SWE D-2 Capacity Calculation Methodology

WORKSHOP

05/07/2017

Agenda

1. Context
2. Guideline on Capacity Calculation and Congestion Management (CACM Regulation)
3. Capacity calculation methodology for the day-ahead and intraday

1. Legal Context

- Approval of CACM Regulation on 24th July 2015
- Approval of Capacity Calculation Regions on 17th November 2016
- Consultation of the Capacity Calculation Methodology [Article 12 CACM Regulation]:
  - 14 June – 14 July
- Proposal of Capacity Calculation Methodology [Article 20(2) CACM Regulation]:
  - Deadline: 17th September 2017 (10 months after CCRs approval)

1 - SWE CCR Context

COMMISSION DE RÉGULATION DE L'ÉNERGIE

Rte

CNMC
COMISIÓN NACIONAL DE LOS MERCADOS Y LA COMPETENCIA

RED ELÉCTRICA DE ESPAÑA

ERSE
ENTIDADE REGULADORA DOS SERVIÇOS ENERGÉTICOS

REN

Guideline on Capacity Calculation and Congestion Management (CACM Regulation)

- Article 21 (1)
- Article 2 (8) and 20 (7)
- Article 14
- Article 2 (11)
- Article 3

1. Article 21 (1)

- The proposal for a common capacity calculation methodology for a capacity calculation region determined in accordance with Article 20(2) shall include at least the following items for each capacity calculation time-frame:

(a) methodologies for the calculation of the inputs to capacity calculation, which shall include the following parameters:

(i) a methodology for determining the **reliability margin** in accordance with Article 22;

(ii) the methodologies for determining **operational security limits, contingencies relevant to capacity calculation and allocation constraints** that may be applied in accordance with Article 23;

(iii) the methodology for determining the **generation shift keys** in accordance with Article 24;

(iv) the methodology for determining **remedial actions** to be considered in capacity calculation in accordance with Article 25.

1. Article 21 (1)

(b) a detailed description of the capacity calculation approach which shall include the following:

(i) a **mathematical description** of the applied capacity calculation approach with different capacity calculation inputs;

(ii) **rules for avoiding undue discrimination between internal and cross-zonal exchanges** to ensure compliance with point 1.7 of Annex I to Regulation (EC) No 714/2009;

(iii) rules for taking into account, where appropriate, **previously allocated cross-zonal capacity**;

(iv) rules on the adjustment of power flows on critical network elements or of cross-zonal capacity due to remedial actions in accordance with Article 25;

(v) for the flow-based approach, a mathematical description of the calculation of power transfer distribution factors and of the calculation of available margins on critical network elements;

(vi) for **the coordinated net transmission capacity approach**, **the rules for calculating cross-zonal capacity**, including the rules for efficiently sharing the power flow capabilities of critical network elements among different bidding zone borders;

(vii) where the power flows on critical network elements are influenced by cross-zonal power exchanges in different capacity calculation regions, the rules for sharing the power flow capabilities of critical network elements among different capacity calculation regions in order to accommodate these flows.

(c) a methodology for the **validation of cross-zonal capacity** in accordance with Article 26.

2. Article 2 (8) and 20 (7)

- Article 2 (8) of the CACM Regulation defines the coordinated net transmission capacity approach as "**the capacity calculation method based on the principle of assessing and defining ex ante a maximum energy exchange between adjacent bidding zones**"

- **TSOs may jointly request the competent regulatory authorities to apply the coordinated net transmission capacity approach** in regions and bidding zone borders other than those referred to in paragraphs 2 to 4, if the TSOs concerned are able to demonstrate that the application of the capacity calculation methodology using the flow-based approach would not yet be more efficient compared to the coordinated net transmission capacity approach and assuming the same level of operational security in the concerned region

3. Article 14

- (1) All TSOs shall calculate cross-zonal capacity for at least the following timeframes:

  (a) day-ahead, for the day-ahead market;

  (b) intraday, for the intraday market.

