Methodological paper:

Estimating the margin available for cross-zonal trade pursuant to ACER Recommendation 01/2019 in light of Article 16(8) of Regulation (EU) 2019/943

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Content

1. Introduction

(1) This document is one of a set of documents describing various methodologies applied in the electricity wholesale markets volume of the annual ACER/CEER Market Monitoring Report (MMR), which aims to present the results of the monitoring of the performance of the internal electricity market in the European Union (EU).

(2) This paper is intended to describe the methodology used to estimate, for each Member State and coordination area, the level of margin available for cross-zonal trade (MACZT) in order to assess performance with respect to the minimum level of margin to be made available for cross-zonal trade, i.e. at least 70% of the maximum admissible active power flow (Fmax), pursuant to Article 16(8) of Regulation (EU) 2019/943, which applies as of 1 January 2020.

(3) ACER Recommendation 01/2019 (hereafter 'Recommendation')[1] describes in detail the principles and calculation formulas underlying the computation of MACZT. This document goes a step further and describes the steps to estimate MACZT for the 2016–2018 time period in the context of the MMR 2018. While the above-mentioned minimum margin did not yet apply during the analysed period, the analysis aims to provide an indication about the room for improvement at this early implementation stage.

(4) In particular, this paper describes the simplifications and caveats necessary to perform the calculations due to limited data, model availability and robustness. This methodological paper may be subject to updates for future editions of the MMR, when the requirement pursuant to Article 16(8) enters into force, and when improved data and models become available to the Agency.

(5) The document is organised as follows: an overview of the approach is first provided, and then the detailed calculation process is presented. Then, the necessary caveats are described, and the required data and the sources are listed. The terms used in this methodological paper follow the definitions included in Section 2 of the Recommendation.

2. General approach

(6) The Recommendation describes the full process to estimate MACZT levels on critical network elements with contingencies (CNECs), and to monitor the impact of allocation constraints and technical profiles on MACZT of these CNECs for the day-ahead (DA) and intraday (ID) timeframes.

(7) The analysis included in the MMR 2018 intends to monitor all these aspects from 2016 until 2018, in order to compare MACZT with the minimum 70% target. However, due to limited availability of data and models, the monitoring focuses on MACZT on CNECs for a subset of Member States and bidding-zone borders, and does not explicitly assess the impact of allocation constraints or technical profiles on MACZT effectively available on CNECs.

(8) Given the current predominance of the DA timeframe among short-term electricity markets, and the current absence of coordinated ID capacity calculation on many bidding-zone borders, the analysis focuses on the DA timeframe.

(9) In order to perform the calculations, the concept of coordination areas is introduced. It refers to the sets of bidding-zone borders where capacity calculation is fully coordinated; for these coordination

[1] See https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Recommendations/ACER%20Recommendation%2001-2019.pdf

areas, the monitoring focuses on a list of CNECs assumed to limit cross-zonal capacity[2], as provided to the Agency.

(10) In line with the Recommendation, the calculation of MACZT is split between the margin from coordinated capacity calculation (MCCC), and the margin from non-coordinated capacity calculation (MNCC). MCCC is available within FB coordination areas; however, it should be estimated for net transfer capacity (NTC) coordination areas, while MNCC should be estimated for all coordination areas. All estimations rely on linear flow-based parameters (power transmission distribution factors, PTDFs).

(11) In areas where NTC applies, positive PTDFs are combined with hourly NTCs (within the coordination area borders) to derive the MCCC. For both NTC and FB coordination areas, the MNCC is estimated by combining (positive and negative) PTDFs and schedules/nominations. The sum of the MCCC and the MNCC is equal to the MACZT. For bidding-zone borders with only HVDC interconnectors, a simplified approach assumes that the MACZT is equal to the NTC on the considered border.

