CWE TSO's methodology for capacity calculation for the Intraday timeframe

CWE NRA approval package

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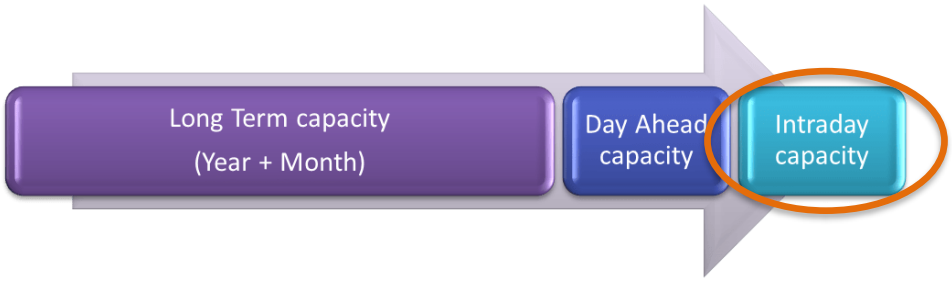
Contents

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 (EU) 2019/943 of 5 June 2019 on the internal market for electricity (which is part of the Clean Energy Package – "CEP") 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 refering 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 version 2.1 as submitted to CWE NRAs on 15.02.2019.

The main changes compared to the version 2.1 are the following:

- Updates related to the CEP Implementation: introduction of ID minRAM factor to recompute a Flow Based Domain from which to extract ID ATCs, to avoid security issues in ID when high virtual capacities are used in DA.
- Updates related to ALEGrO commercialization (new DC border BE-DE).

2 Definitions

- **CMT**: Central Matching Tool. Central tool used for intraday increase/decrease process to consolidate the increase requests and the decrease notifications.
- **CNEC**: Critical Network Element (also known as CBCO, Critical Branch Critical Outage).
- **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.
- **HVDC**: High Voltage Direct Current.
- **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.
- **MinRAMfactor:** Minimum margin on CNECs that will be guaranteed for crossborder exchanges
- **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 Margin on CNECs.
- **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.
- **VH**: Virtual Hub used for the Evolved Flow Based Methodology.

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. First, a Final Flow Based domain will be recomputed for ID ATC extraction purpose, taking into account the input parameters of the final FB domain used for the DA market coupling with updated minRAM factors. The minRAM factors are updated based on an ID minRAM factor defined by each TSO.
    - The ID minRAM factor does not cause any limitation of the RAM per CNEC, which is calculated without virtual capacities.
    - The ID minRAM factor does not cause any limitation of the RAM per CNEC, which is needed to ensure LTAs.
2. The second step for the proposed ID CC methodology is the intitial calculation of the ID ATCs. This Initial ID ATC computed out of the Flow Based domain based on the minRAM set for ID timeframe around the DA market clearing point is the result of a unique and common centralized computation.
3. The third step is a local evaluation by each involved TSO to request a possible increase (Basecase) or decrease (in special situations) on his own borders.
4. The fourth step is a merging step by a common system. The Central Matching Tool (CMT) consolidates the increase requests and the decrease notifications.
5. During the fifth 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.
6. In the sixth 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.
7. In the last and seventh 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 5 to 7 can be performed serveral 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.

