ACER
Agency for the Cooperation of Energy Regulators

ACER Decision on RAOCM: Annex I

Methodology for assessing the relevance of assets for outage coordination

in accordance with Article 84 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation

19 June 2019

Contents

Whereas

(1) This document sets out the Methodology for assessing the relevance of assets for outage coordination (hereafter referred to as 'RAOCM') in accordance with Article 84 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter referred to as the 'SO Regulation').

(2) RAOCM takes into account the general principles and goals set in the SO Regulation as well as Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (hereafter referred to as 'CACM Regulation'), 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 the SO Regulation is to safeguard operational security, frequency quality and the efficient use of the interconnected system and resources. To facilitate these aims, it is necessary for outage coordination to standardise, at least per synchronous area, the identification of relevant assets for outage coordination process organised per outage coordination regions, which are deemed at least equal to capacity calculation regions pursuant to Article 80 of the SO Regulation. Since these outage coordination regions may cover TSOs located in different synchronous areas, RAOCM shall cover all the synchronous areas in the Union.

(3) Article 84 of the SO Regulation constitutes the legal basis for RAOCM. This Article requires the Methodology to be based on qualitative and quantitative aspects to determine the relevance of assets - that are either in a transmission system or distribution system, including closed distribution system - to be taken into account in the coordinated regional outage planning process in order to evaluate the impact of their planned outage on the interconnected transmission system secure operation. Those aspects shall be based '*in particular on: (a) quantitative aspects based on the evaluation of changes of electrical values such as voltages, power flows, rotor angle on at least one grid element of a TSO's control area, due to the change of availability status of a potential relevant asset located in another control area. That evaluation shall take place on the basis of year-ahead common grid models; (b) thresholds on the sensitivity of the electrical values referred to in point (a), against which to assess the relevance of an asset. Those thresholds shall be harmonised at least per synchronous area; (c) capacity of potential relevant power generating modules or demand facilities to qualify as SGUs; (d) qualitative aspects such as, but not limited to, the size and proximity to the borders of a control area of potential relevant power generating modules, demand facilities or grid elements; (e) systematic relevance of all grid elements located in a transmission system or in a distribution system which connect different control areas; and (f) systematic relevance of all critical network elements*'. Article 84 of the SO Regulation equally requires that '*The methodology shall be consistent with the methods for assessing the influence of transmission system elements and SGUs located outside of a TSO's control area established in accordance with Article 75(1)(a).*' In order to achieve this last requirement, the provisions of the RAOCM are therefore closely aligned with the common influence computation method developed under Article 75(1)(a) of the SO Regulation.

(4) According to Article 6(6) of the SO Regulation, the expected impact of the RAOCM on the objective of the SO Regulation has to be described. The RAOCM generally contributes to the achievement of the objectives of the SO Regulation. In particular the RAOCM serves the objective of maintaining operational security throughout the Union, specifically through the enhanced 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.

(5) Furthermore, the RAOCM should 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.

(6) In accordance with Recital (5) of the SO Regulation, synchronous areas do not stop at the Union's borders and can include the territory of third countries. The TSOs should aim for secure system operation inside all synchronous areas stretching on the Union. They should support third countries in applying similar rules to those contained in the SO Regulation. ENTSO for Electricity should facilitate cooperation between Union TSOs and third country TSOs concerning secure system operation.

(7) In conclusion, the RAOCM should contribute to the general objectives of the SO Regulation to the benefit of all TSOs, the Agency, regulatory authorities and market participants.

TITLE 1
General Provisions

Article 1
Subject matter and scope

1. This Methodology for assessing the relevance of assets for outage coordination shall be considered as a TSOs methodology in accordance with Article 84 of the SO Regulation.

2. This methodology shall cover the relevance assessment of assets for outage coordination requirements defined in Title 3 of the SO Regulation and it applies to all TSOs, DSOs, CDSOs and SGUs as defined in Article 2 of the SO Regulation.

