# Proposal for a common
# coordinated capacity calculation methodology
# for Capacity Calculation Region Hansa
# in accordance with Article 20 (2) of the Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a Guideline on Capacity Allocation and Congestion Management

15th of September 2017

**The Transmission System Operators of Capacity Calculation Region Hansa, taking into account the following**:

## WHEREAS

(1) This document is a common Proposal of the Transmission System Operators (hereafter referred to as "TSOs") of Capacity Calculation Region (hereafter referred to as "CCR") Hansa as described in the ACER decision[1].

(2) This Proposal for a common coordinated capacity calculation methodology for the CCR Hansa (herafter referred to as "Proposal") takes into account the general principles and goals set in Commission Regulation (EU) 2015/1222, establishing a guideline on capacity allocation and congestion management (hereafter referred to as the "CACM Regulation"), Commission Regulation (EU) 2017/1485, establishing a guideline on electricity transmission system operation 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-bidding zone border exchanges in electricity (hereafter referred to as "Regulation (EC) No. 714/2009").

(3) The goal of the CACM Regulation is the coordination and harmonisation of capacity calculation and allocation in the day-ahead timeframe and the intraday timeframe.

(4) This Proposal is required by Article 20 (2) of the CACM Regulation:

*"No later than 10 months after the approval of the Proposal for a capacity calculation region in accordance with Article 15(1), all TSOs in each capacity calculation region shall submit a Proposal for a common coordinated capacity calculation methodology within the respective region. ..."*

This Proposal is subject to consultation in accordance with Article 12 of the CACM Regulation.

(5) This Proposal covers all requirements as given in Article 21 (1), (2) and (3) of the CACM Regulation.

(6) According to Article 14 (1) and 14 (2) of the CACM Regulation, all TSOs shall calculate cross-zonal capacity for at least the day-ahead time-frame and intraday time-frame and requires that the cross-zonal capacity for each market time unit shall be calculated.

(7) The proposed capacity calculation methodology (hereafter referred to as "CCM") for the CCR Hansa contributes to, and does not in any way hinder, the achievement of the objectives of Article 3 of the CACM Regulation.

(8) The CCM for the CCR Hansa is based on a Coordinated Net Transfer Capacity[2] (CNTC) methodology with a strong link to adjacent CCRs. As CCR Hansa bidding zone borders, including the German – Western Danish alternating current (hereafter referred to as "AC") border, are radial connections, a capacity calculation methodology based on the flow-based methodology is not more efficient compared to the CNTC approach suggested, assuming the same level of operational security in the Hansa region. Following Article 20 (7) of the CACM Regulation, the CCR Hansa TSOs have in a separate request motivated the efficieny of CNTC in comparison to the flow-based approach. The request is submitted for CCR Hansa National Regulatory Authorities (hereafter referred to as "NRAs") approval together with this Proposal.

(9) The CCM for the CCR Hansa secures optimal use of the transmission capacity as it takes advantage of the flow-based capacity calculation methodologies being developed simultaneously in CCR Nordic and CCR Core in order to represent the limitations in the AC grids. The use of interconnector capacity and AC grid capacity is fully integrated in this way, thereby providing a fair competition for the scarce capacities in the system and an optimal system use. There is no predefined and static split of the capacities on critical network elements, and the flows through

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[1] ACER's definition of the Capacity Calculation Regions (CCRs) of 17 November 2016 (Annex I to CCR decision)
http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/ANNEXES_CCR_DECISION/Annex%20I.pdf
[2] CNTC is understood as a NTC methodology, where coordination is done through the use of the common grid model and the calculations carried out by the coordinated capacity calculator.

CCR Hansa from CCR Core and CCR Nordic are decided based on economic efficiency during the capacity allocation phase.

(10) The CCM for the CCR Hansa treats all bidding zone borders in the CCR Hansa and adjacent CCRs equally, and provides non-discriminatory access to cross-zonal capacity. It creates a basis for a fair and orderly market and a fair and orderly price formation by implementing a simple CCM solution which is integrated with the methodologies of the adjacent CCRs.

