European Network of
Transmission System Operators
for Electricity

Methodology to Identify Regional Electricity Crisis Scenarios in accordance with Article 5 of the REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC

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DISCLAIMER

This document is released on behalf of the ENTSO-E only for the purposes of the public consultation on the ENTSO-E proposal for Methodology to Identify Regional Electricity Crisis Scenarios on risk-preparedness in the electricity sector in accordance with Article 5 of the Commission Regulation (EU) No 2019/941 of European Parliament and of the Council of 5 June 2019. This version of the methodology proposal does not in any case represent a firm, binding or definitive ENTSO-E position on the content.

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Contents

ENTSO-E taking into account the following,

Whereas

(1) This document is a methodology developed by the European Network of Transmission System Operators for Electricity (hereafter referred to as "ENTSO-E") for identifying electricity crisis scenarios at a regional level in accordance with Article 5 of Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC ("RPR") establishing appropriate tools to prevent, prepare for and manage electricity crisis situations. This proposal is hereafter referred to as "methodology for identifying electricity crisis scenarios at a regional level" or the "methodology".

(2) The methodology has been developed by a project group of TSOs and RSCs (which will become RCCs under the electricity Regulation) under the ENTSO-E auspices. It takes into account the general principles and goals set in the RPR as well as the relevant EU legal framework, in particular:
- Directives 2005/89/EC;
- Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU ("Electricity Directive");
- Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity ("Electricity Regulation") hereafter 'Electricity Regulation';
- Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation, OJ [...] ("SO GL");
-Regulation (EU) 2019/942 of the European Parliament and of the Council of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators ("Acer Regulation")
- Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union, OJ L 194, 19.07.2016, p. 1-30. ("NIS Directive");
- Commission Regulation (EU) 2017/2196 of 24 November 2017 establishing a network code on electricity emergency and restoration, OJ ("Network code on emergency and restoration); and
- Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism (OJ L 347, 20.12.2013, p 24).

The goal of the RPR is to ensure the most effective and efficient risk preparedness within the Union. To this end, the Regulation aims at building trust between Member States by ensuring coherence of risk assessments in a crisis situation. Common approach in identifying risk scenarios is needed at Pan-European, regional and national levels to achieve the coherence. The first step toward common approach is the identification of scenarios at Pan-European level which shall be achieved through this methodology.

The identification of electricity crisis scenarios at a regional level requires close cooperation between ENTSO-E and Stakeholders as defined in Article 6 of the Regulation. In particular the TSOs may seek support from the Member States competent authorities in the identification of all risks to the electricity network at a national level.

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SUBMITS THE FOLLOWING PROPOSAL TO THE AGENCY:

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Title 1
General provisions

Article 1
Subject matter and scope

The methodology has been prepared by ENTSO-E in accordance with Article 5 of the RPR and provides the process for identification of the most relevant electricity crisis scenarios at regional level. Subsequently, ENTSO-E shall use the methodology to identify the most relevant electricity crisis scenarios at regional level and update at least every four years as required by Article 6 of the RPR. The national competent authorities shall thereafter rely on the methodology and regional scenarios, in the identification of electricity crisis scenarios at national level as required by Article 7 of the RPR. Consequently, national competent authorities will use the regional crisis scenarios for establishing risk preparedness plans as required by Article 10 of the RPR.

Article 2
Definitions and interpretation

1. For the purposes of this document, the definitions in Article 2 of the RPR shall apply and are repeated here for convenience:

(a) 'security of electricity supply' means the ability of an electricity system to guarantee the supply of electricity to customers with a clearly established level of performance[1], as determined by the Member States concerned;

(b) 'electricity crisis' means a present or imminent situation in which there is a significant electricity shortage, as determined by the Member States and described in their risk-preparedness plans, or in which it is impossible to supply electricity to customers;

(c) 'simultaneous crisis' means an electricity crisis affecting more than one Member State at the same time;

(d) 'competent authority' means a national governmental authority or a regulatory authority designated by a Member State in accordance with Article 3;

(e) 'non-market-based measure' means any supply- or demand-side measure that deviates from market rules or commercial agreements, the purpose of which is to mitigate an electricity crisis;

(f) ‘early warning’ means a provision of concrete, serious, reliable information indicating that an event may occur which is likely to result in a significant deterioration of the electricity supply situation and is likely to lead to electricity crisis;

2. The following clarifications and additions to the above-mentioned definitions shall apply:

(a) ‘impossibility to supply electricity to customers’ means any situation in which not all customers can be supplied with electricity. Customers providing ancillary services in the form of demand side response are out of scope of this methodology;

[1] The reference level of performance used in this methodology is established in Appendix I

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(b) 'region' means a group of Member States whose transmission system operators share the same regional coordination centre as referred to in Article 36 Regulation (EU) 2019/…[++]. Member States may create sub-groups within a region comprising those Member States, which are technically able to provide each other assistance in accordance with Article 15 in the Risk-preparedness regulation. Equally, Member States may create sub-groups between different regions comprising those Member States and RCCs.

3. The following additional definitions shall also apply:

(a) ‘risk indicator’ means a numeric measure, produced through process of finding, recognizing and describing risks, that provides information on the risk level [adapted from 8];

(b) ‘likelihood’ means a chance of something happening[1];

(c) ‘impact’ means an evaluated consequence of a particular outcome[2];

(d) ‘contingency’ means a possible future event, condition or eventuality[2];

(e) ‘mitigating action’ means an action which limits negative consequence of a particular incident[2];

(f) ‘vulnerability’ means something that creates susceptibility to a source of risk that can lead to a consequence[2];

(g) ‘sensitivity analysis’ are systematic procedures for estimating the effects of the choices made regarding methods and data on the outcome of a study[3];

(h) ‘control’ means a measure that maintains and/or modifies risk. Note 1: Controls include, but are not limited to, any process, policy, device, practice, or other conditions and/or actions which maintain and/or modify risk. Note 2: Controls may not always exert the intended or assumed modifying effect[1];

(i) ‘coincident crisis’ means an electricity crisis affecting more than one Member State at the same time, due to multiple unrelated initiating events;

(j) ’EENS%’ is the Expected Energy Not Supplied (also commonly named Expected Energy Not Served) calculated by dividing expected energy not served for the duration of load curtailment by the total annual energy consumption of a Member State;

(k) ’LOLE’ (Loss of Load Expectation) is expressed in hours and represents the number of hours in which supply would not meet demand due to the crisis scenario;

(l) ’Energy consumption of a Member State’ is a sum of consumption over control areas of all TSOs operating in that Member State;

(m) ‘electricity crisis scenario’ means a scenario describing an event that is going (or is expected) to lead to a deterioration of security of supply of electricity affecting community or whole society. A crisis scenario may include more than one region or subgroup defined by Member States or may include parts of two or more regions or subgroups.

