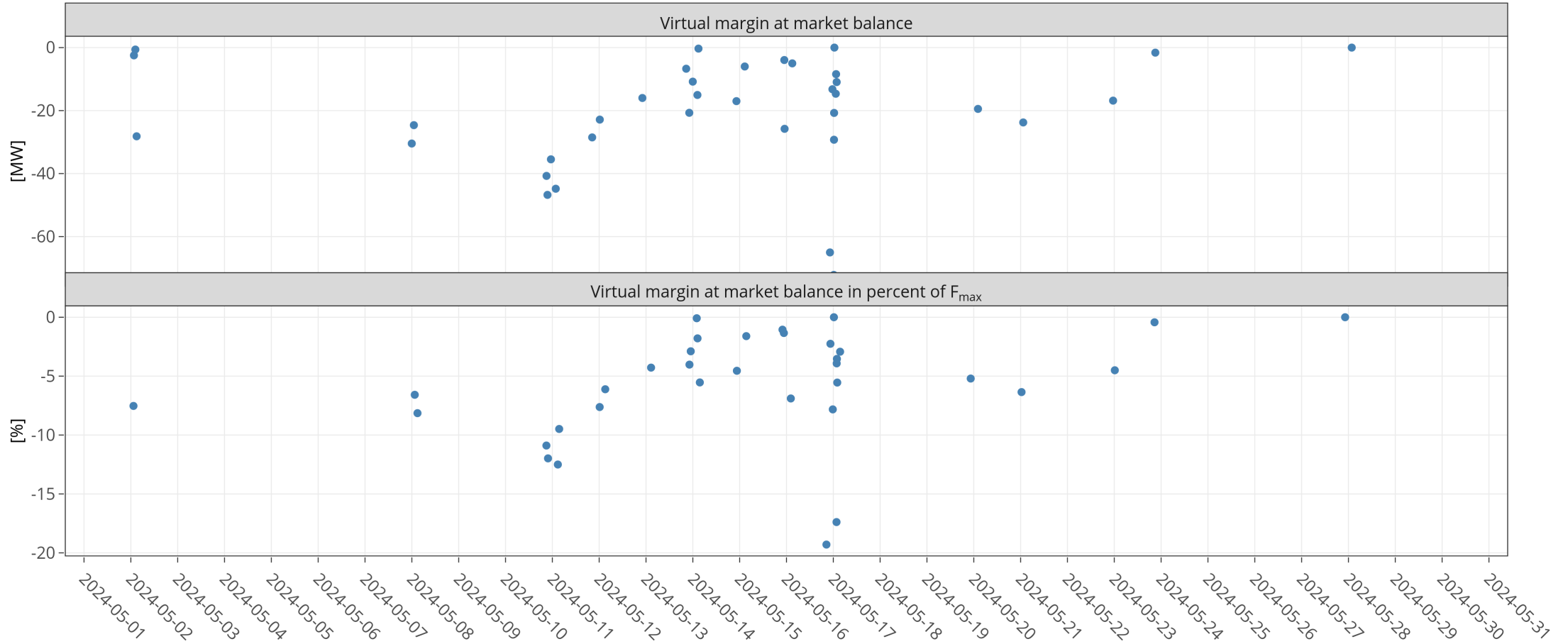
# KPI 6b: Virtual margins at market balance PL



