Explanatory document to Capacity calculation methodology for the day-ahead and intraday market timeframes within the Baltic Capacity Calculation Region by Article 20(2) of the Commission Regulation (EU) 2015/1222 establishing a guideline on capacity allocation and congestion management

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1 INTRODUCTION

The Commission Regulation (EU) 2015/1222 establishing a guideline on Capacity Calculation and Congestion Management (CACM Regulation) foresees to develop and implement a common Day Ahead and Intraday Capacity Calculation Methodology (DA ID CCM) per Capacity Calculation Region.

Baltic CCR TSOs submitted the proposal for the Baltic DA ID CCM on 3rd of October 2018, which the Baltic CCR NRAs approved at the end of 2018.

Three Baltic countries plan to synchronize with Continental Europe Synchronous Area (CESA) in the first quarter of 2025. In addition, considering Baltic CCR NRAs decision on 29th of January 2021, Baltic CCR NRAs encourage the Baltic CCR TSOs to develop a new DA ID CCM in parallel with the new Long Term Capacity Calculation Methodology (LT CCM) proposal, where applicable following the guidance in ACER's decision on the LT CCM and submit a new DA ID CCM proposal to Baltic CCR NRAs in accordance with CACM Regulation article 9(13).

Considering these circumstances, Baltic CCR TSOs provide new updated Baltic DA ID CCM for Baltic CCR NRAs approval including requested changes considering Baltic states synchronization with CESA and proposing new principles which will be considered during the update of Baltic LT CCM. In this explanatory document Baltic CCR TSOs will explain the changes included in the proposal for Baltic DA ID CCM compared to the previous version of Baltic DA ID CCM document.

2 SYNCHRONIZATION WITH CESA

Baltic states synchronization with CESA has legal and technical aspects. Legal aspects relevant for Baltic DA ID CCM development covers changes for currently existing operational agreements. Technical synchronisation aspects, related to Baltic area and relevant for Baltic DA ID CCM are explained in Section 7. New DA ID CCM is developed and planned to be implemented by the time Baltic states are synchronized with CESA when new principles will be applied.

Baltic states currently are operating in different synchronous area called BRELL (Belarus, Russia, Estonia, Latvia and Lithuania). Key operational and organizational principles within common synchronous area of BRELL are set out in an agreement between TSOs of Belarus, Russia, Estonia, Latvia and Lithuania. This agreement also covers capacity calculation and coordination principles between parties as well as other relevant operational aspects for system operations. As Baltic states operate in the same BRELL synchronous area, they must apply common principles set out in aforementioned agreement.

Considering from operational point of view in terms of legal aspects which are relevant to DA ID CCM key difference of new version of DA ID CCM is that references to BRELL agreement are eliminated. This agreement will be no longer relevant for Baltic TSOs as they will operate in CESA. New DA ID CCM sets out principles for capacity calculation in accordance with CACM Regulation. This allows to be fully compliant with EU regulations and full integration with EU capacity coordination processes and markets.

3 COORDINATED NTC CAPACITY CALCULATION APPROACH APPLICATION

Coordinated NTC approach as per CACM Regulation article 21(1)(b)iv is foreseen to be applied by Baltic CCR TSOs in new updated Baltic DA ID CCM. This decision is consistent with the previous version of DA ID CCM where the same method is foreseen to be applied.

Key factors determining coordinated NTC approach adoption in Baltic DA ID CCM are Baltic TSOs electrical grid configuration and desynchronization from BRELL network. Baltic TSOs networks are distributed radially, which allows to better anticipate and manage flows, as there are no possibilities for loop flows to appear. Therefore, varying net positions of each bidding zone results in direct flows on cross borders and there are no loop flows impact for Baltic TSOs networks. In addition, as Baltic TSOs will be desynchronized from BRELL network, there will no longer be any impact from third countries and no loop flows induced by any of third country party network net position variation.

As a result, Baltic states synchronous operation with CESA allows to operate network better by accurately planning flows on cross borders. Therefore, the coordinated NTC approach allows for an optimal use of the transmission infrastructure while maintaining a high level of system security as well as for efficient grid operation for each Baltic TSO. This method allows efficiently determine and coordinate cross border flows in Baltic region by disregarding any impact from third countries or other system operators. Further analysis of CNTC application approach is provided in Annex 2.

3.1 TTC CALCULATION

Net Transmission Capacity (NTC) determines maximum allowable cross border power exchanged between bidding zones. It is equal to Total Transfer Capacity (TTC) reduced by Transmission Reliability Margin (TRM).

TTC will be calculated using Common Grid Model (CGM) according to CACM Regulation article 28(5) and article 29(8)a by evaluating system security analyses and analysed maximum possible exchanges between bidding zones. CGM usage allows to fulfil general requirements of CACM Regulation and efficiently integrate into EU TSOs processes after Baltic TSOs synchronization with CESA.

3.2 TRM CALCULATION

TRM will be calculated by considering netted planned and actual power flow deviations on cross border and adding one standard deviation. This calculation will be done for data set, covering last 12 months period. TRM recalculation and update is foreseen at least every month. In addition, TRM will be calculated and applied for each cross-border interconnection direction. On top of that, for the initial period of synchronization with CESA, data for calculation will not be available, therefore, for one month period it is foreseen to apply fixed TRM values for cross borders. After that, TRM will be calculated based on available data and recalculated every month by adding additional data set, until 12 months data set is available.

