Allegato A

REPORT ON THE IMPLEMENTATION OF THE MINIMUM LEVEL OF AVAILABLE CAPACITY FOR CROSS-ZONAL TRADE (70%) ON THE ITALIAN BORDERS FOR YEAR 2022

7 November 2023

SUMMARY

1 Premise

1.1 According to Article 16(8) of Regulation (EU) 2019/943[1], starting from 1st January 2020 Transmission System Operators (in the following: TSOs) are requested to make available a minimum level of capacity for cross-zonal trade (so called 70% rule).

1.2 A TSO is allowed not to match the minimum level of capacity when one of the following situations occurs:

i) the competent Member States has adopted an action plan pursuant to Article 15 of Regulation (EU) 2019/943; in this case, the minimum level of capacity (70%) shall be reached by 31 December 2025 and, in the meanwhile, a linear trajectory shall be matched;

ii) the competent National Regulatory Authority has granted a derogation on foreseeable grounds where necessary for maintaining operational security pursuant to Article 16(9) of Regulation (EU) 2019/943;

iii) the regional coordination centre, while performing the capacity calculation process, concludes that there are not enough remedial actions to reach the minimum level of capacity and thus reduces the capacity accordingly pursuant to Article 16(3) of Regulation (ERU) 2019/943; this reduction applies also where an action plan is in place, by allowing a TSO to not match the linear trajectory in case of insufficient remedial actions.

1.3 On the verge of the entry into force of the 70% rule, in July 2019 ACER issued the Recommendation 01/2019[2] (in the following: ACER Recommendation) giving some criteria on how to compute the level of capacity for cross-zonal trade. The proposal is self-standing for the regions implementing a flow based capacity calculation, while for the regions implementing a coordinated net transmission capacity (in the following: cNTC), ACER proposed an explicit calculation for the limiting elements[3] only, mandating the TSOs to develop a proper methodology to compute the level of cross-zonal capacity on all the other network elements.

1.4 Based on criteria reported in the Recommendation and on the data provided by the TSOs and the regional coordination centres, ACER publishes a yearly report presenting the level of cross-zonal capacity offered on each border and pointing out whether this level is consistent with the 70% requirement. ACER reports have nonetheless only a monitoring scope: assessing the effective compliance of each TSO against the 70% rule is, in fact, a task reserved to the competent national regulatory authority.

1.5 ARERA approved the assessment of the status of the 70% rule for year 2020 with Decision 420/2021/R/eel[4] and the assessment for year 2022 with Decision 543/2022/R/eel[5].

1.6 The current document presents the assessment for year 2022. Chapter 2 describes how Arera intends assessing the 70% rule in a cNTC capacity calculation process, as the one adopted by Terna on all its bidding zone borders. Chapter 3 illustrates the results for the Northern borders (Italy North CCR), while Chapter 4 is focused on the Greek border. Chapter 5 gives the status

[1] Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the Internal Market for Electricity (recast)

[2] Recommendation No 01/2019 of the European Union Agency for the Cooperation of Energy Regulators of 08 August 2019 on the implementation of the minimum margin available for cross-zonal trade pursuant to Article 16(8) of Regulation (EU) 2019/943

[3] A limiting element is a transmission element that effectively limits the cross-zonal capacity.

[4] Deliberazione 12 ottobre 2021 420/2021/R/eel - Valutazione del livello minimo di capacità (70% rule) per i confini italiani con riferimento all'anno 2020

[5] Deliberazione 2 novembre 2022 543/2022/R/eel - Valutazione del livello minimo di capacità (70% rule) per i confini italiani con riferimento all'anno 2021

of the Italian internal bidding zone borders, Finally, Chapter 6 reports some conclusions, along with some information on the costs borne by Terna to fulfil the 70% rule.

1.7 It is worth underlining that the monitoring is limited to the day ahead process only.

2 70% rule in a cNTC environment

2.a ACER recommendation

2.1 ACER recommends computing the Margin Available for Cross-Zonal Trade ($MACZT_i$) for each critical network element and contingency (CNEC)[6] *i* based on the following criteria:

$$MACZT_i = MCCC_i + MNCC_i$$

where:

- $MCCC_i$is the Margin from Coordinated Capacity Calculation on CNEC *i*;
- $MNCC_i$ is the Margin from Non-Coordinated Capacity Calculation on CNEC *i*.

2.2 $MCCC_i$ is computed for each coordination area, i.e. for each set of borders on which the cross-zonal capacity is computed in a coordinated manner.

2.3 For flow based areas, $MCCC_i$ is equal to the Remaining Available Margin RAM_i resulting from the capacity calculation process as increased to take into account previously allocated and nominated capacities. For cNTC areas, instead, the following formula is suggested:

$$MCCC_i = \sum_b pPTDF_i^b \cdot NTC_b$$

where:

- $pPTDF_i^b$ is the positive PTDF[7] of CNEC *i* in the direction associated to border *b*;
- NTC_b is the net transmission capacity computed in the capacity calculation process for border *b*;
- the sum is extended to all the borders within the coordination area.

2.4 ACER points out that the formula for $MCCC_i$ in cNTC areas provides a reliable estimation only for the limiting CNECs, while for all the other CNECs the formula underestimates the $MCCC_i$ since it doesn't consider the quota of the capacity that remains unused because of the law of physics in a meshed system.

2.5 In both flow based and cNTC areas, $MNCC_i$ is computed by multiplying the corresponding zone related PTDF with the net position associated to each bidding zone. Before the computation the net position is adjusted in order to filter out the exchanges within the coordination area that are taken into account in the $MCCC_i$.

2.6 PTDFs and net positions are computed according to the common grid model used for the capacity calculation process.

[6] A CNEC is the couple of network element and associated contingency that is monitored during the capacity calculation process to take into account the N-1 security. For N security, CNEC are considered without any contingency attached.

[7] PTDF (Power Transfer Distribution Factor) can be border related or zone related; a border related PTDF measures the flow on a given network element induced by 1 MW exchange on the considered border; a zone related PTDF measures the flow on a given network element induced by 1 MW net position on the considered zone (there is an opposite net position in the slack zone).

2.7 In case of borders consisting only of HVDC, the computation can be simplified: since the flows on HVDC are usually fully controllable, $MNCC_i$is equal to zero (i.e. no flows on the HVDC due to exchange outside the coordination area) and $MCCC_i$ is equal to the NTC_b on the considered border.

2.b 70% adjustment in cNTC areas

2.8 The analysis is focused on cNTC areas with borders including AC interconnectors, since for borders with DC interconnectors only, $MCCC_i$ is equal to the NTC_b on the considered border.

2.9 In a cNTC area, NTC is usually computed by an iteration process increasing the injections on the exporting bidding zones, reducing the injections in the importing ones[8] and evaluating the exchange across the border on this new situation by the mean of a full AC load flow (i.e., taking into account the transmission losses and the voltage profile): the process ends when a constraint is detected. The maximum exchange without hitting any constraints is assumed as the Total Transmission Capacity TTC_b on the considered border *b*.

2.10 Let F_i^{last} be the flow on the CNEC *i* at the very last step of the cNTC process, i.e. in the iteration when the gross cross-zonal capacity TTC_b is identified. Let $PTDF_i^b$ be the PTDF associated to CNEC *i* because of flows induced by the exchange on the border *b* withing the coordination area.

2.11 Mimicking the linear approximation adopted in a flow based approach, the flow F_i^0 on the CNEC *i* with no exchanges within the coordinated area can be computed as:

$$F_i^0 = F_i^{last} - \sum_b PTDF_i^b \cdot TTC_b$$

2.12 Then, keeping mimicking the flow based approach:

$$MCCC_i = RAM_i = F_i^{max} - F_i^0 - FRM_i = F_i^{max} - F_i^{last} + \sum_b PTDF_i^b \cdot TTC_b - FRM_i$$

where

- FRM_i is the flow reliability margin on the CNEC *i*.

