Context paper CWE Intraday

Continuous Improvement Process of Intraday Capacity Calculation after FBMC go live

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Contents

1 General information on the process followed

This context paper describes the current and foreseen Intraday Capacity Calculation methodology background as additional information for the "NRA approval package ID ATC after FBMC". It explains the steps that resulted in the current request for approval and gives insight into the roadmap towards Flow Based Intraday.

Due to the structural change in electricity sector, mainly due to increase of volatile feed in of renewable sources, liquid intraday markets becomes more and more important. Cross border capacities are playing a large role in this liquidity by increasing trade opportunity for the market players between market areas. While guarantying security of supply, TSOs have the obligation to deliver to the market as much available capacity as possible.

Since Mid-2013, CWE TSOs have presented an approach focused on two main capacity calculation methods for Intraday to implement regional ID Capacity Calculation (ID CC):

- ID ATC Capacity Calculation for short term and
- FB ID Capacity Calculation for longer term solution.

This approach has largely been driven by the CACM Guideline discussions in which a FB ID CC methodology was selected as target solution.

The activities for the ID ATC CC method have been further elaborated resulting in a division into two steps. The difference between these two steps is related to different local processes and to the premise that this method should be inspired by existing tools, rules and processes. By splitting up the ID ATC CC step into two sub steps, the ID CC roadmap currently consists of the known three-step approach as depicted in Figure 1 below.

The first two steps of the ID CC process are:

1. Bilateral increase / decrease process starting from initial ID ATC values (securing same process as before FB Go Live) and
2. Coordinated increase / decrease process (increase on all CWE borders or decrease own borders).

This further specification has been presented to NRAs for the first time during the CWE FB expert meeting of December 1st, 2014, with the roadmap below (see Figure 1), indicating that for the ID FB CC the "Planning and deadlines will have to be assessed after FB Go Live".

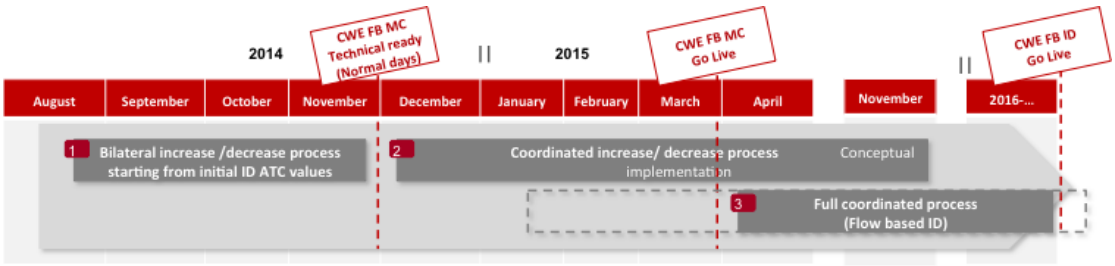

Figure 1: Roadmap of IDCC process in CWE region presented December 1st, 2014.

After detailed clarifications about the first step, the evolution to the second step was reflected by CWE NRAs in their "*Position Paper of CWE NRAs on Flow-Based Market Coupling"* of March 2015. This paper included the approval of CWE NRAs of the launch of the Flow Based Market Coupling and a declaration of their openness to the stepwise approach as presented by CWE TSOs. In addition, the position paper recalled that according to the EU legislation, a Flow Based methodology shall be developed also for the intraday timeframe and stress the needed consistency of such a solution with the pan-European intraday allocation solution.

As an intermediate step to FB ID, "*CWE NRAs ask for intraday capacity recalculation to be properly implemented in ATC by the beginning of November 2015".* The goals of this solution were described clearly: *"This interim solution is intended to allow for more capacity at this timeframe, taking stock of more accurate information on grid, consumption and generation parameters."*

CWE TSOs are convinced that the proposed ID Capacity Calculation Methodology related to step 2 and subject to NRA approval fulfils the above described objectives.