3. TSOs from jurisdictions outside the area referred to in Article 2(2) of the SO Regulation may participate in the relevance assessment of assets for outage coordination on a voluntary basis, provided that:

   (a) for them to do so is technically feasible and compatible with the requirements of the SO Regulation;

   (b) they agree that they shall have the same rights and responsibilities with respect to the relevance assessment of assets for outage coordination as the TSOs referred to in paragraph 2;

(c) they accept any other conditions related to the voluntary nature of their participation in the relevance assessment of assets for outage coordination 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 relevance assessment of assets for outage coordination 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 Regulation.

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

Article 2
Definitions and interpretation

1. For the purposes of this methodology, the terms used shall have the meaning of the definitions included in Article 3 of the SO Regulation, Article 2 of the CACM Regulation, Article 2 of Commission Regulation (EU) No 543/2013 of 14 June 2013 on submission and publication of data in electricity markets, Article 2 of Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators. In addition, the following definition shall apply:

   (1) ‘connecting TSO’ means a TSO of which transmission system a CDSO/DSO network is connected to directly or indirectly.

2. Where this methodology refers to network elements, it includes HVDC systems.

3. The Outage Coordination Region shall be considered equal to the Capacity Calculation Region unless all concerned TSOs agree to merge two or more outage coordination regions into one unique outage coordination region.

4. ’CGM’ stands for ‘common grid model’. ‘ENTSO-E’ stands for ‘ENTSO for electricity’. ‘RSC’ stands for ‘regional security coordinator’.

TITLE 2
Determination of relevant assets

Article 3
Influence computation method

1. The influence computation method has the following characteristics:

    (a) it is able to characterise the influence of the absence of one network element, being a network element, a power generation module, a demand facility connected to a TSO or transmission-connected DSO/CDSO network on the power flow or voltage of another transmission network element;

    (b) it is applicable on a year-ahead common grid model developed in accordance to Article 67 of the SO Regulation;

    (c) the influence is characterised 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 network elements of its control area, of network elements, power generating modules, and demand facilities connected 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 network elements of its control area, of network elements, power generating modules, and demand facilities connected to transmission-connected DSO/CDSO networks located outside its control area, provided that they are modelled in the CGMs used for the computation.

4. Where the power flow influence factors do not sufficiently capture the network elements, power generating modules, and demand facilities that can cause significant voltage variations in TSO's control area, this TSO shall have the right to use voltage influence factors for determination of its proposal of relevant assets.

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 on network elements of its control area, of network elements, power generating modules, and demand facilities connected 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 on network elements of its control area, of network elements, power generating modules, and demand facilities connected to transmission-connected DSO/CDSO networks located outside its control area. This TSO shall inform TSOs to which transmission-connected DSO/CDSO networks are connected to and are affected by application of this

paragraph about its decision to compute voltage influence factors. In turn, each connecting TSO, shall inform of this application the affected transmission-connected DSO/CDSOs.

7. Each TSO shall use the common grid models established according to Article 67 of the SO Regulation when computing power flow and/or voltage influence factors of network elements, power generating modules and demand facilities connected directly or through a DSO/CDSO to another TSO's control area.

Article 4
Possible relevance of dynamic aspects for influence assessment

1. Without prejudice to Article 38(1) of the SO Regulation, when a TSO needs to apply Article 38(6)(b) or Article 38(6)(c) of the SO Regulation 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 connectivity status and electrical values (such as voltages, power flows, rotor angle) of the network elements, power generating modules, and demand facilities connected outside its control area and connected to a transmission system. In such a case, this TSO and the concerned TSOs shall define models, studies and criteria to be used for the assessment and inform their regulatory authorities and relevant RSC(s) about their agreement. These models, studies and criteria shall be consistent with those developed in the application of Article 38 or 39 of the SO Regulation
2. When a TSO needs to apply Article 38(6)(b) or Article 38(6)(c) of the SO Regulation 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 to assess influence of the connectivity status or electrical values (such as voltages, power flows, rotor angle) of the network elements, power generating modules, and demand facilities located in transmission-connected DSOs/CDSOs networks 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 Article 38 or 39 of the SO Regulation.
3. Each TSO, to which transmission-connected DSO/CDSOs are connected to and are affected by application of paragraph 2, 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.
4. When requested according to paragraph 3, 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 Article 38 or 39 of the SO Regulation.
5. Each TSO to which transmission-connected DSO/CDSOs are connected to and are affected by application of paragraph 2 shall share the results of the performed studies with these transmission-connected DSO/CDSOs and affected SGUs.