3.3 NTC CALCULATION

NTC as an initial input for market will be calculated as usual by considering TTC and TRM values. TTC will be reduced by TRM and NTC value will be obtained.

4 CAPACITY ALLOCATIONS BEFORE DAY AHEAD MARKET

4.1 BALANCING CAPACITY ALLOCATIONS

In parallel with the implementation of new DA ID CCM, the Baltic TSOs shall establish common Baltic capacity market for FCR, aFRR and mFRR reserves. As a result of common procurement of given reserves, the Baltic TSOs foresee the need to allocate cross-border capacities of Baltic TSO internal AC cross-border for the exchange and sharing of FRR (aFRR and mFRR) capacities to ensure access of necessary balancing capacities to each Baltic TSO. The capacity allocated for the exchange of balancing capacity and sharing of reserves is determined in accordance with the applicable methodology according to Electricity Balancing Guideline (EBGL) article 38. Cross-zonal capacity in the Baltic CCR is expected to be allocated for the exchange of balancing capacity and sharing of reserves either according to the market-based allocation process (described in EBGL article 41) or the co-optimized process (described in EBGL article 40). In 2025, the market-based process is implemented in the Baltic CCR. The timeline of replacing the market-based process with the co-optimized one is not known and related to significant uncertainty.

The market-based process according to EBGL article 41 allocate cross-zonal capacity to the exchange of balancing capacity and sharing of reserves by comparing the actual value of allocating capacity for balancing capacity with the forecast value of giving the capacity for the day-ahead market and maximising the actual welfare of the balancing capacity market and the forecast welfare for the day-ahead market. The co-optimized process allocates cross-zonal capacity for both balancing capacity and the day-ahead market by comparing the actual value of allocating capacity for balancing capacity with the actual value of giving the capacity for the day-ahead market and maximising the relevant social welfare.

The allocation of balancing capacity affects the capacity that can be given to the day-ahead and intraday markets. The abbreviation of the allocation of balancing capacity in the developed Baltic DA ID CCM is AABC (Already Allocated Balancing Capacity). The available capacity for the day-ahead is calculated by subtracting the AABC from the calculated NTC. Following is a generic example where the ATC (Available Transfer Capacity) is calculated for the direction from area A to area B:

$$ATC_{DA,\ A>B} = NTC_{A>B} - AABC_{A>B};$$

This follows the same principle how intraday capacities are calculated – by taking into account the previous markets allocations. The ATC for intraday from area A to B can be calculated as follows:

$$ATC_{ID\ A>B} = NTC_{ID\ A>B} - AABC_{A>B} - AAC_{A>B} + AAC_{B>A}$$

For the intraday the day-ahead allocations need to be taken into account in both directions to reflect the final ATC. This cannot be applied for AABC, as the AABC becomes available only for the balancing timeframe and cannot be netted in previous market timeframes.

Additional provision in DA/ID CCM NTC calculation procedures is added regarding active power reserves. These reserves shall maintain Baltic electrical system's operational security and normal operational state according to SOGL Article 18(c). Therefore, if there is threat to system's operational security identified after contingency analysis and there are insufficient amount of active power reserves as well as all other non-costly measures are exploited, it is foreseen that

TSOs can limit capacities for day ahead and intraday markets on Baltic internal AC interconnections to ensure operational security.

4.2 LONG TERM CAPACITY ALLOCATIONS

Baltic CCR TSOs do not have any long-term physical allocation processes developed for Baltic CCR cross-border capacities. Relevant Baltic CCR TSOs have set up financial transmission rights on EE-FI and EE-LV cross-borders, but the financial transmission rights do not allocate any physical capacities and do not affect any following market timeframes.

5 LITHUANIA – SWEDEN AND ESTONIA – FINDLAND CROSS BORDERS CAPACITY CALCULATION

Capacity calculation principles are aligned for both Lithuania-Sweden and Estonia-Finland cross borders. Methodology defines that ATC (available transfer capacity) values are coordinated. Proposed approach allows to introduce balancing allocations on HVDC interconnectors when coordinating final capacity available for trading. If TSOs establish balancing capacity exchange agreements according to EBGL Article 38, then it is foreseen to include these allocations in final capacity value. If such agreements are not in place, then full capacity will be given to the capacity market.

Updated Baltic DA ID CCM contains updated proposal regarding Lithuania - Sweden HVDC interconnection capacity determination. For capacities proposal from Nordic side, it is foreseen to align principles with Nordic DA ID CCM.

6 INTRADAY CAPACITY CALCULATION DIFFERENCES

Capacity calculation for intraday timeframe will be performed on D-1 (day-ahead) CGMs with included day-ahead trading results. After Baltic CCR will sever its overhead line connections with BRELL power grid and synchronize with CESA, the Baltic grid will remain as radial network, there would be no loop flow impact on any EE-LV or LV-LT cross borders. Meaning that power reserve distribution coefficients that were used in current capacity calculation in BRELL would be rendered useless. And keeping in mind that Baltic CCR grid after synchronisation with CESA will be radial, planned flow is foreseen to be equal to market flow.