2 Effect of FB go-live on ID capacities

2.1. Less capacity for ID after FB DA process

Since FB DA go live and the intraday process based on the process of step 1 (see Figure 1), there is a reduction of available intraday capacity and both DA and ID capacities show increased volatility.

The available capacity in intraday consists of the result of the left-over from day ahead capacity after market coupling, including an assessment of additional capacities on the Dutch-German and Dutch-Belgian borders.

Flow based methodology provides capacities closer to reality. This results in more accurate but also more volatile capacities. As the capacities for intraday follow the trend of the day ahead capacities, by definition these will be more volatile as well.

Intraday has always been the remaining available capacity depending on the situation and amount allocated in day ahead. When more capacity is being allocated in day ahead, less capacity will be available for intraday.

2.2. Side effect of FB

With the introduction of Flow based for the day ahead timeframe, while having ATC capacity calculation and allocation in intraday, also the notion of 'blocked borders' was introduced. 'Blocked borders' refers to a situation in which for a certain border, there is no more ID capacity available after DA clearing for both directions. In the NTC-world, a system all stakeholders are used to for many years, such a situation cannot occur since capacity used in one direction automatically creates an availability of capacity for the opposite direction.

To better explain this phenomena, the below explanation has already been published and is available to market parties (on the Q&A forum of the JAO website).

2.2.1. ID ATC Calculation

As described in the "initial ID ATC computation" of the approval document, the ID ATC is calculated starting from the day ahead Market Clearing point (indicated with a red dot in Figure 2). The depicted Market Clearing point results from the day ahead market clearing and the nominations of the long term rights.

From this Market Clearing point, the ID ATC domain will be increased stepwise (e.g. 1MW) - equally in all directions - until a flow-based constraint is hit. The flow-based constraints reflect critical branches. When a constraint is hit, the ID ATC domain will be increased in other directions – where no constraints are hit yet.

Different examples and the impact for the ID capacity are described below, based on the different possible outcomes of FB DA market coupling.

2.2.2. Example 1: Market clearing point not constrained

Figure 2 depicts an example in 2 dimensions for the Dutch bidding zone. In this case, the ID ATC square can be increased until 1500 MW for both the Dutch-German and Dutch-Belgian border – in import as well as export direction. In such case, the ID ATC hits four different constraints.

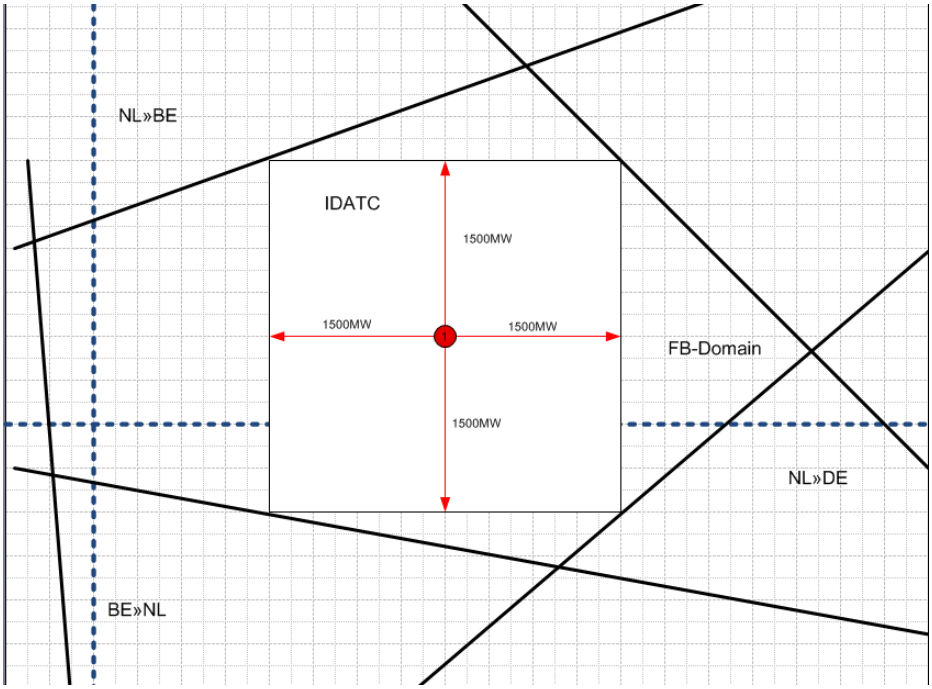

Figure 2: Clearing in the Domain

The resulting ID ATC's are:

