



Methodology for capacity calculation for ID timeframe

NRA approval package

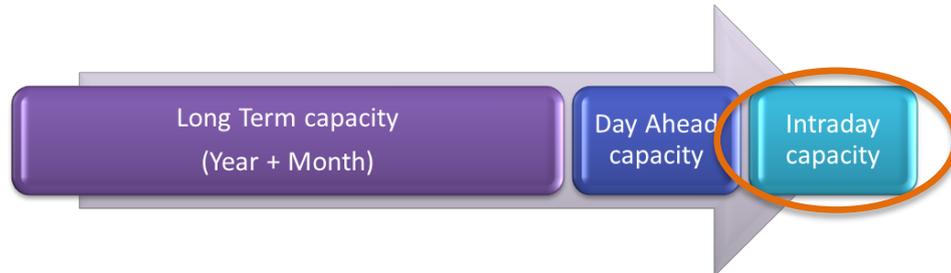
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1 Introduction and purpose

This document gives a description of the calculation of the intraday (ID) capacity for the CWE internal borders. Pursuant to Regulation (EC) 714/2009 (+Annex 1) and based on regulatory approved splitting rules, TSOs allocate capacity in different market timeframes (long term, LT; day-ahead, DA; and intraday, ID). TSOs try to maximize available capacity in all time frames.



The scope of this methodology is strictly limited to the ID timeframe. This model is part of a coordinated approach by the TSOs involved in accordance with the ENTSO-E policies and assumes that the day-ahead capacity, allocated to the market, is the result of the CWE Flow Based Market Coupling.

Up to now no capacity is reserved for ID allocation. All ID capacity given to the market is a result of non-used DA capacity, increase processes after DA allocation, or due to the netting effect.

The target of the CWE Flow Based Market Coupling (FBMC) project was to increase efficiency of capacity allocation in the DA timeframe. This goal was achieved as the increase of DA net positions referring to higher market activity at the border with a higher trade volume. As FBMC is a process for the entire CWE region on all time frames for the capacity market (LT, DA, ID), an increase in the DA net position by default means a decrease in available capacity for the ID market.

The aim of this ID capacity calculation methodology is to have the possibility to release additional capacity to the market players after the flow based market coupling.

Note: this document is an update of the Methodology for capacity calculation for ID timeframe as submitted to CWE NRAs on 05.11.2015.

The main changes compared to the version 1.0 are the following:

- Updates related to the inclusion of the DE-AT bidding zone border

2 Definitions

- **CBCO**: Critical Branch Critical Outage
- **CMT**: Central Matching Tool. Central tool used for intraday increase/decrease process to consolidate the increase requests and the decrease notifications.
- **D2CF**: Two-Days ahead Congestion Forecast. Daily procedure to create a representative load flow model of the grid for the region of the participating TSOs for a specific hour. The dataset to create this model includes the best estimation for: the planned grid outages, the outages of generators, the representative load pattern, wind and solar generation and the load-forecast.
- **DA CGMs & ID CGMs** are the Day Ahead & Intraday Common Grid Models which are the result of the merging of the Individual Grid Models provided

by TSOs in day-ahead or in intraday as their best forecast of the topology, generation and load for a given hour of the Day D.

- **Day D:** delivery day for which capacity increases or rejection are considered.
- **Day D-1:** day before Day D, day ahead.
- **DACF:** Day-Ahead Congestion Forecast.
- **ID ATC:** Intraday Available Transfer Capacity.
- **Increase Feedback Deadline:** this is the latest time a CWE TSO may introduce a feedback for the request of increase on one of the borders for the applicable MTP: acceptance, partial acceptance or justified rejection.
- **Increase Request Deadline (IRD) and decrease Notification Deadline (DND):** this is the latest time a CWE TSO may introduce a request for increase or a notification of decrease on one of his own borders.
- **Initial ID ATCs:** output results of Initial ID ATC computation (left-over capacities after DA FBMC).
- **Firmness:** arrangements to guarantee that capacity rights remain unchanged or are compensated.
- **Full acceptance:** situation in ID increase/decrease process when a TSO will fully accept the requested increase.
- **Market Coupling net positions:** sum of power flows per hub induced by the accepted orders.
- **MTP:** Market Time Period. This is a group of consecutive hours within the Day D.
- **Own border of TSO x:** bidding zone border within CWE across which TSO x has at least one (tie)-line.
- **Partial acceptance:** situation in ID increase/decrease process when a TSO will partially accept the requested increase on the borders on a non-discriminatory basis. This occurs when the requested capacity increases on different borders compete for available margin on the same network element.
- **Post-coupling process:** activities to check the DA MC result and to transform the Net Positions, computed as a result of the market coupling, into Bilateral Exchanges for further processes.
- **Pre-coupling:** activities to compute the DA capacities that will be sent to the MC system.
- **PTDF:** Power Transfer Distribution Factor. Factors showing the impact of the various bilateral exchanges on the overloaded branch.
- **RAM:** Remaining available margins on critical branches.
- **Rejection:** situation in ID increase/decrease process when a TSO will reject the increase requested because the consequences of the request cannot be fully nor partially accepted by the TSO.