(11) The CCM for the CCR Hansa will fully apply in a situation where Advanced Hybrid Coupling (hereafter referred to as "AHC") is implemented in a flow-based capacity calculation in CCR Nordic and CCR Core according to the flow-based CCM proposals of the two regions. The application of AHC ensures that CCR Hansa bidding zone borders will be treated equally to bidding zone borders in the flow-based capacity calculation methodologies, thus ensuring that the CCR Hansa bidding zone borders are not given a special treatment compared to CCR Core or CCR Nordic bidding zone borders. AHC is elaborated upon in the Annex 2 of the explanatory document accompanying this proposal.

(12) The CCM for the CCR Hansa takes advantage of the proposed flow-based capacity calculation methodologies from adjacent CCRs while also ensuring full transparency of the calculation of the actual interconnector capacity. This will in turn result in a better understanding for market participants and improve transparency and reliability of information compared to what is available today on the CCR Hansa bidding zone borders.

(13) The CCM for the CCR Hansa has no negative consequences on the development of capacity calculation methodologies in adjacent CCRs, and can evolve dynamically with the development and merger of CCRs in the future. The CCM for the CCR Hansa therefore does not hinder an efficient long-term operation in CCR Hansa and adjacent CCRs, and the development of the transmission system in the European Union.

(14) With the CCM for the CCR Hansa being aligned with the proposed flow-based CCMs in adjacent CCRs, the selection, inclusion and justification of relevant critical network elements and contingencies, the handling of adjustment of power flows on critical network elements due to remedial actions as well as the mathematical description for the calculation of power transfer distribution factors and the calculation of available margins on critical network elements for the adjacent AC grids are handled in the adjacent CCR's CCM proposals.

(15) With the CCM for the CCR Hansa preconditioning the use of AHC in the adjacent CCRs Nordic and Core there will, when implemented, be no undue discrimination between cross-zonal flows within CCR Hansa and adjacent regions. It will also ensure that there will be no undue discrimination between bidding zone borders within CCR Hansa.

(16) Article 27 (2) of the CACM states that CCR Hansa shall set up a Coordinated Capacity Calculator (hereafter referred to as "CCC") no later than four months after the decision on the capacity calculation methodology referred to in Article 20 and 21 of the CACM Regulation. The CCC will be responsible for calculating the cross-zonal capacities using the methodologystated in this proposal.

**HEREBY SUBMIT THE FOLLOWING PROPOSAL FOR A COMMON COORDINATED CAPACITY CALCULATION METHODOLOGY FOR THE CCR HANSA:**

## Article 1
## Subject, matter and scope

1. As required under Article 20 (2) of the CACM Regulation all TSOs in each CCR shall submit a Proposal for a common coordinated capacity calculation methodology within the respective region.

2. This document establishes a common coordinated CCM for all bidding zone borders allocated to the CCR Hansa.

## Article 2
## Definitions

1. For the purpose of this Proposal, the terms used will have the meaning of the definitions included in Article 2 of the CACM Regulation and Regulation (EC) No. 714/2009 on conditions for access to the network for cross-border exchanges in electricity and Regulation (EC) No. 543/2013 on submission and publication of data in electricity markets.

   In addition, in this Proposal the following definitions shall apply:

   a. Advanced Hybrid Coupling is an enhancement of the flow-based capacity calculation methodology, representing a more detailed modelling of the influence of the High Voltage Direct Current (HVDC) line on the AC network flows and allowing NTC bidding zone borders to compete for the scarce capacity within the flow-based area and vice versa, thereby enabling the capacity allocation algorithm to make an economic optimisation of the flows on NTC bidding zone borders on equal terms with the flows within the flow-based area.

   b. The Net Transfer Capacity (NTC) is the maximum total exchange program between two adjacent bidding zones compatible with security standards, and taking into account the technical uncertainties on future network conditions: NTC = TTC - TRM. In case the Transmission Reliability Margin (TRM) equals zero, the NTC equals the Total Transfer Capacity (TTC).

   c. The Available Transfer Capacity (ATC) is a measure of the transfer capability remaining in the physical transmission network for further commercial activity over and above already committed uses: ATC = NTC − AAC. In case the Already Allocated Capacity (AAC) equals zero, the ATC equals the NTC.

