Core CCR TSOs' proposal for the regional design of the day-ahead common capacity calculation methodology in accordance with Article 20 ff. of Commission Regulation (EU) 2015/1222 of 24 July 2015

27 June 2017

Table of Contents

TSOs of the Core CCR, taking into account the following,

Whereas

1. This document is the proposal developed by the transmission system operators of the Core CCR (hereafter referred to as "Core TSOs") regarding the development of the common capacity calculation methodology in accordance with Article 20 ff. of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on Capacity Allocation and Congestion Management (hereafter referred to as the "CACM Regulation"). This proposal is hereafter referred to as "day-ahead common capacity calculation methodology Proposal".

2. The day-ahead common capacity calculation methodology Proposal 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"). The goal of the CACM Regulation is the coordination and harmonisation of capacity calculation and allocation in the day-ahead cross-border markets. It sets for this purpose requirements to develop a proposal for a day-ahead common capacity calculation methodology to ensure efficient, transparent and non-discriminatory capacity allocation.

3. Article 20(2) of the CACM Regulation stipulates "all TSOs in each capacity calculation region shall submit a proposal for a common coordinated capacity calculation methodology within the respective region."

4. According to Article 9(9) of the CACM Regulation, the expected impact of the day-ahead common capacity calculation methodology Proposal on the objectives of the CACM Regulation has to be described and is presented below. The proposed day-ahead common capacity calculation methodology generally contributes to the achievement of the objectives of Article 3 of the CACM Regulation.

5. The proposed day-ahead common capacity calculation methodology serves the objective of promoting effective competition in the generation, trading and supply of electricity (Article 3(a) of the CACM Regulation) since the same day-ahead common capacity calculation methodology will apply to all market participants on all respective bidding zone borders in the Core CCR, thereby ensuring a level playing field amongst respective market participants. Market participants will have access to the same reliable information on cross-zonal capacities and allocation constraints for day-ahead allocation, at the same time and in a transparent way.

6. The proposed day-ahead common capacity calculation methodology contributes to the optimal use of transmission infrastructure and operational security (Article

3(b) and (c) of the CACM Regulation) since the flow-based mechanism aims at providing the maximum available capacity to market participants on day-ahead timeframe within the operational security limits.

7. The proposed day-ahead common capacity calculation methodology serves the objective of optimising the allocation of cross-zonal capacity in accordance with Article 3(d) of the CACM Regulation since the common capacity calculation methodology is using the flow-based approach which provides optimal cross-zonal capacities to market participants.

8. The proposed day-ahead common capacity calculation methodology is designed to ensure a fair and non-discriminatory treatment of TSOs, NEMOs, the Agency, regulatory authorities and market participants (Article 3(e) of the CACM Regulation) since the day-ahead common capacity calculation methodology is performed with transparent rules that are approved by the relevant national regulatory authorities after the consultation period where applicable.

9. Regarding the objective of transparency and reliability of information (Article 3(f) of the CACM Regulation), the day-ahead common capacity calculation methodology Proposal determines the main principles and main processes for the day-ahead timeframe. The proposed day-ahead common capacity calculation methodology enables TSOs to provide market participants with the same reliable information on cross-zonal capacities and allocation constraints for day-ahead allocation in a transparent way and at the same time.

10. The day-ahead common capacity calculation methodology Proposal also contributes to the objective of respecting the need for a fair and orderly market and price formation (Article 3(h) of the CACM Regulation) by making available in due time the cross-zonal capacity to be released in the market.

11. When preparing the day-ahead common capacity calculation methodology Proposal, TSOs took careful consideration of the objective of creating a level playing field for NEMOs (Article 3(i) of the CACM Regulation) since all NEMOs and all their market participants will have the same rules and non-discriminatory treatment (including timings, data exchanges, results formats etc.) within the Core CCR.

12. Finally, the day-ahead common capacity calculation methodology Proposal contributes to the objective of providing non-discriminatory access to cross-zonal capacity (Article 3(j) of the CACM Regulation) by ensuring a transparent and non-discriminatory approach towards facilitating cross-zonal capacity allocation.

13. In conclusion, the day-ahead common capacity calculation methodology Proposal contributes to the general objectives of the CACM Regulation to the benefit of all market participants and electricity end consumers.

