ENTSO-E report on capacity calculation and allocation 2021

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Contents

About ENTSO-E

ENTSO-E, the European Network of Transmission System Operators for Electricity, is the association for the cooperation of the European transmission system operators (TSOs). The 42 member TSOs, representing 35 countries, are responsible for the secure and coordinated operation of Europe's electricity system, the largest interconnected electrical grid in the world. In addition to its core, historical role in technical cooperation, ENTSO-E is also the common voice of TSOs.

ENTSO-E brings together the unique expertise of TSOs for the benefit of European citizens by keeping the lights on, enabling the energy transition, and promoting the completion and optimal functioning of the internal electricity market, including via the fulfilment of the mandates given to ENTSO-E based on EU legislation.

Executive Summary

Coordinated processes for capacity calculation and allocation harmonise the operation of cross-border markets in Europe to increase competitiveness and integrate renewable generation. Transmission system operators (TSOs) are working to achieve this by implementing a coordinated capacity calculation process in each capacity calculation region (CCR). The CCRs are geographical regions in which the available cross-zonal trading capacity is determined based on forecasts of electricity flows for all market time frames as defined in the capacity allocation and congestion management (CACM regulation; for the day-ahead and intraday time frame) and forward capacity allocation (FCA) regulations (for the long-term time frame).

At the time of this report, most of the capacity calculation methodologies (CCMs) under the CACM regulation have been approved by the relevant regulatory authorities. Therefore, this report focuses on their implementation within the CCRs. Most of the CCMs under the FCA regulation for the long-term time frame have been submitted but are awaiting approval, although some have already been approved.

Capacity calculation region	Approach implemented	Coordinated capacity calculator(s)	Implementation date[1]	
			day-ahead	intraday
Nordic	Flow-based (FB)	Nordic Regional Coordination Centre	Exp. Q3 2022	Exp. Q3 2022
Hansa	coordinated NTC (cNTC)	Nordic Regional Coordination Centre	Exp. Q2 2022 to Q2 2024	Exp. Q2 2022 to Q4 2024
Core	Flow-based (FB)	Coreso & TSCNET Services	Q1 2022	Q1 2023 to Q1 2024
Italy North	coordinated NTC (cNTC)	Coreso & TSCNET Services	Q2 2021	Q2 2021
Greece-Italy	coordinated NTC (cNTC)	Southeast Electricity Network Coordination Centre (SEleNe) capacity calculation	Q3 2021	Q2 2023
South-West Europe	coordinated NTC (cNTC)	Coreso	Implemented (Q1 2020)	Q4 2021
Baltic	coordinated NTC (cNTC)	Baltic Regional Coordination Centre	To be determined	To be determined
South-East Europe	coordinated NTC (cNTC)	SCC / Southeast Electricity Network Coordination Centre (SEleNe) capacity calculation	Exp. Q3 2021	Exp. Q3 2021

Table 1. Status of CACM CCMs in each CCR (as at June 2021)

Several statistical and quality indicators have been drawn up to monitor operations after the launch of the CCMs.[2] This report presents the indicators for CCRs whose coordinated capacity calculation processes under the CACM regulation were already in use during the period it covers (i.e. 2019 and 2020). The statistical and quality indicators for CCRs whose CCMs will soon become operational can be expected to appear in the next edition of this report in 2023. Statistical and quality indicators are the basis on which TSOs assess further harmonisation of CCMs. Since this assessment requires a sufficient data basis, TSOs have proposed 2025 as the target year for this assessment. The conclusion is expected to be included in the 2025 edition of this report.

In addition to the day-ahead and intraday time frame, this report also covers the long-term time frame. **Table 2** shows the implementation status of the CCMs according the FCA regulation per CCR.

1 Exp.: Expected.

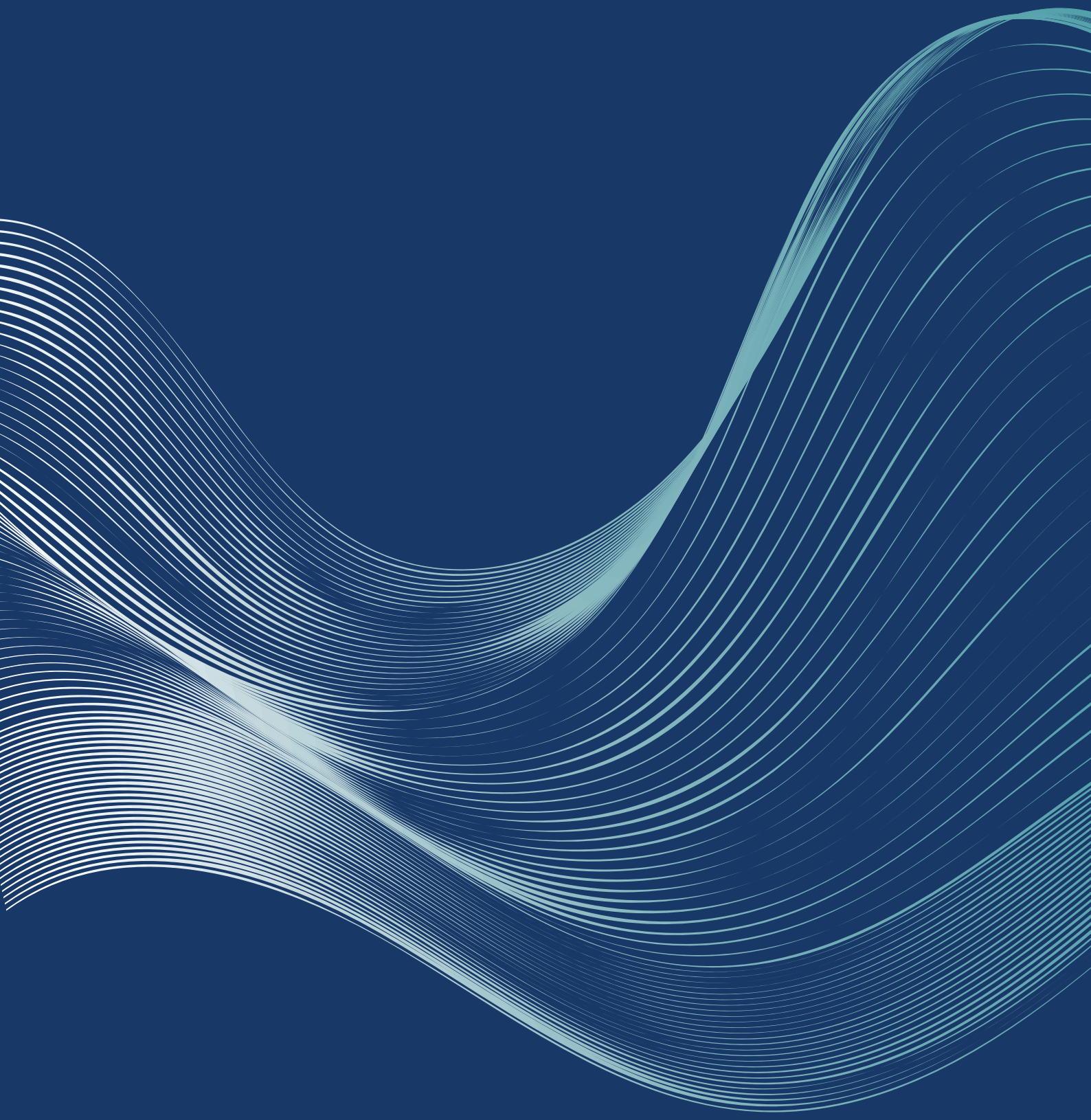
2 Pursuant to Article 31(3) of the CACM regulation.

Capacity calculation region	Approach to be implemented	Status of the proposal	Implementation status		
			Y-1	M-1	Q-1
Nordic	Flow-based (FB)	Approved in Oct. 2019	Ongoing	Ongoing	N/A
Hansa	coordinated NTC (cNTC)	Submitted in Oct. 2020	Ongoing	Ongoing	N/A
Core	Flow-based (FB)	Referred to Agency for the Cooperation of Energy Regulators (ACER) – decision expected for Nov. 2021	Ongoing	Ongoing	N/A
Italy North	Statistical	Approved in May 2020	Exp. Q4 2021	Exp. Q4 2021	N/A
Greece-Italy	coordinated NTC (cNTC)	Approved in Jan. 2020	Ongoing	Ongoing	N/A
South West Europe	coordinated NTC (cNTC)	Approved in March 2020	Ongoing	Ongoing	Ongoing
Baltic	coordinated NTC (cNTC)	Rejected by Agency for the Cooperation of Energy Regulators (ACER) in Nov. 2020	Ongoing	Ongoing	N/A
South East Europe	coordinated NTC (cNTC)	Approved in May 2020	Exp. Q3 2021	Exp. Q3 2021	N/A

Table 2. Status of FCA CCMs in each CCR (as at June 2021)

The launch of the Common Grid Model (CGM) will be a major milestone on the way to the single European market for electricity. The CGM is being implemented to perform tasks related to cross-zonal capacity (CZC) calculation using standardised data with a common information technology framework. By enhancing scalability and data interoperability of all stakeholders involved – especially TSOs and regional security coordinators (RSCs) – the CGM will eliminate inefficiencies and add value to the European CZC calculation processes. As a first step, the minimum viable solution of the CGM is planned to go live by the end of 2021, incorporating the following functions as set out by the European Union (EU) under various network codes:

1. standardised framework for exchanging Individual Grid Models (IGMs) by TSOs;
2. merging of functionality of IGMs into a CGM by RSCs;
3. use of the Physical Communication Network (PCN), ENTSO-E's Communication and Connectivity Service Platform (ECCoSP);
4. use of ENTSO-E's Operational Planning Data Environment (OPDE) Platform;
5. introduction of the Common Grid Model Exchange Standard (CGMES).



1. Introduction

TSOs calculate the optimal level of cross-zonal transmission capacity across various time frames from long-term to real time. This calculation establishes the basis for the efficient performance of the European wholesale electricity markets across these time frames[3].

Both Commission Regulation (EU) 2016/1719 establishing a guideline on forward capacity allocation (the FCA regulation)[4], used for the long-term time frame, and Commission Regulation (EU) 2015/1222 establishing a guideline on capacity allocation and congestion management (the CACM regulation), used for the intraday and day-ahead time frame, provide a framework to harmonise the way in which cross-zonal capacity (CZC) is calculated and allocated in Europe. TSOs – in cooperation with all involved stakeholders – are working intensively on the implementation of the provisions of the FCA and CACM regulations.

Capacity calculation and allocation methodologies compliant with the FCA and CACM regulations are implemented by so-called capacity calculation regions (CCRs). CCRs stem from the need to properly take into account the cross-zonal flows in capacity calculation and allocation for all the market time frames. CCRs ensure that coordinated capacity calculation can be accurately and reliably performed to ensure optimal capacity is made available to the European market **Figure 1** presents the current CCRs.

The FCA and CACM regulations also provide guidelines for transparent monitoring of the implementation of their provisions. The essence of these reporting activities is presented in the biennial ENTSO-E *Capacity Calculation and Allocation Report*. The present edition (2021) covers the period from Q2 2019 to Q4 2020. The report is being delivered to the Agency for the Cooperation of Energy regulators (ACER) and published on ENTSO-E's website.

The report is organised as follows:

- **Chapter 1** introduces the content of the report.
- **Chapter 2** describes the statistical and quality indicators used to monitor capacity calculation and allocation.
- **Chapter 3** recounts the progress made to date with respect to the CCMs in all CCRs.
- **Chapter 4** recounts the progress on the pan-European CGM process and puts forward quality indicators to be provided once the CGM process is approved and implemented.
- **Annexes** provide complementary information such as legal references relevant to the report.

3 For further explanation, see ENTSO-E, 'Chapter 1: Introduction', Market Report, 2021.

4 See Annex I to learn more about the legal references and requirements covered in this report.

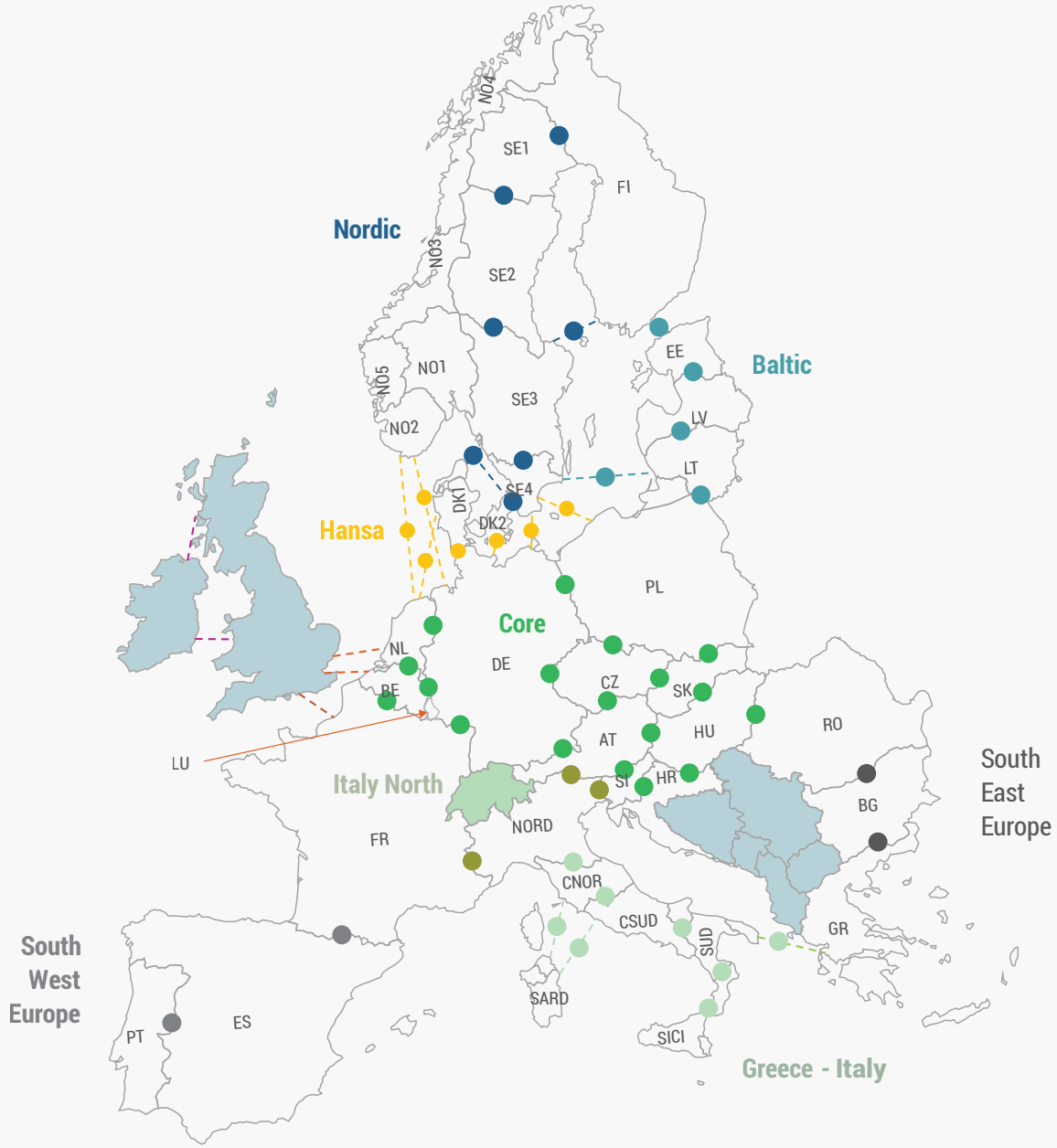
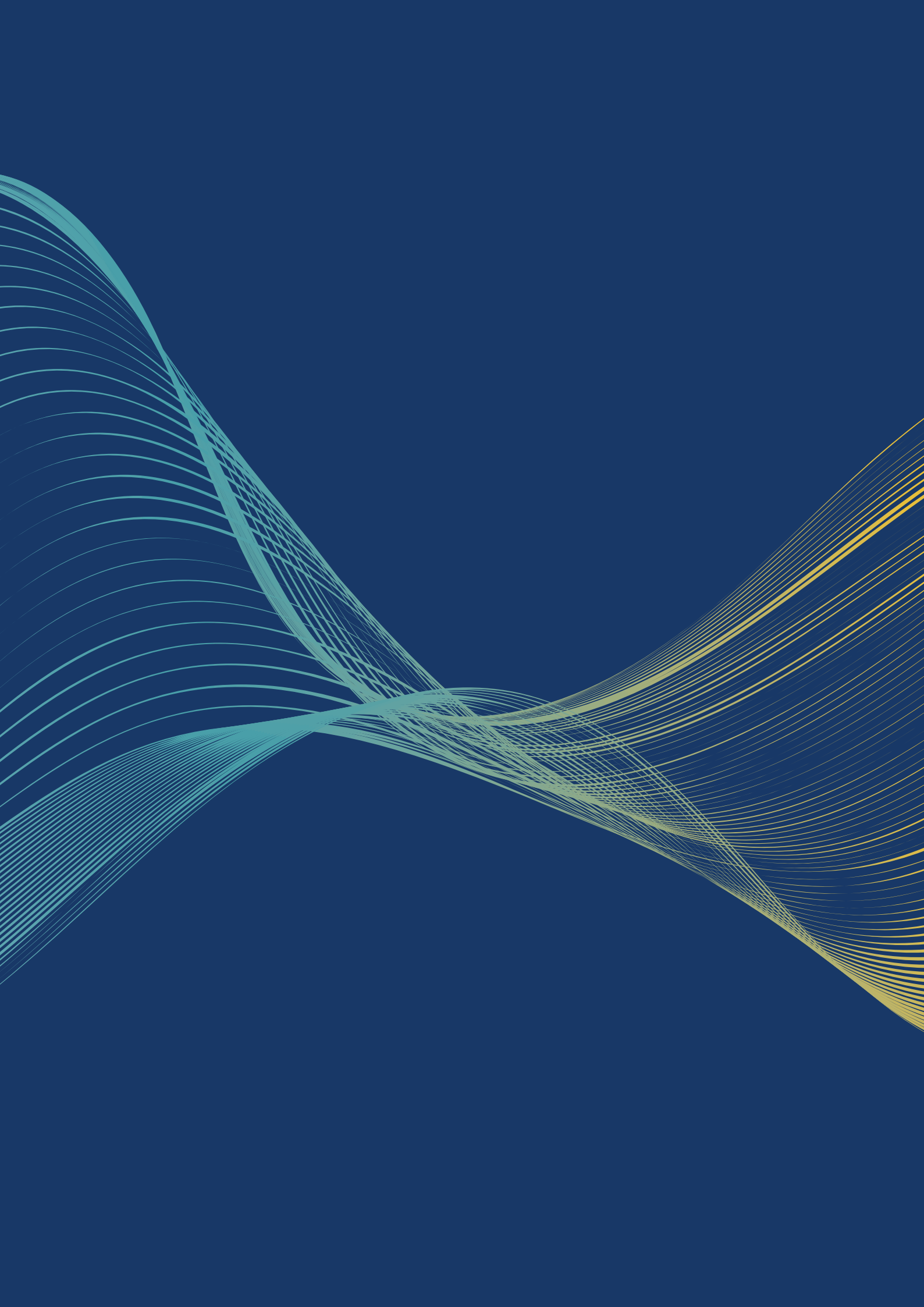


Figure 1. Capacity calculation regions (as at June 2021)



2. Indicators to monitor the capacity calculation and allocation processes

This chapter describes the statistical and quality indicators developed jointly by ACER and ENTSO-E during Q1/2021 to monitor the state of capacity calculation and allocation within the CCRs[5].

The indicators cover (a) reliability margins, (b) available and allocated CZC, (c) the information used for capacity calculation and (d) indicators for assessing and following in the longer term the efficiency of single day-ahead and intraday coupling.

It is important to note that this report presents the indicators for the minority of CCRs whose coordinated capacity calculation and allocation processes compliant with the CACM and FCA regulations were already in use during the period it covers (i.e. 2019 and 2020). The statistical and quality indicators for CCRs whose CCMs will soon become operational can be expected to appear in the next edition of this report in 2023.

1. Statistical indicators on reliability margins

These indicators aim to assess the reliability margin (RM) for capacity calculation in long-term (FCA regulation) as well as day-ahead and intraday (CACM regulation) time frames. The RM is a key part of the capacity calculation process covering discrepancies between the forecasts of the capacity calculation process and real time to ensure system security. Therefore, the RM serves as a 'margin of error' considering uncertainties stemming from external influences that cannot be foreseen.

The process for calculating the RM depends on the capacity calculation approach being implemented in the CCR: coordinated net transmission capacity (cNTC) or flow-based calculation. For cNTC, the RM is based on the transmission reliability margin (TRM), whereas for flow-based, the RM is calculated based on the flow RM (FRM). To assess the RM, the following indicators have been established:

Coordinated net transmission capacity (cNTC)	Flow-Based (FB)
Average TRM values per border/direction and time frame (MW)	Average flow reliability margin (FRM) values as a percentage of the maximum admissible power flow (Fmax) of the critical network element and contingency (CNECs) at Bidding Zone (BZ) level

Table 3. Statistical indicators on reliability margins

5 In accordance with Articles 31(3) of the CACM and 26(3) of the FCA regulations.

2. Statistical indicators on available and allocated CZC

These indicators seek to assess the level of available and allocated CZC across all time frames. Moreover, complementary information on allocation constraints as well as maximum export and import capacities are presented, if relevant.

Coordinated net transmission capacity (cNTC)	Flow-Based (FB)
• Average net transmission capacity (NTC) values • Maximum export and import capacities (for each Bidding Zone individually, and/or the matrix bidding zone - bidding zone) • Average External Constraints (MW) • The portion of the CZC to be allocated, i.e. offered, by each time frame • The portion of the CZC allocated by each time frame	• Average remaining available margin (RAM) values as a percentage of the maximum admissible power flow (F_{max}) of the critical network element and contingency (CNEC) before pre-solved state, at bidding zone level • Maximum export and import capacities for each bidding zone individually and matrix bidding zone to bidding zone (non-simultaneous values)

Table 4. Available statistical indicators of CZC for each CCM approach

3. Quality indicators for the information used for capacity calculation

Two indicators have been developed.

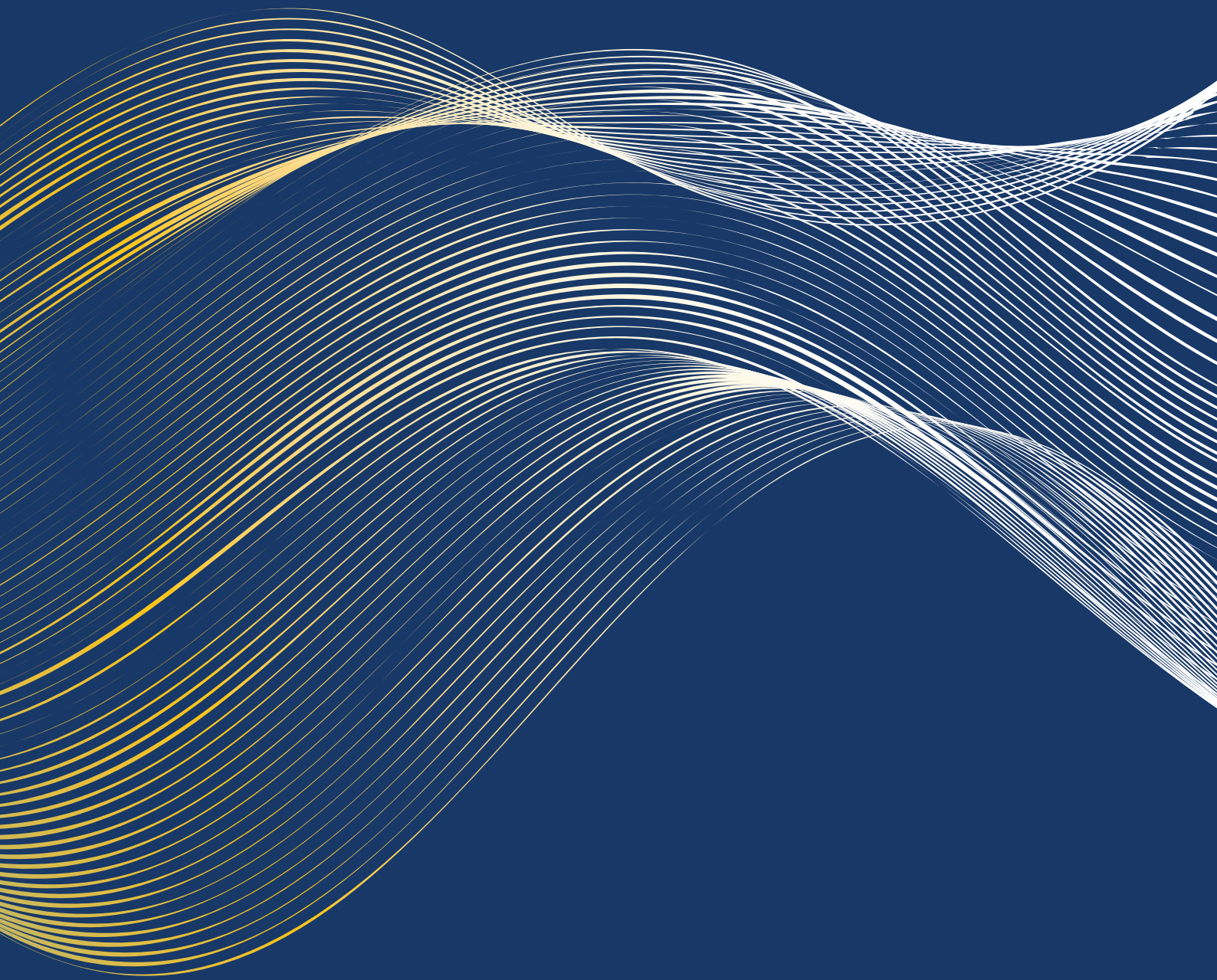
The first indicator assesses the quality of the input data for IGMs and the CGM, by comparing the netted position of a control area of D-1[6] with the corresponding D-2[7] net position reported[8] by the Pan-European verification function (PEVF[9]) as a result of the market outcome. The implementation process is programmed to be completed in Q4 2021; therefore, this quality indicator will be calculated and included in the 2023 edition of this report. More information about this implementation is provided in Chapter 4 of this report.

The second indicator monitors the quality of the information used for the capacity calculation process by identifying the percentage of time when the critical network element and contingency (CNEC) of a NTC calculation is not known by the TSO.

4. Indicators for assessing and following in the longer term the efficiency of single day-ahead and intraday coupling

The purpose of these indicators is to assess the efficiency of the current capacity calculation and allocation framework. Options for further development can be determined based on the findings of these indicators. The welfare loss due to unscheduled allocated flows from other external regions is due to be assessed for CCRs applying the flow-based approach[10].

6 D-1: the day before electricity delivery.
7 D-2: two days before electricity delivery.
8 'Netted area position' is the AC and DC position for a given area.
9 See ENTSO-E, Pan European Verification Function Implementation Guide, 2018.
10 This is performed by multiplying the unscheduled external flows by the shadow price of the respective bidding zone. This information for the Core CCR is expected to become available as soon as the Core day-ahead CCM has gone live.



3. Capacity calculation regions

The following chapter presents the current state of the short-term and long-term capacity calculation in each CCR.

3.1. Nordic

The TSOs in the Nordic CCR are Energinet (DK), Fingrid (FI) and Svenska Kraftnät (SE). Statnett (NO) is also a member of the Nordic CCM project but is not part of the Nordic CCR as defined in ACER Decision No 06/2016 of 17 November 2017 on the electricity TSOs' proposal for the determination of CCRs.

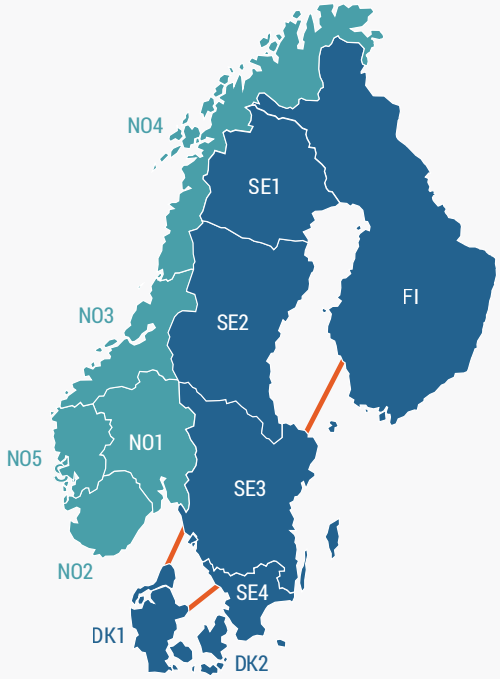


Figure 2. Nordic CCR[11]

3.1.1. Capacity calculation and allocation for the short-term

The Nordic CCM[12] for the day-ahead and intraday time frames was approved by the Nordic national regulatory authorities (NRAs) on 14 October 2020.

- For the day-ahead time frame, the Nordic TSOs implement a flow-based capacity calculation approach.
- For the intraday time frame, the Nordic TSOs implement a flow-based approach. Until the single intraday coupling is able to support the allocation of cross-zonal capacities based on flow-based parameters, the capacity calculation coordinator (CCC) will transform the flow-based parameters into available transfer capability (ATC) as a transitional solution.

To enable familiarisation with the flow-based approach, a stakeholder information platform is hosted by the Nordic RSC. This provides access to flow-based parameters and market simulation results, as well as a draft version of a stakeholder information tool.

11 This CCR includes the following bidding zone borders: Finland-Sweden 1 (FI-SE1), Finland-Sweden 3 (FI-SE3), Sweden 1-Sweden 2 (SE1-SE2), Sweden 2-Sweden 3 (SE2-SE3), Sweden 3-Sweden 4 (SE3-SE4), Sweden 4-Denmark 2 (SE4-DK2) Sweden 3-Denmark 1 (SE3-DK1) and Denmark 1-Denmark 2 (DK1-DK2).

