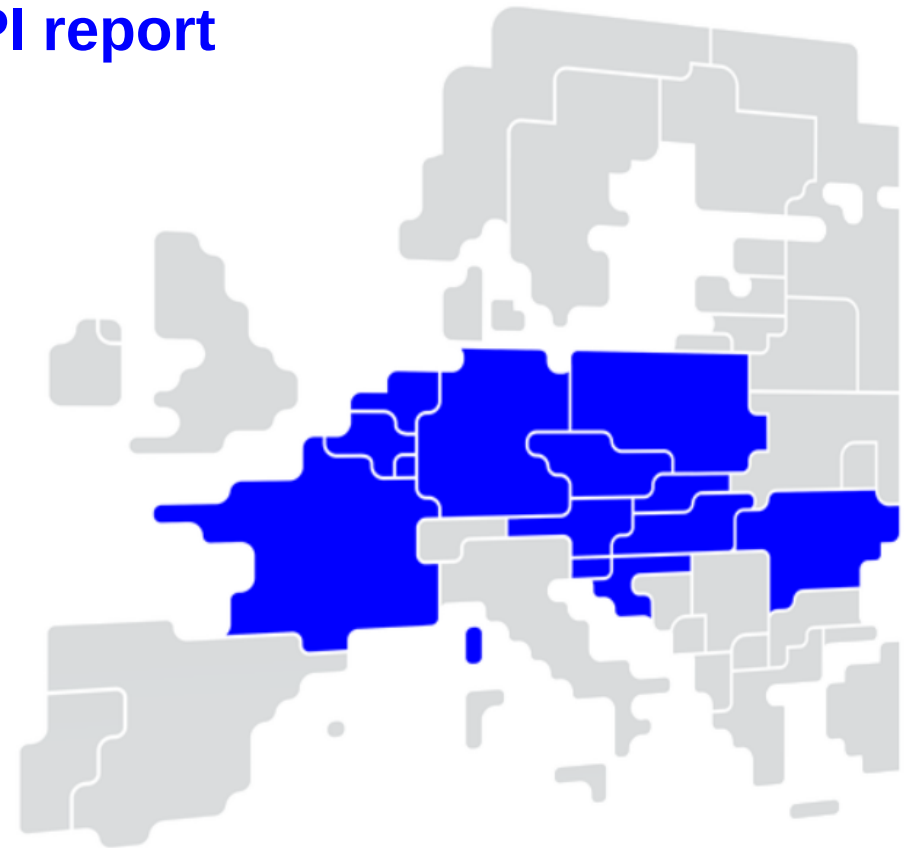


Core FB MC Operational KPI report

November 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

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)

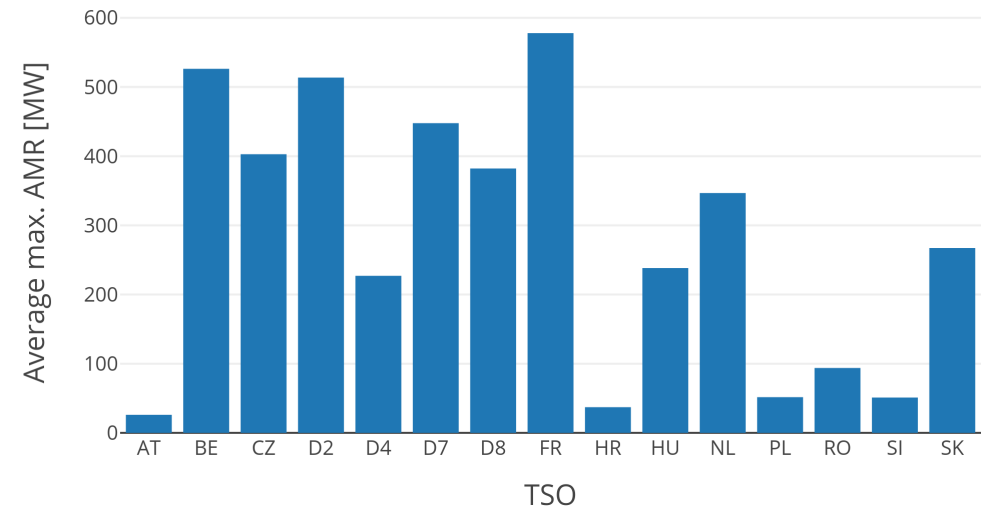
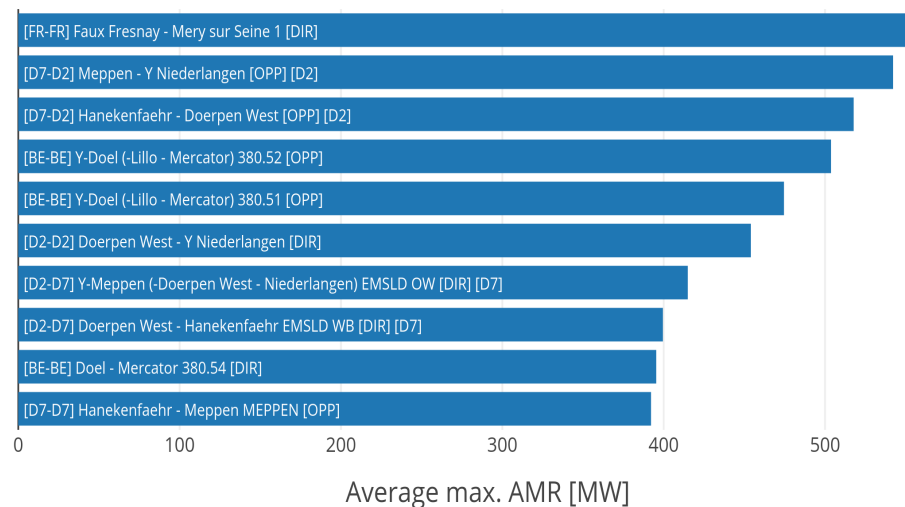
KPI 2: Average maximum AMR per TSO



CNE	Average Maximum AMR (MW)	AMR as % of Fmax
[FR-FR] Faux Fresnay - Mery sur Seine 1 [DIR]	552.86	28.71%
[D7-D2] Meppen - Y Niederlangen [OPP] [D2]	542.16	27.20%
[D7-D2] Hanekenfaehr - Doerpen West [OPP] [D2]	517.74	24.49%
[BE-BE] Y-Doel (-Lillo - Mercator) 380.52 [OPP]	503.70	26.47%
[BE-BE] Y-Doel (-Lillo - Mercator) 380.51 [OPP]	474.54	17.07%
[D2-D2] Doerpen West - Y Niederlangen [DIR]	454.02	22.77%
[D2-D7] Y-Meppen (-Doerpen West - Niederlangen) EMSLD OW [DIR] [D7]	414.93	17.61%
[D2-D7] Doerpen West - Hanekenfaehr EMSLD WB [DIR] [D7]	399.50	16.15%
[BE-BE] Doel - Mercator 380.54 [DIR]	395.37	23.49%
[D7-D7] Hanekenfaehr - Meppen MEPPEN [OPP]	392.15	16.78%

TSO	Average maximum AMR per TSO
AT	25.99
BE	526.30
CZ	402.84
D2	513.58
D4	227.10
D7	447.64
D8	382.24
FR	577.88
HR	37.20
HU	238.18

TSO	Average maximum AMR per TSO
NL	346.64
PL	51.66
RO	93.85
SI	51.14
SK	267.30



KPI 3: Share of MTUs with intervention per TSO



Total BDs
30

Total MTUs
720

MTUs without IVA
224

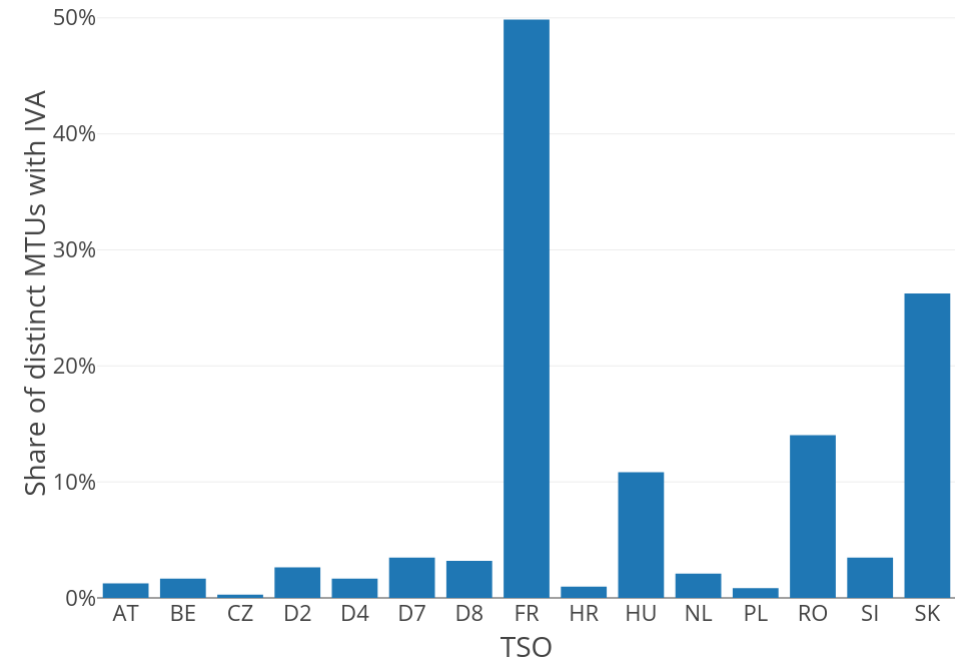
Share of distinct
MTUs without IVA
31.11%

MTUs with IVA
496

Share of distinct
MTUs with IVA
68.9%

TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
CZ	0.28%	2
SI	3.47%	25
AT	1.25%	9
D7	3.47%	25
D8	3.19%	23
D2	2.64%	19
PL	0.83%	6
D4	1.67%	12
SK	26.25%	189
HU	10.83%	78

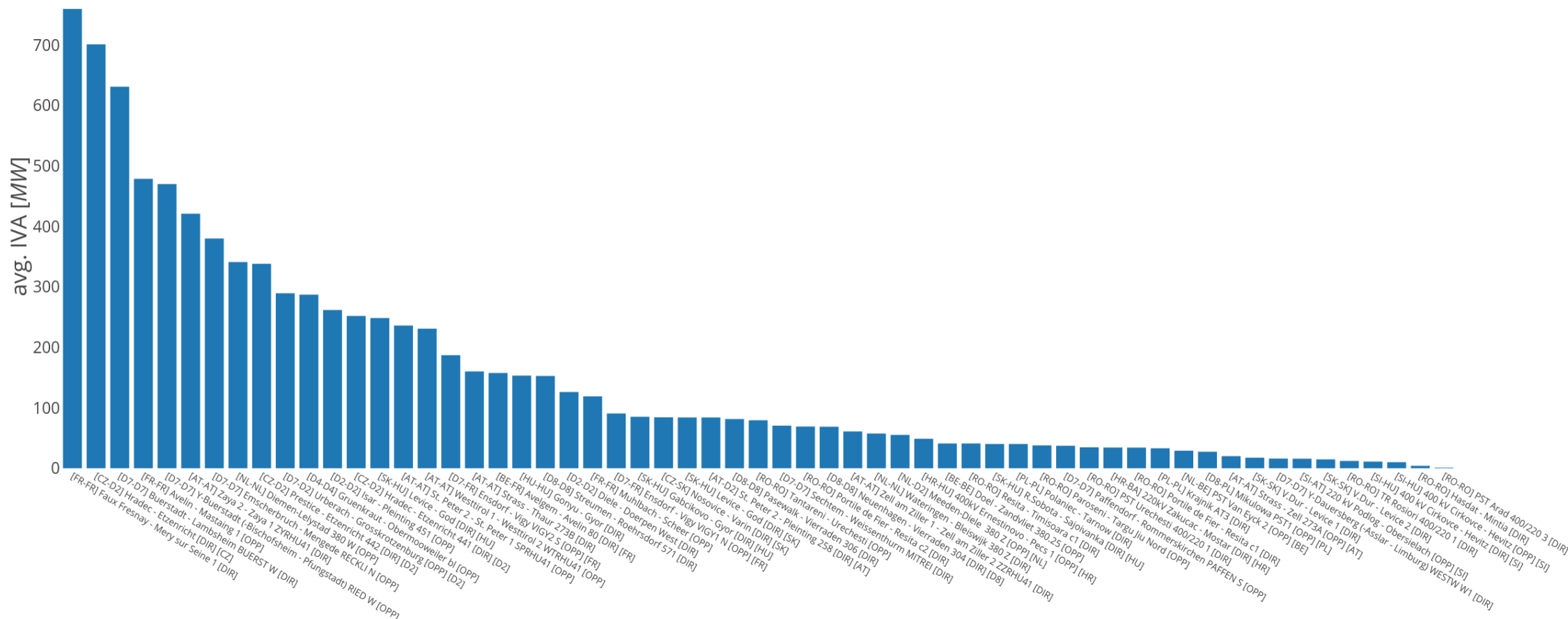
TSO	Share of distinct MTUs with IVA	Distinct MTUs with IVA
BE	1.67%	12
NL	2.08%	15
FR	49.86%	359
RO	14.03%	101
HR	0.97%	7



