

Explanatory Document to the first amendment of the Day-Ahead Capacity Calculation Methodology of the Core Capacity Calculation Region

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

xx xx 2020

Purpose:	<input type="checkbox"/> methodology draft	<input checked="" type="checkbox"/> for public consultation
	<input type="checkbox"/> for NRA approval	<input type="checkbox"/> for final publication
Status:	<input checked="" type="checkbox"/> draft	<input type="checkbox"/> final
TSO approval:	<input checked="" type="checkbox"/> for approval	<input type="checkbox"/> approved
NRA approval:	<input checked="" type="checkbox"/> outstanding	<input type="checkbox"/> approved

Table of Content

1. Introduction	1
2. Post go-live study on CNEC selection.....	1
3. FRM assessment	2
4. Extended LTA Inclusion.....	2
5. Third country integration.....	5
6. Validation of FB parameters.....	6
7. Fallback Procedures.....	7
8. Publication of data	7
9. Timescale of implementation	8

1. Introduction

The Commission Regulation (EU) 2015/1222 establishing a guideline on Capacity Calculation and Congestion Management ('CACM') requires the development and implementation of a common Day-Ahead Capacity Calculation Methodology ('DA CCM') per Capacity Calculation Region ('CCR').

CCR Core ('Core') submitted the proposal for the Core DA CCM on 15th September 2017 and received a Request for Amendment ('RfA') by Core National Regulatory Authorities ('NRAs') on 15th March 2018. On 4th June 2018 Core Transmission System Operators ('TSOs') re-submitted the Core DA CCM. The Core NRAs could not reach a common approval and the Core DA CCM got send to the Agency ('ACER'). In 21st February 2019 ACER published its decision on the Core DA CCM.

In this explanatory document Core TSOs will explain the changes included in the proposal for amendment of the Core DA CCM for public consultation. A track-change version of the Core DA CCM reflecting the proposed changes is shared for informative purpose.

2. Post go-live study on CNEC selection

In Article 5(8) (c) of the Core DA CCM 'reconfiguration of bidding zones' and 'investments in network infrastructure' are removed in the proposal for amendment as criteria or actions the use of internal Critical Network Elements with Contingency ('CNECs') is to be compared within a post-go-live study.

To consider network and generation potential outlooks Core TSOs would need to develop grid investment and generation investment models. There would be a high risk that these models would not be ready in time and even if the models would be ready, there is a high risk this study would consume high resources without delivering valid results. There are a significant number of (arbitrary) assumptions to be concluded (such as geographical scope to measure social welfare, create a representative baseline as reference) and to prepare respective data, systems would need to be prepared and adjusted.

Stakeholders concerns that this study is to ensure that internal CNECs do not unduly prevent the cross-border trades can be addressed by the Regulation (EU) 943/ 2019 ('CEP-Regulation'), in particular the 70% minRAM provision, applied to Core TSOs. Core TSOs have to comply with the minimum margin of 70% and possible national derogations and/or action plans following from the relevant provisions of article 14 to 16 of Regulation (EU) 2019/943.

Core TSOs will focus the CNEC selection study on the most limiting CNECs. While this would not provide insights on bidding zone reconfiguration or grid reinforcement projects, this pragmatic approach will give useful insights and have more qualitative measures. In the CNEC selection study the decided bidding zone (re-)configuration and foreseen grid

reinforcement are then seen as fixed framework conditions.

3. FRM assessment

Sentence 4 of Article 8(3) requests that Core TSOs update “historical CGMs [...] with the deliberated Core TSOs’ actions (including at least the RAs considered during the capacity calculation) that have been applied in the relevant DA CC MTU”. On the one hand this wording provides for some flexibility regarding the adaptation of the Common Grid Models (‘CGMs’) with respect to applied Remedial Actions (‘RAs’). On the other hand it has become evident that exact information about “deliberated Core TSOs’ actions” and their distinction from other factors having an impact on the realized power flows is not available in the current operational planning processes.

If the CGMs were updated only by the RAs considered during the capacity calculation (minimum requirement according to sentence 4 of Article 8(3)), the impact of other RAs activated after DA CC (such as redispatching) on the realized flows would wrongly be accounted as source of uncertainty. Consequently, the true Flow Reliability Margin (‘FRM’) would be overestimated.

