ACER

European Union Agency for the Cooperation of Energy Regulators

Cross-zonal capacities and the 70% margin available for cross-zonal electricity trade (MACZT)

2023 Market Monitoring Report

21 July 2023

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EXECUTIVE SUMMARY

1 This report evaluates the progress of cross-zonal capacities in 2022 and their role in achieving the European Union's energy objectives and market integration. The report emphasizes that maximal access to cross-zonal capacities is crucial for the green transition and for meeting renewable energy targets. The minimum 70% target represents a key tool for achieving the ambitious, more recently set, political objectives for vast offshore renewable generation endowments benefitting large parts of the European continent.

The minimum 70% target represents a key tool for achieving the ambitious, more recently set, political objectives for vast offshore renewable generation endowments.

The barriers observed before the implementation of the 70% target remain.

2 There have been slight improvements since the implementation of the 70% target. However, not all Member States have witnessed those improvements and the target remains unreached in most, even where self-defined national transitional targets apply. While some Member States have reached their targets (70% or a national transitional target derived from action plans and/or derogations), many others fall short. The barriers observed before the implementation of the 70% target remain: significant loop flows due to a suboptimal configuration of bidding zones, costly although insufficient redispatching, and lack of mechanisms to share the cost of redispatching.

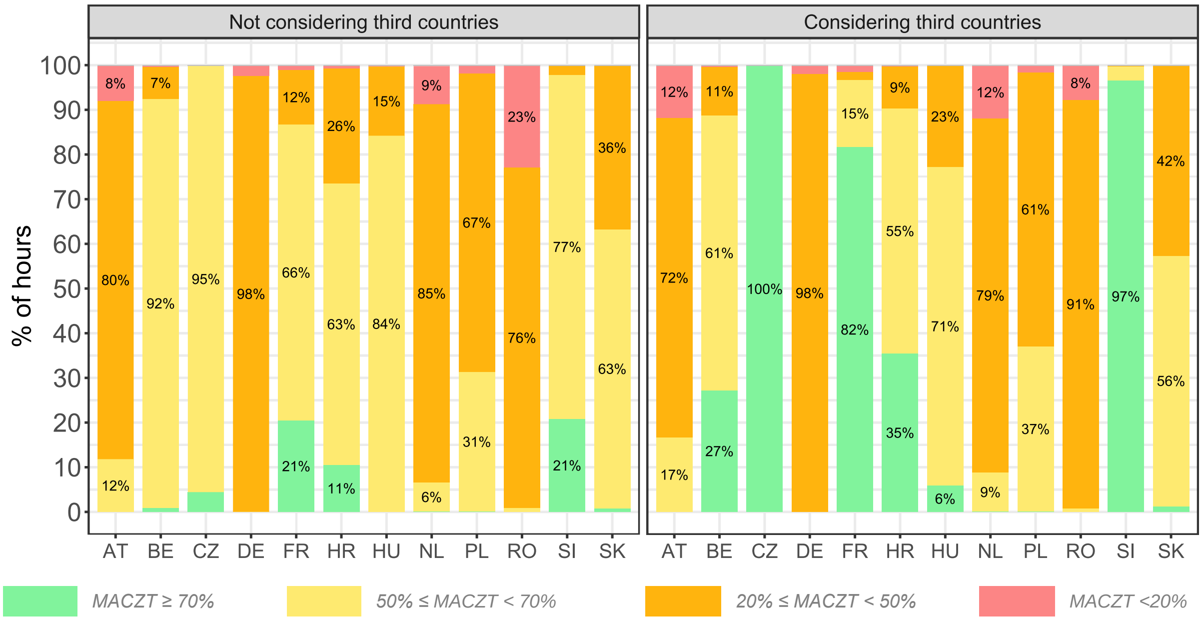
3 Given that the target for all bidding zones will be 70% in 2026, that the volumes of exchanges and corresponding flows are only foreseen to increase over the coming years and decades and given the difficulties of developing grid infrastructure, the challenge of reaching the 70% target gets harder by the year. The target for the European Union will become increasingly difficult and costly to reach; indeed, it is questionable, given the current lack of progress, whether it is possible to reach the target at all.

The 70% target will become increasingly difficult and costly to reach.

Lifting both internal and cross-zonal constraints is key to achieving the 70% target.

4 The introduction of flow-based market coupling in the Core capacity calculation region allowed for a more comprehensive monitoring of a larger share of Member States. It also increased the available capacity for some Member States, notably for the non-CWE Member States. At the same time, some Member States deviated further from the 70% target after the launch of Core flow-based market coupling. In the Core region, cross-zonal constraints most often limit commercial energy exchanges. However, constraints internal to bidding zones are those that most affect the socio-economic welfare. Lifting both internal and cross-zonal constraints is hence key to achieving the 70% target.

Figure 1: Percentage of hours when the minimum 70% target was reached in the Core region (between 9 June 2022 and 31 December 2022)



Source: ACER calculation based on TSO data.

5 It is important to consider that the 70% target is applicable to all bidding zones. This means that the impact of one bidding zone on a neighbouring bidding zone also needs to be addressed. Loop flows, whereby electricity trading inside one bidding zone causes flows that have an impact on other bidding zones, make reaching the 70% target significantly more difficult. Hence, tackling the origin of the significant loop flows today seems to be a prerequisite for reaching the 70% target.

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Progress towards the 70% target is unlikely to happen without acknowledging and tackling the tough trade-offs involved.

6 Given the significance of enhanced cross-zonal capacities across the continent to be able to realise the European Union's political objectives and the slow rate of progress towards the 70% target, focus obviously turns to what can be done about it in the short and medium term. Here, progress is unlikely to happen without acknowledging and tackling the tough trade-offs involved. The options to achieve the 70% target and lifting the barriers are limited. ACER lists the following tools to lift barriers for efficient cross-zonal trading and the completion of the internal market for electricity:

- Expedient grid investment. Reinforcing the grid where congestions occur helps to increase the commercial cross-zonal capacity on the location of the reinforcement; and
- Where it is not sufficient (or cost-efficient) to reach the 70% target, taking on a proper and ambitious bidding zone review remains a key pathway towards a better integrated European electricity market; and
- Applying costly or non-costly remedial actions, such as redispatching, countertrading or the use of phase shifters; and
- Flow-based capacity calculation and allocation, including advanced hybrid coupling, applied to large, meshed coordination areas.

Unilateral restrictions of capacity have a considerable impact on market welfare and prices.

7 The report also identifies some measures that make it harder for the European Union to reach its 70% target. Indeed, unilateral restrictions, such as allocation constraints and individual reductions of capacity, have a considerable impact on the offered cross-zonal capacities and affect welfare and prices.

8 This report shows that the current monitoring of the 70% target in coordinated net transfer capacity areas does not allow for a complete assessment for all concerned Member States due to lack of visibility on critical network elements other than the limiting ones. Finally, to guarantee effective monitoring, ACER stresses the importance of complete and reliable data collection, in line with the recommended formats.

9 The report marks the beginning of a consultation process that may result in recommendations based on the findings.

List of acronyms

Acronym	Meaning
AC	Alternating Current
ACER	European Union Agency for the Cooperation of Energy Regulators
CACM	Capacity Allocation and Congestion Management
CCA	Capacity Coordination Area
CNE	Critical Network Element
CNEC	Critical Network Element with Contingency
CWE	Central West Europe
DC	Direct Current
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
F_{max}	Maximum flow on critical network elements, respecting operational security limits
HVDC	High Voltage Direct Current
IVA	Individual Validation Adjustment
JAO	Joint Allocation Office
MACZT	Margin Available for Cross-Zonal Trade
MCCC	Margin from Coordinated Capacity Calculation
MNCC	Margin from Non-Coordinated Capacity Calculation
NRA	National Regulatory Authority
NTC	Net Transfer Capacity
PTDF	Power Transfer Distribution Factor
RAM	Remaining Available Margin
SEE	South East Europe
SWE	South West Europe
TSO	Transmission System Operator

Introduction

10 This report is produced in accordance with Article 15 of the Regulation 2019/942 establishing a European Union Agency for the Cooperation of Energy Regulators (ACER Regulation). It is part of the monitoring performed by ACER to report on the barriers to the completion of the internal markets for electricity. The report focuses on the assessment of 2022, complemented by some references to 2021 to enhance the analysis.

11 This report provides a market integration context through which the reader can better understand the chapters' empirical findings. This report:

- Aims to explain the importance of maximising cross-zonal commercial capacity; cross-zonal capacity for commercial exchange of energy is a key element of market integration. In a larger context, it is a prerequisite for the energy transition;
- Details how network elements were used during the past year, and emphasizes potential barriers to cross-zonal trade;
- Highlights observed limitations, making a parallel between the bidding zone review process and the analysis of the 70% target;
- Explains the source and possible solutions to limitations in commercial cross-zonal capacity.

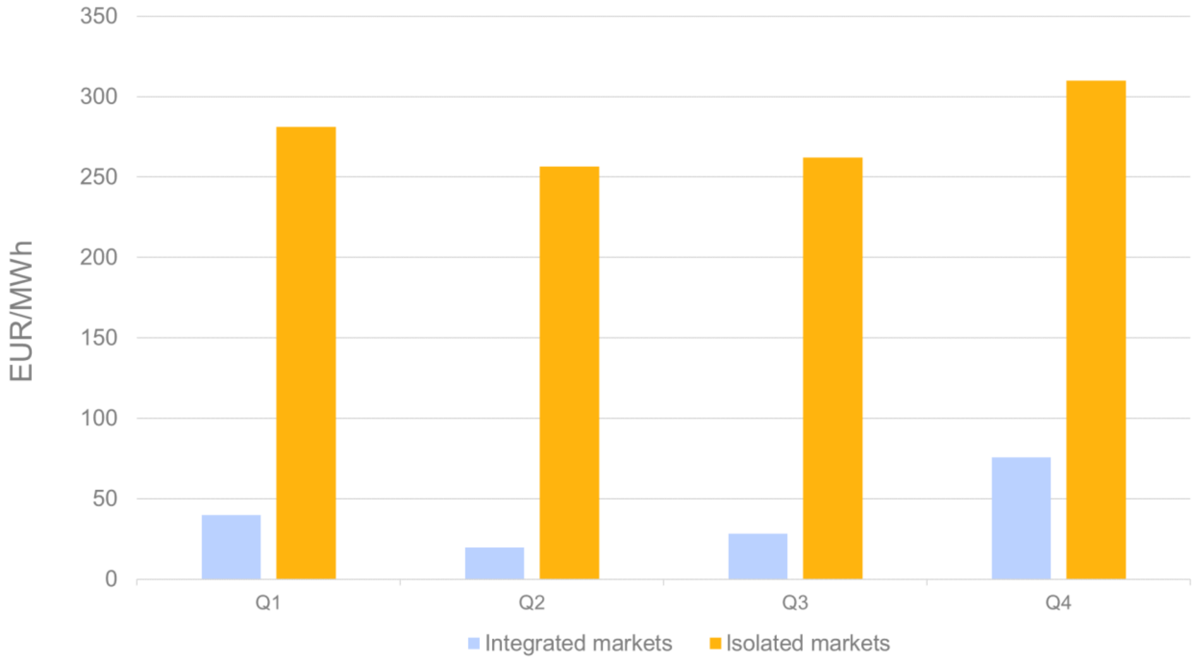
12 The importance of maximal cross-zonal capacity has been emphasised by the energy crisis of 2022, where cross-zonal capacities have played a fundamental role in:

- Mitigating price volatility across the European Union (EU);
- Ensuring security of supply;
- Enhancing the integration of electricity from renewable energy sources into the system;
- Being a key source of flexibility in the EU[1].

13 Cross-zonal trading has a dampening effect on price volatility, as depicted in Figure 2. The figure compares the welfare of a hypothetical situation in which the market does not receive any cross-zonal capacity to the actual historical 2021 market results. It shows that price volatility would have been around seven times higher if national markets had been isolated. Cross-zonal capacities can therefore be considered an effective mitigation against price spikes and their negative impact on consumers.

[1] See for example, Van Nuffel, et al. 2023. Power System Flexibility in the Penta region – Current State and Challenges for a Future Decarbonised Energy System.

Figure 2: Price volatility (EUR/MWh) in integrated and isolated electricity markets in the EU

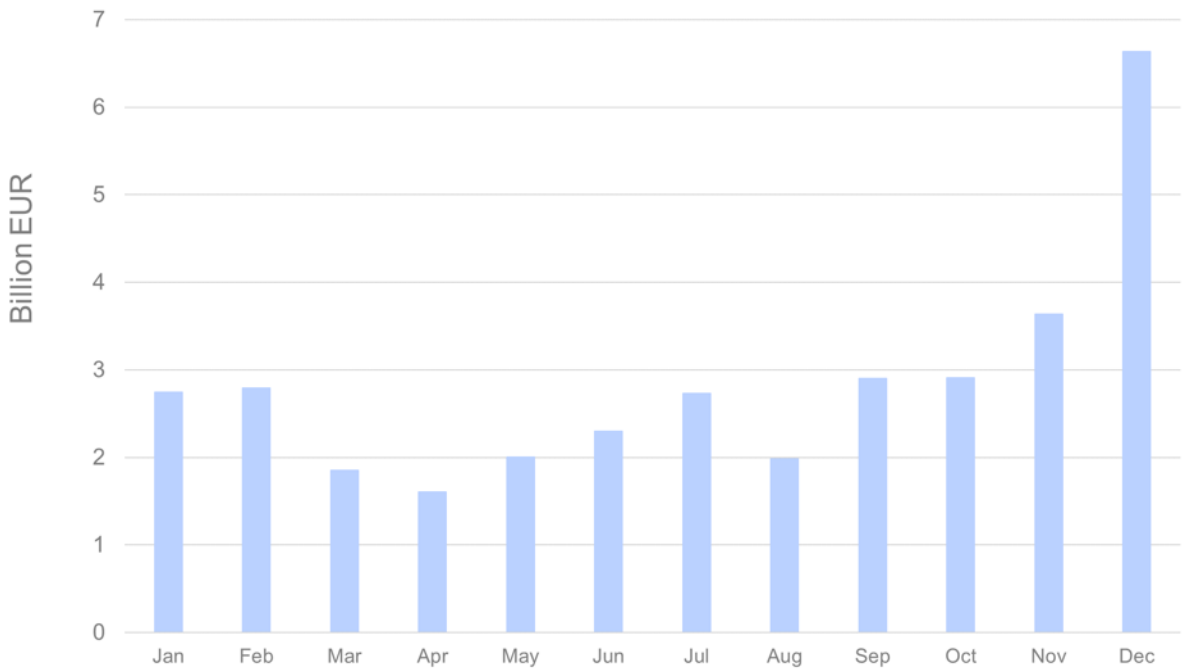


Source: ACER's Final Assessment of the EU Wholesale Electricity Market Design.

Note: Volatility was estimated by using the standard deviation of day-ahead wholesale prices. The standard deviation was calculated per bidding zone for the whole year, then averaged out across the EU.

14 Overall, cross-zonal capacities are a main contributor to welfare creation in the EU. Indeed, ACER's Final Assessment of the EU Wholesale Electricity Market Design estimated the benefits of cross-zonal trading at 34 billion EUR, as shown in Figure 3.

Figure 3: Estimated monthly welfare benefits from cross-zonal electricity trade in 2021



Source: ACER's Final Assessment of the EU Wholesale Electricity Market Design.

15 The development of rules for the calculation and allocation of cross-zonal capacities on electricity interconnectors is an integral step for the completion of the EU's internal electricity market. Over the last decade, progress in capacity allocation has been considerable. Progress in maximising the offered capacity has been much slower.

16 To address this, the Clean Energy for All Europeans Package sets a minimum level of cross-zonal capacity – also called Margin Available for Cross-Zonal Trade (MACZT) – to be offered to the market by Transmission System Operators (TSOs), respecting operational security limits. This so-called minimum 70% target took effect in 2020. The Electricity Regulation allows Member States to adopt transitional measures – action plans and/or derogations – to gradually reach the minimum 70% target, by the end of 2025 at the latest.

17 In monitoring the 70% target across the EU, ACER applies a common methodology for all Member States, described in ACER Recommendation 01/2019. Such a harmonised approach allows to follow actual progress towards the target, and to compare all Member States on an equal footing. The importance of monitoring the 70% target and of a harmonised approach is stressed in the 38th Florence Forum conclusions.

18 This report analyses the current state of play regarding the level of capacity offered for cross-zonal trade, investigates the root causes leading to poorer performance in some areas, and provides conclusions and recommendations on how to improve it.

19 The report is structured as follows. Chapter 1 presents the high-level overview of the evolution of the level of cross-zonal capacity for all bidding zones, in all regions (both the ones applying Net Transfer Capacity (NTC) and the ones applying flow-based capacity calculation approach) and across the long-term and day-ahead timeframes. Chapter 2 assesses the level of cross-zonal capacity against the minimum 70% target and, where applicable, national transitional targets. Chapter 3 shows that more cross-zonal capacity reduces prices and high prices have coincided with low capacities. Finally, Chapter 4 concludes and lists a series of recommendations. The report also contains three annexes, the list of figures and the list of tables.

20 ACER would like to express its gratitude for the valuable contributions received from CREG in the drafting of the present report.

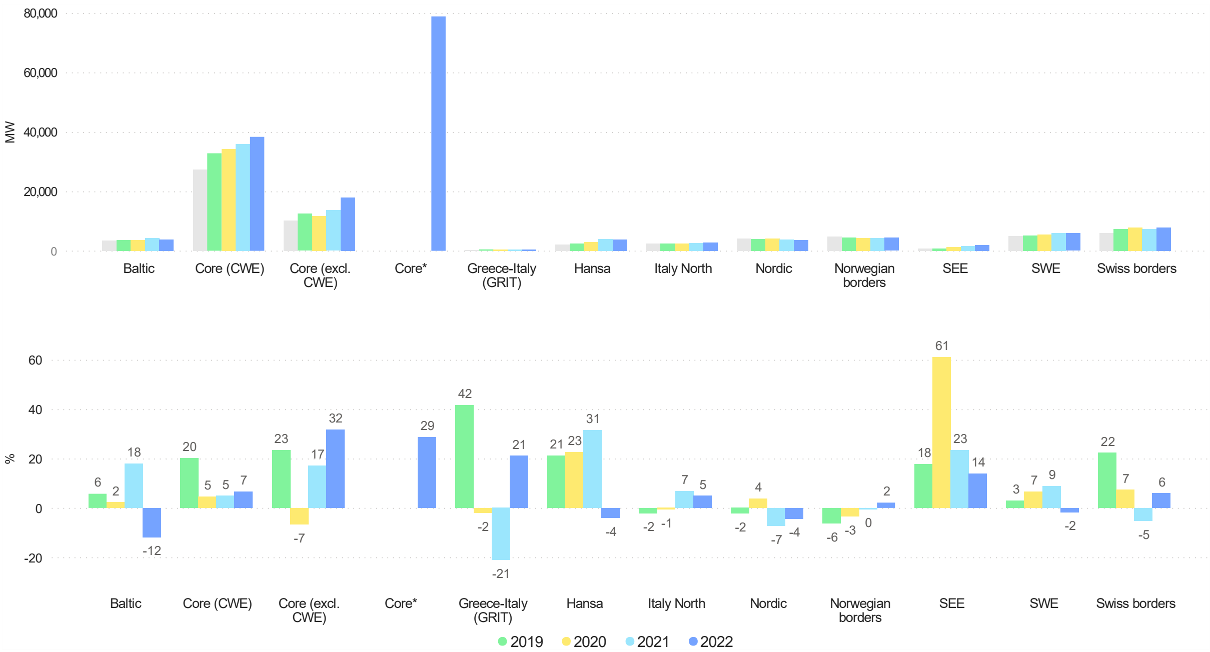
1. Evolution of cross-zonal capacity

21 This chapter provides an assessment of the level of cross-zonal capacity and aims to identify and explain the reasons for the main variations. The chapter starts with aggregate analyses for NTC and flow-based regions alike. Next, it delves into separate assessments of cross-zonal capacities for NTC and flow-based bidding zones.

1.1. Level of import/export capacities for all bidding zones over different timeframes

22 TSOs follow two approaches to calculate capacity made available for cross-zonal trade: NTC and flow-based calculations. As shown in Figure 4, flow-based allows for a more accurate optimisation of network constraints at the level of the capacity calculation region[2] compared to NTC. While the values displayed are not directly comparable,[3] flow-based import and export capacity possibilities given to the market increased consistently since 2019. As of 9 June 2022, flow-based capacity calculation applies to the entire Core region, which involves thirteen Member States of continental Europe.

Figure 4: Annual evolution of day-ahead cross-zonal capacities per European region, absolute (top) and relative (bottom), between 2019 and 2022 (MW and %, respectively)



Source: ACER calculation based on ENTSO-E data.

Note 1: Where the underlying capacity calculation is flow-based (i.e., Core (CWE) and, since 9 June 2022, Core) the figure displays the sum over the borders of the capacity calculation region of the annual average of the absolute value of a maximum and minimum position at each border. Where the underlying capacity calculation is NTC (all regions except those already mentioned), the value is the average annual NTC at a border of the region, multiplied by the number of borders in the region.

Note 2: For the Core region, in 2022: 'Core (excl. CWE)' and 'Core (CWE)' cover the period from 1 January 2022 to 8 June 2022. Values are not extrapolated but averaged over the period. 'Core' covers the period from 9 June 2022 to 31 December 2022. The relative evolution for Core is evaluated against the sum of Core (excl. CWE) and Core (CWE) in 2022.

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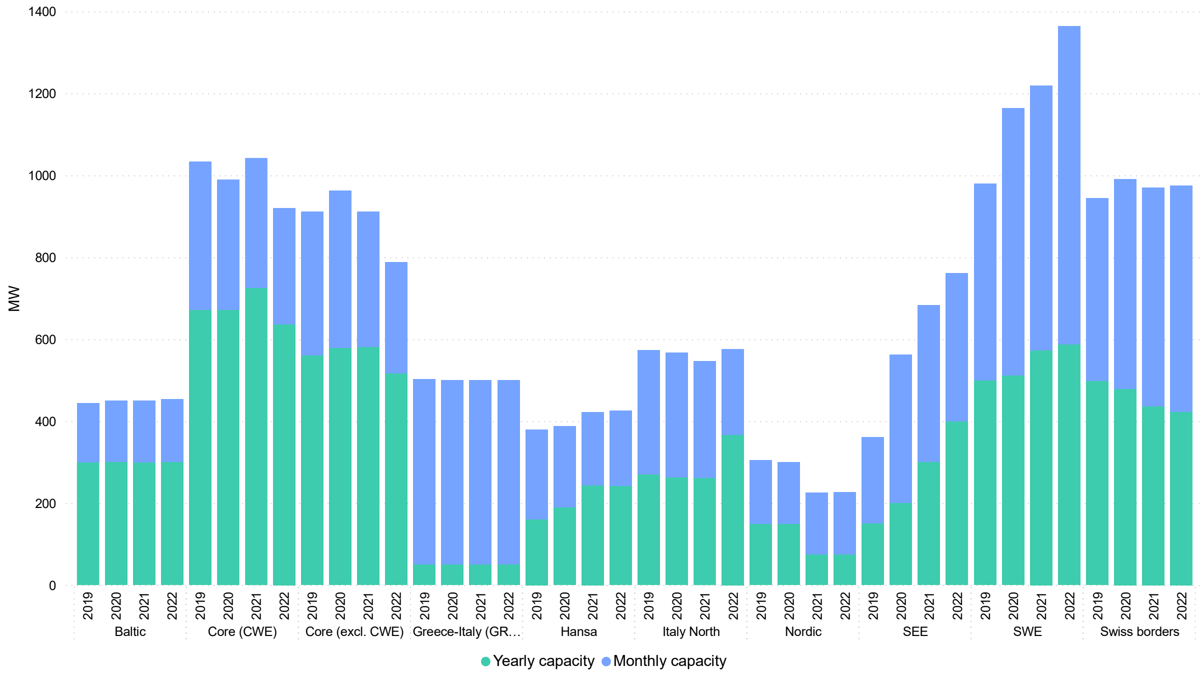
[2] Capacity calculation regions are defined in ACER Decision 04-2021 on the Determination of Capacity Calculation Regions.

[3] Flow-based values portray maximal exchange possibilities given to the market. Such positions are not simultaneously feasible for all bidding zones considered and give an incomplete view of the exchange limitations when not taken together with the PTDFs. The NTC values are typically lower but do give capacities that are simultaneously feasible to the market. See also section 1.3.

23 Figure 4 suggests that the change from NTC to flow-based calculation for some of the Core borders resulted in an overall relative increase in cross-zonal capacity available for trade within the region. This increase is likely the result of optimised calculations, a different basis of comparison between flow-based and NTC, but also of the inclusion of more borders[4].

24 Figure 5 shows the evolution of capacity offered in the context of long-term auctions. Differences in physical grid infrastructure and topology may explain differences between regions concerning offered long-term transmission rights. It also appears that grids with fewer loop flows are less subject to uncertainty and can offer relatively more capacity to the market for longer ahead of time (e.g., South East Europe (SEE) and South West Europe (SWE)).

Figure 5: Annual evolution of average offered monthly and annual capacities per European region between 2019 and 2022 (MW)



Source: ACER calculation based on JAO data.

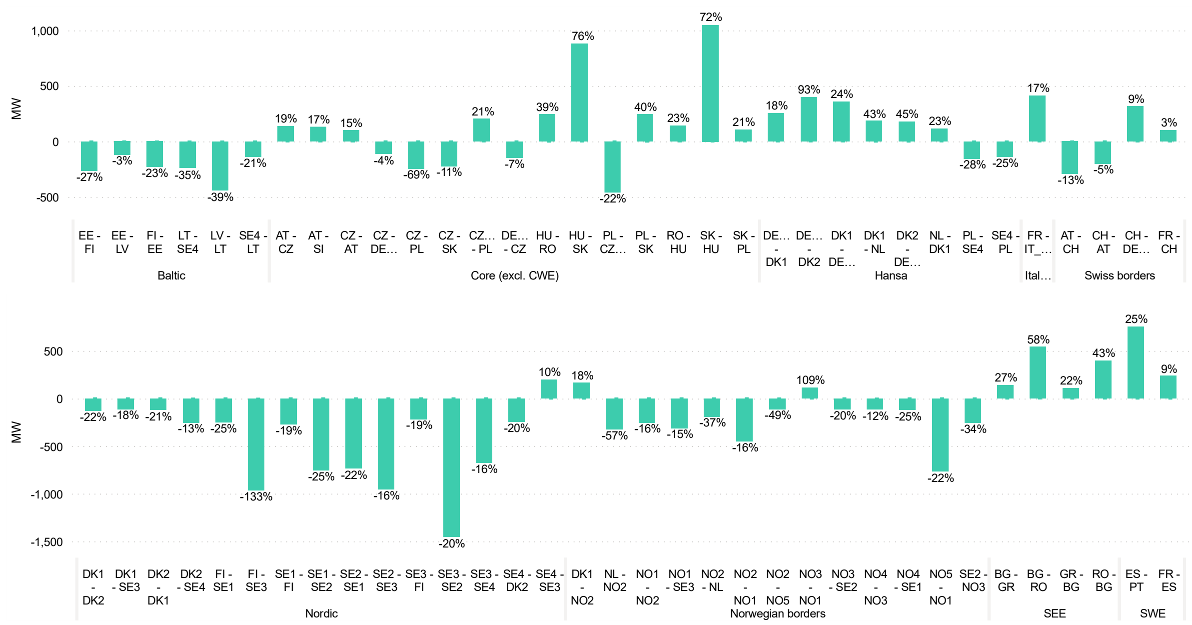
Note: The figure considers offered capacity when allocated capacity was non-null, to avoid double counting due to cancelled auctions.

1.2. Level of cross-zonal capacity where NTC calculation applies

25 Figure 6 shows the major changes in NTC values on European borders between 2021 and 2022. Overall, NTC values remained stable, with some local variations. Notably, they decreased in the Baltic, Nordic regions, and at Norwegian borders (-10%, -9.5% and -8%, respectively), and increases in Italy North and SEE (5.8% and 18%, respectively).

[4] All borders between CWE and non-CWE.

Figure 6: Changes in available capacity (NTC) in Europe between 2021 and 2022 (MW)



Source: ACER calculation based on ENTSO-E, national regulatory authorities, and Nord Pool data.

Note: Differences lower than 100 MW are excluded. Borders within the Core region that are referenced as Core (excl. CWE) were subject to NTC calculation from 1 January 2022 to 8 June 2022.

26 Drops in NTC values in the Nordic region may illustrate remaining network constraints (e.g., east-west flows in Sweden), in the context of changing generation patterns (end of Russian imports to Finland since mid-May 2022, decrease in hydroelectric production, increase in wind production).

1.3. Assessment of cross-zonal capacity in bidding zones where flow-based capacity calculation applies

1.3.1. Evolution of flow-based capacities in CWE region

27 In general, flow-based market coupling offers more exchange possibilities than NTC approach, as it incorporates the modelling of the underlying electricity network and it optimises capacity calculation and allocation at the same time. Flow-based market coupling defines cross-zonal capacities as the combination of Power Transfer Distribution Factors (PTDFs)[5] and the Remaining Available Margin (RAM)[6]. On the contrary, in NTC approach, a single available transmission capacity value defines the cross-zonal exchange possibilities.

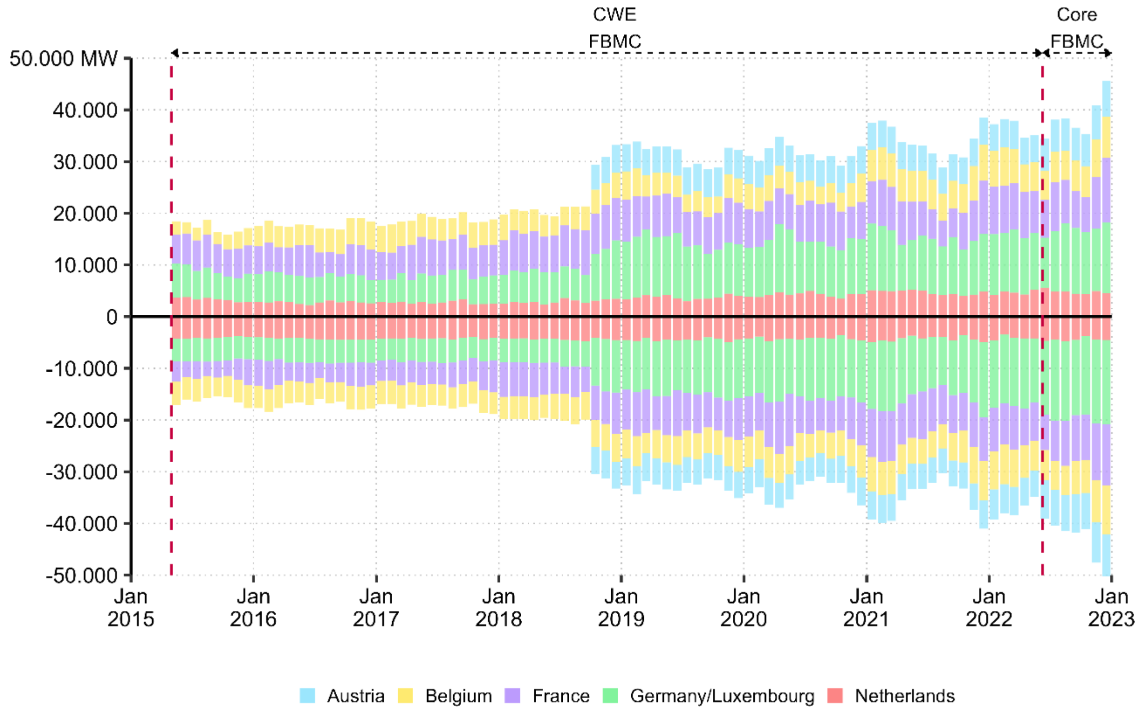
28 Figure 7 shows the evolution of the monthly average capacities for Central West Europe (CWE) bidding zones, either under the CWE or the Core flow-based market coupling framework. These capacities are obtained from the maximum import and export positions for each bidding zone[7]. These capacities tend to increase, in particular since the introduction of the Core day-ahead flow-based market coupling project on 9 June 2022. The distinctive increase in October 2018 corresponds to the moment of the separation of the German/Luxembourgish and Austrian bidding zone.

[5] A PTDF defines how much electricity flows to expect from a 1 MWh exchange between two given locations.

[6] For more background, see for example Schönheit et al, 2021. Toward a fundamental understanding of flow-based market coupling for cross-border electricity trading, Advances in Applied Energy, Volume 2.

[7] See section 1.1 for the limitations on how to interpret these values.

Figure 7: Evolution of monthly average maximum import and export positions in CWE and Core domains for each (former) CWE bidding zone



Source: ACER calculation based on JAO data.

1.3.2. Active constraints are situated within or between bidding zones

29 Active constraints are the Critical Network Elements (CNEs)[8] which effectively limit the cross-zonal exchange[9]. They need to be monitored since they give an indication on the source of limitations to commercial energy exchanges and corresponding price divergence.

30 Figure 8 and Figure 9 describe the share of active constraints, with and without a weighing factor for shadow prices, per element type and per TSO in respectively the CWE region and the Core region. Allocation constraints[10] and constraints on ALEGrO[11] are not considered.

31 Compared to previous years, the number of hours in 2022 where internal lines constituted active constraints decreased. However, when considering only Core day-ahead flow-based market coupling, the share of constraints on cross-zonal network elements (unweighted: 59.88%) decreased compared to the situation when only considering the CWE domain (64.70%).

[8] A CNE is a network element (a line or a transformer) either within a bidding zone or between bidding zones, which is impacted by cross-zonal trades, and which is monitored during the capacity calculation process under certain operational conditions. A CNEC is a CNE that limits the amount of power that can be exchanged, potentially associated to a contingency. A contingency is defined as the trip of a single or several network elements.

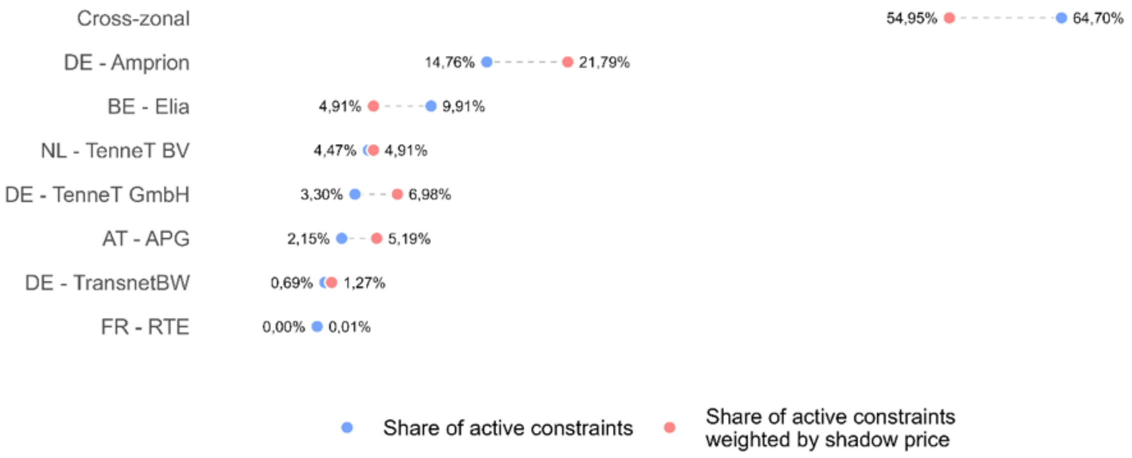
[9] Active constraints have a non-zero shadow price. A shadow price of a given CNEC measures the market welfare gain of relaxing the constraint by one unit. Concretely, the shadow price presents the welfare increase when the RAM of a CNEC is increased by 1 MW.

