European Network of
Transmission System Operators
for Electricity

entsoe

Short-term and Seasonal Adequacy Assessments Methodology Proposal in accordance with Article 8 of the REGULATION (EU) 2019/941 of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC

Date: 8 July 2019

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 Short term and Seasonal Adequacy Assessments Methodology (the Methodology) in accordance with Article 8 of the REGULATION (EU) 2019/941 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on risk-preparedness in the electricity sector. This version of the Methodology Proposal does not in any case represent a firm, binding or definitive ENTSO-E position on the content.

Contents

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ENTSO-E, taking into account the following,

Whereas

This document is a proposal developed by the European Network of Transmission System Operators for Electricity (hereafter referred to as "ENTSO-E") regarding Short-term and Seasonal Adequacy Assessments Methodology (hereafter referred to also as "Methodology") in accordance with Article 8 of Regulation of the European Parliament and Council on risk-preparedness in the electricity sector (hereafter referred to as "RPR") and repealing Directive 2005/89/EC.

(1) The Methodology takes into account the general principles and goals set in the RPR as well as the EU legal framework (Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity, 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, Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation, ("SO GL"), 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).
(2) The goal of the RPR is to ensure the most effective and efficient risk preparedness within the Union. Common approach—through this Methodology—in all adequacy assessment whether carried out at national, regional, or Union level is key to achieve this goal.
(3) Article 8 of RPR sets the legal basis and requirements for the Methodology developed by ENTSO-E. It shall be based on common probabilistic adequacy assessment approach considering uncertainties of inputs–availabilities of transmission capacities, availabilities of power plants, variability of demand, weather conditions and RES energy production–to identify likelihood of national or simultaneous electricity crisis in Europe.
(4) Upon its' adoption, ENTSO-E will use this Methodology–as required by Article 9 of RPR–to issue winter and summer outlooks to alert Member States, transmission system operators and all other relevant stakeholders of adequacy related risks that might occur in the following six months. Regional Coordination Centres (hereafter RCCs) will use this Methodology–as required by Article 9 of RPR–to perform week-ahead to at least day-ahead adequacy assessments to continuously monitor adequacy situation.
(5) TSOs should also apply this Methodology as reference when carrying out any other type of short-term adequacy assessment, especially the week-ahead to, at least day-ahead generation adequacy forecasts provided for in Commission Regulation on establishing a guideline on electricity transmission system operation.
(6) In conclusion, the Methodology contributes to the general objectives of the RPR to the benefit of all market participants and electricity end consumers.

ENTSO-E SUBMITS THE FOLLOWING METHODOLOGY TO THE AGENCY:

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Article 1
Subject matter and scope

The Methodology laid down in this Proposal shall be considered as the Methodology to assess all short-term adequacy assessments, whether carried out at national, regional or Union level and the pan-European seasonal adequacy in accordance with Article 8 of RPR, which are integral part of global adequacy assessments.

Short-term and Seasonal Adequacy assessment purpose is to assess if expected (or planned) availabilities of supply and transmission infrastructure are sufficient to ensure adequacy and under which circumstances a risk may exist. This continuous intra-year monitoring is necessary to ensure that mitigating actions could be taken to respond to changing operational conditions–weather patterns and occurred contingencies. When the assessments show they can pose a risk for adequacy, dedicated measures can be taken to mitigate the risk, for instance generation or network planned outages can be rescheduled.

The mid-term resource adequacy requirements are set in Electricity Regulation 2019/943 (Chapter IV) and is out of the scope of this document. Though, the mid-term resource adequacy methodology has same foundation as the Methodology. Multi-year ahead (mid-term) resource adequacy assessments assess the impact of the system development trends on adequacy, including change of generation capacity mix, change of demand patterns, network developments, etc. It also provides an indication of the general adequacy situation given complete uncertainty of different variables and suggests which assessed zones might be more subject to adequacy risks. As a result, policy makers and other relevant stakeholders might take actions to ensure that reliability standards are satisfied. Furthermore, it may also serve as indicator for market participants about potential needs and opportunities.

Beside their specific purpose, one additional benefit of each study (mid-term, seasonal and short-term) is that findings in one assessment are transferred to the next–shorter time frame assessment. This information transfer raises awareness of data preparation quality importance and suggests where analysis of adequacy deserves more attention. However, each assessment product performs a full updated analysis, using the latest available data.