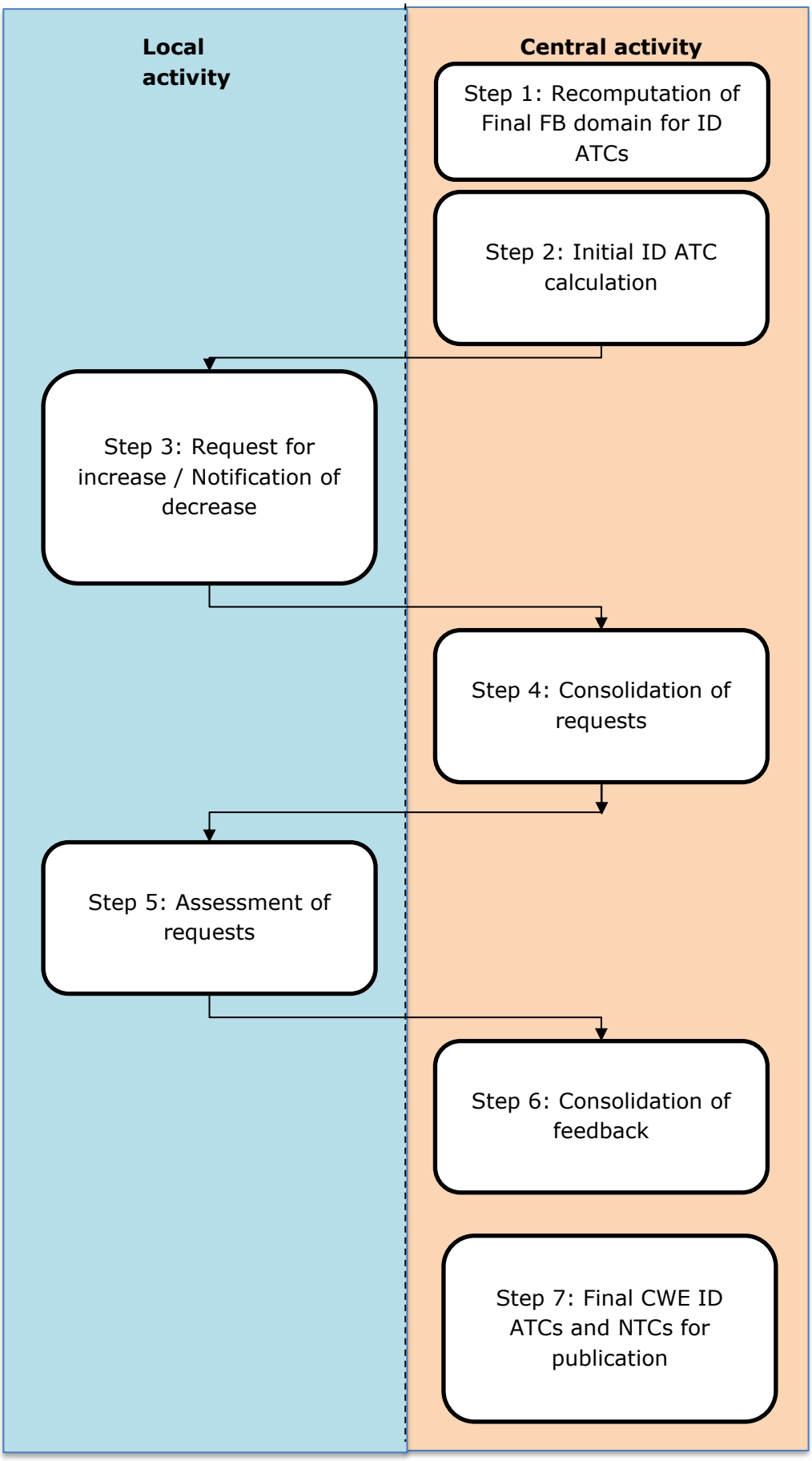


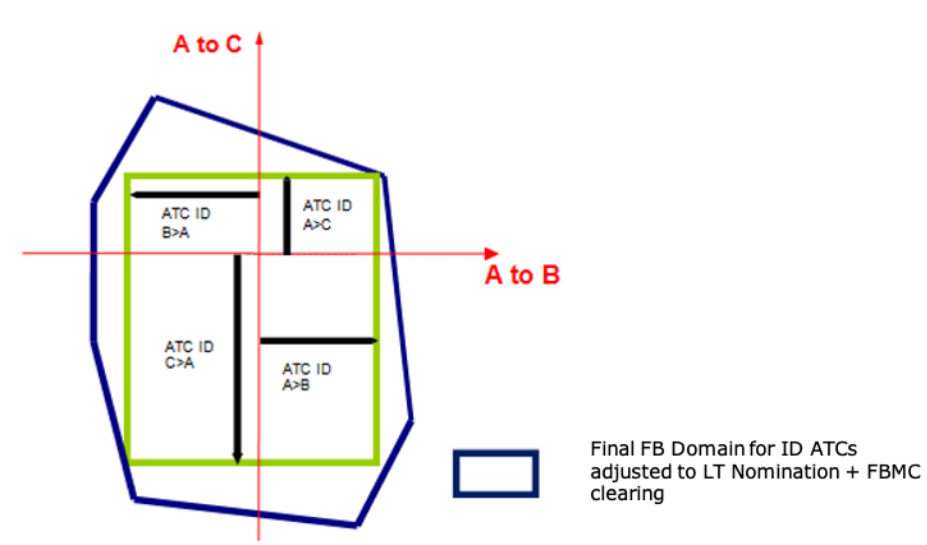
Figure 1: High-level process of ID ATC CC methodology.

4 Coordinated ID ATC CC after FBMC process

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 an updated 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.
- An initial ID minRAM factor set by each TSO to recompute[1] the Flow Based domain used for the ID ATC process.
    - **All CWE TSOs have agreed to set their initial ID minRAM factor at 20%.** This value guarantees there is no regression compared to the pre-CEP situation. Also, TSOs have sufficient operational experience with an ID ATC extraction based on a minRAM factor of 20%. It has proven to be a secure starting point for the subsequent ID ATC increase process, where the possibility of ID ATC increases will be assessed when better and updated information is available.
- Presolved Flow Based parameters curtailed at Market Coupling Point to zero margins in case of a negative RAM. Due to the update of the Flow Based domain the DA Market Coupling Point can be outside of the Flow Based domain. Curtailment of the negative RAM to zero ensures the inclusion of the Market Coupling Point for the ID ATC extraction process.

***** 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

4.1.3 Algorithm

Recomputation of Final FB domain for ID ATCs

First, the FB domain will be recalculated based on the input parameters of the final FB domain used for the DA market coupling with updated minRAM factors, resulting in a new final FB domain for ID ATCs.

Except for the new minRAM factors, the inputs (CGMs, CNECs, RAs, LTAs, External Constraints) will not be changed. Therefore, LTA inclusion remains guaranteed for the new final FB domain for ID ATCs.

