

**Monitoring the margin of capacity available for  
cross-zonal trade for 2021**

*pursuant to Article 16(8) of Regulation (EU) 2019/943 on the  
internal market for electricity*

31 May 2022

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## I. Principles for the monitoring of MACZT

Article 16(8) of Regulation (EU) 2019/943 of the European Parliament and of the of 5 June 2019 on the internal market for electricity established the minimum values for the capacity of the interconnection to be made available by transmission system operators for cross-zonal trade. For borders using a coordinated net transmission capacity approach (hereafter: NTC approach), the minimum capacity shall be 70 % of the transmission capacity respecting operational security limits after deduction of contingencies, as determined in accordance with the capacity allocation and congestion management guideline adopted on the basis of Article 18(5) of Regulation (EC) No 714/2009.

Croatian Transmission System Operator Plc. (hereafter: HOPS) applies Recommendation No 01/2019<sup>1</sup> of the European Union Agency for the cooperation of Energy Regulators (hereafter: ACER) for the calculation of the margin available for cross-zonal trade (hereafter: MACZT).

Currently, HOPS uses uncoordinated unilateral NTC approach for calculating cross-zonal capacities on all its borders with Slovenia, Hungary, Bosnia and Herzegovina and Serbia.

Minimum level of capacities should be guaranteed only on EU borders, namely with Slovenia (SI) and Hungary (HU).

$$MCCC_{NTC}(CC MTU) = \sum_{b \in \text{coordination area}} pPTDF_{zz,b}(CC MTU) * NTC_b(CC MTU)$$

$$MNCC(CC MTU) = \sum_{b \notin \text{coordination area}} PTDF_{zz,b}(CC MTU) * CGME_b(CC MTU)$$

where:

MCCC	means the margin from coordinated capacity calculation, i.e. the portion of capacity of a CNEC available for cross-zonal trade on bidding-zone borders within the considered coordination area
MNCC	means the margin from non-coordinated capacity calculation, i.e. the portion of capacity of a CNEC available for cross-zonal trade on bidding-zone borders outside the considered coordination area
$b$	Oriented bidding-zone border which belongs to the considered coordination area
$pPTDF_{zz,b}$ $= \max(0, PTDF_{zz,b})$	Positive zone-to-zone PTDF associated with the oriented bidding-zone border $b$ (0 for a negative zone-to-zone PTDF)

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<sup>1</sup> ACER Recommendation No 01/2019 of the European Union Agency for the cooperation of Energy Regulators of 08 August 2019 on the implementation of the minimum margin available for cross-zonal trade pursuant to Article 16(8) of Regulation (EU) 2019/943

$NTC_b$	Net transfer capacity of the considered oriented bidding-zone border <sup>2</sup> for the considered timeframe. The NTC should also include capacity reserved for the exchange of balancing capacity. If no NTC value is computed for the considered timeframe, the NTC value published as DA NTC for the considered CC MTU should be used (as such a publication is required pursuant to Article 11(1)(a) of Commission Regulation (EU) 543/2013).
$b \notin$	Oriented bidding-zone border, which does not belong to the considered coordination area
$PTDF_{z2z,b}$	(Positive or negative) zone-to-zone PTDF associated with the oriented bidding-zone border b
$CGME_b$	CGM forecast of the net exchange on the oriented bidding-zone border b. As a fallback (e.g. for historical analyses), scheduled exchanges resulting from SDAC/SIDC (depending on the considered time frame) should be used as a proxy

Within a coordination area, for a given critical network element with contingency (hereafter: CNEC), timeframe (in general day-ahead timeframe) and capacity calculation market time unit (hereafter: CC MTU) which consists of all hours in the year 2021, the margin available for cross-zonal trade is defined by the following equation:

$$MACZT(CC MTU) = MCCC(CC MTU) + MNCC(CC MTU)$$

ACER has a task to monitor the internal electricity market, and therefore issues regular reports on the EU level identifying the scope for improvement with the aim of compliance with the 70% target. To create the report for 2021, HOPS delivered to ACER the following data:

- all limiting CNECs for each MTU during 2021 (all hours in the year 2021),
- NTC un-coordinated values for each MTU during 2021 (all hours in the year 2021),
- one CGM per month.