12 https://forsyningstilsynet.dk/media/8342/bilag-1-ccm-legal-document.pdf.

Day-ahead capacity calculation process of the Nordic CCR

The capacity calculation process for the day-ahead time frame includes the following steps:

- Each Nordic TSO will create an IGM for its bidding zone(s) and send it to the merging agent to merge the IGMs to build the CGM.
- The merging agent will send the CGM to the CCC to calculate F_{max} values.
- Each Nordic TSO will send generation shift key (GSK) strategies, contingencies and operational security limits for its bidding zone(s) to the CCC to calculate F_{max} values.

A TSO may also transform operational security limits for dynamic stability into allocation constraints and send these as combined dynamic constraints for the calculation of F_{max}

- Each Nordic TSO will send CNECs for its bidding zone(s) to the CCC to be considered in capacity calculation.
- The CCC will calculate F_{max} for each CNEC applying the CGM, GSKs, contingencies, operational security limits, combined dynamic constraints and CNECs submitted by each Nordic TSO.
- Each Nordic TSO will send RM, already allocated capacity and remedial action for each CNEC and combined dynamic constraint to the CCC for calculation of the remaining available margin (RAM).
- The CCC will calculate the RAM and combined dynamic constraint for each CNEC taking into account rules for sharing the power flow capabilities of CNECs among different CCRs.
- The CCC will send calculated flow-based parameters to each Nordic TSO for validation.
- Each Nordic TSO will send validated flow-based parameters, including adjustments to flow-based parameters, to the CCC.
- Each Nordic TSO will send allocation constraints to the CCC. The CCC will send the validated flow-based parameters and allocation constraints to relevant nominated electricity market operators (NEMOs) for the purpose of allocating CZC by market coupling operator.
- Relevant NEMOs will publish validated flow-based parameters and allocation constraints to the market.
- The CCC will publish validated flow-based parameters, allocation constraints and other information requested.

A general overview of the stepwise capacity calculation process defined above is schematically represented in **Figure 3**:

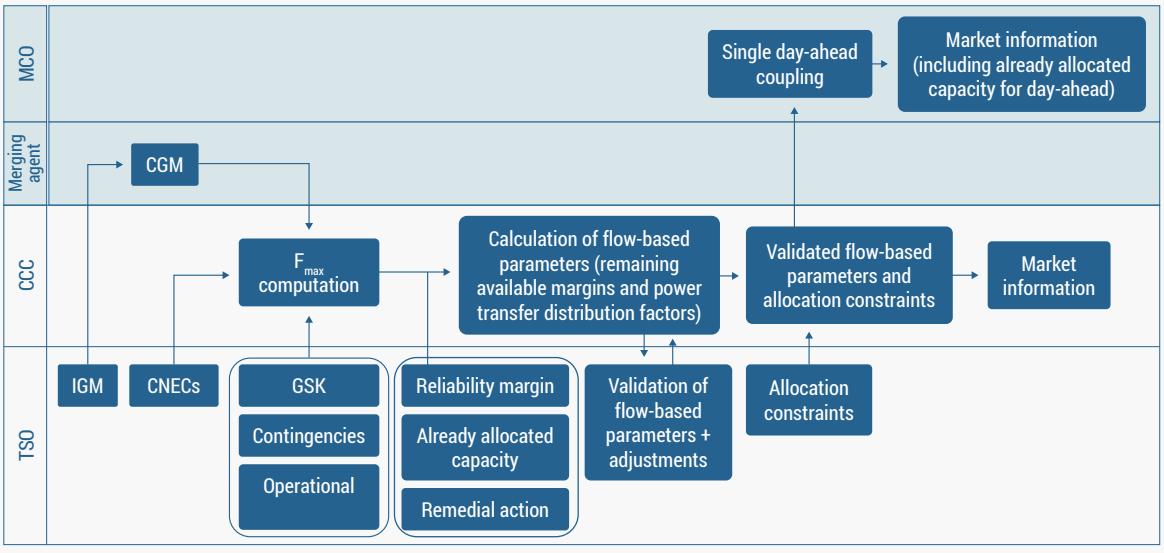


Figure 3. Input and output data and roles of the entities in the capacity calculation process for the day-ahead time frame of the Nordic CCR

Reliability margin methodology

The Nordic TSOs will only determine the RM for AC grid elements and deliver these values to the CCC. The methodology used to determine the AC grid elements RM consists of two steps.

A probability distribution of the deviation between the expected and realised (observed) power flows is determined at least annually for each CNEC based on historical data. This forms the prediction error distribution for each CNEC. The prediction errors will be tailored to a statistical distribution that minimises the modelling error.

The RM value will be calculated by deriving a value from the probability distribution based on the provided TSO risk level value by each Nordic TSO, which is currently set to 95%. The risk level is defined as the area (cumulative probability) right of the RM value and frequency containment reserve (FCR) margin value in their probability distribution.

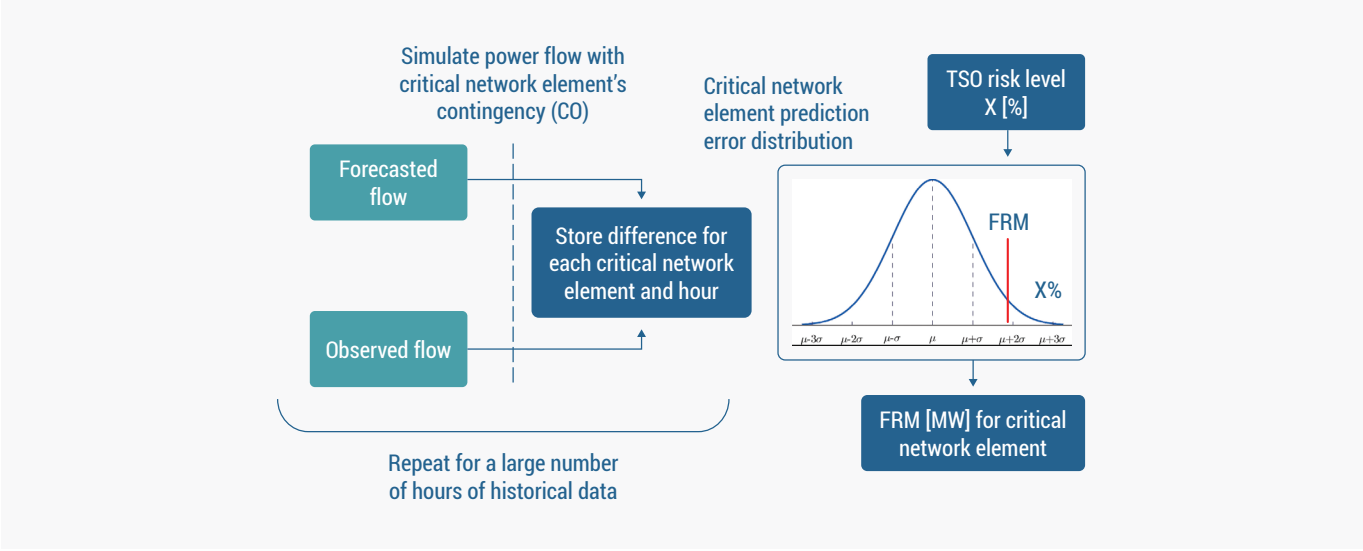


Figure 4. Determining the reliability margin of the Nordic CCR

The TSOs will calculate the RM and frequency containment reserve margin regularly and at least once a year, applying the latest information available. **The unintended deviations of the physical flows due to the adjustments made to maintain a constant frequency (frequency containment reserve margin) will be assessed separately and added to the final RM value.**

Table 5, **Table 6**, **Table 7** and **Table 8** provide an overview of the already accomplished milestones and planned timeline for the implementation of the Nordic CCR day-ahead and intraday capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q3 2018	NRA approval of the Nordic CCR CCM proposal
Q4 2018	NRA Request for Amendment[13]
Q4 2019	NRA approval of the amended Nordic CCR CCM proposal
Q4 2020	NRA approval of the second amended Nordic CCR CCM proposal

Table 5. Nordic CCR: closed milestone(s) for short-term capacity calculation and allocation

13 https://nordic-rsc.net/wp-content/uploads/2019/01/Nordic-CCM-RfA.pdf.

Planned milestone(s)	
Quarter	**Description**
Q3 2018 - Q4 2022	The implementation of the Nordic CCR CCM
Q2 2021	Start of internal parallel run
Q2-Q3 2021	Start of the parallel run transition period
Q3-Q4 2021	Start of the external parallel run
Q4 2022	Nordic day-ahead CCM and intraday CCM go-live window

Table 6. Nordic CCR: planned milestone(s) for short-term capacity calculation and allocation

3.1.2. Capacity calculation and allocation for the long-term

The FCA CCM[14] for the Nordic CCR has been decided upon by ACER. For the long-term time frame, the Nordic TSOs will implement a flow-based capacity calculation approach, the implementation timeline for which is provided in **Table 7**.

Closed milestone(s)	
Quarter	**Description**
Q1 2019	The Nordic CCR TSOs submitted the long-term transmission rights CCM proposal to the NRA
Q2 2019	ACER referral
Q4 2019	ACER decision on the Nordic CCR long-term CCM

Table 7. Nordic CCR: closed milestone(s) for long-term capacity calculation and allocation

Planned milestone(s)	
Quarter	**Description**
TBD	Start of the long-term CCM implementation[15]

Table 8. Nordic CCR: planned milestone(s) for long-term capacity calculation and allocation

Statistical indicators for the bidding zone borders of the Nordic CCR

The following graph shows the offered and allocated long-term capacities during 2019 and 2020 at Nordic CCR internal borders, which will become part of the Nordic CCR's CCM in accordance with the FCA regulation[16]. If a border is not shown in **Figure 5**, the capacity had not been offered within the long-term market time frame represented during the reporting period.

14 https://nordic-rsc.net/wp-content/uploads/2019/01/FCA-Capacity-calculation-methodology-legal-proposal-Vf.pdf.
15 According to LT CCM: implemented at the latest 12 months after DA/ID go-live.
16 Article 10 of the FCA regulation.

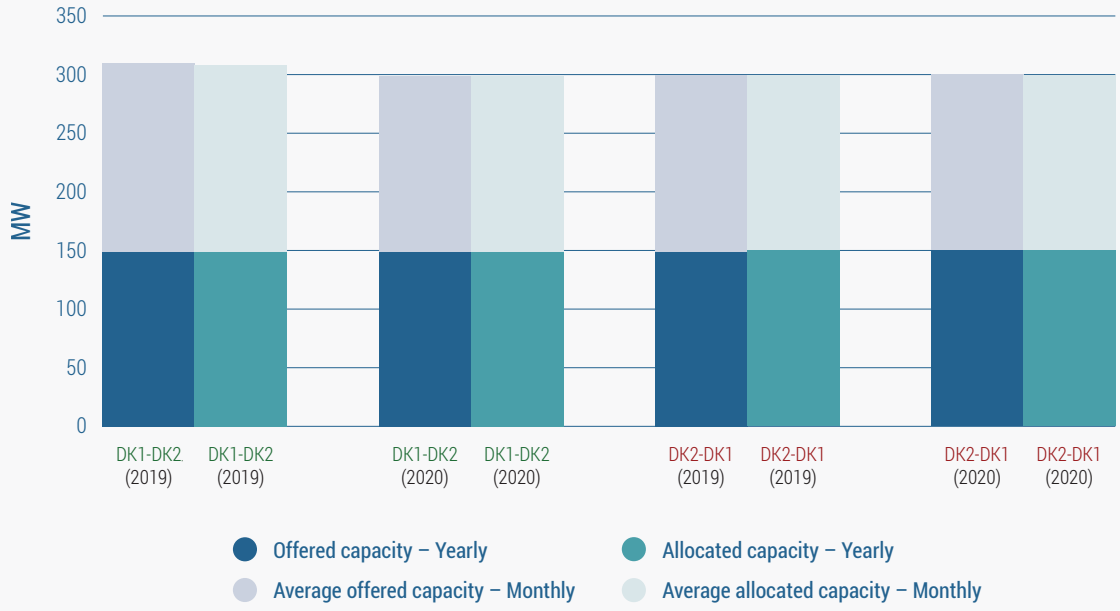


Figure 5. Long-term offered and allocated capacities in Nordic CCR bidding zone borders during 2019 and 2020[17]

Figure 6 and **Figure 7** show the implicit offered and allocated day-ahead capacities and Figure 8 and Figure 9 the intraday capacities from April 2019 to December 2020 at Nordic CCR internal borders, which will become part of the Nordic CCR CCM in accordance with CACM regulation[18]. The values are presented in box-plot diagrams to show the distributional characteristics of the data series.

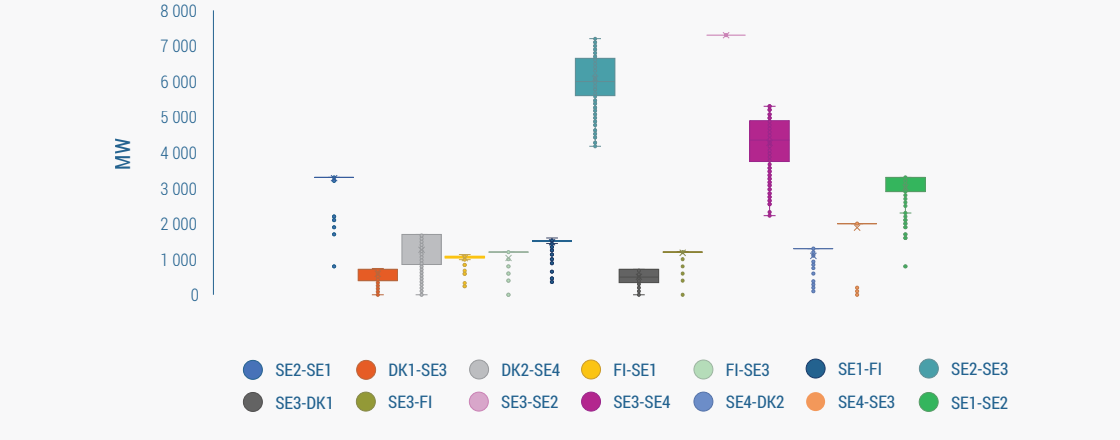


Figure 6. Implicit day-ahead offered capacities in Nordic CCR bidding zone borders from April 2019 to December 2020[19]

17 Source: JAO Publication tool.
18 Article 20 of the CACM regulation.
19 Source: SDAC Operations Committee – OPSCOM.

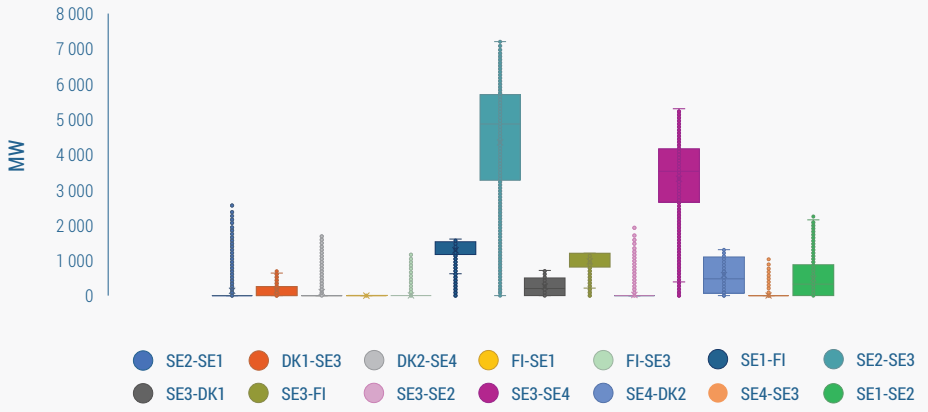


Figure 7. Implicit day-ahead allocated capacities in Nordic CCR bidding zone borders from April 2019 to December 2020[20]

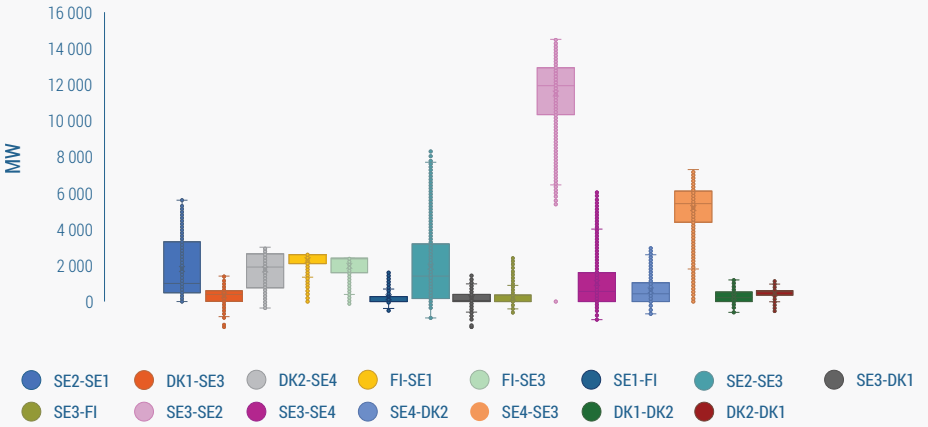


Figure 8. Implicit intraday offered capacities in Nordic CCR bidding zone borders from April 2019 to December 2020[21]

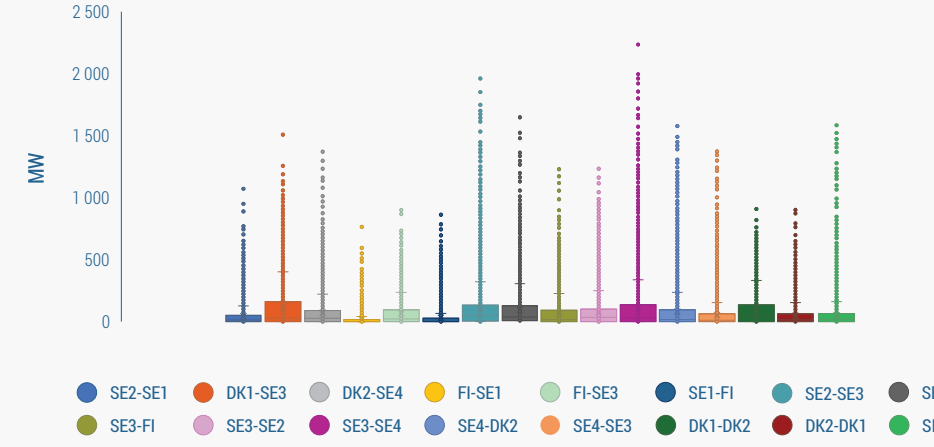


Figure 9. Implicit intraday offered capacities in Nordic CCR bidding zone borders from April 2019 to December 2020[22]

20 Source: SDAC Operations Committee – OPSCOM.
21 Source: SIDC/XBID reporting.
22 Source: SIDC/XBID reporting.

3.2. Hansa

The TSOs of the Hansa CCR are 50Hertz (DE), Baltic Cable AB (SE4 – DE), Energinet (DK), Statnett (NO), PSE (PL), TenneT DE (DE/LU), TenneT NL (NL) and Svenska Kraftnät (SE).

Statnett is expected to join the Hansa CCR once Norway ratifies the CACM regulation. Statnett and Baltic Cable (SE4-DE/LU) are not yet formally part of the Hansa CCR, but actively participate in the regional project.

Figure 10. Hansa CCR[23]

3.2.1. Capacity calculation and allocation for the short-term

Table 9 and **Table 10** provide an overview of the already accomplished milestones and planned timeline for the implementation of the Hansa CCR day-ahead and intraday capacity calculation processes.

23 The Hansa CCR includes the following bidding zone borders: Denmark 1 - Germany/Luxembourg (DK1 - DE/LU), Denmark 2 - Germany/Luxembourg (DK2 - DE/LU), Sweden 4 - Poland (SE4 - PL), Denmark 1 – The Netherlands (DK1 - NL). It is expected that the following bidding zone borders will be added to Hansa CCR: Norway 2 – The Netherlands (NO2 – NL), Norway 2 – Germany/ Luxembourg (NO2 – DE/LU), Sweden 4 - Germany/Luxembourg (SE4 - DE/LU).

Closed milestone(s)[24]	
Quarter	**Description**
Q3 2017	The Hansa CCR TSOs run a public consultation on the intraday and day-ahead CCM proposal
Q3 2017	The Hansa CCR TSOs submitted the intraday and day-ahead CCM proposal for NRA approval
Q1 2018	The Hansa CCR NRAs submitted Request for Amendment to the intraday and day-ahead CCM proposal
Q3 2018	The Hansa CCR TSOs handed in Request for Amendments to the intraday and day-ahead CCM proposal
Q4 2018	The Hansa CCR NRAs approved amended intraday and day-ahead CCM proposal
Q1 2019	ACER's amendment of the determination of CCRs, COBRAcable included
Q2 2019	The Coordinated Capacity Calculators are appointed
Q3 2020	The Hansa CCR NRAs submitted Requests for Amendments to the intraday and day-ahead CCM
Q4 2020	The European Commission published its decision on KF CGS derogation
Q4 2020	The Hansa CCR TSOs ran a public consultation on the amendment of the intraday and day-ahead CCM
Q4 2020	Phase 1 of ID & DA CCM implementation completed for Hansa interconnectors (except NordLink scheduled for 2021)
Q1 2021	The Hansa CCR TSOs submitted the amendments to the intraday and day-ahead CCM
Q2 2021	Phase 1 of intraday and day-ahead CCM implementation for NordLink

Table 9. Hansa CCR: closed milestone(s) for short-term capacity calculation and allocation

Planned milestone(s)	
Quarter	**Description**
Q2 2021	Hansa CCR NRAs approved the amendments to the intraday and day-ahead CCM
Q2 2022	Phase 2 of intraday and day-ahead CCM implementation

Table 10. Hansa CCR: planned milestone(s) for short-term capacity calculation and allocation

It should be noted that the CCM for the Hansa CCR is interlinked with the CCMs being developed in the Nordic CCR and Core CCR. Since the Hansa CCR has the unique feature of all Bidding Zones being currently connected by radial lines, the assessment of cross-border capacity can be split into three separate parts, which allows the TSOs to look at the impact of cross-border trade independently on each part of the grid. The methodology for the Hansa CCR is, therefore, a cNTC methodology for both day-ahead and intraday. Applying an advanced hybrid coupling (AHC) approach, the Hansa CCR's CCM takes advantage of the flow-based methodologies developed in Nordic and Core CCRs. This makes it possible to take into account the limitations in the meshed AC grids , while the effective interconnector capacities are addressed individually within the Hansa CCR. While the implementation of AHC in the Nordic CCR is expected to take place from the beginning of Nordic flow-based CC, it is planned to be applied in the Core CCR in an additional step after the initial launch of the Core day-ahead CCM. This method ensures that the capacity calculation in Hansa CCR is as efficient as possible, from a market point of view and across all time frames. The methodology is easy to implement, and from an operational and security of supply perspective, it is coordinated with adjacent regions. Moreover, the proposed methodology is sustainable throughout the expected future changes in CCR configurations.

24 The respective documents are uploaded on the dedicated part of the ENTSO-E website: https://www.entsoe.eu/network_codes/ccr-regions/#hansa.

Due to the interdependencies with other CCRs, the CCM for the Hansa CCR will be implemented step-by-step, including:

1. appointment of CCC(s);
2. implementation of the CGM;
3. implementation of flow-based capacity calculation with AHC in the Nordic CCR;
4. implementation of flow-based capacity calculation with AHC in the Core CCR;
5. implementation of intraday market coupling with flow-based constraints.

As soon as the ongoing implementation of new processes is complete, the TSOs will send the results of the cross-zonal CC for their respective borders and/or interconnectors to the Hansa CCR's CCC. Based on this, the Hansa CCC will perform the coordinated cross-zonal CC and calculate the minimum CZC. The resulting cross-zonal capacities will be subject to validation by each Hansa CCR TSO for its bidding zone borders. The validated cross-zonal capacities and allocation constraints will be provided to the allocation mechanism by the Hansa CCR's CCC. This so-called Phase 2 implementation of the CCMs is expected to be completed in 2022.

Determination of transmission reliability margins

The methodology to determine the TRM includes the principles for calculating the probability distribution of the deviations between the expected power flows at the time of the CC and realised power flows in real time, and subsequently specifies the uncertainties to be taken into account in the CC. This only applies to the radial-connected AC border DK1–DE/LU.

The TRM calculation consists of the following high-level steps:

1. identification of sources of uncertainty for each total transfer capacity (TTC) calculation process;
2. derivation of independent time series for each uncertainty and determination of probability distribution of each time series;
3. convolution of individual probability distributions and derivation of the TRM value from the convoluted probability distribution, while the 90th percentile is taken as a risk level.

An overview of the roles of the entities involved in the Hansa CCR CC for intraday and day-ahead processes in CC Phase 2.

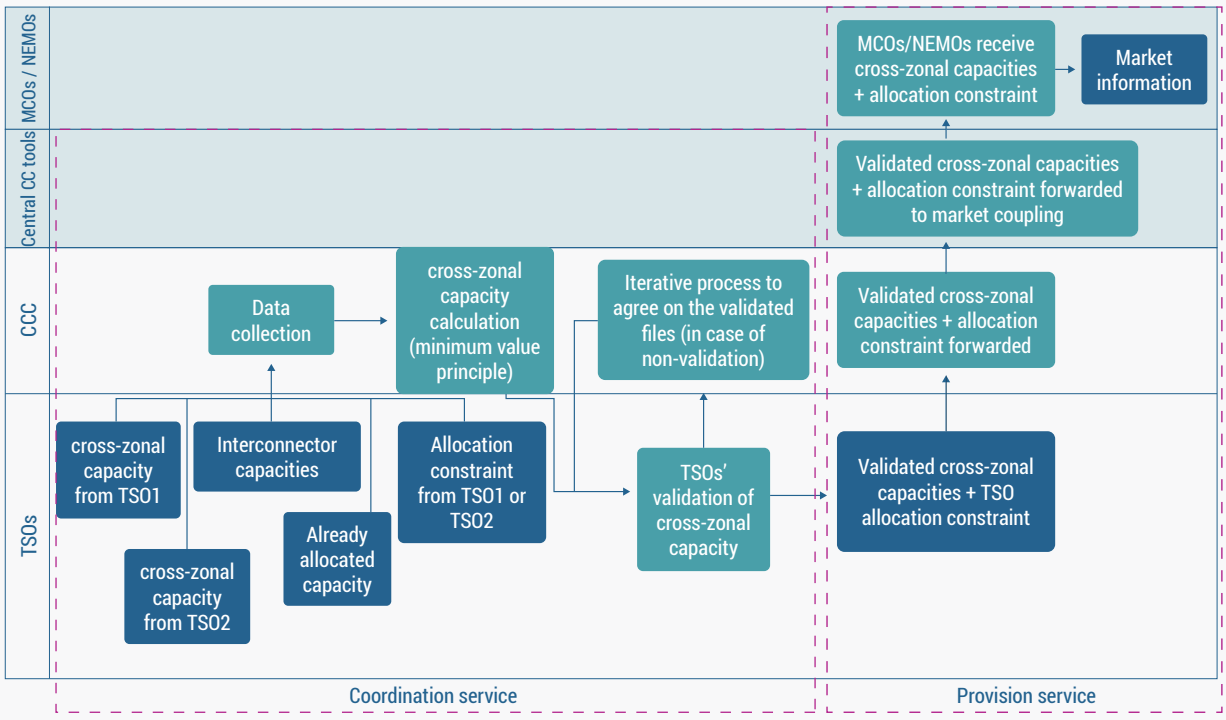


Figure 11. Input and output data and roles of the entities in the capacity calculation process for the day-ahead time frame of the Hansa CCR

3.2.2. Capacity calculation and allocation for the long-term

The Hansa long-term CCM was approved by Hansa NRAs in December 2020. At the same time, the European Commission published its decision on the Kriegers Flak combined grid solution (KF CGS) derogation[25]. Consequently, the Hansa CCR TSOs amended the FCA long-term transmission rights CCM and launched a public consultation on the amendments. The Hansa CCR still proposes implementing a cNTC approach, and only dedicated provisions for KF CGS were added. At the time of writing, no specific time frame has been designated for the go-live of the Hansa long-term CCM.

Figure 12 shows the process and responsibilities within the long-term CCM of the Hansa CCR as well as the interactions with the Nordic and Core CCRs.