3 General principles of ATC ID CC after FBMC

As it was the case in the former CWE DA capacity calculation (CC) process, the proposed ID ATC capacity calculation process combines different local processes with coordination on CWE level in different steps.

1. The starting point for the proposed ID CC methodology is the initial calculation of the ID ATCs which have been described in the CWE Flow Based (FB) approval document in Chapter 4.4 "Initial ID ATC Computation". This Initial ID ATC computed out of the DA FB domain

around the DA market clearing point is the result of a unique and common centralized computation.

2. The second step is a local evaluation by each involved TSO to request a possible increase (Basecase) or decrease (in special situations) on his own borders.
3. The third step is a merging step by a common system. The Central Matching Tool (CMT) consolidates the increase requests and the decrease notifications.
4. During the fourth step, based on this consolidated input, each involved TSO performs a local analysis that enables him to accept fully, accept partially or reject the requested capacity increases in a justified manner.
5. In the fifth step, these acceptance or rejection messages are then gathered and handled in a common way by the CMT. The System will distribute these consolidated acceptances and rejections back to the local TSOs.
6. In the last and sixth 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.

The steps 4 to 6 can be performed several times a day for a certain period of trading. For example, the assessment can be done during the evening for the night hours and during the night for the day hours. The number of iterations depends on the border. For an overview of the proposed ID ATC capacity calculation process see Figure 1.