Taking into account the data received from HOPS together with the relevant data for the whole continental Europe, ACER calculated the following data relevant for calculating MACZT:

- PTDFs,
- MCCC,
- MNCC excluding exchanges with third countries,
- MNCC including exchanges with third countries,
- MACZT excluding exchanges with third countries,
- MACZT including exchanges with third countries.

Results are based only on Day-Ahead timeframe and ACER used forecasted scheduled exchange data retrieved on the ENTSO-E Transparency Platform.

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<sup>2</sup> In case the declared coordination area consists of one side of a bidding-zone border, the NTC computed by the TSO on the considered side of the border should be used instead of the NTC resulting from consolidation with the neighbouring TSO

For the relevant HR-SI and HR-HU coordination areas, the results are calculated by ACER for each oriented bidding-zone border (HR>SI, SI>HR, HR>HU, HU>HR) and delivered to HOPS. During 2021 HOPS had simple local monitoring process in place to enable more capacities to the margin for cross-zonal trade, i.e. the portion of capacity of a CNEC available for cross-zonal trade . However, HOPS mainly depends on ACER’s calculations due to lack of data, low quality of data and time needed to finalize required tools.

Currently at all borders (HR-SI, HR-HU, HR-BA, HR-RS), HOPS determines the amount of available cross-zonal capacities at the annual and monthly level using the net transmission capacity approach.

The above uncoordinated manner of capacity calculation enables an individual transmission system operator to take into account all elements of the transmission network during the NTC calculation (including internal network elements), including those that are not directly associated with cross-zonal trading. The only coordination that exists between two TSOs, in the sense of determining cross-zonal capacities, is that after the independent NTC calculations, the lower value is taken as the joint NTC offered at auction for capacity allocation.

The NTC value for the day-ahead (DA) market is not calculated as there is no reference (D-2) model to use for this calculation. The values of capacities offered on the day-ahead market are determined on the basis of the monthly NTC values, in which the monthly values determine the manner in which the security criteria are met for each market unit in that month. Final NTC monthly values for HR-SI and HR-HU are allocated on JAO and represented the lower calculated NTC value of the two neighbouring TSO. The NTC values calculated by HOPS which are used for the day-ahead (DA) market in 2021 are listed in the Table 1.

**Table 1: Uncoordinated day-ahead NTC values calculated by HOPS for 2021**

Direction	Period	NTC HR (MW)
SI -> HR	01.01. - 31.12.2021	1500
HR -> SI	01.01. - 31.12.2021	1500
HR -> HU	01.01. - 31.12.2021	1000
HU -> HR	01.01. - 31.12.2021	1200

However, the manner of calculation of cross-zonal capacities will change with the application of the regional day-ahead capacity calculation in Core capacity calculation region (CCR), which is expected in the middle of 2022. The calculation of capacity in Core CCR will be based on the flow-based (FB) methodology of capacity calculation (ACER Decision No. 02/2019 of 21 February 2019 on Core day-ahead methodology, and amended and approved by HERA on 26 May 2021).

Based on the data from parallel run Core day-ahead results published on JAO platform<sup>3</sup>, it can be noticed that MACZT for HOPS will be significantly improved with the coordinated capacity calculation in the Core CCR. Flow Based approach will largely increase the capacities that HOPS makes available to market participants. In addition, FB approach will reduce uncertainties and risks in system management, and will more precisely determine and optimize capacities that can be placed on the market.

<sup>3</sup> <https://www.jao.eu/publication-tool>

## II. Report on HOPS compliance in 2021

For the period from 1 January 2020 to 31 December 2020, and from 1 January to 31 December 2021, HOPS submitted to the Croatian Energy Regulatory Agency (hereinafter: HERA) (on 17 December 2019 and 24 November 2020) the requests for derogation from the requirements to ensure the minimum value of 70% transmission capacity is achieved, in accordance with Article 16(8) of the Regulation, for the borders between Croatia and Slovenia, and between Croatia and Hungary, to all critical transmission network elements important for cross-border trading, in accordance with Article 16(9) of the Regulation. Following the prescribed procedure in which, prior to granting authorisation for the derogation, HERA consulted with the regulatory bodies of other Member States. Finally, HERA approved both requests for derogation.

