Third amendment of the Day-Ahead Capacity Calculation Methodology of the Core Capacity Calculation Region

in accordance with Articles 20ff. of the Commission Regulation (EU) 2015/1222 of 24th July 2015 establishing a guideline on capacity allocation and congestion management

8th December 2023

Whereas

TSOs of the Core CCR ("Core TSOs"), taking into account the following:

(1) Owing to the complexity of the subject matter, the Day-Ahead Capacity Calculation Methodology of the Core Capacity Calculation Region (DA CCM) was initially formulated such that certain aspects were left for later refinement, while allowing for an early Go-Live of Core FB DA MC with respective interim solutions. This amendment addresses all aspects for which such refinement is due eighteen months after Go-Live;

(2) Eighteen months after Core FB DA MC Go-Live, Core TSO need to submit to Core NRAs a proposal for amendment of this methodology detailing the methodology for coordinated validation, a list of internal network elements (combined with the relevant contingencies) to be defined as CNECs, further harmonisation of the generation shift key methodology, an approach and justification for selecting FRM, and an approach for using allocation constraints;

(3) With this amendment, Core TSOs aim to detail the coordinated validation methodology and set a timeline for the technical readiness of the tools used in the Core FB DA CC process for the introduction of the coordinated validation. The proposed methodology makes it possible to include network elements not being CNECs pursuant to Article 15(1) as part of the coordinated validation. This is to enable a consistent use of all available RA potential to ensure operational security. At the same time, it is acknowledged that the impact of such network elements on cross-zonal capacities must be monitored pursuant to Article 20(15). Any CVA is capped to guarantee a minimum capacity floor in terms of the percentage of RAM_{bv} pursuant to Article19(2) in relation to the maximum admissible active power per CNEC (F_{max}) pursuant to Article 6(2)(d). The CVA shall be capped to respect this floor, such that any remaining operational security violations are left to the individual validation. The implementation of the coordinated validation is expected not earlier than forty-two months after Core FB DA MC Go-Live.

(4) The provision of a list of internal network elements and the harmonisation of the generation shift key methodology are postponed to forty-two months after Core FB DA MC Go-Live.

(5) The approach and justification for selecting FRM is postponed to sixty months after Core FB DA MC Go-Live. However, the FRM values to be applied until then are set to 10 % of Fmax.

(6) With this amendment, PSE aims at extending the period of using AC by additional two years. Operational experience gathered over the previous two years has proven that allocation constraints are an effective measure to maintain the transmission system within operational security limits and cannot be transferred efficiently into maximum flows on critical network elements, as prescribed by provisions of the CACM Art. 23(3). In absence of explicit reserve capacity procurement, allocation constraints allowed to avoid any cases of insecure operation in Poland that could not have been resolved by operational means. Moreover, no alternatives have been identified as plausible to be implemented until two years after implementing flow-based in Core that would both have lower overall cost while maintaining the similar level of operational security and which would not require a major overhaul of the market design. Given the current legal framework in Poland, in particular responsibilities of PSE regarding dispatching generation units connected to the transmission grid while respecting their

technical characteristics, allocation constraints is the only means of ensuring availability of sufficient balancing capacity reserves in Poland. Currently, the balancing market in Poland is undergoing a significant redesign, aiming at strengthening balancing energy price signals and creating stronger incentives for balanced positions of balancing responsible parties. In combination with the planned market-based process for procuring balancing capacity reserves, this should improve the ability of PSE to manage the secure operation of the Polish power system and potentially even alleviate the need for allocation constraints of the cross-border market coupling process. It is expected that the balancing market redesign will be implemented in mid 2024. This is a very significant change for the whole Polish market and such reform must be well prepared and tested against security requirements. For the above reasons, two years extension for using capacity allocation constraints is necessary in order to gather real-live operational experience from the ongoing market redesign after its successful completion.

(7) The following changes fulfil the objectives set out in Article 3 CACM. In particular, the coordinated validation will bring about improvements in relation to Article 3 (b), (c), (d) and (g) CACM. The coordinated validation contributes to reaching the minimum levels of available capacity for cross-zonal trade pursuant to Article 16(8) Regulation (EU) 2019/943. The aim of the coordinated validation is to maximize cross-zonal capacities while respecting operational security limits and thereby contribute to increased social welfare in the Single Day-Ahead Market Coupling and secure system operation.

(8) The evolved flow-based method described in Article 12 has been introduced with the commissioning of the ALEGrO HVDC link between Belgium and Germany. Operational experience over recent years has shown that the actual method turns out to come along with the undesired effect of very frequent circular flows in the nearby AC grid induced by the ALEGrO schedule after DA MC. The undesired behaviour is attributed to very distant network elements with a low sensitivity to ALEGrO exchanges in the context of the social welfare maximization in Market Coupling. A slight relief of a very distant limiting CNEC is achieved by scheduling ALEGrO against the market direction at the cost of circular flows and full loading of nearby CNECs leading to n-1 violations and application of costly remedial actions in real-time system operation. The circular flows have been observed mainly between the hubs BE, DE, NL and FR, counteracting operational security and reducing Intraday Capacities whilst only leading to a negligible social welfare increase in Day Ahead Market Coupling. In order to prevent such a behaviour of existing and future HVDC Interconnectors on Core bidding zone borders, Core TSOs aim to introduce a zone-to-zone PTDF threshold for virtual hubs in the context of the Evolved flow-based method. By introducing a threshold, this undesired impact can be prevented. The appearance of circular flows and the resulting high loading of nearby AC network elements can be significantly reduced by the PTDF threshold. This means that less congestion in the AC grid, less redispatch, less setpoint volatility and less need of real-time coordination and intervention would be needed which is beneficial for operational security. At the same time higher capacities for ID Capacity Calculation are made available, as AC network elements around the HVDC link and the HVDC link itself are not fully occupied by DA MC for very limited welfare gain in DA. Thus, the overall transmission capacity across all time frames is maximized this way, which is supposed to come along with an increase in overall social welfare.