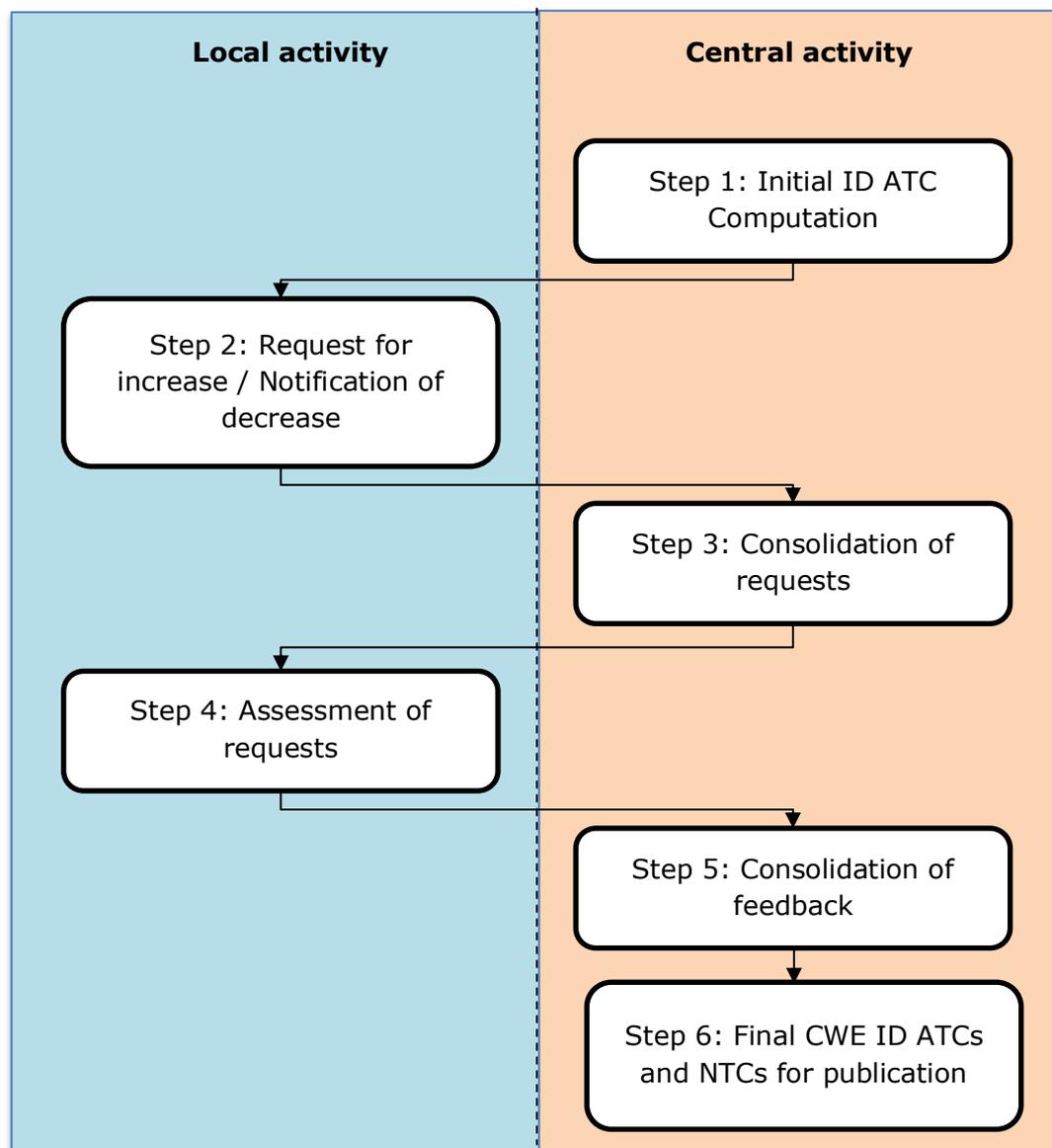


Figure 1: High-level process of ID ATC CC methodology.

4 Coordinated ID ATC CC after FBMC process

Important remark

This step is essential in the ID capacity calculation methodology but has already been presented to CWE NRAs in the context of the approval of the CWE FB Market Coupling.

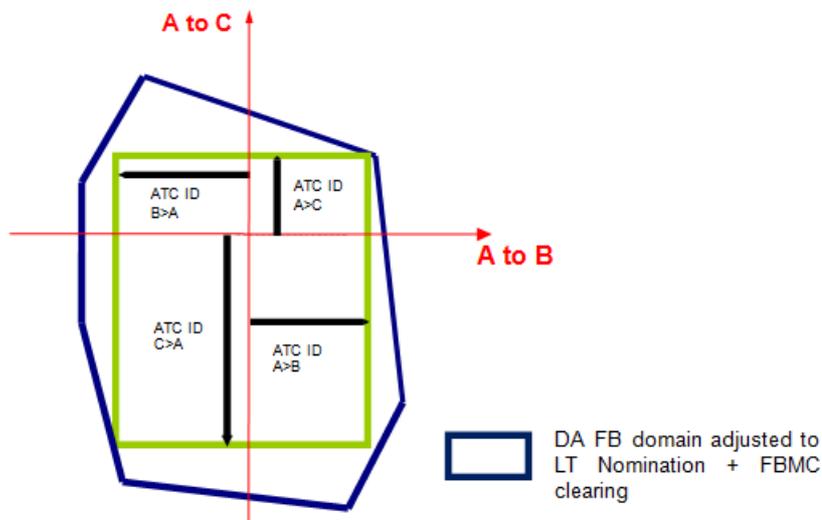
In addition to this first step, the coordinated increase process is described in paragraph 4.2 "Re-computation of ID ATC during intraday timeframe" and is submitted for approval pursuant to Section 15.2 of the Regulation (EC) 714/2009 and Article 5.2 of the Guidelines (Annex 1 of Regulation 714/2009).

4.1 Initial ID ATC Computation

4.1.1 Introduction

The hereafter described procedure is an intermediate step, to make the D-1 Flow Based method compatible with the current ID ATC process. The aim is to assess ID ATC values deduced from the D-1 Flow Based parameters, which have been adjusted according to the D-1 FB MC results. The ID ATCs can be considered as a leftover of the D-1 Flow Based

capacity as illustrated below. With that respect the initial ID ATC computation is not a new capacity calculation process.



The calculated ID ATCs are then used in the same way as the current ID ATCs. This chapter focuses on the process of the ID ATC computation. The input and output parameters are described and the iterative method is explained using a pseudo-code and an example calculation.

4.1.2 Input data

Despite the two days per year with a long-clock change, there are 24 timestamps per day. The following input data is required for each timestamp:

- Market Coupling net positions.
- Presolved Flow Based parameters adjusted to LT nominations; curtailed to zero margins in case of a negative RAM.
- Tolerance margin (in MW), with the possibility to activate it for every country by the respective TSO (may be used in order to propose minimum ID ATC values).

