Methodology for long-term cross-zonal capacity calculation for Italy North CCR in accordance with Article 10 of the Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a Guideline on Forward Capacity Allocation

~~February~~ November 2026

Contents

WHEREAS **3**

GENERAL PROVISIONS **7**

ARTICLE 1: SUBJECT MATTER AND SCOPE 7

ARTICLE 2: DEFINITIONS AND INTERPRETATION 7

METHODOLOGY FOR LONG-TERM CROSS-ZONAL CAPACITY CALCULATION **9**

ARTICLE 3: APPLICATION OF THIS METHODOLOGY 9

ARTICLE 4: CAPACITY CALCULATION APPROACH 9

ARTICLE 5: SELECTION OF HISTORICAL DAY-AHEAD OR INTRADAY CROSS-ZONAL CAPACITY DATA 9

ARTICLE 6: STATISTICAL ANALYSIS OF HISTORICAL DATA 10

ARTICLE 7: RELIABILITY MARGIN METHODOLOGY 11

ARTICLE 8: THE YEARLY CAPACITY CALCULATION 11

ARTICLE 9: THE MONTHLY CAPACITY CALCULATION 11

ARTICLE 10: CROSS-ZONAL CAPACITY VALIDATION METHODOLOGY 12

FINAL PROVISIONS **13**

ARTICLE 11: FALLBACK PROCEDURES 13

ARTICLE 12: PUBLICATION AND IMPLEMENTATION OF THE CCC-FCA METHODOLOGY PROPOSAL 13

ARTICLE 13: LANGUAGE 14

ANNEX 1 ..... **15**

HIGH LEVEL BUSINESS PROCESSES: YEARLY AND MONTHLY CAPACITY CALCULATION 15

STATISTICAL ANALYSIS OF HISTORICAL DATA 17

Building of historical full-grid NTC duration curve *17*

New grid investments *19*

Treatment of Go Live of new grid elements for the yearly/monthly profile computation *20*

THE YEARLY CAPACITY CALCULATION 24

The hourly NTC profile computation for the yearly timeframe *24*

The hourly NTC profile modification to consider the effect of new grid investments *25*

THE MONTHLY CAPACITY CALCULATION 26

The hourly NTC profile computation for the monthly timeframe *26*

ANNEX 2 ..... **28**

IMPROVED EFFICIENCY OF STATISTICAL APPROACH 28

Qualitative Argumentations *28*

Net position forecast dependency *30*

Incremental Cost estimation *31*

WHEREAS

1. This document sets out the common coordinated capacity calculation methodology in accordance with Article 10 of Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on Forward Capacity Allocation (hereafter referred to as the "FCA Regulation") to be applied in Italy North CCR, as defined in accordance with Article 15 of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (hereafter referred to as the "CACM Regulation"). This methodology is hereafter referred to as the "methodology for long-term cross-zonal capacity calculation for Italy North CCR" or as "LT CCM".
2. The LT CCM takes into account the general principles and goals set in the FCA Regulation as well as Regulation (EC) No 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (hereafter referred to as "Regulation (EC) 2019/943").
3. This proposal takes into account the general principles and goals set the "CACM Regulation", to which the FCA Regulation explicitly refers. Ensuring optimal use of the transmission infrastructure and operational security, which are among the objectives of capacity allocation and congestion management cooperation, laid down by Article 3 of CACM Regulation, requires the inclusion of Third Countries' grid elements in the capacity calculation process of Italy North CCR. CACM Regulation's objectives cannot be achieved in any other way. This inclusion is in line with Article 13 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as "SOGL Regulation"), providing that EU TSOs must establish "*cooperation concerning secure system operation*" with non-EU TSOs belonging to the same synchronous area via an agreement with these non-EU TSOs. Moreover, the inclusion is also auspicated by the additional guidance of the European Commission dated 16/07/2019 regarding the consideration of third countries in capacity calculation and their relevance to comply with the 70% requirements pursuant to Article 16(8) of Regulation (EC) 2019/943.
4. The inclusion of Third Countries' grid elements is also the most efficient way to take into account the effective structure of the grid in Italy North CCR. In order to comply with the requirement laid down by EU Regulation and to be adherent to the effective grid structure, this methodology includes Third Countries as Technical Counterparties, foreseeing a TSO-TSO based contractual framework to govern the cooperation between these parties and the Italy North TSOs.
5. Coordinated capacity calculators will take into account the entire network of the Italy North CCR and include Technical Counterparties' remedial actions into coordinated remedial actions' preparation and the optimization procedure. In order to be taken into consideration in the capacity calculation process and enter into a TSO-TSO based contractual framework, Technical Counterparties must fulfil the conditions laid down by Article 1.3 of the "*All TSOs' proposal for a common grid model methodology in accordance with Article 18 of Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on forward capacity allocation*", applicable to TSOs from jurisdictions outside the area referred to in Article 1(2) of CACM Regulation. The contractual framework between Italy North TSOs and the Technical Counterparty will include LT CCM methodology's provisions and ensure that the Technical Counterparty is contractually bound by the same obligations as the ones binding upon Italy North TSOs by virtue of EU Regulations. Such agreement will govern mutual obligations and responsibilities of the Technical Counterparty with Italy North TSOs in relation to the capacity calculation process for long term timeframes.
6. According to Article 4(8) of the FCA Regulation, the LT CCM shall include a proposed timescale for the implementation and a description of the expected impact on the objective of the FCA

Regulation. The timescale for the implementation is included in Article 12. The impact on the objective of the FCA Regulation is described in point (7) of this Whereas section.

7. The LT CCM contributes to and does not in any way hinder the achievement of the objectives of Article 3 of the FCA Regulation, to the benefit of all market participants and electricity and consumers.
8. The LT CCM serves the objective of promoting effective long-term cross-zonal trade with long-term cross-zonal hedging opportunities for market participants (Article 3(a) of the FCA Regulation) by taking into account the hedging needs of market participants by calculating reliable capacities at an early stage and making them available to market participants. This makes long-term planning possible since it ensures that the cross-zonal capacity is calculated in such a way that the same LT CCM will apply to all market participants on all respective bidding zone borders in the Italy North CCR, thereby ensuring a level playing field amongst market participants.
9. The LT CCM contributes to the optimal calculation of long-term capacity (Article 3(b) of the FCA Regulation) since it takes into account historical data, outages and new grid elements. It provides a calculation approach, coordinates the timings of input delivery and validation requirements of the capacity calculation between Italy North TSOs, the Technical Counterparty and the Coordinated Capacity Calculator of Italy North (CCC of Italy North).
10. The LT CCM contributes to the objective of providing non-discriminatory access to long-term cross-zonal capacity (Article 3(c) of the FCA Regulation) by adhering to the rules of the Single Allocation Platform and by publication of the results, hence ensuring non-discrimination between market participants.
11. The LT CCM is designed to ensure a fair and non-discriminatory treatment of Italy North TSOs and the Technical Counterparty, the Agency for the Cooperation of Energy Regulators (hereafter referred to as "ACER"), National Regulatory Authorities (hereafter referred to as "NRAs") and market participants (Article 3(d) of the FCA Regulation) since it has been developed and adopted within a process that ensures the involvement of all relevant stakeholders and independence of the approving process.
12. This LT CCM also contributes to the objective of respecting the need for a fair and orderly forward capacity allocation and orderly price formation (Article 3(e) of the FCA Regulation) by making available in due time the information about cross-zonal capacities to be released in the market, and by ensuring a backup solution when capacity calculation fails to provide results.
13. The LT CCM enables Italy North TSOs to provide market participants with reliable information on cross-zonal capacities and import/export limits for year and month ahead allocation in a transparent way and at the same time. This includes regular reporting on specific processes within capacity calculation. The LT CCM therefore contributes to the objective of transparency and reliability of information (Article 3(f) of the FCA Regulation).
14. Finally, the LT CCM provides a long-term signal for efficient investments in transmission, generation and consumption, and thereby contributes to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union (Article 3(g) of the FCA Regulation).
15. The LT CCM covers the annual and monthly long-term time frames (pursuant to Article 9 of the FCA Regulation).
16. Italy North TSOs and the Technical Counterparty determine the final capacity values to meet the form of product regulated in the Italy North Design of Long-Term Transmission Rights (in accordance with Article 31.3 of the FCA Regulation). Those capacity values are subject to the Italy

North Methodology for splitting long-term cross-zonal capacity (in accordance with Article 16 of the FCA regulation).

17. The LT CCM is based on forecast models of the transmission system. The inputs of the LT CCM are determined more than a year, respectively more than a month, before the electricity delivery date taking into account the available knowledge at that time. Therefore, the outcomes are subject to inaccuracies and uncertainties that are higher than the inaccuracies and uncertainties of the day-ahead capacity calculation methodology. The aim of the reliability margin is to cover the risk induced by these forecast errors.

18. The LT CCM shall be compatible with the day-ahead and intraday capacity calculation methodologies (Article 10(3) of the FCA Regulation). This compatibility is achieved by adopting a statistical approach considering historical inputs from the day-ahead or intraday capacity calculation methodology.