(9) For the purposes of this third amendment to the Core CCR TSOs' Day-Ahead Capacity Calculation Methodology, terms used in this document shall have the meaning of the definitions included in Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity, Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast), Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (CACM Regulation), Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on forward capacity allocation (FCA Regulation), Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing (EB Regulation) and Commission Regulation (EU) No 543/2013 of 14 June 2013 on submission and publication of data in electricity markets and amending Annex I to Regulation (EC) No 714/2009 of the European Parliament and of the Council and the definitions set out in Article 2 Annex I of the Decision No 02/2019 of the Agency for the Cooperation of the Energy Regulators of 21 February 2019 on the Core CCR TSOs' proposal for the regional design of the day-ahead and intraday common capacity calculation methodologies.

Article 1
Implementation of coordinated validation

1. Article 2. Definitions and interpretation shall be amended by introducing a new number 77:

   "77. 'circumstance' means a combination of net positions which is feasible according to the CZC used for the respective validation phase. A circumstance comprises at least the Core bidding zones and, where AHC is applied, the respective external virtual hubs. It may additionally contain bidding zones of technical counterparties."

2. Article 4. Day-ahead capacity calculation process shall be amended by updating paragraph 8 step 8 accordingly:

   "Step 8. The Core TSOs and the CCC shall, according to Article 20, validate the RAM_{bv} with coordinated validation, re-calculate the RAM_{bv}, validate the re-calculated RAM_{bv} with individual validation, and decrease RAM when operational security is jeopardised, which results in the RAM before long-term nominations (RAM_{bn});"

3. Article 6. Methodology for operational security limits shall be amended by updating paragraph 2(f) accordingly:

   "(f) the CCC shall, by default, set the power factor $\cos(\varphi)$ to 1 based on the assumption that the CNE is loaded only by active power and that the share reactive power is negligible (i.e., $\varphi = 0$). If the share of reactive power is not negligible, a TSO may consider this aspect during the individual validation phase in accordance with 1(e)."

4. Article 10. Methodology for remedial actions in day-ahead capacity calculation shall be amended by updating paragraph 4 accordingly:

   "4. For the purpose of the NRAO, all Core TSOs shall provide to the CCC all expected available non-costly RAs and, for the purpose of coordinated capacity validation, all Core TSOs shall provide to the CCC all expected available costly and non-costly RAs."

5. Article 14. Initial flow-based calculation shall be amended by updating paragraph 3a accordingly:

   "3a. For network elements with contingencies from technical counterparties pursuant to Article 20(6a), the steps described in paragraphs 1 to 3 shall be carried out by the CCC in order to enable a potential submission, subject to Article 13(2), of the network elements with contingency by the technical counterparty to the final list of CNECs during coordinated and individual validation. Until then, the network elements with contingencies from technical counterparties shall not be considered as constraints to the formulation of flow-based domain, neither to the NRAO."

6. Article 18. Long-term allocated capacities (LTA) inclusion shall be amended by updating paragraph 5a accordingly:

   "5a. In case the extended LTA approach is applied Core TSOs may additionally carry out the steps described in paragraphs 2 to 5 with the sole purpose to make available a flow-based domain with LTA inclusion as input for the coordinated and individual validation as described in Articles 19 and 20."

7. Article 19. Calculation of flow-based parameters before validation shall be amended accordingly:

   "1. Based on the initial flow-based domain and on the final list of CNECs, the CCC shall calculate for each CNEC the RAM before validation, relying on the following sequential steps:

   (a) the calculation of F_{ref} and $PTDF_f$ through the NRAO according to Article 16;

   (b) the calculation[1] of the adjustment for minimum RAM (AMR) according to Article 17;

   (c) the calculation of the adjustment for the LTA inclusion according to Article 18;

   (d) the calculation of RAM before validation as follows:

$$\overrightarrow{RAM}_{bv,LTAmargin} = \vec{F}_{max} - \overrightarrow{FRM} - \vec{F}_{0,Core} + \overrightarrow{AMR} + \overrightarrow{LTA}_{margin} - \overrightarrow{CVA}$$

Equation 19a

with

[1] AMR, $F_{0,Core}$ and FRM do not apply to external constraints and shall be zero for such constraints.