ID ATC [MW]			
NL->BE	*BE->NL*	*NL->DE*	*DE->NL*
1500	*1500*	*1500*	*1500*

2.2.3. Example 2: Market Clearing constrained by one CB

Besides previous example, Market Clearing points can be constrained by critical branches. As such, the market is cleared on a flow-based constraint.

Figure 3, the bidding zone Netherlands is exporting at the limit of the FB domain. No further export exchanges are feasible from NL->DE neither from NL->BE because these are blocked by a critical branch in both directions. Hence, 0 MW ID ATC is available from NL->DE and NL->BE. ID ATC capacity is only available in the direction from BE->NL and DE->NL.

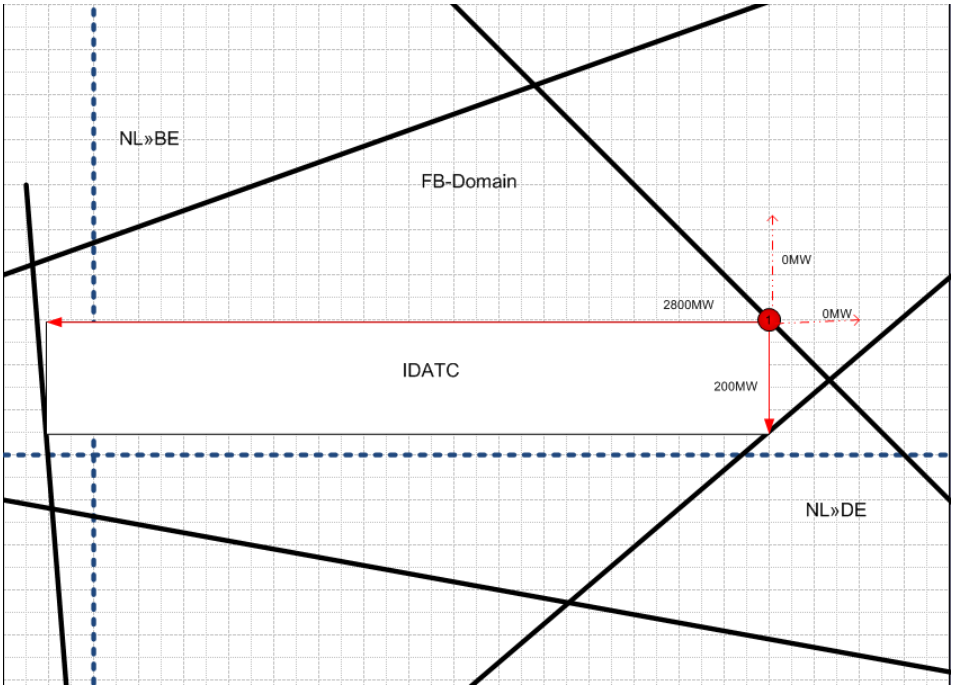

Figure 3: Clearing on an Edge of the domain

The resulting ID ATC's are:

ID ATC [MW]			
NL->BE	*BE->NL*	*NL->DE*	*DE->NL*
0	*200*	*0*	*2800*

2.2.4. Example 3: Market Clearing constrained by several CB

Market Clearing points can also be constrained by several critical branches (in a so-called vertex), which is illustrated in Figure 4.

Figure 4, the bidding zone Netherlands is exporting at the limit of the FB domain.

