ACER Decision on the Methodology for calculating the value of lost load, the cost of new entry, and the reliability standard: Annex III (for information only)

Methodology for calculating the value of lost load, the cost of new entry and the reliability standard

in accordance with Article 23(6) of Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity

31 July 2020, ENTSO-E's comments and proposed changes based on ACER's 24 July preliminary views

Contents

Whereas

(1) This document sets out the methodology for calculating the value of lost load (hereafter referred to as "VOLL methodology"), the cost of new entry (hereafter referred to as "CONE methodology") and the reliability standard (hereafter referred to as "RS methodology") in accordance with Article 23(6) of Regulation (EU) 2019/943 of the European Parliament and Council of 5 June 2019 on the internal market for electricity (recast) (hereafter referred to as "Electricity Regulation"). The three methodologies are collectively referred to as the "VOLL/CONE/RS methodology".

(2) The VOLL methodology sets out the process to calculate the single estimate of the value of lost load for the reliability standard (hereafter referred to as "single VOLL for RS"). The CONE methodology sets out the process to calculate the cost of new entry (hereafter referred to as "CONE"). The RS methodology sets out the process to calculate the reliability standard (hereafter referred to as "RS").

(3) The VOLL/CONE/RS methodology takes into account the general principles and goals set out in the Electricity Regulation as well as in a broader EU legal framework, in particular:

a. Directive (EU) 2019/944 of the European Parliament and Council of 5 June 2019 on common rules for the internal market for electricity (hereafter referred to as "Electricity Directive");

b. Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019 on risk-preparedness in the electricity sector (hereafter referred to as "RPR"); and

c. Regulation (EU) 2017/2196 of 24 November 2017 establishing a network code on electricity emergency and restoration (hereafter referred to as "E&R NC").

(4) The VOLL/CONE/RS methodology aims to derive realistic estimates of the cost of additional capacity resource and of consumers' willingness to pay in order to avoid a supply interruption, thereby helping to calculate a socioeconomically efficient RS. As such, the VOLL/CONE/RS methodology contributes to increased efficiency of the market and a higher level of security of electricity supply in line with the objectives set out in Article 1(a) of Electricity Regulation.

(5) The VOLL/CONE/RS methodology has been developed in line with the principles of the electricity market operation set out in Article 3 of Electricity Regulation. In particular, the CONE methodology helps to ensure that safe and sustainable generation, energy storage and demand response participate on equal footing in the market (pursuant to Article 3(j) of Electricity Regulation) by requiring that all capacity resources be studied. This is in line with the objective set out in Article 1(b) of Electricity Regulation to set fundamental principles for well-functioning, integrated electricity markets with non-discriminatory market access for all capacity resources.

(6) Finally, by providing a harmonised EU approach to calculating the cost of additional capacity resource, consumers' willingness to pay and the RS, the VOLL/CONE/RS methodology also fosters the emergence of a well-functioning and transparent European electricity market, in line with the objective set out in Article 1(d) of Electricity Regulation.

(7) The VOLL/CONE/RS methodology has been developed in line with the relevant requirements set out in Articles 11, 23 and 25 of Electricity Regulation. Regarding the requirement of Article 25(3) of Electricity Regulation that the RS shall be expressed as 'expected energy not served' and 'loss of load expectation', the calculated RS is expressed as 'loss of load expectation', which itself relies on VOLL, which is expressed based on 'expected energy not served'.

(8) As stated in the recital (46) of Electricity Regulation, "*Member States intending to introduce capacity mechanisms should derive resource adequacy targets on the basis of a transparent and verifiable process. Member States should have the freedom to set their own desired level of security*

of supply." The VOLL/CONE/RS methodology aims at laying foundations for this transparent and verifiable process by which the Member States can set their own desired level of security of supply.

(9) Given that the Electricity Regulation does not explicitly specify which entity shall apply the CONE and RS methodologies, the VOLL/CONE/RS methodology does not assign any specific competences in that respect, but refers to the entities designated to calculate the respective values.

(10) In line with Article 23(6) of Electricity Regulation, the VOLL/CONE/RS methodology shall be based on transparent, objective and verifiable criteria. To this aim, the VOLL/CONE/RS methodology establishes requirements to publish the information required by stakeholders to understand the calculated values. In particular, given that the calculations of CONE, the single VOLL for RS and RS might be subject to significant uncertainties, these uncertainties should be properly communicated and explained to ensure efficient decisions related to security of supply.

Commented [A1]: ENTSO-E's Legal and Regulatory group analysis:

A distinction shall be made between the terms 'methodology' and 'calculation', as used in Article 25 of the Electricity Regulation.

1.To be consistent with the transparency requirements of the Regulation, the calculation by MS' [setting of the RS] has to be based on the draft methodology.
2.However, the result of this calculation, setting the RS [by MS]), cannot be 'bound' by the results of the methodology. The reason for that is that MS' have indeed the freedom to set their own desired level of supply, which can be interpreted as having the freedom to calculate their own reliability standard, as long as they follow the methodology set by ENTSO-E and approved by ACER, and include the factors taken into account for this calculation in a transparent, objective and verifiable way.
3. It is also important to mention that there is no obligation in the Electricity Regulation placed on MS' to publish a report with detailed reasons for deviating from the results of the calculations based on the methodology.

Commented [A2]: ENTSO-E's Legal and Regulatory group analysis:

1. ENTSO-E fully agrees with these statements provided the draft methodology includes a 'range of uncertainty (confidence interval)' for the calculation of the RS, (as specified by ENTSO-E draft methodology of 4th May); Then the MS are given the freedom to choose between using a central value or a value within the range of uncertainty. It derives that the calculation results when setting the RS, might likely (but are not obliged to) be found within the range provided by the set methodology (central value + confidence interval), and are hence in line with the rationale of the Electricity Regulation, and specifically the provision found in Recital 46.

TITLE 1 - General provisions

Article 1. Subject matter and scope

1. The VOLL/CONE/RS methodology describes how to calculate

   (a) the single VOLL for RS pursuant to Articles 11 and 25 of Electricity Regulation;

   (b) the CONE pursuant to Article 23(6) of Electricity Regulation; and

   (c) the RS pursuant to Article 25 of Electricity Regulation.

2. The Annexes include

   (a) Annex 1 – Survey template for sectoral VOLLs;

   (b) Annex 2 – Non-binding guidelines to estimate WACC; and

   (c) Annex 3 – Possible corrections for RS.

   (d) (non-binding guidelines separated from the Methodology) – Explanatory note on the calculation of the weighs for the single VOLL estimate with examples of CONE and RS calculation, including the notion of both a central value and of a confidence interval.

The Annexes constitute an integral part of the VOLL/CONE/RS methodology and shall be read together with its provisions.

3. The entity calculating the single VOLL for RS shall calculate the single VOLL for RS pursuant to TITLE 2. In line with Article 11(1) of Electricity Regulation, the entity calculating the single VOLL for RS shall be the relevant regulatory authority, or another competent authority designated by the relevant EU Member State (hereafter referred to as 'MS') for that purpose.

4. The entity calculating CONE shall calculate CONE pursuant to TITLE 3.

5. The entity calculating RS shall calculate RS pursuant to TITLE 4.

Article 2. Definitions and interpretation

1. For the purpose of the VOLL/CONE/RS methodology, the definitions in Article 2 of Electricity Regulation, Article 2 of RPR, ~~and~~ Article 2 of Electricity Directive and Article 3 of "E&R NC" shall apply.

2. The following additional definitions shall also apply. In the event of any inconsistency between the following definitions and the definitions pursuant to paragraph (1), the latter shall prevail:

   (a) 'annual fixed costs' means the yearly costs incurred in the context of operation of a capacity resource once the capacity resource starts operating, independently from the generated or curtailed (in the case of DSR) energy volume;

   (b) 'capital costs' means the costs to develop, construct or refurbish a capacity resource that are incurred during the construction period of that capacity resource;

Commented [A3]: ACER is kindly asked to provide non-binding examples illustrating the soundness of the calculations.

ENTSO-E also kindly ask ACER to consider including the table provided by ENTSO-E on its 4 May submission as part of these non-binding guidelines, including different values of CONE and VOLL and hence to illustrate the ranges of confidence that can be expected after the calculation and the impact on the definition of the RS.