$\vec{F}_{max}$	Maximum active power flow pursuant to Article 6
$\overrightarrow{FRM}$	Flow reliability margin pursuant to Article 8
$\vec{F}_{0,Core}$	Flow without commercial exchanges in the Core CCR, described in Equation 10. For external constraints, in line with Article18(2), this flow is equal to zero. [2]
$\overrightarrow{AMR}$	Adjustment for minimum RAM pursuant to Article 17
$\overrightarrow{LTA}_{margin}$	Flow margin for LTA inclusion, pursuant to Article 18
$\overrightarrow{CVA}$	Coordinated validation adjustment pursuant to Article 20, which may differ from zero only after coordinated validation
$\overrightarrow{RAM}_{bv,LTAmargin}$	Remaining available margin before validation with application of the flow margin for LTA inclusion pursuant to Article 18

(e) in case the extended LTA approach pursuant to Article 18(1a)(b) is applied the calculation of RAM before validation as follows:

$$\overrightarrow{RAM}_{bv,noLTAmargin} = \vec{F}_{max} - \overrightarrow{FRM} - \vec{F}_{0,Core} + \overrightarrow{AMR} - \overrightarrow{CVA}$$

Equation 19b

with

$\overrightarrow{RAM}_{bv,noLTAmargin}$	Remaining available margin before validation without application of the flow margin for LTA inclusion pursuant to Article 18

2. After the determination of CVA pursuant to Article20(4a)ff, the CCC shall re-calculate for each CNEC the RAM before validation pursuant to paragraph 1."

8. Article 20. Validation of flow-based parameters amended accordingly:

Paragraph 3 shall be replaced and be read accordingly:

"3. In the process of cross-zonal capacity validation the Core TSOs shall exchange information on all expected available (non-costly and costly) RAs in the Core CCR, defined in accordance with Article 22 of the SO Regulation. In case the cross-zonal capacity could lead to violation of operational security, all Core TSOs in coordination with the CCC shall verify whether such violation can be avoided with the application of RAs. In this process, the CCC shall coordinate with neighbouring CCCs and optionally technical counterparties on the use of RAs having an impact on neighbouring CCRs. For those CNECs where all available RAs are not sufficient to avoid the violation of operational security, the Core TSOs in coordination with the CCC may reduce the $RAM_{bv,LTAmargin}$ or $RAM_{bv,noLTAmargin}$ to the maximum value which avoids the violation of operational security. This reduction is called 'coordinated validation adjustment' (CVA) and the adjusted RAM is called 'RAM after coordinated validation'."

Paragraph 4 shall be replaced and be read accordingly:

"4. The coordinated validation pursuant to paragraph 3 shall be implemented gradually. During the first forty-two months following the implementation of this methodology in accordance with Article 28(3), the coordinated validation may be limited to exchange of information on the available (non-costly and costly) RAs in the Core CCR and a CCC's advice to individual TSOs based on its operational experience. After the forty-two months, the simplified process shall be replaced by a full analysis pursuant to paragraphs 4a until 4g.

4a. The coordinated validation process step in the Core CCR as set out in paragraph 4 sentence 3 shall be performed by the CCC and the Core TSOs and optionally by the technical counterparties pursuant to Article 13(2) according to the following procedure:

Step 1. The CCC shall use the inputs pursuant to paragraph 4b;

Step 2. The CCC shall, pursuant to paragraph 4c, select the circumstances, being possible market outcomes, that shall be evaluated to determine whether the power system could accommodate them having regard to operational security requirements;

Step 3. The CCC shall analyse the selected circumstances subject to the criteria pursuant to paragraph 4d and applying the remedial action optimisation method pursuant to paragraph 4e;

Step 4. The CCC shall, in coordination with the Core TSOs and optionally technical counterparties pursuant to Article 13(2), determine CVA pursuant to paragraph 4f;

Step 5. The CCC shall disseminate the results of steps 2, 3 and 4 pursuant to paragraph 4g to enable Core TSOs and technical counterparties pursuant to Article 13(2) to consider them in the individual validation process step;

4b. The CCC shall base the full coordinated validation on the following inputs:

(a) the CZC domain based on the flow-based parameters before validation pursuant to Article 19 and, in case the extended LTA approach pursuant to Article 18(1a)(b) is applied, the LTA domain;

(b) the CGM;

(c) all expected available (non-costly and costly) RAs in the Core CCR and optionally in control areas of technical counterparties pursuant to Article 13(2), defined in accordance with Article 22 of the SO Regulation. These may comprise RAs from bidding zones outside the Core CCR, subject to alignment with the respective connecting TSOs. The probability of RAs being available under the modelling assumptions may be taken into consideration when providing RAs;

(d) a list of network elements and contingencies to consider when assessing operational security. Each Core TSO and optionally each technical counterparty pursuant to Article 13(2) shall provide such a list to the CCC. Any network element from the CGM with a voltage level higher than or equal to 220 kV may be considered. The standard properties of these network elements are that they shall not be overloaded after coordinated validation with respect to their operational security limits. Each Core TSO and optionally each technical counterparty pursuant to Article 13(2) may define two parameters to modify the properties of each network element. Firstly, the maximum flow of a network element may be increased. Secondly, a network element may be specified as scanned network element. Scanned network elements may not be overloaded, or not incur additional overloading, pursuant to the specifications in paragraph 4d.