6. Where one or more elements are identified as relevant in application of paragraph 2, the TSO which performed dynamic studies and TSOs to which transmission-connected DSO/CDSO are connected to, shall inform their regulatory authorities and relevant RSC(s) of the elements identified with the reasoning supporting this result.

Article 5
Identification of relevant assets for outage coordination

1. Each TSO shall define its proposition of relevant assets in accordance with Article 3, Article 4 where applicable, and the following paragraphs.
2. Each TSO shall select threshold values inside the range of relevant asset thresholds listed in Annex I that it shall use to determine its proposition of relevant assets in application of paragraph 1. The threshold values shall be identical regardless of the element of which the influence is assessed by this TSO. Each TSO shall communicate to its RSC(s) and ENTSO-E those threshold values in time with the application of paragraph 1. ENTSO-E shall collect those threshold values and shall publish them on its website at least once a year.
3. Each TSO shall include in its proposition of relevant assets:
    (a) all transmission network elements connected outside its control area which have an influence factor greater than the corresponding relevant asset threshold values selected pursuant to paragraph 2;
    (b) all network elements of a transmission-connected DSO/CDSO connected to another TSO's control area, which have an influence factor greater than the corresponding relevant asset threshold values selected pursuant to paragraph 2;
    (c) elements identified in application of Article 4(1) and Article 4(2), where applicable;
    (d) all network elements connecting this TSO's control area to another TSO's control area;
    (e) all the Type D power generating modules and all demand facilities connected outside its control area, which are SGUs and have at least one influence factor higher than the corresponding relevant asset threshold values selected pursuant to paragraph 2. The TSO shall have the right to limit these elements to those higher than 100 MW.
4. In coordination with other TSOs of the outage coordination region it is part of, each TSO shall have the right also to include in its proposition of relevant assets:
    (a) combinations of more than one network element connected outside its control area whose simultaneous outage can be necessary for any particular material or system reason and which can threaten the system security of its control area;
    (b) network elements connected outside its control area whose outage can have an impact on the operation of HVDC systems between synchronous areas;

(c) network elements connected outside its control area whose outage can have an impact on the operation of its control area, such as stability, function of protections, short-circuit assessment.

5. By three months after the approval of this methodology, and when necessary after that, all TSOs of an outage coordination region shall define the common list of relevant assets to be coordinated in this outage coordination region. This list shall include all elements being network elements, power generating modules, and demand facilities proposed as relevant assets in accordance with paragraph 3 and 4 by at least one TSO belonging to this outage coordination region and which is connected in a TSO's control area belonging to this outage coordination region, except elements excluded upon a common agreement between TSOs of the outage coordination region.
6. All TSOs of an outage coordination region shall complement the list identified according to paragraph 5 with the critical network elements identified in accordance with the CACM Regulation for the relevant outage coordination region, and provided that their status of critical network element is sufficiently stable throughout the year.
7. The update of relevant assets lists, between two mandatory relevance assessments in accordance with paragraph 8, and in accordance with Articles 86(1) and 88(1) of the SO Regulation may be performed on a qualitative basis according to new information regarding relevant changes expected or incurred in the network structure or on generation modules and demand facilities.
8. All TSOs of each outage coordination region shall jointly re-assess the relevance of external network elements, power generating modules and demand facilities for outage coordination in accordance with paragraphs 1 to 6 at least once every three years after the first assessment.
9. The assessment of the relevance for outage coordination of elements commissioned between two mandatory relevance assessments in accordance with paragraph 8 may be performed in a qualitative way.
10. If the owner of an element to be included in the relevant assets list on a qualitative basis disagrees with such an approach, TSOs shall use the influence computation method in accordance with Article 3 and where applicable Article 4 for establishing the relevance of such elements for outage coordination.

Article 6
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 the SO Regulation.