Seasonal outlook adequacy assessments are links between one-year-ahead Resource Adequacy and short-term adequacy. The methodology for the Seasonal Outlook builds on mid-term Resource Adequacy experience as the uncertainty, especially related to weather, is still high several months ahead, and full variability of temperature, wind, solar data is possible within the statistical ranges, whereas short-term adequacy have a reduced data uncertainty, and shall consider, when available, weather forecast.

In case major contingencies or input updates (e.g. rescheduling of maintenance) were recorded after the Seasonal Adequacy assessment and ENTSO-E or TSO(s) estimates it could cause adequacy risk, a month-ahead adequacy assessment can be performed.

Outcomes from pan–European adequacy assessment can be refined in regional and national studies, which can incorporate a higher granularity and local sensitivities, while complying with the Methodology.

The Methodology shall cover at least the following uncertainties:

a. the probability of a transmission element outage;
b. the probability of unplanned outage of power plants;
c. variability of demand;
d. variability of energy production from renewable energy sources;
e. weather conditions.

The Methodology shall also enable adequacy assessments to estimate the probability of the occurrence of an electricity crisis and a simultaneous electricity crisis.

This methodology, after ACER approval, shall be adopted by ENTSO-E for Seasonal Adequacy assessments (Winter Outlooks and Summer Outlooks) and by RCCs for short-term adequacy assessments. It shall also

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serve as a reference method, without prejudice to innovation going beyond it, for all other short-term adequacy assessments, whether it would be on national, regional or union level. Regional and national adequacy assessments may use higher granularity, more detailed and different representation of data where necessary.

The Methodology does not limit the geographical scope of the analysis. Adequacy assessments performed by ENTSO-E and RCCs will cover at least a region composed of ENTSO-E members and other TSOs for which SO GL article 81, article 106 or article 107 is applicable. ENTSO-E and RCCs (itself and its' members) shall continuously engage operators of other tightly interconnected systems to establish and foster cooperation. If tightly interconnected neighbouring regions commit for cooperation on adequacy assessments, they should be modelled with the same level of detail as the core analysed systems. Otherwise, contribution to pan-European adequacy of those systems would be considered with the assumption of ENTSO-E's members having interconnections with those systems. Hereafter, these systems will be referred as 'non -explicitly modelled systems'.

Article 2
Definitions and interpretation

For the purposes of the Methodology Proposal, terms used in this document shall have the meaning of the definitions included in Article 2 of the RPR, Electricity Regulation, Electricity Directive;

In addition, in this Methodology Proposal, unless the context requires otherwise, the following terms shall have the meaning below:

a. Normal Conditions–operational conditions, such as weather conditions, supply availabilities and transmission availabilities, resulting in typical operational situations. It relates generally to the fiftieth percentile (50th percentile) of a probability distribution.

b. Severe Conditions–operational conditions, such as weather conditions, generation availabilities and transmission availabilities, resulting in severe operational situations. Severe operational situations are generally considered as observed one out of twenty of all possible occurrences. It relates generally to the ninety fifth percentile (95th percentile) or fifth percentile (5th percentile), of a probability distribution depending which is most critical.

c. Planned outage–state of an asset when it is not available in the power system but this outage was planned in advance. These outages include maintenance, mothballing and any other non-availabilities known in advance.

d. Unplanned Outage (also called Forced Outage)–state of an asset when it is not available in the system and this outage was not planned.

e. Unit Commitment and Economic Dispatch (UCED)–is a mathematical optimization problem, which determines the commitment schedule of generation units and their level of generation, in order to meet demand for every time-step of the modelling horizon. The objective of the problem is to minimize operational cost, while satisfying the operational constraints of the power system.

f. Winter Season–at least period between 1 December and 31 March.

g. Summer Season–at least period between 1 June and 30 September.

h. Seasonal Adequacy Assessment–adequacy assessment of winter and summer season. Their assessment periods are minimum requirements, and additional periods might be assessed if specific and relevant risks are expected. If period is extended, data collection shall be anticipated, hence data will be less up-to-date, possibly reducing the overall quality of the assessment. Thus, assessment period shall be extended only in case of expected risk.

i. Non-explicitly modelled systems–electric systems which do not provide data for adequacy assessment, but are tightly interconnected with any member of ENTSO-E or any other electric system