The 'final ID minRAM factors' which are used as input for the new final FB domain for ID ATCs are calculated as follows for each CNEC:

[1] According to Article 16(8) of the Regulation (EU) 2019/943, it is foreseen that TSOs will provide 70 % of their transmission capacity for cross-zonal trade by the 1st of January 2020, unless there is an approved derogation (Article 16(9)) or action plan (Article 15) in place. In this case, the capacities provided for cross-zonal trade from the 1st of January 2020 and onwards can be lower than 70 %, but will not be lower than the current capacities. With the coming months and years some TSOs begin to raise their minRAM from currently 20 % to higher values. This process will from then on continue gradually. With higher minRAM values in DA capacity calculation, the resulting domains will also increase and consquently the extracted intraday ATCs will increase, leading to high virtual capacities in Intraday.

To start the ID ATC after FBMC process with secure initial ID ATCs, the ATCs will be extracted from a recomputed final Flow Based domain with dedicated ID minRAM values. The usage of this domain with a different minRAM is justified because TSOs see a risk for the security of the grid if ID ATC are directly extracted from a Flow Based Day Ahead domain with high virtual capacities. Indeed in the Intraday timeframe, there is neither sufficient time to perform security analysis in all extreme directions allowed by the ID ATC, nor enough time to coordinate RAs.

Therefore the aim of this process is to start with secure ID ATC values and wait to have updated information (grid situation) to then assess the feasibility of potential increases.

$$Final\ ID\ minRAM\ factor_{CNEC} = MIN(DA\ minRAM\ factor\ after\ validation_{CNEC}; Initial\ ID\ minRAM\ factor_{TSO})$$

Where the 'initial ID minRAM factor' is a parameter that can be set at TSO level.

This results in the following logic:

- If the applied minRAM factor from the DA process is LOWER than the initial ID minRAM factor, the lower value from DA will be kept as the final ID minRAM factor (i.e. the minRAM factor will not be changed). Reductions from the DA validation process below the initial ID minRAM factor are taken into account for the new final FB domain for ID ATCs.
- If the applied minRAM factor from the DA process is HIGHER than the initial ID minRAM factor, the final ID minRAM factor will be equal to the initial ID minRAM factor.

The numerical example on the next page provides an illustration of the ID minRAM factor functionality. The first table represents the reference DA final FB domain. The second table represents the new final FB domain for ID ATCs based on an initial ID minRAM factor setting at 20%.

Information provided for these final FB domains:

- **Fmax** - The maximum admissible power flow per CNEC.
- **FRM** - The flow reliability margin per CNEC.
- **F_{REF}** - The reference flow per CNEC without commercial exchanges within CWE.
- **RAM before AMR & LTA** - The remaining available margin per CNEC before adding any virtual capacities.
- **DA minRAM factor after validation** - The minimum level of RAM per CNEC from the DA capacity calculation process, including possible reductions from the validation step.
- **Initial ID minRAM factor** - Parameter set per TSO for the calculation of the final ID minRAM factor. Only relevant for the new final FB domain for ID ATCs.
- **Final ID minRAM factor** - Minimum level of RAM per CNEC that will be guaranteed for the calculation of ID ATCs, as derived from the DA minRAM factor and the initial ID minRAM factor. Only relevant for the new final FB domain for ID ATCs.
- **AMR** - The adjustment to respect the minimum level of RAM defined by the relevant minRAM factor (DA minRAM factor after validation for the DA final FB domain & Final ID minRAM factor for the new final FB domain for ID ATCs).
- **RAM after AMR** - The remaining available margin per CNEC after addition of the AMR.
- **RAM required to ensure LTA inclusion** - The minimum level of RAM per CNEC which is required to ensure LTA inclusion.
- **LTA margin** - The adjustment to respect the minimum level of RAM required for LTA inclusion.
- **RAM after AMR & LTA** - The remaining available margin per CNEC after addition of the AMR and the LTA margin.

Table 1 – Reference DA final FB domain

CNEC	Fmax	FRM	F_{REF}	RAM before AMR & LTA	DA minRAM factor after validation	|AMR|	RAM after AMR	RAM required to ensure LTA inclusion	|LTA margin|	RAM after AMR & LTA
1	1000	100	100	800	70%	0	800	500	0	800
2	1000	100	400	500	70%	200	700	600	0	700
3	1000	100	300	600	20%	0	600	200	0	600
4	1000	100	750	150	30%	150	300	400	100	400
5	1000	100	800	100	20%	100	200	100	0	200
6	1000	100	900	0	10%	100	100	0	0	100
7	1000	100	200	700	40%	0	700	900	200	900