SUBMIT THE FOLLOWING DAY-AHEAD COMMON CAPACITY CALCULATION METHODOLOGY PROPOSAL TO REGULATORY AUTHORITIES OF CORE CCR:

Article 1
Subject matter and scope

The common capacity calculation methodology as determined in this proposal shall be considered as a proposal of Core TSOs in accordance with Article 20 ff. of the CACM Regulation and shall cover the day-ahead common capacity calculation methodology for the Core CCR bidding zone borders.

Article 2
Definitions and interpretation

1. For the purposes of the day-ahead common capacity calculation methodology Proposal, terms used in this document shall have the meaning of the definitions included in Article 2 of the CACM Regulation, of Regulation (EC) 714/2009, Directive 2009/72/EC and Commission Regulation (EU) 543/2013. In addition, the following definitions and abbreviations shall apply:
    a) 'CCC' is Coordinated Capacity Calculator, as described in Art. 2(11) of the CACM Regulation;
    b) 'CGM' is the common grid model;
    c) 'CGMM' is the Common Grid Model Methodology as submitted to all NRAs by all TSOs on the 27th of May 2016 as amended;
    d) 'CNE' means a critical network element;
    e) 'CNEC' is a critical network element with a contingency;
    f) 'FAV' is the Final Adjustment Value;
    g) 'FRM' is the Flow Reliability Margin;
    h) 'GSK' is the Generation Shift Key;
    i) 'IGM' is the individual grid model;
    j) 'LTN' are the Long Term Nominations;
    k) 'Merging agent' as defined in Article 20 of CGMM;
    l) 'PST' is a phase shifting transformer;
    m) 'PTDF' is the Power Transfer Distribution Factor;
    n) 'RA' means a Remedial Action;
    o) 'RAM' is the Remaining Available Margin;
    p) 'RAO' is the Remedial Action Optimization;
    q) 'SA' is a Shadow Auction;

r) ‘SO GL’ is the System Operation Guideline, one of the network codes/guidelines drafted under the Third Energy Package.

s) ‘zone-to-slack PTDF’ means the power transfer distribution factor of a commercial exchange between a bidding zone and slack node.

t) ‘zone-to-zone PTDF’ means the power transfer distribution factor of a commercial exchange between two bidding zones;

u) ‘preventive’ remedial action means a remedial action which is applied before a contingency occurs;

v) ‘curative’ remedial action means a remedial action which is applied after a contingency occurs.

2. In this day-ahead common capacity calculation methodology Proposal, unless the context requires otherwise:
   a) the singular indicates the plural and vice versa;
   b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of this day-ahead flow-based capacity calculation methodology Proposal; and
   c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Application of this proposal

This Core common capacity methodology proposal solely applies to the day-ahead capacity calculation within the Core CCR. Common capacity calculation methodologies within other capacity calculation regions or other time frames 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 flow-based approach as defined in the day-ahead common capacity calculation methodology, as set forth in Article 20(3) of the CACM Regulation.

Article 5
Methodology for critical network elements and contingencies selection

1. The Core TSOs shall select the critical network elements used in operational security analysis in line with Article 72 of the SO GL.

2. In accordance with Article 23 of CACM Regulation, the Core TSOs shall select the contingencies used in operational security analysis in line with Article 33 of the SO GL.

3. The Core TSOs shall distinguish between:
   a) the CNECs that are significantly influenced by the changes in bidding zone net positions and
   b) the CNECs that are significantly influenced by the remedial actions defined in Article 10, but are not significantly influenced by cross zonal exchanges.

   Depending on the categorization of the CNECs, the treatment during the Remedial Action Optimisation (RAO) may be different. The second category of CNECs will only be considered during the RAO.

4. According to Article 29(3) and Article 21(1)(b)(ii) of the CACM Regulation, the Core TSOs shall ignore the CNECs that are not significantly influenced by the changes in bidding zone net positions in order to calculate the cross-zonal capacity. The CNECs that have a maximum zone-to-zone PTDF as described in Article 12 less than a common threshold shall be justified by the responsible TSO and reported in the monitoring report as described in Article 23.

Core TSOs are investigating the possibility to additionally ensure a minimum RAM for the CNECs limiting the cross-zonal capacity. The applicability of this approach depends on whether sufficient remedial actions are available to ensure the minimum RAM while safeguarding the operational security limits and is subject to the principles on cost sharing in line with Article 74(1) of the CACM Regulation and the recovery of the additional costs incurred by the TSOs.