For the relevant 2021, HERA approved a derogation to HOPS on 24 November 2020 due to the following reasons that can have negative consequences on maintaining operational security:

1. Time necessary to build the required tools to adequately take into account power flows within and outside the Core CCR,
2. Limited redispatching activation potential,
3. Long-term planned network element disconnections.

HOPS was not able to calculate the MACZT with satisfactory certainty (tools under preparation), which in the case of an inaccurate assessment of the capacity available for cross-zonal trade could directly threaten the security of the operation of the system (especially flows from third countries), while there is still a lack of coordinated approach and available remedial actions.

For the duration of the approval derogation, HOPS is committed to allocating capacities no less than the minimum capacity allocated for each market unit in the period 2018 to 2020, and no less than the capacity that corresponds to 20% of the load for each CNEC.

Since Core FB DA CC was not realized in 2021, task to fulfill 20% available capacity of the maximum admissible power flow ( $F_{max}$ ) for cross-zonal trade in each hour for each CNEC should not be enforced.

There are still many uncertainties in calculating MACZT in uncoordinated unilateral NTC calculation approach. One of the main issues is the common grid model and uncertainty of the flows from the broader region, therefore 20% for each hour for each representative CNEC in each direction of the border is not adequate approach. Instead, minimum level of capacities should be based on historical levels which are calculated on NTC uncoordinated approach.

Based on HOPS' data, there is calculation of the average of the 3-year MACZT level calculated by NTC approach of ACER Recommendation. This value per border is: 9.7% for HR-SI and 5.6% for HR-HU, while the values for 2021 should be higher or the same according to the derogation requirement.

Therefore, HOPS intends to calculate the yearly average MACZT level for each border orientation based on MACZT values for each hour in 2021. After that, for each border, MACZT value represents the average MACZT values of the specific border orientation values. For HR-SI this value should be higher than 9.7% and for HR-HU this value should be higher than 5.6%.

For the relevant HR-SI and HR-HU bidding zone border exchanges, limiting CNECs during 2021 were:

- 220 kV Pehlin – Divača \ Basecase (limiting for HR>SI, HR>HU exchanges)
- 220 kV Pehlin – Divača \ N-1 400 kV Melina –Divača (limiting for HR>SI, HR>HU exchanges)
- 400 kV Žerjavinec - Tumbri \ Basecase (limiting for HR>SI, SI>HR, HU>HR exchanges)
- 400 kV Žerjavinec - Tumbri \ N-1 220 kV Mraclin – Žerjavinec (limiting for HR>HU, HU>HR exchanges)
- 220 kV Žerjavinec – Cirkovce \ BASECASE (limiting for HR>SI exchanges)