Core TSOs may decide for the CCC to base the full coordinated validation on further input, as long as this is within the boundaries of Article 3 CACM. Core TSOs may alter the parameters and thresholds of the input where an input would have a significant impact on the resulting CZC, as long as this is within the boundaries of Article 3 CACM. The CCC shall report quarterly on the initial setup and any change in the input or its parameters and thresholds, together with its impact and a due justification.

4c. The CCC shall separately select at least one circumstance for each DA CC MTU, to be analysed in the coordinated validation as set out in paragraph 4 sentence 3. The number of circumstances shall be sufficiently large having regard to the time available for conducting the coordinated validation and the complexity of the analysis per circumstance pursuant to paragraph 4e. During the implementation of the coordinated validation as set out in paragraph 4 sentence 3, the Core TSOs and optionally the technical counterparties pursuant to Article 13(2) shall:

(a) make a justified trade-off between the complexity of the analysis and the number of circumstances;

(b) define criteria for the selection of circumstances. The Core TSOs may alter the criteria after implementation to cope with the evolution of technical or market conditions, as long as this is within the boundaries of Article 3 CACM. The CCC shall report quarterly on any change in the criteria, together with its impact and shall be duly justified by the CCC

Exchanges on borders to non-Core bidding zones via AHC shall be treated equally to exchanges on Core borders when defining and selecting circumstances. Exchanges on borders with technical counterparties may optionally be taken into account in the selection of circumstances.

4d. When analysing a circumstance, the CCC shall use the CGM and apply load flow calculation and contingency analysis. The net positions of the BZs in the CGM shall be shifted towards the net positions of the circumstance. This shift shall, in principle, be done using the GSK pursuant

to Article 9. A deviation from the GSK is allowed, insofar as the injection from generators is altered, to prevent a violation of technical generator bounds. The RA potential related to redispatch shall be adjusted to reflect the dispatch modifications between the CGM and the circumstance.
For each circumstance in each DA CC MTU, the maximum admissible flow on each scanned network element shall, if necessary, be increased such that the difference between the maximum admissible flow and the post-contingency flow in the circumstance prior to the remedial action optimisation pursuant to paragraph 4e is at least as large as a threshold, which shall be set according to the process described in paragraph 4b.
4e. The CCC shall perform an RA optimisation to determine for each circumstance in each DA CC MTU, to which extent this circumstance could be realised with respect to operational security. The circumstance can be realised entirely, if all operational security violations, which might occur after shifting the CGM to the circumstance pursuant to paragraph 4c, and having regard to the network elements, contingencies and properties as specified pursuant to paragraph 4b(d), can be completely eliminated by the application of RAs. In case the circumstance cannot be realised without violating operational security constraints, the RA optimisation shall determine the extent of this violation. The RA optimisation shall further determine an alternative circumstance that is as similar as possible to the original one but can be implemented without violating operational security constraints.
The RA optimisation shall consider the same types of RAs as used in the Core CCR ROSC process, which implements the methodology developed pursuant to Article 76(1) of the SO Regulation, or other congestion management planning processes of the Core TSOs or optionally technical counterparties. To limit the complexity of the RA optimisation and in accordance with the requirements and obligations set out in paragraph 4b, Core TSOs and optionally technical counterparties may adjust the inputs of the coordinated validation to reflect the estimated effect of congestion management planning procedures while adhering to operational security constraints. Such adjustments may comprise, but are not limited to, ignoring network elements or allowing a certain amount of overload. The RA optimisation shall consider preventive and curative RAs with full or partial sharing of the benefit of curative RAs.
The RA optimisation shall be specified such that use of RAs shall precede a reduction to the extent needed to which the circumstance can be realised. The RA optimisation shall be designed in consistency with the approach for determining the limitations of the CZC pursuant to paragraph 4f.
Core TSOs may apply the following means to relax or constrain the RA optimisation:

(a) To avoid unnecessarily strict limitations, Core TSOs may specify optimisation parameters. These may comprise, but are not limited to, ignoring low sensitivities of loadings on network elements with respect to RAs and/or cross-zonal exchanges;

(b) To take into account constraints of the Core CCR ROSC process, which implements the methodology developed pursuant to

Article 76(1) of the SO Regulation, or other congestion management planning processes of the Core TSOs or optionally technical counterparties, Core TSOs and optionally technical counterparties may specify limits on the number of RAs and/or on the total redispatch amount that can be simultaneously applied. These limits may be specified on subsets of RAs.
(c) Core TSOs may define the objective function to minimise the extent of operational security violations and/or to maximise the extent to which the cross-zonal exchanges match the circumstance.

4f. If one or more circumstances for a DA CC MTU cannot be realised to their full extent, the CCC shall limit cross-zonal capacity such that the maximum line loading on network elements that would lead to operational security violations in any circumstance is reduced to comply with operational security limits. CNECs with applied CVA shall be sufficiently effective for reducing the loading of the network elements on which operational security limits would be violated in the circumstance without CVA.
If several circumstances lead to CVA in a given DA CC MTU, the final CVA per CNEC shall be the maximum across all circumstances.
The Core TSOs shall consider a minimum capacity floor in terms of the percentage of RAM_{bv} pursuant to Article 19(2) in relation to the maximum admissible active power per CNEC (F_{max}) pursuant to Article 6(2)(d). The CVA shall be capped to respect this floor, such that any remaining operational security violations are left to the individual validation.
Subject to a previous alignment with the other Core TSOs, the CCC and optionally technical counterparties in which an attempt was made to resolve the reasons for the rejection, a Core TSO may reject with justification all of the CVA resulting from one or several circumstances in one or several MTUs. In case of such rejection the final CVA shall be recomputed as if no CVA had resulted from the rejected circumstances.