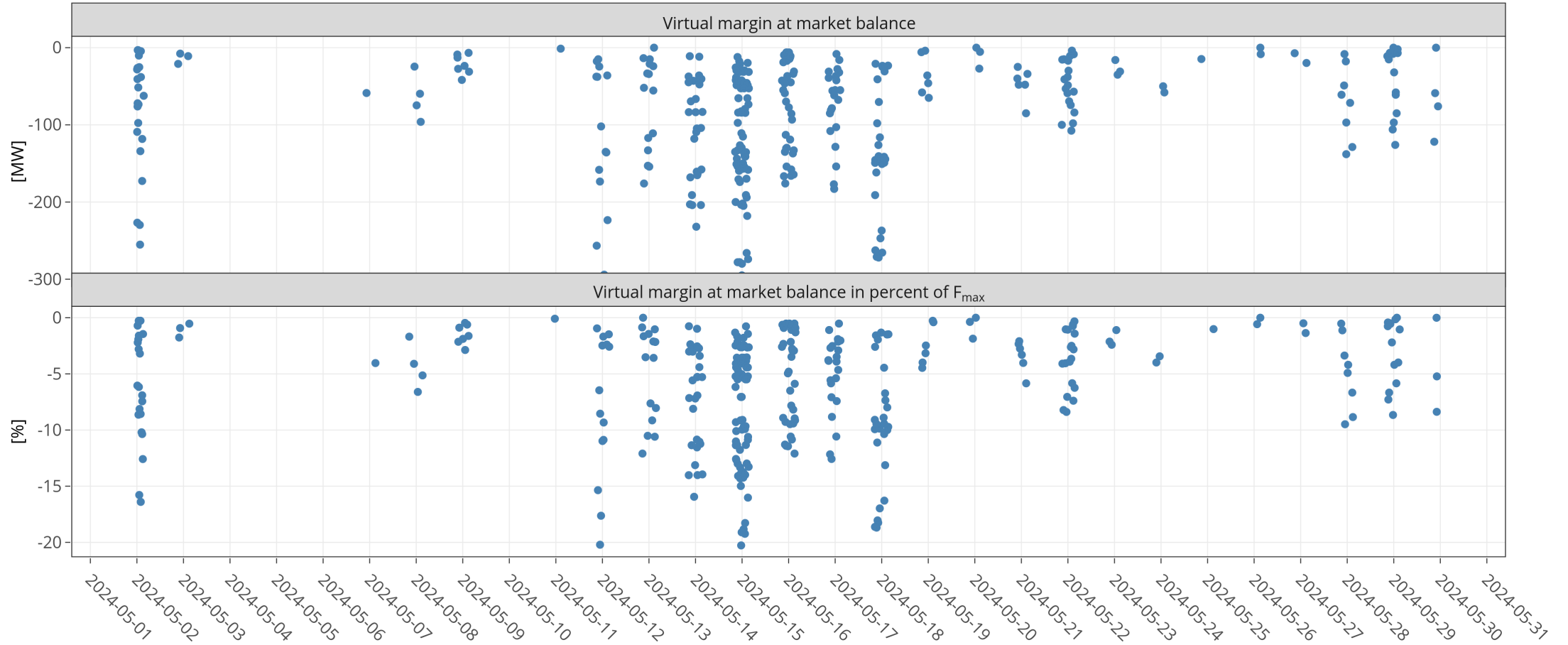
# KPI 6b: Virtual margins at market balance RO



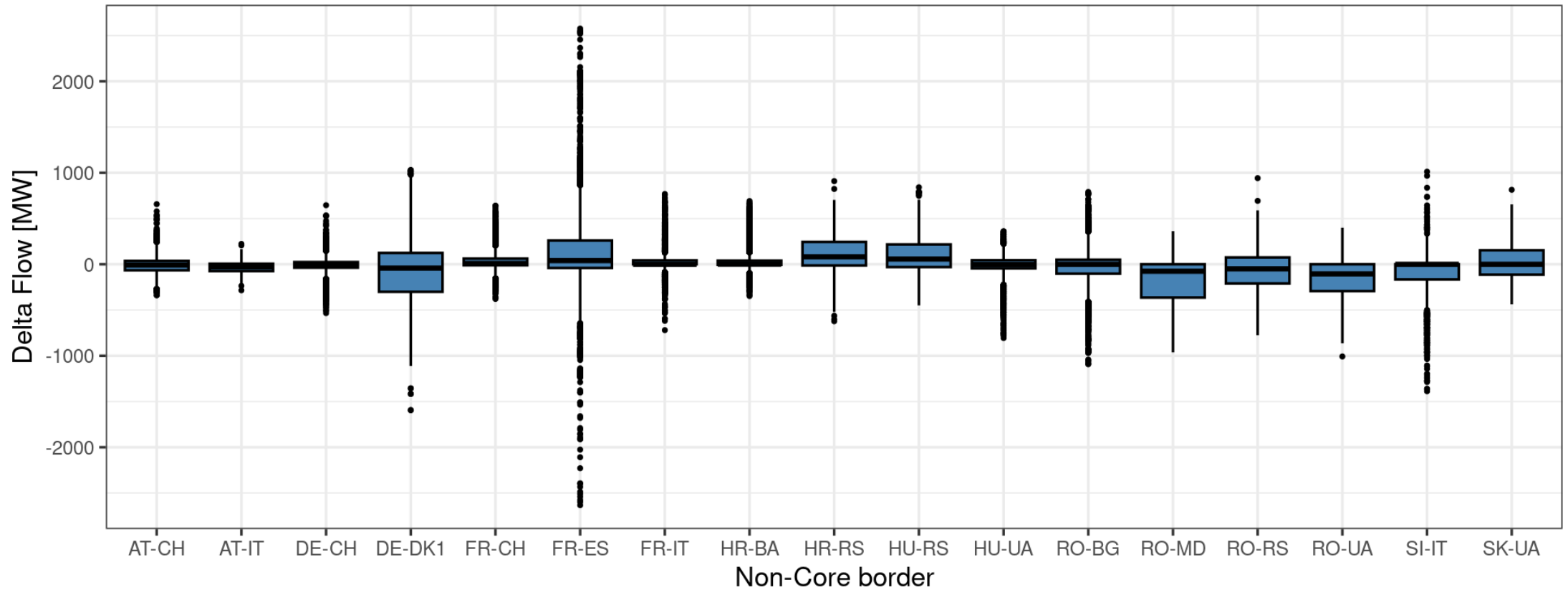
# KPI 6b: Virtual margins at market balance SI