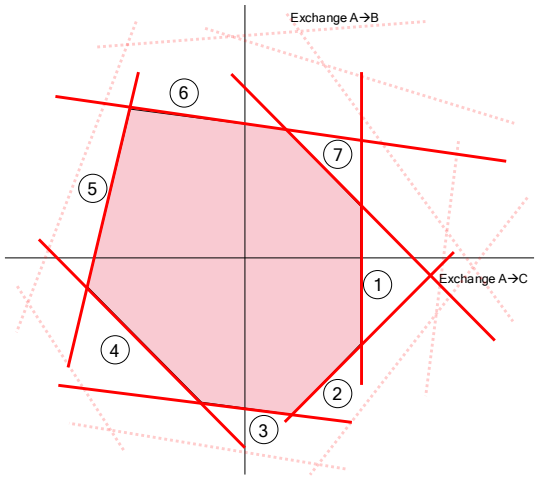
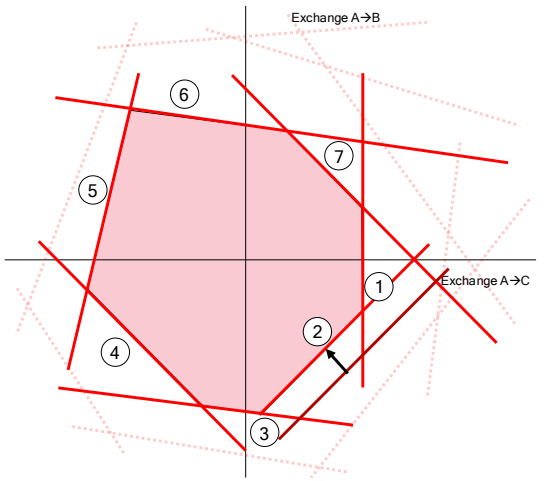


Table 2 – New final FB domain for ID ATCs

CNEC	Fmax	FRM	F_{REF}	RAM before AMR & LTA	DA minRAM factor after validation	Initial ID minRAM factor	Final ID minRAM factor	|AMR|	RAM after AMR	RAM required to ensure LTA inclusion	|LTA margin|	RAM after AMR & LTA
1	1000	100	100	800	70%	20%	20%	0	800	500	0	800
2	1000	100	400	500	70%	20%	20%	0	500	600	100	600
3	1000	100	300	600	20%	20%	20%	0	600	200	0	600
4	1000	100	750	150	30%	20%	20%	50	200	400	200	400
5	1000	100	800	100	20%	20%	20%	100	200	100	0	200
6	1000	100	900	0	10%	20%	10%	100	100	0	0	100
7	1000	100	200	700	40%	20%	20%	0	700	900	200	900



Starting point for ID ATC calculation

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

Second, the remaining available margins (RAM) of the pre-solved CNECs of the new Flow Based domain used for ID ATCs have to be adjusted to the MC results. Due to ID minRAM set by TSOs to calculate this new domain, the pre-solved CNECs may be different from the actual pre-solved CNECs given to the DA market. 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 stored[2]:

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

Equation 1

with $A, B = DE, FR, NL, BE, AT$.

A zone-to-zone PTDF represents the influence of a variation of a commercial exchange from bidding zone A to bidding zone B on CNEC l. The zone-to-zone PTDF is derived from the zone-to-slack PTDFs as seen above.

Only zone-to-zone PTDFs of neighbouring market area pairs connected via AC lines are needed (e.g. $pPTDF_{z2z}(DE > BE)$ will not be used).

In case neighbouring market areas within CWE are connected via HVDC links and the evolved FB methodology is used for the DA market coupling the zone-to-hub PTDFs ($PTDF_{z2h}$) of the virtual hubs can be considered for the calculation of the positive zone-to-zone PTDFs ($pPTDF_{z2z}$) between both market areas.

For example:

$$\mathrm{pPTDF_{z2z}(BE_{DC} > DE_{DC}) = \max(0, PTDF_{z2h}(BE) - PTDF_{z2h}(ALBE) + PTDF_{z2h}(ALDE) - PTDF_{z2h}(DE)}$$

Equation 2

where ALBE and ALDE describe the virtual hubs.

The impact of the cross-zonal exchange over a HVDC interconnector on the CNECs, the converter stations of the cross-zonal HVDC shall be modelled as two virtual hubs, which function equivalently as bidding zones. Then the impact of an exchange between two bidding zones over such HVDC interconnector shall be expressed as an exchange from the first bidding zone to the virtual hub representing the sending end of the HVDC interconnector plus an exchange from the virtual hub representing the receiving end of the interconnector to the second bidding zone. The two virtual hubs will have a combined net position of 0 MW, but their individual net position will reflect the exchanges over the interconnector.

Iteration

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

1. For each CNEC, share the remaining margin between the CWE internal borders that are positively influenced with equal shares.

[2] Negative PTDFs would relieve CNECs, which cannot be anticipated for the ID capacity calculation.

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 CNECs.
4. Update the margins on the CNECs using new bilateral exchanges from step 3 and go back to step 1.

This iteration continues until the maximum value over all CNECs 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 CNECs 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 CNEC
                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 CNEC
                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 6.

For borders connected via HVDC links the bilateral exchanges cannot exceed the maximum transmission capacity of the HVDC links.

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.

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.

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.

Every 3 months, an overview of the individual increase requests per TSO (per oriented CWE border and per hour) will be provided to CWE NRAs for monitoring purposes.

4.2.1.2 Notification of a decrease of capacities on own borders

All TSOs have the possibility to take the necessary steps to guarantee the security of the grid. 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.

Every 3 months, an overview of the individual decrease notifications per TSO (per oriented CWE border and per hour) will be provided to CWE NRAs for monitoring purposes.