No further export exchanges are feasible from NL->DE and from NL-> BE because these are blocked by a critical branch. In addition, no further exchanges can be allocated from BE->NL because – from the Market Clearing point – these exchanges are also constrained by a critical branch. Resulting from this extreme Market Clearing point in the flow-based domain, 0 MW ID ATC is available from NL->DE, NL->BE and BE->NL. ID ATC capacity is only available from DE->NL.

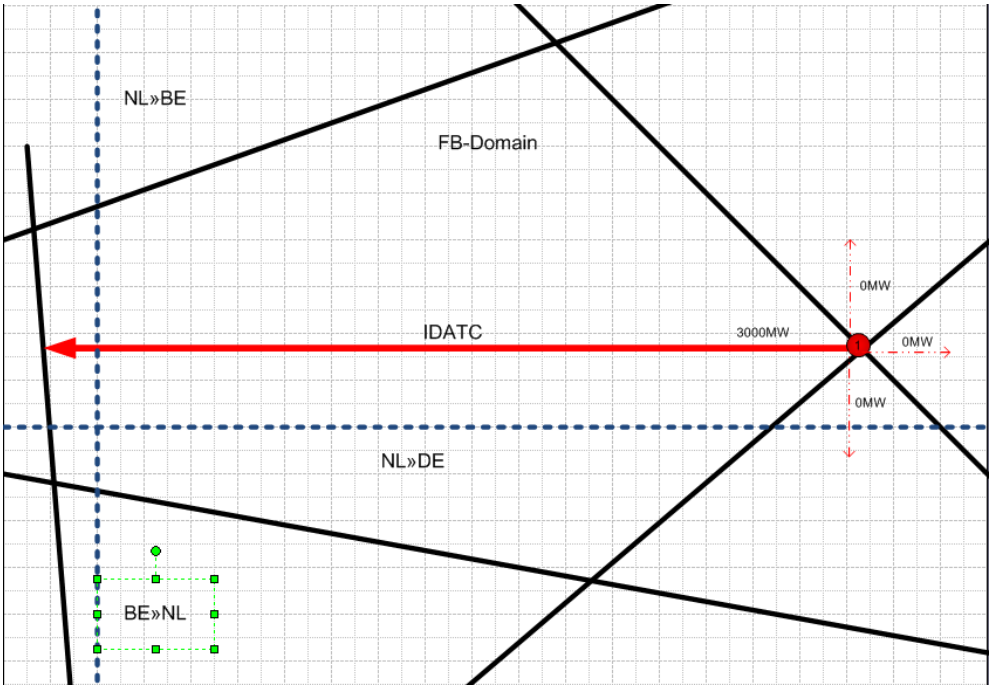

Figure 4: Clearing in aVertex

The resulting ID ATC's are:

ID ATC [MW]			
NL->BE	*BE->NL*	*NL->DE*	*DE->NL*
0	*0*	*0*	*3000*

2.2.5. Extrapolation to a 3D flow based domain (which is the current CWE domain)

The above examples are valid for a 2D flow-based domain representation (three bidding zones). However, for CWE we have to look at four bidding zones, which is represented by a 3D flow-based domain. This may result in even more extreme cases when viewed from the perspective of one bidding zone. Figure 5 depicts how the ID ATC can be represented in the 3D visualization. In such case, it can occur that there is no ID ATC available in any direction for all borders of a single bidding zone, as this could create overloads on a 4th hub.

