South West Europe TSOs common capacity calculation methodology for the day-ahead and intraday market timeframe in accordance with Article 21 of Commission Regulation (EU) 2015/1222 of 24 July 2015

January 2022

Table of Contents

All TSOs, taking into account the following:

Whereas

(1) This document (hereafter referred to as "South West Europe common capacity calculation methodology", or "SWE common capacity calculation methodology"), is a common methodology developed by all Transmission System Operators (hereafter referred to as "TSOs") within the South West Europe Capacity Calculation Region (hereafter referred to as "SWE Region") on the common capacity calculation performed for the capacity allocation within the day-ahead and intraday market timeframes. This methodology is required by Article 20 (2) and developed in accordance with Article 21 of Regulation (EU) 2015/1222 establishing a guideline on Capacity Allocation and Congestion Management (hereafter referred to as the "CACM Regulation").

(2) This methodology (hereafter referred to as the "CCC methodology") takes into account the general principles and goals set in the CACM Regulation as well as 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").

(3) This methodology takes into account the general principles and goals set in the CACM Regulation, while respecting the principles set in Regulation (EC) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast) (hereafter referred to as "Electricity Regulation").

(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, the TSOs shall calculate in a coordinated manner the available cross-border capacity.

(5) Article 21 (1) of the CACM Regulation constitutes the legal basis for this methodology and defines several specific requirements that the CCC methodology 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 following: "*1. (…) TSOs shall calculate cross-zonal capacity for (…) (a) "day-ahead, for the day-ahead market;"* and *"2. For the day-ahead market time-frame, individual values for cross-zonal capacity for each day-ahead market time unit shall be calculated."*, and *"3. 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 except where the requirements of paragraph 7 are met "* and (7) specifies that: *"TSOs may jointly request the competent regulatory authorities to apply the coordinated net transmission capacity approach in regions and bidding zone borders other than those referred to in paragraphs 2 to 4, if the TSOs concerned are able to demonstrate that the application of the capacity calculation methodology using the flow-based approach would not yet be more efficient compared to the coordinated net transmission capacity approach and assuming the same level of operational security in the concerned region."*

(8) 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".*

(9) In the context of this methodology, 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".*

(10) Article 9 (9) of the CACM Regulation requires that the proposed timescale for the implementation and the expected impact of the CCC methodology on the objectives of the CACM Regulation is described. The impact is presented below (point (10)) of this Whereas Section.

(11) Article 16(3) of the Electricity Regulation describes the capacity calculation process and attributes the role of coordinated capacity calculator to the regional coordination centres:

"*Regional coordination centres shall carry out coordinated capacity calculation in accordance with paragraphs 4 and 8 of this Article, as provided for in point (a) of Article 37(1) and in Article 42(1). Regional coordination centres shall calculate cross-zonal capacities respecting operational security limits using data from transmission system operators including data on the technical availability of remedial actions, not including load shedding. Where regional coordination centres conclude that those available remedial actions in the capacity calculation region or between capacity calculation regions are not sufficient to reach the linear trajectory pursuant to Article 15(2) or the minimum capacities provided for in paragraph 8 of this Article while respecting operational security limits, they may, as a measure of last resort, set out coordinated actions reducing the cross-zonal capacities accordingly. Transmission system operators may deviate from coordinated actions in respect of coordinated capacity calculation and coordinated security analysis only in accordance with Article 42(2). By 3 months after the entry into operation of the regional coordination centres pursuant to Article 35(2) of this Regulation and every three months thereafter, the regional coordination centres shall submit a report to the relevant regulatory authorities and to ACER on any reduction of capacity or deviation from coordinated actions pursuant to the second subparagraph and shall assess the incidences and make recommendations, if necessary, on how to avoid such deviations in the future. If ACER concludes that the prerequisites for a deviation pursuant to this paragraph are not fulfilled or are of a structural nature, ACER shall submit an opinion to the relevant regulatory authorities and to the Commission. The competent regulatory authorities shall take appropriate action against transmission system operators or regional coordination centres pursuant to Article 59 or 62 of Directive (EU) 2019/944 if the prerequisites for a deviation pursuant to this paragraph were not fulfilled. Deviations of a structural nature shall be addressed in an action plan referred to in Article 14(7) or in an update of an existing action plan.*"

(12) Article 16(4) of the Electricity Regulation gives a framework for the consideration of costly remedial actions in the capacity calculation:

"*The maximum level of capacity of the interconnections and the transmission networks affected by cross-border capacity shall be made available to market participants complying with the safety standards of secure network operation. Counter-trading and redispatch, including cross-border redispatch, shall be used to maximise available capacities to reach the minimum capacity provided for in paragraph 8. A coordinated and non-discriminatory process for cross-border remedial*

actions shall be applied to enable such maximisation, following the implementation of a redispatching and counter-trading cost-sharing methodology."