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 immediatly 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 decease will prevail over an increase request for the same hour. The CMT will consider the minimum value of the notified decrease[3].
- Increase request for borders connected via HVDC links will be capped to the maximum transmission capacity of the HVDC links.

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.

[3] 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.

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.

Local implementation

This section lists a short summary of each TSOs local implementation of the evaluation of increase requests. A more detailed description of the increase/decrease functionality can be found in the "Explanatory Note on individual TSO's increase/decrease process for ID Capacity Calculation".

Every 3 months, an overview of the individual acceptances/rejections per TSO (per oriented CWE border and per hour) will be provided to CWE NRAs for monitoring purposes.

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.

APG

APG assesses the increase requests with a load flow tool that uses day ahead models (DACF) and the D-1 market clearing point. The security assessments considers the DA CGM and models the impact of capacity increases via linear sensitivities. The assessment of increase requests for all MTPs takes place when the DACF files are available. In case full acceptance is not possible, the values are checked for partial increase requests according to the common rules.

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.

RTE

For each hour of the day, RTE checks the inclusion of the increased ATC domain into a Flow Based domain.

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 CNECs of RTE.It also means that none of the CNECs 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 agreed feedback deadlines.

The current local assessment looks at the thermal loading of a predefined set of network elements (CNEC) under all relevant (n-1)-contingencies. If thermal loadings per CNEC are below a certain threshold (Imax of a certain CNEC in the N-1 situation),the capacity increase is permitted. 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 five borders. Security assessment is performed using AC load flow and CNECs 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 DA CGMs as basis for the security analysis which starts shorty after the CGMs are available for the dedicated Business Day. The focus of increase assessment is on the internal and cross-border CNECs in the control area. Requests are checked simultaneously in likely market directions, meaning simultaneous (increased) 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.

4.2.4 Consolidation of acceptances/rejections

When an Increase Feedback Deadline is reached, the CMT will immediatly 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.

Explanatory Note on individual CWE TSO's increase/decrease process for Intraday Capacity Calculation

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Contents

1 Management summary

1.1 Purpose of the document

The purpose of this explanatory note is to explain the individual increase/decrease process of the ID ATC after flow-based market coupling process as described in the *CWE Methodology for capacity calculation for the Intraday timeframe*.

2 Overview Table

TSO	INCREASE PROCESS	DECREASE PROCESS	How many assessment for Increase/Decrease Process
Amprion	No local process to ask for increase requests in operation. Increase requests for Amprion borders are performed by other CWE TSOs/RSCs. Feasibility of increase requests is checked by local tool considering the latest DA and ID CGMs available. Two validations are performed per Business Day using linear sensitivities similar to a Flow Based approach.	No local process to assess decreases before increase/decrease deadline is operation at the moment. Decreases of capacities for Amprion borders during the increase/decrease process on request by other TSOs possible.	2 (Based on DACF/IDCF)
APG	An automatic import/export increase request is generated internally, if the FB day ahead leftover in combination with the NP is below a certain threshold. APG then assesses this internal increase requests with a load flow tool that uses day ahead models (DACF) and the D-1 market clearing point. The security assessments considers the DA CGM and models the impact of capacity increases via linear sensitivities. The assessment of increase requests for all MTPs takes place when the DACF files are available.	APG does not have a local tool to assess decreases based on schedules or ATCs/day ahead leftovers. After the DACF load flow calculation process to ensure possible increase requests, a unilateral decrease by APG is possible.	1 (Based on DACF)
ELIA	An increase of 300 MW is requested for one or both directions of the Belgian borders. Market directions may be prioritised. 2 assessments are performed per business day. Increase requests are evaluated by performing a detailed security analysis for a set of representative timestamp/corner combinations.	No local process to assess decreases before increase/decrease deadline is foreseen at the moment.	2 (Based on DACF/IDCF)

RTE	Automatic increase request sent in case of FB day ahead leftover in combination with the NP is below a certain threshold on FR-DE and FR-BE frontiers; Feasibility of the increase requests based on some verification of the absence of overload on the French CNEC on the Final flow Based Domain.	Functionality not foreseen to be used on RTE's side	1 (Based on D2CF)
TenneT DE	No local process to ask for increase requests in operation. Increase requests for TenneT DE borders are performed by other CWE TSOs/RSCs. Likely Comers for Increase Requests are checked for likely corners and TenneT DE CNECs via load-flow calculations. In case of an overload the partial acceptance steps are checked for the concerned corner until no overload is detected anymore or the increase request is zero.	No local process to assess decreases before increase/decrease deadline is foreseen at the moment.	1 (Based on DACF)
TenneT NL	Semi-automatic increase request (max feasible value) is sent for the borders BE-NL and DE-NL in both directions.	Based on 2 possibilities a decrease can be applied: • *Critical Grid Situation* (CGS) confirm ENTSO-E definitions. • Unplanned outage in the 380kV grid	4 to 6 (Based on DACF/IDCF)
Transnet BW	No local process to ask for increase requests in operation. Increase requests for TransnetBW borders are performed by other CWE TSOs/RSCs. Feasibility of increase requests is checked by local tool considering the latest CGMs available. Currently with likely corners approach but exchanged in the near future to a linear sensitivity analysis similar to a flow based approach.	No local process to assess decreases before increase/decrease deadline is foreseen at the moment.	1 (Based on DACF)

3 Maximum Increase request on borders

The maximum increase request for borders involving Belgium is 300 MW (e.g. BE <-> FR, BE <-> DE, BE <-> NL), for other border it's 200 MW (e.g. DE <-> FR, AT <-> DE, DE <-> NL).