    In case the CE DA CCM, which is based on a flow-based approach, should go-live while the IN LT CCM is still operational, Italy North TSOs will have to develop and submit a solution to allow the extraction of DA and ID NTC for the borders of the IN Region as an input to the statistical approach before the implementation of the CE DA CCM, taking in due account the duration of the implementation process. IN NRAs and IN TSOs commonly agreed in December 2025 this transitory solution should be submitted to the IN NRAs as an amendment proposal of the IN LT CCM.

19. The statistical approach mentioned in paragraph 18 increases the economic efficiency of the capacity calculation and allows to better address the uncertainties in long-term cross-zonal capacity calculation while ensuring the same level of system security. Namely:

    a. The statistical approach directly benefits from the better forecasts in the short-term process, whenever an improvement on short-term CCM is implemented.

    b. The same high level of firmness for a scenario-based approach would lead to a higher reliability margin value and consequently a lower final capacity than the statistical approach, as described in Annex 2.

    c. With a scenario-based approach, Italy North TSOs and the Technical Counterparty would be obliged to use reference scenarios (in accordance with the FCA Regulation). Such scenarios only refer to ad-hoc cases created for the whole continental Europe and referring to generic scenarios, but do not represent any situations which may be meaningful for a long-term CC in the Italy North CCR. This could possibly lead to reduced capacities in the region. To cover such specific cases, several additional scenarios for NTC calculation would be needed and approved at ENTSO-E level with the process in force.

    d. With a scenario-based approach, an improvement on the reference scenarios, supposed to be congestion free, would be always necessary. As a consequence, the Remedial Action Optimization process would have to be adapted for the long-term timeframe, which requires an unreasonable technical effort, as shown in cost estimations in Annex 2. Besides, the availability of the remedial actions applied during real-time is difficult to ensure so far ahead.

20. Italy North TSOs and the Technical Counterparty remain responsible for maintaining operational security regardless of whether there is a coordinated application of capacity calculation or not. For this reason, they need to validate the calculated cross-zonal capacities to ensure that they do not violate operational security limits. This validation is performed in a coordinated way to verify whether a coordinated application of remedial actions can address possible operational security issues. This step may lead to reductions of cross-zonal capacities below the values originally calculated. In order to avoid undue discrimination, these reductions have to be performed in a coordinated way. In case of missing coordination, the results might be that an Italy North TSO or

the Technical Counterparty might have more capacities to the detrimental effect (operational security issues) of another.

21. Transparency and monitoring of capacity calculation are essential for ensuring its efficiency and understanding. This methodology establishes significant requirements for Italy North TSOs and the Technical Counterparty to publish the information required by market participants, to report the information to regulatory authorities and to analyse the impact of capacity calculation on the market functioning.

GENERAL PROVISIONS

Article 1:
Subject matter and scope

1. The long-term common capacity calculation methodology as determined in this LT CCM is the methodology developed in accordance with Article 10 seq. of the FCA Regulation.
2. Considering the structure of the grid, Third Countries' borders are taken into account via a separate TSO-TSO based contractual framework in the capacity calculation process and referred to, in this methodology proposal, as Technical Counterparties.

Article 2:
Definitions and interpretation

1. For the purposes of the LT CCM, the terms used shall have the meaning given to them in Article 2 of Regulation (EC) 2019/943, Article 2 of Regulation (EC) No 2013/543 of 14 June 2013 on submission and publication of data in electricity markets and amending Annex I to Regulation (EC) No 714/2009 of the European Parliament and of the Council, Article 2 of the CACM Regulation and Article 2 of the FCA Regulation.
2. In addition, the following abbreviations and notations shall apply:

ACER	Agency for the Cooperation of Energy Regulators
BZB	Bidding Zone Border standing also for set of BZB (i.e. technical profiles) where applicable for avoidance of doubt including the Italian-Swiss border
CACM	Capacity Allocation and Congestion Management
CC	Capacity Calculation
CCC	Coordinated Capacity Calculator, as defined in article 2(11) of the CACM Regulation
CCM	Capacity Calculation Methodology
CCR	Capacity Calculation Region, as defined in article 2(3) of the CACM Regulation
D-2	Two days ahead
EC	European Commission
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
ID	Intraday
IVA	Individual Validation Adjustment
LT	Long-Term
LTCC	Long-Term Capacity Calculation
LT CCM	Long-Term Capacity Calculation Methodology
NRA	National Regulatory Authority
NTC	Net Transfer Capacity
OPC	Outage Planning Coordination
SOGL	System Operation Guidelines
TSO	Transmission System Operator
TTC	Total Transfer Capacity

3. In addition, the following definitions shall apply:
   a. 'TERNA' is the Italian Transmission System Operator;
   b. 'RTE' is the French Transmission System Operator;
   c. 'APG' is the Austrian Transmission System Operator;
   d. 'ELES' is the Slovenian Transmission System Operator;
   e. Allocation Constraints means 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;
   f. 'CNTC' means Coordinated Net Transfer Capacity approach for capacity calculation;
   g. 'M-1' means the month before the month of delivery;
   h. 'NTC' means the net transfer capacity that amounts to the maximum total exchange program (MW) for commercial purposes between adjacent bidding zones for each market time unit in a specific direction. NTC is obtained by subtracting the reliability margin from the TTC;
   i. 'Off-Peak Hours' means the hours from 23.00 until 06.59 from Monday to Saturday and all hours for Sunday ;
   j. 'Peak Hours' means the hours from 07.00 until 22.59 from Monday to Saturday;
   k. 'Season' means a part of the year with similar weather conditions. For the scope of this document, the year is conventionally composed by two seasons: SUMMER (from the 1st of May till 30th of September) and WINTER (from the 1st of October till the 30th of April);
   l. 'Technical Counterparty' is any non-EU TSO to be included in the procedures of this methodology through respective TSO-TSO based contractual framework;
   m. 'Third Country' means country from jurisdiction outside the area referred to in Article 1(2) of the FCA Regulation;
   n. 'TTC' means the total transfer capacity that amounts to the maximum total exchange program (MW) complying with the operational security limits between adjacent bidding zones for each market time unit in a specific direction;
   o. 'Y-1' means the year before the year of delivery.

4. Season(s) and Peak/Off-Peak Hours(s) can be combined as four Seasonal Period(s):
   i. Winter peak;
   ii. Winter Off-peak;
   iii. Summer peak;
   iv. Summer Off-peak.

5. In this LT CCM, unless the context requires otherwise:
   a. the singular indicates the plural and vice versa;
   b. headings are inserted for convenience only and do not affect the interpretation of this LT CCM; and
   c. any reference to legislation, regulations, directives, orders, instruments, codes or any other enactment shall include any modification, extension or re-enactment of it when in force.

METHODOLOGY FOR LONG-TERM CROSS-ZONAL CAPACITY CALCULATION

Article 3:
Application of this methodology

1. This proposal applies solely to the common capacity calculation methodology for long-term timeframes within the Italy North CCR. For the avoidance of doubt, respective or relevant provisions of this proposal apply to any relevant Technical Counterparty of the Italy North CCR, by virtue of separate TSO-TSO based contractual framework as mentioned above in Article 1:. Common capacity calculation methodologies within other Capacity Calculation Regions or for other timeframes than long term ones are outside the scope of this proposal.

Article 4:
Capacity Calculation Approach

1. A statistical approach based on historical cross-zonal capacity for day-ahead or intraday timeframes calculated in a coordinated manner in the Italy North Region is applied in order to properly take into account all sources of uncertainty related to the long-term capacity calculation timeframes.
2. As input for the long-term capacity calculation timeframes, the latest available historical NTC values will be used, coming from either the D-2 or ID CC which are based on the CNTC approach according to the D-2 & ID CCMs. After Go-Live of CE DA capacity calculation D-2 samples will be replaced by N~~A~~TC extracted values from the unconstrained FB Domains according CE DA Methodology Art. 23~~2~~, which will be used instead of D-2 NTC values

Article 5:
Selection of historical day-ahead or intraday cross-zonal capacity data

1. In order to allow the CCC to perform the relevant capacity calculation process for long term timeframes, the following relevant input data shall be gathered:
   a. the allocated NTC time series of the past three years for each Italy North TSOs and Technical Counterparty's border/direction. In order to minimize the uncertainty in the allocated NTC time series, the most recent NTC sample coming from D-2 and ID capacity calculation processes will be considered for each historical market time unit.~~;~~ After Go-Live of CE DA capacity calculation D-2 samples will be replaced by N~~A~~TC extracted values from the unconstrained FB Domains according CE DA Methodology Art. 23~~52~~, which will be used instead of D-2 NTC values,
   b. the NTC reductions (maintenance and additional constraint) time series of the past three years for each Italy North and Technical Counterparty's border/direction;
   c. Commissioning date of new investments during the past years for each Italy North and the Technical Counterparty's border;
   d. the real time reduction and capacity curtailment time series of the past three years for each Italy North TSO and Technical Counterparty's border/direction. Such data will be used for filtering out NTC samples affected by reduction in real time and curtailments (for which TSOs will assume that allocated capacity was not secure at all);
   e. Exceptional unplanned outage periods over the past three years for each Italy North TSO and Technical Counterparty's border. Such data will be used for filtering out NTC samples affected

by such exceptional situation;

f. Additional information linked to the ~~D-2 and~~ ID CC processes such as red flags, allocation constraints and process fails time series that will be considered as filtering parameters in the statistical analysis;

g. Additional information linked to the FB DA processes such as IVA from IN TSOs and Technical Counterparty and process fails time series that will be considered as filtering parameters in the statistical analysis.