[10] See section 2.3.2 below.

[11] The ‘Aachen Liège Electricity Grid Overlay’ (ALEGrO) connects the German and Belgian grids with a HVDC line having a transmission capacity of 1 GW.

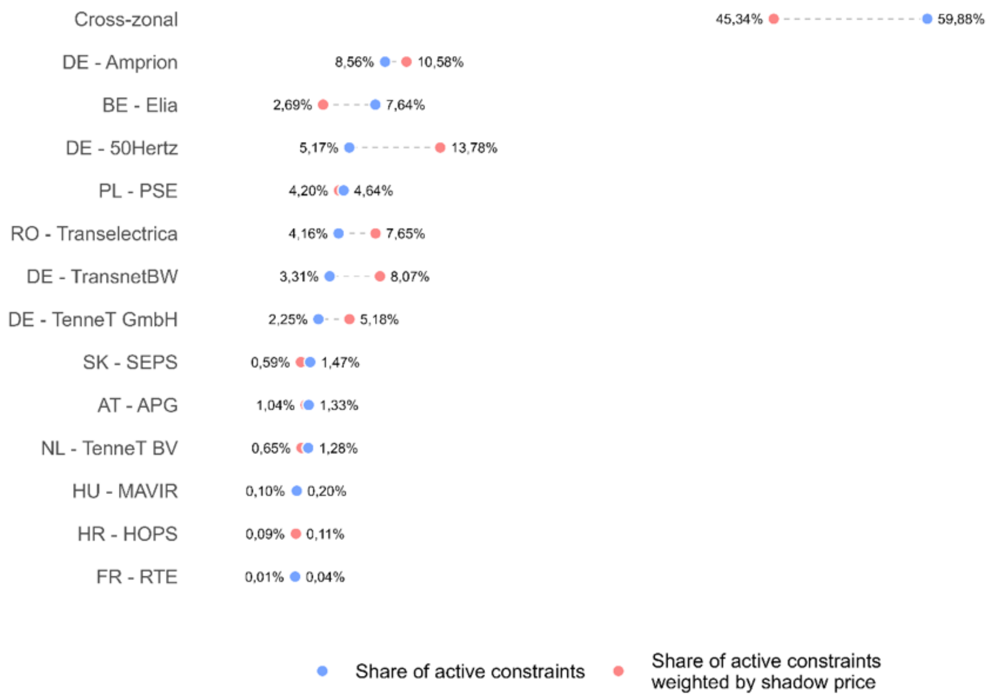
32 When weighing the shares of active constraints against the shadow price[12], it becomes clear that for most TSOs the impact of internal constraints increases, as their weighted share is higher than their unweighted share. In other words, constraints on cross-zonal network elements in the Core region have a lower negative impact on socio-economic welfare (i.e., a lower average shadow price) than internal constraints.

Figure 8: Share of active constraints in the flow-based domain per TSO control area and category in the CWE region (between 1 January 2022 and 8 June 2022)



Source: ACER calculation based on JAO data.

Figure 9: Share of active constraints in the flow-based domain per TSO control area and category in the Core region (between 9 June 2022 and 31 December 2022)



Source: ACER calculation based on JAO data.

[12] A shadow price expresses how much welfare would increase when relaxing the constraint with one unit (in this case 1 MW).

2. Margin available for cross-zonal electricity trade in the EU in 2022

33 This section replaces the former 70% report. The section presents the MACZT in all CNECs across the EU, in relation to the 70% target set in the Electricity Regulation.

34 Monitoring the MACZT is important since it shows the performance of individual Member States towards mitigating price volatility across the EU, ensuring security of supply and enhancing the integration of electricity from renewable energy sources into the system.

35 The present report monitors the MACZT across the EU in line with ACER Recommendation 01/2019, the methodological paper on estimating the MACZT, and the practical note on the monitoring of MACZT. ACER's analysis of the MACZT does not assess the legal compliance of TSOs' actions, which is a task assigned to national regulatory authorities (NRAs). The main principles of the calculations described in these three documents are:

- The MACZT is monitored individually and separately for each Critical Network Element with Contingency (CNEC)[13].
- The MACZT is the sum of the Margin made available within Coordinated Capacity Calculation (MCCC), and the flow induced by cross-zonal exchanges beyond coordinated capacity calculation – the Margin from Non-coordinated Capacity Calculation (MNCC).
- The estimated MACZT focuses on the part of the physical capacity offered for trade in the day-ahead timeframe. In the future, intraday capacity will also be monitored[14].
- The influence of flows on bidding zone borders between EU and non-EU countries is monitored separately.

36 The sections are organised as follows:

- According to the type of interconnectors (Alternating Current (AC)/Direct Current (DC)): the borders encompassing only High-Voltage Direct Current (HVDC) interconnectors (DC borders) are presented separately from the borders encompassing only AC interconnectors or a combination of AC and DC interconnectors on the same border (AC borders).
- According to the level of coordination in capacity calculation and/or geographical area: coordinated flow-based market coupling (CWE and later Core), CNTC, i.e., NTC coordinated at the regional level (SWE, Italy North, SEE and Greece-Italy (GRIT)) and non-coordinated NTC (Nordic, and separately, all other non-coordinated bidding zone borders).

37 Generally, the information is displayed per coordination area, which describes the set of bidding zone borders within which capacity calculation is fully coordinated. A coordination area can be as small as one single border for a TSO, and up to several borders coordinated among all TSOs operating at the borders. In each coordination area, the obligation of meeting the minimum 70% target or transitional targets lies with the Member State's TSO(s). Consequently, the report displays the results per Member State, in addition to per coordination area.

[13] Currently, for CNTC regions, not each CNEC can be monitored; only the limiting CNEC is monitored.

[14] The intraday timeframe is not yet monitored because intraday coordinated capacity calculation methodologies were not yet generally implemented. In addition, the upcoming amendment of the CACM Regulation will provide further clarity on the fulfilment of the minimum 70% target for the intraday timeframe.

2.1. Results of monitoring the margin available for cross-zonal trade on DC bidding zone borders

38 This section analyses the MACZT values on DC bidding zone borders. Table 1 includes an overview of the data ACER collected from TSOs, including the Member State of the TSO that provided the values.

39 The TSOs are asked to provide information on the network element limiting the capacity that can be offered on the DC border. In many cases, the limiting element is the DC interconnector itself. However, the limiting element can also be an element inside the TSO's network. This was the case for Germany (on the border with Norway), Denmark and Sweden, for which the TSOs provided this information. It is important to note that F_{max} represents the physical capacity of the DC interconnector. Hence, the monitoring requires one consistent value for F_{max} reported by both TSOs in case the DC interconnector is the limiting element.

Table 1: Overview of completeness of the data provided by TSOs for the monitoring of MACZT on DC borders – 2022

DC Border	F_{max}	NTC values as calculated by each TSO		Allocation constraints[15]	Limiting AC CNECs
BE-DE	BE, DE	BE	DE		
DE-DK2	DE, DK	DE	DK		
DE-NO2	DE	DE	NO		DE
DE-SE4	Baltic Cable, SE	DE	SE		SE
DK1-DK2	DK	DK			DK
DK1-NL	DK, NL	DK	NL		
DK1-NO2	DK	DK	NO		DK
DK1-SE3	DK, SE	DK	SE		DK, SE
EE-FI	FI	EE	FI		
FI-SE3	FI, SE	FI	SE		SE
GR-IT	GR, IT	GR	IT		
LT-PL	LT, PL	LT	PL	PL	
LT-SE4	LT, SE	LT	SE		SE
NL-NO2	NL	NL	NO		
PL-SE4	PL, SE	PL	SE	PL	SE

The data was provided as requested.

The data item does not apply to the specific border (e.g. if allocation constraints are not applied) or the relevant TSO did not have to provide the data (e.g. the Norwegian TSO).

Source: ACER analysis based on TSO data.

Note 1: The value indicated in the columns refers to the entity (TSO, in the case of Baltic Cable) or the Member State of the entity that provided the data item.

Note 2: Calculations of NTC values on DC borders are currently not coordinated, except on the GR-IT border. Each TSO usually

[15] Allocation constraints reflect operational security limits that cannot be transformed into constraints on a CNEC. They are applied in Belgium, the Netherlands, and Poland. See also section 2.3.2.

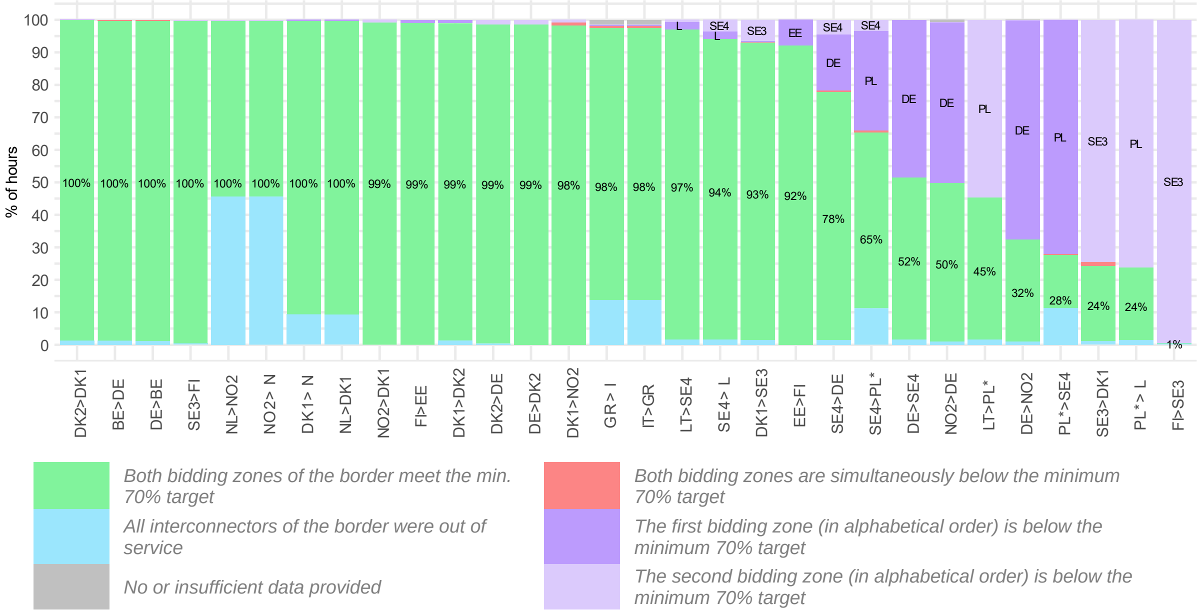
calculates its own NTC value, considering only its own network constraints. The minimum of the two calculated NTC values is offered to the market. The NTC values used in MACZT monitoring are the capacity offered by the TSO, before alignment with the neighbouring TSO.

Note 3: On the DC borders with Norway, the minimum 70% target does not yet apply. However, the data is considered when the information was provided by the neighbouring TSO. Information from Norway was not requested. The monitoring is based solely on the information provided by Norway's respective neighbouring TSO for F_{max}, and the NTC values for Norway are obtained from ENTSO-E Transparency Platform.

2.1.1. Distance to achieving the 70% target

40 Figure 10 shows the percentage of hours for which the minimum 70% target was met. When the 70% target was not met, the figure indicates the bidding zone(s) that did not meet the minimum 70% target.

Figure 10: Percentage of hours when the minimum 70% target was reached on DC borders – 2022



Source: ACER calculation based on TSO data and data from ENTSO-E Transparency Platform.

Note 1: Despite efforts by both TSOs and ACER to clarify inconsistencies in the reported data for the DC borders, some inconsistencies remained at the time of publication. They affect less than 1% of the hours per border and are thus considered to have limited impact on the monitoring results.

Note 2: When AC CNECs are the limiting element, the MACZT is evaluated considering third countries.

41 The MACZT was in general calculated on the interconnector itself, except in the cases where the TSO reported that the limiting element was another element inside of the TSO's network. When the limiting element is another element inside the AC network, the percentage of hours when the target is met often reduces. In the following, the borders on which the 70% target was met in less than 90% of the time are assessed in more detail, starting from the borders with the greatest deviation from the 70% target:

- FI-SE3: The target is met only 1% of hours in the direction FI>SI3 due to reduced capacity given to the market because of operational security considerations concerning the Swedish AC grid, see corresponding market messages on NUCS.

- PL-LT[16]: The low percentage of fulfilment of the target in both directions results from the distribution of Polish allocation constraints. Without considering allocation constraints, the target is met 100% of the time, see also Annex I.
- DK1-SE3: The low percentage of fulfilment of the target in the direction SE3>DK1 results from AC CNECs in the Swedish AC grid.
- PL-SE4: The low percentage of fulfilment of the target results from the distribution of Polish allocation constraints. Without considering allocation constraints, the 70% target is met 95% of hours for the direction PL>SE4 and 96% of the hours for the direction SE4>PL, see also footnote 16 and Annex I.
- DE-NO2: Reductions in both directions are due to AC CNECs in the German network which are the relevant limiting elements.
- SE4-DE: The reason for the reduction in target fulfilment in both directions stems from limitations in the German distribution grid according to a statement by TenneT. "*The deviations from the minimum capacity are due to the special connection situation of the Baltic Cable. The transmission capacity across bidding zones is heavily dependent on the availability of the connections between the TSO TenneT transmission network and the distribution network in the region*".

2.1.2. Distance to achieving the national transitional targets

42 Table 2 presents the DC borders that do not have to comply with the minimum 70% target yet, because they have an action plan or a derogation in place. It presents the targets that the TSOs had to reach at these borders for 2022 (if any) and compares the levels of MACZT with these targets[17].

Table 2: Comparison between the MACZT and the transitional target of Member States on DC borders – 2022

Member State	DC border	Direction	Target for 2022	Comparison between the MACZT and the transitional target
DE	BE-DE	Both	31.0%	Target met 100% of the hours.
	DE-NO2	Both	23.3%	Target met 97% of the hours.
	DE-SE4	DE>SE4	50.9%	Target met 98% of the hours.
		SE4>DE		Target met 99% of the hours.
DE, DK	DE-DK2	Both	Kontek interconnector: 70% Kriegers Flak combined grid solution: 23.3%	As the monitoring does not distinguish between interconnectors per border, the compliance for Kriegers Flak cannot be evaluated. As the compliance with the 70% target is met 99% of the time for the border, the target is assumed to be met for at least 99% of the time.
PL	PL-SE4	PL>SE4	50%	Target met 28% of the hours[18].

Note: The table presents only the Member States and DC borders with a derogation or an action plan in 2022. For all other borders, the minimum 70% target applies. Results are presented in Figure 10.

[16] On the Polish borders with Sweden and Lithuania, the calculations consider the impact of allocation constraints limiting the total import (or export) capacity from (or to) Poland. As described in ACER Recommendation 01/2019 (section 6.2.3.), the impact of the constraint has been split between the different Polish borders, by prioritizing capacity at the borders with the highest price differential. When allocation constraints apply, the interconnectors with Poland can be used to accommodate exchanges between Sweden and Lithuania (via Poland); however, the application of the constraints effectively limits the trading possibilities with Poland. The respective plot without allocation constraints can be found in Annex I.

[17] Annex II provides further insights in derogations and actions plans applied by Member States.

[18] On the Polish border with Sweden, the results consider the impact of allocation constraints limiting the total import (or export) capacity from (or to) Poland. Without considering allocation constraints, the target was met 98% of the hours.

2.2. Results of monitoring the margin available for cross-zonal trade on AC bidding zone borders

2.2.1. Distance to achieving the 70% target

43 This section presents the results of ACER's monitoring of the fulfilment of the 70% target for each Member State and for each coordination area. First, the results of the flow-based regions are shown, i.e., CWE (until 8 June 2022) and Core (from 9 June 2022 onwards). Subsequently, the results of the CNTC regions are displayed, namely SWE, Italy North, SEE, and GRIT. Then, the focus shifts on the Nordic region, where the performance is assessed both for external borders as well as the internal borders of Sweden. Finally, this section concludes with analysing the performance of the uncoordinated borders in continental Europe, i.e., the borders for which the capacity calculation process is uncoordinated between the two sides of the border. With the go-live of the Core flow-based capacity calculation process on 9 June 2022, all those borders, except for DE<>DK1 (which remains uncoordinated) and RO<>BG (which belongs to SEE), are now part of the Core region.

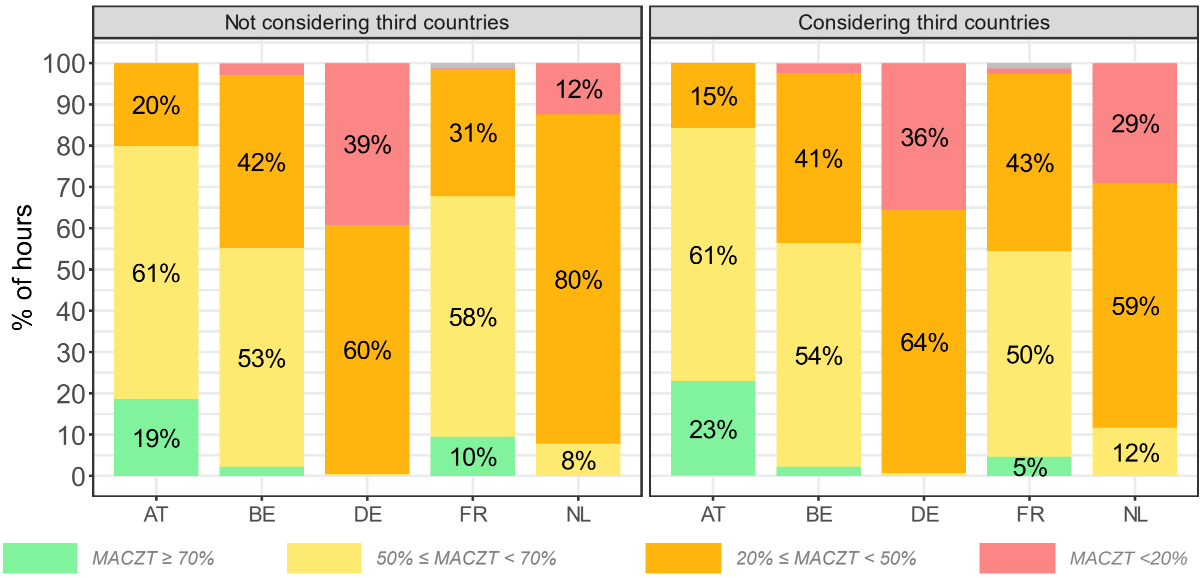
Flow-based areas

2.2.1.1 CWE

44 Figure 11 shows the percentage of hours for which the minimum relative MACZT was above the 70% target, or within a set of predefined ranges. In the CWE region, flow-based capacity calculation applies since 2015. The MACZT can be accurately calculated on all CNECs relevant in the capacity calculation, and not only on the limiting ones.

45 Limited progress, if any, is observed in the CWE countries up until the go-live of the Core capacity calculation process on 9 June 2022. As in 2021, the Member States with the most significant room for improvement are Germany and the Netherlands, for which, in a significant number of hours, the MACZT of the most constrained CNEC was even below 20%.

Figure 11: Percentage of hours when the minimum 70% target was reached in the CWE region (between 1 January 2022 and 8 June 2022)



Source: ACER calculation based on TSO data.

Notes for all CWE figures:

Note 1: The figures present the level of MACZT, which does not correspond to the RAM calculated in the CWE capacity calculation process, as the impact from unscheduled allocated flows is not considered in the process.

Note 2: All CWE TSOs, with the exception of the Belgian TSO, consider Norway as a third country for the purpose of MACZT calculations.

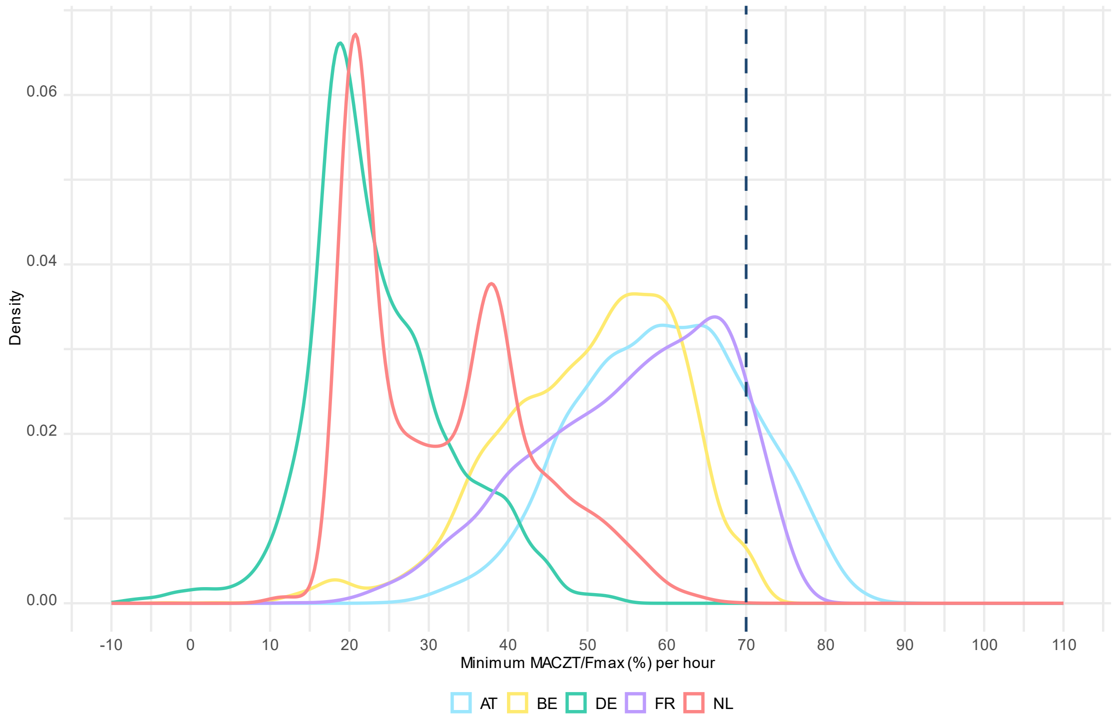
Note 3: Belgium and the Netherlands declared allocation constraints limiting total exchanges from and/or to these two Member States. Allocation constraints are monitored separately and are thus not considered in the figures.

Note 4: The inclusion of long-term allocation of capacities, which must be respected in the day-ahead timeframe by the market coupling algorithm, may lead to an underestimation of MACZT for certain CNECs.

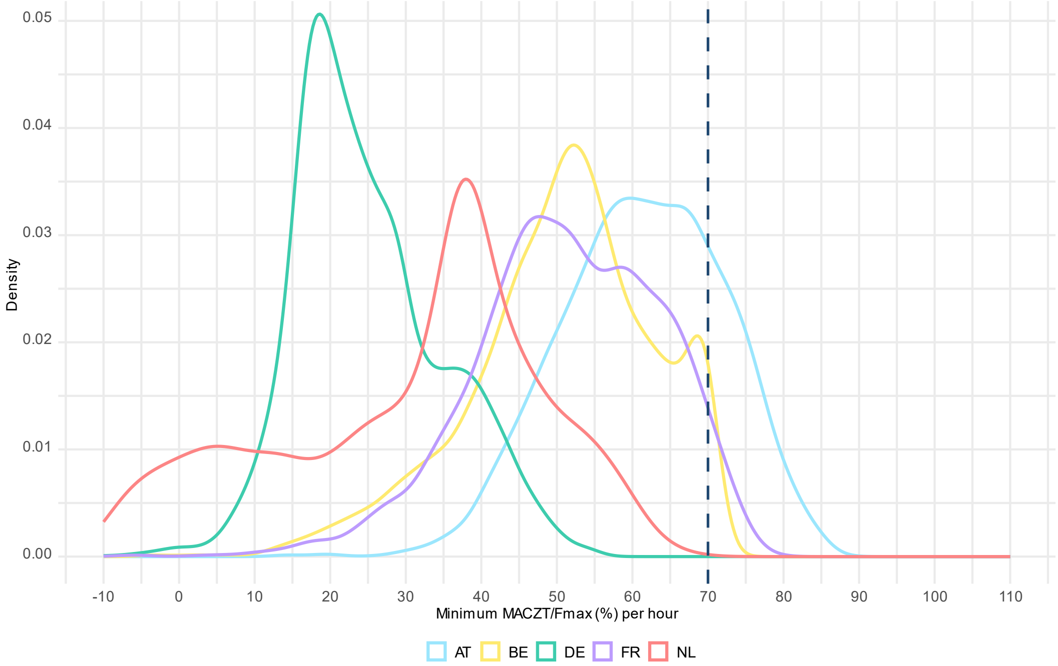
46 Figure 12 shows the density of the hourly minimum relative MACZT on CNECs, per Member State, in the CWE region. It illustrates that, for all considered Member States, significant efforts are still required to reach the 70% threshold.

Figure 12: Density function of the lowest hourly relative MACZT per Member State in the CWE region (between 1 January 2022 and 8 June 2022)

Not considering third countries



Considering third countries



Source: ACER calculation based on TSO data.

2.2.1.2 Core

47 Following the implementation of the Core day-ahead capacity calculation methodology, a wider number of Member States use a flow-based capacity calculation approach for cross-zonal capacities. In this case, MACZT can be more accurately calculated on all CNECs relevant in the capacity calculation, and not only on the limiting ones. As of the go-live of the Core process, TSOs have used a common tool for MACZT data reporting[19], which is in line with ACER Recommendation 01/2019. This constitutes a considerable step towards the harmonization of MACZT monitoring.

48 Figure 13 shows the percentage of hours for which the minimum relative MACZT was above the 70% target, or within a set of predefined ranges. Whereas the figure shows the extent to which Member States reached the 70% target, it does not indicate the reasons for not reaching the target. Such reasons can be found within the Member State or with its neighbours. Unscheduled flows[20] are the most straight-forward example of an obstacle for reaching the 70% target that lies outside the span of control of a Member State. Section 2.3 analyses these reasons in more detail.

49 The go-live of the Core flow-based capacity calculation led to some performance improvements, although not uniformly spread across all Member States. The results tend to be better when including third-country impact, as the flows from third countries (such as Switzerland or the Western Balkans) are considered in the capacity calculation process. The TSOs furthest away from the 70% target remain the German and Dutch TSOs, as well as the Romanian and Austrian TSOs. Full achievement of the 70% target is detected only for the Czech TSO (when considering third-country impact).

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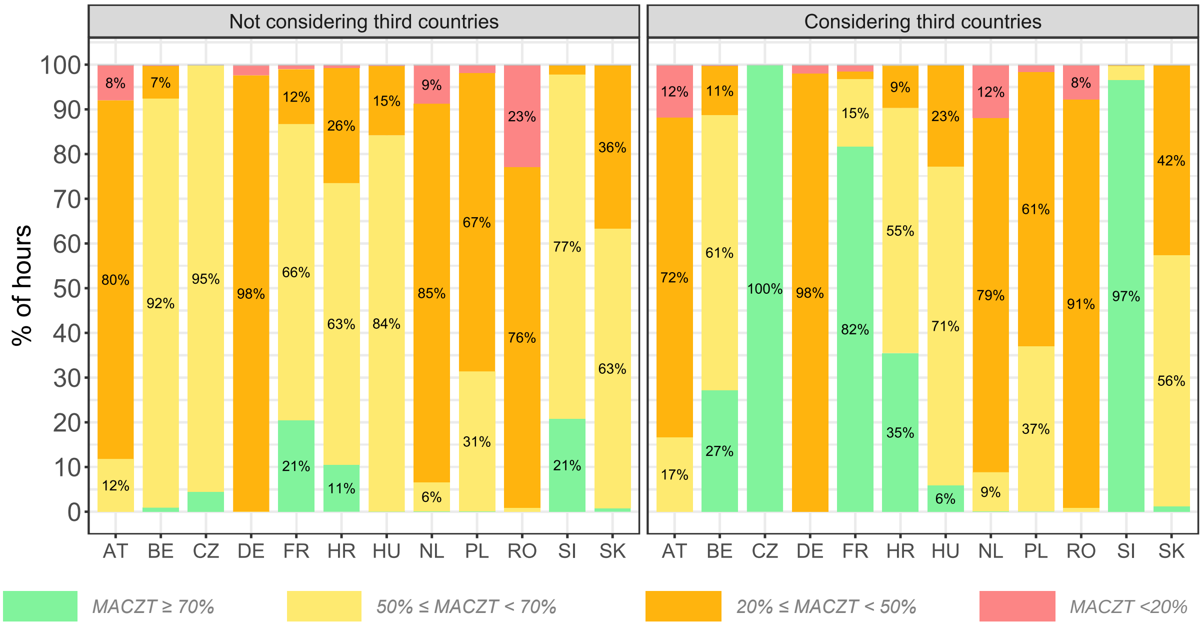
[19] Only the German and Dutch TSOs have provided MACZT data outside of the commonly developed Core reporting tool. In the case of the German TSOs, the MNCC data provided is not in line with ACER Recommendation 01/2019, while the data provided by the Dutch TSO excluded several Core external borders, thus reducing the accuracy of the MNCC calculations.

[20] Unscheduled allocated flows are expected to decrease with the inclusion of more bidding zones in the same capacity calculation region. Loop flows, on the other hand, are not directly affected by such enlargement. Loop flows can be addressed through remedial actions, investments in grids or a review of the bidding zone configuration.

Figure 13: Percentage of hours when the minimum 70% target was reached in the Core region (between 9 June 2022 and 31 December 2022)



Source: ACER calculation based on TSO data.

Notes for all Core figures:

Note 1: The figures present the level of MACZT, which is the combination of the capacities coordinated within the capacity calculation region (RAM) and the impact of uncoordinated flows from outside the capacity coordination region (Fuaf), as described in the Core day-ahead capacity calculation methodology .

Note 2: All Core TSOs, with the exception of the Dutch TSO, consider Norway as a third country for the purpose of MACZT calculations.

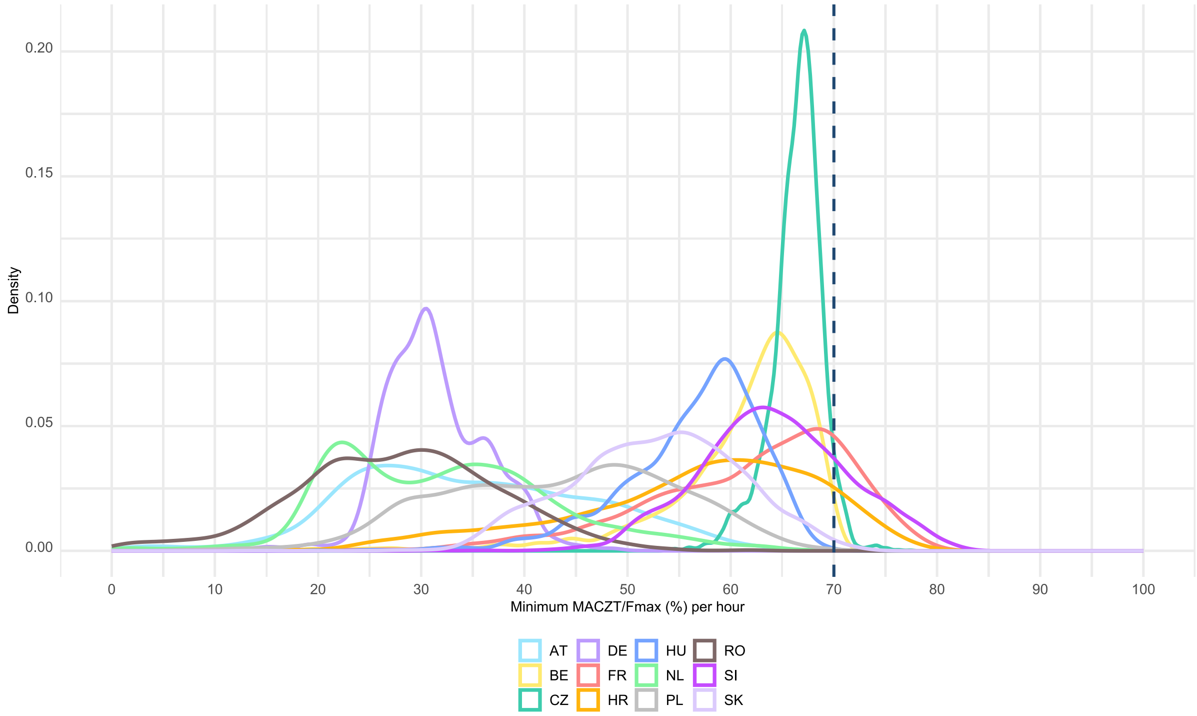
Note 3: Belgium, the Netherlands, and Poland have declared allocation constraints limiting total exchanges from and/or to these two Member States. Allocation constraints are monitored separately and thus not considered in the figures.

Note 4: The inclusion of long-term allocation of capacities, which must be respected in the day-ahead timeframe by the market coupling algorithm, may lead to an underestimation of MACZT for certain CNECs.

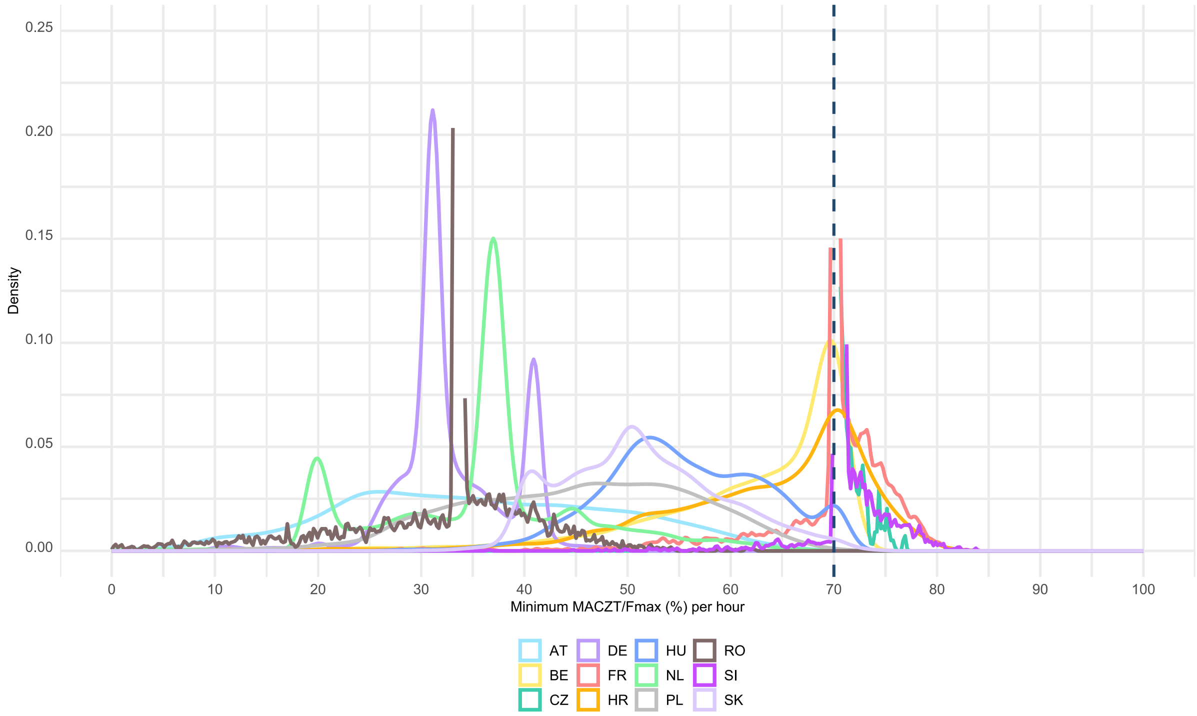
50 Figure 14 shows the density of the hourly minimum relative MACZT on CNECs, per Member State, in the Core region, both considering and excluding the impact of third countries. For the figure that includes the impact of third countries, large density spikes are observed following the targets set by each Member State according to their action plan and/or derogation. As per the Core day-ahead capacity calculation methodology, these targets will be always enforced, provided that no capacity reductions are applied by the relevant TSO.