4 Individual Increase/Decrease Process for ID ATC Extraction

4.1 Amprion

4.1.1 Increase Process

There is no local process to ask for increase requests in operation. Increase requests for Amprion borders are performed by other CWE TSOs/RSCs.

Assessing the feasibility of the consolidating increase requests:

To assess the feasibility of increase requests, two local validations are performed per Business Day using linear sensitivities similar to a Flow Based approach. The assessment is performed by a local tool considering the latest DA and ID CGMs available.

1. h01-h09: DACF CGM (D-1)
2. h10-h24: IDCF CGM (D)

The local validation tool computes the sensitivities (zone2zone PTDFs for the CWE ATC borders) and initial loadflows for each critical network element of Amprion in a basecase or n-1 situation.

Possible loadlflow changes from zone A to zone B due to increase request and leftover ATCs can be described as

$$\Delta flow_{A\rightarrow B} = PTDF_{A\rightarrow B} \cdot (increase\_request_{A\rightarrow B} + ATC_{A\rightarrow B})$$

Only positive PTDF factors are considered for the dedicated critical network element. Both directions of a critical network element are evaluated seperately.

The additional flow for one critical network element can be determined by the sum of the delta flows of each ATC border

$$additional\ flow = \sum_{j=1}^{\substack{number\ of \\ ATC\ borders}} \Delta flow_j$$

In case the additional flow leads to an overload of a critical network element for a basecase or n-1 situation after respecting a security margin (FRM), the initial increase requests will be reduced until no overloads occur anymore.

The reduction of increase requests is performed successively for all borders applying the same partial acceptance steps (200 MW, 100 MW, 50 MW) followed by a full rejection (0 MW). If different increase requests for several borders are made, the increase requests are curtailed to a common level before all borders are reduced. This ensures non-discriminatory among increase requests for all borders.

4.1.2 Decrease Process

No local process to assess decreases before the increase/decrease deadline is in operation at the moment. However, a new local process to assess and apply decreases before the increase/decrease deadline could be developed in the future. Decreases of capacities for Amprion borders during the increase/decrease process on request by other CWE TSOs is possible.

However, when network security in Amprion's, RTE's or TransnetBW's network is endangered, the operator at Amprion's control centre may decide at any time to reduce capacities. When another TSO informs Amprion's control centre via telephone about capacity decreases, Amprion's operator will decide whether or not to apply a capacity reduction.

4.2 APG

4.2.1 Increase Process

Capacity increases are only requested by APG for the Austrian-German border.

An import/export increase of 200 MW is generated internally until 6 pm D-1 , if the FB day ahead leftover in combination with the NP is below a certain defined thresholds for import/export. These thresholds are based on historical data and can vary due to seasonal effects or based on new knowledge gained in the course of using the increase / decrease process.

APG then assesses this internal increase request with a load flow tool that uses day ahead models (DACF) and the D-1 market clearing point. The security assessments considers the DA CGM and models the impact of capacity increases via linear sensitivities.

In detail, for every APG CNEC and MTU, the maximal possible increase (for import/export) is calculated by the formula:

$$Inc_{\max\, i} = \frac{F_{\max\, i} - F_{DA\, i}}{PTDF_{\, i}}$$

$Inc_{\max i}$ … maximum possible increase on a certain CNEC i
$F_{\max i}$ … maximum thermal capacity of a certain CNEC i
$F_{DA\, i}$ … Flow on a certain CNEC i after FB DA MC
$PTDF_{\, i}$ … Power Transfer Distribution Factor for a certain CNEC i for the Border DE/AT based on DACF

After that, the CNEC with the smallest Inc_{max} of a MTU which had an aggregated increase request ≠ 0 MW defines the maximum increase for this MTU by the following formulas:

$200\ MW < Inc_{max}$ → accepted increase = 200 MW
$100\ MW < Inc_{max} < 200\ MW$ → accepted increase = 100 MW
$50\ MW < Inc_{max} < 100\ MW$ → accepted increase = 50 MW
$Inc_{max} < 50\ MW$ → accepted increase = 0 MW

At the end of the process, the operators are in charge to finally accept or decline the import/export increase for every MTU, which was provided by the local tool.

4.2.2 Decrease Process

APG does not have a local tool to assess decreases based on schedules or ATCs/day ahead leftovers.

After the the DACF loadflow calculation process to ensure possible increase requests, a unilateral decrease by APG is possible.

4.3 ELIA

4.3.1 Increase Process

Increase requests

Capacity increases are requested by Coreso on behalf of Elia. An increase of 300 MW is requested for one or both directions of the Belgian borders. Market directions may be prioritised.