2. After the needed inputs described in the Article 5.1 have been gathered, each sample is matched with the respective hourly NTC reductions (maintenance and additional constraint) and the eventual real time reduction/curtailment, red flags, IVA, triggering of export corner and process fails linked to D-2 and ID CC processes.
3. The time window to be used for statistical analysis is the last three years.

Article 6:
Statistical analysis of historical data

1. A statistical analysis of historical data is performed by the following steps below:
   a. The initial dataset for long-term capacity calculation is composed of historical cross zonal capacity values per border in both directions (import and export) as gathered according to Article 5.
   b. All ID NTC values which correspond to non-representative hours in the Italy North CCR are excluded from the dataset, in particular timestamps impacted by:
      - Allocation Constraints~~;~~
      - real time capacity reductions;
      - capacity curtailments;
      - exceptional unplanned outage periods;
      - ~~D-2 and~~ ID capacity calculation process fails,
      - Red flags
   c. All D-2 NTC values which correspond to non-representative hours in the CE CCR are excluded from the dataset, in particular timestamps impacted by:
      - CE DA FB capacity calculation process fails,
      - IVA application from IN TSOs and Technical Counterparty.
   ~~c.~~d. For each historical NTC value per border, the associated NTC reduction per border (if any) is added in order to obtain a capacity corresponding to a full grid situation (without maintenance which could limit the capacity).
   ~~d.~~e. New grid elements commissioned during the historical time window are specifically considered in order to include their impact on all the historical NTC values, as described in Annex 1.
   ~~e.~~f. The initial dataset is divided in four different Seasonal Periods.
2. For each Seasonal Period and border/direction, NTC values are ordered to obtain historical Italy North's full grid NTC duration curves.
3. A risk level of 3% is fixed to allow the selection of long-term capacity per border for each Seasonal Period.
4. The Italy North TSOs and the Technical Counterparty perform every year an analysis on the historical data of the applied curtailment over the last three years Then, the risk level can be updated

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based on the outcome of this analysis. If the risk level is changed, an amendment to the LT CCM shall be submitted.

5. The hourly bilateral NTC reduction profile (which reflects the maintenance plan of the relevant grid elements for the Italy North and the Technical Counterparty bidding zone borders) and the Allocation Constraints profile for each respective border/direction are computed as follows:
   a. The maintenance NTC reduction profile is calculated considering the historical NTC reduction values associated to the unavailability of network elements which have been coordinated during the past OPC processes;
   b. The Allocation Constraint NTC reduction profile is calculated considering the best hourly forecast the Italy North TSOs and the Technical Counterparty can do at yearly and monthly stage and using the last available information. Such reduction refers to maximum import value linked to voltage regulation and dynamic stability issues that affects the capacity calculation process. Such profile will be provided by each Italy North TSOs and Technical Counterparty per season and border/direction.
6. For yearly computation, new grid investment to be commissioned during the delivery period are not considered. As a consequence, additional yearly capacity is 0.
7. For monthly computation, the new grid investments to be commissioned during the delivery period are treated taking as a reference a percentage X % of the investment value, equal to the additional capacity associated to the investment itself. This percentage is defined for each season, period, border and direction as the ratio between the selected long-term capacity value corresponding to the risk level referred to in paragraph 3 and the capacity value corresponding to a risk level of 70 %.
8. More details about new investments and reduction profiles are given in Annex 1.

Article 7:
Reliability margin methodology

1. Reliability margin long-term capacity calculation approach is taken into account by statistical assessment based on historical cross-zonal capacity for day-ahead or intraday timeframes calculated in a coordinated manner in the Italy North CCR. Italy North TSOs and the Technical Counterparty shall not apply any additional reliability margin in the long-term market time frames. Since in the statistical approach the most recent NTC values between Day-Ahead and Intraday timeframes are considered, the D-2 and ID TRM values are implicitly taken into account, thus covering uncertainties from the real time to D-2/ID timeframes. Then, the definition of a proper risk level covers uncertainties from D-2/ID to yearly and monthly timeframes, related to the volatility of the considered D-2 and ID NTC samples.

Article 8:
The yearly capacity calculation

1. The hourly profile for the bilateral yearly NTC, as detailed in Annex 1, is computed by considering:
   a. the full-grid NTC value for each Seasonal Period obtained from the statistical analysis adopting the risk level pursuant to Article 6(3).
   b. the hourly bilateral NTC reductions profile (which reflect the hourly outage planning impact on the yearly profile as described in Article 6(5)a) coordinated during the yearly OPC process and the hourly Allocation Constraint profile as described in Article 6(5)b.
2. For the statistical analysis, new grid investments are considered as out of service as described in Article 6:.5.

Article 9:
The monthly capacity calculation

1. The monthly timeframe statistical methodology aims at updating the yearly NTC profile computed according to Article 8. As detailed in Annex 1, the monthly NTC profile, is calculated considering as follows
   a. The yearly seasonal "full-grid" NTC values: the monthly "full-grid" seasonal NTC is the value of the corresponding Seasonal Period already calculated in the yearly statistical methodology by using the risk level pursuant to Article 6(3).
   b. An updated version of planned maintenance calendar and related NTC bilateral reductions given by OPC processes: in this way it is possible to update the previous yearly NTC profile by considering possible variations in the yearly planned and "extraordinary" out of service combinations.
   c. Recalculated Additional Constraints values based on most updated input data.
2. In the case of a new grid investment committed during the delivery period, due to the absence of previous historical data provided by the D-2 & ID computations, the monthly profile is modified to include the effect of the new investment(s) by adding on top of the NTC profile the percentage X % of the investment value pursuant to Article 6(7). For each new investment a maintenance plan will be also considered in order to properly compute the new NTC profile for each border/direction.

Article 10:
Cross-zonal capacity validation methodology

1. In accordance with Article 15 of the FCA Regulation, referring to Article 26 of the CACM Regulation, the Italy North TSOs and the Technical Counterparty shall have the right to correct cross-zonal capacity relevant to the Italy North TSO's BZBs for reasons of operational security during the validation process. In exceptional situations cross-zonal capacities can be reduced by all Italy North TSOs and the Technical Counterparty. These potential situations are at least:
   a. an occurrence of an exceptional contingency or forced outage as defined in article 3 of the SOGL Regulation;
   b. an occurrence of a mistake in the input data, that leads to an overestimation of cross-zonal capacity from an operational security perspective.
2. In each quarterly report, the Italy North CCC shall publish the reductions of cross-zonal capacity, separately for coordinated and individual validations. The quarterly report shall include at least the following information:
   a. the identification of exceptional contingencies or forced outages;
   b. the volume of reduction of cross-zonal capacity;
   c. the detailed reason(s) for reduction.
3. The Italy North CCC shall coordinate with the CCCs of neighbouring CCRs during the validation process, ensuring at least that the reductions in cross-zonal capacity are shared with them. The Italy North CCC shall provide Italy North TSOs and the Technical Counterparty with any information on decreased cross-zonal capacity from neighbouring CCRs. Italy North TSOs and the Technical Counterparty may then apply the appropriate reductions of cross-zonal capacities as described in paragraph 1.

FINAL PROVISIONS

Article 11:
Fallback procedures

1. If the CCC fails to provide the yearly capacity in due time each Italy North TSO and Technical counterparty should determine the yearly NTC for its relevant borders on their own. Finally, the lower NTC value is chosen per border.
2. If the CCC fails to provide the monthly capacity in due time each Italy North TSO and Technical Counterparty should determine the monthly NTC for its relevant borders on their own taking into account the yearly NTC and the changes in the outage planning, if any. Finally, the lower of value is chosen per border.