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for which SO GL article 81, article 106 and 107 is applicable. Contribution of those systems to the pan-European adequacy assessment shall be considered using assumptions provided by TSO to which they connect to.

j. Explicitly modelled systems–electric systems which are integral part of European power system and for which SO GL article 81, article 106 and 107 is applicable. These systems shall be modelled considering each element of probabilistic model set in this Methodology.

k. Market based measures–any supply or demand measures available in the system complying with market rules and commercial agreements.

l. Non–market measure–any supply or demand-side measure deviating from market rules or commercial agreements.

m. Short-term Adequacy Assessment–adequacy assessment which covers time period shorter than three months.

n. Loss of Load Expectation (LOLE)–in a given geographical zone for a given period, expected number of hours when lack of market based resources is expected to cover the demand needs within transmission grid operational security limits.

o. Loss of Load Probability (LOLP)–in a given geographical zone for a given period, probability to have lack of market based resources to cover the demand needs within transmission grid operational security limits.

p. Expected Energy Not Served (EENS)–in a given geographical zone for a given period, energy which is expected not to be supplied due to lack of market based resources while ensuring transmission grid operational security limits.

q. Adequacy probability indicator–in a given geographical zone for a given period, probability of market based resources being sufficient to supply demand within transmission grid operational security limits. Sum of this indicator and LOLP yields 100%.

In this Methodology Proposal, unless the context requires otherwise:

– the singular indicates the plural and vice versa;
– the table of contents and headings are inserted for convenience only and do not affect the interpretation of this Methodology Proposal; and
– any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3
Adequacy Assessment – Description

1. Adequacy assessments aim to monitor if available supply and transmission availabilities are sufficient to cover demand under various weather and operational conditions.
2. The Short-term and Seasonal adequacy assessments shall use a probabilistic methodology to assess adequacy for the concerned period. The methodology shall follow a Monte-Carlo approach to reflect the variability of weather as well as the randomness of supply and transmission outages.
3. The adequacy assessment shall be based on UCED model.
4. The UCED model shall consider the inter-zonal and inter-temporal (e.g. between 2 successive time-steps) correlation of variables and the characteristics of the geographical perimeter assessed.
5. At least hourly resolution shall be implemented in the model.

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6. Adequacy assessments consist of base case calculations, which, in case of adequacy issues, must be supplemented by sensitivity cases to assess countermeasures to mitigate adequacy risk. Additional sensitivity cases might be defined as well.
7. Adequacy assessments consider three major pillars: demand (including demand side response and system reserve requirements), supply (e.g. generation, storage units) and grid representation which connects demand and supply in different zones. ENTSO-E shall coordinate dedicated pan-European databases aiming to increase consistency of inputs across Europe at hourly basis.
8. All resources shall be considered if they are market based. Any non-market measures, such as strategic reserves, shall not be considered in the base case calculations, but can be assessed as countermeasure in sensitivity cases.
9. Availabilities of supply and interconnectors shall consider planned outages and other known outages (mothballing, etc.). Unplanned outages of supply and interconnectors shall be considered in a probabilistic manner. Assumption on outage rate per unit type shall build on reanalysis of historical outage events in Europe.
10. Any information used in the adequacy assessments shall be based on the most recent available information and state–of–the–art methodologies shall be employed to define them. Information includes planned outages, weather forecast or any other relevant data used in the assessment. Methodologies for data preparation embrace demand, transmission capacity and any other data estimation.

I. Demand

11. Demand shall be derived based on likely weather conditions and shall comply with temporal resolution of the assessment. If any weather forecasts are available at the moment of assessment, these shall be used to estimate demand.
12. Demand side response availabilities shall be used in the assessment if they are available in the concerned period. This concerns elasticity of demand (e.g. demand reduction and demand postponement). It is defined as the maximum demand reductions along with the maximum duration of such reduction; and maximum demand postponement, along with the maximum postponement period. Demand side response which provides system reserves shall be disregarded.
13. Demand for energy exports to non-explicitly modelled systems shall be considered if exports would need to be delivered even in case of supply scarcity in assessed region or if it would have long-term impact on energy availability in the assessed region.
14. Demand for system reserves shall be defined.