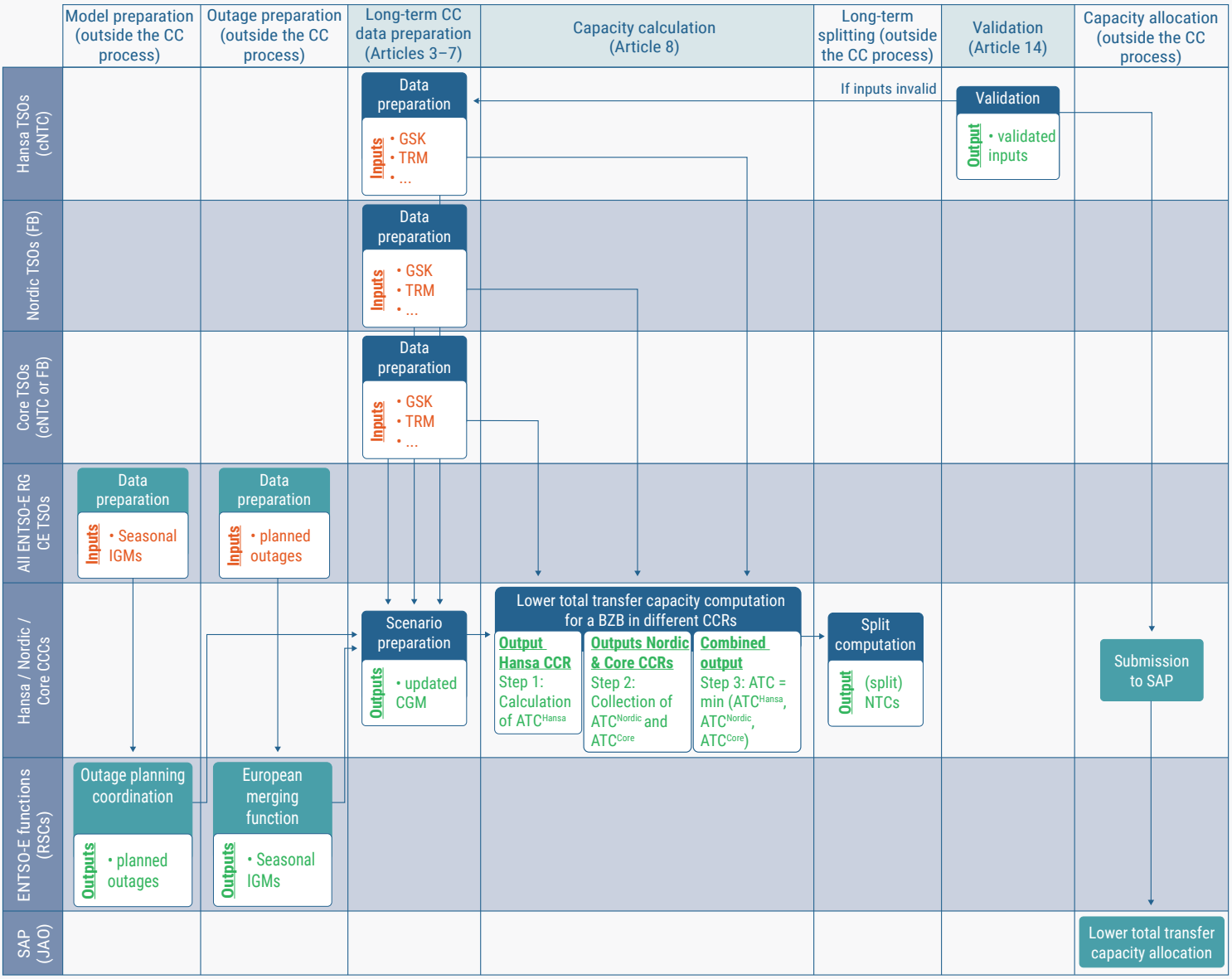


Figure 12. Input and output data and roles of the entities in the capacity calculation process for the year- and month-ahead time frames of the Hansa CCR

25 See European Commission, Application of 30 June 2020 granting the Federal Republic of Germany and the Kingdom of Denmark a derogation according to Article 64 of Regulation (EU) 2019/943 of the European Parliament and of the Council for Kriegers Flak Combined Grid Solution (KF CGS), 2020: https://ec.europa.eu/energy/sites/ener/files/documents/2020_kriegers_flak_application.pdf.

Table 11 and **Table 12** provide an overview of the already accomplished milestones and planned timeline for the implementation of the Hansa CCR long-term capacity calculation processes.

Closed milestone(s)[26]	
Quarter	**Description**
Q1 2018	Regional design of LTTR was approved by the Hansa CCR NRAs
Q2 2019	The Hansa CCR TSOs ran a first public consultation on the long-term CCM and long-term Splitting Rules
Q2 2020	Hansa CCR NRAs approved the long-term Splitting Rules methodology
Q3 2020	Hansa CCR NRAs requested an amendment to the long-term CCM submitted by the Hansa CCR TSOs
Q4 2020	The Hansa CCR TSOs submitted the amended long-term CCM, after the Request for Amendment was considered
Q4 2020	Hansa CCR NRAs approved the Hansa long-term CCM
Q4 2020	The European Commission published its decision on KF CGS derogation
Q1 2021	The Hansa CCR TSOs ran a public consultation on an amendment of the long-term CCM to consider the EC decision on KF CGS derogation
Q1 2021	Long-term Splitting Rules are implemented on (relevant) Hansa borders
Q1 2021	The Hansa CCR TSOs submitted the amendment to the long-term CCM

Table 11. Hansa CCR: closed milestone(s) for long-term capacity calculation and allocation

Planned milestone(s)	
Quarter	**Description**
Q3 2021	Hansa CCR NRAs are expected to issue an approval of the amendment to the long-term CCM

Table 12. Hansa CCR: planned milestone(s) for long-term capacity calculation and allocation

Statistical indicators for the bidding zone borders of Hansa CCR

The following graphs show the offered and allocated long-term capacities during 2019 and 2020 at borders, which will become part of the Hansa CCR Capacity Calculation

26 The respective documents are uploaded on the dedicated part of the ENTSO-E website: https://www.entsoe.eu/network_codes/ccr-regions/#hansa.

Methodology in accordance with FCA regulation[27]. If a border is not shown in **Figure 13**, the capacity had not been offered within the long-term market time frame represented during the reporting period.

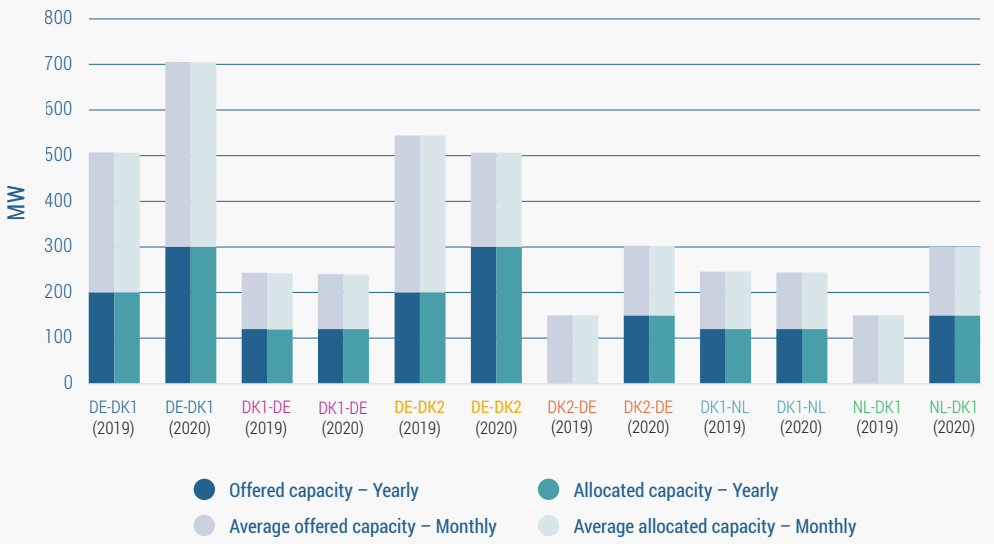


Figure 13. Offered and allocated long-term capacities in Hansa CCR bidding zone borders during 2019 and 2020[28] [29]

Figure 14 and **Figure 15** show the implicit offered and allocated day-ahead capacities and **Figure 16** and **Figure 17** the intraday capacities during 2019 and 2020 at borders, which will become part of the Hansa CCR CCM in accordance with CACM regulation[30]. The values are presented in box-plot diagrams to show the distributional characteristics of the data series.

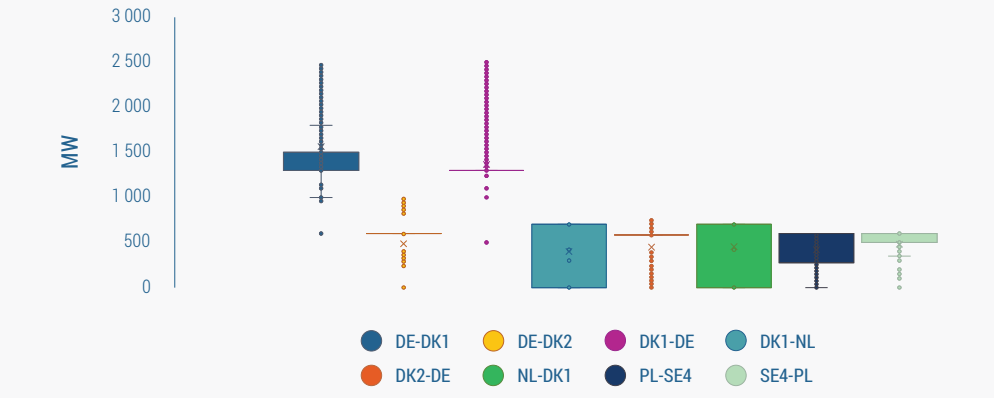


Figure 14. Implicit day-ahead offered capacities in Hansa CCR bidding zone borders from April 2019 to December 2020[31]

27 Article 10 of the FCA regulation.
28 Source: JAO Publication tool.
29 DK2-DE/LU; where there are average OC values above 120 MW, these are due to returned yearly capacities, which were then added to the monthly capacities.
30 Article 20 of the CACM regulation.
31 Source: SDAC Operations Committee – OPSCOM.

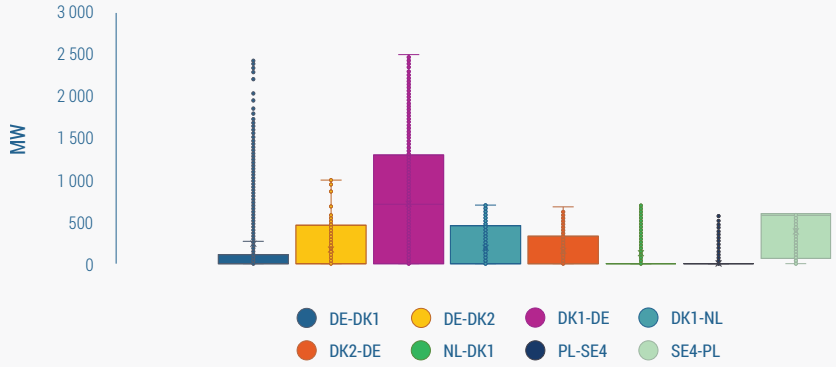


Figure 15. Implicit day-ahead allocated capacities in Hansa CCR bidding zone borders from April 2019 to December 2020[32]

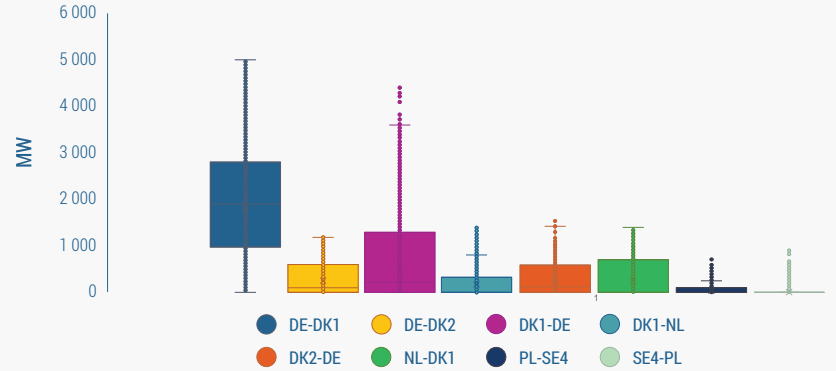


Figure 16. Implicit intraday offered capacities from 15:00 D-1 in Hansa CCR bidding zone borders from April 2019 to December 2020[33] [34]

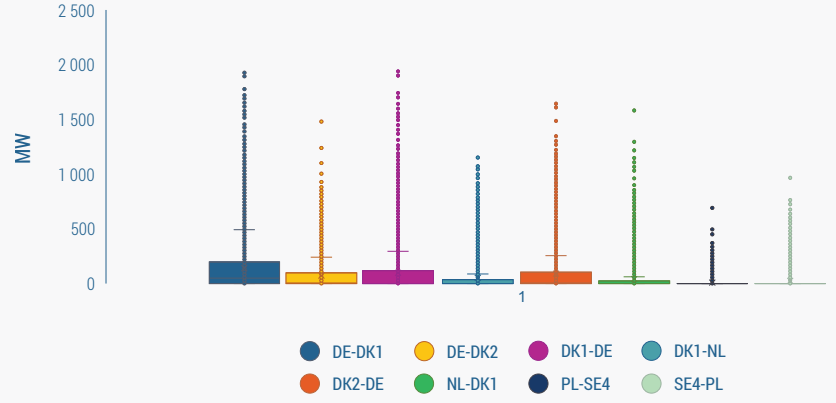


Figure 17. Implicit intraday allocated capacities in Hansa CCR bidding zone borders from April 2019 to December 2020[35]

32 Source: SDAC Operations Committee – OPSCOM.
33 Source: SIDC / XBID reporting.
34 The data represented in this graph consider the offered capacities from 15:00 D-1 and not 18:00 D-1.
35 Source: SDAC Operations Committee – OPSCOM

3.3. Core

The 16 TSOs in Core CCR are 50Hertz, Amprion, APG, ČEPS, CREOS, HOPS, ELES, Elia, MAVIR, PSE, Transelectrica, RTE, SEPS, TenneT NL, TenneT DE and TransnetBW.

Figure 18. Core CCR[36]

TSOs in the Core CCR have set up a special consultative group, the Core Consultative Group (Core CCG), to keep concerned market participants up-to-date and involve them in discussions about the implementation of CCR deliverables within the Core CCR.

3.3.1. Capacity calculation and allocation for the short-term

Table 13 and **Table 14** provide an overview of the already accomplished milestones and planned timeline for the implementation of the Core CCR day-ahead and intraday capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q4 2020	Start of the external parallel run with progressive result publication
Q4 2020	Submission of the first amendment to the day-ahead CCM methodology to the NRAs
Q2 2021	NRAs' approval of the first amendment to the Core CCR day-ahead CCM

Table 13. Core CCR: closed milestone(s) for short-term capacity calculation and allocation

36 The Core CCR includes the following bidding zone borders (BZBs): France-Belgium (FR--- BE), Belgium-Netherlands (BE- NL), France-Germany/Luxembourg (FR-DE/LU), Netherlands- Germany/Luxembourg (NL-DE/LU), Belgium-Germany/Luxembourg (BE-DE/LU) , Germany/Luxembourg-Poland (DE/LU-PL), Germany/Luxembourg-- Czech Republic (DE/LU- CZ), Austria- Czech Republic (AT-CZ), Austria-Hungary (AT- HU), Austria-Slovenia (AT- SI), Czech Republic--Slovakia (CZ-SK), Czech Republic-Poland (CZ-PL), Hungary-Slovakia (HU-SK), Poland-Slovakia (PL- SK), Croatia-Slovenia (HR- SI), Croatia- Hungary (HR-HU), Romania- Hungary (RO- HU), Hungary-Slovenia (HU-SI) and Germany/Luxembourg-Austria (DE/LU-AT).

Planned milestone(s)	
Quarter	**Description**
Q1 2022	Go-live of the day-ahead flow-based capacity calculation
Q1 2023	Go-live of the intraday flow-based capacity calculation (for 22:00 D-1)
Q3 2023	Submission of the second amendment to the Core CCR day-ahead CCM to the NRAs
Q1 2024	Go-live of the intraday flow-based capacity calculation (for 10:00 D)

Table 14. Core CCR: planned milestone(s) for short-term capacity calculation and allocation

Core day-ahead capacity calculation methodology

In the day-ahead CCM first amendment, Core TSOs refer the European Commission decision and indicate that prioritising the interim coupling project over Core flow-based market coupling go-live delays the launch of the latter. More information can be found in the 'Explanatory document to the first amendment of the Day-Ahead Capacity Calculation Methodology of the Core Capacity Calculation Region' issued on 16 November 2020'[37].

Figure 19 provides an overview of the Core flow-based day-ahead capacity calculation process and involved entities.

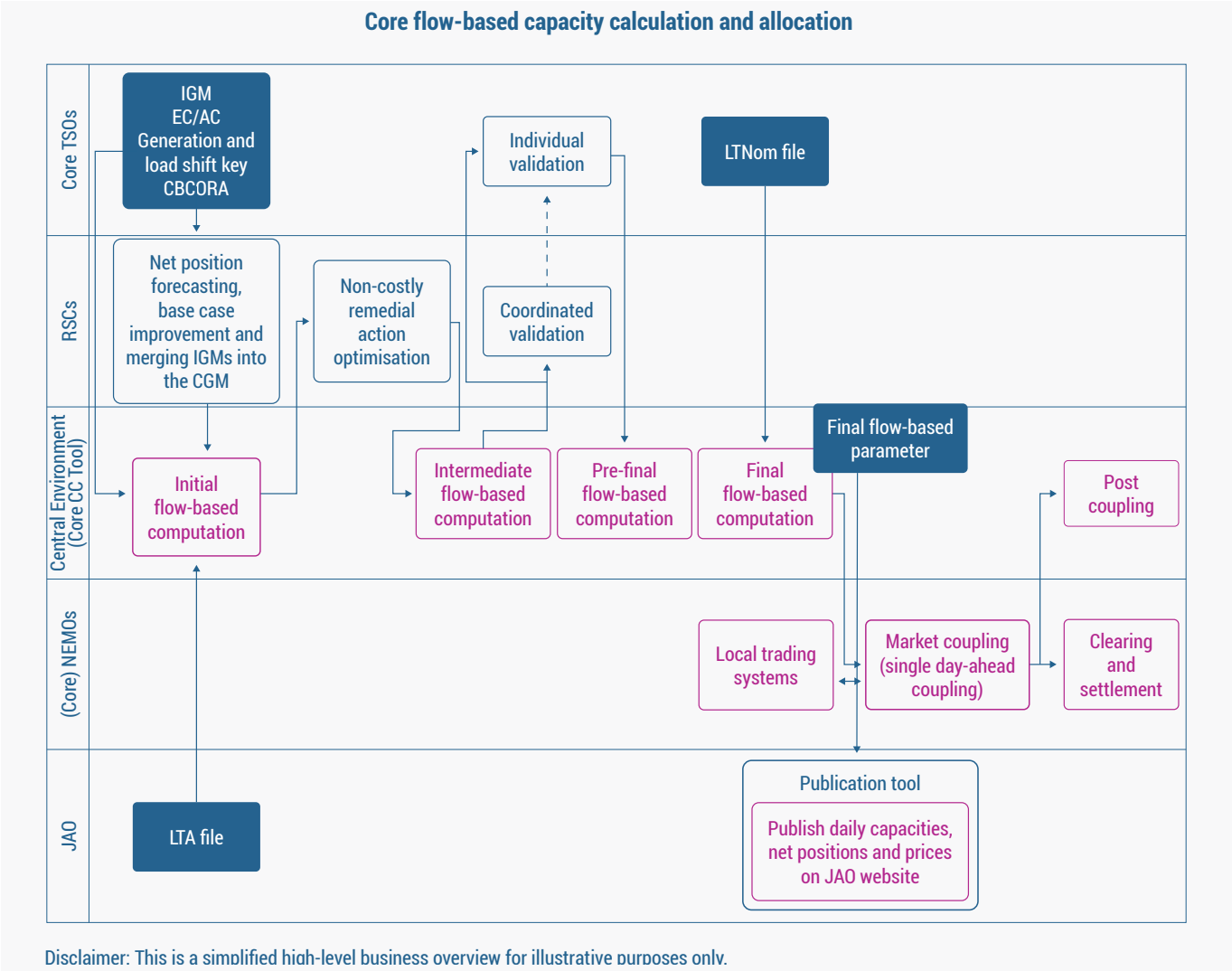


Figure 19. Input and output data and roles of the entities in the capacity calculation process for the day-ahead time frame of the Core CCR

37 https://eepublicdownloads.entsoe.eu/clean-documents/nc-tasks/CORE%20-%2020.1%20-%20TSOs%203rd%20proposal.pdf.

Common Grid Models

The individual TSOs' IGMs are merged to obtain a CGM.

Reliability margins

In the DA CCM first amendment, Core TSOs propose to adjust the FRM assessment – see the DA CCM first amendment.

Given the absence of reliable, consistent and complete data that would make it possible to isolate all "deliberated Core TSOs' actions" in the historical CGMs, Core TSOs propose to determine upper and lower estimates of the true flow reliability margin by only considering the remedial actions during day-ahead capacity calculation (for the upper estimate) and updated historical CGMs (for the lower estimate) to be deliberated Core TSO actions, and by determining the evolution of the generation dispatch between the D-2 CGM and real time. More information can be found in the 'Explanatory document to the first amendment of the Day-Ahead Capacity Calculation Methodology of the Core Capacity Calculation Region' issued on 16 November 2020[38].

Export and import thresholds (min./max.)

Specific export and import thresholds may be necessary to maintain secure grid operation. However, since such limitations cannot be efficiently transformed into operational security limits of individual critical network elements, they are expressed as the maximum import and export constraints of Bidding Zones. Instead of including them in the day-ahead flow-based calculation process, they are included as a so-called allocation constraint within the Euphemia market coupling algorithm. This is carried out as a constraint on the global net position, limiting the net position of the respective bidding zone compared with all Bidding Zones that are part of the single day-ahead coupling.

Start of the external parallel run

As at 16 November 2020, the day-ahead Core flow-based market coupling project parties have started the progressive external parallel run, which facilitated the publication of the first flow-based capacity calculation data and of related simulated market coupling results. The publication of these simulated results allows market participants to get acquainted with the Core flow-based day-ahead results and to start their preparations before the Core flow-based market coupling project goes live. The project parties initially published only selected days whenever the results were deemed sufficiently representative. Between the business days of 16 November 2020 and 14 April 2021, results for 90 of the 150 business days have been published on the JAO website.

After increasing the stability of the external parallel run, the involved TSOs switched to immediate publication of capacity calculation results for seven out of seven business days per week as of 15 April 2021.

Involved TSOs are committed to transparency on the effects and the performance of the application of the methodology. To that end, TSOs publish a monthly key performance indicator report, which was endorsed by Core NRAs[39], on capacity calculation and market coupling results jointly with the relevant NEMOs and set up a dedicated tool for publication together with the JAO.

The monthly report contains 17 indicators that are further described in the accompanying reading guide, both of which are available in the dedicated section 'Core FB DA Parallel Run' section on the JAO website[40].

It should be noted that these indicators are only applicable to the external parallel run that Core CCR TSOs are performing before the go-live. The indicators explained in Chapter 2 of this report are only relevant to CCRs that were operational within the scope of this report.

38 https://eepublicdownloads.entsoe.eu/clean-documents/nc-tasks/CORE%20-%2020.1%20-%20TSOs%203rd%20proposal.pdf.
39 KPI Reading Guide which was elaborated jointly with NRAs.
40 https://www.jao.eu/support/resourcecenter/overview?parameters=%7B%22IsCore%22%3A%22True%22%7Ds.

	Planned milestone(s)
Adjustment for minimum RAM (AMR) and long-term allocation (LTA) inclusion	Average maximum AMR per critical network elements (CNEs) per business day (Top 10)[41]
	Average maximum AMR per TSO per business day
	Average maximum AMR + LTA margin per CNEs per business day (Top 10)[42]
	Average maximum AMR + LTA margin per TSO per business day
TSOs' adjustment after validation	Share of market time unit with intervention per TSO
	Total Individual Validation Adjustment (IVA) applied per market time unit for each critical network element affected by TSO intervention, per business day
Power system impact analysis	Min. and max. net positions per bidding zone
	Virtual margins at market clearing point per TSO, per business day
	RAM before and after remedial action optimisation (RAO) per TSO
	Average sensitivity of remedial actions (RAs) per TSO
	Non-Core exchanges and flow deviations on non-Core bidding zone borders
	Most often pre-solved CNEs (Top 20)[43]
Market coupling analysis	Most limiting CNEs (Top 20)[44]
	Clearing prices, price spread and price convergence
	CNECs with non-zero shadow price per market time unit
	Core Social Welfare
	Paradoxically Rejected Block Orders (PRB)

Table 15. Overview of the indicators in the monthly capacity calculation and market coupling report

Note: In the 2023 edition of this report, Core CCR TSOs will also apply the statistical and quality indicators listed in Chapter 2 of this 2021 edition.

The JAO publication tool is a dedicated online communication platform that fulfils the publication obligations related to Article 25 of the Core Day-ahead Capacity Calculation Methodology. The online platform makes it possible to navigate various publications and download data[45]. The tool is accompanied by a Publication Handbook[46].

Considering that during the external parallel run phase, involved parties continuously gain experience and evolve

41 Only the 10 CNEs with the highest values throughout the day were most often pre-solved/limiting during the reporting period are reported.
42 Only the 10 CNEs with the highest values throughout the day were most often pre-solved/limiting during the reporting period are reported.
43 Only the 10 CNEs with the highest values throughout the day were most often pre-solved/limiting during the reporting period are reported.
44 Only the 10 CNEs with the highest values throughout the day were most often pre-solved/limiting during the reporting period are reported.
45 Publication Tool (jao.eu)https://core-parallelrun-publicationtool.jao.eu/core Publication Tool (jao.eu).
46 Core_PublicationTool_Handbook.pdf (jao.eu)https://core-parallelrun-publicationtool.jao.eu/app/downloads/Core_PublicationTool_Handbook.pdf. Core_PublicationTool_Handbook.pdf (jao.eu).

their processes, there are still various assumptions and known limitations in relation to the stability of the process and CC results that must be considered when interpreting the results. Core TSOs will continue to update the assumptions and limitations associated with the related runs on the JAO website[47].

3.3.2. Capacity calculation and allocation for the long-term

The Core long-term CCM, which considers a flow-based explicit allocation, was submitted to NRAs in December 2020. Because NRAs could not find an agreement, the methodology was referred to ACER, which is required to adopt a decision by November 2021. The flow-based domain will be computed using a scenario-based approach, in line with the FCA regulation. This implies the use of timestamps based on the ENTSO-E reference scenarios.

While awaiting the approval of the methodology, TSOs are working on a high-level design of the long-term capacity calculation tools, and therefore the respective cost and implementation timeline. This allows TSOs to assess the potential for synergies by using existing tools.

As the Core CCR will implement flow-based explicit allocation in the long-term time frame, the single allocation platform will have to be redesigned to support such changes. As Core will not be the only CCR to move from NTC to flow-based explicit allocation for long-term time frames, ENTSO-E will play a significant role in the design and implementation of the new allocation process.

Table 16 and **Table 17** provide an overview of the already accomplished milestones and planned timeline for the implementation of the Core CCR long-term capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q4 2020	Public consultation; relevant NRAs' shadow opinion
Q4 2020	Submission of the Core CCR long-term CC methodology to the NRAs
April 2021	Methodology referred to ACER on the grounds of Article 4(10) of the FCA Regulation

Table 16. Core CCR: closed milestone(s) for long-term capacity calculation and allocation[48]

Closed milestone(s)	
Quarter	**Description**
November 2021	ACER decision on Core CCR long-term CCM expected

Table 17. Core CCR: planned milestone(s) for long-term capacity calculation and allocation[49]

— Statistical indicators for the bidding zone borders of Core CCR

Figure 20 and **Figure 21** show the offered and allocated long-term capacities during 2019 and 2020 at Core CCR internal borders, which will become part of the Core CCR CCM in accordance with FCA regulation[50].

47 https://www.jao.eu/support/resourcecenter/overview?parameters=%7B%22IsCore%22%3A%22True%22%7D.
48 The legal deadline for the submission of the long-term CCM is 21st August 2019.
49 The legal deadline for the submission of the long-term CCM is 21st August 2019.
50 Article 10 of the FCA regulation.

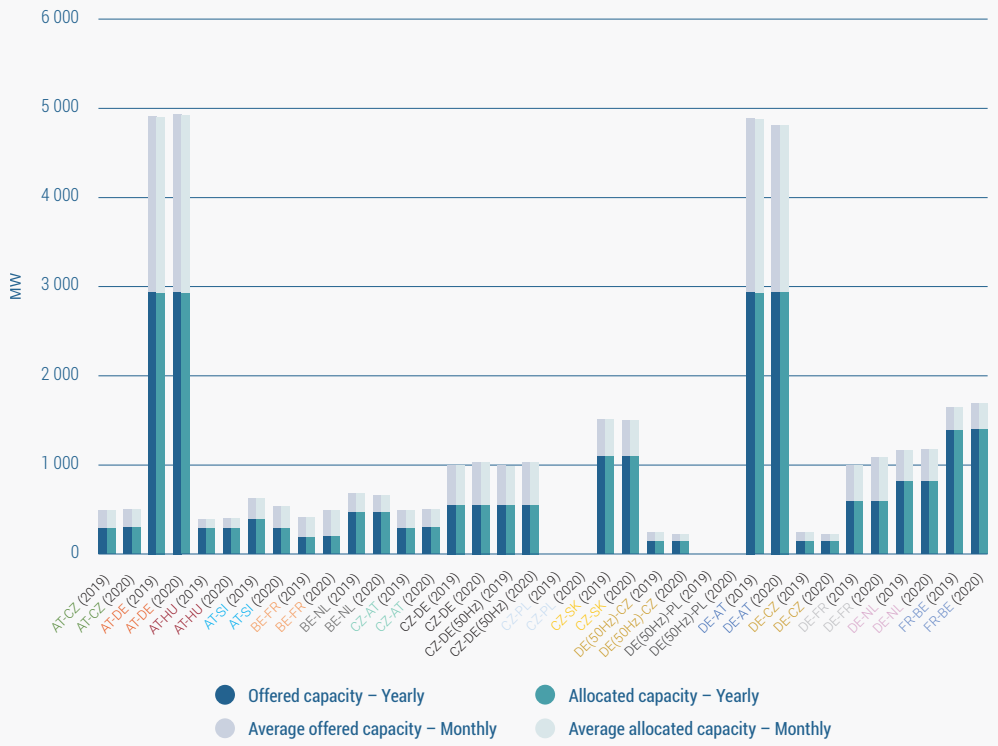


Figure 20. Offered and allocated long-term capacities in Core CCR bidding zone borders during 2019 and 2020[51]

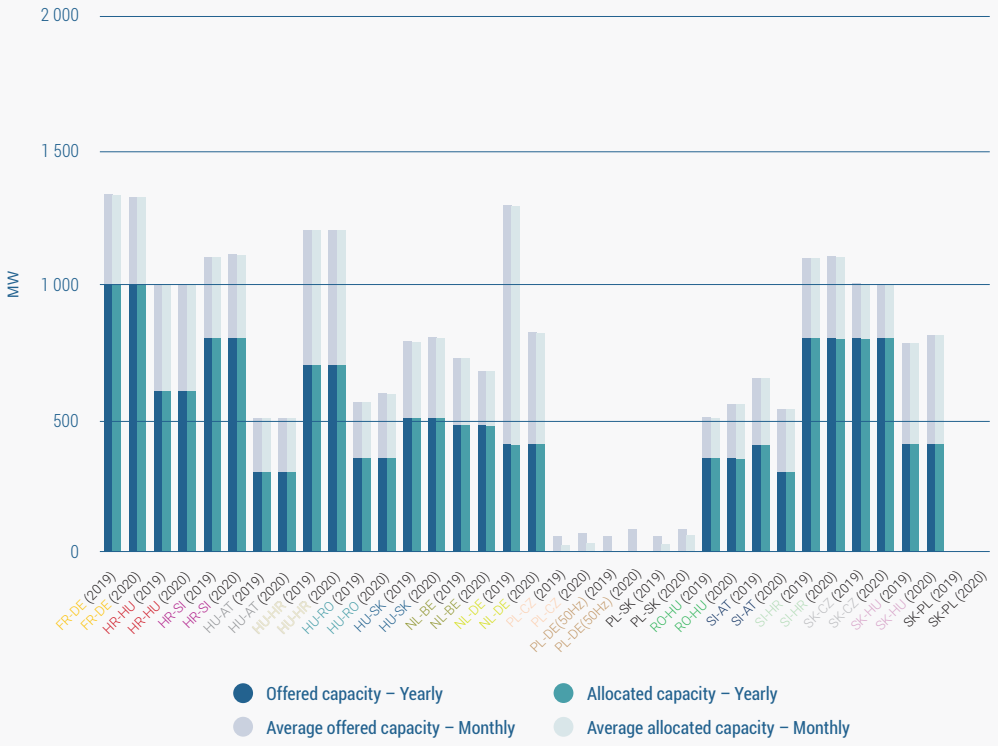


Figure 21. Offered and allocated long-term capacities in Core CCR bidding zone borders during 2019 and 2020[52]

51 Source: JAO Publication tool.
52 Source: JAO Publication tool.

Figure 22 and **Figure 23** show the implicit offered and allocated day-ahead capacities and **Figure 24** and **Figure 25** the intraday capacities from April 2019 to December 2020 at Core CCR internal borders, which will become part of the Core CCR CCM in accordance with CACM regulation[53].