2.13 FRM_i and the transmission reliability margin for the border *b* TRM_b are related as follows:

$$FRM_i = \sum_b PTDF_i^b \cdot TRM_b$$

hence:

$$MCCC_i = F_i^{max} - F_i^{last} + \sum_b PTDF_i^b \cdot TTC_b - FRM_i =$$

$$= F_i^{max} - F_i^{last} + \sum_b PTDF_i^b \cdot (TTC_b - TRM_b)$$

[8] Theoretically it's possible to increase the load in the importing bidding zones and decrease it in the exporting ones as well. This is nonetheless not relevant for the purpose of this report.

2.14 Since

$$NTC_b = TTC_b - TRM_b$$

it is possible to achieve:

$$MCCC_i = F_i^{max} - F_i^{last} + \sum_b PTDF_i^b \cdot NTC_b$$

Current constraints

2.15 Let's assume that the original computation process ends because of a current constraint, i.e. because a subset of CNECs result fully loaded. For these CNECs (in the following: fully loaded CNECs), $F_i^{last} = F_i^{max}$ hence[9]:

$$MCCC_i = F_i^{max} - F_i^{max} + \sum_b PTDF_i^b \cdot NTC_b = \sum_b PTDF_i^b \cdot NTC_b = MCCC_i^{ACER}$$

2.16 For all the other CNECs, instead:

$$MCCC_i = F_i^{max} - F_i^{last} + \sum_b PTDF_i^b \cdot NTC_b \geq \sum_b PTDF_i^b \cdot NTC_b = MCCC_i^{ACER}$$

2.17 This proves that the formula proposed by ACER underestimates the level of capacity for all the not fully loaded CNECs. The limiting CNECs in ACER Recommendation shall thus be intended as fully loaded CNECs.

2.18 Keeping mimicking the flow based approach and neglecting the previously allocated and nominated capacities[10], the Adjusted Margin AMR_i and the final margin RAM_i^{adj} on the CNEC *i* can be computed as:

$$AMR_i = \max(0{,}7 - MACZT_i; 0)$$

$$RAM_i^{adj} = RAM_i + AMR_i = F_i^{max} - F_i^{last} + \sum_b PTDF_i^b \cdot NTC_b + AMR_i$$

2.19 For sake of simplicity, let the coordination area be composed by a single border[11]. The assumption pretty represents the effectiveness of the Italian borders: in Italy North CCR, in fact, the cNTC computation process computes the overall capacity on the four borders (France, Switzerland, Austria and Slovenia) as they were a single border, then the final value is split by the mean of predetermined factors; the Italian internal bidding zone borders are instead always treated independently on each other.

2.20 Given what above, the computation of the final margin is simplified as follows:

$$RAM_i^{adj} = RAM_i + AMR_i = F_i^{max} - F_i^{last} + PTDF_i^b \cdot NTC_b + AMR_i$$

[9] For fully loaded CNECs $PTDF_i^b$ is always positive, otherwise the element would not result fully loaded.

[10] In a cNTC environment, the NTC can be computed neglecting the previously allocated capacities: this means that the NTC represents the whole capacity available on the considered border. The effective capacity offered to the market is then computed deducting the previously allocated one.

[11] It can be either an effective single border or a set of interdependent borders on which the overall capacity is first computed as a whole and then split on all the borders.

2.21 For each CNEC *i* it's then possible to compute the equivalent $NTC_{b,i}^{eq}$ that would fully exploit the RAM_i^{adj}:

$$NTC_{b,i}^{eq} = \frac{RAM_i^{adj}}{PTDF_i^b} = \frac{F_i^{max} - F_i^{last} + PTDF_i^b \cdot NTC_b + AMR_i}{PTDF_i^b}$$
$$= NTC_b + \frac{F_i^{max} - F_i^{last} + AMR_i}{PTDF_i^b} = NTC_b + \Delta NTC_{b,i}^{nused} + \Delta NTC_{b,i}^{AMR}$$

where:

- $\Delta NTC_{b,i}^{nused} = \frac{F_i^{max} - F_i^{last}}{PTDF_i^b}$ is the increase of the cross-zonal capacity associated to the exploitation of the entire thermal capacity on the CNEC *i*;
- $\Delta NTC_{b,i}^{AMR} = \frac{AMR_i}{PTDF_i^b}$ is the increase of the cross-zonal capacity associated to the adjusted margin on the CNEC *i*.

2.22 Eventually, the adjusted cross-zonal capacity NTC_b^{adj} can be computed as:

$$NTC_b^{adj} = \min\left(NTC_{b,i}^{eq}\right) = NTC_b + \Delta NTC_b$$

2.23 The network element *i* having $NTC_{b,i}^{eq} = NTC_b^{adj}$ is considered as the limiting CNEC. On this element $MCCC_i^{adj} = 0.7$ by definition.

2.24 For each CNEC *i* the flow F_i^{adj} should be calculated by the mean of an AC load flow assuming an exchange equal to $TTC_b^{adj} = NTC_b^{adj} + TRM_b$. Anyhow for sake of simplicity the linear approximation can be kept, since the overall error is negligible. This means:

$$F_i^{adj} = F_i^0 + \sum_b PTDF_i^b \cdot TTC_b^{adj} = F_i^{last} - \sum_b PTDF_i^b \cdot TTC_b + \sum_b PTDF_i^b \cdot TTC_b^{adj}$$
$$= F_i^{last} + \sum_b PTDF_i^b \cdot \left(TTC_b^{adj} - TTC_b\right) \geq F_i^{last}$$

2.25 Clearly, some overloads may occur. This is unavoidable if the difference $F_i^{adj} - F_i^{last}$ exceeds the FRM_i on a fully loaded CNEC *i*, or the sum of the unused capacity plus the FRM_i on the other CNECs: proper remedial actions shall be applied to cope with it.

2.26 Let's consider the case with $\Delta NTC_b = 0$, meaning that at least one CNEC *i* shows $\Delta NTC_{b,i}^{nused} = \Delta NTC_{b,i}^{AMR} = 0$. It's the case of a fully loaded CNEC (no adjustment associated to full exploitation) already matching the 70% rule (no margin adjustment needed). In other terms, if a fully loaded CNECs matches the 70% rule in the original computation process, there is no need to perform any adjustment process.

2.27 In case no fully loaded CNECs match the 70% rule in the original computation, the adjustment leads to $\Delta NTC_b > 0$. Theoretically, in this case, in order to identify the proper NTC_b^{adj}, all CNECs should be monitored, since each CNEC could turn to be the limiting one.

2.28 For sake of simplicity let the attention be focused only on the fully loaded CNECs. Let $NTC_b^{*adj} = NTC_b + \min \Delta NTC_{b,i,fully}^{AMR} = NTC_b + \Delta NTC_b^*$ be the adjusted NTC value

computed looking only at the fully loaded CNECs[12]. This value can either be equal to NTC_b^{adj} (in case $\Delta NTC_b = \Delta NTC_b^* = \min \Delta NTC_{b,i,fully}^{AMR}$) or above NTC_b^{adj} (in case $\Delta NTC_b^* > \Delta NTC_b$).

2.29 Clearly if $NTC_b^{*adj} > NTC_b^{adj}$, the overloads on the CNECs turn to be greater, requiring more remedial actions to be applied. This increases a bit the risk for the TSOs, but it comes with a significantly simpler 70% adjustment process (monitoring only a subset of CNECs).

Voltage and stability constraints

2.30 In case of voltage or stability issues all the CNECs are partially loaded.

2.31 From a theoretical point of view, in those cases, the level of cross-zonal capacity should be monitored by looking at all the CNECs: a proper formula should be developed in order to take into account the unused capacity on each CNEC. If no CNECs match the 70% rule, an adjustment process should be run and a proper NTC increase determined. Practically in these cases the 70% adjustment process cannot be performed. When voltage and stability issues occur, the system has already been optimized: this means that an increase of the transmission capacity cannot be sustained because of lack of further regulating capacities. In other terms in those cases only checking the effective level of transmission capacity made available to the market is possible, while any further adjustment is usually out of scope and the TSOs should live with the NTC value coming out from original capacity calculation process.