Figure 14: Density function of the lowest hourly relative MACZT per Member State in the Core region (between 9 June 2022 and 31 December 2022)

Not considering third countries



Considering third countries



Source: ACER calculation based on TSO data.

NTC areas

51 A significant share of Member States follows NTC approach when providing cross-zonal capacities. This implies one single capacity value per border and direction. This value can be jointly calculated within a capacity calculation region, following the implementation of a coordinated NTC (CNTC) capacity calculation methodology, or unilaterally defined by each TSO.

52 In the regions in which CNTC methodology is implemented, namely SWE, Italy North, SEE, and GRIT, TSOs monitor and report to ACER the MACZT on the CNEC (or the allocation constraint) that has limited the capacity calculation process. This means that, for a given hour, information on only one single CNEC is provided for the entire capacity calculation region. However, within the current monitoring methodology, in case the Member State where the limiting CNEC is located does not meet the 70% target, further information would be needed for ACER to determine whether the Member States whose CNECs are not limiting do meet the 70% target[21].

53 Moreover, for the hours where the limiting CNEC is outside of the EU, ACER is not in a position to conclude on the performance of the Member States towards the 70% target due to the fact that this target does not yet apply to any non-EU countries. This is particularly relevant for the Italy North capacity calculation region.

54 In addition, in the areas where NTC approach is applied but where the applicable capacity calculation methodology has not yet been implemented, ACER does not have enough visibility to assess whether the limiting CNECs reported by TSOs are effectively the ones that have been limiting the capacity calculation process.

2.2.1.3 SWE

55 Figure 15 shows the percentage of hours for which the relative MACZT was above the minimum 70% target, or within a set of predefined ranges, in the SWE region. In this region, a CNTC capacity calculation applies. Hence, in line with ACER Recommendation 01/2019, MACZT can be accurately calculated only on the limiting CNECs. Even though the SWE region encompasses two borders, one limiting CNEC is determined for each border separately for each hour.

56 Contrary to previous reports, following an update to the capacity calculation methodology approved by SWE NRAs on 18 January 2022, a fallback CNEC is provided in case the capacity calculation process in SWE was not successful in identifying the limiting CNEC. The fallback CNEC is defined as the most frequently limiting CNEC of the capacity calculation process for the specific timestamp, identified in the last quarterly report as described in Article 16(3) of the Electricity Regulation[22]. The percentage of hours for which the fallback procedure was applied amounts to 16%[23].

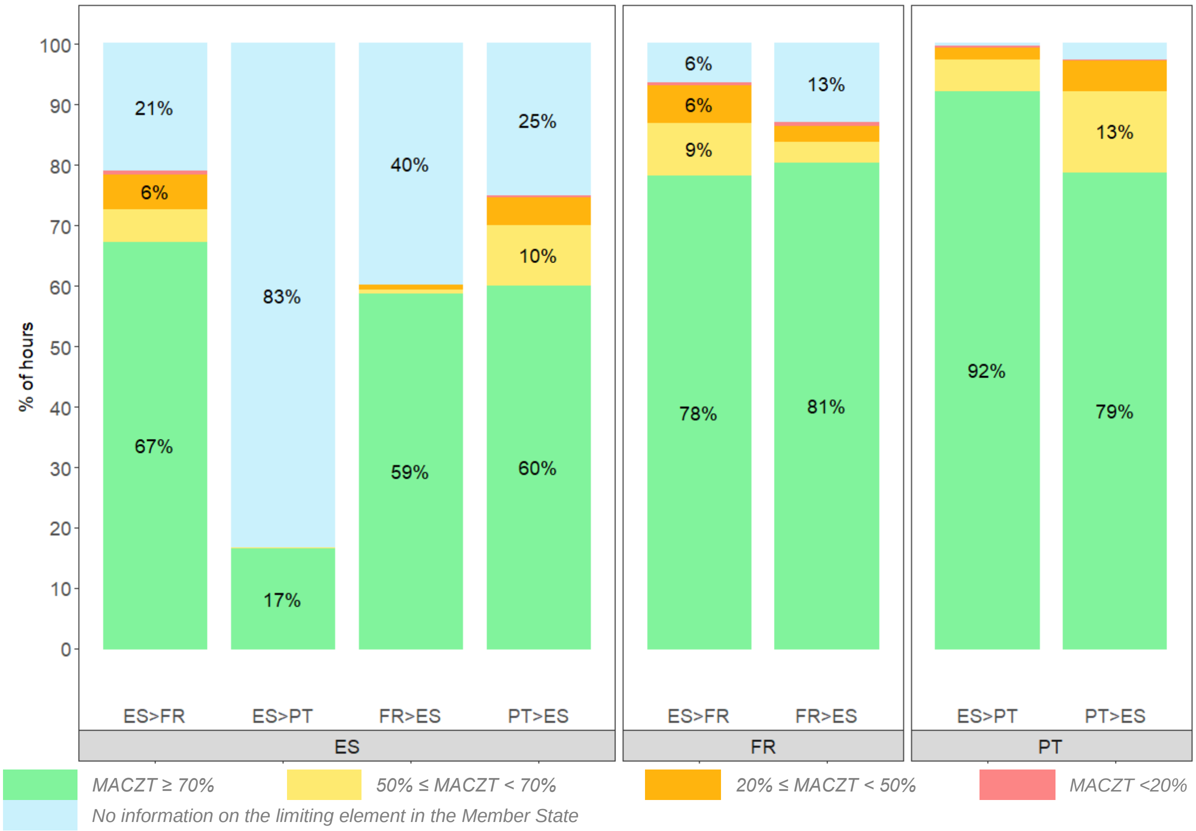
57 Finally, Figure 15 describes the percentage of hours for which the limiting CNEC is, from the perspective of the Member State, located in the neighbouring Member State, and therefore the TSO had no limiting CNEC to report.

[21] As an example, if the MACZT of the limiting CNEC of a Member State is 40% in a given hour, then it is only possible to conclude that the MACZT of the other Member States within the capacity calculation region is at least 41%. In such cases, the fulfilment of the 70% target of those latter Member States cannot be assessed.

[22] See Article 15(2)(b) of the SWE TSOs common capacity calculation methodology for the day-ahead and intraday market timeframe.

[23] In its report, the Portuguese NRA follows the methodology of the previous reports by considering the hours where the fallback procedure was used as 'Limiting element not identified'. For this reason, the results presented in its report may differ from the ones shown here.

Figure 15: Percentage of hours when the minimum 70% target was reached in the SWE region – 2022



Source: ACER calculation based on TSO data.

Note 1: 'No information on the limiting element in the Member State' means that the limiting element for the whole CNTC region was identified in the network of another TSO.

Note 2: When the limiting element was an interconnector, it may be declared by the two TSOs on each side of the border. Therefore, the overall percentage of the time when limiting elements are reported on a given border-direction, considering the two TSOs taken together, is above 100%.

Note 3: TSOs did not calculate the MNCC and did not provide the necessary information to estimate this impact. In general, the MNCC is considered low on these borders. For this reason, the figure does not consider the influence of exchanges with third countries and no additional figure considering exchanges with third countries was produced.

2.2.1.4 Italy North

58 Figure 16 shows the percentage of hours for which the relative MACZT was above the minimum 70% target, or within a set of predefined ranges, in the Italy North region. Contrary to previous reports, for the hours when the offered capacity is limited by the Italian allocation constraint, Italy North TSOs were able to report the CNEC that would have been limiting if the allocation constraint had not been applied.

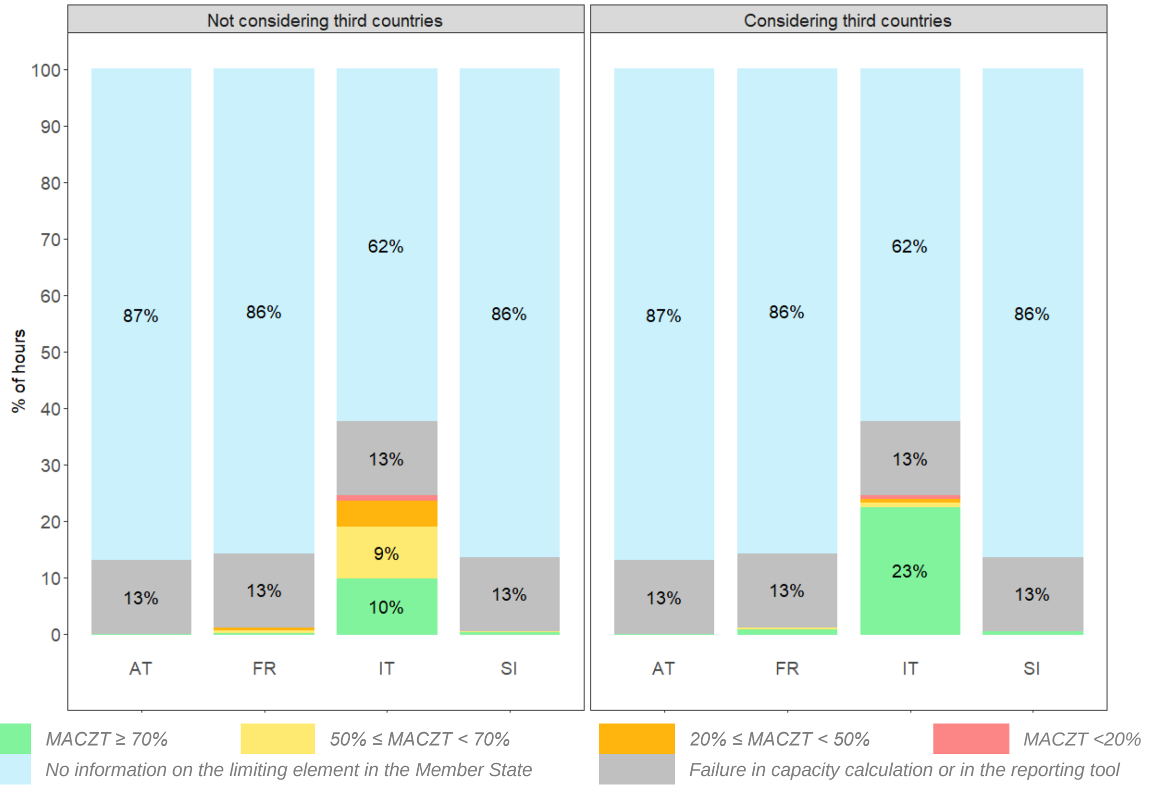
59 13% of the hours, Italy North TSOs did not provide ACER with information on the limiting CNEC due to a failure in the capacity calculation process or in the reporting tool[24]. Figure 16 also describes the percentage of hours for which the limiting CNEC, or allocation constraint, is, from the perspective of the Member State, located in the neighbouring Member State, and therefore the TSO had no limiting CNEC to report. The reason for the significant share of hours where the limiting CNEC is not located within the respective Member State is because, in such cases, the limiting CNEC lies in Switzerland, whose results are not reported.

[24] The reasons for these circumstances include a higher occurrence of missing TSO inputs and a recurring issue at the regional coordination centre of slow computation that is pending a technology migration.

60 The figure shows that, when third-country impact is considered, EU TSOs of the Italy North capacity calculation region meet the 70% target 98% of the hours. This result can be explained by the fact that the capacity calculation methodology is designed such that the limiting CNEC meets the 70% target; a reduction of the NTCs that allows to reach this target is hence only possible when applying validation adjustments. Nonetheless, when such validation takes place, the CNEC that was identified to be limiting before this adjustment may no longer be the one that still limits the amount of capacity offered after validation. In such circumstances, a recalculation of the limiting CNEC is however not foreseen by the capacity calculation methodology. Hence, the information reported to ACER refers to the limiting CNEC before validation.

61 The limiting CNECs reported by Italy North TSOs are always the ones related to the Italian import since a coordinated capacity calculation process in the export direction has not yet been implemented[25]. For this reason, the Italian TSO requested a derogation from the 70% target in this direction for the whole year of 2022.

Figure 16: Percentage of hours when the minimum 70% target was reached in the Italy North region – 2022



Source: ACER calculation based on TSO data.

Note 1: 'No limiting element or allocation constraint in the Member State' means that the limiting element or allocation constraint was in the network of another TSO in the region.

Note 2: Italy North NRAs informed ACER about an agreement between the Italy North TSOs and the Swiss TSO, in place since 28 October 2021, and shared it with ACER in the course of March 2023. Italy North NRAs considered this agreement to be in line with the guidance provided by the European Commission in its letter sent to NRAs on 16 July 2019, allowing to take into account the flows derived from exchanges with Switzerland in the same manner as exchanges between EU countries (as opposed to exchanges with third countries) when monitoring the MACZT. This agreement has however not been made public. Therefore, in accordance with its Recommendation 01/2019 and the European Commission's letter of 16 July 2019, ACER considered the flows derived from exchanges with Switzerland as third-country flows for the estimation of MACZT.

[25] The go-live of the process is currently planned by the end of October 2023.

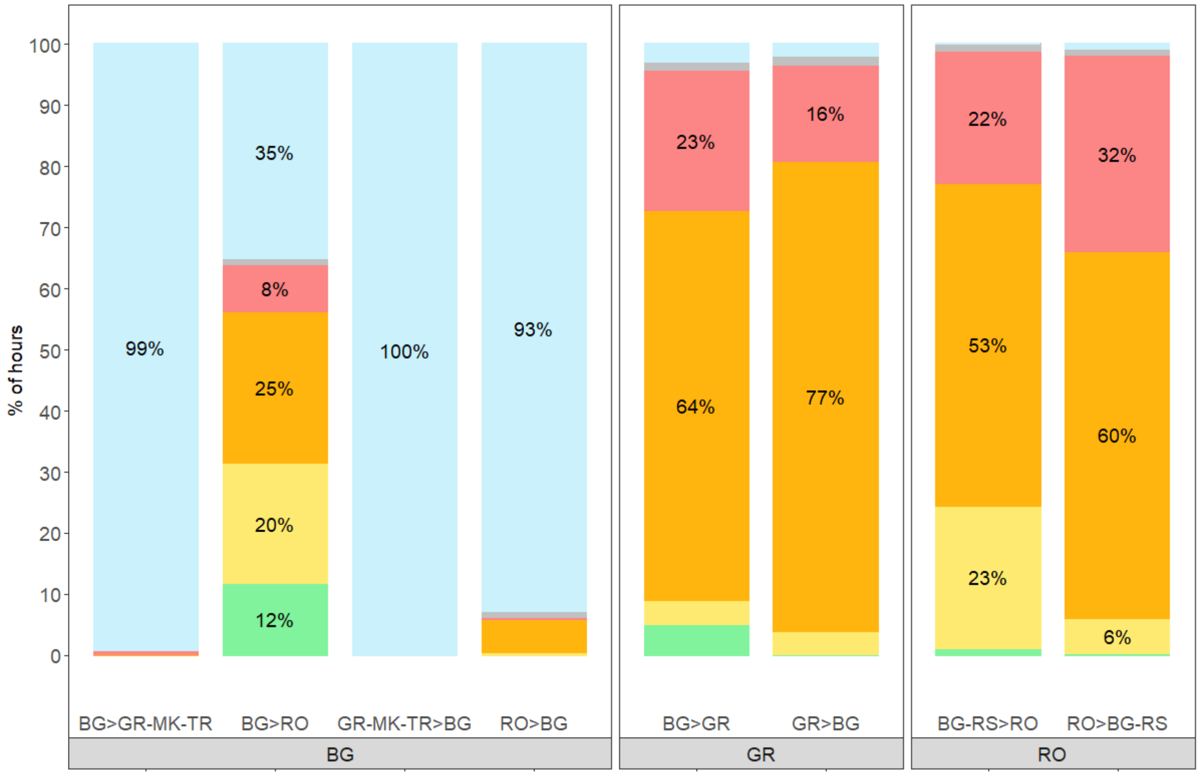
2.2.1.5 SEE

62 Figure 17 shows the percentage of hours for which the relative MACZT was above the minimum 70% target, or within a set of predefined ranges, in the SEE region. In this region, a CNTC capacity calculation applies[26]. Hence, in line with ACER Recommendation 01/2019, MACZT can be accurately calculated only on the limiting CNECs. Even though the SEE region encompasses two borders (BG-GR and BG-RO), one limiting CNEC is determined for each border separately for each hour.

63 Figure 17 describes the percentage of hours for which the limiting CNEC, or allocation constraint, is, from the perspective of the Member State, located in the neighbouring Member State, and therefore the TSO had no limiting CNEC to report. This is particularly evident for the case of Bulgaria, for which the limiting CNEC on the BG-GR border is almost always located in Greece.

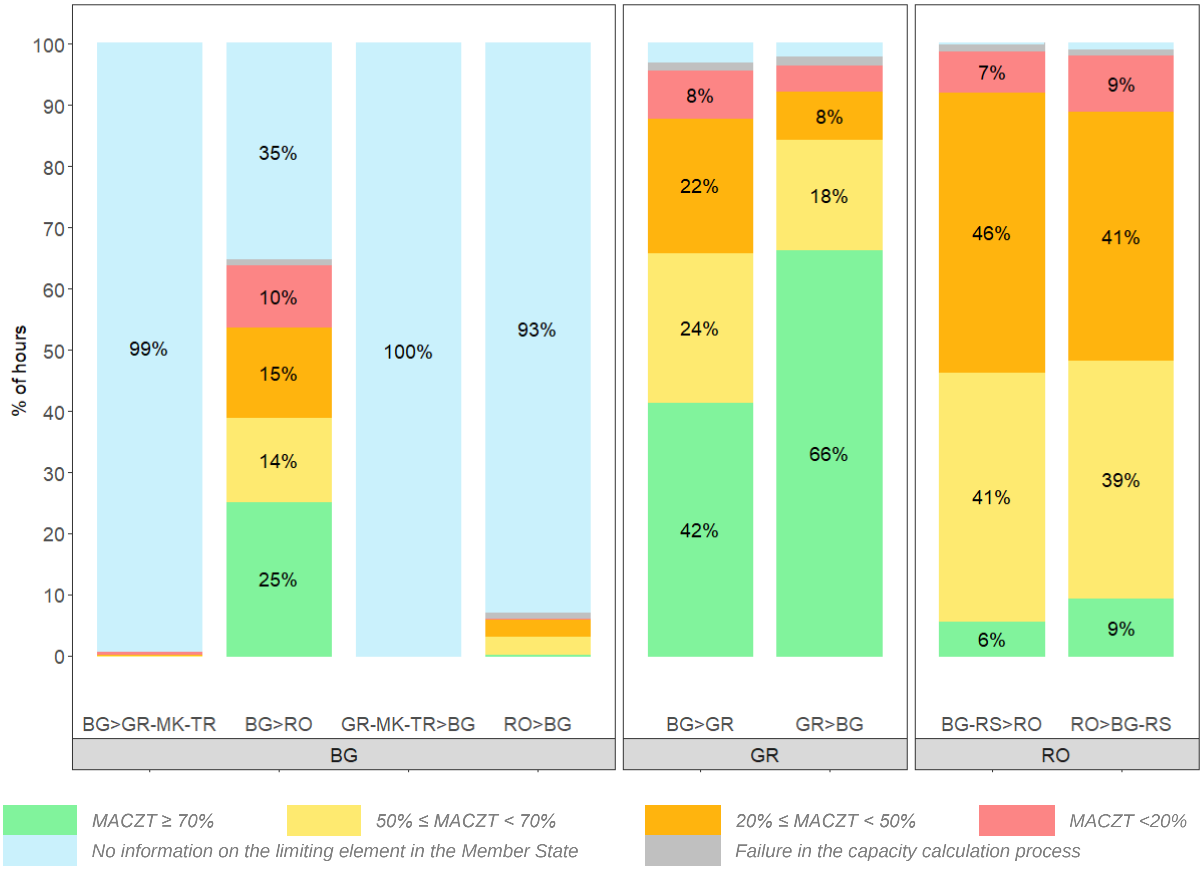
Figure 17: Percentage of hours when the minimum 70% target was reached in the SEE region – 2022

Not considering third countries



[26] Even though the SEE capacity calculation methodology was implemented in July 2021, the Romanian TSO considered a coordinated unilateral NTC capacity calculation on its half bidding zone borders with Bulgaria, Hungary and Serbia until Core flow-based go-live. For this reason, the results shown for Romania in this paragraph cover its borders with Bulgaria and Serbia for the period between 9 June 2022 and 31 December 2022, whereas the results for the first part of the year are shown in section 2.2.1.8.

Considering third countries



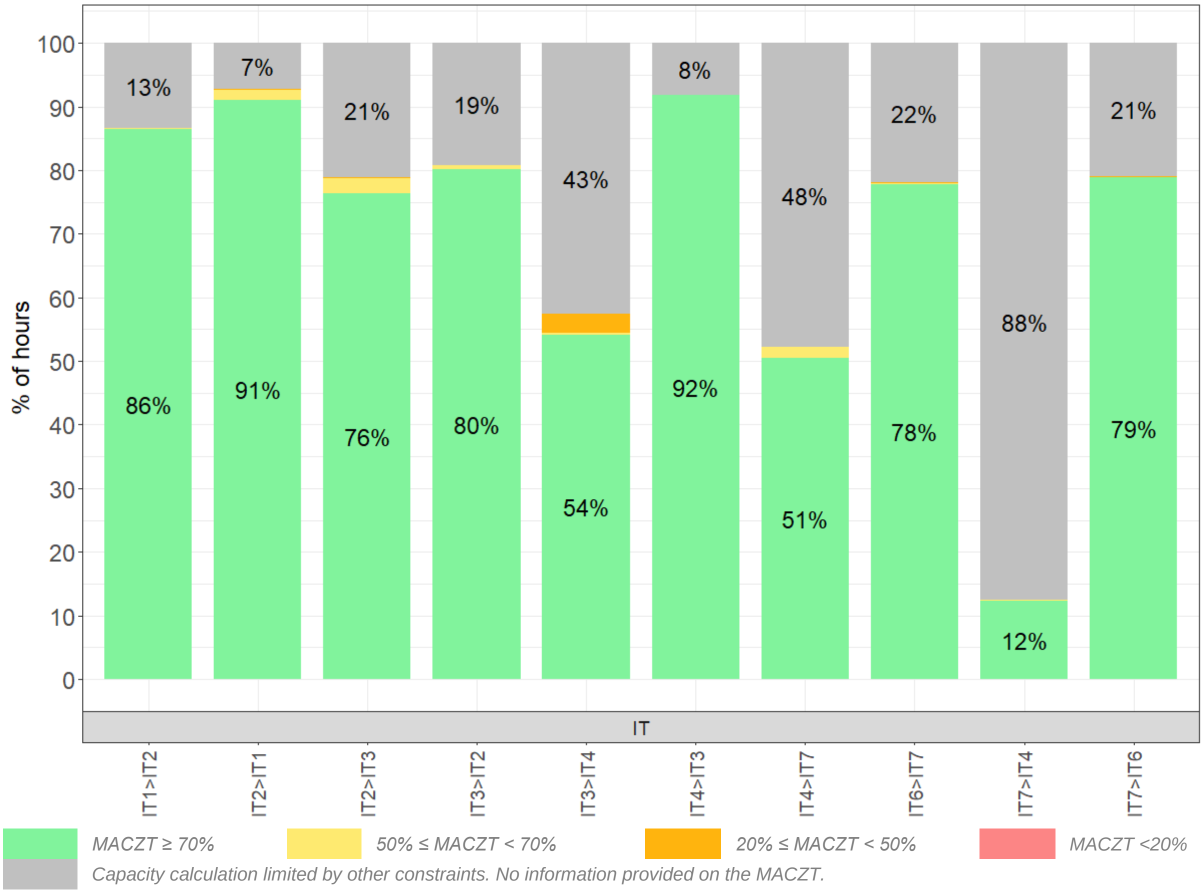
Source: ACER calculation based on TSO data.

2.2.1.6 GRIT

64 Figure 18 shows the percentage of hours for which the relative MACZT was above the minimum 70% target, or within a set of predefined ranges, for the GRIT capacity calculation region[27]. The figure also indicates the percentage of hours when the capacity calculation is limited by 'other constraints'. The Italian TSO does not calculate the impact from flows outside the coordination area. In general, the MNCC is considered low on these borders.

[27] The GRIT capacity calculation region is composed of the internal Italian borders and the HVDC cable between Italy and Greece. The latter is monitored together with all other DC borders in section 2.1. Italy is divided into seven bidding zones.

Figure 18: Percentage of hours when the minimum 70% target was reached for the internal borders of Italy – 2022



Source: ACER calculation based on TSO data.

Note 1: The internal Italian bidding zones are presented as follows: IT1 – Italy North, IT2 – Italy Centre North, IT3 – Italy Centre South, IT4 – Italy South, IT5 – Italy Sardinia, IT6 – Italy Sicily and IT7 – Italy Calabria.

Note 2: The figure does not consider the influence of exchanges with third countries. The necessary information to estimate this impact (considered limited) was not made available by the TSO, so no additional figure considering exchanges with third countries was produced.

Note 3: The grey areas correspond to limitation of the allocation constraints, for which no limiting CNEC was provided. The 'other constraints' were reported by the Italian TSO as 'dynamic stability', 'voltage constraint' or 'failure of the capacity calculation process'.

2.2.1.7 Nordic

65 Figure 19 shows the percentage of hours for which the relative MACZT was above the minimum 70% target, or within a set of predefined ranges, in the Nordic region. Even though the capacity calculation process remains uncoordinated between the two sides of each border, the results for the Nordic region are presented separately compared to the rest of the uncoordinated borders as the Nordic region is expected to implement the flow-based capacity calculation methodology in the course of 2024[28].

66 As a step forward compared to previous data collection rounds, the Swedish TSO started to provide information on the limiting CNEC also for its borders with Norway (NO1<>SE3,

[28] The go-live of the Nordic flow-based capacity calculation methodology is currently foreseen, at the earliest, in Q1 2024. See https://www.nordpoolgroup.com/4ac9c7/globalassets/trading-and-services/go-live-of-nordic-flow-based-ccm-delayed-to-q1-2024.pdf for further details.

NO3<>SE2, NO4<>SE1 and NO4<>SE2). This allows to monitor its performance on these borders as well, as shown in Figure 19.

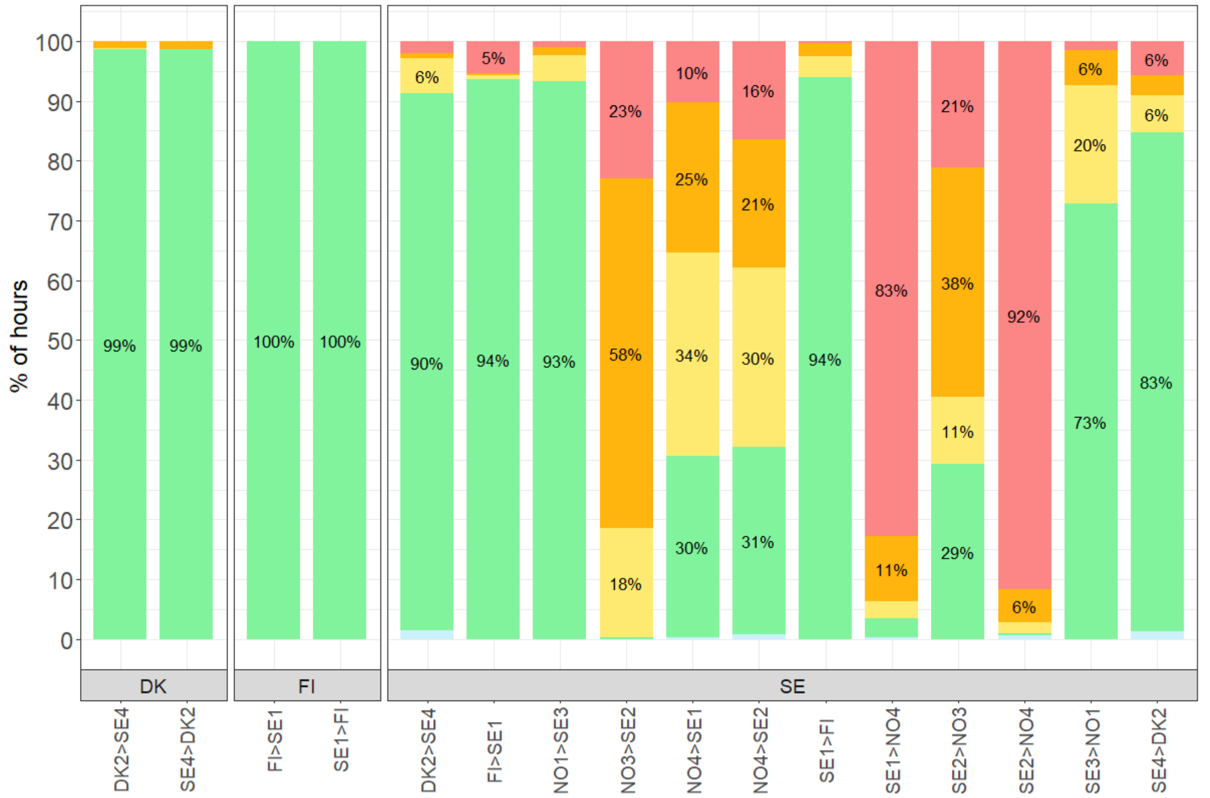
67 As of 30 March 2022, a so-called line set optimisation function was introduced in the day-ahead market coupling algorithm for the borders DK1<>SE3 and NO1<>SE3[29]. This function allows the capacity on these two borders to be optimised by the market algorithm; as an example, if there is a flow from DK1 to SE3, this can increase the flow from SE3 to NO1 as long as it remains lower than the technical limit of that border. This method results in some occurrences where the NTC on the border SE3<>NO1 is negative, which in turn leads to a negative value of MCCC.

Figure 19: Percentage of hours when the minimum 70% target was reached in the Nordic region – 2022

Not considering third countries

[29] For further details about the line set, please refer to https://www.nordpoolgroup.com/49594f/globalassets/download-center/day-ahead/explanation-document-for-nordic-line-sets-march-2022-.pdf.

Considering third countries



Source: ACER calculation based on TSO data.

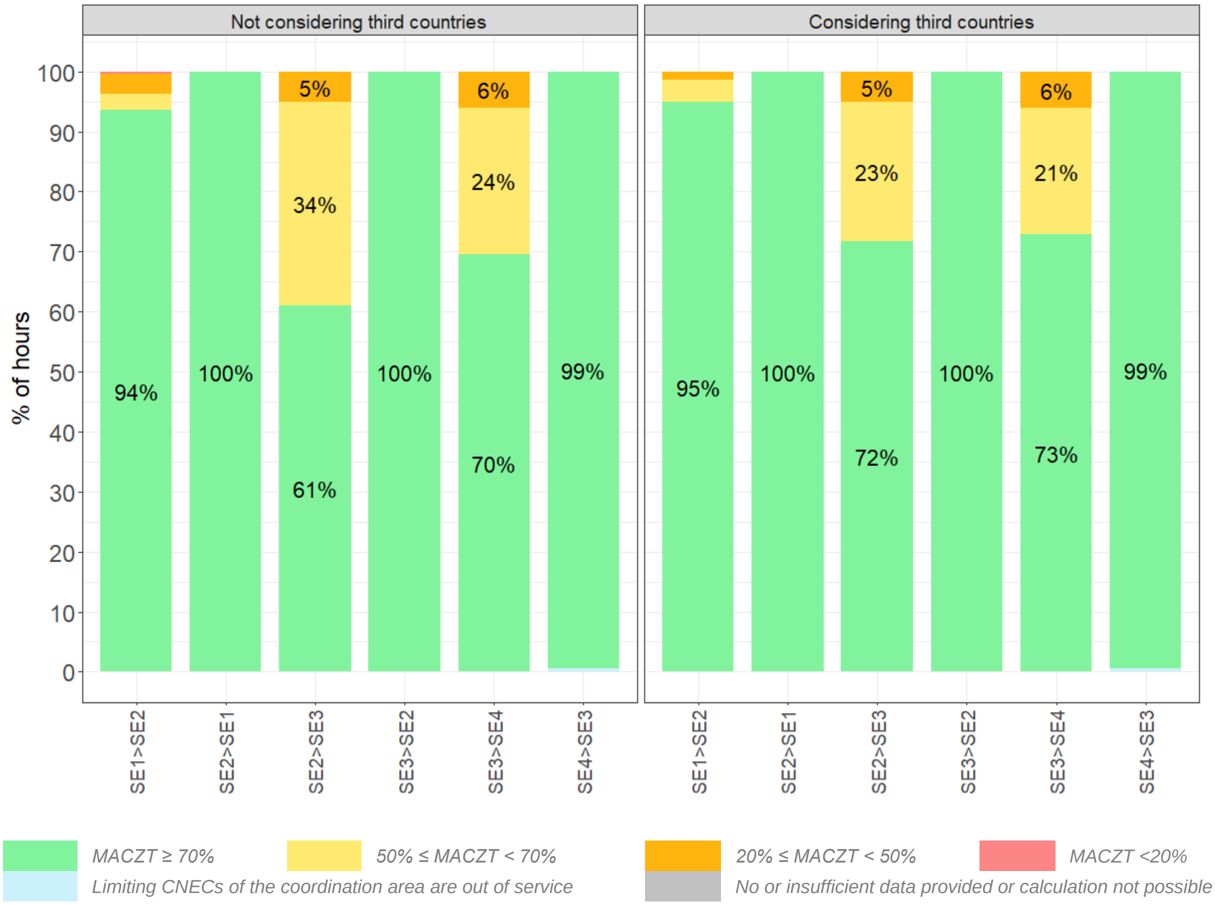
Note 1: Danish and Finnish TSOs did not consider the influence of third countries, therefore the charts not considering and considering third countries are identical for these two Member States.

Note 2: The list of CNECs has been anonymised by the Swedish TSO and no grid model was shared with ACER. This prevents ACER from performing certain consistency checks.

68 Figure 20 shows the percentage of hours for which the relative MACZT was above the minimum 70% target, or within a set of predefined ranges, for the internal borders of Sweden[30].

[30] Sweden is divided into four bidding zones.