The values of the day-ahead and intraday time frames are presented in box-plot diagrams to show the distributional characteristics of the data series. The borders of the CWE flow-based market coupling region, which will become part of the Core CCR, are not shown in the graphs below. This is due to the nature of the CWE flow-based market coupling, in which no bilateral capacities are offered and allocated at the borders[54].

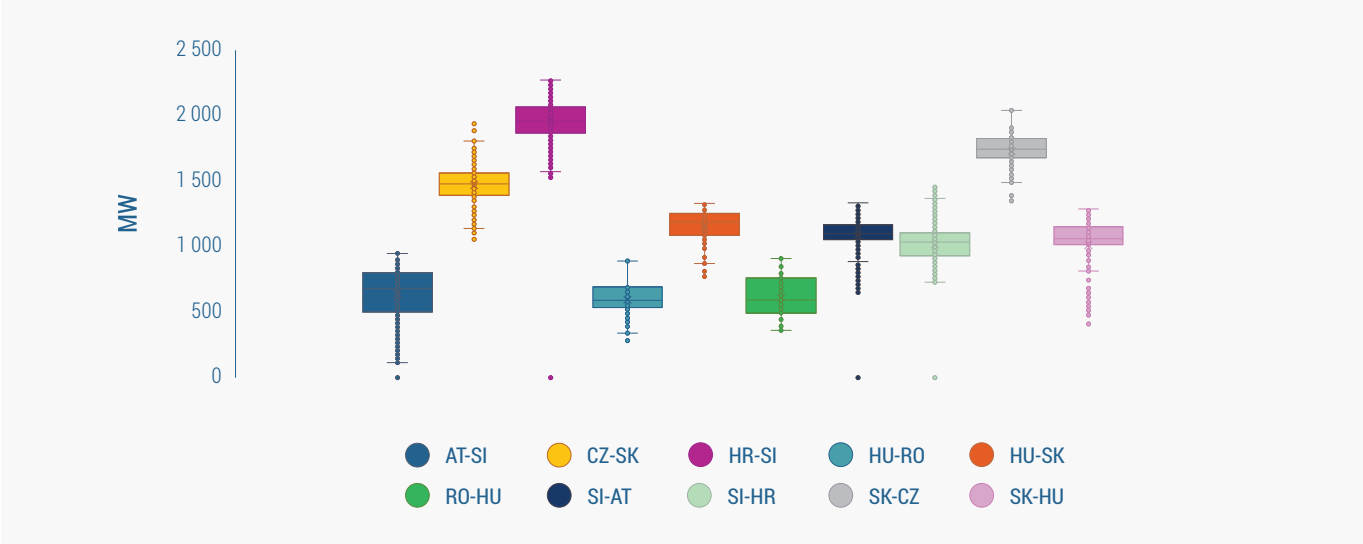


Figure 22. Implicit day-ahead offered capacities in Core CCR bidding zone borders (in both directions) from April 2019 to December 2020[55]

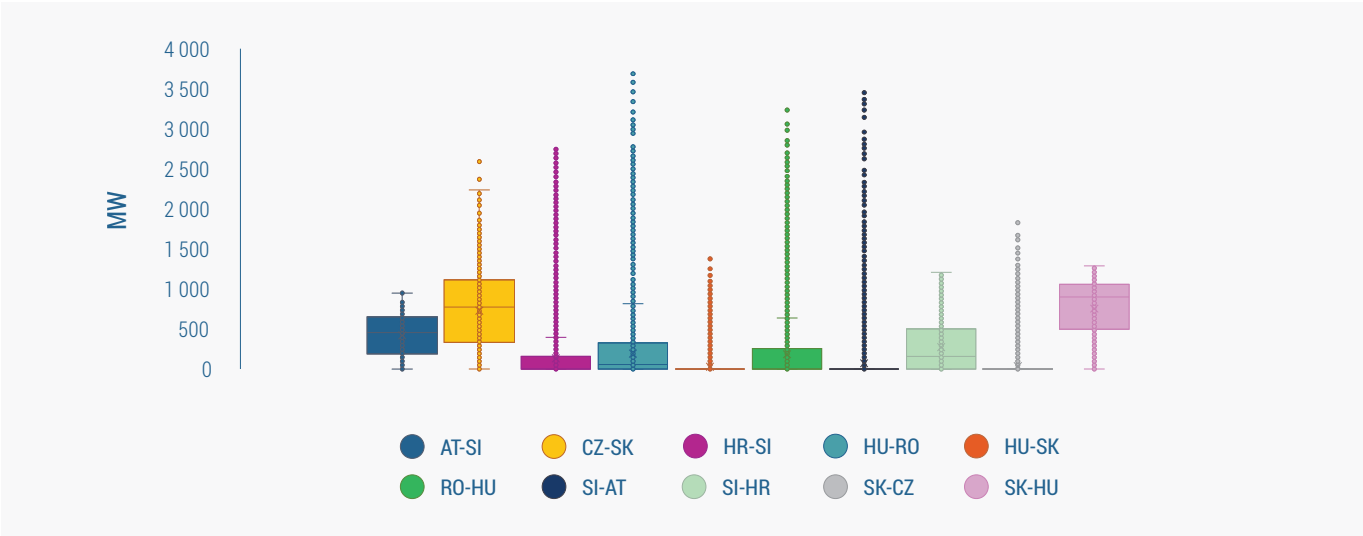


Figure 23. Implicit day-ahead allocated capacities in Core CCR[56] bidding zone borders (both ways) from April 2019 to December 2020[57]

53 Article 20 of the CACM regulation.

54 Instead, the cross-zonal capacity of the CWE region is offered on network elements as so-called 'Remaining Available Margin' (RAM). Based on this, the aggregated import/export volumes per bidding zone, so-called 'Net Positions', are determined.

55 Source: SDAC Operations Committee – OPSCOM.

56 AT<->DE, BE<->FR, BE<->NL, DE<->FR and DE<->NL not included.

57 Source: SDAC Operations Committee – OPSCOM.

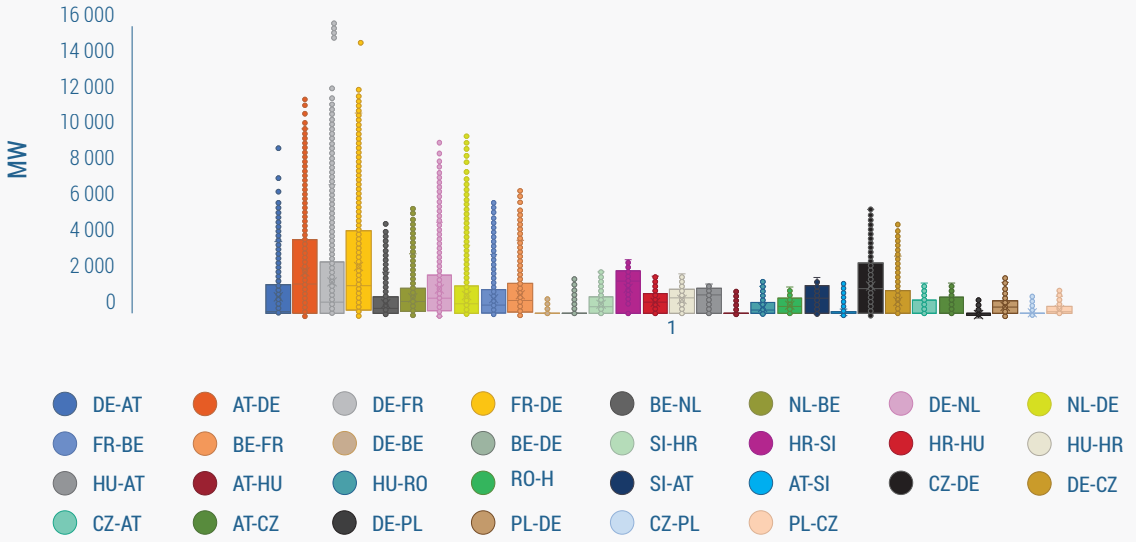


Figure 24. Implicit intraday offered capacities in Core CCR bidding zone individual borders from April 2019 to December 2020[58]

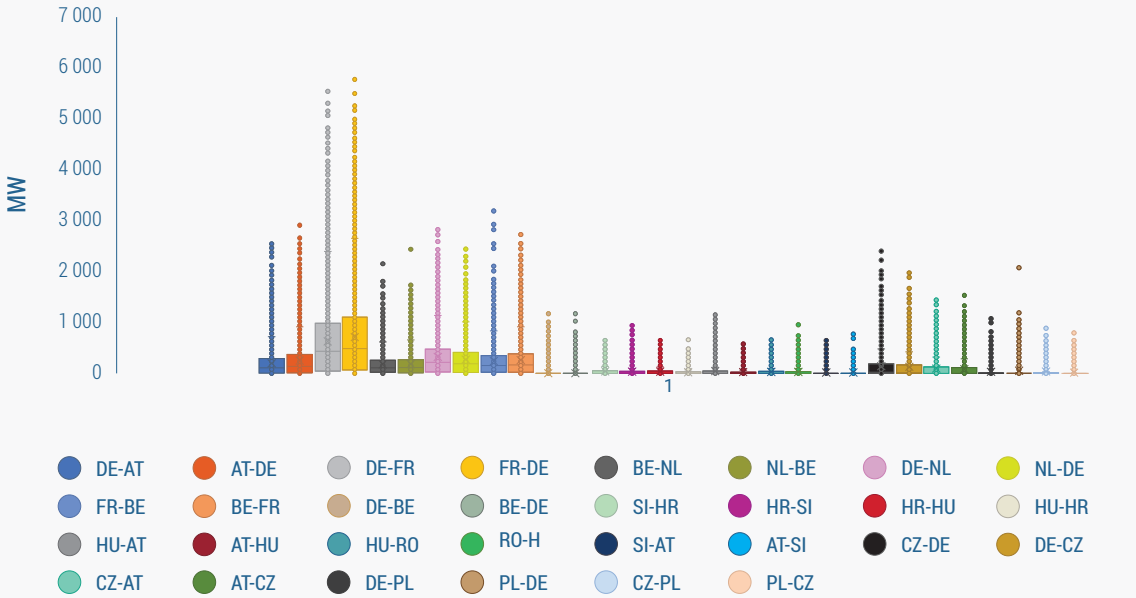


Figure 25. Implicit intraday allocated capacities in Core CCR bidding zone individual borders from April 2019 to December 2020[59]

58 Source: SIDC / XBID reporting.
59 Source: SIDC / XBID reporting.

3.4. Italy north

The capacity calculation process in the Italy North capacity calculation region comprises the following TSOs: APG (AT), ELES (SI), RTE (FR), TERNA (IT) and Swissgrid (CH).

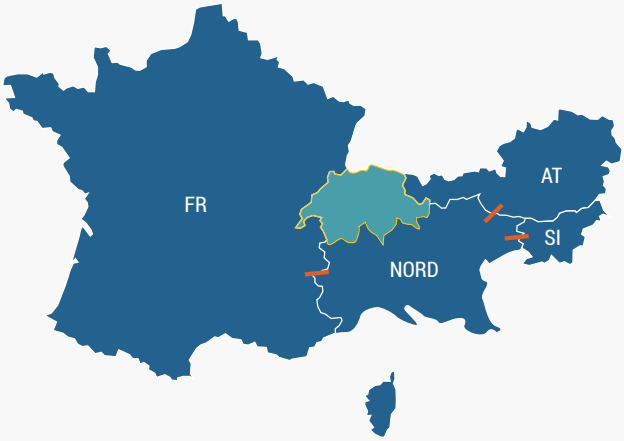


Figure 26. Italy North CCR[60]

3.4.1. Capacity calculation and allocation for the short-term

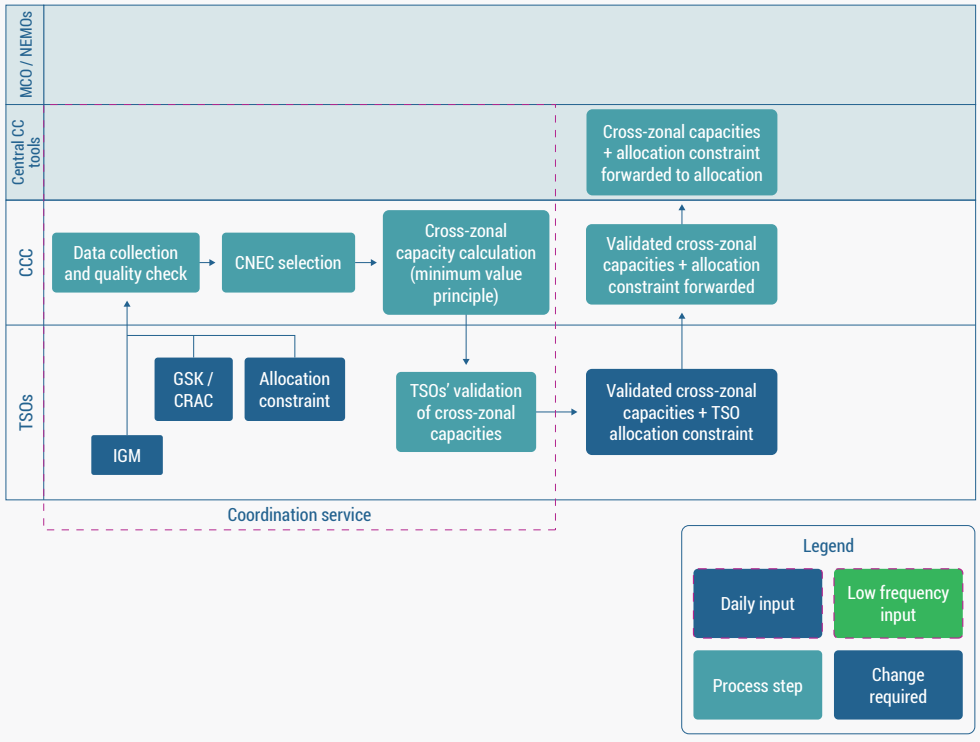


Figure 27. Input and output data and roles of the entities in the capacity calculation process for the D-2 and intraday time frames of the Italy North CCR

60 The Italy North Region comprises the bidding zone borders Italy NORD – France (NORD – FR), TERNA. and RTE; Italy NORD – Austria (NORD – AT), TERNA and APG and Italy NORD – Slovenia (NORD – SI), TERNA and ELES. In addition to the abovementioned borders (constituting the Italy North CCR based on the ACER decision), the bidding zone border Italy NORD – Switzerland (NORD – CH), TERNA. and Swissgrid are included in the capacity calculation of the Italy North Region.

According to the CACM regulation, a flow-based CCM is the target methodology for the Italy North CCR. In the meantime, the TSOs of the region have developed and implemented methodologies based on the cNTC approach. In this methodology, Swissgrid is technically fully included as a technical counterparty. This means that the CH-IT border is treated in the same way as the other borders in the Italy North region.

Day-ahead market time frame

A coordinated capacity calculation process is already in operation in the region, based on a voluntary approach. Since February 2016, individual values for CZC for each day-ahead market time unit have been calculated using the coordinated CCM starting at day D-2.

In June 2018, the TSOs of the region submitted a common methodology proposal to the NRAs to complement the existing CC process. Following an amendment request from the NRAs, the TSOs submitted an amended proposal in March 2019 that was approved in October 2019. Furthermore, TSOs submitted an updated proposal compliant with the EU Electricity Regulation[61], which was approved in July 2020.

The implementation timeline for the changes in the capacity calculation process is set out in the latest version of the methodology.

Intraday market time frame

In June 2018, the TSOs of the region submitted a common methodology proposal to the NRAs for a coordinated CCM for the intraday time frame. Following an amendment request from the NRAs, the TSOs submitted an amended proposal in March 2019, approved in October 2019. Furthermore, TSOs submitted an updated proposal compliant with the EU Electricity Regulation[62], which was approved in July 2020.

TSOs successfully implemented a first version of the intraday capacity calculation process, which will be further upgraded to meet the requirements set out in the intraday CCM. This process provided cross-zonal capacities for the market time units (16h–24h) in November 2019. As soon as the IGM developed in accordance with Articles 55 and 63 of the CACM regulation is implemented in the Italy North region, the individual values for CZC will be computed for all 24 hours of the day in the evening of D-1.

Table 18 and **Table 19** provide an overview of the already accomplished milestones and planned timeline for the implementation of the Italy North CCR day-ahead and intraday capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q1 2016	Go-live of the D-2 capacity calculation
Q2 2017	Implementation phase and internal parallel run for the ID capacity calculation covering hours 16 h–24 h for XBID2 auction
Q3 2019	External parallel run for the intraday capacity calculation covering hours 16 h–24 h for auction
Q4 2019	Go-live of the auction of the intraday capacity calculation covering hours 16 h–24 h
Q4 2019	Approval of the first version of the CCM
Q3 2020	NRA approval of the updated CCMs, including provisions from the Clean Energy for all Europeans Package

Table 18. Italy North CCR: closed milestone(s) for short-term capacity calculation and allocation

61 Regulation (EC) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast).
62 Regulation (EC) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast).

Italy North TSOs plan to restart the work on the drafting of a flow-based CCM after the completion of the implementation of the Export Corner[63] in the cNTC process.

Planned milestone(s)	
Quarter	**Description**
Q2 2021	Consideration of the minimum margins according to Regulation (EC) 2019/943
Q1 2022	Consideration of the Italian export direction during capacity calculation
Q4 2021	Go-live of the auction of the capacity calculation covering hours 12 h–24 h
Q2 2022	Design phase of the capacity calculation covering all 24 intraday hours based on the allocation design for CACM regulation compliance
Q3 2022	Internal parallel run for the capacity calculation covering all 24 intraday hours based on the allocation design for CACM regulation compliance
Q4 2022	External parallel run for the capacity calculation covering all 24 intraday hours based on the allocation design for CACM regulation compliance
Q1 2023	Go-live of the auction of the capacity calculation covering all 24 intraday hours based on the allocation design for CACM regulation compliance

Table 19. Italy North CCR: planned milestone(s) for short-term capacity calculation and allocation

Figure 28 depicts a high-level scheme with the steps needed for and the roles involved in determining the capacity calculation for the day-ahead and intraday time frames.

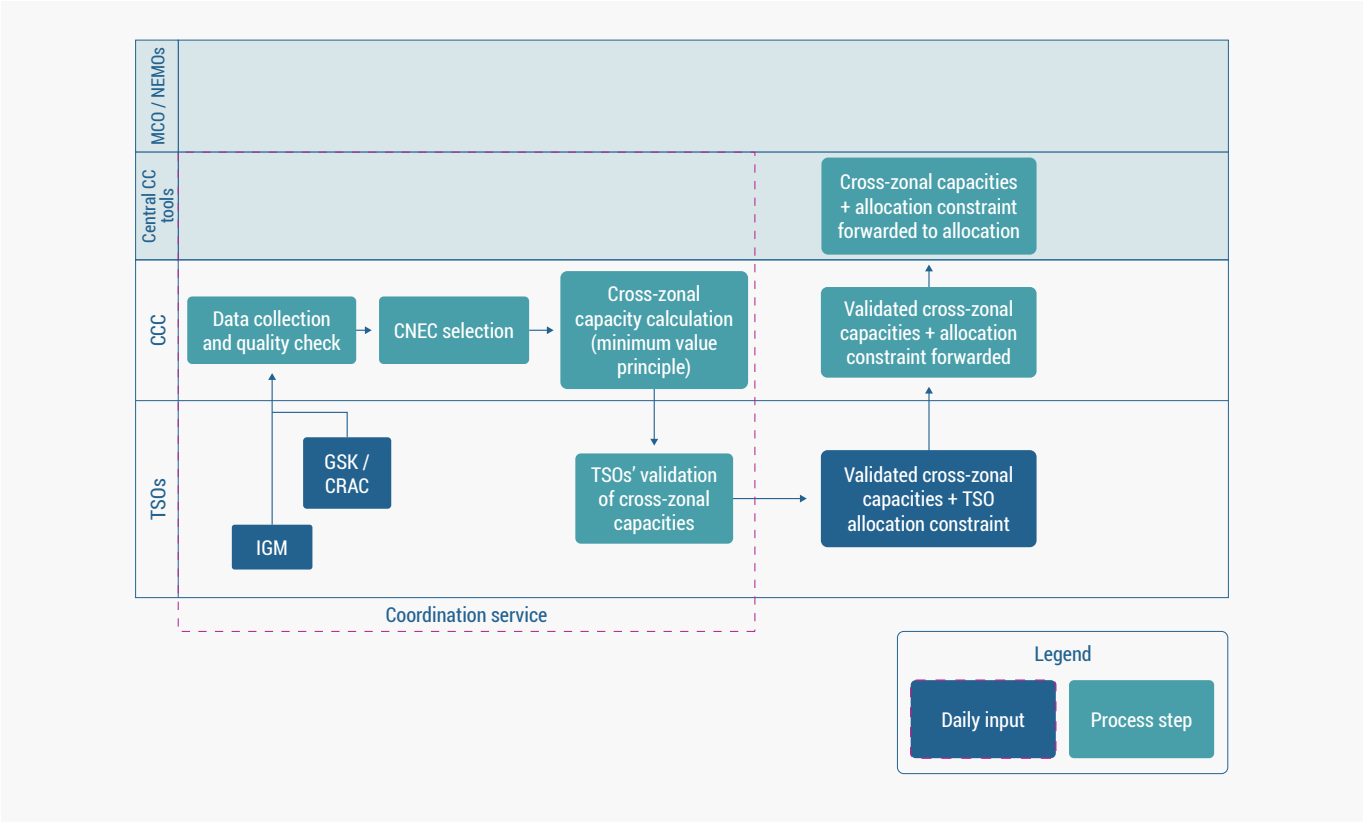


Figure 28. Input and output data and roles of the entities in the capacity calculation process for the day-ahead and intraday time frames of the Italy North CCR

63 I.e. the common capacity calculation when at least one country is expected to be importing from Italy.

A high-level description of the Italy North capacity calculation process is provided below. For a more detailed explanation, Italy North TSOs recommend consulting the published CCMs and their explanatory notes[64].

- The Italy North capacity calculation process, both for day-ahead and intraday time frames, starts with the provision of the necessary input data by the Italy North TSOs. The TSOs provide the following information to the CCC as inputs:
  - IGM;
  - generation (and load) shift key (GLSK);
  - file containing all critical network elements, remedial actions and additional constraints (CRAC);
  - allocation constraint[65].
- The CCC subjects all provided inputs to a quality check and merges the individual files to inputs common to the regions. These are used in the subsequent processes.
- The inputs are used by the CCC to compute the sensitivities with the help of the power transfer distribution factor for each CNEC. The list of CNECs is then filtered by removing all CNECs that do not meet the minimum sensitivity threshold value to ensure that elements with a low sensitivity are not considered during the optimisation process. This filtered CNEC list is used for the next process steps.

CZC calculation

- The CCC computes the cross-zonal capacities considering the following inputs:
  - Outputs of the preceding sub-processes set out in the previous bulleted list.
  - The TRM, which is a capacity margin needed to securely operate the interconnected power systems considering the planning errors, including the errors generated in the forecast when the transfer capacities are computed. Currently, Italy North TSOs use a static TRM value which will be evaluated on a yearly basis and adjusted if required.
- The CCC optimises the CZC considering the following constraints:
  - The cross-border TTC assessment must follow the principles of the 'Methodical guidelines for stable operation in the Italy North CCR,' as well as national regulations and standards implemented in the instructions for parallel operations in the cross-border interconnections, while taking into account the intra- and intersystem operational security.
  - Methodical guidelines for stable operation in the Italy North CCR are used as a basis and reviewed by Italy North TSOs, to ensure the secure and collective operation with neighbouring interconnected TSOs.
  - The cross-Border TTC will be determined by proceeding contingency analysis, complying with the operational security limits of the Italy North CCR and the Italy North TSOs' control area.
  - o Contingency analysis is performed for those contingencies which are agreed upon by Italy North TSOs and thereafter placed on the contingency list. Once agreed upon, this list is provided to the CCC.
- If during the capacity calculation process, the CCCs find different TTC values, the lowest value will be used as a coordinated value.

TSO validation of cross-zonal capacities

- After computing the CZC , the CCC submits the computed CZC to TSOs for validation. TSOs will check the system security for the proposed capacities and in case of an unsecure situation perform one of the following actions to ensure the capacity is reduced to a secure value:
  - request a bilateral reduction of the CZC on one specific border;
  - request a reduction of the total CZC calculated for the Italy North borders.
- At the end of the validation process the CCC considers the requests from reductions submitted by TSOs to reduce the capacity to the maximum secure value.
- Forwarding of validated CZC: After completion of the validation phase, the CZC will be forwarded to the allocation.

64 https://www.entsoe.eu/network_codes/ccr-regions/#italy-north.

65 Please note that the allocation constraint will be removed from the capacity calculation phase and implemented in the Euphemia algorithm at some point in 2021.

3.4.2. Capacity calculation and allocation for the long-term

The Italy North CCR applies a statistical approach based on historical[66] day-ahead or intraday CZC calculated in a coordinated manner. This approach properly takes into account all sources of uncertainty related to the long-term capacity calculation time frame. These historical values will be corrected with foreseen NTC reductions caused by factors such as planned outages. The approach leads to the definition of an hourly capacity both for yearly and monthly time frame.

For both the import and export directions, the TSOs of Italy North CCR will use both for yearly (Y-1) and monthly (M-1) time frames the statistical approach based on allocated NTC data from the last three years . Therefore, as input for the long-term capacity calculation time frames, the latest available historical NTC values will be used,, coming from either the D-2 or ID intraday capacity calculation, which are in turn based on the cNTC approach according to the D-2 or ID intraday CCMs.

Table 20 and **Table 21** provide an overview of the already accomplished milestones and planned timeline for the implementation of the Italy North CCR long-term capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q2 2020	Consultation of Italy North CCR long-term proposals based on a statistical approach in accordance with the FCA regulation
Q2 2020	Submission of Italy North CCR FCA long-term proposals to NRAs based on consultation period
Q4 2020	Approval of Italy North CCR long-term proposals by NRAs after directly amending some parts

Table 20. Italy North CCR: closed milestone(s) for long-term capacity calculation and allocation

Planned milestone(s)	
Quarter	**Description**
Q3 2021	Finalisation of the development of the long-term capacity calculation tool based on the long-term CCMs
Q4 2021	Parallel run and testing of the Italy North long-term capacity calculation implementation
Q4 2021	Go-Live of the Italy North long-term CCMs in accordance with the FCA regulation

Table 21. Italy North CCR: planned milestone(s) for long-term capacity calculation and allocation

The Italy North TSOs finalised the high-level business process in January 2021. This high-level document describes the business processes for the long-term splitting and CCM. The document aims to serve as the basis for the requirements of a tool to be developed to carry out the long-term capacity calculation and splitting processes for the Italy North region.

66 According to the provisions set forth in the FCA regulation (Article 10.2), the approach used in the common CCM shall be either a coordinated net transmission capacity approach – including statistical approach – or a flow-based approach.