(c) 'CM' means capacity mechanism pursuant to Electricity Regulation;

(d) 'construction period' means the period between the final investment decision and the time when the capacity resource becomes operational;

(e) 'cost of debt' means the rate of return that a company provides to its debtholders and creditors;

(f) 'cost of equity' means the rate of return a shareholder requires for investing equity into a business;

(g) 'cost of new entry' (CONE) means both fixed and variable cost of new entry;

(h) 'cost of renewal or prolongation' (CORP) means both $CORP_{fixed}$ and $CORP_{var}$;

(i) 'country risk premium' means the additional returns expected by a rational private investor in order to assume the risk of investing in a particular country compared to a reference country considered as more stable and therefore less risky;

(j) 'demand' means demand pursuant to Article 2 of the ERAA methodology;

(k) 'de-rating capacity factor' means the share of the capacity of an electricity source, which is likely to be on average technically available to operate when ENS is positive;

(l) 'economic lifetime' means the expected period of time during which a capacity resource remains operational to a rational private investor;

(m) 'energy not served' (ENS) means, for a given geographic area and time period, the energy which is not supplied due to insufficient capacity resources to meet the demand; For the purposes of the calculation of the single VOLL estimate and hence the RS, ENS relates the load-shedding borne by the different consumer types following the applicable load-shedding process. It relates to the definition of load-shedding in paragraph (x)

~~(m)~~(n) 'entity calculating CONE' means the entity tasked with calculating CONE;

~~(n)~~(o) 'entity calculating the single VOLL for RS' means the entity tasked with calculating the single VOLL for RS;

~~(o)~~(p) 'entity calculating RS' means the entity tasked with calculating the RS;

~~(p)~~(q) 'equivalent annualised cost' (EAC) means the constant annual payment over the economic lifetime of a project which allows to pay back the capital costs and annual fixed costs of a given reference technology. The net present value of the EAC over the lifetime shall be equal to the net present value of capital costs and annual fixed costs over the economic lifetime of the project;

~~(q)~~(r) 'equity beta' means a measure of the volatility of a given stock's price movement relative to the overall market's movement;

~~(r)~~(s) 'equity risk premium' refers to the excess return that investing in the stock market provides over a nominal risk-free rate, over the same time period;

~~(s)~~(t) 'ERAA methodology' means the methodology for the European resource adequacy assessment in Annex I to ACER Decision XXXX;

~~(t)~~(u) 'expected energy not served' (EENS) means expected ENS;

~~(u)~~(v) 'fixed cost of new entry' ($CONE_{fixed}$) means the total annual net revenue per unit of de-rated capacity (net of variable costs) that a new generation resource or demand-side response would need to receive over its economic lifetime in order to recover its capital costs and annual fixed costs;

~~(v)~~(w) 'fixed cost of renewal or prolongation' ($CORP_{fixed}$) means the total annual net revenue per unit of de-rated capacity (net of variable costs) that an existing capacity resource, which is renewed or whose lifetime is prolonged, would need to receive over its remaining economic lifetime in order to recover the incurred capital costs related to the renewal or prolongation and annual fixed costs;

~~(w)~~(x) 'gearing' means the ratio of debt compared to total assets of one company;

(y) 'load-shedding' means an administrative disconnection performed by the grid operator as a necessary corrective measure to maintain the electricity system's balance when available capacity resources are not adequate to meet total demand, pursuant to Article 11(5)(b)(v) and Article 22 -of the E&R NC-and any other relevant national legislation related to load-shedding procedures.

~~(x)~~(z) 'loss of load expectation' (LOLE) means the expected number of hours, in a given geographic area and in a given time period, during which resources are insufficient to meet the demand and hence finite ENS occurs; For the purposes of the calculation of the RS, the LOLE relates to the definition of ENS in paragraph (m) above.

Commented [A4]: Proposed amendment for internal consistency between ENS and LOLE.

~~(y)~~(aa) 'minimum capacity need for RS' means the minimum amount of additional de-rated capacity required to reach the RS;

~~(z)~~(bb) 'MS' means EU member state;

~~(aa)~~(cc) 'net generating capacity' (NGC) means net generation capacity pursuant to the ERAA methodology

~~(bb)~~(dd) 'nominal risk-free rate' means the interest a rational private investor would expect from a risk-free investment over a specified period of time, such as government securities;

~~(cc)~~(ee) 'peer companies' means a group of companies that share similar characteristics (business, generation portfolio, size, region, etc.);

~~(dd)~~(ff) 'reference technology' means a technology which fulfils the criteria pursuant to Article 10(4);

~~(ee)~~(gg) 'reference new entry' means a technology considered within the CONE methodology, which fulfils the criteria to be considered reference technology;

~~(ff)~~(hh) 'reference renewal/prolongation' means a technology considered for renewal or prolongation, which fulfils the criteria to be considered reference technology (but is excluded from the CONE methodology);

~~(gg)~~(ii) 'reliability standard' (RS) means the measure of the necessary level of security of supply defined by each MS;

~~(hh)~~(jj) 'sectoral VOLL' ($VOLL_{sect}$) means the VOLL of a given consumer type under certain VOLL parameters, e.g. duration period of occurrence, notice of interruption;

~~(ii)~~(kk) 'single VOLL for RS' ($VOLL_{RS}$) means the single estimate of value of lost load pursuant to Article 11(1) of Electricity Regulation;

~~(jj)~~(ll) 'supply interruption' means any interruption of (at least part) of the electricity supplied to a given consumer, irrespective of the underlying cause. Supply interruption shall be equivalent to outage for the purpose of Article 2(9) of Electricity Regulation;

~~(kk)~~(mm) 'variable cost' ('variable cost of new entry' ($CONE_{var}$) for new entries or 'variable cost of renewal or prolongation' ($CORP_{var}$) for existing capacity resources that are renewed or whose lifetime is prolonged), means

i. in the case of a generation or storage resource, the average variable cost of generation over the economic lifetime of that resource. The variable cost of generation includes fuel costs, CO_2 emission costs and other variable operating expenditures (other variable OPEX) over the expected duration of operation of the resource expressed in monetary units per generated MWh; or

ii. in the case of a DSR resource, the average of the minimum market prices for activation of that particular capacity resource over the economic lifetime of that resource;

~~(ll)~~(nn) 'other variable OPEX' means non-fuel or emission related operating costs and maintenance costs, that may be scheduled based on the operation of the capacity resource;

~~(mm)~~(oo) 'weighted average cost of capital' (WACC) means the cost of capital (before corporate income taxes are applied) of a business firm in which each category of capital is proportionally weighted. All sources of capital, including common stock, preferred stock, bonds and any other long-term debt, are included in a WACC calculation;

3. In the VOLL/CONE/RS methodology, unless the context requires otherwise:

(a) the singular indicates the plural and vice versa;

(b) the table of contents and headings are inserted for convenience only and do not affect the interpretation of the VOLL/CONE/RS methodology; and

(c) 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.

TITLE 2 - Calculation of the VOLL

Article 3. Objective of the VOLL calculation

1. Pursuant to Article 11(1) of the Electricity Regulation, where required for the purpose of setting a RS in accordance with Article 25 of the Electricity Regulation, the entity calculating the single VOLL for RS shall calculate a single estimate of the VOLL. That estimate shall be made publicly available.

2. The entity calculating the single VOLL for RS may determine one estimate per bidding zone if there is more than one bidding zone in the considered territory. Pursuant to Article 11(1) of Electricity Regulation, where a bidding zone consists of territories of more than one MS, the entities calculating the single VOLL for RS for these territories shall jointly determine a single VOLL estimate for that bidding zone.

3. Pursuant to Article 11(2) of Electricity Regulation, the entity calculating the single VOLL for RS shall update the single VOLL for RS at least every five years, or earlier, where the entity calculating the single VOLL for RS observes a significant change.

4. Pursuant to Article 2(9) of Electricity Regulation, the single VOLL for RS shall reflect the maximum electricity price that customers are willing to pay to avoid a supply interruption.

5. The calculation of the single VOLL for RS shall at least take into account the variation resulting from the consumer types and the VOLL parameters described in Article 5(1). It shall also take into account societal costs, such as loss of time or comfort.

Article 4. Consumer segmentation

1. Before calculating the single VOLL for RS (Article 7), the entity calculating the single VOLL for RS shall estimate sectoral VOLLs in different inadequacy situations (for example, a shorter or a longer interruption duration) for different categories of consumers, following the principles described in Article 6.

2. The consumer categories should refer at least to those specified in Annex 1, paragraph (4.1). Sub-categories may also be defined within those consumer categories. In case the entity calculating the single VOLL for RS is unable to collect representative data for a given category of consumers, the entity calculating the single VOLL for RS may aggregate categories of consumers only to the extent required by the lack of representative data and ensuring meaningful results. In this case, the entity calculating the single VOLL for RS shall highlight any such aggregation and justify it.