(12) These steps allow computing the MACZT for each CNEC, coordination area and market time unit (MTU)[3], and to compare this level with Fmax. The MACZT is computed both with and without the flow induced by exchanges between EU MSs and non-EU countries.

3. Calculation process

(13) The detailed calculation process relies on the following steps, in line with the Recommendation:

- define the coordination areas,
- define the relevant CNECs,
- compute FB parameters for each CNEC,
- infer the MCCC and MNCC based on FB parameters, hourly NTCs and schedules/nominations, and
- sum the MCCC and MNCC to derive the MACZT and compare to Fmax.

(14) For bidding-zone borders with only HVDC interconnectors, hourly NTCs are directly compared with an estimated hourly Fmax.

3.1 Definition of coordination areas

(15) A coordination area is a set of bidding-zone borders within which capacity calculation is fully coordinated. A coordination area may encompass many bidding-zone borders, or a single bidding-zone border, or one side of a bidding-zone border in case two different[4] NTC values are calculated by each TSO (in which case the lower one is used for capacity allocation).

(16) Once capacity calculation methodologies (CCMs) pursuant to the CACM Regulation are implemented, coordination areas will be equal to capacity calculation regions (CCRs). Before the

[2] This means the CNEC congested first, while others are not, when estimating the maximum exchange on a given bidding-zone border following the methodology used in the 2017 MMR for that purpose. See Annex for the detailed data request.

[3] The current DA MTU is one hour.

[4] Such values are not available within the scope of this study, therefore only NTC values resulting from consolidation between the two TSOs are used.

implementation of these CCMs, coordination areas are defined based on the level of coordination in capacity calculation for the DA timeframe, as assessed in the MMR 2017[5]. Further work will be needed in the future in order to refine the delineation of coordination areas.

(17) Coordination areas are defined as follows:

- Where capacity calculation was defined as fully coordinated (either under the NTC or FB approach), the coordination area comprises of the whole region within which capacity was fully coordinated;
- Where capacity calculation was declared as partially coordinated or bilateral for a given bidding-zone border between two countries, the coordination area is defined as the bidding-zone border(s) which connect the two countries; and
- All bidding-zone borders within a given MS are attributed to one specific coordination area.

(18) The table below describes the list of coordination areas resulting from this assessment, and which are used within this analysis.

Table 1: Declared coordination level of day ahead (DA) capacity calculation, and resulting coordination area, 2017

CCR	Bidding-zone border	Coordination of DA capacity calculation	Coordination area
Baltic	EE – FI		EE – FI
Baltic	EE – LV	BIL	EE – LV
Baltic	LT – LV	BIL	LT – LV
Baltic	LT – PL	BIL	LT – PL
Baltic	LT - SE-4	BIL	LT – SE
Channel	BE – GB		BE – GB
Channel	FR – GB		FR – GB
Channel	GB – NL	BIL	GB – NL
Core (CWE)	AT – DE/LU*	FB	CWE
Core (CWE)	BE – FR	FB	CWE
Core (CWE)	BE – NL	FB	CWE
Core (CWE)	DE/LU – FR	FB	CWE
Core (CWE)	DE/LU – NL	FB	CWE
Core (excl. CWE)	AT – CZ	BIL	AT – CZ
Core (excl. CWE)	AT – HU	BIL	AT – HU
Core (excl. CWE)	AT – SI	BIL	AT – SI
Core (excl. CWE)	CZ – DE/LU		CZ – DE/LU
Core (excl. CWE)	CZ – PL	BIL	CZ – PL
Core (excl. CWE)	CZ – SK	BIL	CZ – SK
Core (excl. CWE)	DE/LU – PL	BIL	DE/LU – PL
Core (excl. CWE)	HR – HU		HR – HU
Core (excl. CWE)	HR – SI		HR – SI
Core (excl. CWE)	HU – RO		HU – RO

[5] See Section 3.2.1 of the MMR 2017 available at https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/MMR%202017%20-%20RETAIL.pdf

