European Network of
Transmission System Operators
for Electricity

entsoe

All TSOs' proposal for the methodology and assumptions that are to be used in the bidding zone review process and for the alternative bidding zone configurations to be considered in accordance with Article 14(5) of Regulation (EU) 2019/943 of the European parliament and of the Council of 5th June 2019 on the internal market for electricity

18 February 2020

Contents

All Transmission System Operators taking into account the following:

Whereas

(1) This document is a common proposal developed by all Transmission System Operators (hereinafter referred to as "**TSOs**") regarding the methodology and assumptions that are to be used in the bidding zone review process and for the alternative bidding zone configurations to be considered pursuant to Article 14(5) of the Regulation (EU) 2019/943 of the European Parliament and Council of 5th June 2019 on the internal market for electricity (recast) (hereinafter referred to as the "**IME Regulation**"). This proposal is hereinafter referred to as the "**BZ Review Methodology**".

(2) The BZ Review Methodology takes into account the general principles and goals set in the IME Regulation and in Regulation (EC) 2015/1222 establishing a guideline on capacity allocation and congestion management (hereinafter referred to as the "**CACM Regulation**").

(3) The BZ Review Methodology allows for a definition of bidding zones in a manner to ensure market liquidity, efficient congestion management and overall market efficiency as set forth in recital 19 of the IME Regulation

(4) The BZ Review Methodology is based on structural congestions as set forth in Article 14(5) of the IME Regulation.

(5) The BZ Review Methodology balances the need for expeditiousness with practical considerations as set forth in Article 14(10) of the IME Regulation by pondering the requirement of Article 14(5) for the IME Regulation to consider structural congestions which are not expected to be overcome within the following three years, taking due account of tangible progress on infrastructure development projects that are expected to be realized within the following three years with the availability of input data for the BZ review as well as with the possibility for member states to opt for an action plan to overcome the structural congestions inside its bidding zone until 31 December 2025 as set forth in Article 15(2) of the IME Regulation.

(6) The BZ Review Methodology is a common proposal of all relevant TSOs taking due consideration of regional specificities.

SUBMIT THE FOLLOWING BIDDING ZONE REVIEW METHODOLOGY TO ALL REGULATORY AUTHORITIES:

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Article 1
Subject Matter and Scope

(1) The BZ Review Methodology is the common proposal of all relevant TSOs in accordance with Article 14(5) of the IME Regulation.

(2) The BZ Review Methodology defines the methodology and assumptions that are to be used in the bidding zone review process and for the alternative bidding zone configurations to be considered.

Article 2
Definitions and Interpretation

(1) For the purposes of the BZ Review Methodology, the terms used shall have the meaning given to them in Article 2 of the IME Regulation and in Article 2 of the CACM Regulation. In case of inconsistencies, the definitions of Article 2 of the IME Regulation shall prevail.

(2) In this BZ Review Methodology, the following abbreviations are used:

(a) ACER: Agency for Cooperation of Energy Regulators;

(b) BZ: Bidding Zone;

(c) BZR: Bidding Zone Review;

(d) BZRR: Bidding Zone Review Region;

(e) CCR: Capacity Calculation Region;

(f) CACM: Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management;

(g) CGM: Common Grid Model;

(h) CNE: Critical Network Element;

(i) CNEC: Critical Network Element and Contingency;

(j) FRM: Flow Reliability Margin;

(k) GSK: Generation Shift Keys;

(l) HHI: Herfindahl-Hirschman Index;

(m) HVDC: High Voltage Direct Current network element;

(n) LF&SA: Load Flow and Security Analysis;

(o) LMP: Locational Marginal Pricing;

(p) LODF: Line Outage Distribution Factors;

(q) MACZT: Margin Available for Cross-Zonal Trade;

(r) NTC: Net Transfer Capacity;

(s) PECD: Pan-European Climate Database;

(t) PEMMDB: Pan-European Market Modelling Database;

(u) PST: Phase Shifting Transformer;

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

(v) PTDF: Power Transfer Distribution Factor;

(w) RAM: Remaining Available Margin;

(x) TSO: transmission system operator;

(y) TYNDP: Ten-Year Network Development Plan.

(3) In the BZ Review Methodology the following terms shall be defined:

(a) 'Bidding Zone Review Region' means region which is a set of Bidding Zones for which collectively a Bidding Zone Review is to be performed;

(b) 'Critical Network Element and Contingency' means a Critical Network Element (CNE) associated with a Contingency used in capacity calculation. For the purpose of this methodology, the term CNEC also covers the case where a CNE is used in capacity calculation without a specified Contingency;

(c) 'Expert-Based Assessment' refers to an approach to define alternative bidding zone configurations, based on a selection of ex-ante defined configurations encompassing splitting or merging of the existing bidding zones. Since these configurations are defined by the concerned TSOs based on their expert assessment (using quantitative analysis to support the choice), these are referred to as expert-based configurations;

(d) 'Energy Not Served' refers to the missing MWh to reach generation per year.

(e) 'Expected Energy Not Served' refers to the expected missing MWh to reach generation per year.

(f) 'Flow Reliability Margin' means the Reliability Margin as defined in Article 2(14) of the CACM Regulation applied to a CNE;

(g) 'Loss of Load Expectation' refers to the predicted hours of no supply per year.

(h) 'MACZT' means the margin available for cross-zonal trade, i.e. the portion of capacity of a CNEC available for cross-zonal trade;

(i) 'Model-Based Assessment' refers to an approach to define alternative bidding zone configurations, based on a model-based (greenfield) approach. The approach is based on two steps: in a first step, a nodal (locational marginal price) market design is simulated, and in a second step, the nodes are clustered in order to constitute a bidding zone;

(j) 'Net Transfer Capacity' means the cross-zonal capacity calculated with the (coordinated) net transmission capacity calculation approach, as defined in Article 2(8) of the CACM Regulation;

(k) 'Power Transfer Distribution Factors' means indicator which describes the impact of a bidding-zone net position or of a commercial exchange between two bidding-zones on a CNEC;

(l) 'Remaining Available Margin' means margin of a CNEC for the considered capacity calculation market time unit.

(m) 'Remaining Capacity Margin' means difference between the maximum available generation capacity and the maximum hourly load per hour.

(n) 'Monetized Benefit' means societal benefit that an alternative bidding zone configuration is expected to entail in terms of Euros with respect to the status quo bidding zone configuration, while considering that impacts of the bidding zone amendments as much as possible by their economic value.

(4) In the BZ Review Methodology, unless the context requires otherwise:

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

(b) headings are inserted for convenience only and do not affect the interpretation of the BZ Review Methodology; and

(c) any reference to legislation, regulations, directives, orders, instruments, codes or any other enactment shall include any modification, extension or re-enactment of it when in force;

(d) any reference to an Article without an indication of the document shall mean a reference to the BZ Review Methodology.

Article 3
Overview of the Bidding Zone Review process

(1) The TSOs of each Bidding Zone Review Region (hereinafter "**BZRR**") shall perform a Bidding Zone Review consisting out of the following steps:

(a) The definition of the exact scenarios and assumptions considered by TSOs of each BZRR, for elements not defined yet by this BZ Review Methodology;

(b) Performing the simulation chain as described in Article 6 of BZ Review Methodology according to these scenarios and assumptions;

(c) The evaluation of the criteria describing the performance of the configurations resulting from the simulation chain according to Article 13 of BZ Review Methodology;

(d) The determination and publication of a final recommendation on maintaining or amending the bidding zones within the BZRR.

Article 4
Configurations

(1) The BZ Review shall be carried out on a regional level by the TSOs of each BZRRs.

(2) The following BZRRs and BZs shall be considered in the BZ Review:

(a) **The BZRR Central Europe** comprises the Bidding Zones: France, Belgium, The Netherlands, Germany/ Luxembourg, Austria, Czech Republic, Poland, Slovakia, Hungary, Slovenia, Croatia, Romania, Denmark 1, Switzerland and Italy 1 (Nord);

(b) **The BZRR Nordic** comprises the Bidding Zones: Finland, Sweden 1, Sweden 2, Sweden 3, Sweden 4, Norway 1, Norway 2, Norway 3, Norway 4, Norway 5 and Denmark 2;

(c) **The BZRR South-East Europe** comprises the Bidding Zones: Bulgaria and Greece;

(d) **The BZRR Central Southern Italy** comprises the Bidding Zones: Italy 2 (Cnor), Italy 3 (Csud), Italy 4 (Sud), Italy 5 (Sici), Italy 6 (Sard), and Italy 7 (Rosn/Cala);

(e) **The BZRR Iberian Peninsula** comprises the Bidding Zones: Spain and Portugal;

(f) **The BZRR Baltic** comprises the Bidding Zones: Estonia, Latvia and Lithuania;

(g) **The BZRR Ireland** comprises the Bidding Zone: Ireland Single Electricity Market;

(h) **The BZRR United Kingdom** comprises the Bidding Zone: Great Britain.

(3) The TSOs of a BZRR shall deliver a set of bidding zone configurations for their BZRR which are to be used in the BZR Process. These sets of configurations contain the current BZ configuration (also referred to as status quo configuration) as the benchmark configuration and additional alternative configurations.

(4) If sufficient justification is provided on the absence of structural congestions that have impact on neighbouring bidding zones under the consideration of applicability of the 70% criterion as intended in Article 16(8) of the IME regulation, TSOs of a BZRRs may submit only the status quo configuration, subject to approval of all national regulatory authorities. In this case, no alternative configurations will be investigated by the TSOs of these BZRRs in the BZ Review.

(5) An overview of the sets of configurations to be used in the BZR process is given in Annexes of this BZ Review Methodology. Configurations are based on an Expert-Based Assessment, a Model-Based Assessments or a combination of both.

Article 5
Scenarios and assumptions

(1) **Target year.** For BZR purposes, target year is a year that is represented in BZR calculations. TSOs of a BZRR may perform sensitivity analyses or complete additional model runs for other target years than the Base Year as defined in paragraph 2.

(2) **Base year** Pursuant to Article 14(5) of the IME Regulation, the BZ review shall be based on structural congestions which are not expected to be overcome within 3 years from methodology approval (hereinafter referred to as "**Base Year**"). The data set used for the Base Year shall be based on the TYNDP scenarios available at the time of performance of the BZ Review.

(3) **Grid data.** For the Base Year, the network model shall be based on the most recent TYNDP process for the available reference grid taking into account at least the relevant network elements operating at voltage levels of 220 kV and higher. In case additional target years would be analysed, network models shall be developed for those years as well. The level of detail of the grid data may vary for the Bidding Zones within the BZRR and shall be determined by the TSOs of the BZRR. The modelling of BZs outside the BZRR may also be simplified, if appropriate. The grid model can include the following adjustments:

(a) TSOs can apply topological changes in their own grid such as opening or closing circuit breakers or busbar breakers, as long as these assumptions are estimated to be suited to the Bidding Zone Review.

(b) If a TSO shows that including 220 kV model results leads to less representative model results, the inclusion of the 220 kV grid is not mandatory.

(c) If one or more TSOs of a BZRR deems that the inclusion of part of the lower voltage levels than 220 kV improves the model, these may also be included.

(4) **Weather years**. Load and a number of generation technologies are dependent on their climatic conditions which are represented in the data as weather years. The model shall be run for at least one representative weather year which may be derived from the TYNDP clustering process. TSOs of a BZRR may run the model and base their final recommendations on multiple weather years as well.

(5) **Load data.** Zonal load data shall be based on the demand data from the Pan-European Market Modelling Database (hereinafter "**PEMMDB**") 'National Trends' scenario for the relevant target year.

(a) As load data is weather dependent, the TSOs of a BZRR shall run the model at least for the weather year defined in paragraph 3 of this Article.

(b) The load data shall be disaggregated to nodal level as defined under paragraph (8).

(c) Demand elasticity is represented via demand side response as defined in the PEMMDB 'National Trends' scenario. The remaining load will be considered inelastic with respect to the market price.

(6) Generation data. Zonal generation data shall be based on the generation data from the PEMMDB 'National Trends' scenario for the relevant target year.

(a) Zonal generation data, such as solar and wind capacity, shall be disaggregated to nodal level as defined under paragraph (8).

(b) Generation data directly connected to the modelled network shall be mapped to the appropriate nodes of the grid model.

(c) Weather dependent generation technologies shall be based on the resource potential time series as generated for the PEMMDB in the Pan-European Climate Database (PECD) for the weather years defined according to paragraph 3 of this Article. Other weather data sources of equal or higher quality may also be used.

(7) Other assumptions. Fuel and CO_2 prices shall be based on the data collected for the most recent TYNDP process for the relevant target year.

(8) Disaggregation to nodal level. To allow for the analysis of alternative zones and for the optional case of an analysis of locational prices, zonal generation and load data from PEMMDB will be disaggregated to nodal level by the TSO operating those nodes, in line with the TYNDP methodology. The TSOs shall provide an explanation on the method used for the disaggregation if not in line with the TYNDP methodology. Generation and load data from zones with a simplified modelling approach (e.g. zones outside of the BZRR) will not be mapped to a nodal level but be considered on a zonal level. Nodal level in this Methodology is understood as the level of substations of the represented voltage levels as described in paragraph 2. Substations at voltage levels not represented in the grid model shall be aggregated to the most relevant substations represented in the models.

(9) Sensitivity analysis. TSOs of a BZRRs may decide to perform additional sensitivity analyses by variation in any of the input data or grid infrastructure. Such additional sensitivity analysis is not mandatory to be performed by the TSOs of a BZRR.

Article 6
Modelling chain

(1) In order to assess the criteria as described in Article 13, the TSOs shall develop a series of steps in a consecutive modelling chain to represent the trade and the flows of electricity through the BZRR electricity grid within the scenario described under Article 5. The steps may be internal to the modelling tool, but results are available for each step. The steps comprise:

(a) For BZRRs where a flow-based approach is used, NTC base case and flow-based capacity calculations to determine the flow-based parameters for the market coupling process;

(b) For BZRRs where an NTC approach is used, NTC capacity calculations to determine one NTC value per BZ border and per direction for the market coupling process;

(c) A market coupling algorithm to determine the final market dispatch of generation;

(d) Load flow calculations based on the results of the market coupling process to determine flows through the electricity network;

(e) An operational security analysis to determine congestions within the electricity grid;

(f) A redispatch simulation/analysis to determine the amount of required remedial actions and their costs as defined in Article 10;

(g) An analysis of flows not induced by cross-zonal trade to determine the effects of the assessed bidding zone configuration on flows in other bidding zones caused by internal trades;

(2) The model shall be run for data at a minimum resolution of every third hour.

(3) For calculations the modelling chain shall make use of the Value Of Lost Load ("VOLL").

Article 7
Capacity calculations

(1) The TSOs shall determine cross-zonal capacities on all borders relevant for the market coupling. The capacity calculation performed for this purpose can be based on NTC approach or on Flow Based approach.

(2) The choice between NTC approach and Flow Based approach shall be made for each BZ border. For existing BZ borders, if technically possible, it shall be made according to the capacity calculation approach that is foreseen to be in use on the given border in the target year. For non-existing BZ borders studied within the configurations, TSOs shall justify their choice of methodology. The possible methodologies for these capacity calculations are described in this Article.

(3) Due to the high level of uncertainty and the risk of an excessive complexity of the modelling chain, TSOs shall strive towards simplification in capacity calculation in comparison to currently operational capacity calculation processes. A trade-off between accuracy of results and simplification shall be aimed at.

(4) **IME Regulation Article 16 requirement**. The IME Regulation requirement on margins available for cross-zonal trade (70%) shall be applied in the capacity calculation taking into consideration:

(a) the information available at the time of BZ Review Methodology approval regarding the MACZT target for each CNEC, taking into account any reductions due to approved action plans and derogations;

(b) indications provided in Recommendation of the ACER of 8 August 2019 on the implementation of the minimum MACZT pursuant to Article 16(8) of IEM Regulation or any other indications or guidelines provided by the NRAs about how to calculate this percentage, as long as they are available within a time period allowing for their consideration in the modelling, e.g. if TSOs receive them reasonably in advance;

(c) the information available at the time of BZ Review Methodology approval about how the different capacity calculation regions plan to implement this requirement in their methodology;

(d) any simplification necessary within the scope of the Bidding Zone Review to avoid excessive complexity.

(5) **Approaches for NTC capacity calculation**. On borders where NTC approach is chosen as well as for the NTC base case calculation within the flow-based approach, TSOs shall choose from the methods listed below. The choice shall be explained taking into account regional specificities.

(a) **NTC approach based on thermal limits**. In this approach, the NTC on a BZ border is calculated as a ratio of the sum of thermal limits of the tie-lines:

i. On each border, the sum of the thermal limits is computed. The NTC on each border is then determined as a percentage (x%) of the sum of the thermal limits.

ii. The percentage x shall be calibrated in a way that gives the closest results on existing borders with the current or foreseen capacity calculation processes. This value of x is then applied to the hypothetical BZ borders that are studied within the configurations.

iii. The time resolution of the NTCs computed with this method shall reflect the time resolution of the tie-lines thermal limits (for instance seasonal ratings).

(b) **NTC approach based on process-specific computations**. In this approach, NTCs are computed by TSOs in a way that takes into account the specificities of the considered CCR and that reflects current or foreseen capacity calculation practices in that CCR. The method shall be based on the following principles:

i. TSOs determine a GSK and a list of CNECs for each bidding zone according to the current or foreseen practices. Different situations of commercial exchanges are created using the GSKs and the resulting grid situations are assessed using the lists of CNECs to detect congestions. Non-costly remedial actions can be taken into account to solve congestions.

ii. For each border, a maximum commercial exchange allowing operational safety (and taking into account impact of exchanges on neighbouring BZ borders) is determined. This maximum value may be determined through a dichotomy process. A transmission reliability margin may be applied.

iii. This calculation shall be carried out on a set of timestamps selected by TSOs in a way that reflects a representative panel of possible grid situations.

(c) **NTC approach based on PTDF**. In this approach, the impact of cross-zonal trade on physical flows is modelled in a linear way through PTDFs. PTDF computation is based on GSKs and CNECs like for the Flow Based approach but considering cross-zonal trade across a single border. NTC values on this border are determined as the maximum exchange not creating any overload on the CNECs considered in the computation. Non-costly remedial actions can be taken into account to solve congestions.

(d) **NTC approach based on TYNDP** for existing borders. For existing borders, where appropriate and relevant, TSOs can use existing NTC values calculated as part of TYNDP process.

(6) Flow Based approach. On borders where Flow Based approach is chosen, the inputs of the capacity calculation shall be determined in accordance with paragraph 7 (Generation Shift Keys), paragraph 8 (CNEC selection) and paragraph 9 (Flow reliability margins) of this Article. The NTC values for the NTC base case shall be computed in line with one of the methods described in paragraph 5 (Approaches for NTC calculation). Non-costly remedial actions can be taken into account to solve congestions and optimise the capacities computed with the flow-based approach. Internal HVDC links and cross-border HVDC links shall be taken into account and their modelling shall be in accordance with capacity calculation methodologies as far as technically feasible.

(7) Generation Shift Keys. The selection of Generation Shift Keys shall be made in a way that is in line with foreseen practices in the relevant CCR, taking into account any simplification deemed necessary for the scope of the BZR.

(8) CNEC selection. TSOs shall choose a set of criteria to select the CNECs among the possible criteria given below. The set of criteria shall be chosen in a way that reflects foreseen practices or according to current approved regulation with simplifications, where necessary, in the given CCR and shall apply to all the bidding zones considered within the given CCR. Contingencies can include generators. The possible criteria to choose from are the following:

(a) Inclusion by default of certain voltage levels or exclusion by default of certain voltage levels;

(b) Inclusion by default of all tie-lines;

(c) Inclusion by default of all grid elements directly connected to a tie-line;

(d) Exclusion of all elements not affected by cross-zonal exchanges for topological reasons: radial connections or grid elements connected to the bulk of the network via radial connections;

(e) Selection of CNECs based on PTDFs. PTDFs are computed in the considered CCR. All CNECs with at least one PTDF value above a certain threshold (to be determined and justified by TSOs, in accordance with capacity calculation methodologies) are selected;

(f) Principle of dominant contingency. For each CNE, only the contingency (or contingencies) leading to the highest PTDF value(s) in both directions are kept;

(g) Principle of defining the most critical operation security limit.

(9) Flow Reliability Margins. The flow reliability margins shall be computed following the current or foreseen practices in the considered CCR.

(10) Output. The capacity calculation shall provide the following results for each timestamp simulated in the rest of the simulation chain:

(a) For BZ borders where NTC approach is used: one NTC value per BZ border and per direction.

(b) For BZ borders where Flow Based approach is used: the list of CNECs, the zonal PTDFs, FRMs and RAMs for these CNECs.

(c) For all BZ borders: the list of non-costly remedial actions applied during capacity calculation and a grid model resulting from the implementation of these non-costly remedial action. This grid state shall be used for the load flow calculation after market coupling.

Article 8
Market coupling

(1) The market coupling algorithm as intended in Article 6 paragraph 1c shall be built up as a linear optimization matching generation with demand with the target of minimizing the total system cost while considering network constraints based on capacity calculation practices.

(a) Optionally and if technically feasible, mixed integer optimization can be used instead of linear optimisation for a more correct representation of start-up and shut-down behaviour of power plants or a better depiction of hydro power plant constraints.

(2) The market coupling algorithm shall take as input load and generation data as described in Article 4 paragraphs 4 and 5.

(3) Representation of network constraints shall take into account the IME Regulation Article 16 as described in Article 7 paragraph 4, and can be as either NTC or flow based:

(a) For bidding zone borders where NTC capacity calculations are applicable, NTC values as determined by the NTC capacity calculation as described in Article 7 paragraph 5;

(b) For regions in which flow based capacity calculation is applicable, the market coupling algorithm shall use for its calculations the list of CNECs, the zonal PTDFs, FRMs and RAMs for these CNECs as calculated in the flow-based capacity calculations as defined under Article 7 paragraph 6,

(4) The market coupling algorithm will result in a power plant dispatch starting with the assumption of perfect competition, i.e. power plants are assumed to operate in the market in a way that leads to cost minimization. The following assumptions about power plant behaviour are taken:

(a) Thermal power plants bid according to their short-run marginal costs, including fuel costs, CO_2 costs, variable operation and maintenance costs as well as relevant start-up costs. In case the power plants have must-run constraints due to e.g. combined heat and power production, industrial process connection or other reasons, the simulation ensures that must-run obligation is always followed.

(b) Wind and solar power plants bid at a marginal cost of €0,00 per MWh by default. However, other bidding prices are possible in case where, subject to subsidy schemes or technical restrictions, it is not likely that the plants would stop their output when marginal price reaches zero. The load factors of weather dependent generation technologies shall be estimated via historical weather profiles. The used data is a combination of installed capacity and load factors as determined for the relevant weather year as set forth in Article 5 paragraph 3.

(c) Regulated (reservoir) hydro power plant bidding strategy may be optimized, subject to constraints set in power plant data. Stochasticity ("water value calculation") or perfect foresight, depending on which approach better describes the hydro power plant behaviour in the respective BZRR might be included. Unregulated hydro power shall be based on unregulated inflow from historical weather profiles for the respective weather year as specified in Article 5 paragraph 3.

(d) Pump storage power plants shall optimize their generation and pumping consumption based on market price signals and constraints set in power plant data. Reservoir inflow shall be estimated by historical weather data as specified in Article 5 paragraph 3.

(e) Large biomass power plants may be represented either as conventional power plants similar to category (a) if the output depends on marginal costs, or fixed infeed time series if the output is price-independent.

(f) Other non-renewable power plants not included under category (a) are represented with infeed time series and a marginal cost that reflects the projected bidding price of the units.

(g) Other Renewable power plants not specifically modelled are represented with load factor time series.

(h) Any other technologies shall be represented in the model in accordance with estimated impact on results and reliability/availability of input data.

(i) If considered relevant, sensitivity analysis can be performed in order to test the effects of different bidding behaviours.

(5) Representation of load

(a) Load input refers to electricity demand, including final electricity use and grid losses but excluding power plant self-consumption. Load flexibility is represented by demand side response. The rest of the load is assumed to be inflexible and represented by a fixed time series for the relevant weather year. In case inflexible load needs to be shed, the Value Of Lost Load (VOLL) shall be assumed as the cost of the shedding.

(b) Demand side response shall be utilized based on its projected availability and cost in the scenario according to the scenarios as described in Article 5 paragraph 4.

(6) Starting from installed power plant capacities, it shall be possible to reserve part of the available capacity for the energy only market for operating reserves and/or balancing mechanisms based on data from PEMMDB.

(7) The market coupling algorithm shall provide as a result the following:

(a) For each time stamp considered and for each represented generating unit the amount of production in MW;

(b) For each time stamp considered the zonal electricity prices in € per MWh;

(c) For each time stamp for each zone the net positions will be determined in MW;

(d) For each time stamp Commercial exchanges between zones;

(e) List of number of occurrences that CNECs were active constraints in case flow-based market coupling applies.

Article 9
Operational security analysis

(1) Based on the optimization results delivered by market simulations, calculations for operational security analysis are performed in order to detect at least power flows exceeding operational security limits in the N-situation and (N-1) situation.

(2) First, the TSOs of a BZRR shall establish a contingency list to be used as basis for the operational security analysis for that BZRR, on the basis of the following principles:

(a) The chosen set of contingencies to be investigated for operational security analysis is independent of the CNEC selection for capacity calculation.

(b) At least all network elements of voltage levels 220 kV and higher that are relevant for the transmission system, subject to current or foreseen practices, are included by default as contingency in the contingency list.

(c) Where deemed necessary in order to detect constraints as listed in (1), network elements of voltage levels below 220 kV can be included as well as contingency in the contingency list.

(d) Occurrences of a loss of (a) power generating module(s) can also be included as contingency in the contingency list

(3) The operational security analysis is carried out for each contingency included in the contingency list.

(4) TSOs shall decide whether seasonal line ratings should be considered.

(5) The detected violated constraints as defined in (1) shall be considered by remedial action simulation in accordance with Article 10.

(6) Due to model simplifications and time constraints regarding the process, the DC load flow calculation approach is recommended. Compared to AC load flow calculation, the DC approximation limits the computational burden for simulating the grid model. Further, this approach is in line with the chosen load flow calculation methods in the previous steps of the BZR model chain.

(7) Optionally, AC load-flow calculations may be performed under certain circumstances:

(a) For certain geographical regions, if agreed by the TSOs of the BZRR.

(b) For the recalculation of cases where DC load flow results are close to the defined operational security limits of network elements.

(8) The load-flow calculations and contingency analysis shall provide as a result the following:

(a) A list of violations found in the operational security analysis including the name of the affected network element, its contingencies and a quantitative description of the constraint violation.

Article 10
Remedial action simulation

(1) A remedial action simulation shall take as input the resulting flows and overloads from the load-flow and security analysis as well as the results from the market coupling simulation.

(2) The use of non-costly remedial actions (PST tap positions and topological actions) shall be simulated as much as possible to reflect operational practices of TSOs. Non-costly remedial actions shall have priority over costly remedial actions. Non-costly remedial actions include at least:

(a) PST tap positions as preventive and/or curative remedial action: use of a range of tap positions to solve congestions

(b) Topological actions: opening or closing a busbar breaker, opening or closing a circuit breaker, switching loads of not represented voltage levels from one node to another (where feasible).

(c) Power flow control using HVDC.

(3) In case a full simulation of non-costly remedial actions is not feasible within the simulation chain due to technical difficulties, there is a risk that this leads to an over-estimation of redispatching costs. TSOs who show that this over-estimation is significant in their control area can use one of the methods listed below to improve the consideration of non-costly remedial actions. The results of those actions shall be used either to apply a correction to the redispatching costs in their area or to estimate the uncertainty on the computed redispatching costs and other relevant results. In the latter case, this uncertainty shall be considered in the assessment of indicators and stated in the result's study.

(a) Exclusion of certain grid elements from the redispatching calculation: the concerned TSO determines the grid elements for which non-costly remedial actions exist that allow to solve congestions and removes those grid elements from the list of elements considered during the optimisation of costly remedial actions.

(b) Limited assessment of non-costly remedial actions: the TSO performs a full optimisation of non-costly remedial on a representative subset of timestamps after market coupling and security analysis. This optimisation can be performed manually or with any suited software outside the BZR simulation chain. By running the redispatching calculation with and without implementation of these non-costly remedial actions, the impact of non-costly remedial actions on redispatching costs and other relevant results is assessed.

(4) Costly remedial actions shall be represented through a cost-based optimization by running an optimal power flow calculation. The redispatch simulation shall be in line with the European redispatch target model as given in Article 13 of the IME Regulation. The optimization therefore shall be performed for the entire BZRR irrespective of the bidding zone or control area borders. The additional power flow calculation shall be targeted to a minimal cost change as compared to the initial unit dispatch resulting from the Market Coupling simulation described under Article 8 while solving (N-1) overloads. The redispatch simulation shall take into account the following:

(a) TSOs shall assess for each generation technology or generation unit within their control area whether it should be made available for the redispatch simulation, considering the actual and likely practices in their respective control area for the respective target year.

(b) The available capacity of generation and demand side management shall be based on the unit dispatch from the market coupling simulation as described in Article 8.

(c) Prices of the capacity activated for redispatch shall be based on the costs of the respective generation type and shall include an additional factor representing opportunity costs, or other mark-ups, if applicable according to foreseen regulations and TSO practices.

(5) The redispatch simulation shall result in:

(a) A new unit dispatch for each unit represented in the grid model;

(b) By comparison with the original unit dispatch after market coupling, the total volume dispatched for the sake of remedial action in MW for each time stamp under consideration;

(c) By comparison with the original unit dispatch according to market coupling, the total additional system costs in euro for each time stamp under consideration.

Article 11
Analysis of flows not induced by cross-zonal trade

(1) In order to calculate flows not induced by cross-zonal trade, the TSOs of a BZRR shall calculate the flow in the situation without any commercial exchanges between the bidding zones of the BZRR, and between the bidding zones from the BZRR and bidding zones from other BZRR. The DC interconnectors shall be modeled as additional bidding zones and a GSK of 1 at the connection point shall be assumed. The basis for this calculation is the CGM used as input for the Capacity Calculation.

$$\vec{F}_{0,all} = \vec{F}_{ref} - \mathbf{PTDF}_{\boldsymbol{all}} \overrightarrow{NP}_{ref,all}$$

With

$\vec{F}_{ref}$	flow per CNEC in the CGM
$\vec{F}_{0,all}$	flow per CNEC in a situation without any commercial exchanges between the bidding zones of the region, between the bidding zones of the region and the bidding zones outside the regions remaining in the same synchronous areas and between the bidding zones from the region and bidding zones from other synchronous areas.
$\mathbf{PTDF}_{\boldsymbol{all}}$	power transfer distribution factor matrix (same as in capacity calculation, where available) for all bidding zones considered (in and outside the region) and all the CNECs of the region
$\overrightarrow{NP}_{ref,all}$	total net positions per bidding zone considered (inside and outside the region) included in the CGM.

(2) $\vec{F}_{0,all}$ represents flows not induced by cross-zonal trade on all the cross-border lines.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

(3) In order to carry out the calculation of flows not induced by cross-zonal trade, alternative methodologies may be used additionally, if agreed upon by TSOs of a BZRR.

Article 12
LMP analysis

(1) Carrying out an LMP analysis is an optional part of the modelling chain. The decision whether to include an LMP analysis lies with the TSOs of a BZRR.

(2) The LMP analysis is supposed to be carried out using an optimization algorithm, minimizing the total system costs with subject to at least the following aspects:

(a) The capacity of the relevant network elements;

(b) The nodal energy balance;

(c) The capacity limits of each power plant. With regard to this criterion, TSOs shall have the option to use a linear relaxation.

(3) The (N-1)-criterion shall be considered at least with a limited list of critical outages e.g. calculated based on LODF and PTDF matrices.

(4) Topological measures shall be taken into account within the analysis. Due to high computational requirements within the framework of an LMP simulation, topological measures should not be part of the optimization problem. BZRRs shall have the option to decide whether:

(a) TSO experts apply topological measures manually before the LMP simulation (only possible for limited time series).

(b) The results are validated by the TSOs with, in case of unrealistic results, subsequent removal of respective grid elements and a repetition of the simulation.

(5) In case of high LMPs (positive or negative) the reason has to be investigated and, if possible, input data should be corrected, and the simulation repeated.

Article 13
Evaluation

13.1. Overview of evaluation criteria

(1) TSOs of a BZRR shall assess the current bidding zone configuration and each alternative bidding zone configuration as proposed by them for the BZRR, and they shall compare these configurations by using at least the criteria listed in Article 33 of the CACM Regulation.

(2) TSOs of a BZRR may use additional evaluation criteria to assess the alternative BZ configurations proposed for the BZRR, if decided and justified by them.

(3) The TSOs in every BZRR shall use at least the following evaluation criteria:

(a) To assess **network security**:

(i) Operational security;

(ii) Security of supply;

(iii) Degree of uncertainty in cross-zonal capacity calculation.

(b) To assess **market efficiency:**

(i) Economic efficiency;

(ii) Firmness costs;

(iii) Market liquidity;

(iv) Market concentration and market power;

(v) Effective competition;

(vi) Price signals for building infrastructure;

(vii) Accuracy and robustness of price signals;

(viii) Transition and transaction costs;

(ix) Infrastructure costs;

(x) Market outcomes in comparison to corrective measures;

(xi) Adverse effects of internal transactions on other bidding zones;

(xii) Impact on the operation and efficiency of the balancing mechanisms and imbalance settlement processes.

(c) To assess **stability and robustness of bidding zones:**

(i) Stability and robustness of bidding zones;

(ii) Consistency across capacity calculation time frames;

(iii) Assignment of generation and load units to bidding zones;

(iv) Location and frequency of congestion (market and grid).

(d) To assess **energy transition:**

(i) RES integration.

13.2. General approach

(1) TSOs shall evaluate each criterion individually according to the evaluation approaches described in Chapter 13.4.

(2) In case the TSOs find that an evaluation criterion cannot be assessed as foreseen in Chapter 13.4 due to technical limitations of the modelling and other unforeseen events, then they shall carry out a qualitative assessment of the said criterion.

(3) The geographical scope of each criterion shall be determined according to chapter 13.3.

(4) The analysis for each criterion shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(5) In case multiple scenarios are considered in the review of a BZRR (for example complete additional target year or one or multiple weather years), the results of all scenarios are combined into a single result per criterion per configuration.

(6) In case of performance of sensitivity analysis, the results of sensitivity analysis will be compared to the results of relevant target year in order to assess the robustness of the target year results with regards to the investigated sensitivity (i.e. test whether the results are valid conditional to the developments investigated in the sensitivity scenario).

(7) The overall assessment shall be made by TSOs on a BZRR level and not on a per-Member State level.

(8) The assessment shall be based on the following three-step approach:

(a) Step 1: **Economic efficiency versus Transition/transaction costs**

i. TSOs shall assess the monetized benefit of the configuration by calculating the delta between on the one hand the change in economic efficiency compared to the status quo configuration (incl. marginal costs of redispatch and an adequate CO_2 price as defined in Article 5) and on the other hand transition/transaction costs, annualized over a period of 3 years. The volume of CO_2 emissions and the amount of energy produced by RES respectively RES curtailment shall be given per configuration for information purposes.

ii. TSOs shall assess the monetized benefit, considering the following:

- If the monetized benefit is less than 0, then the configuration shall not be recommended. However, if the BZRR TSOs can justify that further assessment is needed, they can still proceed to step 2 and assess all other criteria and recommend the configuration in step 3;
- If the monetized benefit is more than 0, then the TSOs shall proceed to step 2 and assess all other criteria and recommend the configuration in step 3.

(b) Step 2: **Assessment of all other criteria**

i. Following the step 1 the TSOs shall assess all other criteria considering them as positive, neutral or negative (scale shall be +/0/-) in comparison with the current bidding zones configuration.

ii. TSOs shall provide a justification for the outcome of their assessment.

(c) Step 3: **Assessment of the final recommendation**

i. In case all criteria assessed in step 2 of this article are positive and the monetized benefit is more than 0, the alternative configuration can be recommended by the TSOs.

ii. In any other case, the severity of the criteria being assessed as negatively impacted shall be further assessed by the TSOs. To perform this severity assessment, the TSOs shall consider input from the NRAs of the relevant BZRR and other relevant stakeholders. Collection of this input shall be organized at least via an expert workshop. The outcome of the assessment of the criteria shall be either:

a. The severity of a criterion individually or the severity of the criteria collectively is classified as unacceptably negative and therefore the TSOs cannot recommend the relevant BZ configuration; or

b. The severity of none of the criteria individually nor the criteria collectively is classified as unacceptably negative and therefore the TSOs can recommend the relevant BZ configuration.

iii. In case after steps 1 to step 3(ii) only one configuration can be recommended, that configuration shall be the final recommendation by the TSOs. In case several configurations can be recommended after steps 1 to step 3(ii), then the configuration with the highest monetized benefit shall be the final recommendation by the TSOs.

iv. Assessment of the uncertainties under which the final recommendation is made shall be provided.

13.3. Geographical delimitation

(1) The evaluation criteria shall be classified into one of the following three categories:

(a) The criteria are computed and evaluated for the geographical scope of the BZRR.

(b) The criteria are given in an aggregated way with only one value for the entire simulated area.

(c) The criteria are detailed at the level of the BZRR or per BZ inside the BZRR while for BZs outside the BZRR, only one aggregated value shall be given.

13.4. Evaluation approach per criterion

(1) **"Operational security"** criterion shall be evaluated as follows:

(a) The assessment of the impact of alternative bidding zone configurations on operational security shall be based on the security analysis as described in Article 9 by assessing those indicators that ensure the transmission system security is in the normal state. The assessment shall possibly be done with the help of indicators such as the amount of redispatching available, energy not served, (N-1)-situation and N-situation violation after redispatching.

(b) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(2) "Security of supply" criterion shall be evaluated as follows:

(a) The evaluation shall be made by comparing the Remaining Capacity Margin and the Energy Not Served between the different configurations under investigation. Additionally, the Loss of Load Expectation and/or the Expected Energy Not Served may be analysed.

(b) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(3) "Degree of uncertainty in CZC calculation" criterion shall be evaluated as follows:

(a) The analysis shall be based on the identification and discussion of fundamental principles/inter-relations. At least the following sources of uncertainty for the capacity calculation shall be used:

i. inaccuracy of zonal PTDFs;

ii. generator outages compensated by frequency containment reserve / frequency restoration reserve (FCR/FRR); and

iii. changes in RES or forecast generation and load.

(4) "Economic efficiency" criterion shall be evaluated as follows:

(a) The assessment of the economic efficiency shall be based on the calculation of the socio-economic welfare. Thereby, total costs are calculated by including marginal costs of redispatch. Additionally, the RES and CO_2 impact shall be reflected appropriately (e.g. include an adequate CO_2 price as defined in Article 5.7). Furthermore, the volume of CO_2 emissions and the amount of energy produced by RES respectively RES curtailment shall be given per configuration for information purposes. The resulting socio-economic welfare shall be used in step one of the overall assessment (see chapter 13.2(8)(a)).

(b) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(5) "Firmness cost" criterion shall be evaluated as follows:

(a) The assessment of the impact of alternative bidding zone configurations on the financial firmness costs shall be based on the identification and discussion of fundamental principles/interrelations. The physical firmness costs are already quantitatively estimated as part of the redispatching simulation, included in the "Economic efficiency" indicator.

(6) "Market liquidity" criterion shall be evaluated as follows:

(a) The assessment of the impact of alternative bidding zone configurations on the market liquidity shall be based on a study and the identification and discussion of fundamental principles/interrelations.

(b) A quantitative assessment of the market liquidity shall be performed based on market-depth analysis, focusing on the price change between the respective orders taking into account cross-zonal possible exchange. This analysis shall be done at least for day-ahead market, but may incorporate additional timeframes, if technically possible. In case TSOs find out that the model results are accompanied by a lot of uncertainties during the calculations, analysis of historical data shall be performed.

(7) "Market concentration and market power" criterion shall be evaluated as follows:

(a) The evaluation for market concentration shall be made by using internationally established indicators such as at least HHI (Herfindal-Hirschman-Index) and RSI/PSI (Residual Supply Index, Pivotal Supplier Indicator) taking into account cross-zonal possible exchange. Other suited indicators may be used additionally.

(b) The evaluation for market power shall be based on a qualitative assessment.

(c) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(8) "Facilitation of effective competition" criterion shall be evaluated as follows:

(a) The assessment of the facilitation of effective competition shall be based on the comparison of results of the four criteria - market liquidity, market concentration, market power and robustness of price signals for the different configurations.

(b) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(9) "Price signals for building infrastructure" criterion shall be evaluated as follows:

(a) The congestion income shows where there is a need for building infrastructure and the price difference gives an exact indication where it is necessary to build it. Therefore, a two-step evaluation approach shall be applied:

   i. **On the bidding zone border level,** the assessment of the price signals for building infrastructure on the bidding zone border level shall be based on the comparison of the price spreads between different bidding zone configurations. Additionally, it shall be possible to assess the correlation between market congestion and physical congestion in bidding zone borders under investigation.

ii. **On the bidding zone review region level,** the assessment of the price signals for building infrastructure on the bidding zone review region level shall be based on the comparison of the congestion incomes of the different configurations.

(b) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(10) **"Accuracy and robustness of price signals"** criterion shall be evaluated as follows:

(a) The accuracy of price signals shall be measured by one or both of the following two options:

i. The correlation, for each bidding zone configuration, between zonal day-ahead price received by each generator and the volume accepted on the given generator in the redispatching simulations either of the bidding zone configuration under investigation or of the Status Quo configuration (upward volumes are considered as positive values and downward volumes are considered as negative values): a positive correlation is an index of a bidding zone configuration which correctly reflects physical congestions and provides accurate price signals.

ii. The correlation, for each bidding zone configuration, between zonal day-ahead price and a specific percentile of the zonal adequacy margin (e.g. the 10° percentile as was used in the last Italian BZR): a positive correlation is an index of a bidding zone configuration which is correctly reflecting scarcity situations and providing accurate price signals.

(b) The robustness of price signals shall be measured from the analysis of zonal price differences between scenarios and sensitivity analyses, if applicable, for each specific bidding zone, in order to depict risks related to political and economic conditions. It shall be assessed using the day-ahead price resulting from the market coupling simulations by comparing prices between different sensitivities and scenarios.

(c) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(11) **"Transition and transaction cost"** criterion shall be evaluated as follows:

(a) A study shall be performed to show an overview of necessary adaptations and to provide a range of related cost estimates. Cost of past BZ reconfigurations shall be used as an input if sufficiently available from all relevant stakeholders. In addition, an expert discussion shall be undertaken.

(b) The study and expert discussion shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(12) **"Infrastructure cost"** criterion shall be evaluated as follows:

(a) The impact of alternative bidding zone configurations on the infrastructure costs shall not be evaluated since, in comparative terms, grid investments would not change in the different configurations.

(13) **"Market outcomes in comparison to corrective measures"** criterion shall be evaluated as follows:

(a) The evaluation shall be made by comparing market dispatch and total redispatch costs including mark-ups and volumes where appropriate between the different configurations under investigation.

The outcome of this evaluation should coincide with the results of the criterion "economic efficiency" (with the exception of the redispatch costs) and shall therefore be only used for comparison and validation purposes and not for the final assessment.

(b) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(14) **"Adverse effects of internal transactions on other BZs"** criterion shall be evaluated as follows:

(a) Based on the analysis of flows not induced by cross-zonal trade as described in Article 11, the effects of a changed bidding zone configuration shall be assessed with regards to the adverse effects of internal transactions on other bidding zones.

(b) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(15) **"Impact on the operation and efficiency of the balancing mechanisms and imbalance settlement processes"** criterion shall be evaluated as follows:

(a) The assessment of this criterion shall be based on an analysis of the reserve requirements per bidding zone for each configuration, i.e. total needs for capacity reserve provision per configuration. The total needs for operating reserves (e.g. FRR) shall be assessed, based on a probabilistic approach (using defined confidence interval), taking into account the uncertainty from a range of influencing factors such as fluctuations of load, potential outages of power plants (or potentially load) and forecast errors for renewable energies.

(b) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(16) **"Stability and robustness of bidding zones over time"** criterion shall be evaluated as follows:

(a) The assessment of the stability and robustness of bidding zones over time shall be based on the comparison of the robustness of the configuration / stability of congestions by changing specific input parameters (e.g. key grid projects, merit order variation) if these sensitivities are applied.

(b) If no sensitivity analyses are available, the assessment will be based only on the expert discussion which needs to consider if:

i. structural congestion in the bidding zone configuration is beneficial for its stability and robustness;

ii. temporary congestion decreases the stability and robustness of bidding zone;

iii. sufficient predictability of (structural) congestion is important.

(c) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(17) **"Consistency across capacity calculation time frames"** criterion shall be evaluated as follows:

(a) The impact of alternative bidding zone configurations on this criterion shall not be evaluated since the question as to whether an alternative bidding zone configuration leads to a higher or lower level of consistency across capacity calculation timeframes is not a technical one but related to the market design.

(18) **"Assignment of generation and load units to BZs"** criterion shall be evaluated as follows:

(a) The analysis shall be made through expert discussions and shall be accompanied by the identification and discussion of fundamental principles/inter-relations. The analysis shall at least compare the level of difficulty of assigning generation and load units to bidding zones between the different configurations under investigation.

(19) **"Location and frequency of congestion (market and grid)"** criterion shall be evaluated as follows:

(a) The evaluation shall be made by comparing market and grid congestion for the configuration under investigation over different sensitivity analyses or target years in order to examine whether the congestion remains sufficiently stable and robust. Thereby, future investment which may relieve existing congestion shall be taken into account.

(b) The analysis shall be accompanied by the identification and discussion of fundamental principles/inter-relations.

(20) **"RES integration"** criterion shall be evaluated as follows:

(a) The total amount of simulated fed-in energy quantities from RES shall be compared between the different configurations under investigation. However, the focus shall be on the long-term effects (e.g. the decade after the simulated target year) of the different configurations on the integration of RES. The long-term analysis shall be based on the identification and discussion of fundamental principles/inter-relations.

Article 14
Implementation

(1) In accordance with Article 14(5) of the IME Regulation, the implementation of the BZ Review Methodology is subject to its approval by the relevant NRAs or a decision on this BZ Review Methodology by the Agency for the Cooperation of Energy Regulators in case the relevant NRAs are unable to reach a unanimous decision.
(2) In accordance with Article 14(6) of the IME Regulation, the TSOs participating in the bidding zone review shall submit a joint proposal to relevant Member States to amend or maintain the bidding zone configuration no later than 12 months after the approval of this BZ Review Methodology.

Article 15
Publication of BZ Review Methodology

The relevant TSOs shall publish the BZ Review Methodology without undue delay after the relevant NRAs have approved the BZ Review Methodology or a decision has been taken by the ACER in accordance with Article 14(5) of the IME Regulation.