# KPI 6b: Virtual margins at market balance SK

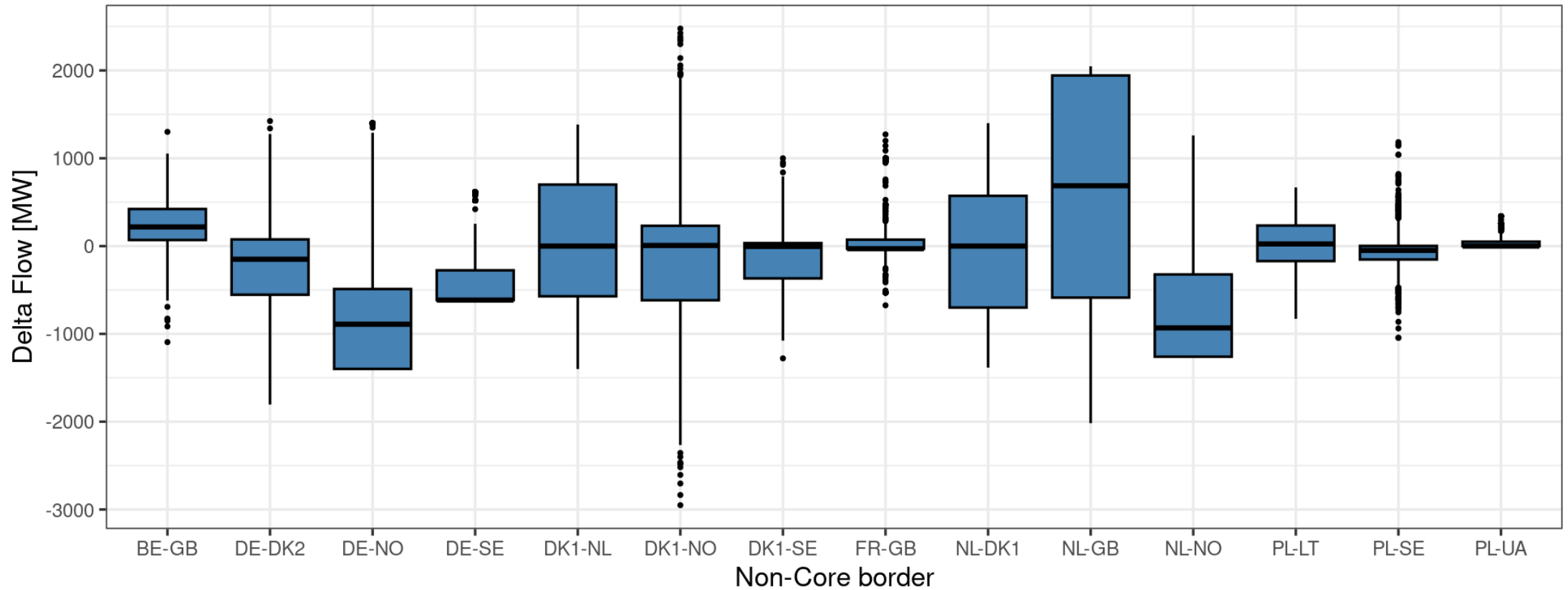


# KPI 7: Non-Core exchanges AC delta flow





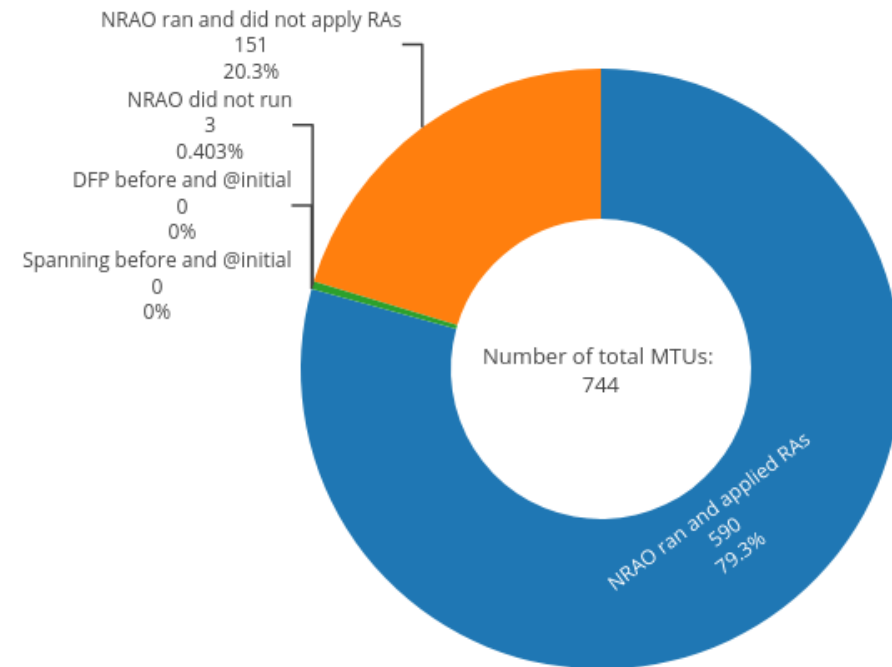
# KPI 7: Non-Core exchanges DC delta flow