Assessing the feasibility of the consolidated increase requests

The local validation of CWE ID ATC increase requests is performed by Coreso on behalf of Elia. 2 assessments are performed per business day:

1. Evening Process:
    - Increase requests for period [00h00-09h00] are evaluated
    - Assessment is based on DACF information.
    - Results are sent to CMT before 21h45 in D-1.
2. Nightly Process:
    - Increase requests for period [09h00-24h00] are evaluated.
    - Assessment is based on IDCF information.
    - Results are sent to CMT before 05h30.

The approach for both processes is the same:

Step 1: Selection of representative timestamps/corners

Considering the already allocated capacity, the initial ATC and the ID ATC increase requests per oriented CWE border, a set of representative timestamp/corner combinations is determined. Different sets of likely corners are evaluated. This is done by making use of sensitivity coefficients which reflect the impact of each CWE commercial exchange on the physical flows in the network.

Corner variations consider both initial ATC and ID ATC increase requests. If the initial ATC is very high for a specific border, it will be capped to a more realistic value based on the ID nominations observed in the past. This is done to avoid being too conservative in the assessment of the ID ATC increase requests.

The selection of the representative timestamp/corner combinations is cross-checked with the Elia operator.

Step 2: Detailed security analysis

A detailed security analysis is performed for the selected timestamp/corner combinations. The same set of acceptance criteria and remedial actions than the ones used locally at Elia for the DACF/IDCF processes is considered. Both preventive and curative RA are taken into account.

Step 3: Validation of results

Coreso calls the Elia operator to present the results. Overloaded CNEC pairs are reported for each timestamp/corner combination which was analysed. The Elia operator can overrule the result in specific situations (i.e. incident has occurred, adequacy issues, voltage issues, …). Based on the studied timestamps, the ID ATC increase requests for the full period are either accepted or rejected.

Step 4: CMT upload

Coreso uploads the Elia feedback for the different ID ATC increase requests to the CMT.

In exceptional situations, Elia can ask Coreso to split the period of the Evening Process or the Nightly Process into 2 sub-periods.

4.3.2 Decrease Process

No local process to assess decreases before increase/decrease deadline is foreseen at the moment.

4.4 RTE

4.4.1 Increase Process

The following process is operated by CORESO on behalf of RTE

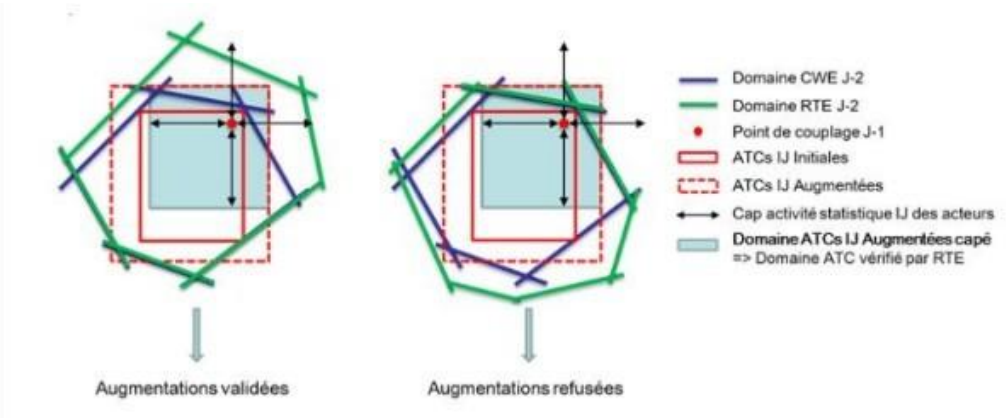
- ✓ If the ATC FR<>BE is below 500 MW, a request for increase of 300MW is sent, nothing otherwise
- ✓ If the ATC FR<>DE is below 1000 MW, a request for increase of 200MW is sent nothing otherwise

Assessing the feasibility of the consolidating increase requests:

The requests are tested on the final Flow Based Domain containing only the RTE CNECs, therefore this process is based on the D2CF CGM used for the Final FlowBased Day Ahead Domain.

The ATC domain with the increased capacity is combined with a statistical plausible approach. This ATC domain is curtailed to the maximum activity already observed in the ID process by Market Participants.

If, on the corners of this ATC domain combined with statistics approach, no French CNECs are overloaded therefore the increase requests are accepted, otherwise there is a rejection.



The square in light blue represents the ATC domain combined with a statistical plausible approach.

The domain delimited by the green CNECs represents the Final FlowBased domain containing only the RTE CNECs.

On the left, the light blue domain is included inside the RTE Green domain so the requests are accepted, on the right, the requests are rejected because some French CNEC will be overloaded on some corners of the light blue domain.

The assessment of consolidated increase/decrease requests is done once per day, in the evening of the D-1.

4.4.2 Decrease Process

This functionality is not foreseen to be used on RTE's side

4.5 Tennet DE

4.5.1 Increase Process

There is no local process to ask for increase requests in operation. Increase requests for TenneT DE borders are performed by other CWE TSOs/RSCs according to the agreed rules about maximum increases.