II. Supply

15. Supply shall be considered as all available generation units, storage units in the assessed system and available imports from non-explicitly modelled neighbouring countries.
16. Generation supply shall be defined in terms of net generating capacity.
17. Storage units shall be defined in terms of net discharge capacity, net charging capacity, storage capacity and cycle efficiency rate.
18. Available imports from non-explicitly modelled neighbouring countries shall be defined in terms of expected availability of energy imports.
19. Any supply not available in the energy market shall be disregarded. This includes but not limits supply units or part of it which are contracted or expected to provide system reserves or any other ancillary services.
20. Any known planned outage which affect supply availability shall be accounted for.

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21. Unplanned outages shall be considered as a random sample of the UCED model, considering probabilities of such events as an input of the model. Probabilities shall be defined based on historical outages in assessed power system.
22. Weather dependent generation (e.g. wind and solar) shall reflect modelled weather conditions to build a data set that is coherent with demand.
23. Any seasonal impact on supply availabilities (e.g. Combined Heat Powerplant availabilities in different seasons) shall be considered.
24. Any energy constraints shall be considered. This is especially relevant for hydro generation modelling. The energy constraints include, but are not limited to, energy inflows, reservoir size and minimum energy release requirements.

III. Grid

25. Study zones are modelled as copper plates.
26. Minimum requirements for study zones granularity shall be smallest level between country and bidding zone.
27. The grid is represented as a set of modelled interconnections between study zones. Modelled interconnections represent Net Transfer Capacity zone coupling or Flow-Based zone coupling. In one adequacy assessment combination of zone coupling methods might be used–some zones might be coupled with Net Transfer Capacity zone coupling and the others with Flow-Based zone coupling. Grid representation shall be evolutive, considering market coupling of each specific region.
28. Exchange constraints are maximum exchange capacity constraints in case of Net Transfer Capacity zone coupling or Reliably Available Margin constraint in case of Flow-Based zone coupling. Exchange constraints may be complemented with total zone position constraint (net import or net export) in case it is mandatory to ensure safe system operations as is common practice in the market coupling.
29. The impact of weather conditions shall be considered when estimating exchange constraints. Weather forecast shall be used when available.
30. If any seasonal pattern of exchange constraints is historically observed, those shall be considered when estimating exchange constraints.
31. Unplanned outages of grid elements shall be considered as a random sample of the UCED model, considering probabilities of such events as an input of the model. Cross–border and internal grid element outage impact on exchange constraints shall be considered.

Article 4
Seasonal Adequacy Assessment

1. Seasonal Adequacy assessment shall be based on probabilistic method described in Article 3.
2. This Article refers to assessments led by ENTSO-E.
3. Seasonal Adequacy assessments shall be based on any relevant indicators. The following are non-exhaustive list of indicators for use in analyses:
    a. Loss of Load Expectation (LOLE)
    b. Loss of Load Probability (LOLP)
    c. Expected Energy Not Served (EENS)
    d. Any other, which can provide additional insight

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4. Seasonal Adequacy assessment shall consist of following steps:
    a. Run of Monte-Carlo probabilistic assessment with UCED model, as defined in Article 3;
    b. Spatial analysis on seasonal basis to detect regions with adequacy risk;
    c. Temporal analysis on weekly basis to detect periods with adequacy risk;
    d. Focused analysis of adequacy in zones and weeks with high risks identified.
5. Seasonal Outlooks shall be published latest by the first day of concerned assessment period.

Article 5
Short-term Adequacy Assessment

1. Short-term adequacy assessments shall be based on the method described in Article 3 of Methodology, considering uncertainties of demand, supply and transmission availabilities. Complementary deterministic assessments–based on the pre-defined scenarios and compliant with the Methodology–might be performed to support prompt result investigation.
2. This section refers to assessments led by the RCCs in cooperation with ENTSO-E.
3. Month ahead adequacy assessment is an extraordinary assessment which can be performed when TSOs need to get more insights to support their decision making in month ahead horizon. This could happen in case of major change in input data compared to seasonal adequacy assessments (e.g. shift of large unit maintenance). This can lead to either on partial re-run of Seasonal Adequacy Assessment calculations after updating specific data, or on run of week ahead study considering month ahead data.
4. Week-ahead to at least day-ahead adequacy assessments shall be based on TSOs' estimates and on ENTSO-E's databases described in Article 3. Data submitted to RCCs shall consider operational security limits.
5. TSOs shall consider the most updated available weather forecast and deliver a range of likely demand, wind and PV infeed and availability of transmission capacities and outages. RCCs shall use this range of likely demand, wind and PV infeed together with the historical distribution of same variables and construct a correlated representative set of demand, wind and PV infeed data for adequacy assessments.
6. Week-ahead to at least day-ahead adequacy assessment shall consider all available and most updated information about planned outages and the uncertainty of unplanned outages of supply and transmission availabilities.
7. Week-ahead to at least day-ahead adequacy is assessed using hourly adequacy probability indicators for each zone. Furthermore, other supporting indicators are used such as expected energy not served and loss of load expectation to be consistent with requirements set in article 105 of SOGL.

