Italy North TSOs proposal for a common D-2 capacity calculation in accordance with Article 21 of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management

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TSOs of the Italy North Region, taking into account the following:

Whereas

(1) This document (hereafter referred to as “D-2 CCC methodology Proposal”), including its annexes, is a common proposal developed by all Transmission System Operators (hereafter referred to as “TSOs”) within the Italy North capacity calculation region (hereafter referred to as “Italy North Region”) regarding the proposal for the common capacity calculation performed for the capacity allocation within the day-ahead timeframe. This proposal is required by Article 21 of Regulation (EU) 2015/1222 on Capacity Allocation and Congestion Management (hereafter referred to as the “CACM Regulation”).

(2) This proposal takes into account the general principles and goals set in the CACM Regulation as well as the Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as “Regulation (EC) No 714/2009”).

In addition, this proposal takes into account the effective structure of the grid and the borders between Italy and Third Countries by establishing TSO-TSO based contractual frameworks to include Third Countries as Technical Counterparties. Therefore, this proposal is developed by TSOs of the Italy North Region, taking into account Technical Counterparties’ grid elements.

(3) This proposal takes into account the general principles and goals set in CACM Regulation. 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 Region. CACM Regulation’s objectives cannot be achieved in any other way but by including Third Countries’ grid elements. 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. In order to comply with the requirement laid down by EU Regulation, this methodology will include Third Countries as Technical Counterparties. Coordinated capacity calculators will take into account the whole Area of Common Interest (hereafter referred to as “ACI”) of the Italy North Region and include Technical Counterparties’ remedial actions into coordinated remedial action preparation and the optimization procedure. TSOs of Italy North Region will conclude an agreement with relevant Technical Counterparties. 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 17 of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management”, applicable to TSOs from jurisdictions outside the area referred to in Article 1(2) of CACM Regulation. This agreement will include D-2 CCC methodology’s provisions and ensure that the Technical
Counterparty is contractually bound by the same obligations as the ones binding upon TSOs of the Italy North Region by virtue of EU Regulations. Such agreement will govern mutual obligations and responsibilities of the Technical Counterparty with TSOs of Italy North Region in relation to the capacity calculation process on all elements of the Area of Common Interest.

(4) The goal of the CACM Regulation is the coordination and harmonisation of capacity calculation and allocation in the day-ahead and intraday cross-border markets. To facilitate these aims and implement single day-ahead and intraday coupling, it is necessary to calculate in a coordinated manner by the TSOs the available cross-border capacity. In line with the requirements of CACM Regulation, the TSOs of Italy North Region will strive to cooperate with Capacity Calculation Regions (hereafter referred to as “CCR”) connected to Italy North Region in order to ensure that capacity calculation take place in the most efficient and thorough way.

(5) Article 21 (1) of the CACM Regulation constitutes the legal basis for this proposal and defines several specific requirements that the D-2 CCC methodology Proposal should take into account:

“1. The proposal for a common capacity calculation methodology for a capacity calculation region determined in accordance with Article 20(2) shall include at least the following items for each capacity calculation time-frame:

(a) methodologies for the calculation of the inputs to capacity calculation, which shall include the following parameters:

(i) a methodology for determining the reliability margin in accordance with Article 22;

(ii) the methodologies for determining operational security limits, contingencies relevant to capacity calculation and allocation constraints that may be applied in accordance with Article 23;

(iii) the methodology for determining the generation shift keys in accordance with Article 24;

(iv) the methodology for determining remedial actions to be considered in capacity calculation in accordance with Article 25.

(b) a detailed description of the capacity calculation approach which shall include the following:

(i) a mathematical description of the applied capacity calculation approach with different capacity calculation inputs;

(ii) rules for avoiding undue discrimination between internal and cross-zonal exchanges to ensure compliance with point 1.7 of Annex I to Regulation (EC) No 714/2009;

(iii) rules for taking into account, where appropriate, previously allocated cross-zonal capacity;

(iv) rules on the adjustment of power flows on critical network elements or of cross-zonal capacity due to remedial actions in accordance with Article 25;

(v) for the flow-based approach, a mathematical description of the calculation of power transfer distribution factors and of the
calculation of available margins on critical network elements;

(vi) for the coordinated net transmission capacity approach, the rules for calculating cross-zonal capacity, including the rules for efficiently sharing the power flow capabilities of critical network elements among different bidding zone borders;

(vii) where the power flows on critical network elements are influenced by cross-zonal power exchanges in different capacity calculation regions, the rules for sharing the power flow capabilities of critical network elements among different capacity calculation regions in order to accommodate these flows.

(c) a methodology for the validation of cross-zonal capacity in accordance with Article 26.”

(6) Article 14 of the CACM Regulation defines the capacity calculation time-frames as “day-ahead, for the day-ahead market. For the day-ahead market time-frame, individual values for cross-zonal capacity for each day-ahead market time unit shall be calculated. For the day-ahead market time-frame, the capacity calculation shall be based on the latest available information. The information update for the day-ahead market time-frame shall not start before 15:00 market time two days before the day of delivery”.

(7) Article 20 (1) of the CACM Regulation defines the approach to use in the common capacity calculation methodologies as “flow-based approach” and Article 20 (3) of the CACM Regulation specifies that: “The TSOs from the capacity calculation region where Italy, as defined in point (c) of point 3.2 of Annex I to Regulation (EC) No 714/2009, is included, may extend the deadline without prejudice to the obligation in paragraph 1 for submitting the proposal for a common coordinated capacity calculation methodology using flow-based approach for the respective region pursuant to paragraph 2 up to six months after Switzerland joins the single day-ahead coupling.”