In the new DA ID CCM the evaluation against actual flow is removed meaning that the capacity calculation formulas will remain consistent when calculating capacity values for either direction.

ID capacity calculation for both directions will be done according to the two formulas bellow:

$$ATC_{ID\ A>B} = NTC_{ID\ A>B} - AABC_{A>B} - AAC_{A>B} + AAC_{B>A}$$

$$ATC_{ID\ B>A} = NTC_{ID\ B>A} - AABC_{B>A} - AAC_{B>A} + AAC_{A>B}$$

It would be important to mention that the AABC included in these two formulas that is already allocated capacity for balancing market will be allocated to the positive-corresponding direction while regular AAC allocations will be allocated to both directions.

where:

$ATC_{ID\ A>B}$; $ATC_{ID\ B>A}$ – Available Transfer Capacity given to the ID electricity market in direction from areas A>B and B>A.

$NTC_{ID\ A>B}$; $NTC_{ID\ B>A}$ – coordinated Net Transmission Capacity relevant for intraday timeframe for the Cross-Border Interconnections in direction from areas A>B and B>A.

$AAC_{A>B}$; $AAC_{B>A}$ – Already Allocated Capacity for the Cross-Border Interconnections in direction from areas A>B and B>A after previous capacity allocation phases.

$AABC_{A>B}$; $AABC_{B>A}$ – Already allocated capacity for balancing market in accordance with Baltic CCR methodology for EB GL article 38 in direction from areas A>B and B>A.

7 LITHUANIA - POLAND SYNCHRONOUS CONNECTION WITH CESA CAPACITY CALCULATION

Considering circumstances, that three Baltic countries are planning synchronous operation with CESA via 400 kV overhead double circuit line between substations Ełk Bis in Poland and Alytus in Lithuania, the permitted power flow on the interface will be critical factor on which safe and reliable Baltic power system (BSPS) operation will depend. Synchronous BSPS operation via relatively weak interface with CESA imposes the need for determination of the LT-PL cross border TTC in specific way and requires in-depth stability assessment.

In the new DA ID CCM is defined, that LT-PL cross border TTC determination shall be performed by evaluating:

- static stability.
- rotor angle stability.
- voltage stability.
- frequency stability.
- small signal stability.

To define LT-PL cross border TTC, power flow limits will be calculated for each type of stabilities mentioned above. Secure grid operation shall be maintained considering all security limits according SOGL art. 25 and SOGL art. 39. LT-PL interconnection contains only one double circuit line connecting BSPS with CESA, which results in need to evaluate all operational security limits which are listed above as they have significant impact for BSPS network secure operation.

TTC limitations resulting from static stability will be based on power flow calculations by applying N-1 outages after which bus voltages and lines loading shall be maintain within permissible limits.

TTC limitation resulting from rotor angle stability criteria will be calculated by applying N-1 disturbances (including three phase symmetrical fault) with predefined clearing time and analysing behaviour of relative rotor angles among generators, if generators after fault remain in synchronous operation, then transient stability is maintained and power flow which was before the fault is acceptable from transient stability point of view.

TTC limitation resulting from voltage stability criteria will be calculated by applying N-1 disturbances (including three phase symmetrical fault) and analysing network node voltages, voltage stability is maintained if voltage doesn’t exceed critical voltage, which can lead to voltage collapse.

TTC limitation resulting from small signal stability criteria will be calculated based on small signal stability analysis. From small signal stability point of view, BSPS behaves as small power system connected by relatively weak connection to larger system. Main aspects of small signal stability analysis are to check sufficiency of the damping of inter-area oscillations. E.g. damping factor of inter-area oscillations shall be higher than defined minimum damping limits. TTC values should ensure safe power transfers in the interconnector in case of N-1 situation. Any sudden power imbalance in BSPS during synchronous operation with CESA will result in changed power flow on the interface, due to instantaneous inertial response of the CESA system and FCR response of the synchronous machines. For the conditions in which:

- BSPS export power to CESA and there is outage of power demand within BSPS (including HVDC link operating in direction to Nordics), or
- BSPS import power from CESA and there is outage of power infeed within BSPS (including HVDC link operating in direction to BSPS or synchronous generator),

power transfer on the interface will be increased. As pointed above, the increased power transfer after any of the disconnections mentioned above, should not exceed the safe transfer limits from small signal stability point of view. Therefore, TTC values for relevant direction shall be defined by applying the following approach:

- power flow limit based on small signal stability criteria in direction to Lithuania shall be calculated considering security limits based on small signal stability criteria and possible loss of biggest infeed in BSPS,
- Power flow limit based on small signal stability criteria in direction to Poland shall be calculated considering security limits based on small signal stability criteria and possible loss of biggest demand in BSPS.

Reliable and robust small signal stability analysis is time consuming and challenging proper power flow and dynamic models of the entire synchronous area are required. Preparation of such a model for certain time horizon is demanding, as it means collecting and adjusting data from different sources, model fine-tuning and validation. Therefore, calculation from small signal stability perspective will be not calculated on daily basis. For capacity calculation process small signal stability limits calculated during BSPS synchronization with CESA studies will be applied. Future recalculation of small signal stability limits will be performed after significant structural changes in BSPS or neighbouring power systems of CESA.