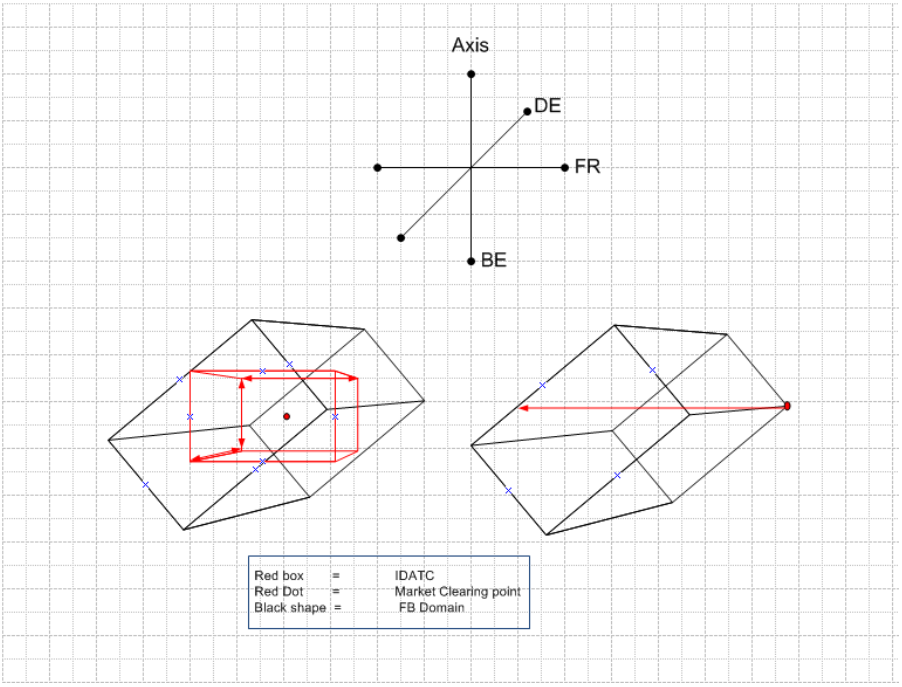

Figure 5: Clearing in a 3D domain (CWE)

The left flow-based domain, in Figure 5, depicts that ID ATC's are available in all directions. The resulting ID ATC's are:

ID ATC [MW]					
NL->BE	*BE->NL*	*NL->DE*	*DE->NL*	*NL->FR*	*FR>NL*
400	*400*	*600*	*600*	*100*	*100*

The right flow-based domain, in Figure 5, depicts an extreme flow-based market clearing point. The increase of the ID ATC domain is in this case blocked in five directions. Therefore, capacity is only available in a single direction (see red arrow). The resulting ID ATC's are:

ID ATC [MW]							
NL->BE	*BE->NL*	*NL->DE*	*DE->NL*	*DE->FR*	*FR>DE*	*BE->FR*	*FR>BE*
0	*0*	*0*	*0*	*3000*	*0*	*3000*	*0*

3 Intraday capacity calculation

3.1. General requirements for ID CC

According to Regulation EC 714/2009, CWE TSOs shall establish an ID Capacity Calculation mechanism. In the CWE NRAs "*Position Paper of CWE NRAs on Flow-Based Market Coupling"* of March 2015, CWE NRAs indicated that a Flow Based methodology shall be developed also for the ID timeframe and an implementation of an ATC intraday capacity recalculation the beginning of November 2015 has to be done as an intermediate step towards FB ID. The goals of this solution were described clearly: "This interim solution is intended to allow for more capacity at this timeframe, taking stock of more accurate information on grid, consumption, generation parameters and renewables."

This position of NRAs refers also to Articles 14.1 and 21 of CACM stipulating that for the common capacity calculation methodologies, a flow-based (FB) approach shall be used as a primary approach for day ahead and intraday timeframes. Needless to remind that in the CWE-region, FB capacity calculation and allocation have already been put in place for the day ahead market. Given the ambitious deadline of 19 months after entry into force for submission of a capacity calculation methodology including the ID time frame, CWE TSOs share the priority of CWE NRAs for the development of such a methodology for ID.

CWE TSOs are convinced that the current proposed ID ATC CC is in line with this request of CWE NRAs (cf. paragraph 3.2 for a full description). The approach for the intermediate step based on ID ATC CC towards full Flow based for Intraday (cf. also paragraph 1 "General information on the process followed) was a result from an impact assessment TSO performed in 2014.