(n) ‘regional level electricity crisis’ means that more than one Member State is in an electricity crisis at the same time (coincident or simultaneous crisis scenario); such a regional crisis situation needs regional

[2] ISO 22300:2018(en), Security and resilience — Vocabulary

[3] ISO 14040:2006(en), Environmental management — Life cycle assessment — Requirements and guidelines

coordination in advance, as decisions of one Member State may affect directly other Member States, which may also be in a crisis state.

(o) ‘initiating event’ or ‘hazard’ means the occasion or situation which initiates the crisis situation, even if it is momentary; in particular it may be an event which causes a critical grid situation to become an electricity crisis;

(p) ‘critical grid situation’ is a potential emergency state, c.f. SO GL Article 18(3), identified in the operational planning phase; during a critical grid situation the available regular countermeasures are exhausted and therefore TSOs are required to take regionally coordinated extraordinary countermeasures;

(q) ‘national electricity crisis’ means that a single Member State is in an electricity crisis;

(r) ‘risk-preparedness plan’ means a plan established by the competent authority of a Member State, that sets out all measures that are planned or taken to prevent, prepare for and mitigate electricity crises; the plan shall consist of national measures, regional and, where applicable, bilateral measures as provided for in Articles 11 and 12 of RPR;

Article 3
Cross-border dependencies

1. The following types of events are susceptible to generate cross-border dependencies and shall therefore be identified in regional and in national electricity crisis scenarios:

(a) The event is cross-border in nature (e.g. a large-scale weather event);

(b) The event is national by nature, but the resulting electricity crisis has cross-border impacts;

(c) Two or more simultaneous or coincident initiating events, mutually aggravating, lead to a cross-border crisis in two or more Member States;

(d) A risk preparedness plan for a given crisis scenario requires multi-party cross-border coordination.

2. These cross-border dependencies can be either regional or cross-regional and fall into two categories:

(a) Direct impact of the crisis on neighbouring power systems, for reasons such as unavailability of several (beyond n-1) interconnectors or internal lines in close electrical proximity, or unavailability of generation;

(b) Indirect impact of the crisis on neighbouring power systems:

   (i) Consequences of actions taken by the country in crisis;
   (ii) Actions asked of neighbours with a significant negative impact on other neighbouring power systems, such as re-planning of maintenance work or higher level of generation to help one country in accordance with relevant Articles of SO GL.

3. Mitigation of the direct and indirect cross-border impacts of crisis falls into the scope of the risk preparedness plans as it requires anticipation and coordination beforehand, including firstly market solutions, but also bilateral agreements between regions, Member States or TSOs.
4. In all of the aforementioned cases, the cross-border dependencies are susceptible to initiate a crisis, or aggravate the situation on a regional level, either directly or by a combination of unrelated events in neighbouring power systems.

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5. They shall thus be identified in regional and in national electricity crisis scenarios.

Article 4
Initiating events

The crisis scenarios shall be identified based on at least the following hazards[4]:

(a) rare and extreme natural hazards;

(b) accidental hazards going beyond the N-1 security criterion, and exceptional contingencies;

(c) consequential hazards including consequences of malicious attacks and of fuel shortages.

With respect to the hazards listed above a classification of circumstances is developed as a hierarchical, standardized system (see Appendix II.2 - Initiating event list).

Article 5
Requirements for a crisis scenario

1. Motivation for defining electricity crisis scenarios

(a) Development of the national and regional electricity crisis scenarios is a prerequisite for risk preparedness plans. The plans are aimed at ensuring the maximum preparedness for electricity crisis situations and an effective management of such situations should they occur, thanks to effective measures taken to prevent and/or mitigate the scenarios;

(b) The process of identifying crisis scenarios at regional and national level requires that a set of assumptions is described (as stated in Appendix I. - Scenario rating scales). These assumptions should be based on considerations of relevant national and regional circumstances;

(c) A specific electricity crisis scenario is developed, serving as a starting point for the further risk analysis and a risk preparedness plan. Scenarios should be sufficiently specific, so that every Member State or TSO for which the scenario is considered relevant, is capable of assessing impact of materialization of that scenario;

(d) National scenarios are prepared separately, such that they can be collated and aggregated into regional scenarios that simulate the scenarios occurring simultaneously across multiple Member States;

2. General requirements for a crisis scenario

(a) Given the motivations stated above, each scenario must fulfil the following quality criteria:

  (iii) it must be specific enough for each TSO to individually, qualitatively and quantitatively describe the consequences in the TSO's Control Area;
  (iv) it should be possible to propose risk preparedness plans, which must either:

    - prevent,
    - prepare for, or
    - mitigate the electricity crisis situations.

  (v) its symptoms should be observable, so that it is possible to execute risk preparedness plans.

[4] As required in RPR Article 5.2

(b) The description has to be as precise and consistent as possible, as any given scenario must clearly and in sufficient detail describe the initial condition(s) of the system, a sequence (chain) of events following the initiating event, and the most likely consequences. The required content of a crisis scenario should cover issues such as:

- (i) a description of initial condition of the system relevant to the scenario,
- (ii) a list of initiating event(s),
- (iii) the estimated time of the expected beginning of the sequence of events,
- (iv) the evolution of the crisis scenario,
- (v) severity of the scenario,
- (vi) cross-border dependencies
- (vii) if applicable, reference crises of the past,
- (viii) other important information related to the scenario, relevant to managing it.

(c) A complete scenario description for each step of the process is given in Appendix III Crisis scenario description template. Scenario description shall – whenever available – contain quantitative data. A range of values is preferred to an exact number (when appropriate), and general characteristics of an area is preferable to a city/district name as it will be easier to build common scenarios. If available, scientific or statistical findings should be included. Deficits in knowledge can initially be compensated for by well-founded assumptions and expert assessments.

3. Sensitive information and TSO-specific information

(a) Each TSO shall share scenario information with ENTSO-E in accordance with national and EU policies and legislation concerning handling of sensitive information,

(b) Information provided to ENTSO-E must be detailed enough to enable ENTSO-E to assess the scenarios on a regional level, referred to Appendix III. Cf. Article 13: Handling of sensitive information.

(c) Appendix III contains checklists of information that Member States should take into account when assessing scenarios but are not required to share with ENTSO-E (e.g. sensitive information and TSO specific information)

(d) Information which is already shared between TSOs, ENTSO-E, regulatory authorities and other third parties to ensure operational or planning tasks in accordance with requirements of SO GL, NC ER and other regulations shall not be considered as sensitive information.