4. Article 2 (11)

- The role of “coordinated capacity calculator” is defined in Article 2 (11) of the CACM Regulation as: “the entity or entities with the task of calculating transmission capacity, at regional level or above”

5. Article 3

- The common capacity calculation methodology proposal contributes to and does not in any way hinder the achievement of the objectives of Article 3:
  - (a) Promoting effective competition in the generation, trading and supply of electricity
  - (b) Ensuring optimal use of the transmission infrastructure
  - (c) Ensuring operational security
  - (d) Optimizing the calculation and allocation of cross-zonal capacity
  - (e) Contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union

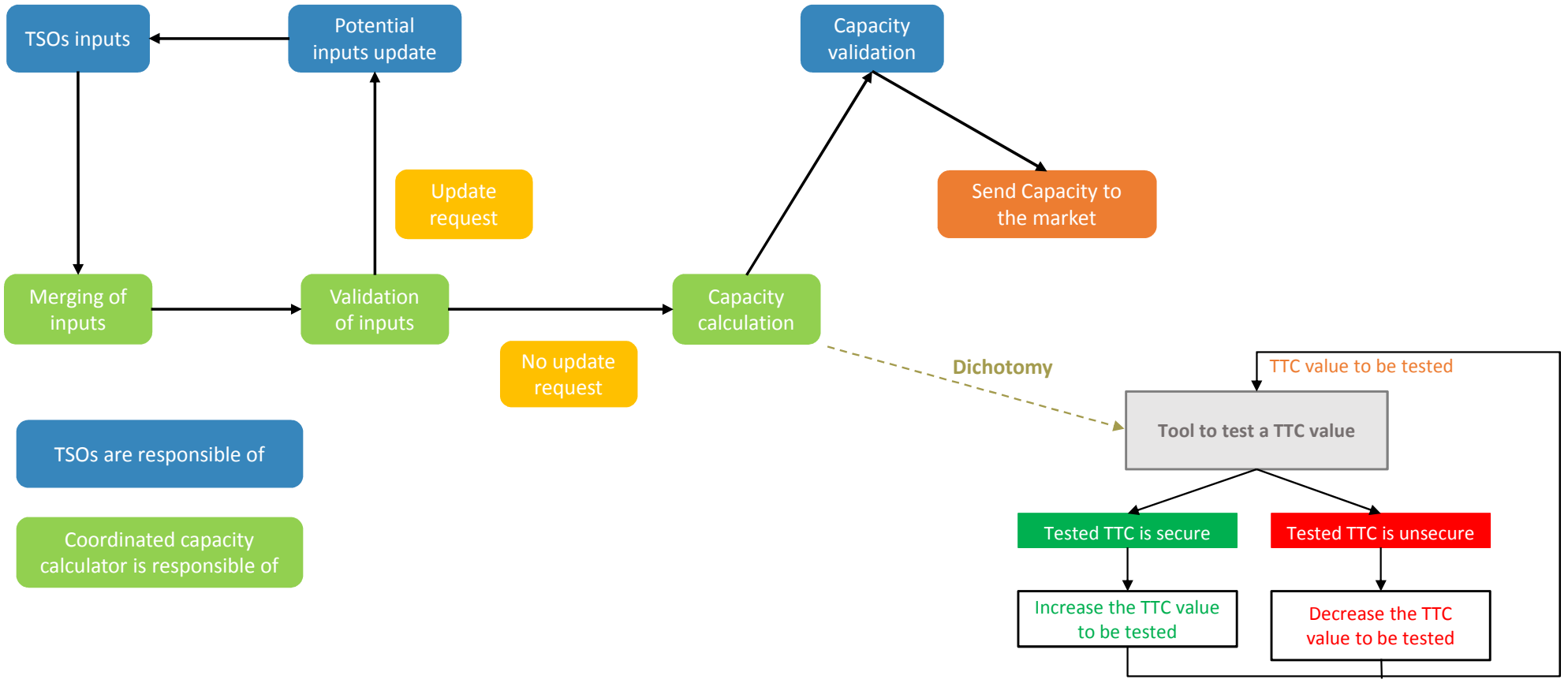
Capacity calculation methodology for the day-ahead and intraday

