CREG PROPOSAL FOR THE ADAPTATION OF THE CBCO SELECTION METHOD AND THE BASE CASE DEFINITION IN THE CWE FLOW BASED MARKET COUPLING

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1 Problem description

Flow Based Market Coupling went life in 2015. It now replaces the former Available Transmission Capacity method to optimally[1] allocate cross-zonal capacity. However, *cross-zonal trading volumes in the CWE region have not yet reached the level of efficiency, transparency and non-discrimination required by the European legal and regulatory framework* [2].

The Critical Branch – Critical Outage (CBCO) selection method proposed by CWE TSOs in the Approval Package - and currently in practice – allows transmission lines to be included as critical branches in the FBMC from the moment the expected impact of cross-zonal trade on that line exceeds 5% for at least one of the 4 possible zone to zone exchanges. In other words, if a 1000 MW cross-zonal exchange between any pair of zones induces at least 50 MW flow on that line.

This CBCO selection method has however not been approved by all NRAs since the method allows the possibility of discriminating cross-zonal trade in favor of internal trade and it neither rules out the possibility for TSOs to push internal congestion to the borders. Both are conflicting with EC Regulation No 714/2009 which requires congestion management and capacity allocation practices to be in line with the objectives of the European internal market in electricity, namely a level playing field for domestic and cross-zonal trade. Therefore, all NRAs agreed to ask for a revision of the method.

The data provided by TSOs to NRAs for 2016 shows that the inclusion of heavily preloaded lines as network constraints in the FBMC algorithm, is highly impacting cross-zonal exchange. In 2016, transmission lines with less than 30% of remaining available margin (RAM) have limited cross-zonal exchange during 2991 hours. 30% RAM means that 70% of the thermal capacity is consumed by non-competitive flows in the base case (i.e. domestic flows and loop flows) and safety margins. In particular, the recent inclusion of four internal lines inside the Amprion region (with PTDF lower than 10%) limited CWE cross-zonal volumes in 1794 hours and this with an average RAM of less than 13%.

Upon CREG's request, Elia simulated the impact of those four Amprion internal lines on the FBMC outcome during November 2016 (these lines being added to FBMC *after* the approval decision by CWE to NRAs). The simulation results show that cross-zonal trade within CWE would have been on average 1000 MW higher if those internal lines had not been included as critical branches, equivalent to a 26% increase of CWE cross-zonal volume, and sometimes up to 5365 MW. Moreover, the increase in cross-zonal volume was the highest during peak-hours. Average price spread between France and Germany would have been reduced by 4.8 €/MWh.

The challenge in congestion management is to meet both objectives of grid security and maximization of available transmission capacity for the market. As long as (small) bidding zones are accepted (and hence no nodal approach), there will be a certain level of preloading by non-competitive flows (due to domestic trade and loop flows), and a grey zone in defining an appropriate target for the level of transmission capacity which is to be made available to the market. The CBCO selection method proposed here provides minimal targets which TSOs should be able to meet with the set of discretionary actions they have at their disposal in the short term. Proper bidding zone configuration in the mid-term and investment in grid reinforcement in the long term, will allow more ambitious targets, in line with the ACER Recommendation 2016/02.

[1] In the limits of the zonal model

[2] ACER Recommendation 2016/02

2 Scope and objective

Current 'Critical Branch - Critical Outage' (CBCO) selection method applied by CWE TSOs does not distinguish between internal lines, interconnection lines or lines adjacent to interconnectors. To all, the 5% PTDF threshold selection criterion applies. In practice it means that all interconnection lines and a large share of internal lines are included in the CBCO set of the FBMC algorithm, irrespective of the level of preloading. The CBCO selection method does not define any requirements on the remaining available margin (RAM) for the market.

As a consequence, the method does not insure compliance to EC Regulation 714/2009 which, as recalled by Acer Recommendation 2016/02, requires that

'the maximum capacity of the interconnections and/or the transmission networks affecting cross-zonal flows shall be made available to the market participants, complying with safety standards of secure network operations' (Article 16(3))

and that

'*TSOs shall not limit interconnection capacity in order to solve congestion inside their own control area, save for the above mentioned reasons and reasons of operational security*' (Point 1.7 of Annex I).

The objective of this note is to propose a CBCO section rule in line with Regulation 714/2009, and in particular with its Art. 1.7 of Appendix 1, and with Acer Recommendation 2016/02.