Article 6
Crisis scenario ranking method

1. Assessment of likelihood

(a) The likelihood of each crisis scenario (national[5] or regional) is classified using a five-step scale. This scale ranges from "very unlikely" to "very likely", corresponding to a quantitative likelihood range, as shown in Appendix I.1 - Crisis likelihood scale;

[5] Likelihood scales, impact scales, crisis severity assessment method (using the national crisis impact scale) and crisis scenario description templates defined in this methodology are designed in such a way, that they are applicable both within the scope of this methodology (Articles 5 and 6 of the RPR), and for other purposes (such as identification and assessment of national electricity crisis scenarios as defined in Article 7 of RPR). Usage of the components of this methodology in the context of Article 7 of RPR is encouraged, but not required.

(b) The assessment of crisis scenario likelihood is based on the expected frequency of occurrence of an initiating event, or a combination of multiple initiating events;[6]

(c) Historical frequency of occurrence of an initiating event may not be an acceptable estimator for the future likelihood of the same type of initiating event. In such situation's expert judgement, simulations or other forward-looking techniques should be used instead. If available, scientific or statistical findings should be taken into consideration. Deficits in knowledge can initially be compensated for by well-founded assumptions and expert assessments;

(d) Derivation of the classification of likelihood has to be documented, so that retracing is possible when the analysis is updated or verified;

(e) The values defined in the classification table must not be modified by TSOs, as it would lead to results incomparable between Member States.

2. Assessment of impact

(a) The impact must be estimated and classified for each defined crisis scenario. In order to classify impact, the main considered values are the expected energy not served (EENS%) and loss of load expectation (LOLE)[7];

(b) For classification, a five-step scale (ranging from "insignificant" to "disastrous") is used, as defined in Appendix I.2. Both EENS and LOLE should be classified for a given electricity crisis scenario;

(c) Only direct impacts shall be assessed. Indirect impacts should not be considered, such as those that are delayed, or depend on additional factors outside of the scope of the scenario. An example may be health issues that are detected in many years' time due to temporary exposure to pollution;

(d) Derivation of the classification of impact has to be documented, so that retracing is possible when the analysis is updated or verified.

3. Probabilistic vs. deterministic assessment of likelihood and impact

(a) The most appropriate way to ensure that the results of the evaluation of likelihood and impacts, performed by the different TSO's, are comparable and consistent, is to use a common approach;

(b) The two categories of methods for calculating those measures are deterministic and probabilistic. Deterministic methods are based on the analysis of one or just a few system configurations selected as most representative of situations that can stress the system. Consider for instance, load flow analyses, where it is assumed that certain major lines or generators may become unavailable. These methods allow the estimation of the impact of a specific situation on reliability, but they cannot estimate the overall system reliability;

[6] A scenario may depend on a number of events and conditions, that are not independent. The types of combinations shall only be known after the regional crisis scenarios are identified according to provisions of Article 8 of this methodology. The likelihood estimation will thus have to take into account both probabilities of each of the events and conditions, and their interrelationships (such as correlation or causality). It is expected, that in case of some of the most relevant electricity crisis scenarios, in which non-trivial combinations of events and conditions occur, a scenario-specific method for evaluating the likelihood may need to be defined.

[7] LOLE and EENS are expected outage duration and energy not served for a given crisis scenario for a given Member State. They are based on a set of worst-case filtering of the assumptions, stressing the system (e.g. extreme temperatures, high forced outages and maintenance rates, low hydro levels, etc.)

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(c) Probabilistic methods aim to estimate the likelihood and/or impact considering that the input variables are stochastic. Such methods perform a relevant calculation of a high number of configurations, with an associated probability of occurrence derived from the underlying variables of a complex model;

(d) A probabilistic method is usually more suitable for representing all of the aspects of an electricity system. In fact, a probabilistic simulation can represent the overall power system by applying random number techniques to generate a wide range of possible states of that system. In that case the impact measure will be a probabilistic (EENS = Expected Energy Not Supplied), that is mathematically described by:

$$EENS = \frac{1}{N}\sum_{j\in S} ENS_j \quad \text{[MWh/year] or [GWh/year]}$$

where ENS_j is the energy not supplied of the system state j ($j \epsilon S$) associated with e.g. a loss of load event of the jth-simulation and where N is the number of simulations considered (assuming that the probabilities of all system states equal);

(e) The Monte Carlo approach is one of the probabilistic methods suitable for representing all of the aspects of an electricity system. For each system state, energy not supplied (ENS) is calculated by simulating different scenarios, and identifying the expected ENS. After an appropriate sample of simulations, it becomes possible to calculate all the measures;

(f) If possible, each scenario should be simulated by the TSOs using a probabilistic method, in order to compute the impact and likelihood measures, as required in Appendix I. Scenarios could cover, for example, a number of different geographical location in the national grid (e.g. terrorist attack on a city, strategic infrastructure for the electrical grid, such as dispatching Centre or critical transmission lines), different time periods (peak load, holidays) and a wide range of possible states of the national system;

(g) A probabilistic method for evaluating both impact and likelihood of each crisis scenario is usually superior to a deterministic one (and thus preferred). However, the required minimum for evaluating the likelihood and impact measures of a crisis scenario is performing a deterministic calculation, based on one (or a few) most likely combinations of transmission grid states and other circumstances relevant for a particular scenario;

(h) In case of the most relevant regional electricity crisis scenarios, ENTSO-E may propose use of a scenario-specific probabilistic method (or methods) for assessing the likelihood and impact measures, relevant to the particular scenario and the nature of its uncertainty. Such method shall be identified by ENTSO-E, consulted with Member States potentially affected by such electricity crisis scenario. As development of necessary computational methods and tools may require considerable time and resources, ENTSO-E shall develop plans for implementation of such methods and tools including cost-benefit analysis. The plans will be subject to approval by the Member States.[8]

4. Assessment of cross-border dependencies

Cross-border dependencies shall be considered aggravating factors in regional scenarios and thus are included in their relevance rating. For each scenario described, the TSO shall analyse the cross-border dependencies with neighbouring power systems through two perspectives:

[8] The definition and development process of the short term adequacy assessment methodology (together with the necessary computing tools) may serve as an example for this process. The development requires substantial time and resources to define a methodology, that covers the uncertainties listed in Art. 8 p. 1.a of the RPR and time scales given there. In case of other crisis scenarios, e.g. related to generation fuel supply, or cybercrime, the relevant uncertainties and time scales may be very different, thus requiring a different (scenario specific) approach.