CCR	Bidding-zone border	Coordination of DA capacity calculation	Coordination area
Core (excl. CWE)	HU – SK	BIL	HU – SK
Core (excl. CWE)	PL – SK	BIL	PL – SK
GRIT	GR – IT	BIL	GR – IT
GRIT	Internal IT borders (before and after bidding-zone reconfiguration)	*	IT
Hansa	DE/LU - DK-1	BIL	DE/LU – DK
Hansa	DE/LU - DK-2	BIL	DE/LU – DK
Hansa	PL - SE-4	BIL	PL – SE
IT North	AT – IT	FC	IT North
IT North	FR – IT	FC	IT North
IT North	IT – SI	FC	IT North
IU	GB – IE	BIL	GB – IE
Nordic	DK-1 - SE-3	BIL	Nordic**
Nordic	DK-2 - SE-4	BIL	Nordic**
Nordic	FI - SE-1	PC	Nordic**
Nordic	FI - SE-3	PC	Nordic**
Nordic	DK-1 - DK-2		Nordic**
Nordic	SE-1 - SE-2		Nordic**
Nordic	SE-2 - SE-3		Nordic**
Nordic	SE-2 - SE-3		Nordic**
Nordic	SE-3 - SE-4		Nordic**
Norwegian borders	DK-1 - NO-2	BIL	Nordic**
Norwegian borders	FI – NO	PC	Nordic**
Norwegian borders	NL - NO-2	BIL	NL – NO
Norwegian borders	NO-1 - SE-3	PC	Nordic**
Norwegian borders	NO-3 - SE-2	PC	Nordic**
Norwegian borders	NO-4 - SE-1	PC	Nordic**
Norwegian borders	NO-4 - SE-2	PC	Nordic**
SEE	BG - GR		BG – GR
SEE	BG - RO		BG – RO
SWE	ES - FR		ES – FR
SWE	ES - PT		ES – PT
Swiss borders	AT - CH	BIL	AT – CH
Swiss borders	CH – DE/LU	PC	CH – DE/LU
Swiss borders	CH - FR	BIL	CH – FR
Swiss borders	CH - IT	FC	CH - IT

Note: The coordination of DA capacity calculation is defined as follows[6]. BIL: pure bilateral NTC calculation. PC: partly coordinated NTC calculation. FC: fully coordinated NTC calculation. FB: flow-based capacity calculation. An empty field means that no capacity calculation was conducted for the DA timeframe. The Austria – Germany/Luxembourg border was not present at the time of the MMR 2017 study; it is affected to the CWE coordination area because this bidding-zone border was introduced within the CWE flow-based initiative. As of 2018, Cyprus is not interconnected and Luxembourg has no bidding-zone border; these MSs are therefore not included in the analysis. Given the lack of data about the interconnector between Italy (Sicily) and Malta, this interconnector is also beyond the scope of the analysis.

** Italian bidding-zone borders are not listed, as a reconfiguration of bidding-zone borders was adopted in 2019 and will enter into force in 2021 in this MS. All bidding-zone borders within Italy are however affected to the "IT" coordination area.*

*** The CNEC data provided by Nordic TSOs does not describe the Member State to which each CNEC belongs to. Therefore, all CNECs (which describe underlying network elements located in Denmark, Finland, Norway and Sweden), and all bidding-zone borders are associated to the Nordic coordination area, without specifying the country to which they belong.*

3.2 CNECs

(19) In order to compute the MACZT, a list of CNECs is considered for each coordination area. For FB coordination areas, the MACZT can be reliably estimated for all provided CNECs based on the margin available on this CNEC assuming no cross-zonal exchanges within the coordination area[7]. However, for NTC coordination areas, due to methodological limitations[8], the MCCC (and thus the MACZT) can be reliably estimated only for the CNECs which actively limited capacity calculation.