4g. The CCC shall re-calculate RAM_{bv} pursuant to Article 19(2) using the applied CVA. The CCC shall share with each Core TSO and technical counterparty pursuant to Article 13(2) all information that is necessary to support consistency of the subsequent individual validation with the coordinated validation. This information shall at least comprise the analysed circumstances, applied RAs and, if applicable, remaining operational security violations after coordinated validation."

Paragraph 5(b) shall be replaced and be read accordingly:

"(b) when all available costly and non-costly RAs are not sufficient to ensure operational security, taking the CCC's analysis pursuant to paragraph 3 into account, and coordinating with the CCC when necessary;"

Paragraph 14 shall be replaced and be read accordingly:

"14. The quarterly report shall also include at least the following aggregated information:

(a) statistics on the number, causes, volume and estimated loss of economic surplus of applied reductions by different TSOs;
(b) general measures to avoid cross-zonal capacity reductions in the future;
(c) changes to inputs, parameters or thresholds of the coordinated validation referred to in paragraph (4b)."

Paragraph 15 shall be replaced and be read accordingly:

"15. When capacity is reduced for operational security limits of a given Core TSO in more than 1% of DA CC MTUs of the analysed quarter, the concerned TSO shall provide to the CCC a detailed report and action plan describing how such deviations are expected to be alleviated and solved in the future. This report and action plan shall be included as an annex to the quarterly report."

9. Article 27. Monitoring, reporting and information to the Core regulatory authorities amended accordingly:

Paragraph 4(b) shall be replaced and be read accordingly:

"(b) according to Article 13(3)(c), the Core TSOs shall monitor the accuracy of non-Core exchanges in the CGM."

Paragraph 5(b) shall be replaced and be read accordingly:

"(b)according to Article 20(13)(f), the CCC shall provide all information on the reductions of cross-zonal capacity, with a supporting detailed analysis from the concerned TSOs where relevant."

Article 2
Amendment on harmonization of FRM approach

1. Article 8. Reliability margin methodology shall be amended accordingly:

Paragraph 7 shall be replaced and be read accordingly:

"7. No later than sixty months after the implementation of this methodology in accordance with Article 28(3), the Core TSOs shall jointly perform the first FRM calculation pursuant to the methodology described above and based on the data covering at least the first year of operation of this methodology. By the same deadline, all Core TSOs shall submit to all Core regulatory authorities a proposal for amendment of this methodology in accordance with Article 9(13) of the CACM Regulation as well as the supporting document as referred to in paragraph 9 below. The proposal for amendment shall include an approach and justification for selecting the FRM from the range between the lower and upper estimates as well as next possible steps for improving the process to approach as much as possible the true FRM."

Paragraph 10 shall be replaced and be read accordingly:

> "10. Until the proposal for amendment of this methodology pursuant to paragraph 7 has been approved by all Core regulatory authorities, the Core TSOs shall use FRM values equal to 10% of F_{max} pursuant to Article 6(2)."

Article 3
Methodology for allocation constraints

1. Article 7. Methodology for allocation constraints shall be amended accordingly:

Paragraph 3 shall be replaced and be read accordingly:

> "3. External constraints may be used by a Core TSO as listed in Annex 1 during a transition period of four years following the implementation of this methodology in accordance with Article 28(3) and in accordance with the reasons and the methodology for the calculation of external constraints as specified in Annex 1 to this methodology. During this transition period, the concerned Core TSOs shall:
>
> (a) calculate the value of external constraints in accordance with Annex 1 and in any case at least on a quarterly basis and publish the results of the underlying analysis;
>
> (b) in case the external constraint had a non-zero shadow price in more than 0.1% of hours in a quarter, provide to the CCC a report analysing: (i) for each DA CC MTU when the external constraint had a non-zero shadow price the loss in economic surplus due to external constraint and the effectiveness of the allocation constraint in preventing the violation of the underlying operational security limits and (ii) alternative solutions to address the underlying operational security limits. The CCC shall include this report as an annex in the quarterly report as defined in Article 27(5);
>
> (c) if applicable and when more efficient, implement alternative solutions referred to in point (b)."

Paragraph 4 shall be replaced and be read accordingly:

> "4. In case the concerned Core TSOs could not find and implement alternative solutions referred to in the previous paragraph, they may, by forty-two months after the implementation of this methodology in accordance with Article 28(3), together with all other Core TSOs, submit to all Core regulatory authorities a proposal for amendment of this methodology in accordance with Article 9(13) of CACM Regulation. Such a proposal shall include the following:"

Paragraph 9 shall be introduced and be read accordingly:

> "9. If one or more Core TSOs plan to apply external constraints, referred

to in Article 7 (1), the relevant Core TSOs shall, together with all other Core TSOs, submit to all Core regulatory authorities a proposal for amendment of this methodology in accordance with Article 9(13) of CACM Regulation. Such a proposal shall include the following:

(a) the technical and legal justification for the need to use an external constraint indicating the underlying operational security limits and why they cannot be transformed efficiently into I_{max} and F_{max};

(b) the methodology to calculate the value of external constraints including the frequency of recalculation."