(a) as an aggravating input for the scenario (”In this scenario, will the local situation worsen if neighbouring power systems are unable to offer support (in reactive power, counter trading/redispatch or energy)?”);

(b) as an output of the national scenario (”In this scenario, will I be prevented from helping neighbouring power systems that face a simultaneous crisis?”).

These two aspects shall be included in the description of scenarios – cf. Appendix III.3 – Crisis scenario description template and will be used to evaluate a general overall rating of the strength of the cross-border dependencies (cf. Appendix I.4).

5. Evaluating electricity crisis scenario – national expected impact measure

(a) The electricity crisis scenarios (national and regional) are evaluated using the above-mentioned classification of likelihood and impact. The overall crisis scenario rating is determined via the table shown in Appendix I.3. The two impact and one likelihood classifications are used to select a crisis scenario rating, ranging from "insignificant" to "disastrous";

(b) This crisis scenario rating, in combination with the cross-border dependency rating described in Article 3 and Appendix I.4, are sufficient for the identification of regional electricity crisis scenarios, as described in Article 8.

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Title 2
Methodology

Article 7
Identification of national electricity crisis scenarios

1. Identification of crisis scenarios at a national level

National crisis scenarios[9] which are candidates for regional crisis scenarios shall be determined by TSOs in close cooperation with the national competent authority. The crisis scenarios should focus on electricity crises only. The identification of such scenarios should be based upon, but not limited to, consideration of:

(a) historical electricity crises that may occur again (both experienced nationally and by other TSOs);

(b) available operational expertise and experience on credible future crisis scenarios;

(c) interruption of cross-border exchanges and/or ancillary services that are heavily relied upon.

Cooperation between the competent authority and the TSO is necessary to identify and define scenarios outside the scope of TSO's expertise.

A scenario is considered relevant if it results in a national electricity crisis, particularly a crisis that has, or results from, cross-border dependencies as described in Article 3. To assess whether an initiating event results in a national electricity crisis, the TSO must be able to estimate the scale of the event in terms of Expected Energy Not Served (EENS) and Loss of Load Expectation (LOLE). It is expected that the TSOs, in cooperation with the national competent authority, should have a method for this estimation, sufficient for estimating if the scenario results in a significant electricity shortage.

2. Identification of cross-border dependencies

For each national scenario that will be defined (cf. Appendix III.1), the following cross-border dependencies shall be assessed:

(a) Availability of redispatch/ counter trading/cross-border exchange of ancillary services to make it possible to inject or to withdraw power from power plants in a certain neighbouring power system;

(b) Availability of reactive power (to support system stability);

(c) Availability of energy support.

3. Description of a national electricity crisis scenario

A detailed description of each scenario should be completed, such that it fulfils the requirements outlined in Article 5. A template for the scenario description is available in Appendix III.1, where the potential initiating events are listed in Appendix II.2. As national crisis scenarios will form a basis for the identification of regional crisis scenarios, relevant cross-border dependencies or impacts on other Member States have to be described (see Articles 3 and 5).

4. Submission of national electricity crisis scenario

The description of all relevant national crisis scenarios (as defined in Article 5 section 2) shall be submitted to ENTSO-E within 6 weeks of receipt of the request. National contact information of the authors should be

[9] The national crisis scenarios are for the purposes of identifying regional crisis scenarios, not for satisfying the requirements of Article 7 of RPR

included. In order to align national crisis scenario description, ENTSO-E might contact the authors to clarify emerging questions.

Article 8
Identification of regional electricity crisis scenarios

In order to identify regional electricity crisis scenarios, as prescribed in Article 6 of the Regulation of Risk preparedness and in line with Appendix I.5 of this methodology, ENTSO-E collects national electricity crisis scenarios as input to this Article. The identification of regional electricity crisis scenarios is comprised of three main parts:

(a) collection and aggregation of national electricity crisis scenarios (including quality and compliance checks);

(b) a gap analysis where missing national electricity crisis scenarios are identified;

(c) preparation of a final set of regional electricity crisis scenarios.

The overall process is detailed below.

1. Aggregation of national scenarios

The national electricity crisis scenarios are collated and combined by ENTSO-E. In order to do so the following steps are carried out:

<u>Step 1: Quality check</u> – Individual submissions from each TSO are quality checked in order to:

(a) Ensure that the minimum required data is completed according to Article 5.2 of this methodology;

(b) Identify if there are any scenarios not considered in national submissions that should be studied by the TSO.

In the event national submissions are considered deficient in either respect, ENTSO-E shall ask the relevant TSOs to address the deficiency in line with Article 7 of this methodology. The clarification shall be provided to ENTSO-E without undue delay, but not later than ten working days from receipt of request for clarification.

In the case clarification is not forthcoming, missing information will be resolved by ENTSO-E during the gap analysis.

<u>Step 2: Categorization –</u> The national crisis scenarios are collated into respective regional scenarios in compliance with Article 5 of this methodology. In particular, national crisis scenarios shall be considered as likely to be regional scenarios if at least one of the following conditions is fulfilled:

(a) The scenarios are likely to be caused simultaneously or consequently by the same initiating event (e.g. a wide range disaster), or by the same combination of initiating events as defined in Article 4 in this methodology;

(b) They are likely to coincide in time in Member States and have significant cross-border relevance as defined in Article 3 in this methodology.

2. Gap analysis

Gap analysis should be performed on a taxonomy of initiating events. This is to determine whether any hazards capable of causing a regional scenario have been overlooked. If a relevant regional scenario has been

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overlooked, it should be added by ENTSO-E in cooperation with the relevant TSOs and Stakeholders as defined in Article 6 of the Regulation, if necessary.

3. Inclusion of scenarios related to connected infrastructure

In addition to the aggregation of national scenarios, ENTSO-E shall also consider infrastructure disruption scenarios. At a minimum, this should include scenarios related to the natural gas supply, as developed by ENTSO-G pursuant to Article 7 of the Regulation (EU) 2017/1938 of the European Parliament and of the Council. Additional scenarios related to connected infrastructure (e.g. gas, ICT) may be considered and included where appropriate, by ENTSO-E in cooperation with the relevant TSOs.

4. Finalisation

ENTSO-E will present the regional electricity crisis scenarios (4 weeks after the receipt of the completed crisis scenario descriptions) to TSOs in Member States to enable assessment in accordance with Article 9 of this methodology. The template for these scenarios is available in Appendix III.2.