Figure 20: Percentage of hours when the minimum 70% target was reached for the internal borders of Sweden – 2022



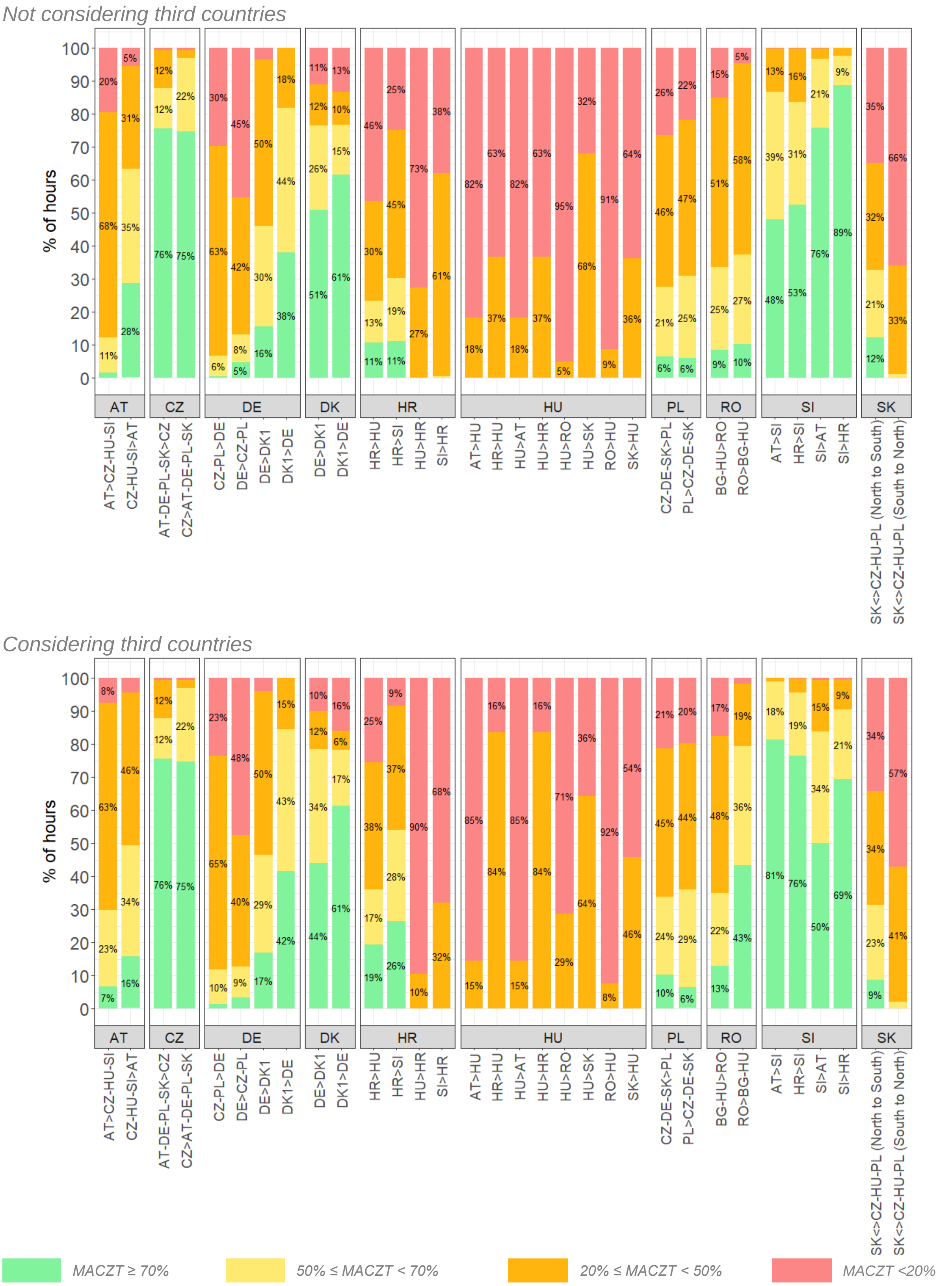
Source: ACER calculation based on TSO data.

2.2.1.8 Uncoordinated borders in continental Europe

69 Figure 21 shows the percentage of hours for which the relative MACZT was above the minimum 70% target, or within a set of predefined ranges, for the remaining uncoordinated borders in continental Europe. The figure considers the impact of the technical profiles of Poland (Polish borders with Czechia, Germany, and Slovakia), after considering allocation constraints, and the technical profile of Germany (German borders with Czechia and Poland).

70 With the go-live of the Core flow-based capacity calculation process on 9 June 2022, all those borders, except for DE<>DK1 and RO<>BG, are now part of the Core capacity calculation region.

Figure 21: Percentage of hours when the minimum 70% target was reached for countries of continental Europe where a coordinated capacity calculation is not yet implemented, for the whole year of 2022 or relevant periods



Source: ACER calculation based on TSO data.

Note: For Austria, information was not available for 49 hours due to local tool errors.

2.2.2. Distance to achieving the national transitional targets

71 This section presents the results of ACER's monitoring of the fulfilment of the transitional targets certain Member States have, in line with an action plan or a derogation[31].

72 Table 3 presents the AC borders that do not yet have to comply with the minimum 70% target. It presents the targets that the TSOs had to reach on these borders for 2022 (if any) and compares the levels of MACZT with these targets. For all Member States and borders that are not mentioned in the table, the minimum 70% target applies for 2022.

73 Figure 22 presents the levels of MACZT compared to the target stipulated by the derogation or action plan when the derogation and/or action plan sets the target for each CNEC.

74 Both Table 3 and Figure 22 consider the impact of the technical profiles of Poland (Polish borders with Czechia, Germany, and Slovakia, for the period before Core flow-based go-live), after considering allocation constraints, and the technical profile of Germany (German borders with Czechia and Poland, for the period before Core flow-based go-live). For flow-based areas, the impact of allocation constraints is not considered.

Table 3: Comparison between the MACZT and transitional targets of Member States on AC borders – 2022

MS	CCA(s)	Direction	Target for 2022	Comparison between the MACZT and the transitory target	
				Not considering third countries	Considering third countries
AT	CWE	N.A.	Target per CNEC set by the derogation and the action plan.	Target met 100% of the hours in the period concerned.	Target met 100% of the hours in the period concerned.
	AT<>CZ -HU-SI	Export	Target per CNEC set by the derogation and the action plan.	Target met 87% of the hours in the period concerned.	Target met 98% of the hours in the period concerned.
		Import		Target met 96% of the hours in the period concerned.	Target met 98% of the hours in the period concerned.
	Core	N.A.	Target per CNEC set by the derogation and the action plan.	Target met 92% of the hours in the period concerned.	Target met 97% of the hours in the period concerned.
	Italy North	Both	Target per CNEC set by the derogation and the action plan.	Target met 100% of the hours in the period concerned.	Target met 100% of the hours in the period concerned.
BE	CWE	Both	Target per CNEC set by the derogation.	Target met 2% of the hours in the period concerned.	Target met 46% of the hours in the period concerned.
	Core	Both	Target per CNEC set by the derogation.	Target met 3% of the hours in the period concerned.	Target met 82% of the hours of in period concerned.
BG	BG-GR, BG-RO	Both	No target set by the derogation.	N.A.	N.A.
CZ	AT-CZ, CZ-DE, CZ-PL, CZ-SK	Export	The derogation sets that a target of 60% must be met on at least 90% of the hours "without outage".	The Czech TSO declared that the hours without outages represent 93% of the year. Target met 91% of the hours in the period concerned.	The Czech TSO declared that the hours without outages represent 93% of the year. Target met 91% of the hours in the period concerned.
		Import	The derogation sets that a target of 40% must be met on at least 90% of the hours "without outage".	The Czech TSO declared that the hours without outages represent 93% of the year. Target met 93% of the hours in the period concerned.	The Czech TSO declared that the hours without outages represent 93% of the year. Target met 93% of the hours in the period concerned.

[31] Annex II gives further insights on the derogations and actions plans applied by Member States.

MS	CCA(s)	Direction	Target for 2022	Comparison between the MACZT and the transitory target	
				Not considering third countries	Considering third countries
DE	CWE	N.A.	Target per CNEC set by the action plan (31%).	Target met 19% of the hours in the period concerned.	Target met 25% of the hours of in the period concerned.
	DE-CZ, DE-PL	Export	Target per CNEC set by the action plan (31%).	Target met 33% of the hours in the period concerned.	Target met 30% of the hours in the period concerned.
		Import		Target met 38% of the hours in the period concerned.	Target met 49% of the hours in the period concerned.
	Core	N.A.	Target per CNEC set by the action plan (31%).	Target met 49% of the hours in the period concerned.	Target met 74% of the hours in the period concerned.
	DE-DK1	Export	Target per CNEC set by the action plan (39.4%).	Target met 61% of the hours in the period concerned.	Target met 61% of the hours in the period concerned.
		Import		Target met 96% of the hours in the period concerned.	Target met 97% of the hours in the period concerned.
ES	SWE (ES-FR)	Export	The derogation sets that the 70% target must be met at least 75% of the hours when there is a limiting CNEC declared in the Member State or where the limiting CNEC is located outside of the Member State.	70% target met 67% of the hours of the year, and 88% of the hours when there is a limiting CNEC declared in the Member State or where the limiting CNEC is located outside of the Member State.	N.A.
		Import		70% target met 59% of the hours of the year, and 99% of the hours when there is a limiting CNEC declared in the Member State or where the limiting CNEC is located outside of the Member State.	N.A.
	SWE (ES-PT)	Export		70% target met 17% of the hours of the year, and 100% of the hours when there is a limiting CNEC declared in the Member State or where the limiting CNEC is located outside of the Member State.	N.A.
		Import		70% target met 60% of the hours of the year, and 85% of the hours when there is a limiting CNEC declared in the Member State or where the limiting CNEC is located outside of the Member State.	N.A.
GR	BG-GR	Both	No target set by the derogation.	N.A.	N.A.
HR	HR-HU	Both	The derogation sets that the average MACZT over the period 1 January – 8 June 2022 should be higher than 5.6%.	The average MACZT over the period concerned is 20%, i.e., above the target.	The average MACZT over the period concerned is 23%, i.e., above the target.
	HR-SI	Both	The derogation sets that the average MACZT over the period 1 January – 8 June 2022 should be higher than 9.7%.	The average MACZT over the period concerned is 31%, i.e., above the target.	The average MACZT over the period concerned is 34%, i.e., above the target.
	Core	N.A.	Target set by the action plan.	Target met 34% of the hours in the period concerned.	Target met 97% of the hours in the period concerned.

MS	CCA(s)	Direction	Target for 2022	Comparison between the MACZT and the transitory target	
				Not considering third countries	Considering third countries
HU	AT-HU	Export	No limiting CNECs with a target set by the action plan.	Target met 9% of the hours in the period concerned.	Target met 6% of the hours in the period concerned.
		Import	Target per CNEC set by the action plan.	Target met 9% of the hours in the period concerned.	Target met 6% of the hours in the period concerned.
	HR-HU	Export	No limiting CNECs with a target set by the action plan.	N.A.	N.A.
		Import	Target per CNEC set by the action plan.	N.A.	N.A.
	HU-RO	Both	No limiting CNECs with a target set by the action plan.	N.A.	N.A.
	HU-SK	Export	No limiting CNECs with a target set by the action plan.	N.A.	N.A.
		Import	Target per CNEC set by the action plan.	N.A.	N.A.
	Core	N.A.	Target per CNEC set by the action plan.	Target met 100% of the hours in the period concerned.	Target met 100% of the hours in the period concerned.
IT	Italy North	Import (only for hours with allocation constraints)	No target set by the derogation when an allocation constraint applies. The regulatory 70% target applies for the hours without allocation constraint.	The hours without allocation constraints represented 94% of the hours of the year. The 70% target was met 39% of the hours concerned.	The hours without allocation constraints represented 94% of the hours of the year. The 70% target was met 91% of the hours concerned.
NL	CWE	N.A.	Target per CNEC set by the derogation and the action plan.	Target met 56% of the hours in the period concerned.	Target met 97% of the hours in the period concerned.
	Core	N.A.	Target per CNEC set by the derogation and the action plan[32].	Target met 35% of the hours in the period concerned.	Target met 88% of the hours in the period concerned.
	DK1-NL	Both	No target set by the derogation.	N.A.	N.A.
PL	CZ-PL, CZ-DE, CZ-SK	Export	Target per CNEC set by the derogation and the action plan.	Target met 62% of the hours in the period concerned.	Target met 66% of the hours in the period concerned.
		Import		Target met 52% of the hours in the period concerned.	Target met 58% of the hours in the period concerned.
	Core	N.A.	Target per CNEC set by the derogation and the action plan.	Target met 90% of the hours in the period concerned.	Target met 96% of the hours in the period concerned.
PT	SWE (ES-PT)	Export	The derogation sets that the 70% target must be met at least 75% of the hours.	70% target met 92% of the hours of the year, and 93% of the hours when there is a limiting CNEC declared in the Member State.	N.A.
		Import		70% target met 79% of the hours of the year, and 81% of the hours when there is a	N.A.

[32] The MACZT target per CNEC is lowered by the amount of IVA applied by the Dutch TSO in the day-ahead validation of capacity (DAVinCy) validation process. This approach differs from the one adopted by all other Core TSOs with an action plan and/or a derogation per CNEC, where the MACZT target is not reduced following the application of IVAs.

MS	CCA(s)	Direction	Target for 2022	Comparison between the MACZT and the transitory target	
				Not considering third countries	Considering third countries
				limiting CNEC declared in the Member State.	
RO	BG-RO	Export	Target per CNEC set by the action plan (34%).	Target met 31% of the hours in the period concerned.	Target met 79% of the hours in the period concerned.
		Import		Target met 54% of the hours in the period concerned.	Target met 81% of the hours in the period concerned.
	BG-RO, HU-RO	Export	Target per CNEC set by the action plan for BG-RO (34%) and by the derogation for HU-RO (33%).	Target met 78% of the hours in the period concerned.	Target met 94% of the hours in the period concerned.
		Import		Target met 63% of the hours in the period concerned.	Target met 66% of the hours in the period concerned.
	Core	N.A.	Target per CNEC set by the derogation (33%).	Target met 29% of the hours in the period concerned.	Target met 79% of the hours in the period concerned.
SK	CZ-SK, HU-SK, PL-SK	Transit north to south	The derogation sets that a target of 40% to be met at least 80% of the hours.	Target met 41% of the hours in the period concerned.	Target met 42% of the hours in the period concerned.
		Transit south to north		Target met 8% of the hours in the period concerned.	Target met 10% of the hours in the period concerned.
	Core	N.A.	The derogation sets that a target of 40% to be met at least 80% of the hours on all CNECs, except for two CNECs, where a target of 30% is to be met at least 80% of the hours.	Target met 100% of the hours in the period concerned.	Target met 100% of the hours in the period concerned.

75 In general, no Member State fully reached its transitional targets, which are lower than the 70% target, in all its coordination areas. However, with the introduction of Core flow-based market coupling for the Member States that were previously applying NTC approach, an apparent significant improvement can be observed, especially for the case of Croatia, Hungary, Poland, and Slovakia. However, the fact that, on those borders, only limiting CNECs have been monitored so far, makes it hardly possible to draw any conclusion on the actual improvement that flow-based brought about in terms of cross-zonal capacity made available to the market. A proper assessment would only have been possible when comparing the same dataset, i.e., all CNECs in both cases.

Figure 22: Percentage of hours when the transitional target is met on all CNECs, for Member States with a derogation and/or an action plan that stipulates a target per CNEC – 2022

Source: ACER calculation based on TSO data.

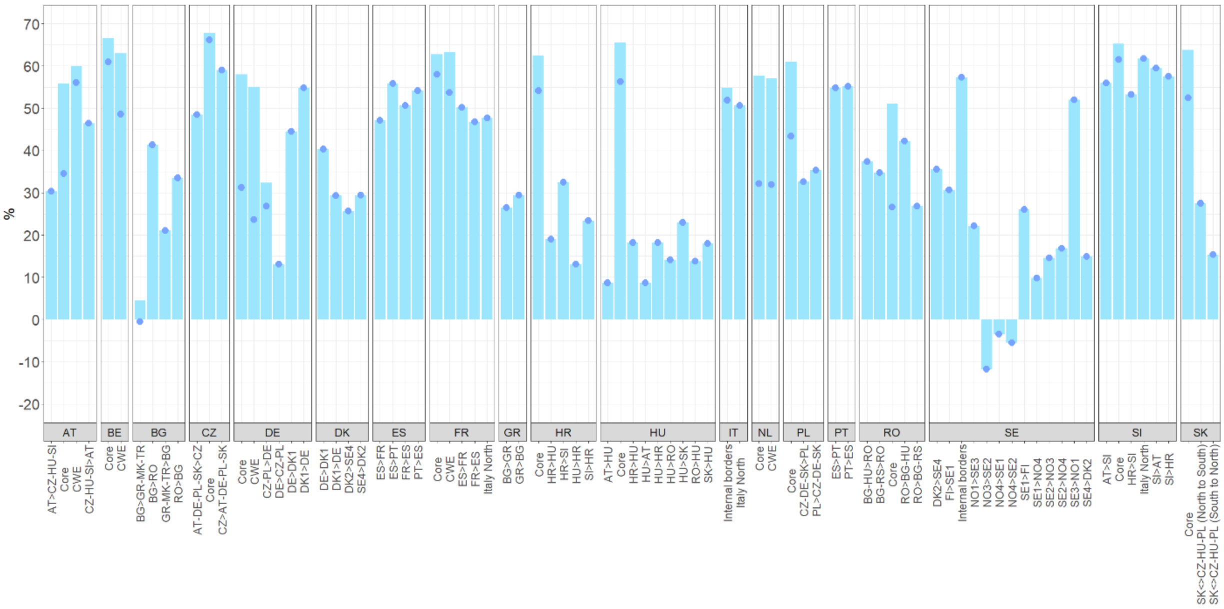
Note: The figure shows the lowest hourly MACZT over reported CNECs, expressed as a percentage of the national transitional target.

2.2.3. Average MACZT when 70% is not reached

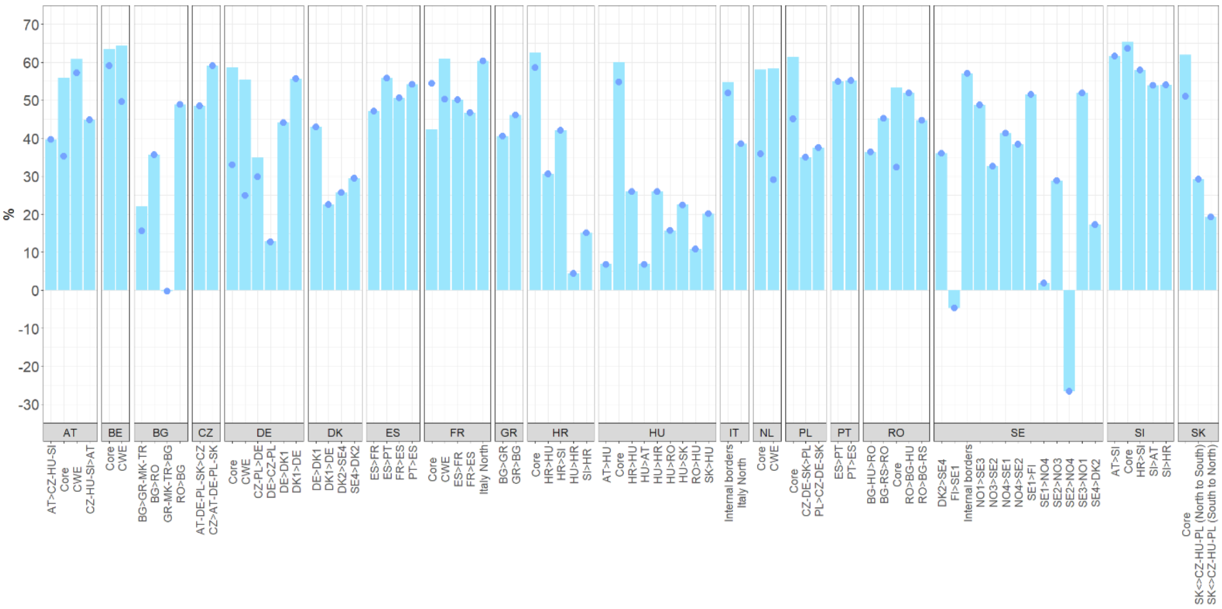
76 As presented in section 2.2.1, the 70% target is not met on most borders. To give an indication of how much additional capacity still needs to be made available, Figure 23 shows the average MACZT over all the CNECs that do not meet the minimum 70% target, over all the hours. In addition, it shows the average of the minimum hourly MACZT on CNECs where the 70% target is not met.

Figure 23: Average margin available on all relevant CNECs where the minimum 70% target is not reached – 2022

Not considering third countries



Considering third countries



Average MACZT on all CNECs where the minimum 70% target is not reached

Average of the minimum hourly MACZT on CNECs where the minimum 70% target is not reached

Source: ACER calculation based on TSO data.

Note 1: The MACZT for the Finnish borders is always meeting or exceeding the 70% target and therefore not part of this figure.

Note 2: After Core go-live, Czechia meets the 70% target for all hours and borders within Core when considering third countries.

Note 3: Negative values of MACZT for Sweden can be explained by the timestamps with negative MCCC due to the line set optimisation function (see section 2.2.1.7) and the presence of significant uncoordinated flows in a region which is characterised by a meshed network.

2.2.4. Impact of other coordination areas on available capacity

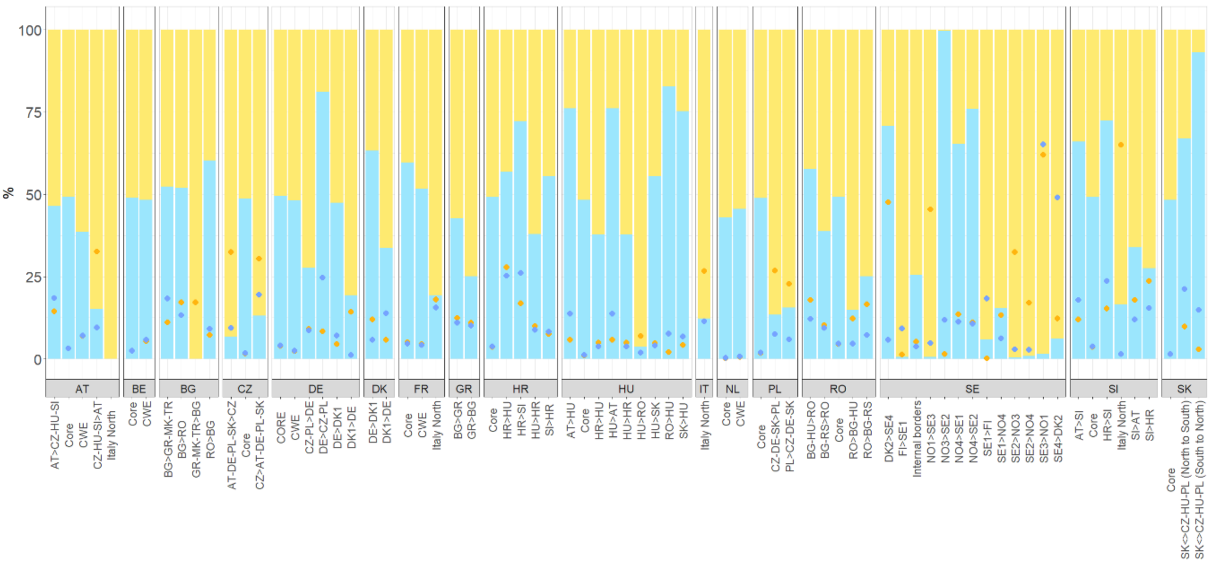
77 The introduction of larger capacity calculation regions, hence increasing coordination among TSOs and thereby making available more detailed knowledge of the grid load, aims at reducing uncertainty in the provision of cross-zonal capacity. MNCC represents the impact of the flows resulting from outside a dedicated capacity coordination region.

78 Figure 24 shows the MNCC values applied to CNECs. More specifically, it presents, for each Member State and coordination area, among all CNECs declared by the TSOs, the share of CNECs with positive MNCC, and the share of CNECs with negative MNCC. As MNCC represents the flow induced by cross-zonal exchanges beyond coordinated capacity calculation, the contribution may also be negative, i.e., it may free capacity on the CNEC. This additional capacity should then become available for trade at bidding zone borders within the coordination area.

79 Figure 24 also shows the average levels, in percentage of F_{max}, of the MNCC values when MNCC was positive, and when MNCC was negative (indicated by the orange and blue dots, respectively). Overall, the figure gives insight into how and to what extent the flows from other coordination areas influence the capacity TSOs can offer on their CNECs. Such flows are computed based on forecasts, which have inherent uncertainties[33]. MNCC values are expected to decrease in the future, e.g., following the implementation of the common grid model methodology and of the capacity calculation methods pursuant to the Capacity Allocation and Congestion Management (CACM) Regulation. This can be explained by the simple fact that fewer non-coordinated capacity calculations will exist.

Figure 24: Share of CNECs with positive and negative MNCC as a % of all CNECs and respective average levels of MNCC as a % of Fmax – 2022

Not considering third countries



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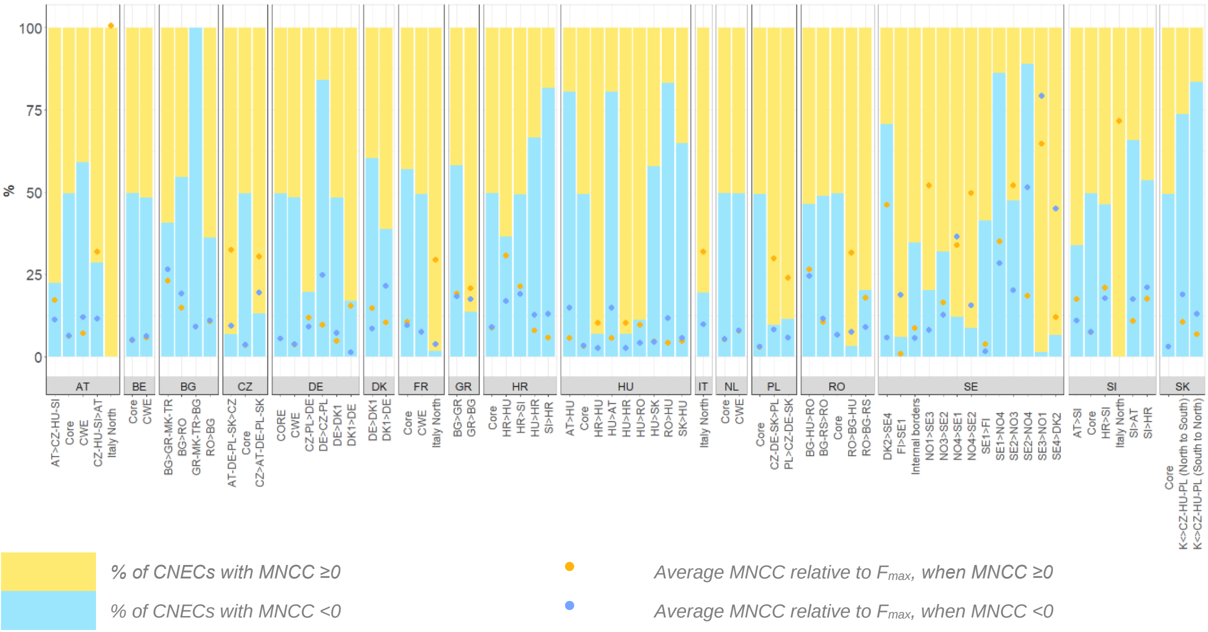
[33] The netting of flows opposite to congestion is legally required. Therefore, TSOs are required to increase MCCC to account for negative MNCC.

Considering third countries



Source: ACER calculation based on TSO data.

Note: The SWE region, Finland, Italy's internal borders, and the border DK2-SE4 for Denmark are not part of this figure because the TSOs did not calculate the MNCC. In general, the MNCC is considered low on these borders.

80 Elements in Figure 24 that have high negative MNCC values in absolute terms are an indicator of the benefit to include more borders into the capacity coordination region. Indeed, the negative MNCC values indicate the extent to which flows resulting from outside a dedicated capacity coordination region may reduce the MACZT, if the netting is not taken into account by increasing MCCC. Enlarging the capacity coordination region and internalising these flows would be beneficial to reaching the 70% target.

81 The presented figures show that the main reductions in terms of MNCC are experienced in those borders that have moved during 2022 from uncoordinated NTC processes to the Core flow-based capacity calculation. This is expected, as a higher number of borders are now coordinated, and partially explains the better performance seen in those Member States that implemented flow-based as of the Core capacity calculation go-live. A direct comparison between the CWE and Core dataset cannot be accurately performed as several external borders were only included in the data reported after the implementation of the Core capacity calculation methodology.

2.3. Structural limitations in the achievement of the 70% target

82 This section aims to assess the causes behind the suboptimal performance of some of the analysed Member States with regard to the 70% target, with a particular focus on those that apply flow-based methodology.

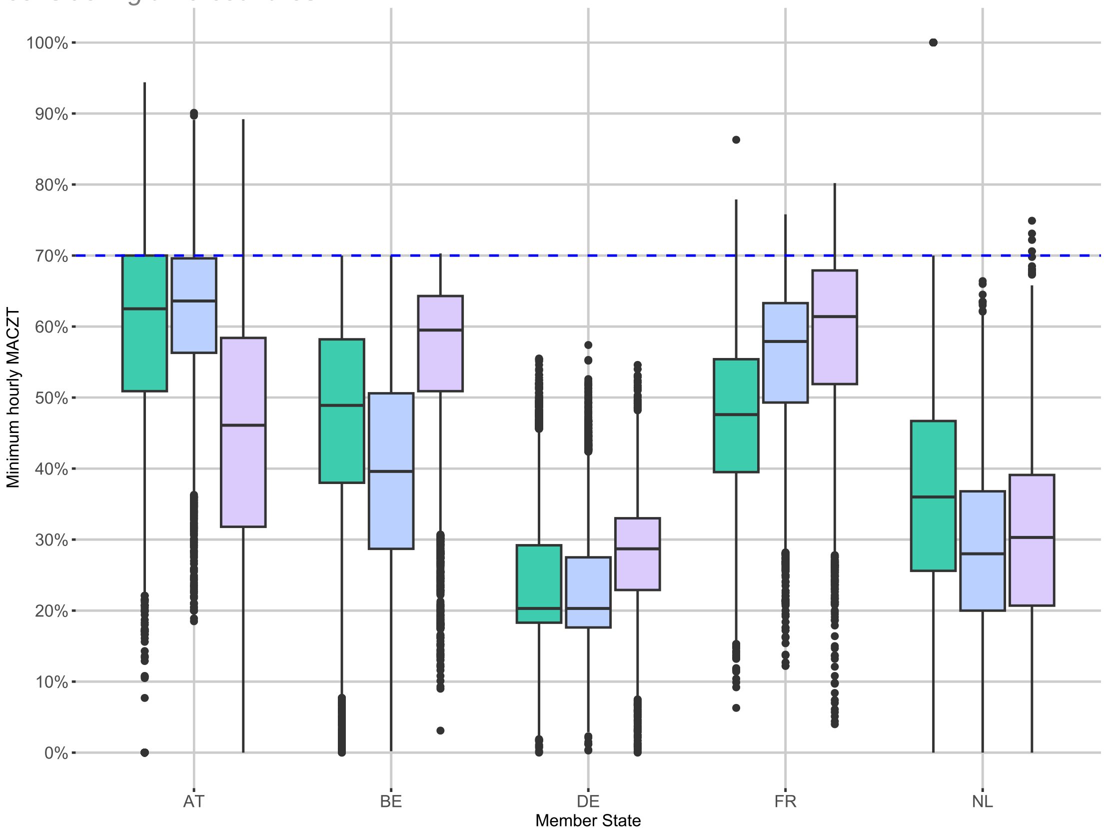
83 For this purpose, it first presents a year-on-year evolution of the hourly MACZT performance for the Member States that have applied flow-based methodology in their control area since the 70% target entered into force, and then analyses the main drivers of such performances.

2.3.1. All Member States need to reach the 70% target, but improvements are not uniform

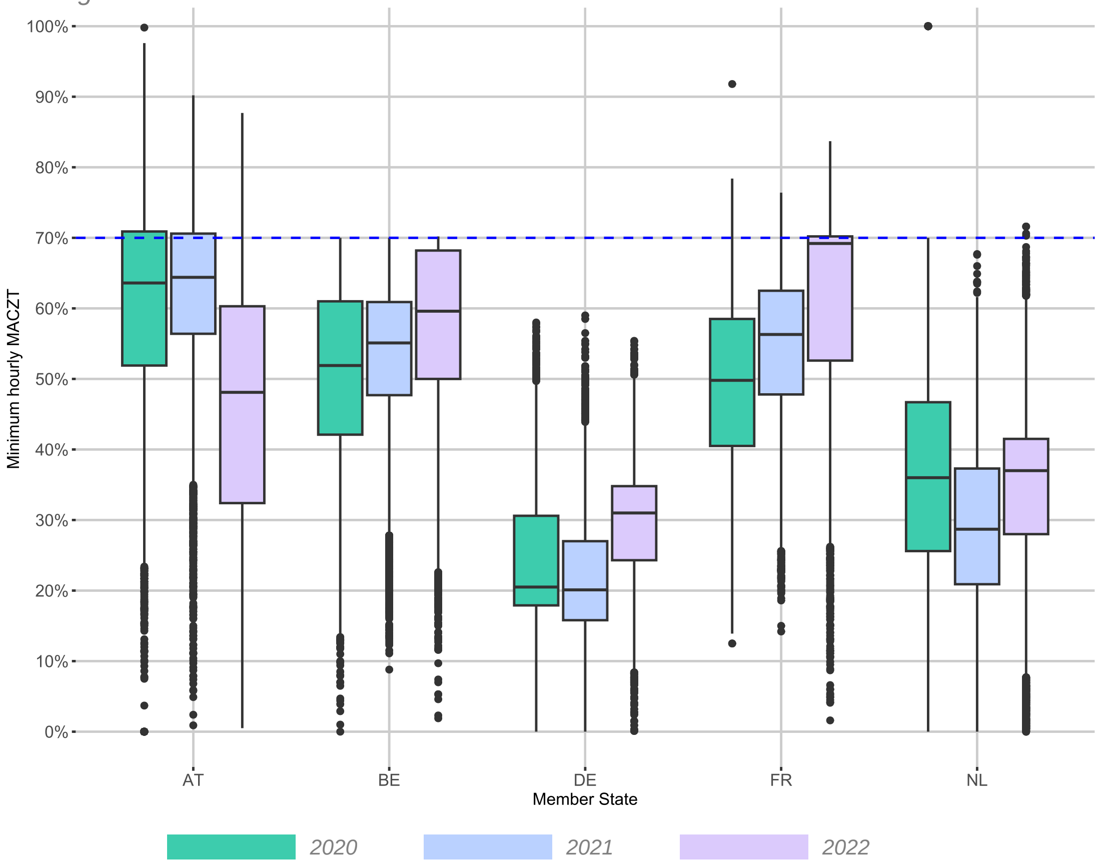
84 Figure 25 shows the distribution of the minimum hourly MACZT for the Member States that have had a flow-based capacity calculation approach prior to the implementation of the Core day-ahead capacity calculation methodology on 9 June 2022 (ex-CWE countries), displayed yearly for the period between 2020 and 2022, both considering and excluding the impact of third-country flows. This shows the evolution of the margins over the years and can serve as a comparison as to which Member States are moving towards the fulfilment of the 70% target.