If, by contrast, the entire generation pattern was adopted from the historical CGMs (i.e. the data source of the realized flows), one would ignore that the evolution of generation dispatch between the D-2 CGM and real time is influenced by numerous effects and processes beyond the Core TSOs’ decision making. One would effectively assume that the entire dispatch is the result of redispatching by TSOs. Since the relevant impact of self-dispatch by balance responsible parties on the power flows would be neglected as FRM contribution, this would obviously lead to an underestimation of the true FRM.

Given the absence of reliable, consistent and complete data that would allow to isolate all “deliberated Core TSOs’ actions” in the historical CGMs, Core TSOs propose to foresee the right to determine upper and lower estimates of the true FRM along the lines of the above considerations.

The proposed amendment further foresees an obligation on Core TSOs to – 18 months after go-live, when the first FRM assessment is due – justify the way in which the final FRM is derived from these estimates, and propose possible steps for improving the process to approach as much as possible the true FRM.

4. Extended LTA Inclusion

The extended Long-Term-Allocation (‘LTA’) inclusion approach was first discussed in CWE and is now also in development in Core. For CWE the approach is currently being implemented in the Single Day-Ahead Coupling (‘SDAC’) to alleviate the performance risk when feeding the market coupling algorithm EUPHEMIA with a higher-dimensional

CWE flow-based domain.

Following the implementation of the DE/LU/AT bidding zone split and the upcoming integration of ALEGrO (HVDC interconnector between BE-DE/LU) the CWE flow-based domain increased twice in dimension. Consequently the LTA inclusion approach based on virtual branches (i.e. the convex hull of minRAM domain and LTA domain) results in a significant increase in the number of constraints provided to the market coupling algorithm. This increase has been analysed and found to be problematic for the market coupling algorithm as the time to first solution is reaching its limit.

A R&D track under SDAC governance successfully elaborated an alternative way of doing the LTA inclusion directly in the market coupling algorithm EUPHEMIA, resulting in a much reduced time to first solution. This LTA inclusion approach is called "Extended LTA inclusion" for which EUPHEMIA expects as input from the capacity calculation process two separate domains representing the cross-zonal capacity, namely the virgin FB domain (minRAM included, without LTA inclusion) and the LTA domain. EUPHEMIA is allowed to choose which combination of both domains creates most social welfare in the SDAC. To perform this optimisation EUPHEMIA applies the so-called "Balas formulation" where the variable "alpha" represents the optimal share of the LTA domain (alpha) versus the optimal share of the virgin FB domain (1-alpha).

Please note that the "Balas domain" illustration in Figure 2 is added for educational purposes only as EUPHEMIA does not actually create such LTA included domain. Instead of the complex mathematical action of creating the union of the virgin FB domain and the LTA domain, EUPHEMIA "selects from" the two domains using the optimization variable alpha.

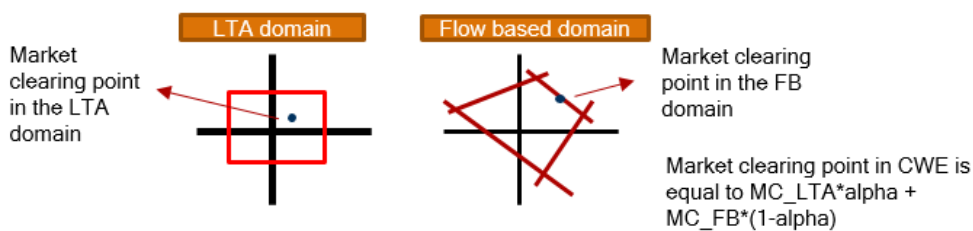


Figure 1: LTA Domain and Virgin FB Domain

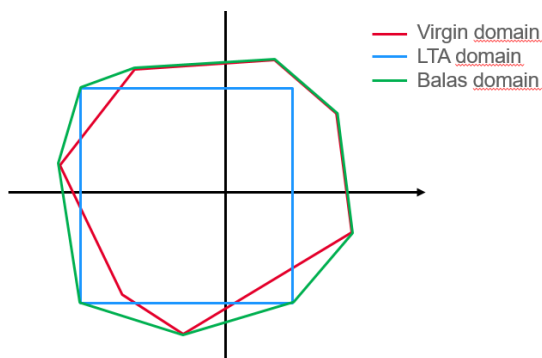


Figure 2: Theoretical Balas Domain Illustration

Extensive analysis performed in the SDAC by CWE parties has shown that the implementation of this Balas formulation for LTA inclusion in EUPHEMIA corresponds to the LTA inclusion via virtual branches: comparable min/max net position and welfare.