Article 6
Methodology for operational security limits

1. In accordance with Article 23 of the CACM Regulation,
   a) the Core TSOs shall respect the maximum admissible current (I_{max}) which is the physical limit of a CNE according to the operational security policy in line with Article 25 of the SO GL. The maximum admissible current can be defined with:
      a) Fixed limits for all market time units;
      b) Fixed limits for all market time units of a specific season;
      c) A value per market time unit depending on the weather forecast.
   b) when applicable, I_{max} shall be defined as a temporary current limit of the CNE in accordance with Article 25 of the SO GL. A temporary current limit means that an overload is only allowed for a certain finite duration.
   c) the value F_{max} describes the maximum admissible power flow on a CNE. F_{max} is calculated from I_{max} by the given formula:

$$F_{max} = \sqrt{3} \cdot I_{max} \cdot U \cdot \cos(\varphi)$$

where I_{max} is the maximum permanent admissible current in kA of a critical network element (CNE). The values for cos(φ) and the reference voltage U (in kV) are fixed values for each CNE; and

d) The maximum admissible power flow on a CNE may be increased or decreased by the Final Adjustment Value (FAV) in order to simulate the effect of a complex Remedial Action (RA) which may not be explicitly modelled in the capacity calculation, or during the validation process in accordance with Article 20.

Article 7
Methodology for allocation constraints

1. In accordance with Article 23(3)(a) of the CACM Regulation, besides active power flow limits on CNEs, other specific limitations may be necessary to maintain the secure grid operation. Since such specific limitations cannot be efficiently transformed into operational security limits of individual CNEs, they are expressed as maximum import and export constraints of bidding zones. These allocation constraints are called external constraints. They are determined by the TSOs and taken into account during the day-ahead market coupling in addition to the power flow limits on CNECs.

2. A TSO may use external constraints in order to avoid situations which lead to stability problems in the network, detected by system dynamics studies.

3. A TSO may use external constraints in order to avoid situations which are too far away from the reference flows going through the network in the D-2 CGM, and which in exceptional cases would induce extreme additional flows on grid elements, leading to a situation which could not be validated as safe by the concerned TSO during the validation step.

4. A TSO may use external constraints in case of a central dispatch model to ensure adequate level of generation reserves, because in such systems the reserve procurement process is integrated with procurement of balancing energy and takes place after the closure of the day-ahead market.

Article 8
Reliability margin methodology

1. The reliability margins (Article 22 of the CACM Regulation) for critical elements (hereafter referred to as “FRM”) are calculated in a two-step approach:
   a) The FRM determination is performed in a first step by comparing the power flows on each CNEC of the Core CCR, as expected with the day-ahead common capacity calculation methodology with the real time flows

observed on the same CNEC. All differences for a defined time period are statistically assessed and a probability distribution is obtained.

b) In a second step, a risk level is applied yielding the FRM values for each CNEC. The FRM values are constant for a given time period, which is defined by the frequency of FRM determination process.

2. In accordance with Article 22(2) and (4) of the CACM Regulation, the FRMs cover the following forecast uncertainties with a risk level to be determined per TSO:
   a) Core external transactions (out of Core CCR control: both between Core CCR and other CCRs as well as among TSOs outside the Core CCR);
   b) Generation pattern including specific wind and solar generation forecast;
   c) Generation Shift Key;
   d) Load forecast;
   e) Topology forecast;
   f) Unintentional flow deviation due to the operation of load frequency controls; and
   g) Flow-based capacity calculation assumptions including linearity and modelling of external (non-Core) TSOs' areas.

3. The Core TSOs shall assess the possible improvements of the inputs of the common capacity calculation in the annual review as defined in Article 21.

Article 9
Generation shift keys methodology

1. In accordance with Article 24 of the CACM Regulation, the Core TSOs developped the following methodology to determine the common generation shift key:

   a) The TSOs shall take into account the available information on generation or load available in the common grid model for each scenario developed in accordance with Article 18 of the CACM Regulation in order to select the nodes that will contribute to the generation shift key.
   b) The TSOs shall define a constant generation shift key per market time unit.
   c) The TSOs belonging to the same bidding zone shall determine a common methodology that translates a change in the net position to a specific change of generation or load in the common grid model.

2. For the application of the methodology, Core TSOs may define:

   a) generation shift keys based proportional to the actual generation in the D-2 CGM for each market time unit;

b) generation shift keys for each market time unit with fixed values based on the D-2 CGM and based on the maximum and minimum net positions of their respective bidding zones; or

c) generation shift keys with fixed values based on the D-2 CGM for each peak and off-peak situations.