(8) Article 20 (2) of the CACM Regulation defines the deadline to submit the common proposal based on the coordinated net transmission capacity approach for the TSOs from the capacity calculation region where Italy, as defined in point (c) of point 3.2 of Annex I to Regulation (EC) No 714/2009, is included:

2. "No later than 10 months after the approval of the proposal for a capacity calculation region in accordance with Article 15(1), all TSOs in each capacity calculation region shall submit a proposal for a common coordinated capacity calculation methodology within the respective region. The proposal shall be subject to consultation in accordance with Article 12."

(9) TSOs of Italy North Region intend to apply a coordinated net transmission capacity methodology as interim approach for capacity calculation within the Italy North Region, without prejudice to the future implementation of a Flow Based approach as the target methodology for the Italy North Region as foreseen in Article 20(1) of the CACM Regulation.

(10) Article 2 (8) of the CACM Regulation defines the coordinated net transmission capacity approach as “the capacity calculation method based on the principle of assessing and defining ex ante a maximum energy exchange between adjacent bidding zones”.

The information update for the day-ahead market time-frame shall not start before 15:00 market time two days before the day of delivery.”

(6) Article 14 of the CACM Regulation defines the capacity calculation time-frames as “day-ahead, for the day-ahead market. For the day-ahead market time-frame, individual values for cross-zonal capacity for each day-ahead market time unit shall be calculated. For the day-ahead market time-frame, the capacity calculation shall be based on the latest available information. The information update for the day-ahead market time-frame shall not start before 15:00 market time two days before the day of delivery”.
In the context of this proposal, the definition of “coordinated capacity calculator” is important and is defined in Article 2 (11) of the CACM Regulation as: “the entity or entities with the task of calculating transmission capacity, at regional level or above”.

Article 9 (9) of the CACM Regulation requires that the proposed timescale for the implementation and the expected impact of the D-2 CCC methodology Proposal on the objectives of the CACM Regulation is described. The impact is presented below in the point (12) of this Whereas Section.

The CCC methodology Proposal contributes to and does not in any way hinder the achievement of the objectives of Article 3 of the CACM Regulation:

Article 3 (a) of the CACM Regulation aims at promoting effective competition in the generation, trading and supply of electricity.

The D-2 CCC methodology Proposal serves the objective of promoting effective competition in the generation, trading and supply of electricity by defining a set of harmonised rules for capacity calculation and congestion management which contributes to the effectiveness of the single day-ahead coupling. Establishing common and coordinated processes for the capacity calculations within the day-ahead market timeframe contributes to achieving this aim.

Article 3 (b) of the CACM Regulation aims at ensuring optimal use of the transmission infrastructure.

The D-2 CCC methodology Proposal contributes to the objective of ensuring optimal use of the transmission infrastructure by using last available inputs based on the best possible forecast of transmission systems at the time of each capacity calculation, updated in a timely manner.

Article 3 (c) of the CACM Regulation aims at ensuring operational security.

The D-2 CCC methodology Proposal contributes to the objective of ensuring operational security by coordinating the capacity calculation with updated inputs for the day-ahead market timeframe at regional level to ensure its reliability.

Article 3 (d) of the CACM Regulation aims at optimising the calculation and allocation of cross-zonal capacity.

By coordinating the timings for the delivery of inputs, calculation approach and validation requirements of the CCC between TSOs and the coordinated capacity calculator, the D-2 CCC methodology proposal contributes to the objective of optimising the calculation and allocation of cross-zonal capacity.

Article 3 (g) of the CACM Regulation aims at contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union.

By using the best possible forecast of the transmission systems at the time of each capacity calculation within the Italy North region, the results of the coordinated capacity calculation contribute to determine the most limiting branches within this region, by then help TSOs for a more efficient development of the electricity transmission system.

In conclusion, the D-2 CCC methodology Proposal contributes to the general objectives of the CACM Regulation.
Italy North TSOs proposal for a common D-2 capacity calculation in accordance with Article 21 of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management

SUBMIT THE FOLLOWING D-2 CCC METHODOLOGY PROPOSAL TO THE NATIONAL REGULATORY AUTHORITIES OF THE REGION:
Article 1
Subject matter and scope

The D-2 CCC methodology as determined in this D-2 CCC methodology Proposal is the common proposal of all Italy North TSOs in accordance with Article 21 of the CACM Regulation.

Considering the structure of the grid Third Countries’ borders are taken into account via a separate agreement 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 D-2 CCC methodology Proposal, the terms used shall have the meaning given to them in Article 2 of Regulation (EC) 714/2009, Article 2 of Regulation (EC) 2013/543 and Article 2 of Regulation (EC) 2015/1222.

2. In addition, the following definitions shall apply:
   a. ‘APG’ means Austrian Power Grid AG, the Austrian system operator;
   b. ‘AT-IT border’ means bidding zone border between Austria and Italy;
   c. ‘CH-IT border’ means bidding zone border between Switzerland and Italy;
   d. ‘ELES’ means ELES, d.o.o., the Slovenian system operator;
   e. ‘FR-IT border’ means bidding zone border between France and Italy;
   f. ‘RTE’ means Réseau de Transport d’Electricité, the French system operator;
   g. ‘SI-IT border’ means bidding zone border between Slovenia and Italy;
   h. ‘Technical Counterparty’ means any non-EU TSO to be included in the procedures of this methodology through respective agreements;
   i. ‘TERNA’ means TERNA S.p.A. Rete Elettrica Nazionale, the Italian system operator;
   j. Third Country means country from jurisdiction outside the area referred to in Article 1(2) of the CACM Regulation.

