Explanatory Note to the balancing timeframe capacity calculation methodology of the SWE capacity calculation region

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Contents

1. Introduction

This technical document sets out the main principles for the coordinated capacity calculation methodology for the balancing timeframe applied in the South-Western Europe capacity calculation region (SWE CCR), being developed in accordance with article 37(3) of the Commission Regulation (EU) 2017/2015 establishing a guideline on electricity balancing (hereafter referred to as the 'EB Regulation').

The EB Regulation proposes the application of a cross zonal capacity calculation methodology within the balancing timeframe for the exchange of balancing energy and for operating the imbalance netting process (hereafter referred to as 'BTCCM').

The EB regulations introduces the balancing capacity calculation method in article 37 (3) and foresees this CCR Capacity Calculation Methodology for the Balancing time frame to be submitted by the end of 2022.

The participating TSOs for this calculation are RE (ES), REN (PT) and RTE (FR), and the following borders are considered: France – Spain and Spain – Portugal.

The aim of this explanatory document is to provide additional information with regard to the BTCCM and how the SWE CCR will provide capacities for Balancing Energy/Platforms/Products.

2. High level Business process

2.1. Interactions with other methodologies

2.1.1. Interaction with IDCC

BTCC methodology shall be consistent with the cross-zonal capacity calculation methodology applied in the intraday timeframe according to Article 37(3) of EB Regulation, and thus defines the basic principles. Therefore, due to the specificities of the SWE CCR, SWE TSOs will use coordinated NTC approach to determine the cross-border capacities for each border of the SWE CCR.

Interaction with ROSC

The followings outputs of the latest SWE ROSC (Regional Operational Security Coordination) process will be used to calculate the BT NTC:

- All preventive remedial actions (RAs) as determined and validated during this process.
- All triggered curative remedial actions as determined and validated during this process.
- Merged common grid model (CGM) with the validated remedial actions.

2.1.2. Interaction with SIDC

SIDC provides the ID allocation results as an input for the BTCC process.

2.1.3. Interaction with balancing platforms

The BTCC process will deliver the cross-zonal capacities that can be allocated for the different balancing processes: TERRE (RR process), MARI (mFRR process), PICASSO

(aFRR) process) and IGCC (IN process). Thus, the TSOs will send the NTC values to the Capacity Management Module (CMM).

2.2. Overview of the BTCC process

The high level BTCC process is shown in Figure 1. The major challenge to be tackled is the window of time available to perform the BTCC process within balancing timeframe. Thus, H-60 min is the Intraday Cross-Zonal Gate Closure Time (ID CZGCT), while the capacity provision deadline for TERRE is H-42 min (and H-30 min for MARI/PICASSO/IN). So, it means the TERRE platform defines 18 min to perform the BTCC process and update NTC value.

The basic principle of the process consists in re-using the merged CGM provided by RCC from the latest SWE ROSC and with the validated RAs. Then, the BTCC shall be performed having as starting point of exchange the allocation results after the ID CZGCT. To do this, the CGM is adjusted to reflect the allocation results as soon as they are available.

This approach is flexible and scalable as e.g., an increase of ROSC runs could also allow more updates of BTCC, which results in the application of more recent grid models.

Additionally, and during the computation phase the above-mentioned remedial actions can be re-assessed if needed and even further remedial actions could be included in a coordinated way by means of the CRAC[1] files provided by TSOs.

Because of the BTCC process is carried out close to Real Time, only RAs with very short activation time would be suitable for BTCC and consequently a limited number of RAs could be considered in BTCC to ensure the operational security.

Due to time constraints, the process requires a simplified methodology for TSOs validation for those situations in which operational security could be endangered.

Thus, before capacity calculation is performed, the TSOs may send to the RCC reasoned NTC limits which final NTC should respect to assure grid security. Thus, maximum efficiency can be created while offering optimal capacity and operational security.

Finally, the validated NTC is sent to the CMM (balancing platforms).