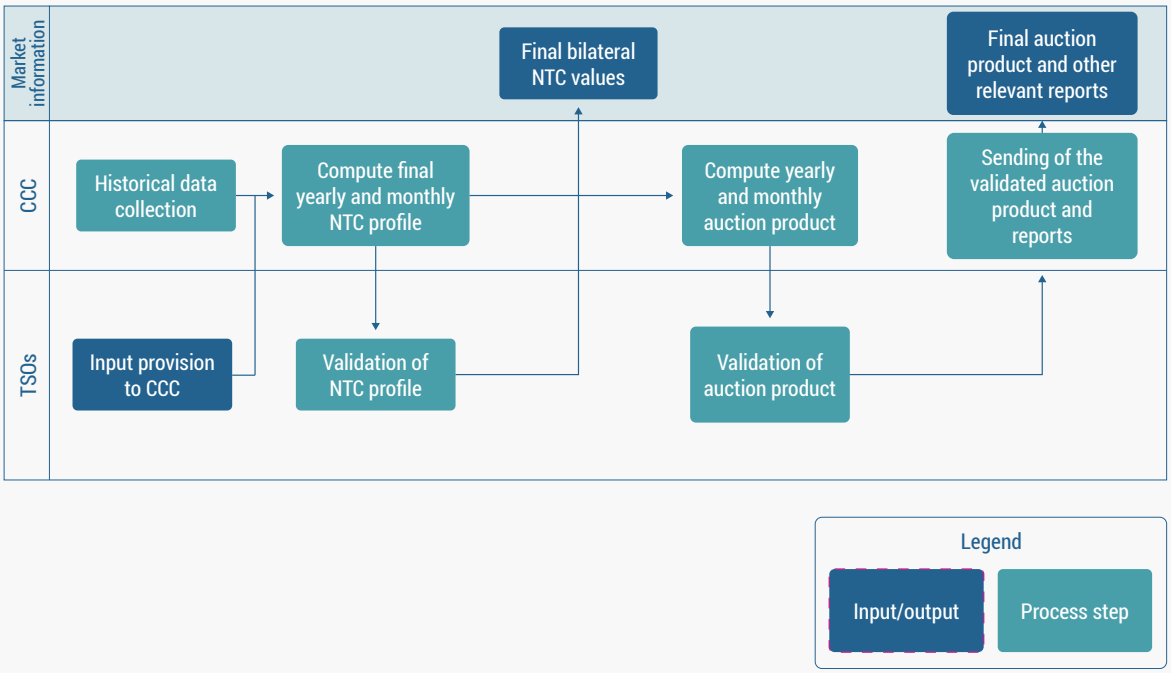


Figure 29. Input and output data and roles of the entities in the capacity calculation process for the long-term capacity calculation process and splitting in the Italy North CCR

A high-level description of the Italy North capacity calculation process is provided below. For a more detailed explanation, Italy North TSOs recommend consulting the published long-term capacity calculation and splitting methodologies and their explanatory notes[67].

The Italy North long-term capacity calculation process starts with consideration of the following:

1. **Historical data collection:** The latest available historical NTC values (NTC data from the last three years) will be used as input for the long-term capacity calculation time frames, coming from either the D-2 or intraday capacity calculation, which are based on the cNTC approach according to the D-2 and intraday CCMs.

2. **Provision of input to the CCC:** In order to allow the CCC to perform the relevant capacity calculation process and long-term splitting, the relevant data will be gathered:

   - the time series of the NTC reduction (maintenance and additional constraints);
   - new grid elements to be commissioned during the delivery period;
   - the commissioning date of new investments made in previous years for each Italy North border and the technical counterparty's border;
   - the real time reduction and capacity curtailment time series of the past three years for each Italy North TSO and technical counterparty's border/direction;
   - the Splitting Rules according to Article 3 and 4 of the 'Methodology for splitting long-term capacity;'
   - a fixed risk level of 3%.

After all the necessary inputs are obtained, the final yearly and monthly NTC profile is computed.

This process step is preceded by statistical analysis of the historical data (input). The initial dataset for long-term capacity calculation is composed of historical CZC values per border in both directions (import and export). All NTC values which correspond to non-representative hours in the Italy North CCR are excluded from the dataset. Afterwards, the initial dataset is divided into four different seasonal periods. For each seasonal period and border/direction, NTC values are ordered to obtain historical Italy North's full-grid NTC duration curves. At this point, the risk level is applied. For the monthly computation, the new grid investments to be commissioned during the delivery period are taken into account.

Computation: After statistical analysis of the historical data is complete, computation of the yearly NTC profile can begin. The hourly profile for the bilateral NTC is computed by considering the full-grid NTC value for each seasonal period obtained from the statistical analysis

67 https://www.entsoe.eu/network_codes/ccr-regions/#italy-north.

for the yearly NTC profile. The monthly NTC profile is calculated by considering the yearly seasonal full-grid NTC values: the monthly "full-grid" seasonal NTC is the value of the corresponding seasonal period already calculated in the yearly statistical methodology by using the risk level and taking into account the new grid investments in the delivery period.

Validation: Validation takes place once the yearly and monthly NTC profiles are computed. The TSOs receive the profiles[68]. In order to ensure operational security, the Italy North TSOs and the technical counterparty have the right to correct CZC relevant to the Italy North TSOs' bidding zone borders.

As a last step, the **yearly and monthly auction product are computed and validated**. The TSOs of the Italy North CCR will offer to the market the maximum volume of capacity for each time frame based on the yearly and monthly NTC profile and the Splitting Rules/criteria according to Article 3 and 4 of the Methodology for splitting long-term CZC. Likewise, the TSOs will validate the yearly and monthly splitting process (auction products) and will send an acknowledgement to the CCC after validation.

Finally, after the long-term capacity calculation and splitting process is concluded, the following data and reporting will be published[69].

- Single Allocation Platform (SAP):
  - The amount of the yearly product that will be allocated, including information on the reduction periods and the product validity percentage and the estimation of the volume of monthly products for the delivery year.
  - For monthly auctions, the amount of the monthly products with their respective reduction periods and a comparison between this effective product and the one estimated before the yearly auction.
  - The duration curve values of the yearly full-grid profile relevant to determine the long-term capacity, highlighting the value associated to the chosen risk level.
- ENTSO-E Transparency Platform: The NTC bilateral daily profile for both yearly and monthly time frames.

Statistical indicators for the bidding zone borders of Italy North CCR

Figure 30 shows the offered and allocated long-term capacities during 2019 and 2020 at Italy North CCR internal borders, which are part of the Italy North CCR Capacity Calculation Methodology in accordance with FCA regulation[70].

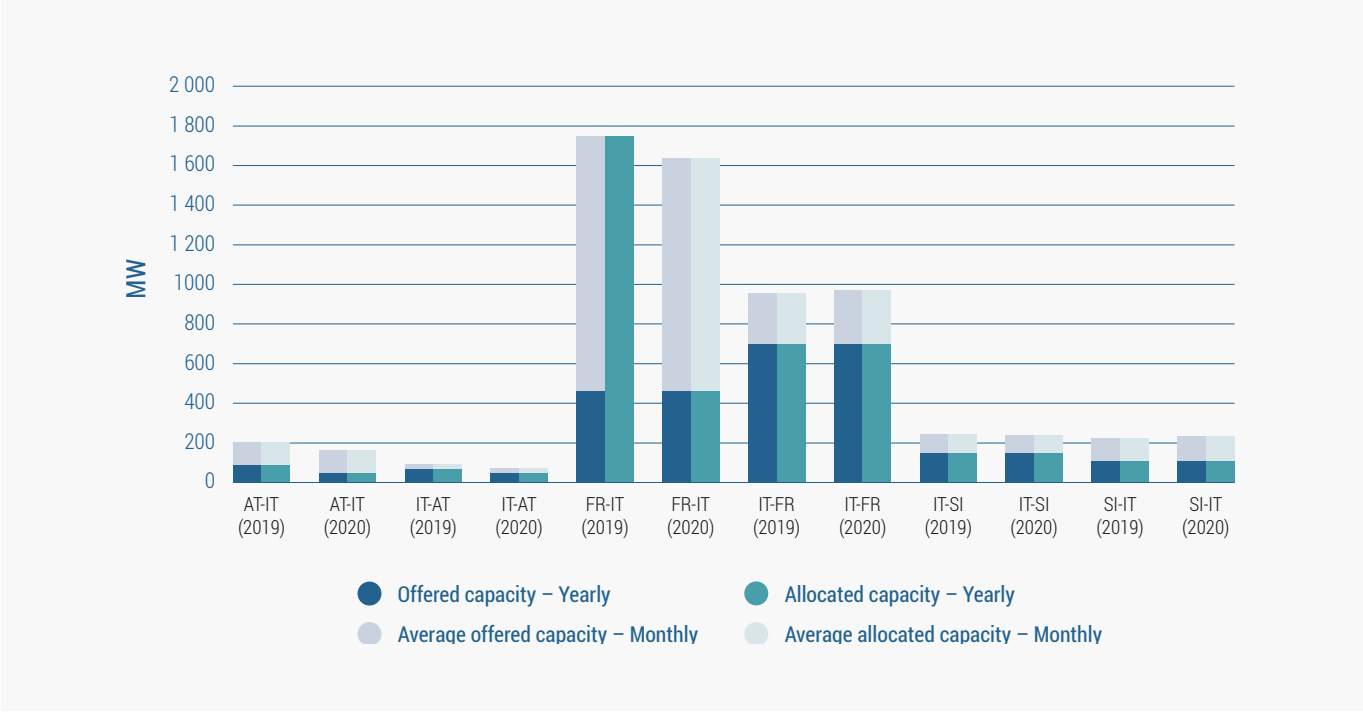


Figure 30. Offered and allocated long-term capacities in Italy North CCR bidding zone borders during 2019 and 2020[71]

68 In accordance with Article 15 of the FCA regulation, referring to Article 26 of the CACM regulation.
69 The TSOs shall also publicly make available the reports described in the Article 12 of the Methodology for long-term cross-zonal capacity calculation for Italy North CCR.
70 Article 10 of the FCA regulation.
71 Source: JAO Publication tool.

The day-ahead offered capacity within the AT-NORD, FR-NORD, NORD-AT, NORD-FR, NORD-SI and SI-NORD bidding zone borders during April 2019 and between April 2019 and December 2020 is consistently up to 10 000.00 (MW).

Figure 31 shows the implicit offered and allocated day-ahead capacities during April 2019 to December 2020 at Italy North CCR internal borders, which are part of the Italy North CCR CCM in accordance with CACM regulation[72]. The values are presented in box-plot diagrams to show the distributional characteristics of the data series. During the period covered in this report, the Italy North CCR bidding zone borders were not yet coupled under the SIDC.

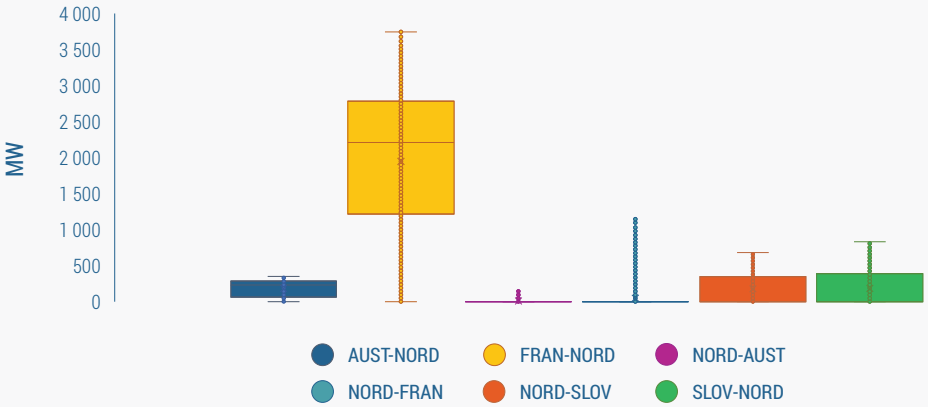


Figure 31. Implicit day-ahead allocated capacities in Italy North CCR bidding zone borders from April 2019 to December 2020[73]

72 Article 20 of the CACM regulation.
73 Source: SDAC Operations Committee – OPSCOM.

3.5. Greece – Italy

The TSOs in Greece-Italy ("GRIT") CCR are: Terna (IT) and IPTO (GR).

Figure 32. GRIT CCR (from 2021)[74]

3.5.1. Capacity calculation and allocation for the short-term[75]

The GRIT capacity calculation methodology for the day-ahead and intraday time frames was approved by GRIT NRAs on 09 December 2020. For the day-ahead and intraday time frame, the GRIT TSOs implement a cNTC approach.

Table 22 and **Table 23** provide an overview of the already accomplished milestones and planned timeline for the implementation of the GRIT CCR day-ahead and intraday capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q3 2017	GRIT CCR TSOs submitted the day-ahead CCM to the GRIT CCR NRAs
Q1 2018	Request for Amendment of the CACM regulation on the day-ahead and intraday CCM from the GRIT CCR NRAs
Q2 2018	The resubmission of the GRIT CCR TSOs of the amended CACM regulation on the day-ahead and intraday CCM
Q3 2018	The GRIT CCR NRAs to approve CACM regulation on the day-ahead and intraday CCM[76]

74 Until the end of 2020, this CCR included the following bidding zone borders: Italy SUD-Greece (SUD-GR), and within Italy, NORD-CNOR, CNOR-CSUD, CNOR-SARD, SARD-CSUD, CSUD-SUD, SUD-ROSN and ROSN-SICI. Starting from 2021, this CCR includes the following bidding zone borders: Italy SUD-Greece (SUD-GR), and within Italy, NORD-CNOR,), CNOR-CSUD, CNOR-SARD, SARD-CSUD, CSUD-SUD, SUD-CALA and CALA-SICI)..

75 https://consultations.entsoe.eu/markets/capacity-calculation-methodology-proposal-grit-ccr/

76 https://consultations.entsoe.eu/markets/fca_art_16_ccr_grit/.

Closed milestone(s)	
Q4 2020	The GRIT CCR NRAs approved CACM regulation on the day-ahead and intraday CCM

Table 22. GRIT CCR: closed milestone(s) for short-term capacity calculation and allocation

Planned milestone(s)	
Quarter	**Description**
Q2 2021	Day-ahead and intraday (10:00 D) capacity calculation parallel run
Q3 2021	Go-Live of the day-ahead and intraday (10:00 D) capacity calculation
Q1 2023	Go-Live of the intraday (22:00 D-1) capacity calculation

Table 23. GRIT CCR: planned milestone(s) for short-term capacity calculation and allocation

Figure 33 provides an overview of the intraday and day-ahead capacity calculation processes and responsibilities within the GRIT CCR.

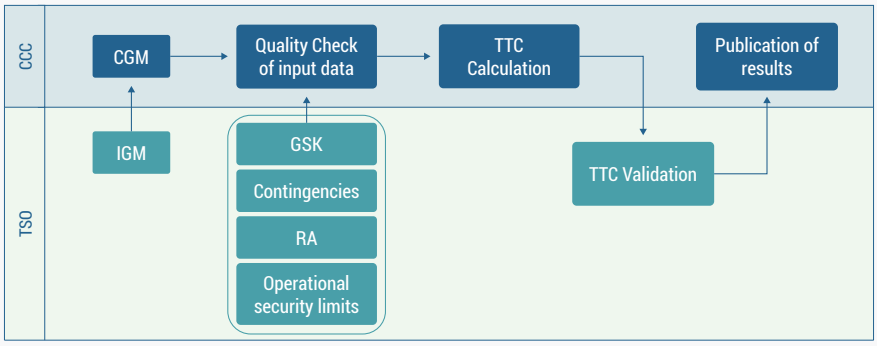


Figure 33. Input and output data and roles of the entities in the capacity calculation process for the day-ahead and intraday time frame of the GRIT CCR

The cross-border TTC will be determined by proceeding contingency analysis, complying with the operational security limits in the GRIT CCR. If during the capacity calculation process, the CCCs find different TTC values, the lowest value will be used as a coordinated value (but only for the Greece-Italy SUD border).

The CCM is based on forecast models of the transmission system. Therefore, the outcomes are subject to inaccuracies and uncertainties. The TRM aims to cover the inaccuracies and uncertainties induced by those forecast errors.

Considering the technical details of the GRIT border, which is a high voltage direct current (HVDC) connection link, the TRM is considered equal to zero. Regarding the internal Italian borders, the TRM value on each border is set to 0 MW since:

Terna manages the power system using an optimal power flow function that can cope with potential cross-border congestions.

- An assessment of the deviations between scheduled and realised flows confirmed that flow deviations could be reliably managed by the above-mentioned function.

After computing the CZC, the CCC submits it to the TSOs for validation. TSOs will then check the system security for the proposed capacities.

At the end of the validation process, the CCC considers the requests from reductions submitted by TSOs to reduce the capacity to the maximum secure value.

Forwarding of validated CZC: After completion of the validation phase, the CZC will be forwarded to the allocation.

3.5.2. Capacity calculation and allocation for the long-term

The approved methodology states that coordinated long-term capacity calculation and splitting will go-live on 1 January 2022. The CCM is based on the cNTC statistical approach.

Table 24 and **Table 25** provide an overview of the already accomplished milestones and planned timeline for the implementation of the GRIT CCR long-term capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q4 2018 – Q1 2019	Consultation on the FCA long-term capacity calculation and splitting methodology based on cNTC approach (1 month) by the GRIT CCR TSOs
Q1 2019	Submission from the GRIT CCR TSOs to GRIT CCR NRAs of the long-term capacity calculation and splitting methodology
Q3 2019	Issued a request for amendment of the long-term capacity calculation methodology by the GRIT CCR NRAs
Q4 2019	The GRIT CCR TSOs re-submitted the amended FCA long-term capacity calculation methodology proposal
Q1 2020	The GRIT CCR NRAs approved the FCA long-term capacity calculation and splitting methodology

Table 24. GRIT CCR: closed milestone(s) for long-term capacity calculation and allocation

Planned milestone(s)	
Quarter	**Description**
Q3 2021	GRIT CCR TSOs envisage the launch of a parallel run
Q1 2022	GRIT CCR TSPs' planned go-live of the long-term capacity calculation and allocation processes

Table 25. GRIT CCR planned milestone(s) for long-term capacity calculation and allocation

Figure 34 provides an overview of the yearly long-term capacity calculation process.

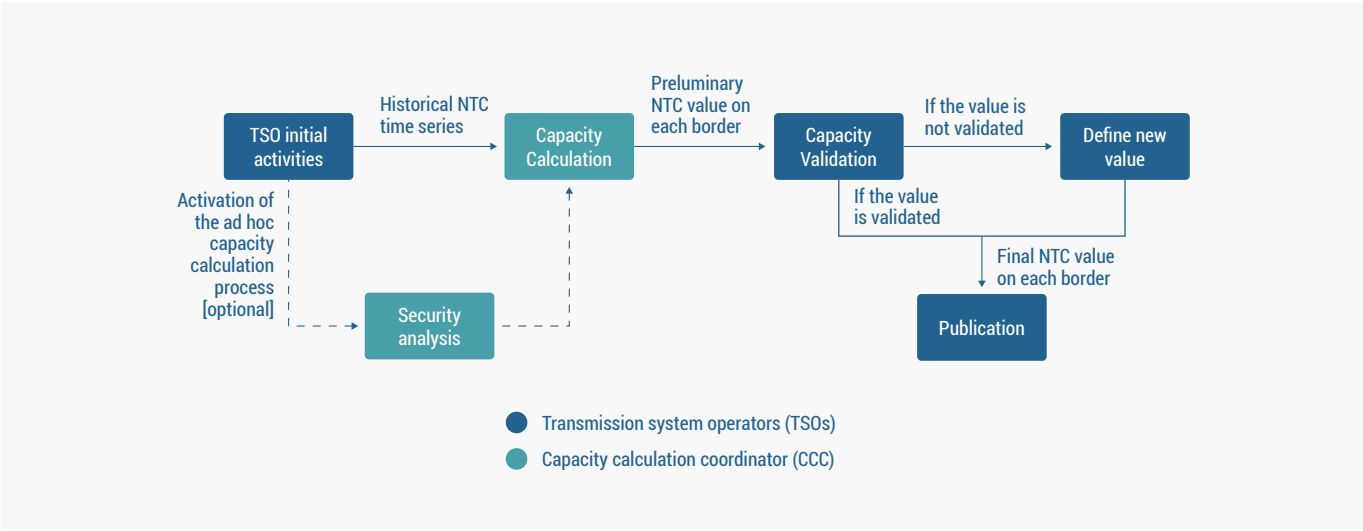


Figure 34. Input and output data and roles of the entities in the capacity calculation process for the yearly time frame in the GRIT CCR

The GRIT CCR's CCC will calculate two values for yearly CZC: for peak and off-peak hours for the whole year for each Italian internal border/direction, respectively, corresponding to the maximum value between the:

- 50°percentile of the historical series (as a proxy of the expected value)
- 10% of the 95°percentile of the historical series (acting as a floor if any relevant long-lasting, exceptional events occurred in the past) increased, when relevant and if positive, of the difference between the TTC value computed according to ad hoc capacity calculation process and the 95°percentile of the historical series.

The ad hoc capacity calculation process is based on security analysis. The use of this process is only triggered when relevant events that cannot be explained by historical series (for example, multiple planned outages or the commissioning of relevant new grid investments) are expected to occur during the delivery period.

Figure 35 provides an overview of the yearly long-term capacity calculation process.

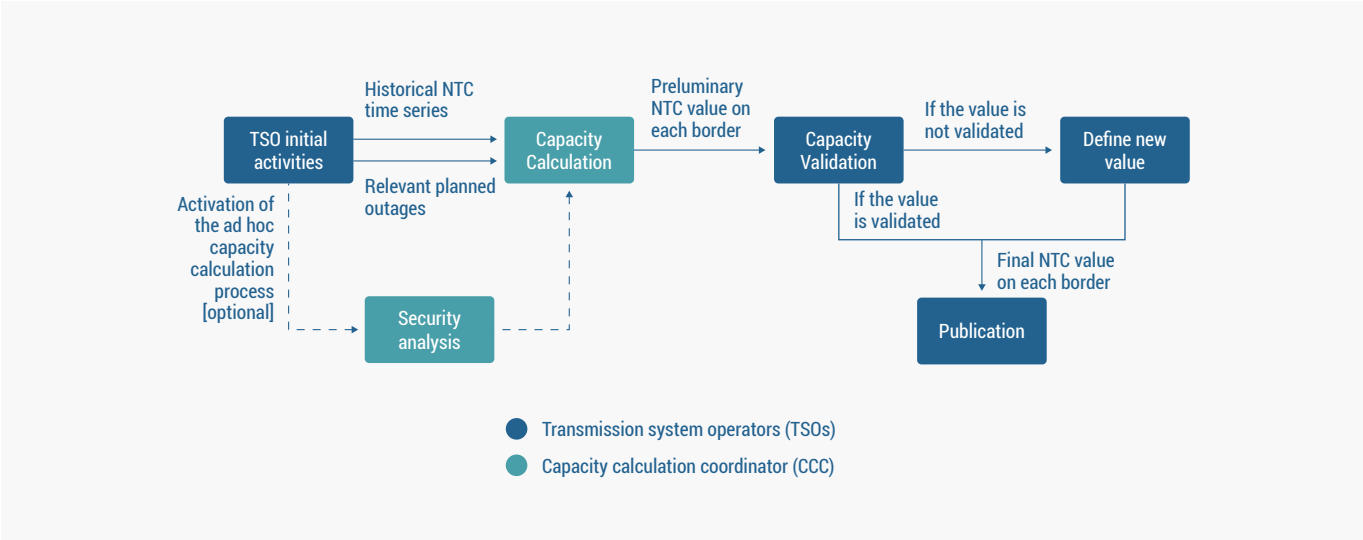


Figure 35. Input and output data and roles of the entities in the capacity calculation process for the monthly time frame in the GRIT CCR

The GRIT CCR's CCC will calculate two values for monthly CZC for each day of the delivery month: for peak and off-peak hours for each border/direction, respectively, corresponding to the maximum value:

- For each planned outage in the day that could impact CZC, the 50° percentile of the historical series considers only the relevant hours in the past when the same element was out of service. The maximum value (which is a proxy of the expected maximum TTC value when all grid elements are available) between
  - the 95° percentile of the historical series of the hours of the same season of the day under assessment;
  - when relevant, the TTC value computed according to "Ad hoc" capacity calculation process.
- When relevant, the TTC value computed according to "Ad hoc" capacity calculation process (this act as a cap in case multiple-outages, as never happened before, are expected).

The GRIT CCR's CCC will establish the CZC for each hour of the delivery period (year/month) for the GRIT SUD border, considering the following:

- If the HVDC link is expected to be available, the 50° percentile of the historical series, considering all hours over the last two years during which the cable was available.
- If a planned outage of the HVDC link is scheduled in the delivery hour, the 50° percentile of the historical series, considering all hours over the last two years during which the cable was unavailable.

For a more detailed explanation, GRIT TSOs recommend consulting the published long-term capacity calculation and splitting methodologies and their explanatory notes[77, 78].

Once the yearly and monthly NTC profiles are computed, validation can begin.

Statistical indicators for the bidding zone borders of GRIT CCR

Figure 36 shows the offered and allocated long-term capacities during 2019 and 2020 at GRIT CCR internal borders, which will become part of the GRIT CCR CCM in accordance with FCA regulation[79].

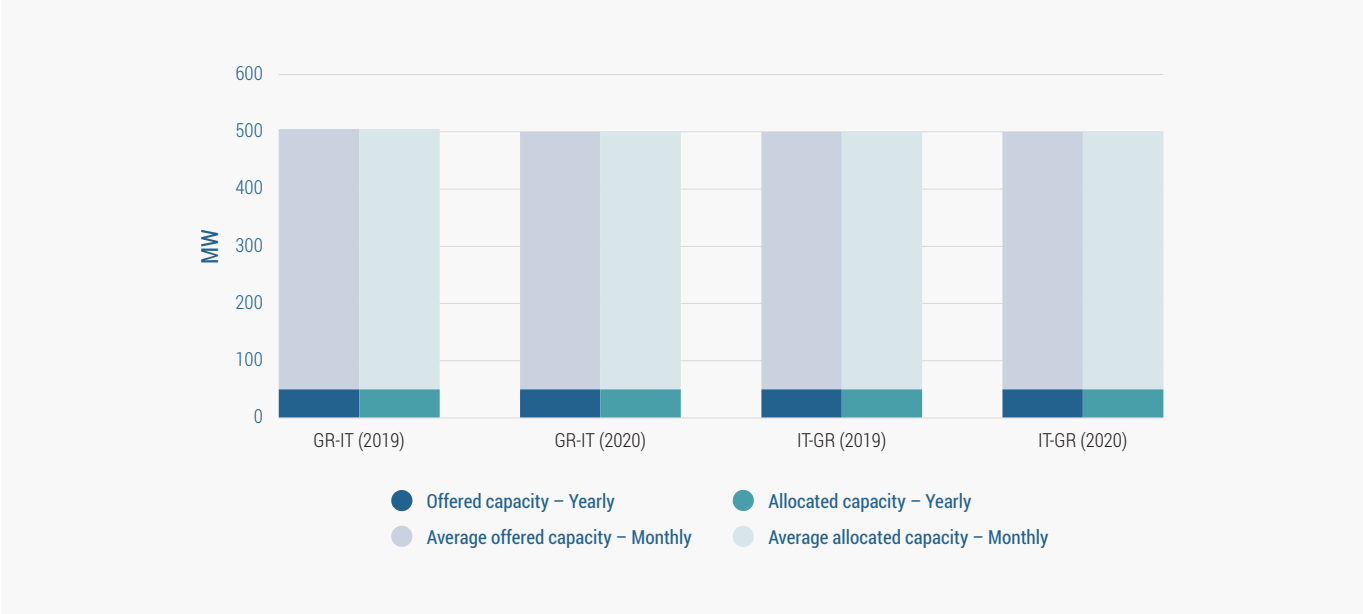


Figure 36. Offered and allocated long-term capacities in GRIT CCR bidding zone borders during 2019 and 2020[80]

Figure 37 and **Figure 38** show the offered and allocated day-ahead capacities during 2019 and 2020 at GRIT CCR internal borders, which will become part of the GRIT CCR CCM in accordance with CACM regulation[81]. The values are presented in box-plot diagrams to show the distributional characteristics of the data series. During the period covered in this report, the GRIT CCR bidding zone borders were not yet coupled under the SIDC.

77 https://consultations.entsoe.eu/markets/fca_art_16_ccr_grit/.
78 https://consultations.entsoe.eu/markets/fca_art_16_ccr_grit/.
79 Article 10 of the FCA regulation.
80 Source: JAO Publication tool.
81 Article 20 of CACM regulation.

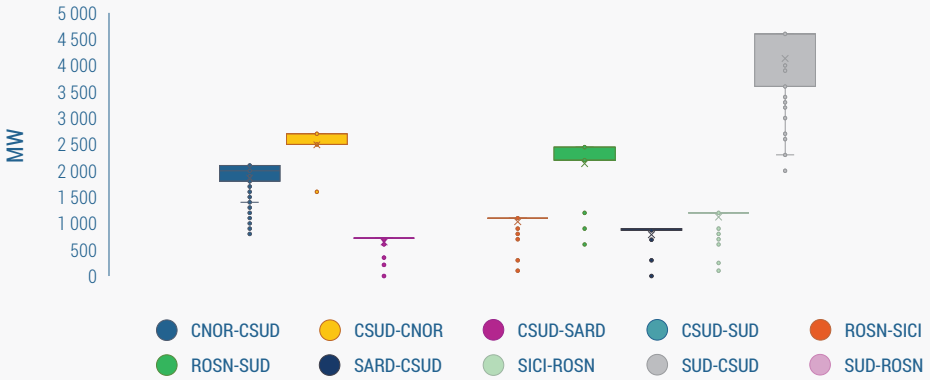


Figure 37. Implicit day-ahead offered capacities in Greece-Italy North CCR bidding zone borders from April 2019 to December 2020[82]

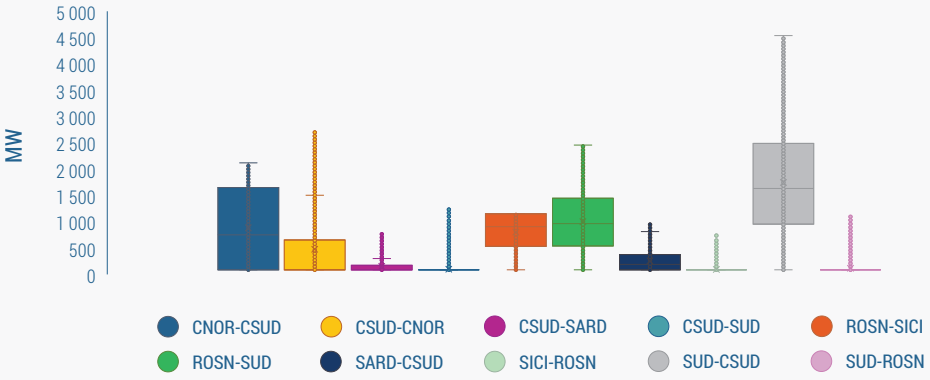


Figure 38. Implicit day-ahead allocated capacities in Greece-Italy North CCR bidding zone borders from April 2019 to December 2020[83]

82 Source: SDAC Operations Committee – OPSCOM.
83 Source: SDAC Operations Committee – OPSCOM.

3.6. South West Europe

The TSOs in the South West Europe (SWE) CCR are RTE (FR), REE (ES) and REN (PT).