3. Definition of Acronyms

   CC  Capacity Calculation
   CCC  Common Capacity Calculation
   CGM  Common Grid Model
   CGMES Common Information Model (CIM) for Grid Model Exchanges
   CNE  Critical Network Element
   CNEC Critical Network Element and Contingency
   CRA Curative Remedial Action
   D-2  Two Days Ahead
   DACF Day Ahead Congestion Forecast
   IDC Intraday Congestion Forecast
   IGM Individual Grid Model
   MC Market Coupling
In this D-2 CCC methodology Proposal, 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 proposal; 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.

**Article 3**

**Application of this proposal**

This proposal applies solely to the D-2 CCC methodology based on the coordinated net transmission capacity approach 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 contracts as mentioned above in Article 1. The D-2 CCC methodology using the flow-based approach, the CCC methodologies within others CCRs and other timeframes are outside the scope of this proposal.

**Article 4**

**Cross-zonal capacities for the day-ahead market**

For the day-ahead market time-frame, individual values for cross-zonal capacity for each day-ahead market time unit shall be calculated using the D-2 CCC methodology.

**Article 5**

**Reliability margin methodology**

1. For the CC performed in D-2, the TSOs and Technical Counterparties of Italy North Region shall define the reliability margin in line with Article 22 of the CACM Regulation and based on the analysis of the following data:
a. unintended deviations of physical electricity flows within a market time unit caused by the adjustment of electricity flows within and between control areas, to maintain a constant frequency;

b. uncertainties which could affect CC, and which could occur between D-2 and real time, for the market time unit being considered.

More details on the computation of the reliability margin are provided in the technical Annex of the D-2 CCC methodology Proposal.

2. The reliability margin in the first year after the approval of the D-2 CCC methodology Proposal shall be defined as fixed value based on experience gained in the previous D-2 CCC methodology, not exceeding the 2018 historical value. Not later than one year after the approval of the D-2 CCC methodology Proposal the TSOs of Italy North Region shall perform the analysis according to the paragraph 1 of this Article and define the appropriate risk level for the definition of reliability margin via a request for amendment.

3. The TSOs and Technical Counterparties of Italy North Region shall review once a year the reliability margin for the whole Italy North Region.

**Article 6**

**Methodologies for operational security limits, contingencies and allocation constraints**

1. For the CC, the TSOs and Technical Counterparties of Italy North Region shall only monitor the operational security limits and contingencies on network elements significantly influenced by cross-zonal power exchanges, defining CNEs and CNECs. The selection of these CNEs and CNECs shall be based on a sensitivity analysis performed for each calculated timestamp by the TSOs and Technical Counterparties of the Italy North Region in the different network states including but not limited to base case, after contingency and after remedial action.

2. Only CNECs with a sensitivity to cross-zonal power exchanges equal or higher than 5% shall be monitored during the CC process (the percentage to be used can be reassessed during the implementation of the D-2 CCC Methodology Proposal). The sensitivity shall be assessed as explained in Annex I. The sensitivity to cross zonal power exchanges shall be equal to the relative change of flow on CNE after the change of zonal balance. The zonal balances are adjusted using the same GLSK as for the CC.

3. The TSOs and Technical Counterparties of Italy North Region may define also a list of MNEs that are influenced by the application of cross-border-impacting remedial actions in line with Articles 75 and 76 of the SOGL Regulation, but are not significantly influenced by the cross-zonal power exchanges. These MNEs shall be monitored during the RAO only if, in accordance with Article 10(5), at least one country is in import from Italy. The additional loading, resulting from the application of RAs, on these monitored elements may be limited during the RAO, while ensuring that a certain additional loading up to the defined threshold (according to Article 8(6)) is always accepted.

4. Where the power flows on CNEs monitored in the CC are influenced by cross-zonal power exchanges in different CCRs, the TSOs and Technical Counterparties of the Italy North Region shall define the rules for sharing the power flow capabilities of CNEs among different CCRs in...
order to accommodate these flows. These rules will be detailed in cooperation with the other CCRs during the implementation phase of this methodology.

5. The TSOs and Technical Counterparties of Italy North Region shall review the list of CNEs to be monitored in the CC process at least once a year.

6. The coordinated capacity calculator shall use the CNEs in accordance with Article 7.3 for the CC performed within Italy North Region in order to determine the maximum net transmission capacity for each bidding-zone border.

7. The Italian operational constraints related to the control of voltage profiles and dynamic stability of Italian system, which are needed to maintain the transmission system within operational security limits but cannot be transformed efficiently into maximum flows on CNEs, shall be expressed via allocation constraints.

8. Ramping constraints, which are needed to avoid large variations of the exchange programs between one hour and the next that may endanger the grid security during real time operations, shall be expressed via allocation constraints.

9. As a temporary solution, allocation constraints indicated in Article 6(6) and 6(7) will be directly applied to the results of the calculation performed by the coordinated capacity calculator. During this period, the unconstrained capacity will be computed in any case and made publicly and easily accessible. Once the market coupling algorithm will be fully capable of managing allocation constraints pursuant to Article 2(6) of the CACM Regulation, computation constraints will be abandoned in favour of allocation constraints pursuant to Article 2(6) of the CACM Regulation.