Allocation constraints

2.32 The allocation constraints are managed directly within the market coupling algorithm. The capacity calculation process is thus not affected and an unconstrained NTC value can be determined, associated with the corresponding constraint; in case of current constraints the 70% adjustment can be run as well and the limiting CNEC properly identified.

2.33 Eventually the effective level of cross-border capacity made available because of the allocation constraints shall be computed according to the extent of the allocation constraint.

2.34 In particular for Italy North CCR the allocation constraint limits sets the maximum value NTC_b^{all} of the capacity that can be imported to Italy: since all the borders are considered as a single equivalent one for the capacity calculation process, applying the allocation constraint means limiting the overall capacity on that equivalent border. If the unconstrained capacity is limited by a current constraint, the impact of the allocation constraints on the limiting CNEC *i* can be computed as follows:

$$MCCC_i^{all} = \frac{NTC_b^{all}}{NTC_b^{adj}} MCCC_i^{adj}$$

If the unconstrained capacity is limited by a voltage or stability constraints, the impact of the allocation constraint is not straightforward. A proper formula is needed in order to compute the $MCCC_i^{all}$ taking into account the unused capacity on all CNECs.

2.35 Similar reasonings are valid for the Italian internal bidding zone borders since they are always treated as independent borders for the purpose of capacity calculation.

[12] Being fully loaded CNECs, $\Delta NTC_{b,i}^{nused}$ is null by definition.

Summary

2.36 In order to be consistent within the 70% margins on all CNECs, the cross-zonal capacity in a cNTC environment shall be assumed equal to the NTC_b^{adj}; in a single border coordination area this value is the one leading to the minimum increase of cross-zonal capacity with respect to the original value; with more borders an equivalent set of NTC values shall be identified;

2.37 In case of a current constraints, if a fully loaded CNEC at the end of the cNTC computation process already matches the 70% rule, NTC_b^{adj} coincides with the original NTC value and no further elaboration is required. If no fully loaded CNECs match the 70% rule at the end of the cNTC computation process, the original NTC value should be increased and all CNECs should be monitored. Focusing the adjustment on the fully loaded CNECs simplifies the process, but may lead to a slight overestimation of the NTC_b^{adj}, with a slightly increased risk for the TSOs; if this risk can be tolerated, there is no need to monitor all the CNECs.

2.38 In case of voltage and stability constraints, adjustments are usually not possible and only checking the effective level of cross-border capacity is doable; also in this case the $MCCC_i$ shall be properly computed.

2.39 The impact of allocation constraints is straightforward

2.c 70% validation in cNTC areas

2.40 The NTC_b^{adj} deriving from the adjustment process is subject to a validation process.

2.41 If there was an adjustment to cope with the 70%, a coordinated validation is performed directly by the regional coordination centre with the aim to check whether there is a proper level of remedial actions to sustain the resulting transmission capacity. If not, the NTC_b^{adj} is reduced accordingly. In general, thus, the coordinated validation leads to a $NTC_b^{coord} < NTC_b^{adj}$.

2.42 The coordinated validation is not needed in case no adjustment is performed, since the AC load flow and the remedial actions optimization process built in with the initial capacity calculation process already ensure the sustainability of the initial NTC_b value. In this case $NTC_b^{coord} = NTC_b$

2.43 The NTC_b^{coord} value is subject to an individual validation: each involved TSO may ask for a reduction for operational security reasons, indicating the new NTC value that it can sustain. The minimum of the NTC indicated by the TSOs is assumed as the final NTC_b^{valid}.

2.d 70% assessment

2.44 The 70% assessment differs depending on the specific constraints limiting the cross border capacity.

Current constraints

2.45 If the NTC_b^{adj} stemming out from the 70% adjustment process is confirmed (i.e. no reduction has been applied either in the coordinated or in the individual validation), all the CNECs can be considered compliant with the 70% rule. For all of them an adjusted margin $MACZT_i^{adj} \geq 0.7$ is indeed made available: in some cases it's fully exploited while in other cases not. This happens also in the flow based environment when the allocation phase optimizes the social welfare by identifying the most efficient solution (i.e., the CNECs to fully exploit) within the flow based domain.

2.46 If the NTC_b^{adj} value is reduced in the coordinated validation and the NTC_b^{coord} is confirmed (i.e. no reduction has been asked for in the individual validation by each involved TSO), the 70% rule cannot be considered fulfilled since the limiting CNEC turns to have a final $MACZT_i^{fin} < 0.7$. In this case all the TSOs can be considered responsible for not matching the 70% rule: for all of them the $MACZT_i^{fin}$ on the limiting CNEC *i* can be assumed as the effective level of cross-zonal capacity made available for cross-border trade. This value can be computed as follows:

$$MACZT_i^{fin} = MCCC_i^{fin} + MNCC_i$$

$$MCCC_i^{fin} = \frac{NTC_b^{fin}}{NTC_b^{adj}} MCCC_i^{adj} = \frac{NTC_b^{coord}}{NTC_b^{adj}} MCCC_i^{adj}$$

2.47 If $NTC_b^{valid} < NTC_b^{coord} = NTC_b^{adj}$. (i.e. no reduction has been applied in the coordinated validation, but at least one TSO has asked for a reduction in the individual validation), the 70% rule cannot be considered fulfilled as well, but in this case only the TSOs having asked for the reduction in the individual validation shall be blamed for not matching the 70% rule, all the others being considered compliant since fine with the NTC_b^{adj} value. For the blamed TSOs, the $MACZT_i^{fin}$ on the limiting CNEC *i* can be considered as the effective level of cross-zonal capacity made available for cross-border trade. For each TSO this value can be computed as follows:

$$MACZT_i^{fin} = MCCC_i^{fin} + MNCC_i$$

$$MCCC_i^{fin} = \frac{NTC_b^{fin}}{NTC_b^{adj}} MCCC_i^{adj} = \frac{NTC_b^{valid}}{NTC_b^{adj}} MCCC_i^{adj}$$

where the NTC_b^{valid} is the NTC value indicated by the involved TSOs in the individual validation.

2.48 In case a reduction is applied both in the coordinated and in the individual validation, all TSOs shall be considered responsible for not fulfilling the 70% rule, but with different level of cross-zonal capacity effectively made available. In particular for the TSOs having requested the individual validation:

$$MCCC_i^{fin} = \frac{NTC_b^{valid}}{NTC_b^{adj}} MCCC_i^{adj}$$

where the NTC_b^{valid} is the NTC value indicated by the involved TSOs in the individual validation.

For all the other TSOs:

$$MCCC_i^{fin} = \frac{NTC_b^{coord}}{NTC_b^{adj}} MCCC_i^{adj}$$

Voltage and stability constraints

2.49 Voltage and stability constraints are usually associated to a lack of further regulating capacities. This can be assimilated to a lack of remedial actions, triggering the provisions of Article 16(3)

of Regulation (EU) 2019/943 that allows a reduction of the cross-border capacity, even below the 70% minimum level.

2.50 In this case there is no need to compute the effective level of transmission capacity for the purpose of the assessment. If the value is nonetheless needed for the monitoring, it should be computed by applying a specific formula taking into account the unused capacity on the partially loaded CNECs.

Allocation constraints

2.51 The assessment depends on the extent of the allocation constraints.

2.52 For Italy North CCR and the Italian internal bidding zone borders, in case of unconstrained capacity limited by a current constraint, the TSOs having requested the allocation constraint shall be assigned a level of cross-zonal capacity computed with:

$$MCCC_i^{all} = \frac{NTC_b^{all}}{NTC_b^{adj}} MCCC_i^{adj}$$

For all the other TSOs the assessment shall be performed on the basis of the unconstrained capacity.

2.53 In case of unconstrained capacity limited by a voltage or stability constraint, for the TSOs having requested the allocation constraint the effective level of cross-border capacity shall be computed by applying a specific formula taking into account the unused capacity on the partially loaded CNECs. All the other TSOs shall instead being considered compliant with the 70% rule because their behaviour is consistent with the provisions of Article 16(3) of Regulation (EU) 2019/943.