Article 16
Miscellaneous

(1) The reference language for the BZ Review Methodology shall be English. For the avoidance of doubt, where the relevant TSOs need to translate the BZ Review Methodology into their national language(s), in the event of inconsistencies between the English version and any version in another language, the relevant TSOs shall be obliged to dispel any inconsistencies by providing a revised translation of the BZ Review Methodology to their relevant national regulatory authorities.

(2) The information and data handled during the execution of the Bidding Zone review is market sensitive information and shall on this basis be treated as confidential, unless specified otherwise by the relevant TSOs. As a result, all information gathered, analysis performed, and other data made available to all TSOs are deemed confidential and shall be managed in accordance with Article 13 of the CACM Regulation and the procedure to ensure its protection.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Annexes:

Annex 1 – Configurations of the Bidding zone review region "Central Europe" which are to be considered in the bidding zone review process;

Annex 2 – Alternative configurations of the Bidding zone review region "Nordics" which are to be considered in the bidding zone review process;

Annex 3 – Alternative configurations of the Bidding zone review region "South East Europe" which are to be considered in the bidding zone review process;

Annex 4 – Configurations of the Bidding zone review region "Central Southern Italy" which are to be considered in the bidding zone review process;

Annex 5 – Configurations of the Bidding zone review region "Baltic" which are to be considered in the bidding zone review process;

Annex 6 – Configurations of the Bidding zone review region "Iberian Peninsula" which are to be considered in the bidding zone review process;

Annex 7 – Configurations of the Bidding zone review region "Single Electricity Market Ireland" which are to be considered in the bidding zone review process;

Annex 8 – Configurations of the Bidding zone review region "United Kingdom" which are to be considered in the bidding zone review process.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Explanatory Document to all TSOs' proposal for the methodology and assumptions that are to be used in the bidding zone review process and for the alternative bidding zone configurations to be considered in accordance with Article 14(5) of Regulation (EU) 2019/943 of the European parliament and of the Council of 5th June 2019 on the internal market for electricity

18 February 2020

Table of Contents

1. Definitions and Interpretations

For the purposes of this document, the terms used shall have the meaning given to them in Article 2 of the IME Regulation and in Article 2 of the CACM Regulation. In case of inconsistencies, the definitions of Article 2 of the IME Regulation shall prevail.

In addition, in this document the terms used have the meaning given to them in Article 2 of the common proposal developed by all Transmission System Operators regarding the methodology and assumptions that are to be used in the bidding zone review process and for the alternative bidding zone configurations to be considered pursuant to Article 14(5) of the Regulation (EU) 2019/943 of the European Parliament and Council of 5th June 2019 on the internal market for electricity (recast), which is hereinafter referred to as the "BZR Methodology".

2. Introduction

ACER initiated the first edition of the bidding zone review process under Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (hereafter referred to as the "CACM Regulation") on 21st December 2016, specifying Central Europe as the relevant region. The process lasted 15 months and ended on 21st March 2018. The review concluded that the evaluation presented for the Bidding Zones (BZs) did not provide sufficient evidence for a modification of or for maintaining the current BZ configuration, hence, the participating TSOs recommended that the current BZ delimitation shall be maintained.

The Regulation (EC) 2019/943 on the internal market for electricity (recast) (hereinafter referred to as the "IME Regulation") entered into force on 5th June 2019 and requires in its article 14 (5) all relevant TSOs to deliver a proposal for the methodology and assumptions that are to be used in the bidding zone review process and for the alternative bidding zone configurations to be considered (hereinafter referred to as "BZR Methodology") by 5th of October 2019.

Upon guidance received from EU Commission, ACER and the NRAs, the "relevant TSOs" for the elaboration of the BZR Methodology shall be understood as all TSOs. The BZR Methodology will therefore be a pan-European one and shall be approved by all NRAs.

All TSOs have submitted a BZR Methodology for approval by all NRAs according to the timeline as set in article 14(5) of the IME Regulation.

However, in a letter dated December 17th 2019, all NRAs informed all TSOs that they consider the proposal for the BZR Methodology as incomplete due to the absence of alternative configurations for some Bidding Zone Review Regions. All NRAs therefore requested all TSOs to complete the proposal with proper alternative bidding zone configurations until February 18th 2020.

Following this letter, all TSOs have requested all NRAs to provide them with specific guidance for which specific member States alternative configurations should be proposed, in order to come up with an updated set of proper bidding zone configurations. On January 24th 2020, all NRAs informed all TSOs that they were not in the position to provide specific guidance on this matter.

All TSOs were therefore not able to overcome the issues already identified in the initial submitted package on alternative configurations, and are therefore now submitting an update of the BZR Methodology containing only limited amendements compared to the BZR Methodology initially submitted. The amendements of the BZR Methodology therefore mainly consist of an adaptation of the wording related to the years of the scenarios to be used for the Bidding Zone Review and an adaptation of the alternative configurations in the Nordic BZRR.

To the understanding of all TSOs, the initial timeline foreseen in the IME Regulation for the BZ Review shall consequently be adapted as follows:

- Proposal for a BZR Methodology to be submitted by all TSOs to all NRAs for approval initially by 5th of October 2019 now by 18th February 2020;
- Decision to be taken by all NRAs within 3 months of submission of the BZR Methodology intially by 5th January 2020 now by 18th May 2020;
- In case NRAs cannot reach a consensus, ACER decision on the BZR Methodology intially by 5th April 2020 now by 18th August 2020;
- Proposal of the participating TSOs to amend or maintain the BZ configuration to the member states or the designated competent authorities no later than 12 months after approval of the BZR Methodology.

This explanatory document provides additional background information and explains the rationale behind the choices made in the proposal for the BZR Methodology. It will be handed over to the NRAs together with the BZR Methodology in order to support their understanding of the BZR Methodology and facilitate its approval.

The following elements are elaborated upon in this explanatory note:

- Section 3: Bidding Zone Configurations. This section provides background information on how TSOs have come up with proposals for the bidding zone configurations to be analysed in the BZR Methodology and includes argumentation per configuration.
- Section 4: Scenarios and Assumptions. This section provides more information about the scenarios used to analyse the different bidding zone configurations, what data is used for the assessment and what assumptions are made for conducting the assessment.
- Section 5: Bidding Zone Review Modelling Chain. This section provides an overview of the full modelling chain used to assess the different bidding zone configurations, and provides some more detailed information of individual parts of this modelling chain
- Section 6: Evaluation. In this section background information is provided per individual criterion which will be used to evaluate the different bidding zone configurations.

3. Bidding Zone Configurations

3.1. Division by Bidding Zone Review Regions (BZRR)

A two-step concept has been adopted for the delivery of the BZR Methodology (including methodology, assumptions and configurations) in order to enable the needed regional flexibility:

1. *All-TSO approach for the delivery of the methodology and assumptions:* a common proposal of all TSOs.
2. *Regional approach for the delivery of configurations:* the proposals on alternative and/or status quo configurations are delivered on a regional level by the BZ Review Regions (BZRRs), as presented in Article 4(2) of the BZ Review Methodology.

The justifications on the choice of alternative configurations, their combinations in BZRRs as well as status quo configurations are provided in Annexes of this explanatory document.

4. Scenarios and assumptions

4.1. Introduction and overview

The bidding zone review will assess the merits of alternative bidding zone configurations as compared to the status quo configuration. Each of these configurations (including the status quo configuration) will be compared on the basis of the same scenarios and assumptions. Each BZRR that is proposing alternative configurations will perform at least one model run for the Base Year for each selected BZ configuration. Optionally, the TSOs of a BZRR can choose to run the model on selected alternative scenarios based on other target years than the Base Year for each configuration as well.

4.2. Target year

The bidding zone review aims at investigating the impact of alternative bidding zone configurations for the Base Year, both for the status quo configurations and for the alternative configurations.

The option to study alternative scenarios or performing additional sensitivity analysis is left open to the BZRRs. A sensitivity analysis can take the form of checking for the robustness by studying alternative assumptions on grid investments or market variables. Complete alternative scenarios can be run for alternative target years or weather years for all configurations, in which target year is understood as a complete scenario with consistent assumptions for a specific year in the future. The results for complete alternative scenarios are combined with the results for the scenario for the Base Year as presented in chapter 6. The options for sensitivity analysis are discussed in chapter 4.10.

4.3. Weather years

The bidding zone review will make use of data out of the Pan-European Market Modelling Data Base (PEMMDB) or other weather data sources of equal or higher quality. This database contains historical time series data for all relevant countries considering weather years ranging from 1982 to 2016 that are necessary for modelling the infeed of weather-dependent generation (such as wind and solar) and for the load. The PEMMDB further contains a 'National Trends' scenario for all data types, i.e. the expected load and generation time series projections, considering representative weather years.

The selected weather years will be based on the conditions that it should be close enough to be able to represent conditions of the Base Year considering the effects of climate change and that it should be representative for weather conditions in other years without many outliers and extremes. A possible method for the selection of weather years is given by the TYNDP methodology, based on a clustering method that ensures the representativeness of the selected year. If multiple weather years are considered, the final recommendation will take into account all modelled weather years as presented in chapter 6.

4.4. Grid model

For the Base Yyear, the reference grid of the TYNDP scenario available at the time of performance of the study will be used. The reference grid model takes into consideration all high voltage network elements that are expected to be available by the end of the Base Year. For the purposes of the bidding zone review at least all network elements that are operated at a voltage level of 220 kV and higher are considered. The BZ Review Methodology allows TSOs to represent the 220 kV grid of its grid only partially or to take it out of the grid model for its control area only in the situation where the representation of the 220 kV grid has a negative effect on the reliability of the results. The main reason for this choice is explained by the fact that overloads at this voltage level in some grids are normally solved by topological actions. Including these congestions in this case would lead to an overestimation of congestions and redispatch costs to solve them.

Considering that a simulation of topological action is not available at this point, a simplification of the network model provides the opportunity to effectively represent such topological measures. As an alternative, TSOs can make manual changes in the grid model to represent topological measures as remedial action.

TSOs are also able to include lower voltage levels if they consider that this improves the simulations.

4.5. Load data

Zonal load data will be based on the demand data from the Pan-European Market Modelling Database (PEMMDB) 'National Trends' scenario for the Base Year. If alternative target years will be assessed by the TSOs of a BZRR, PEMMDB data will be used for that target year. Load data will be disaggregated to nodal level as described in chapter 4.9. The elasticity of load wil be represented through demand side response as is listed in the PEMMDB. A Value of Lost Load (VOLL) parameter will be considered in case not all load can be served generator resources or the available demand side response. The working assumption is to utilize the VOLL in accordance with the Mid-Term Adequacy Forecast (MAF) methodology. This value respects the constraint of being more expensive than the most costly generation, such as to ensure it will be the last option to be selected in the market modelling.

4.6. Generation data

Generation data will be based on the generation data from the PEMMDB 'National Trends' scenario for relevant target year. Generation data with known locational information will be mapped to the appropriate nodes of the grid model. Zonal generation data, such as solar and wind capacity, will be disaggregated to nodal level as defined below in chapter 4.9

The electricity production of weather dependent generation technologies will be based on the weather-related data as generated for the PEMMDB in the Pan-European Climate Database (PECD) or a database of equivalent quality. The choice of weather year(s) or years is explained above in chapter 4.3. Wind and solar generation technologies are represented in PECD as load-factor time series. These indicate for each hour at which percentage of the total installed capacity that generation type is able to produce in a bidding zone.

Weather independent technologies are modelled based on their fundamental costs, as explained in chapter 5.2. The amount of production by the thermal generation fleet is therefore dependent on its prices, the load, the amount of variable renewable energy production and the market coupling process. Moreover, changes in the original dispatch according to the market coupling algorithm may be made according to the redispatch algorithm if it is necessary to solve congestions.

4.7. Consideration of neighbouring regions

As a result of the regional approach of the BZR, simulations carried out by TSOs of a BZRR should be focused on the geographical extent of that BZRR. A trade-off has to be found regarding the geographical scope considered in the simulations:

- On the one hand, considering only the geographical scope of the considered BZRR (i.e. completely removing neighbouring regions from the simulations) would mean that interactions between the grids and markets of neighbouring regions are completely left out;
- On the other hand, performing a full pan-European simulation for each BZRR would mean a high complexity and computational burden for TSOs of all BZRRs. The opportunity of simplification brought by the regional approach would be lost.

The proposed approach consists in applying different degrees of simplification to neighbouring regions depending on how they are connected to the considered BZRR. For simulations of a given BZRR, the table below explains how a BZ outside this BZRR (noted BZoutside) will be taken into account:

Is $Bz_{outside}$ …	Directly connected by a tie-line to the BZRR	Not directly connected by a tie-line
Part of the same synchronous area as the considered BZRR	$BZ_{outside}$ should have a grid and market modelling	Simplifications can be applied in the grid and market modelling of $BZ_{outside}$. If $Bz_{outside}$ has a negligible impact on the BZRR, it does not need to be modelled.
Part of another synchronous area than the considered BZRR	$BZ_{outside}$ should have a suitable market modelling but the grid does not need to be modelled	$BZ_{outside}$ does not need to be modelled

4.8. Other assumptions

The bidding zone review will use as an assumption fuel and CO2 prices based on the data collected for the most recent TYNDP process for the relevant target year. For the analysis of the Base Year, the TYNDP National Trends reference prices included in the scenarios available at the time of performance of the BZR will be used.

4.9. Disaggregation to nodal level

To allow for the analysis of alternative zones and for the optional case of an analysis of locational prices, zonal generation and load data will need to be disaggregated to nodal level in their representation in the grid model. Zonal generation and load data from PEMMDB will be disaggregated to nodal level by the TSO operating those nodes. Generation and load data from zones outside of the BZRR will not be mapped to a nodal level but be considered on a zonal level. Nodal level is understood as the level of substations of the represented voltage levels as described in chapter 4.4. Substations at lower voltage levels than those represented in the grid model will be aggregated to the most relevant substations represented in the models. This could be done on the basis of their Power Transfer Distribution Factors (PTDF). When increasing the production or consumption at a certain grid node, the most relevant substation will show the highest change in flow and therefore have the highest PTDF.

The disaggregation to nodal level can be based on a number of different sources. E.g. population density figures can be considered to reflect the division of total load over the represented grid nodes. The disaggregation of e.g. zonal installed PV capacity can be done according to land use data, such that the generated electricity is divided over the represented grid nodes according to the types of land a technology are normally built on. Land use refers to the purpose the land serves e.g settlements, recreational areas or agriculture. Each TSO can use its own methods to arrive at a nodal representation of zonal data, but these methods should be adequately explained in the bidding zone review documentation.

4.10. Sensitivity analysis

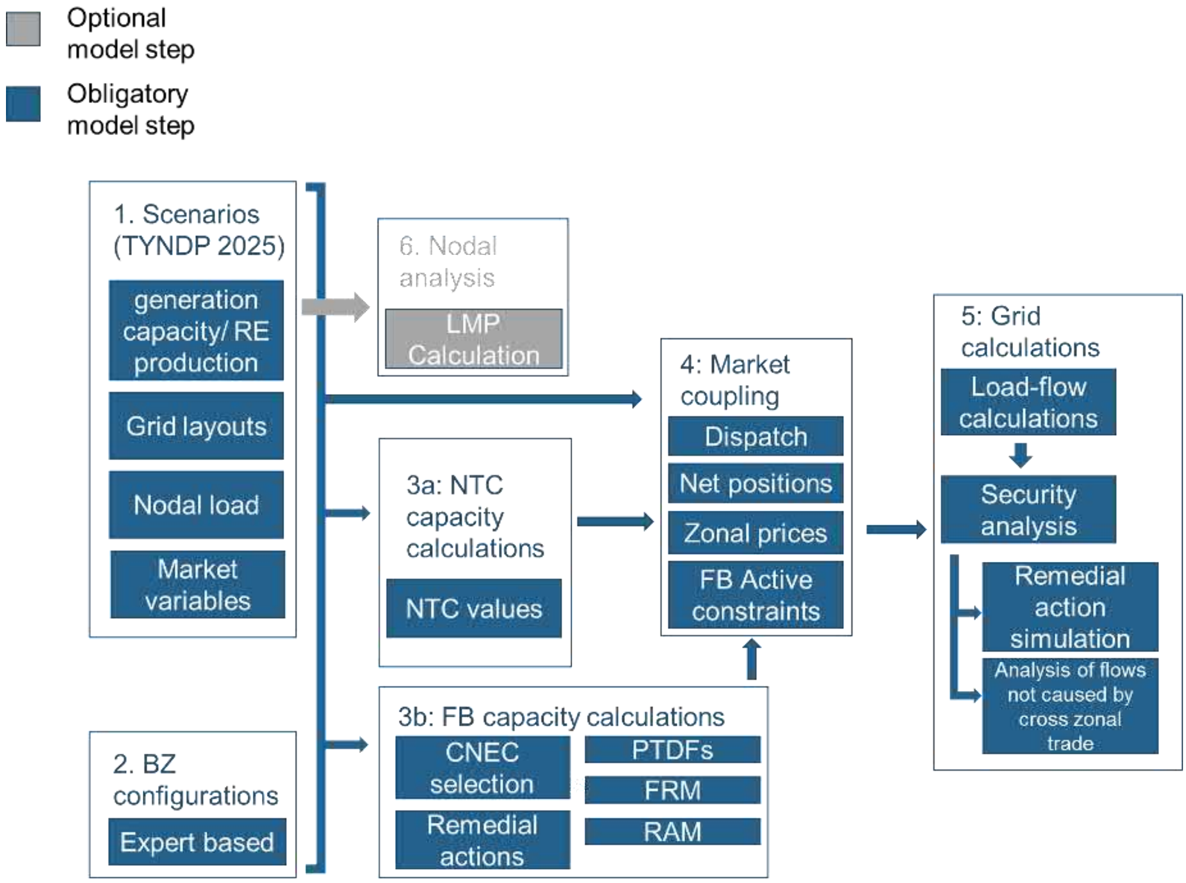
Optionally, the TSOs of a BZRR may decide to perform additional sensitivity analyses by variation of any of the input data including grid infrastructures. When modelling future scenarios, sensitivity analysis is an important tool to capture the impact of uncertainty regarding input data and to test the robustness of results. Since the BZR will focus on the Base Year, there is uncertainty with respect to input parameters such as CO_2 and fuel prices. Additionally, demand and RES infeed variability can differ depending on the weather year that is considered. Furthermore, sensitivity analysis could be used to investigate the robustness of the results to expected grid developments in order to investigate under which conditions the expected benefits remain, e.g. how bidding zone configurations are affected by future grid expansion options. Such analysis will be taken into account in the analysis of uncertainty of the final calculations and to test the 'robustness of price signals' criterion and the 'stability and robustness of bidding zones' as described in chapter 6. If variations have a strong impact on the figures calculated by the model, the uncertainty of the outcome will be higher. If little variation shows, the outcome is robust.

4.11. Configurations

TSOs of each BZRR that have provided alternative configurations will run the model for all the bidding zone configurations as listed in annexes of the BZ Review Methodology including the status quo configuration as well as alternative configurations to be compared to the status quo configuration. The final evaluation of the alternative BZ will be based on the criteria presented in chapter 6.

5. Bidding zone review modelling chain

An overview of the modelling chain that will be used for the analysis of the alternative bidding zone configurations is shown in the figure below. The overview shows all obligatory and optional modelling steps as set in the articles 6 to 12 of the BZR Methodology. Additional information on these modelling steps is given in the paragraphs below. The content of the scnenarios and configurations (block 1 and 2) is explained in article 4.



5.1. Capacity calculation

Additional explanations on article 7.5.a of the BZR Methodology: NTC approach based on process-specific computations

This approach of NTC computation aims at enabling TSOs to utilize as closely as possible the practices used in the approved or foreseen capacity calculation methodologies. For example, this would enable the TSOs to simulate processes based on dichotomy, on the same principle as the current capacity calculation in SWE CCR area or in Italy North CCR. The principle of dichotomy allows, through an iterative approach, to test different levels of commercial exchanges between bidding zones and to determine *via* a security analysis which ones are secure or not from an operational point of view. The highest commercial exchange considered secure serves to determine a TTC (total transmission capacity) from which an NTC can be derived.

Additional explanations on 70% requirement in capacity calculation

The BZR shall respect the requirements of Article 16(8) of the IEM Regulation stating the minimum levels of available capacity for cross-zonal trade. For the implementation of these requirements, Recommendation of the ACER of 8 August 2019 on the implementation of the minimum MACZT pursuant to Article 16(8) of the IEM Regulation shall be taken as a reference or any other indications or guidelines provided by the NRAs about how to calculate this percentage, as long as they are available sufficiently in advance allowing their consideration in the modelling.

The ACER recommendation describes a methodology based on CNECs for both NTC and flow-based approaches.

The capacity available for cross-zonal trade on a CNEC depends on the maximum admissible power flow of the considered capacity calculation market time unit (CC MTU) which is defined as $F_{\max}$.

$F_{\max}$ should be determined in accordance with the implemented CCM and, if relevant, could be implemented as a time-varying value in order to reflect varying ambient conditions.

TSOs may apply allocation constraints according to the requirements set in Article 23(3) of the CACM Regulation, including the possibility to limit the combined import or export from one bidding zone to another to a threshold value.

The margin available for cross-zonal trade (MACZT) for a given market time unit (MTU) is defined as

$$MACZT(MTU) = MCCC(MTU) + MNCC(MTU) \geq MACZT_{\min}(MTU),$$

where $MCCC$ entails the portion of capacity available for cross-zonal trade on bidding zone borders within the considered coordination area and $MNCC$ describes the portion of capacity available for cross-zonal trade outside the considered coordination area. $MACZT_{\min}$ is the minimum margin available for cross-zonal trade.

a. The standard value for $MACZT_{\min}$ is defined as 70 % of $F_{\max}$. However, $MACZT_{\min}$ may differ depending on the simulated year due to derogations and national action plans.

b. The computation of MCCC is described in Recommendation of the ACER of 08 August 2019 on the implementation of the minimum MACZT pursuant to Article 16(8) of Regulation (EU) 2019/943.

c. For the calculation of MNCC in the BZR it is suggested to simplify the approach described in Recommendation of the ACER of 08 August 2019 on the implementation of the minimum MACZT pursuant to Article 16(8) of Regulation (EU) 2019/943 in order to reduce the complexity of the model chain. It is further suggested to assume electricity exchange from trade outside of CCR reaches the maximum NTC volume. In cases where MNCC(MTU) is positive it reduces the minimum MCCC(MTU) and will be included in the MACZT(MTU) calculation. Otherwise it is assumed to be zero. Furthermore, if it is expected that the variations of MNCC do not impact the MACZT significantly, MNCC values could be computed on one timestamps and assumed to be constant on the entire simulated timespan.

In order to consider (n-1) security, MACZT calculations have to take into account contingencies. This is ensured by the use of CNECs.

5.2. Market coupling

The market coupling algorithm combines the information from capacity calculations, generation and load data, and assumptions from the scenarios to determine the unit commitment of generators and their costs. The algorithm performs a cost-minimizing optimization, providing the least costly solution for all market participants for the considered time stamps in the respective target year. Considering that evaluation of all time-stamps of the considered target year would strongly impact the computing time, the bidding zone review will assess at least each third hour.

The market coupling model will generally assume perfect competition. Perfect competition creates a situation in which pricing of market participants is purely based on fundamental costs, representing that power plants operate in a way that leads to overall cost minimization. Results of this assumptions are generally considered to be representative for the resulting prices and unit commitment in the day ahead market process.

Representation of grid constraints

The market coupling algorithm takes into consideration the network constraints as determined in the capacity calculation chapter 5.1. Some bidding zone borders are subject to NTC based capacity calculations, while others make use of the flow-based methodology as current practice in the CWE region. As it is not yet known, which of the capacity calculation methodologies will be used for which bidding zone border, this choice will be determined by the BZRR.

- Where NTC based capacity calculations are performed NTC based constraints will be taken into account in the market coupling calculations.
- For capacity calculation making use of the flow-based methodology, the market-coupling methodology will make use of the zonal PTDFs, GSKs, and FRMs to calculate the constraints for the market coupling algorithm for the CNECs taken into account for capacity calculation. The CNECs selection is described in article 7.8 of the BZR Methodology.

For these constraints the model will take due account of the 70% provision of the IME regulation as described in chapter 5.1. These constraints together determine the domain in which the market can be operated in terms of net positions of the bidding zones. The market coupling algorithm will select the least costly solution within this domain to cover the load.

Representation of generation

The method and data available to represent electricity generation differs per technology. As presented in chapter 4.6, this data is sourced from the PEMMDB.

Thermal generation is considered to bid according to their short-run marginal cost, including fuel costs, CO_2 costs, variable operation and maintenance costs and relevant start-up costs. The fuel costs are a combination of the fuel prices and the efficiency of the power plant, as defined in the database. The fuel and CO_2 emission prices will be consistent with those used for the TYNDP process. Each of these generators will be coupled to a specific node represented in the grid model. In case the power plants have must-run constraints due to e.g. combined heat and power production, industrial process connection or other reasons, the simulation ensures that must-run obligation is always followed. The model will also take into account maintenance and outage frequencies of power plants.

This method of representation in the market model is used for all dispatchable thermal capacities, including CCGTs, gas turbines, internal combustion engine, coal and lignite power plants, nuclear power plants, oil power plants, and biomass-fired power plants. Power plant is considered dispatchable if its production volume is fully or partially dependent on the day-ahead electricity price.

Renewable generation technologies other than dispatchable biomass have different methodologies. The amount of produced Wind, Solar PV and Solar thermal electricity are considered to be weather dependent only. The load factors, i.e. the amount of production with respect to the installed capacity, for wind and solar power has been calculated for the PEMMDB for each of the ENTSO-E countries for the weather years 1982 to 2016. The total installed capacities are available for each current bidding zones but will be disaggregated to a nodal level according to chapter 4.9, 'disaggregation to nodal level'. These technologies are considered to produce energy as long as resources are available, and it is required to serve the load. Only if production in combination with the must-run power plants would exceed the load, these technologies are curtailed. In principle all wind and solar resources are assumed to bid at the marginal price of €0,00 per MWh, since these technologies have negligible short-term marginal costs.

Hydroelectricity is considered as a separate category because they are both resource dependent and, with the exception of run-of-river power plants, are able to have a controllable production. The resource dependency is indicated by the inflow profiles for hydro power plants, which is dependent on the weather year under consideration. Hydroelectric power plants may include reservoir and pumping facilities, while constraints on their utilization/optimization may be applied.

Renewable power plants, other than hydro, wind, solar and dispatchable biomass are categorized as other renewables and will be represented by a price-independent infeed time series.

Non-renewable power plants, other than dispatchable thermal power plants, are represented with infeed time series with an associated marginal cost.

Representation of load

The power demand is considered to be inflexible except the share that is defined to be available for Demand Side Response (DSR). Variations of load are available for all ENTSO-E countries for the weather years 1982 to 2016 and Base Year in the PEMMDB. The market coupling algorithm will meet the requested load for the relevant weather year by combining the generation technologies discussed above by a cost minimization, while respecting the identified grid constraints for each considered hour. The load in PEMMD is zonally defined and will be disaggregated into nodes as described in chapter 4.9 'disaggregation to nodal level'. Load flexibility is represented by an amount available for DSR and its activation cost. There may be several categories of DSR with different activation costs and availability data in each zone In case inflexible load is shed because the available production does not suffice to meet the demand after all available DSR has been activated, the value of lost load (VOLL) is be assumed as the cost of the shedding of the inflexible part of the load.

The market coupling algorithm will determine for each timestamp the unit commitment for all power plants, which sets the power infeed or consumption at each grid node. Secondly, it determines the electricity price in each of the bidding zone. Thirdly, the market coupling calculates the Net Positions of all bidding zones. Fourthly, it determines the Commercial exchanges between bidding zones. Finally, the market coupling algorithm records for each timestamp whether the constraints were actively limiting exchanges. The expected outcomes of the model is as follows:

Output	Unit	Resolution
Amount of production	MW	Per timestamp, per node
Electricity prices	€ per MWh	Per timestamp, per zone
Net positions	MW	Per timestamp, per zone
Commercial exchanges	MW	Per timestamp, per combination

Active constraints	# of timestamps	Per Year per CBCO

5.3. Operational security analysis

This step consists in computing the flows on the grid resulting from the market coupling and detecting congestions.

Load flows are computed in N-situation and in (N-1) situations taking into account the results of the market simulation in terms of generation and load. The considered (N-1) simulations correspond to the list of contingencies defined according to article 9.2 of the BZR Methodology. The recommended approach for the load flow is to compute a DC load flow, but AC load flow can be used upon agreement of TSOs of a BZRR. In each computed situation (N- or N-1), security limit violations are detected. The list of violations (name of the affected grid element, corresponding contingency, quantitative description of the violation) forms the output of the operational security analysis. The expected outcomes of the model is as follows:

Output	Unit	Resolution
List of Violations	MW, element name	Per identified violated Branch and contingency

5.4. Remedial action simulation

In the remedial actions simulation, difficulties often arise when trying to make an automated simulation of remedial actions whose effect cannot be linearised. In particular, simulation of topological actions (such as opening / closing of circuit breakers and busbar couplers) are a major challenge when large geographical areas and large amounts of timestamps are simulated. If these topological actions are not correctly taken into account, many simulation results can be affected (e.g. operational security, redispatching costs, market coupling results…), especially for TSOs where topological actions are frequently used.
TSOs should strive towards a full consideration of all types of remedial actions. However, in case it is not feasible to fully integrate topological remedial actions into the BZR modelling chain, several options to take into account at least partially their effect can be applied in accordance with the BZR Methodology. These options should be applied only for TSOs where they are estimated to be relevant. Some of them focus on the 220 kV level because the previous Bidding Zone Review has shown that difficulties in modelling topological remedial actions can lead to results that are misleading when studying bidding zone configurations (cf. model-based approach in the First Bidding Zone Review). The considered option are presented hereunder in ascending order of complexity:

- Removing all 220 kV lines from the grid model in the entire simulation chain. This would require aggregating the loads and generations of the removed voltage level to the 400 kV substations. This possibility is granted in article 9.2 of BZR Methodology.
- Adapting the topology of the grid model by implementing some topological actions in order to avoid appearance of constraints that otherwise would require a full optimisation of these remedial actions. This possibility is granted in article 9.2 of BZR Methodology.

  Example: in some TSOs, there are frequent cases of contingencies on a 400 kV line that systematically overloads the underlying 220 kV line, and where the usual remedial actions is to open the overloaded 220 kV line curatively. In an incomplete model without optimisation of topological remedial actions, this constraint would be solved with redispatching. However, by opening the 220 kV line from the start in the grid model, the constraint is avoided without leading to an overestimations of redispatching costs.

- Removing 220 kV lines from the list of elements in the redispatching module. Ideally, removing only those lines for which known remedial actions systematically allow to solve congestions would lead to better results. This possibility is granted in article 10.3 of BZR Methodology.
- Limited assessment of non-costly remedial actions: the TSO performs a full optimisation of non-costly remedial on a representative subset of timestamps after market coupling and security analysis. This optimisation can be performed manually or with any suited software outside the BZR simulation chain. By running the redispatching calculation with and without implementation of these non-costly remedial actions, the impact of non-costly remedial actions on redispatching costs and other relevant results is assessed. This possibility is granted in article 10.3 of BZR Methodology.

The second step is to apply an optimization of the Phase Shifting Transformers (PSTs). This optimization will minimize the amount of overloads in the grid based by changing the tap positions of the PSTs. It is both feasible and realistic that such optimization takes place on a transnational level, which is current practice of the TSOs.

When, after the non-costly remedial action optimization, N-1 overloads are still present in the network, costly remedial actions are normally applied to solve these. The most important method used as a costly remedial action is redispatch. The redispatch analysis will take as input the unit commitment from the market coupling algorithm, the relevant network model and the N-1 overloads as calculated by the load-flow and security analysis. Moreover, it will take as an input the units available for redispatch and the prices for redispatching these units in the downward and upward direction. The available units for redispatch will be based on a survey among TSOs, as circumstances, the legal environment and redispatch mechanisms differ significantly per TSO. The TSOs of a BZRR can decide to add a mark up to the fundamental costs that determines the redispatch prices. Based on these inputs, the redispatch algorithm will solve all overloads by redispatching the available units at the least possible costs. In consideration of the System Operations Guideline (SO GL) article 76 and the IME regulation article 13, the redispatch simulation will be done irrespective of bidding zones, or TSO control areas. Since according to regulation it is required to perform such optimization including units in other bidding zones, a transnational optimization is close to the expected reality in the Base Year. The expected outcomes of the model is as follows:

Output	Unit	Resolution
Amount of production	MW	Per timestamp, per node
Redispatch costs	€	Per timestamp, total
Redispatch volume	MWh	Per timestamp, total
Redispatch volume (zonal)	MWh	Per timestam, per zone

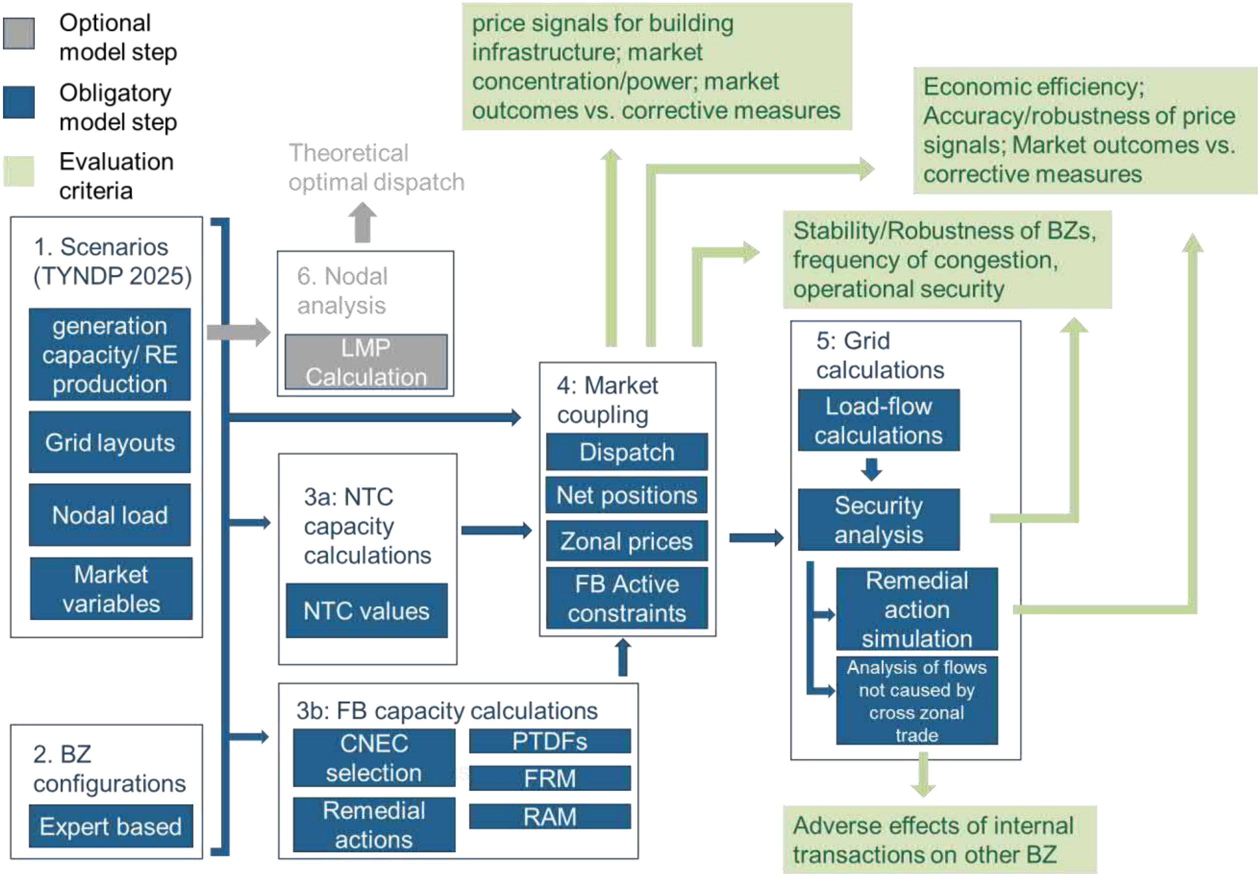
5.5. Analysis of flows not induced by cross-zonal trade

The proposed approach for the analysis of flows not induced by cross border flows comes from the Core capacity calculation methodology. It consists in computing the flows on all grid elements in a situation where the net positions of all bidding zones are shifted to 0 MW (situation with no commercial exchanges). This method has been chosen since it is included in the approved CORE capacity calculation methodology. However, alternative methods for the calculation of flows not induced by cross-zonal trade are currently under investigation in some CCR for other methodologies under development. They may be be considered additionally if agreed by the TSOs of a BZRR. The expected outcomes of the model is as follows:

Output	Unit	Resolution

Flows not induced by cross-zonal trade.	MW	Per cross-border grid element

6. Evaluation



The model chain above represents an indication from where the calculations for certain indicators are obtained. Different parts of the model chain are the source of results for different indicators. Market coupling calculations provide results for price signals for building infrastructure, and market concentration and market power. Together with the remedial action simulation it also assesses economic efficiency, accuracy and robustness of price signals and market outcomes in comparison to corrective measures. Together with the security analysis, the market coupling has impact on the criteria of robustness of bidding zones, frequency of congestions and operational security. The analysis of flows not induced by cross-zonal trade assesses the adverse effects of internal transactions on other BZ. The nodal analysis does not influence the assessment of bidding zone configurations but serves as an additional analysis that is able to show the theoretical optimal dispatch, which can serve as additional information.

Depending on the geographical scope on which the criteria are computed, a BZRR could give results about a neighbouring BZRR. Contradictory results could undermine the studies' credibility. Therefore, three categories are defined into which all criteria have to be classified since some criteria cannot be restricted to the BZRR's geographical scope.

In order to have a better understanding on the evaluation approaches chosen for each criterion further explanation is provided below.

The general principle applied for the evaluation is to monetize as many criteria as possible. However, for the evaluation of most criteria only indicators are available that do not deliver monetized outcomes. Further extensive research is needed to develop evaluation approaches that can deliver monetized results. As such, the methodology may be improved at a later stage in terms of having more criteria monetized.

(1) CACM criterion "Operational security"

The Article 3 (2) of the guidelines on electricity transmission system operation (Commission regulation (EU) 2017 / 1485) defines 'operational security' as 'the transmission system's capability to retain a normal state or to return to a normal state as soon as possible, and which is characterised by operational security limits'. Hereby, 'normal state' means 'a situation in which the system is within operational security limits in the N-situation and after the occurrence of any contingency, taking into account the effect of the available remedial actions'.

(2) CACM criterion "Security of supply"

The criterion is limited to generation adequacy as other elements are considered under the criterion "Operational Security". Generation adequacy refers to sufficient conventional and renewable installed generation capacity to supply the electrical load. While TSOs are responsible for grid security, ensuring security of supply is not a TSO task. Yet, both are interlinked, i.e. grid security cannot be ensured in cases where generation adequacy is at risk. Estimating security of supply is a complex task and can be done by assessing different indicators. For the BZR, the two basic approaches Remaining Capacity Margin (RCM: difference between the maximum available generation capacity and the maximum hourly load per hour) and Energy Not Served (ENS: missing MWh to reach generation per year) must be followed. The more complex approaches Loss of Load Expectation (LOLE: predicted hours of no supply per year) and Expected Energy Not Served (EENS: expected missing MWh to reach generation per year) can be analysed if possible. In order to implement the more complex approaches and monetise the security of supply indicator, it would be required that additional data collection and modelling is carried out. This would mean that the modelling chain is expanded to include a step which is similar to the MAF studies carried out by ENTSO-E on a yearly basis. The additional data to be collected is distribution of outage durations and outage probability. This could, with the already foreseen data to be collected, be used in a probabilistic model in order to determine LOLE and EENS which then could be translated to a monetised value by applying an agreed value of lost load (VOLL).

(3) CACM criterion "Degree of uncertainty in CZC calculation"

The degree of uncertainty in CZC calculation is generally understood as the deviation between the capacity calculation and real-time scenario. For estimating the uncertainties in the computed load flows used for the capacity calculation the "capacity calculation reliability margins" (FRMs/RMs) is used. Uncertainty in CZC calculation is inevitable due to several sources of uncertainty such as inaccuracy of zonal PTDFs, generator outages compensated by frequency containment reserve / frequency restoration reserve (FCR/FRR) and changes in RES or forecast generation and load. At least these sources of uncertainty shall be used to evaluate the degree of uncertainty in CZC calculation.

(4) CACM criterion "economic efficiency"

Economic efficiency is a well-known economic concept, also known as the welfare concept. In energy economics, the market efficiency (indicator of economic efficiency) is derived from market models and is defined as the change in the total system costs (variable production costs in the day-ahead market model including total redispatch costs). Generally, the economic efficiency represents the situation where consumers and producers can maximize their surpluses and therefore improve social welfare. Thereby, only the marginal costs of redispatch are included as mark-ups are only a redistribution from consumers to producers and therefore do not have an effect on overall welfare.

(5) CACM criterion "firmness cost"

CACM Article 2 (44) defines 'firmness' as 'a guarantee that cross-zonal capacity rights will remain unchanged and that a compensation is paid if they are nevertheless changed'. In the following, firmness costs will be understood as the related costs to ensure the cross-zonal capacity rights.

In addition, Article 61 of the Forward Capacity Allocation (FCA) Guidelines clarifies that the cost of ensuring firmness shall include costs incurred from compensation mechanisms associated with ensuring firmness of cross-zonal capacities as well as the cost of redispatching, countertrading and imbalances associated with compensating market participants, and must be borne by TSOs, to the extent possible in accordance with Article 16(6)(a) of Regulation (EC) No 714/2009.

(6) CACM criterion "market liquidity"

Under market liquidity it is generally understood how quickly any market participant is able to buy or sell any volume of energy (implicit) or capacity (explicit) without greatly affecting the market price. If the market is highly liquid, it is the sign of efficient distribution of relevant supply and demand information which leads to an efficient market dispatch. Also, there is a strong relation to the risk exposure. In liquid markets, open trading positions are closed more quickly which facilitates the trading and hedging process. Illiquid markets are connected to a lot of uncertainties which traders must face when they want to trade their assets and this high-risk exposure leads to higher costs. Liquid markets minimise risks and increase total market efficiency.

For the purpose of the quantitative analysis, the market-depth analysis seems to be the best approach for assessment. The analysis will focus on the price change between the respective orders taking into account possible cross-zonal exchanges. It needs to be noted that in the fundamental market model the only possibility is to simulate a single ("aggregated") timeframe i.e. without distinction between long-term, day-ahead or intraday timeframe. In case TSOs find out that the model results are accompanied by a lot of uncertainties during the calculations, analysis of historical data shall be performed.

(7) CACM criterion "Market concentration and market power"

Market concentration describes the number of players with a relevant market share at the demand and supply sides. Market power is a different concept and is related to the capability of certain parties to profitably manipulate market prices.

For the evaluation of "market concentration" two indicators shall be calculated, the HHI (Herfindal-Hirschman-Index) and the RSI (Residual Supply Index), also known as PSI (Pivotal Supplier Indicator).

The HHI is an indicator of economic theory to measure market concentration and is defined as the sum of the squared market shares

$$HHI = \sum_{i=1}^{N} s_i^2$$

where s_i is the market share of company i in the market and N is the total number of companies in the market. The HHI ranges from 1/N to 1.

A small HHI indicates a highly competitive (unconcentrated) market, while a high HHI indicates a high market concentration.

Another well-known indicator to measure market concentration is the RSI, also known as the Pivotal Supplier Indicator, which also considers potential imports. The RSI measures how much capacity remains in the market, when one provider retains its capacity:

$$RSI = \frac{Total\ Supply - Largest\ Seller's\ Supply}{Total\ Demand}$$

where s_i is the market share of company I in the market and N is the total number of companies in the market.

Cross-zonal contributions can in general be considered as follows:

$$Total\ supply = Total\ domestic\ supply\ capacity + Total\ net\ import$$

An RSI above 100% indicates that sufficient capacity remains in the market to meet the demand. An RSI below 100% indicates that the remaining capacity does not meet the demand.

Intermittency of variable renewable generation will be considered when calculation the supply. Since it is not possible to derive meaningful assumptions regarding the net import or export that could be considered for new bidding zone borders for which no historical import and export values are available, the quantitative analysis will neglect these. Yet, consideration of net imports would lead to decreased domestic market concentration, while consideration of net exports would lead to increased domestic market concentration.

Market power is a different concept and is related to the capability of certain parties to profitably manipulate market prices. The measurement of market power is more difficult since it requires competition modules to be incorporated in the modelling. Thus, it shall be assessed qualitatively.

(8) CACM criterion "facilitation of effective competition"

Effective competition is the situation in which there are enough companies in the market able to compete to produce the same product and there does not exist a single company that is able to raise prices significantly above the system marginal cost for a given time period.

The facilitation of effective competition represents the combination of the four criteria - market liquidity, market concentration, market power and robustness of price signals which are strongly interlinked. High market liquidity, low market concentration and low market power in combination with robust price signals are preconditions for effective market competition.

(9) CACM criterion "price signals for building infrastructure"

The CACM Article does not clarify whether the term "infrastructure" refers to investments in generation/demand only or investments in network infrastructure and due to the fact, that "price signals" are mentioned twice in the CACM Article for the purpose of this evaluation the term "infrastructure" is interpreted as transmission grid infrastructure.

There are two different types of lines creating the transmission grid infrastructure – the internal lines and the cross-zonal lines. The internal lines' price signals should be based on actual market results which show the efficiency of the grid and the need for their expansion but in reality, these investments are widely regulated and hence they do not depend on the market price signals. Due to this fact the investments in cross-zonal lines seem more relevant. Price signals for building of cross-zonal lines are represented by price differences between neighbouring zones. Additionally, the correlation between market congestion and physical congestion may be considered for the bidding zone borders under investigation. This would be reflected by measuring whether price differentials between bidding zones and physical congestion in the cross-sections between those bidding zones bidding zones occur simultaneously.

(10) CACM criterion "Accuracy and robustness of price signals"

Accuracy of price signals is understood as the ability of prices to reflect all relevant market and grid conditions. The more accurately prices reflect market conditions and the restrictions of the underlying grid, the better prices will be able to guide market participants in efficiently utilising the power system in the short term and developing the power system in the long term. With this view, it is considered relevant that day-ahead zonal prices lead to:

- Dispatching conditions compatibile with the system security: paying higher prices to power plants of which their infeed relieves congestions and lower prices to power plants of which their infeed increases congestions, and/or
- Higher revenues for generators located in bidding zones which are facing potential scarcity situations in terms of adequacy margins.

Hence, the two indexes identified for measuring price signals accuracy are aimed at measuring the ability of different bidding zone configurations to cope with the two goals mentioned above.

Robustness of price signals is understood as the continuity of price signals with regard to external conditions. Therefore, the more robust a price signal, the less it depends on alternative assumptions with regard to e.g. grid infrastructure, investments in generation and demand and economic variables. Since the robustness of prices makes use of the differences in prices signals for different assumptions it can be quantitatively assessed only if alternative scenarios are simulated, or sensitivity analyses are performed.