This detailed impact assessment was performed by CWE TSOs in 2014 to investigate all possible improvements for the intraday timeframe. Based on the conclusions, CWE TSOs decided to start as soon as possible with developing FB ID version 1 in line with CACM Guidelines, instead of spending time to develop a full coordinated ATC process. Indeed there is no proof available showing that recomputed ATC would even provide better (i.e. more accurate) results.

For the sake of transparency a brief wrap-up of the options evaluated and criteria used is given hereafter. The extensive list of improvements among which the full coordinated ATC process was scored based on the following main criteria:

- Complexity/time need to implement
- Congestion & balancing risk benefit
- CACM compliant

Based on this assessment, two short-term improvements were selected:

- Sensitivity analysis for all borders, to possibly increase/decrease ID ATC capacity
- Coordinate on RAs for the day ahead market direction/corner including PST taps and re-compute the FB-domain but keeping D-2 grid model.

Further research showed that these two improvements:

- have uncertainties with respect to the added value in terms of increase accuracy of computation outcomes, due to among other reasons the multi-lateral and highly meshed characteristics of the CWE system
- take *at least one year* of implementation
- are not directly compliant with the FB ID solution and therefore not in line with CACM
- require resources that were limited for implementation of improvements; a trade-off between work on target vs short-term improvements was required

After thoroughly weighting pros and cons, CWE TSOs decided to focus on a first version of FB ID, based on minimum requirements, to ensure a fast delivery in line with CACM requirements and deadlines.

As any additional intermediate 'improvement' (with uncertainty about the added value in terms of increase accuracy of computation outcomes) would delay FB ID work and could result in delay in complying with the target model that has been integrated in the CACM guideline, TSOs have decided to not further work on these developments. In case of work on this intermediate 'improvement', resources would need to be doubled which seems unfeasible. It would also create about 1 year delay for the target model ID FB CC, which would not be finalized before 2018.

In the light of this, the proposed ID CC is based on a coordination of locally determined ID capacities with other CWE TSOs to make sure these do not cause negative effects in other TSOs networks (loop flows, transits).

Furthermore, to ensure that the proposed ID ATC CC (cf. § 3.3) takes stock of more accurate information on grid, consumption and generation parameters, a daily process is being performed to assess the feasibility of more capacity for the ID timeframe.

It should however be clear that this re-assessment – or any other assessment based in a different methodology – does not automatically lead to more available capacity, as this could also result in less available capacity, but this would serve improved Security of Supply.

3.2. ID ATC re-computation

The high-level process of the ID ATC CC methodology after FBMC is depicted below (see Figure 6). It is a daily process that starts at 18:00h D-1, where the request for increase is announced and several reassessments are performed

taking into account more recent information.