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



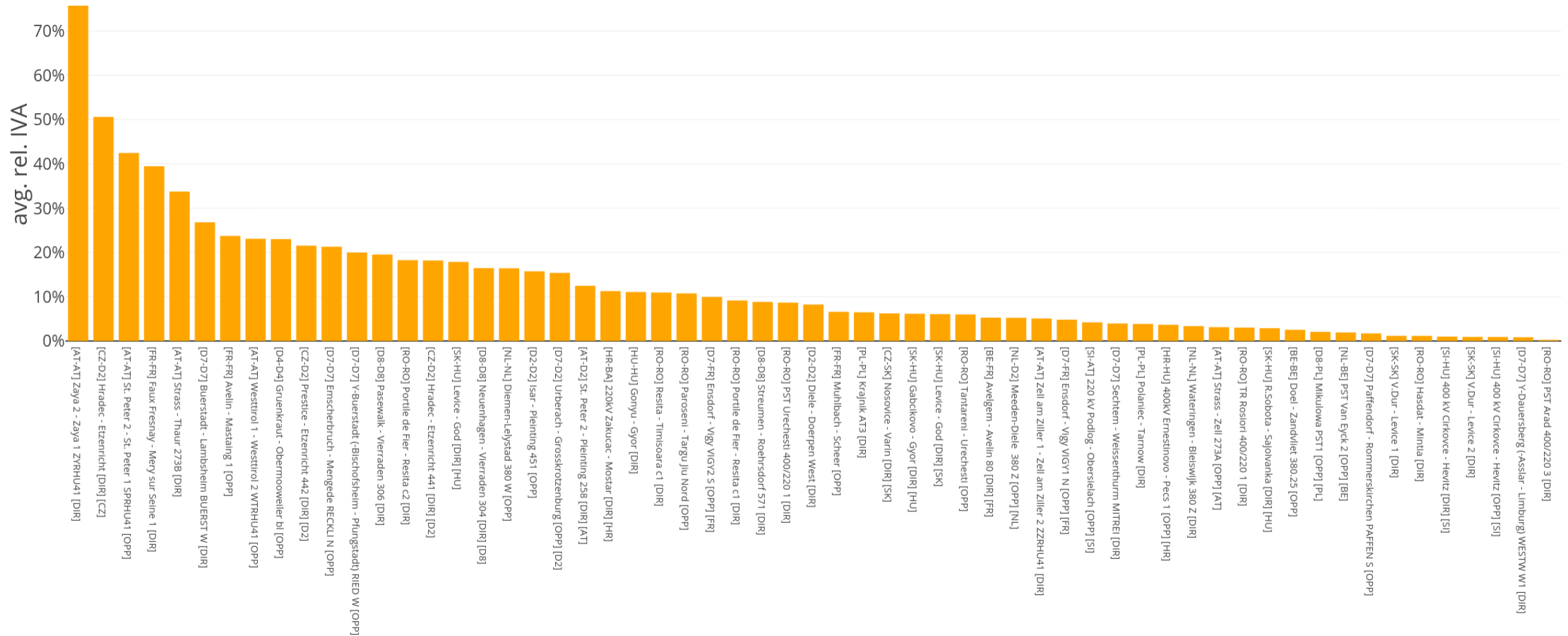
$$\text{avg. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} IVA_{CNEC, MTU} [IVA_{CNEC, MTU} > 0]$$



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



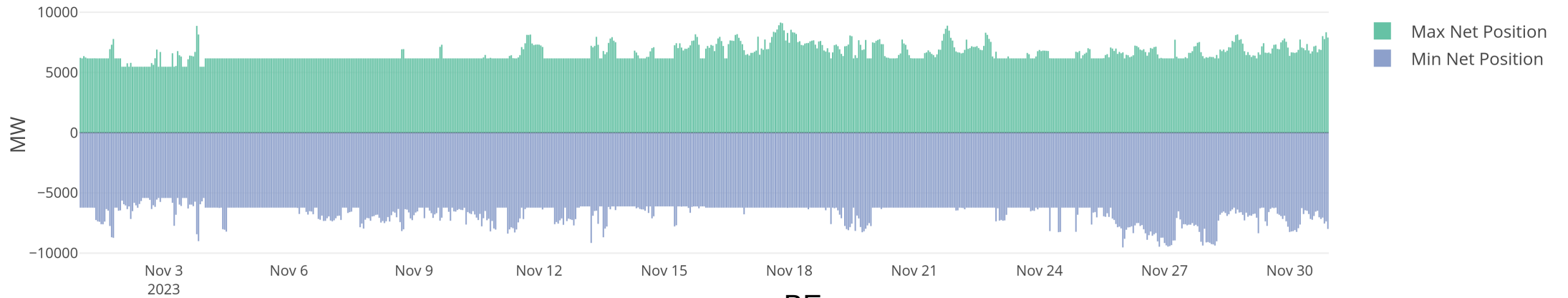
$$\text{avg. rel. IVA}_{CNE} = \frac{1}{\#(CNEC, MTU)[IVA_{CNEC, MTU} > 0]} \sum_{MTU, CNEC} \frac{IVA_{CNEC, MTU}[IVA_{CNEC, MTU} > 0]}{F_{max CNEC, MTU}[IVA_{CNEC, MTU} > 0]}$$



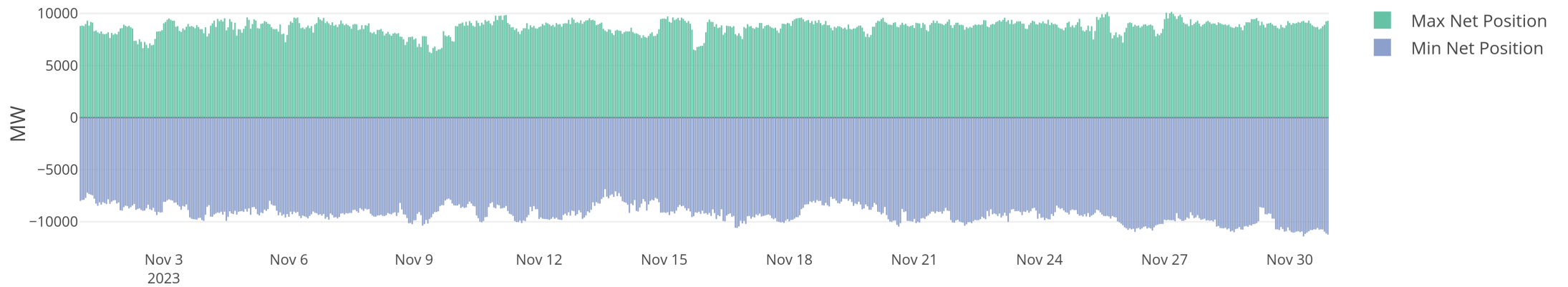
KPI 5: Min & max net positions per BZ hub



AT



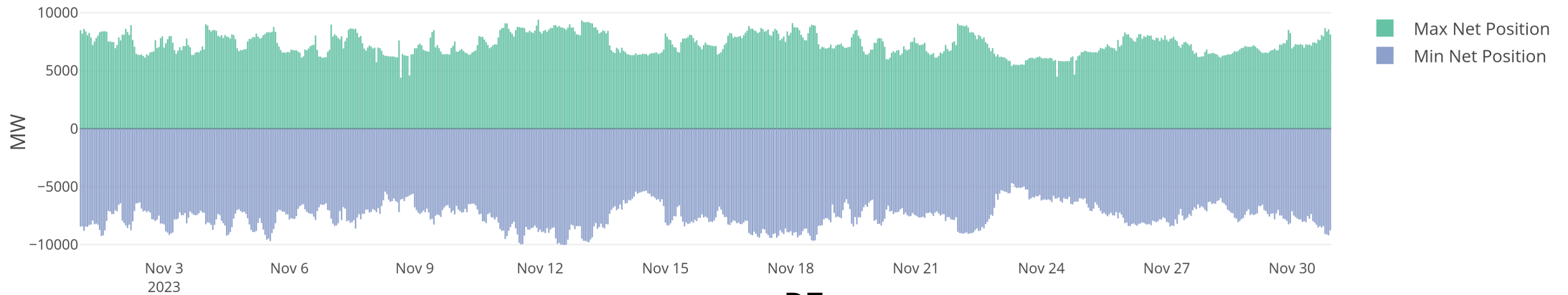
BE



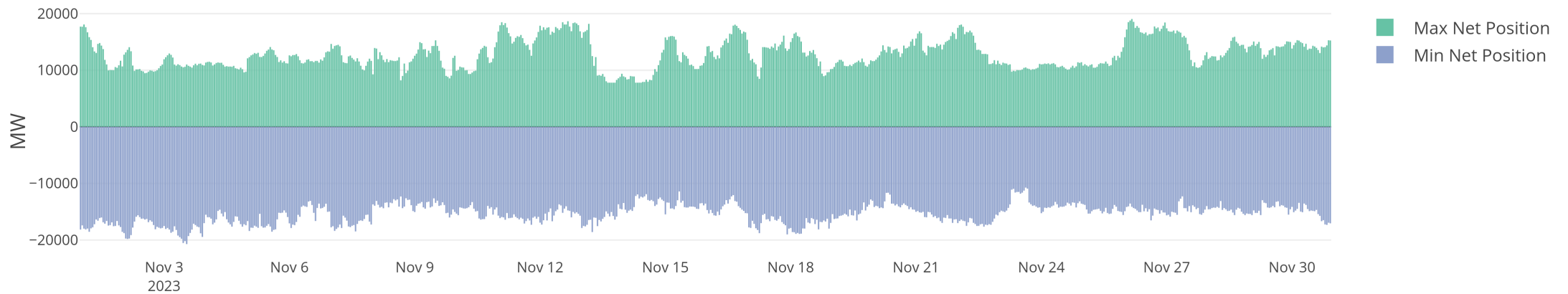
KPI 5: Min & max net positions per BZ hub



CZ



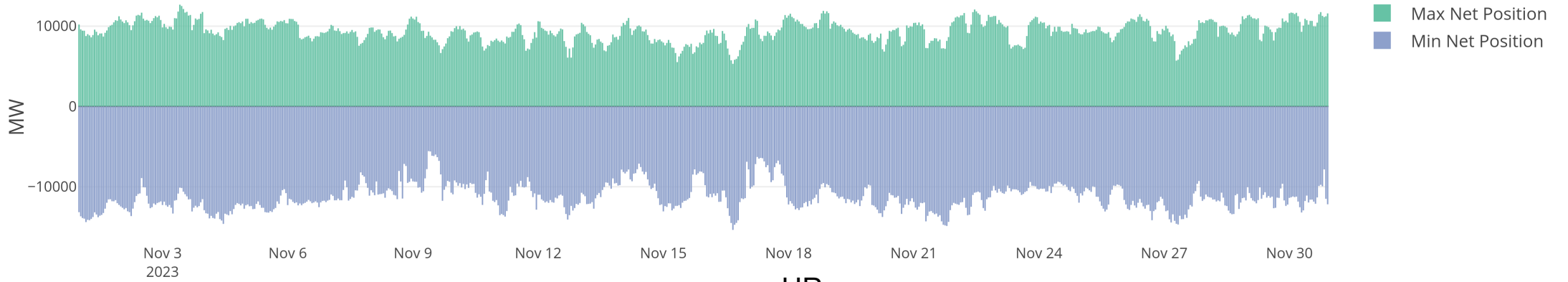
DE



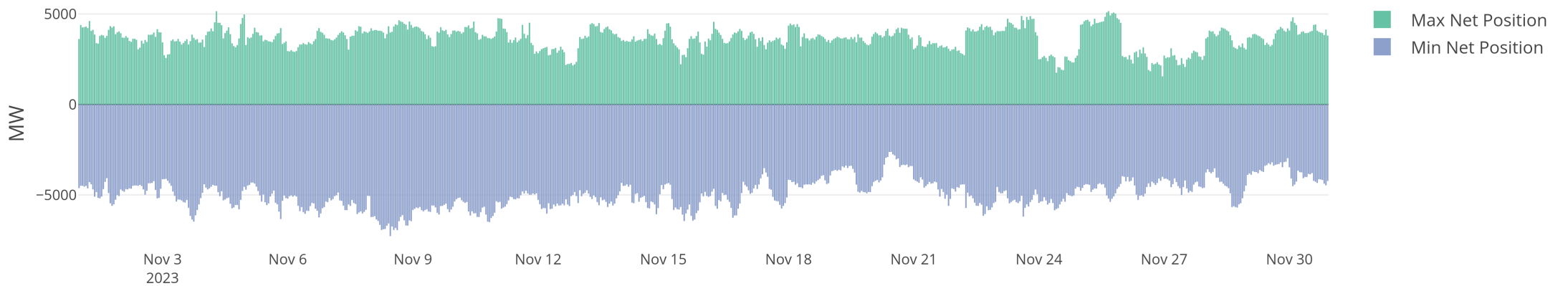
KPI 5: Min & max net positions per BZ hub



FR



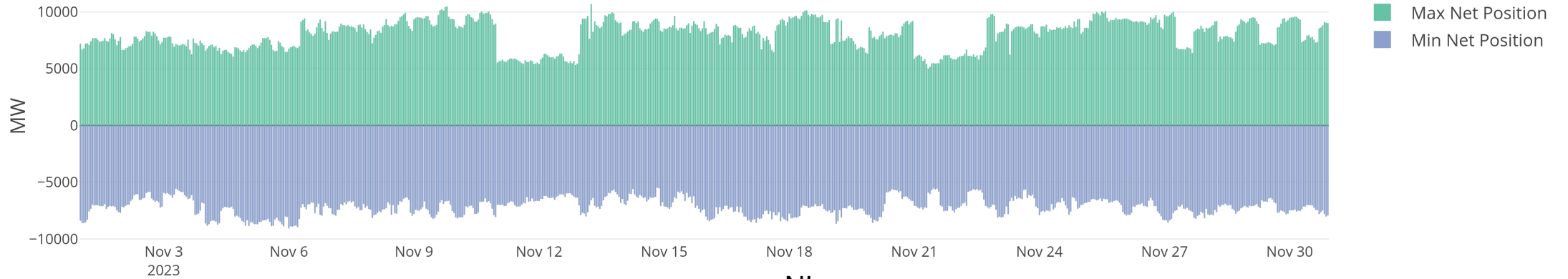
HR



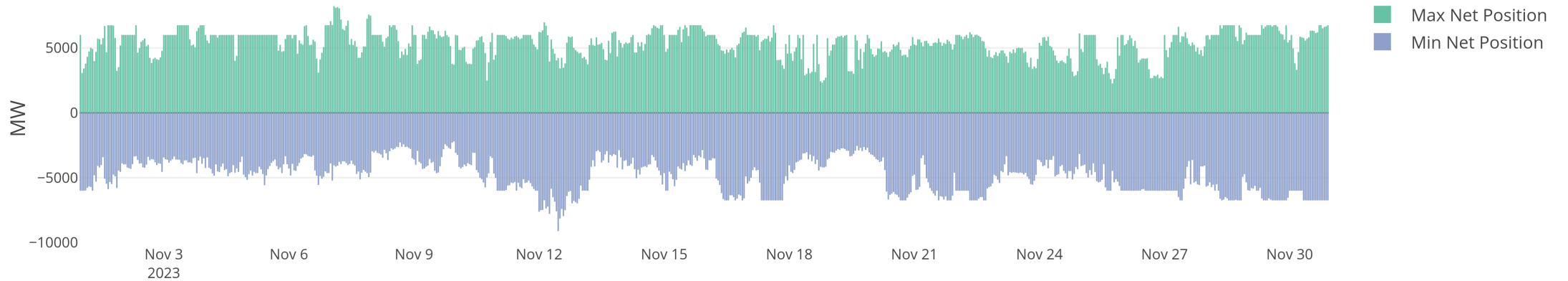
KPI 5: Min & max net positions per BZ hub