(13) Article 16(8) of the Electricity Regulation complements the principles of the CACM Regulation, with the introduction of a requirement for a minimum level of capacity to be offered to the market:

"*Transmission system operators shall not limit the volume of interconnection capacity to be made available to market participants as a means of solving congestion inside their own bidding zone or as a means of managing flows resulting from transactions internal to bidding zones. Without prejudice to the application of the derogations under paragraphs 3 and 9 of this Article and to 6 the application of Article 15(2), this paragraph shall be considered to be complied with where the following minimum levels of available capacity for cross-zonal trade are reached:*

(a) for borders using a coordinated net transmission capacity approach, the minimum capacity shall be 70 % of the transmission capacity respecting operational security limits after deduction of contingencies, as determined in accordance with the capacity allocation and congestion management guideline adopted on the basis of Article 18(5) of Regulation (EC) No 714/2009;

(b) for borders using a flow-based approach, the minimum capacity shall be a margin set in the capacity calculation process as available for flows induced by cross-zonal exchange. The margin shall be 70 % of the capacity respecting operational security limits of internal and cross-zonal critical network elements, taking into account contingencies, as determined in accordance with the capacity allocation and congestion management guideline adopted on the basis of Article 18(5) of Regulation (EC) No 714/2009.

The total amount of 30 % can be used for the reliability margins, loop flows and internal flows on each critical network element."

(14) Articles 15(1), 15(2) and 15(4), and Article 16(9) of the Electricity Regulation introduce possible temporary exemptions to comply with the minimum level of capacity set in the Article 16(8) of the Electricity Regulation through action plans and derogations.

(15) The CCC methodology 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 CCC methodology 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 and intraday coupling. Establishing common and coordinated processes for the capacity calculations within the day-ahead and intraday market timeframes contributes to achieve this objective.

Article 3 (b) of the CACM Regulation aims at ensuring optimal use of the transmission infrastructure. The CCC methodology contributes to achieve 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 CCC methodology contributes to achieve the objective of ensuring operational security by coordinating the capacity calculation with updated inputs for the day-ahead and intraday 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 CCC methodology contributes to achieve 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 SWE region, the results of the coordinated capacity calculation contributes to determine the most limiting branches within this region, thus supporting TSOs for a more efficient development of the electricity transmission system.

(16) In conclusion, the CCC methodology contributes to the general objectives of the CACM Regulation.

Article 1
Subject matter and scope

The CCC methodology as determined in this document is the common methodology for the capacity calculation performed for the day-ahead and intraday market timeframe for SWE CCR in accordance with Article 21 of the CACM Regulation.

Article 2
Definitions and interpretation

1. For the purposes of the CCC methodology, the terms used shall have the meaning set forth in Article 2 of Regulation (EC) 714/2009, Article 2 of Regulation (EC) 543/2013, which amends the previous, Article 2 of the CACM Regulation, and Article 2 of the Electricity Regulation.

2. In addition, the following definitions shall apply:
   a. 'RTE' means Réseau de Transport d'Electricité, the French system operator;
   b. 'FR-ES border' means the bidding zone border between France and Spain;
   c. 'REE' means Red Eléctrica de España, the Spanish system operator;
   d. 'PT-ES border' means the bidding zone border between Portugal and Spain;
   e. 'REN' means Rede Eléctrica Nacional, S.A., the Portuguese system operator;
   f. 'D-1' means the day before the day of delivery
   g. 'D-2' means two days before the day of delivery
   h. 'D-2 Common Grid Model' means the common grid model built for each market time unit two days before the day of delivery for the day-ahead capacity calculation timeframe in accordance with Article 17 of the CACM Regulation
   i. 'Day-ahead Common Grid Model' means the common grid model built for each market time unit on the day before the day of delivery for the intraday capacity calculation timeframe in accordance with Article 17 of the CACM Regulation
   j. 'CNE' means a critical network element
   k. 'CNEC' means a CNE associated with a contingency used in capacity calculation
   l. 'CT Cap' means Counter-trading Cap.
   m. 'Sensitivity ratio' means the variation of the flow, the voltage or the voltage phase angle difference in one critical network element with a change of 1MW in cross-zonal power exchanges of the bidding-zone border considered.
   n. '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 to the TTC.
   o. '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

p. ‘Standard NTC’ means NTC calculated without using costly remedial actions.

q. ‘Standard TTC’ means TTC calculated without using costly remedial actions.

r. ‘Final NTC’ means the Standard NTC adjusted with the use of costly remedial action.