10. Allocation constraints will be given with a level of discretization of 50 MW.

11. For voltage and stability constraints, TSOs of Italy North Region will publish at least the following elements for each market time unit:
   a. the expected total load in the Italian system;
   b. the expected total non-dispatchable production in the Italian system;
   c. the minimum dispatchable thermal generation needed to grant voltage and system stability in the Italian system.

TSOs of Italy North Region will publish also a feature to provide an estimation of the cross-dependence between the level of the allocation constraint and the parameters listed above.

**Article 7**

**Generation shift keys methodology**

1. The TSOs of Italy North Region shall define the generation shift keys in accordance with Article 24 of the CACM Regulation.

2. RTE shall define generation shift keys proportional to the base case scenarios for each market time unit with all expected generating units in the IGM, reflecting RTE’s best forecast of market behaviour.
3. TERNA shall define generation shift keys merit order to the base case scenarios for each market time unit with all expected generating units in the IGM, reflecting TERNA’s best forecast of market behaviour.

4. ELES shall define generation shift keys proportional to the base case scenarios for each market time unit with all expected generating units and selected loads in the IGM, reflecting ELES’s best forecast of market behaviour.

5. APG shall define generation shift keys participation factors to the base case scenarios for each market time unit with all expected generating units in the IGM, reflecting APG’s best forecast of market behaviour. To achieve this the shift is done in generation/load nodes (PV or PQ nodes), according to a participation factor. The chosen nodes are evaluated by APG and are nodes with generation/load units that will change along with a market change. The participation factor for each node is set by APG and reflects the best forecast of generation/load distribution in the Austrian grid.

**Article 8**  
**Methodology for remedial actions in capacity calculation**

1. The TSOs of Italy North Region shall define the remedial actions in accordance with Article 25 of the CACM Regulation.

2. Each TSO of Italy North Region shall define individually the remedial actions of its responsibility area to be used in the day-ahead CCC within Italy North Region.

3. The remedial actions to be defined by each TSO of Italy North Region shall be either preventive (pre-fault) or curative (post-fault). The TSOs of Italy North Region may use the following remedial actions, but not limited to:
   a. changing the tap position of a phase shifter transformer;
   b. topology measure: opening or closing of a line, cable, transformer, bus bar coupler;
   c. switching of a network element from one bus bar to another; or
   d. modification of generation.

The remedial actions given to CC process are assessed by each TSO on a daily basis.

4. All types of remedial actions can be used in preventive and/or curative state. SPS will act only in curative stage, after tripping of grid elements. Due to this there are three different types of remedial actions used in the Italy North CC process:
   a. PRA: They correspond, in operation, to remedial actions to be implemented independently of the occurrence of any outage to relieve the grid. They are also implemented in the CGM
   b. CRA: Each CRA is associated with a given Outage and applied after the Outage happened. They are taken into account during the CC process but not implemented in the model.
   c. SPS: This represents an automatic change in grid topology in case of predefined conditions (e.g. outage of 2 parallel lines) are met. They are taken into account during the CC process but not implemented in the model.
5. Preventive Remedial Actions are implemented in the final CGM of the CC. Their application during later operational security timeframes (DACF, IDCF and real time) shall be evaluated based on the Security Analysis taking into account the latest grid information and in line with the methodologies to be defined according to the Articles 75 and 76 of the SOGL Regulation.

6. In accordance with Article 6(3), each TSO of Italy North Region may define a list of MNEs, for the cases with export direction described in Article 10(5). During the RAO, all the available transmission capacity of the MNEs can be used under the condition that MNEs’ operational security limits including contingencies are respected. Even in case this leads to overloads, at least 5% of each MNE’s respective thermal capacity in contingency case shall be made available for the RAO. The value can be reassessed during the implementation of this D-2 CCC methodology Proposal and shall also be in line with the methodologies developed under Articles 75 and 76 of the SOGL Regulation.

7. Each TSO of Italy North Region shall inform the coordinated capacity calculator in a timely manner on any change in its remedial actions within Italy North Region to ensure an efficient CC.

8. TSOs of the Italy North Region shall coordinate with each other regarding the use of remedial actions to be taken into account in CC and their actual application in real time operation. The coordination of remedial actions is ensured by the CC methodology.

9. Each TSO of the Italy North Region shall ensure that remedial actions are taken into account in CC under the condition that the available remedial actions remaining after calculation, taken together with the reliability margin referred to in Article 5, are sufficient to ensure operational security. The use, during later operational security timeframes (DACF, IDCF and real time), of remedial actions defined during CC process will be coordinated in line with the methodologies to be defined according to the Articles 75 and 76 of the SOGL Regulation.

**Article 9**

**Cross-zonal capacity validation methodology**

1. The TSOs of Italy North Region shall validate the cross-zonal capacities calculated by the coordinated capacity calculator of the Italy North Region.

2. The coordinated capacity calculator shall make available the common grid model for Italy North Region for all scenarios for the relevant market time unit to the TSOs of Italy North Region.

3. TSOs of Italy North Region shall validate the cross-zonal capacities calculated by the Coordinating Capacity Calculator with grid model provided in accordance with Article 9.2.

