
All TSOs' proposal for a methodology for coordinating operational security analysis in accordance with Article 75 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation.

10 July 2018

Disclaimer

This document, provided by all Transmission System Operators (TSOs), is the all TSOs' proposal for the methodology for coordinating operational security analysis in accordance with article 75 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation.

All TSOs, taking into account the following:

Whereas

- (1) This document is a common proposal developed by all Transmission System Operators (hereafter referred to as “TSOs”) regarding the development of a proposal for a Methodology for coordinating operational security analysis (hereafter referred to as “CSA Proposal” or “Methodology”).
- (2) This Methodology takes into account the general principles and goals set in Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as “SO GL”) as well as 2015/1222 establishing a guideline on capacity allocation and congestion management (hereafter referred to as “Regulation 2015/1222”), and Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity (hereafter referred to as “Regulation (EC) No 714/2009”). The goal of SO GL is to safeguard operational security, frequency quality and the efficient use of the interconnected system and resources. To facilitate these aims, it is necessary to enhance standardisation of operational security analysis at least per synchronous area. Standardisation shall be achieved through a common methodology for coordinating operational security analysis.

Article 75 of SO GL constitutes the legal basis for the CSA Proposal and defines several specific requirements that it should include at least: (a) methods for assessing the influence of transmission system elements and SGUs located outside of a TSO's control area in order to identify those elements included in the TSO's observability area and the contingency influence thresholds above which contingencies of those elements constitute external contingencies; (b) principles for common risk assessment, covering at least, for the contingencies referred to in Article 33: (i) associated probability; (ii) transitory admissible overloads; and (iii) impact of contingencies; (c) principles for assessing and dealing with uncertainties of generation and load, taking into account a reliability margin in line with Article 22 of Regulation (EU) 2015/1222; (d) requirements on coordination and information exchange between regional security coordinators in relation to the tasks listed in Article 77(3); (e) role of ENTSO for Electricity in the governance of common tools, data quality rules improvement, monitoring of the methodology for coordinated operational security analysis and of the common provisions for regional operational security coordination in each capacity calculation region.

- (3) With consideration of effective needs for standardisation, the CSA Proposal also contains provisions: (i) to identify remedial actions which need to be coordinated between TSOs and to facilitate efficient remedial actions coordination at the regional level in accordance with the regional methodology to be developed later by all TSOs of a capacity calculation region pursuant to Article 76(1)(b) of SO GL; (ii) to ensure efficient realisation of the operational security analyses for different timeframes under Articles 72 to 74 of SO GL; and (iii) to ensure efficient and timely implementation of relevance assessment of outage coordination assets pursuant to the methodology under Article 84 of SO GL and its necessary coordination with the common influence computation method under Article 75(1)(a) of SO GL.
- (4) In accordance with Article 84(3) of SO GL, the provisions of the CSA Proposal, as regards the definition of the common influence computation method pursuant to Article 75(1)(a), are closely

aligned with the common influence computation method provided in the proposal of methodology for Outage Coordination Asset Assessment developed under Article 84(1) of SO GL.

- (5) According to Article 6 (6) of the SO GL, the expected impact of the CSA Proposal on the objective of the SO GL has to be described. It is presented below. The CSA Proposal generally contributes to the achievement of the objectives of the SO GL. In particular the CSA Proposal serves the objective of maintaining operational security throughout the Union, specifically coordination of system operation and operational planning; transparency and reliability of information on transmission system operation; and the efficient operation of the electricity transmission system in the Union.
- (6) Furthermore, the CSA Proposal shall ensure application of the principles of proportionality and non-discrimination; transparency; optimisation between the highest overall efficiency and lowest total costs for all parties involved; and use of market-based mechanisms as far as possible, to ensure network security and stability.
- (7) In conclusion, the CSA Proposal shall contribute to the general objectives of the SO GL to the benefit of all TSOs, the Agency, regulatory authorities and market participants.

SUBMIT THE FOLLOWING CSA PROPOSAL TO ALL REGULATORY AUTHORITIES:

TITLE 1

General Provisions

Article 1

Subject matter and scope

1. The methodology described in this proposal is the common proposal of all TSOs in accordance with Article 75 of SO GL.
2. This methodology shall cover the coordination of operational security analysis at Pan-European level and it applies to all TSOs, RSCs, DSOs, CDSOs and SGUs as defined in Article 2 of SO GL.
3. TSOs from jurisdictions outside the area referred to in Article 2(2) of SO GL may participate in the coordination of operational security analysis on a voluntary basis, provided that
 - a. for them to do so is technically feasible and compatible with the requirements of SO GL;
 - b. they agree that they shall have the same rights and responsibilities with respect to the coordination of operational security analysis as the TSOs referred to in paragraph 2;
 - c. they accept any other conditions related to the voluntary nature of their participation in the coordination of operational security analysis that the TSOs referred to in paragraph 2 may set;
 - d. the TSOs referred to in paragraph 2 have concluded an agreement governing the terms of the voluntary participation with the TSOs referred to in this paragraph;
 - e. once TSOs participating in the coordination of operational security analysis on a voluntary basis have demonstrated objective compliance with the requirements set out in (a), (b), (c), and (d), the TSOs referred to in paragraph 2, after checking that the criteria in (a), (b), (c), and (d) are met, have approved an application from the TSO wishing to participate on a voluntary basis in accordance with the procedure set out in Article 5(3) of the SO GL.

4. The TSOs referred to in paragraph 2 shall monitor that TSOs participating in coordination of operational security analysis on a voluntary basis pursuant to paragraph 3 respect their obligations. If a TSO participating in the coordination of operational security analysis pursuant to paragraph 3 does not respect its essential obligations in a way that significantly endangers the implementation and operation of SO GL, the TSOs referred to in paragraph 2 shall terminate that TSO's voluntary participation in the coordination of operational security analysis process in accordance with the procedure set out in Article 5(3) of SO GL.

Article 2

Definitions and interpretation

1. For the purposes of this proposal, the terms used shall have the meaning of the definitions included in Article 3 of SO GL, Article 2 of Regulation 2015/1222 and the other items of legislation referenced therein. In addition, the following definitions shall apply:

‘reference load’ means the average load defined as total consumption energy in the control area divided by the number of hours composing the year.

‘permanent occurrence increasing factor’ means a factor that explains a permanent increase of the probability of occurrence of an exceptional contingency.

‘temporary occurrence increasing factor’ means a factor that explains a temporary increase of the probability of occurrence of an exceptional contingency.

‘evolving contingency’ means the loss of several grid elements and/or grid users resulting from the occurrence of a contingency from the contingency list followed by the automatic or manual tripping of additional grid elements which are in violation of their operational security limits.

‘verifiable evolving contingency’ means an evolving contingency for which each and every step subsequent to the initial contingency can be simulated until a stable state is reached.

‘preventive remedial action’ means a remedial action that is the result of an operational planning process and needs to be activated prior to the investigated timeframe for compliance with the (N-1) criterion.

‘curative remedial action’ means a remedial action that is the result of an operational planning process and is activated straight subsequent to the occurrence of the respective contingency for compliance with the (N-1) criterion, taking into account transitory admissible overloads and their accepted duration.

‘restoring remedial action’ means a remedial action that is activated subsequent to the occurrence of an alert state for returning the transmission system into normal state again.

‘set of remedial actions’ means a combination of remedial actions that are to be activated as a whole to maintain operational security.

‘cross-border impact’ means the effect in terms of a change of power flows or voltage on an interconnector or a transmission system element located outside of the TSO's control area resulting from the activation of a remedial action in the TSO's control area.

‘remedial action influence factor’ means a numerical value used to quantify the cross-border impact of a remedial action or of a set of remedial actions.

‘cross-border impacting remedial action’ means a remedial action, considered to be activated by a TSO and whose activation has a significant influence on at least one TSO that is not involved in its activation.

‘cross-RSC impacting remedial action’ means a cross-border impacting remedial action, considered to be activated by a TSO who has delegated tasks to a given RSC in accordance with Article 77(3) of SO GL and whose activation has a significant influence on at least one TSO that is not involved in its activation and who has delegated tasks to another RSC in accordance with Article 77(3) of SO GL.

‘agreed remedial action’ means a remedial action with cross-border relevance according to Article 35 of Regulation 2015/1222 or a cross-border impacting remedial action for which all affected TSOs have given their agreement for the activation of this remedial action on the system, when it will become necessary. Before its activation, such a remedial action is expected to be necessary based on security analyses performed during operational planning.

‘delegating TSO’ means a TSO which has delegated tasks to a RSC in accordance with Article 77(3) of SO GL.

‘local preliminary assessment’ means an operational security analysis performed by a TSO to prepare an individual grid model.

‘coordinated operational security analysis’ means an operational security analysis performed by a TSO on a common grid model, in accordance with Article 72(3) and 72(4) of SO GL.

‘coordinated regional operational security assessment’ means an operational security analysis performed by a RSC on a common grid model, in accordance with Article 78 of SO GL.

2. Where this Methodology refers to grid elements, it includes HVDC systems.
3. ‘IGM’ and ‘CGM’ respectively stand for ‘individual grid model’ and ‘common grid model’. ‘NRA’ stands for “national regulatory authority”. ‘ENTSO-E’ stands for ‘ENTSO for electricity’. ‘RSC’ stands for ‘regional security coordinator’.