- Day-ahead capacity calculation
- Intraday capacity calculation
- Cross-zonal capacities for the day-ahead market and the intraday market
- Reliability margin methodology
- Methodologies for operational security limits, contingencies and allocation constraints
- Generation shift keys methodology
- Methodology for remedial actions in capacity calculation
- Capacity calculation approach
- Cross-zonal capacity validation methodology
- Fallback procedures
- Publication and Implementation of the CCC methodology Proposal

1. Day-ahead capacity calculation (1/2)

- The TSOs of SWE Region shall provide the coordinated capacity calculator with **the last updated information** on the transmission systems in a timely manner for the capacity calculation that is started in the end of D-2
- The capacity calculation process is based on **a Remedial Action Optimization methodology** which aims to find **the higher secure capacity** based on the inputs provided by the TSOs and applying a dichotomy
- The **coordinated capacity calculator** shall define **the values of TTC for each market time unit** up to the first unsecured situation. These values shall be provided to TSOs of the SWE Region for validation
- The coordinated capacity calculator and SWE TSOs shall ensure that **cross-zonal capacity shall be provided to relevant NEMOs in time**

1. Day-ahead capacity calculation (2/2)



2. Intraday capacity calculation

- The TSOs of SWE shall provide the coordinated capacity calculator with **the last updated information** on the transmission systems in a timely manner for the first intraday capacity calculation that is performed in the end of D-1
- The capacity calculation process is based on **a Remedial Action Optimization methodology** which aims to find the higher secure capacity based on the inputs provided by the TSOs and applying a dichotomy
- The **coordinated capacity calculator** shall define **the values of TTC for each market time unit** up to the first unsecured situation. These values shall be provided to TSOs of the SWE Region for validation
- The TSOs of SWE TSOs **shall review the frequency of recalculation two years after the implementation** of the capacity calculation for the intraday market timeframe by performing a cost-benefit analysis on the SWE Region

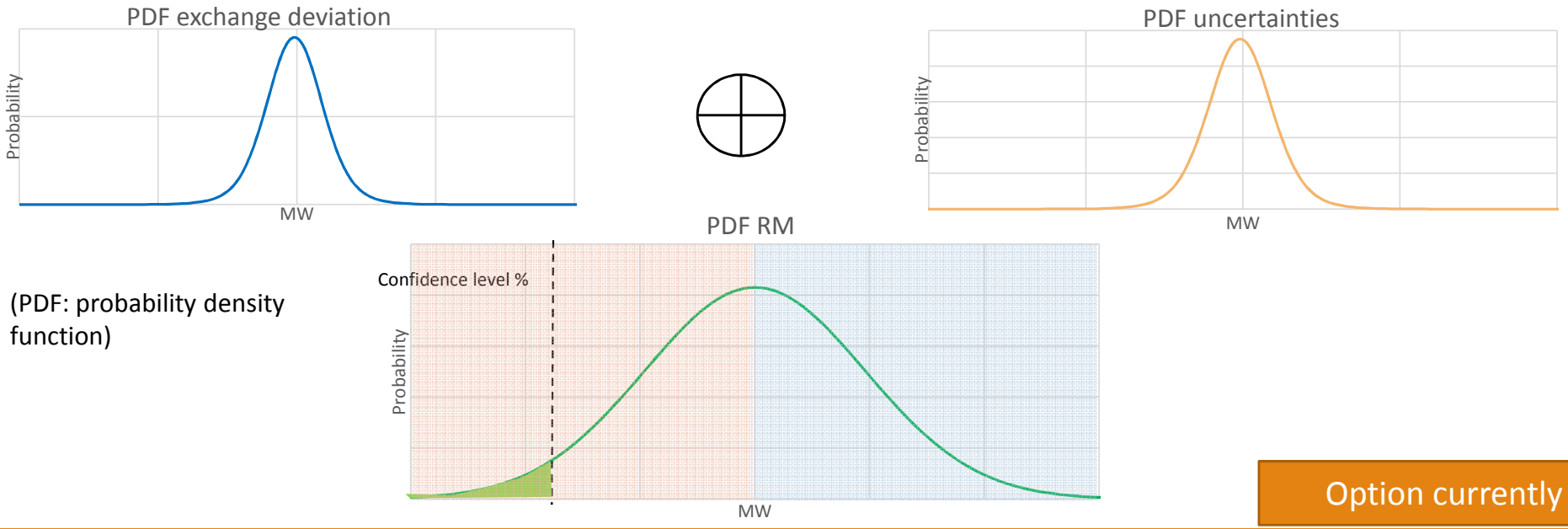
3. Cross-zonal capacities for the day-ahead market and the intraday-market