The calculation will be performed 24 times a day, taking into account the ID CZGCT.

Under some exceptional situations, SWE TSO may ask for an 'on request common grid model update' to perform the calculation when SWE TSOs estimate an important deviation could ocurr between the ROSC CGM and the real time (i.e. relevant outage not considered in ROSC). In case of activating it, new merged CGM will be built based on TSO's IGMs updates. This ad-hoc sub-process is shown with blue colour in Figure 1.

[1] CRAC means **C**ontingency list, **R**emedial **A**ctions and Additional **C**onstraints. The CRAC file defines contingencies (Contingency - Co) and Critical elements (Critical Network Element - CNE) that are studied in the security assessment as well as the Remedial Actions (RA) that TSOs might apply to cope with security violations.

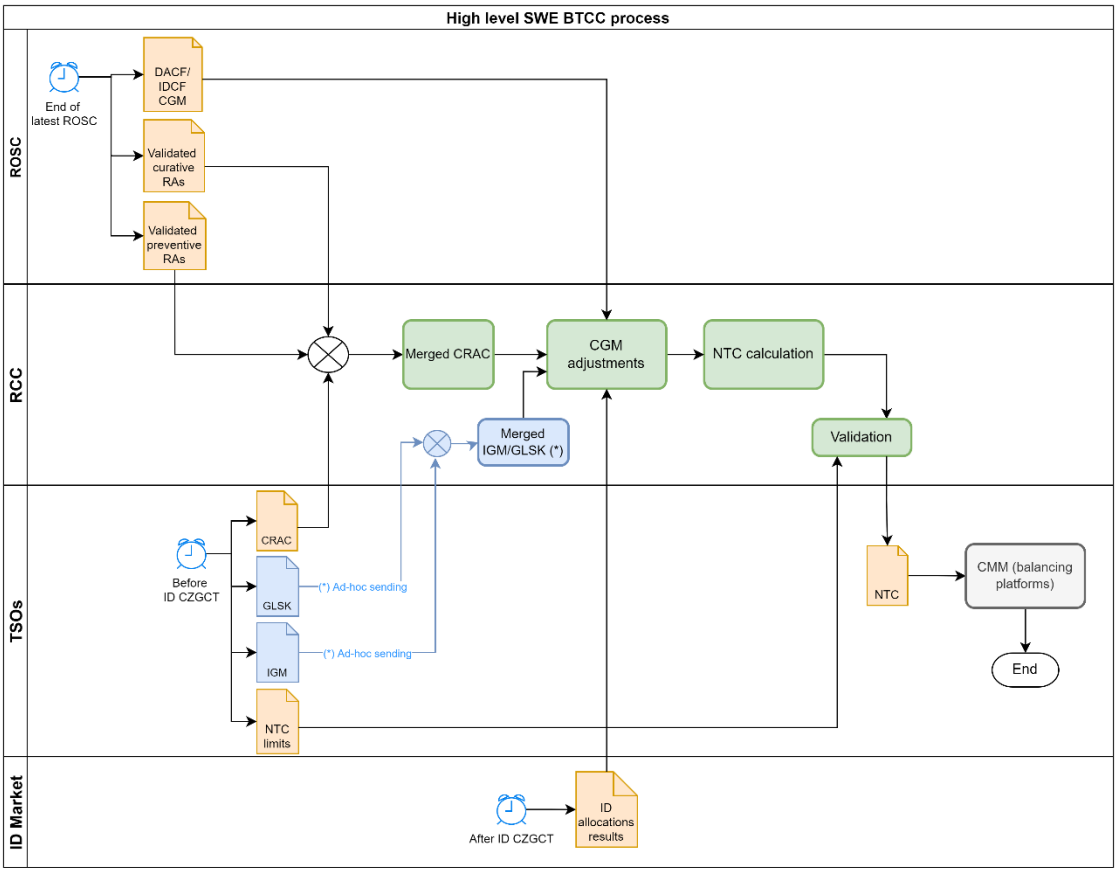


FIGURE 1. HIGH LEVEL BTCC PROCESS

3. Detailed description

3.1. Inputs

3.1.1. Methodologies for operational security limits

According to Article 6 of the proposal, SWE TSOs shall only monitor the operational security limits and contingencies on network elements significantly influenced by cross-zonal power exchanges.