Article 9
Evaluation of regional electricity crisis scenarios at a national level

1. Assessment of scenario impact per Member State

(a) Each relevant regional electricity crisis scenario, identified in accordance with Article 8, shall be assessed at a national level by applying methodology described in Article 6. It is to be noted, that the regional crisis scenarios resulting from collating scenarios provided by the TSOs, are expected to differ from the original descriptions provided by the TSOs. Therefore, a complete assessment of each regional scenario must take place, even if the TSO already assessed the likelihood and impact of the scenarios it originally proposed;

(b) It is also to be noted, that some of the relevant regional electricity scenarios will not be relevant to at least some TSOs. Nevertheless, those TSOs are expected to explicitly rate them with appropriate levels of likelihood and impact;

(c) All the relevant national authorities of the Member States affected, should be informed of the regional electricity crisis scenarios, including at least the information outlined in Article 5.

2. Identification of cross-border impacts per Member State

Based on the national scenario impact, the TSO shall state any cross-border impacts and their severity (if they differ from those already identified in the scenario, via Article 5). This information will be used to capture any potential aggravating conditions of the scenario in Article 11. In addition to these availabilities each TSO shall check the proposed output of the year-ahead-outage planning process and their updates (in accordance to SO GL Article 99 and 100) to evaluate relevant impacts on grid elements necessary for measures in risk preparedness plans or on the risk preparedness plans themselves. In case of forced outages which are handled in accordance with SO GL Article 102, the TSOs shall evaluate relevant impacts on grid elements necessary for the risk preparedness plans or on the risk preparedness plans themselves.

3. Assessment of national impacts

(a) For each Member States the relevant TSOs shall indicate, for their control areas, the likelihood and the impacts on the electricity system of each scenario identified in accordance with Article 8 of this methodology, consistent with the rating scales provided (Appendix I), in terms of Expected Energy Not Supplied (EENS) and Loss of Load Expectation (LOLE). Estimating the likelihood or impact of some scenarios may require a collaboration between TSOs and their competent authorities;

(b) The above evaluation, as already mentioned in Article 6, shall be based on statistical data for the same event or on estimates in the case of a scenario for which there is not enough relevant historical data;

(c) The method used for assessment of likelihood and impact must be indicated in the scenario description (as one of: deterministic calculation and probabilistic calculation), together with the number of sub-scenarios taken into account. The probabilistic method is preferred – the assessment done using such method shall typically be considered more reliable and accurate.

4. Submission of national crisis scenario assessments

Within 6 weeks from receiving the regional scenarios for a national impact assessment, the TSO's will provide to ENTSO-E the completed national impact assessment template (see Appendix III.3 Assessment of national impact to the regional electricity crisis scenarios).

Article 10
Ranking of crisis scenarios by their regional impact

1. Gathering the national impact assessments per Member State

(a) ENTSO-E gathers the regional crisis scenario descriptions, completed by the TSOs. ENTSO-E checks the scenario descriptions for completeness and compliance with this methodology and with the contents of the regional scenarios sent out for assessment. In cases of non-compliance or of missing submissions, ENTSO-E notifies the TSO. Missing or non-compliant submissions:

   (i) may be treated as rating a particular crisis scenario as irrelevant to the member state (national impact rating "Insignificant" and no cross-border dependencies)

   or

   (ii) may be brought to compliance by ENTSO-E in cooperation with the TSOs

   at ENTSO-E's discretion.

(b) In case of any doubts regarding any content of the submitted scenario descriptions and their national assessments, ENTSO-E shall ask the relevant TSOs to address the deficiency in line with Article 7. The clarification shall be provided to ENTSO-E without undue delay, but not later than ten working days from receipt of request for clarification.

2. Consistency Check of cross-border impacts

The cross-border impacts per Member state as defined in the national crisis scenarios (Article 9) shall be assessed for completeness as well as inconsistencies towards the neighbouring power systems and towards the regional crisis scenarios. The assessments for inconsistencies shall be done regional and cross-regional. The assessments shall include the severity of the impact. It is the responsibility of ENTSO-E to ensure the regional and cross-regional assessment is done, this may be delegated to the RCCs.

3. Evaluation of regional impacts

The regional impact of each scenario is assessed using the following method:

(a) for each scenario, the national impact rating and national rating of the strength of the cross-border dependenciesis collected (cf. Appendix III.3);

(b) a rating of a scenario is calculated as a sum over all Member States of national impact ratings weighted by the national ratings of the strength of the cross-border dependencies.

The scales for transforming the national impact rating and national rating of the strength of the cross-border dependencies into numeric values are given in Appendix I, “I.5 Example of regional scenario rating” and “I.4 Cross-border dependency rating”, respectively.

For an example of such calculation see Appendix I, “I.5 Example of regional scenario rating”.

Those national scenarios, that are assessed as not having a regional significance (that is no more than Member State rated the scenario higher than “insignificant”) are captured for future reference in the final report (See Article 11). As these scenarios are not considered regional, they shall not be included in the evaluation and ranking.

4. Ranking regional crisis scenarios according to their relevance

(a) As a result of the calculation performed as described in step 2 above, a single number is assigned to each scenario. The higher the number, the more relevant the regional scenario is;

(b) The number (and thus crisis scenario rank) produced as a result of the procedure defined above, has no physical or e.g. monetary meaning. It’s only meaning, and role is to enable to select the scenarios of highest relevance to ENTSO-E members and their respective Member States for development of risk preparedness plans.

Article 11
Presentation of most relevant scenarios

1. No later than six months after the approval of the methodology ENTSO-E shall submit the regional electricity crisis scenarios, as defined according to Article 8 of this methodology, to the transmission system operators, Regional Coordination Centres, competent authorities and national regulatory authorities and the Electricity Coordination Group.
2. A single report comprising the regional electricity crisis scenarios shall be prepared by ENTSO-E. The relevance of each regional crisis scenario shall be indicated by the score according to Appendix I. The most relevant scenarios shall be the highest scoring scenarios. Each scenario shall be presented in terms of the following minimal information collected from the methodology:

(a) Initiating event(s);

(b) Area of geographical relevance;

(c) National impact & likelihood;

(d) Ranking;

(e) Presence and importance of cross-border dependencies.

Additional information, including any visualization, may be included in the report.

Article 12
Review

1. Periodical assessment of regional crisis scenarios

ENTSO-E will update the regional crisis scenarios every four years, unless circumstances warrant more frequent updates. Such updates could be triggered by ENTSO-E as a result of events such as a significant

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change in national or regional risk assessments, or the detection of a major risk previously not integrated in the regional crisis scenarios.

For instance, new studies on climate change highlighting a significant increase in the frequency or severity of various hydro-meteorological hazards could trigger an update.

2. Periodical assessment of the methodology

ENTSO-E shall update and improve the methodology when significant new information becomes available and justify an update.