4.1.3 Output data

The calculation leads to the following outputs for each timestamp:

- initial ID ATC
- number of iterations that were needed for the ID ATC computation
- branches with zero margin after the ID ATC calculation
- indication if the tolerance margins were activated, and if so, which ID ATC was affected by this

4.1.4 Algorithm

The ID ATC calculation is an iterative procedure and part of the so-called post-coupling process.

Starting point

First, the remaining available margins (RAM) of the pre-solved CBs, which were given to the DA market at the end of the pre-coupling process, have to be adjusted to the MC results. The adjustment is performed using the net positions resulting from the day-ahead MC and the corresponding zone-to-hub PTDFs. The resulting margins serve as a starting point for the iteration (step $i=0$) and represent an updated Flow Based domain from which the ID ATC domain is determined.

From the non-anonymized presolved zone-to-hub PTDFs ($PTDF_{z2h}$), one computes zone-to-zone PTDFs ($pPTDF_{z2z}$), where only the positive numbers are stored¹:

$$pPTDF_{z2z}(A > B) = \max(0, PTDF_{z2h}(A) - PTDF_{z2h}(B))$$

with $A, B = DE, FR, NL, BE, AT$. Only zone-to-zone PTDFs of neighbouring market area pairs are needed (e.g. $pPTDF_{z2z}(DE > BE)$ will not be used).

Iteration

The iterative method applied to compute the ID ATCs in short comes down to the following actions for each iteration step i:

1. For each CB, share the remaining margin between the CWE internal borders that are positively influenced with equal shares.
2. From those shares of margin, maximum bilateral exchanges are computed by dividing each share by the positive zone-to-zone PTDF.
3. The bilateral exchanges are updated by adding the minimum values obtained over all CBs.
4. Update the margins on the CBs using new bilateral exchanges from step 3 and go back to step 1.

This iteration continues until the maximum value over all critical branches of the absolute difference between the margin of computational step i+1 and step i is smaller than a stop criterion.

The resulting ID ATCs get the values that have been determined for the maximum CWE internal bilateral exchanges obtained during the iteration and after rounding down to integer values.

After algorithm execution, there are some Critical Branches with no remaining available margin left. These are the limiting elements of the ID ATC computation.

The computation of the ID ATC domain can be precisely described with the following pseudo-code:

```

While max(abs(margin(i+1) - margin(i))) > StopCriterionIDATC
  For each CB
    For each non-zero entry in pPTDF_z2z Matrix
      IncrMaxBilExchange = margin(i)/NbShares/pPTDF_z2z
      MaxBilExchange = MaxBilExchange + IncrMaxBilExchange
    End for
  End for
  For each ContractPath
    MaxBilExchange = min(MaxBilExchanges)
  End for
  For each CB
    margin(i+1) = margin(i) - pPTDF_z2z * MaxBilExchange
  End for
End While
ID_ATCs = Integer(MaxBilExchanges)
    
```

Configurable parameters:

- StopCriterionIDATC (stop criterion); recommended value is 1.e-3
- NbShares (number of CWE internal commercial borders); current value is 5.

Tolerance margin

The tolerance margin introduces minimum ID ATC values on borders between CWE market areas. This optional process step² comes after the original ID ATC determination and is therefore based on the results obtained before.

¹ Negative PTDFs would relieve CBs, which cannot be anticipated for the ID capacity calculation.

² Since the CWE FB project considers the DA market only, the usage of the ID tolerance margin should be discussed in the current ID framework.

The tolerance margin can be activated by one or more CWE TSOs, which are neighbours to the border, by setting a non-zero value into a reference table. Such TSOs are here labelled with 'TSO_act'.

	TTG	TTB	Amp	TNG	RTE	Elia	APG
DE->NL	0	0	0				
NL->DE	0	0	0				
NL->BE		0				0	
BE->NL		0				0	
BE->FR					0	0	
FR->BE					0	0	
FR->DE			0	0	0		
DE->FR			0	0	0		
DE->AT	0		0	0			0
AT->DE	0		0	0			0

The value in the table is valid for the whole day (all timestamps) and remains unchanged until it is reset by the responsible TSO_act.

The tolerance margin is only accepted within the algorithm if it does not introduce overloadings on the CB of those TSO, which did not activate the tolerance margin (labelled with TSO_other). But the CBs of TSO_act can be overloaded with respect to this procedure.