Article 5. VOLL parameters

1. The entity calculating the single VOLL for RS shall evaluate, for different inadequacy situations, the maximum electricity price that customers are willing to pay to avoid a supply interruption in situations where the production is insufficient to meet the demand (i.e. situations of ENS). The characteristics of the supply interruptions implemented by grid operators pursuant to Article 11(5)(b)(v) and Article 22 of the E&R NC and any other relevant national legislation related to load -shedding procedures ~~and~~ in order to maintain the balance between production and demand shall be specified in terms of:

   (a) duration(s);

   (b) period(s) of occurrence (hour, week day or week-end, season of the year);

(c) pre-notification period: in case the customer was pre-notified about the interruption, the amount of time elapsed between the notification of the customer and the interruption. The pre-notification period shall take into account the mechanisms used to inform the public about electricity crises, if any. As of 2022, those mechanisms will be described in the risk-preparedness plan of each MS, as referred to in Article 11(1)(i) of the RPR, and shall be reflected in the VOLL calculation.

Additional parameters may also be considered, such as the frequency of interruption of electricity supply.

Article 6. Evaluation of sectoral VOLLs

1. The entity calculating the single VOLL for RS shall evaluate the sectoral VOLL for each category or sub-category of consumers (defined according to Article 4) via dedicated surveys. If similar surveys were conducted in line with the VOLL methodology within the last five years, the results of these similar surveys may be used.

2. For the categories (and sub-categories) of consumers and sets of VOLL parameters, for which the weight used to calculate the single VOLL for RS (pursuant to Article 7(54)) is equal to zero, the entity calculating the single VOLL for RS may abstain from evaluating the sectoral VOLLs (including abstaining from asking the related survey questions).

3. The surveys shall rely on a statistically representative sample of each consumer category and sub-category, also in terms of the actual responses received, and apply appropriate statistical processing operations to the output data.

4. The objective of the survey shall be explained to the interviewees at the beginning of the questionnaire. The questionnaire shall contain at least two sections:

   (a) section for collecting information about the interviewee; and

   (b) section describing scenarios of interruption of electricity supply, and asking for VOLL estimates (see paragraphs (5) and (6)).

Annex 1 contains the minimum set of questions that the national surveys shall include.

5. The surveys shall describe scenario(s) of supply interruption to the interviewee and ask for the related VOLLs. The main scenario shall describe the characteristics of supply interruptions in the situations when ENS is likely to occur (see Article 5). The sensitivity of the result to changes of VOLL parameters (for example, a shorter or a longer interruption duration) may be evaluated by adding other interruption scenarios to the questionnaires. The sensitivity to the frequency of the electricity interruptions may also be evaluated.

6. The survey shall at least use the cost estimation method of the willingness to pay, pursuant to Article 2 of Electricity Regulation. The entity calculating the single VOLL for RS may apply a triangulation of different cost-estimation methods on the same customer category and/or sub-category, if the entity computing the VOLL considers that it leads to more robust VOLL estimates. Different cost-estimation methods may include the direct worth and the willingness to accept methods.

7. For each category and/or sub-category of consumers, sectoral VOLLs expressed per supply interruption in the surveys shall be converted in sectoral VOLLs per MWh. For this purpose, the amount of electricity consumption of the interviewee cut off during the interruption scenario shall be estimated, by combining the interviewee's monthly or yearly consumption with standardised consumption profiles (or more precise information if available).

8. The result of surveys shall aim to give a best estimate of the sectoral VOLL for each category of consumers for combinations of the VOLL parameters defined in Article 5. In addition, an uncertainty range may be provided around each best estimate of sectoral VOLL for each category of consumers.

9. The sectoral VOLLs may be cross-checked with other macro-economic evaluations.

Article 7. Single VOLL for RS

1. After evaluating the sectoral VOLL of each category of consumers according to Article 6, the entity calculating the single VOLL for RS shall calculate the single VOLL for RS. The single VOLL for RS shall represent the most likely unit cost of supply interruptions implemented by grid operators in order to maintain the balance between production and demand (taking into account storage and the electricity grid). Such supply interruptions may affect the different categories of consumers in different proportions.

2. The calculation of the single VOLL for RS shall exclude the following consumers:

   (a) price-responsive consumers, for the proportion of their offtake which is price-responsive (provided sufficiently detailed data is available); and

   (b) if relevant, consumers who are expected to receive special protection against disconnection according to the load-shedding plans in place pursuant to Article 11(5)(b)(v) and Article 22 of the E&R NC and any other relevant national legislation related to load-shedding procedures, and, as of 2022, all priority consumers as defined in accordance with Article 11(1)(h) of the RPR.

3. To align with the assumptions underlying the RS calculation pursuant to XXX, the single VOLL for RS shall combine the sectoral VOLL estimates computed pursuant to Article 6 to reflect the EENS, which additional capacity resources would avoid. This EENS shall reflect the applicable load-shedding process. Pursuant to Article 11(5)(b)(v) and Article 22 of the E&R NC, the applicable load-shedding process (leading to ENS) shall be economically efficient and shall have a minimum impact, subject to the technical ability and legal competence of grid operators to conduct load-shedding.

Commented [A5]: Please update:
Economic efficiency is mentioned in the Article 11(6)(b) not 11(5)(b)(v)

4. The single VOLL for RS shall be equal to:

$$VOLL_{RS} = \sum_{\substack{cons.\ types \\ VOLL\ params}} VOLL_{sect.,cons.type,VOLL\ params} * Weight_{cons.type,VOLL\ params}$$

Where:

- $cons.\ types$ describes the consumer types pursuant to Article 4;
- $VOLL\ params$ describes the sets of VOLL parameters pursuant to Article 5;
- $VOLL_{sect.,cons.type,VOLL\ params}$ is the best estimate of the sectoral VOLL of a given consumer type under given VOLL parameters. The sectoral VOLL shall be based on the VOLL parameters, which best reflect the typical load-shedding events expected to take place (e.g. concerning duration and pre-notification). These parameters may take into account the main ENS patterns observed in recent European or national resource adequacy assessments, where applicable;

- $Weight_{cons.type,VOLL\ params}$ is the weight for each consumer type under given VOLL parameters, defined in paragraph (54).

5. The weight for each consumer type and set of VOLL parameters shall reflect the applicable load-shedding process implemented by TSOs within the legally mandated load shedding plans pursuant to Article 11(5)(b)(v) and Article 22 of the E&R NC and any other relevant national legislation related to load-shedding procedures, i.e. it shall either:

(a) Reflect the marginal reduction of load-shedding that additional capacity resource would cause on average, pursuant to Article 19(1), i.e.:

$$Weight_{cons.type,VOLL\ params} = \frac{EENS_{reduction,cons.type,VOLL\ params}}{EENS_{reduction}}$$

Where:

- $Weight_{cons.type,VOLL\ params}$ is the weight for the given consumer type and set of VOLL parameters used to define the single VOLL for RS.
- $EENS_{reduction,cons.type,VOLL\ params}$ is the EENS reduction for the given consumer type and set of VOLL parameters. The EENS reduction may take into account the main ENS patterns observed in recent European or national resource adequacy assessments, where applicable.
- $EENS_{reduction} = \sum_{cons.\ types,VOLL\ params} EENS_{reduction,cons.type,VOLL\ params}$ is the total EENS reduction enabled by the additional capacity resource.
- The amount of additional capacity resource should reflect the minimum capacity need for RS.

; or

(b) ~~As a simplification,~~ reflect the average share of load-shedding borne by each consumer type following the applicable load shedding plans pursuant to Article 11(5)(b)(v) and Article 22 of the E&R NC and any other relevant national legislation related to load-shedding procedures and set of VOLL parameters, i.e.

$$Weight_{cons.type,VOLL\ params} = \frac{EENS_{cons.type,VOLL\ params}}{EENS}$$

Where:

- $Weight_{cons.type,VOLL\ params}$ is the weight for the given consumer type and set of VOLL parameters used to define the single VOLL for RS.
- $EENS_{cons.type,VOLL\ params}$ is the EENS for the given consumer type and set of VOLL parameters. The EENS for the given consumer type may take into account the main ENS patterns observed in recent European or national resource adequacy assessments, where applicable.
- $EENS = \sum_{cons.\ types,VOLL\ params} EENS_{cons.type,VOLL\ params}$ is the total EENS.