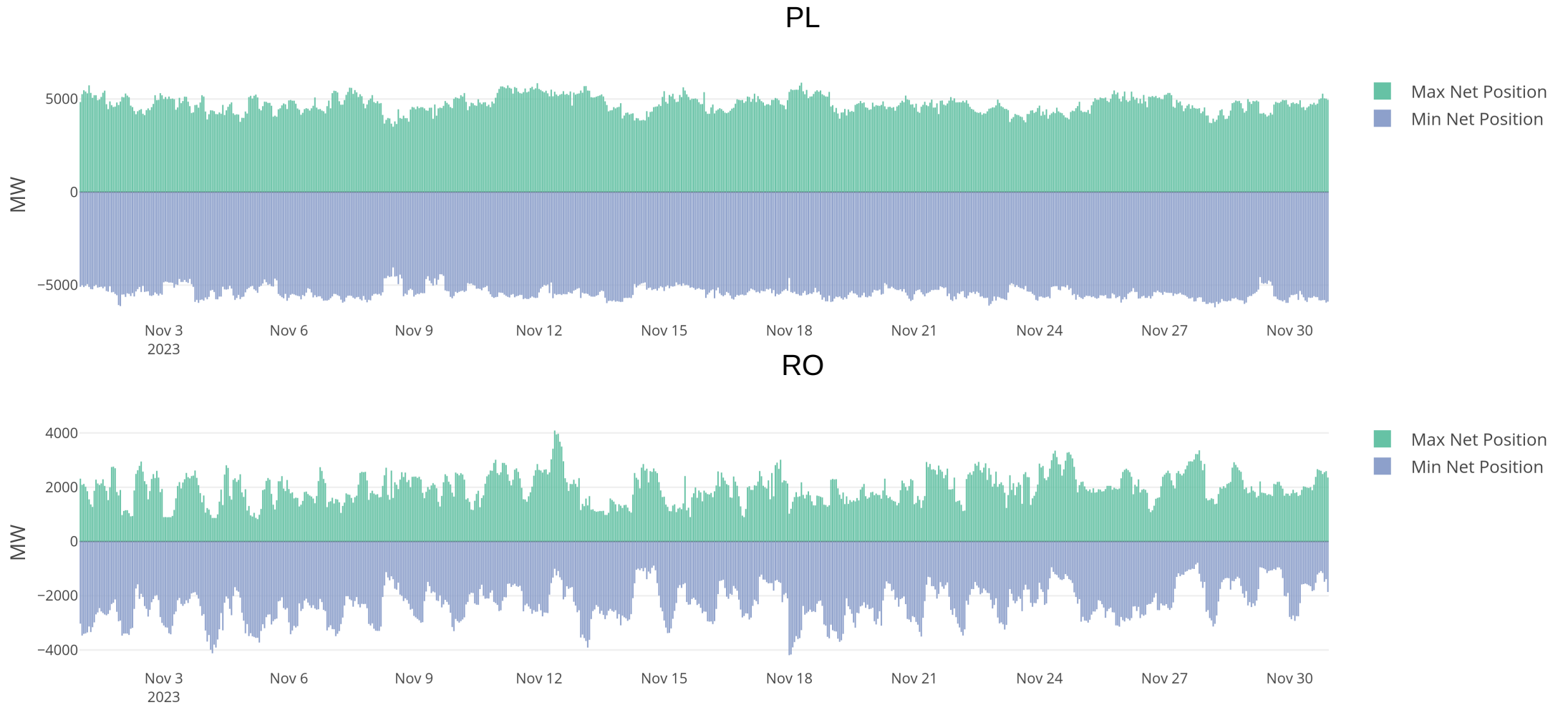
HU



NL



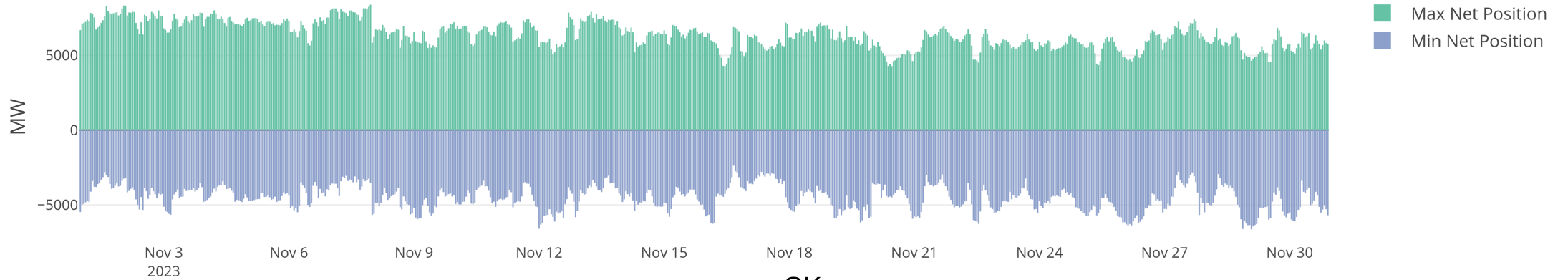
KPI 5: Min & max net positions per BZ hub



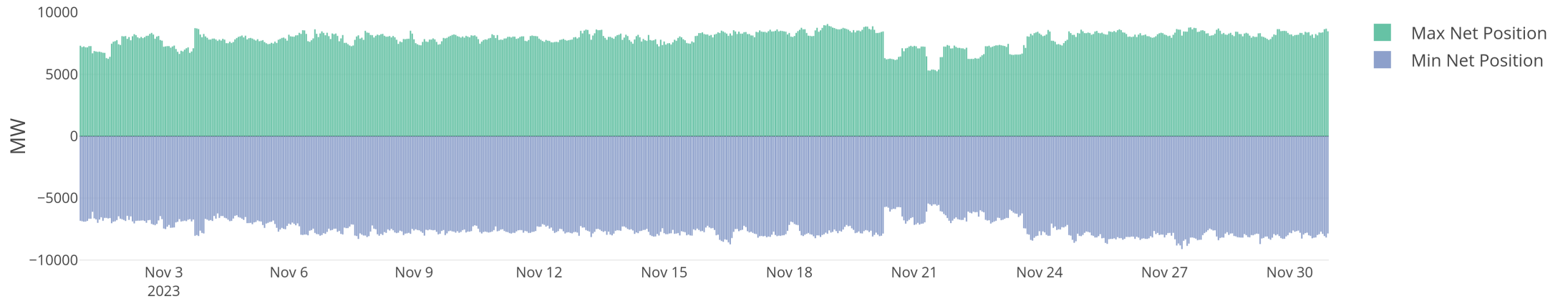
KPI 5: Min & max net positions per BZ hub



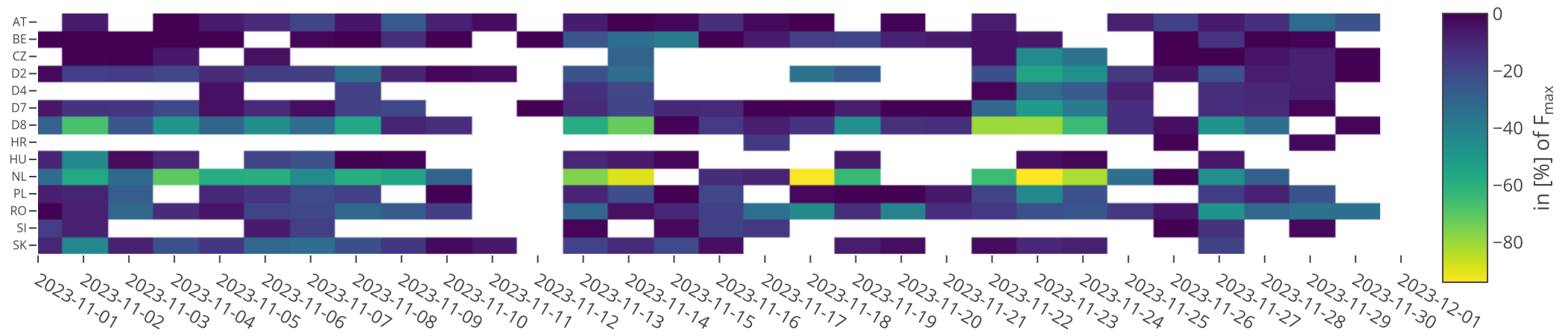
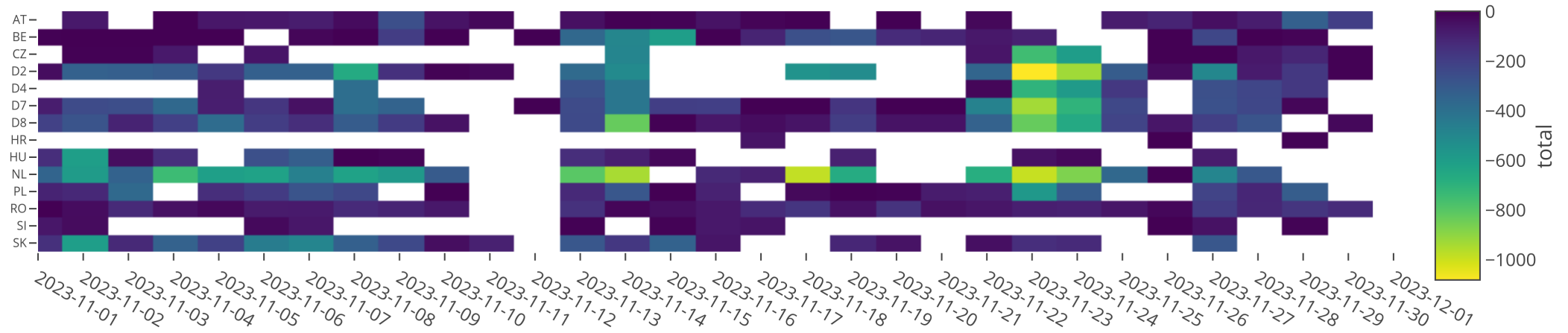
SI