s. ‘MACZT’ (Margin available for cross-zonal trade) is the portion of capacity of a CNEC available for cross-zonal trade;

t. ‘MCCC’ (Margin from coordinated capacity calculation), which is portion of capacity of CNEC available for cross-zonal trade on bidding-zone borders within the considered CCR;

u. ‘MNCC’ (Margin from non-coordinated capacity calculation), which is portion of capacity of CNEC available for cross-zonal trade on bidding-zone borders outside the considered CCR;

v. ‘PTDF’ (Power Transfer Distribution Factors) indicate the incremental change in real power that occurs on transmission lines due to real power transfers between two bidding-zones;

w. ‘Fmax’ is the maximum power flow of the CNE, respecting operational security limits. The Fmax is calculated with a power factor equal to 0,98;

x. ‘ANTC’ is the additional value of capacity to be added to the Standard NTC calculated, in order to obtain a Final NTC that complies with the minimum capacity requirements, according to Article 16(8) of the Electricity Regulation;

y. ‘minMargin’ is the 70 % requirement as defined by article 16(8) of the Electricity Regulation;

z. ‘Margin’ is the actual usage, in percentage, of the capacity of CNE after the capacity calculation dedicated to cross zonal trade and is equal to MACZT / Fmax.

3. In this CCC methodology, 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 methodology

This methodology applies solely to the common capacity calculation methodology within the SWE Region. Common capacity calculation methodologies within others Capacity Calculation Regions or others timeframes are outside the scope of this methodology.

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 common capacity calculation methodology started in D-2. As the methodology study carried on by the SWE TSOs proved that the influence of one border on the other can be neglected, the TSOs of the SWE Region will not share the power flow capabilities of critical network elements

among different bidding zone borders (article 21(1)(b)(vi) of the CACM Regulation). Taking into account the geographical and electrical distance between the SWE CCR and all other CCRs, the power flow capability of critical network elements will not be shared among different CCRs (article 21(1)(b)(vii) of the CACM Regulation).

Article 5
Cross-zonal capacities for the intraday market

For the intraday market timeframe, individual values for cross-zonal capacity for each remaining intraday market time unit shall be calculated using the common capacity calculation methodology performed in the end of D-1 on Day-ahead Common Grid Model. As the methodology study carried on by the SWE TSOs proved that the influence of one border on the other can be neglected, the TSOs of the SWE Region will not share the power flow capabilities of critical network elements among different bidding zone borders (articles 21(1)(b)(vi) of the CACM Regulation). Taking into account the geographical and electrical distance between the SWE CCR and all other CCRs, the power flow capability of critical network elements will not be shared among different CCRs (article 21(1)(b)(vii) of the CACM Regulation).

Article 6
Reliability margin methodology

1. For the capacity calculation performed in D-2 and in the intraday timeframe, the TSOs of SWE Region defined 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 capacity calculation and which could occur between D-2 and real time, for the market time unit being considered.

2. The reliability margin used by the TSOs of SWE Region for the capacity calculation is the following:

    a. For FR-ES border, in both directions, the reliability margin for the capacity calculation performed in D-2 is calculated as the maximum value between 200 MW, covering the unintended deviation part of the reliability margin, and 7.5% of the TTC value, covering the uncertainties of the forecast part of the reliability margin.
    b. For PT-ES border, in both directions, the reliability margin for the capacity calculation performed in D-2 is calculated as the maximum value between 100 MW, covering the unintended deviation part of the reliability margin, and 10% of the TTC value, covering the uncertainties of the part of the reliability margin.
    c. For both the FR-ES and the PT-ES border, in both directions, the reliability margin for the capacity calculation performed for the intraday market timeframe is defined as the same value of reliability margin as calculated for the capacity calculation performed in D-2.

Article 7
Methodologies for operational security limits, contingencies and allocation constraints

1. The TSOs of SWE Region shall not apply allocation constraints in the capacity calculation within SWE Region.

2. For the capacity calculation, the TSOs of SWE Region shall only monitor the operational security limits and contingencies on network elements significantly influenced by cross-zonal power exchanges. The selection of these critical network elements and contingencies shall be based on a sensitivity analysis updated at least once a year by the TSOs of the SWE Region in the different network states including but not limited to base case, after contingency and after activation of remedial actions.

3. The sensitivity can be defined as follow:

$$SI_{CNE} = \frac{P_{final} - P_{initial}}{\Delta E_{border}} \times 100$$

where:

SI_{CNE} is the Sensitivity Index for each monitored element (in %)
ΔE_{border} is the Increase of Exchange program through the border in MW (100 MW by default)
$P_{initial}$ is the CNE flow in initial state (in MW)
P_{final} is the CNE flow after a variation of ΔE through the border (in MW)

4. Only critical network elements with a sensitivity to cross-zonal power exchanges equal or higher than 10% shall be monitored during the capacity calculation process, except for operational security reasons in which a critical network element with a lower sensitivity to cross-zonal power exchanges needs to be monitored to ensure grid security. These particular exceptions shall be justified to the SWE NRAs in the Quarterly Report.