From a CCR Core perspective, the use of convex hull to perform LTA inclusion was considered during the alignment calls between Core TSOs and ACER before the final CCM was published. ACER saw the approach positively but it was left out of the Core DA CCM scope, because the solution discussed at the time (direct determination of convex hull) appeared infeasible. The Core DA CCM stipulates a more rough method for LTA inclusion, the LTA margin approach, which in comparison to the convex hull approach significantly increases the FB domain.

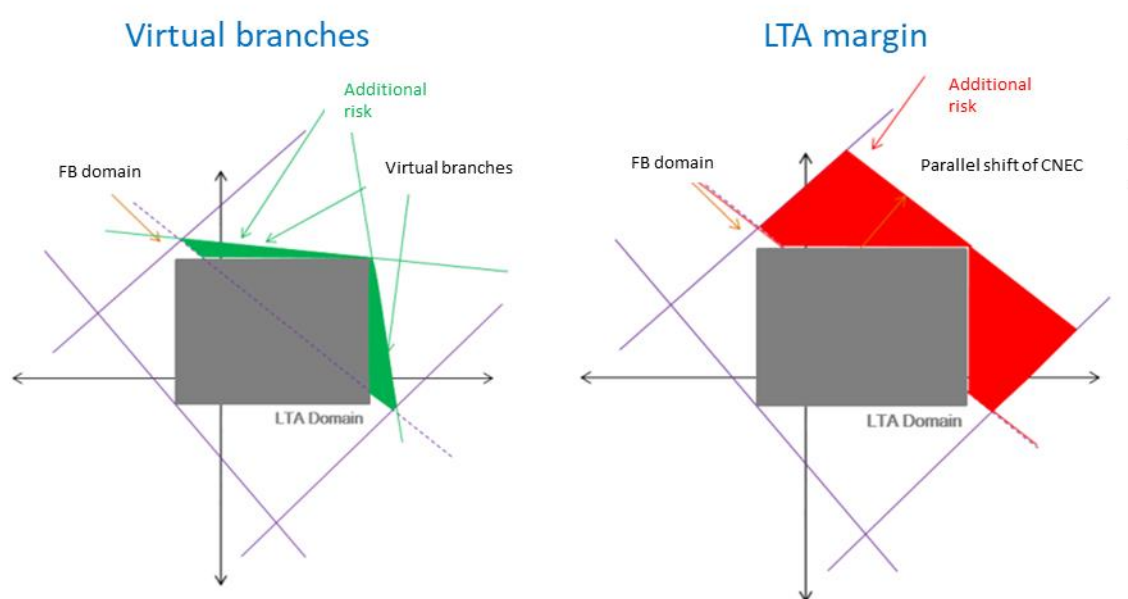


Figure 3: Virtual Branches approach (as currently performed in CWE) and LTA margin approach (as included in the Core DA CCM)

The development of the extended LTA formulation is considered very promising by the Core TSOs as it provides a more secure domain as a result due to less virtual enlargement compared to the current LTA margin approach, while still allowing market trades within the LTA Domain.

The proposed amendment introduces the option to switch to the extended LTA formulation approach when technical feasibility of the new approach in Core will be fully clarified without making it legally binding. The biggest impact is on the individual validation process. Individual validation revolves around selecting one or more market clearing points ('MCPs') which are on the FB domain and validate their feasibility taking into account operational security requirements and the availability of costly and non-costly remedial actions.