Article 10
Methodology for remedial actions in capacity calculation

1. In accordance with Article 25 of the CACM Regulation, Core TSOs shall define Remedial Actions (RAs) to be taken into account in the day-ahead common capacity calculation. These RAs will be used for optimizing the cross-zonal capacities while ensuring secure power system operation.

2. The calculation can take explicit and implicit RAs into account.
   a) Explicit RAs can be:
      - Changing the tap position of a phase shifting transformer (PST);
      - Topological measure: opening or closing of one or more line(s), cable(s), transformer(s), bus bar coupler(s), or switching of one or more network element(s) from one bus bar to another;

      All explicit RAs applied must be coordinated in line with Article 25 of the CACM Regulation.
   b) Implicit RAs can be used when it is practically not possible to explicitly express a RA by means of concrete change in the grid model. The influence of an implicit RA on CNECs is assessed upfront and taken into account by using FAV, which changes the RAMs of the CNECs to a certain amount.

3. The RAs can be preventive or curative.

Article 11
Provision of the inputs

1. The TSOs of the Core CCR shall provide to the coordinated capacity calculator before a certain deadline commonly agreed between the TSOs and the coordinated capacity calculator the following inputs:
   a) D-2 IGMs respecting the methodology developed in accordance with Article 19 of the CACM Regulation;
   b) Critical Network Elements (CNEs) and Contingencies in accordance with Article 5;
   c) Operational security limits in accordance with Article 6;
   d) Allocation constraints in accordance with Article 7;
   e) Flow Reliability Margin (FRM) in accordance with Article 8;

f) Generation Shift Key (GSK) in accordance with Article 9; and

g) Remedial actions in accordance with Article 10.

2. When providing the inputs, the TSOs of the Core CCR shall respect the formats commonly agreed between the TSOs and the coordinated capacity calculators of the Core CCR, while respecting the requirements and guidance defined in the CGMM.

3. When applicable, the merging agent shall merge the D-2 IGMs to create the D-2 CGMs respecting the methodology developed in accordance with Article 17 of the CACM Regulation.

4. The TSOs shall send for each time unit of the day the long term allocated capacities (LTA) to the CCC.

Article 12
Mathematical description of the capacity calculation approach

1. For each CNEC defined in accordance with Article 21(b)(i) of the CACM Regulation, the Core TSOs shall calculate the influence of the bidding zone net position changes on its power flow. This influence is called zone-to-slack Power Transfer Distribution Factor (PTDF). This calculation is performed on the basis of the D-2 CGM and the GSK defined in accordance with Article 9. The nodal PTDFs can be first calculated by subsequently varying the injection on each node of the D-2 CGM. For every single nodal variation, the effect on every CNE's or CNEC's loading is monitored and calculated as a percentage. The GSK shall translate the nodal PTDFs into zone-to-slack PTDFs as it converts the bidding zone net position variation into an increase of generation in specific nodes.

2. PTDFs may be defined as zone-to-slack PTDFs or zone-to-zone PTDFs. A zone-to-slack $PTDF_{A,I}$ represents the influence of a variation of a net position of bidding zone A on a CNE or CNEC. A zone-to-zone $PTDF_{A->B,I}$ represents the influence of a variation of a commercial exchange from A to B on a CNE or CNEC I. The zone-to-zone $PTDF_{A->B,I}$ can be linked to zone-to-slack PTDFs as follows:

$$PTDF_{A->B,I} = PTDF_{A,I} - PTDF_{B,I}$$

3. The reference flow (F_{ref}) is the active power flow on a CNE or a CNEC based on the CGM. In case of a CNE, the F_{ref} is directly simulated from the CGM whereas in case of a CNEC, the F_{ref} is simulated with the specified contingency.

4. The expected flow in the commercial situation i F_i is the active power flow of a CNE or CNEC based on the flow F_{ref} and the deviation of commercial exchanges

between the CGM (reference commercial situation) and the commercial situation i:

$$F_i = F_{ref} + \sum_{k=1}^{n} PTDF_k \times (NP_{k,i} - NP_{k,ref})$$

Where for a CNE or a CNEC:

- F_{ref} is the active power flow in the CGM;
- $PTDF_k$ is the zone-to-slack PTDF of the bidding zone k; and
- $NP_{k,i}$ is the Core Net Position of the bidding zone k in the commercial situation i and $NP_{k,ref}$ is the Core Net Position of the bidding zone k in the CGM.