Article 12:
Publication and Implementation of the CCC-FCA methodology

1. Italy North TSOs and the Technical Counterparty shall publish the LT CCM without undue delay after the approval by all NRAs of Italy North CCR.
2. Italy North TSOs and the Technical Counterparty shall start implementing this LT CCM after the NRAs of the Italy North CCR approve it and shall complete the implementation process no later than 01/11/2027. The same obligation shall apply to the Technical Counterparty pursuant to the TSO-TSO based contractual framework referred to in Article 1. The implementation process shall consist of the development of the appropriate IT tools and infrastructure, design of operational processes and at least an internal test and external parallel run if applicable.
3. Once the LT CCM is implemented, Italy North TSOs and the Technical Counterparty shall publish the following information before each long-term auction:
   a. the duration curve of the yearly and monthly NTC full grid profile relevant to determine the long-term capacity, highlighting the value associated to the chosen risk level;
   b. the NTC bilateral hourly profile for both yearly and monthly timeframes, computed starting from NTC full grid and by deducting maintenances and adding new investments; maintenances profile (along with the associated outages) and new investments profile (along with the associate network reinforcements) shall be made available;
   c. for monthly auctions only, a comparison between the NTC bilateral hourly profile computed in the yearly timeframe and the updated NTC bilateral hourly profile computed in the monthly timeframe.
4. Italy North TSOs and the Technical Counterparty shall publicly make available the following reports:
   a. a yearly report issued by mid-December Y-1, providing the distribution of the samples relevant for long term capacity calculation in Y, the chosen risk level and the appropriate justifications, the correction to the samples to take into account historical planned outages and the new investments, the estimated profile of future planned outages in Y and the estimated profile of allocation constraints;
   b. a yearly report issued by January Y+1 comparing the estimated profile of planned outages and allocation constraints adopted for long term capacity calculation with the effective profile of such outages and constraints occurred in Y;

c. a specific report in case a fallback procedure is triggered either in yearly or monthly capacity calculation.

Article 13:
Language

1. The reference language for the LT CCM shall be English.
2. For the avoidance of doubt, where TSOs need to translate the LT CCM into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 4(13) of the FCA Regulation and any version in another language the relevant TSOs shall, in accordance with national legislation, provide the relevant NRAs with an updated translation of this methodology.

Annex 1

High level business processes: Yearly and Monthly capacity calculation

The business process is described as follows:

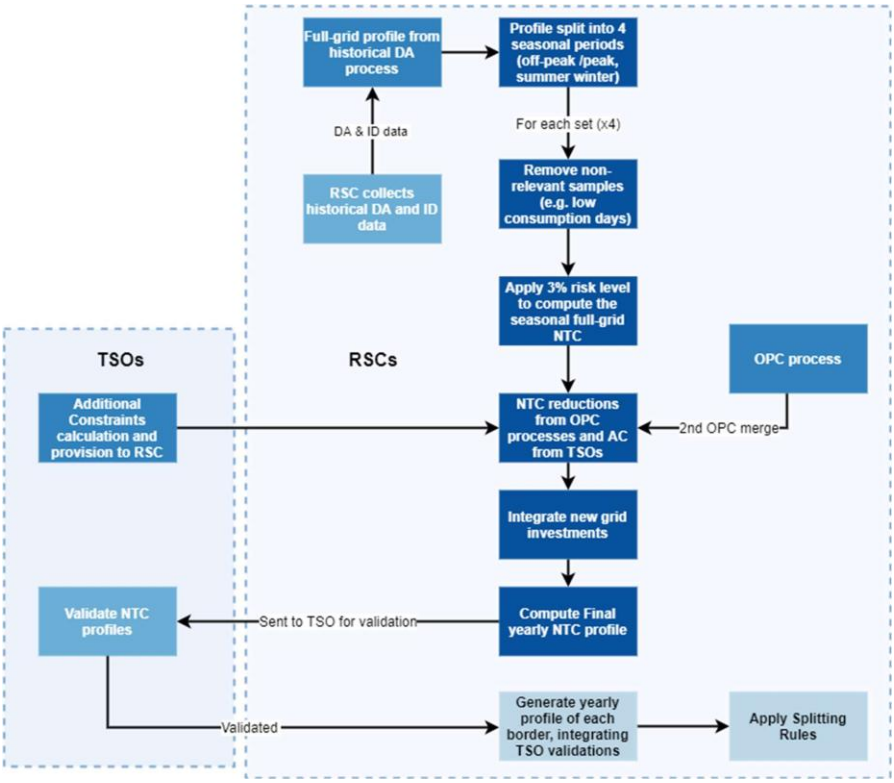

Figure 1: High-Level Business Process of the yearly capacity calculation

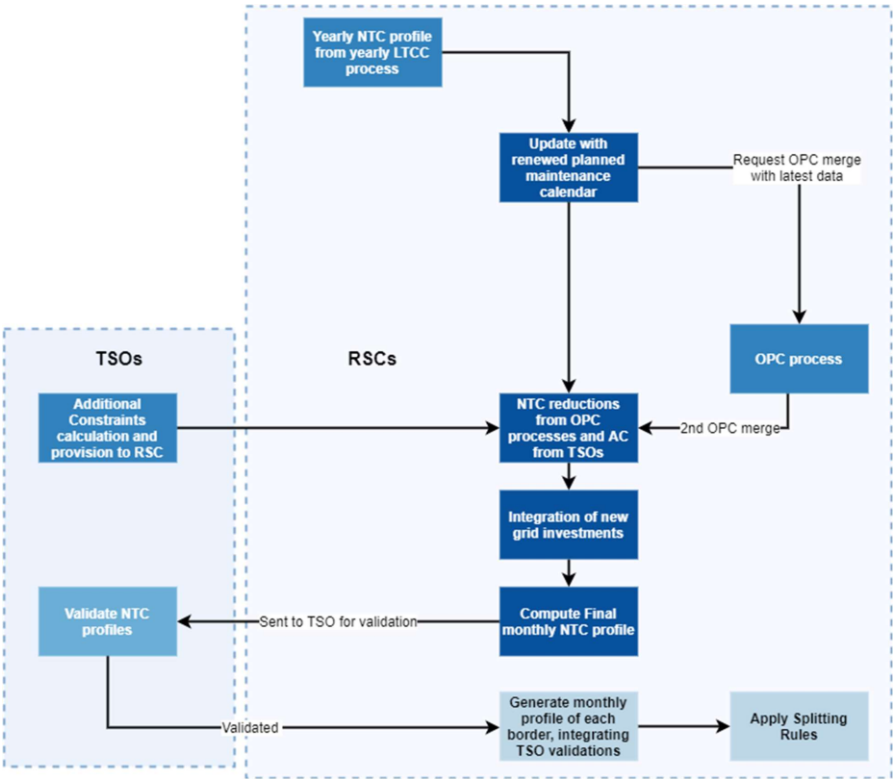

Figure 2: High-Level Business process of the monthly capacity calculation

Statistical analysis of historical data

Building of historical full-grid NTC duration curve

In order to determine the NTC duration curve, a statistical analysis of historical data is achieved following the computation steps below:

1. The initial dataset for long-term capacity calculation is composed of historical cross zonal capacity values per border in both directions (import and export) as described in Article 5~~:~~.
2. All NTC samples which correspond to a non-representative hour in the Italy North CCR ~~(i.e. hours affected by Allocation Constraints, real time capacity reductions, capacity curtailment, and capacity calculation process failed~~as outlined in Art. 6.1.b and 6.1.c~~)~~ are excluded from the dataset.
3. In order to make all NTC samples comparable in the statistic, the values are converted to full-grid values. The conversion is performed by adding to the final NTC sample the value of the daily NTC reductions corresponding to the outages planned for the corresponding hour of the dataset:

$$NTC_{\text{final,full-gri-,h}} = NTC_{\text{final,h}} + NTC_{\text{daily reduction,h}} \quad (1)$$

   Where:

   - $NTC_{\text{final,h}}$= final Italy North NTC or bilateral NTC given to the market for the generic hour "h";
   - $NTC_{\text{daily reduction,h}}$ = total or bilateral daily NTC reduction for the generic hour "h".

   In this way all the hourly NTC values theoretically refer to a grid without any outage (see Figure 3).
4. Once the full-grid NTC values are obtained, all the samples belonging to the same seasonal period are ordered in a duration curve (from the lowest one to the highest one), thus creating seasonal full-grid NTCs curve as function of the selected risk level (see Figure 4).
5. The risk level is defined as the percentage of time where the actual NTC is lower than the determined value, i.e. with a probability equal to the risk level TSOs will not be able to guarantee the computed NTC. When the risk level is higher, the chance increases the computed NTC values are not reached, turning into lower level of firmness.