This proposal is made in the scope of the current EU target model for congestion management, based, in the day-ahead time frame, on a flow-based allocation of transmission capacities using appropriately defined bidding zones. As indicated by Art. 1.7 mentioned above, this means that congestions inside these appropriately defined bidding zones should be exceptional, and that these congestions should not be managed, in the enduring solution, by the cross-zonal congestion management tool (which, in this particular case, will have to reduce cross-zonal capacities for congestions inside a zone). Residuals congestions, if any, should be managed by measures not affecting cross-zonal trade such as re-dispatching.

The current proposal is made in the scope of CWE region for an immediate application. Some minor modifications may be required at the margin to have a method applicable in the new CORE region. These modifications, such as a minimum threshold for the PTDF values of all lines (including cross-zonal lines) and the representation of the losses in the allocation process have to be further studied.

Finally, it is proposed to update and re-validate the set of "accepted" CBCOs internal to a bidding zone on a yearly basis. This is a compromise between the necessity to introduce new CBCOs in function of changing conditions, such as the grid topology, bidding zones definition and the implementation of the CORE method and the workload related to the justification and the approval of the proposed exceptions.

In Section 3 we motivate the need for general acceptance criteria for CBCOs and for a RAM threshold for CBCO selection as prerequisites to meet the EC Regulation 714/2009 targets. To achieve this target in a workable manner, we propose a two-step approach: a first step in which the set of acceptable CBCOs is defined (§ 3.2); and a second step in which – from this preselected set - a sub-set of CBCOs is selected based on a minimal RAM threshold for the daily FB allocation process (§3.3). Quantitative targets are proposed and the discretionary power of TSOs to achieve these targets in the daily establishment of the base case is highlighted. A synthesis of CREG proposal is presented in section 4.

3 Adaptations to the CBCO selection criteria

3.1 ROLE OF THE BASE CASE AND CBCOS IN FBMC

FBMC starts with the definition of a base case, commonly agreed upon by all CWE TSOs. The base case predicts the state of the grid for each individual hour of the next day before any cross-zonal trade has taken place.

Starting from this base case, FBMC optimizes the set of zonal Net Exchange Positions (NEP) such that CWE social welfare is maximized under the selected set of network constraints. The network constraints considered in FBMC are called 'Critical Branches Critical Outages' (CBCOs), with the Critical Outage referring to the N-1 criterion.

Each CBCO is characterized by two key parameters and which are both determined by the base case:

- A set of zone to hub Power Transfer Distribution Factors (PTDF)[3]; which define the estimated change in line loading (MW) as a response to a change in NEP (MW) of each of the zones;
- A Remaining Available Margin (RAM, in MW); which defines the capacity available for cross-zonal exchange.

If a CBCO is included in the FBMC, it imposes that the line loading arising from the combination of Net Exchange Positions does not exceed the commercially available capacity (notation i refers to the bidding zone) :

Sum (**PTDFi** * NEPi) < **RAM**

With the current selection method, all transmission lines which have a zone to zone PTDF of at least 5%, are included in the CBCO set. All these transmission lines can thus constrain the FBMC outcome, irrespective of their topological location and irrespective of their RAM.

As an alternative, we propose to define the set of lines that can be managed by the FBMC based on topological grounds (§ 3.2) and on zone to zone minimal PTDFs values. In a second step, the actual activation of a preselected CBCO is based on a minimal RAM threshold. In order to achieve the latter requirement to a maximum extent, TSOs will need to translate these objectives in the daily establishment of the base case (§ 3.3).

3.2 PROPOSAL OF CBCO PRESELECTION CRITERIA

In this section, we propose a set of criteria for defining the set of transmission lines that can be managed by the FBMC, based on topological grounds. From this set, a subset is effectively selected on a daily basis based on a RAM threshold criterion as explained in §3.3.

Current 5% PTDF threshold applies to all transmission lines, irrespective if those transmission lines are cross-zonal, close-to-cross border or internal. This has two major drawbacks:

[3] A zone to zone PTDF can be deduced by the combination of 2 zones to hub PTDFs

- First, a PTDF-only criterion does not explicitly accounts for the topological location of the network element. It does not guarantee that all cross-zonal lines are included in the CBCO-set, unless the PTDF-threshold is set very low as is currently the case.
- Second, because of the current low value of 5% PTDF threshold, internal lines which are marginally impacted by cross-zonal trade can be included as CBCO. If they are heavily preloaded in the base case, their low RAM now constrains cross-zonal exchanges. Instead, internal congestion should be resolved by appropriate local remedial actions.