5. The remaining available margin (RAM) of a CNE or a CNEC in a commercial situation i is the remaining capacity that can be given to the market taking into account the already allocated capacity in the situation i. This RAM_i is then calculated from the maximum admissible power flow (F_{max}), the reliability margin (FRM), the final adjustment value (FAV) and the expected flow (F_i) with the following equation:

$$RAM_i = F_{max} - FRM - FAV - F_i$$

Article 13
Long term allocated capacities (LTA) inclusion

1. In accordance with Article 21(b)(iii) of the CACM Regulation, the Core TSOs developed the following rules for taking into account the previously allocated cross-zonal capacity:

   a) The objective of the rule is to verify that the RAM of each CNE or CNEC remains positive in all combinations of previously allocated commercial net positions.

   b) "Previously allocated capacities" on all commercial borders of the Core CCR are the long term allocated capacities (LTA). LTA shall be calculated under the framework of Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on forward capacity allocation in accordance with the therein foreseen respective timelines.

2. The following equation is applied to all possible combinations of net positions resulting from full utilization of previously allocated capacities on all commercial borders:

$$F_i = F_{ref} + \sum_{k=1}^{n} PTDF_k \times (NP_{k,i} - NP_{k,ref})$$

with $NP_{k,i}$: Core net position of bidding zone k in LTA utilization combination i then the following equation is checked:

$$RAM_i = F_{max} - FRM - FAV - F_i$$

3. If at least one of the remaining available margin is smaller than zero, this means the previously allocated capacities are not fully covered by the flow-based domain. In this case a method is applied in two steps. The first step is to increase the RAM of limiting CNEs using the FAV concept until a certain threshold value, if desired by the respective TSO. If this is not sufficient, a second step consists in creating virtual constraints and replacing the CNEs or CNECs for which the RAM_i is negative.

Article 14
Rules on the adjustment of power flows on critical network elements due to remedial actions

1. In accordance with Article 21(1)(b)(iv) of the CACM Regulation, this day-ahead common capacity calculation methodology Proposal shall describe the rules on the adjustment of power flows on critical network elements due to remedial actions:
   a) The coordinated application of RAs shall aim at optimizing power flows and thus cross-zonal capacity in the Core CCR. The RAO itself consists of a coordinated optimization of cross-zonal capacity within the Core CCR by means of modifying the shape of the flow-based domain in order to accommodate the expected market preferences;
   b) The optimization shall be an automated, coordinated and reproducible process; and
   c) The Core TSOs shall individually determine the RAs that are given to the RA optimization and the actions should be transparent to all TSOs.

Article 15
Integration of HVDC interconnectors located within the Core CCR

The Evolved Flow Based (EFB) methodology describes how to consider HVDC interconnectors within the flow-based Core CCR during capacity calculation and efficiently allocate cross-zonal capacity on HVDC interconnectors. This is achieved by taking into account the impact of an exchange over an HVDC interconnector on all CNEs directly during the capacity allocation. This, in turn, allows taking into account

the flow-based properties and constraints of the Core CCR (in contrast to an NTC approach) and at the same time ensures optimal allocation of capacity on the interconnector in terms of market welfare.

Article 16
Capacity calculation on non-Core CCR borders

In accordance with Article 21(1)(b)(vii) of the CACM Regulation, the Core TSOs will take into account the influences of other CCRs by making assumptions on what will be the possible non-Core exchanges. These assumptions will be captured in the D-2 CGM used as a basis, or starting point, for FB capacity calculations. The expected exchanges are thus captured implicitly in the RAM over all CNECs. Resulting uncertainties linked to the aforementioned assumptions are implicitly integrated within each CNEC's FRM. As such, these assumptions will impact (increasing or decreasing) the RAMs of Core CNECs.