6. As a simplification, the same set of VOLL parameters may apply for all (reductions of) EENS for a given consumer type. In this case,

Commented [A6]: ENTSO-E appreciates the reference to the applicable load-shedding process. In addition, we would like to propose the following insertion:

'' implemented by TSOs within the legally mandated load shedding plans pursuant to Article 11(5)(b)(v) and Article 22 of the E&R NC and any other relevant national legislation related to load-shedding procedures''

Commented [A7]: ENTSO-E suggests to set this option as option (b) and the one below rather as the 'default' option (a).

Commented [A8]: Idem: ENTSO-E suggests to set this option as the 'default' option (a) and the one above as option (b).

(a) the sectoral VOLL of the given consumer type shall reflect the set of VOLL parameters, which describes average load-shedding conditions applicable to this consumer type. These parameters may take into account the main ENS patterns observed in recent European or national resource adequacy assessments, where applicable; and

(b) the weight shall reflect the total (reduction of) EENs of the consumer type.

7. In case a sectoral VOLL is missing for a given set of VOLL parameters, the entity calculating the single VOLL for RS may use the available sectoral VOLL which reflects similar VOLL parameters to the given set of VOLL parameters. In this case, the entity calculating the single VOLL for RS shall strive to ensure that the next sectoral VOLL calculation estimates the sectoral VOLL for the given set of VOLL parameters.

8. The entity calculating the single VOLL for RS ~~may~~ shall estimate an uncertainty range (‘confidence interval’) in addition to the best estimate of the single VOLL for RS, in order to reflect e.g. the uncertainties around the best sectoral VOLL estimates per category of consumers (see Article 6(8)), and the impact of the weights of each consumer category for the single VOLL for RS.

Commented [A9]: ENTSO-E propose to replace the word ‘may’ by ‘shall’ (also see above).

ENTSO-E believes the definition of an uncertainty range (confidence interval) for the calculation of the RS is as important as the central value for MS’ to articulate their freedom to define their own level of Security of Supply.

The provision of an uncertainty range around the central estimate of the VoLL provides additional insight into the VoLL estimate.

Article 8. Transparency requirements

1. In order to ensure that the VOLL methodology is based on transparent, objective and verifiable criteria (pursuant to Article 23(6) of Electricity Regulation), the entity calculating the single VOLL for RS shall fulfil the following transparency requirements.

2. For each geographic area and timeframe for which the single VOLL for RS was calculated, the entity calculating the single VOLL for RS shall publish at least the following information:

(a) the VOLL parameters pursuant to Article 5;

(b) the survey used for evaluating sectoral VOLLs pursuant to Article 6(1) and the number of respondents per consumer type;

(c) the best estimate of all sectoral VOLLs (reflecting different consumer types and VOLL parameters) computed pursuant to Article 6(8) and describing the cost estimation methods used pursuant to Article 6(6), complemented with uncertainty ranges if applicable;

(d) the price-responsive consumers assumed pursuant to Article 7.2(a) (with enough detail to enable ENTSO-E to ensure a consistent modelling of DSR within the ERAA methodology), and the consumers assumed to receive special protection against disconnection pursuant to Article 7.2(b);

(e) the weights for each sectoral VOLL applied pursuant to Article 7(54), and the assumptions underlying these weights;

(f) the single VOLL for RS computed pursuant to Article 7(3), complemented with uncertainty ranges ~~(‘confidence interval’) if applicable~~; and

(g) other necessary information needed to calculate the single VOLL for RS computed pursuant to Article 7(3).

3. Where the entity calculating the single VOLL for RS identified as confidential a set or a subset of data (or information) mentioned in paragraph (2), this entity may publish the relevant data (or information) in such aggregated form which still preserves their confidentiality. When publishing the aggregated data (or information), this entity shall explain why publishing the data (or information) required by paragraph (2) would cause harm.

Commented [A10]: To ENTSO-E, “cause harm” seems like a strange formulation. ENTSO-E suggests to replace it by “would cause concerns or present problems”.

4. The entity calculating the single VOLL for RS should endeavour to coordinate with the entity calculating RS and the entity calculating CONE (if they are different), to ensure that, where appropriate, the respective data is published on the same website in a user-friendly manner and following a consistent data structure.

TITLE 3 - Calculation of the CONE

Article 9. Overview

1. For the purpose of calculating the reliability standard according to TITLE 4, the entity calculating CONE shall calculate and make publicly available estimates of the $CONE_{fixed}$ and $CONE_{var}$ for generation, storage or DSR, for its geographic area(s) over a given timeframe.

2. The entity calculating CONE should calculate CONE at least every five years, or earlier, where it observes a significant change.

3. The following steps shall be performed in order to calculate the CONE:

   (a) Review and select candidate technologies that can be considered as reference technologies pursuant to Article 10;

   (b) Define the detailed technical characteristics of the reference technologies pursuant to Article 11;

   (c) Estimate capital costs and annual fixed costs for each reference technology pursuant to Article 13;

   (d) Determine an appropriate WACC for each reference technology pursuant to Article 14;

   (e) Compute $CONE_{fixed}$ for each reference technology pursuant to Article 15; and

   (f) Determine the $CONE_{var}$ of each reference technology pursuant to Article 16.

   These tasks shall be performed based on transparent, reliable, objective and verifiable sources and criteria.

4. The entity calculating CONE may coordinate with entities calculating CONE for other jurisdictions, in order to ensure consistency in technical and economic parameters when justified. For example, entities calculating CONE for neighbouring jurisdictions may rely on the same CO_2 emission allowance (or fuel) price for the same year.

5. For each reference technology, the entity calculating CONE may compute either:

   (a) a single value $CONE_{fixed}$ and $CONE_{var}$ to apply over the whole timeframe referred to in Article 25(3) of the Electricity Regulation; or

   (b) a different value for each of the years of the applied timeframe, to account for expected developments that may affect the economic and technical parameters that are used for calculating $CONE_{fixed}$ and $CONE_{var}$ according to Article 10 to Article 16.

Article 10.Defining reference technologies

1. The entity calculating CONE shall identify candidate technologies for the purpose of the calculation of $CONE_{fixed}$ and $CONE_{var}$. Candidate technologies shall refer to any new investment in any technology able to provide resource adequacy benefits, including but not limited to generation capacity, storage facilities and DSR.

2. Reference technologies shall reflect technologies for which investment decisions are likely to be made by rational private investors in MSs. For each candidate technology, the entity calculating CONE shall assess whether the candidate technology fulfils the criteria set out in paragraph (4). Each candidate technology which fulfils these criteria shall become reference technology.

3. The selection of reference technologies shall be independent from and without prejudice to the identification of technologies eligible to participate in the CM of the relevant MS, where such CMs exist or are planned.

4. Each reference technology shall meet the following two cumulative criteria:

   (a) standard technology. A reference technology shall be standard. To identify whether a given technology is standard, the entity calculating CONE shall demonstrate that:

      i. reliable and generic cost information is available for the cost components defined in Article 13;

      ii. the costs of building and operating units of the technology shall be of the same order of magnitude from one project to another; and

      iii. development of the technology is not significantly bound by technical constraints. Technologies with limited individual capacity which can be aggregated in homogeneous clusters shall be considered as standard if reliable data is available to characterise these clusters. Reliable data might consist of cluster capacity, cluster activation price or generation costs and economic and/or technical activation constraints representative of the cluster;

   (b) potential new entry. A reference technology shall have potential for new entry. To demonstrate that the candidate technology is representative of possible capacity additions in the coming years, the entity calculating CONE shall demonstrate that:

      i. capacity representing this technology has been developed in the recent years, is in process of development or is planned for development for the considered timeframe; and

      ii. future development of this technology is not prohibited or otherwise significantly hampered by the national or European regulatory framework.

5. The criteria shall be assessed based on country-specific and up-to-date information from industry experts, competent authorities, competent stakeholders, and academic research. At least one reference technology shall be defined for each MS.