TTC limitations resulting from frequency stability will be based on calculations assessing transition of BSPS to island operation, i.e. after tripping of the Ełk Bis – Alytus double circuit line (Interface). Any physical flow on this interface, when disconnected, will cause imbalance in BSPS and frequency deviation. Main task of frequency stability analysis is to identify biggest possible imbalance of BSPS, which can not endanger frequency stability. After tripping of Interface imbalance of BSPS shall not cause:

- disconnection of the demand, due to underfrequency (in case if Interface trips and flow direction is from Poland to Lithuania).
- disconnection of the generation modules, due to over frequency (in case if Interface trips and flow direction is from Lithuania to Poland).
- exceedance of Rate of Change of Frequency (RoCoF) 1Hz/s (to avoid miss operation of automatic demand disconnection relays in case if Interface trips and flow direction is from Poland to Lithuania).

Frequency stability analysis for calculation of biggest possible imbalance of BSPS calculation will be performed on daily basis during DA and ID capacity calculation process considering the following assumptions:

1. biggest possible imbalances of BSPS shall not exceed frequency stability limits. Stability parameters that will be considered:
    a. RoCoF (1 Hz/s),
    b. zenith (max predefined value of frequency)
    c. nadir (min predefined value of frequency).
2. following system resources impacting frequency response will be evaluated:
    a. free control capacities of HVDC links,
    b. free control capacities of battery energy storage systems,
    c. free control capacity of FCR resources,
    d. frequency depending demand characteristic,
    e. system inertia.

Defined biggest possible imbalances in accordance with assumption provided above will be set as TTC values from frequency stability point of view (biggest possible surplus of BSPS will be set as TTC from LT to PL and biggest possible deficit of BSPS will be set as TTC from LT to PL)

TTC for LT-PL cross border shall be the minimum of TTC's calculated based on static, transient, oscillatory and frequency stability criteria. NTC will be determined by taking into account TRM as described in paragraph 3.2.

It's important to notice, that for TTC based on frequency stability calculation most impacting factor is active power resources which in case of frequency deviation can be activated automatically within 1 s. Such high activation ramping speed can be achieved only by battery energy storage systems (BESS) and HVDC links. Taking into account that HVDC capacity can be used by DA and ID market main system resources to ensure frequency stability is BESS. Due to fact, that currently in BSPS is installed quite low amount of BESS (about 200 MW) TTC based on frequency stability criteria will by most limiting factor for LT-PL cross border TTC calculation.

8 IMPLEMENTATION TIMESCALE

Baltic DA ID CCM is updated considering changes due to Baltic TSOs synchronisation with CESA. This new methodology will replace operational agreements with third countries regarding capacity calculation and secure grid operation. Therefore, CACM Regulation based methodology is foreseen to be fully implemented in order to have legal framework for capacity calculation rules and terminating any existing rules with third countries. Because of this, Baltic DA ID CCM is foreseen to be implemented by the moment Baltic states TSOs are synchronised with CESA.

9 ANNEX 1 – PUBLIC CONSULTATION RESPONSES

Orgnanization	Question	TSO comment
-	8.1. TSOs of the Baltic CCR shall provide to the Capacity Calculator before a certain deadline commonly agreed and coordinated between the TSOs and the Capacity Calculator the following inputs for TTC calculation: • Available power reserves. In this section it is not clear what should be considered. Available power reserves are reserves that are procured by each TSO in each area, or total available reserves of Baltic region (generators that have readiness documents for providing balancing services to TSO)?	Information about reserves amount is needed in capacity calculation to determine maximum possible HVDC links setpoints. This point was foreseen to make sure that Capacity Calculator would correctly identify available reserves amounts and determine maximum HVDC links output. To determine HVDC link capacity total available power reserve amount is needed. Procurement of power reserves will be organized through Baltic Balancing Platform which will be established in 2025. Platform will give output about total available reserves amount in Baltic region as well as reserves available in each TSO control area.
-	12 TRANSMISSION RELIABILITY MARGIN (TRM) CALCULATION METHODOLOGY OF AC CROSS-BORDERS INTERCONNECTORS IN BALTIC TSO'S CONTROL AREA Xi - data sets of the i-th element, defined as deviation of planned power flow from actual power flow (actual flow subtracted from planned flow) over Cross-Border Interconnection. Please explain in detail what is the view of "actual flow" and "planned flow". - Does the balancing energy activation and exchange via border is eliminated from actual flow? If no, please explain why	Balancing energy of aFRR and mFRR activation and exchange via border is included in planned flow. Imbalance netting in Baltic control area is considered in planned flow. Balancing energy and imbalance netting are intended flow by Balancing platforms (MARI and PICASO) and can be taken into account as planned flows in TRM calculation.