As indicated in Article 8 RPR, The Electricity Coordwatination Group, in its formation composed of representatives of the Member States only, may recommend and the Agency or the Commission may request such updates and improvements with due justification. Within six months from the request, ENTSO-E shall submit to the Agency a draft of the proposed changes. Within two months of the receipt of the draft, the Agency shall approve or amend the proposed changes, after consulting the Electricity Coordination Group in its formation composed of representatives of the Member States only. The final version shall be published on the websites of ENTSO-E and the Agency.

Article 13
Handling of sensitive information

1. TSOs and competent authorities are expected to communicate the open national risk information in sufficient detail to allow ENTSO-E to assess if a regional risk may exist as detailed in Article 5 of this methodology.

2. Directive 2008/114/EC is applied to energy sector and certain parts of the electricity transmission system can be identified as sensitive critical infrastructure.

3. Accordingly, the following principles are established:

(a) Confidentiality

- (i) Any confidential or sensitive information received, exchanged or transmitted pursuant to this methodology shall be subject to the conditions of professional secrecy laid down in b, c and d;
- (ii) The obligation of professional secrecy shall apply to any person subject to the provisions of this methodology;
- (iii) Confidential information received by the persons referred to in paragraph 2 in the course of their duties may not be divulged to any other person or authority, without prejudice to cases covered by national law, the other provisions of this methodology or other relevant EU legislation;
- (iv) Without prejudice to cases covered by national law, regulatory authorities, bodies or persons which receive confidential information pursuant to this methodology may use it only for the purpose of the performance of their functions under this methodology.

(b) Publication

- (i) For clarity, the owner of the disclosed information has the right to decide which, if any, disclosed information may be communicated outside of ENTSO-E and to whom and in what format.

Article 14
Publication and implementation of the methodology

1. ENTSO-E shall publish the methodology without undue delay after the Agency has approved it.

Article 15
Language

1. The reference language for this methodology shall be English.

Appendix I: Scenario rating scales

I.1 Crisis likelihood scale

For classification of likelihood of crisis, a five-step scale is used:

Classification	Events per year	1 x in … years	Description/example of initiating event
Very likely	≥ 0.5	2 or less	event expected practically every year, e.g. extreme winds/storms causing multiple failures of overhead lines may be expected nearly every year in some areas
Likely	0.2-0.5	2-5	event expected once in a couple of years, e.g. extreme heat wave causing limits on output of open-loop water-cooled power plants, low water levels at hydro plants, higher load, etc.
Possible	0.1-0.2	5-10	event expected or taken into consideration as a potential threat, e.g. cyber or malicious attack
Unlikely	0.01-0.1	10-100	very rare event with potentially huge impact, e.g. simultaneous floods causing unavailability of generation, distribution and transmission infrastructure
Very unlikely	≤ 0.01	100 or more	event not observed but potentially disastrous, e.g. earthquake causing a huge destruction of transmission, distribution and generation infrastructure

I.2 Crisis impact scales

The consequences should be simulated based on the present knowledge of the system over at least the next four years.

For classification of operational impact of crisis, a five-step scale is used, to classify two different dimensions of impact of EENS% and LOLE which are treated independently as shown in Appendix I.3:

Classification	EENS%* (of annual demand)	LOLE* [hours]
Disastrous	≥0,25%	≥168
Critical	≥0,05% and <0,025%	≥48 and <168
Major	≥0,01% and <0,05%	≥12 and <48
Minor	≥0,002% and <0,01%	≥3 and <12
Insignificant	<0,002%	<3

* See definitions in Article 2.

I.3 Crisis scenario rating at the Member State level

Crisis scenario rating is performed by combining the operational impact rating (resulting from EENS% and LOLE evaluation) and likelihood rating, as illustrated in the Likelihood – Impact Matrix below.

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For example, if a certain crisis is Likely and has Critical EENS impact and Minor LOLE impact, it would be defined as Major.

Impact		Likelihood				
EENS%	**LOLE**	**Very likely**	**Likely**	**Possible**	**Unlikely**	**Very unlikely**
Disastrous	Disastrous	Disastrous	Disastrous	Critical	Major	Minor
Disastrous	Critical	Disastrous	Critical	Critical	Major	Minor
Critical	Disastrous	Disastrous	Critical	Critical	Major	Minor
Disastrous	Major	Disastrous	Critical	Major	Major	Minor
Major	Disastrous	Disastrous	Critical	Major	Major	Minor
Disastrous	Minor	Disastrous	Critical	Major	Major	Minor
Minor	Disastrous	Disastrous	Critical	Major	Major	Minor
Disastrous	Insignificant	Disastrous	Critical	Major	Major	Minor
Insignificant	Disastrous	Disastrous	Critical	Major	Major	Minor
Critical	Critical	Disastrous	Critical	Major	Minor	Minor
Critical	Major	Critical	Critical	Major	Minor	Minor
Major	Critical	Critical	Critical	Major	Minor	Minor
Critical	Minor	Critical	Major	Major	Minor	Minor
Minor	Critical	Critical	Major	Major	Minor	Minor
Critical	Insignificant	Critical	Major	Major	Minor	Minor
Insignificant	Critical	Critical	Major	Major	Minor	Minor
Major	Major	Critical	Major	Major	Minor	Insignificant
Major	Minor	Major	Major	Minor	Minor	Insignificant
Minor	Major	Major	Major	Minor	Minor	Insignificant
Major	Insignificant	Major	Major	Minor	Minor	Insignificant
Insignificant	Major	Major	Major	Minor	Minor	Insignificant
Minor	Minor	Major	Minor	Minor	Insignificant	Insignificant
Minor	Insignificant	Major	Minor	Minor	Insignificant	Insignificant
Insignificant	Minor	Major	Minor	Minor	Insignificant	Insignificant
Insignificant	Insignificant	Minor	Minor	Insignificant	Insignificant	Insignificant

For the purpose of combining and computing consequences across multiple member states, the above crisis scenario ratings are assigned values, shown in the table below:

Crisis scenario rating	**Value** *(used for regional scenario rating)*
Disastrous	**10**
Critical	**5**
Major	**2**
Minor	**1**
Insignificant	**0**

I.4 Cross-border dependency rating

The cross-border dependencies that must be considered are described in Article 3. For each scenario, the level of cross-border dependency must be evaluated using the following scale:

Cross-border dependency rating	Value	Description
None	1	The crisis has no impact on neighbouring countries, even if they are facing simultaneous or coincident crisis.
Minor	1.2	The crisis is susceptible to aggravate a simultaneous or coincident crisis in at least one of the neighbouring countries, either through direct or indirect causes (cf. Article 3).
Major	2	The crisis is susceptible to generate a cross-border crisis in at least one of the neighbouring countries, either through direct or indirect causes (cf. Article 3).