- For the **day-ahead market time-frame**, **individual values for cross-zonal capacity for each day-ahead market time unit** shall be calculated using the common capacity calculation methodology started in D-2 based on D-2 Common Grid Model.
- For the **intraday market time-frame**, **individual values for cross-zonal capacity for each remaining intraday market time unit** shall be calculated using the common capacity calculation methodology performed in the end of D-1 based on Day-ahead Common Grid Model.

4. Reliability margin methodology

- RM will be modelled as a probability distribution function resulting from taking into account two random variables:
  - **Unintended deviation** on the (France-Spain or Portugal-Spain) interconnection and
  - **Uncertainties** of the forecast between D-2 calculation studies and real time

The reliability margin will be based on **a level of confidence** that shall be covered to ensure the transmission system is operated within operational security limits.



(PDF: probability density function)

Option currently tested

4. Reliability margin methodology (transitory period)

Temporary data to be used until statistical data are available

- **Portugal-Spain border**. RM is calculated as the maximum of the two following values:
  - Unintended deviation is defined with a fix value of 100 MW
  - Uncertainties are defined at 10% of the TTC

- **France-Spain border.** RM is calculated as the maximum of the two following values:
  - Unintended deviation is defined with a fix value of 200 MW
  - Uncertainties are defined at 7,5% of the TTC

5. Methodologies for operational security limits, contingencies and allocation constraints

- Allocation constraints shall not be applied in the capacity calculation within SWE Region

- They shall be monitored only the operational security limits and contingencies on network elements **significantly influenced by cross-zonal power exchanges**

Methodology for Critical Network Element and Contingency (CNEC) selection - 4 steps:

1. Creation of an initial pool of CNEs and Contingencies
2. Selection of regional CNEs for the RA optimization – sensitivity study
3. Selection of Contingencies for the RA optimization – sensitivity study
4. CNECs sensible in particular situations

- Operational security limits. Due to the specificities of the SWE CCR, the following magnitudes will be checked:
  - Flows
  - Voltages
  - Voltage Phase Angles Differences

Option currently tested

6. Generation shift keys methodology

- **RTE** shall define **generation shift keys proportional** to the base case scenarios for each market time unit with all expected generating units in the IGM, reflecting RTE's best forecast of market behaviour
- **REE** shall define **generation shift keys based on a merit order list**, reflecting the best forecast of market behaviour for each market time unit with all available generation units
- **REN** shall define **generation and load shift keys based on a merit order list**, reflecting the best forecast of market behaviour for each market time unit with all available generation units