4. In case of one of the following situations, the TSOs of Italy North Region shall assess and validate a secure capacity value.
   a. Contingencies or critical network elements are missing;
   b. A mistake in the modelling was found;
   c. Unplanned outages or a trip of an element in the respective TSO grid occurred;
   d. Presence of constraints which were not detected in the TTC calculation process;
e. Expectation of different flow patterns as a result of different market situations compared to the assumption of the CC process occur, which endanger the operational security.

5. Where one or more TSOs of Italy North Region do not validate the cross-zonal capacity calculated, the concerned TSO(s) shall provide the updated amount of cross-zonal capacities for the border(s) considered and the reasons for the reduction. The final cross-zonal capacity is the minimum value sent by the TSOs of Italy North Region.

6. Whenever a TSO of Italy North Region is reducing the amount of cross-zonal capacity during the validation, a report with the reasons and further details about the reduction shall be created. This report shall be submitted to the NRAs on regularly basis.

7. In accordance with Article 26 (5) of the CACM Regulation, the coordinated capacity calculator shall, every three months, report all reductions made during the validation of cross-zonal capacity to all regulatory authorities of the Italy North Region. This report shall include the location and amount of any reduction in cross-zonal capacity and shall give reasons for the reductions.

Article 10

Day-ahead capacity calculation

1. In accordance with Article 8 of the CACM Regulation, the TSOs of Italy North Region shall calculate cross-zonal capacities for each bidding-zone border of Italy North Region.

2. The TSOs of Italy North Region shall provide the coordinated capacity calculator with the last updated information on the transmission systems in a timely manner for the CC that is started in the end of D-2.

3. The coordinated capacity calculator shall use the CGM built in accordance with Article 28 of the CACM Regulation no later than 6 months after the implementation of the CGM methodology developed in accordance with Article 17 of the CACM Regulation, provided that the necessary tools are developed, and compatibility is ensured.

4. Before using the CGM built in accordance with Article 28 of the CACM Regulation, the CGM is created by merging the whole D2CF data set which contains:
   a. The single D2CF data sets from the participating TSO;
   b. For non-participating TSOs, DACF are chosen instead of the D2CF files in case D2CF files are not available.

5. The import direction to Italy is still expected to be the primary market direction. Therefore, a calculation in import direction from all the concerned countries to Italy is always performed. The export capacity from Italy for each border is principally reassessed every year, and this value is used for the daily allocation.
   Due to the increased probability of exports from Italy on one or more borders, the TSOs and Technical Counterparts of the Italy North Region created a roadmap for the implementation of the CC process in export direction from Italy. This includes as well a process for the determination of the most likely market direction based on specific criteria. In case of forecasted exports from Italy on one or more borders, a second, parallel calculation based on this most likely market direction is
performed. TSOs and Technical Counterparties of the Italy North Region shall implement this capacity calculation process according to the roadmap (Article 12(6)).

6. The CC is performed by the coordinated capacity calculator with an iterative process made up of the following steps, these will be repeated until it is not possible to achieve a higher secure level of capacity:
   a. Security analysis on the CGM, considering the constraints defined in Article 6;
   b. Remedial actions optimization to secure the CGM;
   c. In case the CGM is secure, adjustment of exchanges between Italy and the concerned countries while respecting the allocation constraint.

7. The purpose of the RAO is to find an optimal set of Remedial Actions to secure the CGM. In case the operational limits of a CNE defined in Article 6 are exceeded, Remedial Actions are applied. The final set of Remedial Actions that has the highest positive effect on the congested CNE without creating any negative impact on other CNEs and MNEs (as defined in Article 6) is chosen based on sensitivities.

8. The coordinated capacity calculator shall define the values of TTC for each market time unit. These values shall be provided to TSOs and Technical Counterparties of the Italy North Region for validation.

9. The NTC Calculation for each border is achieved according to the following steps:
   a. TTC Validation, performed in accordance with Article 9;
   b. Border NTC Calculation. The lowest value provided by the TTC Validation sub process is considered, reduced by the TRM and then split between the borders according to agreed splitting factors.

10. The coordinated capacity calculator of the Italy North Region shall provide the relevant NEMOs with the validated NTCs for each bidding-zone border of Italy North Region after application of the reliability margin defined in accordance with Article 5.

11. In accordance with Article 46 of the CACM Regulation, the coordinated capacity calculator and TSOs of Italy North Region shall ensure that cross-zonal capacity shall be provided to relevant NEMOs before the day-ahead firmness deadline as defined in accordance with Article 69 of the CACM Regulation.

**Article 11**

**Fallback procedures**

1. Prior to each CC performed in D-2, the TSOs of Italy North Region shall ensure the coordinated capacity calculator is provided with the already allocated capacities within the long-term timeframe.

2. For the CC performed in D-2, where an incident occurs in the CC process and the coordinated capacity calculator is unable to produce results within the allotted time for the calculation process, the TSOs of Italy North Region shall validate the last coordinated cross-zonal capacities calculated within the long-term timeframe. After this validation step, the coordinated capacity calculator or
TSOs of Italy North Region where applicable, shall provide the relevant NEMOs with this coordinated value.

**Article 12**

**Publication and Implementation of the D-2 CCC methodology Proposal**

1. The TSOs of Italy North Region shall publish the D-2 CCC methodology Proposal without undue delay after all national regulatory authorities have approved the proposed D-2 CCC methodology or a decision has been taken by the Agency for the Cooperation of Energy Regulators in accordance with Article 9 (10), Article 9(11) and 9(12) of the CACM Regulation.

2. The TSOs of Italy North Region have already implemented a D-2 CCC methodology. Since February 1st of 2016, individual values for cross-zonal capacity for each day-ahead market time unit have been calculated using the D-2 CCC methodology.