TITLE 2

Determination of influencing elements

Chapter 1

Influence factor determination

Article 3

Influence computation method

1. The influence computation method has the following characteristics:

- a. It is able to characterize the influence of the absence of one grid element connected to a TSO or DSO/CDSO network on the power flow or voltage of another transmission grid element;
 - b. It is applicable on a year-ahead common grid models developed in accordance to Article 67 of SO GL or on a TSO's grid model with representation of DSO/CDSO systems;
 - c. The influence is characterized with respect to the relative or absolute value of power flow or voltage variation and the result is able to be compared against thresholds.
2. Each TSO shall apply the influence computation method provided in Annex I for computing power flow influence factors on its control area of grid elements located outside the TSO's control area and connected to a transmission system.
3. Each TSO shall apply the influence computation method provided in Annex I for computing power flow influence factors on its control area of grid elements connected to transmission-connected DSO/CDSO grids located outside its control area, provided that they are modelled in the CGMs used for the computation.
4. Where a TSO expects that computing the power flow influence factors on its control area will not sufficiently capture the grid elements that can cause significant voltage variations in its control area, this TSO shall have the right to use voltage influence factors in the determination of its observability area and external contingency list.
5. Where applicable according to paragraph 4, each TSO shall inform affected TSOs about the decision to compute voltage influence factors and shall apply the influence computation method provided in Annex I for computing these factors of grid elements located outside its control area and connected to a transmission system.
6. Where applicable according to paragraph 4 each TSO shall apply the influence computation method provided in Annex I for computing voltage influence factors of grid elements connected to transmission-connected DSO/CDSO grids located outside its control area. This TSO shall inform TSOs to which transmission-connected DSO/CDSO grids are connected to and are affected by application of this paragraph about its decision to compute voltage influence factors.
7. Each TSO, to which the grids of transmission-connected DSOs/CDSOs that are affected by application of paragraph 6 are connected, shall inform these transmission-connected DSO/CDSOs about this application.
8. Each TSO shall inform the concerned DSOs/CDSOs of its control area about the decision to compute power flow and/or voltage influence factors of grid elements of their systems and shall be entitled to ask these DSOs/ CDSOs for technical parameters and data with a reasonable limited depth proportional to the influence computation needs, in order to allow the inclusion of at least part of their grids in the TSO's grid model.
9. When requested according to paragraph 8, each DSO/CDSO shall provide a single coherent set of data within three months after receiving the request, to enable the connecting TSO to incorporate the required part of their grids in its own grid model or in its individual grid models established pursuant to paragraph 12.

10. Each TSO shall use the common grid models established according to Article 67 of SO GL, and complemented as needed pursuant to paragraph 12, when computing power flow and/or voltage influence factors of grid elements connected directly or through a DSO/CDSO to another TSO's control area.
11. When computing the influence of grid elements located in DSOs/CDSOs grids which are connected to its control area, in order to determine whether they are part of its observability area, each TSO shall use either the common grid models established according to Article 67 of SO GL, or its own grid model; in both cases, these models shall be complemented as needed pursuant to paragraph 8.
12. Each TSO shall include in its individual grid model the relevant transmission-connected DSO/CDSO data model which it identifies as necessary for computation of influence factors by another TSO.

Article 4

Possible relevance of dynamic aspects for influence assessment

1. When a TSO needs to apply Article 38(6)(b) or Article 38(6)(c) of SO GL to ensure a secure operation of its transmission system, this TSO shall have the right to request the support of concerned TSOs to use dynamic studies for assessing influence of the grid elements, power generating modules, and demand facilities located outside their control areas and connected to a transmission system. In such case, this TSO and the concerned TSOs shall define models, studies and criteria to be used for the assessment and inform their NRAs about their agreement. These models and studies shall be consistent with those developed in application of Articles 38 or 39 of SO GL
2. When a TSO needs to apply Article 38(6)(b) or Article 38(6)(c) of SO GL to ensure a secure operation of its transmission system, this TSO shall have the right to use dynamic studies to assess influence of the grid elements, power generating modules, and demand facilities located in transmission-connected DSOs/CDSOs grids connected to this TSO. In such a case, the TSO shall use models, studies and criteria, consistent with those developed in application of Articles 38 or 39 of SO GL.
3. When a TSO needs to apply Article 38(6)(b) or Article 38(6)(c) of SO GL to ensure a secure operation of its transmission system, this TSO shall have the right to request the support of concerned TSOs to use dynamic studies for assessing influence of the grid elements, power generating modules, and demand facilities located in transmission-connected DSOs/CDSOs grids connected to other TSOs. In such a case, the TSO performing the computation will inform the TSOs to which transmission-connected DSO/CDSOs are connected to about this decision and shall use models, studies and criteria consistent with those developed in application of Articles 38 or 39 of SO GL.
4. Each TSO, to which transmission-connected DSO/CDSOs are connected to and are affected by application of paragraphs 2 or 3, shall inform these transmission-connected DSO/CDSOs and concerned SGUs connected to these DSOs/CDSOs about the decision to use dynamic studies to assess their influence and shall be entitled to ask these DSOs/CDSOs and SGUs for the corresponding technical parameters and data, provided this request is proportional to the needs of the dynamic study.

5. When requested according to paragraph 4 each transmission-connected DSO/CDSO and each SGU shall provide a single coherent set of data within three months after receiving the request to enable the connecting TSO to incorporate the required part of their systems in models developed in application of Articles 38 or 39 of SO GL.
6. Each TSO to which transmission-connected DSO/CDSOs are connected to and are affected by application of paragraph 2 or 3 shall share results of the performed assessment with these transmission-connected DSO/CDSOs and concerned SGUs.
7. Where one or more elements are identified in application of paragraph 2, the concerned TSO shall inform its NRA of the elements identified with reasoning supporting this result.
8. Where one or more elements are identified in application of paragraph 3, the TSO which performed dynamic studies and the TSOs to which transmission-connected DSO/CDSO are connected to, shall inform their NRAs of the elements identified with the reasoning supporting this result.

Chapter 2

Identification of influencing elements

Article 5

Identification of observability area elements

1. Each TSO shall define its observability area in accordance with Article 3, Article 4 where applicable and the following paragraphs.
2. Each TSO shall aim at agreeing with each transmission-connected DSO/CDSO of its control area what are their grid elements connected to this DSO/CDSO grid which will be part of its observability area based on qualitative assessment.
3. Where deemed necessary by the TSO, this TSO shall aim at agreeing with each non-transmission-connected DSO/CDSO of its control area and its connecting DSO what are the grid elements connected to this DSO/CDSO which will be part of its observability area based on qualitative assessment.
4. If the TSO and the concerned DSO/CDSO do not agree, the identification of elements will be done in accordance to Article 3 and, where applicable, Article 4.
5. Each TSO shall select threshold values inside the range of observability thresholds listed in Annex 1 that it shall use to determine its observability area in application of paragraph 6 and 7. The threshold values shall be identical regardless of the grid element of which the influence is assessed by this TSO. Each TSO shall communicate to ENTSO-E those threshold values in time with the application of paragraph 1 and in accordance to Article 45(10). ENTSO-E shall collect those threshold values and shall publish them on its web site at least once a year.
6. Each TSO shall include in its observability area:
 - a. all grid elements outside its control area which have an influence factor greater than the corresponding observability influence threshold values selected pursuant to paragraph 5;

- b. all grid elements of transmission-connected DSOs/CDSOs of its control area, identified in accordance to paragraph 2 or all grid elements of transmission-connected DSOs/CDSOs identified in accordance to paragraph 4 that have an influence factor greater than the corresponding observability influence threshold values selected pursuant to paragraph 5;
 - c. all grid elements of non-transmission-connected DSOs/CDSOs of its control area, identified in accordance to paragraph 3 or all grid elements of non-transmission-connected DSOs/CDSOs identified in accordance to paragraph 4 that have an influence factor greater than the corresponding observability influence threshold values selected pursuant to paragraph 5;
 - d. all grid elements connecting this TSO's control area to another TSO's control area;
 - e. additional grid elements which are necessary to obtain a fully connected observability area;
 - f. elements identified in application of Article 4(1) to Article 4(3), where applicable;
 - g. busbars to which the grid elements previously identified in accordance with points a to f can be connected.
7. A TSO shall have the right to discard some grid elements identified in accordance with paragraph 6(a) to 6(c), provided their influence factor is not greater than the maximum value of the range of thresholds defined in Annex 1.
 8. In case that a TSO intends to include in its observability area grid elements, power generating modules or demand facilities that are connected to the transmission system and not connected to a busbar identified in accordance with paragraph 6, this TSO shall send a request to the concerned TSOs. The TSOs which receive the request are entitled to accept or reject it.
 9. TSOs shall have the right to agree to keep existing data exchange for elements which are not identified in application of paragraph 6.
 10. TSOs and DSOs shall have the right to agree to keep existing data exchange for elements which are not identified in application of paragraph 6.
 11. Each TSO shall re-assess its observability area in accordance with paragraph 2 to 8 at least once every 5 years.
 12. Between two mandatory assessments in accordance with paragraph 11, any new element commissioned inside a TSO's observability area shall be included in its observability area. If the owner of the new element disagrees with such a qualitative approach, TSOs shall use the influence computation method in accordance to the Article 3 and Article 4, where applicable, for establishing the relevance of such elements.

Article 6

Identification of external contingencies

1. Each TSO shall define its external contingency list in accordance with Article 3, Article 4 where applicable and the following paragraphs.
2. Each TSO shall select threshold values inside the range of external contingency thresholds listed in Annex 1 that it shall use to determine its external contingency list in application of paragraph 1. The

threshold values shall be identical regardless of the grid element of which the influence is assessed by this TSO. Each TSO shall communicate to ENTSO-E those threshold values in time with the application of paragraph 1 and in accordance to Article 45(10). ENTSO-E shall collect those threshold values and shall publish them on its web site at least once a year.