3 Assessment for Italy North CCR

3.a Capacity calculation process

3.1 Italy North CCR encompasses the borders with France, Austria and Slovenia; the border with Switzerland is not formally included in the region, nonetheless because a strict interdependency with the other ones, this border has always been considered within the capacity calculation process.

3.2 Italy North TSOs chose to adopt a cNTC approach: the cross-zonal capacity in the import direction is computed on the entire Northern borders (i.e. an equivalent border across all the Alps is considered) by increasing the injections in France, Switzerland, Austria and Slovenia and by decreasing the injections in Italy. The original methodology, developed on a voluntary basis, was modified to make it compliant with the CACM Regulation[13]: the revised approach has been into force in the day-ahead timeframe since 2020 and in the intraday timeframe since late 2019. After the entry into force of Regulation (EU) 2019/943, the TSOs further modified the capacity calculation methodology to incorporate a 70% adjustment process based on the approach described in Section 2. The proposal was approved by the competent NRAs in July 2020 and the 70% adjustment process entered into force on 29 October 2021.

[13] Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management

3.3 The calculation is delegated to the two regional coordination centres active in the Central Europe System Operation Region which the Italy North CCR belongs to, namely Coreso and TSCNET.

3.4 Only the import capacity is currently computed, while the export capacity is not estimated: TSOs are working at the so called export corner concept that will allow to evaluate the cross-zonal capacity in the export direction on the specific borders on which export are likely to occur[14]. The export corner is expected to entry into force in early 2024.

3.5 The overall import capacity may be limited by specific allocation constraints introduced by the Italian TSO Terna to take into account the voltage and stability issues of the whole Italian system. Namely the system needs a certain amount of regulating resources to be dispatched to ensure voltage regulation and a proper inertia. In standard conditions, when the sum of these resources plus the non-dispatchable production and the full import capacity is lower than the load, all the regulating resources can be effectively dispatched[15]. On the contrary with low load and significant non-dispatchable production, dispatching all the regulating resources with a full import capacity would lead to an overgeneration: in these situations (typical in spring months) the solution is to limit import capacity to leave enough space for the regulating resources to be dispatched. The allocation constraints had been modelled as ex-ante reduction of the cross-border capacity for years. Pursuant to a specific request by NRAs while assessing the capacity calculation methodology, since 17 February 2022 ex-ante reductions have been no longer applied and the market coupling algorithm has been tasked to ensure that Italy is not importing more than what is allowed by the allocation constraint.

3.6 The TSOs check also the so called ramping constraints aimed to mitigate the differences of the NTC values across the market time units. If needed, these constraints cause ex ante reductions of the transmission capacity. For these constraints a shift into the market coupling algorithm was envisaged as well, but it was not deemed feasible and thus was put on hold.

3.7 In Q4 2021 a dedicated agreement between the EU TSOs and Swissgrid (in the following: Swiss agreement) was stipulated, stating that Swissgrid is bound by the same duties as the EU TSOs in all the technical processes run for Italy North CCR. This contractual agreement complements the specific technical agreements already developed for the day-ahead and intraday capacity calculation processes, providing the general framework of cooperation for Italy North CCR. The agreement was positively verified by the Italy North CCR national regulatory authorities, but it wasn't formally approved because some authorities lack the power to approve contracts at national level.

3.b 2022 derogations

3.8 For the year 2022 Terna asked for a derogation:

- on import capacity for all the market time units impacted by allocation constraints: their presence might, in fact, lead to a cross-zonal capacity below the minimum 70% level;
- on export capacity on all the market time units pending the implementation of the export corner.

[14] If no export is likely, the export corner is not run and the overall import capacity is computed. In this case the market is provided with a standard export capacity based on yearly estimation.

[15] Either from the energy market or in the ancillary service market.

3.9 ARERA approved Terna's request in December 2021 with Decision 607/2021/R/eel[16]: the TSO was requested to submit a quarterly report monitoring the level of cross-zonal capacity offered on the Italian Northern borders, along with an estimation of the costs borne to fulfill the 70% rule.

3.10 While approving the national assessment of the 70% report for 2020 with Decision 543/2022/R/eel, ARERA further simplified Terna's reporting duties by substituting the quarterly reports with the transmission of the reports already developed by the competent regional coordination centre Coreso and made available to ACER. Terna shall ensure that these reports include the information on the unconstrained capacity for all the market time units characterized by an allocation constraint.

3.c ***ACER monitoring***

3.11 For 2022, the Italy North CCR data relevant for the 70% rule were provided by Coreso on behalf of all the TSOs of the region: only the information on the limiting CNEC, along with a proper estimation of MACZT, MCCC and MNCC computed according to ACER Recommendation, was sent. Besides, all the data referred to the import capacity only, while no monitoring on the export capacity was possible, pending the implementation of the export corner.

3.12 The 2022 set of data however represents a significant improvement with respect to the previous years, when only the information on the limiting CNEC was given, without any PTDFs, MACZT, MNCC and MCCC, forcing ACER to rely on the PTDFs stemming out from the default common grid model with potential underestimation of the level of cross-border capacity effectively made available.

3.13 Figure 1 summarizes the outcome of ACER assessment for year 2022.

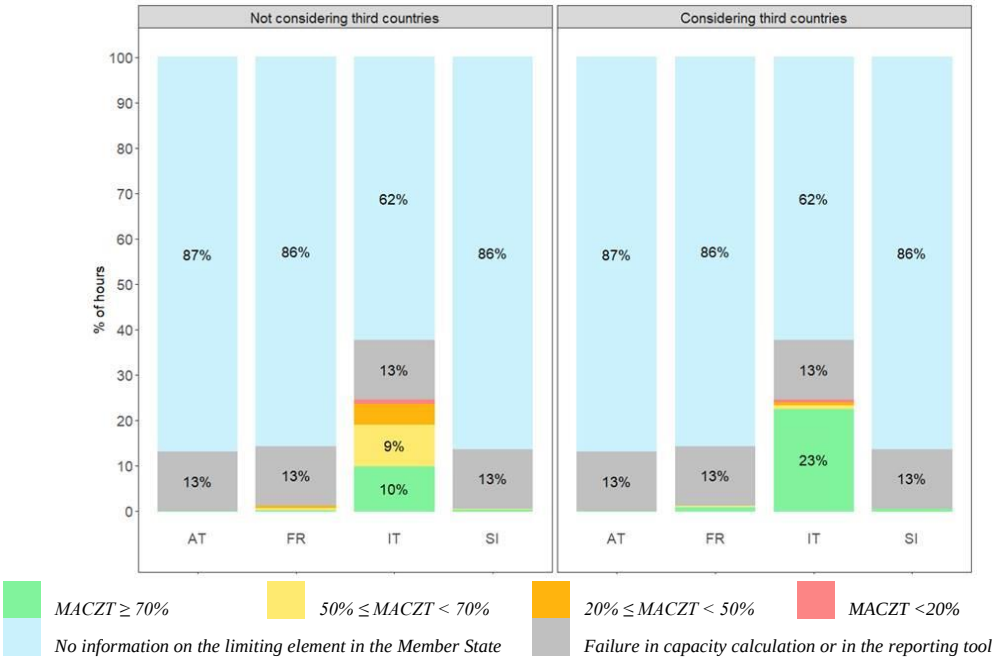


Figure 1 – ACER assessment for Italy North CCR for 2022 – source: ACER report

[16] Deliberazione 21 dicembre 2021, 607/2022/R/eel, "Approvazione della richiesta di deroga per il rispetto del livello minimo di capacità da rendere disponibile per gli scambi tra zone di mercato presentata da Terna S.p.A. con riferimento alla Regione Italy North per l'anno 2022"

3.14 Two different figures are given, one with the contribution of third country flows towards the 70% and one without that contribution. ACER, in fact, deems that the Swiss agreement is not enough since it wasn't formally approved by the national regulatory authorities of the region and, as such, it doesn't fulfil all the preconditions set in the letter by European Commission dated 16 July 2019.