(20) For the Core (CWE) coordination area, CWE TSOs provided the Agency with a detailed list of hourly CNECs (including Fmax values) for most hours of 2016–2018. All CNECs stemming from an internal or cross-border line, and which do not result from the application of the long-term allocated capacity ('LTA') inclusion patch[9], are included in the list of CNECs to be monitored. From this list, only CNECs which can unambiguously be mapped with network elements of the merged grid model[10] are retained, because such mapping is necessary to ensure consistency between the MCCC (coming from CNEC data) and the MNCC (coming from the merged grid model) values.

(21) For the other coordination areas, no detailed CNEC data was available to the Agency. Given that detailed historical data was also unavailable to many TSOs, TSOs provided a simplified list of CNECs (sometimes including Fmax values) for the studied time period[11]. For each CNEC, the TSO which declared it also described the time period during which the CNEC applied. This simplified list leads to the following caveats:

- During the MTUs for which the declared CNECs did not limit capacity calculation within NTC coordination areas, the MCCC (and thus the MACZT) is likely underestimated for these non-limiting CNECs. Similarly, in case the MACZT is monitored for both directions of a CNEC (i.e. from node 1 to node 2, and from node 2 to node 1), it is unlikely that both

[6] See footnote 5.

[7] See Section 5.2.1 of the Recommendation.

[8] See Annex I of the Recommendation.

[9] See CWE flow-based methodology at http://www.jao.eu/DynamicContent/DownloadFile?url=pd0hsynu.kqh.pdf&filename=20190411+CWE+FB+MC+approval+document_MNA+Update_ENG_FV.pdf&openInBrowser=false

[10] The merged grid model describes 17 January 2018 at 10:30 (CET). Other merged grid models describing March, May, July, September or November 2018 were also provided.

[11] See Annex for the detailed data request.

directions would simultaneously limit capacity calculation; the MACZT may thus be underestimated for one of the two directions.

- Some CNECs may have been omitted from the simplified list of CNECs provided by TSOs, and are therefore not monitored.

- Fmax values may have been declared as an average value over multiple MTUs, and may thus not fully reflect the value used during each MTU[12]. In the absence of a declared Fmax value, Fmax is inferred through the FB parameters calculation[13].

(22) For the Baltic CCR, one set of CNECs combined with many outages was provided by Baltic TSOs. To ensure computational feasibility of the process, the two most widely declared outages[14] were retained, and each of the related CNECs was monitored for all hours of 2016–2018.

(23) For the Nordic CCR, hourly sets of CNECs describing the first twelve weeks of 2017 were provided. Nordic TSOs mentioned that "Wednesday hour 03 and 12 for each week, will give a linearization point around typical import/export hours". Therefore, the set of CNECs for the second[15] week of 2017 at 12:00 could be considered as the reference set of CNECs, and a sensitivity analysis could be conducted on the second week of 2017 at 03:00. However, the provided data was generated within a research project, and did not seem to lead to realistic results. Therefore, no final result was generated for the Nordic CCR.

3.3 Calculation of flow-based parameters

(24) Estimating the MACZT for each CNEC (and comparing it to 70% of Fmax) requires computing the flow induced by cross-zonal trade, and thus FB parameters (including zone-to-zone PTDFs[16] and Fmax) for all considered bidding-zone borders.

(25) The computation of FB parameters requires a detailed merged network description, along with an estimate of the impact of a change in a bidding-zone net position on the injections/withdrawal of the various generators and load units within the bidding-zone, i.e. a generation shift key (GSK)[17]. The calculation should ideally be conducted for each MTU, relying on GSKs consistent with implemented capacity calculation processes.

(26) For the Baltic CCR, a set of representative zone-to-zone PTDFs was provided by Baltic TSOs. These PTDFs were computed for various outages and contingency situations, based on a 2018 real-time grid model combined with GSKs used within the operational Baltic capacity calculation process.