3.1.1.1. Critical network elements and contingencies

A Critical Network Element (CNE) is a network element either within a bidding zone or between bidding zones monitored during the capacity calculation process. They are determined by each SWE TSO for its own network according to agreed rules, described in Article 6.

The CNECs are defined by:

- A CNE: a line or a transformer whose flow is significantly impacted by cross-border exchanges; a node whose voltage is significantly impacted by cross-border exchanges; a line whose voltage phase angle difference is significantly impacted by cross-border exchanges after its trip.
- An “operational situation”: base case (N regime) or contingency cases (N-1, N-2).

A contingency is defined as the trip of one single or several network elements that cannot be predicted in advance. A scheduled outage is not a contingency. The normal type of contingency comprises the loss of a single element, which can be:

- a line,
- a tie-line,
- a DC link,
- a generation unit,
- distributed generation of a relevant size like a clustered wind farm, cogeneration, etc.,
- a transformer (including Phase Shifter Transformers),
- a large voltage compensation installation.

Contingencies situation could result from the combined loss of several elements.

3.1.1.2. Definition of operational security limits

- Maximum permanent and temporary current on a Critical Branch: The maximum permanent admissible current/power means the maximum loading that can be sustained on a transmission line, cable or transformer for an unlimited duration without risk to the equipment.

  The temporary current/power limit means the maximum loading that can be sustained for a limited duration without risk to the equipment (e.g. 115% of permanent physical limit can be accepted during 20 minutes). Each individual TSO is responsible for deciding which values (permanent or temporary limit and duration of each overload) should be used.

  As thermal limits and protection settings can vary in function of weather conditions, different values are calculated and set for the different seasons within a year. These values can be also adapted by the concerned TSO if a specific weather condition is forecasted to highly deviate from the seasonal values.

- Maximum/minimum voltage on a node of the network: if the voltage on a node is significantly impacted by cross-border exchanges, the voltage on this element shall be monitored in the capacity calculation.
  Each TSO shall specify the voltage limits for each element of its transmission system.

- Voltage Phase Angles Differences: Following the opening or the outage of tie-lines a manual reclosure may be refused by Parallel Switching Devices (PSDs) in case of voltage phase angle difference exceeding the pre-set threshold of the device.
  The setting of the threshold depends on operational conditions in this respective area of the grid and are often chosen around 30^{o}.

3.1.2. Generation Load Shift Key (GLSK)

3.1.2.1. The proportional shift

This shift methodology will be implemented in RTE control area. This choice is mainly related to the fact that generation in France is composed at 75% by nuclear power that do not vary following a merit order. Indeed the French electricity market being a portfolio market, the merit order is not geographically relevant. Thus a proportional representation of the generation variation, based on RTE's best estimate of the initial generation profile, ensure the best modelling of the French market.

3.1.2.2. The merit order shift

This kind of shift methodology will be implemented in RE and REN control areas.

The main reason for this choice is the fact that both electrical systems have a high level of RES generation installed. Those generators as well as the conventional generation are geographically located in different areas of the countries, then for different generation profiles we get different power flows in the grid elements and consequently different stress areas in the systems with potential impact in the NTC calculations. Some examples:

- If the wind production is high the marginal production could be reduced;
- If the winter is wet the marginal price of hydro power-plants could be lower than the marginal price of thermal power-plants, and vice-versa for dry seasons.
- Depending on the primary sources' prices, the market behaviour will be different and affect the location of the production.