It is accepted that the impact of local events on other TSOs will be estimated using the TSOs expertise on its own network.

I.5 Example of regional scenario rating

The values of crisis scenario ratings (Appendix I.3) and cross-border dependency ratings (Appendix I.4) are used to compute a national rating for the scenario using the following equation:

$$National\ Rating = Crisis\ Scenario\ Rating \times Cross\ Border\ Dependency\ Rating$$

A regional crisis scenario is then evaluated as the sum of all national ratings. The resulting numbers are used only for the relative ranking of scenarios. An example computation of regional crisis scenario ratings, based on three national scenario ratings, is provided below (using values from Appendices I.3 and I.4). Note that in the table below, CBD is an abbreviation of Cross-Border Dependency rating. The values in this table represent the expected output from the national scenario assessments in Article 9. The computation of regional ratings, as in the example below, shall take place in line with Article 10.

	Member State 1			Member State 2			Member State 3			
Scenario Name	**Scenario Rating**	**CBD**	**National rating**	**Scenario Rating**	**CBD**	**National rating**	**Scenario Rating**	**CBD**	**National rating**	**Regional Rating**
Fuel Shortage	1	1	1	5	1.2	6	10	2	20	27
Cyberattack	2	1.2	2.4	2	1	2	5	2	10	14.4
Heat wave	1	1.2	1.2	5	1.2	6	0	2	0	7.2
Cold spell	0	1	0	1	1	1	1	1	1	2

Appendix II: Events that could initiate an electricity crisis scenario (initiating events)

A common list of initiating events descriptions was established, for each of the:

(a) rare and extreme natural hazards;

(b) accidental hazards going beyond the N-1 security criterion, and exceptional contingencies;

(c) consequential hazards including consequences of malicious attacks and of fuel shortages.

II.1 Motivation

As described in "Commission Staff Working Document: Overview of Natural and Man-made Disaster Risks the European Union may face", in the context of the Union Civil Protection Mechanism (UCPM), the European Commission has established a cross-sectoral overview of natural and man-made disaster risks the Union may face. The overview is developed using the results of national assessments of the main risks of natural and man-made disasters across the EU 28 Member States and the six non-EU countries participating in the UCPM.

"Most natural and man-made disasters present cross-border risks due to their geographical nature (earthquakes, fires, severe weather, floods and space weather), as well as the volatility and scale of their impacts (pandemics, livestock epidemics, nuclear/industrial accidents). The (…) impacts of these hazards, as well as their likelihood of occurrence exist irrespective of national borders."

These national assessments should provide a common basis for assessing probability of occurrence of natural and man-made risks that could in turn lead to an electricity crisis.

II.2 Initiating event list

At least the following hazards[10] need to be considered as possible initiating events in developing both national and regional electricity crisis scenarios:

1) rare and extreme natural hazards:
   a) flooding;
   b) drought and associated water shortage
   c) extreme weather (incl. storms, extreme winds, ice storms, snowfall, heavy precipitation, hurricanes, cold spells, heat waves);
   d) forest fire;
   e) seismic and volcanic activities;
   f) infectious threats, incl. pandemic;
   g) space weather hazards;
2) accidental hazards going beyond the N-1 security criterion, and exceptional contingencies:
   a) simultaneous failure of multiple grid elements;
   b) accidental (unintended) violation of N-1 criterion due to human error:
      i) error during operation;
      ii) failure or omission during the maintenance;
      iii) substandard quality of a series of manufactured grid elements.
3) consequential hazards including consequences of malicious attacks and of fuel shortages:

[10] The list of hazards is adapted from *Commission Staff Working Document: Overview of Natural and Man-made Disaster Risks the European Union may face*, Brussels, 23.5.2017, SWD(2017) 176 final.

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a) malicious attacks:
    i) terrorism / sabotage;
    ii) cybercrime;
    iii) malicious manipulation of the market.
b) disruption of fuel supply for electricity generation;
c) not electricity-related industrial accident (e.g. chemical spill, collapse, explosion, gas leak, radiation, transport disruption);
d) not electricity-related critical infrastructure disruption (incl. water & food supply, garbage & sewage collection, fuel supply excl. fuels for electricity generation, telecommunications);
e) energy market originated issue due to speculation or failure of one of the stakeholders to meet its obligations;
f) nuclear / radiological accident;

Note: It is expected, that for many Member States and TSOs some of the above hazards will not be relevant, while some other will be relevant, but not to an electricity crisis scenario. The list given above is meant to help Member States and TSOs only as a checklist against which the national and regional scenarios should be checked for completeness of coverage. It is not required (nor expected) for any Member State to produce a list of national electricity crisis scenarios that would cover all of the above, but it should be consistent with National Risk Assessments.

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Appendix III: Crisis scenario description template

The crisis scenario description template below shall be used for each steps of the process. Columns are to be interpreted as follows:

(a) "Section" describes a block of related information items;

(b) "Item" contains a definition of information needed;

(c) "Information to provide" must be filled by the relevant data provider.

All the template fields below are required and must be completed with non-sensitive information that can be shared by the provider with ENTSO-E members. Information must also be general: for each item understandable general description is needed, without indicating exact locations, equipment, measurements etc., and a range of coherent values is preferable to an exact number.

Check lists are provided in paragraphs III.2 and III.3 as a tool for building a comprehensive description of each scenario. They must be followed to ensure that an important aspect of the scenario is not omitted. Some of the questions may lead to sensitive information that will not be shared by the provider, but they may be useful for the provider to do a self-assessment of a given crisis scenario impact.

III.1 Description of national electricity crisis scenarios

For each national electricity crisis scenario as mentioned in Article 7, the description must follow the following template:

Item	**Information to provide**
Name of entity and date of submission of the scenario	
Contact information if more information is required on the scenario in the following weeks.	
Initiating Event	Brief description of the initiating event generating the crisis.
Season(s) of the year when the scenario is relevant and type of load	Winter/Spring/Summer/Autumn Peak/Base load
Does the event cause a cross-border impact?	Yes/No
Range of Initial Conditions relevant to the scenario	Describe potential initial conditions for the scenario, using a range for these conditions. They do not have to be very specific. **Ex**: on the TSO perimeter, temperatures between 30°C and 35°C for 2 to 5 weeks, associated with low water levels in reservoir, etc.
Description of impacts on the national perimeter	Description of potential impacts of the crisis on the national perimeter, focusing on range/general areas instead of details **Ex**: describe potential impacts in the south of the country/in maritime areas; instead of naming a district or a city

Item	Information to provide
Description of cross-border impacts	All categories described in Article 7.2 must be considered here for relevance
Evolution of the crisis scenario	
Other important information related to the scenario	

The provider will only send information that he accepts to share with ENTSO-E members.