The proposed amendment presents two options to link the selected MCPs to the flow-based domain:

1.) Consider points on the convex hull without computing it. This could be achieved by applying an algorithm (linear optimization) that scales an MCP until it reaches the edge of the convex hull of the virgin domain and the LTA domain. This would lead to the most accurate results, however further analysis of its feasibility needs to be performed by some Core TSOs;

2.) Continue using the LTA margin approach, i.e. base the validation on an LTA-included domain using LTA margin (which will only be computed for the validation phase) and apply the validation adjustments on the domain without LTA inclusion. This approach for determining the validation adjustment is known and being implemented by Core TSOs, however in case of switch to extended LTA formulation it could lead to unnecessary capacity reductions if these are based on market clearing points which are only contained in the LTA margin enlarged domain but not in the Balas domain.

Please note that the version of the amendment submitted for public consultation may further evolve to take into account the outcome of the ongoing feasibility analysis. Amongst others, this concerns the timing/condition(s) of making the switch to extended LTA and a potential alternative way to calculate Available Transmission Capacities ('ATCs') for SDAC fallback procedure (in relation to the addition made in Article 23(5a)).

5. Third country integration

Within a meshed grid, the flows from non-EU countries ('third countries') need to be accounted to secure grid operation for Core TSOs, and therefore a technical cooperation between Core TSOs and third countries is required. The intention for such improved cooperation was laid out in the Synchronous Area Framework Agreement (SAFA) for Continental Europe.

With this in mind Core TSOs together with Swissgrid have developed a concept that can be applied for any third country that shares borders with the Core CCR, wherein third countries who have an agreement with all Core TSOs are granted the right to include network elements with associated contingencies in the DA FB CC process, subject to the same conditions that apply to Core TSOs. As the concept is general for any third country integration, country-specific details will be regulated separately, subject to the unanimous approval of all NRAs.

This concept requires changes to the Core DA CCM to allow for third countries to provide input for the DA FB CC process (Article 4(8a)), to take third country critical network elements and associated contingencies into account in the PTDF calculation steps (Article 11(7a)) and in the initial flow-based computation (Article 14(3a)). These steps are needed

to enable a third country to add a network element with a specific contingency to the final list of CNECs (Article 20(6a.)). The provisions on the conditions that allow a technical counterparty to add a network element with contingency to the final list of CNECs will be regulated separately.

Lastly, new definitions of a ‘technical counterparty’ (a non-EU/third country who has signed a technical agreement with all Core TSOs) and ‘technical agreement’ (on the technical consideration of the third party TSO’s network in Core DA capacity calculation) are added in Article 2.

6. Validation of FB parameters

Article 20(13) (e) on the forecasted flow in the CGM, in the D-1 CGM, and the realised flow, before (and when relevant after) contingency is removed from the Core DA CCM.

This change is driven by following two factors:

Representativeness: Flows in time frames after DA CC differ from those considered during validation. The outcomes would not be representative, because flow deviations occur due to numerous reasons (e.g. freedom of generation dispatch, RAs applied after CC, inaccuracy in (RES) forecasts), being more impacting than a reduction of capacity due to Coordinated Validation (‘CVA’) or Individual Validation (‘IVA’).

Complexity: Currently only the forecasted flow is available, but not the realised flow before and after the contingency on Core level. Getting spatially and temporally complete merged snapshots of the entire Core transmission grid and consistently matching network elements with CGMs is known to be a high effort.

Operational data on real-time flows indeed already exist at a TSO level. They are not collected in a coordinated way, e.g. notation of CNECs can be different in national operational processes from the ones in the CC. Collecting and comparing relevant data points would in theory be possible, however the matching would require many efforts and reliability would be limited. Coordinated processes will be available as soon as methodologies pursuant to CACM Art. 35., CACM Art. 74 and SO GL Art. 76 are implemented. Developments related to other coordinated processes could improve the Core TSOs’ ability to capture and analyse realised flows through the extraction of snapshots.

For the FRM assessment according to Article 8 Core DA CCM, snapshots will already have to be analysed. However, this assessment will not lead to regular publication, which makes it easier to overcome matching issues. A regular publication is expected to be a very complex and time consuming exercise. Nevertheless Core TSOs will seek synergies with these developments in order to deliver the requested data when possible.

Article 20(13) (i) on proposed measures to avoid similar reductions in the future are removed in the proposal for amendment, since they are already part of action plans or derogation according to Regulation (EU) 943/ 2019.