3. Each TSO shall include in its external contingency list at least:
 - a. all contingencies of a single grid element outside its control area which have an influence factor greater than the corresponding external contingency threshold values selected pursuant to paragraph 2;
 - b. all contingencies of grid elements located in transmission connected DSOs/CDSOs grids connected to this TSO, which are located in the TSO's observability area and commonly agreed between the TSO and the DSO/CDSO according to Article 5(2) or all contingencies of grid elements of these DSOs and CDSOs, which are located in the TSO's observability area, and which have an influence factor greater than the correspondent external contingency threshold values selected pursuant to paragraph 2.
4. Each TSO shall have the right to complement its external contingency list with any of the generating modules and demand facilities connected to a busbar identified in accordance with Article 5.
5. All new elements commissioned inside a TSO's observability area shall either be assessed in accordance with Article 3 and, where applicable, Article 4 or shall be included without any assessment in its external contingency list.
6. Each TSO shall re-assess its external contingency list in accordance to paragraph 2 to 4 at least once every 5 years.

TITLE 3

Principles of coordination

Chapter 1

Management of exceptional contingencies

Article 7

Classification of contingencies

1. When building its contingency list as required by Article 33 of SO GL, each TSO shall classify for its own control area:
 - a. The following contingencies as ordinary:
 - i. Loss of a single line / cable;
 - ii. Loss of a single transformer;
 - iii. Loss of a single phase-shifting transformer;
 - iv. Loss of a single voltage compensation device;

- v. Loss of a single component of a HVDC system such as a line or a cable or a single HVDC converter unit;
 - vi. Loss of a single power generation unit;
 - vii. Loss of a single demand facility.
- b. The following contingencies as exceptional:
- i. Loss of grid elements having common fault mode, meaning that a single fault (such as a fault on a busbar, HVDC grounding system, circuit breakers, measurement transformers, ...) will lead to the loss of more than one grid element;
 - ii. Loss of overhead lines built on same tower;
 - iii. Loss of underground cables built in same trench;
 - iv. Loss of grid users having common process mode, meaning that the total or partial sudden loss of one grid user will lead to the total or partial loss of the others (ex: Combined cycle units, ...);
 - v. Loss of grid elements/users simultaneously disconnected as a result of the operation of a Special Protection Scheme;
 - vi. Loss of multiple generation units (including solar and wind farms) disconnected as a consequence of a voltage drop on the grid.
- c. The following contingencies as out-of-range:
- i. Loss of two or more independent lines;
 - ii. Loss of two or more independent cables;
 - iii. Loss of two or more independent transformers or phase shifter transformers;
 - iv. Loss of two or more independent grid users (power generating unit or demand facility);
 - v. Loss of two or more independent voltage compensation devices;
 - vi. Loss of two or more independent busbars;
 - vii. Loss of two or more independent components of a HVDC system such as lines, cables or HVDC converter units.
2. For any other type of contingency resulting in the simultaneous loss of one or several grid users or grid elements and not listed above, each TSO shall classify them in one of the three categories (ordinary, exceptional or out-of-range) according to the definitions provided by Article 3 of SO GL.

Article 8

Occurrence increasing factors handling

1. Each TSO shall determine for each exceptional contingency the relevance and criteria of application of the following occurrence increasing factors:
 - a. permanent occurrence increasing factors:

- i. specific geographical location,
 - ii. design conditions
 - b. temporary occurrence increasing factors:
 - i. operational conditions
 - ii. weather or environmental conditions
 - iii. life time or generic malfunction affecting the risk of failure
- 2. When determining the relevance and criteria of application of occurrence increasing factors listed in paragraph 1b, each TSO shall consider operational, weather or environmental conditions in relation with the specifications and the current state of the equipment.
- 3. When determining the relevance of application of occurrence increasing factors listed in paragraph 1, each TSO shall take into account where available the history of incidents that occurred on the concerned grid elements.

Article 9

Exceptional contingencies with a risk of high cross-control area impact

- 1. Where a TSO expects that exceptional contingencies located in another TSO's control area may lead to consequences above the consequences within the TSO's control area which are considered as acceptable in respect with its national legislation as referred to in Article 4(2)(e) of SO GL, or, if no national legislation exists, in respect with its internal rules, and this other TSO does not include these exceptional contingencies in its contingency list because it does not identify occurrence increasing factors in accordance with Article 8, these TSOs may jointly establish an agreement on additional exceptional contingencies located in one of their control areas which shall have to be included in their contingency lists in order to ensure that the consequences in their control areas remain acceptable.
- 2. When establishing this agreement, these TSOs shall determine the maximum cost of remedial actions above which cost of fulfilment of operational security limits shall not be deemed proportionate to the risk, taking into account their national legislation as referred to in Article 4(2)(e) of SO GL, or, if no national legislation exists, taking into account their internal rules.
- 3. When establishing this agreement, these TSOs shall ensure that all affected TSOs are participating in the agreement.

Article 10

Establishment of the contingency list

- 1. When applying Article 33(1) of SO GL, each TSO shall include in its contingency list:
 - a. the ordinary contingencies;
 - b. the exceptional contingencies fulfilling the application criteria of at least one of the permanent occurrence increasing factor;

- c. the exceptional contingencies fulfilling the application criteria of at least one of the temporary occurrence increasing factors when conditions are met;
 - d. the exceptional contingencies which lead to consequences above the consequences within the TSO's control area which are considered as acceptable in respect with its national legislation as referred to in Article 4(2)(e) of SO GL, or, if no national legislation exists, in respect with its internal rules.
- 2. In addition, each TSO part of an agreement established according to Article 9 shall include in its contingency list where needed the identified exceptional contingencies.
- 3. In addition, each TSO shall include in its contingency list the external exceptional contingencies that may endanger its grid whether they are permanently or temporarily included in another TSO's internal contingency list pursuant to Article 11(1) and (4).
- 4. When assessing the contingencies referred to in point a of paragraph 1, each TSO shall have the right to exclude those which will never lead to consequences above the consequences which are considered as acceptable in respect with its national legislation or, if no national legislation exists, in respect with its internal rules.
- 5. When assessing the contingencies referred to in point d of paragraph 1, each TSO shall take into consideration whether the cost of remedial actions needed to maintain the consequences acceptable is deemed proportional to the risk in respect with its national legislation or, if no national legislation exists, in respect with its internal rules.

Article 11 .

Sharing of the contingency list

- 1. Each TSO shall inform without undue delay the TSOs whose observability area contains grid elements of its contingency list and the relevant RSC(s) about any update of the exceptional contingencies fulfilling the application criteria of at least one of the permanent occurrence increasing factor.
- 2. Each TSO shall inform without undue delay the TSOs whose observability area contains grid elements of its contingency list about any update of the exceptional contingencies that have the potential to fulfil the application criteria of at least one of the temporary occurrence increasing factor.
- 3. When informed by another TSO that an exceptional contingency fulfils at least one of the permanent occurrence increasing factor or has the potential to fulfil the application criteria of at least one of the temporary occurrence increasing factor, each TSO shall assess whether this contingency shall endanger its grid.
- 4. Each TSO shall inform without undue delay the TSOs whose observability area contains grid elements of its contingency list and the relevant RSC(s) about any update of the exceptional contingencies when conditions are met to fulfil the application criteria of at least one of the temporary occurrence increasing factor.
- 5. Each TSO shall inform without undue delay, when conditions are no longer met, the TSOs whose observability area contains grid elements of its contingency list and the relevant RSC(s) about any

update of the exceptional contingencies no longer fulfilling the application criteria of any temporary occurrence increasing factor.

6. Each TSO shall inform the relevant RSC(s) about the contingencies of their contingency list for which the TSO shall not be required to comply with the (N-1) criterion either
 - a. because the TSO decides not to comply with in (N-1) criterion in application of SO GL Article 35(5) or
 - b. because they are part of the set of contingencies jointly agreed in application of Article 12.
7. Each TSO shall inform the relevant RSC(s) about the contingencies identified in application of Article 9.

Chapter 2

Evaluation of contingency consequences

Article 12

Common agreement on cross-control area consequences

1. TSOs shall have the right to jointly agree in a multi-lateral agreement that a set of contingencies of their contingency lists do not respect the (N-1) criterion. The precondition for such a multi-lateral agreement is that the contingencies not respecting the (N-1) criterion have consequences limited to the contracting TSOs' control areas and considered as acceptable within each contracting TSO's control area in respect of their national legislation as referred to in Article 4(2)(e) of SO GL or, if no national legislation exists, their internal rules. These TSOs shall inform all TSOs and RSCs about this agreement.

Article 13

Assessment of consequences

1. In addition to Article 35(1) of SO GL, each TSO shall assess the consequences of any contingency of his contingency list:
 - a. by evaluating that the power deviation between generation and demand resulting of the occurrence of a contingency or of a verifiable evolving contingency does not exceed the reference incident, and that one of the following conditions is fulfilled:
 - i. the operational security limits determined according to Article 25 of SO GL are respected on all grid elements of its control area in compliance with Article 35(1) of SO GL and there is no risk of propagating a disturbance to the interconnected transmission system, or
 - ii. the occurrence of the contingency leads to a verifiable evolving contingency with consequences limited to the perimeter of the TSO's control area and considered as acceptable in respect with its national legislation as referred to in Article 4(2)(e) of SO GL or, if no national legislation exists, in respect with its internal rules, in compliance with Article 35(5) of SO GL
 - b. or by evaluating, with the support of the relevant RSC(s) where applicable, that the power deviation between generation and demand resulting of the occurrence of a verifiable

evolving contingency does not exceed the reference incident, and that the occurrence of the contingency leads to consequences limited to the control areas of TSOs which are party to an agreement defined according to Article 12 and considered as acceptable within each TSO's control area in respect with its national legislation as referred to in Article 4(2)(e) of SO GL or, if no national legislation exists, its internal rules and there is no risk of propagating a disturbance to the rest of the interconnected transmission system.