(11) CACM criterion "transition and transaction cost"

Transition and transaction costs follow an adjustment of a bidding zone configuration. Transition costs are understood as the 'one-time' costs directly related to a configuration change.

Transaction costs generally refer to the costs of participating in the market. They are permanent costs for search and information, bargaining, policing and enforcement. Transaction costs are, to some extent, specific to a given bidding zone configuration.

The type of such costs as well as their level varies largely among different actors affected by a reconfiguration as well as by the reconfiguration itself (e.g. whether BZ border is along TSO border, whether the BZ configuration has been adapted before, whether the grid is highly meshed or not).

(12) CACM criterion "infrastructure cost"

The ENTSO-E Guidelines for Cost Benefit Analysis of Grid Development Projects provides a definition for project costs and states that 'total project expenditures are based on prices used within each TSO and rough estimates on project consistency (e.g. km of lines)". Environmental costs can vary significantly between TSOs. More details on the Cost Benefit Analysis, which is e.g. applied in the TYNDP, can be found in the Guidelines themselves (e.g. project costs are pre-tax).

The grid scenarios considered in the Bidding Zone Review are based on the investments considered in the TYNDP. Due to its broader focus, the TYNDP refers mainly to cross-zonal projects and considers the current bidding zone configuration as an exogenous assumption. Since the Bidding Zone Review has a more detailed focus and aims for the assessment of alternative bidding zone configurations, national grid investment projects (located within the current bidding zones) will be added to the list of TYNDP grid investments for the purpose of this Bidding Zone Review.

Grid investments included in the TYNDP address the major system bottlenecks and structural congestions. Addressing those structural congestions by an adaptation of bidding zones would not remove them but rather disclose those congestions transparently to the market and restrict trading accordingly. This would not, per se, change the need for grid investments. Since, in comparative terms, grid investments would not change in the different configurations, a detailed assessment of the costs of building new grid infrastructure to the full extent is not relevant for the Bidding Zone Review. The absolute level would correspond to the costs of investments reported in the TYNDP.

The impact of alternative bidding zone configurations on the infrastructure costs will not be considered explicitly in the Bidding Zone Review. Instead, we refer here to the TYNDP scenario available at the time of performance of the BZR. In addition, costs for national investment projects can be found in the national grid development plans.

(13) CACM criterion "Market outcomes in comparison to corrective measures"

For this criterion, the market outcome respectively market dispatch and the corrective measures respectively redispatch shall be compared. The question is whether economically inefficient remedial actions are applied. In order to answer this question, in a first step, redispatch costs and possibly volumes are compared between the benchmark and the alternative configuration under investigation. In a second step, market dispatch costs are compared between the benchmark and the alternative configuration under investigation. Finally, the changes from the first two steps are compared so that the change in the overall system costs between the two configurations is given. Since the system costs are also tackled within the criterion "economic efficiency", the outcome of the criterion "market outcomes in comparison to corrective measures" is only used for comparison and validation purposes and not for the final assessment.

(14) CACM criterion "Adverse effects of internal transactions on other BZs"

Adverse effects of internal transactions on other BZs are understood to be flows not induced by cross-zonal trade. Flows not induced by cross-zonal trade is defined as all flows that are still present in case no cross zonal trades are performed in the market coupling..

(15) CACM criterion "Impact on the operation and efficiency of the balancing mechanisms and imbalance settlement processes"

The adjustment of a bidding zone configuration will most likely impact the operation and the efficiency of the balancing mechanisms of the concerned TSOs and the imbalance settlement process.

The type of impacts as well as their level might vary largely among the different TSOs involved in the specific bidding zone reconfiguration. For the evaluation of impacts on balancing mechanisms and imbalance settlement processes. It is important to evaluate the capability of the new LFC blocks associated to the new bidding zones to balance the system taking into account both the new availability of balancing resources and the foreseen level of congestion with the new bidding zones in terms of delivery of balancing power and different market incentives for providers. This is important in new BZs with high RES share where higher balancing needs will exist.

(16) CACM criterion "stability and robustness of bidding zones over time"

This criterion is strongly linked to other CACM criterion "location and frequency of congestion" and in order to ensure stability and robustness of bidding zones over time, bidding zone borders need to reflect structural congestion as well as ensure that it occurs within the same grid area.

(17) CACM criterion "Consistency across capacity calculation time frames"

The question as to whether an alternative bidding zone configuration leads to a higher or lower level of consistency across capacity calculation timeframes is not a technical one but related to the market design. From a technical / economical point of view, the same bidding zones shall be considered across all timeframes. If not, a different structure of bidding zones (e. g. bidding zones in day-ahead markets look different than in the intraday market segments) might lead to inconsistent price signals and might create undesirable arbitrage possibilities (between the different markets). Hence, whether the consistency across all capacity calculation time frames shall be ensured or not is a question of the desired market design. It is, therefore, more a decision than an evaluation criterion.

(18) CACM criterion "Assignment of generation and load units to BZs"

It is in the nature of things that the assignment of units and loads in a new bidding zone configuration cannot become easier or 'better' compared to the current one, because the current bidding zone configuration already considers a clear assignment of every generation and load unit. In general, the geographical location of a generation or load unit should clearly indicate to which bidding zone the unit would be assigned in case of an adaptation of bidding zones. Yet, specific contractual requirements can lead to an assignment which does not correspond to its geographical location. Additionally, it is not unusual that large thermal generation units are connected to more than one substation. If such a generation unit is close to the new bidding zone border, one has to decide to which bidding zone both substations shall be assigned. The analysis for this criterion shall be made through expert discussions and shall compare the level of difficulty of assigning generation and load units to bidding zones between the different configurations under investigation.

(19) CACM criterion "Location and frequency of congestion (market and grid)"

This criterion is strongly linked to the CACM requirement for bidding zones to be 'sufficiently stable and robust over time'. Hereby, the assessment of the location and frequency of congestion forms the basis for the evaluation of whether reconfigured bidding zones can be considered as sufficiently stable and robust over time.

In order to examine whether the congestion remains sufficiently stable and robust over time, congestion has to be compared for the configuration under investigation over different sensitivity analyses or years. Market congestion could thereby be represented by the active market constraints resulting from the market coupling, while grid congestion could be represented by overloads resulting from the grid calculations. Additionally, future investment which may relieve existing congestion shall be taken into account. For this purpose, the ENTSO-E TYNDP could be used.

(20) Criterion "RES integration"

This criterion is not specifically mentioned in CACM Article 33. However, in light of the CEP target to provide clean energy for all Europeans, the integrated amount of energy from RES is an important indicator to be analysed.

Annexes:

Annex 1 – Considerations on Bidding zone review region "Central Europe" bidding zone configurations;

Annex 2 – Justification of alternative configurations of the Bidding zone review region "Nordics" which are to be considered in the bidding zone review process;

Annex 3 – Justification of alternative configurations of the Bidding zone review region "South East Europe" which are to be considered in the bidding zone review process;

Annex 4 – Justification of configurations of the Bidding zone review region "Central Southern Italy" which are to be considered in the bidding zone review process;

Annex 5 – Justification of configurations of the Bidding zone review region "Baltic" which are to be considered in the bidding zone review process;

Annex 6 – Justification of configurations of the Bidding zone review region "Iberian Peninsula" which are to be considered in the bidding zone review process;

Annex 7 – Justification of configurations of the Bidding zone review region "Single Electricity Market Ireland" which are to be considered in the bidding zone review process;

Annex 8 – Justification of configurations of the Bidding zone review region "United Kingdom" which are to be considered in the bidding zone review process.

European Network of
Transmission System Operators
for Electricity

Annex 1: Configurations of the Bidding zone review region "Central Europe" which are to be considered in the bidding zone review process

Bidding Zone Review Region "Central Europe"

18 February 2020

1. Contents

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

This annex depicts in detail the Bidding Zone configurations for the Bidding Zone Review Region"Central Europe" that are to be considered in the bidding zone review process in accordance with Article 14(5) of Regulation (EU) 2019/943 of the European Parliament and the Council of 5th June 2019 on the internal market for electricity (recast).

This annex presents the status quo configuration of the Central Europe Bidding Zone Review Region. The TSOs of the BZRR Central Europe have not been able to conclude on alternative configurations to be used for the bidding zone review. The reasons for this can be found in the annex of the BZRR Central Europe of the explanatory document.

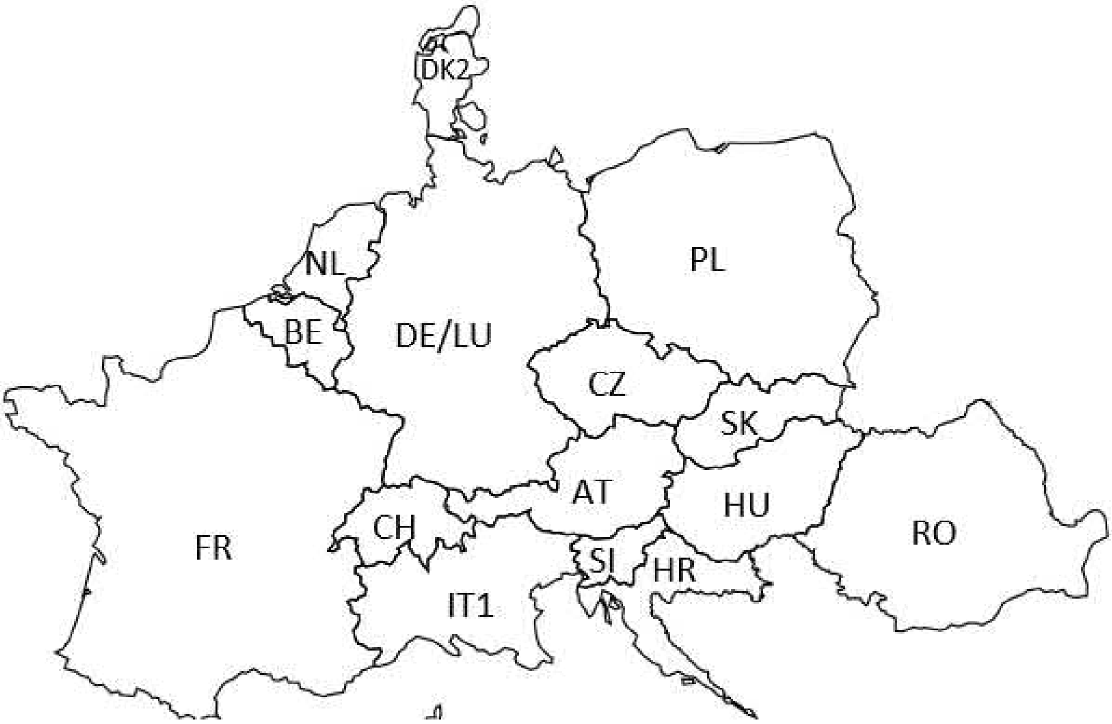


Figure 1: Status quo configuration

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

2. List of the network elements which form the Bidding Zone Borders in the Status Quo configuration

Configuration 1 "Status Quo"								
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**
AT	AT-CH	APG	Westtirol	Swissgrid	Pradella	380	AC	Inn Nord 428
AT	AT-CH	APG	Westtirol	Swissgrid	Pradella	380	AC	Inn Sued 427
AT	AT-CH	APG	Meiningen	Swissgrid	Bonaduz/Montlingen	220	AC	Falknis 407
AT	AT-CH	APG	Meiningen	Swissgrid	Winkeln	220	AC	Stoss Süd 408
AT	AT-CH	APG	Feldkirch	Swissgrid	Eschen	110	AC	Eschen – Feldkirch 197/11
AT	AT-CZ	APG	Dürnrohr	CEPS	Slavetice	380	AC	Duernrohr – Slavetice 437
AT	AT-CZ	APG	Dürnrohr	CEPS	Slavetice	380	AC	Duernrohr – Slavetice 438
AT	AT-CZ	APG	Bisamberg	CEPS	Sokolnice	220	AC	Bisamberg – Sokolnice 243
AT	AT-CZ	APG	Bisamberg	CEPS	Sokolnice	220	AC	Bisamberg – Sokolnice 244
AT	AT-DE	APG	Westtirol	Transnet BW	Bürs	380	AC	Bürs – Westtirol rot 422
AT	AT-DE	APG	Westtirol	Transnet BW	Bürs	220	AC	Bürs – Westtirol weiß 421
AT	AT-DE	APG	Westtirol	Amprion	Memmingen	220	AC	Füssen West 411
AT	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pleinting	220	AC	Pleinting – St. Peter 258
AT	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pirach	220	AC	Pirach – St. Peter 256
AT	AT-DE	APG	St. Peter	TenneT TSO GmbH	Altheim	220	AC	Altheim – St. Peter 233
AT	AT-DE	APG	St. Peter	TenneT TSO GmbH	Simbach	220	AC	Simbach – St. Peter 230
AT	AT-DE	APG	Westtirol	Amprion	Leupolz	380	AC	Füssen Ost 412
AT	AT-DE	APG	Braunau	TenneT TSO GmbH	Neuötting	110	AC	Braunau - Neuötting 199/3
AT	AT-DE	APG	Braunau	TenneT TSO GmbH	Stammham	110	AC	Braunau - Stammham 199/4
AT	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ering	110	AC	Ering - St. Peter 182/5
AT	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ering	110	AC	Ering - St. Peter 182/6
AT	AT-DE	APG	Antiesenhofen	TenneT TSO GmbH	Egglfing	110	AC	Egglfing - Antiesenhofen 188/3b
AT	AT-DE	APG	St.Peter	TenneT TSO GmbH	Egglfing	110	AC	Egglfing - St. Peter 188/5
AT	AT-DE	APG	Aigerding	TenneT TSO GmbH	Passau-Ingling	110	AC	Passau-Ingling - Aigerding 188/1
AT	AT-DE	APG	Ebbs	TenneT TSO GmbH	Oberaudorf	110	AC	Oberaudorf - Ebbs 176/7

AT	AT-DE	APG	Kufstein	TenneT TSO GmbH	Oberaudorf	110	AC	Oberaudorf - Kufstein 176/6
AT	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 413
AT	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 414
AT	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 274E
AT	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 273C
AT	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 274C
AT	AT-DE	APG	Ranna	TenneT TSO GmbH	Hauzenberg	110	AC	Ranna – Hauzenberg 156/1
AT	AT-DE	APG	St. Jakob	Transnet BW	Bürs	110	AC	St. Jakob – Bürs 172/8
AT	AT-DE	APG	Rauz	Transnet BW	Bürs	110	AC	Rauz – Bürs 172/9
AT	AT-DE	APG	Werben	Amprion	Stich 403A	220	AC	Stich Bludenz West 403A
AT	AT-DE	APG	Walgauwerk	Transnet BW	Bürs	220	AC	Bürs - Walgauwerk orange 405A
AT	AT-DE	APG	Meiningen	Transnet BW	Bürs	220	AC	Bürs - Meiningen grün 406A
AT	AT-DE	APG	Nenzing	Transnet BW	Bürs	110	AC	Bürs-Nenzing weiss 197/2
AT	AT-DE	APG	Bürs VKW	Transnet BW	Bürs	110	AC	Bürs - Bürs-VKW rot 197/10
AT	AT-DE	APG	Werben	Amprion	Stich 404A	220	AC	Stich Dellmensingen Ost 404A
AT	AT-HU	APG	Zurndorf	MAVIR	Györ	380	AC	Zurndorf– Györ 439B
AT	AT-HU	APG	Zurndorf	MAVIR	Szombathely	380	AC	Zurndorf– Szombathely 440B
AT	AT-HU	APG	Wien Südost	MAVIR	Györ	220	AC	Wien Südost – Györ 245
AT	AT-HU	APG	Neusiedl	MAVIR	Györ	220	AC	Neusiedl – Györ 246B
AT	AT-IT	APG	Lienz	TERNA	Soverzene	220	AC	Lienz – Soverzene 261
AT	AT-SI	APG	Obersielach	ELES	Podlog	220	AC	Obersielach – Podlog 247
AT	AT-SI	APG	Kainachtal	ELES	Maribor	380	AC	Kainachtal – Maribor 1 473
AT	AT-SI	APG	Kainachtal	ELES	Maribor	380	AC	Kainachtal – Maribor 2 474
BE	BE-DE	ELIA	Lixhe	Amprion	Oberzier	DC	DC	Alegro
BE	BE-FR	ELIA	Monceau	RTE	Chooz	220	AC	Chooz – Monceau
BE	BE-FR	ELIA	Avelgem	RTE	Avelin	380	AC	Avelin – Avelgem
BE	BE-FR	ELIA	Achène	RTE	Lonny	380	AC	Lonny – Achène
BE	BE-FR	ELIA	Aubange	RTE	Moulaine	220	AC	Moulaine – Aubange 1
BE	BE-FR	ELIA	Aubange	RTE	Moulaine	220	AC	Moulaine – Aubange 2
BE	BE-FR	ELIA	Avelgem	RTE	Mastaing	380	AC	Avelgem – Mastaing
BE	BE-FR	ELIA	Momignie 1	RTE	Fourmie	63	AC	Fourmie – Momignie 1
BE	BE-FR	ELIA	Momignie 2	RTE	Fourmie	63	AC	Fourmie – Momignie 2

BE	BE-NL	ELIA	Zandvliet	TenneT TSO B.V	Geertruidenberg	380	AC	Zandvliet – Geertruidenberg
BE	BE-NL	ELIA	Zandvliet	TenneT TSO B.V.	Borssele	380	AC	Zandvliet – Borssele
BE	BE-NL	ELIA	Van Eyck L27	TenneT TSO B.V.	Maasbracht	380	AC	Van Eyck White – Maasbracht
BE	BE-NL	ELIA	Van Eyck L28	TenneT TSO B.V.	Maasbracht	380	AC	Van Eyck Black – Maasbracht
BE	BE-UK	ELIA	Gezelle	NGET	Richborough	400	DC	Nemo Link Interconnector
BE	LU-BE	CREOS	Schifflange	ELIA	Schifflange	220	AC	Schifflange PST - Schifflange
CZ	CZ-AT	CEPS	Sokolnice	APG	Bisamberg	220	AC	Sokolnice-Bisamberg 244
CZ	CZ-AT	CEPS	Slavetice	APG	Dürnrohr	400	AC	Slavetice-Dürnrohr 437
CZ	CZ-AT	CEPS	Slavetice	APG	Dürnrohr	400	AC	Slavetice-Dürnrohr 438
CZ	CZ-AT	CEPS	Sokolnice	APG	Bisamberg	220	AC	Sokolnice-Bisamberg 243
CZ	CZ-DE	CEPS	Hradec	TenneT TSO GmbH	Etzenricht	400	AC	Hradec-Etzenricht 441
CZ	CZ-DE	CEPS	Prestice	TenneT TSO GmbH	Etzenricht	400	AC	Prestice-Etzenricht 442
CZ	CZ-DE	CEPS	Hradec	50Hertz	Rohrsdorf	400	AC	Hradec-Röhrsdorf 445
CZ	CZ-DE	CEPS	Hradec	50Hertz	Rohrsdorf	400	AC	Hradec-Röhrdorf 446
CZ	CZ-PL	CEPS	Lískovec	PSE Op. SA	Bujaków	220	AC	Bujaków – Lískovec 245
CZ	CZ-PL	CEPS	Lískovec	PSE Op. SA	Kopanina	220	AC	Kopanina – Lískovec 246
CZ	CZ-PL	CEPS	Albrechtice	PSE Op. SA	Dobrzeń	400	AC	Dobrzeń – Albrechtice 443
CZ	CZ-PL	CEPS	Nošovice	PSE Op. SA	Wielopole	400	AC	Wielopole – Nošovice 444
CZ	CZ-SK	CEPS	Sokolnice	SEPS	Stupava	400	AC	Sokolnice-Stupava 497
CZ	CZ-SK	CEPS	Nošovice	SEPS	Varin	400	AC	Nošovice- Varin 404
CZ	CZ-SK	CEPS	Lískovec	SEPS	P.Bystrica	220	AC	Lískovec-P.Bystrica 270
CZ	CZ-SK	CEPS	Sokolnice	SEPS	Križovany	400	AC	Sokolnice- Križovany 424
CZ	CZ-SK	CEPS	Sokolnice	SEPS	Senica	220	AC	Sokolnice-Senica 280
CH	CH-AT	Swissgrid	Pradella	APG	Westtirol	380	AC	Inn Sued
CH	CH-AT	Swissgrid	Pradella	APG	Westtirol	380	AC	Inn Nord
CH	CH-AT	Swissgrid	Eschen	APG	Feldkirch	110	AC	Eschen – Feldkirch
CH	CH-AT	Swissgrid	Rüthi	APG	Meiningen	220	AC	Schwarz
CH	CH-AT	Swissgrid	Rüthi	APG	Meiningen	220	AC	Rot
CH	CH-DE	Swissgrid	Asphard	TransnetBW	Kühmoos	380	AC	Wehra
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Breitematt	110	AC	Trafo 20 Laufenburg
CH	CH-DE	Swissgrid	Laufenburg	Amprion	Tiengen	380	AC	Andelsbach
CH	CH-DE	Swissgrid	Laufenburg	Amprion	Kühmoos	380	AC	Seelbach
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Eggberg

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

CH	CH-DE	Swissgrid	Oftringen	TransnetBW	Gurtweil	220	AC	Blau
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Hotzenwald
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Gurtweil	220	AC	Alb Süd
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Trossingen	380	AC	Wutach / Trossingen – Laufenburg rot
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Heimbach
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Murg
CH	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	380	AC	Aare – West
CH	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	220	AC	Aare – Ost
CH	CH-FR	Swissgrid	Vallorcine	RTE	Pressy	220	AC	
CH	CH-FR	Swissgrid	Bassecourt	RTE	Sierentz	380	AC	
CH	CH-FR	Swissgrid	Bassecourt	RTE	Mambelin	380	AC	
CH	CH-FR	Swissgrid	Riddes	RTE	Cornier	220	AC	Morgins Sud
CH	CH-FR	Swissgrid	Laufenburg	RTE	Sierentz	380	AC	Wiesental Nord
CH	CH-FR	Swissgrid	Verbois	RTE	Genissiat	220	AC	1
CH	CH-FR	Swissgrid	Verbois	RTE	Bois-Tollot	380	AC	
CH	CH-FR	Swissgrid	St. Triphon	RTE	Cornier	220	AC	Morgins Nord
CH	CH-FR	Swissgrid	Verbois	RTE	Genissiat	220	AC	2
CH	CH-FR	Swissgrid	Romanel	RTE	Bois-Tollot	380	AC	
CH	CH-IT	Swissgrid	Airolo	TERNA	Ponte	220	AC	San Giacomo
CH	CH-IT	Swissgrid	Lavorgo	TERNA	Musignano	380	AC	
CH	CH-IT	Swissgrid	Gorduno	TERNA	Mese	220	AC	Jorio
CH	CH-IT	Swissgrid	Soazza	TERNA	Bulciago	380	AC	Forcola
CH	CH-IT	Swissgrid	Riddes	TERNA	Avise	220	AC	Bernard Ouest
CH	CH-IT	Swissgrid	Riddes	TERNA	Valpelline	220	AC	Bernard Est
CH	CH-IT	Swissgrid	Serra	TERNA	Pallanzeno	220	AC	Monscera
CH	CH-IT	Swissgrid	Robbia	TERNA	San Fiorano	380	AC	Sassalbo
CH	CH-IT	Swissgrid	Robbia	TERNA	Gorlago	380	AC	Vartegna [1]
CH	CH-IT	Swissgrid	Mendrisio	TERNA	Cagno	380	AC	
CH	CH-IT	Swissgrid	Campocologno	TERNA	Tirano	150	AC	
CH	CH-IT	Swissgrid	Campocologno	TERNA	Villa di Tirano	132	AC	
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	380	AC	Bürs – Westtirol rot 422
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Altheim	220	AC	Altheim – St. Peter 233
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Simbach	220	AC	Simbach – St. Peter 230
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pirach	220	AC	Pirach – St. Peter 256
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pleinting	220	AC	Pleinting – St. Peter 258
DE	AT-DE	APG	Westtirol	Amprion	Kempten	220	AC	Westtirol - Kempten
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	220	AC	Bürs – Westtirol weiß 421
DE	AT-DE	APG	Westtirol	Amprion	Leupolz	380	AC	Füssen Ost 412
DE	AT-DE	APG	Braunau	TenneT TSO GmbH	Neuötting	110	AC	Braunau - Neuötting 199/3

DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ranna	110	AC	Ranna (Bedarfsübergabestelle) 147 (156/1)
DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ranna	110	AC	Ranna (Bedarfsübergabestelle) 147 (156/2)
DE	AT-DE	APG	Braunau	TenneT TSO GmbH	Stammham	110	AC	Braunau - Stammham 199/4
DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ering	110	AC	Ering - St. Peter 182/5
DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ering	110	AC	Ering - St. Peter 182/6
DE	AT-DE	APG	Antiesenhofen	TenneT TSO GmbH	Egglfing	110	AC	Egglfing - Antiesenhofen 188/3b
DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Egglfing	110	AC	Egglfing - St. Peter 188/5
DE	AT-DE	APG	Aigerding	TenneT TSO GmbH	Passau-Ingling	110	AC	Passau-Ingling - Aigerding 188/1
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 413
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 414
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 274E
DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 273C
DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 274C
DE	AT-DE	APG	Ebbs	TenneT TSO GmbH	Oberaudorf	110	AC	Oberaudorf - Ebbs 176/7
DE	AT-DE	APG	Kufstein	TenneT TSO GmbH	Oberaudorf	110	AC	Oberaudorf - Kufstein 176/6
DE	AT-DE	APG	St. Jakob	TransnetBW	Bürs	110	AC	St. Jakob – Bürs 172/8
DE	AT-DE	APG	Rauz	TransnetBW	Bürs	110	AC	Rauz – Bürs 172/9
DE	BE-DE	ELIA	Lixhe	Amprion	Oberzier	DC	DC	Alegro
DE	CH-DE	Swissgrid	Asphard	TransnetBW	Kühmoos	380	AC	Wehra
DE	CH-DE	Swissgrid	Oftringen	TransnetBW	Gurtweil	220	AC	Blau
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Gurtweil	220	AC	Alb Süd
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Heimbach
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Kühmoos	380	AC	Seelbach
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Murg
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Tiengen	380	AC	Andelsbach
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Eggberg
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Hotzenwald
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Breitematt	110	AC	Trafo 20 Laufenburg
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Trossingen	380	AC	Wutach / Trossingen – Laufenburg rot
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	220	AC	Aare – Ost
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	380	AC	Aare – West
DE	CZ-DE	CEPS	Prestice	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 442
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 445

DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 446
DE	CZ-DE	CEPS	Hradec	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 441
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Bjaeverskov	400	DC	Bentwisch – Bjaeverskov
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Kontek	380	AC	Bentwisch – Bjaeverskov
DE	DE-DKE	50Hertz	Bentwisch	Energinet	CGS	150	AC	Bentwisch – Bjaeverskov
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö1
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Kassö	220	AC	Flensburg-Kassö rt
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Ensted	220	AC	Flensburg-Ensted gb
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö2
DE	DE-FR	TransnetBW	Eichstetten	RTE	Vogelgrun	220	AC	Kaiserstuhl – Nord
DE	DE-FR	TransnetBW	Eichstetten	RTE	Muhlbach	380	AC	Ill
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 1 – Nord
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 2 – Süd
DE	DE-FR	Amprion	Ensdorf	RTE	St. Avold	220	AC	St. Avold
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden schwarz
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden weiß
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo schwarz
DE	DE-NL	Amprion	Oberzier	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant weiß
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo weiß
DE	DE-NL	Amprion	Siersdorf	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant schwarz
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem schwarz
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem weiß
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	220	AC	Vierraden – Krajnik 508
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	220	AC	Vierraden – Krajnik 507
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 567
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 568
DE	DE-SE	TenneT TSO GmbH	Herrenwyk	Svenska Kraftnät	Arrie	400	DC	Baltic Cable
DE	DE-AT	Amprion	Stich 403A	APG	Werben	220	AC	Stich Bludenz West 403A
DE	DE-AT	APG	Walgauwerk	TransnetBW	Bürs	220	AC	Bürs - Walgauwerk orange 405A
DE	DE-AT	APG	Meiningen	TransnetBW	Bürs	220	AC	Bürs - Meiningen grün 406A
DE	DE-AT	APG	Nenzing	TransnetBW	Bürs	110	AC	Bürs-Nenzing weiss 197/2
DE	DE-AT	APG	Bürs VKW	TransnetBW	Bürs	110	AC	Bürs - Bürs-VKW rot 197/10

DE	DE-AT	Amprion	Stich 404A	APG	Werben	220	AC	Stich Dellmensingen Ost 404A
DK1	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Ensted	220	AC	Flensburg-Ensted gb
DK1	DE-DK1	TenneT TSO GmbH	Audorf	Energinet	Kassö	380	AC	Audorf-Kassö 2/bl
DK1	DE-DK1	TenneT TSO GmbH	Audorf	Energinet	Kassö	380	AC	Audorf-Kassö 1/gn
DK1	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Kassö	220	AC	Flensburg-Kassö rt
DK1	DK1-SE	Energinet	400 kV Vester Hassing	Svenska Kraftnät	132 kV Lindome	250	DC	HVDC Kontiskan 2
DK1	DK1-SE	Energinet	400 kV Vester Hassing	Svenska Kraftnät	400 kV Lindome	250	DC	HVDC Kontiskan 1
DK1	DK1-NL	Energinet	Endrup	TenneT TSO B.V.	Eemshaven	320	DC	COBRAcable
DK1	DK1-NO	Energinet	150 kV Tjele	Statnett	300 kV Kr.sand	250	DC	HVDC Skagerrak 1
DK1	DK1-NO	Energinet	150 kV Tjele	Statnett	300 kV Kr.sand	250	DC	HVDC Skagerrak 2
DK1	DK1-NO	Energinet	400 kV Tjele	Statnett	300 kV Kr.sand	350	DC	HVDC Skagerrak 3
FR	BE-FR	ELIA	Avelgem	RTE	Avelin	400	AC	Avelin – Avelgem
FR	BE-FR	ELIA	Aubange	RTE	Moulaine	220	AC	Moulaine – Aubange
FR	BE-FR	ELIA	Aubange	RTE	Mont St Martin	220	AC	Aubange – Mont Saint Martin
FR	BE-FR	ELIA	Achène	RTE	Lonny	400	AC	Lonny – Achène
FR	BE-FR	ELIA	Jamiolle	RTE	Chooz	220	AC	Chooz – Jamiolle
FR	BE-FR	ELIA	Avelgem	RTE	Mastaing	380	AC	Avelgem-Mastaing
FR	BE-FR	ELIA	Momignie 1	RTE	Fourmie	63	AC	Fourmie – Momignie 1
FR	BE-FR	ELIA	Momignie 2	RTE	Fourmie	63	AC	Fourmie – Momignie 2
FR	CH-FR	Swissgrid	Vallorcine	RTE	Pressy	220	AC	
FR	CH-FR	Swissgrid	Bassecourt	RTE	Mambelin	400	AC	
FR	CH-FR	Swissgrid	Bassecourt	RTE	Sierentz	400	AC	
FR	CH-FR	Swissgrid	Riddes	RTE	Cornier	220	AC	Morgins Sud
FR	CH-FR	Swissgrid	Laufenburg	RTE	Sierentz	400	AC	Wiesental Nord
FR	CH-FR	Swissgrid	St. Triphon	RTE	Cornier	220	AC	Morgins Nord
FR	CH-FR	Swissgrid	Verbois	RTE	Genissiat	220	AC	1
FR	CH-FR	Swissgrid	Verbois	RTE	Genissiat	220	AC	2
FR	CH-FR	Swissgrid	Chamoson	RTE	Bois-Tollot	400	AC	
FR	CH-FR	Swissgrid	Verbois	RTE	Bois-Tollot	400	AC	
FR	DE-FR	TransnetBW	Eichstetten	RTE	Vogelgrun	220	AC	Kaiserstuhl – Nord
FR	DE-FR	TransnetBW	Eichstetten	RTE	Muhlbach	400	AC	Ill
FR	DE-FR	Amprion	Ensdorf	RTE	St. Avold	220	AC	St. Avold
FR	DE-FR	Amprion	Ensdorf	RTE	Vigy	400	AC	Vigy - 1N
FR	DE-FR	Amprion	Ensdorf	RTE	Vigy	400	AC	Vigy - 2S
FR	ES-FR	REE	Vic	RTE	Baixais	400	AC	
FR	ES-FR	REE	Benos	RTE	Lac Doo	150	AC	
FR	ES-FR	REE	Irun	RTE	Errondenia	150	AC	
FR	ES-FR	REE	Hernani	RTE	Argia	400	AC	

FR	ES-FR	REE	Arkale	RTE	Argia	220	AC	
FR	ES-FR	REE	Biescas	RTE	Pragneres	220	AC	
FR	ES-FR	REE	Santa Llogaia	RTE	Baixais	320	DC	Santa Llogaia – Baixas 1
FR	ES-FR	REE	Santa Llogaia	RTE	Baixais	320	DC	Santa Llogaia – Baixas 2
FR	FR-IT	RTE	Albertville	TERNA	Rondissone	400	AC	2
FR	FR-IT	RTE	Albertville	TERNA	Rondissone	400	AC	1
FR	FR-IT	RTE	Menton	TERNA	Camporosso	220	AC	
FR	FR-IT	RTE	Villarodin	TERNA	Venaus (Venalzio)	400	AC	
FR	FR-UK	RTE	Mandarins	NGC	Sellindge	270	DC	1
FR	FR-UK	RTE	Mandarins	NGC	Sellindge	270	DC	2
HR	HR-BA	HOPS	ERNESTINOVO	NOSBiH	UGLJEVIK	400	AC	ERNESTINOVO-UGLJEVIK
HR	HR-BA	HOPS	KONJSKO	NOSBiH	MOSTAR	400	AC	KONJSKO-MOSTAR
HR	HR-BA	HOPS	ĐAKOVO	NOSBiH	TUZLA	220	AC	ĐAKOVO-TUZLA
HR	HR-BA	HOPS	ĐAKOVO	NOSBiH	GRADAČAC	220	AC	ĐAKOVO-GRADAČAC
HR	HR-BA	HOPS	ZAKUČAC	NOSBiH	MOSTAR	220	AC	ZAKUČAC-MOSTAR
HR	HR-BA	HOPS	MEĐURIĆ	NOSBiH	PRIJEDOR	220	AC	MEĐURIĆ-PRIJEDOR
HR	HR-HU	HOPS	ŽERJAVINEC	MAVIR	HÉVÍZ 1	400	AC	ŽERJAVINEC-HÉVÍZ 1
HR	HR-HU	HOPS	ŽERJAVINEC	MAVIR	HÉVÍZ 2	400	AC	ŽERJAVINEC-HÉVÍZ 2
HR	HR-RS	HOPS	ERNESTINOVO	EMS	SR.MITROVICA 2	400	AC	ERNESTINOVO-SR.MITROVICA 2
HR	HR-SI	HOPS	MELINA	ELES	DIVAČA	400	AC	MELINA-DIVAČA
HR	HR-SI	HOPS	TUMBRI	ELES	KRŠKO 1	400	AC	TUMBRI-KRŠKO 1
HR	HR-SI	HOPS	TUMBRI	ELES	KRŠKO 2	400	AC	TUMBRI-KRŠKO 2
HR	HR-SI	HOPS	PEHLIN	ELES	DIVAČA	220	AC	PEHLIN-DIVAČA
HR	HR-SI	HOPS	ŽERJAVINEC	ELES	CIRKOVCE	220	AC	ŽERJAVINEC-CIRKOVCE
HR	HR-BA	HOPS	PLAT	NOSBiH	TREBINJE	220	AC	PLAT-TREBINJE
HR	HR-BA	HOPS	SISAK	NOSBiH	PRIJEDOR	220	AC	SISAK-PRIJEDOR
HR	HR-BA	HOPS	GRAČAC	NOSBiH	KULEN VAKUF	110	AC	GRAČAC-KULEN VAKUF
HR	HR-BA	HOPS	SLAVONSKI BROD 2	NOSBiH	BOSANSKI BROD	110	AC	SLAVONSKI BROD 2-BOSANSKI BROD
HR	HR-BA	HOPS	IMOTSKI	NOSBiH	GRUDE	110	AC	IMOTSKI-GRUDE
HR	HR-BA	HOPS	STON	NOSBiH	NEUM	110	AC	STON-NEUM
HR	HR-BA	HOPS	OPUZEN	NOSBiH	NEUM	110	AC	OPUZEN-NEUM
HR	HR-BA	HOPS	OPUZEN	NOSBiH	ČAPLJINA	110	AC	OPUZEN-ČAPLJINA
HR	HR-BA	HOPS	KOMOLAC	NOSBiH	TREBINJE	110	AC	KOMOLAC-TREBINJE
HR	HR-BA	HOPS	BUSKO BLATO	NOSBiH	LIVNO	110	AC	BUSKO BLATO-LIVNO
HR	HR-BA	HOPS	VRGORAC	NOSBiH	LJUBUŠKI	110	AC	VRGORAC-LJUBUŠKI

HR	HR-BA	HOPS	ŽUPANJA	NOSBiH	ORAŠJE	110	AC	ŽUPANJA-ORAŠJE
HR	HR-BA	HOPS	KNIN	NOSBiH	BOSANSKO GRAHOVO	110	AC	KNIN - BOSANSKO GRAHOVO
HR	HR-RS	HOPS	BELI MANASTIR	EMS	APATIN	110	AC	BELI MANASTIR-APATIN
HR	HR-RS	HOPS	NIJEMCI	EMS	ŠID	110	AC	NIJEMCI-ŠID
HR	HR-SI	HOPS	MATULJI	ELES	ILIRSKA BISTRICA	110	AC	MATULJI-ILIRSKA BISTRICA
HR	HR-SI	HOPS	BUJE	ELES	KOPER	110	AC	BUJE-KOPER
HR	HR-SI	HOPS	NEDELJANEC	ELES	FORMIN	110	AC	NEDELJANEC-FORMIN
HR	HR-HU	HOPS	ERNESTINOVO	MAVIR	PÉCS	400	AC	ERNESTINOVO - PÉCS 1
HR	HR-HU	HOPS	ERNESTINOVO	MAVIR	PÉCS	400	AC	ERNESTINOVO - PÉCS 2
HU	HU-AT	MAVIR	Győr	APG	Neusiedl	220	AC	Győr -Neusiedl 246B
HU	HU-AT	MAVIR	Győr	APG	Wien-Südost	220	AC	Győr - Wien-Südost 245
HU	HU-AT	MAVIR	Győr	APG	Zurndorf	400	AC	Győr - Zurndorf 439B
HU	HU-AT	MAVIR	Szombathely	APG	Zurndorf	400	AC	Szombathely - Zurndorf440B
HU	HU-HR	MAVIR	Hévíz	HEP-OPS	Žerjavinec	400	AC	Hévíz -Žerjavinec II.
HU	HU-HR	MAVIR	Hévíz	HEP-OPS	Žerjavinec	400	AC	Hévíz -Žerjavinec I.
HU	HU-HR	MAVIR	Pécs	HEP-OPS	Ernestinovo	400	AC	Pécs-Ernestinovo I.
HU	HU-HR	MAVIR	Pécs	HEP-OPS	Ernestinovo	400	AC	Pécs-Ernestinovo II.
HU	HU-HR	MAVIR	Siklós	HEP-OPS	Donji Miholjac	120	AC	Siklós-Donji Miholjac / not considered
HU	HU-HR	MAVIR	Lenti	HEP-OPS	Nedeljanec	120	AC	Lenti-Nedeljanec / not considered
HU	HU-RO	MAVIR	Sándorfalva	Transelectrica	Arad	400	AC	Sándorfalva-Arad
HU	HU-RO	MAVIR	Békéscsaba	Transelectrica	Nadab	400	AC	Békéscsaba-Nadab
HU	HU-RS	MAVIR	Sándorfalva	EMS	Subotica	400	AC	Sándorfalva-Subotica
HU	HU-SK	MAVIR	Győr	SEPS	Gabčíkovo	400	AC	Győr-Gabčíkovo
HU	HU-SK	MAVIR	Göd	SEPS	Levice	400	AC	Göd-Levice
HU	HU-UA	MAVIR	Albertirsa	Ukrenergo	Zahidno Ukrainska	750	AC	Albertirsa- Zahidno Ukrainska
HU	HU-UA	MAVIR	Sajószöged	Ukrenergo	Mukachevo	400	AC	Sajószöged-Mukachevo
HU	HU-UA	MAVIR	Kisvárda	Ukrenergo	Mukachevo	220	AC	Kisvárda-Mukachevo
HU	HU-UA	MAVIR	Tiszalök	Ukrenergo	Mukachevo	220	AC	Tiszalök-Mukachevo
IT	AT-IT	APG	Lienz	TERNA	Soverzene	220	AC	Lienz – Soverzene
IT	IT-AT	Terna	Tarvisio	APG	Arnoldstein	132	AC	Tarvisio-Arnoldstein
IT	CH-IT	Swissgrid	Airolo	TERNA	Ponte	220	AC	San Giacomo
IT	CH-IT	Swissgrid	Lavorgo	TERNA	Musignano	380	AC	
IT	CH-IT	Swissgrid	Gorduno	TERNA	Mese	220	AC	Jorio

IT	CH-IT	Swissgrid	Riddes	TERNA	Valpelline	220	AC	Bernard Est
IT	CH-IT	Swissgrid	Riddes	TERNA	Avise	220	AC	Bernard Ouest
IT	CH-IT	Swissgrid	Soazza	TERNA	Bulciago	380	AC	Forcola
IT	CH-IT	Swissgrid	Serra	TERNA	Pallanzeno	220	AC	Monscera
IT	CH-IT	Swissgrid	Robbia	TERNA	San Fiorano	380	AC	Sassalbo[2]
IT	CH-IT	Swissgrid	Robbia	TERNA	Gorlago	380	AC	Vartegna
IT	CH-IT	Swissgrid	Mendrisio	TERNA	Cagno	380	AC	
IT	CH-IT	Swissgrid	Campocologno	TERNA	Tirano	150	AC	
IT	CH-IT	Swissgrid	Campocologno	TERNA	Villa di Tirano	132	AC	
IT	FR-IT	RTE	Z Menton	TERNA	Camporosso	220	AC	
IT	FR-IT	RTE	Albertville	TERNA	Rondissone	400	AC	1
IT	FR-IT	RTE	Albertville	TERNA	Rondissone	400	AC	2
IT	FR-IT	RTE	Villarodin	TERNA	Venalzio (Venaus)	400	AC	
IT	IT-SI	TERNA	Redipuglia	ELES	Divaca	380	AC	
IT	IT-SI	TERNA	Padriciano	ELES	Divaca	220	AC	
LU	LU-BE	Creos	Schifflange	ELIA	Aubange	220	AC	Aubange - PST Schifflange
NL	BE-NL	ELIA	Zandvliet	TenneT TSO B.V.	Geertruidenberg	380	AC	Zandvliet – Geertruidenberg
NL	BE-NL	ELIA	Zandvliet	TenneT TSO B.V.	Borssele	380	AC	Zandvliet – Borssele
NL	BE-NL	ELIA	Van Eyck	TenneT TSO B.V.	Maasbracht	380	AC	Van Eyck White – Maasbracht
NL	BE-NL	ELIA	Van Eyck	TenneT TSO B.V.	Maasbracht	380	AC	Van Eyck Black – Maasbracht
NL	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden weiß
NL	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden schwarz
NL	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo weiß
NL	DE-NL	Amprion	Oberzier	TenneT TSO B.V.	Maasbracht	380	AC	Maasbracht - Oberzier 380 Wit
NL	DE-NL	Amprion	Siersdorf	TenneT TSO B.V.	Maasbracht	380	AC	Maasbracht – Siersdorf 380 Zwart
NL	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo schwarz
NL	DE-NL	Amprion	Niederrhein	TenneT TSO B.V.	Doetinchem	380	AC	Niederrhein – Doetinchem schwarz
NL	DE-NL	Amprion	Niederrhein	TenneT TSO B.V.	Doetinchem	380	AC	Niederrhein – Doetinchem weiß
NL	NL-DK1	TenneT TSO B.V.	Eemshaven	Energinet	Endrup	320	DC	COBRAcable
NL	NL-NO	TenneT TSO B.V.	Eemshaven	Statnett	Feda	450	DC	Eemshaven – Feda (NorNed)
NL	NL-UK	TenneT TSO B.V.	Maasvlakte	NGET	Isle of Grain	450	DC	Maasvlakte – Isle of Grain (BritNed)
PL	PL-BY	PSE Op. SA	Wólka Dobrzyńska	Bel Energo	Brześć	110	AC	Wólka Dobrzyńska – Brześć
PL	PL-CZ	PSE Op. SA	Bujaków	CEPS	Lískovec	220	AC	Bujaków – Lískovec 245
PL	PL-CZ	PSE Op. SA	Kopanina	CEPS	Lískovec	220	AC	Kopanina – Lískovec 246

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

PL	PL-CZ	PSE Op. SA	Dobrzeń	CEPS	Albrechtice	400	AC	Dobrzeń – Albrechtice 443
PL	PL-CZ	PSE Op. SA	Wielopole	CEPS	Nošovice	400	AC	Wielopole – Nošovice 444
PL	PL-DE	PSE Op. SA	Krajnik	50-Hertz	Vierraden	400	AC	Krajnik – Vierraden 507
PL	PL-DE	PSE Op. SA	Krajnik	50 Hertz	Vierraden	400	AC	Krajnik – Vierraden 508
PL	PL-DE	PSE Op. SA	Mikułowa	50 Hertz	Hagenwerder	400	AC	Mikułowa – Hagenwerder 567
PL	PL-DE	PSE Op. SA	Mikułowa	50 Hertz	Hagenwerder	400	AC	Mikułowa–Hagenwerder 568
PL	PL-SE	PSE Op. SA	Słupsk	Svenska Kraftnät	Karlshamn	450	DC	SwePol Link
PL	PL-SK	PSE Op. SA	Krosno Iskrzynia	SEPS	Lemesany	400	AC	Krosno-Lemesany 478
PL	PL-SK	PSE Op. SA	Krosno Iskrzynia	SEPS	Lemesany	400	AC	Krosno-Lemesany 477
PL	PL-UA	PSE Op. SA	Zamość	WPS	Dobrotwór	220	AC	Zamość – Dobrotwór
PL	PL-LT	PSE SA	Ełk Bis	LITGRID AB	Alytus	400	AC	Ełk Bis – Alytus
SI	SI-AT	ELES	Podlog	APG	Obersielach	220	AC	Podlog-Obersielach
SI	SI-AT	ELES	Maribor	APG	Kainachtal	400	AC	Maribor-Kainachtal
SI	SI-AT	ELES	Maribor	APG	Kainachtal	400	AC	Maribor-Kainachtal
SI	SI-HR	ELES	Divaca	HEP	Pehlin	220	AC	Divaca-Pehlin
SI	SI-HR	ELES	Cirkovce	HEP	Zerjavinec	220	AC	Cirkovce-Zerjavinec
SI	SI-HR	ELES	Krško	HEP	Tumbri	400	AC	Krško-Tumbri
SI	SI-HR	ELES	Divaca	HEP	Melina	400	AC	Divaca-Melina
SI	SI-HR	ELES	Koper	HEP	Buje	110	AC	Koper-Buje
SI	SI-HR	ELES	Il.Bistrica	HEP	Matulji	110	AC	Il.Bistrica-Matulji
SI	SI-HR	ELES	Formin	HEP	Nedeljanec	110	AC	Formin-Nedeljanec
SI	SI-HR	ELES	Krško	HEP	Tumbri	400	AC	Krško-Tumbri
SI	SI-IT	ELES	Divaca	TERNA	Redipuglia	400	AC	Divaca-Redipuglia
SI	SI-IT	ELES	Divaca	TERNA	Padriciano	220	AC	Divaca- Padriciano
SK	SK-CZ	SEPS	Varín	ČEPS	Nošovice	400	AC	Varín – Nošovice
SK	SK-CZ	SEPS	Stupava	ČEPS	Sokolnice	400	AC	Stupava – Sokolnice
SK	SK-CZ	SEPS	Senica	ČEPS	Sokolnice	220	AC	Senica – Sokolnice
SK	SK-CZ	SEPS	P. Bystrica	ČEPS	Lískovec	220	AC	P. Bystrica – Lískovec
SK	SK-CZ	SEPS	Križovany	ČEPS	Sokolnice	400	AC	Križovany – Sokolnice
SK	SK-HU	SEPS	Levice	MAVIR	Göd	400	AC	Levice – Göd
SK	SK-HU	SEPS	Gabčíkovo	MAVIR	Győr	400	AC	Gabčíkovo – Győr
SK	SK-PL	SEPS	Lemešany	PSE Op. SA	Krosno	400	AC	Lemešany – Krosno 477
SK	SK-PL	SEPS	Lemešany	PSE Op. SA	Krosno	400	AC	Lemešany – Krosno 478
SK	SK-UA	SEPS	V. Kapušany	WPS	Mukačevo	400	AC	V. Kapušany – Mukačevo

Table 1: Bidding Zone Borders of the Status Quo configuration

European Network of Transmission System Operators for Electricity

Annex 1: Considerations on Bidding Zone Review Region "Central Europe" Bidding Zone configurations

Bidding Zone Review Region "Central Europe"

18 February 2020

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

1 Contents

This document provides an explanation to the competent regulatory authorities and the Agency on what has prevented an agreement amongst the TSOs of the Bidding Zone Review Region Central Europe to propose a set of configurations to be investigated in the bidding zone review process in accordance with Article 14(5) of Regulation (EU) 2019/943 of the European Parliament and the Council of 5th June 2019 on the internal market for electricity (recast).