2. In this Proposal, unless the context requires otherwise:

   a. The singular indicates the plural and vice versa.

   b. Headings are inserted for convenience only and do not affect the interpretation of the Proposal.

   c. References to an "Article" are, unless otherwise stated, references to an article of this Proposal; and

   d. Any reference to legislation, regulations, directives, orders, instruments, codes or any other enactment includes any modification, extension or re-enactment of it when in force.

## CHAPTER 1
## Capacity Calculation Methodology for the day-ahead timeframe

## Article 3
## Mathematical description

1. The following mathematical description applies for the calculation of available transfer capacity on the DC lines between bidding zones.

The available transfer capacity $\text{ATC}_{i,DC,A \to B}$ on a DC line i in the direction A→B is calculated from:

$$\text{ATC}_{i,DC,A \to B} = \text{TTC}_{i,A \to B} - \text{AAC}_{i,A \to B} + \text{AAC}_{i,B \to A}$$

where

| | | |
|---|---|---|
| A | := | Bidding zone A. |
| B | := | Bidding zone B. |
| $\text{ATC}_{i,DC,A \to B}$ | := | Available Transfer Capacity on a DC line $i$ in direction A→B provided to the day-ahead market. |
| $\text{TTC}_{i,A \to B}$ | := | Total Transfer Capacity of a DC line $i$ in direction A→B, on the receiving end. The TTC corresponds to the full capacity of the DC line, in case of no failure on the interconnector, including converter stations. |

The TTC for a DC line $i$ is defined as follows:
$$\text{TTC}_{i,A \to B} = \alpha_i \cdot P_{i,\text{max thermal}} * \left(1 - \beta_{i,\text{Loss},A \to B}\right)$$

| | | |
|---|---|---|
| $\text{AAC}_{i,A \to B}$ | := | Already Allocated and nominated Capacity for a DC line i in direction A→B. |
| $\text{AAC}_{i,B \to A}$ | := | Already Allocated and nominated Capacity for a DC line i in direction B→A. |
| $\alpha_i$ | := | Availability factor of equipment defined through scheduled and unscheduled outages, $\alpha_i$, being a real number in between and including 0 and 1. |
| $P_{i,\text{max thermal}}$ | := | Thermal capacity for a DC line $i$. |
| $\beta_{i,\text{Loss},A \to B}$ | := | Loss factor for a DC line $i$ in direction A→B, which can be a different value depending on $\alpha_i$. |

2. The following mathematical description applies for the calculation of avaiblable transfer capacity on the AC lines.

The available transfer capacity $\text{ATC}_{AC,A \to B}$ on a bidding zone border that is connected by AC lines in the direction A→B is calculated from:

$$\text{ATC}_{AC,A \to B} = \text{TTC}_{A \to B} - \text{TRM}_{A \to B} - \text{AAC}_{A \to B} + \text{AAC}_{B \to A}$$

where

| | | |
|---|---|---|
| A | := | Bidding zone A. |
| B | := | Bidding zone B. |
| $\text{ATC}_{AC,A \to B}$ | := | Available Transfer Capacity of a bidding zone border in direction A→B, provided to the day-ahead market. |
| $\text{TTC}_{A \to B}$ | := | Total Transfer Capacity of a bidding zone border in direction A→B. |
| $\text{TRM}_{A \to B}$ | := | Transmission Reliability Margin for a bidding zone border in direction A→B. |
| $\text{AAC}_{A \to B}$ | := | Already Allocated and nominated Capacity for a bidding zone border in direction A→B. |
| $\text{AAC}_{B \to A}$ | := | Already Allocated and nominated Capacity for a bidding zone border in direction B→A. |

## Article 4
## Methodology for determining the reliability margin

1. The methodology for determining the TRM applies solely to the AC lines included in the CCR Hansa.

2. The TRM calculation shall consist of the following steps:
   a. Identification of sources of uncertainty for each TTC calculation process;
   b. Derivation of independent time series for each uncertainty and determination of probability distributions (PD) of each time series;
   c. Convolution of individual PDs and derivation of the TRM value from the convoluted PD.


## Article 5
## Methodology for determining operational security limits and contingencies relevant to capacity calculation and allocation constraints

1. Operational security limits are the acceptable operating boundaries for secure grid operation such as thermal limits, voltage limits, short-circuit current limits, frequency and dynamic stability limits.