Chapter 3

Coordination of remedial actions

Article 14

Cross-border impact of sets of remedial actions

1. When designing a set of remedial actions, TSOs shall assess the cross-border impact of the whole set and shall not assess the cross-border impact of each elementary remedial action constituting the set.
2. When jointly designing a set of remedial actions in application of Article 20 and 78 of SO GL, TSOs shall consider this set of remedial actions as cross-border impacting for them.

Article 15

Quantitative assessment of cross-border impact

1. When TSOs have to quantitatively assess the cross-border impact of a remedial action or of a set of remedial actions in accordance with Article 16(1), TSOs shall use the remedial action influence factor defined by the maximum flow deviation on their interconnectors normalised by their permanent admissible load resulting from the application of a remedial action or of a set of remedial actions.
2. When assessing the influence factor of a remedial action as described in paragraph 1, TSOs shall have the right to agree, when preparing the proposal for the methodology for the preparation of remedial actions managed in a coordinated way under Article 76(1)(b) of SO GL, on additional external elements included in their observability area to be considered in addition to their interconnectors.
3. TSOs shall have the right to agree, when preparing the proposal for the methodology for the preparation of remedial actions managed in a coordinated way under Article 76(1)(b) of SO GL, to assess quantitatively the cross-border impact based on change of voltage. In that case, the TSOs shall agree on the list of nodes where such assessment will take place.
4. For preventive remedial actions, the change of flows or voltage shall be assessed on the N situation and on each of the N-1 situations resulting of the contingency list simulation. For curative remedial actions, the change of flows or voltage shall be assessed on the simulation of the post-contingency situation for which this curative remedial action has been designed.
5. TSOs shall consider remedial actions or sets of remedial actions for which the remedial action influence factor is higher than a threshold commonly agreed as cross-border impacting when preparing the proposal for the methodology for the preparation of remedial actions managed in a coordinated way under Article 76(1)(b) of SO GL.

6. If no such threshold is defined, TSOs shall consider remedial actions or sets of remedial actions as cross-border impacting when the remedial action influence factor defined in paragraph 1 is higher than 5%.

Article 16

Process for cross-border impact assessment

1. When preparing the proposal for the methodology for the preparation of remedial actions managed in a coordinated way under Article 76(1)(b) of SO GL, using either a qualitative or a quantitative approach or a combination of them, all TSOs of each CCR shall jointly determine:
 - a. the potential remedial actions or sets of remedial actions that are deemed cross-border impacting and the corresponding TSOs affected by those remedial actions. For remedial actions or sets of remedial actions that are quantifiable such as redispatching for congestion management, countertrading, change of set point on HVDC systems or change of taps on phase-shifting transformers the quantity above which these remedial actions or sets of remedial actions become cross-border impacting shall be defined;
 - b. the potential remedial actions or sets of remedial actions that are not deemed cross-border impacting;
 - c. the cases where a qualitative or a quantitative approach shall be applied to determine the cross-border impact of a remedial action or set of remedial actions, for those remedial actions which are not identified according to points a and b, and
 - d. the frequency of update of the previous items.
2. In day-ahead or intraday operational planning, when designing a remedial action, each TSO shall assess, in accordance with the cases where a qualitative or quantitative approach shall be applied as defined in application of paragraph 1.c, the cross-border impact of remedial actions that have not been assessed in application of paragraph 1.a and b.
3. During real time operation, if the system is in alert state, when designing restoring remedial actions, each TSO shall assess, in accordance with the cases where a qualitative or quantitative approach shall be applied as defined in application of paragraph 1.c the cross-border impact of remedial actions that have not been assessed in application of paragraph 1.a and b.
4. During real time operation, if the system is in emergency state and only when operational conditions allow it, when designing restoring remedial actions, each TSO shall assess, in accordance with the cases where a qualitative or quantitative approach shall be applied as defined in application of paragraph c, the cross-border impact of remedial actions that have not been assessed in application of paragraph 1.a and b.

Article 17

Principles for coordination of cross-border impacting remedial actions

1. In day-ahead or intraday operational planning, each TSO shall manage in a coordinated way remedial actions that have been deemed cross-border impacting with the affected TSOs and the support of

concerned RSCs pursuant to Article 78(2) of SO GL, following the methodology for the preparation of remedial actions managed in a coordinated way developed in compliance with Article 76 of SO GL.

2. During real time operation, if the system is in alert state, when designing restoring remedial actions that have been deemed cross-border impacting, each TSO shall manage them in a coordinated way with the affected TSOs by at least ensuring that every affected TSO is informed about the operational security limits violation(s) to be relieved by those remedial actions and has accepted the activation of those remedial actions.
3. During real time operation, if the system is in emergency state and only when operational conditions allow it, when designing restoring remedial actions that have been deemed cross-border impacting, each TSO shall manage them in a coordinated way with the affected TSOs by at least ensuring that every affected TSO is informed about the operational security limits violation(s) to be relieved by those remedial actions and has accepted the activation of those remedial actions.
4. When a TSO considers the design of a cross-border impacting remedial action or when a RSC pursuant to Article 78(2) of SO GL proposes the design of a cross-border impacting remedial action, each affected TSO shall accept the proposed remedial action provided that:
 - a. this remedial action is considered available in a consistent manner from the time frame of its decision to all the subsequent timeframes of operational security analyses, up to real time
 - b. and
 - i. when this remedial action is preventive, it is not setting the affected TSO's grid in an alert state based on the CGM(s) used for its decision and it does not imply additional cost on the affected TSO, without considering impact on costs of change in losses,
 - ii. when this remedial action is curative, it is not leading to a violation of operational security limits in the affected TSO's grid after the simulation of the corresponding contingency based on the CGM(s) used for its decision and it does not imply additional cost on the affected TSO, without considering impact on costs of change in losses.
5. When the conditions established in the previous paragraph are not met, each affected TSO shall accept or refuse the proposed remedial action on the basis of the conditions established in the methodology for the preparation of remedial actions in a coordinated way developed under Article 76(1)(b) of SO GL.

Article 18

Remedial actions availability and consistency

1. When designing remedial actions in application of Article 20 of SO GL or when providing to the relevant RSC the updated list of possible remedial actions in application of Article 78(1)(b) of SO GL, each TSO shall consider that the remedial actions which were available for the coordinated operational security analyses, coordinated regional operational security assessments or capacity calculations previously performed for the same timestamps remain available, except the remedial actions which have become unavailable for technical reasons.
2. When relieving a violation of operational security limits during a coordinated operational security analysis in application of Article 72 of SO GL for day-ahead and intraday timeframes, provided

relieving is done in a consistent way with the common provisions developed pursuant to Article 76 of SO GL, each TSO shall take into consideration all the remedial actions already agreed during capacity calculations, coordinated operational security analyses or coordinated regional security assessments previously performed for the same timestamps, except the remedial actions which have become unavailable for technical reasons.

3. When a TSO wants to modify a remedial action or of a set of remedial actions which have previously been managed in a coordinated way and agreed, this TSO shall again assess the cross-border impact of the new remedial action or set of remedial actions and where necessary manage them in a coordinated way with the affected TSOs in accordance with Article 17.

Article 19

Preventive remedial actions activation

1. Each TSO shall activate preventive remedial actions at the shortest time compatible with the delay required to activate them provided that:
 - a. their need is confirmed by the latest coordinated operational security analysis or coordinated regional operational security assessment performed of the expected situation and
 - b. when they have been deemed cross-border impacting, they have been managed in a coordinated way with the affected TSOs in compliance with Article 16.
2. When preparing the activation of the preventive remedial actions, in order to provide enough flexibility in the daily operational activities, each TSO shall have the right to decide to activate them earlier than when it is necessary with consideration of the operational conditions and provided that:
 - a. it does not introduce any operational security limits violation and
 - b. when they have been deemed cross-border impacting, this has been managed in a coordinated way with the affected TSOs in compliance with Article 17.

Article 20

Requirements for coordinated regional operational security assessments

1. When preparing the proposal for common provisions for regional operational security coordination as required by Article 76(1) of SO GL, all TSOs of each CCR shall jointly determine the minimum set of grid elements on which operational security limits violations have to be identified and solved.
2. The grid elements established in application of paragraph 1 shall at least include all the critical network elements of the CCR.
3. The common provisions for regional operational security coordination developed as required by Article 76(1) of SO GL by all TSOs of each CCR shall ensure that, when coordinated regional operational security assessments are performed in application of Article 78 of SO GL, the following objectives are met:
 - a. already agreed remedial actions are included in the individual grid models;

- b. all violations of operational security limits on the grid elements identified in application of paragraph 1 are relieved using at least the remedial actions provided by TSOs in application of Article 78(1)(b) of SO GL;
- c. every TSO affected by a cross-border impacting remedial action or by a remedial action of cross-border relevance as determined in accordance with Article 35 of Regulation 2015/1222 is informed about the operational security limits violations to be solved by this remedial action and ensures that this TSO has agreed it and;
- d. the coordination of cross-border impacting remedial actions and the coordination of remedial action of cross-border relevance as determined in accordance with Article 35 of Regulation 2015/1222 are treated in a consistent way.