7. Methodology for remedial actions in capacity calculation (1/2)

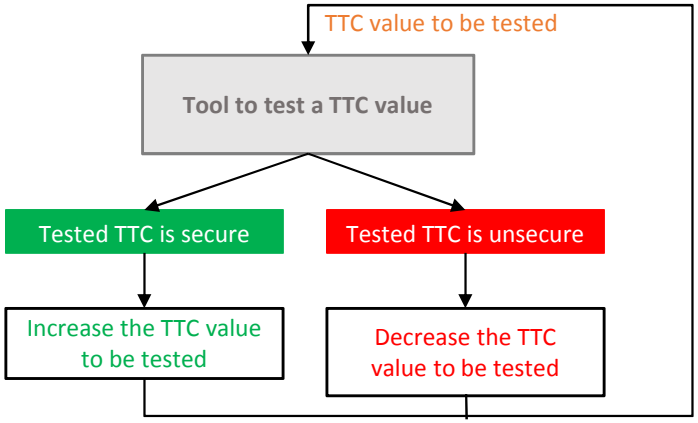
- Each TSO of SWE Region shall **define individually the remedial actions** of its responsibility area to be used in the capacity calculation **and inform in a timely manner on any change**
- The remedial actions to be defined by each TSO of SWE Region shall be either **preventive** (pre-fault) or **curative** (post-fault)
- **RTE and REE** shall **coordinate**, prior to the capacity calculation, the remedial actions that can be shared with each other
- **REN and REE** shall **coordinate**, prior to the capacity calculation, the remedial actions that can be shared with each other
- Curative remedial actions with costs in specific situations where technically and economically relevant and in accordance with national regulation

7. Methodology for remedial actions in capacity calculation (2/2)

- Examples of remedial actions:
  - Changing the tap position of a phase shifter transformer (PST)
  - Topology measure: opening or closing of a line, cable, transformer, bus bar coupler or switching of a network element from one bus bar to another
  - HVDC set-point change
  - Modification of generation
  - FACTs action, activation or deactivation of reactance (s), capacitor (s)

8. Capacity calculation approach

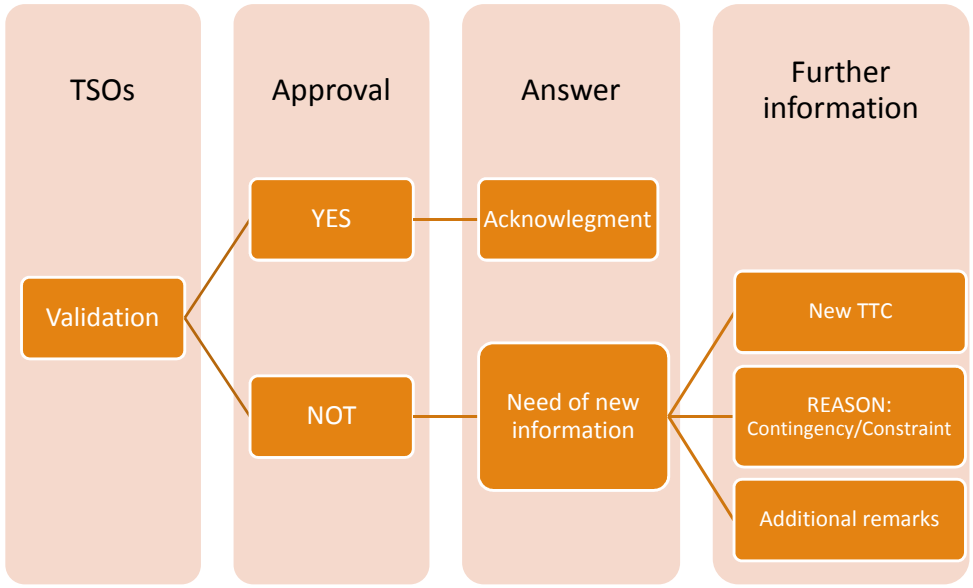
- Due to the specificities of the SWE CCR, SWE TSOs will use **coordinated NTC approach** to determine the cross-border capacities for each border of the SWE CCR
- Remedial Action Optimization (RAO)
  - RA handling
  - Computation