Figure 25: Yearly evolution of the minimum hourly MACZT values for all CWE countries between 2020 and 2022

Not considering third countries



Considering third countries



Source: ACER calculation based on TSO data.

Note 1: Q1 data of 2020 was not available for both Belgium and the Netherlands, and therefore it is not included in the 2020 data for either Member State.

Note 2: The Netherlands' data excluding the impact of third countries for 2020 could not be provided, and therefore third-country flows are included in both plots.

Note 3: German and Austrian data for 2022 after the implementation of the Core capacity calculation methodology include borders that were previously outside the scope of the CWE capacity calculation.

85 Based on the presented data, no generalized improvement can be inferred between years 2020 and 2021 on MACZT values. On the other hand, MACZT results of 2022 for some Member States are improved, coinciding with the implementation of the new flow-based capacity calculation methodology for the whole Core capacity calculation region.

86 These improvements, however, are not uniformly distributed and are generally not enough to keep up with the national MACZT targets, as seen in Figure 22. Moreover, a sizeable number of the Member States of the Core capacity calculation region have requested derogations to the fulfilment of the 70% target or have an action plan, mainly to cope with the impact of loop flows from neighbouring countries and the derived cost-sharing of remedial actions. Such flows impact neighbouring bidding zones, preventing them from maximising the amount of cross-zonal capacity available for trade, and meeting the 70% target. Loop flows may be tackled through bidding zone reconfiguration or other measures to ensure non-discrimination in capacity calculation.

87 The transitional targets set in those derogations can significantly impact the offered cross-zonal capacities, by reducing the MACZT target set in the capacity calculation process. This presents a strong limitation in the advancement towards the 70% target and emphasizes the need for addressing the underlying causes behind the need for derogations, so that all Member States can move simultaneously towards the common 70% target.

2.3.2. Unilateral capacity reductions limit the progress to 70%

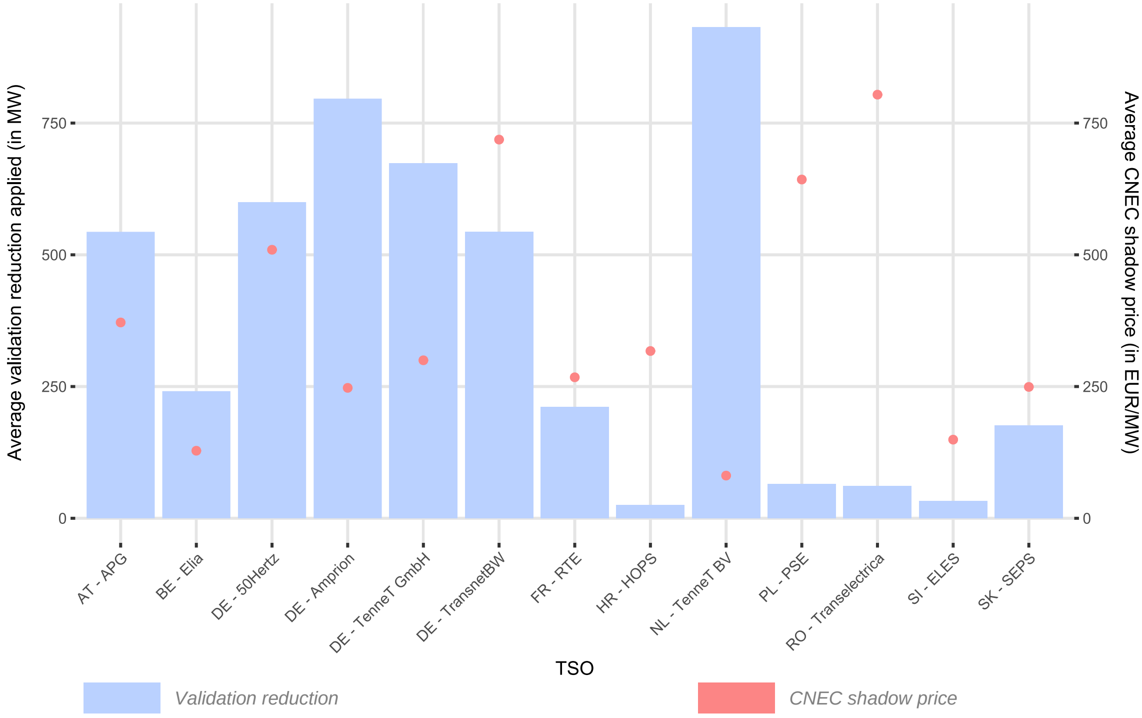
88 Some mechanisms are available for Core TSOs to reduce MACZT values below the national transitional targets derived from action plans or derogations, imposing another major obstacle in the achievement of the 70% target. This is the case for validation adjustments and allocation constraints. In addition, unilateral reductions of cross-zonal capacities have also taken place in the Nordic region. The following paragraphs illustrate such limitations.

Some TSOs frequently apply individual validation adjustments

89 Article 20 of the Core day-ahead capacity calculation methodology describes the individual and coordinated validation adjustments, which allow Core TSOs to reduce the margins for cross-zonal exchanges under specific circumstances, for reasons of operational security[34]. They therefore influence the outcome of the flow-based market coupling and the constraints in cross-zonal trading. While coordinated validations are not applied today in the absence of a common process, Core TSOs can apply individual validation adjustments (IVAs) either unilaterally or jointly among a share of TSOs.

90 These validation adjustments may have a significant impact in the overall efficiency of the internal market, as they can severely constraint the capacities offered. This impact can be best estimated by analysing the shadow price of the CNECs for which a validation adjustment has been performed. With this in mind, Figure 26 presents the average value of adjustment applied per TSO on all active constraints (i.e., those with a non-zero shadow price), against the average shadow price of those constraints.

Figure 26: Average market impact of the validation adjustments per TSO in the Core region (between 9 June 2022 and 31 December 2022)



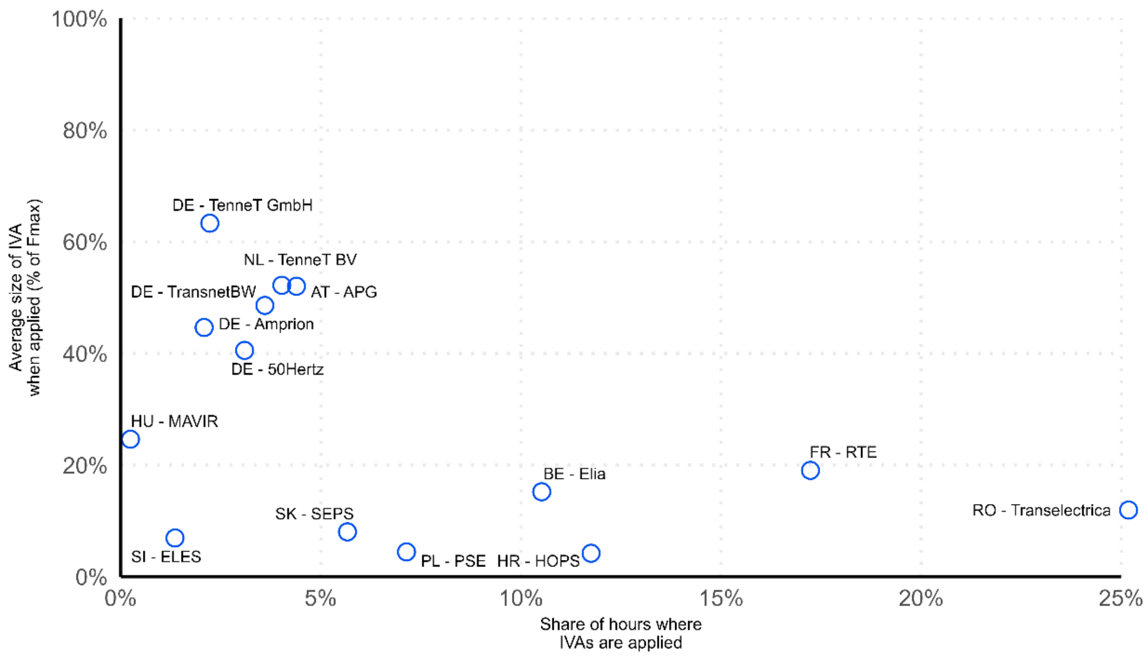
Source: ACER calculation based on TSO data.

[34] TSOs have the right to decrease the RAM for reasons of operational security during the individual validation, through IVAs. IVAs can only be applied to the minimum degree that is needed to ensure operational security considering all expected available costly and non-costly remedial actions.

91 Figure 27 shows how often IVAs are applied (in % of all hours, horizontally) and how much they reduce the RAM on average (in % of F_{max}, vertically). While some TSOs apply IVAs very frequently (e.g., Transelectrica, RTE, Elia and HOPS), these adjustments are fairly low in magnitude compared to other TSOs that apply them less frequently (for example TSOs of Austria, Germany and the Netherlands, see also below[35]). This latter group of TSOs on average reduces up to 40-60% of the total F_{max} value through IVAs.

92 The application of IVAs is the main driver to frequent reductions below the 20% minRAM threshold. It is worth noting that the Member States, such as Czechia or Slovenia, which achieve better results in terms of fulfilment of the 70% target (as depicted in Figure 13), but also those that have met their national targets (as depicted in Figure 22), were primarily associated with TSOs that either applied IVAs in a more limited manner or did not apply them at all.

Figure 27: Application of individual validation adjustments by Core TSOs (between 9 June 2022 and 31 December 2022)



Source: ACER calculation based on JAO data.

93 As presented above, the application of validation adjustments can have a significant impact in the day-ahead electricity prices across the whole capacity calculation region, and this impact is not necessarily limited to the bidding zone where the capacity reduction has been applied[36]. This magnifies the importance of a transparent and limited usage of this mechanism. However, this is not the case currently, as validation reductions are structurally applied by some TSOs and may not necessarily disclose all the information required for a detailed assessment of their justification.

94 Moreover, the different methodologies for assessing the need for validation adjustments are not transparent nor harmonized across all Core TSOs. In these assessments, it is critical that security limits of internal network elements that are not sensitive to cross-zonal exchanges do not lead to validation adjustments, and that all available remedial actions, both costly and non-costly, are considered.

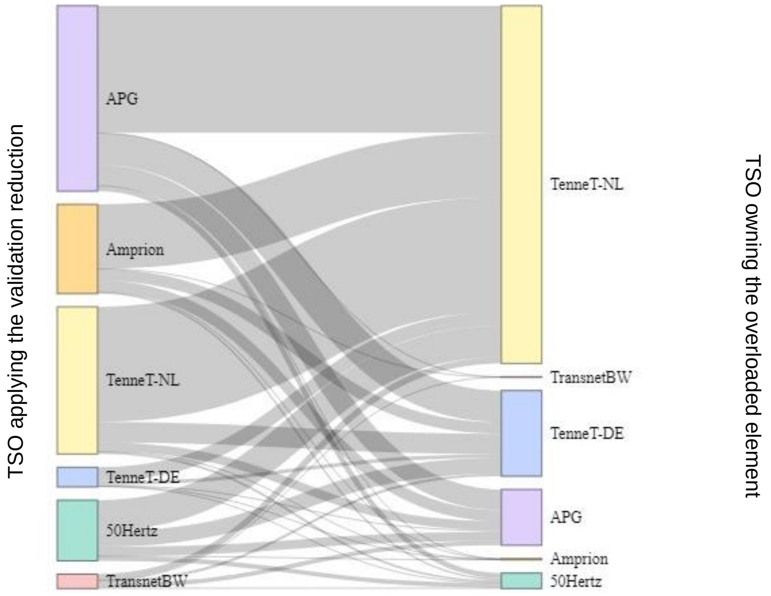
[35] These TSOs jointly validate the resulting flow-based domain by relying on the so-called *DAVinCy* validation tool.

[36] See section 3.1. for further information.

The DAVinCy process centralises the application of IVAs for some Core TSOs

95 The German, Dutch and Austrian TSOs jointly perform an assessment of the validation adjustments through a centralised process, so-called *DAVinCy* (day-ahead validation of capacity). In this process, application of IVAs is very often used to clear congestion of network elements located on other TSOs' control areas. This is shown in Figure 28, by plotting on the left of the figure the TSOs applying the validation adjustment, and on the right of the figure the TSOs owning the overloaded element for which the validations were applied. The boxes representing the different TSOs are sized depending on the volume (in GWs) of validation adjustments applied.

Figure 28: Sankey diagram of the application of IVAs for the DAVinCy TSOs (between 9 June 2022 and 31 December 2022)



Source: ACER calculation based on TSO data.

96 As shown in the diagram, the TSOs applying the largest amount of validation reductions are the Austrian and Dutch TSOs, while the network elements causing the reductions of capacity are in most cases in the Dutch TSO's control area. Indeed, most of the validation reductions applied in Austria correspond to overloaded elements in the control area of the Dutch TSO.

97 In this joint DAVinCy validation process, the participating TSOs effectively restrict the capacities that can be offered in other bidding zones, as when they identify the need to contract the flow-based domain in a direction where it is bound by a 'foreign' CNEC (i.e., that is not owned by any of the validating TSOs), IVA is applied on a 'substitute' CNEC from a DAVinCy TSO instead, which was not initially bounding the domain. This leads to very high applications of IVAs, as first the CNEC needs to be shifted to the edge of the domain, and only the remainder IVAs effectively constraints the flow-based domain.

98 This practice demonstrates that a coordinated assessment on the need for capacity reductions at a capacity calculation region level is fundamental to limiting the potential cross-impact between different TSOs when applying these reductions.

99 Furthermore, pursuant to Article 16(3) of the Electricity Regulation, the need for capacity reductions identified by TSOs corresponds to a lack of sufficient remedial actions to secure a given market clearing point. Under the current bidding zone configuration, the volume of remedial actions necessary to guarantee the minimum cross-zonal capacity targets will continuously increase with the growing share of renewable energy integration, potentially leading to a significant increase in the use of IVAs.

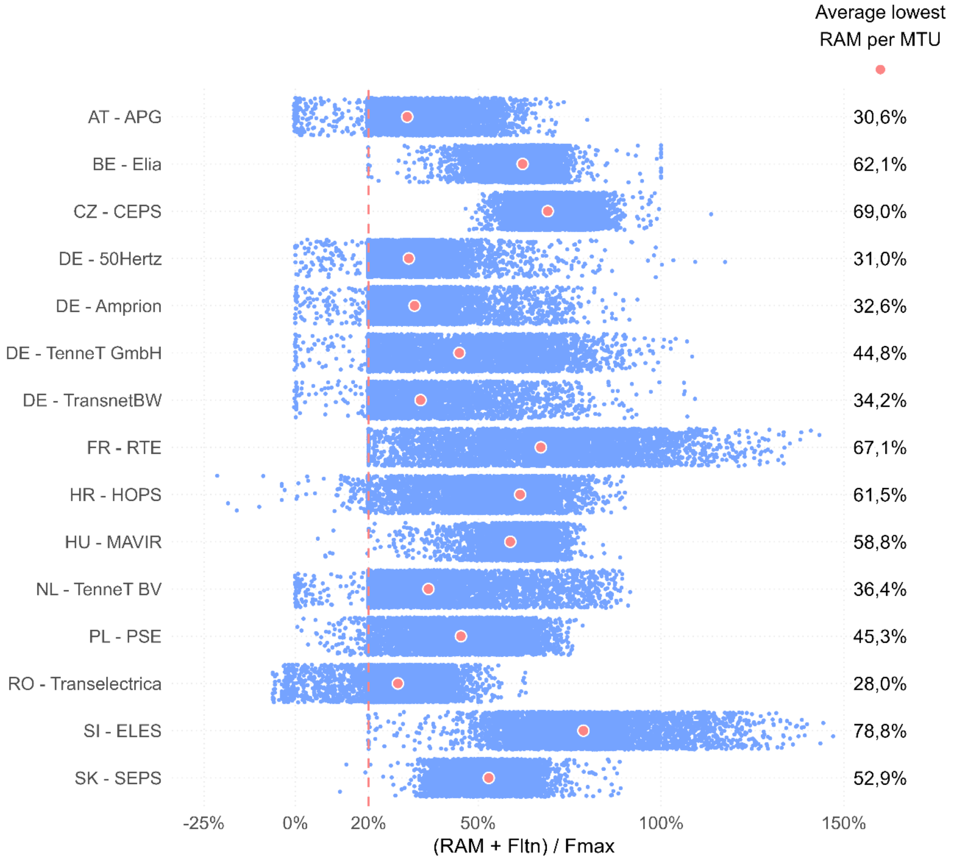
The remaining available margin goes below its minimum threshold, because of individual validation adjustments

100 The RAM, in conjunction with PTDFs, defines the amount of commercial capacity on a CNEC that is given to the market. It is therefore one of the main factors that define the outcome of flow-based market coupling. According to the Core day ahead capacity calculation methodology, a minimum threshold (minRAM) applies for (RAM + F_{LTN}) / F_{max}: this should at least be 20%[37].

101 Figure 29 describes, for each Core TSO, the distribution of MCCC, expressed as a percentage of the thermal capacity of that network element (F_{max}). Observations to the left of the red line show violations of this threshold. These are only allowed under specific circumstances through the application of IVAs[38]. Nevertheless, the figure shows a considerable number of violations of the minRAM threshold.

102 The average RAM (for the day-ahead market, not including the flows from long-term nominations F_{LTN}) is shown in the right column, calculated as the average of the lowest value per hour for each TSO during the considered period (between 9 June 2022 and 31 December 2022).

Figure 29: Distribution of the lowest RAM over Fmax among all CNECs in the Core region, per TSO (between 9 June 2022 and 31 December 2022)



Source: ACER calculation based on JAO data.

Note: In accordance with Article 17 of the Core day-ahead capacity calculation methodology, the 20% minRAM is assessed, per CNEC, on the value (RAM + FLTN) / Fmax.

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[37] F_{LTN} is the expected flow after considering long-term nominations over a certain CNEC; F_{max} is the maximum admissible power flow over a certain CNEC, also referred to as the thermal capacity of the CNEC; (RAM + F_{LTN}) defines MCCC, i.e., the portion of capacity of a CNEC available for cross-zonal trade on bidding zone borders within the considered coordination area.

[38] See section 2.3.1.

Allocation constraints can drastically limit exports and imports for some Core TSOs

103 Allocation constraints reflect operational security limits that cannot be transformed into flow-based parameters on a CNEC[39]. They take the form of import or export limitations. Allocation constraints hence add additional constraints to the cross-zonal capacity given to the market and affect the outcome of flow-based market coupling. Article 7 of the Core day-ahead capacity calculation methodology considers the application of allocation constraints as a temporary measure for the Belgian, Dutch and Polish TSO. Prior to its implementation, allocation constraints have been used by the Belgian and Dutch TSO in CWE.

104 As foreseen in section 6.2.1 of the ACER Recommendation 01/2019, ACER assessed whether the allocation constraints imposed by the TSOs in the flow-based regions (CWE up until 8 June 2022, and Core afterwards) would restrict the flow-based domains should the minimum 70% target be reached on all CNECs. The analysis showed that in 2022, had the minimum 70% target been reached on all CNECs in the Member State in question for all hours:

- The allocation constraints applied by the Belgian TSO would have restricted the flow-based domain 18.78% of the time in the CWE region, and 82.28% in the Core region.
- The allocations constraints applied by the Dutch TSO would have restricted the flow-based domain 21.67% of the time in the CWE region, and 59.49% in the Core region.
- The allocations constraints applied by the Polish TSO[40] would have restricted the flow-based domain 85.51% of the time in the Core region.

105 The performed analysis illustrates that allocation constraints become even more relevant as additional bidding zones are included into the flow-based market coupling. This is to be expected, as the additional trading opportunities made possible by the extra dimensions of the flow-based domains increase the likelihood of the allocation constraints being limiting.

106 Moreover, Figure 30 looks at the application of allocation constraints (per bidding zone and per direction) since the go-live of the Core flow-based market coupling. Red values indicate that the allocation constraint is set, for that hour, to zero (effectively limiting the import or export of that bidding zone to zero). To distinguish between orange and green, the highest net position of 2022 is taken for the bidding zone and direction: orange values indicate that the allocation constraint was set between zero and the highest observed net position (hence "somewhat" limiting the import or export), while the green values indicate that the allocation constraint was above the highest observed net position (hence not limiting the import and export). Grey values indicate that no allocation constraints were applied.

[39] The CACM Regulation defines allocation constraints as '*the constraints to be respected during capacity allocation to maintain the transmission system within operational security limits and have not been translated into cross-zonal capacity or that are needed to increase the efficiency of capacity allocation'*.

[40] In the case of Poland, an allocation constraint applies to the overall net position of the Member State, thus impacting both its AC and DC borders. As described in ACER Recommendation 01/2019, the impact of the constraint has been split between the different Polish borders, by prioritizing capacity in the borders with the highest price differential. Following the go-live of the Core flow-based capacity calculation, the minimum/maximum Core net position of Poland has been used as an indicator of the available Polish transmission capacity on its AC borders.

Figure 30: Application of allocation constraints in selected bidding zones

Source: ACER calculation based on TSO data.

Note: The maximum observed positions (in MW) are: Belgium (4779.5 export; 3273.1 import); Netherlands (6393.8 export; 5141.2 import); Poland (3809 export; 2512.1 import).

107 The figure shows that Polish allocation constraints have considerably limited cross-zonal exchanges with Poland for the majority of hours of the analysed period. In most cases, this limitation completely precludes any electrical export from Poland to its neighbouring countries. This has played a significant role in the European day-ahead electricity market, by effectively decoupling the Polish bidding zone from the rest of the Core hubs for a sizeable share of hours.

108 In the case of Belgium and the Netherlands, the allocation constraints imposed by the relevant TSOs have had a smaller impact in capacity allocation. Only in the case of the export direction of the Netherlands, the allocation of capacities for cross-zonal exchange could have been restricted by the Dutch allocation constraints.

Unilateral reductions of cross-zonal capacities occurred also in the Nordic region

109 In late autumn 2021, significant limitations in the available cross-zonal capacity between Sweden and Norway occurred. In particular, the limitations set by the Swedish TSO on the cross-zonal capacity between SE3 and NO1 due to challenges in the Swedish transmission grid[41] have led to situations where no export from SE3 was allowed. In response to such reduction of export capacity from Sweden to Norway, the Norwegian TSO announced a reduction of export capacity from southern Norway to Sweden.

[41] The Swedish TSO reported phase-out of production on the west coast, more production surplus in northern Sweden and Finland and more export capacity on the Norwegian HVDC interconnectors as the main reasons for a so-called 'east-west flow' that results in a reduction of transmission capacity to and from SE3.

110 A closer, more tailored, cooperation between the two TSOs started to emerge in the last weeks of 2021 with the common goal of restoring sufficiently high value of cross-zonal capacities on the affected borders, while maintaining operational security. The results of this dialogue materialised in the course of March 2022, when the so-called line set for bidding zone borders DK1<>SE3 and NO1<>SE3 entered into operation in the single day-ahead coupling algorithm[42]. This additional constraint allows to optimise the simultaneous available cross-zonal capacity on the two borders directly in the market coupling algorithm, instead of pre-defining a maximum value for each border.

[42] For further details about the line set, please refer to section 2.2.1.7.

3. Unnecessarily constrained capacities may lead to price spikes across the EU

111 Chapter 3 aims to illustrate the impact of constrained cross-zonal capacities in the internal electricity market, by studying the correlation between price spikes across the EU and commercial transmission capacities. It does this by first looking at the welfare and price impact of low cross-zonal capacities in a flow-based context, in the Core region. Then, it continues by analysing the price spike in the Baltic countries on 17 August 2022, as an example of the impact of low capacities in a NTC region. In both cases, a direct impact on socio-economic welfare can be derived.

3.1. Low cross-zonal capacities coincide with welfare limitation and price impacts in the Core region

112 This section aims to provide an overview of the interrelation between cross-zonal capacities offered in the Core capacity calculation region and its resulting market welfare, with the intention of stressing the importance of the fulfilment of the legal national responsibilities with regard to cross-zonal capacities.

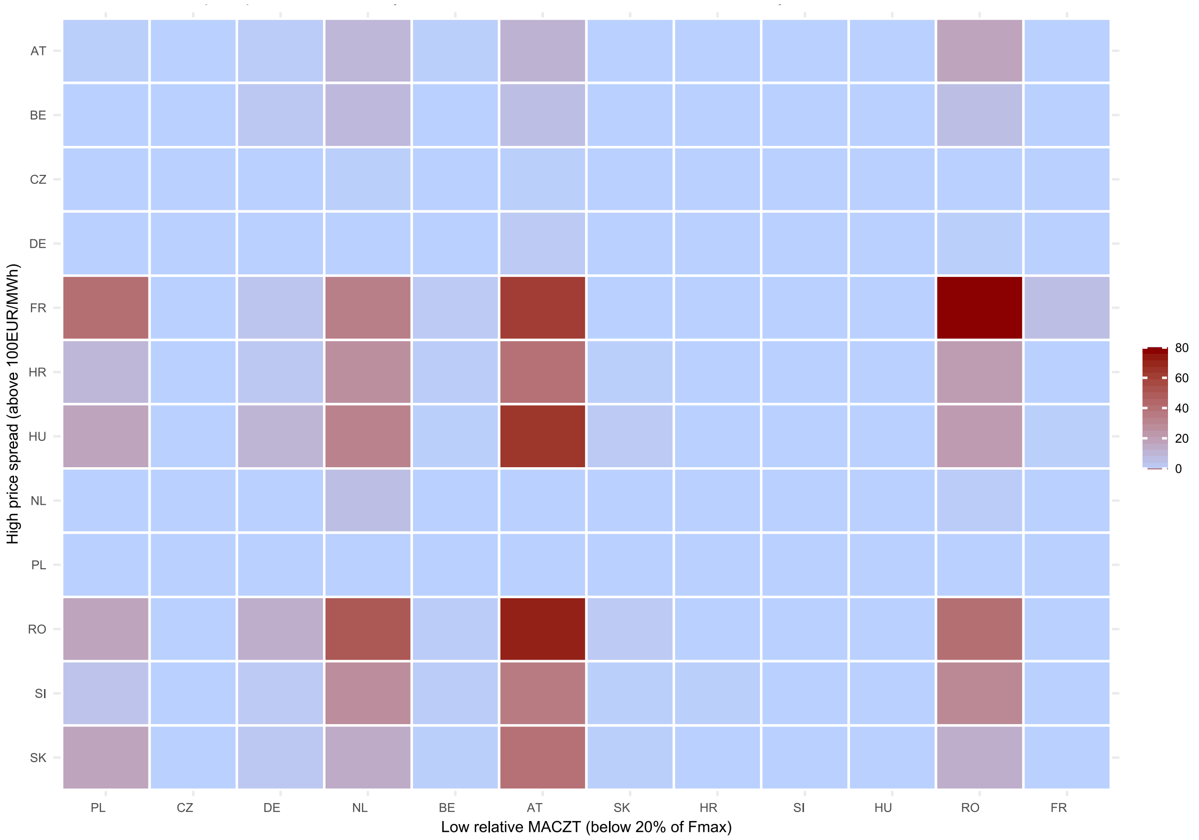
113 Figure 31 represents the density of occurrences where a price spike in a Core bidding zone has coincided with low margins available for cross-zonal trade in any Core hub. Price spikes for a given bidding zone are calculated as at least a 100 EUR/MWh difference between the considered bidding zone's price and the average price of the remaining Core bidding zones. A margin for cross-zonal trade has been considered low whenever the most constrained CNEC for a given hour had a MACZT[43] lower than 20% of F_{max}.

114 In Figure 31 shown below, only positive price divergences have been considered, thus situations where a Member State has significantly lower prices than the rest of Core have been ignored for the purpose of this figure[44].

[43] MACZT is used in Figure 31 instead of RAM as a better indicator of the overall cross-zonal capacities provided to the market.

[44] When observing the same results for absolute price divergences, the impact of the Polish allocations constraints illustrated in previous sections becomes evident, as cases of high negative price divergences correspond almost exclusively to Poland.

Figure 31: Simultaneous occurrences of price spikes and low MACZT values in Core Member States since Core capacity calculation go-live (between 9 June 2022 and 31 December 2022)



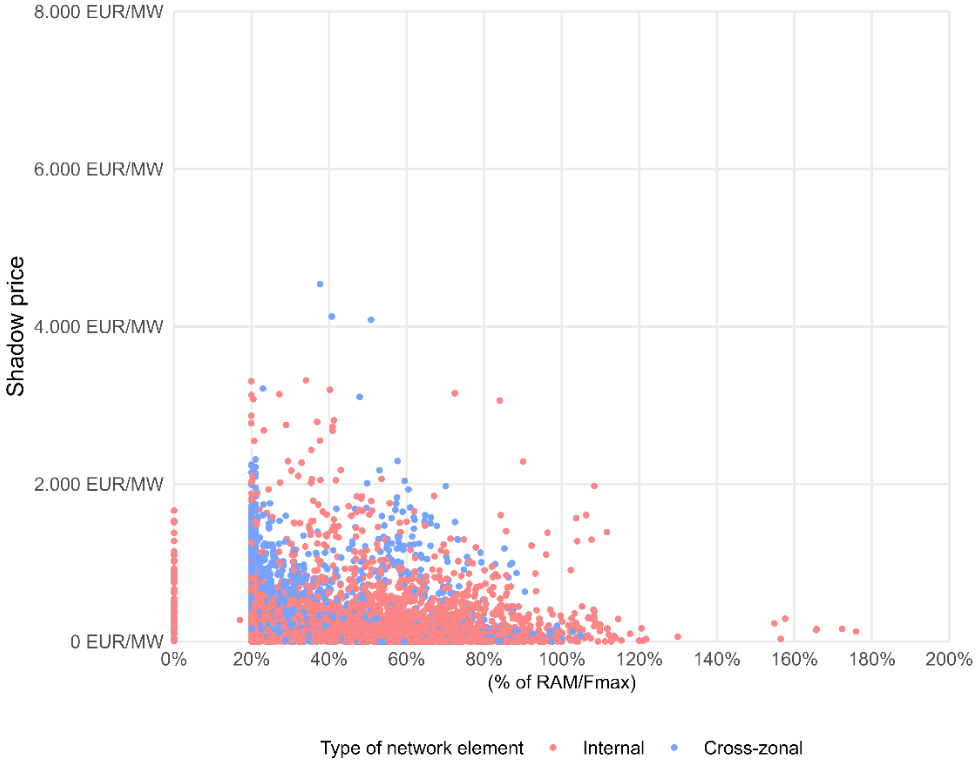
Source: ACER calculation based on TSO data.

115 As shown in Figure 31, a significant number of price spikes in most of the Core Member States have coincided with low MACZT in a relatively limited number of Member States, mainly Poland, the Netherlands, Austria, and Romania. Although this plot does not necessarily demonstrate causality between the two variables, the correlation between the two is evident.

116 When having a deeper look at the data for France, often in need of import from neighboring Member States in 2022 due to a large share of unavailability of its nuclear park, significant price spikes have systematically coincided with low cross-zonal capacities being offered somewhere across the Core capacity calculation region. This was especially evident for multiple hours in the last days of August 2022, where day-ahead prices in France often exceeded 800 EUR/MWh, following very constrained cross-zonal capacities due to extensive IVA application.

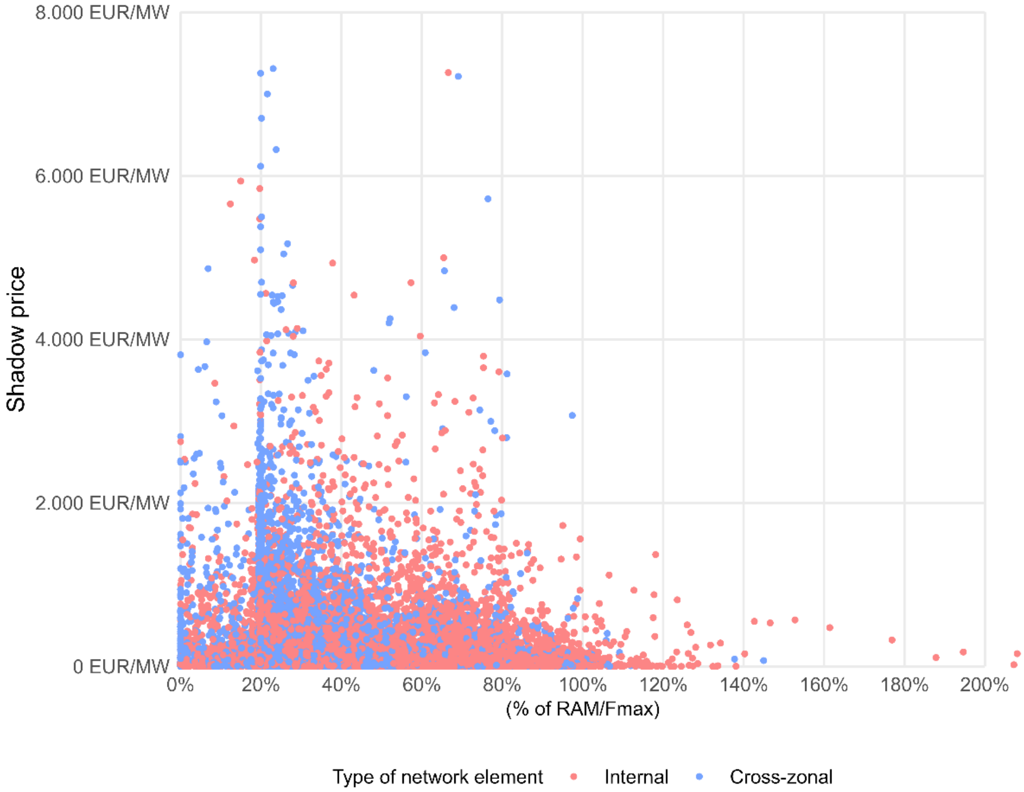
117 Figure 32 and Figure 33 show the link between capacity margins (plotted horizontally, as the ratio between RAM and F_{max}) and the shadow price (plotted vertically), for both CWE (top) and Core (bottom) regions. The figures show that lower margins generally lead to higher shadow prices, suggesting significant reductions in welfare.

Figure 32: Shadow price coinciding with low margins on network elements in the CWE region (between 1 January 2022 and 8 June 2022)



Source: ACER calculation based on TSO data.