III.2 Description of regional electricity crisis scenarios by ENTSO-E

The description of regional electricity crisis scenarios as mentioned in Article 8 must follow the following template. The scenario must be sufficiently detailed and specific for each TSO to individually assess the relevance, but not too detailed for the likelihood of the scenario to remain high.

Item	Information to provide
Name of the scenario	
Contact information if more information is required on the scenario in the following weeks.	
Season(s) of the year when the scenario is relevant, type of day, hour (if relevant)	Winter/Spring/Summer/Autumn Peak/Base Load
Broad geographical area	
Initial Conditions	
Initiating Event	Brief description of the initiating event generating the crisis.
Evolution of the crisis scenario	
Severity of the scenario	Duration of direct impact, consequential hazards, incl. potential impact on fuel and energy markets (gas, electricity), etc.
Other relevant information	

Checklist to use for a comprehensive description of the scenario:

Section	Item	Considered	Not relevant
	load, generation, frequency, available reserves, import capabilities, stability, level of system control		

Description of initial condition of the system relevant to the scenario	weather conditions (temperature, wind speed, rain, hail, snow, etc.)		
	internal and cross-border congestions		
	re-dispatching performed before the start of the initiating event		
	internal and regional generation and transmission limitations		
Initiating events (with a reference to critical grid situations, if relevant), including:	details of the initiating events (their parameters and related circumstances, if relevant)		
	the likely geographic location or part of the system affected by the event (type of line, substation, PST, interconnector, dispatching centre, etc.)		
The time of the expected beginning of sequence of events:	season of the year		
	type of day (week, weekend, holiday, day before holidays)		
	peak or base load		
The evolution of the crisis scenario	the course of events (event chain)		
	system parameters (frequency, voltage drop at critical points, etc.) at every stage of scenario		
	expected system response (automatic or manual) to the trigger and to every event in the chain		
	spontaneous propagation of the scenario vs the need for human action in the following stages of the crisis		
	potential for human error/omission/wrong decision		
	required availability of the power system elements or fuel supply		
	possible mitigation and/or corrective actions to be taken before the crisis occurs and their availability		
	time required for mitigation and/or corrective actions, including time before overloading of successive grid elements		

III.3 Assessment of national impact to the regional electricity crisis scenarios

The description of national electricity crisis scenarios by TSOs (as mentioned in Article 9) must follow the following template. The checklist below is to be used to ensure the assessment is comprehensive.

Item	Information provided
Reference of the scenario as described by ENTSO-E	
Crisis scenario level (as described in Appendix I.1)	Disastrous/Critical/Major/Minor/Insignificant
Cross-border dependency rating	Major/Minor/None
Method used for assessment of likelihood (deterministic calculation/probabilistic calculation/ statistical data, number of sub-scenarios taken into account, etc.)	
Method used for assessment of impact (deterministic calculation/probabilistic calculation/ number of sub-scenarios taken into account in case of a probabilistic approach, etc.)	
Strength and type of cross-border dependencies	
Severity of the scenario – national specificities to ENTSO-E description	National specificities relevant for the scenario: duration, length of direct impact, consequential hazards, incl. potential impact on fuel and energy markets (gas, electricity), etc.
Other relevant information	

Checklist to consider for a comprehensive impact assessment:

Some items in the checklist below can be sensitive information: in those cases they shall not be shared by the provider, but will be considered for the provider to do a self-assessment of a given crisis scenario impact (likelihood and consequences).

Impacts and likelihood:

Section	Item	Considered	Not relevant
Severity of the scenario	duration of the scenario		
	assessment of likelihood of scenario materialisation		
	assessment of direct impact on security of supply (EENS) – the most likely and the worst case		
	overall risk assessment (taking into account EENS, LOLE likelihood)		
	impact & likelihood assessment – one of: deterministic calculation or probabilistic calculation		
	number of sub-scenarios considered for likelihood & impact assessment (in case of a probabilistic approach).		
	the length of the direct impact		
	consequential hazards, incl. potential impact on fuel and energy markets (gas, electricity)		
	subjects of protection negatively affected by the event (persons, environment, infrastructure, etc.)		
	time required to restore the system to pre-crisis state		

	need for remedial actions or other coordinated actions beyond TSO (national/regional)		
Reference crises of the past	list of comparable events that have occurred in the past (regardless of whether the crisis developed to the full extent, or not)		
	post crisis review (lessons learnt): main similarities and differences between the scenario and past crises, including the improvements/deterioration of the system condition/robustness, operational standards, maintenance practices, etc.		
Readiness of operators and authorities to handle the crisis	Ability of TSOs and DSOs to prepare and/or react: • availability of backup/support/spare components; • established activation protocol; • availability of clear and precise crisis procedures.		
	readiness of the local and national authorities/TSOs: • existence and verification (tests, exercises) of relevant national crisis plans; • existence of a clear/unambiguous chain of command; • legal basis for handling crisis situations.		
	national crisis plans drafted/implemented/verified;		
	readiness/limitations of the relevant rescue/relief services;		
	ability to provide for a cross-border coordination;		
	availability of communication channels;		
	findings concerning the damage susceptibility and/or robustness of the affected persons/elements, incl.: • robustness of the transmission system; • match/adequacy of the system response to events; • flexibility of reaction to the scenario; • simulation exercises.		
Other important information related to the scenario relevant to managing it.			

Cross-border dependencies:

Section	**Item**	**Considered**	**Not relevant**
Strength and type of cross-border dependencies	Description of cross-border dependencies as a possible aggravating input for the scenario (reliance on assistance from neighbouring TSOs);		
	Description of cross-border dependencies as a possible output of the national crisis (decreased ability to assist neighbouring TSOs).		
Interdependencies In the described scenario, will your situation worsen if	Availability of redispatch/counter trading/cross-border exchange of ancillary services to make it possible to inject or to withdraw power from power plants in a certain neighbouring power system;		

Section	Item	Considered	Not relevant
neighbouring power system are unable to offer the following support?	Availability of reactive power (to support system stability);		
	Availability of energy support.		
Interdependencies During the described scenario, would you be able to assist neighbouring power system in the following fields if they face simultaneous crisis?	Availability of redispatch/counter trading/cross-border exchange of ancillary services to make it possible to inject or to withdraw power from power plants in a certain neighbouring power system;		
	Availability of reactive power (to support system stability);		
	Availability of energy support		