3.2. TRM

According to Article 5 of the proposal, the reliability margin (TRM) shall be consistent with the cross-zonal capacity calculation methodology applied in the intraday timeframe established under CACM Regulation and based on the combination of:

a) unintended deviations of physical electricity flows within a market time unit caused by the adjustment of electricity flows within and between control areas, to maintain a constant frequency;
b) uncertainties which could affect capacity calculation and which could occur between the balancing capacity calculation time-frame and real time, for the market time unit being considered.

After the studies performed in SWE CCR for the Intraday capacity calculation timeframe, the TRM shall be a fixed value and calculated as follows:

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

and 10% of the TTC value, covering the uncertainties of the part of the reliability margin.

3.3. Remedial Action

During coordinated NTC calculation SWE TSOs will take into account Remedial Actions (RAs). The general purpose of the application of RAs is to maintain the transmission system within the operational security limits during the capacity calculation process, where maximum power exchanges are reached, with the subsequent benefit of the market.

A RA can be:

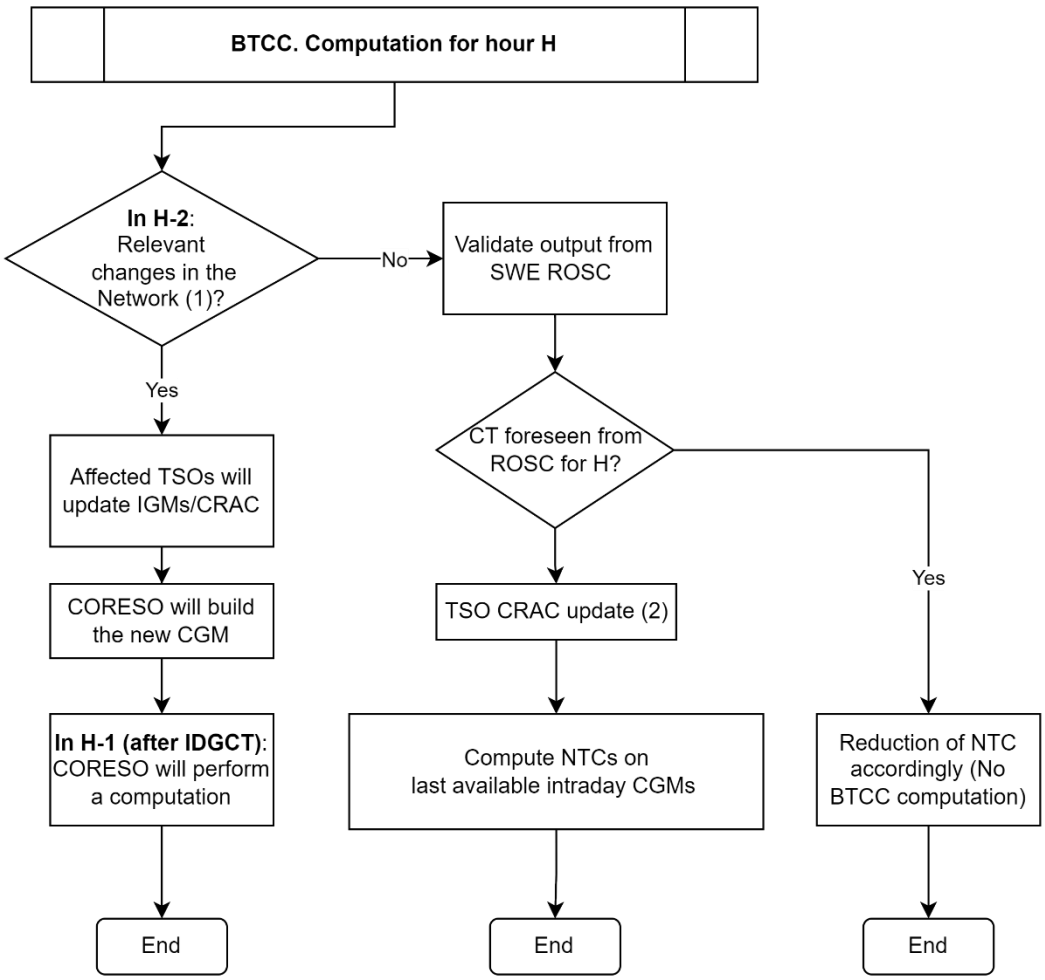
- Changing the tap position of a phase shifting transformer (PST),
- Topological measure: opening or closing of one or more line(s), cable(s), transformer(s), bus bar coupler(s) or switching of one or more network element(s) from one bus bar to another,
- Change of generator in-feed or load,
- Change the flow in the HVDC links France-Spain: use of the modulation modules,
- Change the flow in a line using a FACTS (flexible alternating current transmission system),
- Change the voltage on a node by activating/deactivating reactance(s) or capacitor(s).