2. Thermal limits of the CCR Hansa interconnectors are considered in the TTC calculation process described in Article 3 for the day-ahead timeframe and Article 8 for the intraday timeframe.

3. Operational security limits and contingencies in the AC grids adjacent to the CCR Hansa interconnectors, reflecting the flow interactions between the CCR Hansa interconnections and the AC grids, are considered in the flow-based parameters of CCR Nordic and CCR Core.

4. CCR Hansa TSOs can assess individually the operational security limits which cannot be reflected in the flow-based parameters of adjacent CCRs, including but not limited to: voltage stability limits, short-circuit limits, dynamic stability limits.

5. TSOs may apply allocation constraints that are needed to maintain the transmission system within operational security limits and that cannot be transformed efficiently into maximum flows on critical network elements or constraints intended to increase economic surplus, including but not limited to:

   i. The production in a bidding zone shall be above a given minimum production level; and

   ii. The combined import or export from one bidding zone to other neighbouring bidding zones shall be limited in order to ensure adequate level of generation reserves required for secure system operation; and

   iii. Maximum flow change on DC-lines between MTUs (ramping restrictions); and

   iv. Implicit loss factors on DC-lines

6. Each TSO applying allocation constraints of Article 5 (5) shall describe the allocation constraint with the applied limits and communicate these transparently to the market participants together with a justification.

7. Each TSO shall provide, among others, the operational security limits, and allocation constraints to the CCC in accordance with Article 29(1) of CACM Regulation.


## Article 6
## Methodology for determining generation shift keys

1. On the radial AC connection the generation shift key is modelled to represent the distribution of the power flow between the cross-bidding zone border lines.

2. Flow interactions between the CCR Hansa interconnections and the adjacent grids are reflected in the corresponding flow-based parameters.

## Article 7
## Methodology for determining remedial actions to be considered in capacity calculation

The impact of remedial actions such as phaseshifters meant to influence the flow distribution on the tie-lines on the AC border shall, if available, be considered in the determination of the TTC value.

## CHAPTER 2
## Capacity Calculation Methodology for the Intraday timeframe

## Article 8
## Mathematical description

1. The following mathematical description applies for the calculation of avaiblable transfer capacity on DC lines between bidding zones.

    The available transfer capacity $ATC_{i,DC,A \to B}$ on a DC line i in the direction A➔B is calculated from:

$$ATC_{i,DC,A \to B} = TTC_{i,A \to B} - AAC_{i,A \to B} + AAC_{i,B \to A}$$

    where

| | | |
|---|---|---|
| A | := | Bidding zone A. |
| B | := | Bidding zone B. |
| $ATC_{i,DC,A \to B}$ | := | Available Transfer Capacity on a DC line i in direction A➔B provided to the intraday market. |
| $TTC_{i,A \to B}$ | := | Total Transfer Capacity of a DC line i in direction A➔B, on the receiving end. The TTC corresponds to the full capacity of the DC line, in case of no failure on the interconnector, including converter stations. The TTC for a DC line i is defined as follows: $$TTC_{i,A \to B} = \alpha_i \cdot P_{i,max\,thermal} * \left(1 - \beta_{i,Loss,A \to B}\right)$$ |
| $AAC_{i,A \to B}$ | := | Already Allocated and nominated Capacity for a DC line i in direction A➔B. |
| $AAC_{i,B \to A}$ | := | Already Allocated and nominated Capacity for a DC line i in direction B➔A. |
| $\alpha_i$ | := | Availability factor of equipment defined through scheduled and unscheduled outages, $\alpha_i$, being a real number in between and including 0 and 1. |
| $P_{i,max\,thermal}$ | := | Thermal capacity for a DC line i. |
| $\beta_{i,Loss,A \to B}$ | := | Loss factor for a DC line i in direction A➔B, which can be a different value depending on $\alpha_i$. |