2. Annex 1: Justification of usage and methodology for calculation of external constraints should be amended accordingly

Title of Annex 1 shall be replaced and be read accordingly:

"Annex 1: List of Core TSOs and their justification of usage and methodology for calculation of external constraints"

Text of the Annex 1 shall be replaced and be read accordingly:

"External constraints may be used by the following Core TSOs:
1: Poland – PSE

The following section depicts in detail the justification of usage and methodology currently used by each Core TSO to design and implement external constraints, if applicable. The legal interpretation on eligibility of using external constraints and the description of their contribution to the objectives of the CACM Regulation is included in the Explanatory Note.

1. Poland:
PSE may use an external constraint to limit the import and export of the Polish bidding zone.
Technical and legal justification
Implementation of external constraints as applied by PSE is related to Integrated Scheduling Process IPS applied in Poland (also called central dispatching model) and the way how reserve capacity is being ensured by PSE. Within the current legal framework in Poland, there is no explicit balancing capacity reserves procurement process – which makes for a significant difference between Poland and other Core CCR countries with respect to the approach to ensure availability of generation reserves. Therefore, for Poland, the only means of ensuring sufficient generation reserves is to use allocation constraints and thus set a limit to how much electricity can be imported or exported in the SDAC. Capacity allocation constraints are a legally prescribed means, defined by CACM Regulation (Art. 23(3) and art. 21(1)(a)(ii) CACM).
In a central dispatching model, in order to balance generation and demand and ensure secure energy delivery, the TSO dispatches generating

units taking into account their operational constraints, transmission constraints and reserve capacity requirements. This is realised in an integrated scheduling process as a single optimisation problem called security constrained unit commitment (SCUC) and economic dispatch (SCED).

Integrated Scheduling Process starts after the day-ahead capacity calculation and SDAC and continues until real-time. This means that reserve capacity is not blocked by TSO in advance of SDAC and in effect not removed from the wholesale market and SDAC. However, if balancing service providers (generating units) would already sold too much energy in the day-ahead market because of high exports, they may not be able to provide sufficient upward or downward reserve capacity within the integrated scheduling process.[1]

Within aforementioned integrated scheduling process, generation units connected to the transmission grid are dispatched by PSE with the aim to respect power purchase agreement concluded between the market participants on the wholesale market, while minimizing overall costs of energy supply. When doing so, PSE is obliged to respect power system operation conditions, as well as the technical characteristics of generation units both on the level of individual generation units and on the level of power plants.

Allocation constraints serve thus as a means to limit balancing service providers to sell too much energy in the day-ahead market , so that to ensure and enforce that they will be able to provide sufficient reserve capacity in the integrated scheduling process that is run after the day-ahead market. This limitation cannot be efficiently expressed by translating it into transfer capacities of critical network elements offered to the market. If this limit was to be reflected in cross-zonal capacities offered by PSE in the form of an appropriate adjustment of cross-zonal capacities, this would imply that PSE would need to guess the most likely market direction (imports and/or exports on particular interconnectors) and accordingly reduce the cross-zonal capacities in these directions. In the flow-based approach, this would need to be done on each CNEC in a form of reductions of the RAM. However, from the point of view of market participants, due to the inherent uncertainties of market results, such an approach is burdened with the risk of suboptimal splitting of allocation constraints onto individual interconnections – overestimated on one interconnection and underestimated on the other, or vice versa. Also, such reductions of the RAM would limit cross-zonal exchanges for all bidding zone borders having impact on Polish CNECs (i.e., transit flows), whereas the allocation constraint has an impact only on the import or export of the Polish bidding zone, whereas the trading of other bidding zones is unaffected.

Allocation constrains are applied in DA allocation process, with values determined in D-1, per each hour individually based on generation adequacy analysis for this hour. They are determined for the whole Polish power system, meaning that they are applicable simultaneously for all CCRs in which PSE has at least one bidding zone border (i.e., Core, Baltic and Hansa). This solution is the most efficient application of external constraints. Considering allocation constraints separately in each CCR would require PSE to split global external constraints into CCR-related sub-values, which would be less efficient than maintaining the global value. Moreover, in the hours when Poland is unable to absorb any more power from outside due to violated minimal downward reserve capacity requirements, or when Poland is unable to export any more power due to insufficient upward reserve capacity requirements, Polish transmission infrastructure is still available for cross-border trading between other bidding zones and between different CCRs.

[1] This conclusion equally applies for the case of lack of downward balancing capacity, which would be endangered if balancing service providers (generating units) sell too little energy in the day-ahead market, because of too high imports.

Methodology to calculate the value of external constraints

When determining the external constraints, PSE takes into account the most recent information on the technical characteristics of generation units, forecasted power system load as well as minimum reserve margins required in the whole Polish power system to ensure secure operation and forward import/export contracts that need to be respected from previous capacity allocation time frames.