5. Only contingencies with a delta of sensitivity to cross-zonal power exchanges, between the base case and the case with the contingency of one critical network element, equal or higher than 5%, shall be considered in the capacity calculation process.

6. The TSOs of SWE Region shall review the list of critical network elements to be monitored in the capacity calculation process at least once a year.

7. The coordinated capacity calculator shall use the critical network elements in accordance with Article 7.3 for the capacity calculation performed within SWE Region in order to determine the maximum net transmission capacity for each bidding-zone border.

8. This methodology to select the monitored elements is in line with article 21(1)(b)(ii) since it is an objective way to use in the capacity calculation only monitored elements inside a bidding zones that are significantly taking part in the cross-zonal exchange. This way cross-zonal and internal exchanges are treated on the same level of importance, avoiding undue discrimination of one over the other.

Article 8
Generation and load shift keys methodology

1. The TSOs of SWE Region shall define the generation shift keys methodology in accordance with Article 24 of 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. REE shall define generation and load shift keys based on a merit order list, reflecting the best forecast of market behaviour for each market time unit with all available loads that are enable to participate in balancing markets and all available generation.

4. REN shall define generation and load shift keys based on a merit order list, reflecting the best forecast of market behaviour for each market time unit with all available loads that are enable to participate in balancing markets and all available generation.
   In addition, for loads that do not participate in balancing markets, REN shall define load shift keys proportional to the base case scenarios for each market time unit, reflecting REN's best forecast of market behaviour.

Article 9
Methodology for remedial actions in capacity calculation

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

2. Each TSO of SWE Region shall define individually the remedial actions of its responsibility area to be used in the capacity calculation within SWE Region with market time unit resolution.

3. The remedial actions to be defined by each TSO of SWE Region shall be either preventive (pre-fault) or curative (post-fault). The TSOs of SWE Region may use, *inter alia,* the following remedial actions:

   i. Non-costly

   a. Changing the tap position of a phase shifter transformer.
   b. Topology measure: opening or closing of a line, cable, transformer, bus bar coupler or switching of a network element from one bus bar to another.
   c. HVDC modulation.
   d. Activation/deactivation of FACTS, reactance(s), capacitor(s).

   ii. Costly

   a. Redispatching or modification of generation patterns, either cross-border or internal.
   b. Countertrading.

4. The TSOs of SWE Region shall review the list of the remedial actions that can be used in the capacity calculation within SWE region at least once a year.

5. For each market time unit, in order to improve computation time and precision, SWE TSOs can adapt the list of available remedial actions offered for the capacity calculation. These remedial actions are adapted to the grid situation and forecast.

6. Each TSO of SWE Region shall inform the coordinated capacity calculator in a timely manner on any change in its remedial actions within SWE Region to ensure an efficient capacity calculation.

7. RTE and REE shall coordinate, prior to the capacity calculation, the remedial actions that can be shared with each other to maximize the available cross-zonal capacities for the FR-ES border.

8. REN and REE shall coordinate, prior to the capacity calculation, the remedial actions that can be shared with each other to maximize the available cross-zonal capacities for the PT-ES border.

9. Each TSO of the SWE Region makes available costly remedial actions in accordance with the provisions of the methodology for coordinated redispatching and countertrading with cross-border relevance as defined in Article 35 of CACM Regulation. If any two available remedial actions deliver equivalent effects, the action with a lower cost shall be prioritized.

10. To comply with the minimum capacity requirements according to Article 16(8) of the Electricity Regulation, SWE TSOs shall apply countertrading as costly remedial action, as detailed in the article 14 of this methodology. SWE TSOs will consider applying further remedial actions for this purpose, as provided for in the present Article.

Article 10
Day-ahead capacity calculation

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

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

3. The TSOs of SWE Region shall provide the coordinated capacity calculator with the previously allocated cross-zonal capacities on each border of the SWE Region.

4. The coordinated capacity calculator shall retrieve the most recent common grid model as defined in Article 2.1 of CACM regulation.

5. The capacity calculation process is based on a Remedial Action Optimization methodology which aims to find the higher secure capacity based on the inputs provided by the TSOs and applying a dichotomy.

    a. The workflow shall test several level of cross-zonal exchange by using Generation and Load Shift Keys and determine if this level of exchange is respecting all the monitored critical network elements after the occurrence of all the monitored contingencies as defined in article 29(8)(a) of CACM regulation, applying available remedial actions when necessary as defined in article 29(8)(b) of CACM regulation. All these inputs are sent by SWE TSOs.