The following procedure describes the calculation of the tolerance margin:

Define first the TSO(s)/countries having activated the tolerance margin in the ID ATC computation as 'TSO_act', whereas the other TSOs are identified as 'TSO_other'. Then perform the following check, which may result in an adjustment of the ID ATCs corresponding to the borders of TSO_act:

```

FOR all TSO_act DO
  Store the old ID ATC values of TSO_act
  IF the ID ATCs of TSO_act < tolerance margin THEN
    Set TSO_act ID ATCs to the tolerance margin value
  IF this leads to overloaded TSO_other CBs THEN
    Discard the new ID ATCs for TSO_act and retrieve the stored ones
  ELSE
  Store and apply the new set of TSO_act ID ATCs
    
```

The tolerance margin³ used for the ID ATC calculation takes into account the level of uncertainty of the ID ATC calculation based on the D2CF grid model. Given the uncertainty level of these calculations in the D-2 stage, some TSOs have the possibility to put a minimum value on the ID ATC in order not to prematurely and maybe unnecessarily block the market. The initial value of the ID ATC will then not be initially lower than the tolerance margin, however security calculations performed after day-ahead market coupling (e.g. using DACF) might still reduce or increase the ID ATC in line with system security requirements.

³ The tolerance margin is one of the options currently being investigated by a dedicated workgroup and out of scope of this approval package.

The ID ATC initially at zero might not be confirmed by the recalculation, therefrom the possible usage of the tolerance margin.

4.2 Re-computation of ID ATC during intraday timeframe

After the first computation, the TSOs have the possibility to re-assess the new capacities. This chapter describes the process after the first computation.

4.2.1 Requesting increase or notifying decrease of capacities on own borders

4.2.1.1 Requesting increased capacities on own borders

Capacity increases can be requested by all CWE TSOs for each hour of the Day D on their own borders via the CMT. Please note that the inclusion of the border between Austria and Germany in the process is currently not foreseen. An extension of the process to this border might be applied in the future.

The starting point for the local analysis to launch an increase request is the already available initial ID ATCs. In order to maximize the acceptance of the requests, the TSOs should favour a request for the borders and directions where the available capacity provided to the market after the FB MC is low.

Every increase request is capped with a fixed value per border and direction. These fixed values are proposed by each TSO for their own borders and commonly approved by the involved CWE TSOs. After having gained experience with the increasing process TSOs will reevaluate the cap.

The requested capacity increase is an intention for a capacity increase. However, due to constraints identified during the local analysis (during the fourth step of the process cf §4.2.3), it can be the case that a proposed capacity increase for a specific border is rejected by the same TSO who requested it.

The Increase Request Deadline is set for all MTP simultaneously to ensure a coordinated assessment on local side.

4.2.1.2 Notification of a decrease of capacities on own borders

In line with the task to secure the grid, all TSOs have the possibility to take the necessary steps to guarantee this (just like today). Intraday capacity reduction is a pragmatic process that allows involved TSOs for any hour of the Day D to reduce Intraday ATCs, on their own borders, in cases operational security issues arise.

As the notification for decrease is an emergency process, a capacity reduction is an input to the assessment of capacity increases and cannot be rejected by other TSOs.

As firmness of the trades applies, only capacity that was not yet allocated will be reduced, even if a higher decrease is requested.

4.2.2 Consolidation of the requests of increase and notification of decrease

When the Increase Request/Decrease Notification deadline is reached, the CMT will immediately proceed for each hour of the Day D with the consolidation per border and direction of the received information respecting the following rules:

- In case only Increase Request have been sent, the CMT will take the maximum of the requests. If this value is higher than the fixed maximum increase authorized on this border, the CMT will cap the request to this maximum authorized increase.

- In case a Decrease Notification has been sent, the notification for decrease will prevail over an increase request for the same hour. The CMT will consider the minimum value of the notified decrease⁴.

The CMT will then send for each hour of the Day D and for each CWE border and direction (which is covered by the re-computation process) the resulting increase or decrease to the CWE TSOs.

4.2.3 Assessing the feasibility of requested increases

After receiving the requests of increase and notification for decrease, the involved TSOs have to assess locally the feasibility of the requests.

A request for increase can be:

- **Fully accepted**
- **Partially accepted**

There are situations when requested capacity increases on different borders compete for available margin on the same network element.

In this case, the TSO will partially accept increases on the borders on non-discriminatory basis.
- **Rejected** in case the consequences of the requests cannot be fully nor partially accepted by the TSO.

After the assessment, the TSO will notify the CMT with the status of each request for each MPT before the Increase Feedback Deadlines.