2 General introduction

According to article 4.3 of the All TSOs proposal for the methodology and assumptions that are to be used in the bidding zone review process and for the alternative bidding zone configurations to be considered in accordance with Article 14(5) of Regulation (EU) 2019/943 of the European Parliament and the Council of 5th June 2019 on the internal market for electricity (recast) (the “IME Regulation”), hereinafter referred to as the "BZR methodology", the TSOs of a Bidding Zone Review Region (BZRR) shall deliver a set of bidding zone configurations for their BZRR which are to be used in the Bidding Zone Review Process.

Alternatively, according to article 4.4. of the proposed BZR methodology, the TSOs of a BZRR may submit only the status quo configuration, if sufficient justification is provided on the absence of structural congestions that have impact on neighbouring bidding zones under the consideration of applicability of the 70% criterion as intended in Article 16(8) of the IME regulation.

The BZRR Central Europe (BZRR CE), comprising of the bidding zones France, Belgium, The Netherlands, Germany/ Luxembourg, Austria, Czech Republic, Poland, Slovakia, Hungary, Slovenia, Croatia, Romania, Denmark 1, Switzerland and Italy 1, also had the task to deliver a set of alternative bidding zone configurations to be used in the Bidding Zone Review Process, or to provide sufficient justification on the absence of structural congestions if only the status quo configuration was to be provided.

The TSOs of BZRR Central Europe have not been able to agree upon a set of alternative configurations to be provided for the BZRR CE to be used in the Bidding Zone Review Process. This document provides the competent regulatory authorities and the Agency with explanations on the process followed by the BZRR CE TSOs, the relevant proposals and argumentations as provided by the individual TSOs of the BZRR Central Europe, and explains what has prevented an agreement amongst the TSOs of the BZRR on a set of configurations.

3 Process followed by BZRR CE TSOs to determine alternative configurations

The TSOs of the BZRR CE had agreed upon the following two-step process to come to a set of bidding zone configurations to be collectively proposed by the BZRR CE TSOs according to article 4(3) of the proposed BZR methodology:

1. Per Member State, the TSOs of that Member state will come forward with either:
    a. Alternative bidding zone configurations for the Member State to be investigated in the next Bidding Zone Review, including a justification for the proposed configuration; or
    b. The status quo bidding zone configuration in its Member State and a justification why no alternative bidding zone configuration would have to be investigated for the Member State
2. The BZRR CE TSOs will discuss the individual proposals and combine them to come to a balanced set of configurations to be investigated by the BZRR CE TSOs.

The outcome of step 1 of the process above is described in section 4 and section 0 of this document; an explanation why the BZRR CE TSOs could not come to a set of alternative bidding zone configurations to be proposed for investigation in the next bidding zone review, is given in section 0.

4 Overview of TSOs which did not provide alternative configurations and their arguments why

In Table 1, the individual justification of each TSO of the BZRR CE which did not provide alternative configurations is given. For the sake of clarity, these justifications reflect the individual positions of the respective TSOs.

Member State	TSO	BZ	Justification
France	RTE	FR	**On the horizon of this bidding zone review there are no structural congestions in France** As part of its legal obligations, RTE has carried out its grid development study (SDDR: *Schéma décennal de développement du réseau*) that has been published and submitted to the French NRA's approval on 17th September 2019. The SDDR offers RTE's best forecast on grid congestion and grid development needs until 2035 in four different scenarios with different evolutions of the energy mix. The methodologies used in this study were developed to reflect the specificities of the French electric system. The SDDR presents the following results: - In the period 2021-2025, with an amount of RES below 50 GW in all the considered scenarios, RTE's 220 and 400 kV transmission grid will not face any significant increases in congestions, redispatching costs or RES curtailment. The 220 and 400 kV levels will not require any major developments in that period. Development needs will mainly be focused on connections of new RES capacities and not on the reinforcement of the transmission grid. - When the amount of installed RES exceeds 50 GW (closer to 2030 or later depending on the considered scenario), congestions will increase and significant grid developments will be required on all voltage levels in order to mitigate the increase in congestion costs. RTE currently faces a low level of congestion (with redispatching costs around 10 million euros per year) with the French configuration as a single bidding zone. Considering the results of the SDDR study, it appears that challenging this configuration is not relevant before the target year 2025. **Studying an alternative bidding zone configuration in France would complexify the bidding zone review from a methodological point of view and put it at risk without proven benefit.** As shown by the difficulties faced and explained in the first Bidding Zone Review, the scope and complexity of the Bidding Zone Review make it difficult to correctly model the local specificities of all TSOs. For instance, topological remedial actions, which are heavily used in RTE to solve congestion, could not be taken into account in the study. This explains why congestions shown in this study were so different from those faced by RTE (in the model-based approach, the overall cost of congestion for continental Europe was estimated around 100 million euros and the congestion cost associated to the constraints on the French 225 kV network was estimated around 70% of this amount). Submitting alternative configurations for France in the Bidding Zone Review would imply the risk of displaying results that would not be deemed reliable by RTE and would not be consistent with the SDDR which, as stated above, does not show any significant increases in congestions in the period 2021-2025.
Belgium	Elia	BE	1. A split of the Belgian bidding zone is not required since Belgium does not face structural congestions (as illustrated by the low redispatch costs). This approach is consistent with the choice not to apply for an action plan pursuant to the Article 15 of the Electricity Regulation. Moreover, a split would be detrimental for the liquidity of the bidding zone, hence for the quality of the underlying price formation. 2. A merge does not appear appropriate at a time where the legislation pushes towards smaller bidding zone and the non-consideration of internal elements in the capacity calculation process. The expected gain in efficiency in the market coupling thanks to the 70% rule of the Electricity Regulation also reduces the need for considering a merge of bidding zone since the grid will already be used as efficiently as possible.
Czech republic	CEPS	CZ	"Czech Republic (ČEPS, a.s.) does not propose any alternative configuration. Proposal to maintain the current bidding zone is fully in line with conclusions resulting from Market monitoring report 2017 elaborated by ACER and Technical report provided by ENTSO-E. According to the results from the latest Technical report, there is no structural congestion within the Czech Republic bidding zone. In more details, for the capacity calculation for the purpose of DA allocation time frame, no congestions on internal network elements of bidding zone Czech Republic have been recorded. In D-1 time frame and real-time, only several congestions on internal network elements are reported, but they are far from meeting the definitions of structural congestions. The majority of congestions in real-time were caused by unexpected high power flows from the northern direction (either from 50Hertz or PSE) during planned maintenance periods. Few congestions resulted as a consequence of redispatching outside of the Czech Republic. After putting the PST between ČEPS and 50Hertz in July 2017, the level of congestions reported on internal network elements in transiting path from Germany (50Hertz) to the southeast had decreased for both time frames.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Member State	TSO	BZ	Justification
			Based on absence of structural congestion within Czech Republic bidding zone, maintenance of current bidding zone is proposed. In Market monitoring report, efficiency of current bidding zone configuration has been assessed by pair of indicators. First assessment criteria monitors cross-zonal capacity and the second one costly remedial actions. The performance of each country or bidding zone is assessed for each criteria, and is classified into three possible categories. A bidding zone configuration is considered inefficient, and should be improved, when it performs poorly on either the cross-zonal capacity or costly remedial actions criteria. According to the results, current bidding zone (Czech Republic) is not considered inefficient since it does not perform poorly on either the cross-zonal capacity or costly remedial actions criteria. Therefore proposal to maintain the current bidding zone (Czech Republic) is in accordance with conclusions stated in Market monitoring report."
Poland	PSE	PL	According to Article 14(1) of Regulation 2019/943 Member States shall take all appropriate measures to address congestions. Bidding zone borders shall be based on long-term, structural congestions in the transmission network. Bidding zones shall not contain such structural congestions unless they have no impact on neighbouring bidding zones, or, as a temporary exemption, their impact on neighbouring bidding zones is mitigated through the use of remedial actions and those structural congestions do not lead to reductions of cross-zonal trading capacity in accordance with the requirements of Article 16 (also known as 70% requirement). The configuration of bidding zones in the Union shall be designed in such a way as to maximise economic efficiency and to maximise cross-zonal trading opportunities in accordance with Article 16, while maintaining security of supply. As already described in the report from the First Edition Bidding Zone Review, the Polish bidding zone appears to be a fairly coherent one, without major dominant east – west or north – south power flows, nor any others. The power flow pattern changes with seasons and with demand, thus making it practically impossible to determine one unique, congestion-based geographical PL split suitable for all seasons and demand situations. PSE would like to emphasise that the split of Poland analysed in the First Edition Bidding Zone Review was only one of the theoretically possible splits resulting from the clustering exercise, without significant advantages over other possible split scenarios. The price differences between the Polish bidding zones in the different split scenarios were quite marginal (in the order of tens of euro cents per MWh), which from a PSE point of view confirms that there is no strong indication for any robust split of the Polish bidding zone. Moreover, it should be underlined that most of the (very limited) LMP price differential in Polish bidding zones have come from constraints located outside of Poland. This was clearly visible when comparing shadow prices of European critical branches – shadow prices of the Polish branches were order of magnitude lower than those in other European countries. Further, ENTSO-E Technical Report 2018 has shown that congestions of structural character in Poland are active only on Polish borders or their direct vicinity: cross-border lines and lines directly connected to border substations, and hence they are highly influenced by unscheduled flows and usually result from dynamic changes of those unscheduled flows. Any other constraints presented in the report cannot be deemed as structural congestions. The frequency of those constraints is relatively low, e.g. 220 kV Pila Krzewina – Plewiska is active just 0.5 % of all hours in 2017 and grid investments are expected to solve those constraints in near future, e.g. a new double circuit line 400 kV-Pila Krzewina – Plewiska in 2021. It need to be noted that according to Article 14(5) of Regulation 2019/943 the methodology for the bidding zone review shall be based on structural congestions which are not expected to be overcome within the following three years, taking due account of tangible progress on infrastructure development projects that are expected to be realised within the following three years. In parallel, Article 14(7) of Regulation 2019/943 gives an option to Member States to decide whether to apply Action Plan or to review and amend its bidding zone. This decision has still not be taken in Poland and many other EU countries, providing high level of uncertainties related to future flow patterns and eventual congestions resulting from them. Considering all the above, based on available information and current expert knowledge, PSE sees no sound justification for any split of Polish bidding zone. Internal transactions within the Polish bidding zone have no significant influence on power flows in neighbouring systems, and in particular, they do not constitute a structural cause for the worsening of conditions for the secure operation of these systems. Instead, given the dynamic development of intermittent sources of energy and the resulting frequent and significant trading pattern changes, PSE favours a more significant redesign of the European market by moving from a zonal model towards a more locational one, thereby avoiding the need for ex ante defining of bidding zones and all the implications these entail.
Slovakia	SEPS	SK	Due to the fact that there is no structural congestion registered on the internal lines and the occurance of such congestion has been detected only on the cross-border lines and bearing in mind the fact that the geographical area of Slovak bidding zone, which is one of the smallest in the BZRR of Central Europe, SEPS decided not to provide any additional bidding zone configuration (especially split of our bidding zone) for the next BZR except the current one.

Member State	TSO	BZ	Justification
Hungary	MAVIR	HU	MAVIR does not propose to perform calculations on any split configuration in case of the Hungarian bidding zone as we believe that, as a long-term solution, the appropriate bidding zone delimitation (or its correction via an Action Plan according to Article 15 of the CEP Regulation) shall be determined taking into account the fulfilment of the 70% requirement in the flow-based capacity calculation methodology (i.e. the target model of CACM). Furthermore, MAVIR does not have a tool, the necessary data or an applicable methodology to assess the fulfilment of the 70% requirement in the current (NTC-based) capacity calculation methodology in advance before the allocation – in fact for the determination of the current NTC fulfilment regarding the 70% requirement the foreseen ACER calculations (scheduled for September-October of 2019) are necessary. The eventual structural congestions according to the DA Flow Based CC may be assessed once the relevant data and the ACER compliant common capacity calculation tool are available. In this respect MAVIR could only use the results of the latest Technical Report which does not contain any structural congestion within the Hungarian bidding zone, and we believe that no alternative proposal that is justifiable and sufficiently long-lasting (i.e. equally valid once the FBCC is implemented) can be determined at this point.
Slovenia	ELES	SI	1. A split of the Slovenian bidding zone is not required since Slovenia does not face structural congestions. This can be justified by the low redispatch costs. Besides that, all redispatch costs are a consequence of the congestions on North Italian Border. This approach is consistent with the choice not to apply for an action plan pursuant to the Article 15 of the Electricity Regulation. Moreover, a split would be detrimental for the liquidity of the bidding zone, hence for the quality of the underlying price formation. 2. A merge does not appear appropriate at a time where the legislation pushes towards smaller bidding zone and the non-consideration of internal elements in the capacity calculation process. The expected gain in efficiency in the market coupling thanks to the 70% rule of the Electricity Regulation also reduces the need for considering a merge of bidding zone since the grid will already be used as efficiently as possible.
Croatia	HOPS	HR	Croatia, through its transmission system operator (HOPS), and following its obligations from EU legislation, have accomplished satisfying cross-border transmission capacities with the CEE region (Hungary and Slovenia) with satisfying all technical criteria for secure power system operation and safe supply to end consumers. Changing existing BZ configuration, in Croatian case, would result in congestion within the Croatian transmission network and that is the reason why we are standing by the decision that current situation is the most efficient one, single BZ in Croatian control area.
Romania	Transelectrica	RO	With regard to the bidding zone review process, for Romania, there are no alternative bidding zone configurations. This is due to the fact that there are no structural congestions on the long-term run in the transmission network. This assumption is based on the present situation and the Ten Years Network Development Plan of Transelectrica. Currently, the transmission network rated voltage is mainly of 220 kV in the south-western part of the country and most limiting CNEC in the capacity calculation and allocation is the CNE 220 kV double circuit OHL Porţile de Fier – Reşiţa with contingency the second circuit of the same OHL. The investment projects included in the Ten Years Network Development Plan (https://www.transelectrica.ro/web/tel/plan-perspectiva) of Transelectrica approved by NRA with impact on cross-zonal capacity are: • 400 kV OHL Nădab – Oradea Sud (with comissioning date in 2021); • 400 kV OHL Porţile de Fier – Reşiţa (with comissioning date in 2022); • 400 kV OHL d.c. Reşiţa – Timişoara – Săcălaz (with comissioning date in 2024); • 400 kV OHL d.c. Timişoara – Săcălaz – Arad (with comissioning date in 2027); • 400 kV OHL Smârdan – Gutinaş (with deadline in 2024); • 400 kV OHL d.c. Cernavodă – Gura Ialomiţei - Stâlpu (with comissioning date in 2022). Most of these projects are approved as Projects of Common Interest. As an important information the existing 220 kV double circuit Portile de Fier-Resita will remain functional and the new 400kV OHL Portile de Fier – Resita will be also operational.
Denmark	Energinet	DK1	From DK we are not proposing a split of the bidding zones due to the fact that we currently do not see any significant challenges with meeting the 70% requirement. In todays capacity calculation the point of departure is 100% capacity on the network elements and a few dynamic restrictions which will not be influenced by a bidding zone split.
Switzerland	Swissgrid	CH	Switzerland does not propose alternative bidding zone configurations because current congestions will be eliminated by the realization of the Strategic Grid 2025 as stated in the ENTSO-E Technical Report 2018.

Member State	TSO	BZ	Justification
Italy	Terna	IT1	No alternative proposals have been submitted because no relevant internal structural congestions have been detected in the Entso-E Bidding Zone Configuration Technical Report 2018 (except for the ones already considered for the existing Bidding Zone borders with neighboring Countries and within Italy). In addition, it should be highlighted that several internal grid investments are already ongoing in order to further enhance the network for coping with expected future scenarios (as reported in the EntsoE Ten Year Network Development Plan as well as in the Italian network development plan). Finally, it should be worth mentioning that Italy is already subdivided in several Bidding Zones in order to properly reflect internal structural congestions (and this is the only case among the Countries involved in the Central Europe BZRR).

Table 1: Overview of CE BZRR TSOs which did not provide alternative configurations and their justification for doing so

5 Overview of the provided alternative configurations and their justifications

In this section, an overview is given about the alternative configurations that were provided by some of the CE BZRR TSOs.

For the sake of clarity, the argumentations provided reflect the individual positions of APG and TenneT TSO B.V regarding the proposal for Austria and the Netherlands, and the joint position of the TSOs 50 Hz, Amprion, Transnet BW and TenneT TSO GmbH regarding the proposals for Germany.

5.1 Austria

APG has proposed to investigate the following alternative bidding zone configuration:

Figure 1: Proposal of APG for a joint DE-AT bidding zone

The network elements which would form the Bidding Zone Borders of this configuration, are given in Table 2. This list should be combined with the bidding zone borders as included in Table 7.

Configuration "AT-DE Merger"									
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**	**New/different compared to status quo?**
AT	AT-CH	APG	Westtirol	Swissgrid	Pradella	380	AC	Inn Nord 428	No
AT	AT-CH	APG	Westtirol	Swissgrid	Pradella	380	AC	Inn Sued	No

Configuration "AT-DE Merger"

								427	
AT	AT-CH	APG	Meiningen	Swissgrid	Bonaduz/Montlingen	220	AC	Falknis 407	No
AT	AT-CH	APG	Meiningen	Swissgrid	Winkeln	220	AC	Stoss Süd 408	No
AT	AT-CH	APG	Feldkirch	Swissgrid	Eschen	110	AC	Eschen – Feldkirch 197/11	No
AT	AT-CZ	APG	Dürnrohr	CEPS	Slavetice	380	AC	Duernrohr – Slavetice 437	No
AT	AT-CZ	APG	Dürnrohr	CEPS	Slavetice	380	AC	Duernrohr – Slavetice 438	No
AT	AT-CZ	APG	Bisamberg	CEPS	Sokolnice	220	AC	Bisamberg – Sokolnice 243	
AT	AT-CZ	APG	Bisamberg	CEPS	Sokolnice	220	AC	Bisamberg – Sokolnice 244	
AT	AT-HU	APG	Zurndorf	MAVIR	Györ	380	AC	Zurndorf–Györ 439B	
AT	AT-HU	APG	Zurndorf	MAVIR	Szombathely	380	AC	Zurndorf–Szombathely 440B	
AT	AT-HU	APG	Wien Südost	MAVIR	Györ	220	AC	Wien Südost – Györ 245	
AT	AT-HU	APG	Neusiedl	MAVIR	Györ	220	AC	Neusiedl – Györ 246B	
AT	AT-IT	APG	Lienz	TERNA	Soverzene	220	AC	Lienz – Soverzene 261	
AT	AT-SI	APG	Obersielach	ELES	Podlog	220	AC	Obersielach – Podlog 247	
AT	AT-SI	APG	Kainachtal	ELES	Maribor	380	AC	Kainachtal – Maribor 1 473	
AT	AT-SI	APG	Kainachtal	ELES	Maribor	380	AC	Kainachtal – Maribor 2 474	
DE	CH-DE	Swissgrid	Asphard	TransnetBW	Zählpunkt TransnetBW	380	AC	Wiesental Süd	
DE	CH-DE	Swissgrid	Asphard	TransnetBW	Kühmoos	380	AC	Wehra	
DE	CH-DE	Swissgrid	Oftringen	TransnetBW	Gurtweil	220	AC	Blau	
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Gurtweil	220	AC	Alb Süd	
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Heimbach	
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Kühmoos	380	AC	Seelbach	
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Murg	
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Tiengen	380	AC	Andelsbach	

Configuration "AT-DE Merger"

DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Eggberg	
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Hotzenwald	
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Breitematt	110	AC	Trafo 20 Laufenburg	
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Trossingen	380	AC	Wutach / Trossingen – Laufenburg rot	
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	220	AC	Aare – Ost	
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	380	AC	Aare – West	No
DE	CZ-DE	CEPS	Prestice	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 442	No
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 445	No
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 446	No
DE	CZ-DE	CEPS	Hradec	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 441	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Bjaeverskov	400	DC	Bentwisch – Bjaeverskov	No
DE	DE-DKW	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund -Kassö1	No
DE	DE-DKW	TenneT TSO GmbH	Flensburg	Energinet	Kassö	220	AC	Flensburg -Kassö rt	No
DE	DE-DKW	TenneT TSO GmbH	Flensburg	Energinet	Ensted	220	AC	Flensburg -Ensted gb	No
DE	DE-DKW	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund -Kassö2	No
DE	DE-FR	TransnetBW	Eichstetten	RTE	Vogelgrun	220	AC	Kaiserstuhl – Nord	No
DE	DE-FR	TransnetBW	Eichstetten	RTE	Muhlbach	380	AC	Ill	No
DE	DE-FR	TransnetBW	TransnetBW Transportnetze	RTE	Sierentz	380	AC	Wiesental Süd	No
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 1 – Nord	No
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 2 – Süd	No
DE	DE-FR	Amprion	Ensdorf	RTE	St. Avold	220	AC	St. Avold	No
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden schwarz	No
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden weiß	No
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo schwarz	No
DE	DE-NL	Amprion	Oberzier	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant weiß	No

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Configuration “AT-DE Merger”									
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo weiß	No
DE	DE-NL	Amprion	Siersdorf	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant schwarz	No
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem schwarz	No
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem weiß	No
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	220	AC	Vierraden – Krajnik 508	No
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	220	AC	Vierraden – Krajnik 507	No
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 567	No
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 568	No
DE	DE-SE	TenneT TSO GmbH	Herrenwyk	Svenska Kraftnät	Arrie	400	DC	Baltic Cable	No

Table 2: Bidding Zone Borders of Configuration AT-DE Merger

General justification

Austria and Germany has formed a joint bidding zone for over 15 years. Due to potential structural congestions in middle Europe, figured out by different entities, a split at the political border of Germany and Austria was under investigation during the first edition of the bidding zone review from 2015 until March 2018.

During May 2017, it was agreed by the NRAs of Austria “E-Control Austria” and Germany “Bundesnetzagentur” to follow a recommendation from ACER from 2015 and to introduce a capacity allocation and congestion management on the common border by 01.10.2018.

As the evaluations presented in the final report of the bidding zone review did not provide sufficient evidence for a modification of or for maintaining of the current BZ configuration, TSOs recommended to maintain the current bidding zone delimitation. Given the lack of clear evidence for or against a split many stakeholders felt affronted and challenged the legal background.

We propose that the common AT-DE bidding zone should be analysed during the official process foreseen for such an investigation, i.e. the bidding zone review of the TSOs, and assessed by the criteria defined in Article 33 of EU Regulation 2015 / 1222, especially if structural congestion influences the delimitation of bidding zones.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

5.2 Germany

German TSOs proposed the following three alternative bidding zone configurations for Germany:

- **Configuration 1** consists of a split of the German/Luxemburg bidding zone along the borders of the federal states Bavaria and Baden-Württemberg into a Northern and a Southern bidding zone.
- **Configuration 2** consists of s a split of the German/Luxemburg bidding zone approximately along the borders of the federal states Bavaria, Hesse, North Rhine-Westphalia in the south (following the borders of control areas), into a North-Eastern and a South-Western bidding zone.
- **Configuration 3** extends on configuration 2 with an additional split along the border of Schleswig Holstein.

General justification for the three configurations
Germany has planned large-scale investments on grid infrastructure reinforcements that should solve the potential structural congestions in the long term. The proposed splits could potentially help to achieve the 70% minRAM CEP requirement in the transition period until the measures described in the German Grid Development Plan are implemented (especially in case of delays).

Justification for configuration 1 "Two bidding zones, split along BW and BY"
The configuration addresses the fact, that significant congestions in Germany follow a north-south direction as extensive wind generation capacity is located in the north and large consumption centres are found in the south of Germany. The relevance of this configuration for addressing potential structural congestions is reflected in the fact that it was assessed in the first edition of the biding zone review (ENTSO-E, 2018). Considering that some major grid development projects addressing the discrepancy in generation and consumption between north and south Germany are yet to be realized, the main motivation for analysing this configuration remains.

Justification for configuration 2 "Two bidding zones, North-Eastern/South-Western split"
Similar to the previous configuration, this configuration addresses the north-south direction of the congestions in case of delayed implementation of the measures described in the German Grid Development Plan. This split has proven to effectively reduce congestions in a recently published quantitative analysis focusing on 2025 scenario under consideration of the 70% minRAM CEP requirements[1]. The motivation for analysing this configuration is that it better follows the expected congestion locations, which appear between control areas approximately at the borders of Bavaria with Thuringia, and of Hesse and North Rhine Westphalia with Lower Saxony.

Justification for configuration 3 "Three Bidding Zones Split"
The configuration addresses the fact, that due to extensive wind generation in the north, there will be congestions in northern Germany until the complete grid expansion according to the Grid Development Plan is implemented.

The motivation for analysing this configuration is the expectation that market prices in a Bidding Zone of Schleswig-Holstein with extensive wind supply might be very low. The consequence might be that Schleswig-Holstein will then not export to southern Germany but to Denmark and Norway. This might successfully counteract the European north-south flows through Germany. The expectation is, that wind curtailment in Schleswig-Holstein might be reduced, the wind farms might become competitive in the European market and would as such be better integrated into the market.

[1] Ivan Marjanovic, Johannes Henkel, Bernhard Hasche, Nils Engelke, Dirk Biermann and Albert Moser „Neue Strombinnenmarkt-Verordnung: Welche Optionen zur Management von Engpässen gibt es und was bedeuten sie?", Energiewirtschaftliche Tagesfragen, June 2019

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

The network elements which would form the Bidding Zone Borders of these configurations, are given in Table 3, 4 and 5.

Configuration DE split 1									
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**	**New/different compared to status quo?**
D7	D7-D4	Amprion	Maximiliansau	TransnetBW	Kühmoos	380	AC	Maximiliansau - Daxlanden Kühmoos	Yes
D7	D7-D4	Amprion	Maximiliansau	TransnetBW	Kühmoos	380	AC	Maximiliansau - Kühmoos	Yes
D7	D7-D4	Amprion	Mutterstadt	TransnetBW	GKM	220	AC	Mutterstadt - GKM	Yes
D7	D7-D4	Amprion	Rheinau	Amprion	Hoheneck	380	AC	Rheinau - Hoheneck	Yes
D7	D7-D4	Amprion	Pfungstadt	TransnetBW	Weinheim	380	AC	Pfungstadt - Weinheim	Yes
D7	D7-D4	Amprion	Osterath HGUE	TransnetBW	KKP	380	DC	Osterath HGUE - KKP	Yes
D2	D2-D2	TenneT	Großkrotzenburg	TenneT	Bergrheinfeld	380	AC	Großkrotzenburg - Bergrheinfeld	Yes
D2	D2-D2	TenneT	Großkrotzenburg	TenneT	Trennfeld	220	AC	Großkrotzenburg - Trennfeld	Yes
D2	D2-D8	50Hertz	Wolmirstedt	TenneT	Isar	DC	DC	Wolmirstedt - Isar	Yes
D2	D2-D8	50Hertz	Altenfeld	TenneT	Redwitz	380	AC	Altenfeld - Redwitz	Yes
D2	D2-D8	50Hertz	Remptendorf	TenneT	Redwitz	380	AC	Remptendorf - Redwitz	Yes
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	380	AC	Bürs – Westtirol rot 422	No
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Altheim	380	AC	Altheim – St. Peter	Yes
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Simbach	380	AC	Simbach – St. Peter	Yes
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pirach	220	AC	Pirach – St. Peter 256	No
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pleinting	220	AC	Pleinting – St. Peter 258	No
DE	AT-DE	APG	Westtirol	Amprion	Kempten	220	AC	Westtirol - Kempten	No
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	220	AC	Bürs – Westtirol weiß 421	No
DE	AT-DE	APG	Westtirol	Amprion	Leupolz	380	AC	Füssen Ost 412	No
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 413	No
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 414	No
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 274E	No

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 273C	No
DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 274C	No
DE	BE-DE	Elia	Lixhe	Amprion	Oberzier	DC	DC	Alegro	No
DE	CH-DE	Swissgrid	Asphard	TransnetBW	Kühmoos	380	AC	Wehra	No
DE	CH-DE	Swissgrid	Oftringen	TransnetBW	Gurtweil	220	AC	Blau	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Gurtweil	220	AC	Alb Süd	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Heimbach	No
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Kühmoos	380	AC	Seelbach	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Murg	No
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Tiengen	380	AC	Andelsbach	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Eggberg	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Hotzenwald	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Trossingen	380	AC	Wutach / Trossingen – Laufenburg rot	No
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	220	AC	Aare – Ost	No
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	380	AC	Aare – West	No
DE	CZ-DE	CEPS	Prestice	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 442	No
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 445	No
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 446	No
DE	CZ-DE	CEPS	Hradec	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 441	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Kontek	380	AC	Bentwisch – kontek	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	CGS	150	AC	Bentwisch - CGS	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Bjaeverskov	400	DC	Bentwisch – Bjaeverskov	No
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö1	No
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Kassö	220	AC	Flensburg-Kassö rt	No
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Ensted	220	AC	Flensburg-Ensted gb	No
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö2	No
DE	DE–DK1	TenneT TSO GmbH	Klixbüll/Süd	Energinet	Endrup	380	AC	Klixbüll/Süd - Endrup	Yes
DE	DE-FR	TransnetBW	Eichstetten	RTE	Vogelgrun	220	AC	Kaiserstuhl – Nord	No
DE	DE-FR	TransnetBW	Eichstetten	RTE	Muhlbach	380	AC	Ill	No
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 1 – Nord	No
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 2 – Süd	No
DE	DE-FR	Amprion	Ensdorf	RTE	St. Avold	220	AC	St. Avold	No
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden schwarz	No
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden	No

								weiß	
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo schwarz	No
DE	DE-NL	Amprion	Oberzier	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant weiß	No
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo weiß	No
DE	DE-NL	Amprion	Siersdorf	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant schwarz	No
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem schwarz	No
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem weiß	No
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	380	AC	Vierraden – Krajnik 508	No
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	380	AC	Vierraden – Krajnik 507	No
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 567	No
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 568	No
DE	DE-SE	TenneT TSO GmbH	Herrenwyk	Svenska Kraftnät	Arrie	400	DC	Baltic Cable	No
DE	DE-AT	Amprion	Stich 403A	APG	Werben	220	AC	Stich Bludenz West 403A	No
DE	DE-AT	APG	Walgauwerk	TransnetBW	Bürs	220	AC	Bürs - Walgauwerk orange 405A	No
DE	DE-AT	APG	Meiningen	TransnetBW	Bürs	220	AC	Bürs - Meiningen grün 406A	No
DE	DE-AT	Amprion	Stich 404A	APG	Werben	220	AC	Stich Dellmensingen Ost 404A	No
DE	DE-NO	TenneT TSO GmbH	Wilster/West	Stattnett	Tonstad	525	DC	Wilster/West - Tonstad	Yes
DE	DE-GB	TenneT TSO GmbH	Fedderwarden	NeuConnect	Großbritanien	?	DC	Fedderwaden - GB	Yes
LU	LU-BE	Creos	Schifflange	ELIA	Aubange	220	AC	Aubange - PST Schifflange	No

Table 3: Bidding Zone Borders of configuration DE Split 1

Configuration DE split 2									
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**	**New/different compared to status quo?**
D2	D2-D7	TenneT	Dörpen/West	Amprion	Niederrhein	380	AC	Dörpen/West - Niederrhein	Yes
D2	D2-D7	TenneT	Dörpen/West	Amprion	Hanekenfähr	380	AC	Dörpen/West -	Yes

								Hanekenfähr	
D2	D2-D7	TenneT	Niederlangen	Amprion	Meppen	380	AC	Niederlangen - Meppen	Yes
D2	D2-D7	TenneT	Cappeln/West	Amprion	Merzen	380	AC	Cappeln/West - Merzen	Yes
D2	D2-D7	TenneT	Ganderkesee	Amprion	St. Hülfe	380	AC	Ganderkesee - St. Hülfe	Yes
D2	D2-D7	TenneT	Ohlensehlen	Amprion	Wehrendorf	380	AC	Ohlensehlen - Wehrendorf	Yes
D2	D2-D7	TenneT	Bechterdissen	Amprion	Gütersloh	380	AC	Bechterdissen - Gütersloh	Yes
D2	D2-D2	TenneT	Bechterdissen	Tennet	Elsen	380	AC	Bechterdissen - Elsen	Yes
D2	D2-D2	TenneT	Grohnde	Tennet	Würgassen	380	AC	Grohnde - Würgassen	Yes
D2	D2-D2	TenneT	Lamspringe	Tennet	Hardegsen	380	AC	Lamspringe - Hardegsen	Yes
D2	D2-D8	50Hertz	Wolmirstedt	TenneT	Isar	DC	DC	Wolmirstedt - Isar	Yes
D2	D2-D8	TenneT	Mecklar	50Hertz	Vieselbach	380	AC	Mecklar - Vieselbach	Yes
D2	D2-D8	50Hertz	Altenfeld	Tennet	Redwitz	380	AC	Altenfeld - Redwitz	Yes
D2	D2-D8	50Hertz	Remptendorf	Tennet	Redwitz	380	AC	Remptendorf - Redwitz	Yes
D2	D2-D7	TenneT	Emden/Ost	Amprion	Osterath HGUE	DC	DC	Emden/Ost - Osterath HGUE	Yes
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	380	AC	Bürs – Westtirol rot 422	No
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Altheim	380	AC	Altheim – St. Peter	Yes
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Simbach	380	AC	Simbach – St. Peter	Yes
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pirach	220	AC	Pirach – St. Peter 256	No
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pleinting	220	AC	Pleinting – St. Peter 258	No
DE	AT-DE	APG	Westtirol	Amprion	Kempten	220	AC	Westtirol - Kempten	No
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	220	AC	Bürs – Westtirol weiß 421	No
DE	AT-DE	APG	Westtirol	Amprion	Leupolz	380	AC	Füssen Ost 412	No
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 413	No
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 414	No
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 274E	No
DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 273C	No
DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 274C	No
DE	BE-DE	Elia	Lixhe	Amprion	Oberzier	DC	DC	Alegro	No
DE	CH-DE	Swissgrid	Asphard	TransnetBW	Kühmoos	380	AC	Wehra	No
DE	CH-DE	Swissgrid	Oftringen	TransnetBW	Gurtweil	220	AC	Blau	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Gurtweil	220	AC	Alb Süd	No

DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Heimbach	No
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Kühmoos	380	AC	Seelbach	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Murg	No
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Tiengen	380	AC	Andelsbach	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Eggberg	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Hotzenwald	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Trossingen	380	AC	Wutach / Trossingen – Laufenburg rot	No
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	220	AC	Aare – Ost	No
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	380	AC	Aare – West	No
DE	CZ-DE	CEPS	Prestice	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 442	No
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 445	No
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 446	No
DE	CZ-DE	CEPS	Hradec	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 441	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Kontek	380	AC	Bentwisch – kontek	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	CGS	150	AC	Bentwisch - CGS	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Bjaeverskov	400	DC	Bentwisch – Bjaeverskov	No
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö1	No
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Kassö	220	AC	Flensburg-Kassö rt	No
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Ensted	220	AC	Flensburg-Ensted gb	No
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö2	No
DE	DE–DK1	TenneT TSO GmbH	Klixbüll/Süd	Energinet	Endrup	380	AC	Klixbüll/Süd - Endrup	Yes
DE	DE-FR	TransnetBW	Eichstetten	RTE	Vogelgrun	220	AC	Kaiserstuhl – Nord	No
DE	DE-FR	TransnetBW	Eichstetten	RTE	Muhlbach	380	AC	Ill	No
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 1 – Nord	No
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 2 – Süd	No
DE	DE-FR	Amprion	Ensdorf	RTE	St. Avold	220	AC	St. Avold	No
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden schwarz	No
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden weiß	No
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo schwarz	No
DE	DE-NL	Amprion	Oberzier	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant weiß	No
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo weiß	No
DE	DE-NL	Amprion	Siersdorf	TenneT TSO	Maasbracht	380	AC	Selfkant	No

				B.V.				schwarz	
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem schwarz	No
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem weiß	No
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	380	AC	Vierraden – Krajnik 508	No
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	380	AC	Vierraden – Krajnik 507	No
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 567	No
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 568	No
DE	DE-SE	TenneT TSO GmbH	Herrenwyk	Svenska Kraftnät	Arrie	400	DC	Baltic Cable	No
DE	DE-AT	Amprion	Stich 403A	APG	Werben	220	AC	Stich Bludenz West 403A	No
DE	DE-AT	APG	Walgauwerk	TransnetBW	Bürs	220	AC	Bürs - Walgauwerk orange 405A	No
DE	DE-AT	APG	Meiningen	TransnetBW	Bürs	220	AC	Bürs - Meiningen grün 406A	No
DE	DE-AT	Amprion	Stich 404A	APG	Werben	220	AC	Stich Dellmensingen Ost 404A	No
DE	DE-NO	TenneT TSO GmbH	Wilster/West	Stattnett	Tonstad	525	DC	Wilster/West - Tonstad	Yes
DE	DE-GB	TenneT TSO GmbH	Fedderwarden	NeuConnect	Großbritanien	?	DC	Fedderwaden - GB	Yes
LU	LU-BE	Creos	Schifflange	ELIA	Aubange	220	AC	Aubange - PST Schifflange	No

Table 4: Bidding Zone Borders of configuration DE Split 2

Configuration DE split 3									
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**	**New/different compared to status quo?**
D2	D2-D7	TenneT	Dörpen/West	Amprion	Niederrhein	380	AC	Dörpen/West - Niederrhein	Yes
D2	D2-D7	TenneT	Dörpen/West	Amprion	Hanekenfähr	380	AC	Dörpen/West - Hanekenfähr	Yes
D2	D2-D7	TenneT	Niederlangen	Amprion	Meppen	380	AC	Niederlangen - Meppen	Yes
D2	D2-D7	TenneT	Cappeln/West	Amprion	Merzen	380	AC	Cappeln/West - Merzen	Yes
D2	D2-D7	TenneT	Ganderkesee	Amprion	St. Hülfe	380	AC	Ganderkesee - St. Hülfe	Yes
D2	D2-D7	TenneT	Ohlensehlen	Amprion	Wehrendorf	380	AC	Ohlensehlen - Wehrendorf	Yes

D2	D2-D7	TenneT	Bechterdissen	Amprion	Gütersloh	380	AC	Bechterdissen - Gütersloh	Yes
D2	D2-D2	TenneT	Bechterdissen	Tennet	Elsen	380	AC	Bechterdissen - Elsen	Yes
D2	D2-D2	TenneT	Grohnde	Tennet	Würgassen	380	AC	Grohnde - Würgassen	Yes
D2	D2-D2	TenneT	Lamspringe	Tennet	Hardegsen	380	AC	Lamspringe - Hardegsen	Yes
D2	D2-D8	50Hertz	Wolmirstedt	TenneT	Isar	DC	DC	Wolmirstedt - Isar	Yes
D2	D2-D8	TenneT	Mecklar	50Hertz	Vieselbach	380	AC	Mecklar - Vieselbach	Yes
D2	D2-D8	50Hertz	Altenfeld	Tennet	Redwitz	380	AC	Altenfeld - Redwitz	Yes
D2	D2-D8	50Hertz	Remptendorf	Tennet	Redwitz	380	AC	Remptendorf - Redwitz	Yes
D2	D2-D7	TenneT	Emden/Ost	Amprion	Osterath HGUE	DC	DC	Emden/Ost - Osterath HGUE	Yes
D2	D2-D8	TenneT	Brunsbüttel	50Hertz	Brunsbüttel	380	AC	Brunsbüttel - Brunsbüttel	Yes
D2	D2-D8	TenneT	Audorf/Süd	50Hertz	Hamburg/Nord	380	AC	Audorf/Süd - Hamburg/Nord	Yes
D2	D2-D8	TenneT	Hamburg/Nord	50Hertz	Hamburg/Nord	220/380	AC	Hamburg/Nord - Hamburg/Nord	Yes
D2	D2-D2	TenneT	Wilster/West	TenneT	Stade/West	380	AC	Wilster/West - Stade/West	Yes
D2	D2-D2	TenneT	Kummerfeld	TenneT	Dollern	380	AC	Kummerfeld - Dollern	Yes
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	380	AC	Bürs – Westtirol rot 422	No
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Altheim	380	AC	Altheim – St. Peter	Yes
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Simbach	380	AC	Simbach – St. Peter	Yes
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pirach	220	AC	Pirach – St. Peter 256	No
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pleinting	220	AC	Pleinting – St. Peter 258	No
DE	AT-DE	APG	Westtirol	Amprion	Kempten	220	AC	Westtirol - Kempten	No
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	220	AC	Bürs – Westtirol weiß 421	No
DE	AT-DE	APG	Westtirol	Amprion	Leupolz	380	AC	Füssen Ost 412	No
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 413	No
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 414	No
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 274E	No
DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 273C	No
DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 274C	No
DE	BE-DE	Elia	Lixhe	Amprion	Oberzier	DC	DC	Alegro	No
DE	CH-DE	Swissgrid	Asphard	TransnetBW	Kühmoos	380	AC	Wehra	No
DE	CH-DE	Swissgrid	Oftringen	TransnetBW	Gurtweil	220	AC	Blau	No

DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Gurtweil	220	AC	Alb Süd	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Heimbach	No
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Kühmoos	380	AC	Seelbach	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Murg	No
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Tiengen	380	AC	Andelsbach	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Eggberg	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Hotzenwald	No
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Trossingen	380	AC	Wutach / Trossingen – Laufenburg rot	No
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	220	AC	Aare – Ost	No
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	380	AC	Aare – West	No
DE	CZ-DE	CEPS	Prestice	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 442	No
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 445	No
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 446	No
DE	CZ-DE	CEPS	Hradec	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 441	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Kontek	380	AC	Bentwisch – kontek	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	CGS	150	AC	Bentwisch - CGS	No
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Bjaeverskov	400	DC	Bentwisch – Bjaeverskov	No
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö1	No
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Kassö	220	AC	Flensburg-Kassö rt	No
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Ensted	220	AC	Flensburg-Ensted gb	No
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö2	No
DE	DE–DK1	TenneT TSO GmbH	Klixbüll/Süd	Energinet	Endrup	380	AC	Klixbüll/Süd - Endrup	Yes
DE	DE-FR	TransnetBW	Eichstetten	RTE	Vogelgrun	220	AC	Kaiserstuhl – Nord	No
DE	DE-FR	TransnetBW	Eichstetten	RTE	Muhlbach	380	AC	Ill	No
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 1 – Nord	No
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 2 – Süd	No
DE	DE-FR	Amprion	Ensdorf	RTE	St. Avold	220	AC	St. Avold	No
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden schwarz	No
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden weiß	No
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo schwarz	No
DE	DE-NL	Amprion	Oberzier	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant weiß	No
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo weiß	No

DE	DE-NL	Amprion	Siersdorf	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant schwarz	No
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem schwarz	No
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem weiß	No
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	220	AC	Vierraden – Krajnik 508	No
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	220	AC	Vierraden – Krajnik 507	No
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 567	No
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 568	No
DE	DE-SE	TenneT TSO GmbH	Herrenwyk	Svenska Kraftnät	Arrie	400	DC	Baltic Cable	No
DE	DE-AT	Amprion	Stich 403A	APG	Werben	220	AC	Stich Bludenz West 403A	No
DE	DE-AT	APG	Walgauwerk	TransnetBW	Bürs	220	AC	Bürs - Walgauwerk orange 405A	No
DE	DE-AT	APG	Meiningen	TransnetBW	Bürs	220	AC	Bürs - Meiningen grün 406A	No
DE	DE-AT	Amprion	Stich 404A	APG	Werben	220	AC	Stich Dellmensingen Ost 404A	No
DE	DE-NO	TenneT TSO GmbH	Wilster/West	Stattnett	Tonstad	525	DC	Wilster/West - Tonstad	Yes
DE	DE-GB	TenneT TSO GmbH	Fedderwarden	NeuConnect	Großbritanien	?	DC	Fedderwaden - GB	Yes
LU	LU-BE	Creos	Schifflange	ELIA	Aubange	220	AC	Aubange - PST Schifflange	No

Table 5: Bidding Zone Borders of configuration DE Split 3

However, since no agreement could be found on the BZRR level for the reasons set forth under Article 6, the German TSOs have decided to withdraw the alternative configurations described above and consequently, to provide only the status quo configuration for Germany.