Figure 39. South West Europe CCR[84]

3.6.1. Capacity calculation and allocation for the short-term

SWE NRAs approved the SWE CCM for the day-ahead and intraday time frames in November 2018.

For the day-ahead time frame, the SWE CCR TSOs implemented a cNTC approach in January of 2020 and foresee implementing the same methodology for the intraday capacity calculation during 2021.

The high-level capacity calculation process for the day-ahead time frame is shown in **Figure 40**. The figure identifies the roles of the entities involved and the input and output data in the capacity calculation process. This capacity calculation process shall also be applied for the intraday time frame when it is implemented.

The CGM used in the capacity calculation for this period is a SWE regional CGM, which resulted from the three TSOs merging their respective IGMs. Both the IGMs and the CGM were created using the Common Grid Model Exchange Standard (CGMES). SWE was the first CCR to implement this format in an operational capacity calculation process.

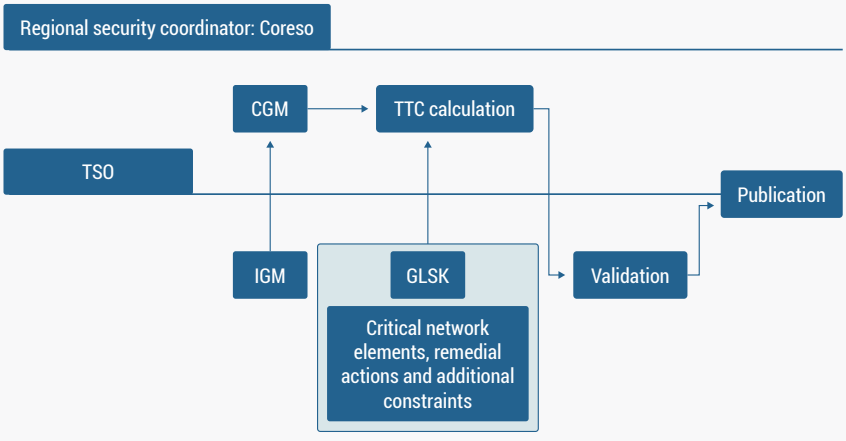


Figure 40. Input and output data and roles of the entities in the capacity calculation process for the day-ahead and intraday time frames of the SWE CCR

84 This CCR includes the following BZBs: Portugal – Spain (PT – ES) and Spain – France (ES – FR).

At the time of writing of this report, the following milestones are planned for SWE CCR:

Planned milestone(s)	
Quarter	**Description**
Q1 2021	Go-live of a regional tool for monitoring the 70% fulfilment provided for in the Clean Energy for all Europeans Package
Q4 2021	Go-live of the intraday capacity calculation
Q4 2021	Go-live of the capacity calculation fulfilling the 70% fulfilment provided in the Clean Energy for all Europeans Package

Table 26. SWE CCR: planned milestone(s) for short-term capacity calculation and allocation

3.6.1.1. Indicators

The following indicators provide an evaluation of the results of the utilisation of the SWE regional CCM in the day-ahead time frame since its implementation between 29 January 2020 and 31 December 2020.

1. **Coordinated net transmission capacity calculations: Average TRM values per border/ direction and time frame (MW)**

   The following TRM values have been applied according to the SWE CCR's CCM:

   - For the FR - ES border, in both directions, the RM for the capacity calculation performed on D-2 is calculated as the maximum value between **200 MW**, covering the **unintended deviation** part of the RM, and **7.5% of the TTC value**, covering the **uncertainties of the forecast** part of the RM.
   - For the ES - PT border, in both directions, the RM for the capacity calculation performed on D-2 is calculated as the maximum value between **100 MW**, covering **the unintended deviation** part of the reliability margin, and **10% of the TTC value**, covering the **uncertainties of the forecast** part of the RM.

The following values have been obtained:

Border	Direction	Average TRM (MW)
France-Spain (FR – ES)	ES->FR	224.36
	FR->ES	224.44
Portugal-Spain (PT – ES)	ES->PT	335.51
	PT->ES	325.28

Table 27. Average transmission RM values per border/direction and time frame (from 29 January to 31 December 2020)[85]

85 Source: SWE CCR TSOs.

2. Average net transmission capacity values and allocation constraints (MW)

Border	Direction	Average NTC (MW)	Frequency of MTUs with allocation constraints (%)
France-Spain	FR->ES	2 607	0
	ES->FR	2 461	0
Portugal-Spain	PT->ES	2 927	0
	ES->PT	3 020	0

Table 28. Average net transmission capacity values and allocation constraints (MW) (From 29 January to 31 December 2020)[86]

3. The portion of the CZC allocated by each time frame

This indicator compares the effectively allocated capacity in relation to the offered capacity in both day-ahead, according to the SWE CCM, and intraday time frames and per direction, considering the arithmetic mean of hourly results. Specifically, the intraday time frame indicator for the SWE CCR covers the aggregated capacity allocated within Iberian CRIDAs and net allocation within the continuous intraday market. For the intraday continuous market, only the hourly net allocation is considered, although for a single hour, several exchanges could have been established in both directions of the interconnection.

CC time frame / BZB	FR-ES	PT-ES
Day-ahead	80.26%	40.47%
Intraday	14.43%	18.67%

Table 29. Portion of the CZC allocated by each time frame (from 29 January to 31 December 2020)[87]

4. Price convergence at market coupling

This indicator reflects the percentage of hours in which price convergence between the SWE Bidding Zones was achieved. For calculating the price convergence at the CCR level, hourly prices from the three Bidding Zones have been evaluated simultaneously.

Bidding zone borders	FR-ES	PT-ES	FR-ES-PT
Price convergence at Market Coupling	39.57%	96.13%	38.28%

Table 30. Price convergence at market coupling (from 29 January to 31 December 2020)[88]

86 Source: SWE CCR TSOs.
87 Source: SWE CCR TSOs.
88 SWE CCR TSOs.

5. Coordinated net transmission capacity calculations: maximum export/import NTC

Per Bidding Zone:

	Export	Import
Portugal	4 545 M W	5 085 MW
Spain	8 010 MW	8 018 MW
France[89]	3 746 MW	3 838 MW

Table 31. Maximum export/import NTC per Bidding Zone (from 29 January to 31 December 2020)[90]

Per Bidding Zone Border and Bidding Zone to Bidding Zone:

From: To:	Portugal	Spain	France
Portugal	–	5 085 MW	3 700 MW*
Spain	4 545 MW	–	3 746 MW
France	3 700 MW[91]	3 838 MW	–

Table 32. Maximum NTC per Bidding Zone Border and Bidding Zone to Bidding Zone (From 29 January to 31 December 2020)[92]

6. Percentage of time when limiting CNEC at NTC calculation is not known by a TSO

This indicator comprises the following reasons which did not identify the most limiting CNEC during the CC process:

- Insufficient generation and load shift key (GLSK) (only at the ES-PT border)
- IT issue (lead to NTC Long-term values as a backup solution)
- Alternating Current load flow divergence
- CNE not provided (process failed when exporting CNE information)

Border	Direction	CNEC not identified (% time)
France-Spain	FR->ES	12
	ES->FR	11
Portugal-Spain	PT->ES	12
	ES->PT	16

Table 33. Percentage of time when limiting CNEC at NTC calculation is not known by a TSO (From 29 January to 31 December 2020)[93]

89 The total export/import capacities of France are outside the scope of SWE region. The value indicated only represents the capacities within SWE region.

90 Source: SWE CCR TSOs.

91 The value indicated for non-adjacent Bidding Zones is the maximum value among the most restrictive BZB value, in each hourly period, crossed between those Bidding Zones.

92 Source: SWE CCR TSOs.

93 Source: SWE CCR TSOs.

3.6.2. Capacity calculation and allocation for the long-term

SWE CCR NRAs approved the SWE CCM for long-term time frames in February 2020. At the time of writing of this report its implementation is ongoing in accordance with timeline foreseen in the methodology.

The methodology for long-term time frames follows the same cNTC approach and principles already implemented for the day-ahead, with the same tasks assigned to each role and the same Coordinated Capacity Calculator. The methodology will be applied to all time frames for which there is long-term transmission right allocation: year-ahead, month-ahead and quarter-ahead (the latter only for the Spain-Portugal border). The most updated long-term outage plans will be taken into account to create the scenarios to be evaluated in each calculation. A specific sub-methodology to calculate the long-term TRM values is also included.

The high-level capacity calculation process for the long-term time frame is shown in **Figure 41** which identifies the input and output data and the roles of the entities involved in the capacity calculation process.

Since a pan-European CGM is not available, the CGM used in the capacity calculation will be a SWE regional CGM, which resulted from the three TSOs merging their respective IGMs. Both the IGMs and the CGM will be created using the CGMES.

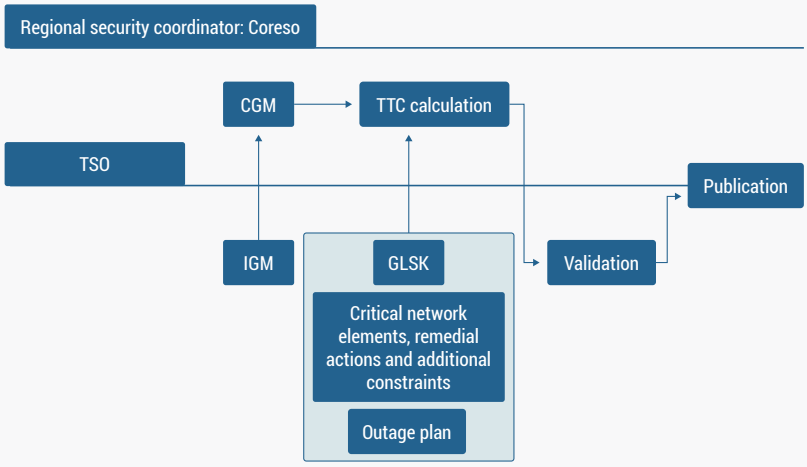


Figure 41. Input and output data and roles of the entities in the capacity calculation process for the year-, month- and quarter-ahead time frame of the SWE CCR

At the time of writing, the implementation planning is being reassessed, because the resources in the SWE CCR focus on the implementation of the intraday capacity calculation and the 70% fulfilment of the Clean Energy for all Europeans Package.

Table 34 and **Table 35** provide an overview of the already accomplished milestones and planned timeline for the implementation of the SWE CCR long-term capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q2 2019	SWE CCR TSOs submitted the long-term CCM proposal to the relevant NRAs
Q1 2020	SWE CCR TSOs submitted an amendment to the SWE long-term CCM initial proposal
Q1 2020	SWE CCR NRAs approved the SWE long-term CCM proposal

Table 34. SWE CCR: closed milestone(s) for long-term capacity calculation and allocation

Planned milestone(s)	
Quarter	**Description**
Under definition	Implementation of the long-term CCM by SWE CCR TSOs and SWE RSC (Coreso)
Under definition	Long-term CMM Go-Live covering yearly, quarterly (ES-PT) and monthly ahead capacity calculation

Table 35. SWE CCR: planned milestone(s) for long-term capacity calculation and allocation

The following graphs show the offered and allocated long-term capacities during 2019 and 2020 at PT-ES and FR-ES borders, which are part of the SWE CCR CCMs in accordance with FCA regulation[94].

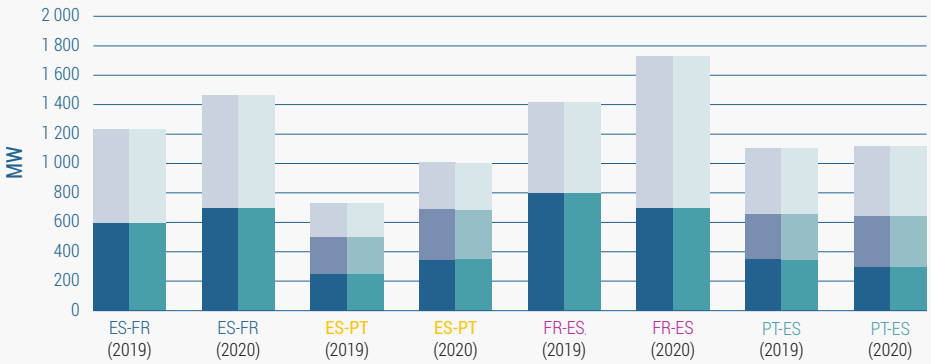


Figure 42. Offered and allocated long-term capacities in SWE CCR bidding zone borders during 2019 and 2020[95]

The following graphs show the offered and allocated capacities in day-ahead time frame as well as offered and used capacities in intraday time frame during 2019 and 2020 at PT-ES and FR-ES borders, which are part of the SWE CCR Capacity Calculation Methodology in accordance with CACM regulation[96]. The values are presented in box-plot diagrams to show the distributional characteristics of the data series.

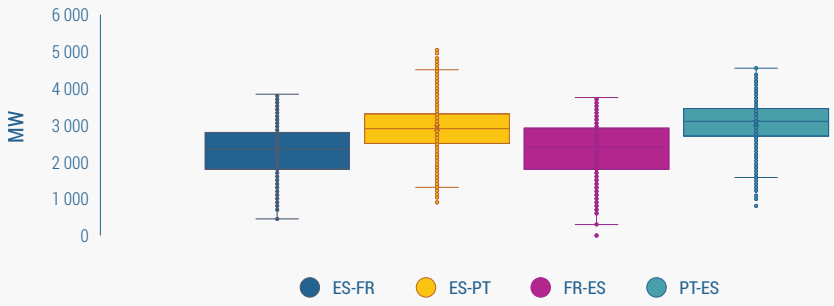


Figure 43. Implicit day-ahead offered capacities used in SWE CCR bidding zone borders from April 2019 to December 2020[97]

94 Article 10 of the FCA regulation.
95 Source: JAO Publication tool.
96 Article 20 of the CACM regulation.
97 Source: JAO Publication tool.

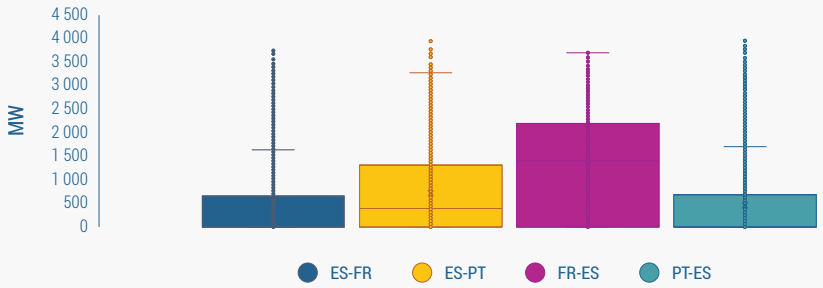


Figure 44. Implicit day-ahead allocated capacities used in SWE CCR bidding zone borders from April 2019 to December 2020[98]

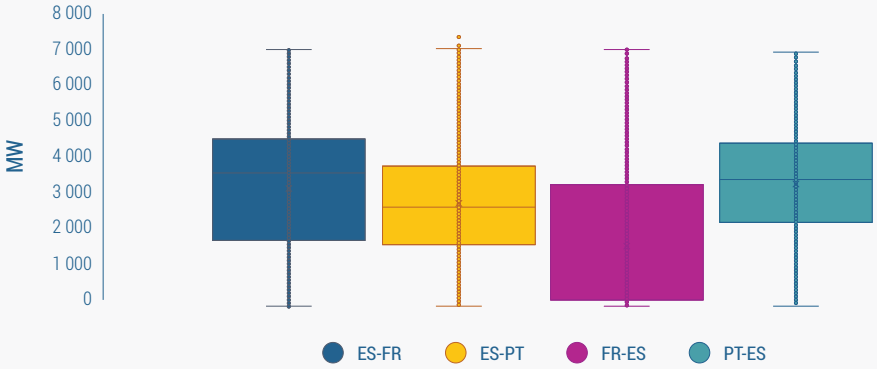


Figure 45. Implicit intraday offered capacities in SWE CCR bidding zone borders from April 2019 to December 2020[99]

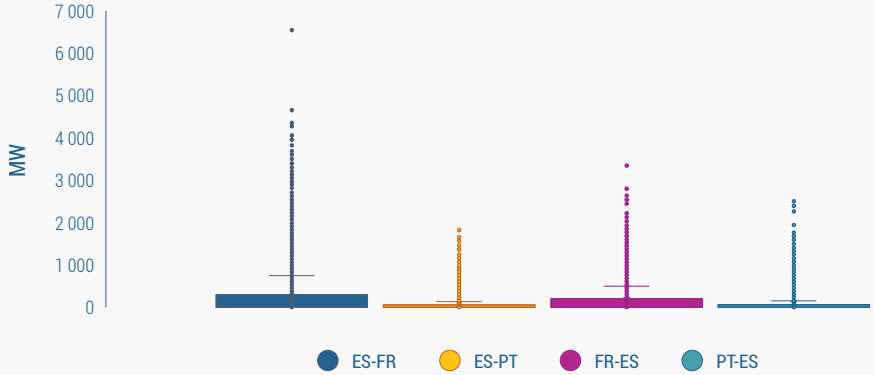


Figure 46. Implicit intraday used[100] capacities in SWE CCR bidding zone borders from April 2019 to December 2020[101]

98 Source: JAO Publication tool.

99 Source: SIDC / XBID reporting.

100 All cross-border transactions in both directions of the interconnection within the same delivery period are considered. The intraday used capacity may or may not be unavailable for subsequent processes depending on the net allocation (net value of used capacity on both directions) of each delivery period.

101 Source: SIDC / XBID reporting.

3.7. Baltic

The TSOs in the Baltic CCR are Elering (EE), Litgrid (LT), AST (LV), Fingrid (FI), Svenska (SE) and PSE (PL).

Figure 47. Baltic CCR[102]

3.7.1. Capacity calculation and allocation for the short-term

The Baltic CCR will develop a cNTC approach for CZC calculation and allocation. By Q4 2018, the Baltic CCR TSOs received approval from the relevant NRA and started preparing to implement the Baltic CCR CCM. Preconditions for the implementation of the Baltic CCR CCM were:

- the implementation of the coordinated re-dispatching and countertrading methodology according to Article 35 of the CACM regulation;
- the implementation of the re-dispatching and countertrading cost-sharing methodology within the Baltic CCR required by Article 74 of the CACM regulation;
- the Baltic NRA's approval and implementation of the document specifying terms, conditions and methodology on CZC calculation, provision and allocation with third countries (i.e. Estonia–Russia, Latvia-Russia, Lithuania-Belarus, Lithuania-Russia[103]) across Baltic State borders and these third countries.

Moreover, Baltic CCR TSOs were in communication with Baltic CCR NRAs on the best way and time frame to implement the Baltic CCR CCM. The CCM timescale for implementation of the day-ahead and intraday time frames within the Baltic CCR is provided in **Table 36** and **Table 37**.

102 This CCR includes the following bidding zone borders: Finland-Estonia (FI-EE), Estonia-Latvia (EE-LV), Lithuania -Latvia (LT-LV), Lithuania-Poland (LT-PL), and Sweden-Lithuania (SE4-LT).

103 In the Kaliningrad area.

Closed milestone(s)	
Quarter	**Description**
Q4 2018	Approval of the coordinated re-dispatching and countertrading methodology according to Article 35 of the CACM regulation
Q1 2019	Approval and implementation by the Baltic NRAs of the document specifying terms, conditions and methodology of CZC calculation, provision and allocation across borders of Baltic States and third countries
Q2 2019	Approval of the coordinated re-dispatching and countertrading cost-sharing methodology within the Baltic CCR required by Article 74 of the CACM regulation
Q3 2019 – Q1 2021	Communication with Baltic NRAs regarding implementation of the CCM and other methodologies
Q1 2021	Letter from Baltic CCR NRAs on the implementation of the CCM

Table 36. Baltic CCR: closed milestone(s) for short-term capacity calculation and allocationv

Planned milestone(s)	
Quarter	**Description**
To be determined	Implementation of the coordinated re-dispatching and countertrading methodology according to Article 35 of the CACM regulation
To be determined	Implementation of the re-dispatching and countertrading cost-sharing methodology within the Baltic CCR required by Article 74 of the CACM regulation
To be determined	Implementation of the Baltic CCR cNTC CCM

Table 37. Baltic CCR: planned milestone(s) for short-term capacity calculation and allocation

The steps of the capacity calculation process can be described as follows:

1. As an input, the CZC calculation process receives the RMs and the remedial actions.

   a) The TRM is a capacity margin, which considers planning errors, including the errors made due to imperfect information issued by third countries at the time the transfer capacities have been calculated. The TRM calculation methodology covers cross-border interconnections between Lithuanian and Latvian power systems as well as between Latvian, Russian and Estonian power systems.

      The TRM for HVDC interconnectors is 0 MW, whereas the TRM for the AC borders is calculated based on statistical data, i.e. the deviation of factual power flow from planned power flow over the cross-border interconnection. TRM is equal to the average arithmetic value plus one standard deviation using the above factual and planned power flow data.

   b) The remedial actions are the changes in network topology and the changes in the power systems' balance, for example, changing generation.

2. The TTC is the calculation for cross-borders with AC interconnectors in the Baltic TSOs' control area.

   a) The cross-border interconnection TTC assessment for AC interconnectors will follow the methodological principles in the 'Methodical guidelines for stable operation in the BRELL[104] loop,' as well as national regulations and standards implemented and agreed in the instructions for parallel operations in the cross-border interconnections between the TSOs involved, while taking into account intra- and intersystem operational security.

   b) Methodical guidelines for stable operation in the BRELL Loop are used as a basis and reviewed by TSOs to ensure the secure and collection operation with neighbouring interconnected TSOs.

   c) The TTC will be determined by the proceeding contingency analysis, complying with the operational security limits of the BRELL Loop and the Baltic TSOs' control area.

104 Belarus, Russia, Estonia, Latvia and Lithuania.

d) Contingency analysis is performed for those contingencies which are agreed upon by Baltic TSOs and thereafter placed on the contingency list. Once agreed upon, this list is provided to the CCC.

e) The list of critical network elements in the Baltic TSO control area will be shared with all Baltic TSOs and the CCC.

The cross-border TTC calculation will be carried out using mutually coordinated data and information as inputs. These inputs are the CGM, which includes the power transmission equipment model of the BRELL Loop and scenarios describing net positions for each of the Baltic TSOs' control areas and the Russian/Belarusian power systems, valid for given calculation purposes.

f) When determining the TTC values, TSOs and the CCC can take into account ambient temperatures for different seasonal periods within the control area as well as effective emergency power reserves within the Baltic TSOs' control areas and Russian/Belarusian power systems to ensure operational security.

g) If during the capacity calculation process, neighbouring TSOs find different TTC values for the same cross-border interconnection, the lowest value will be used as a coordinated value.

3. TTC calculation for cross-borders with HVDC interconnectors

a) The TTC of each border that consists solely of HVDC connections is limited by the sum of ratings of HVDC interconnectors that connect the relevant Bidding Zones. In order to establish the TTC limitation related to adjacent AC networks , contingency analyses based on N-1 criteria (i.e. a loss of any single element of the power system) will be performed using CGMs. While performing contingency analyses after applying N-1 criteria, the following limits will not be exceeded:

   a. thermal limits that correspond to the relevant ambient temperature of network elements;

   b. voltage limits in network nodes;

   c. rotor angle stability limits.

b) The maximum permissible capacity of a HVDC interconnector will be limited when there is a lack of available power reserves to mitigate the failure of the HVDC interconnector.

c) The relevant party performing the contingency analysis should check if the maximum capacity for each connection in each direction could be provided to the market. If the contingency analysis reveals that network security cannot be guaranteed when the HVDC interconnectors are fully loaded in any direction, then capacity on the relevant border in the relevant direction will be reduced until network parameters are within permissible limits during the analysis.

d) The TTC of the relevant HVDC interconnector is the minimum capacity value that is the outcome of the contingency analyses that the relevant parties perform on each side of the relevant interconnector.

e) For Baltic CCR TSOs, the cross-border TTC calculations will be carried out using the following data and information as inputs:

   a. the CGM, which includes:

      i. the power transmission equipment model of the BRELL[105] Loop and scenarios describing net positions for each of the Baltic TSOs' control areas and the Russian/Belarusian power systems, valid for given calculation purposes;

      ii. the model of the Polish power system from the European merging function, supplemented with the 110 kV sub-transmission grid and the scenarios reflecting the net position of the Polish bidding zone, valid for given calculation process;

      iii. the models of the Nordic power systems from European merging function;

   b. generation, renewable generation and load shift keys;

   c. critical network elements;

   d. planned outages;

   e. the contingency list;

   f. remedial actions;

   g. operational security limits.

105 Belarus, Russia, Estonia, Latvia and Lithuania.

Intraday capacity calculation and allocation

Before cross-zonal capacities are provided to the intraday market, the following steps need to be carried out:

1. calculation by the TSOs and CCC of the NTC value for the day-ahead market;
2. provision of the day-ahead market results by NEMO, complying with the NTCs and allocation constraints;
3. calculation of the ATC value for the intraday market.

After the day-ahead firmness deadline, all CZC and allocation constraints are firm for day-ahead capacity allocation unless there is an emergency situation or a force majeure event. The day-ahead firmness deadline is 60 minutes before the day-ahead gate closure time unless there is another deadline. After the day-ahead firmness deadline, the CZC that has not been allocated may be adjusted for subsequent allocations, subject to allocation constraints. The intraday CZC is firm as soon as it is allocated and is subject to allocation constraints unless there is an emergency situation or a force majeure event.

If due to the time constraints, ATC values cannot be calculated by the CCC and validated by TSOs before the intraday cross-zonal gate opening time, TSOs will provide ATC capacities for their respective borders for intraday market time frame based on the day-ahead NTCs and the results of the day-ahead market coupling, as well as evaluation of operational security by TSOs.

If neighbouring TSOs come up with different ATC values for provision to the respective border, the lowest value will be used as a coordinated value and will be provided to the intraday market for allocations. Updated ATC values will be provided to the intraday market as soon as possible after calculation and validation have been successfully finalised.

During the intraday trading process, ATC values – apart from changes arising from NTC updates – will be adjusted automatically by the respective market operator/market platform after each trade affecting the respective border. The value of the ATC adjustment (increase or decrease) will be equal to the commercial flow over the respective border as a result of trade. The same refers to allocation constraints, which, apart from changes arising from their updates, will be adjusted automatically by the respective market operator/market platform after each trade affecting the respective power system. The volume of this adjustment (an increase of decrease), will be equal to the change of net position of a given power system as a result of trade.

In the Baltic CCR, there is no need for rules for efficiently sharing the power flow capabilities of critical network elements between different bidding zone borders, as there is no such critical network element in this CCR that would clearly and in most cases influence the power flow capabilities of several borders at once. Therefore, the methodology does not contain these rules, given that no such sharing takes place.

Currently, CZC and allocation constraints are provided to NEMOs for implicit allocation by TSOs (after TSOs have participated in the coordination process). In the future, when the CCC performs its functions, including validating the CZC, the TSOs will provide allocation constraints to the CCC, who will send them to NEMOs to allocate capacity.

Figure 48 is a high-level diagram of the steps and roles involved in determining the capacity calculation for the day-ahead and intraday time frames.

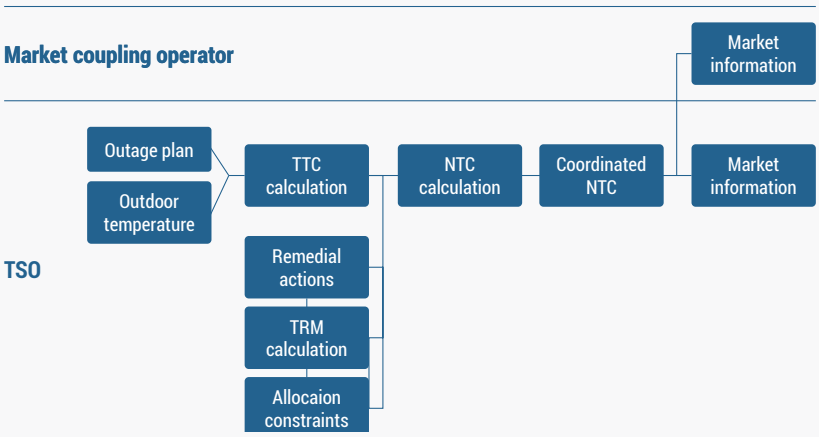


Figure 48. Input and output data and roles of the entities in the capacity calculation process for the day-ahead time frame of the Baltic CCR[106].

106 More information can be found at https://www.acer.europa.eu/en/Electricity/MARKET-CODES/CAPACITY-ALLOCATION-AND-CONGESTION-MANAGEMENT/16%20CCM/Action%205%20-%20CCM%20Baltic%20revised%20amended%20proposal.pdf.