	- Does the imbalance netting in Baltic control area is considered calculating actual flow? if no, please explain why.	
-	**17 TOTAL TRANSFER CAPACITY (TTC) CALCULATION FOR LITHUANIAN - POLAND AC CROSS-BORDER INTERCONNECTOR** TTC1(PL>LT); TTC1(LT>PL) – small signal stability limit with N-1 line outages evaluation in directions to PL>LT and LT>PL. Please explain what "small signal stability limit" is and why PL-LT connection is considered as weak one that this stability limit is being considered?	Small signal stability limits mean, that due to synchronous network topology there is limitation to transmit/receive active power from Continental Europe to /from Baltic PS. In case of exceeding small signal stability limits Baltic PS generators can start oscillating against rest of continental Europe generators with frequency (0,3-0,6 Hz). Small signal stability criteria shall be evaluated for PL-LT connection, because this is interface of Baltic PS with Continental Europe
-	**19 INTRADAY AVAILABLE TRANSMISSION CAPACITY CALCULATION BETWEEN LITHUANIAN AND POLISH POWER SYSTEMS** NTC(PL>LT) - NTC between Lithuanian and Polish power systems calculated in accordance to formula (17) by taking into account actual value of TTC(PL>LT) and TTC(PL>LT)(F) (TTC(PL>LT) and TTC(PL>LT)(F) used in day ahead time frame for NTC calculation can be changed in case of changes in prognosis, topology, and in maintenance plans). Please explain what are those variables TTC(PL>LT)(F) and TTC(PL>LT)(F) are. They are used in the text, but nowhere in the calculations.	Answer: ID ATC value is calculated according to formula 19: $ATC_{PL>LT} = \underline{\mathbf{NTC_{(PL>LT)}}} - AAC_{(PL>LT)} + AAC_{(LT>PL)}$ Where $\underline{\mathbf{NTC_{(PL>LT)}}}$ is calculated according to formula 17: $NTC_{(PL>LT)} = \underline{\mathbf{TTC_{(PL>LT)}}} - TRM_{(PL>LT)}$ Where $\underline{\mathbf{TTC_{(PL>LT)}}}$ is calculated according to formula 15: $TTC_{PL>LT} = \min(PL\ TTC_{SS(PL>LT)};\ LT\ TTC_{SS(PL>LT)};\ \underline{\mathbf{TTC_{(PL>LT)(F)}}})$ Where $\mathbf{TTC_{(PL>LT)(F)}}$ is one of the evaluated parameters to determine TTC value. $\mathbf{TTC_{(PL>LT)(F)}}$ - TTC of Lithuania-Poland Cross-Border interconnection in direction

		to Lithuania calculated by Lithuanian TSO considering frequency stability limits as in **Error! Reference source not found.**. Both explanations for $\mathbf{TTC}_{(PL>LT)(F)}$ and $\mathbf{TTC}_{(LT>PL)(F)}$ are under formulas 15 and 16. These values are determined for each capacity direction. Paragraph 17.2.4 lists out multiple parameters which influence $\mathbf{TTC}_{(PL>LT)(F)}$ value. According to formula 15, the minimum value of three constituents determines the final TTC.
LATVENERGO	**1. Methodology lacks transparency on TTC and NTC values.** Without knowing at least the range of likely TTC values, it is impossible to understand the values of NTC. Lack of information to market participants on expected values means higher risks, which ends up with higher supply costs to consumers.	For the TTC's calculation is necessary to dispose of network model and planning balance data. Network data is available only for TSO's and it's mean, that only TSO's can calculate TTC's values. TSO's is obliged to provide NTC's values for one year perspective and this information is available for market participants.
LATVENERGO	**2. Methodology lacks transparency on the effect of the remedial TSOs actions on TTC and NTC values.** Although methodology states that non-costly remedial actions shall be fully exploited by the TSOs, it is not clear what effect those actions may have on TTC and NTC values. In addition, it is unclear what kind of costly remedial actions will be employed by the TSO to increase the cross-border transfer capacities.	Examples of non-costly remedial actions are: shunt reactors connection/disconnection, line's connection/disconnection to reserve, topology variations. Costly remedial action example is HVDC emergency power control application. Remedial actions are used to alleviate constraint on network elements which affect TTC, and elimination of constraint would result in increased TTC values. Network elements constraint situations are highly dependent on grid topology, prognosis for system load and it's distribution and system generation distribution. Therefore, each constraint situation is unique, and it is impossible to identify in general case how remedial actions impact TTC values. Therefore, it

		is foreseen that TTC will be evaluated daily by taking into account latest available data and prognosis on grid topology situation, load schedule and other relevant system model parameters. Usage of remedial actions is individual in each case.
LATVENERGO	**3. Methodology lacks transparency on the effect of Baltic energy storage systems on TTC and NTC values.** Although methodology states that available fast frequency reserves provided by Battery energy storage systems will affect TTC and NTC values, it is not clear how those variables interact and correlate.	Fast frequency response provided by Battery energy storage plays a significant role in ensuring frequency stability after disconnection of Baltic PS from Continental Europe synchronous area. Frequency stability factor is used for TTC calculation. Main task for frequency stability evaluation is to check ability of Baltic PS to keep frequency within define range after disconnection from Continental Europe synchronous area with active power imbalance equal to power flow before disconnection. Due to the quick response (within 1 s) energy storage is the main measure capable of compensating system imbalance and to keep frequency within defined range. The maximum power flow (TTC) which is equal to biggest imbalance of Baltic PS operating in island mode is almost equal to available amount of Battery energy storage providing fast frequency response.