Article 11.Technical characteristics

1. For each reference technology, the entity calculating CONE shall determine technical specifications. These specifications shall at least include the specifications, which are expected to impact the cost estimates defined in Article 13 and the de-rating capacity factor estimation defined in Article 12 shall be defined. Such specifications may include the following, where applicable:

   (a) plant/unit type and configuration;

   (b) fuel type and the fuel supply specifications;

   (c) NGC of energy generation or demand reduction capabilities of DSR;

(d) electrical and, where applicable, total efficiency (e.g. for combined heat and power);

(e) emission factors of CO_2 per amount of electricity generated;

(f) constraints on continuous energy production or demand reduction (e.g. storage capacity, energy constraints, maximum activation duration and/or maximum number of activations per year);

(g) expected operational conditions (e.g. electricity generation or curtailment, number of start-ups, charge/discharge cycles);

(h) for DSR, categories of consumers that are able to reduce their consumption;

(i) electricity network voltage level to which a capacity resource of the reference technology would be connected;

(j) fuel supply network to which a capacity resource of the reference technology needs to be connected;

(k) environmental requirements and environmental compliance costs;

(l) construction period (in years);

(m) economic lifetime (in years);

(n) licensing, permitting and spatial planning requirements; and

(o) location.

2. These specifications shall, as far as possible, be defined based on:

(a) preference estimates by rational private investors, taking into account recently built or planned projects in the territory of the MSs or in similar countries;

(b) in the absence of existing or planned units, expectations on future business cases, regulation and infrastructure;

(c) relevant assumptions of the latest national, regional or European resource adequacy assessment or any other dedicated national study or assessment;

(d) the applicable legal and regulatory framework in the relevant MS.

3. Data sources may also include information provided by operators, information from industry experts, databases and modelling software, academic research, expertise from competent stakeholders.

Article 12.De-rating capacity factor

1. The entity calculating CONE shall determine a de-rating capacity factor for each reference technology. The de-rating capacity factor shall reflect the statistical degree to which the installed capacity of the reference technology is expected to contribute to resource adequacy when ENS occurs.

2. The de-rating capacity factor shall be calculated using the data on the relevant technical characteristics presented in Article 11, as well as available and reliable information on the operation of the reference technology. In particular, this calculation shall at least reflect:

   (a) expected availability rate when ENS is positive; and

   (b) energy and activation constraints when ENS is positive.

3. The RS calculated according to the RS methodology will indirectly depend on the de-rating capacity factors. To avoid potential circularity issues, the calculation of the de-rating capacity factors may be based on the assumption of a system that is compliant with any previously-existing RS, if any. The validity of the de-rating capacity factors calculated under this assumption shall be carefully monitored. In case the observed de-rating capacity factor derived from ERAA and/or relevant national studies deviates significantly from the one calculated to define $CONE_{fixed}$ under the above-mentioned assumption, a different choice of de-rating capacity factor and hence of the corresponding value of $CONE_{fixed}$ may be justified.

4. Where de-rating capacity factors for units that fall into the same category as a reference technology are calculated for the purpose of an existing or planned CM, the entity calculating CONE shall take the CM de-rating capacity factors of these units into account to calculate the de-rating capacity factors for $CONE_{fixed}$ for each reference technology.

Article 13.Capital costs and annual fixed costs

1. The entity calculating CONE shall estimate the capital costs and annual fixed costs for each reference technology.

2. The entity calculating CONE shall assess the capital costs of the reference technologies, including all costs incurred during the construction period. It shall also define the yearly cash flows associated with capital costs during the construction period.

3. The cost elements considered as part of the capital costs may inter alia include:

   (a) contractor's costs, including (where applicable and relevant) equipment, construction labour, materials, contractor's fees, contractor's contingency;

   (b) owner's costs, including (where applicable and relevant) project development costs including costs for licenses and permits, costs incurred during the testing phase prior to operation, electrical interconnection costs, gas or other fuel network connection costs, financing fees, owner's contingency, measurement and control technology, software and communication technology, dual fuelling costs (if required by legislation) and cost of land; and

   (c) other upfront costs related to environmental compensation, local resident compensation, decommissioning, etc.

4. The entity calculating CONE shall define the annual fixed costs of the reference technologies. If needed (for instance, in case of an increase in the maintenance costs), specific annual fixed costs may be defined for each year of the economic lifetime. Elements of the annual fixed costs may inter alia include (where applicable and relevant):

   (a) labour costs;

   (b) fixed maintenance and repair costs;

(c) insurance and asset management costs;

(d) taxes and levies;

(e) transaction and control costs;

(f) annual fixed costs to compensate the underlying demand for DSR;

(g) fuel supply service contracts (excluding the fuel costs);

(h) fixed electricity transmission and distribution charges; and

(i) other annual costs including environmental compensation costs, local resident compensation costs etc.

5. The capital costs and annual fixed costs shall be assessed by the entity calculating CONE considering the technical specifications determined according to Article 11, and taking into account as much as possible country-specific prices, characteristics and requirements. These costs shall be based on transparent, reliable and verifiable sources.

6. The entity calculating CONE shall use identical cost factors for all reference technologies, for those cost factors which are independent from the reference technology.

7. All costs shall be expressed in the local currency per installed capacity and in real terms.

8. Data sources used for the definition of the capital costs and annual fixed costs may include: information provided by operators, information from industry experts, industry databases, academic research, or competent stakeholders.

9. For each reference technology, the entity calculating CONE shall provide the best estimate of the capital costs and annual fixed costs. It may also provide an uncertainty range for these costs.

Article 14.WACC

1. The entity calculating CONE shall determine the WACC to use to calculate the EAC of the reference technologies, according to Article 15.

2. The WACC calculated by the entity calculating CONE should be applicable in its territory for a rational private investor investing in the reference technology. It shall represent the minimum rate of return required by fund providers (shareholders and/or creditors) to finance investment in the reference technology in the relevant MS and shall be based on transparent market data.

3. Where relevant and upon availability of robust data, the entity calculating CONE shall calculate a different WACC for each reference technology (or specific group of reference technologies) in order to account for differences in risks (taking into account hedging opportunities expected to be available).

4. If WACC estimates are already available, the entity calculating CONE may rely on them to the extent that they are relevant to its territory, recent and representative of the minimum rate that a rational private investor would require to invest in the reference technologies.

5. If no relevant value is available, the entity calculating CONE shall calculate a new WACC value (or different WACC values per reference technology, as appropriate). To this end, the entity calculating CONE may rely on the non-binding guidelines set out in Annex 2.

6. The entity calculating CONE shall provide the best estimate of the WACC for each reference technology. The entity calculating CONE may estimate an uncertainty range to reflect the uncertainties.

Article 15.Fixed CONE

1. For each reference technology, the EAC is calculated using the following formula:

$$EAC = \left[\sum_{i=1}^{X} \frac{CC(i)}{(1+WACC)^i} + \sum_{i=X+1}^{X+Y} \frac{AFC(i)}{(1+WACC)^i}\right] \cdot \frac{WACC \cdot (1+WACC)^{X+Y}}{(1+WACC)^Y - 1}$$

Where:

- i represents each year over the construction period and economic lifetime;
- X is the construction period (in years) defined according to Article 11;
- Y is the economic lifetime (in years), defined according to Article 11;
- $CC(i)$ is the best estimate of the capital costs incurring each year of the construction period (in local currency per MW), defined according to Article 13;
- $AFC(i)$ is the best estimate of the annual fixed costs incurring each year during the economic lifetime (in local currency per MW), defined according to Article 13; and
- $WACC$ is the best estimate of WACC as defined in Article 14.

2. The $CONE_{fixed}$ for a given reference technology ($CONE_{fixed,RT}$) shall be calculated as the ratio between the EAC and the de-rating capacity factor:

$$CONE_{fixed,RT} = \frac{EAC_{RT}}{K_{d,RT}}$$

Where:

- EAC_{RT} represents the EAC of a given reference technology calculated according to the formula mentioned in paragraph (1) (in local currency per MW); and
- $K_{d,RT}$ is the de-rating capacity factor of the reference technology, defined according to Article 12.

3. For each reference technology, a best estimate of $CONE_{fixed}$ shall be provided. An uncertainty range ~~may~~ shall also be provided ('confidence interval'), taking into account uncertainties affecting the capital costs, annual fixed costs and WACC of the reference technology.

Article 16.Variable CONE

1. The entity calculating CONE shall estimate the cost elements of the $CONE_{var}$ for each reference technology and for every year of a given timeframe pursuant to Article 25(3) of Electricity Regulation.

2. The cost elements considered as part of the $CONE_{var}$ may inter alia include:

(a) fuel costs estimated based on the efficiency of the generation reference technology and the expected price of fuel during the applied timeframe;

(b) CO_2 emission costs estimated based on the expected emission factor of the generation reference technology and the expected price of CO_2 allowances during the applied timeframe;

(c) Other variable OPEX costs consisting of the expected cost of consumable materials (ammonia, limestone, water, etc.), by-products handling (ash, slug, etc.), etc., as well as

variable operating and maintenance cost estimated based on the number of expected operating hours and/or start-stop cycles of the generation or charge-discharge cycles of storage resource;

(d) minimum activation prices for DSR resources;

(e) taxes and levies which relate to variable production.