Article 17
Calculation of the final flow-based domain

1. After the determination of the optimal preventive and curative RAs, the RAs are explicitly associated to the respective Core CNECs (thus altering their Reference flow F_{ref} and PTDF values) and the final FB parameters computed in the following sequential steps:

    a. Execution of the rules for previously allocated capacity in Article 13;

    b. Only the constraints that are most limiting the net positions need to be respected in the Market Coupling: the non-redundant constraints (or the "presolved" domain). As a matter of fact, by respecting this "presolved" domain, the commercial exchanges also respect all the other constraints. The redundant constraints are identified and removed by the CCC by means of the so-called "presolve" process;

    c. As the reference flow (F_{ref}) is the physical flow computed from the D-2 CGM, it reflects the loading of the CNEs and CNECs given the forecast commercial exchanges of the reference day. Therefore, this reference flow has to be adjusted to take into account the effect of the LTN (Long Term Nominations) of the MTU (Market Time Unit) instead. The PTDFs remain identical in this step. Consequently, the effect on the FB capacity domain is a shift in the solution space.
    For the LTN adjustment, the power flow of each CNE and CNEC is calculated with the linear equation described in Article 13:

$$F_{LTN} = F_{ref} + \sum_{k=1}^{n} PTDF_k \times (NP_{k,LTN} - NP_{k,ref})$$

d. Finally the remaining available margin for the DA-allocation can be calculated as follow:

$$RAM_{LTN} = F_{max} - FRM - FAV - F_{LTN}$$

e. In addition, the external constraints are adjusted such that the limits provided to the Market Coupling mechanism refer to the increments or decrements of the net positions with respect to the net positions resulting from LTN.

Article 18
Precoupling backup and default processes

1. In accordance with Article 21(3) of the CACM Regulation, this proposal shall include a fallback procedure for the case where the initial capacity calculation does not lead to any results:
   a. Spanning for filling up gaps if some timestamps are missing can be computed. When inputs for flow-based parameters calculation are missing for less than three hours, it is possible to compute spanned flow-based parameters with an acceptable risk level, by the so-called spanning method. The spanning method is based on an intersection of previous and sub-sequent available flow-based domains, adjusted to zero balance (to delete impact of reference program). For each TSO, the CNEs from the previous and sub-sequent timestamps are gathered and only the most constraining ones of both timestamps are taken into consideration (intersection).
   b. In case of impossibility to span the missing parameters, TSOs can deploy the computation of “Default flow-based parameters”. This computation shall be based on existing Long Term bilateral capacities. These capacities can be converted easily into flow-based external constraints (i.e. import or export), via a simple linear operation. In order to optimize the capacities provided in this case to the allocation system, involved TSOs will adjust the long term capacities during the capacity calculation process. Eventually, delivered capacities will be equal to “LTA value + n” for each border, transformed into flow-based constraints, “n” being positive or null and computed during the capacity calculation process. Involved TSOs, for obvious reasons of security of supply, cannot commit to any value for “n” at this stage.

Article 19
ATC for Shadow Auctions

1. In the event of unavailability of the normal or backup operation of the Core day-ahead price coupling a fallback solution will be applied, this means that shadow auctions (SA) will be organized. This process require the determination of bilateral ATC figures for each market time unit, what is in line with the "All Core TSOs' proposal for Fallback Procedures"[1].

2. The flow-based domains will serve as the basis for the determination of the ATC values that are input to the Shadow Auctions (hereafter referred to as "SA ATC"). As the selection of a set of ATCs from the flow-based domain leads to an infinite set of choices, an algorithm has been designed that determines the SA ATC values in a systematic way.

3. The following input data are required for each market time unit:
    a. LTA values;
    b. presolved flow-based parameters as sent to the PXs.

4. The following outputs are the outcomes of the computation for each market time unit:
    a. ATC values for Shadow Auction;
    b. constraints with zero margin after the SA ATC computation.

5. The SA ATC computation is an iterative procedure.

    a. Starting point: First, the remaining available margins (RAM) of the presolved constraints (CNEs, CNECs and external constraints) have to be adjusted to take into account the starting point of the iteration.
    b. From the zone-to-slack PTDFs (PTDFz2s), one computes zone-to-zone PTDFs (pPTDFz2z), where only the positive numbers are stored:

$$pPTDF_{z2z}(A > B) = \max\left(0, PTDF_{z2s}(A) - PTDF_{z2s}(B)\right)$$

    where A, B are two different Core bidding zones. Only zone-to-zone PTDFs of Core internal borders, i.e. of neighbouring market area pairs are needed.