3.15 Failures occur in 13% of the cases: these includes the market time units for which no data are sent by Coreso because of issues in the capacity calculation process or in the reporting tool.

3.16 In 25% of the market time units the limiting CNEC is located within Italy[17], in 1% it is located in France and in a further 1% in Slovenia; the occurrence of a limiting CNEC in Austria is negligible. In 60% of the hours, thus, there is no limiting CNECs within EU: in all these cases the limiting CNEC is, in fact, located within Switzerland, but this country is not explicitly monitored by ACER because it doesn't belong to EU.

3.17 Focusing the attention on the limiting CNECs in EU countries, the 70% rule is matched in almost all the market time units if the third country flows are counted (right graph in Figure 1), while the situation is indeed worse in case third country flows are excluded (left graph in Figure 1). This is particularly true for Italy and France, while the for Slovenia and Austria the effect of third country flows is not so evident.

3.18 Moreover, according to the capacity calculation methodology in place in Italy North CCR, the unconstrained capacity shall be determined and the limiting CNEC duly identified in any case, even if there is an allocation constraint in place. This allows to estimate the MACZT in all the market time units (but those ones where a failure in the process occurs). For this reason the data sent by Coreso to ACER don't include any information on the allocation constraints.

*3.d **ARERA assessment***

3.19 Differently from the previous years, when unilateral estimation provided by Terna were exploited, for 2022 ARERA bases its national assessment of the 70% rule on joint information defined by all the TSOs of the CCR or by the competent RCCs. Namely the following set of data are used:

- the data sent by Coreso to ACER for the 70% monitoring, related to the entire year;
- the list of the allocation constraints applied in the joint calculation process, provided by Terna to ARERA, related to the entire year;
- the report on the coordinated validation sent by the TSOs of Italy North CCR to the national regulatory authorities related to the first semester of 2022; these reports mark all the market time units where a reduction of the cross-border capacity is disposed because of lack of remedial actions;
- the reduction reports submitted by TSCNET to ACER and the national regulatory authorities pursuant to Article 16(3) of Regulation (EU) 2019/943, related to the second semester of 2022; these reports summarize the reasons behind each reduction of the cross-border capacity, pointing out whether the reduction is due to a coordinated validation or to an individual validation; in the latter case the list of the TSOs asking for the reduction is given as well.

3.20 Moreover, ARERA deems that the Swiss agreement is fully in line with the European Commission letter dated 16 July 2019 The absence of a formal approval by the regulatory authorities, despite being mentioned in the letter, cannot be considered a blocking point, since

[17] Including the interconnectors that are usually modelled twice, once for each involved TSO.

in some countries the authorities don't have power at national level for such decisions. What is important is instead fulfilling the other preconditions stated in the letter, i.e. (a) the consideration of third country constraints in the EU capacity calculation process, (b) the consideration of the EU constraints in the third country capacity calculation process, (c) the presence of a proper cost sharing mechanism in place. Italy North CCR matches all the three items: a full capacity calculation looking at all the CNECs in all the countries including Switzerland has been in place since the very beginning (items (a) and (b)) and a cost sharing mechanism started at the beginning at 2022. Therefore, all the flows with Switzerland can be counted towards the 70%.

3.21 Coming to the main results, ARERA conducts its own assessment according to the considerations and the process illustrated in Section 2.

3.22 First the level of cross-border capacity is evaluated looking at all the borders as an equivalent one: the level of cross-zonal capacity made available on the limiting CNEC is depicted, independent of the geographical location of this CNEC. The outcome is reported in Figure 2 (without the information about the allocation constraints, Coreso data are used) and in Figure 3 (highlighting the presence of the allocation constraints for the market time units where the 70% rule is not matched, Coreso data complemented by Terna list about allocation constraints are used).

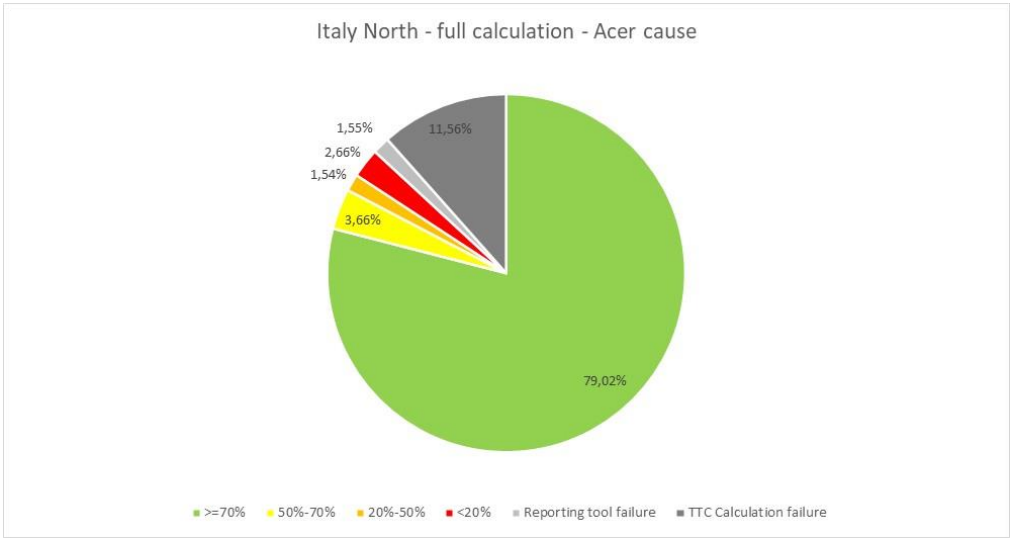


Figure 2 – ARERA assessment for Italy North CCR for 2022 – source: ARERA rielaboration based on Coreso data

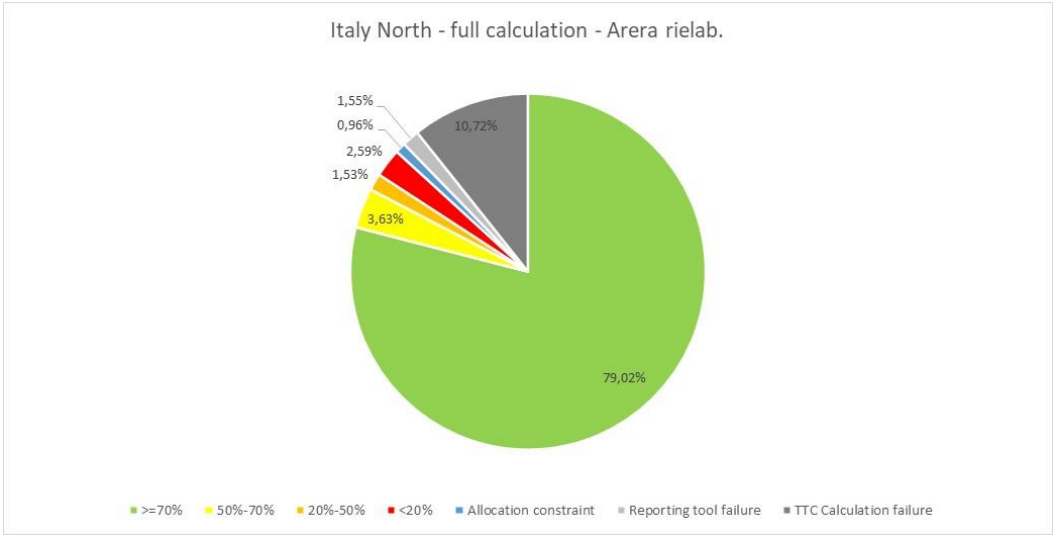


Figure 3 – Assessment with allocation constraints - source: ARERA rielaboration based on Coreso and Terna data

3.23 The 70% rule is respected in 79,02% of the market time units, witnessing a significant level of compliance of the Italy North capacity calculation process. Compared with the ACER assessment in Figure 1, it's evident that the 70% rule is matched by Swiss limiting CNECs as well.