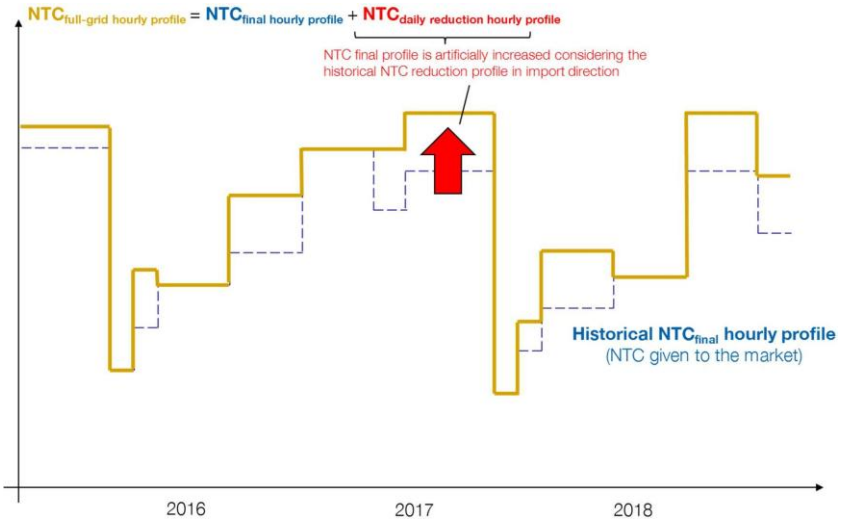

Figure 3: historical full-grid NTC hourly profile computation considering a time window 2016-2018

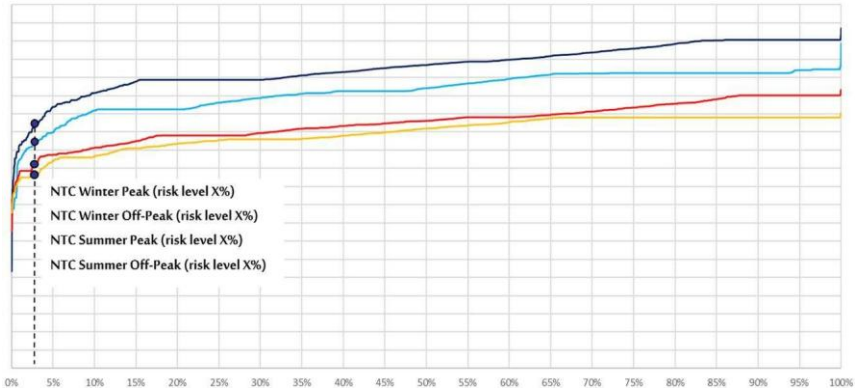

Figure 4: Duration Curve computed for the four Seasonal Periods

New grid investments

The new grid investments commissioned during the historical time window are treated by taking into account a proper NTC increase able to simulate the Investment Value I_{value} of the new network element. This effect is derived from the outcome of the OPC processes related to the periods after the commission of the new investment. In particular for the new network element I_{value} is assumed equal to the NTC reduction assumed in the OPC processes in case of its unavailability. Samples before the commissioning date are treated as cases with "New Grid Investments out of service": for the ~~long term~~long-term capacity calculation process, these samples are corrected to take into account the effect of the new investment; namely for these samples, I_{value} is added on top of the final NTC given to the market (as already done for normal out of services cases to obtain the full-grid profile).

$$I_{\text{value}} = NTC_{\text{red,new grid investment}} \quad (2)$$

An example is provided in figure 5, referred to a hypothetic long term capacity calculation related to 2019, based on 2016-2018 dataset. Here a new investment is assumed to be committed around mid-2017.

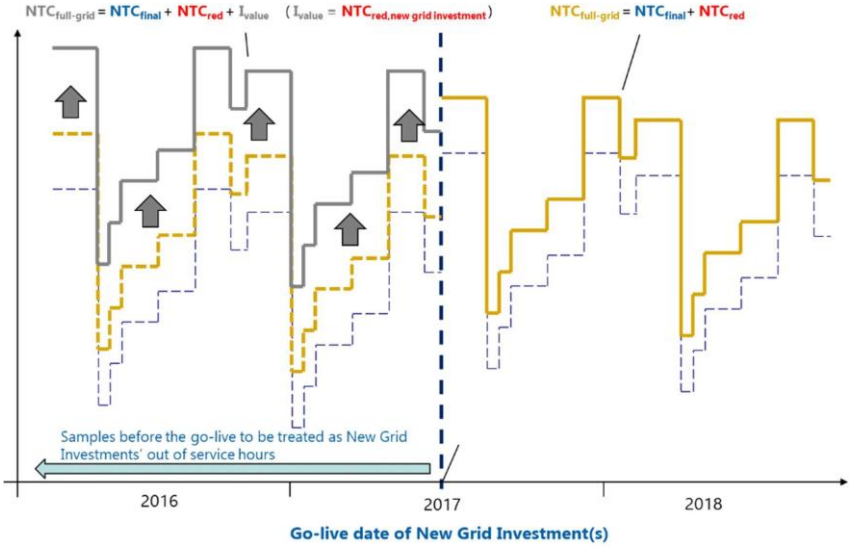

Figure 5: Treatment of New Grid Investment(s) after and before its respective Go-Live date in the historical data

Treatment of Go Live of new grid elements for the yearly/monthly profile computation

Yearly profile computation: For new investments committed in the delivery period, no additional benefit is considered. Figure 6, related to a hypothetic yearly computation for 2019, provides an example.

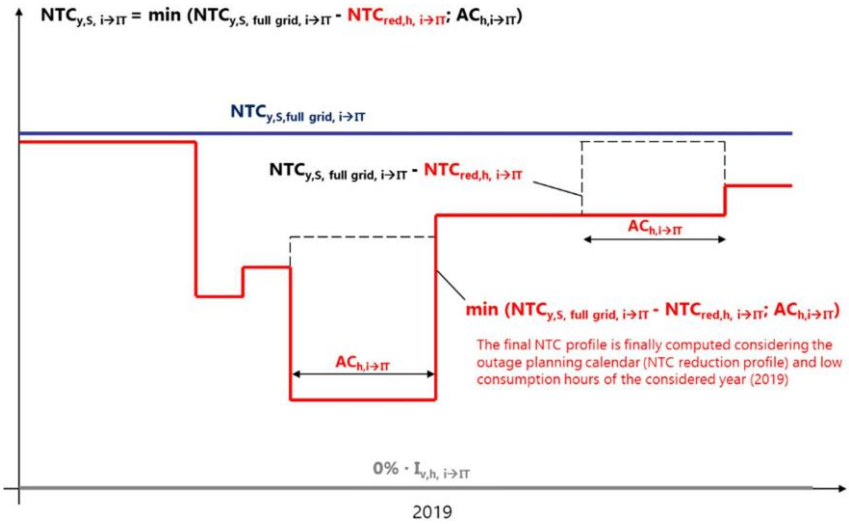

Figure 6: Treatment of Go Live of New Grid Investment(s) for the yearly profile computation.

Monthly profile computation: For new investments committed in the delivery period, a X% of the positive benefit I_{value} associated to the new network element is considered in the months after the commissioning until the end the year. I_{value} is assumed equal to the reduction value associated to the unavailability of this element, as estimated at the time of the computation basing on the value already agreed among respective operational planning departments and, if applicable, already used during the D-2 processes of the previous weeks/months. An example related to a hypothetic computation for 2019 is given in figure 7.

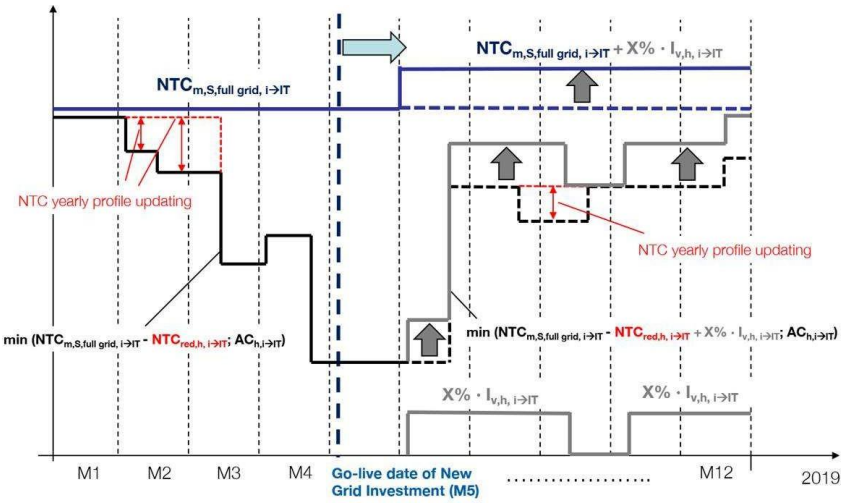

Figure 7: Treatment of Go Live of New Grid Investment(s) for the monthly profile computation

Justification for the X%. For the new investments I_{value} originates from the operational planning and D-2 process of the previous considered years. Due to lack of historical values of the New Grid Investment committed in the delivery period, the available values based on the most recent OPC and D-2 processes are not proven as secure in all situations to come since operational conditions could change radically in the future. Chosen portion of X% for the consideration of the New Grid Investments is thus based on the consideration that the long-term Investment Values are supposed to be firm in at least 30% of the cases, hence associated to a risk level of 70%. In order to associate a duration curve to each New Grid Investments value, the following monthly factor is computed as a function of the risk level (RL):

$$k_{\mathrm{m,S,i\rightarrow IT}}\ (RL) = \frac{\mathrm{NT}_{\ \mathrm{m,full-grid,S,i\rightarrow IT}}(\mathrm{RL})}{\mathrm{NT}_{\ \mathrm{m,full-grid,S,i\rightarrow IT}}(\mathrm{RL=7\ \ \%})} \qquad (3)$$

Where:

- m = month of the computation;
- S = season Winter Peak/Off-Peak and Summer Peak/Off-Peak;
- RL = risk level;
- $NTC_{\mathrm{m,full-grid,S,i\rightarrow IT}}(RL)$ = seasonal full-grid NTC of a generic border.