3.7.2. Capacity calculation and allocation for the long-term

The FCA regulation obliges the TSOs to issue long-term transmission rights on a bidding zone border unless the competent regulatory authorities of the bidding zone border have adopted coordinated decisions not to issue long-term transmission rights on the bidding zone border.

Based on the assessments on the functioning of the wholesale electricity markets, relevant NRAs agreed the following:

- The Finnish and Estonian NRAs agree not to request the respective TSO to issue long-term transmission rights or to make other cross-zonal hedging products available at the FI-EE bidding zone border.
- The Latvian and Estonian NRAs agree not to request the respective TSO to issue long-term transmission rights or to make other cross-zonal hedging products available at the LV-EE bidding zone border.
- The Lithuanian, Latvian, Swedish and Polish regulators bilaterally agreed that long-term transmission rights should not be issued on the Lithuanian-Latvian (LT-LV), Lithuanian-Sweden (LT-SE4) and Lithuanian-Polish (LT-PL) bidding zone borders, but also that other long-term cross-zonal hedging products must be made available to support the functioning of the wholesale electricity markets within the above-mentioned bidding zone borders.

Based on a decision by the relevant NRAs, Financial Transmission Rights options will be offered on the Latvian – Estonian (LV-EE) border in the direction towards Latvia.

Based on the FCA regulation, the single allocation platform (SAP) is responsible for facilitating the allocation of long-term transmission rights at the European level.

Table 38 and **Table 39** provide an overview of the already accomplished milestones and planned timeline for the implementation of the Baltic CCR long-term capacity calculation processes.

Closed Milestone(s)	
Quarter	**Description**
Q2 2019	Approval of the Baltic CCR long-term CCM by Baltic CCR TSO Steering Committee and launch of a public consultation
Q2 2019	Approval of the Baltic splitting long-term CZC by Baltic CCR TSO Steering Committee and launch of a public consultation
Q3 2019	Review of the feedback received from public consultations and approval of the Baltic CCR long-term CCM by Baltic CCR TSO Steering Committee for submission to Baltic CCR NRAs (as planned).
Q3 2019	Review of the feedback received from public consultations and approval of the Baltic CCR splitting long-term CZC methodology by relevant Baltic CCR TSO Steering Committee members for submission to relevant Baltic CCR NRAs (as planned)
Q3 2019	Submission of Baltic CCR long-term CCM to Baltic CCR NRAs (as planned)
Q3 2019	Submission of Baltic CCR splitting long-term CZC methodology for splitting CZC to the relevant NRA (as planned)
Q1 2020	Request for Amendment for Baltic CCR long-term CCM from Baltic CCR NRAs to Baltic CCR TSOs
Q1 2020	Submission of the amended Baltic CCR long-term CCM to Baltic CCR NRAs
Q1 2020	Approval and publication of the Baltic CCR splitting long-term CZC methodology (as planned)
Q2 2020	Submission of a letter from the Baltic CCR NRAs to ACER requesting a decision on Baltic CCR long-term CCM submitted by Baltic CCR TSOs
Q3 2020	ACER public consultation and hearing phase for the decision on the Baltic CCR long-term CCM
Q4 2020	Publication of ACER Decision No 27/2020 on the Baltic CCR long-term CCM

Table 38. Baltic CCR: closed milestone(s) for long-term capacity calculation and allocation

Closed Milestone(s)	
Quarter	**Description**
2025	Expected time for implementation of the Baltic CCR long-term CCM and splitting long-term CZC

Table 39. Baltic CCR: planned milestone(s) for long-term capacity calculation and allocation

On 17 November 2020, ACER issued a decision (No 27/2020)[107] on the Baltic CCR's long-term CCM as the FCA and CACM regulations and the BRELL agreements[108] foresee some deviations in the capacity calculation approach. This decision does not force Baltic CCR's TSOs to implement the long-term CCM before BRELL synchronisation has taken place, as this could potentially endanger the operational security of the Baltic networks. Nonetheless, a new methodology will be developed in the 24 months following the decision.

Currently, one of the possible challenges is uncertainty, as Baltic CCR TSOs shall develop a methodology for the operating conditions in which the region is still not operating.

Allocation statistical indicators for the bidding zone borders of Baltic CCR

Figure 49 shows the offered and allocated long-term capacities during 2019 and 2020 at Baltic CCR internal borders, which will become part of the Baltic CCR CCM in accordance with FCA regulation[109].

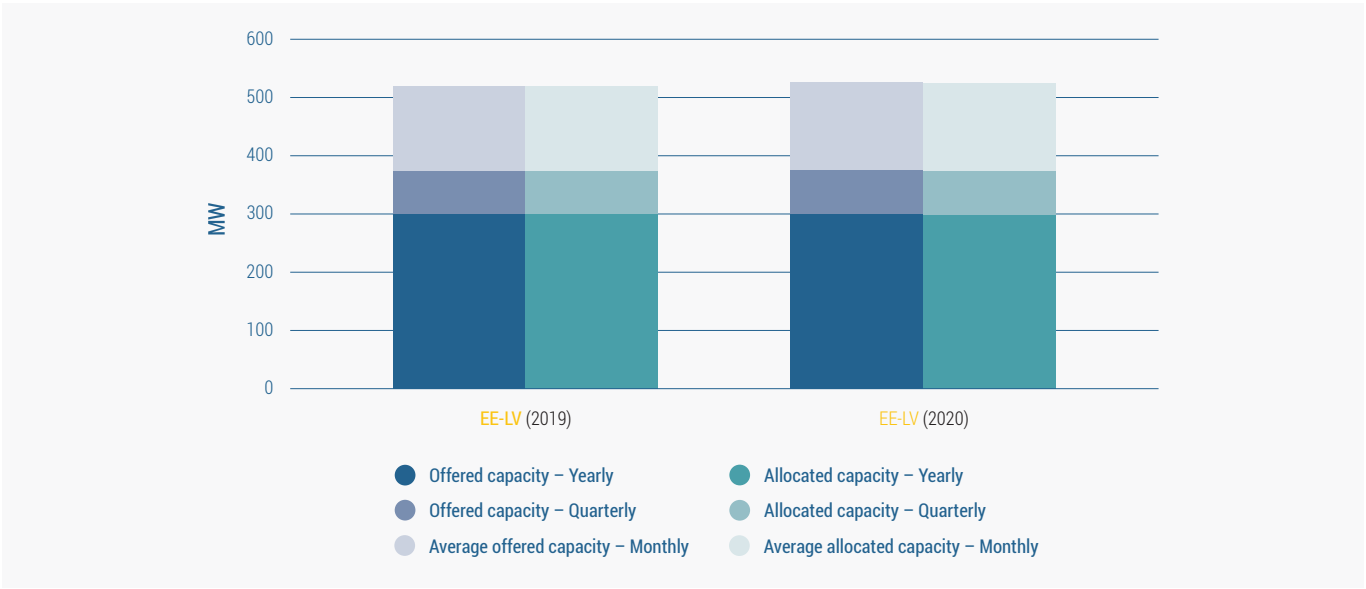


Figure 49. Offered and allocated long-term capacities in Baltic CCR bidding zone borders during 2019 and 2020[110]

107 ACER Decision No. 27/2020: https://eepublicdownloads.entsoe.eu/clean-documents/nc-tasks/Baltic%20-%2010.1%20-%20ACERs%20decision.pdf.

108 Agreements specifying the operation of three Baltic TSOs synchronously with Belarus and Russia.

109 Article 10 of the FCA regulation.

110 Source: JAO Publication tool.

Figure 50 and **Figure 51** show the offered and allocated day-ahead and **Figure 52** and **Figure 53** intraday capacities during April 2019 to December 2020 at borders, which will become part of the Baltic CCR CCM in accordance with CACM regulation[111]. The values are presented in box-plot diagrams to show the distributional characteristics of the data series:

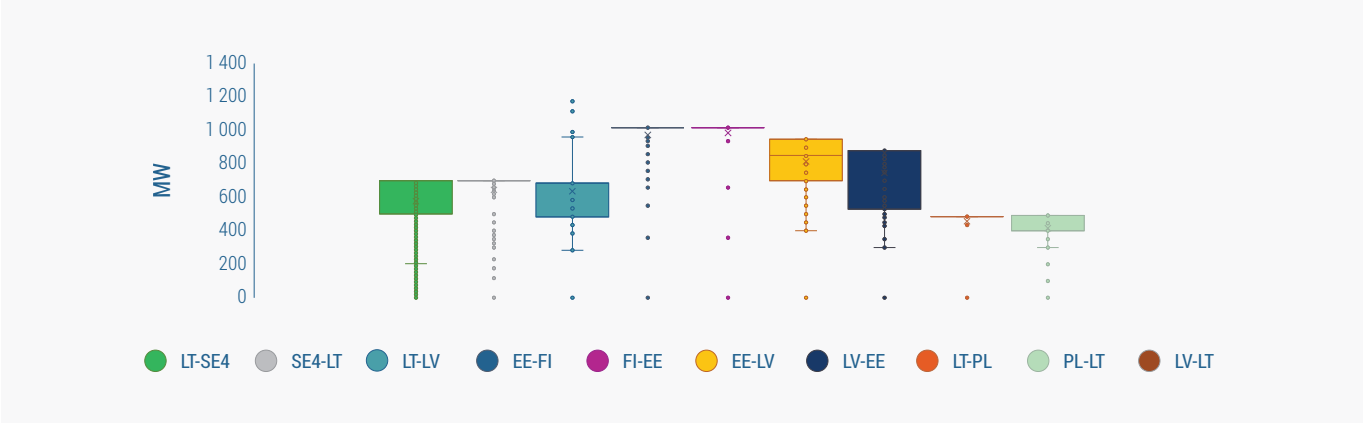


Figure 50. Implicit day-ahead offered capacities in Baltic CCR bidding zone borders from April 2019 to December 2020[112]

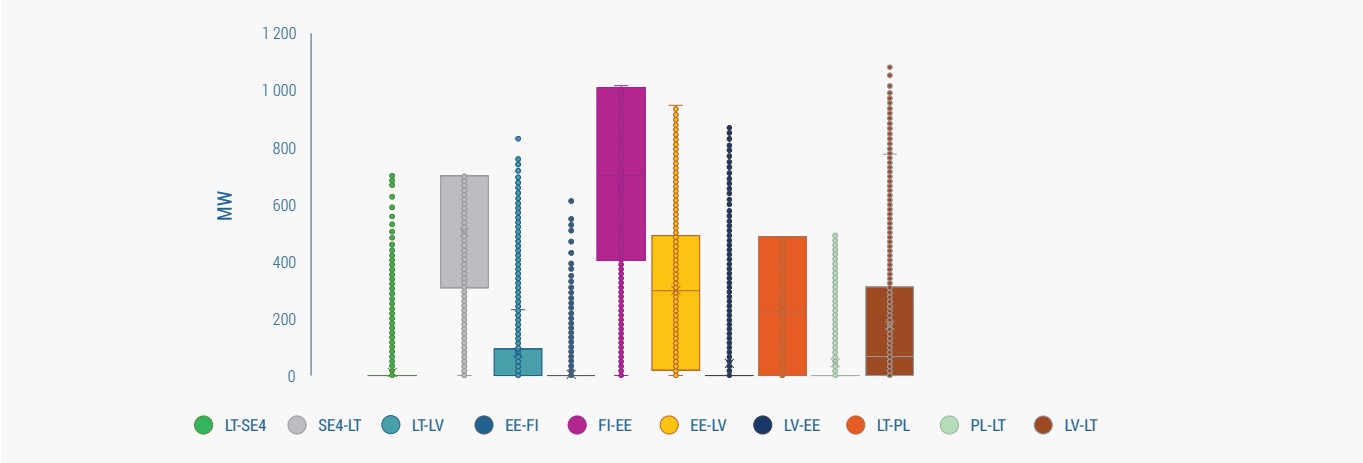


Figure 51. Implicit day-ahead allocated capacities in Baltic CCR bidding zone borders from April 2019 to December 2020[113]

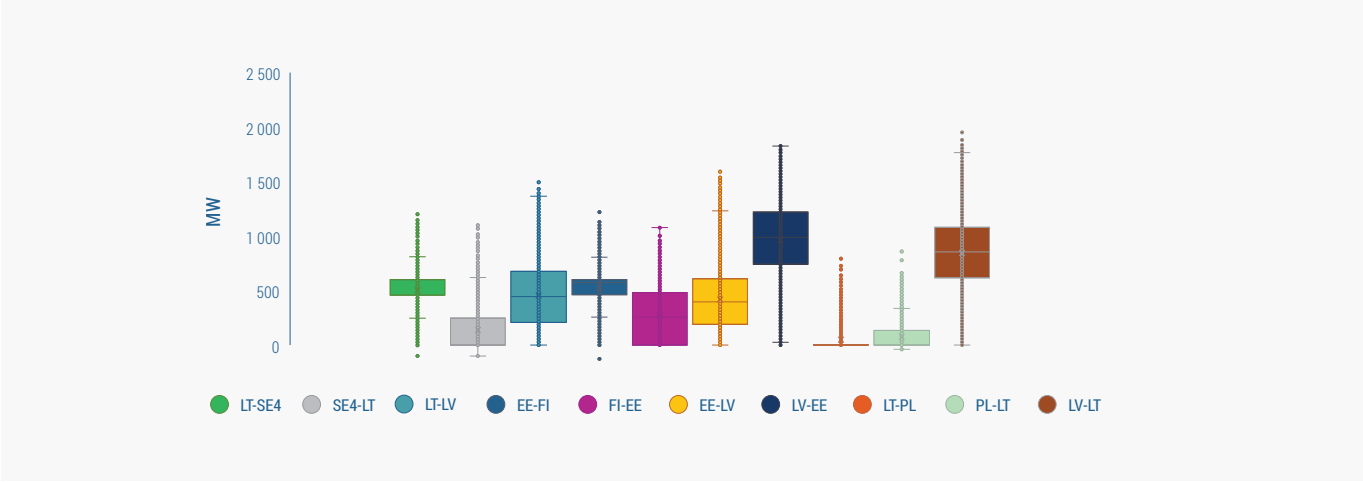


Figure 52. Implicit intraday offered capacities in Baltic CCR bidding zone borders from April 2019 to December 2020[114]

111 Article 20 of the CACM regulation.
112 Source: SDAC Operations Committee – OPSCOM.
113 Source: SDAC Operations Committee – OPSCOM.
114 Source: SIDC / XBID reporting.

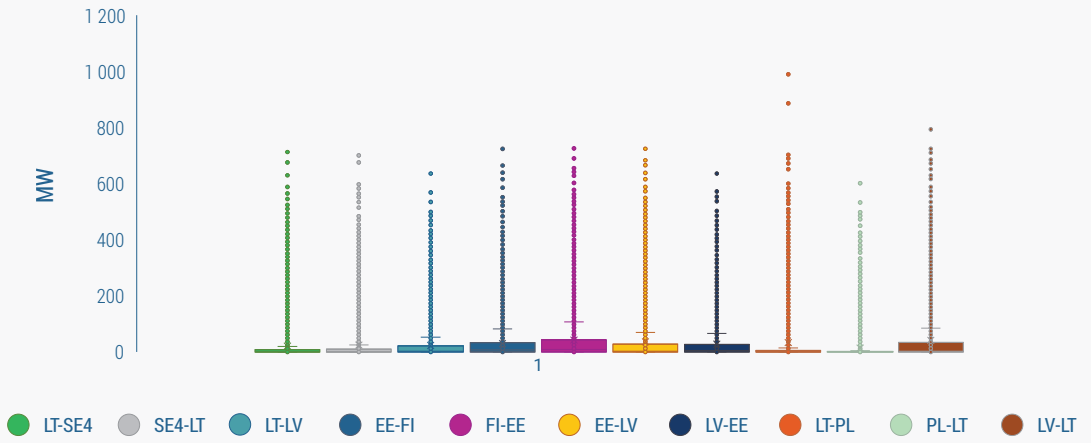


Figure 53. Implicit intraday allocated capacities in Baltic CCR bidding zone borders from April 2019 to December 2020[115]

3.8. South East Europe

The TSOs in the South East Europe (SEE) CCR are ESO (BG), IPTO (GR) and Transelectrica (RO).

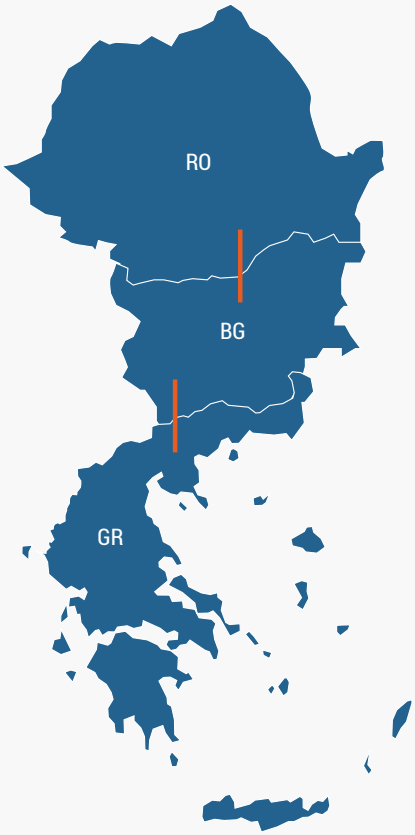


Figure 54. SEE CCR[116]

115 Source: SIDC / XBID reporting.

116 This CCR includes the following bidding zone borders: Greece-Bulgaria (GR-BG) and Bulgaria-Romania (BG-RO).

3.8.1. Capacity calculation and allocation for the short-term

Table 40 and **Table 41** provide an overview of the already accomplished milestones and planned timeline for the implementation of the SEE CCR day-ahead and intraday capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q1 2018	SEE CCR TSOs' submission of the SEE short-term CCM (day-ahead and intraday) to the SEE CCR NRAs
Q2 2019	SEE CCR NRAs approval of the SEE short-term CCM (day-ahead and intraday) submitted by the SEE CCR TSOs
Q2 2020	Establishment of the SEleNe capacity calculation
Q3 2020	SEE CCR TSOs' submission of Version 1 of the SEE short-term CCM (day-ahead and intraday) to the SEE CCR NRAs
Q1 2021	SEE CCR NRAs' approval of the SEE short-term CCM submitted by the SEE CCR TSOs
Q1 2021	Go-live of the SEleNe capacity calculation

Table 40. SEE CCR: closed milesstone(s) for short-term capacity calculation and allocation

Planned milestone(s)	
Quarter	**Description**
Q3 2021	Go-live of the SEE short-term CCM

Table 41. SEE CCR: planned milestone(s) for short-term capacity calculation and allocation

Given that at the time of writing, day-ahead and intraday capacity calculation processes are not implemented in the SEE region, it is expected that the corresponding information for the applicable indicators will be provided in the future.

3.8.2. Capacity calculation and allocation for the long-term

At the time of writing this report, the long-term CCM pursuant to Article 10 of the FCA regulation is in the drafting phase.

Table 42 provides an overview of the already accomplished milestones and planned timeline for the implementation of the SEE CCR long-term capacity calculation processes.

Closed milestone(s)	
Quarter	**Description**
Q3 2019	CCR submission of the SEE long-term CCM to the NRAs
Q3 2019	CCR submission of the long-term Splitting Rules to the NRAs
Q4 2020	NRA approval of the SEE long-term CCM submitted by the CCR
Q4 2020	NRA approval of the long-term Splitting Rules submitted by the CCR
Q1 2023	Go-live of the long-term Splitting Rules
Q1 2023	Go-live of the SEE long-term CCM

Table 42. SEE CCR: closed milestone(s) for long-term capacity calculation and allocation

As the drafting of the SEE CCR's long-term CCM is ongoing, the SEE CCR TSOs cannot currently provide an indication of the future use of long-term indicator(s).

Statistical indicators for the bidding zone borders of South East Europe CCR

Figure 55 shows the offered and allocated long-term capacities during 2019 and 2020 at borders, which will become part of the SEE CCR LTTR CCM. If a border is not shown, no long-term capacity had been offered during the reporting period.

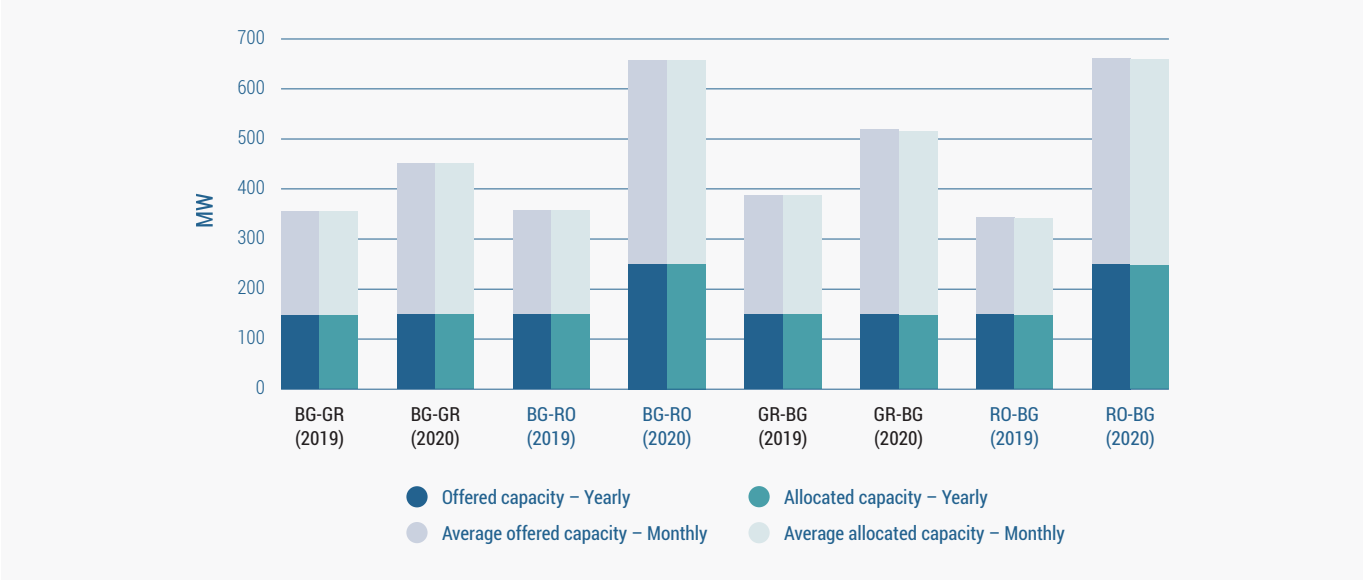


Figure 55. Offered and allocated long-term capacities in SEE CCR bidding zone borders during 2019 and 2020[117]

Figure 56 and **Figure 57** show the offered and allocated intraday capacities during 2019 and 2020 at South Easter Europe CCR internal borders, which will become part of the South Easter Europe CCR Capacity Calculation

117 Source: JAO Publication tool.

Methodology in accordance with CACM regulation[118]. The values are presented by box-plot diagrams to show the distributional characteristics of the data series. During the period covered in this report, the South-Eastern Europe CCR bidding zone borders did not register any offered and/or allocated capacity within the SDAC.

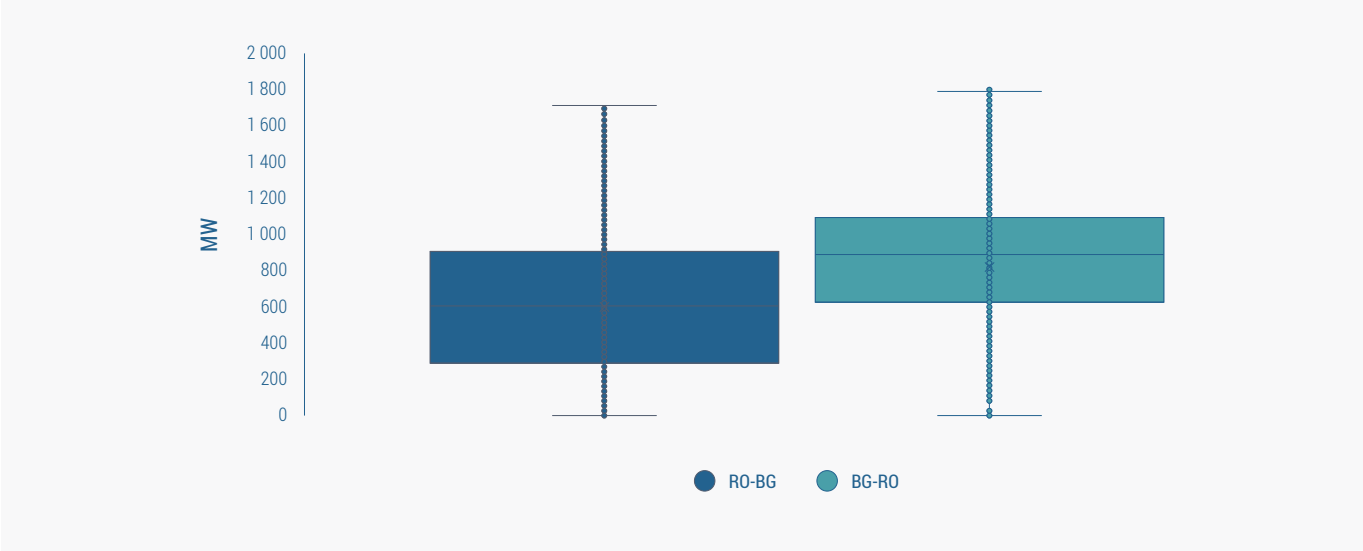


Figure 56. Implicit intraday offered capacities in SEE CCR bidding zone borders from November 2019 to December 2020[119]

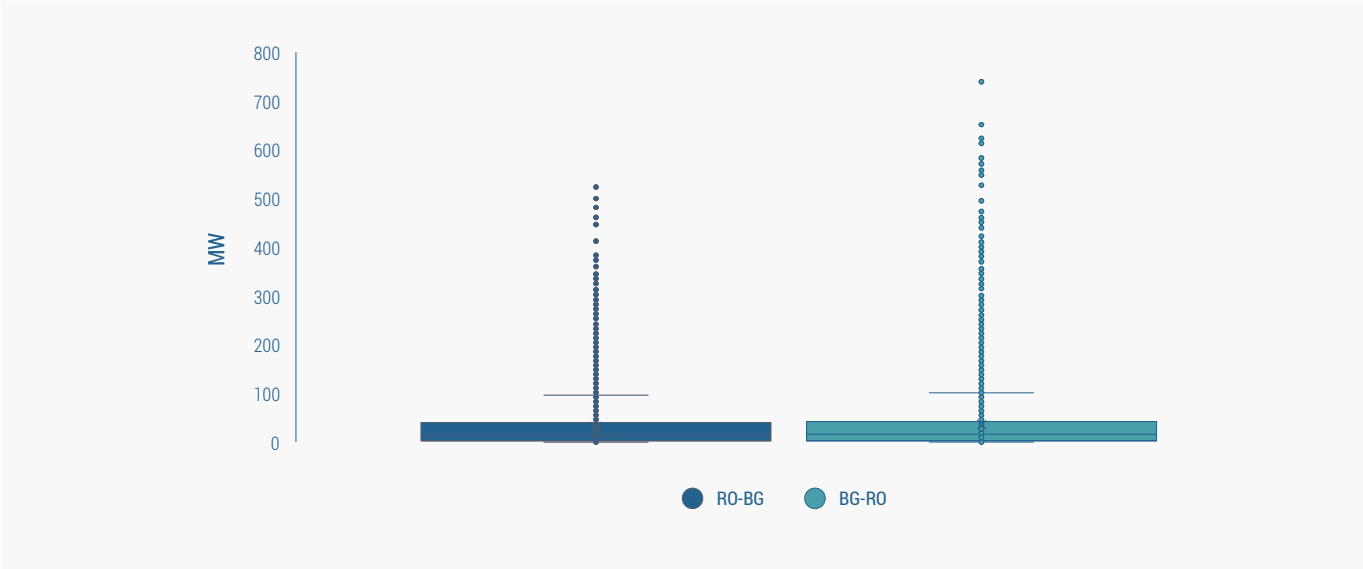
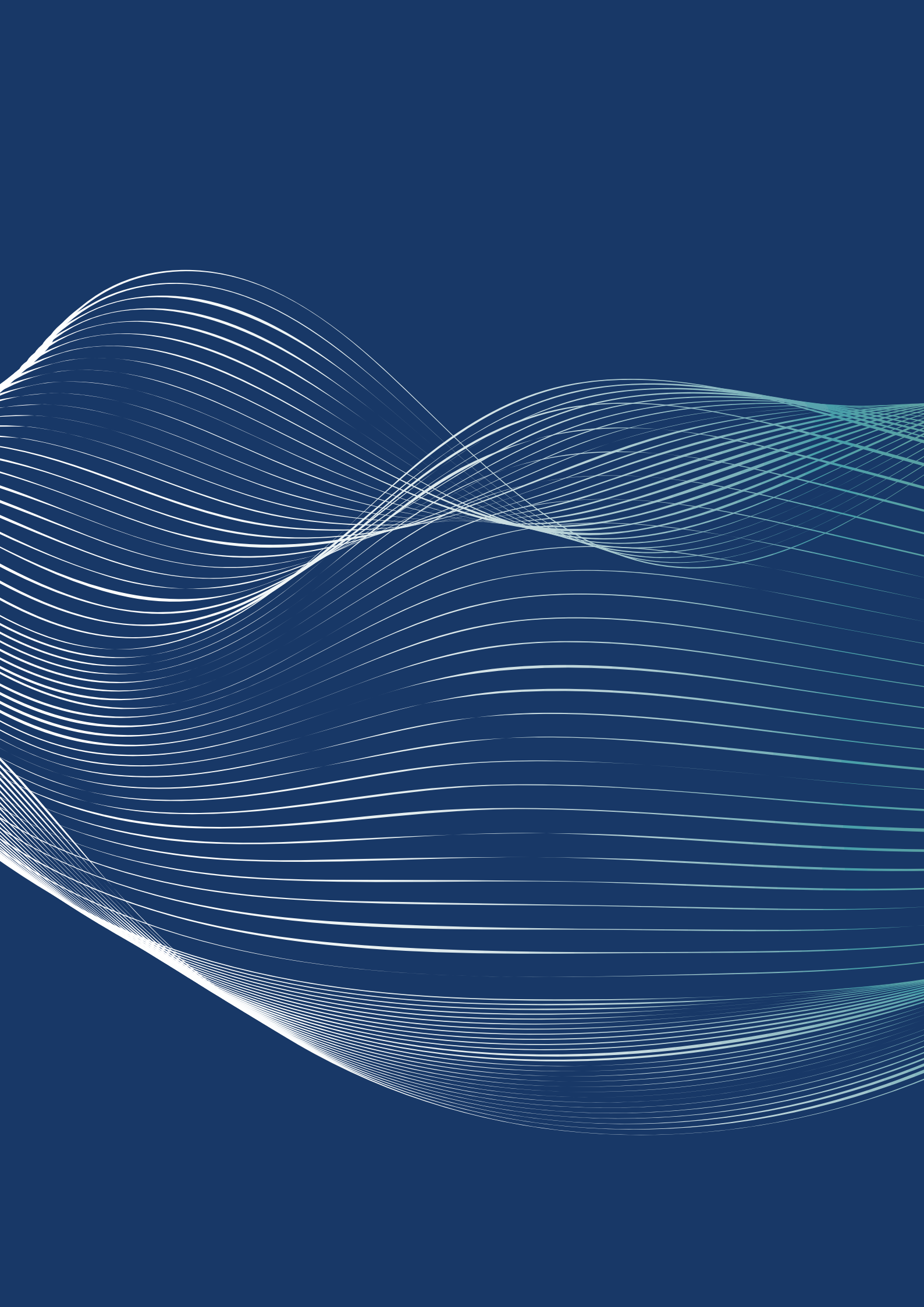


Figure 57. Implicit intraday allocated capacities in SEE CCR bidding zone borders from November 2019 to December 2020[120]

118 Article 20 of CACM regulation.
119 Source: SIDC / XBID reporting.
120 Source: SIDC / XBID reporting.



4. Common Grid Model

This chapter describes the objective, scope and status of the CGM deployment as part of ENTSO-E's CGM Programme. The CGM deployment contains, among others, the Physical Communication Network (PCN) and ENTSO-E's Operational Planning Data Environment (OPDE) Platform, including ENTSO-E's Communication and Connectivity Service Platform (ECCoSP). Short- and long-term capacity calculations and other services will use the CGM building process once all relevant methodologies are approved and implemented.