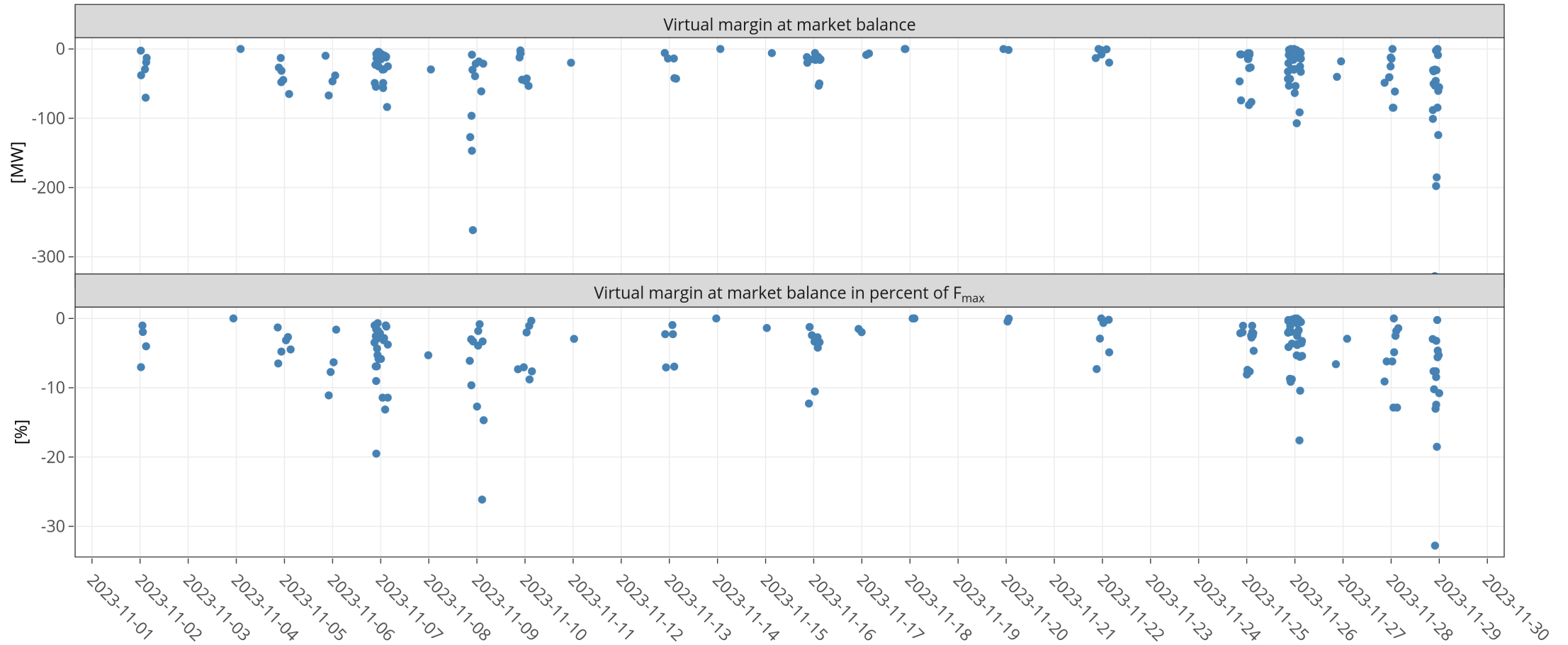
SK



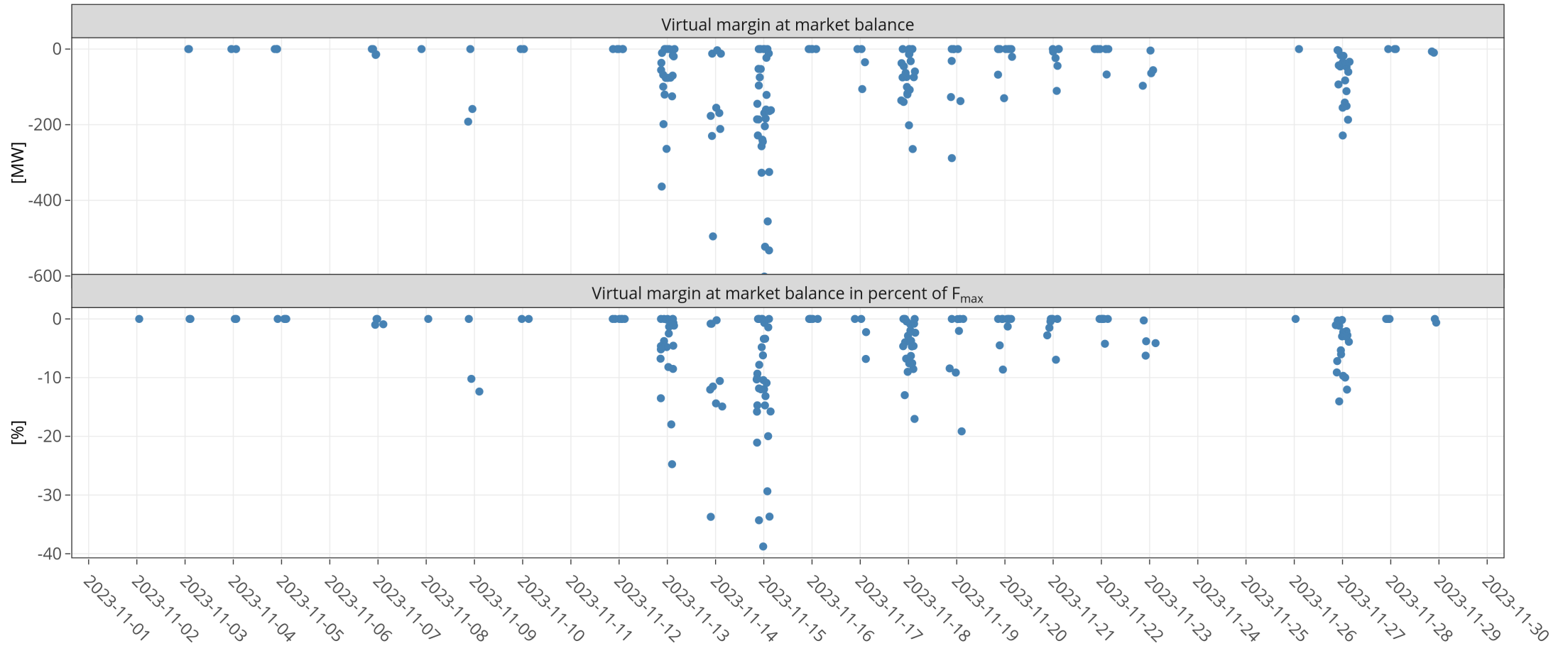
KPI 6a: Highest virtual margins at market balance for CORE TSOs



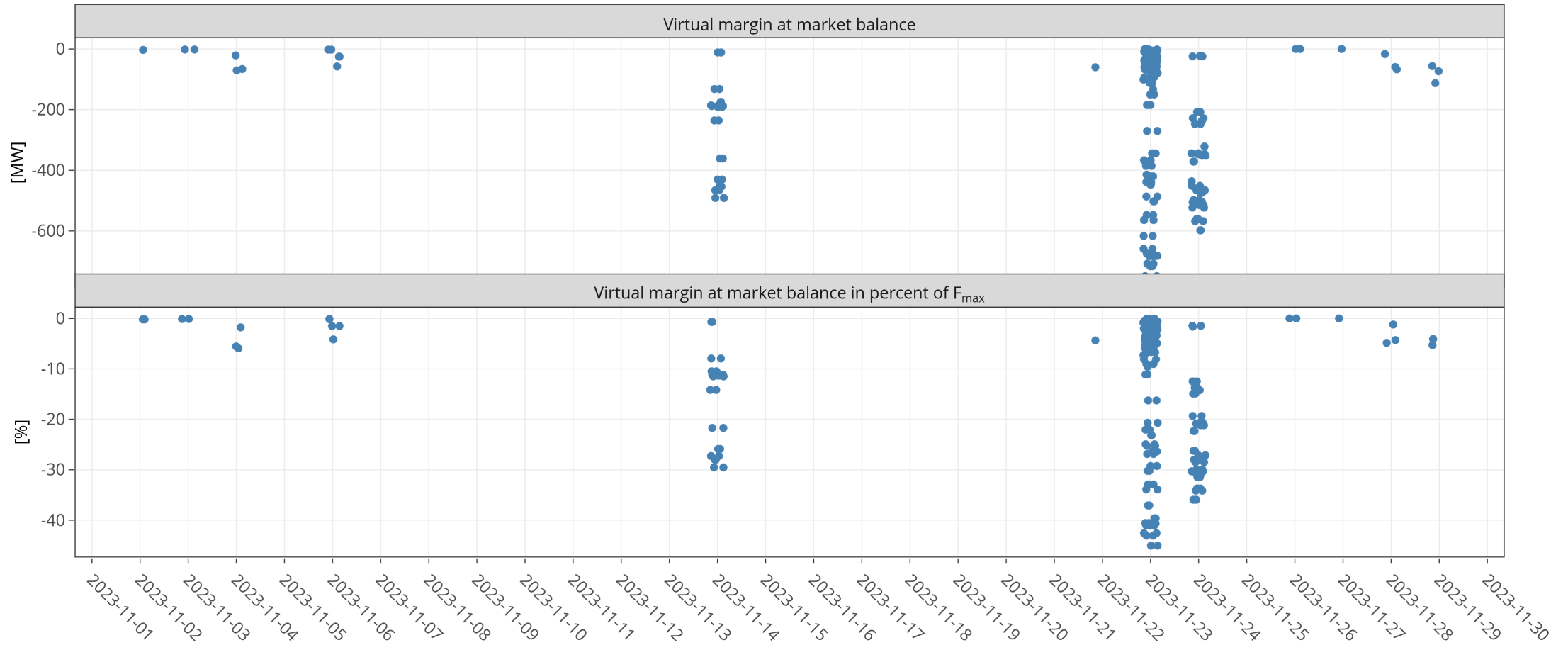
KPI 6b: Virtual margins at market balance AT



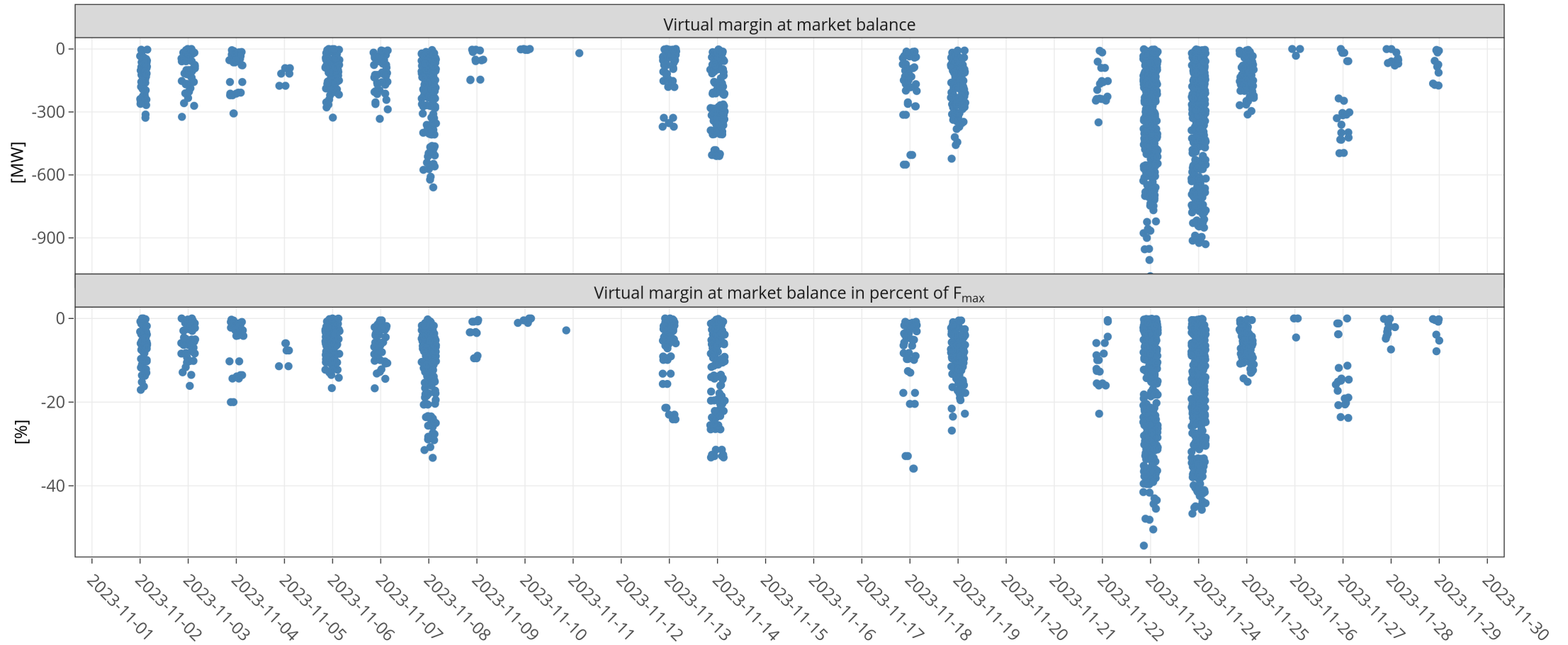
KPI 6b: Virtual margins at market balance BE



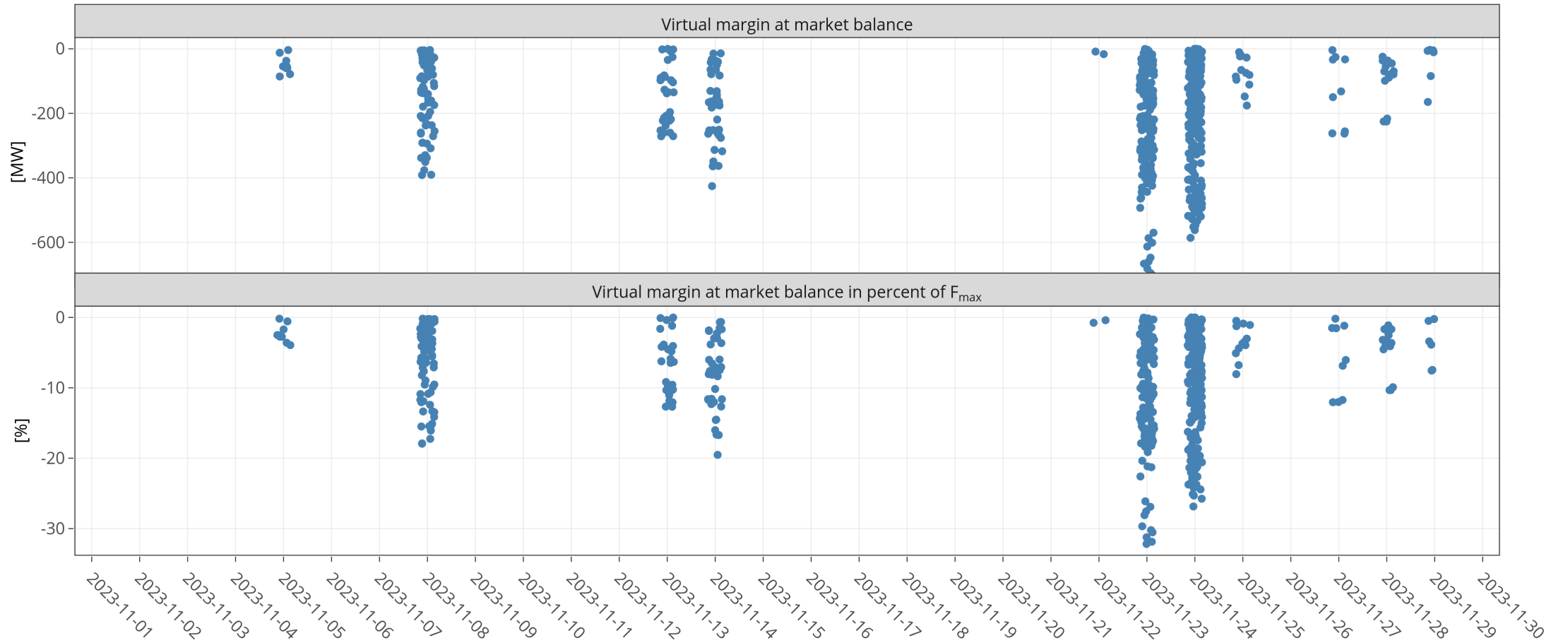
KPI 6b: Virtual margins at market balance CZ