The BTCC process is carried out close to Real Time. Therefore, only RAs with very short activation time would be suitable for BTCC and consequently a limited number of RAs could be considered in BTCC. That is why it is chosen to use ROSC already agreed remedial actions during the latest ROSC processes as starting point of the computation.

3.4. Capacity calculation approach

Due to the specificities of the SWE CCR, SWE TSOs will use coordinated NTC approach to determine the cross-border capacities for each border of the SWE CCR. An independent value will be determined for each MTU of the day.

The Figure 2 shows the diagram of the NTC computation approach used.



(1) In comparison with ROSC CGMs. Only in case of any TSO request
(2) RAs available for operators in balancing timeframe and agreed by TSOs

FIGURE 2. NTC COMPUTATION APPROACH

It is based on a computation which aims to find the higher secure capacity based on the inputs provided by the TSOs and with the following features:

- In case countertrading (CT) is proposed as remedial action by ROSC process, no BTCC computation will be done and the TTC value will respect the ROSC output.
- Otherwise, the algorithm determines higher exchange which is safe after the occurrence of all the monitored contingencies, applying available remedial actions when necessary.

Additionally, SWE TSO may ask for an 'on request common grid model update' to perform the calculation. In case of activating it, new merged CGM will be built based on TSO's IGMs updates.

As there is a very limited time to perform the process, the prioritization will be to calculate a NTC of each border in the direction of Intra-Day cross-zonal schedules after ID CZGT. However, for those cases in which the IT process is fast enough, the NTC value of the other direction could be provided too.

3.5. TSO validation

According to Article 10 of the proposal, the TSOs of SWE Region should validate the cross-zonal capacities calculated by the RCC of the SWE Region. As mentioned before, due to the BTCC process is carried out very close to real time, the process requires a simplified methodology for TSOs validation for those situations in which operational security could be endangered.

To do that, SWE TSOs have decided to send NTC limits at the begininning of the process. In this way, RCC can validate the proposed NTC by itself whithout having to send it to TSOs and waiting for their answers. Thus, the validation phase become simpler and faster, getting that the RCC send the final NTC to TSOs in just one-way communication.

As it's mentioned in the Article, SWE TSO may send NTC limits in advance and only based on the following reasons:

- dynamic behaviour of the grid;
- unplanned outage not considered in the used CGM;
- incomplete input;
- lack of upwards or downwards reserve.

4. Fallback procedure

In case of suffering from any issue during the BTCC process (missing input data, corrupted data, IT issues, any other failure,...) which prevent obtaining results, TSOs shall use the last published NTC from the previous regional coordinated capacity calculation processes.

5. Publication of data and reporting

This article 12 details the data to be published by SWE TSOs related to the calculation and validation process.

The objective of this article is to deliver to the market participants the data related with capacity calculation process in the shortest possible period.

The disclosure of this data will use the standard channels for delivery of information.

6. Publication and Implementation of the BTCC methodology

In this article, SWE TSOs inform of the roadmap implementation of the new process.