Article 21

Remedial actions inclusion in individual grid models

1. When preparing individual grid models pursuant to Article 70 of SO GL, each TSO shall include any remedial action already agreed as a result of previous coordinated operational security analyses in accordance with Article 18(2) or previous coordinated regional operational security assessments in accordance with Article 78 of SO GL.
2. When preparing individual grid models pursuant to Article 70 of SO GL, each TSO shall have the right to perform a local preliminary assessment.
3. When performing a local preliminary assessment, and provided this is consistent with the common provisions developed as required by Article 76(1) of SO GL, each TSO may choose whether or not to relieve operational security limits violations on:
 - a. grid elements identified in application of Article 20(1) of this Methodology as they will be relieved during the subsequent coordinated regional operational security assessment;
 - b. any other grid elements provided those operational security limits violations are likely to be solved by remedial actions which are not deemed cross-border impacting;
 - c. any other grid elements provided those operational security limits violations are likely to be solved by subsequent coordinated regional operational security assessment.
4. When preparing individual grid models pursuant to Article 70 of SO GL, in addition to the remedial actions referred to in paragraph 1 and taking into account where applicable the results of the local preliminary assessment referred to in paragraph 2, each TSO may include any non-cross-border impacting remedial actions and may include cross-border impacting remedial actions provided this is consistent with the common provisions developed as required by Article 76(1) of SO GL.

Chapter 4

Realisation of operational security analyses with respect to uncertainty management and regional coordination

Article 22

Long term studies (year-ahead up to week-ahead)

1. In order to apply requirements of Article 72(1)(a) or (b) or Articles 98(3), 100(3) and (4) of SO GL, each TSO shall have the right to decide to apply local scenarios for its control area in addition to the scenarios required according to Article 65 of SO GL, in order to improve robustness of the analyses against uncertainties.
2. Where the need for local scenarios is identified, the TSO shall determine for which operational planning activities those local scenarios are to be considered and shall inform the TSOs of its capacity calculation region or of its outage coordination region and the relevant RSCs about the content of those local scenarios and their usage purpose.
3. Where a TSO defines local scenarios for operational security analysis in accordance with Article 72(1)(a) or (b) or for outage coordination in accordance with Articles 98(3), 100(3) and (4) of SO GL, and these scenarios differ from the scenarios defined by all TSOs according to Article 65 of SO GL, other TSOs shall not be obliged to build their individual grid models for the local scenarios.
4. Where a TSO defines local scenarios for operational security analysis in accordance with Article 72(1)(a) or (b) of SO GL, this TSO shall define, in coordination with other TSOs of the concerned capacity calculation region, which grid models shall be used to study these local scenarios. These grid models shall be derived from the common grid models established pursuant to Article 67 of SO GL, using appropriate substitutes or derived models where appropriate.
5. Where a TSO defines local scenarios for outage coordination in accordance with Articles 98(3), 100(3) and (4) of SO GL, this TSO shall define, in coordination with other TSOs of the outage coordination region, which grid models shall be used to study these local scenarios. These grid models shall be derived from the common grid models established pursuant to Article 67 of SO GL, using appropriate substitutes or derived models where appropriate.

Article 23

Day-ahead Operational Security Analysis

1. Each TSO shall perform in day-ahead a coordinated operational security analysis on the basis of a best forecast approach where the forecasted situation of each timestamp of the next day shall be established in accordance with the following:
 - a. Considering that a margin in line with Article 22 of Regulation (EU) 2015/1222 shall be taken into account for capacity calculation processes, and that the goal of the operational security analysis is to identify expected operational security limit violations and consequent remedial actions, each TSO shall not add any reliability margin to its operational security limits when evaluating the results of the coordinated operational security analysis, and shall not include in

- its day-ahead individual grid models any additional reliability margin to the operational security limits.
- b. Individual grid models and subsequent common grid models, created in the application of Article 70(2) of SO GL and according to the methodology of Article 70(1) of SO GL, shall include load and intermittent generation forecasts established on the basis of the latest available forecasts for load and intermittent generation according to Article 37 and Article 38.
 - c. Individual grid models and subsequent common grid models, created in the application of article 70(2) of SO GL and according to the methodology of Article 70(1) of SO GL, shall include market results, schedules, and planned topology of the transmission system.
 - d. Remedial actions shall be included in individual grid models and subsequent common grid models as required in Article 21 and Article 20.
2. The coordinated operational security analysis referred to in paragraph 1 shall be performed in accordance with Articles 72(1)(c) and 74(1) and (2) of SO GL, between T1 and T5 on the basis of the day-ahead common grid model built in accordance with Article 33(1), where T1 and T5 are defined in accordance with Article 44.
 3. Each TSO shall have the right to delegate this task to the RSC(s) to which it has delegated tasks in accordance with Article 77(3) of SO GL, while the TSO shall keep the legal responsibility of this task.
 4. When preparing the proposal for the common provisions for regional operational security coordination as required by Article 76 of SO GL, all TSOs of a CCR shall have the right to establish particular rules and processes, applicable in day-ahead to the coordinated operational security analyses performed by these TSOs and the coordinated regional operational security assessment performed by the RSCs, needed to manage the exceptional situations where the accuracy of one or more of the forecasts variables included in the individual grid models is insufficient to allow the correct identification of operational security limit violations by application of paragraph 1. These rules and processes shall ensure that, when they are activated, all affected TSOs and RSCs, including those not implied in the proposal, are informed and can take account of these activations in their own processes.

Article 24

Intraday Operational Security Analysis

1. Each TSO shall determine the minimum number and hours of assessment runs in intraday timeframe where it performs a coordinated operational security analysis in accordance to Article 72(1)(d) and 74(1) and (2) of SO GL, taking into account at least:
 - a. Conditions and frequency for coordinated regional operational security assessment provided by an RSC and adopted pursuant to Article 76(1)(a) of SO GL in the capacity calculation regions the TSO is taking part;
 - b. Intraday relative timeline distribution of the market activity affecting the positions of market participants in its control area;
 - c. Time needed to activate remedial actions;

- d. Impact of solar or wind generation variations on its system, due to locally connected generation assets or connected inside other control areas;
 - e. Impact of load variations.
- 2. The minimum number shall be greater or equal to 3.
- 3. Each TSO shall perform the coordinated operational security analyses as required in paragraph 1 on the basis of a best forecast approach, where the forecasted situation of each timestamp in the intraday timeframe shall be established in accordance with the following:
 - a. Considering that a margin in line with Article 22 of Regulation (EU) 2015/1222 shall be taken into account for capacity calculation processes, and that the goal of the operational security analysis is to identify expected operational security limit violations and consequent remedial actions, each TSO shall not add any reliability margin to its operational security limits when evaluating the results of the coordinated operational security analysis, and shall not include in its intraday individual grid models any additional reliability margin to the operational security limits.
 - b. Individual grid models and subsequent common grid models, created in the application of Article 70(2) of SO GL and according to the methodology of Article 70(1) of SO GL, shall include load and intermittent generation forecasts established on the basis of the latest available forecasts for load and intermittent generation according to Article 37 and Article 38.
 - c. Individual grid models and subsequent common grid models, created in the application of article 70(2) of SO GL and according to the methodology of Article 70(1) of SO GL, shall include market results, schedules, and planned topology of the transmission system.
 - d. Remedial actions shall be included in individual grid models and subsequent common grid models as required in Article 21 and Article 20.
- 4. When performing a coordinated operational security analysis in intraday, and where the results of the coordinated operational security analysis have significantly evolved with a regional impact compared to the previous ones, the TSO shall coordinate with the affected TSOs in accordance with Article 72(5) of SO GL and the relevant RSC(s), in order to:
 - a. share information about the significant changes of results, at least flows;
 - b. agree on change on previously agreed remedial action or on new remedial action with cross-border impact which may become required due to moving closer to or exceeding the operational security limits.
- 5. With respect to the conditions and frequency of intraday coordination of operational security analysis established pursuant to Article 76(1)(a) of SO GL, the TSO shall have the right to delegate part or all of the coordinated operational security analyses defined in accordance with paragraph 1 to the RSC(s) to which it has delegated tasks in accordance with Article 77(3) of SO GL, while the TSO shall keep the legal responsibility of these tasks.
- 6. When preparing the proposal for the common provisions for regional operational security coordination as required by Article 76 of SO GL, all TSOs of a CCR shall have the right to establish particular rules

and processes, applicable in intraday to the coordinated operational security analyses performed by these TSOs and the coordinated regional operational security assessment performed by the RSCs, needed to manage the exceptional situations where the accuracy of one or more of the forecasts variables included in the individual grid models is insufficient to allow the correct identification of operational security limit violations by application of paragraph 3. These rules and processes shall ensure that, when they are activated, all affected TSOs and RSCs, including those not implied in the proposal, are informed and can take account of these activations in their own processes.

Article 25

Handling of extreme event

1. In case of an expected extreme event, such as a weather event, able to trigger significant effects on network assets' or generation assets' availability or on load demand, each TSO shall attempt to evaluate the expected consequences within its control area, with a focus on the period of the day where the event will take place until the end of the day.
2. Where the result of this analysis is that such events are capable of leading to an emergency or black-out state, the TSO shall inform without delay neighbouring TSOs and the RSC(s) to which it has delegated tasks in accordance with Article 77(3) of SO GL, and, where necessary, affected DSOs and SGUs.