(27) For the synchronous area of Continental Europe, due to the limited number of historical merged grid models available, FB parameters are computed based on one merged grid model provided by ENTSO-E[18] (sensitivity analyses might be conducted with other merged grid models in the future). This simplification means that:

[12] In order to ensure feasibility of the calculations, hourly Fmax values were not used, only their average was taken into account.

[13] Fmax is derived from Imax declared in the UCTE file and from the voltage of the line

[14] i.e. the outages associated with the most contingencies

[15] The first week is avoided given that it may cover part of the holiday season.

[16] See Sections 5.2 and 5.3 of Recommendation. Due to limitations mentioned by ENTSO-E TSOs related to the UCTE file format, DC (rather than AC) PTDF calculations were conducted.

[17] i.e. a GSK or load shift key (LSK)

[18] See footnote 10.

- The grid model describes one individual set of generation, load and network patterns, which may not be fully representative of the whole time period considered.

- The grid model is updated to switch on all interconnectors, in order to avoid that a maintenance which took place during the modelled MTU impacts results for the whole year[19].

- No other topological action or remedial action is added to the merged grid model.

(28) Additionally, for Continental Europe, other caveats or specific actions are needed to perform the computations:

- In order to estimate the impact of exchanges over HVDC lines leaving Continental Europe on CNECs located in Continental Europe, a modelling artefact is used: some x-nodes[20] defined in the grid model are attributed to countries outside Continental Europe, to force the computation of zone-to-zone PTDFs reflecting the impact of the following HVDC bidding-zone borders: DE/LU – DK2, DK1 – NO2, FR – GB, GB – NL, LT – PL, NL – NO, PL – SE4. This PTDF calculation ignores the impact of other DC bidding-zone borders (such as DE/LU – SE4 and GR - IT).

- The merged grid model only provides information about the country within which each node is located, but not about the bidding-zone within which each node is located. The merged grid model thus does not easily allow computing zone-to-zone PTDFs for countries with multiple internal bidding-zones (such as Italy[21]).

- GSKs proportional to the generation present in the merged grid model are assumed, enabling the calculation of FB parameters based on the updated merged grid model.

(29) For the Nordic CCR, a few sets of PTDFs were computed based on an experimental merged grid model stemming from a research project aimed at analysing the viability of flow-based capacity allocation in the Nordic CCR. GSKs proportional to both generation and load were used.

(30) For the regular monitoring of MACZT levels starting on 1 January 2020, consistency with implemented capacity calculation processes should be ensured, i.e. a larger number of merged grid models (ideally one per MTU and timeframe) should be used, and combined with the GSKs used within the implemented capacity calculation processes.

3.4 Computing MACZT

(31) For each CNEC, coordination area and MTU, the MCCC and the MNCC are computed as follows.

(32) Two ways to estimate the MCCC are used depending on the capacity calculation approach used in the coordinated area. For FB coordination areas, i.e. for the CWE coordination area, the margin with zero cross-zonal exchanges within this coordination area is derived from the data provided by CWE TSOs (based on nominations resulting from long-term capacity allocation). For NTC coordination areas, the MCCC is estimated in line with Section 5.2.2 of the Recommendation. This estimation combines the positive PTDFs obtained in the previous section with hourly NTC values,

[19] Outages of internal network elements included in the merged grid model remained, and may still affect the whole results.

[20] See https://cimug.ucaiug.org/Groups/Model%20Exchange/UCTE-format.pdf. Most properties of the x-node remain identical. However, in order to ensure smooth functioning of the FB parameters calculation (especially with respect to GSKs), x-nodes with no generation are updated to set the generation level to 0.1MW.

[21] Information about the affectation of each node to an internal Italian bidding-zone was collected. Due to a lack of time and resources, it could unfortunately not be taken into account.

to obtain hourly MCCC values. In this latter case, and in order to ensure representative results, only hours during which all NTC values were available within the coordination area are retained.