Figure 33: Shadow price coinciding with low margins on network elements in the Core region (between 9 June 2022 and 31 December 2022)



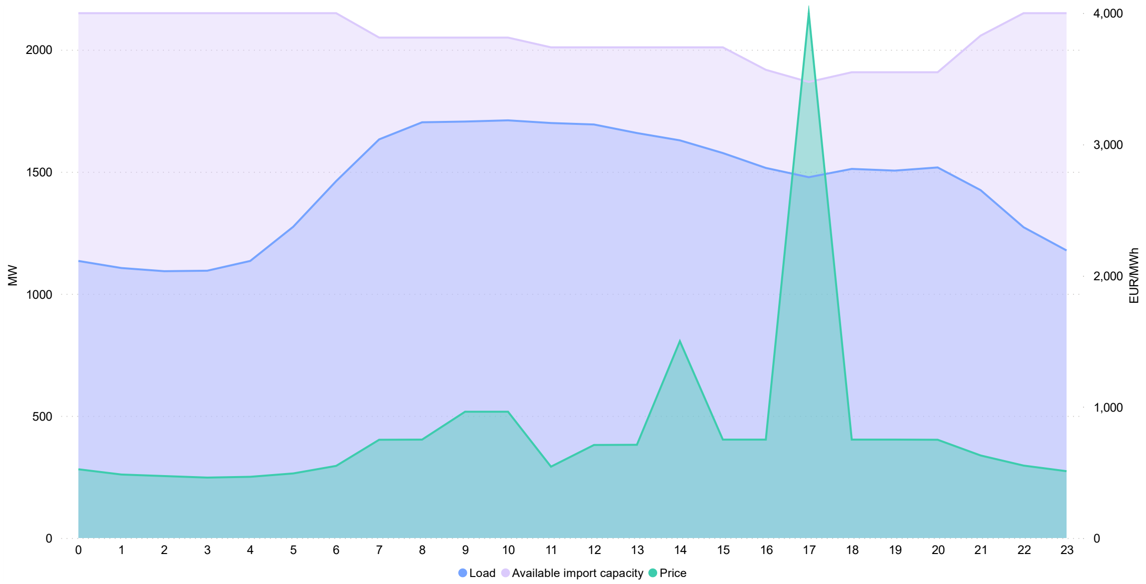
Source: ACER calculation based on JAO data.

3.2. Case study: How cross-zonal capacity levels affect day-ahead prices

118 Maximising cross-zonal transmission capacity is vital for a well-functioning European electricity market, optimising interconnection usage to address price volatility, renewable integration, security of supply, and market flexibility. The need for increased interconnection capacity became more evident during the 2022 crisis. The situation in the Baltic region on 17 August 2022 serves as a notable example.

119 Figure 34 presents load, day-ahead prices, and import capacity in the Baltic region on 17 August 2022. It reveals a peak price from 17:00 to 18:00. Interestingly, the peak price on 17 August 2022 corresponds to the highest import restrictions but not to the peak load, suggesting that the determining factor was the cross-zonal capacity.

Figure 34: Hourly variations in load, import capacity, and day-ahead price in the Baltic region – 17 August 2022 (MW, MW and EUR/MWh, respectively)



Source: ACER calculation based on Nord Pool data.

Note: Day-ahead price and load values refer to the Lithuanian bidding zone.

120 On 16 August 2022, during the day-ahead trading session, maximum prices of 4,000 EUR/MWh were recorded from 17:00 to 18:00 in Estonia, Latvia and Lithuania. Nord Pool activated 50 MW peak load capacity reserves in Lithuania for the entire day, resulting in curtailing 2.14 MW of electricity consumption.

121 On 17 August 2022, several assets experienced planned outages. Import capacities in the Baltic region were notably low, especially during the hour of maximum price. Capacities between Poland and Lithuania decreased from 492 MW to 350 MW after 16:00. Similarly, capacities between Sweden and Lithuania were reduced from 700 MW to 660 MW between 11:00 and 18:00. Import capacities between Finland and Estonia decreased from 958 MW to nearly 800 MW from 8:00 to 19:00.

122 The trading day witnessed a significant anomaly due to unavailability of transmission lines, reducing import opportunities in the Baltic region. Combined with summer maintenance of fossil fuel power plants, this created a challenging situation. Activating the 50 MW peak load plant prevented reaching maximum prices for three hours. Summer maintenance highlights the tight supply situation in the Baltic region, where a minor deviation can lead to scarcity.

4. Conclusions

- **Maximal availability of cross-zonal capacities is a prerequisite to the green transition and the EU's immediate energy objectives, enabling market integration.**

123 This monitoring report assesses the evolution of cross-zonal capacities as well as the elements driving the capacities, with a view of better understanding how maximal cross-zonal capacities can be offered to the market.

124 The vast power transmission investment needs ahead presuppose efficient utilisation of all new and existing infrastructure. Indeed, renewable energy targets such as 300 GW of offshore wind by 2050, will need to be accompanied by means of moving the vast electricity supply to the consumers in the EU. Moreover, as references to situations in France and the Baltics have shown in the current report, security of supply risks are best tackled at the European level, with ample cross-zonal capacity. Finally, with increasing price volatility, for example due to further electrification of heating, all sources of flexibility need to be used. To meet all these challenges, cross-zonal capacities have a key role to play.

- **Maximal availability of cross-zonal capacities increases socio-economic welfare.**

125 The importance of maximal availability of cross-zonal capacities is apparent when considering the impact on socio-economic welfare. Indeed, the report shows that lower margins of cross-zonal capacities generally lead to higher shadow prices, suggesting significant reductions in welfare, and systematically coincide with hours of high price divergences across the EU.

126 Especially in a crisis year, it becomes apparent that the maximisation of cross-zonal capacities needs to be considered for every possible scenario. This includes considering import and export options into and out of bidding zones with changed needs because of changing market fundamentals.

- **All Member States need to reach the minimum 70% target, already today or in 2026 at the latest.**

127 The 70% target, which is currently only applied to the long-term and day-ahead timeframe, offers a clear benchmark that bidding zones need or will need to adhere to. When interpreting the results of its monitoring, it is important to consider the 70% target is applicable to all bidding zones. This means that the impact of one bidding zone on a neighbouring bidding zone, for example via loop flows, also needs to be addressed at its root. This is also made explicit by several TSOs as loop flows from other bidding zones and the absence of a mechanism to make the originators of loop flows internalise their cost are a main justification for their derogations. The 70% target can therefore only be deemed to be successfully met when all bidding zones simultaneously reach it.

- **The report concludes that today the margin of cross-zonal capacity available for trade remains limited. Few Member States reach the 70% or national transitional target.**

128 The monitoring of the MACZT shows that the EU is not reaching the target yet. Given that the target for all bidding zones will be 70% in 2026, that the volumes of exchanges and corresponding flows are only foreseen to increase over the coming years and decades and given the difficulties to develop grid infrastructures, the challenge for reaching the 70% gets harder by the year. The target can be assumed to become increasingly difficult – if possible at all – and costly to reach.

129 In 2022, some Member States reached the 70% or their transitional targets. This does not mean the effort for these Member States comes to an end. The impact of all Member States on their neighbours reaching 70% matters just as much.

130 Derogations to the 70% target or to the national transitional targets, granted in a sizeable share of Member States, preclude the relevant Member States from advancing towards the 70% target. The underlying reasons for these derogations need to be tackled in order to enable the concerned Member States to reach the 70% target by 2026.

- **Lifting both internal and cross-zonal constraints is key to achieving the 70% target. The options to achieve this are limited.**

131 To reach the 70% target in all bidding zones or, more generally speaking, achieve a maximal efficient use of cross-zonal capacity, 'all tools in the toolbox' need to be considered:

  - Expedient grid investment. Reinforcing the grid where congestions occur, helps increase the commercial cross-zonal capacity on the location of the reinforcement; **and**
  - Where it is not sufficient (or cost-efficient) to reach the 70% target, reconfigure the bidding zones that are hampering the achievement of the 70% target for all impacted bidding zones. The triggers for the ongoing bidding zone review therefore persist; **and**
  - Applying costly or non-costly remedial actions, such as redispatching (while avoiding excessive curtailment of generation from renewable energy sources, which should not rise above 5%), countertrading or the use of phase shifters;[45] **and**
  - Flow-based capacity calculation & allocation, including Advanced Hybrid Coupling, applied to large, meshed coordination areas.

- **The report also concludes that some measures make it harder for the EU to reach its 70% target.**

132 Unilateral restrictions, such as allocation constraints or individual validation reductions, constitute barriers to reaching the 70% target. Polish allocation constraints represent a significant obstacle to trade in Core and Hansa regions. These restrictions impact socio-economic welfare and electricity prices, and will therefore need continued justification and corresponding monitoring.

133 Application of validation adjustments in the Core region must not result in TSOs pushing internal congestions to the borders, nor in breaching the 20% minRAM requirement. These capacity adjustments need to be applied in a transparent and limited manner, only when strictly required due to operational security reasons, as they can constitute a significant barrier to cross-zonal trading and market integration.

- **On the monitoring exercise itself, the current monitoring of the 70% in CNTC areas does not allow for a complete assessment for all concerned Member States.**

134 As stated in paragraph 5.1 of the ACER Recommendation 01/2019, as a main principle, for transparency and consistency purposes, MACZT should be monitored on all CNECs used in capacity calculation regardless of whether the capacity calculation applies the flow-based or CNTC approach.

135 For the flow-based approach, this principle implies monitoring all CNECs introduced by TSOs within the capacity calculation process, including for example CNECs identified as redundant at the very end of the process.

136 The same principle should apply for the CNTC approach. Nonetheless, given that currently applicable NTC capacity calculation methodologies either do not calculate MACZT on all CNECs or do not report it to ACER, ACER so far could only estimate MACZT on the CNECs that limited capacity calculation. However, within the current monitoring methodology, in case the Member State where the limiting CNEC is located does not meet the 70% target, further information would

[45] ACER monitors remedial actions in its forthcoming 'Market Integration Report'.

be needed for ACER to determine whether the Member States whose CNECs are not limiting do meet the 70% target.

137 Moreover, for the hours where the limiting CNEC is outside of the EU, no information on the performance of the Member States towards the 70% target can be inferred since this target does not yet apply to any non-EU countries. This is particularly relevant for the Italy North capacity calculation region.

- **Data quality matters when performing monitoring.**

138 ACER benefits from TSOs applying the ACER Recommendation 01/2019 on MACZT calculation. Concretely, transparency will increase when all Core TSOs harmonise the data provision by using the available common tool for MACZT data reporting, which is in line with the above-mentioned Recommendation. Furthermore, ACER stresses that timely delivery of the necessary data is a precondition for effective monitoring.

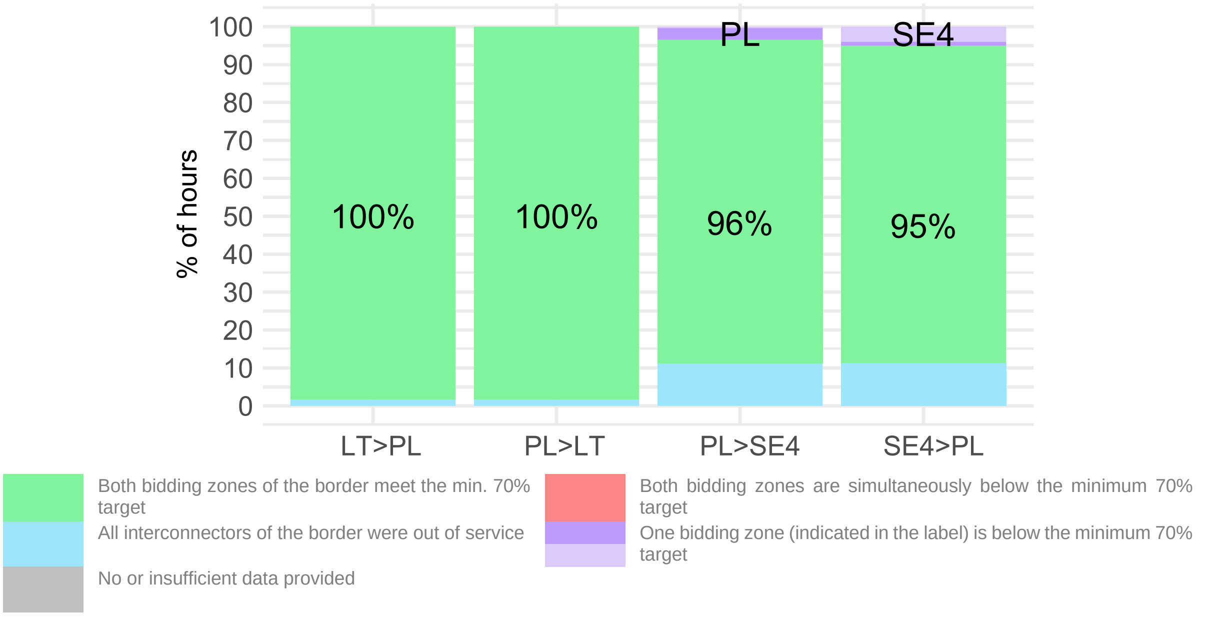
- **In line with ACER's monitoring strategy, the main conclusions of this report may result in a formal recommendation or opinion by the end of the year.**

139 To best frame such process, this report is followed by a public consultation.

5. Annex I: Additional figures and tables

5.1. DC borders

Figure 35: Percentage of hours when the minimum 70% target was reached on Polish DC borders, without considering allocation constraints – 2022



Source: ACER calculation based on TSO data.

Note: Without considering the Polish allocation constraint, the 70% target is met in at least 95% of the hours as shown. Results considering the impact of Polish allocation constraints are shown in Figure 10 and show a lower percentage of hours for which the 70% target was met.

5.2. Complementary assessment on the German national target

140 During the 2022 monitoring exercise, as in previous years, the data provided to ACER by the German TSOs has not been calculated in line with the methodology described in ACER Recommendation 01/2019 on the implementation of the minimum MACZT. In particular, the MACZT calculated by German TSOs does not consider the potential netting possibilities granted by relieving flows from outside the coordination area. ACER has therefore recalculated the MNCC for the German TSOs following the methodological paper on estimating the MACZT, which foresees the use of certain fallback data in case the correct data is not provided by the relevant TSO.

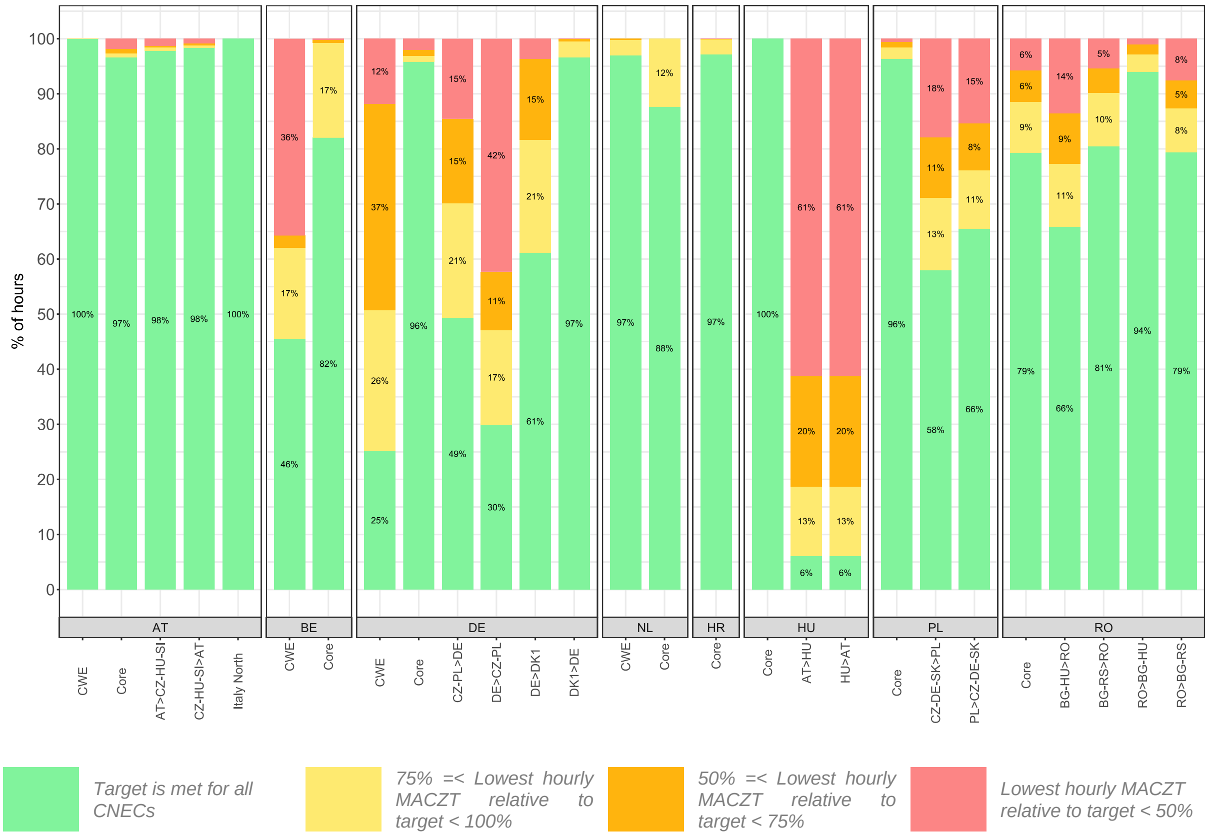
141 Nevertheless, as a portion of the required data is published by the Core TSOs in the JAO Publication Tool, ACER has decided to produce a counterfactual figure on the distance to achieving the national transitional targets using the data from the Publication Tool. This publicly available data has been calculated according to ACER Recommendation 01/2019, although presents certain caveats:

- The data is only available since the implementation of the Core capacity calculation methodology (i.e., only since the 9 June 2022).
- It does not disaggregate the flows from third countries.
- It is not consistent in format nor content with the data request letter sent by ACER to all TSOs.

142 Figure 36 shows the percentage of the time when the transitional target is met on all CNECs, for Member States with a derogation and/or an action plan that stipulates a target per CNEC, when using data from the JAO Publication Tool for Germany. As such, the only difference with Figure 22 is the value corresponding to the Core capacity calculation region in Germany.

Figure 36: Percentage of hours when the transitional target is met on all CNECs, for Member States with a derogation and/or an action plan that stipulates a target per CNEC, when using JAO Publication Tool data for Germany – 2022

Considering third countries



Source: ACER calculation based on TSO and JAO data.

143 When comparing the same figure with the two different data sources, it can be noted that the fallback assumptions required to recalculate MNCC values lead to a certain degree of inaccuracy in the results. As the capacity calculation in the Core region ensures that at least the national target of MACZT is provided to the market unless IVAs are applied, the MACZT calculation based on fallback data will likely lead to an underestimation of the performance of the relevant Member State in fulfilling the transitional target. This highlights the importance of obtaining correct and complete data directly from the TSOs, in order to produce the most accurate assessment possible.

5.3. Overview of data used by ACER

Table 4: Overview of the completeness and quality of the data provided by TSOs for the monitoring of the MACZT on AC borders – 2022

CCAs	Member State	TSO	Overall ACER's assessment of data completeness and quality	Observations
CWE	AT	APG		
	BE	Elia		ACER recalculated MNCC values for about one third of the hours due to a failure in Elia's calculation tool. The MNCC values provided without third countries did not exclude Norway.
	DE	Amprion		The MNCC values provided were not calculated in line with the Recommendation. ACER recalculated them.
		TenneT		
		Transnet		
	FR	RTE		
	LU	CREOS	N.A.	LU is part of the DE/LU bidding zone, but capacity is not offered at LU borders.
	NL	TenneT		ACER recalculated MNCC values without third countries due to an issue in TenneT's calculation tool.
Core	AT	APG		
	BE	Elia		
	CZ	CEPS		
	DE	50Hertz		The MNCC values provided were not calculated in line with the Recommendation. ACER recalculated them.
		Amprion		
		TenneT		
		Transnet		
	FR	RTE		
	HR	HOPS		
	HU	MAVIR		
	LU	CREOS	N.A.	LU is part of the DE/LU bidding zone, but capacity is not offered at LU borders.
	NL	TenneT		ACER recalculated MNCC values without third countries due to an issue in TenneT's calculation tool.
	PL	PSE		
	RO	Transelectrica		
	SI	ELES		
	SK	SEPS		
Italy North	AT	APG		Data was provided jointly for the full year.
	FR	RTE		

CCAs	Member State	TSO	Overall ACER's assessment of data completeness and quality	Observations
	IT	TERNA		
	SI	ELES		
SWE	ES	REE		Data was provided jointly for the full year.
	FR	RTE		
	PT	REN		
AT-CZ, AT-HU, AT-SI	AT	APG		ACER recalculated MNCC values without third countries due to an issue in APG's calculation tool.
Internal borders	IT	TERNA		The TSO did not calculate MNCC. The impact on results is likely limited.
BG-GR	BG	ESO		
BG-RO				
AT-CZ, CZ-DE, CZ-PL, CZ-SK	CZ	CEPS		
DE-CZ and DE-PL	DE	TenneT		The MNCC values provided were not calculated in line with the Recommendation. The MCCC values provided did not take into account the technical profile in line with the Recommendation. ACER recalculated them.
		50Hertz		
DE-DK1		TenneT		The MNCC values provided were not calculated in line with the Recommendation. ACER recalculated them.
DE-DK1	DK	Energinet		
DK2-SE4				
FI-SE1	FI	Fingrid		
BG-GR	GR	IPTO		
HR-HU	HR	HOPS		
HR-SI				
AT-HU	HU	MAVIR		
HR-HU				
HU-RO				
HU-SK				
EE-LV	EE	Elering		No grid model and no CNECs were provided; no monitoring was possible.
LT-LV	LT	Litgrid		No grid model and no CNECs were provided; no monitoring was possible.
EE-LV, LT-LV	LV	AST		No grid model and no CNECs were provided; no monitoring was possible.

CCAs	Member State	TSO	Overall ACER's assessment of data completeness and quality	Observations
CZ-PL, CZ-DE, CZ-SK	PL	PSE		The MCCC and MNCC values provided were not calculated in line with the Recommendation. ACER recalculated them.
BG-RO, HU-RO	RO	Transelectrica		
DK2-SE4	SE	SVK		The list of critical network elements (CNECs) has been anonymised by the TSO and no grid models were shared with ACER. This prevents ACER from performing a certain number of consistency checks. In particular, ACER noticed discrepancies with the neighbouring TSO in the PTDFs, which could not be verified.
FI-SE1				
Internal borders				
AT-SI	SI	ELES		
HR-SI				
CZ-SK, HU-SK, PL-SK	SK	SEPS		

All the data was provided as requested.

Most or all the data was provided. Some non-critical elements were missing or the provision of data was not fully in line with the Recommendation. The impact on the MACZT results was limited and/or fallback data could be used.

Most or all the data was provided. Some essential elements were missing or the provision of data deviated significantly from the Recommendation. The impact on the MACZT results was relevant and/or using fallback data was not always possible.

No or insufficient data provided. Monitoring the MACZT was not possible at all, or only very limited.

The data was provided late by the TSO. It put at risk its inclusion in the report and significantly limited the time available for ACER to perform the necessary quality checks.

Table 5: Overview of the data used by ACER in the report and for the calculation when performed by ACER – 2022

CCAs	MS	TSO	Results			Data used by ACER for calculation					Comments
			MCCC	MNCC without third countries	MNCC with third countries	CNECs	PTDFs	NTC	Forecast sched.	Alloc. const.	
CWE	AT	APG	TSO	TSO	TSO						
	BE	Elia	TSO	ACER/ TSO	ACER/ TSO	TSO	TSO		TSO/ EE-TP	TSO	See Note 1.
	DE	TenneT	TSO	ACER	ACER	TSO	TSO		EE-TP		See Note 2.
		Transnet	TSO	ACER	ACER	TSO	TSO		EE-TP		
		Amprion	TSO	ACER	ACER	TSO	TSO		EE-TP		
	FR	RTE	TSO	TSO	TSO						
	LU	CREOS									
	NL	TenneT	TSO	ACER	TSO	TSO	TSO		TSO/ EE-TP	TSO	See Note 3.
Core	AT	APG	TSO	TSO	TSO						
	BE	Elia	TSO	TSO	TSO					TSO	
	CZ	CEPS	TSO	TSO	TSO						
	DE	50Hertz	TSO	ACER	ACER	TSO	TSO		EE-TP		See Note 2.
		Amprion	TSO	ACER	ACER	TSO	TSO		EE-TP		
		TenneT	TSO	ACER	ACER	TSO	TSO		EE-TP		
		Transnet	TSO	ACER	ACER	TSO	TSO		EE-TP		
	FR	RTE	TSO	TSO	TSO						
	HR	HOPS	TSO	TSO	TSO						
	HU	MAVIR	TSO	TSO	TSO						
	LU	CREOS									
	NL	TenneT	TSO	ACER	TSO	TSO	TSO		TSO/ EE-TP	TSO	See Note 3.
	PL	PSE	TSO	TSO	TSO					TSO	
	RO	Transelect rica	TSO	TSO	TSO						
	SI	ELES	TSO	TSO	TSO						
	SK	SEPS	TSO	TSO	TSO						
Italy North	AT	APG	TSO	TSO	TSO						
	FR	RTE	TSO	TSO	TSO						
	IT	TERNA	TSO	TSO	TSO						

CCAs	MS	TSO	Results			Data used by ACER for calculation					Comments
			MCCC	MNCC without third countries	MNCC with third countries	CNECs	PTDFs	NTC	Forecast sched.	Alloc. const.	
	SI	ELES	TSO	TSO	TSO						
SWE	ES	REE	TSO								
	FR	RTE	TSO								
	PT	REN	TSO								
AT-CZ, AT-HU, AT-SI	AT	APG	TSO	ACER	TSO	TSO	TSO		TSO/ EE-TP		
Internal	IT	TERNA	TSO								
BG-GR	BG	ESO	ACER	ACER	ACER	TSO	ACER	TSO/ EE-TP	EE-TP		
BG-RO			ACER	ACER	ACER	TSO	ACER	EE-TP	EE-TP		
AT-CZ, CZ-DE, CZ-PL, CZ-SK	CZ	CEPS	TSO	TSO	TSO						
DE-CZ and DE-PL	DE	TenneT	ACER	ACER	ACER	TSO	TSO	TSO	EE-TP	TSO	See Note 2 and Note 4.
		50Hz	ACER	ACER	ACER	TSO	TSO	TSO	EE-TP	TSO	
DE-DK1		TenneT	TSO	ACER	ACER	TSO	TSO		EE-TP		See Note 2.
DE-DK1	DK	Energinet	ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		
DK2-SE4			ACER			TSO	TSO	TSO			
FI-SE1	FI	Fingrid	TSO								
BG-GR	GR	IPTO	ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		
HR-HU	HR	HOPS	ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		
HR-SI			ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		
	LU	CREOS									
AT-HU	HU	MAVIR	ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		
HR-HU			ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		

CCAs	MS	TSO	Results			Data used by ACER for calculation					Comments
			MCCC	MNCC without third countries	MNCC with third countries	CNECs	PTDFs	NTC	Forecast sched.	Alloc. const.	
HU-RO			ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		
HU-SK			ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		
EE-LV	EE	Elering									
LT-LV	LT	Litgrid									
EE-LV, LT-LV	LV	AST									
CZ-PL, CZ-DE, CZ-SK	PL	PSE	ACER	ACER	ACER	TSO	TSO	TSO	TSO	TSO	See Note 4 and Note 5.
BG-RO, HU-RO	RO	Transelectrica	ACER	ACER	ACER	TSO	ACER	TSO/ EE-TP	EE-TP		
DK2-SE4	SE	SVK	ACER	ACER	ACER	TSO	TSO	TSO	EE-TP		
FI-SE1			ACER	ACER	ACER	TSO	TSO	TSO	EE-TP		
Internal			ACER	ACER	ACER	TSO	TSO	TSO	EE-TP		
AT-SI	SI	ELES	ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		
HR-SI			ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		
CZ-SK, HU-SK, PL-SK	SK	SEPS	ACER	ACER	ACER	TSO	ACER	TSO	EE-TP		

ACER	*ACER calculation*	TSO/ EE-TP	*Data provided by the TSO or retrieved from ENTSO-E Transparency Platform*
TSO	*Data provided by the TSO*		*Data not provided and/or calculations not possible*
EE-TP	*Data from the ENTSO-E Transparency Platform*		*Data not applicable or not used for the calculations*

Source: ACER elaboration.

Notes referred to in the table:

Note 1: ACER recalculated MNCC values for about one third of the hours due to a failure in Elia's calculation tool.

Note 2: ACER estimated the MNCC values because the MNCC estimations provided by TSOs considered full simultaneous NTC on the borders beyond the coordination area, which is not in line with the Recommendation.

Note 3: ACER recalculated MNCC values without third countries due to an issue in TenneT's calculation tool.

Note 4: ACER estimated the MCCC values because the estimations provided by the TSO did not consider the technical profile in line with the Recommendation and/or the allocation constraints that further limit cross-zonal capacity.

Note 5: ACER estimated the MNCC values because the estimations provided by the TSO did not consider the case when MNCC is negative.

Table 6: List of coordination areas – 2022

Bidding zone border	Side(s)	Coordination area	Calculation type	Applicability period
AL-GR	GR	North GR borders (GR side)	UNILATc	
AT-CZ	AT	AT-CZ_HU_SI (AT side)	UNILATc	Until 8 June 2022
AT-CZ	CZ	CZ borders	UNILATc	Until 8 June 2022
AT-CZ	Both	Core	FB	From 9 June 2022
AT-DE	Both	CWE	FB	Until 8 June 2022
AT-DE	Both	Core	FB	From 9 June 2022
AT-HU	AT	AT-CZ_HU_SI (AT side)	UNILATc	Until 8 June 2022
AT-HU	HU	AT-HU (HU side)	UNILAT	Until 8 June 2022
AT-HU	Both	Core	FB	From 9 June 2022
AT-IT1	Both	Italy North	CNTC	
AT-SI	AT	AT-CZ_HU_SI (AT side)	UNILATc	Until 8 June 2022
AT-SI	SI	AT-SI (SI side)	UNILAT	Until 8 June 2022
AT-SI	Both	Core	FB	From 9 June 2022
BE-DE	Both	CWE	FB	Until 8 June 2022
BE-DE	Both	Core	FB	From 9 June 2022
BE-FR	Both	CWE	FB	Until 8 June 2022
BE-FR	Both	Core	FB	From 9 June 2022
BE-GB	BE	BE-GB (BE side)	UNILAT	
BE-GB	GB	GB-BE_FR_NL (GB side)	UNILATc	
BE-NL	Both	CWE	FB	Until 8 June 2022
BE-NL	Both	Core	FB	From 9 June 2022
BG-GR	BG	BG-GR_MK_TR (BG side)	UNILATc	
BG-GR	GR	North GR borders (GR side)	UNILATc	
BG-MK	BG	BG-GR_MK_TR (BG side)	UNILATc	
BG-RO	BG	BG-RO_RS (BG side)	UNILATc	Until 8 June 2022
BG-RO	RO	RO borders	UNILATc	Until 8 June 2022
BG-RO	Both	BG-RO_RS	CNTC	From 9 June 2022
BG-RS	BG	BG-RO_RS (BG side)	UNILATc	Until 8 June 2022
BG-RS	BG	BG-RO_RS	UNILATc	From 9 June 2022
BG-TR	BG	BG-GR_MK_TR (BG side)	UNILATc	
CH-IT1	Both	Italy North	CNTC	
CZ-DE	CZ	CZ borders	UNILATc	Until 8 June 2022
CZ-DE	DE	DE-CZ_PL	UNILATc	Until 8 June 2022

Bidding zone border	Side(s)	Coordination area	Calculation type	Applicability period
CZ-DE	Both	Core	FB	From 9 June 2022
CZ-PL	CZ	CZ borders	UNILATc	Until 8 June 2022
CZ-PL	PL	PL-CZ_DE_SK	UNILATc	Until 8 June 2022
CZ-PL	Both	Core	FB	From 9 June 2022
CZ-SK	CZ	CZ borders	UNILATc	Until 8 June 2022
CZ-SK	SK	SK-CZ_HU_PL	UNILATc	Until 8 June 2022
CZ-SK	Both	Core	FB	From 9 June 2022
DE-DK1	DE	DE-DK1_NO2 (DE side)	UNILATc	
DE-DK1	DK	Hansa	UNILATc	
DE-DK2	DE	DE-DK2 (DE side)	UNILAT	
DE-DK2	DK	Hansa	UNILATc	
DE-FR	Both	CWE	FB	Until 8 June 2022
DE-FR	Both	Core	FB	From 9 June 2022
DE-NL	Both	CWE	FB	Until 8 June 2022
DE-NL	Both	Core	FB	From 9 June 2022
DE-NO2	DE	DE-DK1_NO2 (DE side)	UNILATc	
DE-PL	DE	DE-CZ_PL	UNILATc	Until 8 June 2022
DE-PL	PL	PL-CZ_DE_SK	UNILATc	Until 8 June 2022
DE-PL	Both	Core	FB	From 9 June 2022
DE-SE4	DE	DE-SE4 (DE side)	UNILAT	
DE-SE4	SE	DE-SE4 (SE side)	UNILAT	
DK1-DK2	Both	Nordic	UNILATc	
DK1-NL	DK	Hansa	UNILATc	
DK1-NL	NL	DK1-NL (NL side)	UNILAT	
DK1-NO2	DK	Nordic	UNILATc	
DK1-SE3	SE	DK1-SE3 (SE side)	UNILAT	
DK1-SE3	DK	Nordic	UNILATc	
DK2-SE4	SE	DK2-SE4 (SE side)	UNILAT	
DK2-SE4	DK	Nordic	UNILATc	
EE-FI	EE	EE-FI (EE side)	UNILAT	
EE-FI	FI	EE-FI (FI side)	UNILAT	
EE-LV	Both	EE-LV	CNTC	
ES-FR	Both	SWE	CNTC	
ES-PT	Both	SWE	CNTC	

Bidding zone border	Side(s)	Coordination area	Calculation type	Applicability period
FI-SE1	FI	FI-SE1 (FI side)	UNILAT	
FI-SE1	SE	FI-SE1 (SE side)	UNILAT	
FI-SE3	FI	FI-SE3 (FI side)	UNILAT	
FI-SE3	SE	FI-SE3 (SE side)	UNILAT	
FR-GB	FR	FR-GB (FR side)	UNILAT	
FR-GB	GB	GB-FR_NL_BE (GB side)	UNILATc	
FR-IT1	Both	Italy North	CNTC	
GB-NL	GB	GB-FR_NL_BE (GB side)	UNILATc	
GB-NL	NL	GB-NL (NL side)	UNILAT	
GR-IT4	GR	GRIT	UNILAT	
GR-IT4	IT	GRIT	UNILAT	
GR-MK	GR	North GR borders (GR side)	UNILATc	
GR-TR	GR	North GR borders (GR side)	UNILATc	
HR-HU	HR	HR-HU (HR side)	UNILAT	Until 8 June 2022
HR-HU	HU	HR-HU (HU side)	UNILAT	Until 8 June 2022
HR-HU	Both	Core	FB	From 9 June 2022
HR-SI	HR	HR-SI (HR side)	UNILAT	Until 8 June 2022
HR-SI	SI	HR-SI (SI side)	UNILAT	Until 8 June 2022
HR-SI	Both	Core	FB	From 9 June 2022
HU-RO	HU	HU-RO (HU side)	UNILAT	Until 8 June 2022
HU-RO	RO	RO borders	UNILATc	Until 8 June 2022
HU-RO	Both	Core	FB	From 9 June 2022
HU-SK	HU	HU-SK (HU side)	UNILAT	Until 8 June 2022
HU-SK	SK	HU-SK (SK side)	UNILATc	Until 8 June 2022
HU-SK	Both	Core	FB	From 9 June 2022
IT1-IT2	Both	GRIT	CNTC	
IT1-SI	Both	Italy North	CNTC	
IT2-IT3	Both	GRIT	CNTC	
IT3-IT4	Both	GRIT	CNTC	
IT2-IT5	Both	GRIT	CNTC	
IT3-IT5	Both	GRIT	CNTC	
IT4-IT7	Both	GRIT	CNTC	
IT6-IT7	Both	GRIT	CNTC	
LT-LV	Both	LT-LV	CNTC	

Bidding zone border	Side(s)	Coordination area	Calculation type	Applicability period
LT-PL	LT	LT-PL (LT side)	UNILAT	
LT-PL	PL	LT-PL (PL side)	UNILAT	
LT-SE4	LT	LT-SE4 (LT side)	UNILAT	
LT-SE4	SE	LT-SE4 (SE side)	UNILAT	
NO1-SE3	SE	NO1-SE3 (SE side)	UNILAT	
NO3-SE2	SE	NO3-SE2 (SE side)	UNILAT	
NO4-SE1	SE	NO4-SE1 (SE side)	UNILAT	
NO4-SE2	SE	NO4-SE2 (SE side)	UNILAT	
PL-SE4	PL	PL-SE4 (PL side)	UNILAT	
PL-SE4	SE	PL-SE4 (SE side)	UNILAT	
PL-SK	PL	PL-CZ_DE_SK	UNILATc	Until 8 June 2022
PL-SK	SK	SK-CZ_HU_PL	UNILATc	Until 8 June 2022
PL-SK	Both	Core	FB	From 9 June 2022
RO-RS	RO	BG-RO_RS	CNTC	
SE1-SE2	Both	SE1-SE2	CNTC	
SE2-SE3	Both	SE2-SE3	CNTC	
SE3-SE4	Both	SE3-SE4	CNTC	

Note 1: A coordination area describes a set of bidding zone borders within which capacity calculation is fully coordinated. Until capacity calculation methodologies pursuant to the CACM Regulation are implemented, such coordination areas will normally remain smaller than capacity calculation regions defined across the EU.