Chapter 5

Inter-RSC Coordination

Article 26

General requirements

1. RSCs shall use English for all communication and documentation exchanges between them.
2. RSCs shall aim at providing permanent capability for coordination with other RSCs, on 24 hours a day basis. Where an RSC is not organized for that, a back-up solution shall be defined by the RSC and its delegating TSOs to allow possible exchange of information at the request of other RSCs during the periods where this RSC is unavailable.

Article 27

Overlapping zones

1. In order to achieve transparency and consistency between processes set up in accordance to Article 77 of SO GL, where at least two neighbouring TSOs have delegated tasks in accordance with Article 77(3) of SO GL to two different RSCs, these RSCs and all their delegating TSOs shall agree on the overlapping zone between these RSCs by identifying:
 - a. the network elements constituting this overlapping zone and by which RSC(s) they are monitored;
 - b. the potential remedial actions generally available to solve operational security limits violations on these network elements.

2. For the remedial actions identified pursuant to paragraph 1.b, using either a qualitative or a quantitative approach or a combination of them, these RSCs and TSOs shall determine:
 - a. the remedial actions that are deemed cross-RSC impacting and the corresponding TSOs affected by each of those remedial actions. For remedial actions or sets of remedial actions that are quantifiable such as redispatching for congestion management, countertrading, change of set point on HVDC systems or change of taps on phase-shifting transformers, the quantity above which these remedial actions or set of remedial actions become cross-RSC impacting shall be defined;
 - b. the remedial actions that are not deemed cross-RSC impacting.
3. RSCs and TSOs shall agree on the update conditions of this information at least for the tasks listed in Articles 78, 80, 81 of SO GL.

Article 28

Monitoring of inclusion of agreed remedial actions in the individual grid models

1. Each RSC shall monitor in the relevant timeframes the correct inclusion of the agreed remedial actions in the IGMs by the TSOs, as required by Article 70(4) of SO GL.
2. When a RSC identifies that a previously agreed remedial action has not been included in the IGM by a TSO, that RSC shall inform the other relevant RSCs about it. The relevant RSC in charge of providing the task of CGM building for this TSO according to Article 77(3)(b) of SO GL shall, pursuant to Article 79(3) of SO GL, ask the relevant TSO to correct its IGM.

Article 29

Back-up for the common grid model building task

1. RSCs shall set up the relevant organization between them to guarantee the availability of common grid models built in application of Article 79 of SO GL with a target of absence of interruption for the different timeframes.
2. In case of an interruption of service, RSCs shall aim at recovering the service availability as soon as possible and inform the TSOs of the expected time of recovery.

Article 30

Assessment of cross-RSC influence of remedial actions

1. When designing a remedial action for relieving an operational security limits violation in the overlapping zone for which the cross-RSC impact is not assessed in accordance with Article 27(2.b), the relevant RSC shall consider it as cross-RSC impacting.
2. When designing a remedial action which is deemed cross-RSC impacting for relieving an operational security limits violation, the RSC shall coordinate with the other concerned RSCs to identify its effects. All affected TSOs shall agree on the use of this remedial action before it is activated.

3. When applying Article 78(1) of SO GL, each TSO shall decide and inform its RSC whether a remedial action provided to its RSC is offered simultaneously to different CCRs or is offered only to one CCR, provided that this remedial action can potentially solve operational security limits violations on the elements identified according to Article 20(1) in more than one proposal for common provisions for regional operational security coordination per CCR as required by Article 76(1) of SO GL.
4. When applying paragraph 2, the affected TSOs, with the support of their RSCs, shall agree on the use of this remedial action when it does not create new operational security limits violations or does not worsen any existing one, according to Article 17(4) and provided they do not have other reason to refuse it. Where it does create new operational security limits violations or worsen any existing one, RSCs shall coordinate to try to find the most effective remedial action or set of remedial actions, including or not the initial remedial action identified in accordance with paragraph 2, to be proposed to their TSOs to remove all operational security limits violations. When doing so, they shall not take into account the possible restrictions set up according to paragraph 3. All affected TSOs shall agree on the use of this improved proposal before it is activated. For the remedial actions with costs, the identification and agreement on such set of remedial actions may be restricted to those possible with consideration of the existence of agreed cost sharing rules between the concerned TSOs, at least those established according to Article 74 of Regulation 2015/1222.

Article 31

Investigation of possible additional remedial actions

1. When a RSC is not able to propose to its delegating TSOs an effective and economically efficient remedial action to remove a violation of operational security limits, this RSC shall coordinate with other relevant RSCs in order to try to find another possible remedial action or set of remedial actions to remove it. When doing so, RSCs shall not take into account the possible restrictions set up according to Article 30(3). In case such a remedial action or set of remedial actions is identified, its design shall be agreed by all the affected TSOs.
2. For the remedial actions with costs, the identification and agreement on such remedial actions in accordance to paragraph 1 may be restricted to those possible with consideration of the existence of agreed cost sharing rules between the concerned TSOs, at least those established according to Article 74 of Regulation 2015/1222.

Article 32

Exchange of results

1. Each RSC shall exchange the results of coordinated regional operational security assessments with other RSCs having an overlapping zone with it for checking and consolidating them where required, notably for cross-RSC impact assessment. They shall at least exchange information about needed remedial actions and all relevant information useful to support the results.

Article 33

Cross-regional day-ahead coordinated operational security assessment

1. TSOs and RSCs shall apply at least the following cross-regional day-ahead coordinated operational security assessment process, where T0, T1, T2, T3, T4, T5 are defined in accordance with Article 44:
 - a. At latest at hour T0, all TSOs shall deliver IGMs covering the whole next day and RSCs shall make available to all TSOs and RSCs the corresponding CGMs before hour T1 where T1 is equal to T0 +60 minutes, in accordance with Article 22(4)(d) of the methodology established pursuant to Article 70(1) of SO GL.
 - b. At latest at hour T2, each RSC shall perform a coordinated regional operational security assessment as required by Article 78(2) of SO GL.
 - c. At latest at hour T2, RSCs shall share between them the results of these coordinated regional operational security assessments. Between T2 and T3, TSOs shall deliver updated IGMs taking into account preventive remedial actions agreed during this coordinated regional operational security assessment, and making also available curative remedial actions agreed during this coordinated regional operational security assessment.
 - d. At latest at hour T3, RSCs shall make available to all TSOs and RSCs the corresponding CGMs in accordance with Article 22(4)(e) of the methodology established pursuant to Article 70(1) of SO GL.
 - e. At latest at hour T4, each RSC shall perform a secondary coordinated regional operational security assessment as required by Articles 78(2) and (3) of SO GL on the basis of the CGMs established in accordance with paragraph d, including where relevant analysing the use of additional remedial actions pursuant to Article 30(4) and Article 31.
 - f. Between T4 and T5, RSCs shall organize a session, such as a teleconference, where the results of coordinated regional operational security assessments performed according to paragraph e and proposed remedial actions are shared. During this session, TSOs and RSCs shall consolidate the final outcomes of the whole process described from paragraphs a to f, and TSOs shall agree on the remedial actions, in application of Article 78(4) of SO GL. Each TSO shall participate to this session or shall appoint its RSC to represent it at the session while the TSO keeps the legal responsibility to agree on remedial actions.
 - g. Each TSO shall include the agreed remedial actions in accordance with paragraph f in their first intraday IGMs to be provided after T5 in accordance with the requirements of the methodology developed according to Article 70(1) of SO GL.
2. During this process, RSCs and TSOs may have additional exchanges needed to facilitate its effectiveness.
3. Later in intraday, when RSCs perform coordinated regional operational security assessments or TSOs perform coordinated operational security analyses, they shall take the cross-regional day-ahead coordinated operational security assessment final outcomes and agreed remedial actions as a reference basis, against which needed adaptations shall be assessed.

4. Where violations of operational security limits remain not solved at the end of the cross-regional day-ahead coordinated operational security assessment process, the concerned TSOs and RSCs shall agree on the objectives and the needed steps to follow in intraday in order to improve the management of these remaining violations.
5. When paragraph 4 applies, the concerned RSCs shall record the event and the outcome of the intraday activity to manage these remaining violations after the cross-regional day-ahead coordinated operational security assessment process, and shall report this information in the report prepared in accordance with Article 17(2) of SO GL.

Article 34

Intraday coordinated regional operational security assessment

1. RSCs shall aim at synchronizing the coordinated regional operational security assessments they perform in accordance with Article 78 of SO GL, for harmonized timeframes in intraday, taking into account the approved proposals set up by TSOs in the different capacity calculation regions in accordance with Article 76(1) of SO GL.

Article 35

Outage planning coordination tasks

1. In application of Articles 80(4) and 80(5) of SO GL, when a RSC and its delegating TSOs have not succeeded to remove an outage planning incompatibility, this RSC shall coordinate with other RSCs to endeavour to propose cross-RSC solutions to remove the incompatibility.

Article 36

Regional adequacy assessment tasks

1. RSCs shall define a process in order to strengthen the regional adequacy assessment performed by each RSC as required by Article 81 of SO GL, by identifying the capabilities of further support between regions, for at least the timeframe of week-ahead and for other agreed timeframes.
2. This process shall at least ensure that RSCs exchange information on available generation capacity and demand and interconnection capacities in each region, when performing regional adequacy assessment as required by Article 81 of SO GL.