3. The TSOs of Italy North Region will implement this D-2 CCC methodology proposal by complementing the already implemented D-2 CCC methodology, referred to in Article 12(2), in accordance to the articles of this proposal. The implementation of this D-2 CCC methodology proposal will start as soon as the NRAs of the Italy North Region will approve it and be completed no later than 12 months after the approval of NRAs, except for the features listed in Article 12(6). The TSOs of Italy North Region will evaluate the possibility to increase the 5% threshold, referred to in Article 6.2, by submitting a proper study to Italy North NRAs by March 2019 at the latest.

4. The TSOs of Italy North Region currently calculate individual values for cross-zonal capacity based on eight timestamps per day. The TSOs of Italy North Region foresee to calculate individual values for cross-zonal capacity based on twelve timestamps per day at the latest 24 months after the implementation of the CGMES. The migration from eight to twelve timestamps calculated per day will be efficiently evaluated with regard to the management of IT tools on RSC side.

5. The TSOs of Italy North Region currently develop a common coordinated CC methodology using flow-based approach. The TSOs of Italy North Region intend to submit this proposal based on the following planning:
Italy North TSOs proposal for a common D-2 capacity calculation in accordance with Article 21 of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management

This planning is subject to adjustment due to dependencies with other deliverables. In any case, the TSOs of Italy North Region shall respect the deadline for submitting the proposal for a common coordinated CC methodology using flow-based approach up to six months after Switzerland joins the single day-ahead coupling.

6. The TSOs of Italy North Region foresee the implementation of the following parts of this methodology that are not yet into operation, based on the timeline below:

<table>
<thead>
<tr>
<th>D2CC</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export Corner Calculation Implementation</td>
<td>01/09/2020</td>
</tr>
<tr>
<td>Allocation Constraints</td>
<td></td>
</tr>
<tr>
<td>Adaptation of D-2CC process to temporary solution</td>
<td>Q4 2020 at the latest By the approval of the CCM</td>
</tr>
<tr>
<td>RfC for market coupling algorithm</td>
<td></td>
</tr>
<tr>
<td>Adaptation of D-2CC process to long term solution</td>
<td>As soon as RfC is implemented By the approval of the CCM</td>
</tr>
<tr>
<td>Adaptation of AC discretization level</td>
<td></td>
</tr>
</tbody>
</table>

**Article 13 Language**

1. The reference language for this CCC Proposal shall be English.

2. For the avoidance of doubt, where TSOs of Italy North Region need to translate this D-2 CCC methodology Proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs of Italy North Region in accordance with Article 9(14) of the CACM Regulation and any version in another language, the relevant TSOs of Italy North Region
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shall be obliged to dispel any inconsistencies by providing a revised translation of this D-2 CCC methodology Proposal to their relevant national regulatory authorities.
Annex I

Load Flow Algorithm

The CC process is performed using Alternate Current (AC) load flow algorithms (available in the technical literature), considering reactive power capability limits of generators.

Iterative Approach for TTC Calculation

The CC step can be described as a calculation by dichotomy. The coordinated capacity calculator will define a starting capacity level and check if this level of exchange allows the transmission system to be operated within its operational security limits (i.e. no overloads are observed on CNEs). Starting capacity level is equal to the reduced yearly value of TTC (i.e. yearly calculated value reduced for capacity of planned outages).

If the level is secure or can be made secure by optimizing remedial actions, the coordinated capacity calculator will then test a higher value of TTC. Otherwise, it will then test a TTC value in between the
secure and unsecure TTC values until it reaches the last secure TTC. Stopping criteria for optimization is finding last secure and first unsecure level of import. Once both are found, last secure import is considered as maximum Italian import.

The dichotomy is set with a 50 MW step in order to optimize the capacity offered to the market while reducing the computation time. Considering optimal remedial actions have been applied in each step of CC, the dichotomy approach guarantees final solution is less than 50 MW suboptimal compared to absolute maximum Italian import.

**PTDF computation for the selection of critical network elements**

Critical network elements are selected based on their sensitivity to cross-zonal power exchanges, evaluated through a *PTDF* matrix. The elements of this matrix represent the influence of a commercial exchange between bidding zones on power flows on the considered combinations of CNE’s and contingencies. The calculation of the *PTDF* matrix is performed on the basis of the CGM and the GSK.

The nodal *PTDFs* are first calculated by subsequently varying the injection on each node of the CGM. For every single nodal variation, the effect on every CNE’s or CNEC’s loading is monitored and calculated as a percentage (e.g. if an additional injection of a 100 MW has an effect of 10 MW on a CNEC, the nodal *PTDF* is 10 %).

Then the GSK translates the nodal *PTDFs* into zonal *PTDFs* (or zone-to-slack *PTDFs*) as it converts the zonal variation into an increase of generation in specific nodes.