2. The following mathematical description applies for the calculation of avaiblable transfer capacity on the AC lines.

    The available transfer capacity $ATC_{AC,A \to B}$ on a bidding zone border that is connected by AC lines in the direction A➔B is calculated from:

$$ATC_{AC,A \to B} = TTC_{A \to B} - TRM_{A \to B} - AAC_{A \to B} + AAC_{B \to A}$$

    where

| | | |
|---|---|---|
| A | := | Bidding zone A. |
| B | := | Bidding zone B. |

| | | |
|---|---|---|
| $\mathrm{ATC}_{AC,A\rightarrow B}$ | := | Available Transfer Capacity of a bidding zone border in direction A→B, provided to the intraday market. |
| $\mathrm{TTC}_{A\rightarrow B}$ | := | Total Transfer Capacity of a bidding zone border in direction A→B. |
| $\mathrm{TRM}_{A\rightarrow B}$ | := | Transmission Reliability Margin for a bidding zone border in direction A→B. |
| $\mathrm{AAC}_{A\rightarrow B}$ | := | Already Allocated and nominated Capacity for a bidding zone border in direction A→B. |
| $\mathrm{AAC}_{B\rightarrow A}$ | := | Already Allocated and nominated Capacity for a bidding zone border in direction B→A. |

## Article 9
### Frequency of reassesment of the capacity in the intraday timeframe

1. The TTC for the intraday timeframe will be reassessed by the CCC when updated Common Grid Models are available, at least once in the intraday timeframe.

2. In case of unexpected events on the CCR Hansa interconnectors, and if these would impact cross-zonal capacity, the capacity in the intraday timeframe will be reassessed by the CCC.

3. The AAC is continuously updated.

## Article 10
### Methodologies for determining the reliability margin, operational security limits and contingencies relevant to capacity calculation and allocation constraints, generation shift keys and remedial actions to be considered in capacity calculation

The methodologies according to Article 4 to 7 of this Proposal for the day-ahead timeframe also apply for the intraday timeframe.

## CHAPTER 3
### Common provisions

## Article 11
### Methodology for the validation of cross-zonal capacity

1. In reference to the CACM Regulation Article 26(1), each TSO shall validate and have the right to correct cross-zonal capacity provided by the CCC, for bidding zone borders directly relevant to the TSO.

2. In reference to CACM Article 26(3) each TSO may reduce cross-zonal capacity during the validation of cross-zonal capacity referred to in paragraph 1 for reasons of operational security.

3. Each TSO shall validate the cross zonal capacity by checking that the correct input data, as sent by the TSO as mentioned in Article 29 (1) of the CACM Regulation, is used; may employ validation tools and can perfom its own calculations using the common grid model.

4. Any information on increased or decreased cross-zonal capacity from neighbouring CCCs will be provided by the CCC to the TSOs to be taken into account during the validation.

5. Each TSO sends its capacity validation result to the relevant CCC and to the other TSOs of CCR Hansa.

## Article 12
## Fallback for capacity calculation in the day-ahead and intraday timeframe

In case the capacity calculation cannot be performed by the CCC, the concerned TSOs will bilaterally calculate and agree on cross-zonal capacities. The TSOs shall individually apply the CCM and the result will be selected by using the minimum value of the calculated results from TSOs on the relevant bidding zone border. The concerned TSOs shall submit the capacities to the CCC and to the other TSOs of CCR Hansa.

## Article 13
## Implementation

Implementation of this Proposal will be a stepwise process to the following milestones:

1. Implementation of the methodology for the Common Grid Model.

2. The CCC of CCR Hansa is appointed and in operation pursuant to Article 27 (2) of CACM Regulation.

3. The flow-based CCM proposals of CCR Core and of CCR Nordic have been implemented including Advanced Hybrid Coupling for the interconnectors in CCR Hansa. After this, the day ahead capacity calculation methodology is implemented. Pursuant to Article 20(8) a 6 month testing of the methodology shall be coordinated with CCR Nordic and CCR Core.

4. The Single Intraday Coupling solution can apply flow-based parameters and relevant TSO and Nominate Electricity Market Operator (NEMO) processes have been adapted accordingly. After this step the CCM for the intraday timeframe is implemented.

## Article 14
## Language

1. The reference language for this Proposal is English.

2. To avoid any doubt, where TSOs need to translate this Proposal into their national language(s), in the event of inconsistencies between the English version published by the TSOs in accordance with Article 9 (14) of the CACM Regulation and any version in another language, the concerned TSOs shall, in accordance with national legislation, provide the relevant National Regulatory Authorities with an updated translation of the Proposal.