3. The entity calculating CONE shall assess the cost elements of the $CONE_{var}$ considering the technical specifications determined according to Article 11, and taking into account as much as possible country-specific prices, characteristics and requirements. The cost elements shall be based on transparent, reliable and verifiable sources.

4. All costs shall be expressed in the local currency and in real terms.

5. The expected operational characteristics of the reference technologies over the applied timeframe that are necessary to estimate the cost components of the $CONE_{var}$ shall be based on the latest national, regional or European resource adequacy assessments or on dedicated national studies.

6. Other data sources used for the estimation of the cost components of the $CONE_{var}$ may include: information provided by operators, information from industry experts, industry databases, academic research, and expertise from competent stakeholders.

7. The entity calculating CONE shall provide a best estimate of $CONE_{var}$ for each reference technology. The entity calculating CONE ~~may~~ shall also provide an uncertainty range (‘confidence interval’).

Commented [A11]: ENTSO-E thinks that the confidence interval should be systematically calculated.

8. For a given reference technology, if the entity calculating CONE expects that $CONE_{var}$ will be negligible compared to the best estimate of the single VOLL for RS pursuant to TITLE 2, the entity calculating CONE may estimate the order of magnitude of $CONE_{var}$, which would reflect paragraph (1). If the order of magnitude of $CONE_{var}$ turns out to be negligible compared to the best estimate of the single VOLL for RS, the entity calculating CONE may abstain from calculating $CONE_{var}$.

Article 17.Transparency requirements

1. In order to ensure that the CONE methodology is based on transparent, objective and verifiable criteria (pursuant to Article 23(6) of Electricity Regulation), the entity calculating CONE for RS shall fulfil the following transparency requirements.

2. For each geographic area and timeframe for which the CONE was calculated, the entity calculating CONE shall publish at least the following information:

(a) the fuel cost for all fuels considered pursuant to Article 16.2(a); and

(b) the CO_2 emission allowance price considered pursuant to Article 16.2(b).

3. For each geographic area, timeframe, and reference new entrant for which the CONE was calculated, the entity calculating CONE shall publish at least the following information:

(a) the technical characteristics pursuant to Article 11(Article 4), and the source used to retrieve the data;

(b) the de-rating capacity factor pursuant to Article 12;

(c) the capital cost and annual fixed cost pursuant to Article 13, and the source used to retrieve the data;

(d) the WACC pursuant to Article 14, and the main assumptions underlying the calculation;

(e) the cost elements defining $CONE_{var}$ pursuant to Article 16; and

(f) $CONE_{fixed}$ and $CONE_{var}$ (or its order of magnitude), along with uncertainty ranges ('confidence interval')~~when applicable~~, pursuant to Article 15 and Article 16.

Commented [A12]: ENTSO-E thinks that the confidence interval should be systematically calculated

4. Where the entity calculating CONE identified as confidential a set or a subset of data (or information) mentioned in paragraph (3), this entity may publish the relevant data (or information) in such aggregated form which still preserves their confidentiality. When publishing the aggregated data (or information), this entity shall explain why publishing the data (or information) required by paragraph (3) would cause harm.

Commented [A13]: To ENTSO-E, "cause harm" seems like a strange formulation. ENTSO-E suggests to replace it by "would cause concerns or present problems".

5. The entity calculating CONE should endeavour to coordinate with the entity calculating the single VOLL for RS and the entity calculating RS (if they are different), to ensure that, where appropriate, the respective data is published on the same website in a user-friendly manner and following a consistent data structure.

TITLE 4 - Calculation of the RS

Article 18.LOLE threshold per reference technology

1. For each reference new entry, which has a variable cost lower than the single VOLL for RS pursuant to Article 7, the entity calculating RS shall compute a LOLE threshold ($LOLE_{RT}$), where RT refers to 'Reference Technology'. For each reference renewal/prolongation, which has a variable cost lower than the single VOLL for RS pursuant to Article 7, the entity calculating RS may compute $LOLE_{RT}$.

2. For each reference new entry, the best estimate of $LOLE_{RT}$ shall be:

$$LOLE_{\mathrm{RT}} = \frac{CONE_{fixed}}{VOLL_{RS} - CONE_{var}}$$

Where:

- $LOLE_{\mathrm{RT}}$ is the LOLE threshold related to the reference new entry, in h
- $CONE_{fixed}$ is the best estimate of the fixed CONE pursuant to Article 15, in local currency/MW
- $VOLL_{RS}$ is the best estimate of the single VOLL for RS, in local currency/MWh
- $CONE_{var}$is the best estimate of the variable CONE pursuant to Article 16, in local currency/MWh. If the $CONE_{var}$ is negligible compared to $VOLL_{RS}$, $CONE_{var}$ may be neglected

3. In cases where renewal/prolongation of existing capacity resources is possible, CORP may be calculated to reflect the renewal or prolongation of existing capacity resources. CORP may only consider renewal and prolongations which fulfil the requirements to be reference technology, i.e. only reference renewals/prolongations shall be retained. For these reference renewals/prolongations, the CORP (fixed and variable) shall be computed in line with the principles used for computing CONE (following the methodology described in Article 11 to Article 16), i.e.

   (a) Reflecting the likely choices rational private investors would make for the renewal or prolongation;

   (b) Reflecting the yearly fixed and variable costs related to the renewal or prolongation;

   (c) Estimating the de-rating capacity factor of the capacity resource;

   (d) Converting the costs into EAC for the renewal or prolongation.

4. For each reference renewal/prolongation, the best estimate of $LOLE_{RT}$ shall be:

$$LOLE_{\mathrm{RT}} = \frac{CORP_{fixed}}{VOLL_{RS} - CORP_{var}}$$

Where:

- $LOLE_{\mathrm{RT}}$ is the LOLE threshold related to the reference renewal/prolongation, in h
- $CORP_{fixed}$ is the best estimate of the fixed CORP computed similarly to Article 15, in local currency/MW

- $VOLL_{RS}$ is the best estimate of the single VOLL for RS, in local currency/MWh
- $CORP_{var}$ is the best estimate of the variable CORP calculated similarly to Article 16, in local currency/MWh. If the $CORP_{var}$ is negligible compared to $VOLL_{RS}$, $CORP_{var}$ may be neglected

Article 19.Conditions of validity of the LOLE threshold

1. The LOLE threshold reflects an economic optimisation between the marginal cost of a new capacity resource (CONE) or a renewal/prolongation (CORP) where relevant, and the marginal reduction of EENS (LOLE * VOLL). The optimum is reached when these two quantities are equal.

2. This economic optimality theory relies on the following assumptions:

   (a) The marginal reduction of EENS can be expressed in terms of LOLE, i.e. the following formula holds:

   $$\frac{dEENS[Q]}{dQ} = -LOLE$$

   where Q denotes the installed capacity of the capacity resource

   In particular, this assumption holds if:

   i. no energy constraint affects capacities of the electric system during hours of ENS; or

   ii. energy constraints are properly represented through the de-rating capacity factor introduced in Article 15(2), and the installed capacity mentioned in the formula above (Q) represents firm quantities (i.e. installed capacity multiplied by the de-rating capacity factor K_d).

   (b) New capacity resource is required in order to reduce EENS.

   (c) EENS is only reduced in the concerned geographic area.

3. The entity calculating RS may monitor the validity of these assumptions for each reference new entry, or each reference renewal/prolongation, where relevant. If the assumptions are not met for a given reference technology, the entity calculating RS may apply corrections to the above definitions pursuant to Annex 3. If corrections are made to the LOLE threshold described in Article 18, the corrected LOLE target should be used to calculate RS in line with Article 20.

Article 20.Calculation of the RS

1. The entity calculating RS shall calculate a LOLE target for the RS, based on the LOLE thresholds of the reference new entries, and of the reference renewals/prolongations where relevant, pursuant to Article 18. The LOLE target may either be calculated per MS or per bidding-zone.

2. Pursuant to Article 25(1) of Electricity Regulation, where a bidding zone consists of territories of more than one MS, the entities calculating RS for these territories shall jointly calculate a single RS for that bidding zone.