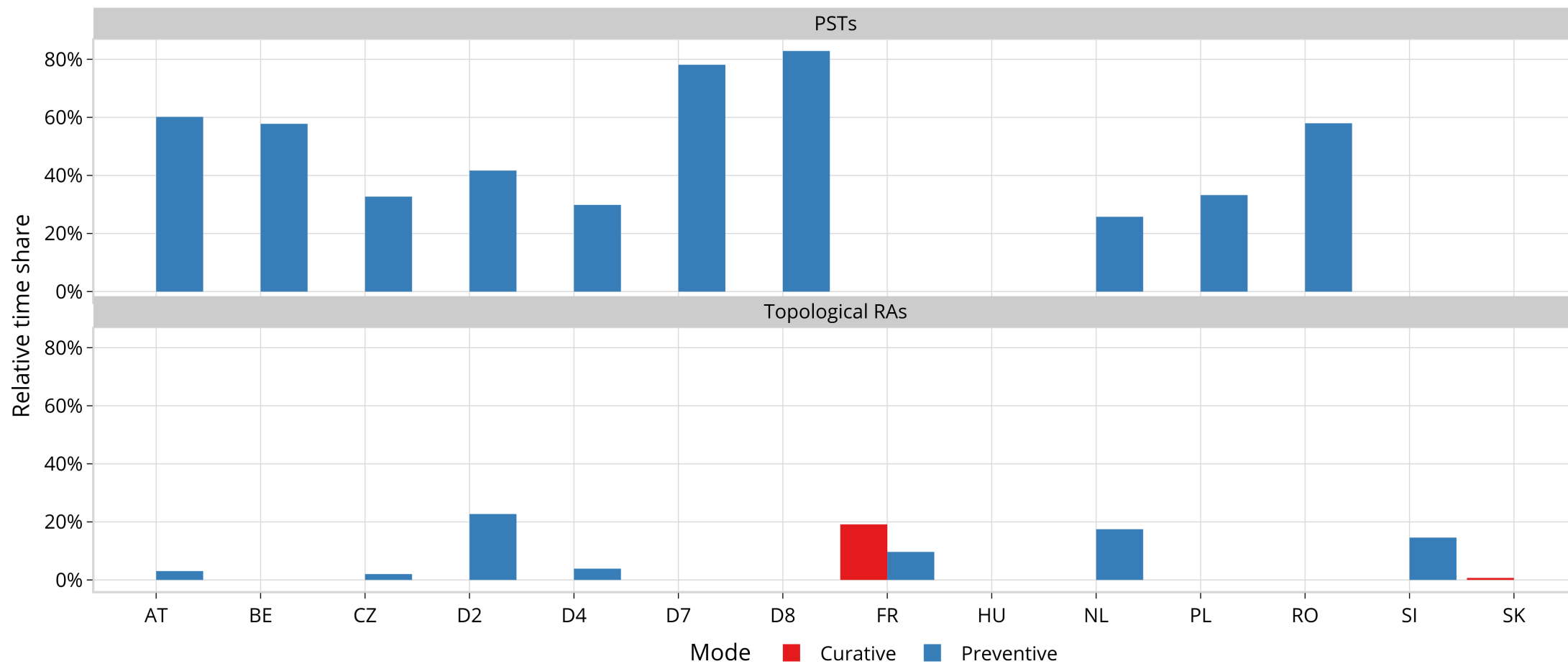
# KPI 8: NRAO – Applied Remedial Action



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

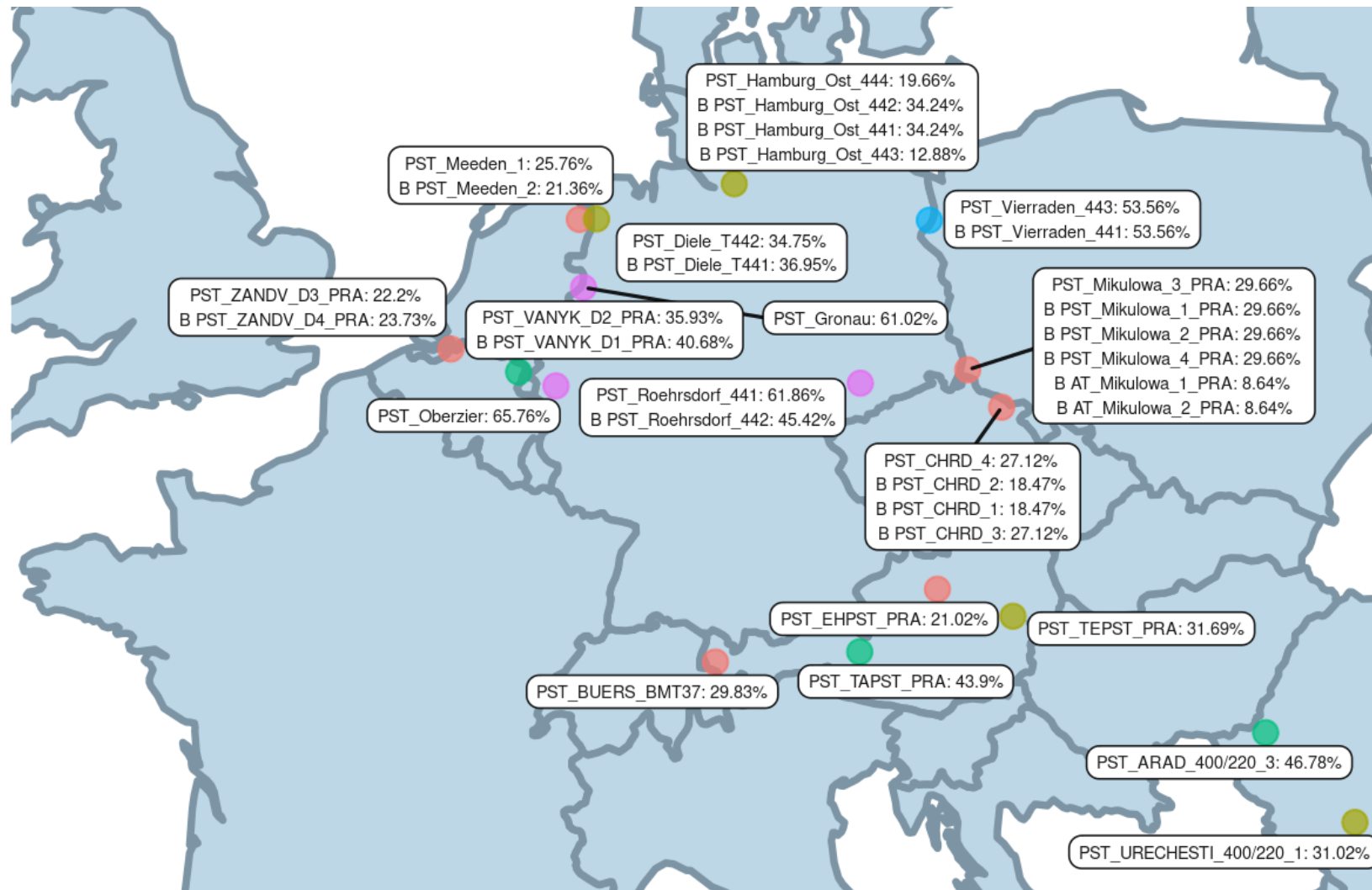


# KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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

## Relative Time Share of Applied PSTs in Preventive Mode



Relative Time Share [%]