IGNITIS	1. **Methodology is not compliant with Regulation 2019/943.** Even though Regulation 2019/943 clearly states that commercial electricity flows resulting from cross-border trade must correspond to at least 70% of the maximum thermal capacity of the respective limiting network element, this threshold obviously will not be reached. Upgraded LitPol Link is one of the most powerful network elements in the region (its switchyard contains three 410/345/10.5 kV, 600 MW autotransformers which are the most powerful in the Baltic countries), however, according to the information provided by Lithuanian TSO during a webinar, it seems that only a minor fraction of all available LitPol Link capacity will be allocated for market trading (only about 150 MW).	According to Regulation 2019/943 (Article 8a) minimum capacity shall be 70 % of the transmission capacity respecting operational security limits, but not thermal capacity limits as you stated in the comment. For LT-PL interconnection security limits are defined taking into account different stability criteria (small signal stability, frequency stability, rotor angle stability) in most cases TTC calculation security limits will be defined by ensuring frequency stability and this fact influence low TTC and accordingly NTC values.
IGNITIS	2. **Methodology lacks transparency on TTC and NTC values.** Although it is clear that TRM values are equal to 50 MW, but the TTC values are unknown. Without knowing at least the range of likely TTC values, it is impossible to understand the values of NTC. In addition, market participants do not have information related to CGM and the influence of critical network elements on TTC values; therefore, to ensure greater transparency of the methodology and comprehensibility of the calculation results, please provide several examples of marginal TTC calculations in the explanatory note of the methodology.	TTC is Total Transfer Capacity and is highly dependent on grid topology, prognosis for system load and it’s distribution and system generation amount and distribution. TTC calculation is an activity performed using CGM (common grid model) – electrical system grid model, representing system data and parameters. TTC is maximum power flow value on Cross-Border between two bidding zone areas resulted from modelling net position variation and contingency analysis. TTC value is obtained by summing up power flow values of cross-border lines above 110 kV after Operational Security or stability limits reached for any CNE while modelling net position increase in exporting area and decrease in importing area and performing N-1 contingency analysis. Therefore, it is foreseen to evaluate TTC daily considering latest available electrical system data. CGM is not disclosed publicly as it is confidential information. Therefore,

		comprehensive examples of TTC calculation cannot be disclosed.
IGNITIS	3. **Methodology lacks transparency on the effect of the remedial TSOs actions on TTC and NTC values.** Although methodology states that non-costly remedial actions shall be fully exploited by the TSOs, it is not clear what effect those actions may have on TTC and NTC values. Please provide the list, possible amounts in MW and impact values in MW of these different non-costly remedial actions to the TTC values on each cross border, especially on the Lithuania – Poland cross border interconnection in the explanatory document. Also, it is unclear what kind of costly remedial actions will be employed by the TSO to increase the cross-border transfer capacities.	Examples of non-costly remedial actions are: shunt reactors connection/disconnection, line's connection/disconnection to reserve, topology variations. Costly remedial action example is HVDC emergency power control application. Remedial actions are used to alleviate constraint on network elements which affect TTC, and elimination of constraint would result in increased TTC values. Network elements constraint situations are highly dependent on grid topology, prognosis for system load and it's distribution and system generation distribution. Therefore, each constraint situation is unique, and it is impossible to identify in general case how remedial actions impact TTC values. Therefore, it is foreseen that TTC will be evaluated daily by taking into account latest available data and prognosis on grid topology situation, load schedule and other relevant system model parameters. Usage of remedial actions is individual in each case.

IGNITIS	4. **Methodology lacks transparency on the effect of Baltic energy storage systems on TTC and NTC values.** Although methodology states that available fast frequency reserves provided by Battery energy storage systems (BESS) will impact TTC and NTC values on Lithuania-Poland cross border, it is not clear how those variables interact and correlate. Please provide more detailed information on the relationship between BESS sizes and the TTC/NTC values on Lithuania-Poland interconnector in the explanatory document.	Fast frequency response provided by Battery energy storage plays a significant role for ensuring frequency stability after disconnection of Baltic PS from Continental Europe synchronous area. Frequency stability factor is used for TTC calculation. Main task for frequency stability evaluation is to check ability of Baltic PS to keep frequency within define range after disconnection from Continental Europe synchronous area with active power imbalance equal to power flow before disconnection. Due to the quick response (within 1 s) Battery energy storage is the main measure capable of compensating system imbalance and to keep frequency within defined range. The maximum power flow (TTC) which is equal to biggest imbalance of Baltic PS operating in island mode is almost equal to available amount of Battery energy storage providing fast frequency response.
IGNITIS	5. **Methodology treats double circuit LitPol Link interconnector as a single circuit line.** Methodology states that the Lithuanian-Polish cross border interface is „relatively weak“ and treats double circuit LitPol Link interconnector in a same manner as other single circuit lines. However, double circuit lines are more reliable that single circuit lines. The disconnection of one of the two circuits does not mean that the other circuit will also be disconnected.	Lithuanian-Polish cross border interconnection is one double circuit line (two lines on the same tower). This is only one synchronous Baltic electrical system connection to continental Europe's electrical grid. This connection has significant importance as it enables power transfer as well as frequency and balance support from continental Europe's. Disconnection of this interface means that Baltic region should remain in stable grid operation by maintaining system frequency, dynamic stability and system balance control. Because of that, it is foreseen to evaluate Lithuanian-Polish cross border capacity (TTC) considering these parameters. According to COMMISSION REGULATION (EU) 2017/1485 of 2 August 2017 establishing a guideline on