Article 6
Adequacy Assessment–Process

1. Adequacy assessment process consists of these key steps:
    a. Data preparation
    b. Probabilistic modelling
    c. Result analysis
    d. Report drafting
    e. Result dissemination

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I. Data preparation

2. Data preparation is process of collection, estimation, forecasting or any other process related to data preparation for adequacy assessment.
3. Data preparation is performed by individual TSOs or a dedicated expert working groups. It shall be based on the data available on common platforms (like Transparency Platform or other) whenever possible.
4. Data preparation shall ensure that data used in probabilistic modelling is consistent across Europe. The same interpretation and assumptions shall be used by different parties involved in data preparation. This is ensured by respecting common data collection guidelines and/or by preparing data centrally within dedicated expert working groups.
5. In case adequacy assessment is performed considering neighbouring power systems, datasets from pan-European databases shall be used whenever available. This is especially relevant for regional and national adequacy assessments, for which data of neighbouring systems might be available in pan-European databases employed in pan-European adequacy assessments.
6. Consistent data sets shall be used in pan-European, regional and national adequacy assessments. This means that same information shall be used for all adequacy assessments–pan-European, regional and national–unless there is information update between studies. Nevertheless, different levels of details might be applied in each study.
7. Any data collected for adequacy assessment shall pass a quality check ensuring that data is complete, consistent, accurate and precise.
8. Data preparation shall consider the most recent information available.

II. Probabilistic modelling

9. Probabilistic modelling is performed based on the Methodology defined in Article 3 and the data collected for specific assessment.
10. Before results are subject to detailed result analysis, qualitative result analysis shall be performed. This can be ensured through the four eyes principle, by cross check of a second modelling expert.

III. Result analysis

11. Result analysis is a process of quantitative adequacy result investigation.
12. Quantitative adequacy result investigation is based on probabilistic indicators. It may be complemented by additional analysis examining patterns of adequacy risks.
13. Result analysis shall include quantitative simultaneous adequacy risk investigation.

IV. Report drafting

14. Drafting of the report is the process of compiling a document to present the findings of the adequacy assessment.
15. The report shall be exhaustive, informative, and strive to be reader friendly. It can consist of a high-level summary and dedicated technical appendices, thus being able to address different target audiences.

V. Result dissemination

16. Result dissemination is the process of informing all relevant bodies about adequacy assessment results.
17. Results shall be disseminated before the start of the assessment period.
18. At least all parties participating in the adequacy assessment shall get the results.
19. In case an adequacy risk is identified in regional or national adequacy assessment, relevant parties of the neighbouring systems shall be informed.

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20. ENTSO-E Pan-European Seasonal Adequacy assessment results shall be published and presented to the Electricity Coordination Group. Where risks are identified relevant parties and the Electricity Coordination Group shall be informed as soon as the Seasonal assessments results are available, to support preparation of mitigation measures.
21. TSOs shall initiate internal and external communication with ENTSO-E coordination in case adequacy risk is identified in any of the adequacy assessments. When relevant, a critical grid situation communication process shall be triggered by a concerned TSO or RCC.

Article 7
Publication and implementation of the Methodology Proposal

1. ENTSO-E shall publish the Methodology Proposal without undue delay after the Agency has approved the proposed Methodology in accordance with Article 8(3) of RPR.
2. ENTSO-E and RCCs shall implement the Methodology latest by 10 months after its approval.