7. Fallback Procedures

During the detailed development of the procedures and IT requirements for back-ups and fallbacks Core TSOs concluded on an opportunity to improve the back-ups.

Before applying the Day-Ahead capacity calculation fallback procedure as defined in Article 22(b), in case of a technical failure in the tools, an error in the communication infrastructure or corrupted or missing input data, the Core TSOs and the CCC shall calculate the missing results by using the results of the initial flow-based calculation to directly run the computation of the final flow-based parameters. Core TSOs concluded that the outcomes of an initial flow based computation is more representative compared to a complete fallback procedure.

In the process of detailing the requirements for default flow based parameters, it became clear that principles of creating a convex hull around defined corners, as applied in other regions, cannot be applied for all Core bidding zone borders, due to drastically increasing mathematical complexity. In order to mitigate this, the same method as described for ‘Extended LTA inclusion’ will be applied. Consequently the publication of the LTA domain depicted in Article 21 is relevant for both default flow based parameters as well as the extended LTA inclusion topics.

In order to make this necessary (technical) change, the references in the Core CCM to so called “External constraints” are replaced by ‘exchange restrictions’. The main principles remain in both approaches, but just use another technical method to achieve the same.

8. Publication of data

In Article 25(2)(d)(xiii) publishing the Core net position for each TSO is removed in the proposal for amendment. Core TSOs do not have direct access to the Core net position per TSO for those bidding zones in which multiple TSOs are represented. Considering the additional IT developments required on the Core CC Tool, Core TSOs propose to not disclose this detailed information.

Article 25(2)(e) ii. on flows resulting from net positions resulting from the SDAC is removed in the proposal for amendment. Instead it will be published in the quarterly report according to Article 27 (5). Implementing this as part of the operational system and daily publications would have a significant impact on the systems. Moreover, the required information to compute this is already published by Core TSOs. Core TSOs therefore will

include this in the quarterly reports, so it can be computed outside the operational system and avoid having to create new and additional interfaces and computation modules.

9. Timescale of implementation

The implementation of Flow Based Day-Ahead Capacity Calculation ('FB DA CC') in CCR Core has always been a priority for Core TSOs. The implementation is a significant and complex topic, which is acknowledged by all stakeholders. Core is the largest CCR in Europe and with more than 35 project parties involved (TSOs, NEMOs, RSCs, Service providers & vendors) implementing the methodology, systems, procedures, contracts and governance is challenging.

A clear condition prior working on a final implementation roadmap is to have a final methodology and in addition, also understand the impact this methodology has on IT and processes. This known interdependency is also the reason why during the development of methodologies Core TSOs develop prototypes to perform experimentation. Based on the outcome of the experimentation Core TSOs have the possibility to adjust a method and/or processes prior finalisation.

Core TSOs decided that implementation of Core FB DA CC is a priority and activities had to be launched directly after the submission of the methodology. Awaiting the Core DA CCM decision of ACER, and despite the risk of re-work in case of content changes, Core TSOs initiated many activities based on their initial proposal.

Main activities that were initiated prior ACER DA CCM decision in the period between July 2018 and December 2018 are the following:

- Selection of main IT vendors
- Preparation & launch of INT//Run (Phase 4.1)
- Development of KPIs and macro's to enable TSOs to assess data quality & results
- Design basic version of Core Capacity Calculation tool

The internal parallel run launched in 2018 was based on working assumptions in relation to the initial methodology, systems used were prototypes and this was running on a temporary IT infrastructure. The internal parallel run provided the Core TSOs with first operational experiences, ability to improve data quality and opportunity to discover issues that could be solved in the final industrialised system.

During the six month preceding the decision of ACER on Core CCM, the timescale for implementation was discussed. During the last two months preceding the final decision, Core TSOs repeatedly challenged the proposed implementation deadline as the TSO planning that was released in Oct 2018 had hardly any contingency (only one month) and did not take into account the changes proposed by ACER which were expected to have

significant impact on the tool development and Core TSOs processes and therefore on the project planning. Core TSOs again shared their doubts on the feasibility of the proposed date of December 1st, 2020 during ACER's public consultation and later during the finalisation of the Core DA CCM. Despite this input, the Agency evaluated that the implementation risks were minimal and kept the implementation deadline. On 11 Jan 2019, ACER communicated the deadline to be firm, without a comprehensive impact analysis.