5.3 The Netherlands

TenneT TSO B.V. proposed to investigate a split of the current bidding zone NL into three different bidding zones: NL1, NL2 and NL3, as depicted in Figure 2.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Figure 2: Proposal of TenneT TSO B.V. for a split of The Netherlands into three bidding zones.

The network elements which would form the Bidding Zone Borders of this configuration, are given in Table 6. This list should be combined with the bidding zone borders as included in Table 7; the bidding zone borders which are new compared to the bidding zone borders of Table 7 are marked as "New", the bidding zone borders which are changed because of the split are marked as "Changed".

Configuration: NL split									
Cty-CBk	Bidding Zone Border	TSO1	Station 1	TSO2	Station 2	Voltage level [kV]	Type	Network element Name	New/ different compared to status quo?
NL	NL1-NL2	TenneT TSO B.V.	Lelystad	TenneT TSO B.V.	Ens	380	AC	Lelystad-Ens 380 Wit	New
NL	NL1-NL2	TenneT TSO B.V.	Lelystad	TenneT TSO B.V.	Ens	380	AC	Lelystad-Ens 380 Zwart	New
NL	NL1-NL2	TenneT TSO B.V.	Doetinchem	TenneT TSO B.V.	Hengelo	380	AC	Doetinchem-Hengelo 380 Wit	New
NL	NL1-NL2	TenneT TSO B.V.	Doetinchem	TenneT TSO B.V.	Hengelo	380	AC	Doetinchem-Hengelo 380 Zwart	New
NL	NL2–NL3	TenneT TSO B.V.	Boxmeer	TenneT TSO B.V.	Dodewaard	380	AC	Boxmeer – Dodewaard 380 Zwart	New
NL	NL2–NL3	TenneT TSO B.V.	Maasbracht	TenneT TSO B.V.	Dodewaard	380	AC	Maasbracht – Dodewaard 380 Zwart	New
NL	NL2-NL3	TenneT TSO B.V.	Krimpen a/d IJssel	TenneT TSO B.V.	Geertruidenberg	380	AC	Krimpen a/d IJssel–Geertruidenberg 380 Wit	New
NL	NL2-NL3	TenneT TSO B.V.	Krimpen a/d IJssel	TenneT TSO B.V.	Geertruidenberg	380	AC	Krimpen a/d IJssel–Geertruidenberg 380 Zwart	New
NL	BE-NL3	ELIA	Zandvliet	TenneT TSO B.V.	Rilland	380	AC	Zandvliet – Rilland 380 Grey/29	Changed[2]
NL	BE-NL3	ELIA	Zandvliet	TenneT TSO B.V.	Rilland	380	AC	Zandvliet – Rilland 380 White/30	Changed[2]
NL	BE-NL3	ELIA	Van Eyck	TenneT TSO B.V.	Maasbracht	380	AC	Maasbracht - Van Eyck 380 Black/27	Changed
NL	BE-NL3	ELIA	Van Eyck	TenneT TSO B.V.	Maasbracht	380	AC	Maasbracht - Van Eyck 380 White/28	Changed
NL	DE-NL1	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden 380 Wit	Changed
NL	DE-NL1	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden 380 Zwart	Changed
NL	DE-NL1	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo 380 Wit	Changed
NL	DE-NL1	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo 380 Zwart	Changed
NL	DE-NL3	Amprion	Oberzier	TenneT TSO B.V.	Maasbracht	380	AC	Maasbracht - Oberzier 380 Wit	Changed
NL	DE-NL3	Amprion	Siersdorf	TenneT TSO B.V.	Maasbracht	380	AC	Maasbracht – Siersdorf 380 Zwart	Changed
NL	DE-NL2	Amprion	Niederrhein	TenneT TSO B.V.	Doetinchem	380	AC	Doetinchem - Niederrhein 380 Wit	Changed
NL	DE-NL2	Amprion	Niederrhein	TenneT TSO B.V.	Doetinchem	380	AC	Doetinchem - Niederrhein 380 Zwart	Changed
NL	NL2-UK	TenneT TSO B.V.	Maasvlakte	National Grid	Isle of Grain	450	DC	Maasvlakte – Isle of Grain (BritNed)	Changed
NL	NL1-NO	TenneT TSO B.V.	Eemshaven	Stattned	Feda	450	DC	Eemshaven – Feda (NorNed)	Changed
NL	NL1–DK1	TenneT TSO B.V.	Eemshaven	Energinet	Endrup	320	DC	COBRAcable	Changed

Table 6: Bidding Zone Borders of configuration NL Split

[2] Note that these network elements replace the current network elements "Zandvliet – Geertruidenberg" and "Zandvliet-Borssele", because of the substation "Rilland" which will gradually come in operation from Q4 2019.

General justification

The main reason for TenneT TSO B.V. to propose to investigate a split of the current single Dutch bidding zone is to investigate to what extent a bidding zone split enables TenneT TSO B.V. to reach the 70% target as defined in article 16(8) the CEP IME regulation, and what would be the resulting effects on market efficiency. By splitting the Netherlands in multiple bidding zones, flows between generators and loads in the different parts of the Netherlands are no longer the result from transactions internal to bidding zones, but are instead the result of market transactions between the bidding zones resulting from capacity allocation via the day-ahead and intraday market coupling process. TenneT TSO B.V. expects that this change provides a positive contribution to its ability to comply with the IME regulation obligation to offer minimum levels of available capacity for cross-zonal trade, while also respecting operational security limits.

An investigation of a Dutch split into three bidding zones is justified by the following reasons:

- Two main starting points were defined to determine appropriate alternative bidding zone configurations for the Netherlands:
  - Firstly, congestions that are expected in the target year studied in the bidding zone review serve as the main basis for defining new bidding zone borders.
  - Secondly, making 150 kV network elements into cross-border elements is not preferred due to reasons of operational security, as the 150 kV network has significantly less capacity than the 380 kV grid and there is a lack of available remedial actions to effectively manage flows on this voltage level.
- TenneT TSO B.V. observes that the typical electricity flow through its grid is from the north to the south, and expects that this will remain to be the case in the future considered for the bidding zone review. In order to improve the ability to manage these flows via the capacity calculation and capacity allocation processes and reduce the dependence on costly remedial actions, TenneT TSO B.V. is of the opinion that it could be beneficial to make the northern part of the Dutch electricity grid into a separate bidding zone (NL1 in Figure 2). By doing so, electricity flows generated by conventional power stations at the Eemshaven region, onshore and offshore wind farms, and large-scale PV installations in the NL1 zone compete with cross-border flows (via NorNed, COBRAcable, and DE-NL interconnectors) via the market coupling process for access to capacity towards important load centres in the Netherlands, such as in the provinces Noord-Holland and Zuid-Holland located in NL2. The loads and generators in the north of the Netherlands can relatively easily be positioned in a separate bidding zone by making two 380 kV network elements, being Lelystad-Ens and Doetinchem-Hengelo, into cross-border elements.
- TenneT TSO B.V. has identified two important and currently regularly congested 380 kV network elements Lelystad-Ens and Krimpen-Geertruidenberg. Despite planned and foreseen grid investments these are expected to remain to be congested for the target year considered in this bidding zone review, certainly under consideration of the 70% provision of the IME regulation. Therefore these network elements were selected to become cross-border elements in the alternative configuration to be investigated.
- In order to make Krimpen-Geertruidenberg into a cross-border element, it needs to be combined with another network element to complete the bidding zone border. The 380 kV network element of Dodewaard-Boxmeer is for TenneT TSO B.V. the most appropriate network element to combine with Krimpen-Geertruidenberg to become a cross-border element. This split creates 3 horizontal bidding zones that could effectively improve the control over north-south flows through the capacity calculation and market coupling processes. Furthermore, combining Krimpen-Geertruidenberg with Dodewaard-Boxmeer enables to separate zone NL3 from zone NL2 by only making two 380 kV lines into cross-border elements without the necessity to split over 150kV network elements. Besides the issues 150 kV network elements as cross-border elements, it would be especially difficult to do so for 150 kV network elements in the middle of the Netherlands, as this is strongly meshed from east to west. Therefore, it is not possible for TenneT TSO B.V. to

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

separate east and west of the Netherlands in different bidding zones and unambiguously assign load and production to one of these bidding zones.

- This configuration contains a relatively balanced amount of generation and consumption within each bidding zone.
- The proposed splits are expected to provide beneficial local incentives for future investments in additional loads (e.g. for power to gas) in those areas where a surplus of renewable energy is expected due to a significant increase of RES generation (such as offshore wind). Moreover, this bidding zone configuration is expected to create incentives to invest in demand response, storage or generation in those areas where a reduction of conventional fossil-fuelled generation is expected.
- Furthermore, price signals from multiple bidding zones are expected to have a positive effect on social welfare, considering that less costs are incurred to perform costly remedial actions such as redispatch.
- This configuration separates the Netherlands mostly according to the borders of its provinces, which are also the basis for Regional Energy Strategies under development in the Netherlands according to the *National Climate Agreement* for the overall purpose of delivering the energy transition.

6 Explanation why the TSOs of the BZRR CE could not come to an agreement on a set of configurations

In this section, an explanation is provided why the BZRR CE TSOs could not come to a set of alternative bidding zone configurations to be proposed for investigation in the next bidding zone review, on the basis of the individual proposals and argumentation provided as described in section 4 and section 5 of this document.

In total, only for 3 of the 15 bidding zones of the BZRR CE alternative bidding zone configurations were proposed by the individual TSOs. These were:

- A split of the Bidding Zone "The Netherlands" in three bidding zones
- Three possible splits for the Bidding Zone "Germany / Luxembourg" in either two or three bidding zones
- A merger of the bidding zones "Austria" and "Germany / Luxembourg".

The TSOs of the BZRR CE TSOs discussed intensively the individual proposals but were not able to combine them into a set of configurations which was acceptable for all TSOs of the BZRR CE to be investigated by them in the bidding zone review process. Below, the main reasons why it was not possible to come to an agreement on a set of configurations have been set out:

- Some TSOs considered the proposed configuration of the merger of bidding zones "Austria" and "Germany / Luxembourg" not appropriate because this would increase unscheduled flows through other bidding zones and would make it more difficult for the TSOs of the affected bidding zones to comply with the 70% criterion of Article 16(8) of the IME regulation.
- Some TSOs considered that in the framework of a pan European bidding zone review, it would not be appropriate for the BZRR CE to focus only on alternative configurations of a few bidding zones on the basis of the individual proposal of their TSOs, while alternative configurations of many of the other bidding zones in the BZRR CE would not be investigated at all. Only a balanced investigation of alternative configurations for the majority of the Bidding Zones in central Europe would explore all relevant options on a fair and equal basis.
- At least a configuration which includes a split of all the larger bidding zones in the BZRR CE was missing for some TSOs. On the other hand, some TSOs considered that with regard to Articles 14(1) and 14(3) of the IME regulation, the geographical size of a bidding zone is not a valid criterion for a split and that only the existence of structural congestions in the time horizon of the study was relevant.
- Some TSOs considered that the set was not balanced, as a small Member State such as the Netherlands proposed to investigate an alternative bidding zone configuration while other Member States with comparable levels of congestion did not propose to investigate an alternative bidding zone configuration, and that this set would therefore not be acceptable for approval by the competent regulatory authorities.
- Some TSOs considered that the size of the BZRR CE and involvement of all the TSOs of this BZRR would not be appropriate to study alternative bidding zone configurations in only a few member states. In case only these splits would have to be analysed, a more efficient set-up with a narrower scope and more limited number of TSOs would be sufficient to assess the alternative configurations and be more appropriate.
- Some TSOs considered that investigating alternative bidding zone configuration in the next bidding zone review process is not appropriate, as across Europe "Action Plans" according to article 15 of

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

the IME Regulation are to be instigated which will have a severe but yet unknown impact on the future electricity grid and electricity market.

Annex 1: List of the network elements which form the Bidding Zone Borders in the Status Quo configuration

Configuration 1 "Status Quo"								
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**
AT	AT-CH	APG	Westtirol	Swissgrid	Pradella	380	AC	Inn Nord 428
AT	AT-CH	APG	Westtirol	Swissgrid	Pradella	380	AC	Inn Sued 427
AT	AT-CH	APG	Meiningen	Swissgrid	Bonaduz/Montlingen	220	AC	Falknis 407
AT	AT-CH	APG	Meiningen	Swissgrid	Winkeln	220	AC	Stoss Süd 408
AT	AT-CH	APG	Feldkirch	Swissgrid	Eschen	110	AC	Eschen – Feldkirch 197/11
AT	AT-CZ	APG	Dürnrohr	CEPS	Slavetice	380	AC	Duernrohr – Slavetice 437
AT	AT-CZ	APG	Dürnrohr	CEPS	Slavetice	380	AC	Duernrohr – Slavetice 438
AT	AT-CZ	APG	Bisamberg	CEPS	Sokolnice	220	AC	Bisamberg – Sokolnice 243
AT	AT-CZ	APG	Bisamberg	CEPS	Sokolnice	220	AC	Bisamberg – Sokolnice 244
AT	AT-DE	APG	Westtirol	Transnet BW	Bürs	380	AC	Bürs – Westtirol rot 422
AT	AT-DE	APG	Westtirol	Transnet BW	Bürs	220	AC	Bürs – Westtirol weiß 421
AT	AT-DE	APG	Westtirol	Amprion	Memmingen	220	AC	Füssen West 411
AT	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pleinting	220	AC	Pleinting – St. Peter 258
AT	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pirach	220	AC	Pirach – St. Peter 256
AT	AT-DE	APG	St. Peter	TenneT TSO GmbH	Altheim	220	AC	Altheim – St. Peter 233
AT	AT-DE	APG	St. Peter	TenneT TSO GmbH	Simbach	220	AC	Simbach – St. Peter 230
AT	AT-DE	APG	Westtirol	Amprion	Leupolz	380	AC	Füssen Ost 412
AT	AT-DE	APG	Braunau	TenneT TSO GmbH	Neuötting	110	AC	Braunau - Neuötting 199/3
AT	AT-DE	APG	Braunau	TenneT TSO GmbH	Stammham	110	AC	Braunau - Stammham 199/4
AT	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ering	110	AC	Ering - St. Peter 182/5
AT	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ering	110	AC	Ering - St. Peter 182/6
AT	AT-DE	APG	Antiesenhofen	TenneT TSO GmbH	Egglfing	110	AC	Egglfing - Antiesenhofen 188/3b
AT	AT-DE	APG	St.Peter	TenneT TSO GmbH	Egglfing	110	AC	Egglfing - St. Peter 188/5
AT	AT-DE	APG	Aigerding	TenneT TSO GmbH	Passau-Ingling	110	AC	Passau-Ingling - Aigerding 188/1
AT	AT-DE	APG	Ebbs	TenneT TSO GmbH	Oberaudorf	110	AC	Oberaudorf - Ebbs 176/7
AT	AT-DE	APG	Kufstein	TenneT TSO GmbH	Oberaudorf	110	AC	Oberaudorf - Kufstein 176/6
AT	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 413

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

AT	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 414
AT	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 274E
AT	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 273C
AT	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 274C
AT	AT-DE	APG	Ranna	TenneT TSO GmbH	Hauzenberg	110	AC	Ranna – Hauzenberg 156/1
AT	AT-DE	APG	St. Jakob	Transnet BW	Bürs	110	AC	St. Jakob – Bürs 172/8
AT	AT-DE	APG	Rauz	Transnet BW	Bürs	110	AC	Rauz – Bürs 172/9
AT	AT-DE	APG	Werben	Amprion	Stich 403A	220	AC	Stich Bludenz West 403A
AT	AT-DE	APG	Walgauwerk	Transnet BW	Bürs	220	AC	Bürs - Walgauwerk orange 405A
AT	AT-DE	APG	Meiningen	Transnet BW	Bürs	220	AC	Bürs - Meiningen grün 406A
AT	AT-DE	APG	Nenzing	Transnet BW	Bürs	110	AC	Bürs-Nenzing weiss 197/2
AT	AT-DE	APG	Bürs VKW	Transnet BW	Bürs	110	AC	Bürs - Bürs-VKW rot 197/10
AT	AT-DE	APG	Werben	Amprion	Stich 404A	220	AC	Stich Dellmensingen Ost 404A
AT	AT-HU	APG	Zurndorf	MAVIR	Györ	380	AC	Zurndorf– Györ 439B
AT	AT-HU	APG	Zurndorf	MAVIR	Szombathely	380	AC	Zurndorf– Szombathely 440B
AT	AT-HU	APG	Wien Südost	MAVIR	Györ	220	AC	Wien Südost – Györ 245
AT	AT-HU	APG	Neusiedl	MAVIR	Györ	220	AC	Neusiedl – Györ 246B
AT	AT-IT	APG	Lienz	TERNA	Soverzene	220	AC	Lienz – Soverzene 261
AT	AT-SI	APG	Obersielach	ELES	Podlog	220	AC	Obersielach – Podlog 247
AT	AT-SI	APG	Kainachtal	ELES	Maribor	380	AC	Kainachtal – Maribor 1 473
AT	AT-SI	APG	Kainachtal	ELES	Maribor	380	AC	Kainachtal – Maribor 2 474
BE	BE-DE	ELIA	Lixhe	Amprion	Oberzier	DC	DC	Alegro
BE	BE-FR	ELIA	Monceau	RTE	Chooz	220	AC	Chooz – Monceau
BE	BE-FR	ELIA	Avelgem	RTE	Avelin	380	AC	Avelin – Avelgem
BE	BE-FR	ELIA	Achène	RTE	Lonny	380	AC	Lonny – Achène
BE	BE-FR	ELIA	Aubange	RTE	Moulaine	220	AC	Moulaine – Aubange 1
BE	BE-FR	ELIA	Aubange	RTE	Moulaine	220	AC	Moulaine – Aubange 2
BE	BE-FR	ELIA	Avelgem	RTE	Mastaing	380	AC	Avelgem – Mastaing
BE	BE-FR	ELIA	Momignie 1	RTE	Fourmie	63	AC	Fourmie – Momignie 1
BE	BE-FR	ELIA	Momignie 2	RTE	Fourmie	63	AC	Fourmie – Momignie 2
BE	BE-NL	ELIA	Zandvliet	TenneT TSO B.V	Geertruidenberg	380	AC	Zandvliet – Geertruidenberg
BE	BE-NL	ELIA	Zandvliet	TenneT TSO B.V.	Borssele	380	AC	Zandvliet – Borssele

BE	BE-NL	ELIA	Van Eyck L27	TenneT TSO B.V.	Maasbracht	380	AC	Van Eyck White – Maasbracht
BE	BE-NL	ELIA	Van Eyck L28	TenneT TSO B.V.	Maasbracht	380	AC	Van Eyck Black – Maasbracht
BE	BE-UK	ELIA	Gezelle	NGET	Richborough	400	DC	Nemo Link Interconnector
BE	LU-BE	CREOS	Schifflange	ELIA	Schifflange	220	AC	Schifflange PST - Schifflange
CZ	CZ-AT	CEPS	Sokolnice	APG	Bisamberg	220	AC	Sokolnice-Bisamberg 244
CZ	CZ-AT	CEPS	Slavetice	APG	Dürnrohr	400	AC	Slavetice-Dürnrohr 437
CZ	CZ-AT	CEPS	Slavetice	APG	Dürnrohr	400	AC	Slavetice-Dürnrohr 438
CZ	CZ-AT	CEPS	Sokolnice	APG	Bisamberg	220	AC	Sokolnice-Bisamberg 243
CZ	CZ-DE	CEPS	Hradec	TenneT TSO GmbH	Etzenricht	400	AC	Hradec-Etzenricht 441
CZ	CZ-DE	CEPS	Prestice	TenneT TSO GmbH	Etzenricht	400	AC	Prestice-Etzenricht 442
CZ	CZ-DE	CEPS	Hradec	50Hertz	Rohrsdorf	400	AC	Hradec-Röhrsdorf 445
CZ	CZ-DE	CEPS	Hradec	50Hertz	Rohrsdorf	400	AC	Hradec-Röhrdorf 446
CZ	CZ-PL	CEPS	Lískovec	PSE Op. SA	Bujaków	220	AC	Bujaków – Lískovec 245
CZ	CZ-PL	CEPS	Lískovec	PSE Op. SA	Kopanina	220	AC	Kopanina – Lískovec 246
CZ	CZ-PL	CEPS	Albrechtice	PSE Op. SA	Dobrzeń	400	AC	Dobrzeń – Albrechtice 443
CZ	CZ-PL	CEPS	Nošovice	PSE Op. SA	Wielopole	400	AC	Wielopole – Nošovice 444
CZ	CZ-SK	CEPS	Sokolnice	SEPS	Stupava	400	AC	Sokolnice-Stupava 497
CZ	CZ-SK	CEPS	Nošovice	SEPS	Varin	400	AC	Nošovice- Varin 404
CZ	CZ-SK	CEPS	Lískovec	SEPS	P.Bystrica	220	AC	Lískovec-P.Bystrica 270
CZ	CZ-SK	CEPS	Sokolnice	SEPS	Križovany	400	AC	Sokolnice- Križovany 424
CZ	CZ-SK	CEPS	Sokolnice	SEPS	Senica	220	AC	Sokolnice-Senica 280
CH	CH-AT	Swissgrid	Pradella	APG	Westtirol	380	AC	Inn Sued
CH	CH-AT	Swissgrid	Pradella	APG	Westtirol	380	AC	Inn Nord
CH	CH-AT	Swissgrid	Eschen	APG	Feldkirch	110	AC	Eschen – Feldkirch
CH	CH-AT	Swissgrid	Rüthi	APG	Meiningen	220	AC	Schwarz
CH	CH-AT	Swissgrid	Rüthi	APG	Meiningen	220	AC	Rot
CH	CH-DE	Swissgrid	Asphard	TransnetBW	Kühmoos	380	AC	Wehra
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Breitematt	110	AC	Trafo 20 Laufenburg
CH	CH-DE	Swissgrid	Laufenburg	Amprion	Tiengen	380	AC	Andelsbach
CH	CH-DE	Swissgrid	Laufenburg	Amprion	Kühmoos	380	AC	Seelbach
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Eggberg
CH	CH-DE	Swissgrid	Oftringen	TransnetBW	Gurtweil	220	AC	Blau
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Hotzenwald
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Gurtweil	220	AC	Alb Süd

CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Trossingen	380	AC	Wutach / Trossingen – Laufenburg rot
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Heimbach
CH	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Murg
CH	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	380	AC	Aare – West
CH	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	220	AC	Aare – Ost
CH	CH-FR	Swissgrid	Vallorcine	RTE	Pressy	220	AC	
CH	CH-FR	Swissgrid	Bassecourt	RTE	Sierentz	380	AC	
CH	CH-FR	Swissgrid	Bassecourt	RTE	Mambelin	380	AC	
CH	CH-FR	Swissgrid	Riddes	RTE	Cornier	220	AC	Morgins Sud
CH	CH-FR	Swissgrid	Laufenburg	RTE	Sierentz	380	AC	Wiesental Nord
CH	CH-FR	Swissgrid	Verbois	RTE	Genissiat	220	AC	1
CH	CH-FR	Swissgrid	Verbois	RTE	Bois-Tollot	380	AC	
CH	CH-FR	Swissgrid	St. Triphon	RTE	Cornier	220	AC	Morgins Nord
CH	CH-FR	Swissgrid	Verbois	RTE	Genissiat	220	AC	2
CH	CH-FR	Swissgrid	Romanel	RTE	Bois-Tollot	380	AC	
CH	CH-IT	Swissgrid	Airolo	TERNA	Ponte	220	AC	San Giacomo
CH	CH-IT	Swissgrid	Lavorgo	TERNA	Musignano	380	AC	
CH	CH-IT	Swissgrid	Gorduno	TERNA	Mese	220	AC	Jorio
CH	CH-IT	Swissgrid	Soazza	TERNA	Bulciago	380	AC	Forcola
CH	CH-IT	Swissgrid	Riddes	TERNA	Avise	220	AC	Bernard Ouest
CH	CH-IT	Swissgrid	Riddes	TERNA	Valpelline	220	AC	Bernard Est
CH	CH-IT	Swissgrid	Serra	TERNA	Pallanzeno	220	AC	Monscera
CH	CH-IT	Swissgrid	Robbia	TERNA	San Fiorano	380	AC	Sassalbo
CH	CH-IT	Swissgrid	Robbia	TERNA	Gorlago	380	AC	Vartegna [1]
CH	CH-IT	Swissgrid	Mendrisio	TERNA	Cagno	380	AC	
CH	CH-IT	Swissgrid	Campocologno	TERNA	Tirano	150	AC	
CH	CH-IT	Swissgrid	Campocologno	TERNA	Villa di Tirano	132	AC	
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	380	AC	Bürs – Westtirol rot 422
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Altheim	220	AC	Altheim – St. Peter 233
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Simbach	220	AC	Simbach – St. Peter 230
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pirach	220	AC	Pirach – St. Peter 256
DE	AT-DE	APG	St. Peter	TenneT TSO GmbH	Pleinting	220	AC	Pleinting – St. Peter 258
DE	AT-DE	APG	Westtirol	Amprion	Kempten	220	AC	Westtirol - Kempten
DE	AT-DE	APG	Westtirol	TransnetBW	Bürs	220	AC	Bürs – Westtirol weiß 421
DE	AT-DE	APG	Westtirol	Amprion	Leupolz	380	AC	Füssen Ost 412
DE	AT-DE	APG	Braunau	TenneT TSO GmbH	Neuötting	110	AC	Braunau - Neuötting 199/3
DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ranna	110	AC	Ranna (Bedarfsübergabestelle) 147 (156/1)

DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ranna	110	AC	Ranna (Bedarfsübergabestelle) 147 (156/2)
DE	AT-DE	APG	Braunau	TenneT TSO GmbH	Stammham	110	AC	Braunau - Stammham 199/4
DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ering	110	AC	Ering - St. Peter 182/5
DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Ering	110	AC	Ering - St. Peter 182/6
DE	AT-DE	APG	Antiesenhofen	TenneT TSO GmbH	Egglfing	110	AC	Egglfing - Antiesenhofen 188/3b
DE	AT-DE	APG	St.Peter	TenneT TSO GmbH	Egglfing	110	AC	Egglfing - St. Peter 188/5
DE	AT-DE	APG	Aigerding	TenneT TSO GmbH	Passau-Ingling	110	AC	Passau-Ingling - Aigerding 188/1
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 413
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 414
DE	AT-DE	APG	Westtirol	TenneT TSO GmbH	Silz	220	AC	Westtirol – Silz 274E
DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 273C
DE	AT-DE	APG	Vill	TenneT TSO GmbH	Silz	220	AC	Y-Vill – Silz 274C
DE	AT-DE	APG	Ebbs	TenneT TSO GmbH	Oberaudorf	110	AC	Oberaudorf - Ebbs 176/7
DE	AT-DE	APG	Kufstein	TenneT TSO GmbH	Oberaudorf	110	AC	Oberaudorf - Kufstein 176/6
DE	AT-DE	APG	St. Jakob	TransnetBW	Bürs	110	AC	St. Jakob – Bürs 172/8
DE	AT-DE	APG	Rauz	TransnetBW	Bürs	110	AC	Rauz – Bürs 172/9
DE	BE-DE	ELIA	Lixhe	Amprion	Oberzier	DC	DC	Alegro
DE	CH-DE	Swissgrid	Asphard	TransnetBW	Kühmoos	380	AC	Wehra
DE	CH-DE	Swissgrid	Oftringen	TransnetBW	Gurtweil	220	AC	Blau
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Gurtweil	220	AC	Alb Süd
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Heimbach
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Kühmoos	380	AC	Seelbach
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	380	AC	Murg
DE	CH-DE	Swissgrid	Laufenburg	Amprion	Tiengen	380	AC	Andelsbach
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Eggberg
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Kühmoos	220	AC	Hotzenwald
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Breitematt	110	AC	Trafo 20 Laufenburg
DE	CH-DE	Swissgrid	Laufenburg	TransnetBW	Trossingen	380	AC	Wutach / Trossingen – Laufenburg rot
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	220	AC	Aare – Ost
DE	CH-DE	Swissgrid	Beznau	Amprion	Tiengen	380	AC	Aare – West
DE	CZ-DE	CEPS	Prestice	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 442
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 445
DE	CZ-DE	CEPS	Hradec	50Hertz	Röhrsdorf	380	AC	Röhrsdorf – Hradec 446
DE	CZ-DE	CEPS	Hradec	TenneT TSO GmbH	Etzenricht	380	AC	Hradec – Etzenricht 441

DE	DE-DKE	50Hertz	Bentwisch	Energinet	Bjaeverskov	400	DC	Bentwisch – Bjaeverskov
DE	DE-DKE	50Hertz	Bentwisch	Energinet	Kontek	380	AC	Bentwisch – Bjaeverskov
DE	DE-DKE	50Hertz	Bentwisch	Energinet	CGS	150	AC	Bentwisch – Bjaeverskov
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö1
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Kassö	220	AC	Flensburg-Kassö rt
DE	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Ensted	220	AC	Flensburg-Ensted gb
DE	DE-DK1	TenneT TSO GmbH	Jardelund	Energinet	Kassö	380	AC	Jardelund-Kassö2
DE	DE-FR	TransnetBW	Eichstetten	RTE	Vogelgrun	220	AC	Kaiserstuhl – Nord
DE	DE-FR	TransnetBW	Eichstetten	RTE	Muhlbach	380	AC	Ill
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 1 – Nord
DE	DE-FR	Amprion	Ensdorf	RTE	Vigy	380	AC	Vigy 2 – Süd
DE	DE-FR	Amprion	Ensdorf	RTE	St. Avold	220	AC	St. Avold
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden schwarz
DE	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden weiß
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo schwarz
DE	DE-NL	Amprion	Oberzier	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant weiß
DE	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo weiß
DE	DE-NL	Amprion	Siersdorf	TenneT TSO B.V.	Maasbracht	380	AC	Selfkant schwarz
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem schwarz
DE	DE-NL	Amprion	Niederreihn	TenneT TSO B.V.	Doetinchem	380	AC	Niederreihn – Doetinchem weiß
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	220	AC	Vierraden – Krajnik 508
DE	DE-PL	50Hertz	Vierraden	PSE Op. SA	Krajnik	220	AC	Vierraden – Krajnik 507
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 567
DE	DE-PL	50Hertz	Hagenwerder	PSE Op. SA	Mikułowa	380	AC	Hagenwerder – Mikułowa 568
DE	DE-SE	TenneT TSO GmbH	Herrenwyk	Svenska Kraftnät	Arrie	400	DC	Baltic Cable
DE	DE-AT	Amprion	Stich 403A	APG	Werben	220	AC	Stich Bludenz West 403A
DE	DE-AT	APG	Walgauwerk	TransnetBW	Bürs	220	AC	Bürs - Walgauwerk orange 405A
DE	DE-AT	APG	Meiningen	TransnetBW	Bürs	220	AC	Bürs - Meiningen grün 406A
DE	DE-AT	APG	Nenzing	TransnetBW	Bürs	110	AC	Bürs-Nenzing weiss 197/2
DE	DE-AT	APG	Bürs VKW	TransnetBW	Bürs	110	AC	Bürs - Bürs-VKW rot 197/10
DE	DE-AT	Amprion	Stich 404A	APG	Werben	220	AC	Stich Dellmensingen Ost 404A
DK1	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Ensted	220	AC	Flensburg-Ensted gb

DK1	DE-DK1	TenneT TSO GmbH	Audorf	Energinet	Kassö	380	AC	Audorf-Kassö 2/bl
DK1	DE-DK1	TenneT TSO GmbH	Audorf	Energinet	Kassö	380	AC	Audorf-Kassö 1/gn
DK1	DE-DK1	TenneT TSO GmbH	Flensburg	Energinet	Kassö	220	AC	Flensburg-Kassö rt
DK1	DK1-SE	Energinet	400 kV Vester Hassing	Svenska Kraftnät	132 kV Lindome	250	DC	HVDC Kontiskan 2
DK1	DK1-SE	Energinet	400 kV Vester Hassing	Svenska Kraftnät	400 kV Lindome	250	DC	HVDC Kontiskan 1
DK1	DK1-NL	Energinet	Endrup	TenneT TSO B.V.	Eemshaven	320	DC	COBRAcable
DK1	DK1-NO	Energinet	150 kV Tjele	Statnett	300 kV Kr.sand	250	DC	HVDC Skagerrak 1
DK1	DK1-NO	Energinet	150 kV Tjele	Statnett	300 kV Kr.sand	250	DC	HVDC Skagerrak 2
DK1	DK1-NO	Energinet	400 kV Tjele	Statnett	300 kV Kr.sand	350	DC	HVDC Skagerrak 3
FR	BE-FR	ELIA	Avelgem	RTE	Avelin	400	AC	Avelin – Avelgem
FR	BE-FR	ELIA	Aubange	RTE	Moulaine	220	AC	Moulaine – Aubange
FR	BE-FR	ELIA	Aubange	RTE	Mont St Martin	220	AC	Aubange – Mont Saint Martin
FR	BE-FR	ELIA	Achène	RTE	Lonny	400	AC	Lonny – Achène
FR	BE-FR	ELIA	Jamiolle	RTE	Chooz	220	AC	Chooz – Jamiolle
FR	BE-FR	ELIA	Avelgem	RTE	Mastaing	380	AC	Avelgem-Mastaing
FR	BE-FR	ELIA	Momignie 1	RTE	Fourmie	63	AC	Fourmie – Momignie 1
FR	BE-FR	ELIA	Momignie 2	RTE	Fourmie	63	AC	Fourmie – Momignie 2
FR	CH-FR	Swissgrid	Vallorcine	RTE	Pressy	220	AC	
FR	CH-FR	Swissgrid	Bassecourt	RTE	Mambelin	400	AC	
FR	CH-FR	Swissgrid	Bassecourt	RTE	Sierentz	400	AC	
FR	CH-FR	Swissgrid	Riddes	RTE	Cornier	220	AC	Morgins Sud
FR	CH-FR	Swissgrid	Laufenburg	RTE	Sierentz	400	AC	Wiesental Nord
FR	CH-FR	Swissgrid	St. Triphon	RTE	Cornier	220	AC	Morgins Nord
FR	CH-FR	Swissgrid	Verbois	RTE	Genissiat	220	AC	1
FR	CH-FR	Swissgrid	Verbois	RTE	Genissiat	220	AC	2
FR	CH-FR	Swissgrid	Chamoson	RTE	Bois-Tollot	400	AC	
FR	CH-FR	Swissgrid	Verbois	RTE	Bois-Tollot	400	AC	
FR	DE-FR	TransnetBW	Eichstetten	RTE	Vogelgrun	220	AC	Kaiserstuhl – Nord
FR	DE-FR	TransnetBW	Eichstetten	RTE	Muhlbach	400	AC	Ill
FR	DE-FR	Amprion	Ensdorf	RTE	St. Avold	220	AC	St. Avold
FR	DE-FR	Amprion	Ensdorf	RTE	Vigy	400	AC	Vigy - 1N
FR	DE-FR	Amprion	Ensdorf	RTE	Vigy	400	AC	Vigy - 2S
FR	ES-FR	REE	Vic	RTE	Baixais	400	AC	
FR	ES-FR	REE	Benos	RTE	Lac Doo	150	AC	
FR	ES-FR	REE	Irun	RTE	Errondenia	150	AC	
FR	ES-FR	REE	Hernani	RTE	Argia	400	AC	
FR	ES-FR	REE	Arkale	RTE	Argia	220	AC	
FR	ES-FR	REE	Biescas	RTE	Pragneres	220	AC	
FR	ES-FR	REE	Santa Llogaia	RTE	Baixais	320	DC	Santa Llogaia – Baixas 1

FR	ES-FR	REE	Santa Llogaia	RTE	Baixais	320	DC	Santa Llogaia – Baixas 2
FR	FR-IT	RTE	Albertville	TERNA	Rondissone	400	AC	2
FR	FR-IT	RTE	Albertville	TERNA	Rondissone	400	AC	1
FR	FR-IT	RTE	Menton	TERNA	Camporosso	220	AC	
FR	FR-IT	RTE	Villarodin	TERNA	Venaus (Venalzio)	400	AC	
FR	FR-UK	RTE	Mandarins	NGC	Sellindge	270	DC	1
FR	FR-UK	RTE	Mandarins	NGC	Sellindge	270	DC	2
HR	HR-BA	HOPS	ERNESTINOVO	NOSBiH	UGLJEVIK	400	AC	ERNESTINOVO-UGLJEVIK
HR	HR-BA	HOPS	KONJSKO	NOSBiH	MOSTAR	400	AC	KONJSKO-MOSTAR
HR	HR-BA	HOPS	ĐAKOVO	NOSBiH	TUZLA	220	AC	ĐAKOVO-TUZLA
HR	HR-BA	HOPS	ĐAKOVO	NOSBiH	GRADAČAC	220	AC	ĐAKOVO-GRADAČAC
HR	HR-BA	HOPS	ZAKUČAC	NOSBiH	MOSTAR	220	AC	ZAKUČAC-MOSTAR
HR	HR-BA	HOPS	MEĐURIĆ	NOSBiH	PRIJEDOR	220	AC	MEĐURIĆ-PRIJEDOR
HR	HR-HU	HOPS	ŽERJAVINEC	MAVIR	HÉVÍZ 1	400	AC	ŽERJAVINEC-HÉVÍZ 1
HR	HR-HU	HOPS	ŽERJAVINEC	MAVIR	HÉVÍZ 2	400	AC	ŽERJAVINEC-HÉVÍZ 2
HR	HR-RS	HOPS	ERNESTINOVO	EMS	SR.MITROVICA 2	400	AC	ERNESTINOVO-SR.MITROVICA 2
HR	HR-SI	HOPS	MELINA	ELES	DIVAČA	400	AC	MELINA-DIVAČA
HR	HR-SI	HOPS	TUMBRI	ELES	KRŠKO 1	400	AC	TUMBRI-KRŠKO 1
HR	HR-SI	HOPS	TUMBRI	ELES	KRŠKO 2	400	AC	TUMBRI-KRŠKO 2
HR	HR-SI	HOPS	PEHLIN	ELES	DIVAČA	220	AC	PEHLIN-DIVAČA
HR	HR-SI	HOPS	ŽERJAVINEC	ELES	CIRKOVCE	220	AC	ŽERJAVINEC-CIRKOVCE
HR	HR-BA	HOPS	PLAT	NOSBiH	TREBINJE	220	AC	PLAT-TREBINJE
HR	HR-BA	HOPS	SISAK	NOSBiH	PRIJEDOR	220	AC	SISAK-PRIJEDOR
HR	HR-BA	HOPS	GRAČAC	NOSBiH	KULEN VAKUF	110	AC	GRAČAC-KULEN VAKUF
HR	HR-BA	HOPS	SLAVONSKI BROD 2	NOSBiH	BOSANSKI BROD	110	AC	SLAVONSKI BROD 2-BOSANSKI BROD
HR	HR-BA	HOPS	IMOTSKI	NOSBiH	GRUDE	110	AC	IMOTSKI-GRUDE
HR	HR-BA	HOPS	STON	NOSBiH	NEUM	110	AC	STON-NEUM
HR	HR-BA	HOPS	OPUZEN	NOSBiH	NEUM	110	AC	OPUZEN-NEUM
HR	HR-BA	HOPS	OPUZEN	NOSBiH	ČAPLJINA	110	AC	OPUZEN-ČAPLJINA
HR	HR-BA	HOPS	KOMOLAC	NOSBiH	TREBINJE	110	AC	KOMOLAC-TREBINJE
HR	HR-BA	HOPS	BUSKO BLATO	NOSBiH	LIVNO	110	AC	BUSKO BLATO-LIVNO
HR	HR-BA	HOPS	VRGORAC	NOSBiH	LJUBUŠKI	110	AC	VRGORAC-LJUBUŠKI
HR	HR-BA	HOPS	ŽUPANJA	NOSBiH	ORAŠJE	110	AC	ŽUPANJA-ORAŠJE
HR	HR-BA	HOPS	KNIN	NOSBiH	BOSANSKO GRAHOVO	110	AC	KNIN - BOSANSKO GRAHOVO

HR	HR-RS	HOPS	BELI MANASTIR	EMS	APATIN	110	AC	BELI MANASTIR-APATIN
HR	HR-RS	HOPS	NIJEMCI	EMS	ŠID	110	AC	NIJEMCI-ŠID
HR	HR-SI	HOPS	MATULJI	ELES	ILIRSKA BISTRICA	110	AC	MATULJI-ILIRSKA BISTRICA
HR	HR-SI	HOPS	BUJE	ELES	KOPER	110	AC	BUJE-KOPER
HR	HR-SI	HOPS	NEDELJANEC	ELES	FORMIN	110	AC	NEDELJANEC-FORMIN
HR	HR-HU	HOPS	ERNESTINOVO	MAVIR	PÉCS	400	AC	ERNESTINOVO - PÉCS 1
HR	HR-HU	HOPS	ERNESTINOVO	MAVIR	PÉCS	400	AC	ERNESTINOVO - PÉCS 2
HU	HU-AT	MAVIR	Győr	APG	Neusiedl	220	AC	Győr -Neusiedl 246B
HU	HU-AT	MAVIR	Győr	APG	Wien-Südost	220	AC	Győr - Wien-Südost 245
HU	HU-AT	MAVIR	Győr	APG	Zurndorf	400	AC	Győr - Zurndorf 439B
HU	HU-AT	MAVIR	Szombathely	APG	Zurndorf	400	AC	Szombathely - Zurndorf440B
HU	HU-HR	MAVIR	Hévíz	HEP-OPS	Žerjavinec	400	AC	Hévíz -Žerjavinec II.
HU	HU-HR	MAVIR	Hévíz	HEP-OPS	Žerjavinec	400	AC	Hévíz -Žerjavinec I.
HU	HU-HR	MAVIR	Pécs	HEP-OPS	Ernestinovo	400	AC	Pécs-Ernestinovo I.
HU	HU-HR	MAVIR	Pécs	HEP-OPS	Ernestinovo	400	AC	Pécs-Ernestinovo II.
HU	HU-HR	MAVIR	Siklós	HEP-OPS	Donji Miholjac	120	AC	Siklós-Donji Miholjac / not considered
HU	HU-HR	MAVIR	Lenti	HEP-OPS	Nedeljanec	120	AC	Lenti-Nedeljanec / not considered
HU	HU-RO	MAVIR	Sándorfalva	Transelectrica	Arad	400	AC	Sándorfalva-Arad
HU	HU-RO	MAVIR	Békéscsaba	Transelectrica	Nadab	400	AC	Békéscsaba-Nadab
HU	HU-RS	MAVIR	Sándorfalva	EMS	Subotica	400	AC	Sándorfalva-Subotica
HU	HU-SK	MAVIR	Győr	SEPS	Gabčíkovo	400	AC	Győr-Gabčíkovo
HU	HU-SK	MAVIR	Göd	SEPS	Levice	400	AC	Göd-Levice
HU	HU-UA	MAVIR	Albertirsa	Ukrenergo	Zahidno Ukrainska	750	AC	Albertirsa- Zahidno Ukrainska
HU	HU-UA	MAVIR	Sajószöged	Ukrenergo	Mukachevo	400	AC	Sajószöged-Mukachevo
HU	HU-UA	MAVIR	Kisvárda	Ukrenergo	Mukachevo	220	AC	Kisvárda-Mukachevo
HU	HU-UA	MAVIR	Tiszalök	Ukrenergo	Mukachevo	220	AC	Tiszalök-Mukachevo
IT	AT-IT	APG	Lienz	TERNA	Soverzene	220	AC	Lienz – Soverzene
IT	IT-AT	Terna	Tarvisio	APG	Arnoldstein	132	AC	Tarvisio-Arnoldstein
IT	CH-IT	Swissgrid	Airolo	TERNA	Ponte	220	AC	San Giacomo
IT	CH-IT	Swissgrid	Lavorgo	TERNA	Musignano	380	AC	
IT	CH-IT	Swissgrid	Gorduno	TERNA	Mese	220	AC	Jorio
IT	CH-IT	Swissgrid	Riddes	TERNA	Valpelline	220	AC	Bernard Est
IT	CH-IT	Swissgrid	Riddes	TERNA	Avise	220	AC	Bernard Ouest
IT	CH-IT	Swissgrid	Soazza	TERNA	Bulciago	380	AC	Forcola

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

IT	CH-IT	Swissgrid	Serra	TERNA	Pallanzeno	220	AC	Monscera
IT	CH-IT	Swissgrid	Robbia	TERNA	San Fiorano	380	AC	Sassalbo[2]
IT	CH-IT	Swissgrid	Robbia	TERNA	Gorlago	380	AC	Vartegna
IT	CH-IT	Swissgrid	Mendrisio	TERNA	Cagno	380	AC	
IT	CH-IT	Swissgrid	Campocologno	TERNA	Tirano	150	AC	
IT	CH-IT	Swissgrid	Campocologno	TERNA	Villa di Tirano	132	AC	
IT	FR-IT	RTE	Z Menton	TERNA	Camporosso	220	AC	
IT	FR-IT	RTE	Albertville	TERNA	Rondissone	400	AC	1
IT	FR-IT	RTE	Albertville	TERNA	Rondissone	400	AC	2
IT	FR-IT	RTE	Villarodin	TERNA	Venalzio (Venaus)	400	AC	
IT	IT-SI	TERNA	Redipuglia	ELES	Divaca	380	AC	
IT	IT-SI	TERNA	Padriciano	ELES	Divaca	220	AC	
LU	LU-BE	Creos	Schifflange	ELIA	Aubange	220	AC	Aubange - PST Schifflange
NL	BE-NL	ELIA	Zandvliet	TenneT TSO B.V.	Geertruidenberg	380	AC	Zandvliet – Geertruidenberg
NL	BE-NL	ELIA	Zandvliet	TenneT TSO B.V.	Borssele	380	AC	Zandvliet – Borssele
NL	BE-NL	ELIA	Van Eyck	TenneT TSO B.V.	Maasbracht	380	AC	Van Eyck White – Maasbracht
NL	BE-NL	ELIA	Van Eyck	TenneT TSO B.V.	Maasbracht	380	AC	Van Eyck Black – Maasbracht
NL	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden weiß
NL	DE-NL	TenneT TSO GmbH	Diele	TenneT TSO B.V.	Meeden	380	AC	Diele – Meeden schwarz
NL	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo weiß
NL	DE-NL	Amprion	Oberzier	TenneT TSO B.V.	Maasbracht	380	AC	Maasbracht - Oberzier 380 Wit
NL	DE-NL	Amprion	Siersdorf	TenneT TSO B.V.	Maasbracht	380	AC	Maasbracht – Siersdorf 380 Zwart
NL	DE-NL	Amprion	Gronau	TenneT TSO B.V.	Hengelo	380	AC	Gronau – Hengelo schwarz
NL	DE-NL	Amprion	Niederrhein	TenneT TSO B.V.	Doetinchem	380	AC	Niederrhein – Doetinchem schwarz
NL	DE-NL	Amprion	Niederrhein	TenneT TSO B.V.	Doetinchem	380	AC	Niederrhein – Doetinchem weiß
NL	NL-DK1	TenneT TSO B.V.	Eemshaven	Energinet	Endrup	320	DC	COBRAcable
NL	NL-NO	TenneT TSO B.V.	Eemshaven	Statnett	Feda	450	DC	Eemshaven – Feda (NorNed)
NL	NL-UK	TenneT TSO B.V.	Maasvlakte	NGET	Isle of Grain	450	DC	Maasvlakte – Isle of Grain (BritNed)
PL	PL-BY	PSE Op. SA	Wólka Dobrzyńska	Bel Energo	Brześć	110	AC	Wólka Dobrzyńska – Brześć
PL	PL-CZ	PSE Op. SA	Bujaków	CEPS	Lískovec	220	AC	Bujaków – Lískovec 245
PL	PL-CZ	PSE Op. SA	Kopanina	CEPS	Lískovec	220	AC	Kopanina – Lískovec 246
PL	PL-CZ	PSE Op. SA	Dobrzeń	CEPS	Albrechtice	400	AC	Dobrzeń – Albrechtice 443
PL	PL-CZ	PSE Op. SA	Wielopole	CEPS	Nošovice	400	AC	Wielopole – Nošovice 444

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

PL	PL-DE	PSE Op. SA	Krajnik	50-Hertz	Vierraden	400	AC	Krajnik – Vierraden 507
PL	PL-DE	PSE Op. SA	Krajnik	50 Hertz	Vierraden	400	AC	Krajnik – Vierraden 508
PL	PL-DE	PSE Op. SA	Mikułowa	50 Hertz	Hagenwerder	400	AC	Mikułowa – Hagenwerder 567
PL	PL-DE	PSE Op. SA	Mikułowa	50 Hertz	Hagenwerder	400	AC	Mikułowa– Hagenwerder 568
PL	PL-SE	PSE Op. SA	Słupsk	Svenska Kraftnät	Karlshamn	450	DC	SwePol Link
PL	PL-SK	PSE Op. SA	Krosno Iskrzynia	SEPS	Lemesany	400	AC	Krosno-Lemesany 478
PL	PL-SK	PSE Op. SA	Krosno Iskrzynia	SEPS	Lemesany	400	AC	Krosno-Lemesany 477
PL	PL-UA	PSE Op. SA	Zamość	WPS	Dobrotwór	220	AC	Zamość – Dobrotwór
PL	PL-LT	PSE SA	Ełk Bis	LITGRID AB	Alytus	400	AC	Ełk Bis – Alytus
SI	SI-AT	ELES	Podlog	APG	Obersielach	220	AC	Podlog-Obersielach
SI	SI-AT	ELES	Maribor	APG	Kainachtal	400	AC	Maribor-Kainachtal
SI	SI-AT	ELES	Maribor	APG	Kainachtal	400	AC	Maribor-Kainachtal
SI	SI-HR	ELES	Divaca	HEP	Pehlin	220	AC	Divaca-Pehlin
SI	SI-HR	ELES	Cirkovce	HEP	Zerjavinec	220	AC	Cirkovce-Zerjavinec
SI	SI-HR	ELES	Krško	HEP	Tumbri	400	AC	Krško-Tumbri
SI	SI-HR	ELES	Divaca	HEP	Melina	400	AC	Divaca-Melina
SI	SI-HR	ELES	Koper	HEP	Buje	110	AC	Koper-Buje
SI	SI-HR	ELES	Il.Bistrica	HEP	Matulji	110	AC	Il.Bistrica-Matulji
SI	SI-HR	ELES	Formin	HEP	Nedeljanec	110	AC	Formin-Nedeljanec
SI	SI-HR	ELES	Krško	HEP	Tumbri	400	AC	Krško-Tumbri
SI	SI-IT	ELES	Divaca	TERNA	Redipuglia	400	AC	Divaca-Redipuglia
SI	SI-IT	ELES	Divaca	TERNA	Padriciano	220	AC	Divaca- Padriciano
SK	SK-CZ	SEPS	Varín	ČEPS	Nošovice	400	AC	Varín – Nošovice
SK	SK-CZ	SEPS	Stupava	ČEPS	Sokolnice	400	AC	Stupava – Sokolnice
SK	SK-CZ	SEPS	Senica	ČEPS	Sokolnice	220	AC	Senica – Sokolnice
SK	SK-CZ	SEPS	P. Bystrica	ČEPS	Lískovec	220	AC	P. Bystrica – Lískovec
SK	SK-CZ	SEPS	Križovany	ČEPS	Sokolnice	400	AC	Križovany – Sokolnice
SK	SK-HU	SEPS	Levice	MAVIR	Göd	400	AC	Levice – Göd
SK	SK-HU	SEPS	Gabčíkovo	MAVIR	Győr	400	AC	Gabčíkovo – Győr
SK	SK-PL	SEPS	Lemešany	PSE Op. SA	Krosno	400	AC	Lemešany – Krosno 477
SK	SK-PL	SEPS	Lemešany	PSE Op. SA	Krosno	400	AC	Lemešany – Krosno 478
SK	SK-UA	SEPS	V. Kapušany	WPS	Mukačevo	400	AC	V. Kapušany – Mukačevo

Table 7: Bidding Zone Borders of the Status Quo configuration

European Network of
Transmission System Operators
for Electricity

Annex 2: Alternative configurations of the Bidding zone review region “Nordics” which are to be considered in the bidding zone review process

Bidding Zone Review Region Nordic Region

18 February 2020

This annex depicts in detail the Bidding Zone configurations for the Bidding Zone Review "Nordics" that are to be considered in the bidding zone review process in accordance with Article 14(5) of Regulation (EU) 2019/943 of the European Parliament and the Council of 5th June 2019 on the internal market for electricity (recast).