Article 8
Language

1. The reference language for this Methodology Proposal shall be English.

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Appendix I
High-level information flow scheme

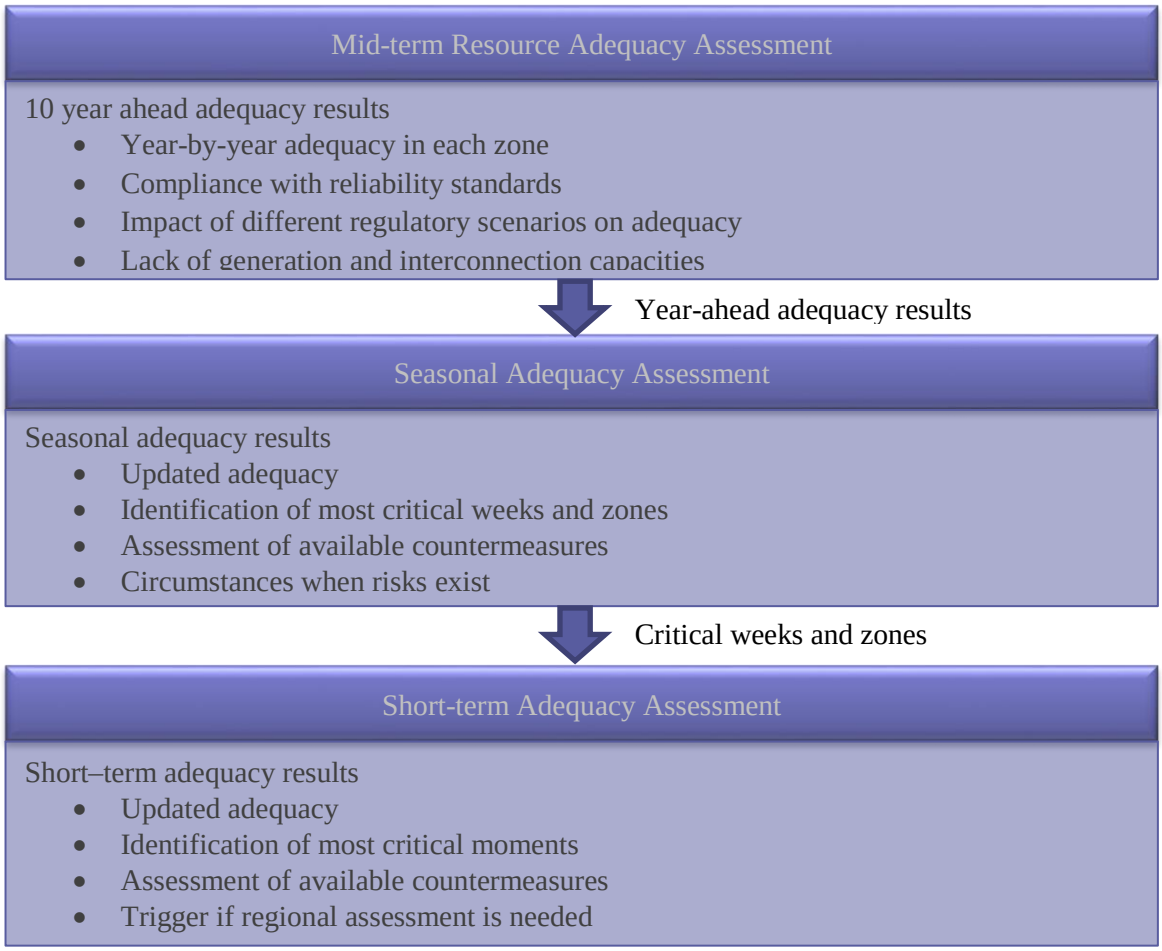

Figure 1: Information flow between adequacy assessments in different time horizons

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Appendix II
High-level Business process diagram