- 20%-30%
- 30%-40%
- 40%-50%
- 50%-60%
- 60%-70%

# 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

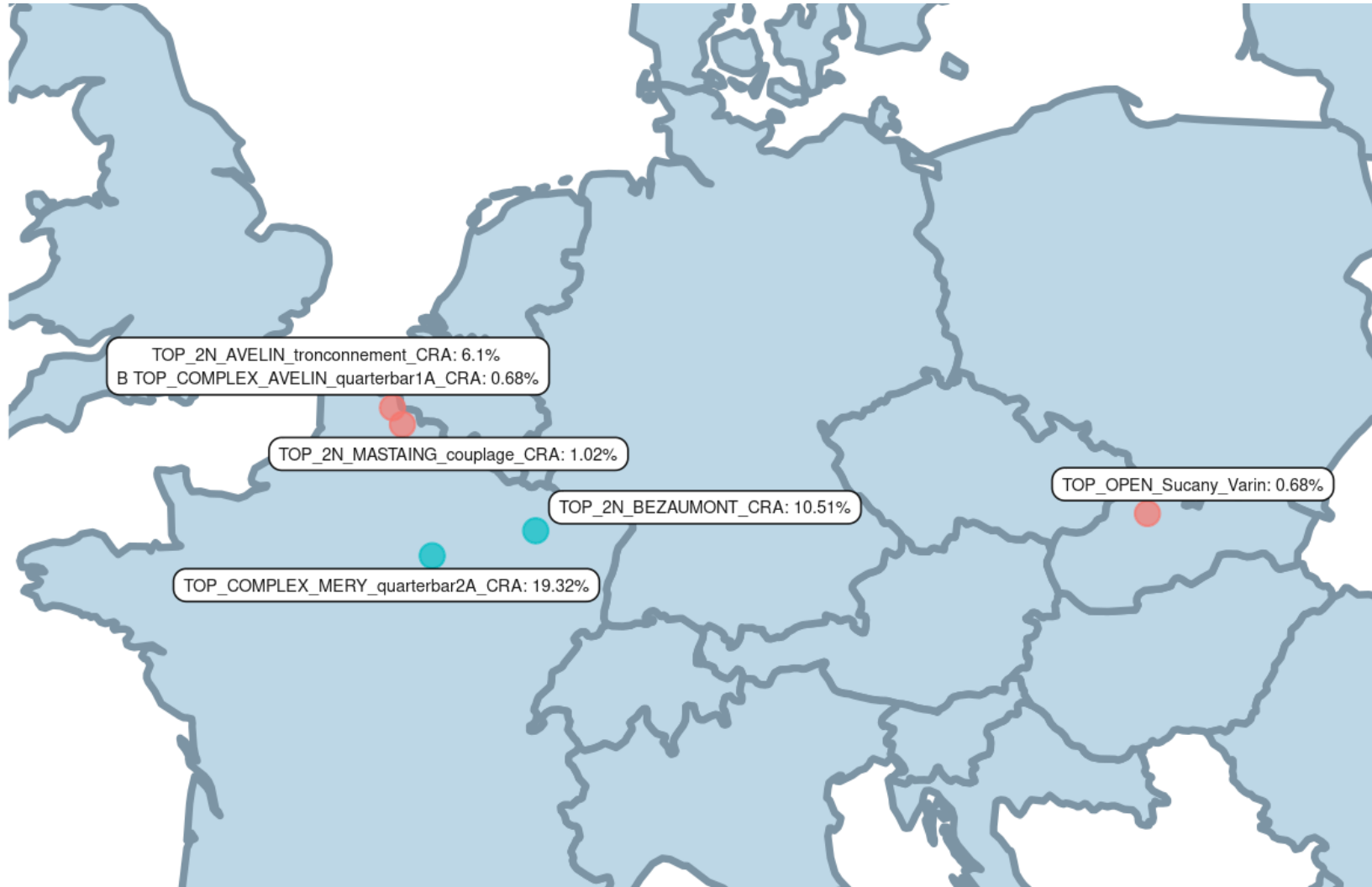


Relative Time Share [%]

- 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



Relative Time Share [%]