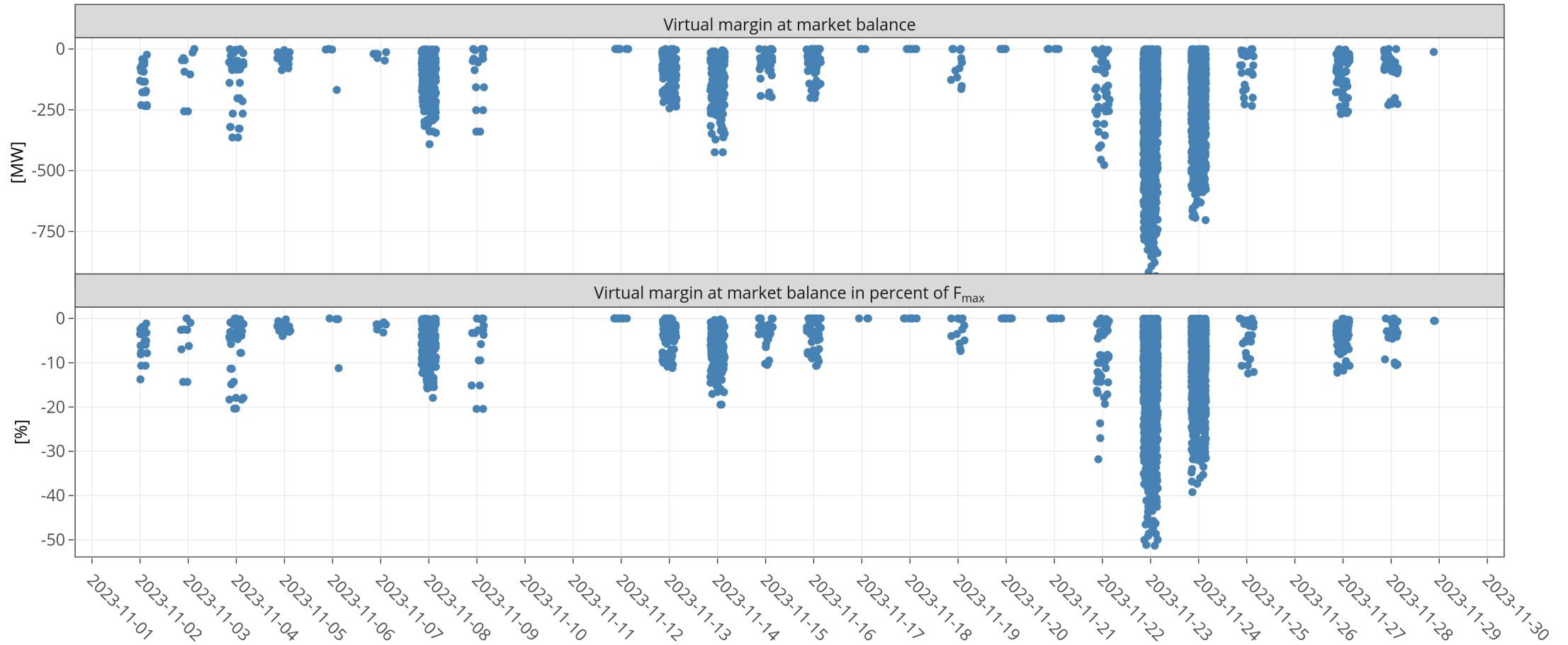
KPI 6b: Virtual margins at market balance D2



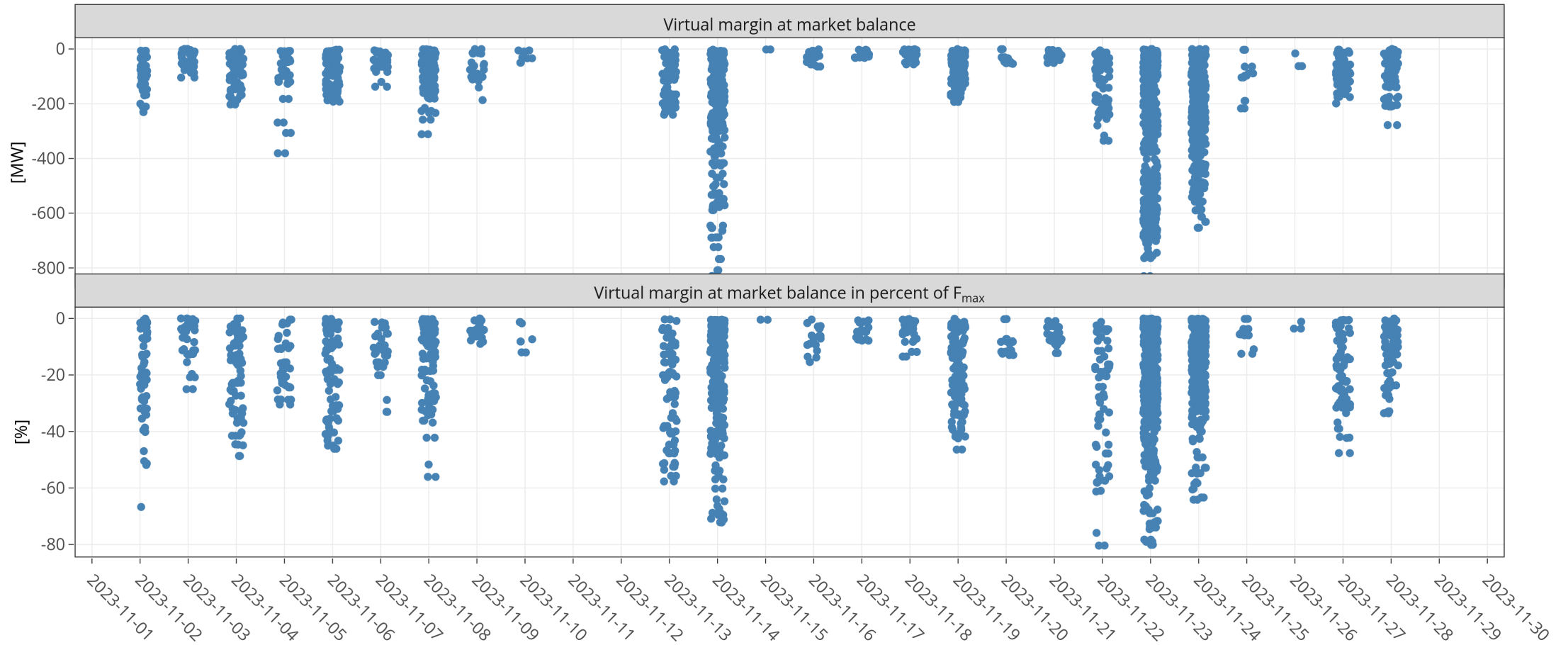
KPI 6b: Virtual margins at market balance D4



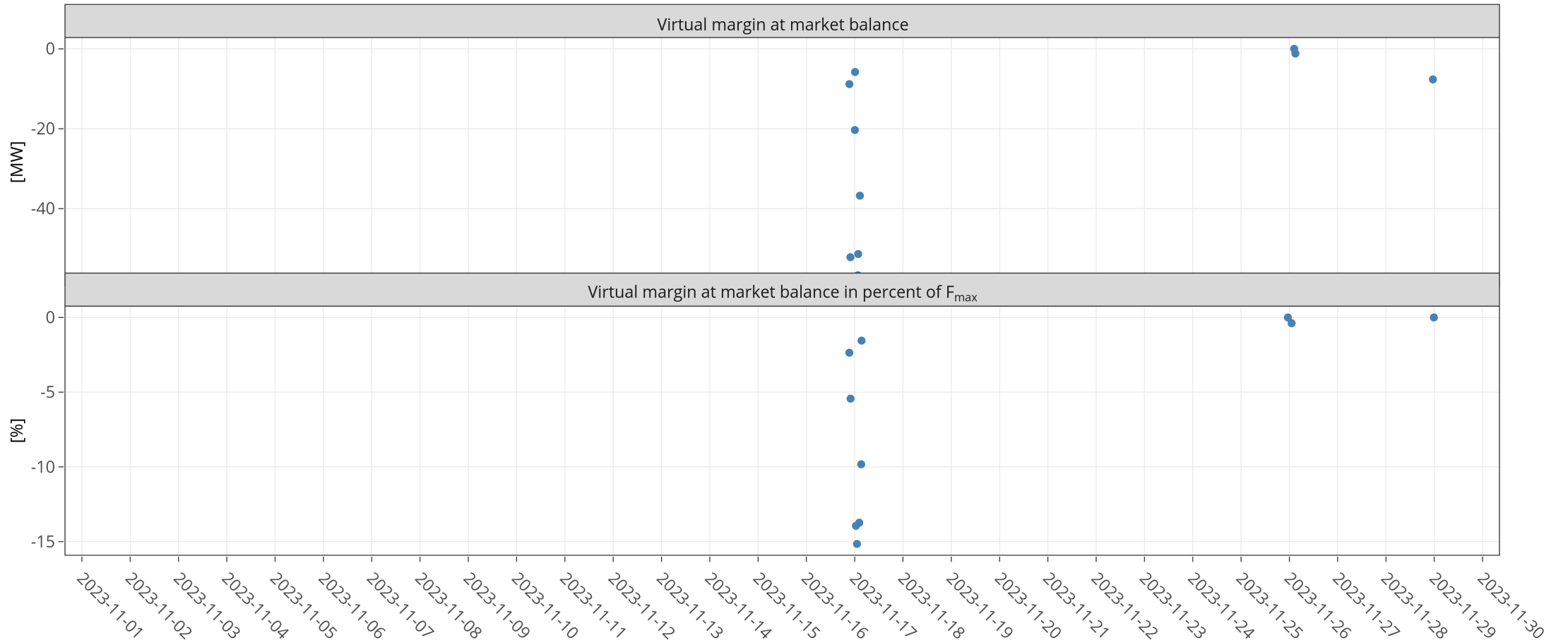
KPI 6b: Virtual margins at market balance D7



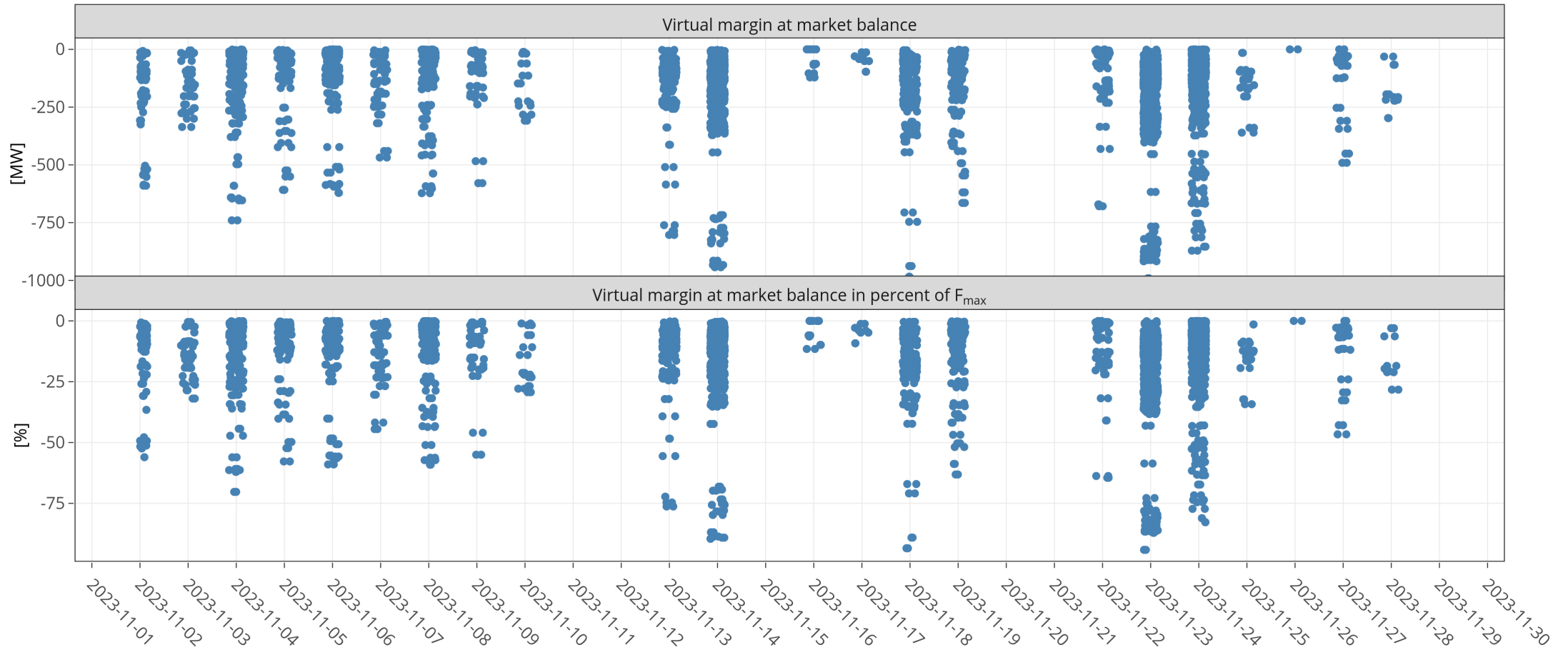
KPI 6b: Virtual margins at market balance D8



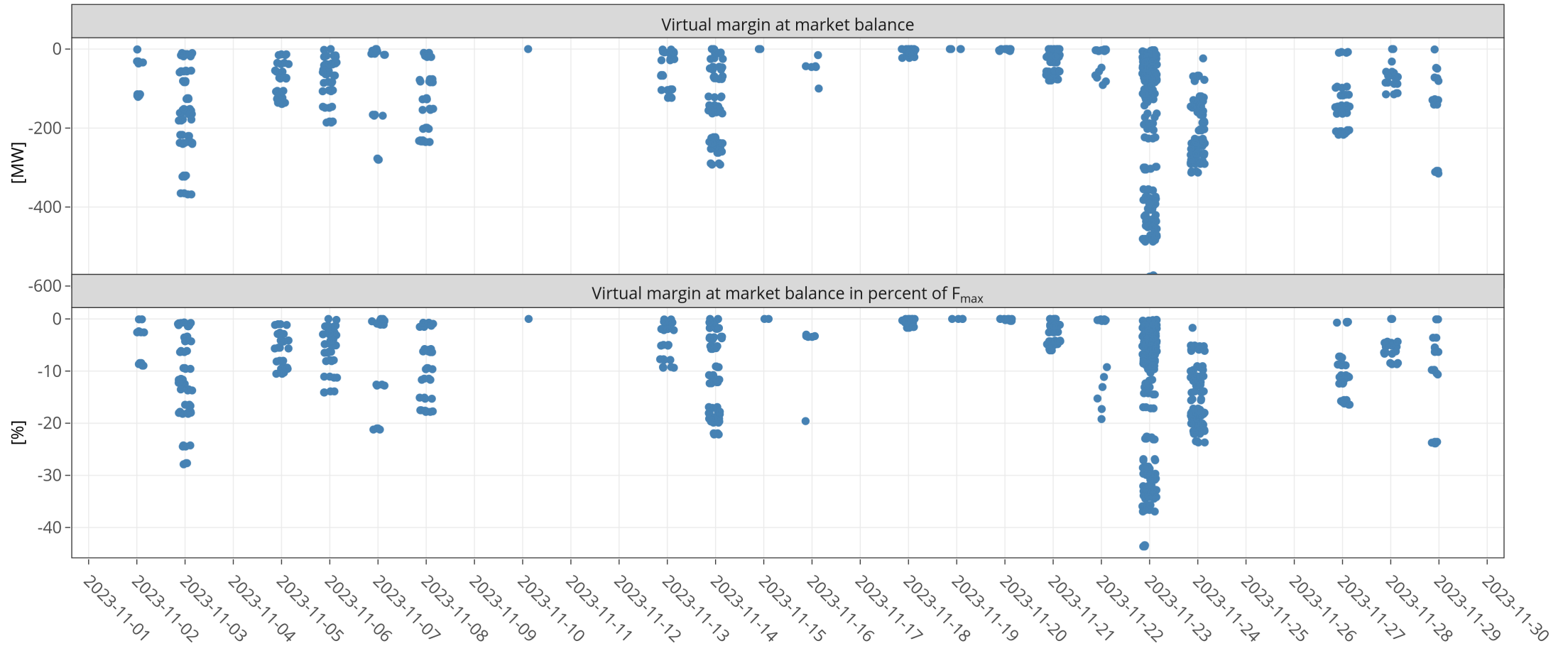
KPI 6b: Virtual margins at market balance HR