3.24 The allocation constraints occurred in 5,72% of the market time units (501 market time units on 8760 for the whole year), but only in 0,96% of the market time units the application of these constraints lead to a level of cross-border capacity below 70% (0,11% of the market time units) or to a failure in the capacity calculation process (0,85% of the market time units). In all the other cases the 70% rule is nonetheless matched. This situation is reflected in Figure 3, where the portions associated to a missing 70% rule or to a failure in the capacity calculation process are reduced with respect to Figure 2.

3.25 Moving forward, ARERA investigates the reasons behind the level of cross-border capacity below the 70%: looking at the reduction report, it's assessed whether the reduction is due to a coordinated validation or to an individual validation by a specific TSO. The outcome is reported in Figure 4 (no allocation constraints information) and in Figure 5 (with information on allocation constraints).

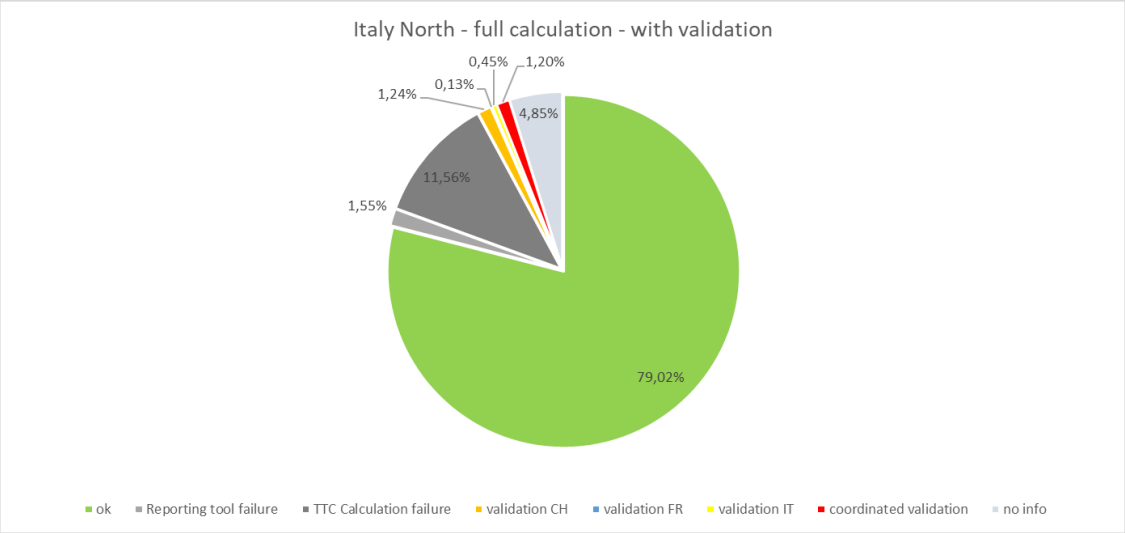


Figure 4 – Validation for Italy North CCR for 2022 – source: ARERA rielaboration based on reduction reports data

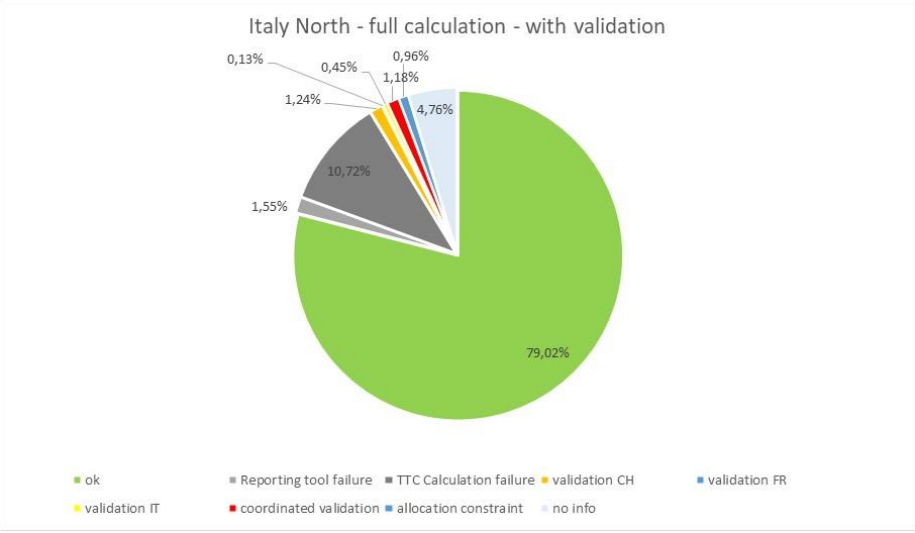


Figure 5 – Validation with allocation constraints – source: ARERA rielaboration based on reduction reports data

3.26 No information is available in 4.85% of the market time units (very light blue in Figure 4): these mostly belong to the first semester for which information on individual validation is missing. In the remaining market time units, the reductions are due to coordinated validation (in red) or to a validation requested by the Swiss TSO (orange) or the Italian TSO (yellow) or the French TSO (light blue), while no individual validation below the 70% minimum level seem to be requested by the Austrian and Slovenian TSOs.

3.27 The allocation constraints have a slight impact on the coordinated validation (0,02% of the market time units), while in all the other cases the allocation constraints occurred either when the capacity calculation fails (0,85% of the market time units, see Figure 3 as well) or when no information on the reduction is available (0,9% of the market time units).

3.28 ARERA asked Terna for an estimation of the costs borne to fulfil the 70% rule. Terna clarified that in 2022 for Italy North CCR no significant costs occurred since no costly remedial actions was activated and the flows were managed and optimized by the mean of non-costly actions.

3.e A comparison between the reports

3.29 The set of data provided by Coreso allows a comprehensive assessment of the level of cross-border capacity for the Italy North CCR, without the need to account for unilateral estimation by Terna.

3.30 The consistency between the ACER report and the national one is thus ensured. There are nonetheless some differences:

i) ACER doesn't include any information on the allocation constraints, since it doesn't receive any data by Coreso on this topic; ARERA auspicates that for the next years information on the presence of the allocation constraints can be given, independent of the estimation of the MACZT;

ii) ARERA doesn't limit the assessment at the monitoring of the level of the cross-zonal capacity made available by the TSOs, but it tries understanding the reasons behind level of capacity below the 70%; this investigation is fundamental to identify the TSOs to blame for not offering a proper level of cross-zonal capacity according to the approach illustrated in Section 2.

3.31 Given what above, Table I summarizes the main findings in terms of responsibilities, taking into account the allocation constraints.

TABLE I – FINDINGS FOR RESPONSIBILITIES IN ITALY NORTH CCR

	70% rule matched	16(3) 70% reduction	IT 70% reduction	FR 70% reduction	CH 70% reduction	Allocation constraints	No info available	Calculation failures	Reporting failures
MTUs	6922	103	39	11	109	84	417	939	136
%	79,02%	1,18%	0,45%	0,13%	1,24%	0,96%	4,76%	10,72%	1,55%

3.32 Terna is surely compliant in the green cells because either the 70% is matched by the limiting CNEC (and thus by all the CNECs as explained in Section 2) or there is an allocation constraint that is covered by the derogation granted by ARERA.

3.33 In the light green cells the level of cross-border capacity is below the 70%, but this is due to a lack of remedial actions (coordinated validation) or by a reduction requested by another TSO. In the former case the reduction is allowed by Article 16(3) of Regulation 2019/943, hence no TSOs can be blamed, while in the latter case Terna can be considered compliant because it accepts the value stemming out from the capacity calculation process and consistent with the 70% rule.

3.34 Terna is surely responsible in the red cell: it asks for a reduction during the individual validation.

3.35 The yellow cell would require a deeper investigation.

3.36 To conclude, Terna is compliant with the provisions of the Regulation 2019/943 in 82,52% of the market time units, while only in less than 0,50% has surely offered a level of cross-border capacity below the 70%. In the remaining market time units a proper assessment is impossible to achieve because of lack of information or failures in the processes.

4 Italy – Greece border

4.a Capacity calculation process

4.1 Italy – Greece border belongs to GRIT CCR that implements a capacity calculation process based on a cNTC approach.

4.2 Namely, being the Italy – Greece border a pure DC interconnection[18], the computation is simplified and the full thermal capacity (500 MW) is usually offered to the market, but in case there is the need to reduce the flows because of congestions in the AC networks in Italy and/or in Greece.