On 21 February 2019 ACER issued its decision No.02/2019 on the Core CCR TSOs' proposals for the regional design of the day-ahead and intraday common capacity calculation methodologies ('DA CCM decision'). Core TSOs performed a high-level impact assessment and defined the impact of ACERs DA CCM decision on the prototypes. Based on this assessment Core TSOs prepared adjustments of the tools and in addition worked on the final design for the industrialised systems.

In the months after the DA CCM decision - while working on the prototypes and designs for industrialised systems - Core TSOs concluded that the DA CCM decision had an even more significant, unforeseen impact than initially expected. The main impact was on concrete IT changes. The target process had also to be changed fundamentally as Core TSOs were limited in their interventions of updating inputs during the process, requiring more detailed checks and time for the first process steps to secure a stable operational process and avoid operational security risks, impacting the IT developments further.

The main impacting elements from the final DA CCM were:

- Significantly stricter requirements on capacity calculation with a target set at 70% minRAM (impacting concept of individual validation and the core function of IT systems)
 - Automatic CNEC selection filtering in the common IT system
 - Changes to NRAO (introduction of loop flow constraint)
- Significantly increased reporting requirements
- Formal quality assessment for published data, setting up of additional KPIs
- Anticipation and preparation of 6 post go-live studies

Having the final DA CCM available, the lessons learned from the internal parallel run of 2018 (>100 BDs simulated) and the detailed impact on the industrialized systems allowed Core TSOs to create a detailed planning, based on concrete activities and (external) dependencies.

When this first version of detailed planning was available, Core TSOs communicated to Core NRAs & ACER on the 27th of July 2019 an expected delay that would impact the main milestones (external parallel run and Go Live). Core TSOs also decided to put the internal parallel run on-hold. There were too many limitations of the prototypes to meet the DA CCM requirements. The investment for altering them further would have been too

significant and would have created longer lead-times for the implementation of the target solutions.

The Core TSOs developed their detailed planning, based on the following assumptions:

- The scope is fixed within DA CCM and all requirements have to be implemented prior Go Live
- The quality of CC cannot be jeopardized as TSOs are responsible to secure security of supply
- The legal requirement for the external parallel run lasting at least 6 months according to article 20.8 CACM Regulation and Article 28.3 (b) Core DA CCM
- Implement functionalities step-wise to have a minimum viable solution (covering main DA CCM requirements) as soon as possible in order to create experience in the course of implementation to mitigate partly the risks

The detailed planning and milestones were further discussed with NRAs, EC and ACER in October and December 2019, where Core TSOs explained, supported by a thorough impact assessment, the various options considered to meet the Core DA CCM deadlines:

- Step-wise NRAO implementation and shorten critical phases
 - i.e. INT//run, training of operators, integration testing and EXT//Run)
- Step-wise NRAO implementation and turn internal//run phases into EXT//Run
 - i.e. starting EXT//Run with immature systems and prices, without fully trained operators and without NRAO)

Core TSOs however advice strongly against these options as they were seen as unrealistic:

- Shortening critical phases is to the detriment of quality and risking operational security
- Insufficient time for developing and stabilizing local systems & training of operators
- Lack of time for analyzing results, risking objection from stakeholders when published
- Risk of re-planning is significant, which can lead to additional delays

This led to the conclusion that implementing the DA CCM by the imposed deadline of 1st of December 2020 is infeasible.

Investigating further alternatives was therefore also not recommended. Creating an aligned detailed planning to which parties commit was a significant effort and investigating in more detail alternative scenarios or re-planning would only have created further delays. Core TSOs also see as of the utmost importance to agree on a stable, realistic planning, that provides visibility on the changes and allows all parties, including Market Participants, to adopt the changes on their side, too.

The proposed detailed planning and associated main milestones from Core TSOs ensure that the planning is still ambitious and keep the pressure on all parties involved to

implement Core FB DA CC as soon as feasible and in a responsible manner. There are still significant remaining risks (i.e. delayed delivery/changes in requirements, local TSO readiness, significant bugs found during testing and/or validation of systems and external dependencies). Having a realistic planning that parties can trust and commit to is also seen as key for such multi-party project in order to synchronize the efforts and avoid disordered planning changes.