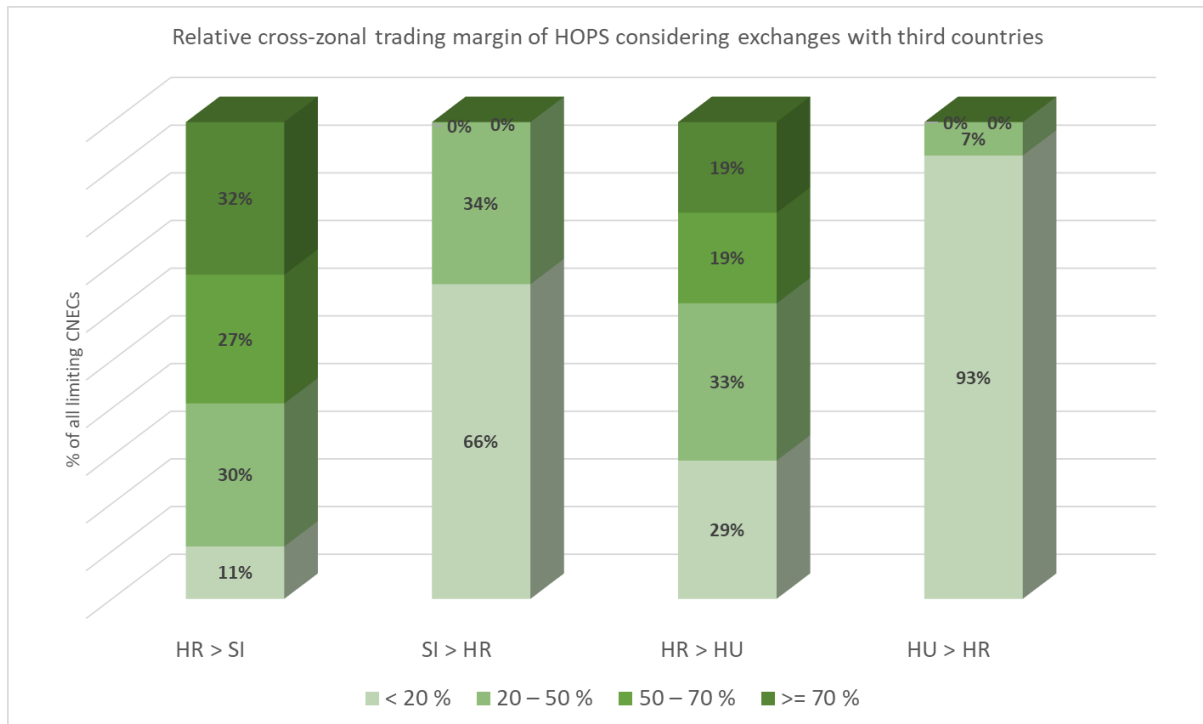
It should be emphasized that only one limiting CNEC was defined for each MTU and for each oriented bidding zone border. Concretely, this means that for specific hour during 2021 and for example bidding zone orientation from Croatia to Hungary only one of the following CNECs was taken into account for the MACZT calculation: 220 kV Pehlin – Divača \ Basecase, 220 kV Pehlin – Divača \ N-1 400 kV Melina –Divača, 400 kV Žerjavinec - Tumbri \ N-1 220 kV Mraclin – Žerjavinec).

Based on the ACER's calculations, summary of statistics of MACZT in uncoordinated approach is provided by following:

- Figure 1. Relative cross-zonal trading margin of HOPS considering exchanges with third countries: the percentage of MTU during 2021 for which MACZT value calculated on the limiting CNEC for the relevant BZB exchange enters within the observed ranges (<20%, 20-50%, 50-70%, >70%) considering exchanges with third countries,
- Figure 2. Relative cross-zonal trading margin of HOPS excluding exchanges with third countries: the percentage of MTU during 2021 for which MACZT value calculated on the limiting CNEC for the relevant BZB exchange enters within the observed ranges (<20%, 20-50%, 50-70%, >70%) excluding exchanges with third countries,
- Table 2. Statistics of (un)coordinated NTC approach including third countries for 2021: minimum MACZT value detected per month for 2021 on the limiting CNEC for the relevant BZB exchange considering exchanges with third countries based on which average value per border is calculated,
- Table 3. Statistics of (un)coordinated NTC approach excluding third countries for 2021: minimum MACZT value detected per month for 2021 on the limiting CNEC for the relevant BZB exchange excluding exchanges with third countries based on which average value per border is calculated.

Based on HOPS' simple local monitoring process (explained in section I. of this document), conclusions of the detailed ACER calculations are in line with the expectation and values are very similar to the HOPS' simple local monitoring.

**Figure 1. Relative cross-zonal trading margin of HOPS considering exchanges with third countries**



In a situation where exchanges with third countries are taken into account, it can be seen that export direction between Croatia and Slovenia had the best result in terms of MACZT levels (32% of time more or equal than 70% of MACZT was ensured).

On the other hand, import direction between Croatia and Hungary had the lowest result in terms of MACZT values (in 93% of time MACZT value was lower than 20%).