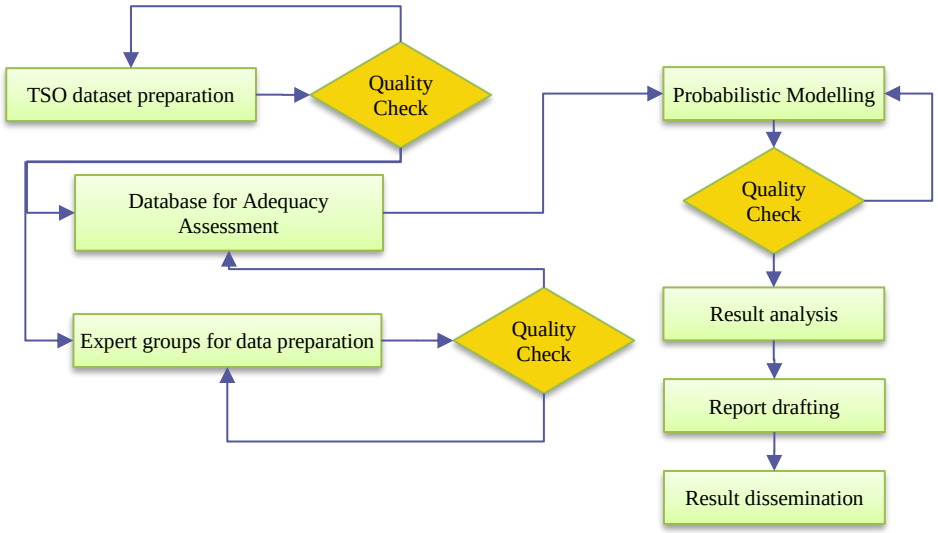

Figure 2: Principle process for adequacy assessments

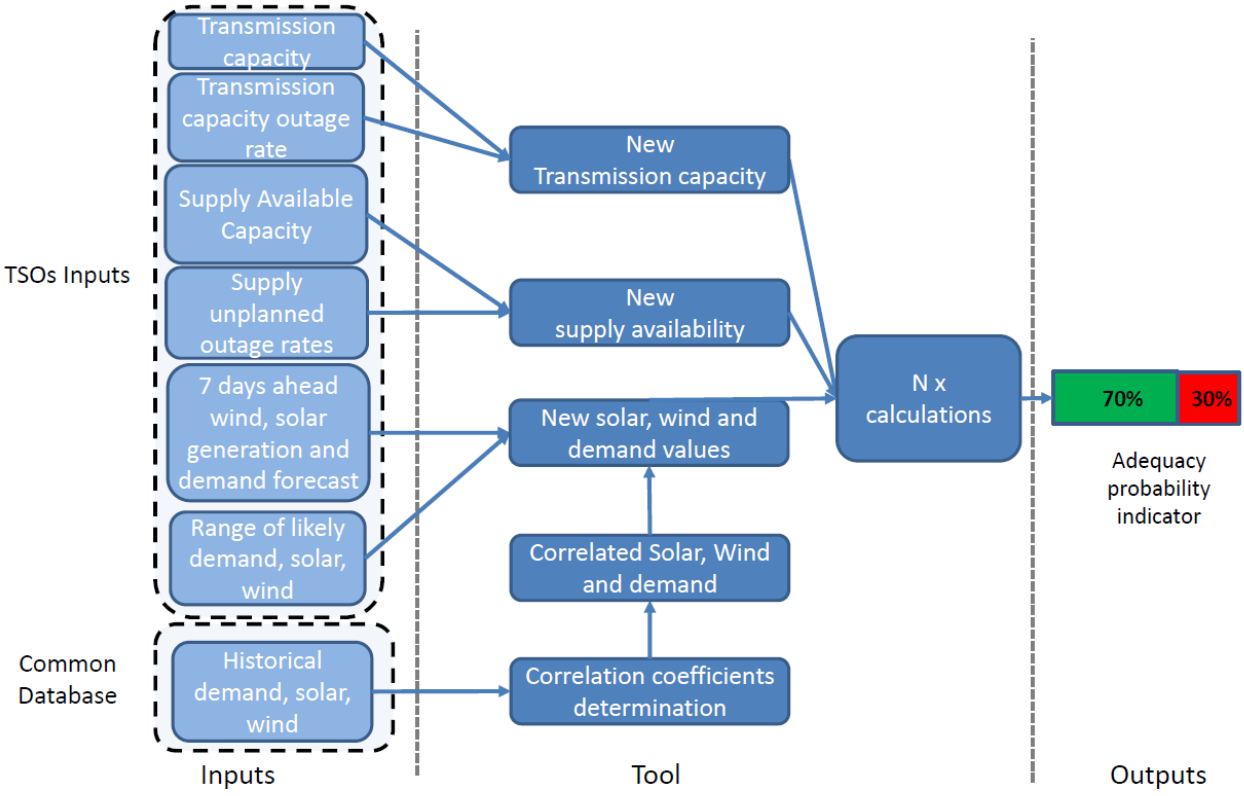

Figure 3: Foreseen week-ahead short-term adequacy assessment process

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