1. Overview of the configurations of the Bidding Zone Review Region Nordic

The following table summarizes the alternative configurations to be further considered in the Bidding Zone Review Region Nordic (BZRR Nordics).

Nordic	TSO	BZ1	Action Plan	Config 1	Config 2	Config 3	Config 4	Config 5
				Current Configuration	Split of NO4 (NO4a and NO4b)	Merge of current SE3 and SE4, and new SE5	Merge of current SE3 and SE4, merge of current SE1 and SE2, and new SE5	Config 2 and config 4 combined
Denmark[1]	Energinet	DK2	No	1 BZ	1 BZ	1 BZ	1 BZ	1 BZ
Sweden	Svenska kraftnät	SE1, SE2, SE3, SE4	No	4 BZ	4 BZ	4 BZ (expert based)	3 BZ (expert based)	3 BZ (expert based)
Finland	Fingrid	FI	No	1 BZ	1 BZ	1 BZ	1 BZ	1 BZ
Norway	Statnett	NO1, NO2, NO3, NO4, NO5	No	5 BZ	6 BZ (expert based)	5 BZ	5 BZ	6BZ (expert based)

Table 1: Alternative configurations to be further considered in the BZRR Nordics.

[1] Denmark is a part of two Bidding zone review regions, and DK1 is included in the continental Europe region.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

2. Detailed information per configuration

a) Current bidding zone configurations

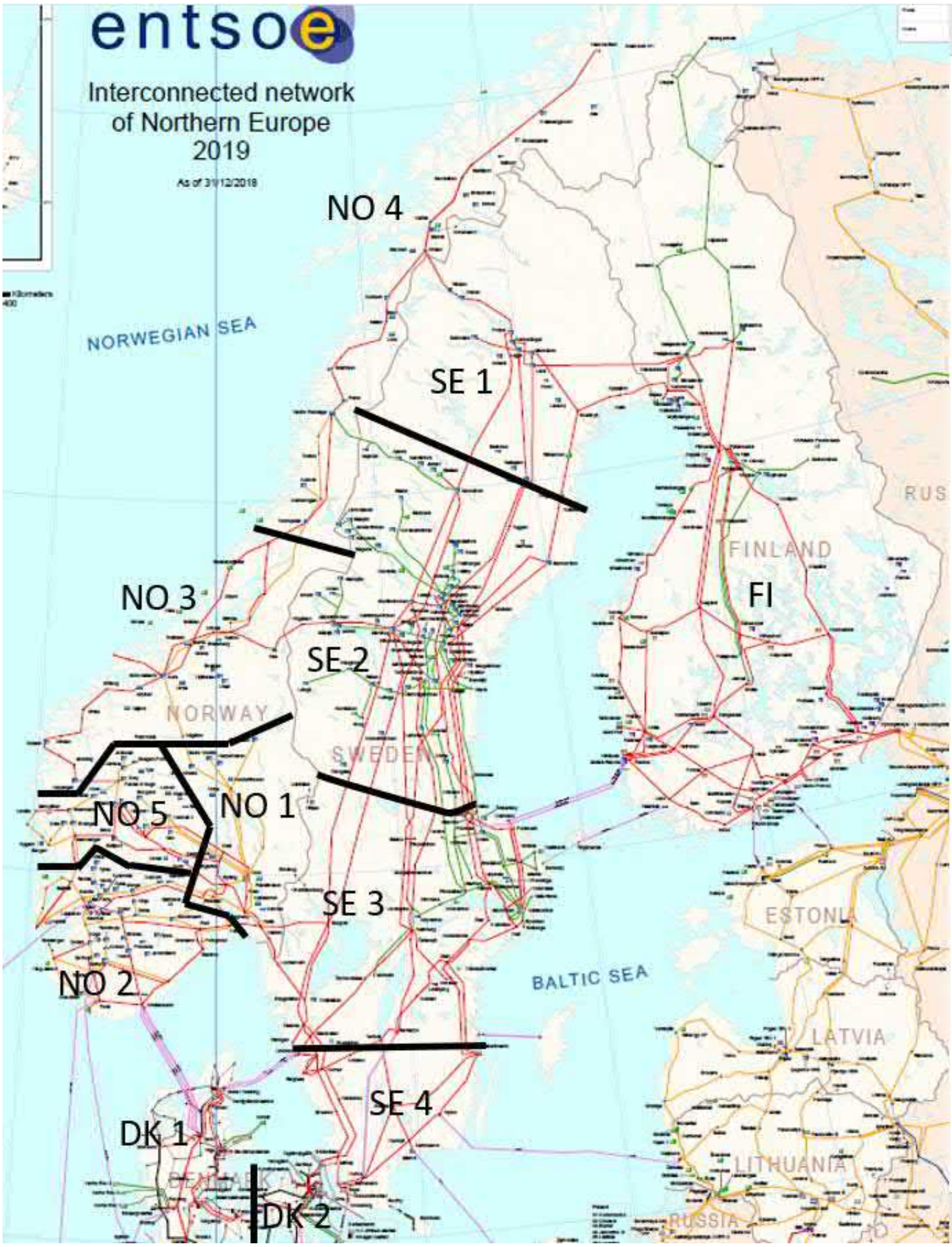


Figure A: Current configurations.

b) A geographical overview of alternative bidding zone delineations to be assessed

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Figure B: Alternative configuration to be analysed for Sweden and Norway. In the proposed configuration regarding Sweden, a modified BZ SE3 is introduced in the Stockholm Metropolitan Area. The current BZ SE4 is expanded to include the remaining area of current BZ SE3. The current BZ SE1 is merged with BZ SE2. In Norway a split of NO4 is proposed, and a new BZ NO6 is introduced. For Denmark and Finland no alternative configuration will be assed at this stage.

The network elements which will form the Bidding Zone Borders of this configuration, is given in table 2.

Bidding Zone Border	TSO1	TSO2	Voltage level [kV]	Type	New/different compared to status quo?
SE2-SE3	Svk	Svk	400 kV & 220 kV	Southbound 400 and 220 kV tie-lines	Status quo
SE3-New SE5	Svk	Svk	220 kV	220 kV and 400 kV in-feed network elements	Different
NO1-NO2	Statnett	Statnett	420, 300 kV	Tie-lines	Status quo
NO2-NO5	Statnett	Statnett	300 kV	Tie-line	Status quo
NO5-NO1	Statnett	Statnett	420, 300 kV	Tie-lines	Status quo
NO3-NO5	Statnett	Statnett	420 kV	Tie-line	Status quo
NO1-NO3	Statnett	Statnett	300 kV	Tie-line	Status quo
NO3-NO6	Statnett	Statnett	420, 300 kV	Tie-lines	Status quo (currently NO3-NO4)
NO6-NO4	Statnett	Statnett	420 kV	Tie-line	New
NO1-SE3	Statnett	SvK	420 kV	Tie-lines	Status quo
NO3-SE1	Statnett	SvK	420 kV	Tie-line	Status quo (currently NO3-SE2)
NO6-SE1	Statnett	SvK	220 kV	Tie-line	Status quo (currently NO4-SE2)
NO4-SE1	Statnett	SvK	420 kV	Tie-line	Status quo

Table 2: Bidding Zone Borders of alternative configuration Sweden and Norway. As regards Norway and Sweden, All BZ borders to the rest of the Nordic TSOs are unchanged in the proposed configuration. The current border NO4-SE2 is renamed NO6-SE2 and NO3-SE2 is renamed NO3-SE1, in the proposal, but the tie-line of the border is unchanged.

Sweden

Identification and assessment of the exact network elements that constitute the border between SE3 and the new BZ SE5 in the alternative configuration for Sweden will be part of the upcoming regional BZ review.

European Network of
Transmission System Operators
for Electricity

Annex 2: Justification of alternative configurations of the Bidding zone review region "Nordics" which are to be considered in the bidding zone review process

Bidding Zone Review Region Nordic Region

18 February 2020

Justification/Explanation on alternative configurations for BZRR Nordic

Sweden

In the Nordic regional BZ review, an assessment of an alternative BZ configuration where (1) the Stockholm Metropolitan Area constitutes a new BZ, ~~and~~ (2) current BZ SE4 is merged with the rest of current BZ SE3, and (3) current BZ SE2 is merged with the current BZ SE1, is proposed.

Power flows and trade patterns in the Swedish National Grids are changing rapidly as a result of thermal power plant decommissioning near traditional load centers in the southern parts of the country and a strong urbanisation trend. In the Stockholm Metropolitan Area, with a peak load demand of about 4 GW, preliminary market coupling simulations combined with load-flow and security analysis indicate congestions in the region are present in scenarios for 2020, 2025 and up until 2030. The same preliminary modelling exercise have indicated few market outcomes that result in congestions between the borders of current BZs SE3 and SE4. The main factors that contribute to this development is nuclear power plant decommissioning, new cross-BZ interconnectors and upcoming investments in the transmission grid.

The structural bottlenecks on the Swedish east coast in and around the Stockholm Metropolitan Area are foreseen to be mitigated by future investments in the mid 2030's at the latest. As the time horizon to fully alleviate congestion problems through investments is 10+ years, Svenska kraftnät proposes to include the configuration alternative in the Nordic regional BZ review.

Since the initial methodology proposal was submitted to all NRAs in October 2019, the proposed alternative configurations have been discussed with stakeholders and NRAs in stakeholder meetings. The outcome of the NRA and stakeholder dialogue is that the BZ review also should assess if BZ SE1 and BZ SE2 should be merged, modified or remain as it is in the current configuration. The background for including the bidding zone border between the BZ SE1 and the BZ SE2 in the review is that the border only been congested in the day ahead market for a few hours the last years.

Norway

Statnett analyses indicate that congestions out of the northernmost bidding zone, NO4, will increase in the future. Splitting the NO4 will help us manage the bottlenecks efficiently.

From NO4 there are connections to Middle Norway (NO3), Northern Sweden (SE1 and SE2) and a weak non-market connection to Finland. The sum capacity of these lines is good. However, skewed loading of the different corridors prevents full utilization.

We expect this situation to become more frequent in the future, as the surplus in NO4 increases, partly due to increased wind power capacity, and because it can be even harder to predict the location of the generators that produce within the area. The challenge is mainly the interaction between the lines to Norway (NO3) and Sweden (SE1). Our simulation results show that the line to SE1 in many cases fill up first, leaving capacity to NO3 unused.

When we solve this type of congestion, it is challenging that the current NO4 bidding zone is such a large geographical area. This makes it necessary to predict the distribution of generation between the northern and southern parts of the area. Additionally, it is challenging that we do not know where the generation will be located until close to the hour of operation. Altogether, this makes the current NO4 zone a poor tool for keeping the flow within safe limits of operation, and we think a split will be beneficial for system operation.

The consequences of a split are further discussed in the Statnett Long-term Market Analysis 2018-40.

Finland

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

The ACER/CEER Annual Report on the Results of Monitoring the Internal Electricity Markets in 2017 found Finland's performance to be adequate related both to 1) availability of HVAC capacity for cross-zonal trading and 2) use of costly remedial actions. Furthermore, ENTSO-E Bidding Zone Configuration Technical Report 2018 shows generally a very low amount of congestion on internal Finnish lines, while the amount of congestion was also reduced in 2017 compared to 2015-2016. Based on these findings, as well as plans to commission additional internal reinforcements in the early 2020s, studying alternative Bidding Zone configurations is not considered to be relevant for Finland in the upcoming Bidding Zone Review.

Currently NO4-FI capacity is included into SE1-FI capacity and commercial transactions are allocated from latter interconnector. Considering the non-market connection to NO4 bidding zone, evaluation of NO4-FI becoming a market border is included part of the bidding zone review process. The bidding zone review process supports profound and reliable analyses to increase Northern Finland´s market transparency.

Denmark

From DK, Energinet is not proposing a split of the bidding zones due to the fact that we currently do not see any significant challenges with meeting the 70% requirement. In todays capacity calculation the point of departure is 100% capacity on the network elements and a few dynamic restrictions which will not be influenced by a bidding zone split. In addition to this, the ENTSO-E technical report from 2018 shows that the congestions in relation to Denmark is found on the interconnectors to other bidding zones and not inside the two Danish Bidding zones.

Summary

We propose that the above showed alternative configuration should be analysed during the official process foreseen for such an investigation, i.e. the bidding zone review of the concerned TSOs, and assessed by the criteria defined in Article 33 of EU Regulation 2015/1222.

European Network of Transmission System Operators for Electricity

Annex 3: Alternative configurations of the Bidding zone review region “South East Europe” which are to be considered in the bidding zone review process

Bidding Zone Review Region "SEE"

18 February 2020

1. Contents

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

This annex depicts in detail the Bidding Zone configurations for the Bidding Zone Review "SEE" that are to be considered in the bidding zone review process in accordance with Article 14(5) of Regulation (EU) 2019/943 of the European Parliament and the Council of 5th June 2019 on the internal market for electricity (recast).

2. Overview of the configurations of the Bidding Zone Review Region "SEE"

1. The BZRR considers SEE Bidding Zone configurations. This includes the Bidding Zone Configuration currently in place, and an additional Bidding Zone Configuration for Greece.

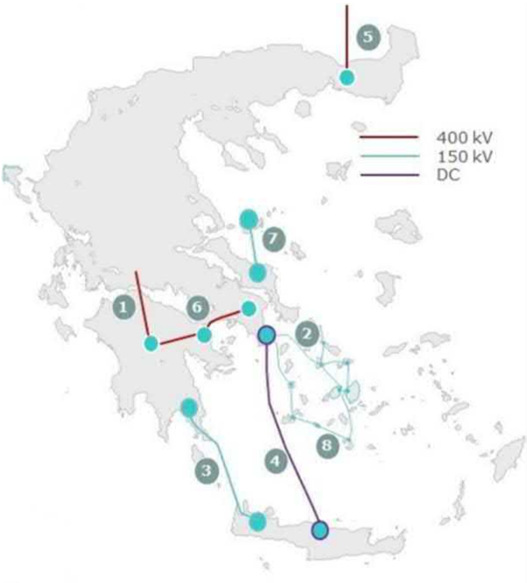
2. An overview of the configurations, including: name of the configuration, number of the configuration (for reference purposes), the number of bidding zones per Member State, and whether the bidding zone configuration in a Member States has an expert-based or model-based justification, is given in Table 1.

3. A geographical overview of the bidding zone delineations is given in Figure 1.

4. Each configuration is described in more detail in Section 3 of this Annex.

Configuration nr	1	2	3	…	…	…
Configuration Name	**Status Quo**	**Bidding zone GR, CR**	[Name]	**…**	**…**	**…**
ember State 1	[# BZs] [EB/MB]	[# BZs] [EB/MB]	[# BZs] [EB/MB]	…	…	…
Greece	**…1 [EB]**	**2… [EB]**	…	…	…	…
Bulgaria	**…1 [EB]**	**1… [EB]**	…		…	…
…	…	…	…	…	…	…
…	…	…	…	…	…	…
…	…	…	…	…	…	…

Table 1: Overview of the Bidding Zone Configurations and the number of Bidding Zones per Member State per configuration



ID	Project description	Expected commissioning year
1	First 400 kV branch to Peloponnese (OHL Megalopoli – Patras – Acheloos)	2019
2	Cycladic Islands interconnection (Phases A, B and C)	2020 (2018 for Phase A, 2019 for Phase B and 2020 for Phase C)
3	Crete interconnection (Phase I)	2020
4	Crete interconnection (Phase II)	2023
5	New 400 kV interconnector to Bulgaria N. Santa (GR) – Maritsa (BG)	2023
6	Second 400 kV branch to Peloponnese (OHL Megalopoli – Korinthos – Koumoundouros)	2024
7	Skiathos island interconnection	2020
8	Cycladic Islands interconnection (Phase D)	2024

Figure 1. Geographical overview of the bidding zone delineations

3. Detailed information per configuration

This section provides detailed information per configuration.

1: Status Quo Configuration

1. The overview of the Status Quo Configuration is inserted for convenience.

2. The network elements which will form the Bidding Zone Borders of this configuration, is given in **Error! Reference source not found.**.

In this configuration it is assumed that no new Bidding Zones are considered in Greece until 2023, therefore the status quo configuration of a single GR BZ is taken into account.

The current internal congestion in the 150 kV system in the area of the Peloponnese will be alleviated by the beginning of 2020, due to the construction of a 400 kV line between the Acheloos EHVSS and the Patras and Megalopoli EHVSSs. The Peloponnese system will be further strengthened with the construction of a second 400 kV line connecting Megalopoli and Koumoundourou EHVSSs.

A new line between Nea Santa (GR) and Maritsa East (BG) is expected to be constructed within 2023. This line will impact on the NTC between GR and BG, however it will not produce any internal congestion within the GR BZ.

All other new system transmission expansions focus in the interconnection of further isolated Greek islandic systems with the mainland and cause no internal congestion within the GR BZ.

The island of Crete will be interconnected with the Greek mainland in two phases. During Phase I, internal congestion will occur between the Peloponnese and Crete (150 kV line between Molaoi and Chania HVSS). During this period, redispatching will be required and it is estimated that daily redispatch volume will be approximately 3,3 GWh, resulting in redispatching cost of approximately 240 M€ per year. However, this situation will be remediated by 2023, once the Phase II of the project will be completed (with the construction of the DC cable between Koumoundourou HVSS and Damasta HVSS) and no further internal congestion will be evident between the Greek mainland and the Crete system.

Since this phenomenon will occur only for two years and past the completion of Phase II of the interconnection a second BZ will not be required, the first configuration considered is a single Bidding Zone, which consists of the entire interconnected Greek system with all foreseen expansions until 2023 (status quo configuration).

Configuration 1 Status Quo Configuration									
Cty-CBk	Bidding Zone Border	TSO1	Station 1	TSO2	Station 2	Voltage level [kV]	Type	Network element Name	New/different compared to status quo?
GR	GR - BG	IPTO	a.Thessaloniki b. Nea Santa	ESO-EAD	a. Blageovgrad b. Maritsa East	400 kV 400 kV	AC AC		No
GR	GR-IT	IPTO	Arachthos	TERNA	Galatina	400 kV	DC		No

Table 2: Bidding Zone Borders of Status Quo configuration

2: "Bidding Zones: GR, CR" (New Configuration)

1. A geographical overview of the bidding zone delineations is given in Figure 1.

2. The network elements which will form the Bidding Zone Borders of this configuration, is given in Table 2.

In this configuration, it is assumed that starting from the date when the island of Crete is interconnected in year 2020 (Phase I), the Greek system will consist of two bidding zones compared to one zone, as in the status quo configuration. The first bidding zone will be mainland Greece and small interconnected islands (GR BZ) and the second bidding zone will be the island of Crete (CR BZ). The new bidding zone configuration is proposed due to the extension of the Greek system to the island of Crete, which was previously an autonomous system.

The two 150kV AC lines of Phase I of the interconnection have an estimated transfer capacity of 150MW-180MW and do not suffice to supply the total net load of Crete. Since the conventional generation units in Crete are mostly oil units, with much higher generation cost than the generation units operating in the mainland, it is expected that there will always be congestion in the interconnection in the direction of mainland Greece to Crete (GR towards CR). The annual redispatching costs are estimated around 240 M€. IPTO balancing market system has already provisioned the possibility for protentional additional bidding zones and there is no significant additional cost for implementing the two proposed bidding zones in the market.

Therefore, in this configuration Bidding Zone is proposed for the Greek mainland and adjacent small interconnected islands (GR) and an additional Bidding Zone for Crete (CR). It should be noted that this proposed new BZ is internal (within the Greek territory) and it does not affect any cross-border flows between the GR BZ and adjacent Bidding Zones, thus any other TSOs than IPTO.

Configuration 2 "Bidding Zones: GR, CR" (New Configuration)									
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**	**New/different compared to status quo?**
GR	GR - BG	IPTO	a.Thessaloniki b. Nea Santa	ESO-EAD	a. Blageovgrad b. Maritsa East	400 kV 400 kV	AC AC		No
GR	GR-CR	IPTO	a. Molaoi b. Koumoundourou	IPTO	a. Chania b. Damasta	150 kV 500 kV	AC DC		Yes
GR	GR-IT	IPTO	Arachthos	TERNA	Galatina	400 kV	DC		No

Table 2: Bidding Zone Borders of Configuration "Bidding Zones: GR, CR" (New Configuration)

European Network of
Transmission System Operators
for Electricity

Annex 3: Justification of alternative configurations of the Bidding zone review region “South East Europe” which are to be considered in the bidding zone review process

Bidding Zone Review Region "SEE"

18 February 2020

1. Contents

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

This document contains information to be provided by a BZRR for the explanatory note, which will be made for the BZ Review Methodology, in line with the guidance of the BZTF to the BZRR on how to select configurations and what information on the configurations has to be provided.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

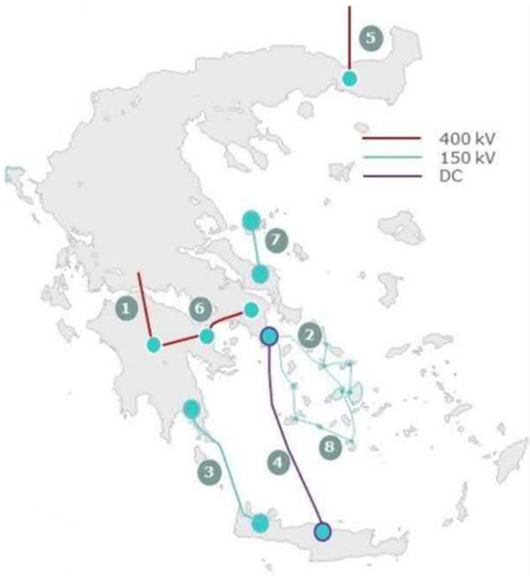
2. General justification for the set of configurations

The Greek interconnected system currently consists of the HV (150 kV) and EHV (400 kV) system in the Greek mainland and adjacent islands. In the past, until the beginning of 00’s, due to spatial allocation of generation and demand, internal congestion occurred between the North and South areas of the system. However, due to system expansion in addition to the construction of new generation units in the southern part of Greece, this phenomenon is no longer evident. Internal congestion is currently observed only in a specific part of the 150 kV system, the Peloponnese area. However, those congestion incidents are expected to be eliminated by the beginning of 2020, once a new 400 kV OHL between the mainland and the Peloponnese area is constructed (1). Therefore, according to the current status, if mainland Greece and adjacent islands are concerned, there is no need for examination of additional bidding zone configurations other than the GR BZ.

New transmission expansion projects apart from the aforementioned OHL to Peloponnese focus on connecting non-interconnected islands to the Greek mainland (2, 3, 4, 7, 8). Greece has almost 200 inhabited islands, most of which are planned to be connected to the mainland either directly through the HV system, or indirectly through the MV network.

The biggest interconnection project for IPTO is currently the interconnection of Crete, the largest Greek island. Crete, is going to be interconnected in two phases:

- Phase I: AC 150kV line connection of 2x200 MVA (3) with an expected NTC of 150-180 MW which is expected to be completed by the end of 2020.
- Phase II: DC 500 kV cable connection of 2x500 MVA (4) with an expected NTC of 800 MW, which is expected to be completed by the end of 2022.



ID	Project description	Expected commissioning year
1	First 400 kV branch to Peloponnese (OHL Megalopoli – Patras – Acheloos)	2019
2	Cycladic Islands interconnection (Phases A, B and C)	2020 (2018 for Phase A, 2019 for Phase B and 2020 for Phase C)
3	Crete interconnection (Phase I)	2020
4	Crete interconnection (Phase II)	2023
5	New 400 kV interconnector to Bulgaria N. Santa (GR) – Maritsa (BG)	2023
6	Second 400 kV branch to Peloponnese (OHL Megalopoli – Korinthos – Koumoundouros)	2024
7	Skiathos island interconnection	2020
8	Cycladic Islands interconnection (Phase D)	2024

IPTO analysis has shown that during Phase I of the interconnection, which is going to last two years, the 150 kV line will be congested almost 100% of the year, because generation cost in Crete is much higher than in the Greek mainland, while residual Crete demand to be covered by units other than Renewables is always above 180 MW. For this reason, the Greek NRA has asked IPTO to examine the possibility of creating a new BZ in Crete. However, past the completion of Phase II of the project, no congestion is foreseen between the Greek mainland (existing GR BZ) and Crete (proposed CR BZ).Therefore, for the purpose of this study, the examination of two configurations is proposed:

- Configuration 1: Bidding Zone GR (Status Quo Configuration)
- Configuration 2: Bidding Zones GR, CR (New Configuration)

3. Per configuration

Configuration 1 "Bidding Zone: GR" (Status Quo Configuration)

Description of the configuration

In this configuration it is assumed that no new Bidding Zones are considered in Greece until 2023, therefore the status quo configuration of a single GR BZ is taken into account.

As mentined above, the current internal congestion in the 150 kV system in the area of the Peloponnese will be alleviated by the beginning of 2020, due to the construction of a 400 kV line between the Acheloos EHVSS and the Patras and Megalopoli EHVSSs. The Peloponnese system will be further strengthened with the construction of a second 400 kV line connecting Megalopoli and Koumoundourou EHVSSs.

A new line between Nea Santa (GR) and Maritsa East (BG) is expected to be constructed within 2023. This line will impact on the NTC between GR and BG, however it will not produce any internal congestion within the GR BZ.

All other new system transmission expansions focus in the interconnection of further isolated Greek islandic systems with the mainland and cause no internal congestion within the GR BZ.

Finally, as already discussed, the island of Crete will be interconnected with the Greek mainland in two phases. During Phase I, internal congestion will occur between the Peloponnese and Crete (150 kV line between Molaoi and Chania HVSS). During this period, redispatching will be required and it is estimated that daily redispatch volume will be approximately 3,3 GWh, resulting in redispatching cost of approximately 240 M€ per year. However, this situation will be remediated by 2023, once the Phase II of the project will be completed (with the construction of the DC cable between Koumoundourou HVSS and Damasta HVSS) and no further internal congestion will be evident between the Greek mainland and the Crete system.

Since this phenomenon will occur only for two years and past the completion of Phase II of the interconnection a second BZ will not be required, the first configuration considered is a single Bidding Zone, which consists of the entire interconnected Greek system with all foreseen expansions until 2023 (status quo configuaration).

Configuration 1 "Bidding Zone: GR" (Status Quo Configuration)									
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**	**New/different compared to status quo?**
GR	GR - BG	IPTO	a.Thessaloniki b. Nea Santa	ESO-EAD	a. Blageovgrad b. Maritsa East	400 kV 400 kV	AC AC		No
GR	GR-IT	IPTO	Arachthos	TERNA	Galatina	400 kV	DC		No

Configuration 2 "Bidding Zones: GR, CR" (New Configuration)

Description of the configuration

Justification for splits, mergers and different delineations compared to the status quo configuration.

In this configuration, it is assumed that starting from the date when the island of Crete is interconnected in year 2020 (Phase I), the Greek system will consist of two bidding zones compared to one zone, as in the status quo configuration. The first bidding zone will be mainland Greece and small interconnected islands (GR BZ) and the second bidding zone will be the island of Crete (CR BZ). The new bidding zone configuration is proposed due to the extension of the Greek system to the island of Crete, which was previously an autonomus system.

The two 150kV AC lines of Phase I of the interconnection have an estimated transfer capacity of 150MW-180MW and do not suffice to supply the total net load of Crete. Since the conventional generation units in Crete are mostly oil units, with much higher generation cost than the generation units operating in the mainland, it is expected that there will always be congestion in the interconnection in the direction of mainland Greece to Crete (GR towards CR). The annual redispatching costs are estimated around 240 M€. IPTO balancing market system has already provisioned the possibility for potential additional bidding zones and there is no significant additional cost for implementing the two proposed bidding zones in the market.

Therefore, in this configuration Bidding Zone is proposed for the Greek mainlan and adjacent small interconnected islands (GR) and an additional Bidding Zone for Crete (CR). It should be noted that this proposed new BZ is internal (within the Greek territory) and it does not affect any cross-border flows between the GR BZ and adjanent Bidding Zones, thus any other TSOs than IPTO.

Configuration 2 "Bidding Zones: GR, CR" (New Configuration)									
Cty-CBk	Bidding Zone Border	TSO1	Station 1	TSO2	Station 2	Voltage level [kV]	Type	Network element Name	New/different compared to status quo?
GR	GR - BG	IPTO	a.Thessaloniki b. Nea Santa	ESO-EAD	a. Blageovgrad b. Maritsa East	400 kV 400 kV	AC AC		No
GR	GR-CR	IPTO	a. Molaoi b. Koumoundourou	IPTO	a. Chania b. Damasta	150 kV 500 kV	AC DC		Yes
GR	GR-IT	IPTO	Arachthos	TERNA	Galatina	400 kV	DC		No

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

European Network of Transmission System Operators for Electricity

Annex 4: Configurations of the Bidding zone review region "Central Southern Italy" which are to be considered in the bidding zone review process

Bidding Zone Review Region "CSI"

18 February 2020

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

1. Contents

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

This annex depicts in detail the Bidding Zone configurations for the Bidding Zone Review "CSI" that are to be considered in the bidding zone review process in accordance with Article 14(5) of Regulation (EU) 2019/943 of the European Parliament and the Council of 5th June 2019 on the internal market for electricity (recast).

2. Overview of the configurations of the Bidding Zone Review Region "CSI"

1. The BZRR considers CSI Bidding Zone configurations. This includes the Bidding Zone Configuration currently in place (Bidding Zone Configuration 2019/2020), and the Bidding Zone Configuration as it is approved to be implemented in 2021 by the Italian National Reglatory Authority (ARERA Decision 103/2019/R/EEL) (Bidding Zone Configuration 2021).

2. An overview of these configurations, including: name of the configuration, number of the configuration (for reference purposes), the number of bidding zones per Member State, and whether the bidding zone configuration in a Member States has an expert-based or model-based justification, is given in Table 1.

3. A geographical overview of the bidding zone delineations is given in Figure 1.

4. Each configuration is described in more detail in Section 3 of this Annex.

Configuration nr	1	2
Configuration Name	**Bidding Zone Configuration 2019/2020**	**Bidding Zone Configuration 2021**
Italy	[6+1[1]] [EB]	[6+1[2]] [EB]

Table 1: Overview of the Bidding Zone Configurations and the number of Bidding Zones per Member State per configuration

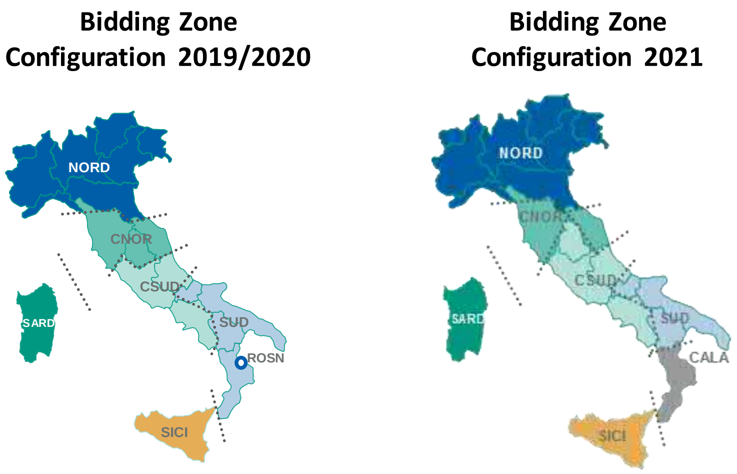


Figure 1. Geographical overview of the bidding zone delineations

[1]6 Bidding Zones are part of the CSI BZRR and 1 of the Central Europe BZRR
[2]6 Bidding Zones are part of the CSI BZRR and 1 of the Central Europe BZRR

3. Detailed information per configuration

This section provides detailed information per configuration.

1: Bidding Zone Configuration 2019/2020

1. The overview of the Status Quo Configuration is inserted for convenience.

2. A geographical overview of the bidding zone delineations is given in Figure 1.

3. The network elements which will form the Bidding Zone Borders of this configuration, is given in Table 2.

BZ Border	BZ_1	Station_1	BZ_2	Station_2	Voltage level [kV]	Type	Network element Name
Nord-Cnor	Nord	La Spezia	Cnor	Marginone	380	AC	La Spezia – Marginone
Nord-Cnor	Nord	La Spezia	Cnor	Acciaiolo	380	AC	La Spezia – Acciaiolo
Nord-Cnor	Nord	Bargi	Cnor	Calenzano	380	AC	Bargi – Calenzano
Nord-Cnor	Nord	Forlì	Cnor	Fano	380	AC	Forlì – Fano
Nord-Cnor	Nord	S. Martino in XX	Cnor	Fano	380	AC	S. Martino in XX – Fano
Nord-Cnor	Nord	La Spezia	Cnor	Avenza	220	AC	La Spezia – Avenza
Nord-Cnor	Nord	S. Colombano	Cnor	Avenza	220	AC	S. Colombano – Avenza
Nord-Cnor	Nord	S.B.Querceto	Cnor	Calenzano	220	AC	San Benedetto del Querceto – Calenzano
Nord-Cnor	Nord	Colorno	Cnor	Avenza	220	AC	Colorno – Avenza
Cnor-Csud	Cnor	Suvereto	Csud	Montalto	380	AC	Suvereto 1 – Montalto
Cnor-Csud	Cnor	Suvereto	Csud	Montalto	380	AC	Suvereto 2 – Montalto
Cnor-Csud	Cnor	Pian della Speranza	Csud	Roma Nord	380	AC	Pian della Speranza – Roma Nord
Cnor-Csud	Cnor	Rosara	Csud	Teramo	380	AC	Rosara – Teramo
Cnor-Csud	Cnor	Villavalle	Csud	Villanova	380	AC	Villavalle – Villanova
Cnor-Csud	Cnor	Villavalle	Csud	Tuscania	380	AC	Villavalle – Tuscania
Cnor-Csud	Cnor	Rosara	Csud	Montorio	220	AC	Rosara – Montorio
Cnor-Csud	Cnor	Villavalle	Csud	S. Giacomo	220	AC	Villavalle – S. Giacomo
Cnor-Csud	Cnor	Villavalle	Csud	Roma Nord	220	AC	Villavalle – Roma Nord
Cnor-Csud	Cnor	Villavalle	Csud	S. Lucia	220	AC	Villavalle – S. Lucia
Csud-Sud	Csud	Benevento	Sud	Troia	380	AC	Benevento - Troia
Csud-Sud	Csud	Gissi	Sud	Larino	380	AC	Gissi - Larino
Csud-Sud	Csud	Bisaccia	Sud	Melfi	380	AC	Bisaccia – Melfi
Csud-Sud	Csud	Montecorvino	Sud	Laino	380	AC	Montecorvino 1 – Laino
Csud-Sud	Csud	Montecorvino	Sud	Laino	380	AC	Montecorvino 2 – Laino
Csud-Sud	Csud	Tusciano	Sud	Laino	220	AC	Tusciano – Laino
Rosn-Sici	Rosn	Rizziconi	Sici	Sorgente	380	AC	Rizziconi-Sorgente 1
Rosn-Sici	Rosn	Rizziconi	Sici	Sorgente	380	AC	Rizziconi-Sorgente 2
Cnor-Sard	Cnor	Suvereto	Sard	Codrogianos	200	DC	SACOI
Csud-Sard	Csud	Latina	Sard	Fiumesanto	500	DC	SAPEI
Sud-GR	Sud	Galatina	GR	Arachthos	500	DC	GRITA

Table 2: Bidding Zone Borders of Configuration 1 "Bidding Zone Configuration 2019/2020"

2: Bidding Zone Configuration 2021

1. The overview of the Status Quo Configuration is inserted for convenience.

2. A geographical overview of the bidding zone delineations is given in Figure 1.

3. The network elements which will form the Bidding Zone Borders of this configuration, is given in Table 3.

BZ Border	BZ_1	Station_1	BZ_2	Station_2	Voltage level [kV]	Type	Network element Name
Nord-Cnor	Nord	La Spezia	Cnor	Marginone	380	AC	La Spezia – Marginone
Nord-Cnor	Nord	La Spezia	Cnor	Acciaiolo	380	AC	La Spezia – Acciaiolo
Nord-Cnor	Nord	Bargi	Cnor	Calenzano	380	AC	Bargi – Calenzano
Nord-Cnor	Nord	Forlì	Cnor	Fano	380	AC	Forlì – Fano
Nord-Cnor	Nord	S. Martino in XX	Cnor	Fano	380	AC	S. Martino in XX – Fano
Nord-Cnor	Nord	La Spezia	Cnor	Avenza	220	AC	La Spezia – Avenza
Nord-Cnor	Nord	S. Colombano	Cnor	Avenza	220	AC	S. Colombano – Avenza
Nord-Cnor	Nord	S.B.Querceto	Cnor	Calenzano	220	AC	San Benedetto del Querceto – Calenzano
Nord-Cnor	Nord	Colorno	Cnor	Avenza	220	AC	Colorno – Avenza
Cnor-Csud	Cnor	Suvereto	Csud	Montalto	380	AC	Suvereto 1 – Montalto
Cnor-Csud	Cnor	Suvereto	Csud	Montalto	380	AC	Suvereto 2 – Montalto
Cnor-Csud	Cnor	Pian della Speranza	Csud	Roma Nord	380	AC	Pian della Speranza – Roma Nord
Cnor-Csud	Cnor	Rosara	Csud	Teramo	380	AC	Rosara – Teramo
Cnor-Csud	Cnor	Arezzo	Csud	Pietrafitta	220	AC	Arezzo-Pietrafitta
Cnor-Csud	Cnor	Rosara	Csud	Montorio	220	AC	Rosara – Montorio
Csud-Sud	Csud	Benevento	Sud	Troia	380	AC	Benevento - Troia
Csud-Sud	Csud	Gissi	Sud	Larino	380	AC	Gissi - Larino
Csud-Sud	Csud	Bisaccia	Sud	Melfi	380	AC	Bisaccia – Melfi
Csud-Sud	Csud	Montecorvino	Sud	Laino	380	AC	Montecorvino 1 – Laino
Csud-Sud	Csud	Montecorvino	Sud	Laino	380	AC	Montecorvino 2 – Laino
Csud-Sud	Csud	Tusciano	Sud	Laino	220	AC	Tusciano – Laino
Sud-Cala	Sud	Aliano	Cala	Laino	380	AC	Aliano-Laino
Sud-Cala	Sud	Montecorvino	Cala	Laino	380	AC	Montecorvino 1 – Laino
Sud-Cala	Sud	Montecorvino	Cala	Laino	380	AC	Montecorvino 2 – Laino
Sud-Cala	Sud	Tusciano	Cala	Laino	220	AC	Tusciano – Laino
Cala-Sici	Rosn	Rizziconi	Sici	Sorgente	380	AC	Rizziconi-Sorgente 1
Cala-Sici	Rosn	Rizziconi	Sici	Sorgente	380	AC	Rizziconi-Sorgente 2
Cnor-Sard	Cnor	Suvereto	Sard	Codrogianos	200	DC	SACOI
Csud-Sard	Csud	Latina	Sard	Fiumesanto	500	DC	SAPEI
Sud-GR	Sud	Galatina	GR	Arachthos	500	DC	GRITA

Table 3: Bidding Zone Borders of Configuration 1 "Bidding Zone Configuration 2021"

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Annex 4: Justification of configurations of the Bidding zone review region “Central Southern Italy” which are to be considered in the bidding zone review process

Bidding Zone Review Region "CSI"

18 February 2020

1. Contents

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

2. Regulatory Framework

The European target model for the Internal Electricity Market (IEM) foresees energy markets (day-ahead and intraday) based on a zonal representation of the European Power System.

Bidding zones are then essential elements of today's and tomorrow's market design and they "*should be defined in a manner to ensure efficient congestion management and overall market efficiency*", as stated in the EU Regulation 1222 / 2015 (CACM).

The definition of bidding zone borders is therefore a question of major relevance for the IEM and requires dedicated analysis.

This topic has been tackled in the Italian Power System since the beginning of the Electricity Markets: the Italian Control Area has been subdivided in several Bidding Zones in order to cope with internal structural congestions.

Prior to the entry into force of the CACM, the Italian bidding zones review process was based on the regulatory framework set by the Resolution 111/06. According to this process, the efficiency of the existing Bidding Zones configuration was assessed every three years performing a full review aimed at identifying the optimal configuration for the successive three years.

In 2018 the first Italian Bidding Zones Review pursuant to CACM Regulation (in application of article 32.1.b), **has been formally launched by the Italian National Authority (ARERA) with the Resolution 22/2018/R/eel**. The formal launch (which sets a strict deadline for a very complex task) has been anticipated by an informal stage where Terna and ARERA worked on methodologies and assumptions in order to find a trade-off between model complexity and results quality (started with ARERA Decision 461/2016/R/eel).

The main differences between the old process and the new one (CACM) can be summarized as follow:

- According to Resolution 111/06, a Bidding Zones review had to be performed every three years (without a triggering event) while, under the CACM Regulation, a review shall be formally launched after a triggering event (this launch is mainly linked to the results of a dedicated monitoring process[1]).
- The list of criteria to be evaluated has been significantly enlarged, according to CACM article 33.1.
- The time horizon under assessment has been enlarged: from 3 years up to 10 years, according to CACM article 33.2.

[1] A technical report (prepared by All TSOs) and a market report (prepared by All NRAs) shall be published every three years at European Level. In addition, Italian NRA requested to Terna an annual report (starting from 2019) for monitoring the Italian Bidding Zones efficiency.