(33) For all coordination areas, the MNCC is estimated in line with the second equation of Section 5.3 of the Recommendation. This equation combines the zone-to-zone PTDFs obtained according to the previous section with hourly schedules/nominations.[22] The MNCC is split between schedules on bidding-zone borders between MSs, and schedules on bidding-zone borders between a MS and a third country.

(34) Summing the MCCC and MNCC leads to MACZT for each CNEC, coordination area and MTU. As mentioned above, two sets of MACZT results (excluding and including borders between EU and non-EU bidding-zones) are computed.

3.5 Coordination areas with only DC bidding-zone borders

(35) For coordination areas which only include bidding-zone borders with HVDC interconnectors, as TSOs are assumed to fully control the flows on these interconnectors, the monitoring process is simplified as follows, in line with Section 5.4 of the Recommendation.

(36) First, one CNEC is defined for each individual HVDC interconnector without contingency[23]. The Fmax of this CNEC is defined as the thermal capacity of the interconnector, corrected for declared unavailability periods (as perceived from DA[24]). In case an unavailability is declared, Fmax is corrected proportionally to the ratio between the decreased NTC (during the unavailability period) and the maximum NTC observed over the full study period. Finally, the MACZT is assumed to be equal to the NTC.

3.6 Allocation constraints

(37) Section 6.2 of the Recommendation describes how to monitor the impact of allocation constraints on the MACZT effectively available on CNECs. In particular, the monitoring of external constraints (the most widely used type of allocation constraints) is described in sub-section 6.2.1 of the Recommendation.

(38) Monitoring the impact of external constraints requires access to the MACZT on at least all pre-solved CNECs for a given MTU. Such detailed information can only be available for the CWE coordination area. However, for this coordination area, issues with mapping between CNEC data and merged grid model information did not allow MACZT monitoring on some CNECs. Therefore, the impact of external constraints on the MACZT on CNECs has not been studied.

(39) The monitoring of other types of allocation constraints is also beyond the scope of this historical analysis.

3.7 Technical profiles

(40) Given that technical profiles are likely to be phased out following the introduction of FB capacity calculation in the Core CCR, and due to the limited data available, the impact of technical profiles on the MACZT is not directly assessed.

[22] As a result, MNCC contributions are only computed for bidding-zone borders for which zone-to-zone PTDFs are available.

[23] TSOs did not declare any other CNEC for these borders.

[24] To ensure consistency with the assumption that the MACZT is estimated for the DA capacity calculation process, only unavailability occurrences which were declared by DA 12:00 (UTC) were taken into account, because occurrences declared later would not be reflected in the DA NTC.

4. Caveats

(41) When applying the methodology described above, the following caveats and considerations apply:

- For the synchronous area of Continental Europe, the methodology relies on one set of PTDFs, computed based on one merged grid model, which is unlikely to be fully in line with hourly historical capacity calculation processes. For example, the topology of which may not be fully in line with the topology used during capacity calculation. Furthermore, remedial actions are not considered. Similarly, one set of PTDFs is used within the Baltic region.

- GSKs proportional to the generation or load in the merged grid model are used, and are likely not fully aligned with the GSKs used during capacity calculation.

- The list of CNECs is simplified for all coordination areas but the CWE coordination area. Therefore, some CNECs declared by TSOs may not always be limiting, leading to underestimate MCCC on these elements for some MTUs.

- Difficulties in mapping CNEC data with information from the merged grid model prevented from estimating MACZT on some CNECs. Some limiting CNECs may also not have been included in the simplified list of CNECs provided by TSOs.

- The FB parameters provided by Nordic TSOs do not come from an operational merged grid model (since the generation of such a model is not yet implemented). These parameters should be used with great caution.

- DA NTCs or schedules/nominations were missing for a limited number of bidding-zone borders and hours.

- For bidding-zone borders with bilateral capacity calculation, NTC values computed by each TSO on each side of the border before consolidation were unavailable, therefore MACZT only reflects the consolidated bilateral NTC.