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 via CWE GSKs for the most likely combinations of simultaneous exchanges on all five borders (hereafter referred to as likely corners). Security assessment is performed for all defined likely corners using AC load flow security analysis and CNECs of TenneT DE. If the network security assessment fails for at least one likely corner, the PTDF of each border is checked against a threshold (currently 5%) and the security assessment is repeated with reduced increase requests for those borders with PTDF higher than the threshold in order to check for the possibility of partial acceptance. Borders with PTDF lower than the threshold remain unchanged to not prevent increases on non-impacting borders for concerned CNECs.

The assessment of increase requests takes place for all MTPs simultaneously once per day using the merged DA CGMs.

Note: there might be changes needed due to ALEGrO, i.e. 6 borders instead of 5, increasing to corners further. The impact assessment is not finalized yet.

4.5.2 Decrease Process

No local process to assess decreases before increase/decrease deadline is foreseen at the moment.

4.6 Tennet NL

4.6.1 Increase Process

TenneT NL sends every day an increase request for the borders BE-NL and DE-NL in both directions. By default it's always the maximum capacity increase per border and direction. The request only deviates if an decrease situation occurs (see Decrease Process). After D-1 18:00 TenneT NL validates the increase request from each border via a TTC (Total Transfer Capacity) computation. The loadflow application calculates the max feasible transfer capacity per border and direction againt the following components:

- Most recent Common Grid Model (CGM), DACF or IDCF
- Newest forecast information from marketpaties
- Only 380kV Critical network elements from the Dutch are taken in to account (impact only on own grid)
- Left over capacity from Flowbased DA (Intaday ATC)
- Validations steps with rounding (50MW)
- Depending on the grid situation, TenneT NL validates min. 4 times till 6 times per business day. It respects the gate opening and closures timing from the ID CMT.

4.6.2 Decrease Process

Based on 2 posibillities a decrease can be applied:

- *Critical Grid Situation* (CGS) according to ENTSO-E definitions.
- Unplanned outage in the 380kV grid or on Dutch HVDC interconnector(s)

If one of the possibilities occur before D-1 18:00 than the grid operator analyses the unexpected grid situation. Based on the outcome, the operator can decide to reduce the left-over intraday ATC till it's minimum capacity.

The Intraday ATC without virtual capacity is seen as the minimum capacity which can be given to the market based on the information available.

The $\Delta flow_{A\rightarrow B}$ will be provided to the ID CMT as decrease request.

if $\mathrm{ATC(without\ virtual\ capacity)_{A\rightarrow B}} > \mathrm{ATC(left\ over\ capcity)_{A\rightarrow B}}$ then

$\Delta \mathrm{flow_{A\rightarrow B}} = 0$ else

$$\Delta \mathrm{flow_{A\rightarrow B}} = -(\mathrm{ATC(left\ over\ capcity)_{A\rightarrow B}} - \mathrm{ATC(without\ virtual\ capacity)_{A\rightarrow B}})$$

4.7 TransnetBW

4.7.1 Increase Process

There is no local process to request an increase of capacity in operation. Increase requests for TransnetBW borders are performed by other CWE TSOs/RSCs.

Assessing the feasibility of the consolidating increase requests:

For assessing the feasibility of the increase requests, local validations are performed per Business Day with a load flow tool which uses Day Ahead Common Grid Models as basis. Shortly after the CGMs are available the ID assessment process starts with a simultaneous check of the increase requests if they can be granted. In case a full acceptance is not possible, the process is repeated with the partial increase requests according to the common rules.

The current process will be exchanged with a new process based on linear sensitivities similar to the flow based process. The calculation of PTDFs is based on a common grid model. The local tool calculates the zonal PTDF at the CWE borders for the base case and relevant n-1 cases.

The load flow changes from zona A to B with the increase request $request_{A\rightarrow B}$ and the available transfer capacity on the border $ATC_{A\rightarrow B}$ can be described as:

$$\Delta flow_{A\rightarrow B} = PTDF_{A\rightarrow B} \cdot (request_{A\rightarrow B} + ATC_{A\rightarrow B})$$

During the calculation positive PTDF Factors are considered to determine the maximum influence on each CNE. At the end of the process the individual influences are added up to gain the total additional flow for each critical network element with a certain contingency (CNEC)

$$\Delta TotalFlow = \sum_{j=1}^{\substack{number\ of \\ ATC\ border}} \Delta flow_j$$

If the total additional flow overloads a given CNEC the initial request will be reduced until no CNEC is overloaded.

The reduction of increase requests is performed successively for all borders applying the same partial acceptance steps (200 MW, 100 MW, 50 MW) followed by a full rejection (0 MW). If different increase request for several borders are requested, the increase requests are curtailed to a common level before all borders are reduced. This prevents discrimination among increase requests of different borders.

4.7.2 Decrease Process

No local process to assess decreases before increase/decrease deadline is foreseen at the moment. However, when network security is endangered on TransnetBW grid or surrounding borders which could be eliminated by a decrease of ID ATC on the border DE/LU-FR, DE/LU-AT the TransnetBW operators may inform Amprion or APG operators that a decrease of capacities is necessary to ensure grid security.