3. For a given LOLE threshold, the capacity resource potential up to the LOLE threshold is:

$$capacity\ resource\ potential\ (LOLE_{threshold}) = \sum_{\substack{i\ \in reference\ new\ entries \\ LOLE_{RT}(i)\ \leq\ LOLE_{threshold}}} CL(i) + \sum_{\substack{i\ \in reference\ renewal/prolongation \\ LOLE_{RT}(i)\ \leq\ LOLE_{threshold}}} CL(i)$$

Where:

- $capacity\ resource\ potential\ (LOLE_{threshold})$ is the total amount of capacity resource available up to a given $LOLE_{threshold}$
- $CL(i)$ is the capacity limit of the reference new entry or renewal/prolongation i (a number higher than the minimum capacity need for RS if the considered reference technology has no capacity limit)
- $LOLE_{RT}(i)$ is the best estimate of the LOLE threshold of the reference new entry or renewal/prolongation (i) (in line with Article 18)

4. A minimum capacity need for RS shall be defined based on the results of the latest available national, regional or European resource adequacy assessments (e.g. based on the relation between the observed number of hours with ENS and the capacity margins of the electric system). The minimum capacity need for RS shall be lower than the maximum hourly ENS observed during the latest European or national resource adequacy assessment.

5. The LOLE target for RS shall be the minimum (best estimate) LOLE threshold which fulfils the minimum capacity need for RS, i.e.:

$$LOLE_{target\ for\ RS} = \min(LOLE_{threshold});$$
$$capacity\ resource\ potential\ (LOLE_{threshold}) \geq minimum\ capacity\ need\ for\ reliability\ standard$$

6. The RS shall express the level of security of supply which maximises the socioeconomic surplus over a given timeframe. At this level of security of supply, the incremental cost of additional capacity resource is equal to the incremental saving of load curtailments to customers.

7. For a given MS or bidding-zone, the calculated RS shall be equal to the target LOLE for RS pursuant to paragraph (5). For a given timeframe pursuant to Article 25(3) of Electricity Regulation, the entity calculating RS may either

   (a) calculate a different value of the RS for each year of this timeframe, in order to reflect expected changes in the values underlying the target LOLE for RS; or

   (b) calculate a single value of the RS for the whole timeframe. In this case, the single RS value shall be equal to the target LOLE for RS computed pursuant to TITLE 4, and considering the average values of CONE, CORP and VOLL over the given timeframe for each reference new entry or renewal/prolongation.

8. The entity calculating RS ~~may~~ shall provide an uncertainty range ('confidence interval') to reflect the uncertainty of the values used to compute the LOLE target for RS pursuant to paragraph (5).

8.9. Following Recital (46) of the Electricity Regulation ~~'ER'~~ the final choice regarding the desired level of adequacy, expressed in terms of the Reliability Standard target LOLE, shall be set by the Member State in a transparent and verifiable manner. The result of this calculation by MS~~'~~s, when setting the RS, shall not be 'bound' by the central RS estimate ~~RS~~ result after the Article 20(7) of the methodology. MSs shall have the freedom to set their own desired level of security of supply~~,~~ and may therefore use both the central estimate of the target LOLE described in Article 20(7) and its 'confidence interval' described in Article 20(8) when doing so.

Commented [A14]: ENTSO-E propose to replace the word 'may' by 'shall' (also see above).

ENTSO-E believes the use of a central value combined with a confidence interval by MS' provides the way to fully respect recital (46) of the Electricity Regulation.

Article 21.Transparency requirements

1. In order to ensure that the CONE methodology is based on transparent, objective and verifiable criteria (pursuant to Article 23(6) of Electricity Regulation), the entity calculating CONE for RS shall fulfil the following transparency requirements.

2. For each geographic area and timeframe for which RS was calculated, the entity calculating RS shall publish at least the following information

   (a) For each reference new entry and renewal/prolongation

      i. The best estimate of $CONE_{fixed}$ or $CORP_{fixed}$, along with an uncertainty range when applicable;

      ii. The best estimate (or order of magnitude) of $CONE_{var}$ or $CORP_{var}$, along with an uncertainty range when applicable;

      iii. The best estimate of the LOLE threshold pursuant to Article 18;

      iv. Whether the conditions of validity pursuant to Article 19 are fulfilled. If not, how the best estimate of the LOLE threshold was corrected, and what was the amount of the correction.

      v. The capacity potential;

   (b) The single VOLL for RS;

   (c) The minimum capacity need for RS, and the main assumptions underlying the minimum capacity need for RS; and

   (d) The calculated RS including both its central estimate value and its 'confidence interval'.

3. Where the entity calculating RS identified as confidential a set or a subset of data (or information) mentioned in paragraph (2), this entity may publish the relevant data (or information) in such aggregated form which still preserves their confidentiality. When publishing the aggregated data (or information), this entity shall explain why publishing the data (or information) required by paragraph (2) would cause harm.

4. The entity calculating RS shall publicly consult

   (a) the methodology used to estimate the minimum capacity need for RS; and

   (b) the methodology to estimate corrections to LOLE thresholds pursuant to Article 19.

5. The entity calculating RS shall publicly consult significant amendments to the methodologies mentioned in paragraph (4).

6. The entity calculating RS should endeavour to coordinate with the entity calculating the single VOLL for RS and the entity calculating CONE (if they are different), to ensure that, where appropriate, the respective data is published on the same website in a user-friendly manner and following a consistent data structure.

TITLE 5 - Final provisions

Article 22.Language

1. The official language for the VOLL/CONE/RS methodology shall be English.

Annex 1 – Survey template for sectoral VOLLs

1. This Annex sets out minimum content requirements for the introduction section and a minimum set of questions, to include in nationally-conducted surveys on sectoral VOLL. The questions may be translated in the official languages of the MSs (including adapting the currency used for the economic questions). The structure and wording of the survey may be adapted in order to ensure that realistic information will be collected. The first part of the survey (or some questions in this part) may be removed, if the entity conducting the survey already collected identical information about consumers, or if the remaining questions of this part (combined with information already available to the entity conducting the survey) allow to derive robust values for the questions removed.

2. The definition of each consumer type should follow the definition used by Eurostat or national statistical offices.

3. Introduction

   The following survey aims to assess the effect of an interruption to your supply of electricity. In order to assess the impact of such an interruption, you will be asked questions that allow to identify which type of consumer you belong to, and to understand how much you value an uninterrupted supply of electricity. Your answers will be aggregated with statistical methods to estimate the maximum price that consumers are willing to pay to avoid an interruption of electricity supply. Therefore, this survey has two parts:

   1) In the first part, you will provide information about your electricity consumption.
   2) In the second part, you will evaluate the impact of the proposed supply interruptions on your well-being.

   Please make sure that the person who responds to the survey is the one in charge of the electricity bills in your household or company, or has the relevant knowledge to respond.

   Your answers are important, as they will be used to better design the electricity systems in your country and in the other MSs: please take the time to give your best answer and only in case you cannot find the good one, select the “I don’t know” field.

4. Survey – Part 1

   1) What type of electricity consumer do you belong to?
      a. Household
      b. Commerce or service sector (tertiary)
      c. Public service
      d. Small-medium enterprise in the industrial sector
      e. Large enterprise in the industrial sector
      f. Transport sector
      g. I don’t know

   2) How much was the amount to be paid for your last electricity bill?
      a. Billing period: … Cost: … EUR
      b. I don’t know

   3) Optional: How much was the total amount paid for your electricity last year?
      a. Year: … Cost: … EUR
      b. I don’t know

4) How much was your electricity consumption last month:
    a. Billing period: … Consumption: … kWh
    b. I don't know

5) How much was your total electricity consumption last year:
    a. Year: … Consumption: … kWh
    b. I don't know

6) What is the power rating of your electricity contract?
    a. … kW
    b. I don't know

7) Have you entered into a contract for interruptibility or demand-response, i.e. an agreement with your electricity supplier allowing interruptions or flexible provision of electricity?
    a. Yes
    b. No
    c. I don't know

7.a) If yes to question 7) What is the average proportion of your power consumption that participates in demand response or interruptible demand?
    a. …kW
    b. I don't know

8) Have you experienced any interruption of your electricity supply in the past two years?
    a. Yes, once
    b. Yes, more than once
    c. No
    d. I don't know / I don't remember

9) Are you satisfied with the continuity of your electricity supply?
    a. Very satisfied
    b. Satisfied
    c. Dissatisfied
    d. Very dissatisfied
    e. I don't know

5. Survey – Part 2

In this part of the survey, you are asked to evaluate how much you would be willing to pay to avoid an interruption of your electricity supply in specific circumstances.