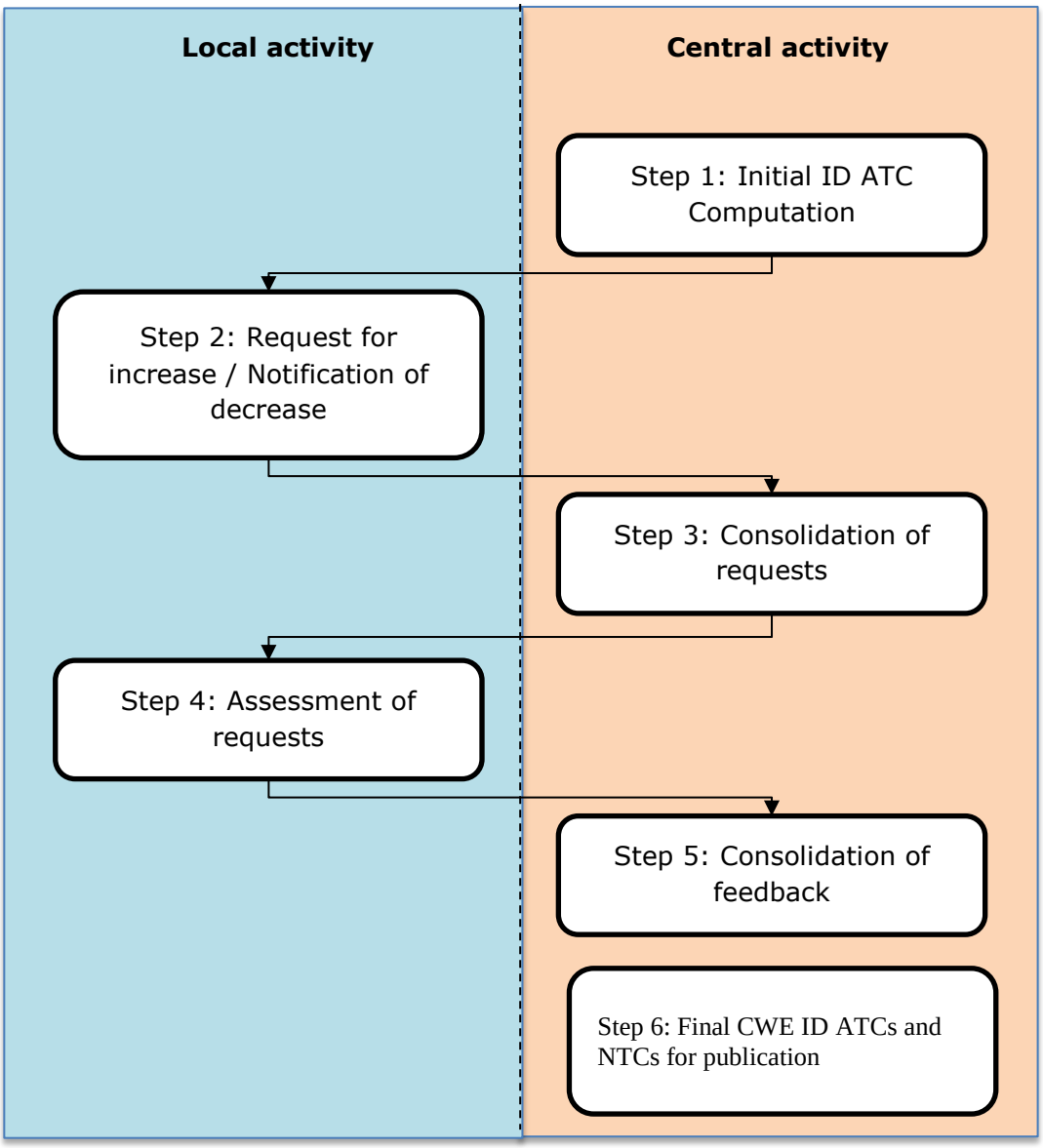

Figure 6: High-level process of ID ATC CC methodology.

The proposed ID ATC CC process is inspired by the process that was implemented before FB Go Live on the DE-NL and BE-NL borders and the CWE ATC DA process, that also combined different local processes with coordination on CWE level in consecutive steps:

1. The starting point for the proposed ID CC methodology are the initial ID ATC values which result from the CWE FB day ahead process. This initial ID ATC is computed out of the DA FB domain around the DA market clearing point and is the result of a unique and common centralized computation.

2. The first step is followed by a local assessment by CWE TSOs evaluating a possible increase or decrease on their own borders.

3. The third step is a merging step by a common system. A Central Matching Tool (CMT) consolidates the increase requests and the decrease notifications.

4. Based on this consolidated input all CWE TSOs perform a local analysis that enables them to accept, partially accept or reject the requested capacity increases in a justified manner.

5. The acceptance or rejection messages are handled in a common way by the CMT.

6. In the last step, each TSO will then be able to use these common CWE ID ATCs and NTCs as input for the capacity allocation of their respective borders.

3.3. CWE TSO Intraday roadmap towards CACM compliancy

CACM obliges CWE TSOs to finalize the FB ID methodology 19 (cf.§ 3.1) months after the entry into force, therefore by Q2 2017 the methodology should be provided. This three-step roadmap ensures a delivery of a FB ID CC method in line with the CACM obligations to finalize the method end of 2016.