		electricity transmission system operation (SOGL) article 18 and article 33.1 this interface is treated as an exceptional contingency which is considered during system security analysis in order to maintain normal Baltic system state.
Eesti Energia AS	**The document lacks transparency and information and is therefore not in line with the principles and objectives stipulated in Commission Regulation 2015/1222 Article 3.** 1) Chapters 13 and 14 of this document cover the trading capacity calculation for day ahead and intraday markets for internal Baltic AC interconnectors. As the Baltic TSOs are pursuing for unprecedented 50-70% cross-zonal capacity allocation for balancing reserves, which we are clearly against of, then this document should at least include information about that and also an evaluation of socioeconomic effects of such actions. We can only agree with the current wording if the AABC, already allocated balancing capacity, is coherent with the principles of EBGL Article 41, which states that cross-zonal capacity allocated on a market-based process shall be limited to 10 % of the available capacity for the exchange of energy.	In the Methodology define only principals how allocated capacity for balancing market shall be evaluated in the NTC calculation. All principals related to allocation of capacity for balancing capacity market will be defined in the “Methodology for the market-based allocation process of cross-zonal capacity for the exchange of balancing capacity for the Baltic CCR”. For more details concerning principles for applying the market-based allocation process of cross-zonal capacity for the exchange of balancing capacity or sharing of reserves please see ”DECISION No 10/2021 OF THE EUROPEAN UNION AGENCY FOR THE COOPERATION OF ENERGY REGULATORS of 13 August 2021 on the market-based allocation process of cross-zonal capacity for the exchange of balancing capacity for the Baltic CCR”

Eesti Energia AS	2) It remains unclear, which methodology is planned to be used for LitPol Link trading capacity calculation. Whether it is according to Chapters 18 and 19 or whether it is according Chapter 26: Appendix 1, which explains Polish TSOs approach to capacity calculation.	Both methodologies are used for capacity calculation on LitPol Link as chapters 18 and 19 refer to the operational security limits, i.e. acceptable operating boundaries for secure grid operation, and chapter 26 (Appendix 1) to the allocation constraints, i.e. constraints needed to keep the transmission system within operational security limits.
Eesti Energia AS	3) Please clarify whether the approach used by Polish TSO according to Chapter 26: Appendix 1 is also valid after the Polish balancing market reform?	Yes, approach described in chapter 26 (Appendix 1) is also valid after the Polish balancing market reform, however allocation constraints may be active less often.
Eesti Energia AS	4) As with Chapters 13 and 14, it remains unclear in Chapter 17 what is the actual TTC, total trading capacity of LitPol Link. Please provide information what are the expected numerical values for a) forecasted inertia levels in BSPS, b) available fast frequency response settings on HVDC links in BSPS, c) forecasted available fast frequency reserves amount provided by Battery Energy Storage Systems (BESS) in BSPS, d) TTC_SS considering dynamic small signal stability limits, e) TTC_1 considering small signal stability limit with N-1 line outages evaluation, f) TTC_2 without considering N-1 line outages, g) TTC_0 small signal stability limit without N-1 line outages , h) MaxInf - biggest N-1 infeed, i) MaxDem biggest N-1 dAemand.	Taking into account all criteria defined in Chapter 17 forecasted NTC values for LT-PL interconnection could be about 150 MW.

Eesti Energia AS	5) What are the fast frequency response and fast frequency reserves provided by HVDC links and Battery Energy Storage Systems? During the Baltic LFC block balancing market consultations, Baltic TSOs have repeatedly stated that only FCR, aFRR and mFRR balancing reserves are needed and will be procured from market participants after joining CESA. Now, information is given that some assets are providing fast frequency response and fast frequency reserves. This is against the principles of Directive 2019/944 Article 40 which states TSO must a) ensure non-discrimination as between system users or classes of system users, particularly in favor of its related undertakings and b) procure ancillary services from market participants. Therefore please immediately give information about when and how can a market participant provide fast frequency reserve with its assets.	Due to the technical aspects only HVDC's and Battery Energy Storage Systems can provide fast frequency response (response shall be performed within 1 s.). Currently and in the near future (in 3 years perspective) Baltic TSO's is not planning to ensure any amount of fast frequency reserve as additional ancillary services. Fast frequency response will be used only as emergency measures by using technical possibilities of HVDC's and Battery Energy Storage Systems without additional procurement from market participant. Baltic TSO's on a daily basis will forecast availability of fast frequency response from HVDC's and Battery Energy Storage Systems and will take accordingly in evaluation of frequency stability calculations.

10 ANNEX 2 – CNTC APPROACH JUSTIFICATION

Baltic CCR TSOs investigate the application of coordinated net transmission capacity (CNTC) approach in it's own CCR according to Commission Regulation (EU) 2015/1222 Article 20(7).

The Baltic CCR TSOs acknowledge the objectives of the Commission Regulation (EU) 2015/1222 on capacity allocation and congestion management which, among others, are:

- ensuring optimal use of the transmission infrastructure;
- ensuring operational security;
- optimising the calculation and allocation of cross-zonal capacity.

With this in mind, the Baltic CCR TSOs aim to implement an efficient capacity calculation process, which allows for an optimal use of the transmission infrastructure while maintaining a high level of system security.

Baltic CCR consists of two DC-connected borders between EE-FI and LT-SE4 and synchronous area connection between LT-PL and AC connections between EE-LV and LV-LT.