4.2.3.1 Local implementation

Amprion

Amprion checks upon the feasibility of capacity increases via a local simulation tool that models the effect of capacity increases of Amprion's network. The tool uses DA CGMs or ID CGMs and models the impact of capacity increases via linear sensitivities.

In case this tooling should not be available when the process goes live, a slimmer, intermediate method based on contingency analysis results will be applied for a limited time. For the borders BE-NL and BE-FR no rejections of increase requests are planned to be conducted with this slimmer, intermediate method.

Elia

ELIA assesses ATC around the clearing point in D-1 and in intraday on Belgian borders and in all directions based on DA CGMs or ID CGMs. Calculation will be performed for a given MTP on representative hour(s) for this period. In this assessment, realistic values in the direction of the likely corner(s) are considered for the non-Belgian borders. Based on this, ELIA defines for this period the (partial) increase ID ATC possible on the Belgian borders and motivated (partial) acceptances or rejections for other borders, if any.

For the assessment, the same set of acceptance criteria and remedial actions as the ones used locally at Elia for the DACF process is considered.

On request of ELIA, Coreso may be in charge for Elia of the assessment whether or not to increase capacity for the aforementioned time periods. Based on this information Elia's operator will decide about possible rejections of capacity increases.

In all cases, the notification of rejections will be provided to the CMT by Coreso.

RTE

For each hour of the day, RTE checks the inclusion of the increased ATC domain into a flow-based domain.

⁴ For example, the CMT will receive two requests for decrease (-100 MW and -200 MW) and one increase request (100 MW), in this case the CMT will consider the minimum value, namely -200 MW, as consolidated notification of decrease.

The ATC domain is the initial ATC domain centrally computed increased by the requests on each border. If the resulting domain is larger than the normal behaviour of the market players in the intraday timeframe, the domain is reduced in this market direction.

The flow-based domain used for the inclusion is the flow-based domain with only the critical branches of RTE without the French external constraints. It also means that none of the branches of other CWE TSOs and none of the external constraints are in this domain.

TenneT TSO B.V.

For the Dutch-German and Dutch-Belgian borders harmonized procedures were already developed, meaning that the capacity analyses are running in parallel and use identical parameters for the decision making for the intraday capacity.

For both borders, several timeframes are used to analyse the capacity increases for the forthcoming hours. The analyses is in line with the feedback deadlines specified in HLBP of ID ATC after FBMC.

The current local assessment looks at the thermal loading of a predefined set of network elements under all relevant (n-1)-contingencies. If thermal loadings are below a certain threshold, the capacity increase is permitted. In addition, an NTC update is made using updated wind forecasts. In case operational security issues are expected/arise for the coming hours, operators can take these results into account when releasing intraday capacity. Consequently, a decision whether or not to accept an increase request is made hour-wise.

TenneT TSO GmbH

The increase requests are assessed starting from DA CGM and the D-1 clearing point. Maximum utilization of potential ID ATCs (total of initial ATCs, decrease notifications and increase requests) is simulated for the most likely combinations of simultaneous exchanges on all four borders. Security assessment is performed using AC load flow and CBCOs of TenneT TSO GmbH. If the network security assessment fails for at least one likely market direction, it is repeated with reduced increase requests in order to check for the possibility of partial acceptance.

The assessment of increase requests takes place for all MTPs simultaneously.

TransnetBW

TransnetBW assesses the increase requests with the help of local load flow tool that uses day ahead and intraday CGM as basis. The focus of increase assessment is on the CBCOs in the control area. Requests are checked in all possible market directions meaning simultaneous exchanges on all borders. In case full acceptance is not possible, the process is repeated with partial increase requests according to the common rules. The results of possible reductions of the local assessment are sent to CMT.

APG

As the border DE-AT is currently not foreseen to be involved in the increase/decrease process, no local activity is outlined here for the APG side.

4.2.4 Consolidation of acceptances/rejections

When an Increase Feedback Deadline is reached, the CMT will immediately proceed for each hour of the applicable MTP with the consolidation per border and direction of the received information respecting the following rule:

- In case justified rejections are received, the CMT will consider the lowest value as the result of the applicable increase.

The CMT will then send for each hour of the Day D and for each CWE border and direction to the CWE TSOs the resulting ID ATCs/NTCs as the sum of the initial ID ATCs and the consolidated increase/decrease for the applicable MTP.

4.2.5 Providing ID ATCs for allocation

After receiving the updated capacity from the CMT, the responsible TSOs offer the capacity to the market players with the allocation rules and platforms.