$k_{\mathrm{m,S,i\rightarrow IT}}(RL)$ represents, thus, the seasonal full-grid NTC duration curve of a generic border i→IT normalized on the corresponding long-term capacity value with a risk level of 70%. Figure 8 shows the factor curve as a function of the selected risk level.

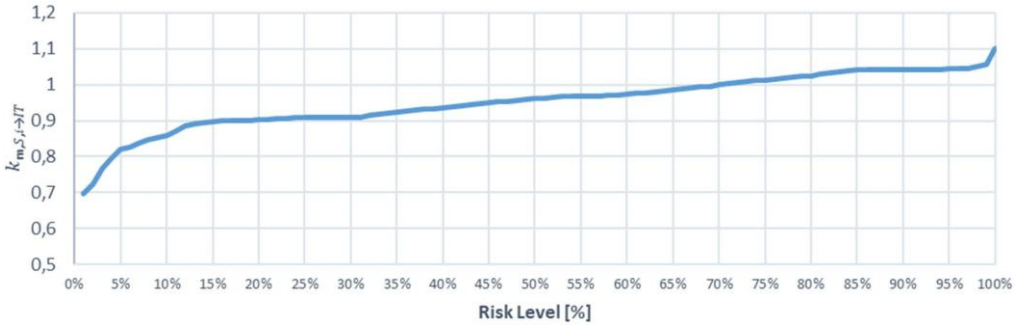

Figure 8 : Duration curve of $k_{m,S,i\to IT}$ factor

For the monthly computation of month m, the New Grid Investments value duration curve is defined as follow:

$$X_m\%(RL) = k_{m,S,i\to IT}\,(RL) * 100 \tag{4}$$

$$Iv_{m,S,i\to IT}\,(RL) = \frac{X_m\%(RL) * NTC_{red,new\ grid\ investment,i\to IT}}{100} \tag{5}$$

Where:

- m = month of the computation;
- S = season Winter Peak/Off-Peak and Summer Peak/Off-Peak;
- RL = risk level;
- $NTC_{red,new\ grid\ investment,i\to IT}$ = D-2 Investment NTC reduction on the border i→IT;
- $Iv_{m,S,i\to IT}(RL)$ = seasonal Investment Value duration curve for a generic risk level on the border i→IT.

Then, the New Grid Investment chosen portion X% for each season, period, border and direction is defined as follows:

$$X_m\% = k_{m,S,i\to IT}\,(RL = 3\%) * 100 \tag{6}$$

$$Iv_{m,S,i\to IT}\,(RL = 3\%) = \frac{X_m\%(RL=3\%) * NTC_{red,new\ grid\ investment,i\to IT}}{100} \tag{7}$$

In this way, the chosen Investment value for the monthly computations presents a level of firmness equivalent to the one of the selected long-term capacity value corresponding to a risk level of 3%: $NTC_{y,full-grid,S,i\to IT}(RL = 3\%)$ (see example in Figure 9).

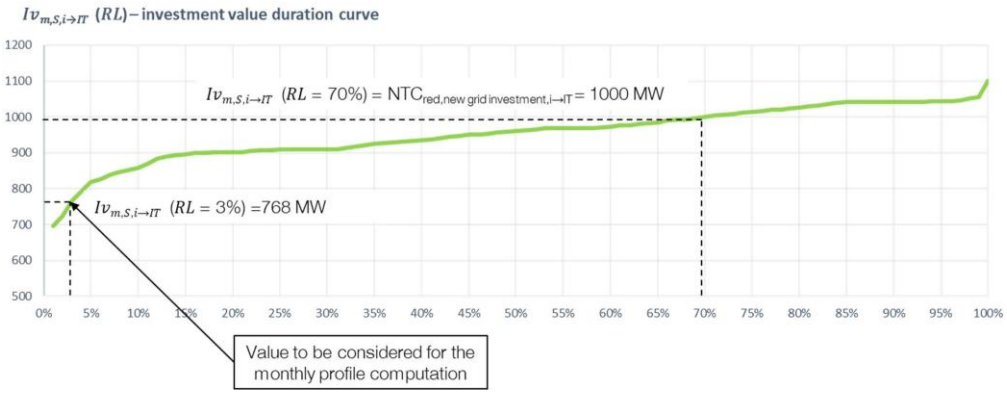

Figure 9 : Example of new grid investment duration curve (as function of Risk Level), considering a $NTC_{\text{red,new grid investment,i}\to\text{IT}}$ *= 1000 MW.*

The yearly capacity calculation

The hourly NTC profile computation for the yearly timeframe

The hourly profile for the Bilateral NTCs is computed by considering the hourly bilateral NTC reductions profile of Allocation Constraint profile as follows:

(8) $$NTC_{y,h,IT\rightarrow i} = \min\left(NTC_{y,full-grid,S,IT\rightarrow i} - NTC_{red,h,IT\rightarrow i}\ ;\ AC_{h,IT\rightarrow i}\right)$$

Where:

- $NTC_{y,full-grid,S,IT\rightarrow i}$ = yearly "full grid" NTC of a generic border i and generic season/period S (value obtained from the duration curves after fixing the risk level);
- $NTC_{red,h,IT\rightarrow i}$ = NTC reduction value for the generic border i and hour h (which reflect the hourly outage planning);$AC_{h,IT\rightarrow i}$
- $AC_{h,IT\rightarrow i}$ = Allocation Constraint planned for the generic border i and the generic hour h.

More details are given in Figure 10.

For each hour, the NTC reduction values are determined taking into account the latest updates from the OPC process.

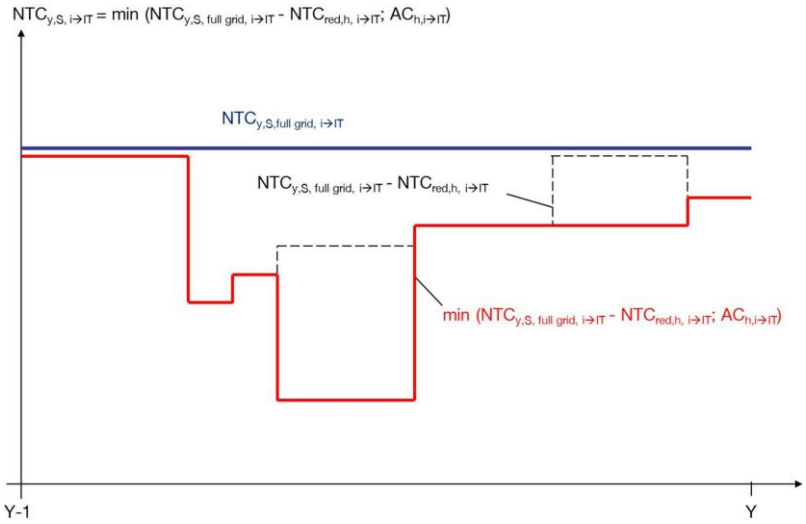

Figure 10 : Example of bilateral NTC seasonal yearly product calculated by considering the bilateral "full grid" seasonal NTC (flat value for the entire season/period), the bilateral hourly NTC reductions and bilateral hourly Allocation Constraint profiles.

The hourly NTC profile modification to consider the effect of new grid investments

Once the effect of a new grid investment to be committed during the delivery period is calculated for each season and border/direction, its respective investment value is added on top of hourly NTC import/export profiles that already consider maintenances and Allocation Constraints, as shown in Figure 5Figure 7.

For each new investment a maintenance plan is also considered in order to incorporate in the ~~the~~ new NTC profile for each border/direction the consequences related to the prospected unavailability of this element during the delivery period.

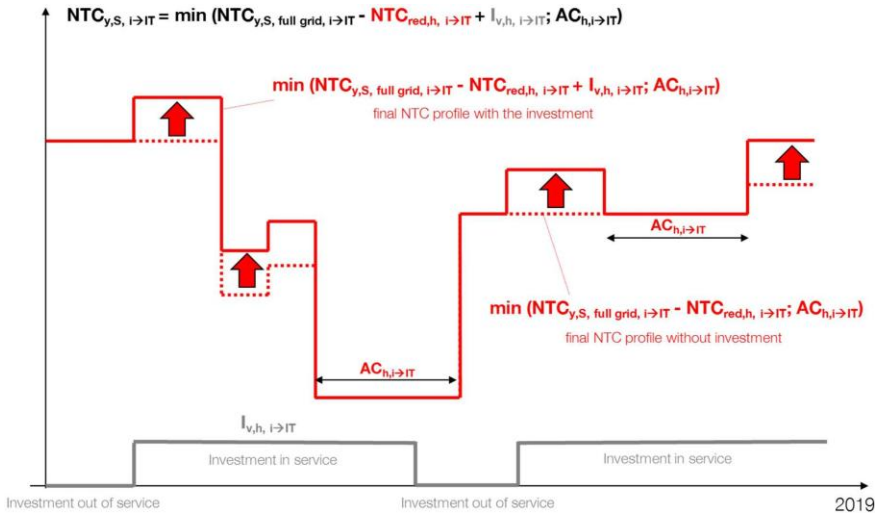

Figure 11 : Final NTC hourly profile computation considering the general inclusion of a new grid investment and its hourly Investment value profile (according to its availability plan).