The transition from delivery to operations – the so-called CGM building process – is facilitated by the CGM Programme, a project led by TSOs and RSCs. The CGM building process will serve as the basis for providing practical services according to the network codes, including short- and long-term capacity calculation, coordinated security analysis, outage planning coordination and short-term adequacy analysis. Once the minimum viable solution of the CGM building process is live, this will enable the migration of the services mentioned above to the Common Grid Model Exchange Standard (CGMES) and ENTSO-E's OPDE Platform.

After the minimum viable solution of the CGM building process has gone live, quality and statistical indicators will be provided in the 'Annual report on regional coordination assessment' under Article 17 of Commission Regulation (EU) 2017/1485 of 2 August 2017, establishing a guideline on electricity transmission system operation. In the meantime, status reports, including statistical and quality indicators, will be provided regularly to relevant stakeholders.

Since 1 February 2020, the United Kingdom (UK) has withdrawn from the European Union (EU) and has therefore become a non-EU country. During the transition period, the EU and the UK negotiated a Trade and Cooperation Agreement, signed on 30 December 2020 that has provisionally applied since 1 January 2021. As discussions about the interpretation and implementation of the Trade and Cooperation Agreement are ongoing, possible implications from the Trade and Cooperation Agreement are not yet considered in this chapter.

4.1. Background and introduction

ENTSO-E's CGM Programme is tasked with facilitating the pan-European exchange of network model data between TSOs and RSCs, as set out by the EU under various network codes:

- Article 64 of the Commission Regulation (EU) 2017/1485 of 2 August 2017, establishing a guideline on electricity transmission system operation;
- Article 17 of the Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management;
- Article 18 of the Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on forward capacity allocation.

The exchange of IGMs and CGMs will ease the cooperation between TSOs and result in an even more secure and cost-efficient pan-European grid.

The CGM Programme is a complex multi-stakeholder and multi-service provider programme responsible for delivering pan-European merged network models in line with the following network code requirements:

- rollout of a pan-European PCN;
- creation of the CGM methodologies stipulated by the various network codes, describing the CGM building process;
- establishment of a standardised structure for IGMs and CGMs;
- establishment of validation rules required to ensure the completeness and quality of IGMs and CGMs;
- development of a data-exchange platform, enabling IGMs and CGMs to be shared between TSOs and RSCs;
- monitoring and checking of deliveries from ENTSO-E, TSOs and RSCs.

Further network code requirements in terms of operational security, operational planning and scheduling, CACM and FCA regulations are managed outside the CGM Programme's scope.

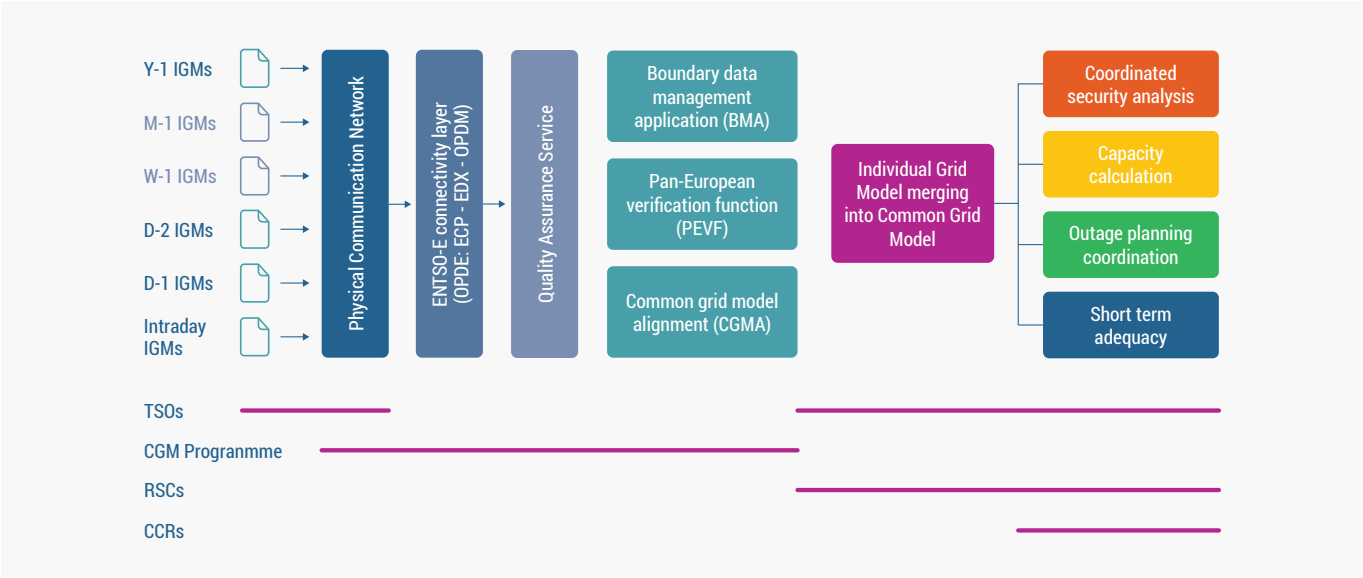


Figure 58. High-level CGM Programme's scope with dependent services[121]

Regardless of whether it is applied in the context of short- or long-term capacity calculation, when using the PCN, ECCoSP, ENTSO-E's OPDE Platform and the CGMES, the CGM building process involves the following steps:

1. contribution of IGMs by TSOs;
2. quality assurance for provided IGMs;
3. alignment of net positions/market data to ensure the pan-European balance of the CGM;
4. addition of the repository of commonly agreed boundaries for adjacent grids;
5. provision of the CGM via the merging of IGMs;
6. quality assurance for provided CGMs.

RSCs merge IGMs provided by TSOs covering time frames spanning from one year before real time to one hour before real time into a pan-European CGM and feed the merged CGM back into the system.

4.2. Status report

The CGM Programme is responsible for launching the minimum viable solution by the end of 2021. This means putting in place an operational CGM building process for TSOs and RSCs using the PCN, ENTSO-E's OPDE Platform, including the ECCoSP, and relevant business applications for secure pan-European data exchange, compliant with security requirements and data quality standards.

During 2020, the Programme reached several critical milestones:

- Sixty-seven per cent of TSOs have been connected to the PCN.
- All relevant application specifications and business documentation have been completed.
- There have been two releases of ENTSO-E's OPDE Platform, including the connection of new applications and updating of existing applications.
- Two upgrades of ENTSO-E's ECCoSP have been completed.
- Service operations have been carried out for ENTSO-E's OPDE Platform.
- Testing of the CGM building process has been carried out with ENTSO-E, TSOs and RSCs.

The CGM Programme is currently transitioning from a delivery phase to live operations. The transition phase will commence at the start of 2021 and will conclude a cutover to live operations at the end of 2021. In 2021, the CGM Programme is focused on several key deliverables and milestones for the transition from programming to operational mode:

- completion of the PCN rollout ;
- delivery of the remaining releases of the OPDE Platform for the go-live of the minimum viable solution;
- completion of the connection between the PEVF Platform and the OPDE;

121 ECP: Energy Communication Platform software; EDX: ENTSO-E Data Exchange software; OPDM: Operational planning data management.

- coordination of readiness activities for the go-live of the minimum viable solution of the CGM building process together with TSOs and RSCs;
- transition from delivery to operationality, supporting further change, maintenance and the operations of the OPDE and PCN;
- alignment with subsequent services outlined in the network codes.

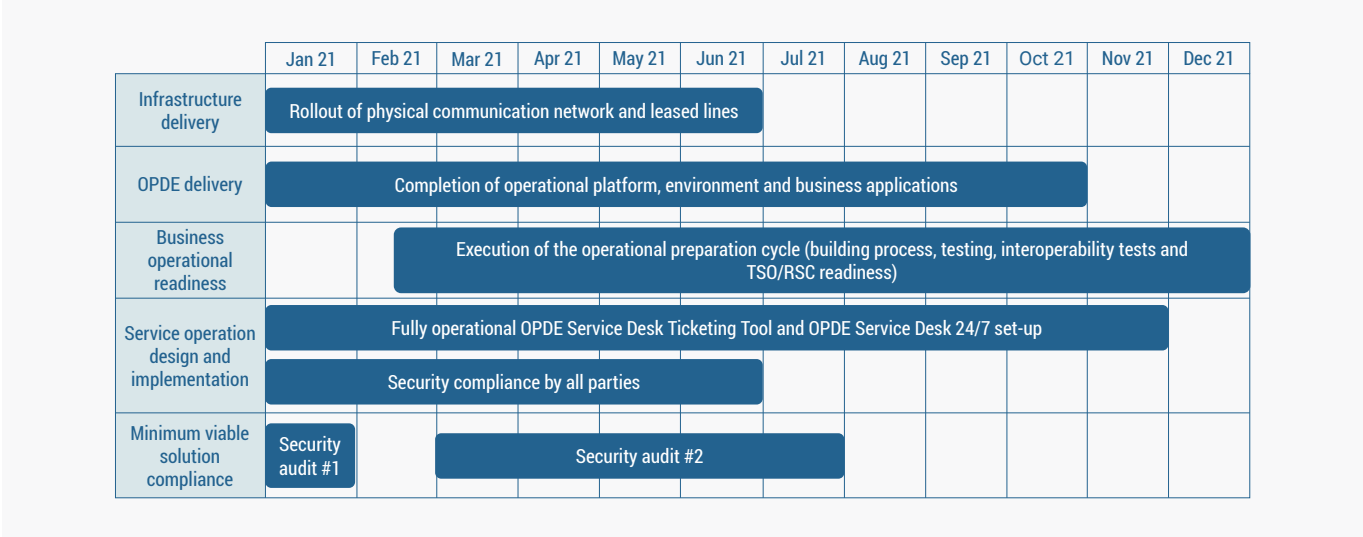


Figure 59. The high-level schedule of the Common Grid Model Programme

The collaboration of ENTSO-E, TSOs and RSCs is vital to successfully implementing the CGM building process as the foundation for a more secure, cleaner and cost-efficient European energy transition. The CGM Programme Team has finalised the detailed scope, schedule and cost baseline for the scheduled go-live of a minimum viable solution at the end of 2021. This includes contingency plans for deliverables on the critical path with mitigation actions; for example, crucial workstreams have been enforced with additional resources, operational preparation cycles have been initiated, and criteria for the go-live of a minimum viable solution have been described in a maturity model.

When the minimum viable solution goes live, an operating model will be in place ensuring continuous operations and further development of ENTSO-E's OPDE. The governance model will ensure that the governance for each component reflects the needs of the associated business processes.

ENTSO-E is working with TSOs and RSCs to develop a pan-European CGM, facilitating a more accurate, reflective and effective data-sharing system. Establishing a brand-new PCN and a state-of-the-art data-exchange environment in a multi-stakeholder and multi-service environment requires:

- gathering of expectations and requirements among all stakeholders and business processes;
- harmonising requirements among all stakeholders and business processes;
- translating requirements to a certain level to enable impact assessment;
- identifying dependencies and possible implications across applications;
- ensuring fit-for-purpose delivery, including a structured testing approach;
- fostering readiness of TSOs and RSCs in terms of operations and security;
- handing over to operations while continuously maintaining existing components;
- establishing a contractual framework facilitating the collaboration of all parties.

4.3. The CGM building process – transition from delivery to operations

The CGM operational preparation phase consists of the building process (executing the end-to-end CGM building process) and interoperability (carrying out the technical verification of the IGMs, CGMs and associated validation rules). The focus of the CGM operational preparation cycles is to build confidence and fluency by running end-to-end CGM processes. Early cycles establish challenging yet achievable levels of activity, goals, and their related

performance targets.These activities increase in frequency and intensity in future cycles. Starting in Cycle 7 (July 2021), operational preparation cycles are designed to mirror the frequency and intensity of live operations, with building process activities occurring seven days a week.

At the time of writing this report, the CGM Programme's operation preparation Cycle 3 has recently been completed. This cycle was conducted in the production environment of ENTSO-E's OPDE. Cycle 3 included the end-to-end CGM building process for one energy delivery day per week for the last two weeks in the month. In Cycle 3, 53% of TSOs and 80% of RSCs participated in the building process activities. The metrics for Cycle 3, shown below, are formulated considering all TSOs and RSCs expected to participate in the CGM live operations.

1. 43% of IGMs submitted
2. 33% of IGMs published
3. 43% of pre-processing data submitted
4. 100% of CGM alignment data sets published
5. 100% of PEVF data sets created
6. 100% of PEVF data sets published
7. 100% of CGMs submitted
8. 100% of CGMs published
9. 26% of IGMs included in CGMs.

The statistical and quality indicators are a snapshot from a very early stage of the preparation cycles. From these results, we observe a positive trend of increasing participation by TSOs and satisfactory results from the service providers and RSCs' activities. The operational preparation Cycle 3 shows good progress and is one further step towards live operations.

The outlined statistical and quality indicators are in line with the indicators agreed by all TSOs according to the requirements in the network codes and CGM methodologies.

4.4. The journey towards an integrated and harmonised service operation

The CGM Programme's deliverables enable TSOs and RSCs to produce consistent and synchronised calculations using harmonised pan-European CGM data. The CGM building process and all dependent services will be operated using:

- the CGMES as a data format;
- ENTSO-E's OPDE for data exchange.

As implementation schedules vary across services and regions, a phased approach is:

- putting each service into operation as quickly as possible;
- allowing flexible adaptation to a changing environment;
- enabling a profound integration of all streams.

The phased approach is structured around three major phases:

1. Delivery of the CGM building process and dependent services. The CGMES and ENTSO-E's OPDE will be used wherever possible. Some services may be based on different data formats and/or different communication means.
2. Migration or implementation of services to the CGMES and/or ENTSO-E's OPDE.
3. Integrated operation of the CGM building process and dependent services based on the CGMES and ENTSO-E's OPDE.

The CGM and associated services will increase efficiency in system operations, allow the reduction of network costs by minimising the risk of wide-ranging events, strengthens the security of supply and maximises the availability of transmission capacity to support market efficiency.

4.5. Beyond the minimum viable solution go-live of the CGM building process

The CGM building process serves as the foundation for the harmonised and integrated operation of the following services:

- short and long-term capacity calculation at the regional level;
- outage planning coordination at the cross-regional and regional level;
- short-term adequacy forecasts at the cross-regional and regional level;
- coordinated security analysis at the pan-European and regional level.

To exchange data via ENTSO-E's OPDE, said data should be compliant with the CGMES. Given that using the CGMES is a pre-requisite for migrating services to ENTSO-E's OPDE, the planned service operation dates based on the CGMES are outlined in **Table 43.**

The information in **Table 43** on the status of CGMES implementation within services is based on data provided by each service/region, which was gathered in a survey conducted in November 2020. Updated information can be expected in May 2021 as the process of ascertaining the relevant implementation status is carried out twice a year, in cooperation with the CCRs.

Service	Scope	Total	2021	2022	2023	2024	2025	Beyond/Unknown
Capacity calculation[122]	Intraday	10	2	0	1	0	0	7
	Day-ahead	10	3	2	0	1	0	4
	Long-term	2	0	0	0	0	0	2
Outage planning coordination[123]	Cross-regional	1	0	1	0	0	0	0
	Regional	1	0	1	0	0	0	0
Short-term adequacy[124]	Cross-regional	1	0	1	0	0	0	0
	Regional	1	0	1	0	0	0	0
Coordinated security analysis[125]	Cross-regional	1	0	0	0	0	1	0
	Regional	10	1	2	0	1	3	3

Table 43. Planned dates for compliance with the CGMES by service, from November 2020

In general, most services are planning to implement CGMES-based services and integrate ENTSO-E's OPDE data exchange between 2021 and 2025. Some services have planned their initial go-live using the CGMES, while others are planning to migrate to the CGMES from different data formats. Furthermore, some services have planned their integration of ENTSO-E's OPDE-based data exchange to coincide with integrating the CGMES, while others are planning to migrate to the CGMES first.

122 For the intraday Capacity Calculation (CC) service, information on the implementation plan was not available for most of the regions at the time of writing this report. For the day-ahead capacity calculation service, the majority of regions have already planned to implement or migrate to a CGMES-based service by 2025. For the long-term capacity calculation service, it was identified that two regions will design their services exclusively using grid models, but they had no, however clear plan for implementing the CGMES. For the rest of the regions, it is currently assumed that the long-term capacity calculation service will be delivered without the need for grid models (for example, a statistical approach). However, this will be confirmed during the update of the report in May 2021.

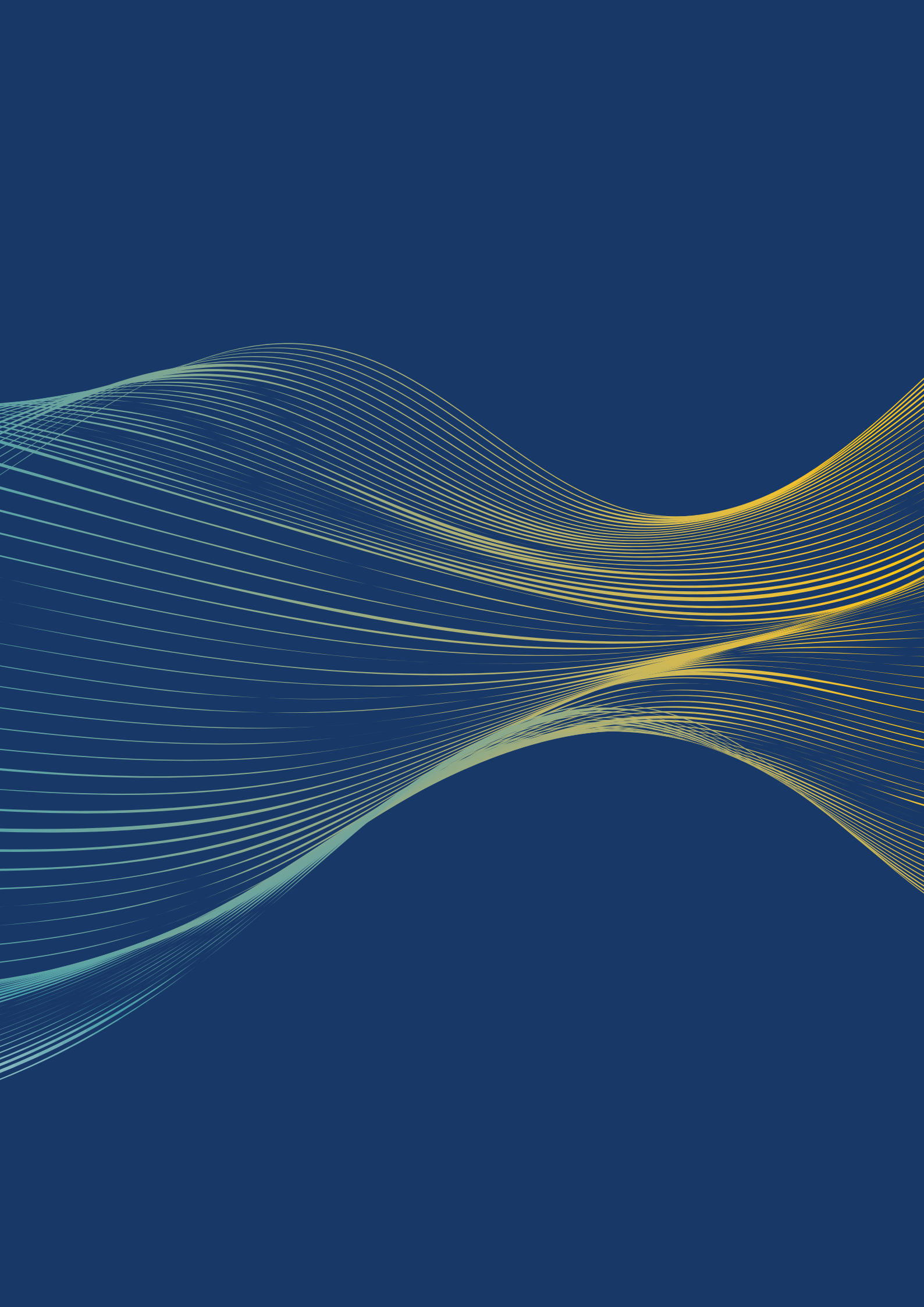
123 It should be noted that the Regional Outage Planning Coordination service shall be implemented in all the regions using common principles and following the same CGMES-compliant process design, since it was designed under scope of the ENTSO-E RSC Project.

124 It should be noted that the Regional Short-Term Adequacy forecasts service shall be implemented in all the regions using common principles and following the same CGMES-compliant process design, since it was designed under scope of the ENTSO-E RSC Project.

125 Cross-regional Coordinated Security Analysis (CSA) pursuant to Article 75 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation can be implemented in its full scope only after the regional implementation (per Article 76 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation) has been finalised in all the regions.

Drafting team:

Haider, Ali (Fingrid), Lin, Milda (Litgrid), Schrade, Marius (50Hertz), Kröger, Kilian (Amprion), De la Cruz, Rubén (REE), Morollón Castro, Gonzalo (ENTSO-E).



Annexes

Annex I – Legal references and requirements

ENTSO-E is required to draft a report on capacity calculation and allocation and to submit it to ACER, the Agency for the Cooperation of Energy regulators, in line with Articles 82(2)(b) and 31(1) of Commission Regulation (EU) 2015/1222 of 24 July 2015, establishing a guideline on capacity allocation and congestion management (hereafter the "CACM regulation") and Articles 26 and 63(1)(c) of Commission Regulation (EU) 2016/1719 of 26 September 2016, establishing a guideline on forward capacity allocation (hereafter "the FCA regulation").

This report ensures the fulfilment of ENTSO-E reporting obligations as outlined in Articles 31(2) and 82(2)(b) of the CACM regulation and Articles 26(2) and 63(1)(c) of the FCA regulation.

In two letters on 20 and 22 January 2021 ACER requested ENTSO-E to deliver the CACM and FCA report on capacity calculation and allocation no later than 3 September 2021. Following the most recent monitoring plans, submitted in May 2018 to ACER, the consequent reports will be submitted together with a similar report under CACM regulation, when requested by ACER.

Annex II – Glossary

50Hertz	50Hertz Transmission GmbH (1 of the 4 German TSOs)
ACER	Agency for the Cooperation of Energy Regulators
AHC	Advanced hybrid coupling
AMR	Adjustment for the minimum remaining available margin
APG	Austrian Power Grid AG (Austrian TSO)
Amprion	Amprion GmbH (1 of the 4 German TSOs)
AT	Austria
ATC	Available transfer capability
AST	AS Augstsprieguma tikls (Latvian TSO)
Baltic Cable	Baltic Cable AB
BE	Belgium
BG	Bulgaria
BRELL	Belarus, Russia, Estonia, Latvia and Lithuania
BZ	Bidding Zone
BZB	Bidding zone border
CACM	Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management
CGES	Crnogorski Elektroprenosni Sistem AD (Montenegrin TSO)
CC	Capacity calculation
CCM	Capacity calculation methodology
CCR	Capacity calculation region
CCC	Capacity calculation coordinator
EPS	EPS a.s. (Czech TSO)
CGM	Common grid model
CGMA	Common grid model alignment
CGMES	Common grid model exchange standard
CGMM	Common grid model methodology
CH	Switzerland
CNE	Critical Network Element
CNEC	Critical network element and contingency means a CNE associated with a contingency used in capacity calculation. For the purpose of this methodology, the term CNEC also cover the case where a CNE is used in capacity calculation without a specified contingency
CNOR	Central-Northern (Italian bidding zone)
cNTC	Coordinated net transmission capacity
CREOS	Creos Luxembourg SA (Luxembourgish TSO)
CSUD	Central-South (Italian bidding zone)
CZ	Czech Republic
CZC	Cross-zonal capacity
D-1	Day before electricity delivery
D-2	Day two-days before electricity delivery
DA	Day-ahead
DC	Direct current
DE	Germany
DK	Denmark

ECCoSP	European and Digital Platform
EE	Estonia
Elia	Elia Transmission System Operator SA (Belgian TSO)
ENTSO-E	European Network of Transmission System Operators for Electricity
Energinet	Energinet Eltransmission A/S (Danish TSO)
Elering	Elering AS (Estonian TSO)
ELES	ELES, d.o.o. (Slovenian TSO)
ESO	Electroenergien Sistemen Operator EAD (Bulgarian TSO)
EMS	Akcionarsko dru□tvo Elektromre□a Srbije (Serbian TSO)
EU	European Union
FB	Flow-based
FCA	Forward capacity allocation
FCR	Frequency containment reserve
FI	Finland
Fingrid	Fingrid Oyj (Finish TSO)
FOGN	Foggia (Italian bidding zone)
FR	France
FRM	Flow Reliability Margin
GR	Greece
GRIT	Greece – Italy
HR	Croatia
HOPS	Croatian Transmission System Operator Ltd
HU	Hungary
IPTO	Independent Power Transmission Operator SA (Greece TSO)
ID	Intraday
IGM	Individual grid model
IOP	Interoperability test
IT	Italy
JAO	Joint Allocation Office
Litgrid	Litgrid AB (Lithuanian TSO)
LT	Lithuania
LU	Luxembourg
LV	Latvia
MAVIR	Magyar Villamosenergia-ipari Átviteli Rendszerirányító Zártkör□en M□köd□ Részvénytársaság (Hungarian TSO)
MC	Market coupling
MEPSO	Macedonian Transmission System Operator AD
MTU	Market Time Unit
MW	Megawatt
MWh	Megawatt hour
NEMO	Nominated Electricity Market Operator
NL	Netherlands
NORD	Northern (Italian bidding zone)
NOS BiH	Nezavisni Operator Sustava u Bosni i Hercegovini (Bosnia and Herzegovina TSO)
NTC	Network transmisión capacity
NRA	National regulatory authority

OPC	Outage planning coordination
OPSCOM	Operational Committee
OPDE	Operational planning data environment
OPDM	Operational planning data management
OST	OST sh.a – Albanian Transmission System Operator
PEVF	Pan-European verification platform function
PL	Poland
PPD	Pre- and post-coupling data
PSE	Polskie Sieci Elektroenergetyczne (Polish TSO)
Q1	First quarter
Q2	Second quarter
Q3	Third quarter
Q4	Fourth quarter
REE	Red Eléctrica de España SAU (Spanish TSO)
REN	Rede Eléctrica Nacional, SA (Portuguese TSO)
RCC	Regional Coordination Centre
RM	Reliability margin
RO	Romania
ROSN	Rossano (Italian bidding zone)
RTE	Réseau de Transport d'Electricité (French TSO)
RSC	Regional security coordinator
SARD	Sardinia (Italian bidding zone)
SE	Sweden
SEE	South East Europe
SEPS	Slovenská elektriza□ná prenosová sústava, a.s. (Slovakian TSO)
SI	Slovenia
SICI	Sicily (Italian bidding zone)
SONI	System Operator for Northern Ireland Ltd
SK	Slovakia
Statnett	Statnett SF (Norway TSO)
SUD	Southern (Italian bidding zone)
Svenska	Svenska kraftnät (Swedish TSO)
SWE	South West Europe
Swissgrid	Swissgrid ag (Swiss TSO)
TenneT NL	TenneT TSO B.V. (Dutch TSO)
TenneT DE	TenneT TSO GmbH (1 out of 4 German TSOs)
Terna	Rete Elettrica Nazionale SpA (Italian TSO)
TR	Transmission right
Transelectrica	National Power Grid Company Transelectrica SA (Romanian TSO)
TransnetBW	TransnetBW GmbH (1 of the 4 German TSOs)
TSO	Transmission System Operator

Annex III – List of Figures

Annex IV – List of Tables