*PTDFs* can be defined as zone-to-slack *PTDFs* or zone-to-zone *PTDFs*. A zone-to-slack *PTDF*: represents the influence of a variation of a net-position on a CNE or CNEC. A zone-to-zone *PTDF*: represents the influence of a variation of a commercial exchange from A to B on a CNE or CNEC i. The zone-to-zone *PTDF*: can be linked to zone-to-slack *PTDFs* as follows:

\[
PTDF_{A \rightarrow Bi} = PTDF_{Ai} - PTDF_{Bi}\]

\[Equation 1\]

---

1 In this load flow calculation the variation of the injection of the considered node is balanced by an inverse change of the injection at the slack node.
Zone-to-zone PTDFs must be transitory i.e.

\[ PTDF_{A,C,i} = PTDF_{A,B,i} + PTDF_{B,C,i} \quad \text{Equation 2} \]

The validity of Equation 2 is ensured by Equation 1

Once all \( PTDF_{A,B,i} \) are computed for each element \( i \), all the elements which satisfy the condition:

\[ PTDF_{FR,IT,i} * SF_{FR,IT} + PTDF_{CH,IT,i} * SF_{CH,IT} + PTDF_{AT,IT,i} * SF_{AT,IT} + PTDF_{SI,IT,i} * SF_{SI,IT} \geq \text{threshold} \]

can be classified as CNE or CNEC significantly impacted by cross zonal power exchanges of the Italy North Region, where \( SF_{j,IT} \) represents the splitting factor for the border \( j \)-IT, in line with the shifting methodology applied during CC.

As a starting point, a \textit{threshold} equal to 0.05 will be used. This value may be reassessed during the implementation of the D-2 CCC Methodology, if deemed necessary by Italy North TSOs.

**TRM figure computation**

The process for the TRM\textsubscript{1} determination could be described as follows:

- **Step 1:** define the statistical period: one full year.
- **Step 2:** discard the timestamps (TSs) of the statistical period not useful for the study (e.g. TS where no CC has been performed, TS with the capacity limited by Additional Constraint, etc.). Also, TSs for which the TTC have been calculated via extrapolation have to be discarded.
- **Step 3:** retrieve the following data for all the selected TS:
  - D-2 TTC without cap/floor (referred as “TTC D-2”),
  - the Real time CGM for the selected TS,
  - reduced Splitting factors.
- **Step 4:** compute the TTC on the real time CGM (referred as “TTC RT”) selected after step 3 for all the selected TS. Then compute all the difference between D-2 and real-time recalculated TTCs (“TTC RT” – “TTC D-2”) and plot those deltas in a distribution curve.
Δ (« SN TTC » - « D-2 TTC »)
Distribution

\[ \text{Distribution function} = \text{uncertainties of the forecast} \]

The process for the TRM distribution function could be described as follows:

- Step 1: define the statistical period: one full year.
- Step 2: for the statistical period retrieve the control program error for the Italian control area (difference between the scheduled program and the actual physical exchange at the Northern Italian interconnection). One-minute average values could be used.
- Step 3: plot those deltas in a distribution curve:

\[ \text{TRM}_2 \text{distribution function} = \text{unintended deviation} \]
Once TRM₁ and TRM₂ distribution functions have been calculated ($f_{TRM₁}$ and $f_{TRM₂}$, respectively) the TRM distribution function ($f_{TRM}$) can be calculated as convolution of above-mentioned distribution functions:

$$f_{TRM} = f_{TRM₁} * f_{TRM₂}$$

The TRM shall be defined as the percentile of the convolution of the probability distribution functions of the two variables TRM₁ and TRM₂, with risk level kept below 10% (e.g. 90 percentile means 10% risk, 99 percentile 1% risk). When defining the percentile and the risk level, the historical experiences (i.e. TRM of 500 MW) should be taken into account.

### Generation and Load Shift Keys

GSK file is defined for:

- an area;
- a time interval: GSK is dedicated to individual daily hours in order to model differences between peak and off-peak conditions per TSO.

Generation and Load shift keys are needed to transform any change in the balance of control area into a change of injections in the nodes of that control area. In order to avoid newly formed unrealistic congestions caused by the process of generation shift, TSOs define both generation shift key (GSK) and load shift key (LSK), where GSKs constitute a list specifying those generators that shall contribute to the shift and LSKs constitute a list specifying those load that shall contribute to the shift in order to take into account the contribution of generators connected to lower voltage levels (implicitly contained in the load figures of the nodes connected to the 220 and 400 kV grid). Each TSO can decide how to represent its best generation shift.

If GSK and LSK are defined, a participation factor is also given:

- G(a) Participation factor for generation nodes
- L(a) Participation factor for load nodes

The sum of G(a) and L(a) for each area has to be to 1 (i.e. 100%).

### Definition of GSK and LSK Nodes:

The list of GSK nodes contains one or more node defined by:

- the name of UCTE Node
- the maximum power production of the node (optional for prop and fact, mandatory for the other methods)
- the minimum power production of the node (optional for prop and fact, mandatory for the other methods)

Several methods are supported by the process:

- **Proportional:**
  Shift in defined generation/load nodes, proportionally to the base case generation/load.
  
  - $P_g(n)$ Active generation in node n, belonging to area a (nodes n defined in GSK list) or
  
  - $P_l(n)$ Active load in node n, belonging to area a (nodes n defined in LSK list)

The participation of node n in the shift, among selected gen. nodes (GSK) is given by:

$$Kg(n,a) = G(a) \cdot \frac{P_g(n)}{\sum_n P_g(n)}$$
The participation of node \( n \) in the shift, among selected load nodes (LSK) is given by:

\[
K_l(n, a) = L(a) \cdot \frac{P_l(n)}{\sum_n P_l(n)}
\]

- **Participation factors:**
  
  Shift in defined generation/load nodes (PV or PQ nodes), according to the participation factors:
  
  - \( k_g(n) \) Participation factor for generation in node \( n \), belonging to area \( a \)
  - \( k_l(n) \) Participation factor for load in node \( n \), belonging to area \( a \)