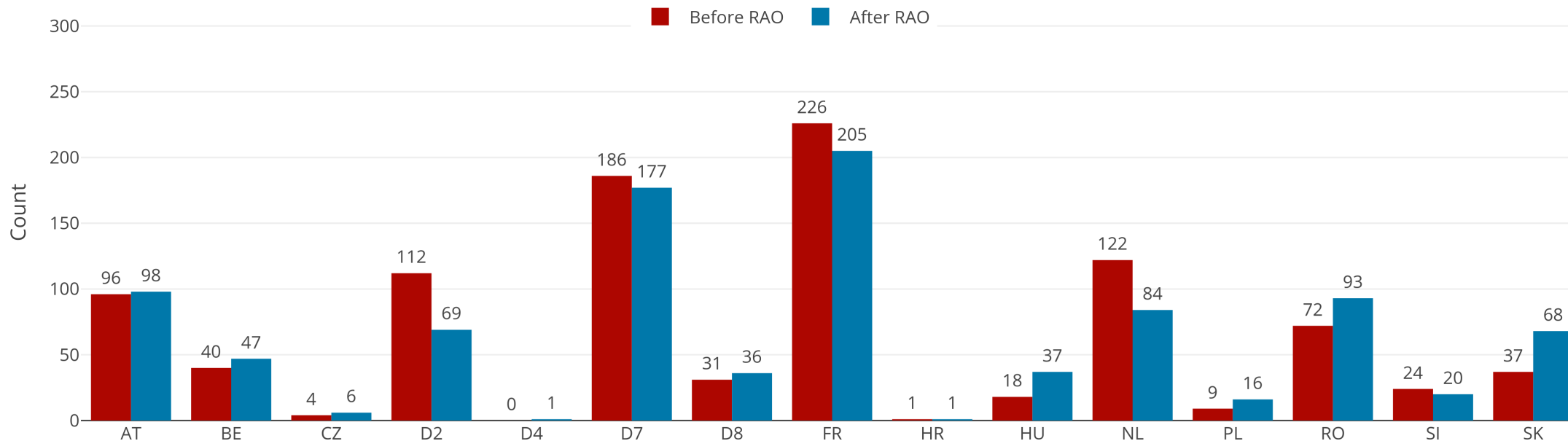
- 0%-10%
- 10%-20%

# 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.



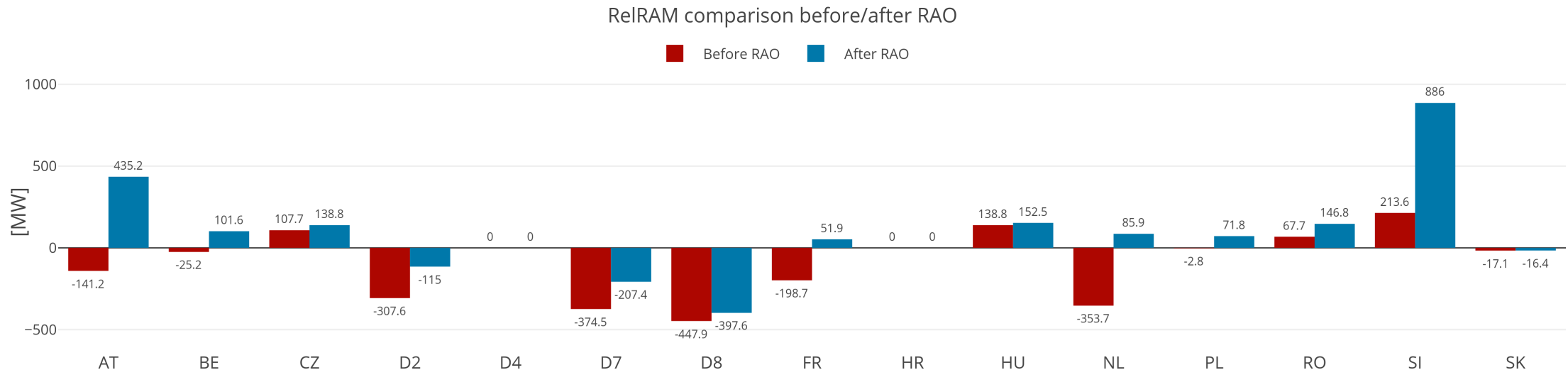
# KPI 10: Average variation of relative RAM before and after NRAO