For the Portuguese system, in the simulation steps of the capacity calculation process, once the Portuguese Generation Shift Keys is exhausted in one direction, the simulation process will continue changing the Portuguese consumption (Load Shift Keys) in the opposite direction.

b. The computation will start from the Common Grid Model coordinated schedule.
c. The TSOs of the SWE region will use a precision of 50 MW for the calculation in order to maintain a good balance between operationally acceptable calculation time and market needs.
d. The coordinated capacity calculator will not apply rule for avoid undue discrimination between borders of the SWE CCR neither between the SWE CCR and any other CCR as defined in article 29(8)(c)&(d) of CACM regulation as already mentioned in Article 4.

6. The workflow will run a load flow at each level of the dichotomy applying a Newton-Raphson solution method.

7. The RAO will monitor at each step of the calculation the maximum flows, the adequate voltage levels and the maximum voltage phase angle differences defined by the TSOs on all the CNEs. The margin for a given CNE is defined as the difference between the maximum flow/voltage/angle difference allowed on the CNE and the measured flow/voltage/angle difference on the element after simulating a load flow. In the case of under-voltage assessment, the margin is defined as the difference between the measured voltage and minimum voltage allowed on the CNE.

8. In the SWE region a positive margin methodology is used, meaning that as soon as all the margins computed with a given TTC value are positive, the remedial actions optimization stops and moves directly to the next TTC value.

9. The coordinated capacity calculator shall define the values of TTC for each market time unit up to the first unsecured situation. These values shall be provided to TSOs of the SWE Region for validation.

10. Once the TTC is validated, the reliability margin is deduced from the final TTC as defined in article 29(8)(e) of CACM regulation.

11. This computation should take place during the night before the day-ahead allocation.

12. In accordance with Article 46 of CACM Regulation, the coordinated capacity calculator and SWE TSOs shall ensure that cross-zonal capacity shall be provided to Single Day-Ahead Coupling before the day-ahead firmness deadline as defined in accordance with Article 69 of CACM Regulation.

Article 11
Intraday capacity calculation

1. In accordance with Article 14 of CACM Regulation, the TSOs of SWE Region shall calculate cross-zonal capacities for each bidding-zone border of SWE Region.

2. The TSOs of SWE Region shall provide the coordinated capacity calculator with the last updated information on the transmission systems in a timely manner for a first intraday capacity calculation that is performed in the end of D-1, and for a second calculation performed in intraday.

3. The TSOs of SWE Region shall provide the coordinated capacity calculator with the previously allocated cross-zonal capacities on each border of the SWE Region.

4. The coordinated capacity calculator shall retrieve the most recent common grid model as defined in Article 2.1 of CACM regulation.

5. The capacity calculation process is based on a Remedial Action Optimization methodology which aims to find the higher secure capacity based on the inputs provided by the TSOs and applying a dichotomy.
    a. The workflow shall test several level of cross-zonal exchange by using Generation and Load Shift Keys and determine if this level of exchange is respecting all the monitored critical network elements after the occurrence of all the monitored contingencies as defined in article 29(8)(a) of CACM regulation, applying available remedial actions when necessary as defined in article 29(8)(b) of CACM regulation. All these inputs are sent by SWE TSOs.
    For the Portuguese system, in the simulation steps of the capacity calculation process, once the Portuguese Generation Shift Keys is exhausted in one direction, the simulation process will continue changing the Portuguese consumption (Load Shift Keys) in the opposite direction.
    b. The computation will start from the Common Grid Model coordinated schedule.
    c. The TSOs of the SWE region will use a precision of 50 MW for the calculation in order to maintain a good balance between operationally acceptable calculation time and market needs.
    d. The coordinated capacity calculator will not apply rule for avoid undue discrimination between borders of the SWE CCR neither between the SWE CCR and any other CCR as defined in article 29(8)(c)&(d) of CACM regulation as already mentioned in Article 4.

6. The workflow will run a load flow at each level of the dichotomy applying a Newton-Raphson solution method.

7. The coordinated capacity calculator shall define the values of TTC for each market time unit up to the first unsecured situation. These values shall be provided to TSOs of the SWE Region for validation.

8. In the SWE region a positive margin methodology is used, meaning that as soon as all the margins computed with a given TTC value are positive, the remedial actions optimization stops and moves directly to the next TTC value.

9. Once the TTC is validated, the reliability margin is deduced from the final TTC as defined in article 29(8)(e) of CACM regulation.