- Some bidding-zone borders, e.g. between Austria and Germany/Luxembourg, were introduced recently. Before the introduction of this border, exchanges between Austria and Germany/Luxembourg were internal exchanges (thus excluded from MACZT). Following the introduction of this border, exchanges between Austria and Germany/Luxembourg became cross-zonal exchanges (thus included in MACZT). Overall, the introduction of this border will likely increase MACZT, especially on Austrian and German CNECs. However, as the introduction of this border took place in October 2018, not enough information was available to assess its specific impact on MACZT.

- The caveats of the underlying generic methodology, i.e. of the Recommendation, also apply

5. Data

Table 2: Data required to estimate the MACZT

Description	Unit	Time granularity	Geographic granularity	Source
Merged grid model			Synchronous area	ENTSO-E (for the synchronous area of Continental Europe)

List of limiting CNECs (with Fmax and PTDFs when applicable)		MTU	Member State, coordination area	ENTSO-E, TSOs
Mapping between Core (CWE) CNECs identifiers and merged grid model			Core (CWE) CNEC	CWE TSOs (inferred by ACER as a fallback)
DA NTC	MW	MTU	Bidding-zone border	ENTSO-E transparency platform, Nordpool
DA schedule	MW	MTU	Bidding zone border	ENTSO-E transparency platform (final schedule after intraday as a fallback)
Long-term nominations	MW	MTU	Core (CWE) bidding-zone borders	JAO

Annex – detailed data request sent to TSOs

(42) This Annex describes the detailed specification of the data provided by TSOs to enable this historical analysis. Most of the data was provided ad-hoc for this task. Similar, richer data will need to be regularly provided in the future, in order to monitor the achievement of the target introduced by Article 16(8) of Regulation (EU) 2019/943.

(43) The requested data is as follows

- A few[25] representative merged grid models, which describe typical grid situations of the Nordic and Baltic CCRs, including the neighbouring grids which significantly influence flows in the region[26]. The merged grid model should be provided following the UTCE, CGMES or CIM (v14) data format. In case such a grid model cannot be provided on time, and as a temporary solution until such grid models are provided to ACER, zone-to-zone PTDFs (computed assuming GSKs proportional to generation in the merged grid model) should be provided by TSOs for all CNECs and bidding-zone borders[27].

- A list of representative[28] CNECs which were often introduced in the implemented capacity calculation methodologies between 2016 and 2018, with the following attributes:

    i. The exact identifier (as defined in the provided merged grid model) of the critical network element and the contingency;

    ii. The TSO[29] and MS(s) to which the CNEC should be attributed;

    iii. The bidding-zone borders, for which capacity calculation process currently includes the CNEC (to allow defining in which coordination area(s) the CNEC will be monitored);

    iv. The maximum active power flow of the CNEC, as seasonal[30], yearly or fixed value(s) reflecting the currently-implemented capacity calculation methodology. In case of time-varying values, the exact dates when each value starts and ends should be provided;

    v. Zone-to-zone PTDFs for all bidding-zone borders, in case a grid model cannot be provided on time to the Agency (see above).

[25] At least one, and no more than one for every other month of 2016–2018.

[26] A network equivalent of third countries may be used in order to reflect the impact of these on electricity flows within MSs.

[27] Including bidding-zone borders with third countries (if any).

[28] CNECs that often restricted capacity calculation or allocation should be provided with priority. The list of CNECs of each Member State should reflect all capacity calculation regions to which this MS belongs. In order to ensure that the calculation process remains feasible within the timeline of ACER market monitoring tasks, the number of declared CNECs should be limited to what is strictly necessary to ensure a representative data set.

[29] A CNEC should be attributed to the TSO which usually introduced it in the capacity calculation process.

[30] Hourly values may be defined for some CNECs, if strictly necessary to ensure a representative data set.