The proposed solution defines **selection criteria for the acceptance as a CBCO based on topological grounds, distinguishing 3 categories: cross-zonal lines, close- to-cross-zonal lines and internal lines.**

3.2.1 Preselection of cross-zonal lines (category 1)

Acceptance of all cross-zonal lines as CBCO in the FBMC is evident because congestion management on cross-zonal lines requires by definition a cross-zonal congestion mechanism. Nevertheless, with the merge of the CWE and CEE regions in the CORE region, a minimum low threshold criteria applied to PTDFs may be kept if justified in order to avoid inefficient congestion management actions, e.g. to avoid that a cross-zonal line limits cross-zonal exchange between distant zones. Considerations for network losses may also be opportune here.

3.2.2 Preselection of lines close to cross-zonal lines (category 2)

The same holds for internal lines which can be considered as quasi cross-zonal on topological grounds (this cross-zonal status has to be reviewed on a daily basis for insertion as constraints in the FB process – see section 3.3 below). This means that there should be no possibility to manage congestions on these lines other than using the cross-zonal FBMC mechanism. In particular, no possibility of re-dispatching, PST use or topology change should apply for that line at that moment.

3.2.3 Preselection of internal lines (category 3)

With respect to internal lines, TSO have raised concerns with a categorical exclusion of all internal lines on a short notice since it may not comply with their objective of guaranteeing grid security for transmission lines heavily impacted by high cross-zonal flows. The CBCO selection method should thus conditionally and for a limited duration allow internal lines to be accepted as CBCO.

Two conditions are proposed for acceptance of internal lines as CBCOs.

First, their PTDF should be significantly higher than the current threshold of 5%, indicating that the line is heavily loaded by cross-zonal exchanges. A threshold value of 15% is proposed per line or corridor (a bundle of parallel lines). This threshold should be based on the measurement of the average of the maximum zone to zone PTDF involving that line for the previous year.

Second, internal lines which are systematically preloaded in the base case because of domestic flows, should not be accepted as CBCOs in the market coupling. Those lines are internal, both in topological sense as in functional sense. Therefore, it is proposed that, in addition to the previous condition, preselected lines should have an average annual loading due to exchanges internal to the bidding zone

below 50% of the thermal capacity Fmax, evaluated for the year before. This means for these lines a commercial margin RAM of approx. 40% if the FRM is assumed to be 10%.

3.3 DAILY ACTIVATION OF THE PRESELECTED CBCOS ON THE BASIS OF A RAM THRESHOLD

In the previous sections, we proposed a set of conditions to define which transmission lines can be considered as preselected CBCOs in the FBMC.

In this section, we propose that, on top of these acceptance criteria, in the daily operation a minimal RAM requirement must be satisfied in order to be effectively included as CBCO for a specific hour in the FBMC. The RAM on a line is defined by the base case. The RAM requirement for CBCO inclusion is thus directly linked with the daily establishment of the base case.

Current FB selection method allows all CBCOs with one zone to zone PTDF of at least 5% to be selected, irrespective of their RAM value, and thus, for lines internal to a zone, irrespective of their impact on cross-zonal exchange.

The lack of a minimal RAM requirement gives rise to non-efficient and discriminatory congestion management practices as explained below. Low RAM values are caused by one or more of the following factors:

- a conservative definition of the maximum line capacity (Fmax (MW));
- high preloading in the base case, originating from trade within the bidding zone ('domestic trade');
- high preloading in the base case, originating from trade within another bidding zone ('loop flows');
- a conservative definition of the Flow Reliability Margin (FRM (MW));
- the usage of positive Final Adjustment Values (FAVs (MW)).

Therefore, if highly preloaded lines give rise to most of the congestion in the FBMC framework, it means that TSO's do not use their full discretionary power to maximize the available capacity to the market, such as:

- not adapting the Fmax in function of the weather-dependent thermal line capacity;
- not improving D-2 forecasts uncertainty in order to reduce the FRM ;
- not restricting the use of positive FAVs for exceptional cases and not fostering the use of negative FAVs to free up capacity for the market;
- not coordinating the use of Remedial Actions (PST, topological measures and re-dispatching) to minimize loop flows in the base case.

These non-efficiencies and discriminations are not compliant to the EC Regulation 714 [Articles 16(1) and Article 16(3)], as recalled in the Acer Recommendation 2016/02.

The list of discretionary actions that TSOs can take in the definition of the base case, the definition of the Flow Based parameters, the selection of critical branches and the use of Remedial Actions,

highlights their responsibility and their power to meet the objectives of grid security and maximizing the available capacity for the market in a non-discriminatory way.

Therefore, for reason of efficiency and non-discrimination, a minimal RAM value should be a decisive criterion for CBCO inclusion. Transmission lines which can be accepted as CBCOs (section 3.2) but which do not reach the RAM threshold for a specific hour, will be excluded from the CBCO selection for that hour. Otherwise, those lines preloaded by non-competitive flows would be allowed to limit cross-zonal flow and thus to limit competitive flows, creating a discrimination.