TITLE 4
Forecast updates with respect to uncertainty management

Chapter 1
Forecasts

Article 37
Forecast of intermittent generation

1. Each TSO shall consider the following criteria in establishing forecasts of intermittent generation in accordance with paragraphs 2 to 5:
 - a. The forecasts established shall cover at least the control area of the TSO, including intermittent generation located in underlying DSO/CDSO grids, and shall be complemented where necessary in accordance with paragraph b;
 - b. Each TSO shall evaluate if there are cases where the installed intermittent generation in specific geographical regions within its control area are such that it would be insufficient to establish forecasts at control area level only. Where such cases are identified the TSO shall determine an appropriate frequency of forecast for the intermittent sources within the identified geographical region such that deviations from the forecast would not endanger the operational security of the interconnected system
 - c. The requirements of paragraphs 2 to 5 shall be considered as minimal requirements and each TSO shall assess whether the accuracy of the resulting forecasts is sufficient in application of Articles 70(4) and 70(5) of SO GL.
2. Where total wind (resp. total solar) installed capacity is between 1% and 10% of the reference load, each TSO shall establish/receive at least one wind (resp. solar) generation forecast established in day-ahead for each hour of the day of delivery. It must be established after weather forecast has been made available.
3. Where total wind (resp. total solar) installed capacity is between 10 and 40 % of the reference load:
 - a. each TSO shall establish/receive in intraday an update of the wind (resp. solar) hourly forecast at least 2 times per day, based on at least 2 weather forecast updates.
 - b. in cases where total wind and total solar installed capacities each are above 10 % of the reference load, and the sum of the total installed capacity of wind and solar is above 40 %, each TSO shall establish/receive in intraday every hour an update of the wind and solar hourly forecast, based on at least 2 weather forecast updates and using the best available estimation of actual generation after having qualified that it allows to improve forecast accuracy, compared to the accuracy resulting of requirement of paragraph 3 point a.
4. Where total wind (resp. total solar) installed capacity is above 40 % of the reference load, each TSO shall establish/receive in intraday every hour an update of the wind (resp. solar) hourly forecast, based on at least 2 weather forecast updates and using the best available estimation of actual generation after

having qualified that it allows to improve forecast accuracy, compared to the accuracy resulting of the application of requirement of paragraph 3 point a.

5. Where another type of intermittent generation installed capacity, such as run of river hydro generation, is above 1% of the reference load, each TSO shall establish/receive at least one forecast for this generation type, established in day-ahead for each hour of the day of delivery.

Article 38

Forecast of load

1. Each TSO shall consider the following criteria in establishing forecasts of load in accordance with paragraphs 2 to 3:
 - a. The forecasts established shall cover at least the control area of the TSO, including the load of underlying DSO/CDSO grids and shall be complemented where necessary in accordance with paragraph b;
 - b. Each TSO shall evaluate if there are cases where load and grid conditions in specific geographical regions within its control area would make it insufficient to establish forecasts at control area level only. Where such cases are identified the TSO shall determine an appropriate frequency of forecast for the load within the identified geographical region such that deviations from the forecast would not endanger the operational security of the TSO's system;
 - c. Where aspects, such as demand response or energy storage, may affect the load forecast, each TSO shall ensure that the effects of these factors are considered in the forecasts;
 - d. The requirements of paragraphs 2 to 3 shall be considered as minimal requirements and each TSO shall assess whether the accuracy of the resulting forecasts is sufficient in application of Articles 70(4) and 70(5) of SO GL.
2. Each TSO shall receive/establish in day-ahead one load forecast per hour for every day, using the best information available in day-ahead.
3. For a control area where the MW/°C gradient is greater than 1% of the reference load, the relevant TSO shall receive/establish a load forecast per hour for all the day of delivery, based on a weather forecast established at least in the afternoon of the day before the day of delivery. For the control area, the relevant TSO shall establish/receive at least one update in intraday between 0h and 12h for the remaining hours of the day of delivery.

Chapter 2

Grid models updates in intraday

Article 39

Frequency of grid model updates

1. By 1st January 2023, and then at least every three years, all TSOs shall assess the need to review the individual grid models and common grid models intraday update frequency as defined in the

methodology developed according to Article 70(1) of SO GL, taking into account the expected evolution of volatile parameters, such as market positions, intermittent generation, load.

TITLE 5

Governance and implementation

Chapter 1

Governance

Article 40

Identification and governance of common functions and tools

1. All TSOs, with the support of the RSCs, shall aim at regularly identifying the common functions and tools needed for a secure and efficient system operational planning and the relevant information which need to be exchanged among them, at least to implement the tasks listed in Articles 78-79-80-81 of SO GL. The functions and tools and relevant information to be identified shall be of pan-European use or of regional use.
2. For the functions and tools and relevant information identified in accordance with paragraph 1, as well as for those needed to implement the common grid model building task defined in Article 79 of SO GL and the operational planning data environment defined in Article 114 of SO GL, all relevant TSOs, with the support of the RSCs, using, where deemed useful, ENTSO-E bodies, resources and budget and, in that case, in accordance with the provisions of ENTSO-E articles of association, shall:
 - a. decide on their development;
 - b. provide for the needed budgets for their development and maintenance
 - c. agree on the rules applicable for the management of the development and maintenance, including evolutions,
 - d. agree on the applicable process to select the hosting entities for their operation, notably in terms of competence and resources necessary to achieve the needed levels of reliability, confidentiality and security
 - e. and agree on the characteristics of the service delivered by these functions and tools.
3. To facilitate the development and operation of function and tools identified in accordance with paragraph 1, all TSOs, using, where deemed useful, ENTSO-E bodies and resources, shall aim at using or defining standards for project management, data exchange, IT common services.

Article 41

Data quality assessment

1. For the functions and tools and relevant information identified in accordance with Article 40, all relevant TSOs, with the support of the RSCs, shall identify whether the data exchanged in this process require a specific data quality management comparable to the one developed in Article 23 of the methodology developed according to Article 70 of SO GL.

2. Where such a need is identified, all relevant TSOs shall:
 - a. define, with the support of the RSCs, the data quality criteria applicable, the applicable process to check that the criteria are satisfied before using the data and the process for monitoring data quality criteria achievement;
 - b. identify, using where deemed useful ENTSO-E bodies and resources, a common body in charge of analysing results of the data quality monitoring, reviewing the level of quality needed and preparing when relevant the revisions of the data quality criteria.

Article 42

Monitoring of regional coordination

1. All TSOs, with the support of ENTSO-E bodies and resources, shall organize every three years an inquiry towards TSOs and RSCs, in order to collect their evaluation of the appropriateness and efficiency of the processes and rules applied for the coordination of the operational security analyses, outage coordination and short-medium term adequacy analyses in the operational planning timeframe. This inquiry shall allow all TSOs to establish conclusions and identify, if any, improvement perspectives in terms of:
 - a. data quality;
 - b. efficiency and adaptation of processes to day-ahead or intraday activities, and flexibility to handle out-of-procedure situations;
 - c. availability of remedial actions to solve system security issues in a coordinated way, where a coordinated approach is relevant;
 - d. existing barriers to coordination.
2. When defining the scope of this inquiry, in order to keep the inquiry process efficient, all TSOs shall take account of the information and conclusions made in the reports established in accordance with Article 17 of SO GL.
3. The conclusions of this inquiry shall be published on the ENTSO-E website. ENTSO-E shall inform the Agency for the Cooperation of Energy Regulators of this publication and each TSO shall inform its NRA.

Article 43

Reporting on probabilistic risk assessment development

1. All TSOs, with the support of ENTSO-E bodies and resources, shall monitor, report and publish on ENTSO-E website by 31 December 2021 on the progress achieved in Europe on the subject related to operational probabilistic coordinated security assessment and risk management.
2. When reporting on the progress achieved, all TSOs shall:
 - a. identify the findings that are proven mature enough to be translated towards operational application and propose a roadmap for their operational implementation;

- b. consider the questions and challenges that still require further R&D activities and
 - c. define the frequency of update of this report taking into account the expected progress to be done in the coming years. If no such frequency may be defined, a frequency of once every three years shall be used.
- 3. By 31 December 2019, all TSOs shall identify the data that needs to be collected in order to prepare for a potential future use of operational probabilistic coordinated security assessment and risk management, and then review it on the basis of the findings of the reports established in accordance with paragraph 1 and 2.
- 4. All TSOs shall setup the operational processes required to collect the data referred to in paragraph 3.

Chapter 2

Implementation

Article 44

Definition of common hours

- 1. By 3 months after the approval of this methodology, all TSOs, with the support of all RSCs, shall jointly define the hours T0 to T5. ENTSO-E shall publish these hours on its web site.
- 2. As long as ENTSO-E has not published these hours, the following default values shall apply: T0=18.00 CET; T1= 19.00 CET; T2=20.00 CET; T3=20.45 CET; T4=21.30 CET; T5= 22.00 CET.
- 3. All TSOs shall assess every three years the adequacy of the cross-regional day-ahead coordinated operational security assessment process as defined in Article 33 to the needs. They shall at least analyse the opportunities to start earlier and to reduce the total length of the process. The result of the first assessment shall be available not later than two years after the start of operation of the process.