On the 15th of May 2018, after one month of public consultation (including a public workshop), the final version of the study has been submitted to ARERA, which:

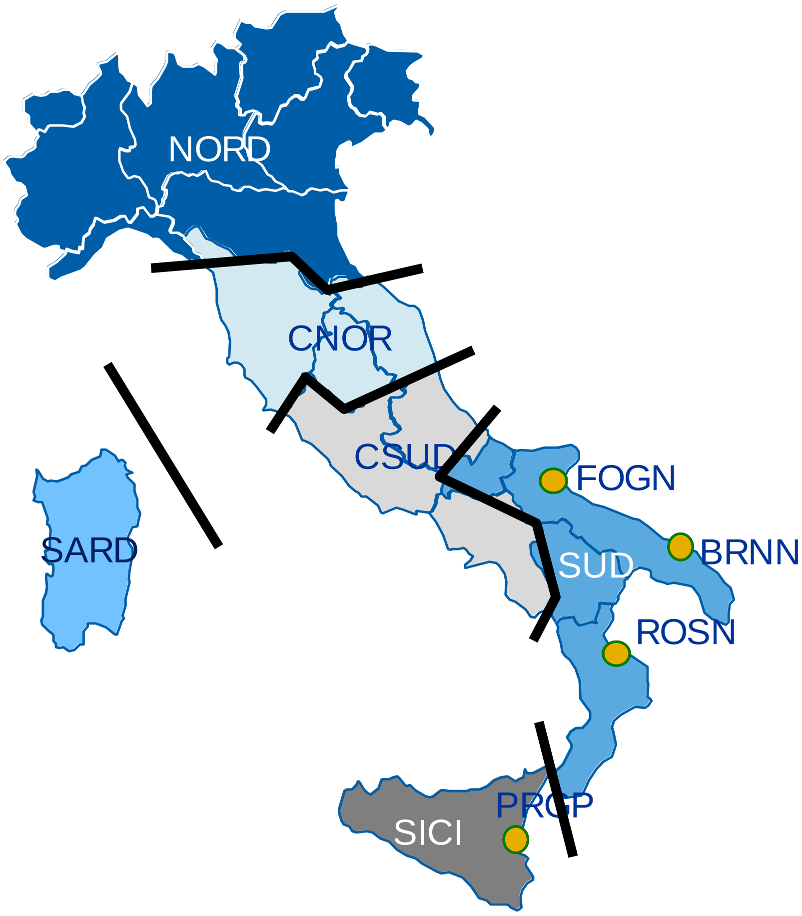
- **Approved the study and decided to implement a first change to the previous Bidding Zone configuration starting from the 1st of January 2019** (deleting 3 out of the 4 national virtual Bidding Zones, namely "Brindisi", "Foggia" and "Priolo"). (ARERA Decision 386/2018/R/EEL, 12th of July 2018)
- **Approved Terna's proposal for a new Bidding Zone Configuration** ("Alternativa Base" described in the following chapter) **and asked for implement it in 2021**. (ARERA Decision 103/2019/R/EEL, 19th of March 2019).

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

3. Starting Bidding Zones configuration and alternatives considered in the recent Bidding Zone study in Italy

The Italian Bidding Zones configuration, which was in place until the end of 2018, entered into force in 2009[2] and it contained:

- 6 geographical[3] Bidding Zones
- 4 virtual[4] Bidding Zones



Alternative Bidding Zone configurations can be identified according to two different approaches:

- "Expert-based": different Bidding Zone configurations are defined by TSO's experts according to statistical analysis, their knowledge of the Power System as well as taking into account the outcomes of other studies (eg. Ten Year Network Development Plan, Mid Term adequacy Forecast, National development plan, other studies carried out by Terna). This approach is well established and proved to be effective for the Italian case.

---

[2] In 2012 the virtual Bidding Zones "Monfalcone" has been merged to the geographical Bidding Zones "Nord".
[3] A geographical Bidding Zone is a zone with a direct link with a geographical area.
[4] A virtual Bidding Zone is a zone composed by some power plants having a direct infeed on some preselected 380kV nodes.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

- “Model-based”: different Bidding Zone configurations are defined according to dedicated algorithms and clustering techniques. This kind of approaches can produce more efficient delimitations, but they are still in a “research and development” stage.

Terna applied an “expert-based” approach for the purposes of Bidding Zone review, designing in parallel a step-by-step process for developing and fine-tuning **“model-based” techniques to be applied in the future** to the Italian case[5].

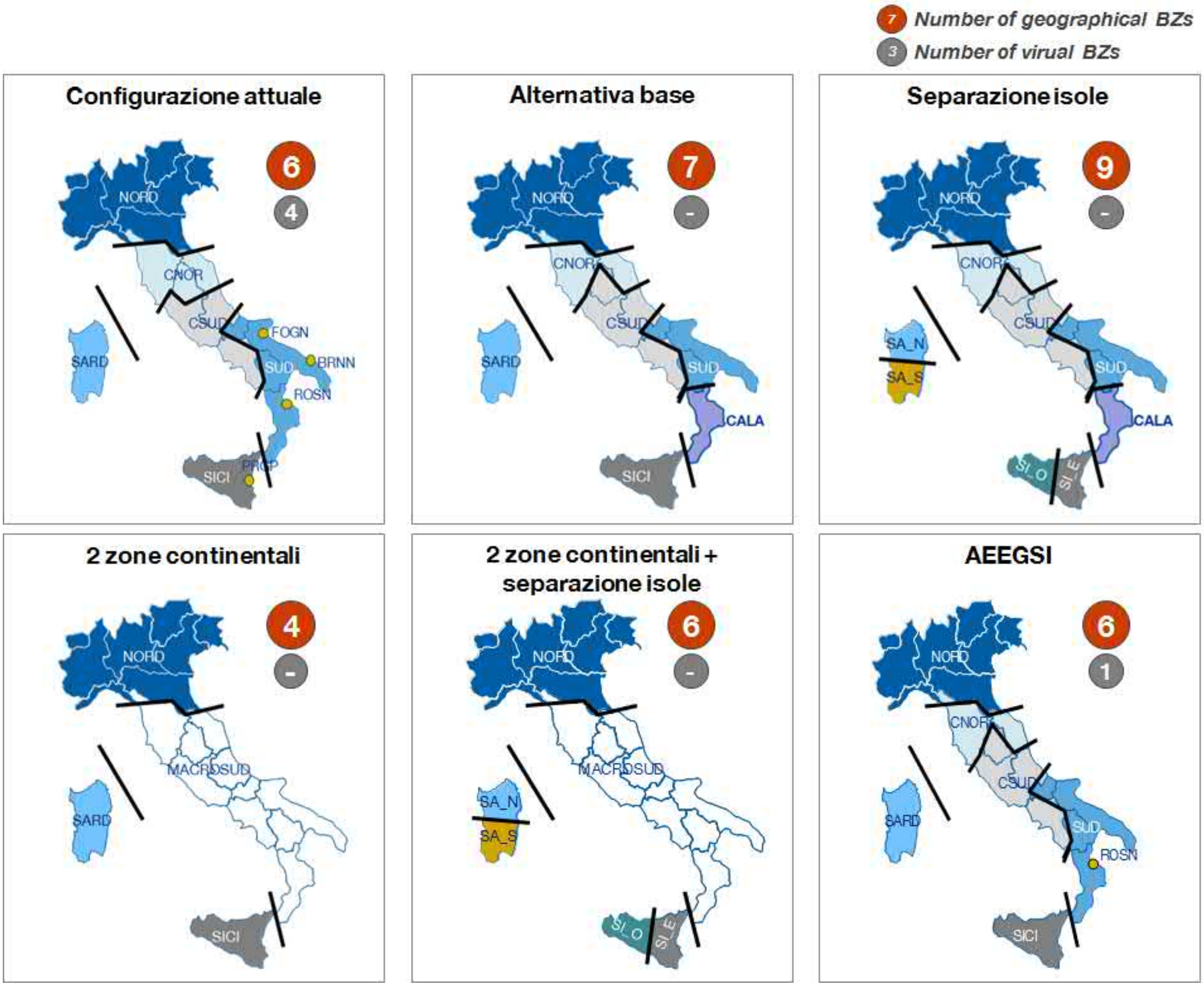
In total, **six Bidding Zone configurations have been assessed** in the review:

- “Configurazione attuale”: configuration in place
- “Alternativa base”:
  - Umbria region moved from “Centro-Sud” to “Centro-Nord” Bidding Zone;
  - All the virtual Bidding Zones merged to the connecting geographical Bidding Zone;
  - New geographical Bidding Zone “Calabria”.
- “Separazione Isole”: in addition to “Alternativa base” changes, Sardinia and Sicily Bidding Zones are splitted.
- “2 zone continentali”: all the continental bidding zones under assessment[6] are merged.
- “2 zone continentali con separazione delle isole”: in addition to “2 zone continentali” changes, Sardinia and Sicily Bidding Zones are splitted.
- “AEEGSI”:
  - Umbria region moved from “Centro-Sud” to “Centro-Nord” Bidding Zone;
  - “Foggia”, “Brindisi” and “Priolo” virtual Bidding Zones are merged to the connecting geographical Bidding Zone.

[5] In accordance to ARERA’s Resolutions 496/2017/R/eel and 22/2018/R/eel, Terna sent a first proposal to the Italian NRA on the 28th of February 2018. A dedicated R&D project is ongoing in collaboration with relevant Italian Universities.

[6] Bidding Zone “Nord” is not in the scope of this study since it is covered by the “FIRST EDITION OF THE BIDDING ZONE REVIEW” launched by ACER on the 21st of December 2016.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu


Number of geographical BZs
Number of virual BZs
Configurazione attuale
6
4
NORD
CNOR
CSUD
SUD
SARD
SICI
FOGN
BRNN
ROSN
PRGP
Alternativa base
7
-
NORD
CNOR
CSUD
SUD
CALA
SARD
SICI
Separazione isole
9
-
NORD
CNOR
CSUD
SUD
CALA
SA_N
SA_S
SI_O
SI_E
2 zone continentali
4
-
NORD
MACROSUD
SARD
SICI
2 zone continentali + separazione isole
6
-
NORD
MACROSUD
SA_N
SA_S
SI_O
SI_E
AEEGSI
6
1
NORD
CNOR
CSUD
SUD
ROSN
SARD
SICI

4. Scenarios considered in the assessment

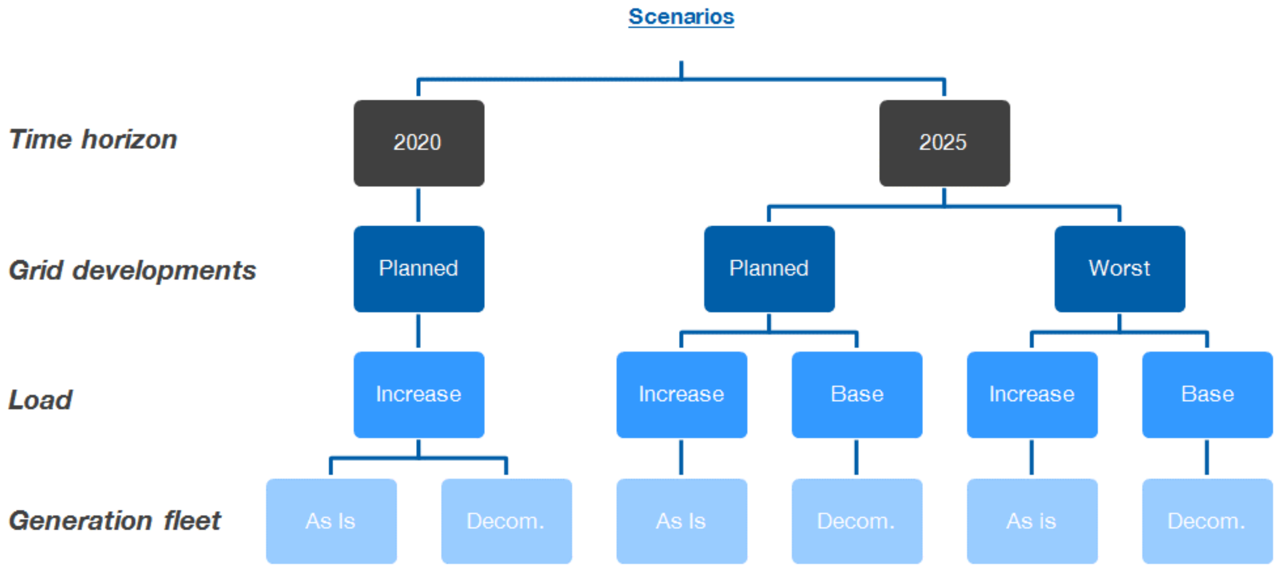
In order to cover a time horizon of ten years and to cope with the uncertainties of the future changes, Terna considered important to assess the impact of the identified Bidding Zone configurations on different scenarios.

Four drivers have been considered in the scenario definition:

- **Time horizon**: 2020 and 2025 have been identified as relevant years to cover the whole period (covering efficiently also the 3 years time horizon required in the Clean Energy Package);
- **Grid developments**: several grid reinforcements are expected to be commissioned by 2025, anyhow some of them are still in a preliminary phase and their commissioning can be delayed due to authorization or external issues. For this reason, a "planned" and a "worst" grid scenario have been considered.
- **Load**: due to the long-term prospective, for the 2025 scenario, 2 different levels of demand have been considered;
- **Generation fleet**: due to the decommissioning trend registered in the last years in the Italian Power System, a base case and a decommissioning scenario[7] have been considered both for 2020 and 2025.

In total, **six scenarios have been considered in this study**:

[7] RES installed capacity is expected to grow in both cases, but thermoelectric capacity is expected to decrease in the second one.



ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

5. Evaluation of Bidding Zones Configuration

CACM Regulation (article 33.1) requires to assess the performances of the different configurations in terms of network security, overall market efficiency and stability and robustness. These high level criteria are also detailed providing a list of aspects to be considered.

In order to cope with these requirements, **Terna developed a system of quantitative indicators which enable a direct comparison between different configurations**.

The indexes can be linked to the CACM criteria as follow:

- Network security:
  - Operational Secuirty: *Cindex*
  - Security Of Supply: *EENSadeguatezza*
  - Uncertainties in the capacity calculation: *TTCindex*
- Overall Market Efficiency:
  - Economic efficiency/surplus: *CTindex*
  - Firmness costs, feasible market outcomes: *CRindex + (VOLL x EENSsicurezza)*
  - Market liquidity: *LIQindex*
  - Market concentration and power, effective competition: *RSI index*
  - Price signals for building infrastructure: *SZ index, SM index*
  - Accuracy of price signals: *CPMindex*
  - Robustness of price signals: *SIPindex*
  - Unscheduled flows: *LFindex*
- Stability and robustness:
  - Location and frequency of congestions: *SFLCindex*

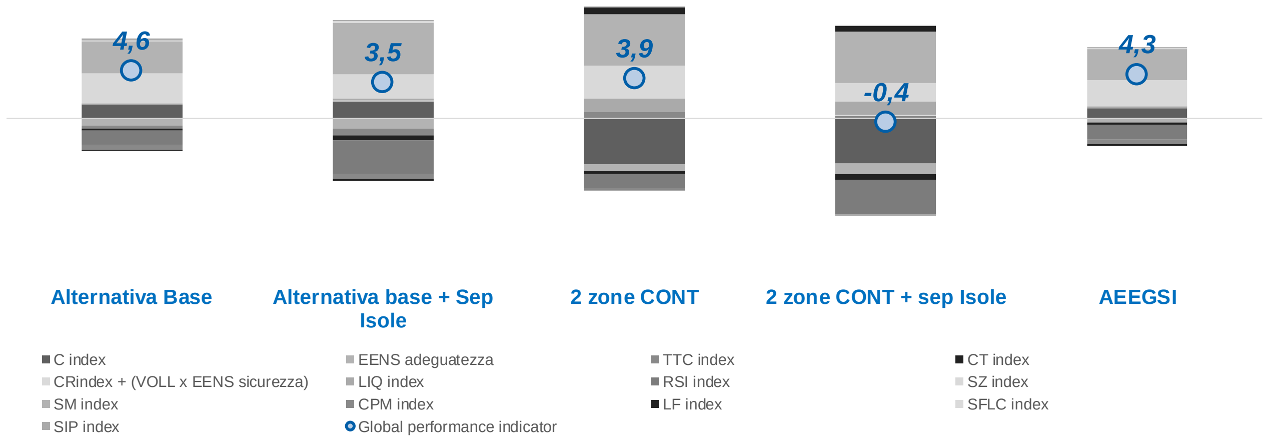
Please note that, instead, the following CACM criteria are implicitly satisfied by:

- the examined configurations:
  - "*the need for bidding zones to be consistent for all capacity calculation time-frames*"
  - "*the need for each generation and load unit to belong to only one bidding zone for each market time unit*"
- the scenarios considered in the study:
  - "*the need for bidding zones to be sufficiently stable and robust over time*"
  - "*the cost of building new infrastructure which may relieve existing congestion*"

The "transition and transaction costs" criterion has been assessed submitting a dedicated survey to the relevant Stakeholders during the public consultation process.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Final normalized values of the quantitative indexes are reported in the figure below (positive values mean a benefit compared to current configuration).



Please note that in order to obtain a final global indicator:

- Scenarios are weighted in order to attribute more relevance to the short-medium term timeframe, assuming that a new review can be anyhow relaunched in case big issues will appear by 2025.

6. Conclusions

On the basis of the analysis carried out, **Terna recommended to amend the Bidding Zone configuration that was in place in 2018, adopting the "Alternativa Base" option**.

The outcomes of this study also suggest **assessing again the Bidding Zone configuration close to the 2025**, **when it is expected that structural congestions in the Continental Italy will be relieved by planned grid investments**. In the new review, also model-based configurations will be considered.

According to relevant ARERA Decisions the **proposed Bidding Zone configuration changes are going to be applied in 2021** (Bidding Zone Configuration 2021 described in the CSI Annex to the Bidding Zone Review Methodology), **after a first light improvement adopted starting from the 1st of January 2019** (Bidding Zone Configuration 2019/2020 further described in the CSI Annex to the Bidding Zone Review Methodology). The Italian Control Area is (and it will continue to be) separated in several internal Bidding Zones allowing to correctly and efficiently reflect structural congestions in the energy markets (as shown even in the EntsoE Technical Report[8]).

Hence, **Terna considers the above mentioned CACM Bidding Zone Review and the related ongoing implementation process as fulfilling the Clean Energy Package requirements for the GRIT Bidding Zone Review Region**, considering also that the assessed time horizons match with the CEP requirements and no relevant changes occurred in the meantime.

Starting a new Bidding Zone Review in this moment would threat the improvements linked to the ongoing Bidding Zone Configuration changes approved by the Italian NRA and expected to be completed in 2021. This would lower market efficiency in the near future and prevent to perform a new study when it will be more effective since, according to relevant Stakeholder opinions and CACM Regulation, Bidding Zones Configurations should be "stable over the time".

[8] https://docstore.entsoe.eu/Documents/Events/2018/BZ_report/20181015_BZ_TR_FINAL.pdf

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

European Network of
Transmission System Operators
for Electricity

Annex 5: Configurations of the Bidding zone review region “Baltic” which are to be considered in the bidding zone review process

Bidding Zone Review Region "Baltics"

18 February 2020

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

1. Overview of the status quo configuration of the Bidding Zone Review Region "Baltic"

1.1. A summary table describing the status quo configuration

Based on the justification presented in the first paragraph, Baltic states provide only status quo configuration for the Bidding zone review.

	1	2	3	4
Configuration Name	**Status Quo**	**Large Bidding Zones**	**Country Split**	**Small Bidding Zones**
EE	1	-	-	-
LV	1	-	-	-
LT	1	-	-	-

1.2. Map of the BZRR for the status quo configuration

The power systems of Baltic States including Estonia, Latvia and Lithuania currently are operating in parallel with Russian and Belarus power systems as members of Integrated Power System/Unified Power System (IPS/UPS) where primary power reserves and frequency regulation is provided by Russian power system. Baltic power system together with Russia and Belarus are members of electrical BRELL ring (shortened Belarus, Russia, Estonia, Latvia and Lithuania), consisting of 330 kV, 500 kV and 750 kV transmission lines. The tight electrical interconnection of Baltic States with Russia and Belarus provided by now are reliable, flexible and secure in system operation within Baltic States and whole BRELL ring. After Baltic States joined to European Union, integration of Latvia, Lithuania and Estonia within common EU energy market has been identified as a strategic priority for the Baltic States and the EU. During the last fifteen years a couple of new interconnections from Baltic States to neighboring bidding zones have been established. The power exchanges between Nordic-Baltic and Continental Europe – Baltic have been improved. Baltic States have three HVDC interconnectors to Nordic countries (EstLink 1 between FI and EE with capacity 350 MW, EstLink 2 between FI and EE with capacity 650 MW and NordBalt between LT and SE with capacity 700 MW) and one HVDC interconnection to Continental Europe (LitPol link between LT and PL with capacity 500 MW). Full list of interconnectors is shown in paragraph 2.3. Currently Baltic States are very well connected with IPS/UPS power system and together they have nine 330 kV interconnectors to Russia/Belarus. Power exchange between Baltic States and Russia/Belarus is limited and all electricity trade is going on via Lithuania bidding zone. Such kind of approach for energy import from Russia/Belarus is applied in order not to limit the cross-border power exchange between Baltic States internally and reduce electricity dependence from non-EU countries in general. In Baltic States the cross-border capacities are quite enough. Some overloads on cross-border EE – LV have been identified and countertrade measure were applied. In order to

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

strengthen the EE – LV cross-border the new interconnection link is going to be built during the year of 2020.

1.3. List of network elements which are the bidding zone borders

Cty_C Bk	Border	Partner_1	Station_1	Partner_2	Station_2	kV	Type	Name	New/Different compared to status quo?
EE	EE-FI	Elering OÜ	Harku	Fingrid	Espoo	±150	DC	ESTLINK 1	No
EE	EE-FI	Elering OÜ	Püssi	Fingrid	Anttila	450	DC	ESTLINK 2	No
EE	EE-LV	Elering OÜ	Tartu	AS Augstsprieguma tikls	Valmiera	330	AC	Tartu-Valmiera L301	No

Cty_C Bk	Border	Partner_1	Station_1	Partner_2	Station_2	kV	Type	Name	New/Different compared to status quo?
EE	EE-LV	Elering OÜ	Tsirguliina	AS Augstsprieguma tikls	Valmiera	330	AC	Tsirguliina-Valmiera L354	No
EE	EE-LV	Elering OÜ	Tsirguliina	AS Augstsprieguma tikls	Valka	110	AC	Tsirguliina-Valka L677	No
EE	EE-LV	Elering OÜ	Ruusmäe	AS Augstsprieguma tikls	Aluksne	110	AC	Ruusmäe-Aluksne L683	No
EE	EE-RU	Elering OÜ	Eesti	RAO UES	Kingisep	330	AC	Eesti- Kingisep L373	No
EE	EE-RU	Elering OÜ	Balti	RAO UES	Leningradskaya	330	AC	Balti-Leningradskaya L374	No
EE	EE-RU	Elering OÜ	Tartu	RAO UES	Pskov	330	AC	Tartu-Pskov L358	No
LT	LT-LV	LITGRID AB	Klaipeda	Augstsprieguma tikls	Grobine	330	AC	Klaipeda –Grobine LN324	No
LT	LT-LV	LITGRID AB	Siauliai/Telsiai	Augstsprieguma tikls	Jelgava	330	AC	Siauliai/Telsiai-Jelgava LN 305/457	No
LT	LT-LV	LITGRID AB	Panevezys	Augstsprieguma tikls	Plevines HE	330	AC	Panevezys – Plevines HE LN 316	No
LT	LT-LV	LITGRID AB	Ignalinos AE	Augstsprieguma tikls	Liksna	330	AC	Ignalinos AE – Liksna LN 452	No
LT	LT-LV	LITGRID AB	Paroveja	Augstsprieguma tikls	Nereta	110	AC	Paroveja – Nerata LN 622	No
LT	LT-LV	LITGRID AB	Zarasai	Augstsprieguma tikls	Daugpilis	110	AC	Zarasai – Daugpilis LN 631	No
LT	LT-LV	LITGRID AB	Ignalinos AE	Augstsprieguma tikls	Daugpilis	110	AC	Ignalinos AE – Daugpilis LN 632	No
LT	LT-RU	LITGRID AB	Klaipeda	FSK	Sovietsk	330	AC	Klaipeda –Sovietsk LN325	No
LT	LT-RU	LITGRID AB	Jurbarkas	FSK	Sovietsk	330	AC	Jurbarkas – Sovietsk LN 326	No
LT	LT-RU	LITGRID AB	Kruonio HAE	FSK	Sovietsk	330	AC	Kruonio HAE – Sovietsk LN 447	No
LT	LT-RU	LITGRID AB	Pagegiai	FSK	0-5	110	AC	Pagegiai – 0-5 LN 104	No
LT	LT-RU	LITGRID AB	Pagegiai	FSK	0-5	110	AC	Pagegiai – 0-5 LN 105	No
LT	LT-RU	LITGRID AB	Kybartai	FSK	Nesterov	110	AC	Kybartai – Nesterov LN 130	No
LT	LT-RU	LITGRID AB	Nida	FSK	Tomoznaja Rosiji	10	AC	Nida – Tomoznaja Rosiji LN 249	No
LT	LT-RU	LITGRID AB	Nida	FSK	Rybacij	10	AC	Nida – Rybacij LN 248	No
LT	LT-RU	LITGRID AB	K. Naumiestis	FSK	P/C 2114	10	AC	K. Naumiestis – P/C 2114 LN 240	No
LT	LT-BY	LITGRID AB	Ignalinos AE	Belenergo	Polock	330	AC	Ignalinos AE – Polock LN 450	No
LT	LT-BY	LITGRID AB	Ignalinos AE	Belenergo	Smorgon	330	AC	Ignalinos AE – Smorgon LN 452	No
LT	LT-BY	LITGRID AB	Ignalinos AE	Belenergo	Beloruskaja	330	AC	Ignalinos AE – Beloruskaja LN 705	Yes
LT	LT-BY	LITGRID AB	Vilnius	Belenergo	Molodecno	330	AC	Vilnius – Molodecno LN 333	No
LT	LT-BY	LITGRID AB	Alytus	Belenergo	Grodno	330	AC	Alytus – Grodno LN 368	No

Cty_C Bk	Border	Partner_1	Station_1	Partner_2	Station_2	kV	Type	Name	New/Different compared to status quo?
LT	LT-BY	LITGRID AB	Ignalinos AE	Belenergo	Opsa	110	AC	Ignalina - Opsa	No
LT	LT-BY	LITGRID AB	Ignalinos AE	Belenergo	Vidzi	110	AC	Ignalinos AE – Vidzi	No
LT	LT-BY	LITGRID AB	Didziasalis	Belenergo	Kozenai	110	AC	Didziasalis – Kozenai	No
LT	LT-BY	LITGRID AB	Svencionys	Belenergo	Lentupis	35	AC	Svencionys – Lentupis	No
LT	LT-BY	LITGRID AB	Pabrade	Belenergo	Podolci	110	AC	Pabrade - Podolci	No
LT	LT-BY	LITGRID AB	Kalveliai	Belenergo	Asmena	110	AC	Kalveliai - Asmena	No
LT	LT-BY	LITGRID AB	Salcininkai	Belenergo	Voronovo	110	AC	Salcininkai – Voronovo	No
LT	LT-BY	LITGRID AB	Leipalingis	Belenergo	Grodno	110	AC	Leipalingis – Grodno	No
LT	LT-BY	LITGRID AB	Dieveniskes	Belenergo	Subotnikai	35	AC	Dieveniskes - Subotnikai	No
LT	LT-SE4	LITGRID AB	Klaipėda	Svenska kraftnät	Nybro	±300	DC	NordBalt	No
LT	LT-PL	LITGRID AB	Alytus	Polskie Sieci Elektroenergetyczne	Ełk	±70 kV	DC	LitPol Link	No
LV	EE-LV	AS Augstsprieguma Tīkls	Valmiera	Elering OÜ	Tartu	330	AC	LN 301	No
LV	LT-LV	AS Augstsprieguma Tīkls	Jelgava	Lietuvos energija AB	Šiauliai	330	AC	LN 305	No
LV	LT-LV	AS Augstsprieguma Tīkls	Pļaviņu HES	Lietuvos energija AB	Panévežys	330	AC	LN 316	No
LV	LT-LV	AS Augstsprieguma Tīkls	Grobiņa	Lietuvos energija AB	Klaipéda	330	AC	LN 324	No
LV	EE-LV	AS Augstsprieguma Tīkls	Valmiera	Elering OÜ	Tsirguliina	330	AC	LN 354	No
LV	LT-LV	AS Augstsprieguma Tīkls	Līksna	Lietuvos energija AB	Ignalinos AE	330	AC	LN 451	No
LV	LT-LV	AS Augstsprieguma Tīkls	Nereta	Lietuvos energija AB	Paroveja	110	AC	LN 622	No
LV	LT-LV	AS Augstsprieguma Tīkls	Daugavpils	Lietuvos energija AB	Zarasai	110	AC	LN 631	No
LV	LT-LV	AS Augstsprieguma Tīkls	Daugavpils	Lietuvos energija AB	Ignalinos AE	110	AC	LN 632	No
LV	EE-LV	AS Augstsprieguma Tīkls	Valka	Elering OÜ	Tsirguliina	110	AC	LN 677	No
LV	EE-LV	AS Augstsprieguma Tīkls	Alūksne	Elering OÜ	Rusmäe	110	AC	LN 683	No
LV	LV-RU	AS Augstsprieguma Tīkls	Rēzekne	FSK OES Rosii	Velikoreckaja	330	AC	LN 309	No
LV	BY-LV	AS Augstsprieguma Tīkls	Skrudaliena	Bel Energo	Braslavu	110	AC	LN 630	No

European Network of
Transmission System Operators
for Electricity

Annex 5: Justification of configurations of the Bidding zone review region “Baltic” which are to be considered in the bidding zone review process

Bidding Zone Review Region "Baltics"

18 February 2020

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

1. Justification for only status quo configuration

With the entry into force of the Regulation (EU) 2019/943 of the European Parliament and Council of 5th June 2019 on the internal market for electricity (recast) (hereinafter referred to as the "IME Regulation") the relevant TSOs must deliver bidding zone configurations to be used in a next bidding zone review process. According to the Bidding zone review methodology all Bidding zone review regions by default shall provide alternative configuration. However, regions whom are able to provide argumentation why performing the bidding zone review is not necessary, can provide only the status quo configuration.

Based on information mentioned above, Baltic TSOs submit the argumentation for exemption not to perform the Bidding zone review in Baltic region. Baltic TSOs emphasize the following arguments to be considered:

- The Baltic Biding zone review region is compliant with IME Regulation art. 16, that at least 70% of capacity shall be provided to the market[1]. The Baltic TSO carried out a calculation of the volume of interconnection capacity to be available to market participants using the year 2018 network data. Based on calculations, the Baltic TSOs concluded that interconnection capacity available to the market exceeds 70% of the NTC, and thus corresponds to the amounts specified in paragraph 16 (8) of the IME Regulation. In table No. 1 the summary of data with interconnection capacity present the values that are offered to the market.

  Moreover, Bidding zone configuration technical report conducted by ENTSO-E reveals that the congestion between bidding zones in year 2017 did not increase and there were few cross-border overhead lines which were influencing the power exchanges between bidding zones. The capacity limitations on cross-borders were small (less than 10% for each line in 2017). These limitations have been recognized during security analysis coordination to maintain security of supply. The system reliability issue is very important as the Baltic States' power systems are operating in synchronous mode with IPS/UPS.

	LV>EE	EE>LV	LV>LT	LT>LV
Available cross-zonal capacity[2]	99%	97%	99%	100%

Table 1: Average AC cross-border capacity available for market in year 2018

The price convergence remains high between bidding zones. In table 2, the data shows 98% price convergence between Latvian-Lithuanian bidding zones in year 2018. In year 2018 a slight decrease in price convergence was observed between Lithuanian and Sweden 4th

[1-2] These values are calculated by comparing coordinated NTCs with coordinated TTCs, where coordinated NTC is the maximum trading capacity (commercial power flow value) which is given to the market for day-ahead trading and TTC is the maximum active power (physical flow) value for respective cross-border interconnection (which is used by dispatchers in real time operations). Calculations were made by Latvian TSO Augstsprieguma tīkls.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

bidding zones, that could be explained by HVDC NordBalt cable maintenance works during the year of 2018.

Regions	2018	2017
Estonia-Finland	95%	99%
Estonia-Latvia	74%	82%
Latvia-Lithuania	98%	94%
Lithuania-Sweden 4	64%	69%

Table 2: Electricity price convergence in Baltic region, year 2018, 2017.

- There is no structural congestion inside the Bidding zones. According to the Bidding zone configuration technical report by ENTSO-E in Baltic bidding zones only few congestions have been identified during period from 2015-2017. They were rather small, and each occurred less than 2% of the time in the year. For the real time congestions on cross-border EE-LV, Latvian and Estonian TSOs have applied countertrade measures. Table 3 summarizes costs of countertrade actions from year 2016 to year 2018 on EE-LV borders. It shows the decrease in year 2017 and increase in year 2018 due to maintenance work on the NordBalt HVDC cable.

Year	Costs of countertrade, EUR
2016	764 041.1
2017	192 211.44
2018	1 927 041.26

Table 3: Countertrade on EE-LV border 2016-2018.

Redispatch or counter-trade has never been used for managing congestion inside the Baltic bidding zones. The countertrade has been applied only on cross-border of EE-LV and none on cross-border of LV-LT. To decrease structural congestion and countertrading costs, Latvian and Estonian TSOs currently are developing one new interconnection between Latvia and Estonia by planning to finish construction works until year 2020 and until year 2025 will improve existing two interconnection capacities, thus reducing costs to minimum.

- Baltic bidding zones are already one of the smallest in European electricity market (average 10 TWh each). Table 4 provides the Baltic countries electricity demands for the year 2018. During symposium organized by ENTSO-E, ACER and EC stated that "Member State borders shall be considered in BZ configurations, TSOs shall strive for similar BZ sizes", therefore Baltic bidding zone splitting by creating smaller bidding zones is not an option and merging will disrupt the borders of bidding zones within state borders.

2018	Estonia	Latvia	Lithuania	Finland	SE4
Demand, TWh	8,4	7,3	12,2	85,8	24,3

Table 4: Electricity demand in Baltic bidding zones (NordPool data)

- Baltic bidding zones are (until synchronization with central-Europe) connected to other EU bidding zones by direct current connections, therefore, not impacting other bidding zones with unscheduled flows.
- The ACER's Market Monitoring Report (ACER, published in 22.10.2018) analysis concluded that in the Baltic Biding Zones region there is no need to investigate the bidding zone improvement, and remedial actions are adequate. The Agency recommends (Table 5) improvements to the existing bidding zone configuration should be investigated with priority in the Core, Hansa and SWE CCRs, because of the low cross-zonal capacities made available for trading and high costs of remedial actions. Investigations were also advisable in all other CCRs except the Nordic, Baltic and GRIT. [MMR]

Region	Improvement to be investigated	Priority level	Cross-zonal capacity	Costly remedial actions	Potential underlying issue
Core	Yes	High	Poor	Poor	Internal congestions in Germany and, to a lesser extent, in Austria and the Netherlands. Large LF volumes.
Hansa	Yes	High	Poor	Poor	Internal congestions in Germany.
SWE	Yes	High	Poor	Poor	Internal congestions in Spain.
Channel	Yes	Moderate		Poor	Internal congestions in GB.
IT North	Yes	Moderate	Poor	To be monitored	Internal congestions in Austria. Significant LF volumes between Austria and Italy.
IU	Yes	Moderate		Poor	Internal congestions in GB.
SEE	Yes	Moderate	Poor	Adequate	
Baltic	No			Adequate	
GRIT	No				
Nordic	No		To be monitored	Adequate	

Source: NRAs, ENTSO-E and ACER calculations (2018).

Table 5: Need for investigating bidding zones

European Network of
Transmission System Operators
for Electricity

Annex 6: Configurations of the Bidding zone review region "Iberian Peninsula" which are to be considered in the bidding zone review process

Bidding Zone Review Region "Iberian Peninsula"

18 February 2020

1.1 Description of the status quo

A geographical overview of the bidding zone delineations is given in following figure:

A summary table describing the status quo is given in following table:

	1
Configuration Name	**Status Quo**
ES	1 [EB]
PT	1 [EB]

The network elements which will form the Bidding Zone Borders of this configuration, is given in the following table.

Configuration 1 "Status Quo"								
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**
ES	ES-PT	REE	Cartelle	REN	Lindoso	400	AC	Cartelle-Lindoso 1
ES	ES-PT	REE	Cartelle	REN	Lindoso	400	AC	Cartelle-Lindoso 2
ES	ES-PT	REE	Cedillo	REN	Falaguerira	400	AC	
ES	ES-PT	REE	Brovales	REN	Alqueva	400	AC	
ES	ES-PT	REE	Aldeadávila	REN	Lagoaça	400	AC	
ES	ES-PT	REE	Puebla de Guzmán	REN	Tavira	400	AC	
ES	ES-PT	REE	Aldeadávila	REN	Pocinho	220	AC	Aldeadávila-Pocinho 1
ES	ES-PT	REE	Aldeadávila	REN	Pocinho	220	AC	Aldeadávila-Pocinho 2
ES	ES-PT	REE	Saucelle	REN	Pocinho	220	AC	

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

ES	ES-PT	REE	Conchas	REN	Lindoso	132	AC	
ES	ES-PT	REE	Badajoz	REN	Elvas	66	AC	
ES	ES-PT	REE	Rosal de la frontera	REN	Vila verde de ficalho	15	AC	
ES	ES-PT	REE	Encinasola	REN	Barrancos	15	AC	
ES	ES-FR	REE	Vic	RTE	Baixais	400	AC	
ES	ES-FR	REE	Benos	RTE	Lac Doo	150	AC	
ES	ES-FR	REE	Irun	RTE	Errondenia	150	AC	
ES	ES-FR	REE	Hernani	RTE	Argia	400	AC	
ES	ES-FR	REE	Arkale	RTE	Argia	220	AC	
ES	ES-FR	REE	Biescas	RTE	Pragneres	220	AC	
ES	ES-FR	REE	Santa Llogaia	RTE	Baixais	320	DC	Santa Llogaia – Baixas 1
ES	ES-FR	REE	Santa Llogaia	RTE	Baixais	320	DC	Santa Llogaia – Baixas 2
PT	ES-PT	REE	Cartelle	REN	Lindoso	400	AC	Cartelle-Lindoso 1
PT	ES-PT	REE	Cartelle	REN	Lindoso	400	AC	Cartelle-Lindoso 2
PT	ES-PT	REE	Cedillo	REN	Falaguerira	400	AC	
PT	ES-PT	REE	Brovales	REN	Alqueva	400	AC	
PT	ES-PT	REE	Aldeadávila	REN	Lagoaça	400	AC	
PT	ES-PT	REE	Puebla de Guzmán	REN	Tavira	400	AC	
PT	ES-PT	REE	Aldeadávila	REN	Pocinho	220	AC	Aldeadávila-Pocinho 1
PT	ES-PT	REE	Aldeadávila	REN	Pocinho	220	AC	Aldeadávila-Pocinho 2
PT	ES-PT	REE	Saucelle	REN	Pocinho	220	AC	
PT	ES-PT	REE	Conchas	REN	Lindoso	132	AC	
PT	ES-PT	REE	Badajoz	REN	Elvas	66	AC	
PT	ES-PT	REE	Rosal de la frontera	REN	Vila verde de ficalho	15	AC	
PT	ES-PT	REE	Encinasola	REN	Barrancos	15	AC	

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

European Network of
Transmission System Operators
for Electricity

Annex 6: Justification of configurations of the Bidding zone review region "Iberian Peninsula" which are to be considered in the bidding zone review process

Bidding Zone Review Region "Iberian Peninsula"

18 February 2020

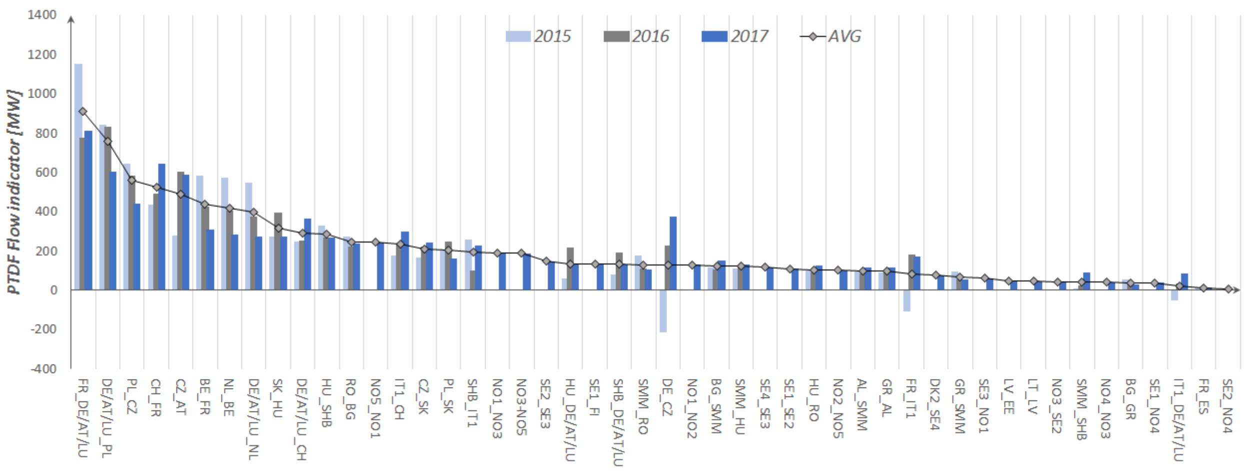
1.1 Argumentation why Iberian Peninsula proposes to provide only status quo configuration

The absence of structural internal congestions within Iberian Peninsula both affecting cross-border trading and purely internal congestions without cross-border affection lead Iberian TSOs to propose maintaining current BZ configuration within Iberian Peninsula.

Following indicators will demonstrate that current BZ configuration needs no review either from Article 14 of Regulation (EU) 2019/943 perspective or from Article 32 of Commission Regulation (EU) 2015/1222 as neither internal structural congestions affecting cross-border trade nor purely internal structural congestions affecting market efficiency exist.

- **Impact on neighbouring bidding zones**

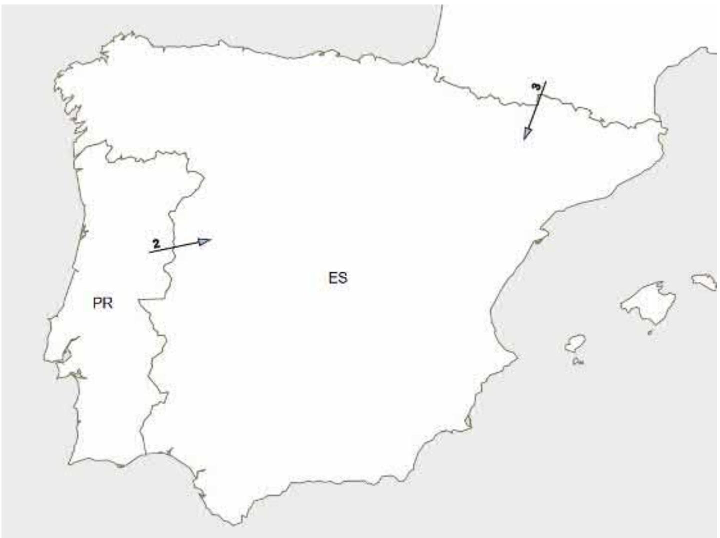
  As it was reported by the Bidding zones Technical Report 2018, the Iberian Peninsula shows a radially structured part of the EU system and its PTDF Flow deviation indicator is negligible for other bidding zones border.



Source: https://docstore.entsoe.eu/Documents/nc-tasks/EBGL/CACM_A34.4_20181015_BZ_TR_FINAL.pdf

The following map shows the average PTDF Flow Indicator for 2018 (in MW). The PTDF indicator estimates the size of loop flows and also includes uncertainties related to the PTDF matrixes adopted for the computation as it is described in the BZ TR 2018. As it can be seen in the map, PTDF values for PT-ES and FR-ES interconnection are negligible (2MW and 3MW respectively) compared to the PTDF values for other BZ borders as represented in the figure above. This shows the inexistent interdependency between Iberian Peninsula and central Europe due to both the weak level of interconnection in FR-ES BZ border and the radial nature of the electric interconnection between Iberian Peninsula and the rest of Europe.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu



PTDF Flow Indicator from 2018 for SWE (in MW)

Hence being the Iberian Peninsula relatively isolated from the rest of Europe it has no impact on neighbouring bidding zones which justifies that the study of the Iberian Peninsula BZs configuration is carried out separately from the rest BZs in Europe.

- **Cross-zonal trading** (BZ Review criteria according with Article 14 of Regulation (EU) 2019/943)

  Cross-border affection of internal congestions can be measured firstly by combination of two assessments:

  1. Level of available transmission capacity with regards to cross-zonal trade possibilities.
     Firstly it should be assessed for which interconnections cross-zonal capacity is scarce and hence represents a limitation to cross zonal trade. This must be assessed analyzing both, level of utilization of the interconnection (relation between commercial schedule and available transmission capacity) and level of price convergence of BZs at both sides of interconnection (% hours with same price shows whether cross-zonal capacity limits or not cross-zonal trade). Following tables show both ratios for Iberian Peninsula interconnections (*2019 data until 31st July 2019*):

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

% Utilization	2017	2018	*2019*
PT-ES	39,91	39,75	*39,75*
FR-ES	84,83	86,88	*90,93*

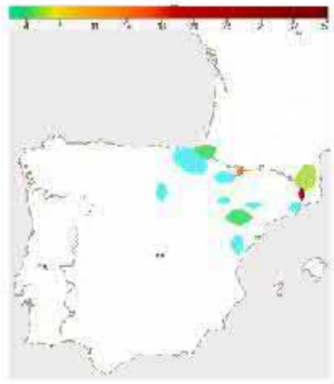
Source: www.iesoe.eu

Price convergence [% hours]	2017	2018	*2019*
PT-ES	93,30	94,78	*92,96*
FR-ES	24,86	24,49	*16,71*

Source: www.iesoe.eu

As it can be concluded from the tables above, while PT-ES BZ border does not represent any limitation at all for cross-zonal trade (high value of price convergence combined with low ratio of utilization) FR-ES BZ border does limit cross-zonal trade (low value of price convergence combined with high ratio of utilization).
Hence the assessment of impact of internal structural congestions on cross-zonal trade is focused on FR-ES interconnection only as in practice there exist no limitations for cross-zonal trade between Portugal and Spain.