[1] Submitted to the Core NRAs on the 17th of May 2017.

c. The iterative procedure to determine the SA ATC starts from the LTA domain. As such, with the impact of the LTN already reflected in the RAMs, the RAMs need to be adjusted in the following way:

$$Margin(0) = RAM_{LTN} - pPTDF_{z2z} * (NTC_{min} - LTN) Margin(0) \\ = RAM_{LTN} - pPTDF_{z2z} * (NTC_{min} - LTN)$$

6. The iterative method applied to compute the SA ATCs in short comes down to the following actions for each iteration step i:

   a. For each CNE, CNEC and external constraint, share the remaining margin between the Core internal borders that are positively influenced with equal shares.
   b. From those shares of margin, maximum bilateral exchanges are computed by dividing each share by the positive zone-to-zone PTDF.
   c. The bilateral exchanges are updated by adding the minimum values obtained over all CNEs, CNECs and external constraints.
      Update the margins on the CNEs, CNECs and external constraints using new bilateral exchanges from step 3 and go back to step 1.
   d. Iterations continue until the maximum value over all constraints of the absolute difference between the margin of iterations i+1 and i is smaller than a stop criterion.
   e. The resulting SA ATCs get the values that have been determined for the maximum Core internal bilateral exchanges (obtained in iteration i+1) after rounding down to integer values.
   f. After algorithm execution, there are some CNEs, CNECs and external constraints with no remaining available margin left. These are the limiting constraints of the SA ATC computation.

Article 20
Capacity validation methodology

In accordance with Article 26 of the CACM Regulation,

a. Each TSO may reduce cross-zonal capacity during the validation of cross-zonal capacity relevant to the TSO's bidding zone borders for reasons of operational security.
b. When performing the validation, the TSOs may consider the operational security limits, but may also consider additional grid constraints, grid models, and other relevant information. Therefore the TSOs may use, but are not limited to, the tools developed by the CCC for analysis and might also employ verification tools not available to the CCC.

c. In case of a required reduction, a TSO may use FAV for its own CNECs or adapt the external constraints to reduce the cross-zonal capacity. In this case a new final FB computation will be launched. In exceptional situations, a TSO may also request a common decision to launch the Default Flow-Based parameters.
d. The regional coordinated capacity calculator shall coordinate with neighbouring coordinated capacity calculators during the validation process.
e. Any information on decreased cross-zonal capacity from neighbouring coordinated capacity calculators shall be provided to the TSOs. The TSOs may then apply the appropriate reductions of cross-zonal capacities.

Article 21
Reviews and updates

1. In accordance with Article 27(4) of the CACM Regulation all TSOs shall regularly and at least once a year review and update the key input and output parameters listed in Article 27(4) (a)-(d) of the CACM Regulation.

2. If the operational security limits, contingencies and allocation constraints used for capacity calculation need to be updated based on this review, TSOs shall publish the changes early in advance before the implementation.

3. In case the review proves the need of an update of the reliability margins, TSOs shall publish the changes early in advance before the implementation.

4. The review of the remedial actions taken into account in capacity calculation shall include at least an evaluation of the efficiency of specific PST considered during RAO, the topological RA considered during RAO, the generation (Redispatch) RA considered during RAO.

5. In case the review proves the need for updating the application of the methodologies for determining generation shift keys, critical network elements and contingencies referred to in Articles 22 to 24 of the CACM Regulation, changes have to be published before the final implementation

Article 22
Publication of data

In accordance with Article 3 of the CACM Regulation aiming at ensuring and enhancing the transparency and reliability of information, at least the following data

items shall be published in addition to the data items and definitions of Commission Regulation (EU) No 543/2013 on submission and publication of data in electricity markets:

1. Initial Flow-Based parameters (without LTN) shall be published at D-1 before the nominations of long-term rights for each market time unit of the following day. For this set of initial FB-parameters all long term nominations at all Core borders are assumed as zero (LTN=0).

2. The LTN for each Core border where PTRs are applied shall be published at D-1 (10:30 target time)[2] for each market time unit of the following day.

3. Final Flow-Based parameters shall be published at D-1 (10:30 target time) for each market time unit of the following day, comprising the zone-to-slack PTDFs and the RAM for each "presolved" CNEC.

4. Additionally, at D-1 (10:30 target time), the following data items shall be published for each market time unit of the following day:
    a. Maximum and minimum net position of each bidding zone,
    b. Maximum bilateral exchanges between all Core bidding zones,
    c. ATCs for Shadow auctions.