The monthly capacity calculation

The hourly NTC profile computation for the monthly timeframe

The monthly timeframe statistical methodology aims at updating the yearly NTC profile already described in the previous paragraphs. In other words, the monthly NTC profile is computed starting from the monthly "full grid" NTC and applying updated NTC reductions and Allocation Constraints profiles.

The starting monthly "full grid" NTC is the value of the corresponding Seasonal Period, as computed in the yearly capacity calculation.

$$NTC_{\mathrm{m,full-grid,S,i\rightarrow IT}} = NTC_{\mathrm{y,full-grid,S,i\rightarrow IT}} \quad (9)$$

Where:

- S= season Winter Peak/Off-Peak and Summer Peak/Off-Peak;
- $NTC_{\mathrm{y,full-gri\ ,S}}$ = seasonal full-grid NTC associated to the risk level adopted for yearly computation.

An updated version of planned maintenance calendar and related NTC bilateral reductions is applied: in this way it is possible to update the previous yearly NTC profile by considering possible variations in the yearly planned and "extraordinary" out of service combinations.

$$NTC_{\mathrm{m,h,i\rightarrow IT}} = NTC_{\mathrm{m,full-grid,S,i\rightarrow IT}} - NTC_{\mathrm{red,h,i\rightarrow IT}} \quad (10)$$

Where:

- $NTC_{\mathrm{m,h,i\rightarrow IT}}$ = hourly NTC profile obtained by deducting the hourly NTC reduction profile from the monthly "full-grid" NTC;$NTC_{\mathrm{red,h,i\rightarrow IT}}$
- $NTC_{\mathrm{red,h,i\rightarrow IT}}$ = hourly NTC reduction profile.

The effect of new investments to be committed during the delivery period is added.

Finally, the resulting profile is compared with the recalculated Allocation Constraints profile based on most updated input data.

$$NTC_{\mathrm{m,h,i\rightarrow IT}} = \min\left(NTC_{\mathrm{m,full-grid,S,i\rightarrow IT}} - NTC_{\mathrm{red,h,i\rightarrow IT}}\ ;\ AC_{\mathrm{h,i\rightarrow IT}}\right)$$

Where

- $NTC_{\mathrm{m,full-grid,S,i\rightarrow IT}}$ = monthly "full grid" NTC of the generic border and the generic season S;
- $NTC_{\mathrm{red,h,i\rightarrow IT}}$ = hourly NTC reduction profile of the generic border (eventually updated in the monthly process);
- $AC_{\mathrm{h,i\rightarrow IT}}$ = hourly Allocation Constraint profile of the generic border.

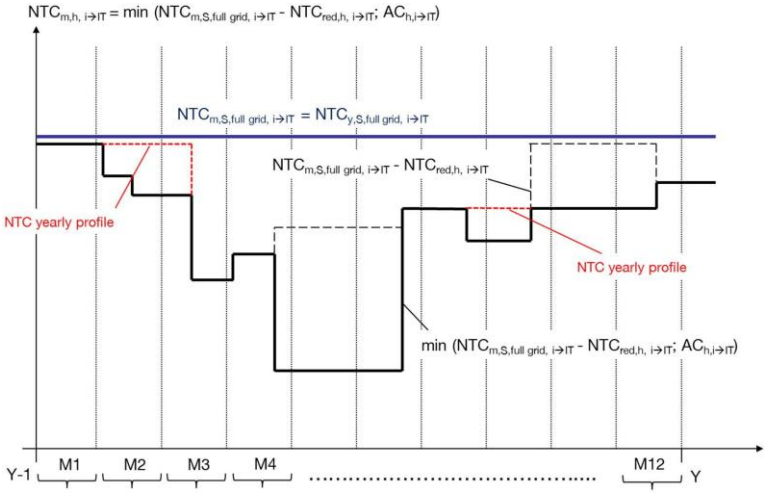

Figure 12: Example of bilateral NTC season/period monthly product calculated by considering the bilateral "full grid" season/period NTC (flat value for the entire winter peak period), the bilateral season/period NTC reductions (based on the updated monthly planned maintenance calendar) and the updated bilateral Low Consumption profile

Annex 2

Improved efficiency of statistical approach

According to Article 10(4)b of the FCA Regulation, the following requirements are set for using a statistical approach by the TSOs of the Italy North Region and Technical Counterparties:

I. Increase the efficiency of the capacity calculation methodology
II. Better take into account the uncertainties in long-term cross-zonal capacity calculation than the security analysis in accordance with paragraph 4(a)
III. Increase economic efficiency with the same level of system security

Qualitative Argumentations

The following paragraphs list the main arguments in a qualitative manner to show a statistical approach is more beneficial than a scenario-based approach.

Initiating a process for creating satisfactory scenarios for Italy North would require significant resources and incur delays in the planning. Italy North TSOs and the Technical Counterparty would have to find an agreement with all ENTSO-E TSOs in order to create additional time stamps, which would be useful for the Italy North region. This would lead also to a higher effort of the ENTSO-E TSOs side.

As part of a preliminary experimentation exercise and using the common all TSOs' winter scenario for 2019, the models were found to be pre-congested. This resulted in problems with convergence of the load-flow analysis and to very low or even non-existing long-term capacities for the borders in Italy-North Region. As a consequence, a special process step for a base case quality improvement would be required in the LT CC process.

Likewise, the firmness of the capacities is important for the long-term capacities: ensuring a high level of firmness for a scenario-based approach would result in a high TRM/FRM value, which would result in lower capacities. Moreover, the ~~scenario based~~scenario-based approach would need to define a robust and statistically valid methodology for the TRM/FRM calculation since the reference scenarios, being specific and artificially created cases, do not cover all possible situations which may happen over long timeframes (e.g. all possible hours of a year/month and impossibility to have meaningful long term forecasts of variable such as renewable sources and load). Therefore, Italy North TSOs and the Technical Counterparty would need to define a statistical methodology for the TRM/FRM calculation regardless of the approach chosen. This should be carried out in parallel with the scenario-based process developments, thus increasing TSOs and RSCs' workload and leaving the scenario-based calculations without significant added value.

Finally, the scenarios would be not fully representative for the Italy North CCR and they would not always capture all Italy North CCR particularities (like different flow distribution on Italy North borders linked to the influence of the external CCRs).

Moreover, a statistical long-term CC approach would directly benefit from the better forecasts in the short-term process, each time an improvement on short-term CCM is implemented (based on the Day Ahead and Intra Day results).

The following paragraphs list the main arguments in a quantitative manner to show that statistical approach is more beneficial than a scenario-based approach.

In particular, Italy North TSOs and the Technical Counterparty performed an experimental scenario-based computation, using the ENTSO-E Winter Peak reference model of 2019, in order to:

- Compare scenario based and statistical capacity values
- Assess the quality level of the ENTSO-E reference models to be used for the scenario-based computation
- Assess the reliability and firmness of the calculated scenario-based capacity

The ENTSO-E Winter Peak reference model of 2019 was used to perform such analysis and the following issues were noticed:

- The used model has a very low quality in terms of reactive power and voltage regulation settings of some generators. Such issues caused divergence of the load flow calculation algorithm. Hence, the TSOs had to manually improve such model before starting the scenario-based capacity calculation. In a hypothetical automatic scenario-based process, such poor input data quality would have resulted in a LTCC process fail;
- After the application of the above-described improvements, the N-1 security analysis was performed monitoring the Italy North CNEC list, resulting in a pre-congested model, mainly due to the random PSTs and bus-bar couplers settings which affect the yearly reference scenario. In such model, the tie-line Lienz-Soverzene between Austria and Italy turns to be pre-congested in N and N-1 state due to uncoordinated settings of the PSTs in Lienz (Austria), Divaca (Slovenia) and Padriciano (Italy) sub-stations;
- Such pre-congestions lead to a very low calculated TTC value of 5735 MW, which was calculated without optimizing Remedial Actions, being their availabilities and real-time application very difficult to ensure so far ahead.
- The full-grid scenario based NTC of 5235 MW, obtained by deducting the current D-2 TRM value of 500 MW to the calculated TTC, was compared with the statistical full-grid winter peak value obtained by fixing the risk level of 3%, as described in the Article 6(2) of this methodology (see Figure 13). Such comparison showed a scenario-based capacity 1424 MW lower than the statistical NTC with the selected risk level of 3%.
- Moreover, such comparison was performed without considering a robust and statistically valid methodology for the long-term TRM calculation (for sake of simplicity the same TRM as in D-2 has been considered). Therefore, being the year and month ahead uncertainties higher than the D-2 or ID ones and since the reference scenarios do not cover all possible situations which may happen over long timeframe, to ensure a high level of firmness for the computed scenario-based capacity a higher TRM values would have been set, with a consequent lower capacities.