2. Impact of internal structural congestions in level cross-zonal trade.
   Once the interconnections that limit cross-zonal trade have been identified (ie.: FR-ES interconnection for Iberian Peninsula's case) it has to be assessed to which extent this limitation was due to internal structural congestions or to congestions located directly at the BZ border elements.
   The structural congestions relevant to be assessed for evaluating their impact on cross-zonal trades are those that are identified in the capacity calculation process (CCDA) as these are the ones that could limit the capacity to be offered to the market. Congestions detected afterwards will not limit cross-zonal trades as these are considered firm after allocation occurs but can only imply higher firmness costs impacting the market efficiency and will be assessed in the next bullet point through ACER's indicator "RA performance".
   The following maps show the network congestions at transmission level in Spanish Bidding Zone identified during capacity calculation process that limited FR-ES cross-zonal trade (FR-ES CCDA) from 2017 to 2019 (data until 31st July 2019).



CCDA 2017

CCDA 2018

CCDA 2019 (until 31/7/2019)

As anticipated in ENTSO-E's BZ Technical Report 2018, the FR-ES CCDA in the Spanish bidding zones have experienced a decrease from 2017 to 2019 due to several action plans in the Spanish transmission network. In 2018 and 2019, the FR-ES CCDA in the Spanish bidding zone are mostly placed on the interconnection lines between France and Spain and sometimes close to them. The frequency of internal REE active market constraints having some impact on the Spain-France border has stayed below 5% of the time since 2018 for all internal congestions. Therefore, these congestions cannot be qualified as structural congestions as they are caused by variable reasons as network element outages or unusual operational situations related to RES or demand.

Hence, in the Iberian Peninsula there exist no internal structural congestions affecting cross-zonal capacity in FR-ES interconnection. Indeed, FR-ES CCDA in the Iberian Peninsula are placed on the interconnection lines between France and Spain. This fact is reflected in an increase of NTC in the FR-ES border expected only by the commissioning of the new interconnection in 2025.

- **Market efficiency** (BZ Review criteria according with Article 33 of Commission Regulation (EU) 2015/1222)
  Impact of purely internal congestions can be measured by the market efficiency in each Bidding Zone.
  According to ACER's Market Monitoring Report 2017, market efficiency of BZ configuration can be monitored by calculating the ratio between the cost of remedial actions per unit of demand being those BZs presenting a ratio greater than 1.0 €/MWh considered as inefficient.
  Before following this approach it should first be noted that there exist several different reasons for carrying out remedial actions other than those that could be solved by new BZ configuration (physical congestions on network elements could be solved directly by the

market if it is possible to gather all congested network elements creating a new BZ border). Hence, in order to reliably determining the potential interest of modifying BZ configuration according to remedial actions costs first it needs to be determined the share of total remedial actions costs that corresponds to physical congestions in elements of the transmission network.

Given that this classification of Remedial Actions per underlying cause (network congestion at transmission level, voltage issues at transmission level, other issues at transmission level, issues at distribution level) was not implemented until 2018 there exist no official registers of costs resulting from Remedial Actions for solving network congestion for properly calculating RA performance indicator for 2017. The following table estimates the indicator in 2017 assuming the ratio between costs associated to network congestions at transmission level and total Remedial Action costs was the same both in 2018 (for which this classification is already in place in ACER data request for MMR 2018) and for 2017. Data for 2018 and 2019 (until 31st July) have been calculated with real data for costs associated to Remedial Actions for solving network congestions.

		2017	**2018**	**2019**
Spain	Total costs of Remedial Actions [k€]	371.475	367.743	137.500
	Costs of Remedial Actions related to network congestion at transmission level [k€]	*62.112**	61.656	9.020
	Total national consumption [GWh]	252.506	253.576	146.295
	RA performance [€/MWh]	*0,25**	**0,24**	**0,06**
Portugal	Total costs of Remedial Actions [k€]	44.525	16.764	**
	Costs of Remedial Actions related to network congestion at transmission level [k€]	*0**	0	**
	Total national consumption [GWh]	49.638	50.897	**
	RA performance [€/MWh]	*0**	**0**	**

* Values estimated assuming same share of cost both in 2018 and 2017 of remedial actions between the different underlying causes.

** REN data for 2019 will be not available until October 2019 and will be included in the updated version of the document

As it can be seen, the Remedial Action performance indicator is lower than 1.0 €/MWh meaning that no reconfiguration of BZ is needed in the Iberian Peninsula for market efficiency reasons either.

To conclude, given the positive results of the assessment of current BZ configuration of Iberian Peninsula for all the indicators evaluated above (lack of impact in neighbouring bidding zones, lack of impact of internal structural congestions in cross-zonal capacity and good market efficiency) there exist no justification to review the Status Quo in Iberian Peninsula.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Annex 7: Configurations of the Bidding zone review region "Single Electricity Market Ireland" which are to be considered in the bidding zone review process

Bidding Zone Review Region "SEM Ireland"

18 February 2020

1.1 Description of the status quo

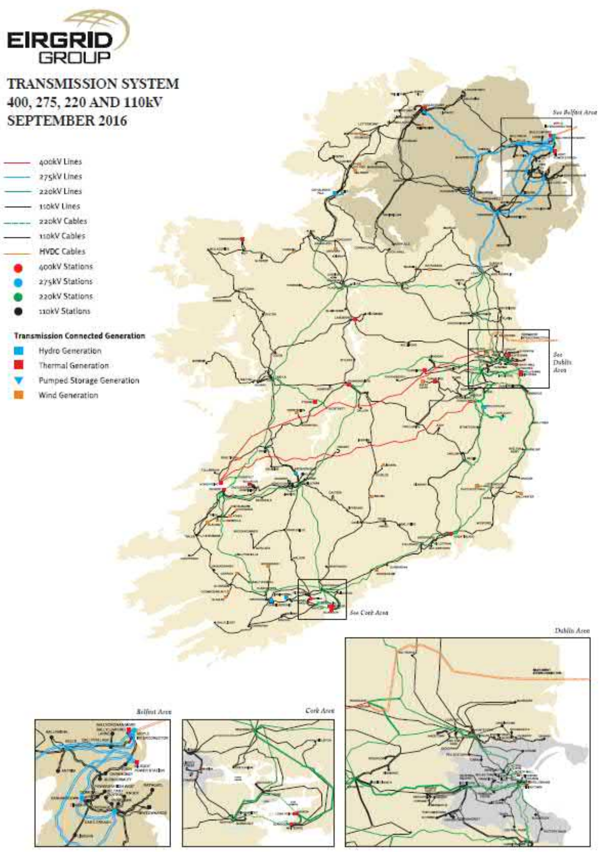
A geographical overview of the bidding zone delineations is given in following figure:

Figure 7: SEM and GB Bidding Zones

Source: EirGrid Group

A transmission system map for the SEM bidding zone covering the Ireland and Northern Ireland transmission system is provided in Figure 8.

Figure 8: Ireland and Northern Ireland transmission system map



Source: EirGrid Group

A summary table describing the status quo is given in following table:

1	
Configuration Name	**Status Quo**
SEM	1 [EB]
GB	1 [EB]

The network elements which will form the Bidding Zone Borders of this configuration, is given in the following table.

Configuration [Nr] [Name]									
Cty-CBk	**Bidding Zone Border**	**TSO1**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**	**New/different compared to status quo?**
SEM	SEM-GB	NGESO	Auchencrosh	NGESO	Mark Hill	275	DC	Auchencrosh-Mark Hill	No
SEM	SEM-GB	NGESO	Mark Hill	NGESO	Coylton	275	AC	Mark Hill-Coylton	No
SEM	SEM-GB	SONI	Ballycronan More	SONI	Ballylumford	275	AC	Ballyycronan More-Ballylumford	No
SEM	SEM-GB	SONI	Ballylumford	SONI	Hannahstown	275	AC	Ballylumford-Hannahstown	No
SEM	SEM-GB	SONI	Ballycronan More	SONI	Hannahstown	275	AC	Ballycronan More-Hannahstown	No
SEM	SEM-GB	SONI	Ballylumford	SONI	Hannahstown	275	AC	Ballylumford-Hannahstown	No
SEM	SEM-GB	SONI	Ballylumford	SONI	Kells	275	AC	Ballylumford-Kells	No
SEM	SEM-GB	SONI	Ballylumford	SONI	Magherafelt	275	AC	Ballylumford-Magherafelt	No
SEM	SEM-GB	EirGrid	EWIC	EirGrid	Portan	380	DC	EWIC-Portan	No
SEM	SEM-GB	EirGrid	Woodland	EirGrid	Portan	380	DC	Woodland-Portan	No
SEM	SEM-GB	EirGrid	Woodland	EirGrid	Maynooth	220	AC	Woodland-Maynooth	No
SEM	SEM-GB	EirGrid	Woodland	EirGrid	Oldstreet	380	AC	Woodland-Oldstreet	No
SEM	SEM-GB	EirGrid	Woodland	EirGrid	Corduff	220	AC	Woodland-Corduff	No

SEM	SEM-GB	EirGrid	Woodland	EirGrid	Louth	220	AC	Woodland-Louth	No

European Network of
Transmission System Operators
for Electricity

Annex 7: Justification of configurations of the Bidding zone review region “Single Electricity Market Ireland” which are to be considered in the bidding zone review process

Bidding Zone Review Region "SEM Ireland"

18 February 2020

1.1 Argumentation for SEM status quo configuration

Summary

Ireland and Northern Ireland introduced a new, fully integrated Single Electricity Market (SEM) on 1st October 2018 comprising a single bidding zone for the island. With regard to Article 14 of Regulation (EU) 2019/943 and Article 32 of Commission Regulation (EU) 2015/1222 it is proposed to maintain the current bidding zone configuration for SEM for the following reasons:

- The SEM is a new market that needs time to settle down and the data required to support any potential case for diverging from the status quo is not yet in place;
- SEM does not have direct links to its European neighbouring countries and is only connected to GB via two HVDC links; GB in turn is also only connected to the European continent via a number of HVDC links;
- ACER's Annual Report 2017 confirms that there are no issues with the provision of cross-zonal capacity or remedial actions for SEM. It also highlights that NTC and tradable SEM-GB capacities have been increasing;
- The Ireland-UK (IU) Capacity Calculation Methodology was approved by the relevant NRAs on 23 July 2018 and provides that the maximum available capacity will be offered to the market and also that TSOs will make available non-costly and costly remedial actions.
- The expected social welfare gains from SEM joining the Single Day-ahead Market Coupling can now be realized following the introduction of the new SEM in 2018. This is particularly the case when one considers that 95% of the SEM traded volume is in the Day-ahead Market (DAM).
- The latest figures from the SEM Committee indicate that the interconnectors are working efficiently with flows overwhelmingly in the correct direction.

Cross-zonal Capacity

There is no direct HVDC link from the island of Ireland to the European continent. The transmission system in Ireland and Northern Ireland is only interconnected with other European countries via Great Britain by means of two offshore HVDC links – Moyle connecting Northern Ireland at Ballycronan More to Scotland at Auchencrosh and the East West Interconnector connecting Ireland at Woodland to Wales at Deeside. However, our system is operated in such a way that the cross-border flows are not constrained on the HVDC interconnectors in real-time (see Figure 1).

Figure 1: Real-time (ICS) for the period 2015-2017

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

Source: ENTSO-E Bidding Zone Configuration Technical Report 2018

HVDC interconnectors are virtually unaffected by the factors that impact available cross-zonal capacity on HVAC interconnectors. ACER noted in its "Annual Report on the Results of Monitoring the Internal Electricity and Gas Markets in 2016" that the share of the benchmark capacity made available for trading was much higher (over 85% on average) for High-Voltage Direct Current (HVDC) interconnectors. As a result, ACER determined in its 2017 Annual Report that the countries connected to the rest of Europe with HVDC interconnectors only (i.e. United Kingdom and Ireland) did not need to be analysed, as they perform considerably better than average.

The amount of cross zonal capacity made available to the market in SEM has been increasing in recent years (see Figure 2)[1].

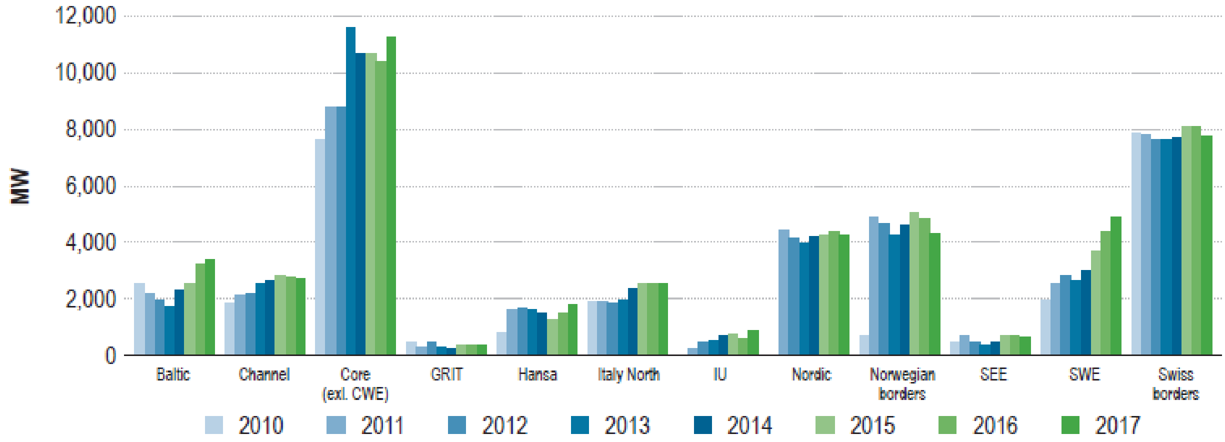
The objective of the current capacity calculation process is to give the market with the highest possible capacity for energy trading taking into account the available interconnector capacity, secure and efficient operation of the power systems on both sides of the Interconnector and the possibility of faults on either network. The Capacity Calculation Methodology in Article 20(2) of Commission Regulation (EU) 2015/1222 has been approved by the National Regulatory Authorities in Ireland and UK and provides that the cross-zonal capacity shall be equal to the Maximum Permanent Technical Capacity (MPTC) value unless a specific planned or unplanned outage with significant impact on the interconnector exists in one of the bidding zones to which that interconnector is connected or an alternative lower firm capacity value is stated in a connection agreement between an interconnector owner and a connecting TSO. In addition, TSOs will make available all non-costly remedial actions and costly remedial actions that are deemed to be reasonable, efficient and proportionate. The negligible impact of the SEM HVDC interconnections to neighbouring European countries, the availability of the maximum available

[1] Capacity decreased in the second half of 2016 (and at the beginning of 2017), following an interconnector fault on the East West interconnector (EWIC).

cross-zonal capacity to the market and availability of non-costly and costly remedial actions all contribute to the achievement of the terms set out in Article 14 of Regulation (EU) 2019/943.

The initial list of CNECs to be considered in the cross-zonal capacity calculation for the IU region, are listed below and can be found in Annex 1 of the IU Capacity Calculation Methodology.
- CNECs relating to Moyle Interconnector in SONI control area
- CNECs relating to Moyle Interconnector in National Grid control area
- CNECs relating to East West Interconnector in EirGrid control area

Figure 2: NTC averages of both directions on cross-zonal borders, aggregated per CCR – 2010–2017 (MW)



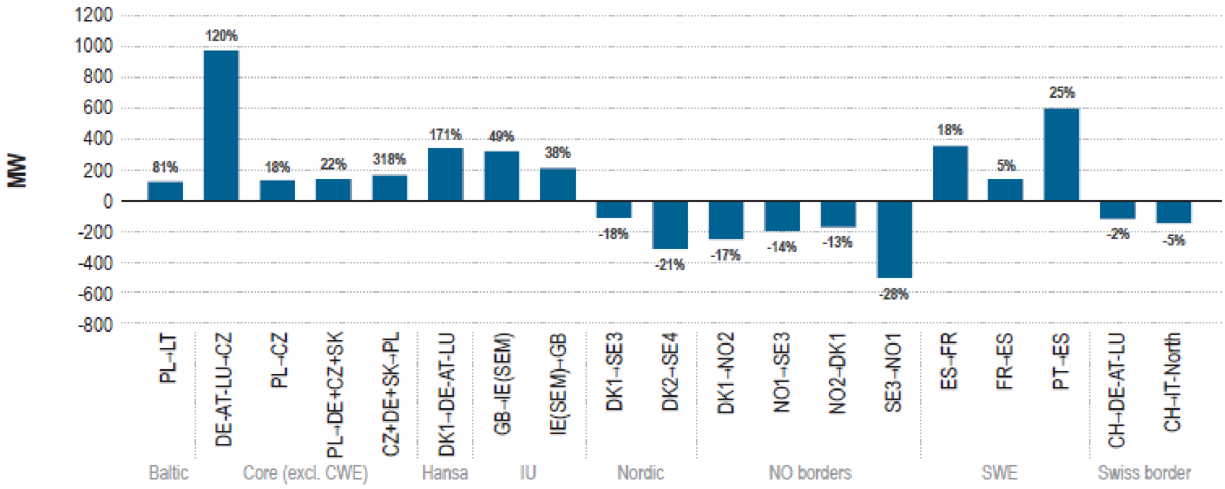
Source: ACER/CEER - Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2017 – Electricity Wholesale Markets Volume

Overall, ACER concludes in its Annual Report 2017 that improvements should be investigated in the IU Capacity Calculation Region, due to the relatively high costs of remedial actions arising from internal exchanges in the GB bidding zone; however, it notes these internal congestions do not seem to lead to discrimination of cross-zonal exchanges. Importantly, there is no corrective action to be taken in the SEM bidding zone on cross-zonal capacity or remedial actions.

Efficient Cross-Zonal Trade

ACER also identifies in its Annual Report 2017 that cross-zonal trade between the SEM and GB markets has significantly increased in 2017 (see Figure 3).

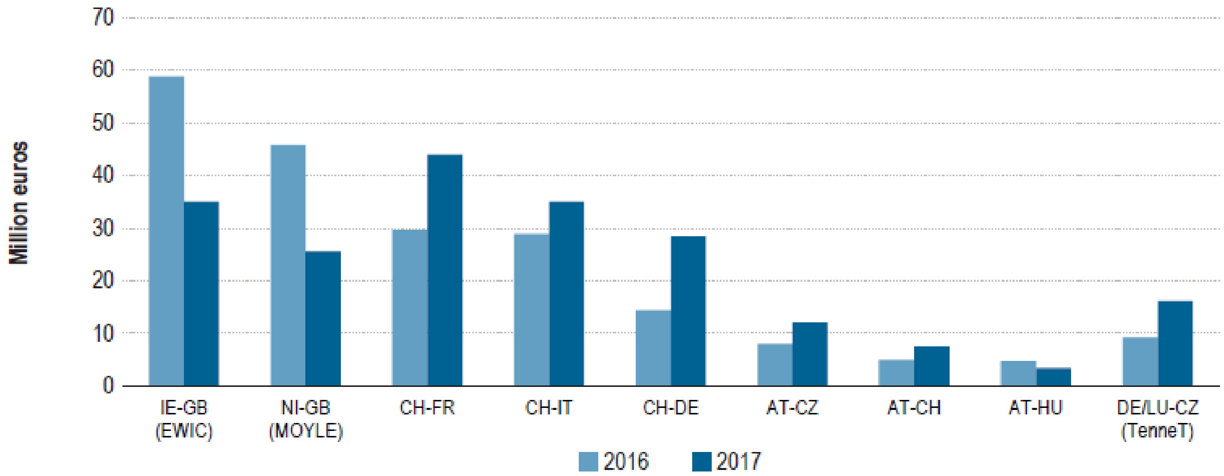
Figure 3: Changes in tradable capacities (NTC) in Europe



Source: ACER/CEER - Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2017 – Electricity Wholesale Markets Volume

As the SEM was only introduced in October 2018, products pursuant to Commission Regulation (EU) 2015/1222 were not tradable prior to this and could not therefore be included for the reporting year. ACER highlighted in its Annual Report 2017 that significant social welfare gains were still to be made for the SEM-GB bidding zone border (see Figure 4). SEM is now part of the Single Day-ahead Market Coupling, which will lead to increased market efficiencies and social welfare gains for electricity consumers going forward.

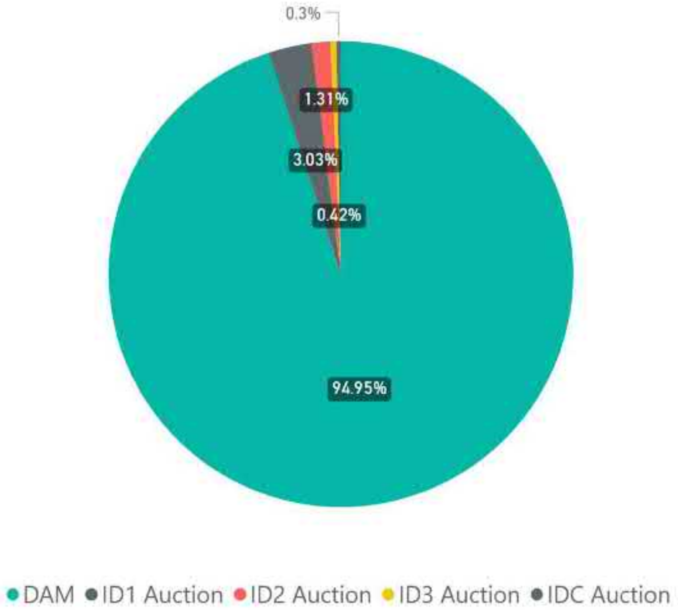
Figure 4: Estimated social welfare gains still to be obtained from further extending DA market coupling per border (€millions)



Source: ACER/CEER - Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2017 – Electricity Wholesale Markets Volume

The SEM Committee, the decision making authority for the Single Electricity Market on the island of Ireland, published its report on "Single Electricity Market Performance 1 April 2019 – 30 June 2019 (SEM-19-035)" on 8th August 2019. The key findings from the report indicate that prices in the day-ahead market are 19% lower than in the equivalent period last year; that the day-ahead market is highly liquid with over 95% of volumes traded (see Figure 5); and that the interconnectors between the SEM and GB bidding zones continue to flow efficiently (see Figure 6).

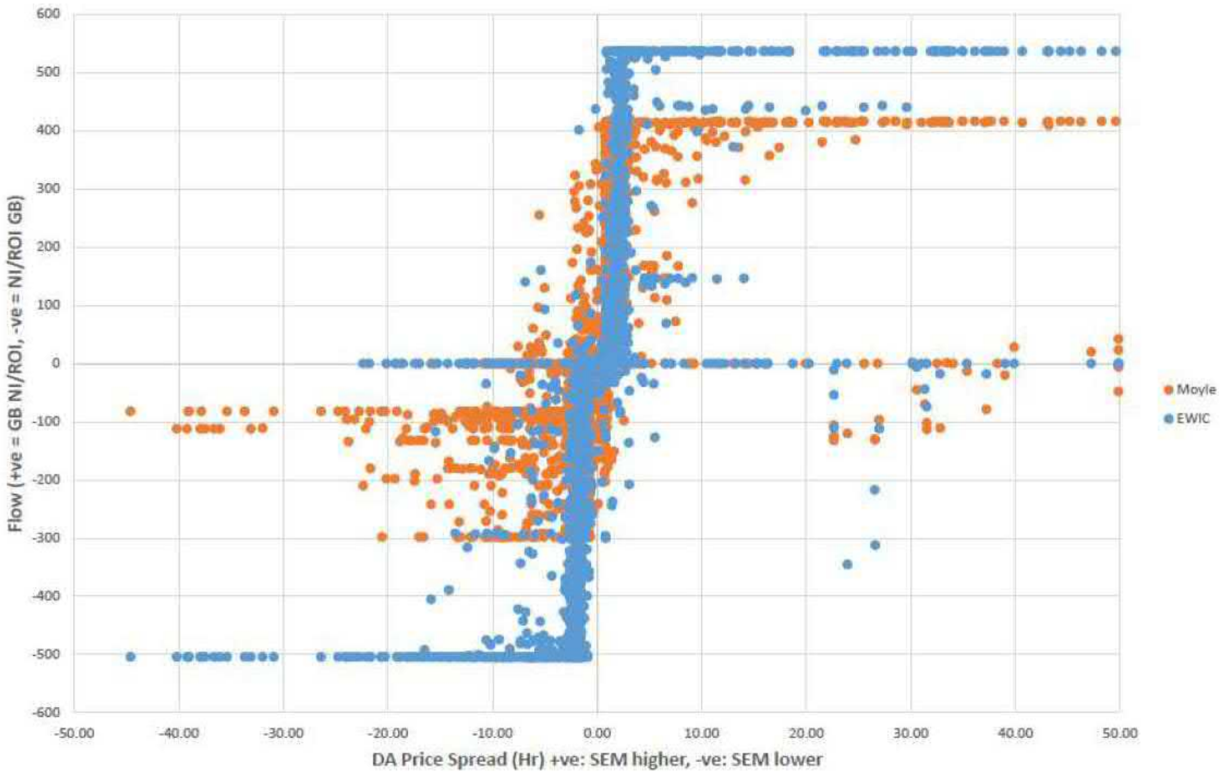
Figure 5: Market share by volume



Source: Single Electricity Market Performance 1 April 2019 – 30 June 2019 (SEM-19-035), 8 August 2019.

In the new SEM, physical flows on Moyle and EWIC Interconnectors are linked to the SEM Day Ahead market and the price difference between it and the DAM price in GB. The X axis shows the difference in DAM prices between the SEM and GB so that the positive price difference on the right of the graph is when the SEM price is higher than the GB price and the Interconnector should be importing. The negative values on the left of the graph are when the SEM price is lower and the interconnectors should be exporting. The Y-axis shows the volume of the flow and its direction so that in the upper half of the graph, in which values are positive, the Interconnectors are importing into the SEM from GB. In the lower half the negative values indicate an export.

Figure 6: Interconnector efficiency



Source: Single Electricity Market Performance 1 April 2019 – 30 June 2019 (SEM-19-035), 8 August 2019.

For there to be evidence of efficient trading the scatter graph should show the periods of flow in the upper right of the graph and bottom left. In the upper right quadrant the SEM price is higher than the GB price and the Interconnectors are importing. In the bottom left quadrant the SEM price is lower than the GB price and the interconnectors are exporting. The flows on Moyle and EWIC are overwhelmingly in the correct direction. However a few exceptions in the lower right quadrant can be observed. These can be attributed to the market coupling error which occurred at the beginning of 7th June due to a technical issue experienced by EPEX. The issue was caused by the submission of a corrupt order, not one placed from a SEM participant, nor an issue with the market coupling algorithm. As per the fall back procedure, local auctions were held for each national market area. This resulted in no GB price being available to provide the market price spread for this period.

Annex 8: Configurations of the Bidding zone review region “United Kingdom” which are to be considered in the bidding zone review process

Bidding Zone Review Region UK

18 February 2020

1. Contents

This annex depicts in detail the Bidding Zone configurations for the Bidding Zone Review UK that are to be considered in the bidding zone review process in accordance with Article 14(5) of Regulation (EU) 2019/943 of the European Parliament and the Council of 5th June 2019 on the internal market for electricity (recast).

2. Overview of the configurations of the Bidding Zone Review Region UK

1. The BZRR shall investigate the UK region Bidding Zone configurations. This includes the Bidding Zone Configuration as it is in place per 1/1/2020 as status quo configuration.

2. For the avoidance of doubt the UK region includes only Great Britain. Northern Ireland (part of the United Kingdom) is part of the Ireland region and the IE bidding zone and is therefore dealt within in Appendix 7.

3. Today, and as expected for 1/1/2020, Great Britain consists of one bidding zone. This configuration of a single GB market has existing since the introduction of BETTA[1] (British Electricity Trading and Transmission Arrangements) which came in to effect on 1 April 2005. The principal objective of the BETTA reform was the creation of a single, competitive wholesale electricity trading market in Great Britain. It joined the previous separate, but electrically synchronous, markets of Scotland and England & Wales.

4. The Great Britain electricity system is connected only to other systems via HVDC interconnectors. The GB system is a single synchronous area, managed by National Grid Electricity System Operator.

5. The borders of the current bidding zone are the HVDC Interconnectors connecting GB to other synchronous areas. Namely, Moyle Interconnector and East West Interconnector to the Irish (IE) bidding zone, and IFA, NEMO and BritNed connecting to the Core region and the France (FR), Belgium (BE) and Netherlands (NL) bidding zones respectively. As further interconnection is commissioned to other or the same bidding zones, the new interconnector will form part of the bidding zone border.

6. A geographical overview of the bidding zone delineations is given in Figure 1.

7. Each configuration is described in more detail in Section 3 of this Annex.

Configuration nr	1
Configuration Name	**Status Quo**
United Kingdom	Great Britain (England, Scotland and Wales)

Table 1: Overview of the Bidding Zone Configurations and the number of Bidding Zones per Member State per configuration

[1] https://www.ofgem.gov.uk/sites/default/files/docs/2005/02/9549-2605.pdf

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

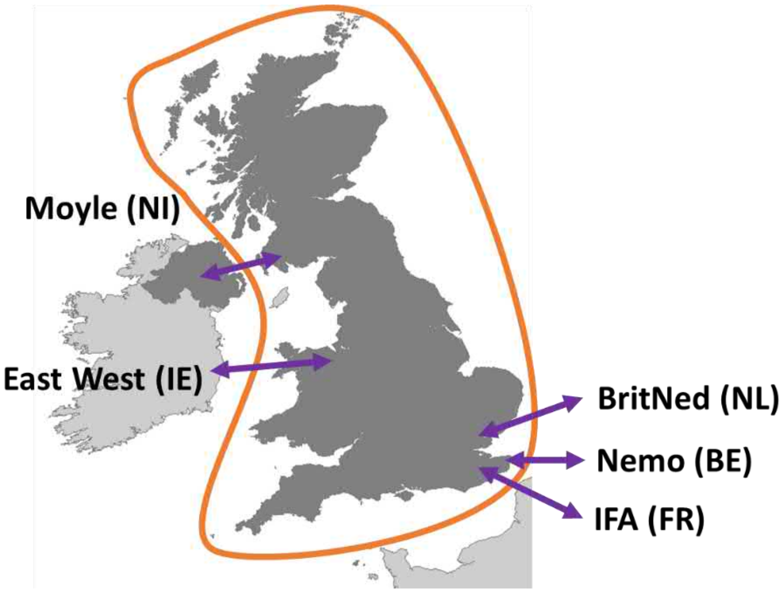


Figure 1: Current GB Bidding Zone outlined in Orange, with the HVDC interconnectors to other synchronous areas illustrated in purple

3. Detailed information per configuration

This section provides detailed information per configuration.

1: Status Quo Configuration

1. The overview of the Status Quo Configuration is inserted for convenience.
2. A geographical overview of the bidding zone delineations is given in Figure 2.
3. The network elements which will form the Bidding Zone Borders of this configuration, is given in Table 2.

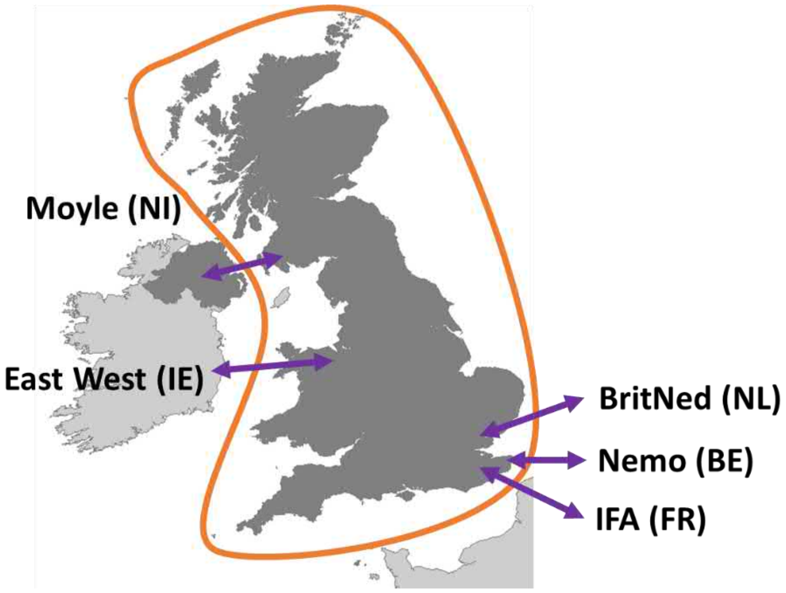


Figure 2: Current GB Bidding Zone outlined in Orange, with the HVDC interconnectors to other synchronous areas illustrated in purple

Configuration 1 "Status Quo"									
Cty-CBk	**Bidding Zone Border**	**TSO1[2]**	**Station 1**	**TSO2**	**Station 2**	**Voltage level [kV]**	**Type**	**Network element Name**	**New/different compared to status quo?**
GB	UK-BE	NGESO	Richborough	ELIA	Gezelle	400	DC	Nemo Link	Status Quo
GB	UK-NI	NGESO	Auchencrosh	SONI	Moyle	250	DC	Moyle	Status Quo
GB	FR-UK	RTE	Mandarins	NGESO	Sellindge	270	DC	IFA	Status Quo
GB	UK-NL	NGESO	Isle of Grain	TenneT	Maasvlakte	450	DC	BritNed	Status Quo
GB	UK-IE	NGESO	Deeside	Eirgrid	Woodland	260	DC	EWIS	Status Quo

Table 2: Bidding Zone Borders of Configuration 1 "Status Quo"

[2] The GB TSO is listed as National Grid Electricity System Operator Ltd (NGESO), the system operator for the whole of GB. The substations listed are owned by different Transmission Owners (TOs) – SP Transmission Plc own Auchencrosh, and the others (Richborough, Sellindge, Isle of Grain and Deeside) are owned by National Grid Electricity Transmission Plc.

European Network of
Transmission System Operators
for Electricity

Annex 8: Justification of configurations of the Bidding zone review region “United Kingdom” which are to be considered in the bidding zone review process

Bidding Zone Review Region UK

18 February 2020

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

1. General justification for the set of configurations

Today, and as foreseen for 1/1/2020, Great Britain consists of one bidding zone. This configuration of a single GB market has existing since the introduction of BETTA[1] (British Electricity Trading and Transmission Arrangements) which came in to effect on 1 April 2005. The principal objective of the BETTA reforms was the creation of a single, competitive wholesale electricity trading market in Great Britain. It joined the previous separate, but electrically synchronous, markets of Scotland and England & Wales.

The GB transmission system is interconnected with other European countries through a few offshore HVDC links; however, the GB system is operated in such a way that the cross-border flows are not constrained on the HVDC interconnectors in real-time. Whilst there is some congestion on internal boundaries, this is a known feature of the efficient operation of the GB market rather than considered structural congestion.

The borders of the current bidding zone are the HVDC Interconnectors connecting GB to other synchronous areas. Namely, Moyle Interconnector and East West Interconnector to the Irish (IE) bidding zone, and IFA, NEMO and BritNed connecting to the Core region and the France (FR), Belgium (BE) and Netherlands (NL) bidding zones respectively. As further interconnection is commissioned to other or the same bidding zones, the new interconnector will form part of the bidding zone border.

Rationale for the Status Quo

The requirement to undertake a bidding zone review follows from the Clean Energy Package. Article 14.1 outlines the rationale behind bidding zones:

> *Member States shall take all appropriate measures to address congestions. Bidding zone borders shall be based on long-term, structural congestions in the transmission network. Bidding zones shall not contain such structural congestions unless they have no impact on neighbouring bidding zones, or, as a temporary exemption, their impact on neighbouring bidding zones is mitigated through the use of remedial actions and those structural congestions do not lead to reductions of cross-zonal trading capacity …*

In GB, we make the argument that our existing *status quo* bidding zone configuration (of one bidding zone for GB) does not lead to a reduction in cross-zonal trading capacity. The congestion that is seen in GB is transient and internal, and evidence of an efficient regime for consumers. Value of consumers is sought by savings in delaying transmission investment, balanced by short-term increased remedial action costs. The rationale for maintaining the existing single bidding zone is twofold:

- **High-level of cross-border capability available:** within GB the near maximum capacity of cross-border interconnection is routinely offered to the market, thus maximising potential for cross-border exchange of energy, and therefore our bidding zone configuration does not affect the efficient functioning of other bidding zones or the single energy market.
- **We do not have structural congestion in GB - transient internal congestion is a known feature of the GB market and frameworks:** Transient internal congestion and the associated remedial costs, are an integral and explicit part of the way in which GB delivers an efficient and effective transmission system and system operation. This ensures the best value for consumers; as in some circumstances, short-term temporary congestion and the cost of remedial actions are more efficient that early transmission build or reinforcements.

High-level of cross-border capability available

Within GB we routinely offer the full cross-border interconnector capacity to the market, with the market then deciding how much to flow on the interconnector subject to the price spread between the GB and BE, FR, IE and NL markets. Therefore, we are complaint with the intention of Article 16. Interconnector capacity

[1] https://www.ofgem.gov.uk/sites/default/files/docs/2005/02/9549-2605.pdf

offered to the market is only reduced in exceptional circumstances when other commercial means have been exhausted by the System Operator, or are likely to prove ineffective due to the specific market spread. The reduction is capacity is taken to ensure a secure system can be operated in real-time.

We do not have structural congestion in GB - transient internal congestion is a known feature of the GB market and frameworks

Structural congestion is defined as being congestion that is capable of being unambiguously defined, is predictable, is geographically stable over time, and frequently reoccurs under normal electricity system conditions. Moreover, Article 14.1 requires that this congestion must be long-term when considering bidding zones.

Within GB, we have congestion on some of our internal boundaries from time-to-time, and under certain operating conditions. These operating conditions are a combination of the locational generation and demand patterns, the interconnector flow (resulting from market coupling), availability and operability of the transmission network at a given time and operation consideration of system security.

We argue that this congestion is however neither *long-term* nor *structural*. This argument is based on two key assertions – firstly, congestion within GB and the associated remedial costs are an integral and explicit parts of the way in which GB delivers an efficient and effective transmission system and system operation. Secondly, that it delivers the best value for consumers; as, under many circumstances, short-term temporary congestion and the cost of remedial actions are more efficient that early transmission build or reinforcements.

The GB regime allows for the connection of generation ahead of wider transmission system reinforcements being undertaken – the "connect and manage" regime. The GB regime also considers the timing and type of investment needed in the network, and makes decision to minimise cost of consumer, and maximise consumer value – the "network option analysis" process. In both cases, congestion (and remedial action payments) will happen in the short-term, but this is evidence of an efficient outcome for consumers, as the cost of remedial actions is lower than the cost of earlier transmission reinforcements.

It is the nature of a constantly evolving system, that new connections continue to drive additional investment requirements. Take for example, the large volume of wind generation connected – and forecast to continue to connect in Scotland - requiring additional capacity to be built north-to-south. The Western HVDC link, commissioned in 2018, brings up to 2.2GW of capacity between Scotland (Hunterston) and England and Wales (Deeside). However, our Electricity Ten Year Statement[2] process shows, based on our Future Energy Scenarios[3], that further capacity will be needed in the future. However, this capacity will only be built when it is economic to do so, resulting in congestion and remedial action costs in the interim.

In GB we plan for the future network, based on credible scenarios. Then, build transmission reinforcement to address congestion only when it is most economic to do so. In the interim, we have some congestion and the remedial action costs. However, the internal congestion is neither structural or long-term, and does not significantly affect capacity offered for cross-border trade.

Connect and manage regime for advancing (low carbon) generation connections

The connect and manage regime has been part of the GB generator connection arrangements since 2011. The regime allows new electricity generators to connect to the network once all enabling works are complete, but ahead of wider transmission system reinforcements. This brings on generation – especially low carbon generation – sooner than would otherwise be the case. As the wider reinforcements, have not taken place, there will be occasions when there are system operability issues caused by the new generation, and the system operator therefore takes remedial actions to secure the system.

[2] https://www.nationalgrideso.com/document/133836/download
[3] http://fes.nationalgrid.com/

Therefore, a direct consequence of the connect and manage regime is higher remedial action costs under certain times, ahead of wider reinforcements. However, by delaying wider reinforcements the costs to the consumer overall are lower than they would otherwise have been, and secondly it allows generation – including low carbon generation – to connect to the system earlier than it otherwise would have done. For most the time the newly connected generation can operate without constraint, and it is only at times of network outage or (for example) high wind output that the transient internal congestion occurs.

Network options assessment process

To reduce future congestion in the GB transmission system, National Grid Electricity System Operator (ESO) utilises long-term optimisation to identify the best way to reinforce the network during system planning. The cost of congestion is quantified by total constraint costs incurred on approximately 40 boundaries as listed in the Electricity Ten-Year Statement[4] (ETYS).

National Grid ESO is required to publish the ETYS on an annual basis to identify the future system needs in bulk power transfers of different boundaries. The required transfer for each boundary is then fed back to the Transmission Owners (TOs) or other relevant parties for them to propose network reinforcement options to meet the identified future system needs. A range of network reinforcements, including both build, reduced-build and commercial service options, are then submitted to National Grid ESO to assess for their cost and benefit.

The assessment and selection process is known as the Network Options Assessment[5] (NOA) where benefits in boundary constraint savings in future years delivered by the options are considered against their total capital expenditures. The process is conducted under different Future Energy Scenarios[6] (FES) followed by a least-worst regret analysis to mitigate the risk that investments of certain options are inefficiently driven by certain energy backgrounds which is highly uncertain in the distant future. National Grid ESO publishes the NOA report each January, recommending to the TOs and relevant parties its best view into the future of which options should be invested in over the coming years to achieve an optimal balance between reinforcing and constraining the network. This process seeks to optimise the delivery dates of the network reinforcements, should the investments be delivered early, there is a risk of inefficient capital spend and should the options being delivered late, we will see additional congestion costs. The balance is designed to offer the best value of money for consumers.

In the most recent NOA report, January 2019, National Grid ESO recommended investment of £59.8m in 2019/20 across 25 projects to potentially deliver projects worth almost £5.4bn. It was also found that commercial solutions can provide significant consumer benefit, especially in the period before asset-based options are yet to be delivered including ESO-led commercial solutions. The commercial solutions, instead and ahead of network investment, can make consumer savings up to £1.1bn between 2020 and 2028, but will lead to additional remedial costs in the interim.

It is important to note that while the investment recommendations are given by National Grid ESO, the TOs and other relevant parties will ultimately be responsible for ensuring reinforcements are delivered in time to meet system needs. For projects with large infrastructure investments, the TOs must also pass the Strategic Wider Work[7] (SWW) submission to the GB regulator (Ofgem) for approval and to determine the project's final specifications and commissioning date.

Historically, the highest levels of transient internal congestion have been seen on three internal boundaries, as shown in Figure 1.

[4] https://www.nationalgrideso.com/insights/electricity-ten-year-statement-etys
[5] https://www.nationalgrideso.com/insights/network-options-assessment-noa
[6] http://fes.nationalgrid.com/
[7] https://www.ofgem.gov.uk/electricity/transmission-networks/critical-investments/strategic-wider-works

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu

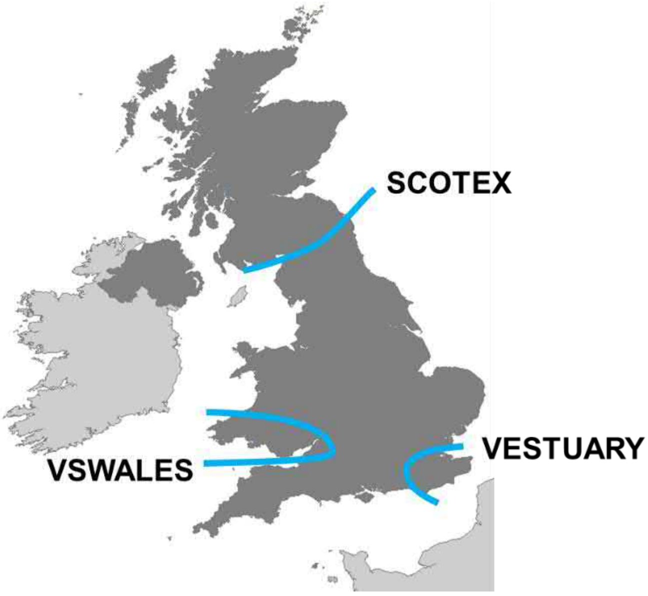


Figure 1: Historic GB internal boundaries with the highest congestion

1. SCOTEX. This boundary crosses the border between Scotland and England. Scotland has a lot of connected wind generation which results in some congestion. A combination of connect and manage schemes and difficult reinforcements in the region has made the SCOTEX boundary historically an active constraint. A new western HVDC link between Scotland and England & Wales has provided additional capacity across this boundary and was commissioned in 2018. This has alleviated much of the congestion on this boundary.
2. VSWALES is congested due to high voltages levels. The area has a lack of reactive absorption measures with the increasing level of renewable penetration and lower transmission demand. With fewer units of synchronous plant that could provide voltage support operating in merit, additional congestion spend has been incurred on the boundary, especially overnight. However, this constraint is being increasingly eliminated due to ongoing reactive compensation schemes.
3. VESTUARY. This boundary has historically seen higher constraints due to plant outages. To mitigate the voltage limitation and lower the congestion spend on this boundary, several new shunt reactors were commissioned in the area in late 2017/18. National Grid ESO and National Grid Electricity Transmission are collaborating to bring back online another large shunt reactor which has been out of service on a long-term fault.

The following section summaries the future reinforcements of the three most congested internal boundaries within GB, and how they are going to addressed to cope with future predicted transient internal congestion. Please refer to the NOA Methodology[8] for more details about how the NOA is conducted and the NOA report[9] for National Grid ESO's full investment recommendations.

For boundaries in Scotland and Northern England, including SCOTEX, the NOA process has identified 18 schemes to be delivered between 2020 and 2029 to ensure stability and reducing congestion of future flows in this region. One of the proposals, deemed to be economic and efficient in comparison to transmission build, is for a commercial solution with a duration of 40 years to provides boundary benefit across Anglo–

[8] https://www.nationalgrideso.com/document/149636/download
[9] https://www.nationalgrideso.com/document/137321/download

Scottish border and further south (referred to as CS01 in NOA). This commercial service will cause additional remedial action costs rather than incurring network investment spend.

For boundaries in the Wales and West Midlands region, including VSWALES, the NOA process has identified that it is not economic to proceed with any of the transmission reinforcement proposal at this time as there is not expected to be sufficient congestion in future on this boundary to warrant investment.

For boundaries in the south and east of England region, including VESTUARY, the NOA process has identified nine schemes to be delivered between 2020 and 2026 to ensure stability and reducing congestion of flow in this region. One of the proposals, deemed to be economic and efficient in comparison to transmission build, is for a commercial solution with a duration of 40 years providing boundary benefit across SC1 and SC2 on the south coast (referred to as CS25 in NOA).

Summary

Cross-border interconnection between GB and other bidding zones is routinely offered at the maximum capacity of the HVDC interconnectors. It is not curtailed due to transient internal congestion within GB.

It is a feature of the GB market that there is some internal congestion – this is a sign of a functioning and efficient market. It means that generation capacity – including low carbon generation – is being connected ahead of strategic wider works being complete, and that transmission investment is being delivered at the point of economic need. The result is some costs through remedial actions in the near term to address the transient internal congestion.

Overall, consumers are well served by the single GB bidding zone in the context of the European market.

ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51 • info@entsoe.eu • www. entsoe.eu