Scenario 1: typical summer peak

Suppose it is [*month, day, hour to be specified at national level*]. This is the moment in summer where electricity consumers have the highest demand in our country.

Interruption type A: no notice given

Your electricity provider interrupts your electricity supply because of an event beyond its control. Your electricity supplier does not notify you in advance, consequently you experience an unexpected interruption of your electricity supply, for which you have no time to prepare.

10) How much would you be willing to pay to avoid an electricity interruption of 1 hour:
    a. … EUR
    b. I don't know

11) How much would you be willing to pay to avoid an interruption that, instead of 1 hour, lasts:
    c. 2 minutes:
        i. …EUR
        ii. I don't know
    d. 4 hours:
        i. …EUR
        ii. I don't know
    e. 1 day:
        i. … EUR
        ii. I don't know

Interruption B: notice given

Now imagine that you face an interruption of electricity supply in the same moment as above [month, day, hour], but you receive a 1-day notice on the interruption (i.e. you know one day before that the interruption will occur). This means that you may be able to adapt your behaviour to mitigate the consequences of the interruption.

12) How much would you be willing to pay to avoid an electricity interruption of 1 hour:
    a. … EUR
    b. I don't know

13) How much would you be willing to pay if, instead of 1 hour, the interruption lasts:
    c. 2 minutes:
        i. …EUR
        ii. I don't know
    d. 4 hours:
        i. …EUR
        ii. I don't know
    e. 1 day:
        i. … EUR
        ii. I don't know

Scenario 2: typical winter peak

Suppose it is [month, day, hour to be specified at national level]. This is the moment in winter where electricity consumers have the highest demand in our country.

Interruption type A: no notice given

Your electricity provider interrupts your electricity supply because of an event beyond its control. Your electricity supplier does not notify you in advance, consequently you experience an unexpected interruption of your electricity supply, for which you have no time to prepare.

14) How much would you be willing to pay to avoid an electricity interruption of 1 hour:

f. … EUR
g. I don't know

15) How much would you be willing to pay to avoid an interruption that, instead of 1 hour, lasts:
   h. 2 minutes:
      i. …EUR
      ii. I don't know
   i. 4 hours:
      i. …EUR
      ii. I don't know
   j. 1 day:
      i. … EUR
      ii. I don't know

Interruption type B: notice given

Now imagine that you face an interruption of electricity supply in the same moment as above [month, day, hour], but you get a 1-day notice on the interruption. This means that you may be able to adapt your behaviour to mitigate the consequences of the interruption.

16) How much would you be willing to pay to avoid an electricity interruption of 1 hour:
   f. … EUR
   g. I don't know

17) How much would you be willing to pay if, instead of 1 hour, the interruption lasts:
   h. 2 minutes:
      i. …EUR
      ii. I don't know
   i. 4 hours:
      i. …EUR
      ii. I don't know
   j. 1 day:
      i. … EUR
      ii. I don't know

Annex 2 – Non-binding guidelines to estimate WACC

1. The following paragraphs set out non-binding guidelines to calculate a WACC value. The proposed methodology is to calculate the real WACC based on the following formula:

$$WACC = \frac{1 + \left[CoE \cdot \frac{1-g}{1-t} + CoD \cdot g\right]}{1+i} - 1$$

where:

- CoE represents the cost of equity, as defined in paragraph (2);
- CoD represents the cost of debt, as defined in paragraph (7);
- g represents the gearing, as defined in paragraph (9);
- t corresponds to tax rate, as defined in paragraph (10);
- i represents the long-term inflation rate of the Euro zone.

2. The cost of equity can be expressed as:

$$CoE = r_f + \beta \cdot ERP + CRP$$

where:

- r_f represents the nominal risk-free rate, as defined in paragraph (3);
- ERP corresponds to the equity risk premium, as defined in paragraph (4);
- β is the equity beta, as defined in paragraph (5);
- CRP corresponds to the country risk premium, as defined in paragraph (6).

3. For all MSs, the nominal risk-free rate shall be determined based on average past yield observations of the Eurozone country with the best credit rating. Maturity of bonds shall be consistent with the economic lifetime of each reference technology and be liquid enough to provide representative results.

4. The equity risk premium shall measure the extra return that is required by rational private investors for shifting their money from a risk-free investment into a diversified equity portfolio. Several approaches can be used to estimate this equity risk premium (historical data, estimated based on forecasts or survey results). The entity calculating CONE may refer to widely used and recognised sources to define the equity risk premium. In any case, the entity calculating CONE shall ensure that assumptions made to calculate equity risk premium are consistent with choices made to define the nominal risk-free rate.

5. Equity beta is a measure of the relative risk of the investment compared to the market as whole. It can be inferred from capital market evidence for peer companies based on the following steps:

   (a) peer companies shall be determined: they must be publicly traded, have characteristics similar to a potential firm investing in the reference technology and be exposed to the same systematic risk (comparable business line, region, size, risk profile, etc.);

   (b) For each peer company, a raw beta shall be determined by the use of regression techniques based on historical data;

   (c) The entity calculating CONE may apply an adjustment to the calculated raw beta to improve the accuracy of the final estimation (e.g. based on the Blume adjustment);

   (d) The entity calculating CONE shall un-lever the equity beta of each firm by determining its asset beta (for instance based on the Hamada formula). Then the average asset beta over

the peer group shall be converted into equity beta using the gearing value defined according to paragraph (9).

6. For each MS, the country risk premium measures the additional premium on equity that a company investing in the MS would require compared to an identical firm investing in the country used to define the nominal risk-free rate according to paragraph (3). The country risk premium can be computed based on additional default premium required by rational private investors to hold bonds in the MS, compared to the reference country's bonds, or based on values provided in the literature.

7. The cost of debt can be determined as:

$$CoD = r_{\mathrm{f}} + D_{\mathrm{p}}$$

where:

- (r_{f}) represents the nominal risk-free rate, defined according to paragraph (3);
- (D_{p}) represents the debt premium, defined according to paragraph (8).

8. The debt premium represents the expected compensation of creditors of investments of a specific risk category compared to a risk-free investment. The debt premium can be determined based on

(a) spread of publicly-traded debts from peer companies which are likely to invest in the reference technology (when debt has been raised); or

(b) default spread associated with credit ratings of peer companies which are likely to invest in the reference technology. In any case, maturity of debts considered to define the debt premium shall be consistent with maturity considered for the calculation of the nominal risk-free rate according to paragraph (3) and with the economic lifetime of the reference technology.

9. Gearing refers to the proportion of debt in the total asset value. Gearing shall be determined based on observable gearing for publicly-traded companies which are likely to invest in the reference technology.

10. The tax rate shall represent the corporate income tax rate applied in the MS for companies which are likely to invest in the reference technology.

11. In case a MS has a currency different from the Euro, the WACC computed according to paragraph (1) may be corrected according to the following equation so that it may apply to cash flows expressed in local currency:

$$WACC_{local\ currency} = (1 + WACC_{\mathrm{Euro}}) \cdot \frac{1+i}{1+j} - 1$$

Where:

- $WACC_{\mathrm{euros}}$ represents the WACC computed according to paragraph (1);
- i corresponds to long term inflation rate estimate of the Euro zone;
- j corresponds to long term inflation rate estimate of the local currency.

Annex 3 – Possible corrections for RS

1. If assumptions set out in Article 19(2) are not met, the entity calculating RS may apply corrections to the formula described in Article 18(2) or (4).

2. For each assumption, possible corrections are as follows:

   (a) Where a reference renewal/prolongation or a reference new entry is energy-constrained (e.g. DSR or storage), the consistency between the de-rating capacity factor used in the definition of CONE or CORP and the marginal reduction of EENS, $\frac{dEENS[Q]}{dQ}$ shall be thoroughly verified.

   (b) In electric systems where an additional capacity resource brings a non-negligible increase or reduction in costs C (in the electricity sector or in other sectors, such as e.g. heat), other than fixed and variable costs related to ENS avoided (e.g. batteries or DSR operating on the energy market), the formula for the LOLE threshold may be updated as:

$$LOLE_{RS} = \frac{CONE_{fixed} + \frac{dC}{dQ}}{VOLL_{RS} - CONE_{var}}$$

   where C is equal to costs for the electricity and other sectors, other than fixed and variable costs related to ENS avoided and Q denotes the installed capacity of the capacity resource. For reference renewals/prolongations, CORP shall be used instead of CONE.

   In this case, the methodology used for dC/dQ calculation shall be communicated transparently, and shall be consistent with the ERAA methodology.