5. In compliance with national regulations, the following information may be published at D-1 (10:30 target time):
    a. Real names of CNEC,
    b. CNE EIC code and Contingency EIC code,
    c. Detailed breakdown of RAM:
        i. F_{max}
        ii. F_{LTN}
        iii. FRM
        iv. FAV

6. In compliance with national regulations, the following information of the D-2 CGM for each market time unit, for each Core bidding zone and each TSO may be published ex-post at D+2:
    a. Vertical load
    b. Production
    c. Best forecast of Net position.

[2] This is CET during the winter period and CEST during the summer period.

Article 23
Monitoring and information to NRAs

1. With reference to paragraph (3) of the Whereas and Article 26(5) of the CACM Regulation, monitoring data shall be provided towards the Core NRAs as basis for supervising a non-discriminatory and efficient Core congestion management.

2. The provided monitoring data shall also be the basis for the biennial report to be provided according to Article 27(3) of the CACM Regulation.

3. Monitoring data shall be treated as confidential by the Core NRAs and shall not be disclosed to the public.

4. The following monitoring items related to the Core FB capacity calculation shall be provided to the Core NRAs on a monthly basis:
    a. Results of the hourly LTA checks,
    b. Line Sensitivity Check,
    c. Hourly Min/Max Net Positions per bidding zone,
    d. Hourly Intraday ATCs for all Core borders,
    e. Max Bilateral Exchanges for each Core bidding zone border (hourly),
    f. Volume of the Flow-Based domains (hourly),
    g. Usage of the Final Adjustment Value FAV,
    h. External Constraints,
    i. Hourly Shadow Auction ATCs for all Core-borders,
    j. Overview of timestamps where spanning is applied (per month),
    k. Overview of timestamps for which default FB parameters were applied (per month),
    l. Hourly non-anonymized presolved CNECs, disclosing PTDF, F_{MAX}, FRM, FAV, RAM and $F_{LTN,}$
    m. Key aggregated figures per country and border:
        – Number of presolved CNEs
        – Number of precongested cases
        – Number of CNEs exceeded by LTA
        – Number of CNEs exceeded by ATC
        – Number of of presolved CBs with RAs applied
        – Number of presolved CNEs without RAs applied
        – Number of presolved CNEs, breaching the max zone-to-zone PTDF threshold
        – Number of hours using the FAV
        – Number of hours, spanning technology was applied
        – Number of hours, default FB parameters were applied,

n. In case of occurrence: justification when FAV is applies,
o. In case of occurrence: justification when the max zone-to-zone PTDF threshold is breached of presolved CNECs,
p. Reductions made during the validation of cross-zonal capacity in accordance with Article 26 (5) of the CACM Regulation.

Article 24
Timescale for implementation of the Core flow-based day-ahead capacity calculation methodology

Below, in accordance with Article 9(9) of the CACM Regulation, a proposed timescale for implementation is presented:

1. The TSOs of the Core CCR shall publish the flow-based day-ahead capacity calculation methodology Proposal without undue delay after all national regulatory authorities have approved the proposed 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. Subject to several dependencies (e.g. progress of the internal parallel run, implementation, proposed changes to the concept, NRA approval of the methodology), the TSOs of the Core CCR shall implement the flow-based day-ahead capacity calculation methodology to launch the external parallel run no later than S1-2019 and S1-2020 as the go-live window for the market, except the execution of the methodology for FRM in line with Article 22 of the CACM Regulation.

3. For a transitional period, the FRM shall be determined in accordance with Article 8.

4. For the day-ahead capacity calculation, the FRM defined in accordance with Article 8 shall be implemented 3 months after collecting 1 year of data (including those from external parallel run) and no later than the end of S2-2019.

5. After the implementation of the flow-based day-ahead capacity calculation methodology, the Core TSOs are willing to work on a solution that fully takes into account the influences of the adjacent CCRs during the capacity allocation i.e. the so called advanced hybrid coupling concept.

6. The deadlines defined in the above Article 23(2), Article 23 (3), and Article 23(4) can be modified on request of all TSOs of the Core CCR to their national

regulatory authorities, where testing period does not meet necessary conditions for implementation.

The Core TSOs will implement the day-ahead flow-based capacity calculation methodology on a Core bidding zone border only after the day-ahead market coupling operator function is implemented in accordance with Article 7(3) of the CACM Regulation.

Article 25
Language

The reference language for this proposal shall be English. For the avoidance of doubt, where TSOs need to translate this 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 TSO shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the proposal.