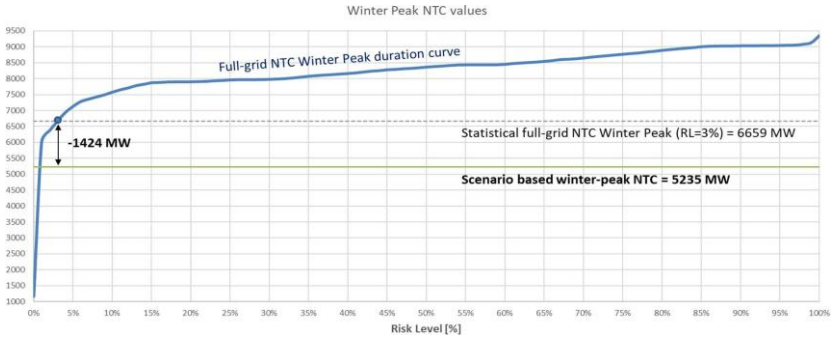

Figure 13: comparison between the scenario based and statistical NTC values.

Net position forecast dependency

In addition, the influence of other countries on the Italy North capacity calculation process was investigated using again the ENTSO-E Winter-Peak reference model of 2019. This analysis was performed by changing the Net Position (NP) forecast of Germany.

In this case, only the Winter Peak period was considered With the Remedial Actions (WRA). A positive variation of the shift between France to Germany means an increase of the exchange from France to Germany. A negative one, depicts an increase of the exchange from Germany to France.

The ENTSO-E reference scenario has a French NP of +10575 MW and a German NP of + 6655 MW. The total NTC value for Italy North region is 9985 MW. Table 1 and Figures 13 show the global picture of this test case. When the Δ shift between France and Germany decreases from -1000 MW to -3000 MW, the total NTC value decreases too but the limiting element does not change.

On the contrary, the increasing of Δ shift from 0 to +1000 MW increases the total NTC of Italy North CCR while, the continuous increasing of the Δ from +1000 MW to + 4000 MW lowers the final NTC value and makes the tie line couple Riddes-Valpelline #Albertville-Rondissone 1&2 the new limiting element.

To conclude, this small example provides an idea of the effect of non-Italy North Countries on the CCR. The only acceptable value of the shift variation is between 0 + 3000 MW since it does not affect considerably the final NTC of Italy North region. The detailed impact on the limiting element Soazza-Bulciago is illustrating in the second graph next page.

Table 1 : NTC value comparison with variation Delta shift (NP-FR>NP-DE)

FR NET POSITION	**+ 7704**	**+ 9632**	**+ 10575**	**+ 11535**	**+ 13567**	**+ 14529**
DE NET POSITION	+ 9412	+ 7576	+ 6655	+ 5714	+ 3776	+2802
Δ shift (NPFR>NPDE)	-3000	-1000	REFERENCE STUDY	1000	3000	4000
Full Grid Situation	**Winter Peak WRA**	**Winter Peak WRA**	**Winter Peak WRA**	**Winter Peak WRA**	**Winter Peak WRA**	**Winter Peak WRA**
Limiting Element	**Soazza-Bulciago #Robbia-**	**Soazza-Bulciago #Robbia-**	**Soazza-Bulciago #Robbia-**	**Soazza-Bulciago #Robbia-**	**Riddes-Valpelline**	**Riddes-Valpelline #Albertville-Rondissone 1&2**
	Bulciago/ SanFiorano	**Bulciago/ SanFiorano**	**Bulciago/ SanFiorano**	**Bulciago/ SanFiorano**	**#Albertville-Rondissone 1&2**	

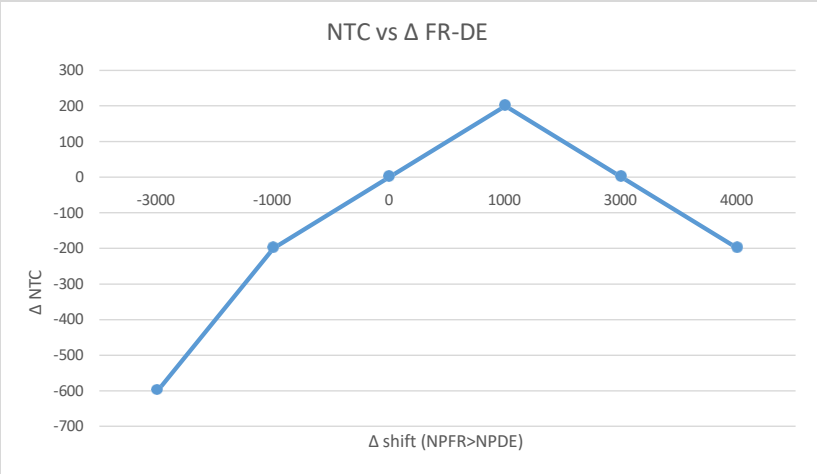

Figure 14: NTC value with Delta shift variation

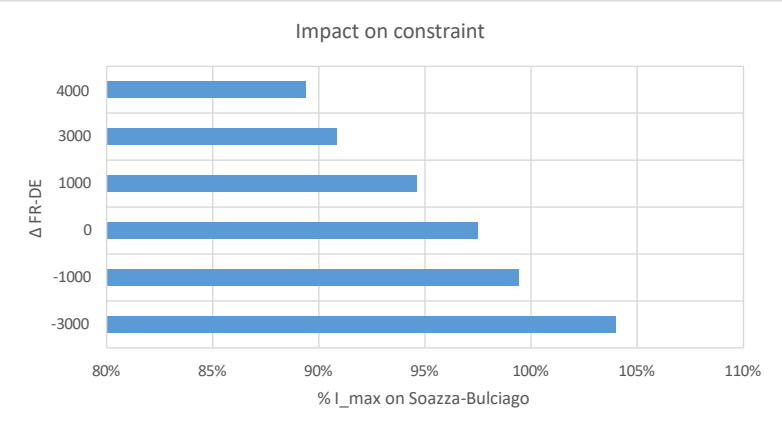

Figure 15: The impact of FR□DE exchange variation on the initial critical network element ***Soazza-Bulciago***

Incremental Cost estimation

The cost estimation is based on the additional amount of workload for IN TSOs and also for ENTSO-E TSOs in case a scenario based approached would be chosen for the IN region (see Table 2 below). The analysis was developed estimating the effort, given in equivalent Man Day (MD), necessary for the development of the capacity calculation process with a scenario based and a statistical approach. The cost comparison between the two approaches is given in Table 2.

Table 2 : Cost estimation for different approaches in details (MD = Man Day)

Tasks	Scenario-based approach MD RSCs	MD TSOs	Statistical approach MD RSCs	MD TSOs
1. 4 additional scenarios for IN region				
a. ENTSO-E scenario CGM gathering	3	600[1]	0	0
b. Specific Italy North scenario building			0	0
c. Validation of specific scenarios by other CCR			0	0
2. Base case improvement	20	25	0	0
3. Integration of full year D-2&IDCC data	5	5	5	5
4. Definition of risk level	0,5	5	0,5	5
5. Integration of planned outages	0,5	10	0,5	5
6. TRM computation	20	25	0	0
7. TSO LT Capacity validation	0	25	0	5
Total FTE (MD)	**49**	**695**	**6**	**20**

The main effort provided by choosing the scenario-based approach is related to the definition of the additional scenarios for Italy North CCR by all ENTSO-E TSOs. In particular, the development process for the scenario-based approach would require a significant effort for the gathering process for RSCs and TSOs which can be estimated in global 603 mandays. This step would not be necessary going with a statistical approach.

The effort for completing the global implementation process can be estimated considering the tasks from 2 to 7. The cost of the implementation process for the ~~scenario based~~scenario-based approach results in 141 Man Days, while the statistical approach requests 26 Man Days. The main difference is the additional effort that a ~~scenario based~~scenario-based approach requires for the improvement of the base cases. This step would not be necessary for the statistical approach because the samples are already optimized.

Figure 16 shows a direct comparison between the estimated costs of development of the two different approaches.

[1] Estimated 5 MDs per TSO per scenario and assuming 30 TSOs.

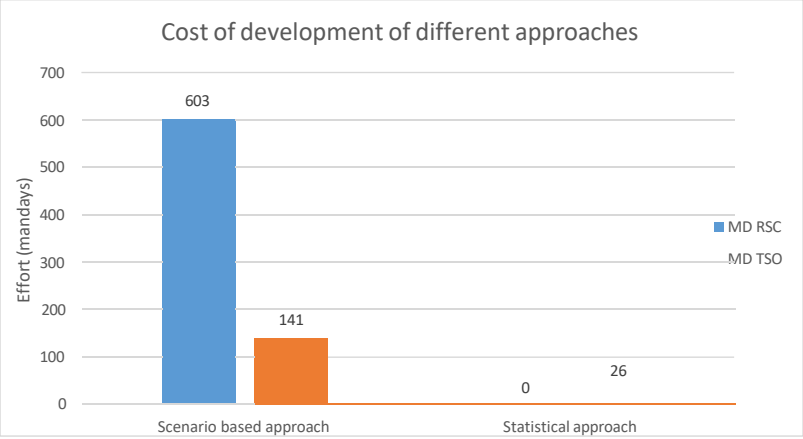

Figure 16: Cost estimation in efforts of the implementation of the scenario-based and the statistical approach