External constraints are bidirectional, with independent values for each DA CC MTU, and separately for directions of import to Poland and export from Poland.

For each hour, the constraints are calculated according to the below equations:

$$EXPORT_{constraint} = P_{CD} - (P_{NA} + P_{ER}) + P_{NCD} - (P_L + P_{UPres}) \quad (1)$$

$$IMPORT_{constraint} = P_L - P_{DOWNres} - P_{CD_{min}} - P_{NCD} \quad (2)$$

Where:

P_{CD}	Sum of available generating capacities of centrally dispatched units as declared by generators2
$P_{CD_{min}}$	Sum of technical minima of available centrally dispatched generating units
P_{NCD}	Sum of schedules of generating units that are not centrally dispatched, as provided by generators (for weather-dependent intermittent renewable generation: forecasted by PSE)
P_{NA}	Generation not available due to grid constraints (both planned outage and/or anticipated congestions)
P_{ER}	Generation unavailability's adjustment resulting from issues not declared by generators, forecasted by PSE

[2] Note that generating units which are kept out of the market on the basis of strategic reserve contracts with the TSO are not taken into account in this calculation.

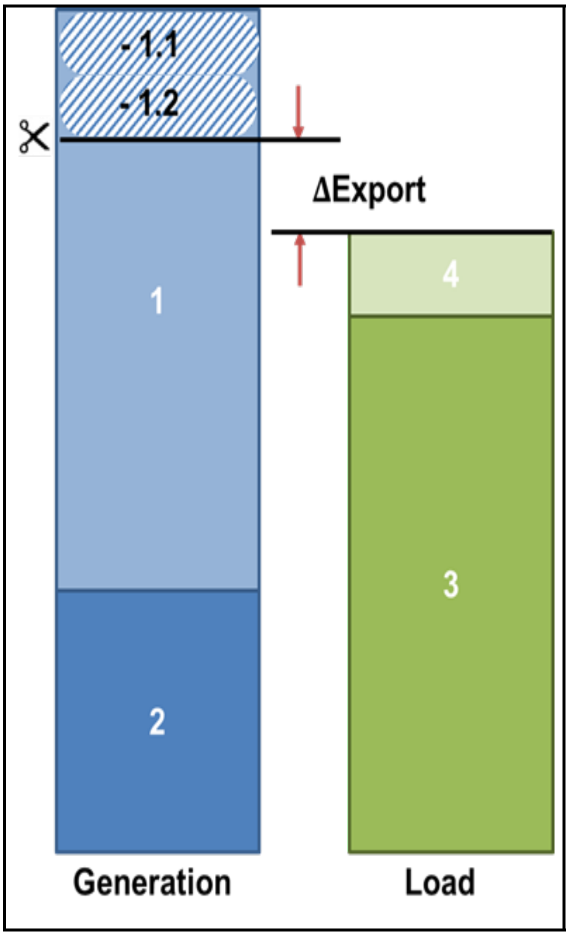
due to exceptional circumstances (e.g., cooling conditions or prolonged overhauls)

P_L — Demand forecasted by PSE

P_{UPres} — Minimum reserve for upward regulation

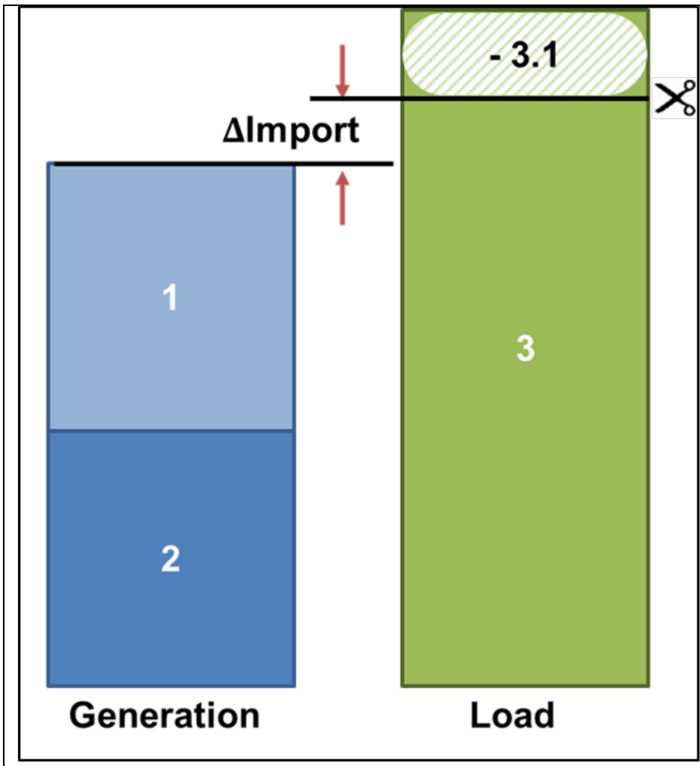
$P_{DOWNres}$ — Minimum reserve for downward regulation

For illustrative purposes, the process of practical determination of external constraints in the framework of the day-ahead capacity calculation is illustrated below in Figures 1 and 2. The figures illustrate how a forecast of the Polish power balance for each hour of the delivery day is developed by PSE in the morning of D-1 in order to determine reserves in generating capacities available for potential exports and imports, respectively, for the day-ahead market.
External constraint in export direction is applicable if DExport is lower than the sum of cross-zonal capacities on all Polish interconnections in export direction. External constraint in import direction is applicable if DImport is lower than the sum of cross-zonal capacities on all Polish interconnections in import direction.