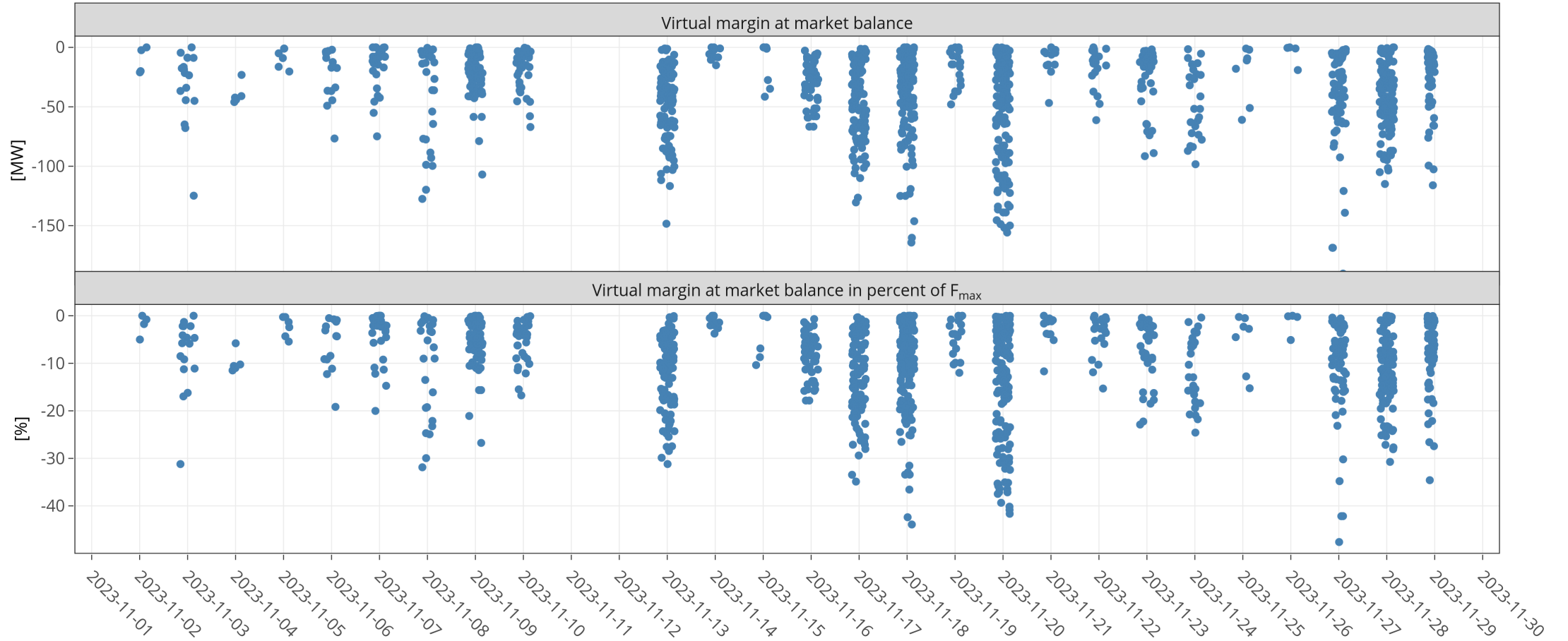
KPI 6b: Virtual margins at market balance NL



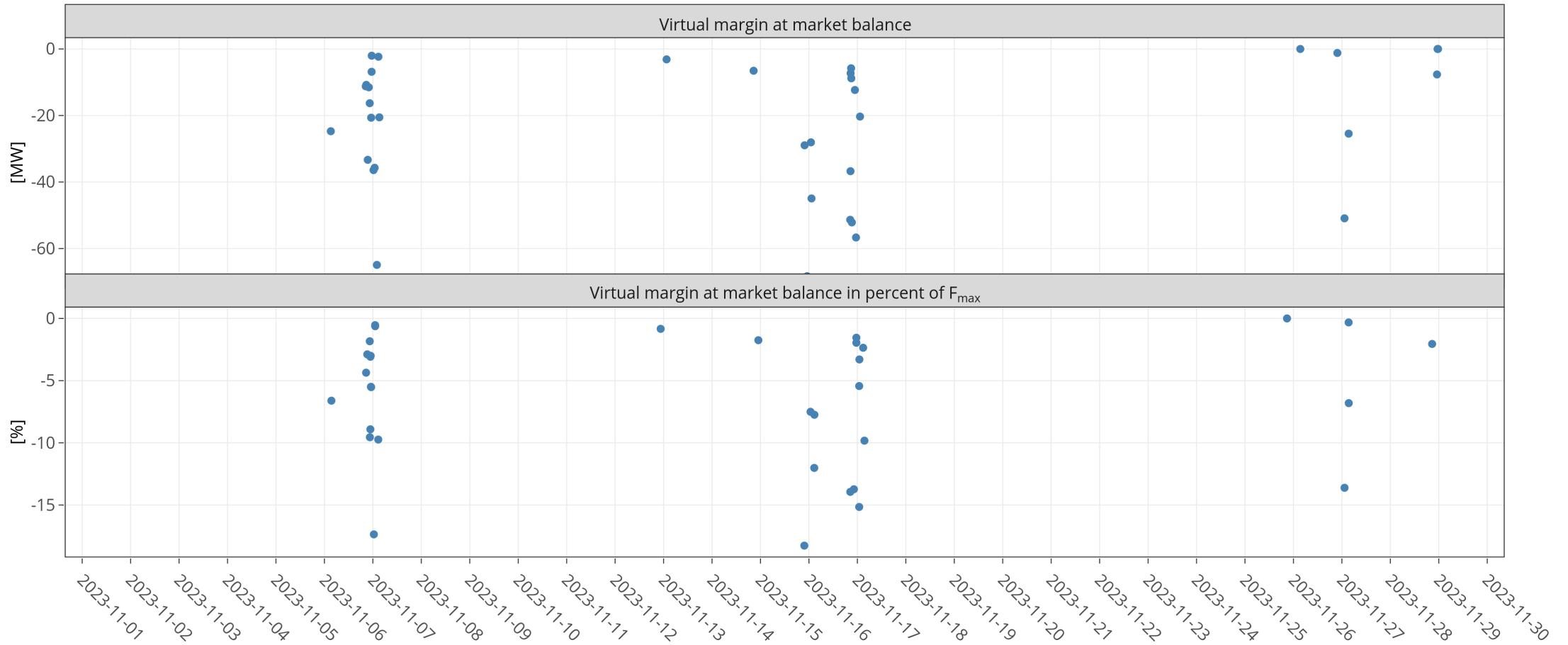
KPI 6b: Virtual margins at market balance PL



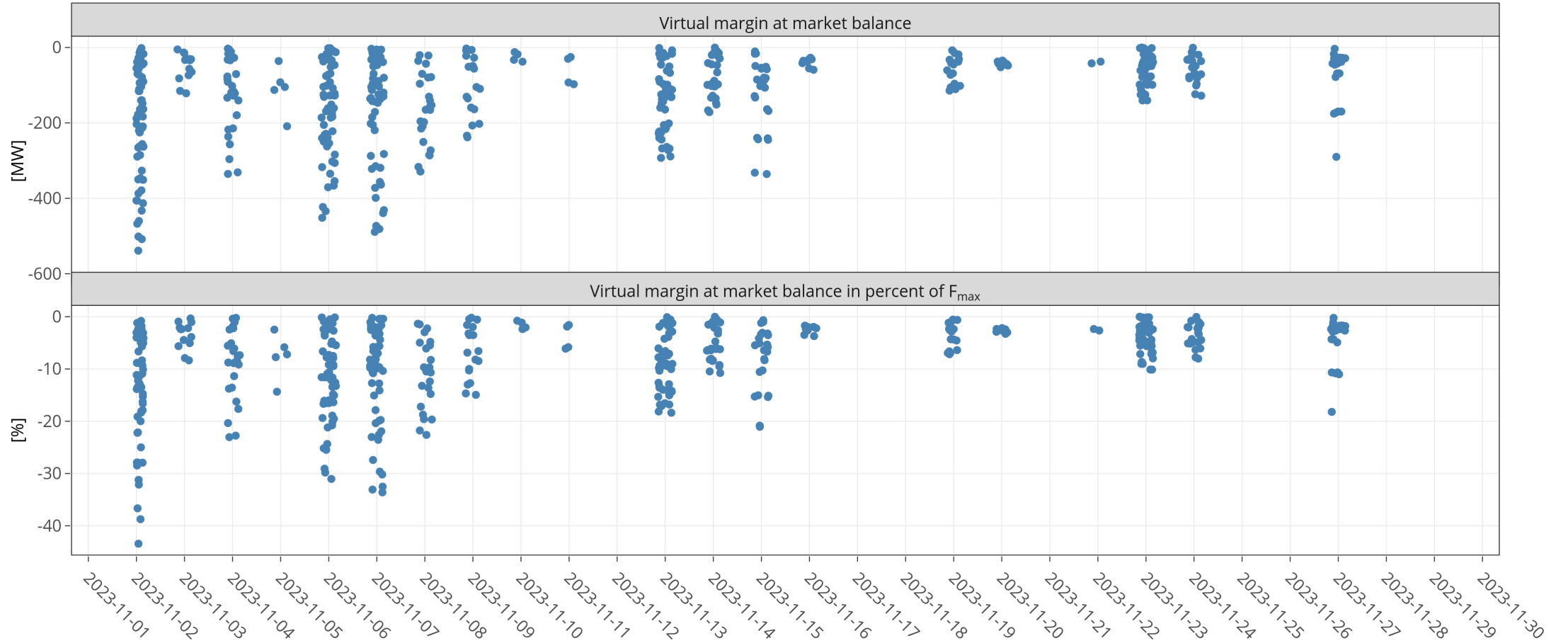
KPI 6b: Virtual margins at market balance RO



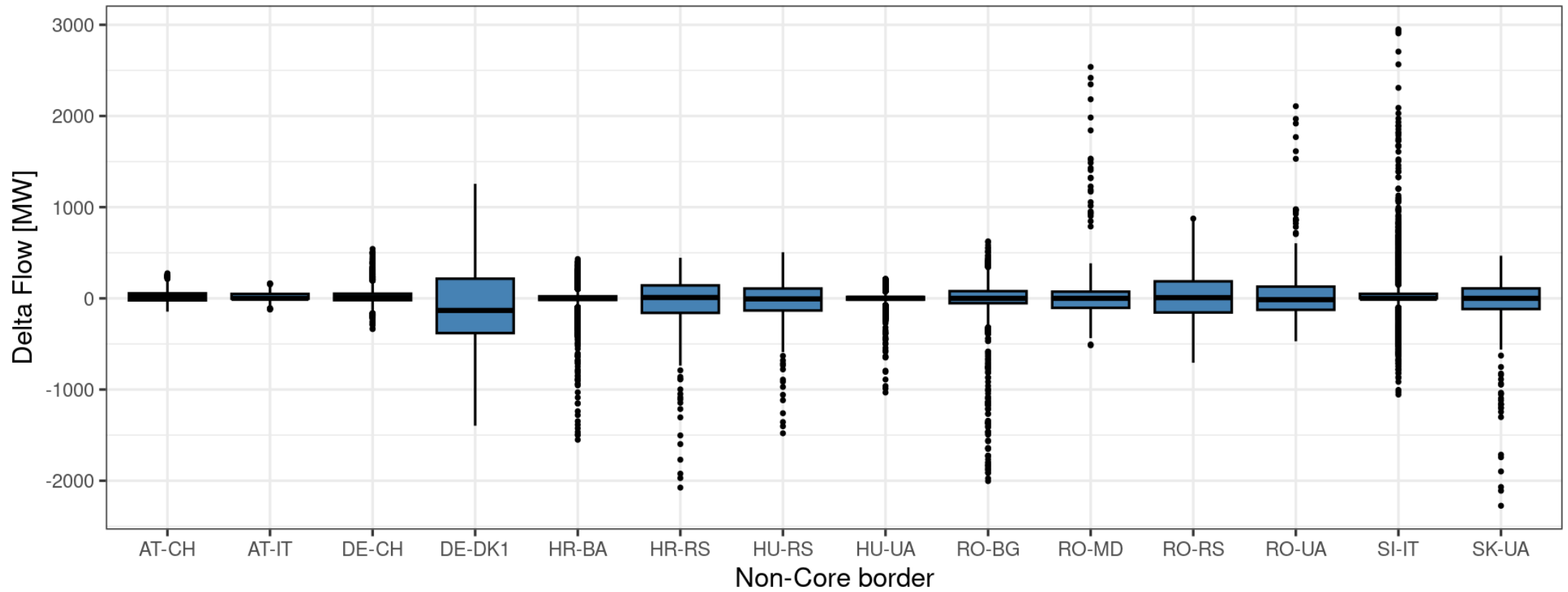
KPI 6b: Virtual margins at market balance SI