  The participation of node \( n \) in the shift, among selected gen. nodes (GSK) is given by:

\[
K_g(n, a) = G(a) \cdot \frac{k_g(n)}{\sum_n k_g(n)}; \ 0 \leq k_g(n) \leq 10
\]

The participation of node \( n \) in the shift, among selected load nodes (LSK) is given by:

\[
K_l(n, a) = L(a) \cdot \frac{k_l(n)}{\sum_n k_l(n)}; \ 0 \leq k_l(n) \leq 10
\]

- **Reserve:**
  
  All power plants, which are chosen for the shift, are modified proportionally to the remaining available capacity, as presented hereafter in these equations (1) and (2).

\[
P_{l^{inc}} = P_l + \Delta E \cdot \frac{p_{l^{max}} - P_l}{\sum_{i=1}^{n} (p_{l^{max}} - P_i)} \quad (1)
\]

\[
P_{l^{dec}} = P_l + \Delta E \cdot \frac{p_{l^{min}} - P_l}{\sum_{i=1}^{n} (p_{l^{min}} - P_i)} \quad (2)
\]

Where:

- \( P_l \) = Actual power production.
- \( P_{l^{min}} \) = Minimal power production.
- \( P_{l^{max}} \) = Maximal power production.
- \( \Delta E \) = Power to be shifted.
- \( P_{l^{inc}} \) = New power production after positive shift.
- \( P_{l^{dec}} \) = New power production after negative shift.

- **Merit order**
  
  The chosen generation nodes shift up or down according to the correspondent merit order list GSKup or GSKdown, as described following:
  
  - upward list contains the generation nodes which performs the total positive shift.
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- downward list contains the generation nodes which performs the total negative shift.

Merit order factor defines the number of generation node to be shifted simultaneously. It means that the first group (number defined with Merit order factor) of generating nodes are shifted together and if it is not sufficient, the next group generating nodes are used to complete the total shift, and so on. The total shift is distributed to the last group of Merit order factor generation nodes proportionally to their available margin as defined for Reserve shift. Generation shift keys in Italy North region are determined by each TSO individually on the basis of the latest available information about the generating units and loads.

**Activities and timings of the process**

The main activities of the process are summarized in the following table:

<table>
<thead>
<tr>
<th>ID</th>
<th>Activity</th>
<th>Start Time</th>
<th>End Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Italy North TSOs deliver input files to Coordinated Capacity Calculator</td>
<td>16:00 D-2</td>
<td>19:00 D-2</td>
</tr>
<tr>
<td>002</td>
<td>Building of the CGM by the Coordinated Capacity Calculator</td>
<td>19:00 D-2</td>
<td>21:00 D-2</td>
</tr>
<tr>
<td>003</td>
<td>TTC Calculation and transmission of the results to Italy North TSOs</td>
<td>21:00 D-2</td>
<td>3:00 D-1</td>
</tr>
<tr>
<td>004</td>
<td>Validation of the results by Italy North TSOs</td>
<td>3:00 D-1</td>
<td>7:00 D-1</td>
</tr>
<tr>
<td>005</td>
<td>NTC Calculation</td>
<td>7:00 D-1</td>
<td>7:30 D-1</td>
</tr>
</tbody>
</table>

The intermediate timings may be subject to adjustments in the future if deemed necessary by Italy North TSOs.

**Annex II**

**Handling of Remedial Actions**

The scheme below summarizes the conditions to be fulfilled with this combination of remedial actions to state that all security constraints are respected. Each rounded square represents a different network state.

On N state, preventive remedial actions are implemented and Imax of “base case” CNEs are monitored.

On N-1 states, CNECs are applied and Imax_AfterOutage are monitored. They represent transient admissible current on the monitored branches. Transient current can exceed permanent admissible current provided that available SPS and curative remedial actions are sufficient to keep permanent current not greater than permanent admissible current.

On After Curative states, outage, SPS and curative remedial actions are implemented and Imax_AfterCRA are monitored. They represent permanent admissible current on the monitored branches.

If an outage or a remedial action leads to an unbalance situation due to a modification of generation or load pattern, this unbalance has to be compensated inside the concerned country, by using the GSK of this one.

On SPS states, outage and SPS are applied, Imax_AfterSPS are monitored. Imax_AfterSPS represent transient admissible current on the monitored branches after SPS. Transient current can exceed permanent...
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admissible current, provided that available curative remedial actions are sufficient to keep permanent current not greater than permanent admissible.

In order to prevent overloading of network elements that are influenced by the application of cross-border-impacting remedial actions during the CC in export direction from Italy, these network elements can be included as MNEs in the RAO. For each MNE i in a contingency case, the following has to hold:

\[ \text{Loading}_{\text{after RAO},i} \leq \max(0 I_i; \text{Loading}_{\text{before RAO},i} + \text{Threshold}) \]
Loading$_{\text{before RAO}}$ … Loading of the MNE in a contingency case (based on maximum thermal capacity) before RAO

Loading$_{\text{after RAO}}$ … Loading of the MNE in a contingency case (based on maximum thermal capacity) after application of a remedial action during the RAO

OL$_i$ … Represents operational limits of the respective MNE in a contingency case

In words:
If Loading$_{\text{before RAO}}$ is over OL$_i$ the Loading$_{\text{after RAO}}$ cannot become bigger than Loading$_{\text{before RAO}}$ plus the defined Threshold.