1. Sum of available generating capacities of centrally dispatched units as declared by generators, reduced by:
   1.1. Generation not available due to grid constraints
   1.2. Generation unavailability's adjustment resulting from issues not declared by generators, forecasted by PSE due to exceptional circumstances (e.g., cooling conditions or prolonged overhauls)
2. Sum of schedules of generating units that are not centrally dispatched, as provided by generators (for weather-dependent intermittent renewable generation: forecasted by PSE) Demand forecasted by PSE
3. Minimum necessary reserve for up regulation

Figure 1: Determination of external constraints in export direction (generating capacities available for potential exports) in the framework of the day-ahead capacity calculation.



1. Sum of technical minima of centrally dispatched generating units in operation

2. Sum of schedules of generating units that are not centrally dispatched, as provided by generators (for weather-dependent intermittent renewable generation: forecasted by PSE)

3. Demand forecasted by PSE, reduced by:
    3.1. Minimum necessary reserve for down regulation

Figure 2: Determination of external constraints in import direction (reserves in generating capacities available for potential imports) in the framework of the day-ahead capacity calculation.

Frequency of re-assessment
External constraints are determined in a continuous process based on the most recent information, for each capacity allocation time frame, from forward till day-ahead and intra-day. In case of day-ahead process, these are calculated in the morning of D-1, resulting in independent values for each DA CC MTU, and separately for directions of import to Poland and export from Poland.

Time periods for which external constraints are applied
As described above, external constraints are determined in a continuous process for each capacity allocation timeframe, so they are applicable for all DA CC MTUs of the respective allocation day."

Article 4
Amendments to postpone post go-live studies

1. Article 5. Definition of critical network elements and contingencies shall be amended accordingly:

Paragraph 5 shall be replaced and be read accordingly:

> "5. No later than forty-two months after the implementation of this methodology in accordance with Article 28(3), all Core TSOs shall jointly develop a list of internal network elements (combined with the relevant contingencies) to be defined as CNECs and submit it by the same deadline to all Core regulatory authorities as a proposal for amendment of this methodology in accordance with Article 9(13) of the CACM Regulation. After its approval in accordance with Article 9 of the CACM Regulation, the list of internal CNECs shall form an annex to this methodology."

Paragraph 6 shall be replaced and be read accordingly:

> "6. The list pursuant to the previous paragraph shall be updated every two years. For this purpose, no later than forty-two months after the approval by all Core regulatory authorities of the proposal for amendment of this methodology pursuant to previous paragraph and this paragraph, all Core TSOs shall jointly develop a new proposal for the list of internal CNECs and submit it by the same deadline to all Core regulatory authorities as a proposal for amendment of this methodology in accordance with Article 9(13) of the CACM Regulation. After its approval in accordance with Article 9 of the CACM Regulation, the list of internal CNECs shall replace the relevant annex to this methodology."

2. Article 9. Generation shift key methodology shall be amended accordingly:

Paragraph 6 shall be replaced and be read accordingly:

> "6. Within forty-two months after the implementation of this methodology in accordance with Article 28(3), all Core TSOs shall develop a proposal for further harmonisation of the generation shift key methodology and submit it by the same deadline to all Core regulatory authorities as a proposal for amendment of this methodology in accordance with Article 9(13) of the CACM Regulation. The proposal shall at least include:
>
> (a) the criteria and metrics for defining the efficiency and performance of GSKs and allowing for quantitative comparison of different GSKs; and
>
> (b) a harmonised generation shift key methodology combined with, where necessary, rules and criteria for TSOs to deviate from the harmonised generation shift key methodology."

Article 5
Amendment regarding circular flows challenge around HVDC interconnectors

1. Article 12. Integration of HVDC interconnectors on bidding zone borders of the Core CCR shall be amended by updating paragraph 4 accordingly:

"4. The virtual hubs introduced by this methodology are only used for modelling the impact of an exchange through a HVDC interconnector and no orders shall be attached to these virtual hubs in the coupling algorithm. The two virtual hubs will have a combined net position of 0 MW, but their individual net position will reflect the exchanges over the interconnector. The flow-based net positions of these virtual hubs shall be of the same magnitude, but they will have an opposite sign. $PTDF_{VH\_1,l}$ and $PTDF_{VH\_2,l}$ of all or only a subset of CNECs can be set to zero before the DA market coupling if $\left| PTDF_{VH\_1,l} - PTDF_{VH\_2,l} \right|$ is below a certain threshold. The adjustment is to be done after the NRAO optimization described in Article 16 and before the validation steps described in Article 20. This PTDF threshold shall not exceed 1% and may be applied during the transition period preceding the Go-Live of Core CCR ROSC process, which implements the methodology developed pursuant to Article 76(1) of the SO Regulation. Core TSOs shall report quarterly on the initial setup and any change of this threshold together with the impact which entails from a non-zero threshold and a due justification."