4.3 The computation is delegate to the regional coordination centre SEleNe that acts through the regional desk Esperia based in Rome.

4.b ACER monitoring

4.4 Figure 7 reports the ACER assessment for DC borders: they are all grouped in a single graph because of similar behaviour.

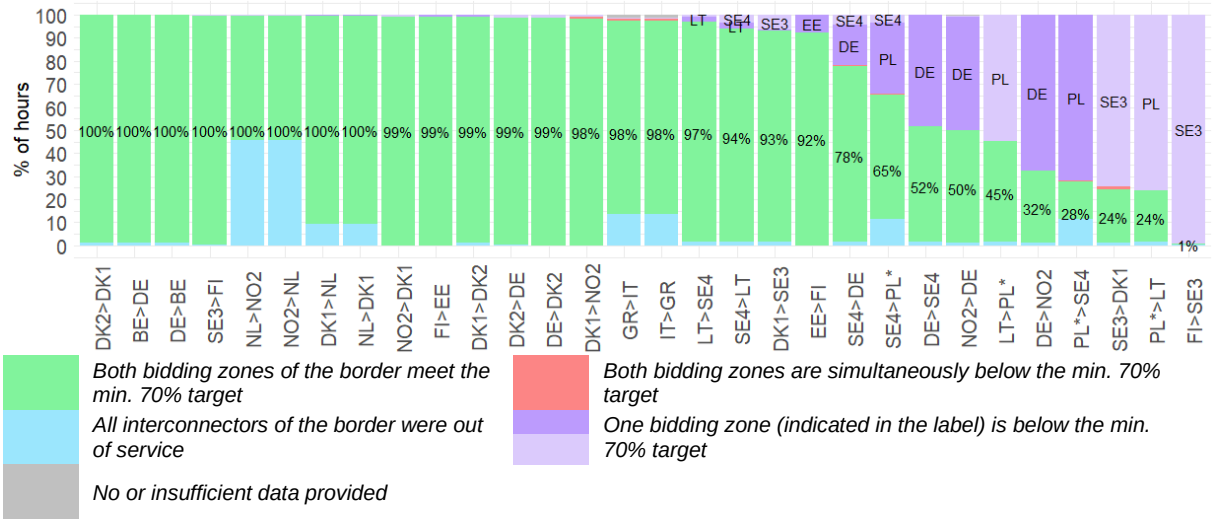


Figure 7 – ACER assessment for DC borders for 2022 – source: ACER report

4.5 Unfortunately the 70% rule is respected only in 98% of the market time units, with slightly more than 10% of the market time units where the cable is marked as unavailable (light blue portion).

4.6 This represents a drawback with respect to performances achieved in the previous years when the 70% rule was matched in 100% of the market time units.

[18] There is one DC cable from Galatina in Italy to Arachthos in Greece.

4.c ***ARERA assessment***

4.7 The cable underwent a major fault at the reactor in Galatina station in August 2022 leading to more than 20 days of unavailability. This, combined with the ordinary maintenance (lasting for about 4-5 weeks) and some minor faults, gives a global unavailability for 1208 market time units (13,79%).

4.8 5 days (120 market time units – 1,37%) are missing because of issues in the input data preparation and in the communication between Terna and the competent regional coordination centre.

4.9 In 63 market time units (0,72%) the capacity is effectively reduced. Namely, in 55 market time units the reduction was requested by the Greek because of unavailable network elements close to the Greek cable station and lack of alternative remedial actions, while in 8 market time units the reduction was triggered by Terna for a similar situation close to the Italian cable station. In both cases the reduction, being due to a lack of remedial actions, shall be deemed consistent with the Regulation 2019/943, hence no TSOs can be blamed.

4.10 In conclusions, Terna can be considered compliant with the Regulation 2019/943 in 98,63% of the market time units, while a deeper investigation would be useful for the remaining 1,37% for which no computation was possible.

4.11 The assessment is pretty similar to the ACER one, the only difference being in the fact that ARERA investigates the reasons behind a level of cross-zonal capacity below the 70%.

4.12 No significant costs were reported by Terna: in the only cases where some potential problems may arise on the local network in Italy and in Greece, the overall cross-border capacity was ex-ante reduced.

5 Italian internal bidding zones

5.a ***Capacity calculation process***

5.1 Italian internal bidding zones belong to GRIT CCR as well. The cross-zonal capacity has been computed since the opening of the electricity market in 2004 by the mean of a cNTC approach, monitoring both the current and the voltage constraints. In specific sections (e.g. borders with Sicily) dynamic stability has been considered as well.

5.2 Before the entry into force of the CACM Regulation, NTC values were estimated on a yearly basis and adjusted on a daily basis in case of significant outages or to take into account the expected load and renewable production levels by the mean of proper sensitivities.

5.3 With the entry into force of the CACM Regulation, the capacity calculation process was adjusted to be compliant with the new regulatory framework foreseeing a daily computation. The first version of the capacity calculation methodology was approved in July 2018. During the implementation phase the methodology was further amended to take into account the 70% rule: the final version of the methodology was approved in December 2020 and its implementation ended on 3 August 2021. As for the cable with Greece, the capacity calculation is run by SEleNe through its regional desk Esperia.

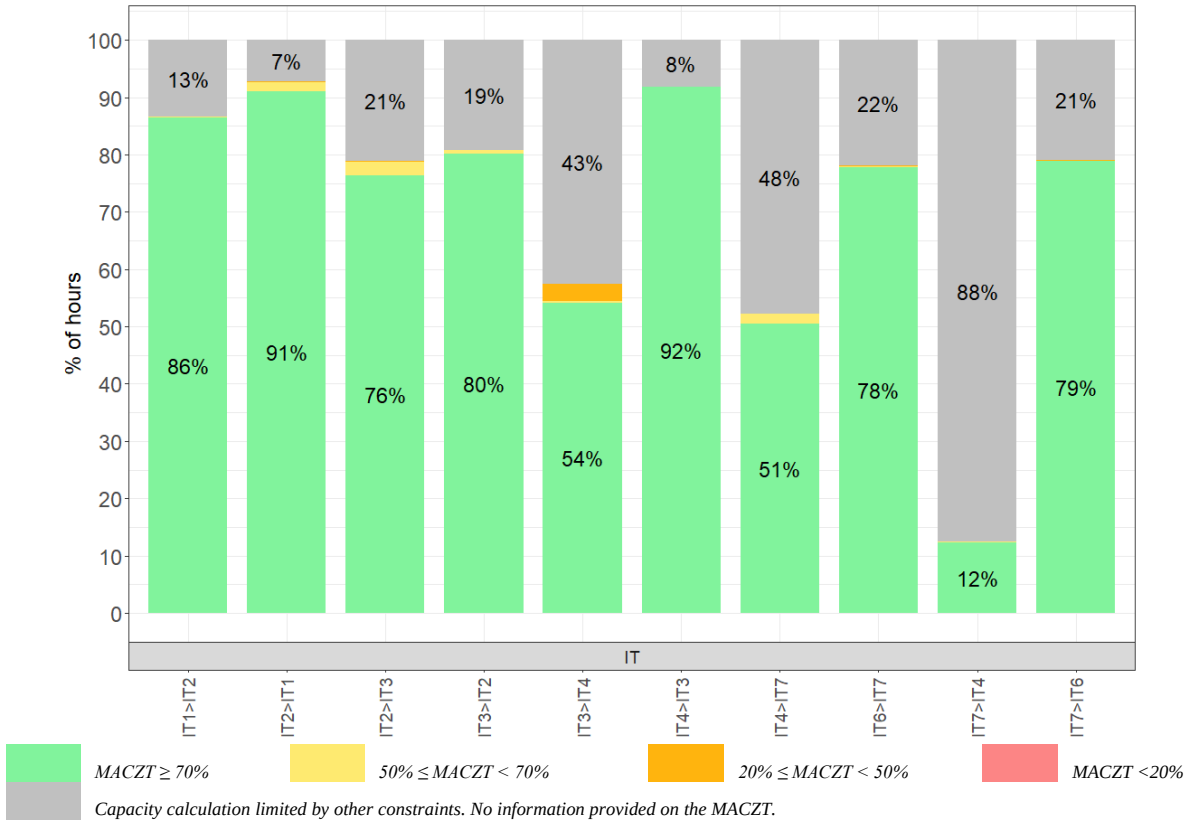
5.4 In order to allow a smooth and secure transition towards the new methodology, a cap was applied aimed to avoid an extreme difference between the daily calculation outcomes and the yearly estimations. This might impede in some scenarios to reach the 70% target. The cap has

been definitely phased out since 22 March 2022, ensuring that the 70% is matched in all the scenarios.