Article 7
Language

1. The reference language for this methodology shall be English. For the avoidance of doubt, where TSOs need to translate this methodology into their national language(s), in the event of inconsistencies between the English version published by TSOs in accordance with Article 8(1) of the SO Regulation and any

version in another language the relevant TSOs shall provide, in accordance with national legislation, their regulatory authorities with an updated translation of the methodology.

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
Relevant Asset	15 – 25%	3 - 5%	0.03 – 0.05 pu

AI.2 Influence Computation Method

In order to compute influence of system elements connected outside TSO's control area on its control area the following definitions have been introduced:

- Element t is a network element connected in TSO's control area and which is influenced by a system element connected outside TSO's control area;
- Element r is a network element, power generating module or demand facility element connected outside TSO's control area whose influence is assessed;
- Elements i are network elements connected either in TSO's control area or outside TSO's control area which are disconnected to represent planned (or forced) outages.

AI.2.1 Power flow influence factor

AI.2.1.1 Network elements

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

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

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

Where

$IF_r^{pf,id}$: Power flow identification influence factor of a network element r on the TSO's control area; the factor is normalised 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 network element r on the TSO's control area; this factor is not normalised

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: Network element connected inside TSO's control area where the active power difference is observed;

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

i: Network element connected 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 network elements, connected either in TSO's control area or outside TSO's control area, modelled in the network model whose possible outage should be taken into account in the assessment.;

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

R: Set of network elements connected outside TSO's control area to be assessed

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

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

$P_{n-\mathrm{i}-\mathrm{r}}^{t}$: Active power flow through the network element t with the network element r and the network 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 network 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 network 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 network element r which belongs to the set R, assessing its influence on every network element t of the TSO's control area for which the assessment is performed, and considering possible outages (network element i).

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 of a synchronous area are treated as outages of AC elements.

Each TSO shall classify a ‘r’ element as selected for its proposition of relevant assets 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.2.1.2 Significant Grid Users

Power flow influence factor for generating modules and demand facilities can be computed using the same formulae adopted for network elements, considering them as the element r and assuming:

P_{n-i}^{t}: Active power flow through the network element t with the generating module or demand facility r (connected outside TSO’s control area) connected to the network and the network element i disconnected from the network;

P_{n-i}^{r}: Active power infeed (generated by the generating module or consumed demand facility r), when connected to the network, considering the network element i disconnected from the network;

$P_{n-\mathrm{i}-\mathrm{r}}^{t}$: Active power flow through the network element t with the generating module or demand facility r and the network 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 network element t in the scenario s for an unlimited duration;

$PATL^{s,r}$: installed capacity in MW or MVA of the generating module or demand facility r in the scenario s.

Contrary to network elements, the outage of a generating module or a demand facility leads to an imbalance between generation and demand. The impact on the balance between generation and load of a planned outage of a generating module/demand facility is different from the impact of a contingency. In the first case, the market rules will provide for a balance equilibrium, the unavailable generation being compensated by local other units or by imports. In the second case, the balance will be ensured by reserve activation. These differences can result in different impacts on the security of the network between the planned outage and the tripping of the same element. As a result, influence factors for assessing the relevance of generating modules and demand facilities for outage coordination shall be computed by restoring the net balance of the control area or the control block in which the generator/demand facility is located when computing $P_{n-\mathrm{i}-\mathrm{r}}^{t}$. Such restoration shall be performed according to a pro-rata approach on the dispatchable generators already activated in the TSO’s control area or control block.

AI.2.2 Voltage influence factor

If a TSO decides to use voltage influence factors in the determination of its proposition of relevant assets, the influence of an element r shall be assessed using the following formula:

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

Where:

IF_r^v: Voltage influence factor of a network element, power generating module or demand facility 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: Network element, power generating module or demand facility connected outside TSO's control area whose voltage influence factor is assessed;

R: Set of elements connected outside TSO's control area to be assessed

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

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

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

The formula must be applied, for each 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 an 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 an 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 an element is highly dependent on the load/generation pattern i.e. the active and reactive load of the element in the investigated scenarios.

Where a TSO intends to use voltage influence factors, the TSO shall classify the 'r' element as selected for its proposition of relevant assets 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