10. In accordance with Article 56 of CACM Regulation, the coordinated capacity calculator and SWE TSOs shall ensure that cross-zonal capacity shall be provided to Single Intraday Coupling as soon as available and before the execution of the relevant intraday auctions as defined in accordance with Article 55 of CACM Regulation, once implemented.

11. The TSOs of SWE Region shall review the frequency of recalculation no later than two years after the implementation of the capacity calculation for the intraday market timeframe by performing a cost-benefit analysis on the SWE Region. The results of this cost-benefit analysis shall be submitted to all regulatory authorities of the SWE region.

Article 12
Monitoring process

1. Recommendation No 01/2019 of the European Union Agency for the Cooperation of Energy Regulators of 08 August 2019 on the implementation of the minimum margin available for cross-zonal trade pursuant to Article 16(8) of the Electricity Regulation proposes a method to monitor the margin available for cross-zonal trade in accordance with Article 16(9).

2. Based on the aforementioned ACER Recommendation, the MACZT (Margin available for cross-zonal trade) is estimated for each CNEC, day-ahead timeframe, market time unit (MTU). It is divided in two parts: MCCC and MNCC.

   Within coordination areas, which currently apply or intend to apply the coordinated NTC approach within the considered timeframe, the MCCC for each CNEC is calculated with the combination of NTCs that results in the highest loading of the CNEC. The margin combines positive zone-to-zone PTDFs and NTCs as follows:

$$MCCC_{NTC}(MTU) = \sum_{b \in coordination\ area} pPTDF_{z2z,b}(MTU) * NTC_b(MTU)$$

   Where

b	Oriented bidding-zone border which belongs to the considered coordination area
$pPTDF_{z2z,b} = \max(0, PTDF_{z2z,b})$	Positive zone-to-zone PTDF associated with the oriented bidding-zone border b (0 for a negative zone-to-zone PTDF)

   Within a coordination area, for a given CNEC, timeframe and MTU, the fulfilment test is defined by the following equation:

$$MACZT(MTU) = MCCC(MTU) + MNCC(MTU) \geq 70\%\ F_{max}(MTU)$$

3. The adjustment for monitoring the minimum level of capacity as set in Article 16(8) of the Electricity Regulation for SWE CCR considers that SWE borders are without influence from other borders outside the SWE region (other CCRs and Morroco). Thus, MNCC is equal to zero.

   Moreover, considering the NTC approach for SWE CCR, the monitoring CEP's 70% rule only applies to the most limiting CNEC from the resulting Day-Ahead (D-2) Capacity Calculation processes for each timestamp and direction, and is provided by the coordinated capacity calculator of the SWE Region.

4. Within SWE CCR, for a given CNEC, timeframe and MTU, the fulfilment test is defined by the following equations (in coordinated NTC approach):

$$MACZT_{SP\rightarrow FR} = pPTDF_{SP\rightarrow FR} \times NTC_{SP\rightarrow FR} + pPTDF_{PT<->SP} \times NTC_{PT<->SP} \geq 70\%F_{max}$$
$$MACZT_{FR\rightarrow SP} = pPTDF_{FR\rightarrow SP} \times NTC_{FR\rightarrow SP} + pPTDF_{PT<->SP} \times NTC_{PT<->SP} \geq 70\%F_{max}$$
$$MACZT_{SP\rightarrow PT} = pPTDF_{SP\rightarrow PT} \times NTC_{SP\rightarrow PT} + pPTDF_{FR<->SP} \times NTC_{FR<->SP} \geq 70\%F_{max}$$
$$MACZT_{PT\rightarrow SP} = pPTDF_{PT\rightarrow SP} \times NTC_{PT\rightarrow SP} + pPTDF_{FR<->SP} \times NTC_{FR<->SP} \geq 70\%F_{max}$$

5. PTDFs will be calculated dynamically for each CNE, border, direction, timestamp and state:

   (a) Base case PTDF
   (b) PTDF after contingency
   (c) PTDF after contingency and remedial actions

   Finally the selected PTDF will be the highest among the 3 states.

Article 13
Cross-zonal capacity recalculation using countertrading

1. The coordinated capacity calculator shall ensure that the Final NTC fulfils the minimum capacity requirements according to Article 16(8) of the Electricity Regulation.

2. The process to fulfil the minimum capacity requirements consists of adding an Additional NTC (ANTC) to the Standard NTC calculated by the Capacity Calculator, without Costly Remedial Actions, to obtain a Final NTC that takes into account the available Costly RAs.

3. In cases where the limiting CNEC has not been identified, as in situations related to IT issues or loadflow divergences, the provisions of this article do not apply. These shall be reported to market participants as soon as possible, and to NRAs in the Quarterly Report.