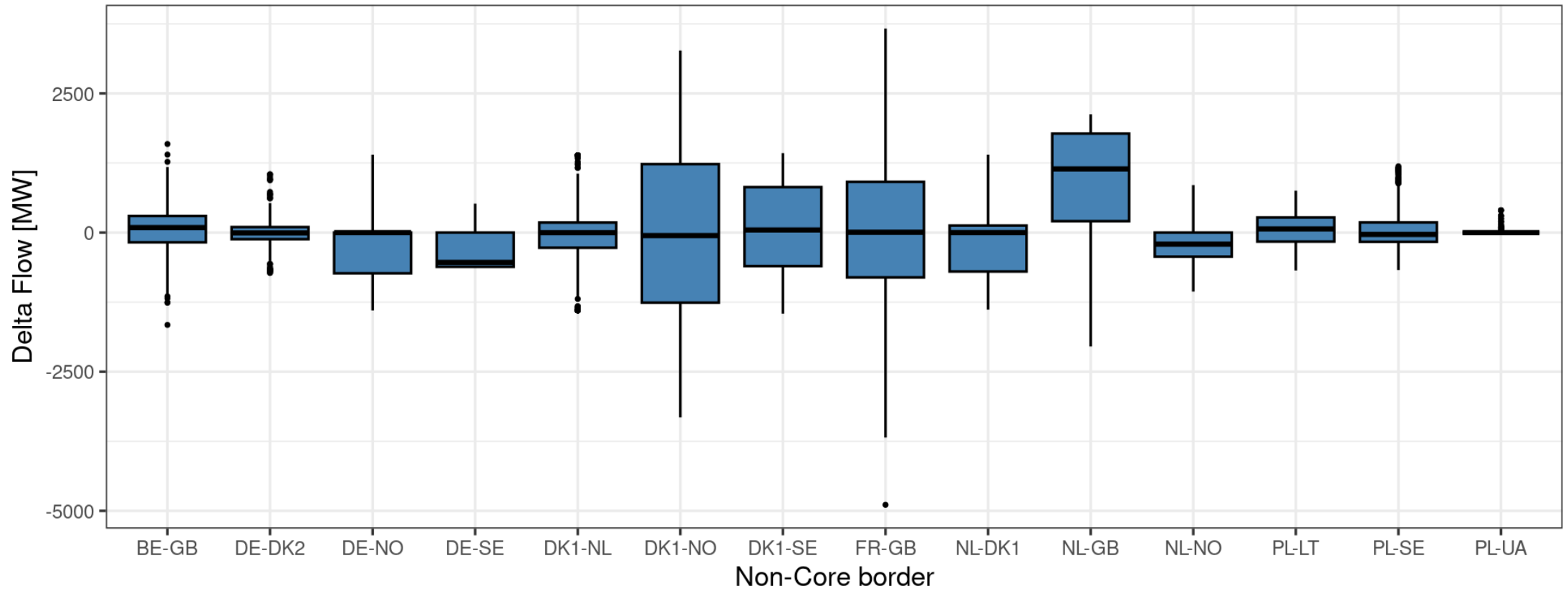
KPI 6b: Virtual margins at market balance SK



KPI 7: Non-Core exchanges AC delta flow



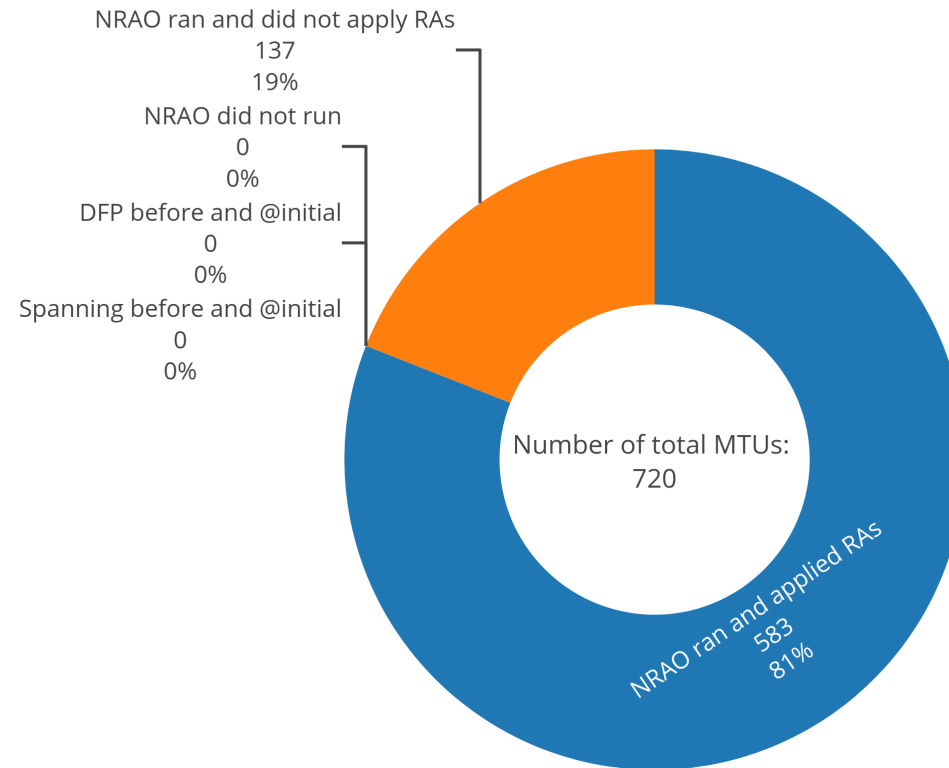
KPI 7: Non-Core exchanges DC delta flow



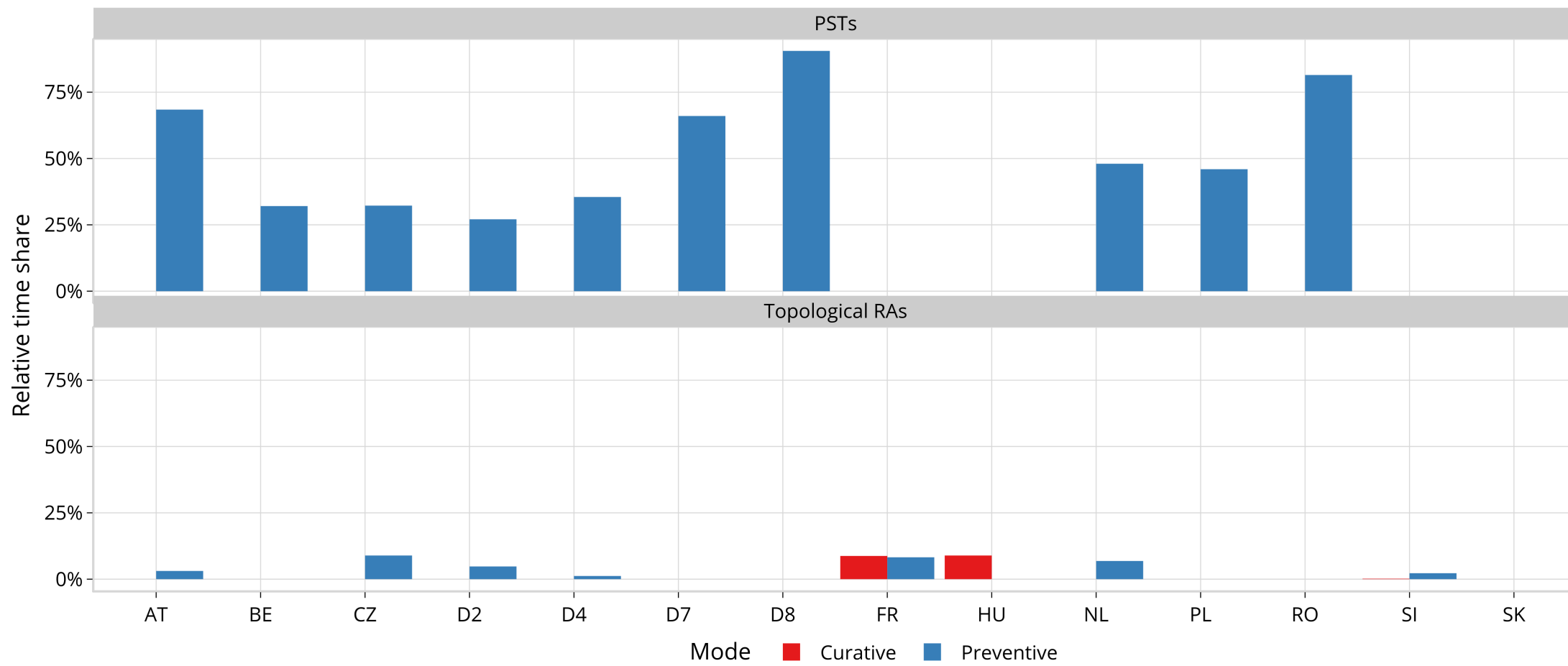
KPI 8: NRAO – Applied Remedial Action



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

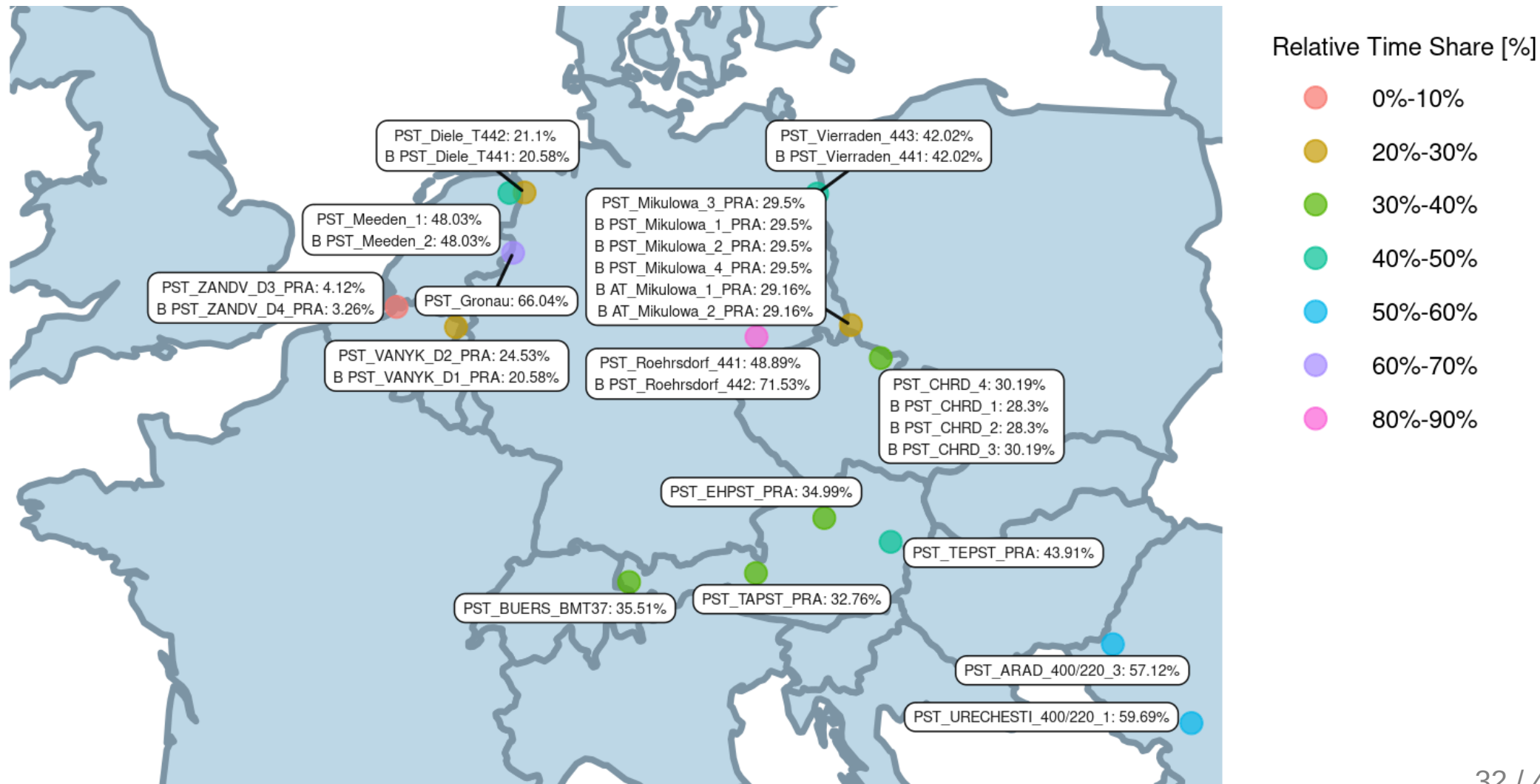


KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode



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



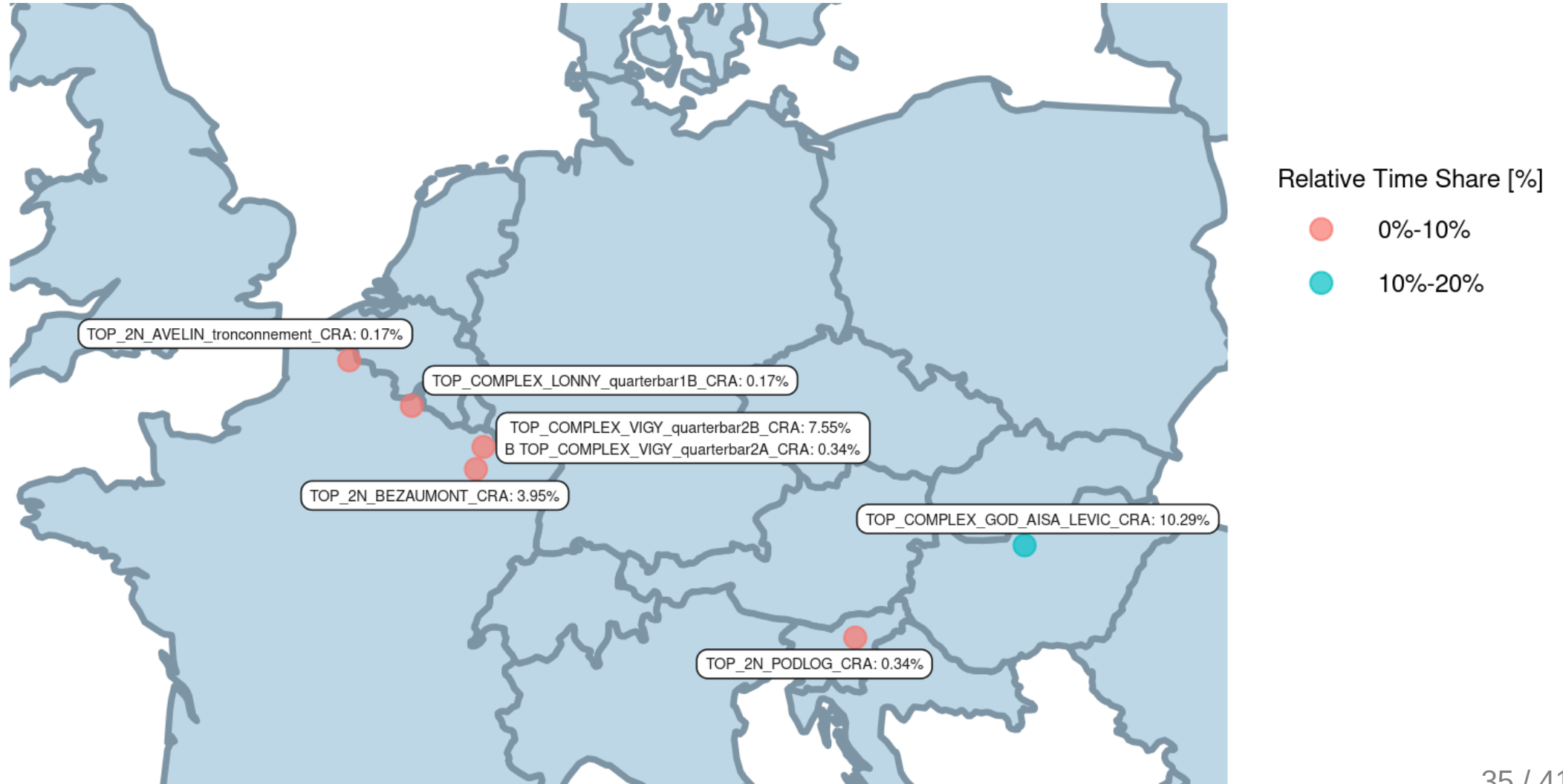
KPI 8: Relative Time Share of Applied RAs, by TSO, Type and Mode