Article 45

Timescale for implementation

- 1. Upon approval of the present methodology each TSO shall publish it on the internet in accordance with Article 8(1) of SO GL.
- 2. After approval of this methodology, and unless differently stipulated in the previous articles or in the following paragraphs of this article, each TSO and RSC shall apply the requirements of this methodology within 6 months after its approval.
- 3. Each TSO shall apply the requirements of Article 38 within 12 months and of Article 37 within 24 months after approval of this methodology.
- 4. RSCs and their delegating TSOs concerned by the application of the requirements of Article 27 shall have established the elements defined in paragraph 1 and 2 by 6 months after the submission of the proposal(s) to be developed by the corresponding TSOs in application of Articles 76 and 77 of SO GL.
- 5. Not later than 6 months after the RSC task pursuant to Article 78 of SO GL has been implemented for its served TSOs, in application of the approved proposal of these TSOs as required by Article 76 and 77

of SO GL, the concerned RSCs and these TSOs shall participate to the cross-regional day-ahead coordinated operational security assessment process in accordance with Article 33.

6. Not later than 6 months after RSC tasks pursuant to Article 78 of SO GL have been implemented in application of approved proposals as required by Article 76 and 77 of SO GL, concerned RSCs shall implement the requirements of Article 30, Article 31, and Article 32.
7. Not later than 12 months after RSC tasks pursuant to Article 79 of SO GL have been implemented in application of approved proposals as required by Article 76 and 77 of SO GL, concerned RSCs shall have implemented the relevant organization between them to guarantee the availability of common grid models in accordance with Article 29.
8. Not later than 6 months after RSC tasks pursuant to Article 80 of SO GL have been implemented in application of approved proposals as required by Article 76 and 77 of SO GL, concerned RSCs shall implement the requirements of Article 35.
9. Not later than 6 months after RSC tasks pursuant to Article 81 of SO GL have been implemented in application of approved proposals as required by Article 76 and 77 of SO GL, concerned RSCs shall implement the requirements of Article 36.
10. Each TSO shall apply the requirements of Article 5(1) and Article 6(1) by three months after approval of this methodology. In case the CGMs required by the Article 67 of SO GL are not available when this methodology is approved, each TSO shall apply the requirements of these articles by three months after these CGMs are made available.
11. Each TSO shall apply Article 5(4), where applicable, by three months after receiving needed data from DSO/CDSOs according to Article 3(8).
12. Each TSO shall apply the requirements of Article 4, where applicable, by six months after receiving needed data from concerned TSOs, DSO/CDSOs and SGUs according to Article 4(5).

Article 46

Language

1. The reference language for this CSA Methodology shall be English. For the avoidance of doubt, where TSOs need to translate this proposal into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8(1) of SO GL and any version in another language the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authorities with an updated translation of the proposal.

Annex I

AI.1 Influence threshold

Power flow influence factor is evaluated by computing two elementary factors: power flow identification influence factor and power flow filtering influence factor. These factors are defined in AI.2.

Set of elements	Power flow identification influence threshold	Power flow filtering influence threshold	Voltage influence threshold
Observability area	5 – 10 %	3 – 5%	0.01 – 0.02 pu
External Contingency list	15 – 25%	3 – 5%	0.03 – 0.05 pu

AI.2 Influence Computation Method

In order to compute influence of elements located outside TSO's control area on its control area the following definitions have been introduced (Figure 1):

- Element t is a grid element located in TSO's control area and which is influenced by an element located outside TSO's control area;
- Element r is a grid element located outside TSO's control area whose influence is assessed;
- Elements i are grid elements located either in TSO's control area or outside TSO's control area which are disconnected to represent planned (or forced) outages.

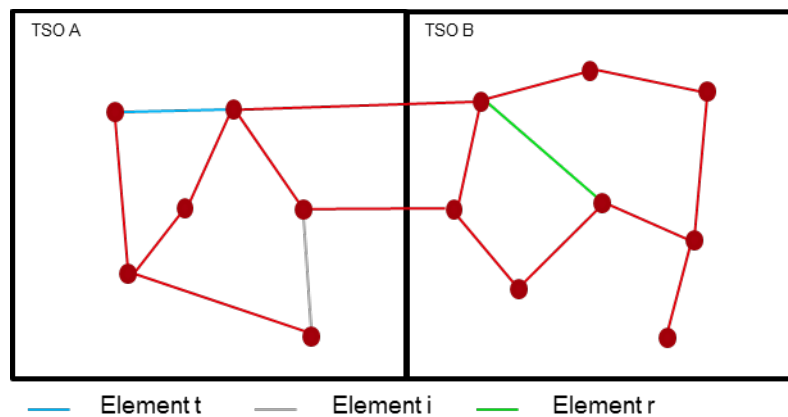


Figure 1

AI.2.1 Power flow influence factor

AI.2.1.1 Grid elements

The influence of a grid element (r) shall be assessed by each TSO using following formulae:

$$IF_r^{pf,id} (in \%) = MAX_{\forall i \in I, \forall s, \forall t \in T} \left(\frac{P_{s,n-i-r}^t - P_{s,n-i}^t}{P_{s,n-i}^r} \cdot \frac{PATL^{s,r}}{PATL^{s,t}} \cdot 100 \right)$$

$$IF_r^{pf,f} (in \%) = MAX_{\forall i \in I, \forall s, \forall t \in T} \left(\frac{P_{s,n-i-r}^t - P_{s,n-i}^t}{P_{s,n-i}^r} \cdot 100 \right)$$

Where

$IF_r^{pf,id}$: Power flow identification influence factor of a grid element r on the TSO's control area; the factor is normalized in order to take into account potential impacts induced by differences in PATL values;

$IF_r^{pf,f}$: Power flow filtering influence factor of a grid element r on the TSO's control area; this factor is not normalized;

s: Scenarios. Settings of HVDC systems and PSTs in the different scenarios are assumed to be already defined, in a coherent way, in the context of the scenarios/CGMs development process;

t: Grid element located inside TSO's control area where the active power difference is observed;

T: Set of grid elements located in the TSO's control area, which are part of the CGM and for which the assessment is performed;

i: Grid element located either in TSO's control area or outside TSO's control area (different from elements r and t) considered disconnected from the network when assessing the formula;

I: Set of grid elements, located either in TSO's control area or outside TSO's control area, modelled in the grid model whose possible outage should be taken into account in the assessment;

r: Grid element located outside TSO's control area whose power flow influence factor is assessed;

R: Set of grid elements located outside TSO's control area to be assessed;

P_{n-i}^t : Active power flow through the grid element t with the grid element r connected to the network and the grid element i disconnected from the network;

P_{n-i}^r : Active power flow through the grid element r, when connected to the network, considering the grid element i disconnected from the network;

P_{n-i-r}^t : Active power flow through the grid element t with the grid element r and the grid element i disconnected from the network;

$PATL^{s,t}$: Permanently Admissible Transmission Loading is the loading in MVA or MW that can be accepted by grid element t in the scenario s for an unlimited duration;

$PATL^{s,r}$: Permanently Admissible Transmission Loading is the loading in MVA or MW that can be accepted by grid element r in the scenario s for an unlimited duration.

NB: Those computations have to be done inside one synchronous area. By principle, $IF_r^{pf,id}$ and $IF_r^{pf,f}$ are equal to 0 when r and t are not located in the same synchronous area.

The formulae must be applied, for each grid element r which belongs to the set R , assessing its influence on every grid element t of the TSO's control area for which the assessment is performed, and considering possible outages (grid element i) (Figure 1).

The influence factor of an element connected in a given synchronous area on another element connected in a different synchronous area shall be equal to 0. Outages of HVDC links inside a synchronous area are treated as outages of AC elements.

Each TSO shall classify a “ r ” element as selected for a given type of influence factor computation (observability area or external contingency) when the following conditions are simultaneously satisfied:

Power flow identification influence factor > Chosen-threshold1

Power flow filtering influence factor > Chosen-threshold2

where Chosen-threshold1 and Chosen-threshold2 are uniquely chosen by the TSO inside the ranges provided above in AI.1

AI.2.2 Voltage influence factor

If a TSO decides to use voltage influence factors in the determination of the aforementioned lists (observability area or external contingency) the influence of a grid element r shall be assessed using the following formula:

$$IF_r^v = \text{MAX}_{\forall s, \forall m(m \in M)} \left(\left| \frac{V_{s,n-1}^{m,r} - V_{s,n}^m}{V_{base}^m} \right| \right)$$

Where:

IF_r^v : Voltage influence factor of a grid element r on a node m of the TSO's control area;

s : Scenarios. Settings of HVDC systems and PSTs in the different scenarios are assumed to be already defined, in a coherent way, in the context of the scenarios/CGMs development process;

r : Grid element located outside TSO's control area whose voltage influence factor is assessed;

R : Set of grid elements located outside TSO's control area to be assessed;

$V_{s,n-1}^{m,r}$: Voltage at node m with the grid element r disconnected from the network;

$V_{s,n}^m$: Voltage at node m with the grid element r connected to the network;

V_{base}^m : Nominal voltage in the node m .

The formula must be applied, for each grid element r which belongs to the set R , assessing its influence on every node n of the TSO's control area. The voltage influence factor of a grid element r is the maximum value of the previous calculations.

Hence, the influence factor on voltage is the maximum Voltage Deviation on any internal node m resulting from the outage of a grid element r in any scenario. For sake of simplicity, voltage is expressed in per unit. Contrary to the influence of flows, the influence on voltage of a grid element is highly dependent on the load/generation pattern i.e. the active and reactive load of the grid element in the investigated scenarios.

Where a TSO intends to use voltage influence factors, the TSO shall classify a "r" element as selected for a given type of influence factor computation (observability area or external contingency) when the following condition is satisfied:

Voltage influence factor > Chosen-threshold

where Chosen-threshold is uniquely chosen by the TSO inside the ranges provided above in AI.1