The Figure 7 below provides more insight in the different steps that are needed to realise the implementation of an ID FB CC.

- The process for defining a FB ID concept and high-level process is on-going and FB ID experimentations are currently being performed. This activity will last until Q2 2016.
- Once the FB ID concept is finalized and the specifications for a prototype are clear, expert experimentation will take place with the support of this prototype. This activity will be finalized end of 2016
- When the experimentation is finalized, the process will have been stabilized and implementation activities will be initiated from Q1 2017 onwards.

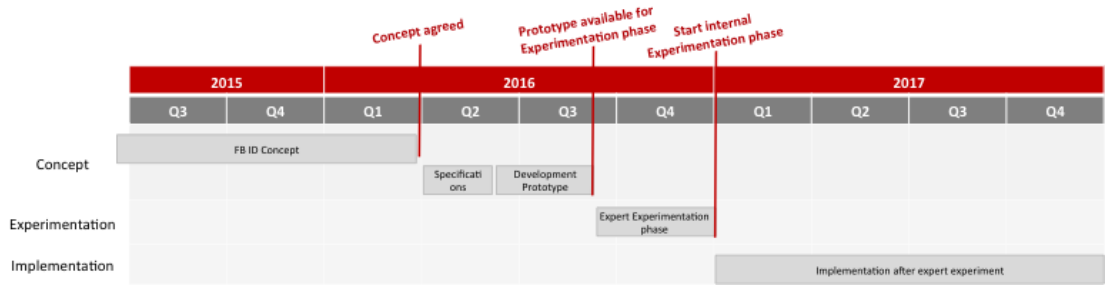

Figure 7: High-level planning CWE FB ID

3.4. Challenges in developing FB ID v1

The main objective for the FB ID version 1, is to create a FB ID method based on minimum requirements to ensure a delivery in line with CACM Guideline, while also ensuring a quick delivery. The DA process can be seen as a good starting point (from a conceptual and technical point of view) and therefore various methods and related input data from day ahead are re-used, limiting the effort to define new methods for inputs that are similar for day ahead and intraday.

However, it should be underlined that Flow based for intraday is not simply updating the grid models and again computing with same systems/methods as day ahead the results for intraday.

The current Common Grid Models available for intraday, namely the DACF/IDCF are used for other (local) processes and not yet for regional capacity calculations. Consequence: there is no CWE Common Grid Model DACF/IDCF with common alignment, content, quality checks and process.

After updating the common grid model, there are more actions required to be able to provide FB parameters, which are captured by the below challenges:

- Coordination/optimization/verification in a commonly aligned and regional manner
- There is less time in Intraday (12 hours is needed for the day ahead process, ID process will have to be shorter for computing results, automatic coordination and verification), to perform the activities mentioned, which imposes other requirements to the process as well, such as a higher level of automated calculation and coordination processes
- Since, the methodologies and process to do this are still to be developed, a re-computation only will not suffice

To develop a methodology suitable for intraday experimentation it is therefore focused on answering questions like stated below:

- How to update main inputs (CNEs, COs, RAs, GSKs, ECs, ...), consistent with new information contained in CGMs ?
- How to optimize RAs around the DA clearing points and which objective to reach?
- How to consider the 24 timestamps?
- How to fit with more constraining timings?
- How often re-computation is feasible and provides market's added values?
- How to extract new ID ATCs out of the new FB domains?

When introducing Flow based day ahead as regional capacity calculation methodology, also significant time was required to develop the required methodologies, processes, prototypes and finally an industrialized system.

As mentioned, various principles from Flow based day ahead will be re-used, but the same trajectory is needed for Flow based for intraday to be able to create a stable and significantly improved (Flow based) intraday process

CWE TSOs have already started working on these challenges and have estimated that defining a concept which proves sufficiently efficient regarding the above challenges and develop, implement and test the associated centralised/decentralised processes is expected to take about 3 years, which is consistent with CACM guidelines.