The RAM of a line is determined by the base case. To reach the RAM threshold for the use of a CBCO as active element in the day-ahead FB allocation process, TSOs will need to translate this RAM requirement in their process of establishing the base case. This can be done through the combination of individual and coordinated TSO actions in the daily operation (PST, Redispatching, topological changes).

In parallel, TSOs should integrate ongoing improvements in the methodologies for the definition of Flow Based parameters (e.g. Fmax and FRM) and load forecasting.

The RAM requirement for the inclusion of CBCO in the active constraints of the FB MC gives TSOs the incentive to use their discretionary power and coordinate their actions to maximize the available capacity for the market in the base case.

For the daily establishment of the base case, the following RAM thresholds are proposed):

1. 50% RAM for the cross-zonal and quasi-cross zonal lines (categories 1 and 2)
2. 40% RAM for the preselected internal lines (category 3)

The RAM threshold is defined as a percentage of the thermal capacity Fmax. If the RAM of a given internal CBCO cannot reach the above objective, the internal CBCO cannot limit the FB domain and the preselected line cannot be included in the daily FBMC.

If the RAM of a given cross-border or close-to-cross-border line cannot reach the objective, full transparency of the origin of the loop flows is required, as well as transparency on the set of Remedial Actions taken by TSOs to maximize the RAM. TSOs must systematically explain the reasons of the problems encountered.

For the establishment of the base case, and the sharing of the costs of re-dispatching actions, the polluter pays principle should be applied. This means that with the above principles, re-dispatching costs will be paid by the country at the origin of the loop-flows and mainly internal re-dispatching will be considered for a fast implementation.

In other to fully comply with legal requirements linked to EC Regulation 714/2009, more stringent threshold levels must be applied in the future. Therefore, values indicated above should be considered as an intermediate step towards a more ambitious objective of 70% of RAM for categories 1 & 2 and of 60% for the category three. A yearly revision of thresholds and CB definition should be made.

4 Synthesis of CREG Proposal

The CBCO selection process must ensure that a maximum amount of transmission capacity is made available for the market and ensure grid security in a non-discriminatory way.

To meet these objectives, CREG proposes a two-step process, starting with the CBCO preselection and ending with the determination of a base case that stops discrimination of cross-zonal exchange in favor of internal exchanges.

This proposal only constitutes an interim solution which may be not fully compliant with all CACM requirements (in particular those linked to efficiency) waiting for the enduring solution based on optimized bidding zones.

This two steps process is needed if we want a feasible implementation of the proposed selection process and daily operation (which should be in line with ACER recommendation) and which may provoke some additional re-dispatching costs (see below).

For the CBCO preselection, the following rule is proposed for being considered as an acceptable CBCO:

1. To be cross-zonal (at a first glance no PTDF threshold is required here)
2. To be directly connected to a cross-zonal line (quasi cross zonal) and having no other possibilities to manage congestion on that line at that time ; this criteria is dynamic and will have to be assessed each day in the operational procedure (see below); (at a first glance, no PTDF threshold is required here)
3. To be an internal line heavily impacted by cross-zonal exchanges (above 15% per corridor – lines operated in parallel) AND having an average loading of that line due to exchanges internal to the bidding zone only below 50% for the year before (FRM not included). This means for these lines a commercial margin of approx. 40% if the FRM is assumed to be 10%.

For the daily establishment of the base case, TSOs have to take into account the necessary measures (re-dispatching, topology changes and PST settings), which allow, for the preselected critical branches resulting from the process described above, a commercial capacity (RAM) above:

3. 50% RAM for the lines defined according steps 1 and 2 above;
4. 40% RAM for the internal lines heavily impacted defined under step 3 above.

The RAM threshold is defined as a percentage of the thermal capacity Fmax. If the RAM of a given internal CBCO cannot reach the above objective, the internal preselected CBCO cannot limit the FB domain and thus cannot be included.

If the RAM of a given cross-border or close-to-cross-border line cannot reach the objective, full transparency of the origin of the loop flows is required, as well as transparency on the set of Remedial Actions taken by TSOs to maximize the RAM. The values indicated above should be considered as an intermediate step towards a more ambitious objective of 70% of RAM for categories 1 & 2 and of 60% for the category three. A yearly revision of thresholds and CB definition should be made.

For the establishment of the base case, and the sharing of the costs of re-dispatching actions, the polluter pays principle should be applied. This means that with the above principles, re-dispatching costs will be paid by the country at the origin of the loop-flows and mainly internal re-dispatching will be considered.