4. The Additional NTC is computed as follows for each MTU:

$$ANTC_b = Min\left\{\underset{k}{\text{Min}}\left[\frac{(70 - Margin_k) * Fmax_k}{pPTDF_{k,b}}\right];\ Cap\ CT_b\right\}$$

   Where:
   k is the most limiting element and the 400 kV tie-lines.

   $Margin_k(\%) = \frac{MACZT_k}{Fmax_k} * 100$ and calculated with the Standard NTC values

   If k is a tie-line a new PTDF will be determined after a new powerflow computation and the ANTC calculation will be updated.

5. The Final NTC is computed as follows:

$$NTC_{final(b)} = NTC_{standard(b)} + ANTC_b$$

6. The SWE TSOs shall ensure the availability of the additional NTC using remedial actions, which shall include countertrading, in accordance with Article 9.

7. As provided for in Article 16(3), the additional NTC can be limited at a maximum technical limit of countertrading in which operational security could be endangered, corresponding to:

   (i) the full amount of available generation capacity in the electric system ("lack of energy criterion"), or

   (ii) an amount that would lead to the ensuing "Final NTC" exceeding the Fmax in at least one of the interconnectors for that oriented border.

   (iii) to a situation in which activating further countertrading would lead to additional congestion related with the mobilization of that energy, which would invalidate the "secure scenario" result of the NTC calculation ("congestion shift criterion").

   In these situations, a minimum amount of countertrading of 200 MWh by MTU for PT<>ES, and of 200 MWh by MTU for FR<>ES, for both directions, shall at least be used for the recalculation.

   These situations shall be reported to market participants as soon as possible, and to NRAs in the Quarterly Report defined in Article 16(3).

8. The dispositions of the present article shall be applied to fulfil the minimum capacity requirements foreseen in Article 16(8) of the Electricity Regulation. The compliance to such provision shall be assessed by NRAs as competent entities.

9. No longer than 18 months after the implementation of the methodology, TSOs shall provide NRAs with a study regarding the use of countertrading to increase the capacity offered to the markets. This study must include information regarding the average CAP CT offered by border and direction, the percentage of time the CAP CT was reached. NRAs may require their national TSO to demonstrate in this study that the countertrading offered correspond to their best effort without endangering the operational security of the system. NRAs may then require TSOs to submit an amendment of the methodology before the end of 2023.

Article 14
Cross-zonal capacity validation methodology

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

2. The coordinated capacity calculator shall make available the common grid model for SWE Region in the extreme scenarios for the relevant market time unit to the TSOs of SWE Region.

3. Where required, TSOs can validate the cross-zonal capacities calculated by performing security analysis with grid model provided in accordance with Article 10.2.

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

5. Where one or more SWE TSOs do not validate the cross-zonal capacity calculated, the reason for the reduction could be

    a. dynamic behavior of the grid,
    b. unplanned outage that occurs after the deadline to update the inputs and
    c. incomplete input.

6. Where one or more SWE TSOs do not validate the cross-zonal capacity calculated, the coordinated capacity calculator shall update the margin available for cross-zonal trade (MACZT) in accordance with Article 12(2) considering the Final NTC after TSO(s) validation for the concerned time market units. Moreover, the coordinated capacity calculator shall update the level of CEP's 70% fulfilment in accordance with Article 12(4).

Article 15
Fallback procedures

1. Prior to each capacity calculation started in D-2, the TSOs of SWE Region shall ensure the coordinated capacity calculator is provided with the last coordinated cross-zonal capacities calculated within the long term timeframe.

2. For the capacity calculation performed in D-2, where an incident occurs in the capacity calculation process and the coordinated capacity calculator is unable to produce results within the allotted time for the calculation process, the SWE TSOs and coordinated capacity calculator will proceed as follows:
    a. If no NTC value is obtained from the CC process, SWE TSOs shall validate the last coordinated cross-zonal capacities calculated in the long term timeframe and review it where relevant.
    b. If no limiting CNEC is obtained from the CC process, the back-up limiting CNEC for the corresponding border, direction and timestamp will be assigned. This back-up limiting CNEC is defined as the most frequent limiting CNEC of the D-2 capacity calculation process for the specific timestamp, identified in the last Quarterly Report as described in Article 16(3). For the Monitoring process according to Article 12, an average pPTDF of the same period of application of the Quarterly Report will be applied.

    These measures are transitory, being its results subject to assessment after 6 months. If necessary, the measures shall be reviewed until the end of 2022.

3. Prior to each capacity calculation performed for intraday market timeframe, the TSOs of SWE Region shall ensure the coordinated capacity calculator is provided with the already allocated capacities in previous timeframes.