The planning and main milestones communicated to ACER, NRAs and MPs can be found below:

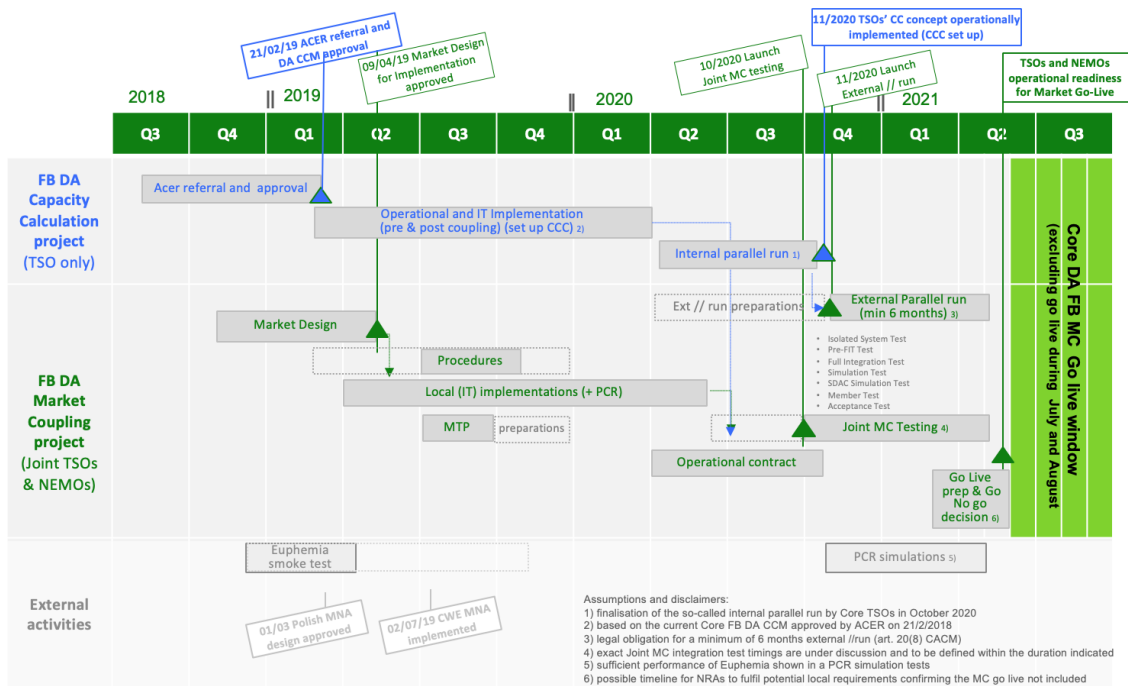


Figure 4: Main milestones of Core DA CCM implementation

Core TSOs have performed a Covid-19 impact analysis on the Core projects. The situation is extraordinary in all countries in Europe. The longer this crisis will go on the higher will be the probability that this is going to have an impact on the planned milestones. There is a risk of delay of milestones – however currently we are not able to put this into concrete terms. TSOs are carefully monitoring the situation and make their best effort not to have additional delays due to this situation. Should there be a materialization of the risks in the Core projects, TSOs will make it explicit to the stakeholders. This situation however prevents any acceleration of the project.

Core TSOs are convinced that the detailed planning as a result of a thorough impact assessment based on the final Core DA CCM and alignment with all parties that have to contribute to the implementation of Core FB DA CC is the only realistic approach to implement Core FB DA CC as soon as feasible and allow market parties to prepare themselves for its implementation.

Furthermore, with their proposal to set a new implementation date, the Core TSOs fulfil their obligations under Article 3 CACM Regulation.

Considering that implementing Core FB DA CC by 1st of December 2020 is infeasible and taking into account the result from the discussions between all relevant parties as well as decisions taken by the authorities, Core TSOs are submitting a proposal for an amendment to align reality with the formal obligations. Therefore the amended Article 28(3) of Core DA CCM reflects the latest moment of the implementation, 30th of September 2021, as the formal deadline for implementation of Core FB DA CC. Core TSOs, with the support of the NEMOs, aim at going live between May and September 2021.