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

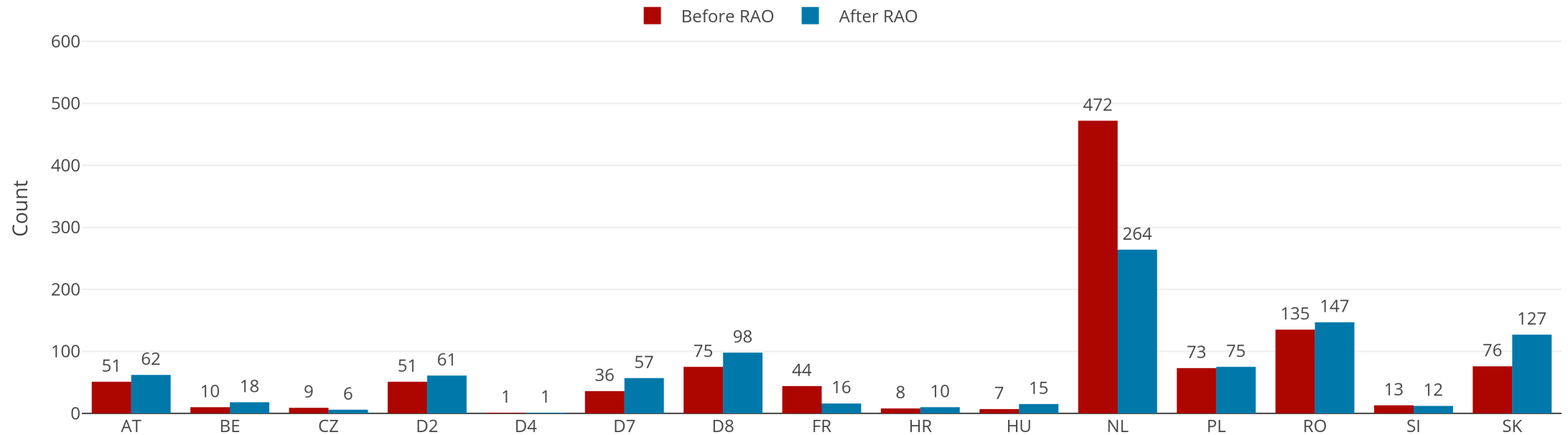


KPI 9: Most limiting CNEC per TSO (NRAO)



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

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.

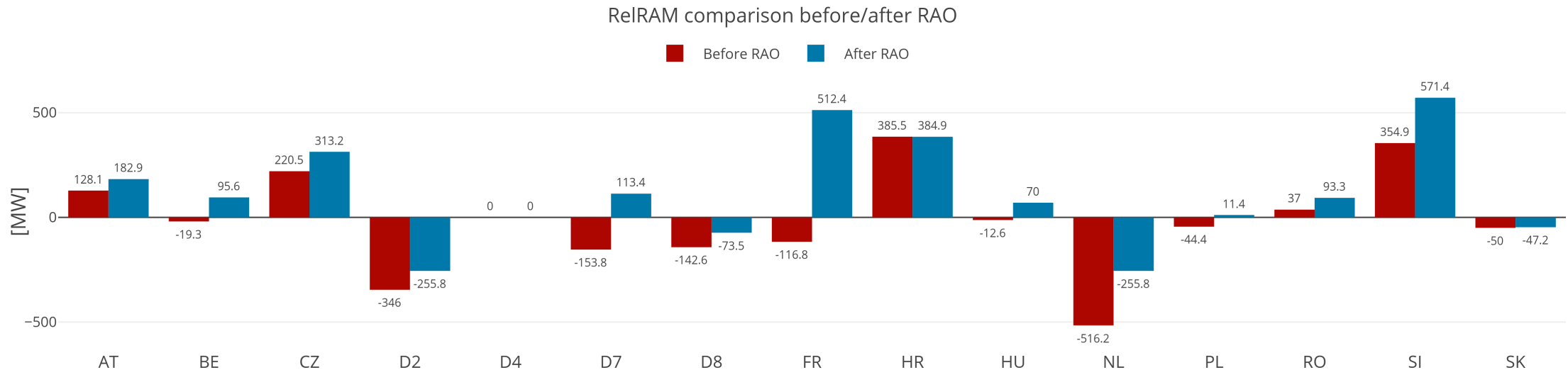
KPI 10: Average variation of relative RAM before and after NRAO



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
[RO-RO] TR Rosiori 400/220 1 [DIR]	720	788	39.01%	18.75%	81.00%	0.1294	0.2811
[HR-SI] 220kV Pehlin - Divaca [OPP] [HR]	720	1247	110.70%	69.79%	155.08%	0.2123	0.5046
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	720	720	59.75%	25.67%	96.52%	0.2123	0.5046
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	720	1666	90.19%	61.52%	115.92%	0.2489	0.6015
[CZ-SK] Sokolnice - Krizovany [OPP] [CZ]	720	760	92.90%	75.90%	108.15%	0.3938	1.6354
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	703	1128	61.64%	19.11%	123.31%	0.1918	0.5656
[SK-SK] H.Zdana - Sucany [DIR]	702	702	74.37%	67.24%	97.91%	0.1855	0.8177
[AT-SI] Obersielach - Podlog 247 [OPP] [AT]	702	725	112.04%	31.18%	178.32%	0.1918	0.5657
[D8-PL] Mikulowa PST1 [OPP] [PL]	689	689	44.52%	28.18%	76.21%	0.3893	1.436
[BE-BE] Lixhe - Gramme 380.11 [OPP]	688	713	63.52%	48.90%	79.45%	0.214	0.5208
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	685	686	50.81%	34.56%	77.42%	0.3031	1.0472
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	684	951	61.89%	20.00%	136.20%	0.2193	1.0116
[SK-SK] Gabcikovo - P.Biskupice [DIR]	684	684	79.62%	69.87%	97.85%	0.2767	1.1222
[PL-CZ] Kopanina - Liskovec [DIR] [PL]	684	780	70.21%	45.97%	96.58%	0.094	0.3419
[SK-SK] V.Dur - Krizovany [DIR]	674	674	79.47%	61.65%	97.80%	0.2576	1.0751
[CZ-SK] Nosovice - Varin [OPP] [SK]	673	2244	107.48%	80.88%	139.32%	0.4032	1.4738
[CZ-D2] Hradec - Etzenricht 441 [DIR] [D2]	665	665	49.74%	19.99%	73.67%	0.183	0.7919
[NL-BE] PST Van Eyck 2 [OPP] [BE]	664	1003	80.54%	35.01%	114.00%	0.4194	0.9958
[SK-HU] Gabcikovo - Gonyu [OPP] [HU]	663	1148	84.32%	65.27%	118.84%	0.3923	1.3271
[HU-HU] Gonyu - Gyor [DIR]	661	1313	73.02%	35.16%	101.81%	0.2854	1.4322

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
[D8-PL] Mikulowa PST1 [OPP] [PL]	177	177	224.29	38.55%	29.55%	57.12%	0.3893
[NL-D2] Meeden-Diele 380 Z [OPP] [NL]	172	172	859.77	24.58%	19.94%	83.57%	0.2634
[RO-RO] TR Rosiori 400/220 1 [DIR]	158	158	1450.8	32.03%	18.75%	63.75%	0.1269
[FR-D7] Vigy - Ensdorf VIGY1 N [DIR] [D7]	122	122	233.2	51.11%	19.96%	83.55%	0.24
[AT-SI] Obersielach - Podlog 247 [DIR] [AT]	52	54	170.51	47.14%	19.11%	89.62%	0.1918
[RO-RO] Resita - Timisoara c1 [DIR]	51	51	1245.8	27.20%	19.79%	51.07%	0.1378
[SK-HU] Levice - God [DIR] [HU]	49	49	546.21	48.86%	33.57%	71.70%	0.3184
[BE-FR] Achene - Lonny 380.19 [OPP] [BE]	41	41	152.1	84.33%	61.52%	101.69%	0.2439
[CZ-D8] Hradec - Rohrsdorf 445 [OPP] [D8]	37	37	160.33	36.24%	32.88%	39.86%	0.2906
[AT-AT] Westtirol 1 - Westtirol 2 WTRHU41 [OPP]	36	36	94.81	47.88%	20.00%	104.10%	0.2064
[D7-FR] Ensdorf - Vigy VIGY1 N [OPP] [FR]	31	31	325.23	44.90%	20.01%	70.49%	0.2398
[CZ-D2] Hradec - Etzenricht 441 [DIR] [D2]	29	29	217.85	47.36%	38.24%	59.31%	0.1785
[FR-D7] Vigy - Ensdorf VIGY2 S [DIR] [D7]	25	25	319.58	58.72%	19.90%	72.88%	0.2073
[PL-PL] Krosno Iskrzynia - Tarnow [OPP]	25	25	338.64	41.85%	34.92%	70.63%	0.3805
[SK-SK] V.Dur - Levice 1 [DIR]	25	25	216.7	44.12%	40.36%	49.48%	0.2152
[HR-SI] 220kV Pehlin - Divaca [DIR] [HR]	23	23	505.26	67.31%	33.42%	91.98%	0.2065
[NL-NL] Krimpen a/d IJssel-Geertruidenberg 380 W [DIR]	22	22	203.53	38.17%	20.03%	50.96%	0.4856
[CZ-PL] Wielopole - Nosovice [DIR] [PL]	21	21	46.06	44.96%	35.93%	53.75%	0.2981
[RO-RO] Portile de Fier - Resita c1 [DIR]	21	21	820.1	25.27%	19.79%	44.39%	0.096
[D2-D2] Altheim - Sittling 219 [OPP]	21	21	776.16	45.03%	28.33%	72.44%	0.0643

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 = $400\text{mW}/0.4 = 1250\text{MW}$

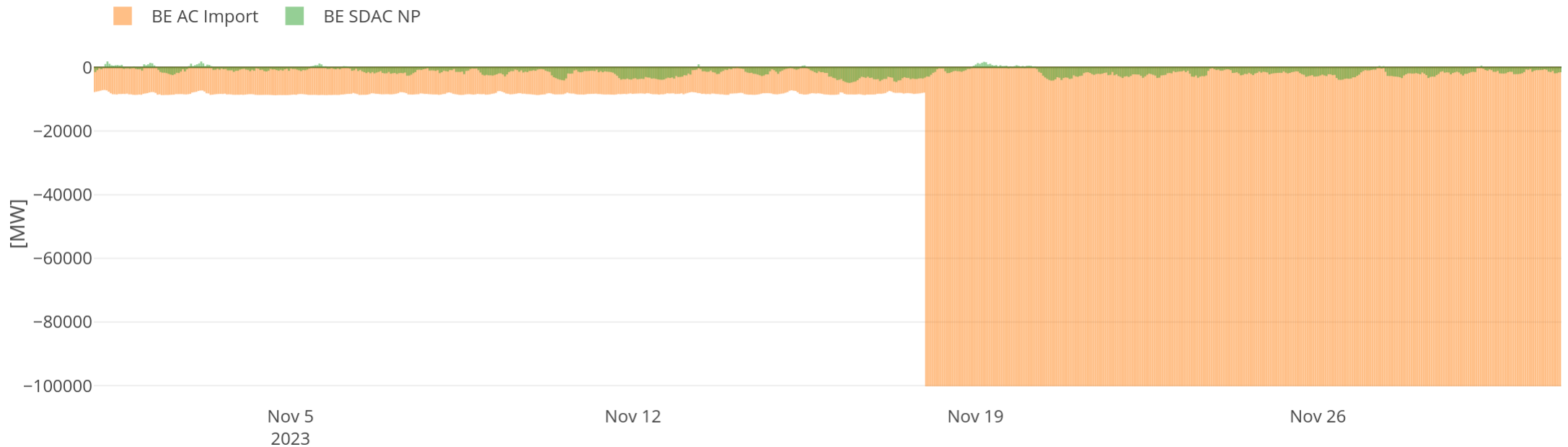
KPI 13a: Allocation Constraints - Belgium



	# MTUs
AC was Limiting MC	0

	BE AC Import [MW]
Avg.	-47938.47
Min.	-99999.00
Max.	-6901.00

Belgium only uses import allocation constraints



KPI 13b: Allocation Constraints - Poland



	# MTUs
AC was limiting MC	212
AC < 0 MW	57
AC = 0 MW	141
AC > 0 MW	14

	PL AC Import [MW]	PL AC Export [MW]
Avg.	-1953.67	3051.02
Min.	-9960.00	0.00
Max.	0.00	10118.00