**Figure 2. Relative cross-zonal trading margin of HOPS excluding exchanges with third countries**

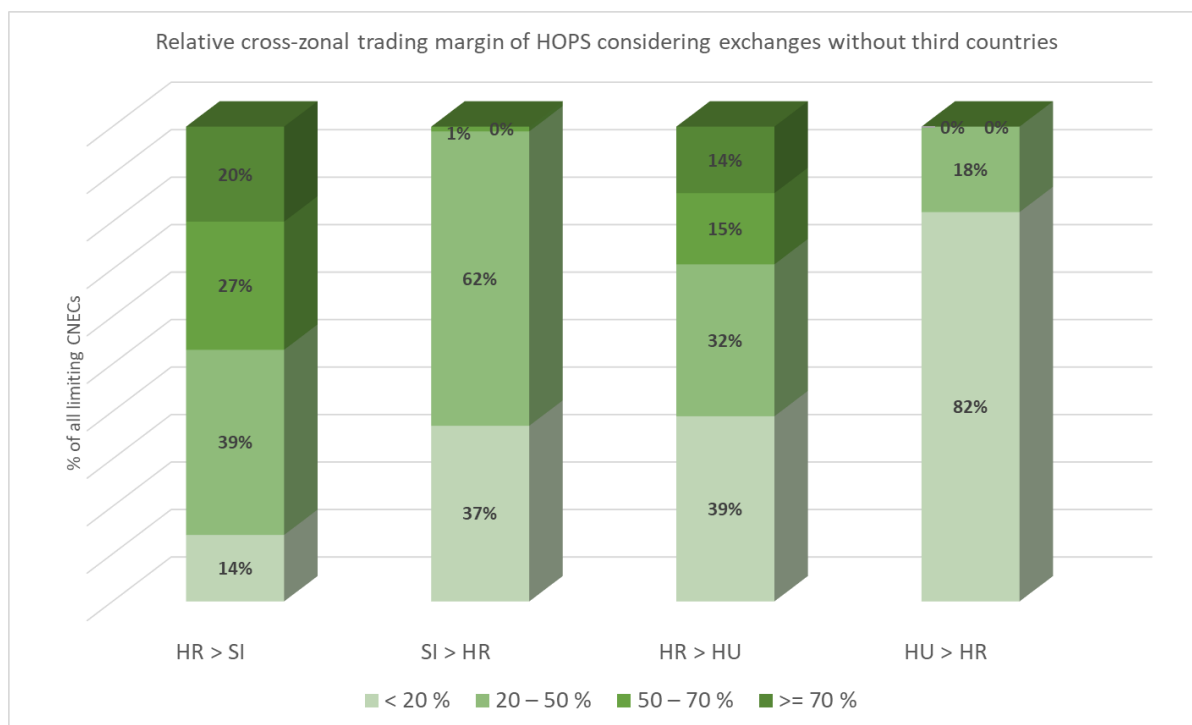


Figure 2 shows that there is a big influence of flows stemming from exchanges with third countries on MACZT values. This behaviour is expected since Croatia has two non-EU borders with Bosnia and Herzegovina and Serbia.

In a situation where exchanges with third countries are not taken into account, it can be seen that export direction between Croatia and Slovenia had the best result in terms of MACZT levels (20% of time more or equal than 70% of MACZT was ensured).

On the other hand, import direction between Croatia and Hungary had the lowest result in terms of MACZT values (in 82% of time MACZT value was lower than 20%).

**Table 2: Statistics of MACZT in uncoordinated NTC approach including exchanges with third countries for 2021**

Border direction	MACZT in uncoordinated NTC approach including third countries (per month)												2021	
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	Average	
HR-SI	92.25	92.17	61.11	24.04	54.45	44.82	40.99	51.69	46.47	52.97	62.90	60.32	57.02	36.46
SI-HR	19.11	22.75	18.04	17.69	22.75	14.19	9.53	11.15	10.40	12.09	14.37	18.86	15.91	
HR-HU	66.07	60.22	40.04	36.01	34.88	22.31	15.97	13.01	46.52	40.83	36.38	61.27	39.46	21.22
HU-HR	-1.78	1.47	4.28	3.70	6.08	2.06	4.56	11.22	-2.87	2.35	4.98	-0.26	2.98	

Table 2 represent the monthly average level of MACZT per bidding zone border orientation. It can be seen that for January 2021, average MACZT level for HU→HR had negative sign (MACZT value of -1.78) which shows the big influence of MNCC parameter.