Note 2: Coordination level of day-ahead capacity calculation is defined as follows:

- *FB: flow-based capacity calculation.*
- *CNTC: fully coordinated NTC calculation.*
- *UNILATc: coordinated unilateral NTC capacity calculation on several half bidding zone borders.*
- *UNILAT: unilateral NTC capacity calculation, i.e., not coordinated on either side of a border (half bidding zone border coordination).*

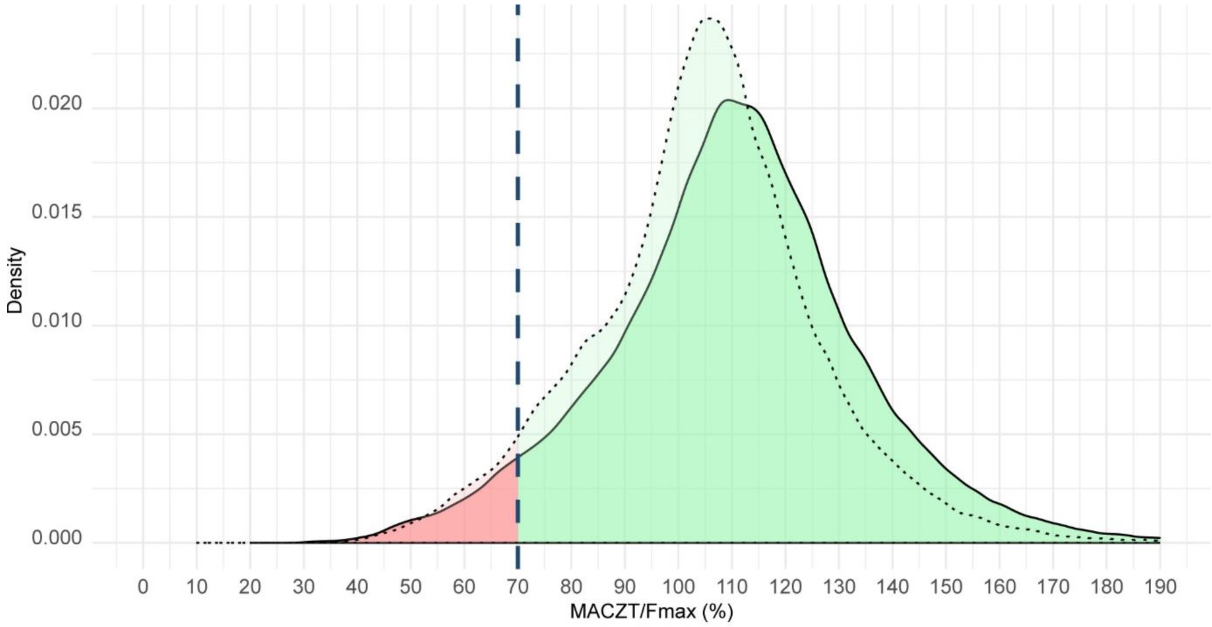
Note 3: Cyprus is not interconnected. Luxembourg is part of the German bidding zone with no capacity offered to the market coupling on the interconnector between Belgium and Luxembourg. Therefore, no bidding zone borders were reported for these two Member States.

5.4. Density functions of the MACZT for all CNECs, per Member State

144 The following figures show the distribution functions of MACZT in all reported CNECs, per Member State, for those Member States that apply flow-based methodology (CWE up to 8 June 2022, and then Core).

145 The presented figures confirm the claim that, even if some Member States show a better performance in terms of MACZT after the implementation of the Core capacity calculation methodology, these improvements are not general nor uniformly distributed across all Member States.

Figure 37: Density function of the relative MACZT for all CNECs in Austria for the CWE capacity calculation region (between 1 January 2022 and 8 June 2022)



CNECs below 70% without third countries

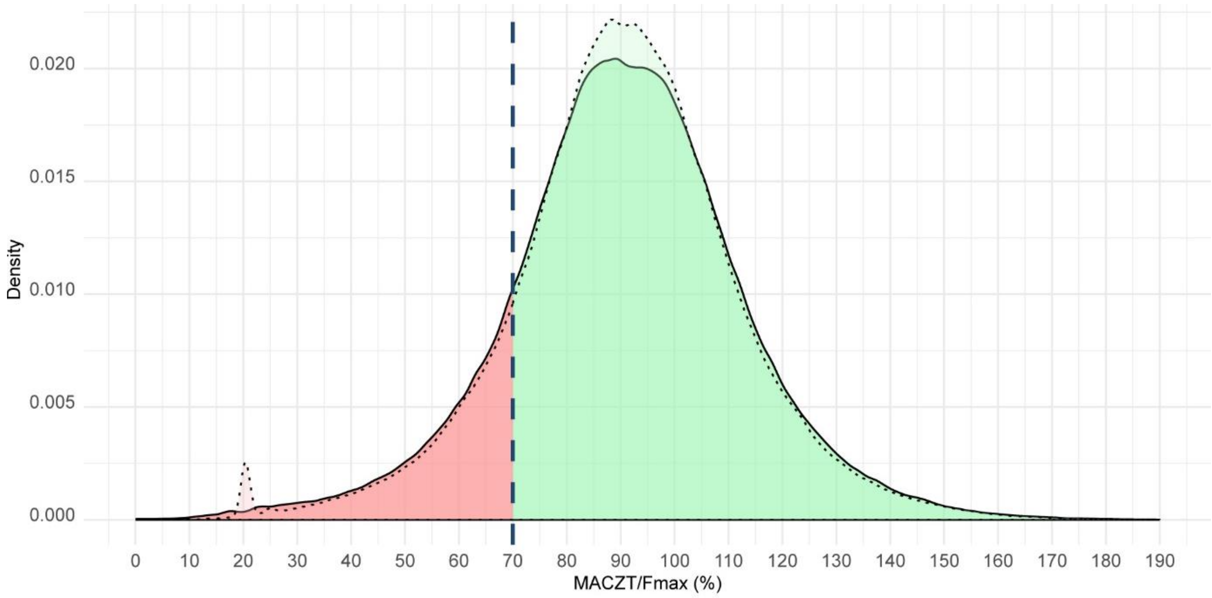
CNECs below 70% with third countries

CNECs above 70% without third countries

CNECs above 70% with third countries

Source: ACER calculation based on TSO data.

Figure 38: Density function of the relative MACZT for all CNECs in Austria for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



CNECs below 70% without third countries

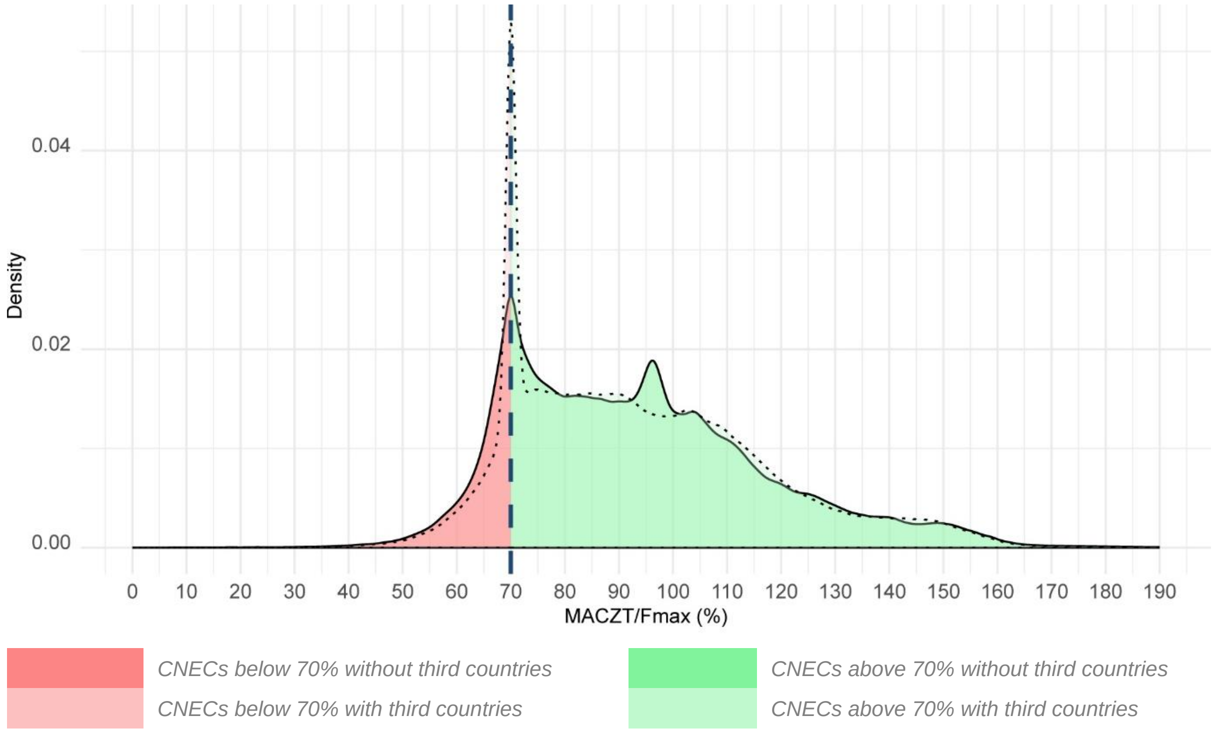
CNECs below 70% with third countries

CNECs above 70% without third countries

CNECs above 70% with third countries

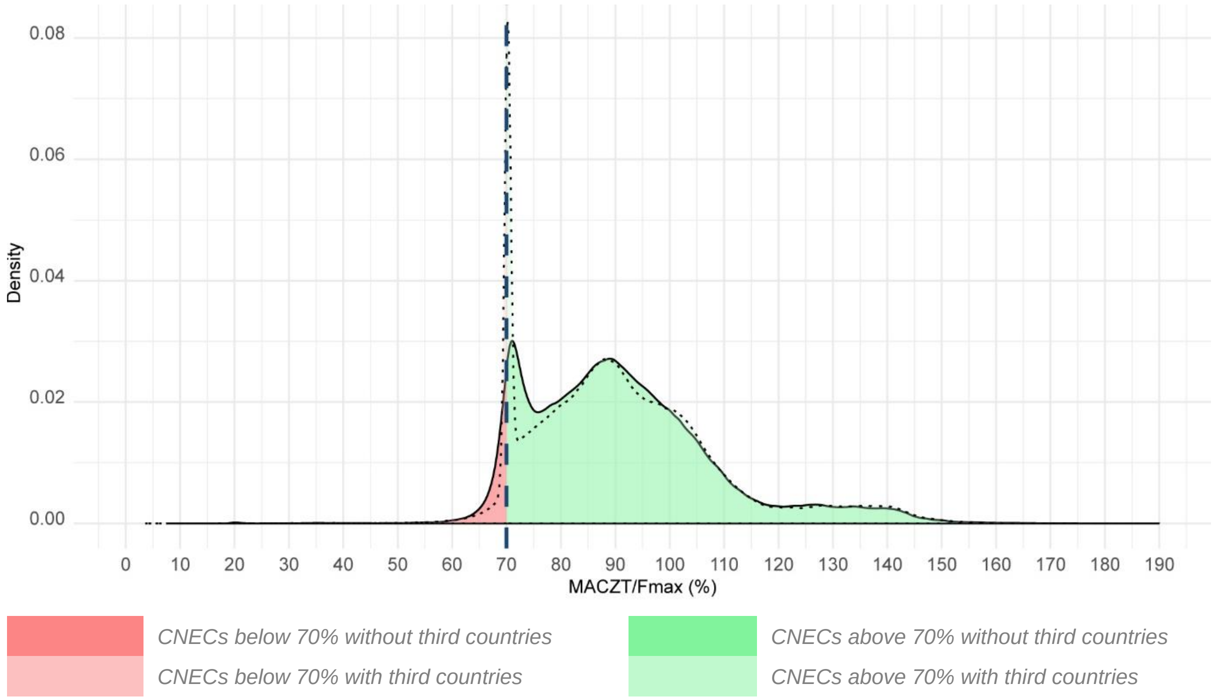
Source: ACER calculation based on TSO data.

Figure 39: Density function of the relative MACZT for all CNECs in Belgium for the CWE capacity calculation region (between 1 January 2022 and 8 June 2022)



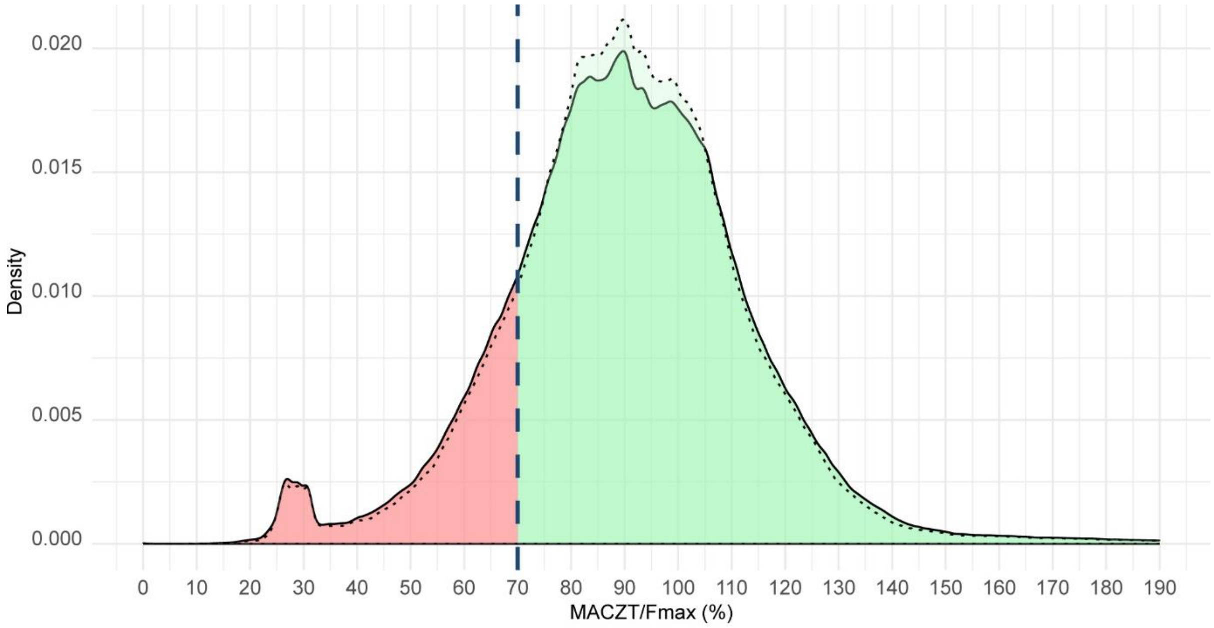
Source: ACER calculation based on TSO data.

Figure 40: Density function of the relative MACZT for all CNECs in Belgium for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



Source: ACER calculation based on TSO data.

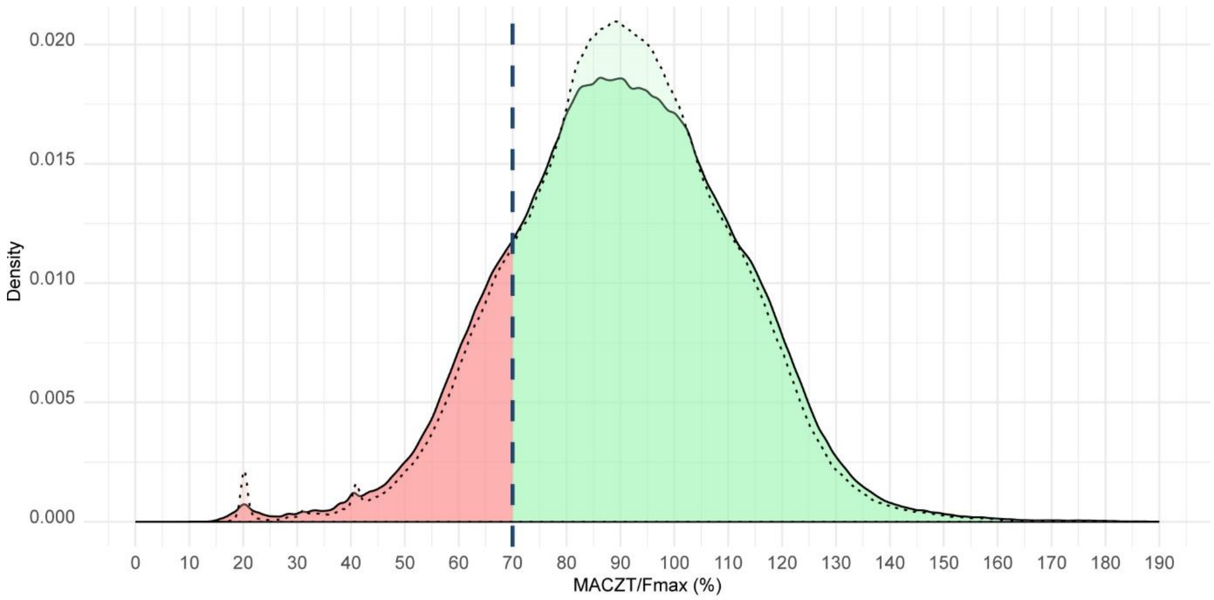
Figure 41: Density function of the relative MACZT for all CNECs in Germany (Amprion) for the CWE capacity calculation region (between 1 January 2022 and 8 June 2022)



CNECs below 70% without third countries
CNECs below 70% with third countries
CNECs above 70% without third countries
CNECs above 70% with third countries

Source: ACER calculation based on TSO data.

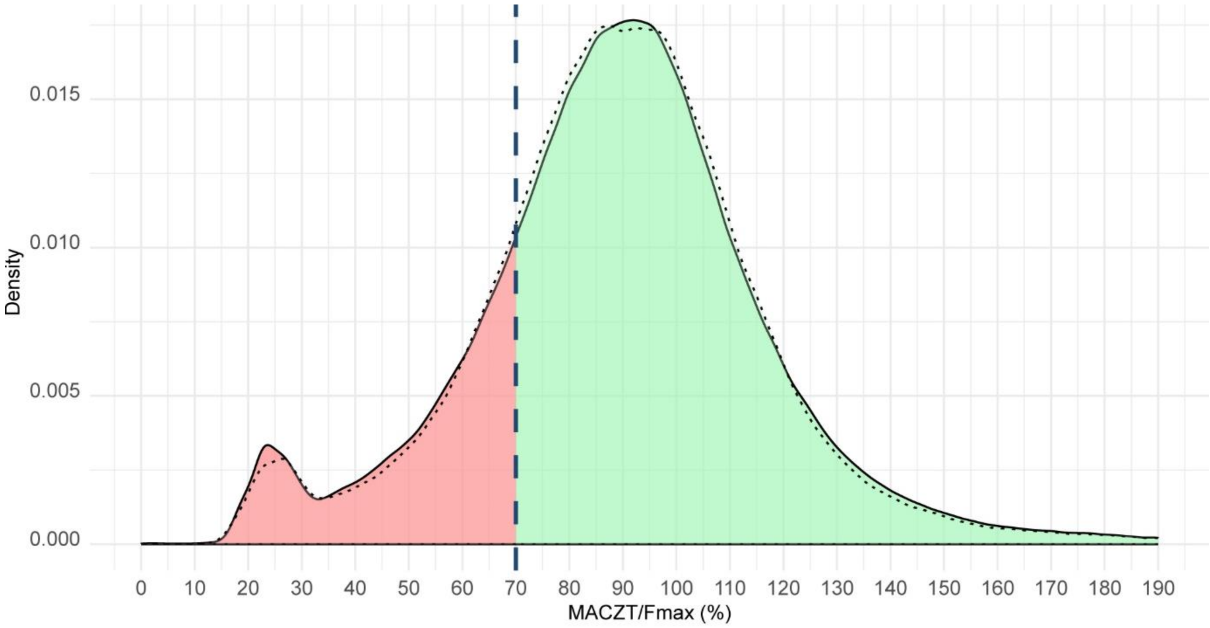
Figure 42: Density function of the relative MACZT for all CNECs in Germany (Amprion) for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



CNECs below 70% without third countries
CNECs below 70% with third countries
CNECs above 70% without third countries
CNECs above 70% with third countries

Source: ACER calculation based on TSO data.

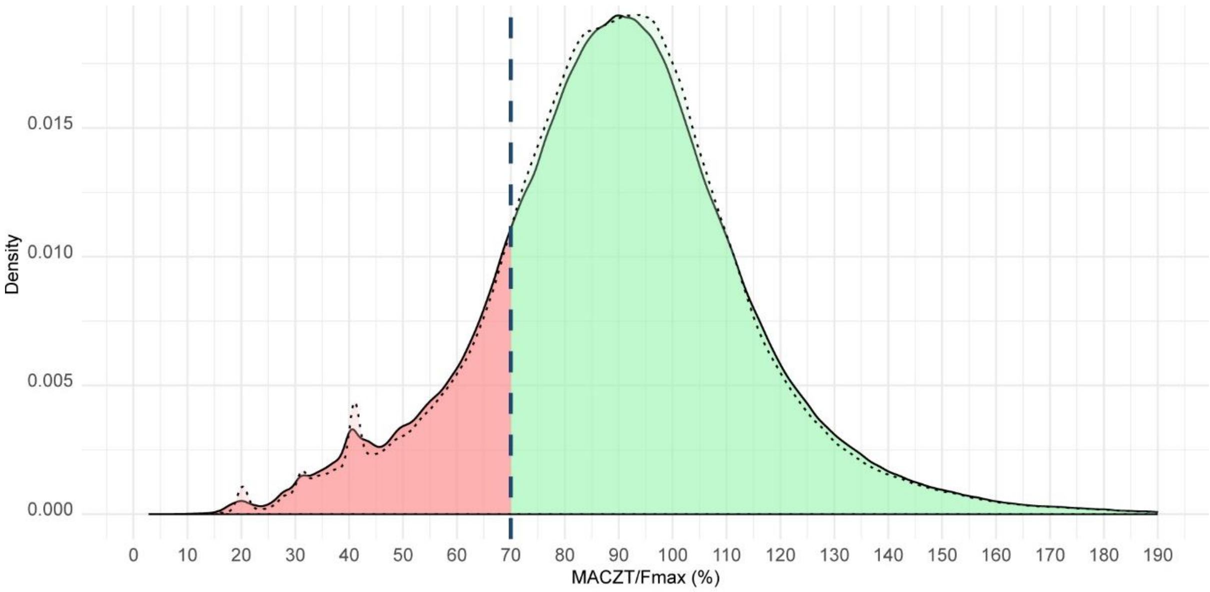
Figure 43: Density function of the relative MACZT for all CNECs in Germany (TenneT DE) for the CWE capacity calculation region (between 1 January 2022 and 8 June 2022)



CNECs below 70% without third countries
CNECs below 70% with third countries
CNECs above 70% without third countries
CNECs above 70% with third countries

Source: ACER calculation based on TSO data.

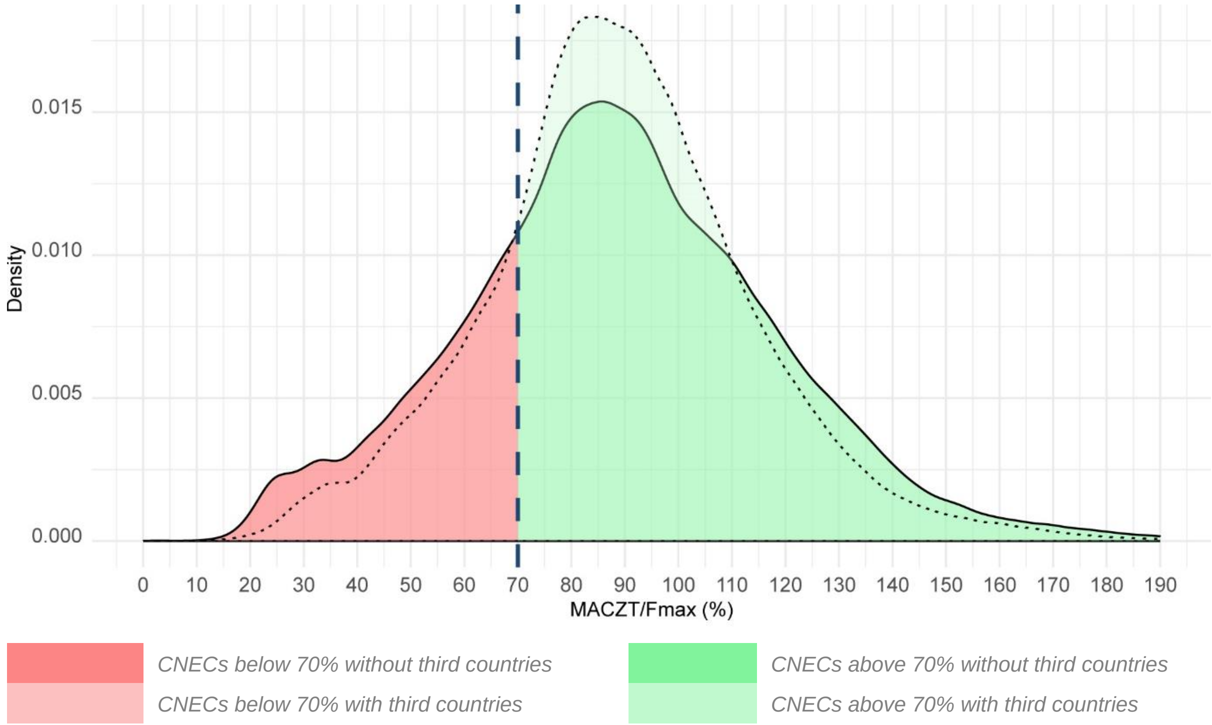
Figure 44: Density function of the relative MACZT for all CNECs in Germany (TenneT DE) for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



CNECs below 70% without third countries
CNECs below 70% with third countries
CNECs above 70% without third countries
CNECs above 70% with third countries

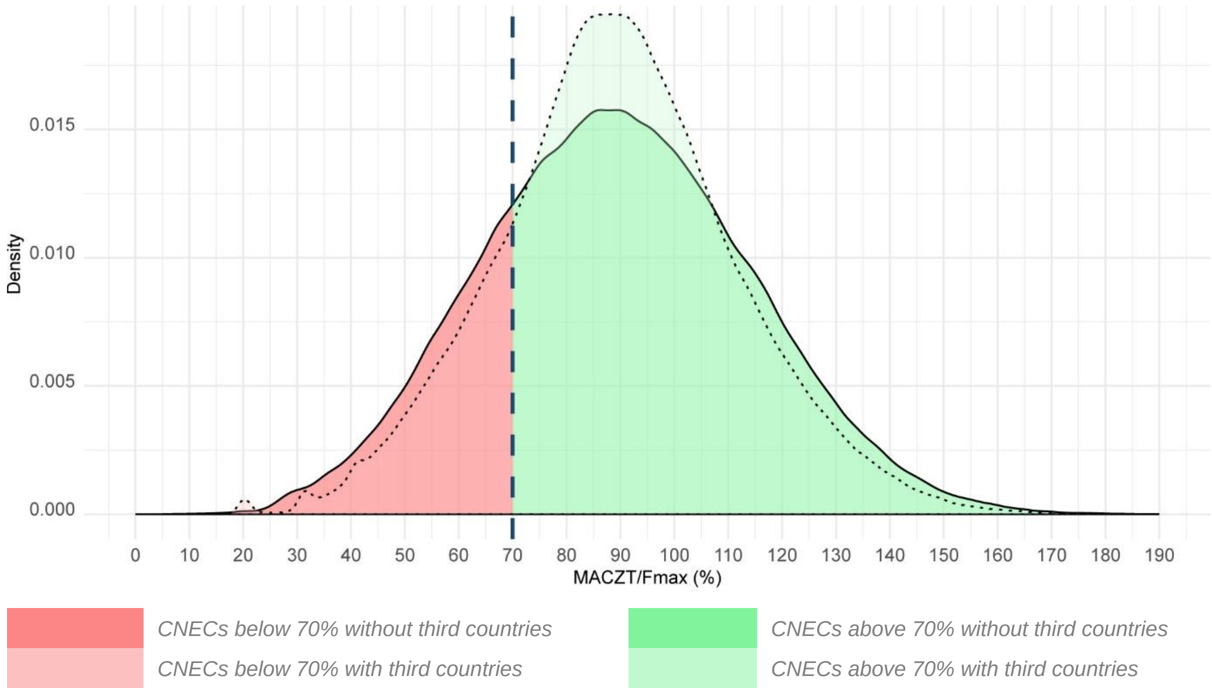
Source: ACER calculation based on TSO data.

Figure 45: Density function of the relative MACZT for all CNECs in Germany (TransnetBW) for the CWE capacity calculation region (between 1 January 2022 and 8 June 2022)



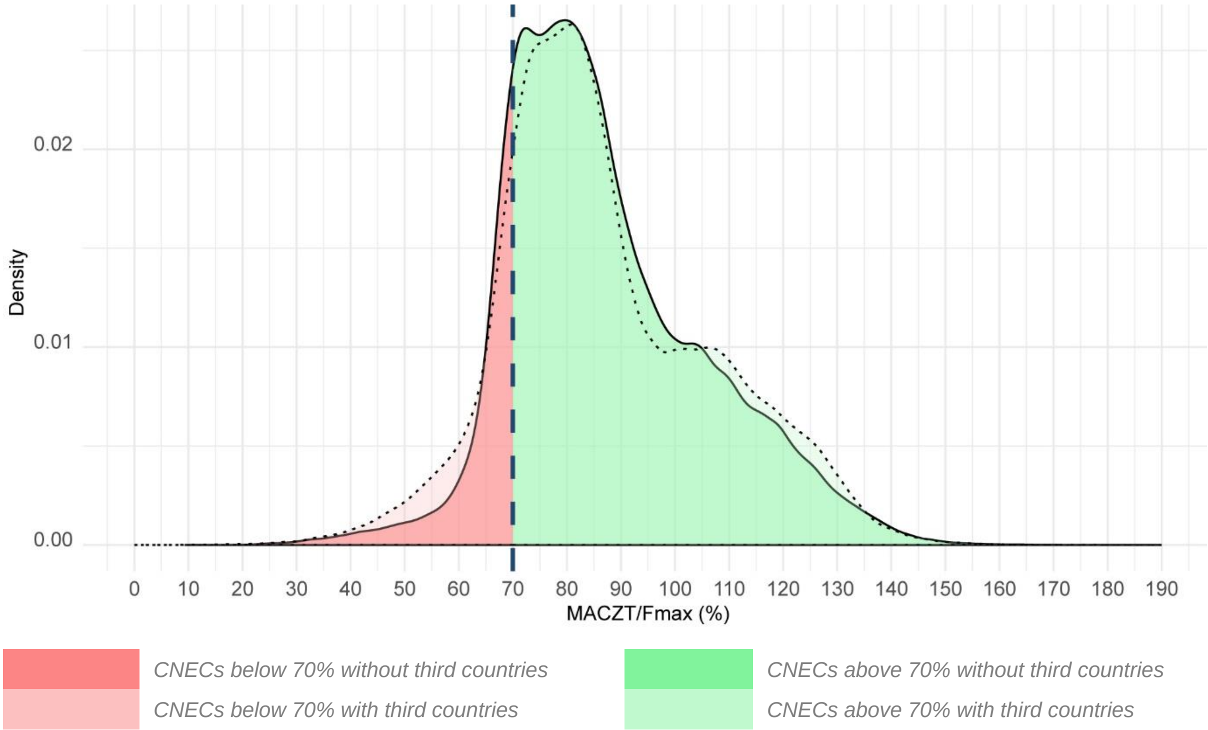
Source: ACER calculation based on TSO data.

Figure 46: Density function of the relative MACZT for all CNECs in Germany (TransnetBW) for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



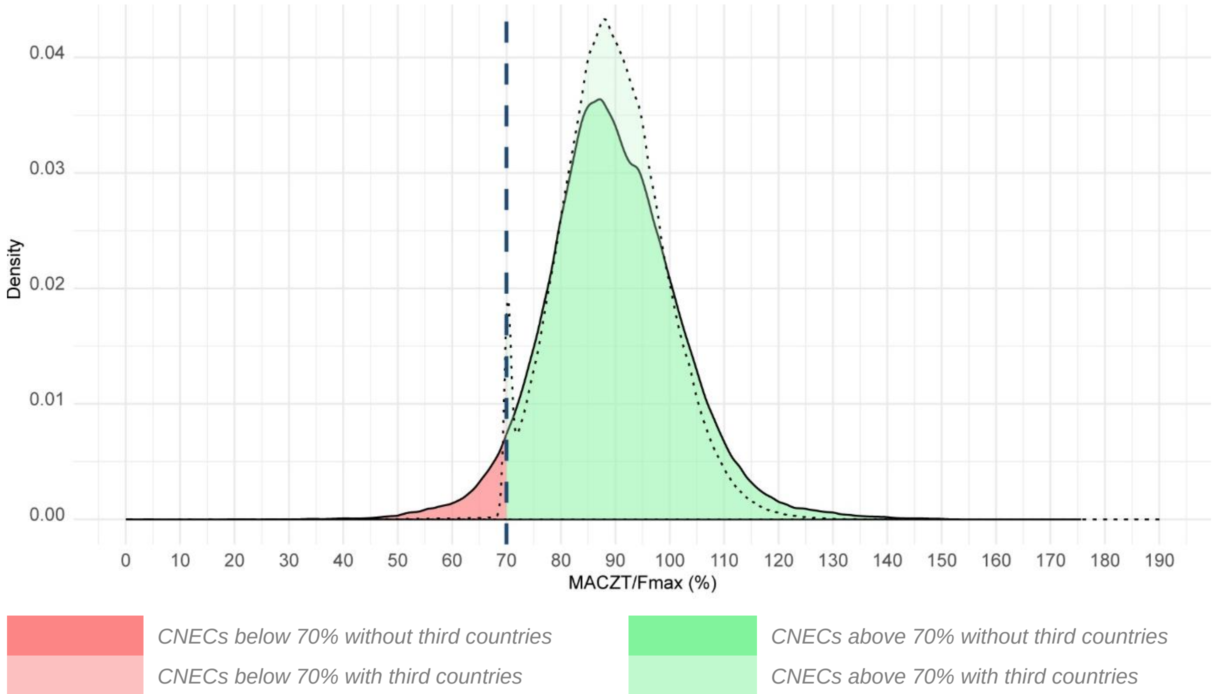
Source: ACER calculation based on TSO data.