5.b ***ACER monitoring***

5.5 ACER bases its assessment on the data provided by Esperia.

5.6 Figure 7 summarizes the main findings. The borders with Sardinia are not considered, since for them no MACZT information was given because the related cross-zonal capacity is always determined to ensure the operational stability of the Sardinia network.



IT1	*Italy NORD*	*IT6*	*Italy SICI*
IT2	*Italy CNORD*	*IT5*	*Italy SARD*
IT3	*Italy CSUD*	*IT7*	*Italy CALA*
IT4	*Italy SUD*		

Figure 7 – ACER assessment for Italian internal bidding zone borders – source: ACER report

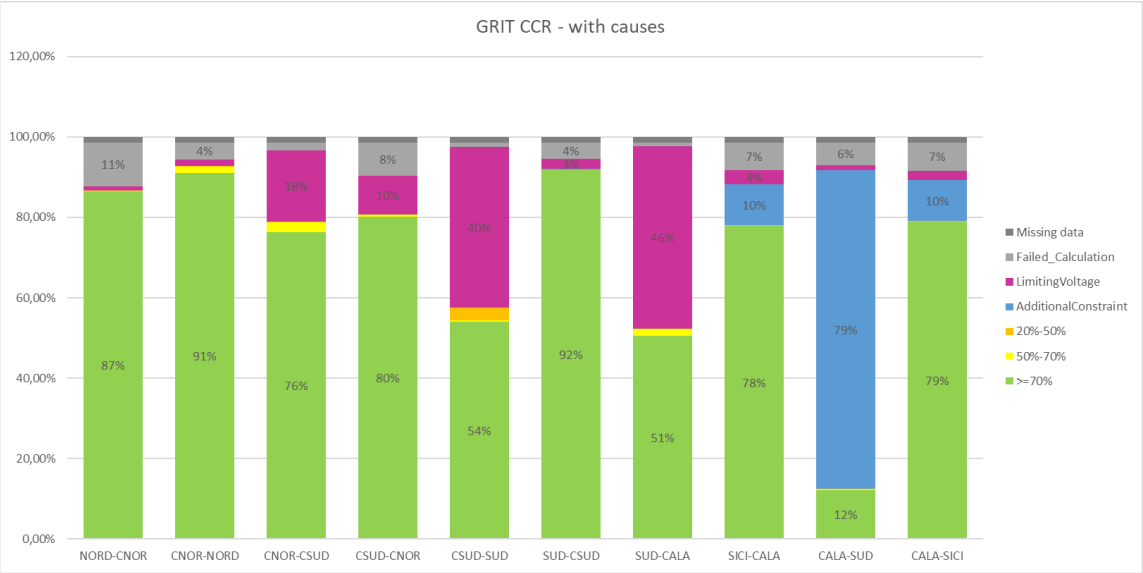
5.7 The grey area includes all the market time units for which no information on the MACZT is provided: this may be caused either by a failure in the calculation process or by another constraint different from current constraints limiting the cross-zonal capacity.

5.8 Neglecting the grey areas, the 70% rule is matched almost everywhere, but in few cases for the borders NORD-CNORD, CNORD-NORD, CNORD-CSUD, CSUD-CNORD, CSUD-SUD and SUD-CALA.

5.c ***ARERA assessment***

5.9 ARERA bases its own national assessment on the same set of data sent by Esperia to ACER, complemented by some specific information requested to Terna about the missing data.

5.10 Figure 8 summarizes the main findings.



5.11 The data about matching the 70% rule (green area) resembles what was already highlighted by ACER, the only difference due to the rounding.

5.12 ARERA differentiates the grey area, separating the different constraints affecting the capacity calculation and pointing out the missing data.

5.13 For some borders the voltage constraints (purple) is quite relevant, while for other borders other additional constraints (blue) play the most relevant role. In both cases these constraints can be related to lack of proper regulating capacities, witnessing that no alternative remedial actions could be introduced to further increase the level of the cross-border capacity.

5.14 Terna can be thus considered compliant in almost all the market time units, with only a few ones not matching the 70% rule. But for the missing data, it's nonetheless worth remarking that the margins below the 70% threshold are due to the application of the cap that blocked the capacity calculation process before the 70% level is matched. These situations occurred till 17 March 2022, and no further issues have been reported since then.

5.15 According to the information provided by Terna, especially on the CSUD-SUD border, the 70% rule lead to a cross-zonal capacity significantly higher than the one that could be sustained according to the operational security, but in most cases this cross-zonal capacity was not exploited by the market. Only in few cases on the borders CSUD-CNORD, SUD-CSUD, CALA-SUD the cross-zonal capacity increased because of the 70% rule was exploited leading to the activation of proper remedial actions. Terna reported a global cost lower than 100 k€, the overall expense being mitigated by:

- changes in the cross-zonal flow due to the redispatching activities to ensure proper reserve margins;
- close to real time optimization actions that have not been considered in the capacity calculation.

6 Conclusions

6.1 From a pure legal perspective, the granting of a derogation for Italy North CCR exempted Terna from any obligation stemming from the application of the 70% rule on Northern borders in all the market time units with allocation constraints.

6.2 In the above mentioned situations, Terna legal compliance is thus guaranteed by definition, while in all the other cases (Italy – Greece border, Italian internal bidding zone borders and Italy North without allocation constraints) the 70% compliance shall be properly assessed.

6.3 In Italy North CCR the analysis of the reduction reports allows to better understand the reasons behind a missing 70% rule match. According to this, Terna gets a positive assessment (including the allocation constraints) in more than 82% of the market time units. A failure occurred in around 13% of the market time units: this is an increase with respect to the values occurred in 2021. Slightly less than 5% of the hours cannot be monitored because of missing information: this is mainly related to the first semester when the reduction report by TSCNET was not available. For the next years this aspect should be mitigated because the reduction report are now regularly provided.

6.4 In Greece-Italy CCR, the Greece-Italy border performed quite well with 98% of the market time units matching the 70% rule. The overall performances is nonetheless a bit worse than in the previous years due to a reduction of cross-border capacity because of a lack of alternative remedial actions in 63 market time units. There are also 120 market time units with missing data.

6.5 For the Italian bidding zone borders the activation of the 70% adjustment in August 2021, combined with the phase out of the cap in March 2022 ensured the 70% rule fulfilment in all the market time units when the cross-zonal capacity is limited by a current constraint. Due to specificities of the Italian transmission network, voltage and stability constraints play a significant role in a number of borders; anyhow in all these cases, Article 16(3) of the Regulation 2019/943 applies and the reduction below the 70% is allowed because these constraints indicate a lack of alternative remedial actions. Hence the overall performance by Terna is outstanding, practically leaving the problems only to the missing data.

6.6 Coming to a comparison between ACER and ARERA assessment, when relying on consistent datasets the two entities get pretty similar results.

6.7 Nonetheless some differences popped up. First ARERA monitored the entire Northern borders, assessing the 70% compliance with respect to the CNECs in the coordinated capacity calculation process independent of their geographical location. ACER, instead, looked at each single border and neglected the Swiss elements.

6.8 Then, ARERA investigated the reasons behind the missing 70% rule match, while ACER limited to point out the low level of cross-zonal capacity made available by the TSOs.