9. Cross-zonal capacity validation methodology

- The TSOs of SWE Region shall **validate** the cross-zonal capacities calculated by the coordinated capacity calculator of the SWE Region

- Where one or more SWE TSOs do not validate the cross-zonal capacity calculated, the concerned TSO(s) shall **provide** the coordinated capacity calculator with **the updated amount of cross-zonal capacities** for the border considered and the **reasons** for the reduction. The final cross-zonal capacity is the **minimum value sent by the SWE TSOs of the border** considered

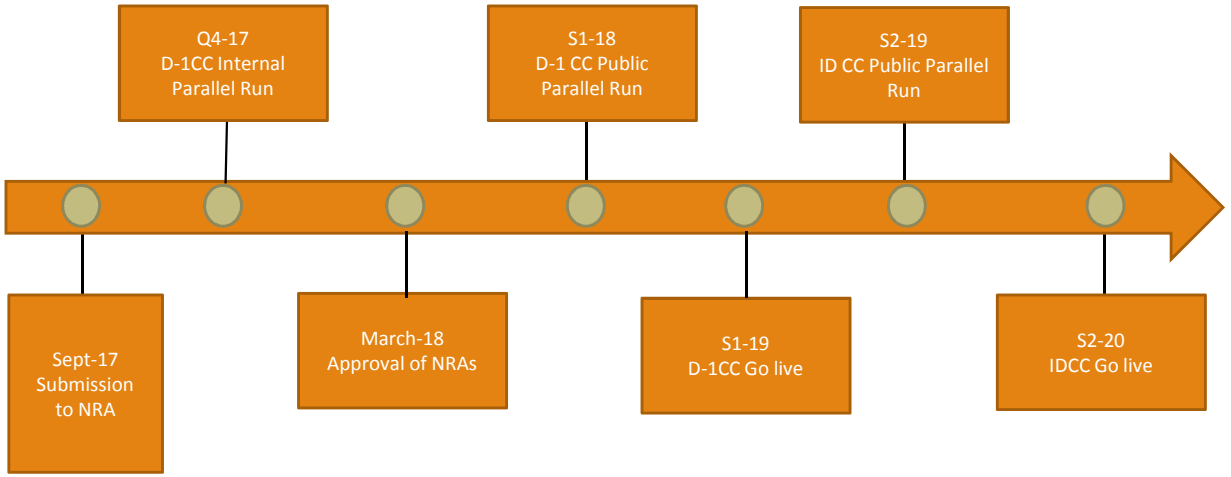


10. Fallback procedures

- **For the capacity calculation performed in D-2**, where an incident occurs and the coordinated capacity calculator is unable to produce results, the coordinated capacity calculator or SWE TSOs where applicable, shall provide the single allocation platform with the **already coordinated capacities calculated within the long term timeframe**

- **For the capacity calculation performed in the end of D-1**, where an incident occur in the capacity calculation process and the coordinated capacity calculator is unable to produce results, the coordinated capacity calculator or TSOs of SWE Region where applicable, shall provide the NEMOs of SWE Region with **the last coordinated cross-zonal capacities calculated within SWE Region for the market time unit considered**

11. Publication and Implementation of the CCC methodology Proposal



Main dates:

- **September 2017**: Submission of the methodology for approbation
- **Q4 2017**: Start of Internal parallel run
- **March 2018**: Approval of the methodology by the SWE NRAs
- **S1 2018**: Start of the Capacity Calculation for the day-ahead market timeframe External parallel run
- **S1 2019**: Go-Live criteria of the Capacity Calculation for the day-ahead market timeframe are met
- **S2 2019**: Start of Capacity Calculation for the intraday market timeframe parallel run
- **S2 2020**: Go-Live criteria of the Capacity Calculation for the intraday market timeframe are met

Questions