In general, more capacities are given to Croatian border with Slovenia, compared to the border with Hungary.

**Table 3: Statistics of MACZT in uncoordinated NTC approach excluding exchanges with third countries for 2021**

Border direction	MACZT in (un)coordinated NTC approach excluding third countries (per month)												2021	
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	Average	
HR-SI	77.44	72.68	43.71	19.75	51.46	42.06	41.16	40.09	47.05	43.71	50.02	54.25	48.62	35.78
SI-HR	28.49	35.12	28.07	24.95	22.39	22.83	16.73	17.10	17.91	17.51	18.94	25.31	22.95	
HR-HU	51.26	40.71	23.72	31.71	31.89	19.56	16.14	1.40	47.10	31.57	23.53	55.19	31.15	21.04
HU-HR	7.38	13.68	14.60	11.57	12.97	11.18	12.12	17.09	5.66	8.18	9.85	6.96	10.94	

It is interesting to notice that in a situation when exchanges with third countries are not taken into account for MACZT calculation, there are no negative MACZT values on HU-HR bidding zone border orientation.

In general, average MACZT levels for the whole 2021 are similar wheter or not exchanges with third countries are taken into account.

Based on the above mentioned MACZT statistics, the average MACZT value on specific border is the following:

- HR-SI: 34.46% including third countries and 35.78% excluding third countries, and
- HR-HU: 21.22% including third countries and 21.04% excluding third countries.

Since HOPS is committed to allocating capacities higher than 9.7% for HR-SI and higher than 5.6% for HR-HU, **HOPS concludes that is 100% compliant with the derogation request for 2021.**

### III. Conclusion

Calculation of the MACZT is based on ACER's Recommendation No 01/2019. Currently, systematic calculation of day-ahead capacities is not enforced on any of the bidding zone borders. HOPS uses uncoordinated unilateral NTC approach for calculating monthly cross-zonal capacities on all borders.

At the end of 2020, HERA approved HOPS' request for derogation for the year 2021. As indicated in the derogation, HOPS is committed to allocating capacities no less than the minimum capacity allocated for each market unit in the period 2018 to 2020, and no less than the capacity that corresponds to 20% of the load for each CNEC.

Based on HOPS' data, there is calculation of the average of the 3-year MACZT level calculated by NTC approach of ACER's Recommendation. This value per border is: 9.7% for HR-SI and 5.6% for HR-HU. Therefore, according to the approved derogation, MACZT values for 2021 should be higher or the same than the previously mentioned values.

Based on the MACZT statistics, the average MACZT values on specific borders are the following (detailed in the Table 2, Table 3):

- HR-SI: 34.46% including third countries and 35.78% excluding third countries, and
- HR-HU: 21.22% including third countries and 21.04% excluding third countries.

These values are determined by minimum MACZT value detected per each month during 2021 on the limiting CNEC for the relevant BZB exchange considering exchanges with(out) third countries based on which average value per border is calculated, according to the principle set out in the request for derogation. It could be noticed (statistics per month in Table 2 and Table 3) that HOPS is significantly affected by flows with and between third countries.

Since HOPS is committed to allocating capacities higher than 9.7% for HR-SI and higher than 5.6% for HR-HU, **HOPS concludes that is 100% compliant with the minimum level of capacities set in the derogation.**

Structural congestion report was approved by HERA on 12 November 2021. HOPS has proposed that a decision be requested from the relevant Ministry on the manner of resolving structural congestion in the form of an action plan, as stipulated in Article 14(7) of the Regulation, with the aim of achieving final compliance with Article 16(8) of the Regulation by the start of 2026. HOPS delivered to the Ministry relevant technical data for the creation of the action plan. It is expected that action plan will be published in the middle of 2022.

Go-live of the Core day-ahead flow-based capacity calculation in the middle of 2022 will change the way how cross-zonal capacities on HR-SI and HR-HU are calculated and will substantially increase the MACZT levels.