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-SK] V.Dur - Levice 1 [DIR]	737	737	44.60%	28.45%	64.88%	0.2338	0.9899
[SI-HU] 400 kV Cirkovce - Hevitz [OPP] [SI]	737	1571	81.24%	45.90%	108.84%	0.2535	0.9726
[HU-HU] Gonyu - Gyor [DIR]	737	1529	77.11%	61.23%	109.68%	0.305	1.7725
[HU-HU] Gonyu - Gyor [OPP]	737	960	104.98%	70.40%	143.39%	0.305	1.7725
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	736	780	55.46%	15.24%	89.84%	0.2875	0.7046
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	736	1333	115.01%	81.28%	175.94%	0.2875	0.7046
[SK-HU] Levice - God [DIR] [HU]	733	758	66.34%	55.99%	79.22%	0.279	0.9935
[CZ-SK] Liskovec - P. Bystrica [OPP] [CZ]	732	732	100.01%	68.73%	142.47%	0.1093	0.3991
[SI-HU] 400 kV Cirkovce - Hevitz [DIR] [SI]	732	1738	99.69%	71.15%	137.24%	0.2535	0.9726
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	731	1394	66.03%	19.70%	130.30%	0.2899	1.3007
[AT-D2] St. Peter 2 - Pleinting 258 [DIR] [AT]	724	1314	56.02%	19.55%	139.48%	0.2097	0.8166
[CZ-SK] Sokolnice - Stupava [DIR] [CZ]	720	720	73.21%	63.49%	87.59%	0.2787	1.1079
[PL-CZ] Kopanina - Liskovec [DIR] [PL]	715	1007	71.47%	46.45%	108.80%	0.1238	0.4431
[CZ-SK] Sokolnice - Krizovany [DIR] [CZ]	713	713	74.35%	62.63%	89.18%	0.2699	1.1031
[AT-CZ] Duernrohr 1 - Slavetice 437 [OPP] [AT]	713	713	66.03%	39.24%	105.43%	0.2995	1.2233
[PL-CZ] Kopanina - Liskovec [OPP] [PL]	710	912	104.05%	71.15%	134.72%	0.1238	0.4431
[SK-SK] V.Dur - Krizovany [DIR]	697	697	79.30%	64.40%	94.57%	0.2341	0.8498
[CZ-SK] Liskovec - P. Bystrica [DIR] [CZ]	697	697	80.67%	53.67%	111.20%	0.1093	0.3991
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	695	1069	55.54%	39.29%	88.70%	0.401	1.5089
[SK-SK] Gabcikovo - P.Biskupice [DIR]	691	691	80.38%	64.87%	97.66%	0.2793	0.9817

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-SI] Obersielach - Podlog 247 [DIR] [AT]	161	166	1035.82	55.85%	21.21%	110.50%	0.1713
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	156	213	598.71	38.90%	19.96%	66.30%	0.1986
[FR-D7] Vigy - Ensdorf VIGY1 N [DIR] [D7]	150	166	701.99	43.46%	19.96%	72.29%	0.2044
L 400kV N0 2 CREYS-ST-VULBAS-OUEST	127	127	808.55	25.21%	20.02%	38.02%	0.1238
[SK-SK] V.Dur - Levice 1 [DIR]	120	120	438.74	39.44%	28.45%	49.14%	0.214
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	117	117	246.42	83.49%	60.32%	96.88%	0.2638
[FR-FR] Creys - Saint-Vulbas 2 [OPP]	92	92	1032.69	24.63%	20.04%	39.69%	0.1156
[HU-HU] Szolnok - Szeged [DIR]	92	92	1789.32	42.02%	15.85%	90.85%	0.1147
[RO-RO] TR Rosiori 400/220 1 [DIR]	86	86	809.53	40.05%	20.25%	69.00%	0.1307
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	85	85	207.95	50.46%	40.87%	67.20%	0.3911
[FR-FR] Avelin - Mastaing 1 [DIR]	71	71	421.18	79.12%	63.14%	100.16%	0.27
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	70	70	854.97	28.32%	19.94%	63.34%	0.2316
[D8-PL] Mikulowa PST1 [DIR] [PL]	58	58	264.13	53.75%	44.42%	72.11%	0.341
[D7-FR] Ensdorf - Vigy VIGY1 N [OPP] [FR]	55	56	337.57	20.12%	20.12%	20.12%	0.204
[AT-D2] St. Peter 2 - Pleinting 258 [DIR] [AT]	49	49	247.56	33.49%	19.74%	77.09%	0.1613
[D8-D8] Vierraden - Vierraden PST441 [DIR]	27	27	309.69	47.35%	37.95%	56.71%	0.303
[NL-D2] Meeden-Diele 380 W [OPP] [NL]	26	26	558.15	25.69%	19.94%	62.39%	0.2264
[RO-RS] Portile de Fier - Djerdap [OPP] [RO]	23	23	142.9	31.69%	20.07%	62.02%	0.4461
[CZ-SK] Nosovice - Varin [DIR] [CZ]	21	21	68.5	69.49%	62.00%	88.93%	0.4181
[FR-FR] Frasnes - Genissiat [OPP]	20	20	1372.95	28.02%	20.02%	41.84%	0.0925

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	422
AC < 0 MW	113
AC = 0 MW	298
AC > 0 MW	11

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1530.14	4553.37
Min.	-8258.00	0.00
Max.	0.00	15425.00