4. For each capacity calculation performed for intraday market timeframe, where an incident occurs in the capacity calculation process and the coordinated capacity calculator is unable to produce results, the SWE TSOs shall validate the last cross-zonal capacities calculated within SWE Region for the market time unit considered and review it where relevant. The coordinated capacity calculator or TSOs of SWE Region where applicable, shall provide the NEMOs of SWE Region with coordinated value.

Article 16
Publication of data and Reporting

1. The TSOs of the SWE CCR shall[1] publish the following CC relevant data:

    a. Data related to the monitoring process

    For each market time unit:

    i. Timestamp of the associated MTU;
    ii. Border and direction (FR→SP, SP→FR, PT→ES, ES→PT);
    iii. Standard TTC values in MW (for 2 borders and 2 directions);
    iv. Standard NTC values in MW (for 2 borders and 2 directions);
    v. The most limiting CNE (only one) and Contingency identified per timestamp, border and direction;
    vi. Clear name and EIC code of both CNE and Contingency;
    vii. Fmax of a CNE (in MW). Assumption of cos phi =0.98;
    viii. CNE location (name and EIC code): TSO which the CNE is attributed (REE/REN/RTE)
    ix. Zone to Zone PTDF for each CNEC (per unit, for 2 borders and 2 directions)
    x. MCCC of the most limiting CNEC (for 2 borders and 2 directions)
    xi. Margin (%)=MCCC/Fmax
    xii. MACZT≥ 70%: "YES" if Margin ≥ 70%. Otherwise, "NO".

    b. Data related to the adjustment process

    For each market time unit:

    i. ANTC
    ii. Final NTC
    iii. MACZT after adjustment ≥70%: "YES" or "NO"
    iv. The final most limiting CNE (only one) and Contingency identified per timestamp, border and direction
    v. Clear name and EIC code of both CNE and Contingency

    c. Data related to the validation process

    For each market time unit, if any adjustment is performed in the validation phase:

    i. Explanation on the reason for non-validation

[1] *National laws for protection of critical infrastructure could limit the publication of information mentioned in point v and vi*

ii. TSO triggering the non-validation signal
iii. Reduced Final NTC
iv. MACZT after Reduction

2. All data listed in paragraph 1 are published on a daily basis, using standard channels for delivery of information to market participants (such as the JAO platform), at latest one hour before the day-ahead market gate closure time.

3. In accordance with Article 26 (5) of CACM regulation, the coordinated capacity calculator shall, every three months, provide a "Quarterly Report" to all regulatory authorities of the SWE region containing, at least:
    a. all reductions made during the validation of cross-zonal capacity
    b. the location and amount of any reduction in cross-zonal capacity and the reasons for the reductions
    c. CNEs with sensitivity lower than 10% that have been included for security reasons, including an explanation of such reason
    d. All situations in which the adjustment phase fails, or the CT Cap is reached, with a detailed explanation of the reason
    e. All activations of the fallback solution, with a detailed explanation of the reason and preventive & curative actions engaged to avoid process failures in the future.
    f. any other deviation from the standard process that can have an impact on cross-zonal capacity in the SWE Region

4. The following information shall be communicated to market participants, as soon as available, using the JAO platform and other TSO channels:

    a. activations of the fallback solution, including the fallback capacity made available
    b. reductions made during the validation of cross-zonal capacity
    c. situations in which the adjustment phase fails, or the CT Cap is reached
    d. any other deviation from the standard process that can have a significant impact on cross-zonal capacity in the SWE Region
    e. if any of the aforementioned issues bears the risk of extending itself in time, an estimation on when it could be solved

Article 17
Publication and Implementation of the CCC methodology

1. The TSOs of the SWE Region shall publish the CCC methodology without undue delay after all national regulatory authorities of SWE CCR have approved it.

2. The TSOs of the SWE Region shall implement the CCC methodology with immediate effect, except for the following:

    a. Cross-zonal capacity recalculation using Countertrading in D-2 no later than Q4 of 2021;
    b. The first calculation for intraday market timeframe not later than Q4 of 2021;
    c. The second calculation for intraday market timeframe not later than Q1 of 2022;

d. Daily publication of data to market participants provided for in Article 16(2), no later than Q2 of 2022;
e. Communication of relevant information to market participants provided for in Article 16(4), no later than Q3 of 2022.

3. The previous version of this methodology, approved by the NRAs of SWE CCR on the 15/Nov/2018, is repealed.

Article 18
Transitory period

For a transitory period and until the Common Grid Model is available at Union level, coordinated capacity calculator shall merge the individual grid model provided by each TSO of the SWE region. During the merging process, quality checks of the information provided by each TSO of the SWE Region shall be performed by the coordinated capacity calculator.

Article 19
Language

1. The reference language for this common capacity calculation Proposal shall be English.

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