Figure 47: Density function of the relative MACZT for all CNECs in France for the CWE capacity calculation region (between 1 January 2022 and 8 June 2022)



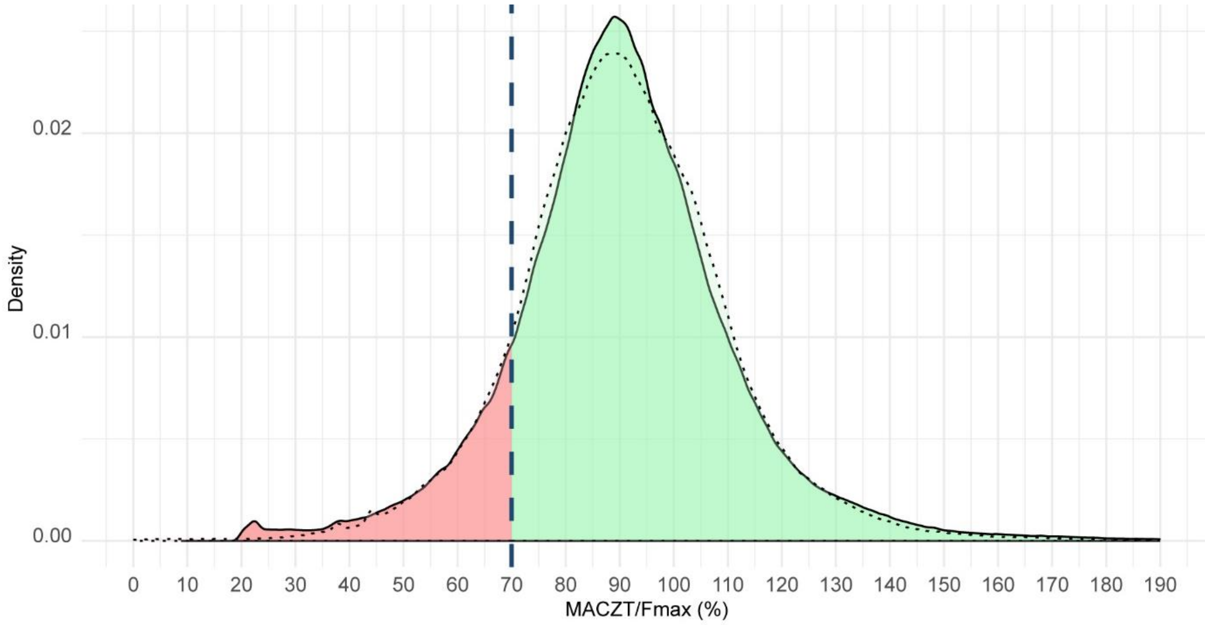
Source: ACER calculation based on TSO data.

Figure 48: Density function of the relative MACZT for all CNECs in France for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



Source: ACER calculation based on TSO data.

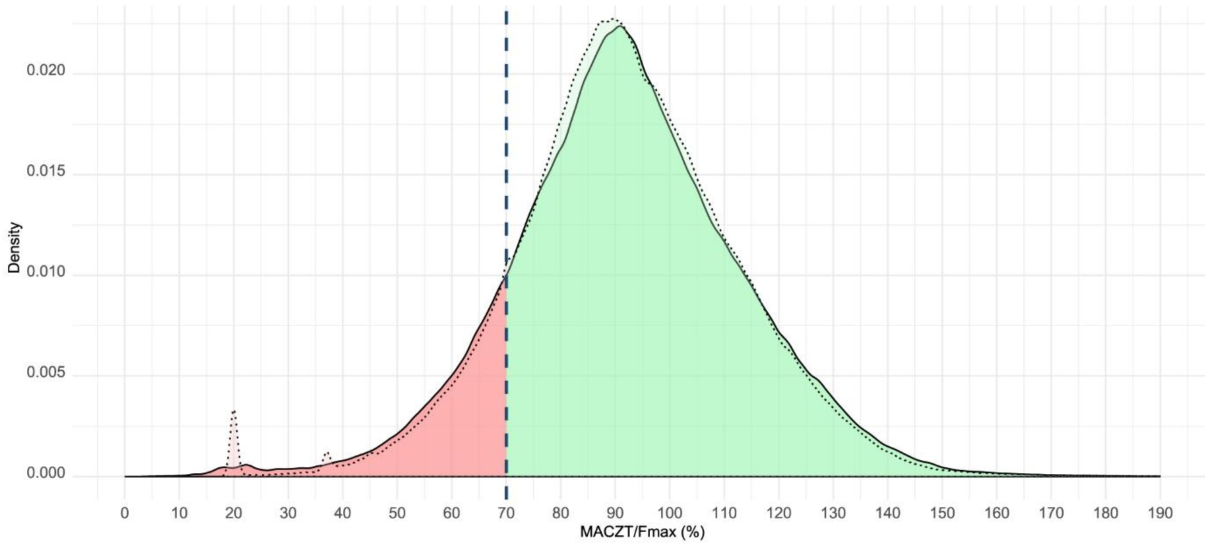
Figure 49: Density function of the relative MACZT for all CNECs in the Netherlands for the CWE capacity calculation region (between 1 January 2022 and 8 June 2022)



CNECs below 70% without third countries
CNECs below 70% with third countries
CNECs above 70% without third countries
CNECs above 70% with third countries

Source: ACER calculation based on TSO data.

Figure 50: Density function of the relative MACZT for all CNECs in the Netherlands for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)

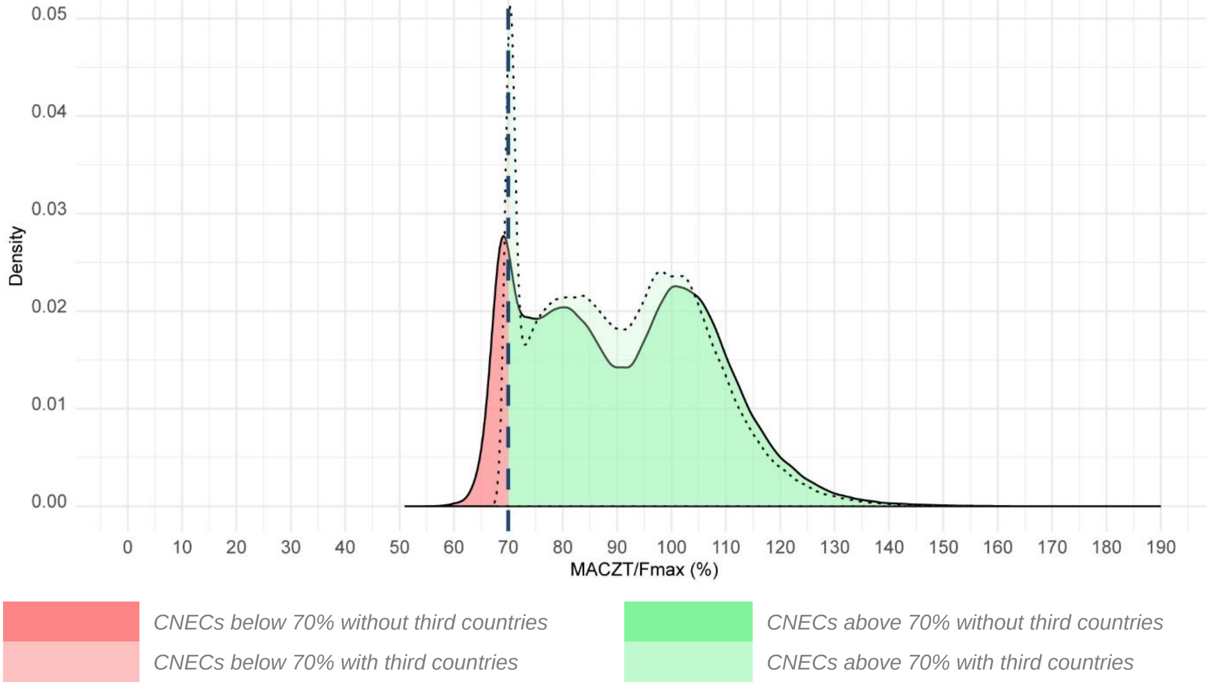


CNECs below 70% without third countries
CNECs below 70% with third countries
CNECs above 70% without third countries
CNECs above 70% with third countries

Source: ACER calculation based on TSO data.

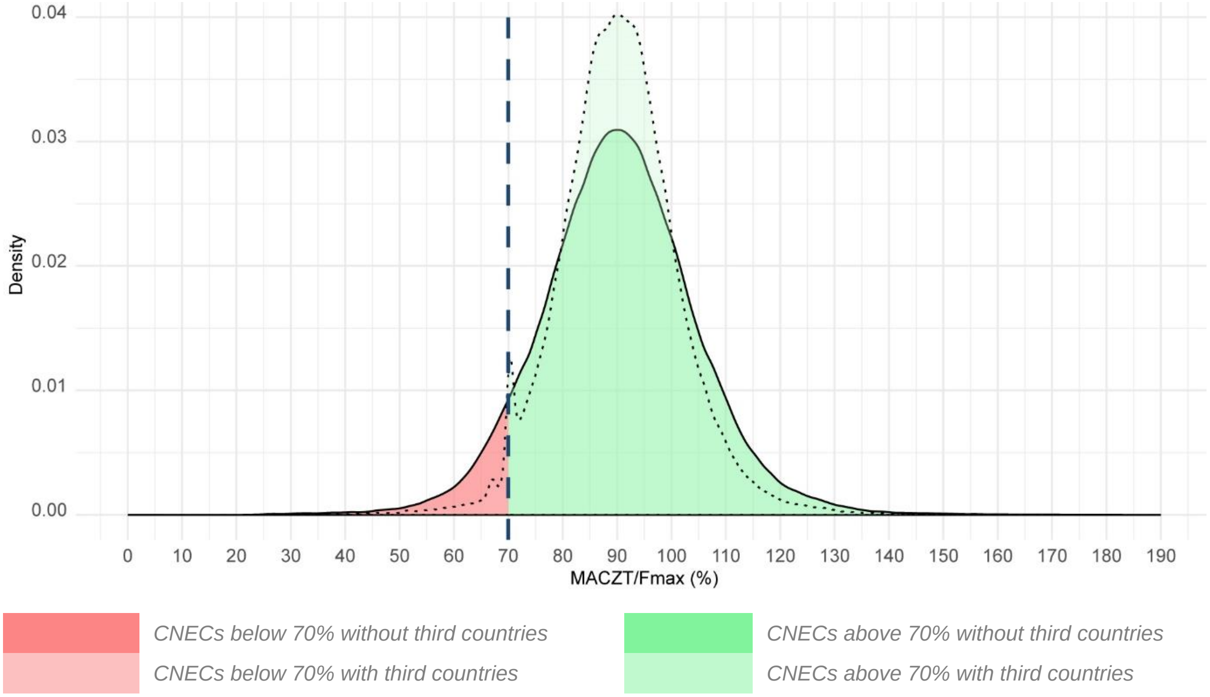
146 From this point onwards, the Member States that started applying a flow-based methodology after the implementation of the Core capacity calculation methodology on the 9 June 2022 are covered.

Figure 51: Density function of the relative MACZT for all CNECs in Czechia for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



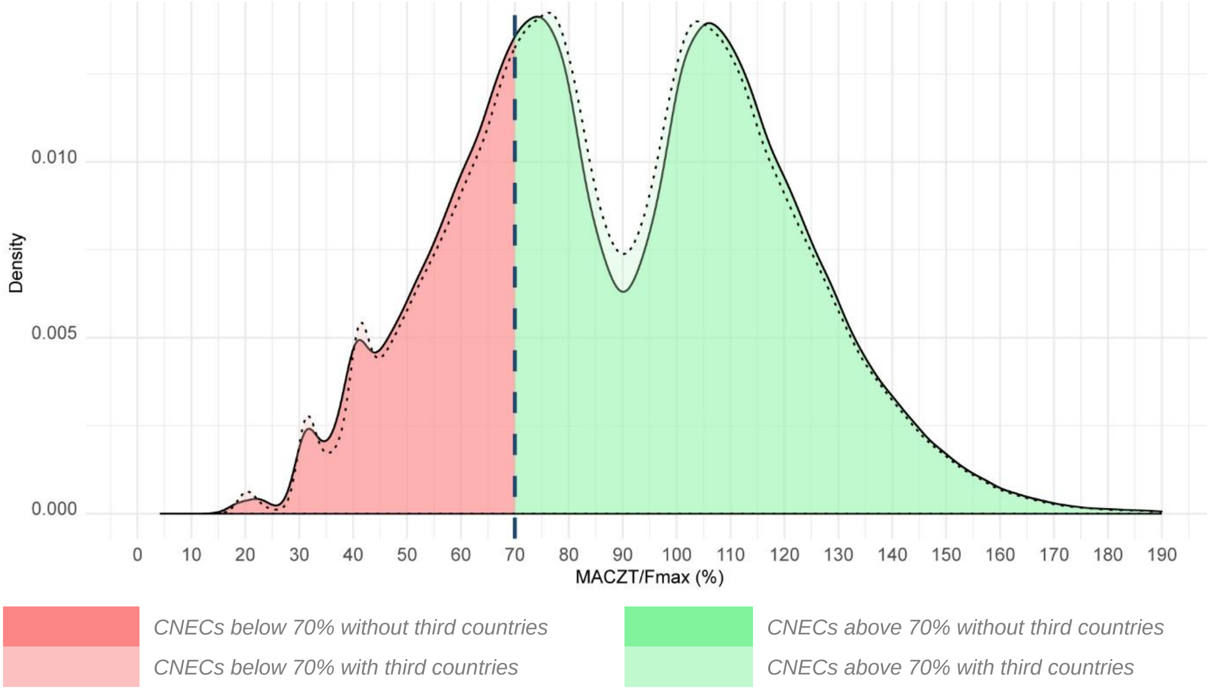
Source: ACER calculation based on TSO data.

Figure 52: Density function of the relative MACZT for all CNECs in Croatia for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



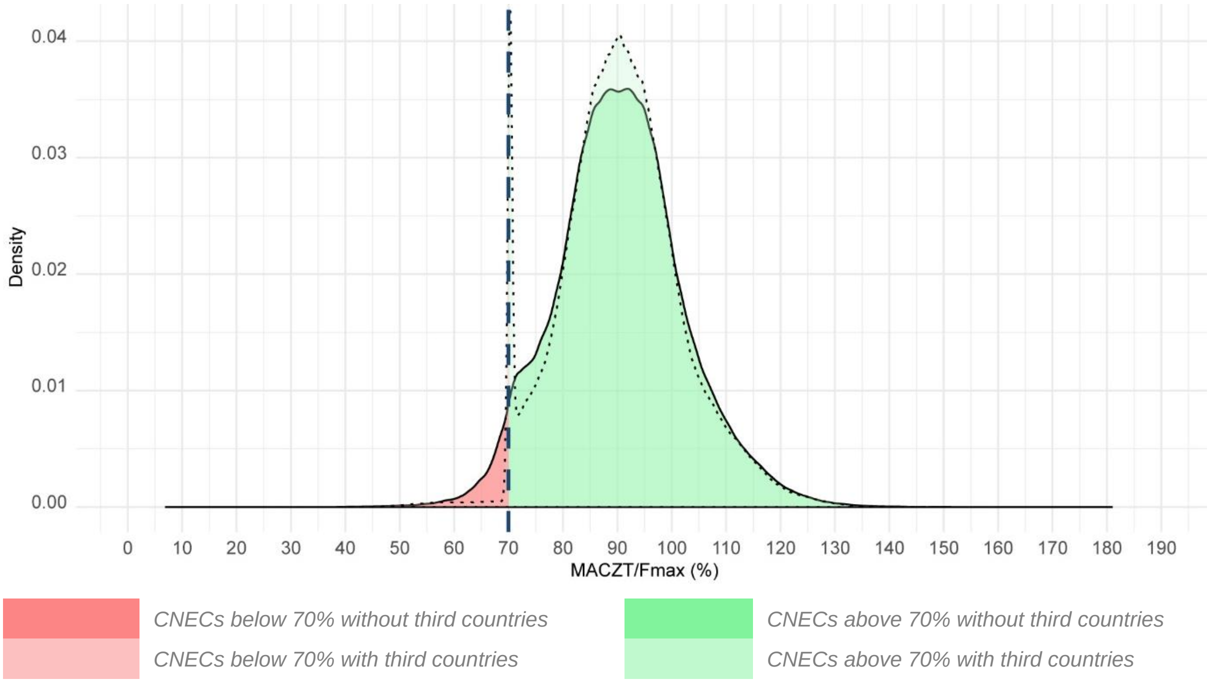
Source: ACER calculation based on TSO data.

Figure 53: Density function of the relative MACZT for all CNECs in Germany (50 Hertz) for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



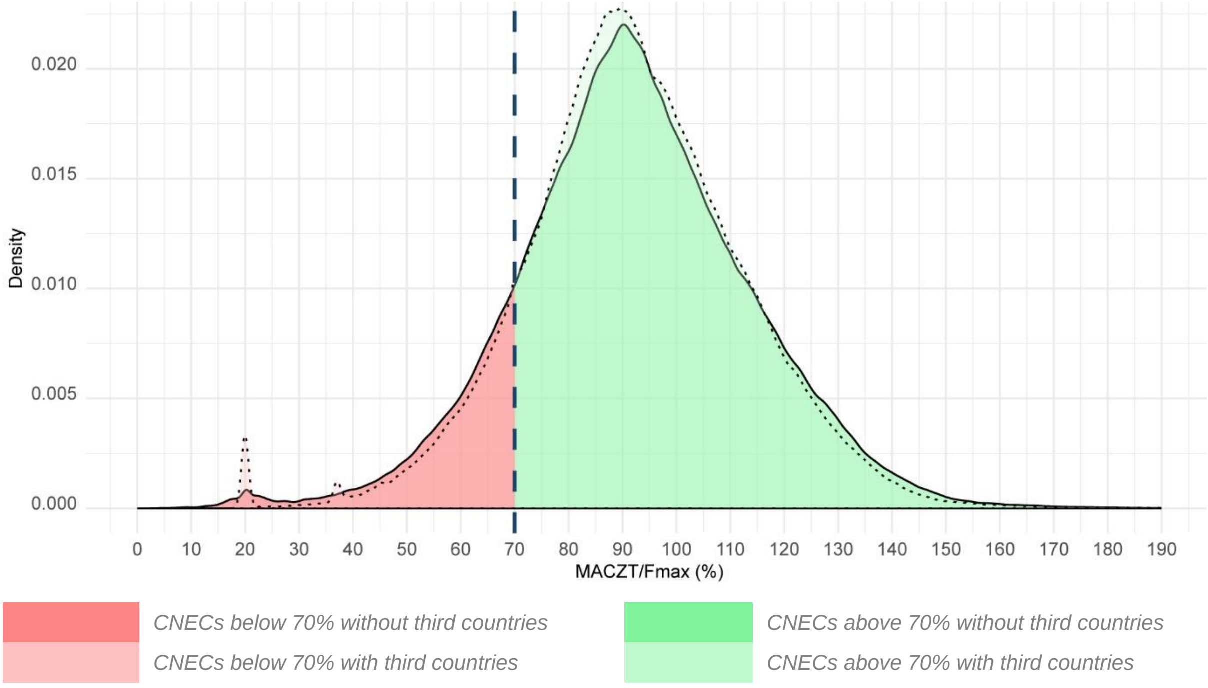
Source: ACER calculation based on TSO data.

Figure 54: Density function of the relative MACZT for all CNECs in Hungary for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



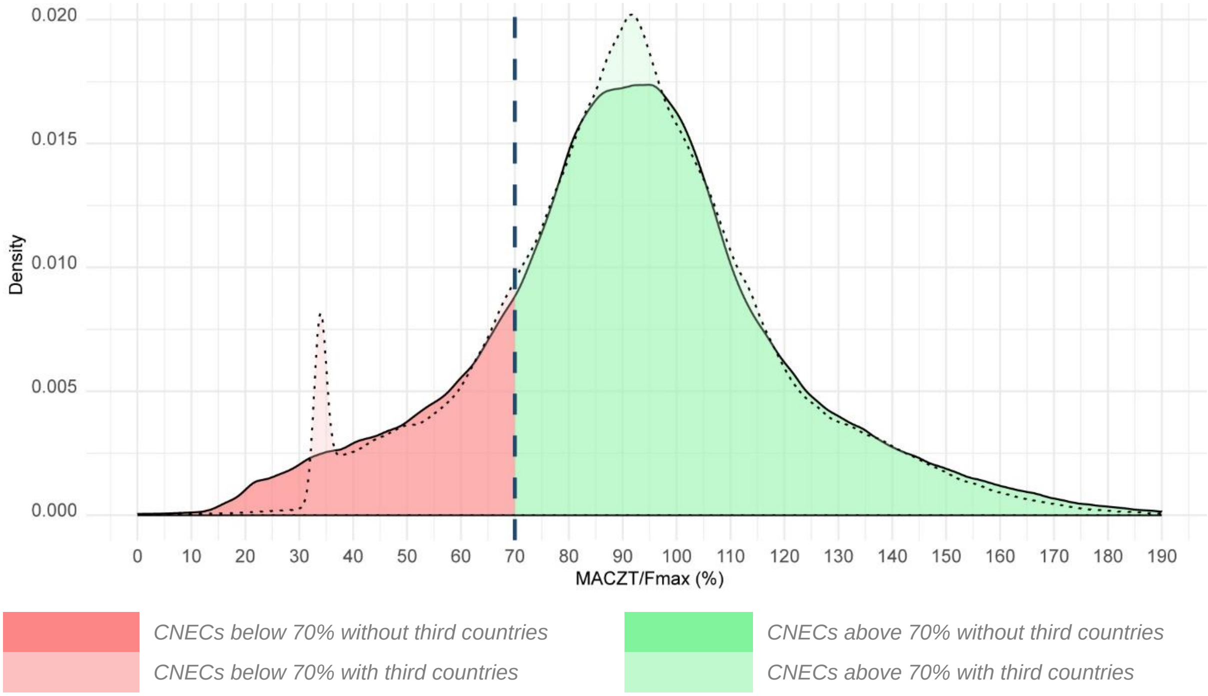
Source: ACER calculation based on TSO data.

Figure 55: Density function of the relative MACZT for all CNECs in Poland for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



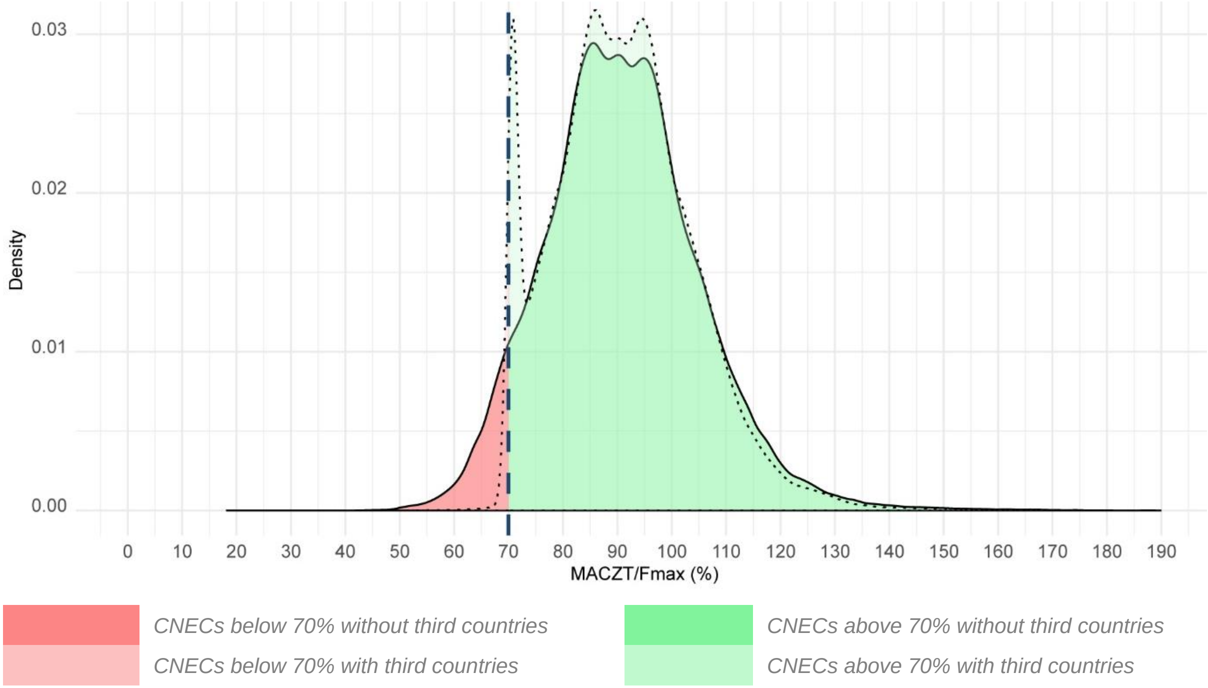
Source: ACER calculation based on TSO data.

Figure 56: Density function of the relative MACZT for all CNECs in Romania for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



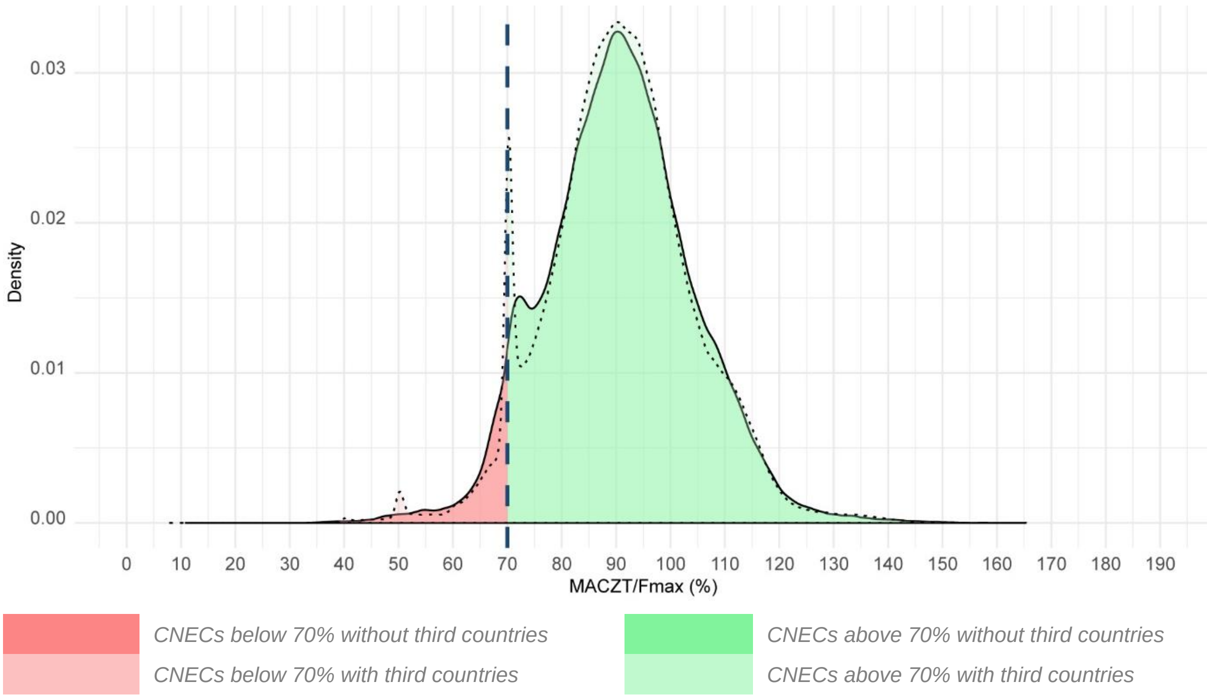
Source: ACER calculation based on TSO data.

Figure 57: Density function of the relative MACZT for all CNECs in Slovenia for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)



Source: ACER calculation based on TSO data.

Figure 58: Density function of the relative MACZT for all CNECs in Slovakia for the Core capacity calculation region (between 9 June 2022 and 31 December 2022)

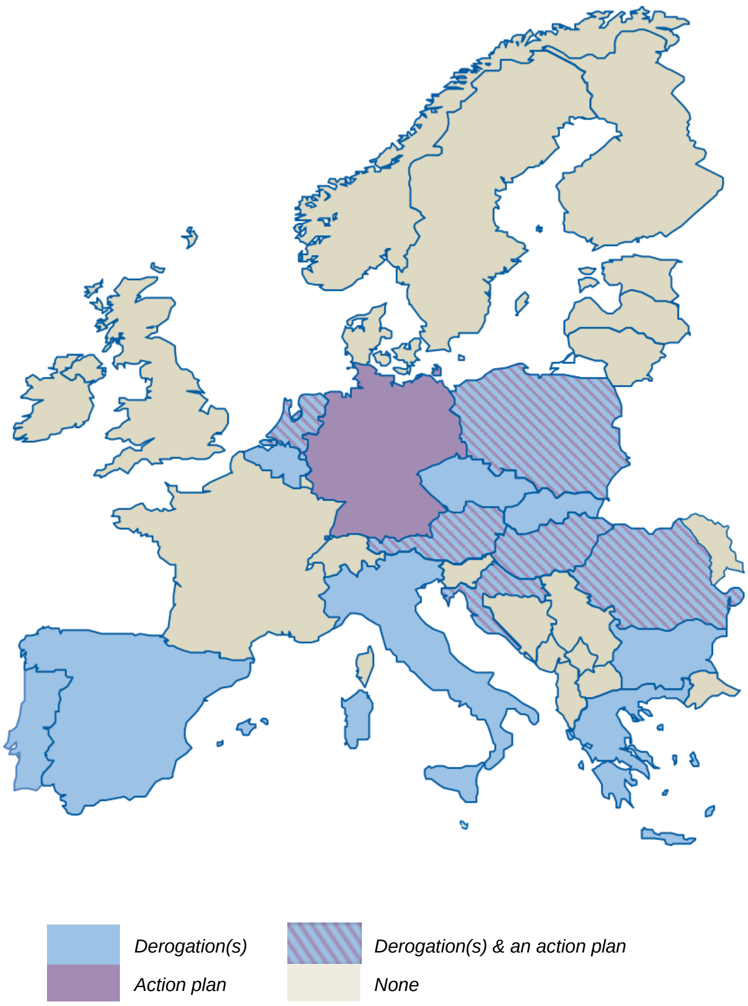


Source: ACER calculation based on TSO data.

6. Annex II: Derogations and action plans

147 Figure 59 presents an overview of the MSs that have a derogation and/or an action plan in place for 2022. For more details about the derogation and action plans per Member State, as well as a complete overview of the derogations and action plans granted for full period 2020-2023, please refer to ACER's website.

Figure 59: Overview of derogations and action plans for 2022



Source: ACER elaboration based on information provided by NRAs.

Note 1: A Member State is considered to have a derogation and/or an action plan in place if they apply to at least one of its capacity calculation regions or for one of its bidding zone borders.

Note 2: For Bulgaria, the derogation was approved on 28 October 2020 for a period of two years, hence it is only applicable until 28 October 2022. For Czechia, the derogation is only applicable for the period between 1 January 2022 and 8 June 2022, i.e., before Core flow-based go-live. For Croatia, the action plan entered into force on 25 February 2022.

7. Annex III: Reports by NRAs and TSOs

148 In the practical note on the monitoring of MACZT, jointly developed by ACER and NRAs over the course of 2022, each NRA has expressed its preferred approach on how to assess compliance of the 70% target from 2021 onwards. This annex aims to qualitatively assess the reports that have served as a basis for the NRA compliance assessment for the year 2021.

149 Pursuant to Article 15(4) of the Electricity Regulation, TSOs of Member States that have an action plan in place must develop a yearly assessment on the fulfilment of the linear trajectory target set out in the action plan. This assessment must be then submitted to the relevant regulatory authority for approval. On the other hand, NRAs of Member States without an action plan in place could decide on which approach to follow for the monitoring of the 70% target, either by relying on ACER's report on 70% cross-zonal capacity, or by developing their own reports.

150 Table 7 provides an overview of the national compliance reports for 2021.

Table 7: Overview of national compliance reports for 2021

Member State	Action plan	Report basis for compliance assessment	Report published for 2021	Follows ACER Recommendation 01/2019 on MACZT calculation and ACER and NRA practical note on 70% reporting	Report's conclusion on Member State's compliance	Mitigations tackled in the report	Comment
Austria	Yes	TSO	Yes	No	Compliant	No	Margin for uncertainty has been included when calculating MNCC
Belgium	No	NRA	Yes	Yes	Non-compliant	Yes	
Bulgaria	No	NRA	No	No	-	-	No report was provided by the Bulgarian NRA
Croatia	Yes	TSO	No	-	-	-	Action plan is only applicable from 2022, thus no report was produced.
Czechia	No	ACER	Yes	Yes	-	-	
Denmark	No	ACER	Yes	Yes	-	-	
Estonia	No	NRA	Yes	No	Compliant	No	Common report for all Baltic Member States.
Finland	No	ACER	Yes	Yes	-	-	
France	No	NRA	Yes	No	Partial compliance	Yes	CRE concludes that the target of the French derogation was met for all periods and regions except for two months in the CWE region. CRE studies only hours where there is no price convergence and CNECs that are presolved.
Germany	Yes	TSO	Yes	No	Compliant	No	BNetzA considers a different methodology in their MNCC calculation.
Greece	No	NRA	No	No	-	-	No report was provided by the Greek NRA
Hungary	Yes	TSO	No	-	-	-	Action plan is only applicable from 2022, thus no report was produced.
Italy	No	NRA	Yes	Yes	NA	No	No compliance assessment required as Italian derogation of 2021 doesn't set a minimum target
Latvia	No	NRA	Yes	No	Compliant	No	Common report for all Baltic Member States

Member State	Action plan	Report basis for compliance assessment	Report published for 2021	Follows ACER Recommendation 01/2019 on MACZT calculation and ACER and NRA practical note on 70% reporting	Report's conclusion on Member State's compliance	Mitigations tackled in the report	Comment
Lithuania	No	NRA	Yes	No	Compliant	No	Common report for all Baltic Member States
Netherlands	Yes	TSO	Yes	Yes	Non-compliant	Yes	
Poland	Yes	TSO	Yes	-	-	-	Report shared with ACER is only available in Polish
Portugal	No	NRA	Yes	Yes	Non-compliant	Yes	
Romania	Yes	TSO	Yes	Yes	Compliant	No	
Slovakia	No	ACER	Yes	Yes	-	-	
Slovenia	No	ACER	Yes	Yes	-	-	
Spain	No	ACER	Yes	Yes	-	-	
Sweden	No	ACER	Yes	Yes	-	-	

Source: ACER elaboration based on information provided by NRAs and TSOs.

Note: For the purpose of this table, the following Member States have been omitted: Republic of Cyprus, Malta, Ireland and Luxembourg.

8. List of Figures

9. List of Tables