After Estonia. Latvia and Lithuania will exit BRELL agreement and sever it's connections with Russia, Belorussia and Kaliningrad and connects it's grid fully with Continental Europe all of the Baltic CCR interconnections will be radial. This means that there won't be any alternative paths for unscheduled flows. All flows will go directly from bidding zone A to bidding zone B without any loop flows, this will be demonstrated in further analysis.

CNTC capacity calculation approach efficiency comparison with flow-based capacity calculation approach for Baltic CCR

The strength of the flow-based approach is its ability to model the simultaneous influences of cross-border trades over several bidding-zone borders on critical grid elements in the investigated CCR, affected by several cross zonal exchanges. Particularly in highly meshed grids, like the Continental European and Nordic AC grids, this approach offers a good model on the impact of real power flows. On radial interconnections and HVDC links – the latter being fully controllable devices – however, the power flow has a predefined path across the bidding-zone border. This allows accurately calculate and evaluate cross-zonal flows as no loop flows impact is not observed for any cross-border.

Here, the flow-based capacity calculation does not yield any additional benefit compared to the CNTC approach. This is demonstrated in Figure 1.

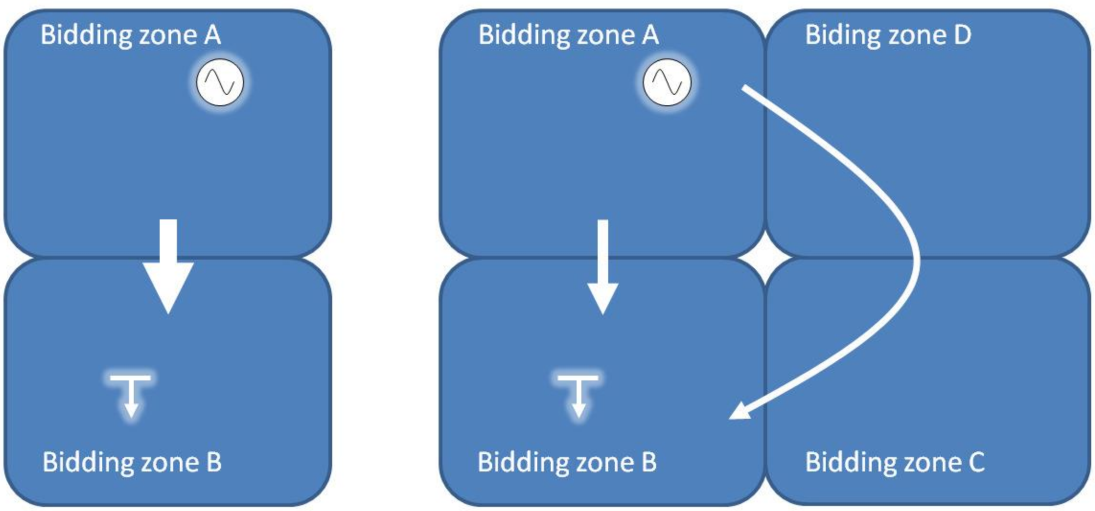

Figure 1: Radial (left) and meshed (right) bidding-zone configuration.

In Figure 1 (left), the bidding zones A and B are interconnected in a radial way. Just like the Baltic bidding-zone borders , there is a one-to-one translation from the commercial power exchange between those bidding zones into a physical cross-border flow on the lines. Translated into the flow-based parameters, this means the interconnection has a PTDF = 1. With the general flow-based equation being:

$$PTDF_{A \to B} \cdot NP_{A \to B} \leq RAM$$

The full change in net position (NP) between the bidding zones A and B fully manifests onto the capacity of the interconnection. In case there are several lines connecting the two radially connected zones, the individual PTDFs of these lines sum up to 1 in total. The same amount of power that enters the line also has to leave it again (not considering grid losses). In a setup as in Figure 1 (left), there are no synchronous interconnections to other bidding zones. Therefore, any exchanges between other bidding zones (not shown in the example of Figure 1) have a PTDF = 0 onto this interconnection. Bidding-zone borders connected by HVDC lines also have no effect on the interconnection between A and B.

In case of an NTC calculation, the NTC value between the bidding zones A and B is equivalent to the full change in net position since the full flow has to pass through the interconnection between A and B. Therefore, both methods will lead to the same results. This shows that the CNTC method is an efficient means to allocate the commercial exchanges.

In Figure 1 (right), the situation in meshed grids – like the Continental European and Nordic power systems – is depicted. A commercial exchange between the two bidding zones A and B results

in a physical flow fanning out through the meshed grid. It is exactly this behaviour that is captured by the flow-based methodology, which makes it the preferred solution in meshed grids.

Given the physical layout of the Baltic CCR , the situation of Figure 1 (right) cannot happen on the Baltic CCR bidding-zone borders. In fact, in radially connected systems, the flow-based methodology does not provide different results and therefore has not any added value compared to CNTC, as there are no alternative routes from bidding zone A to bidding zone B.

CNTC in Baltic CCR is therefore the preferred solution for the CCM in Baltic CCR.

Simple Simulation Assessment

The calculation was done based on 2025 model when Baltic CCR would connect it's network with continental Europe see Figure 2.

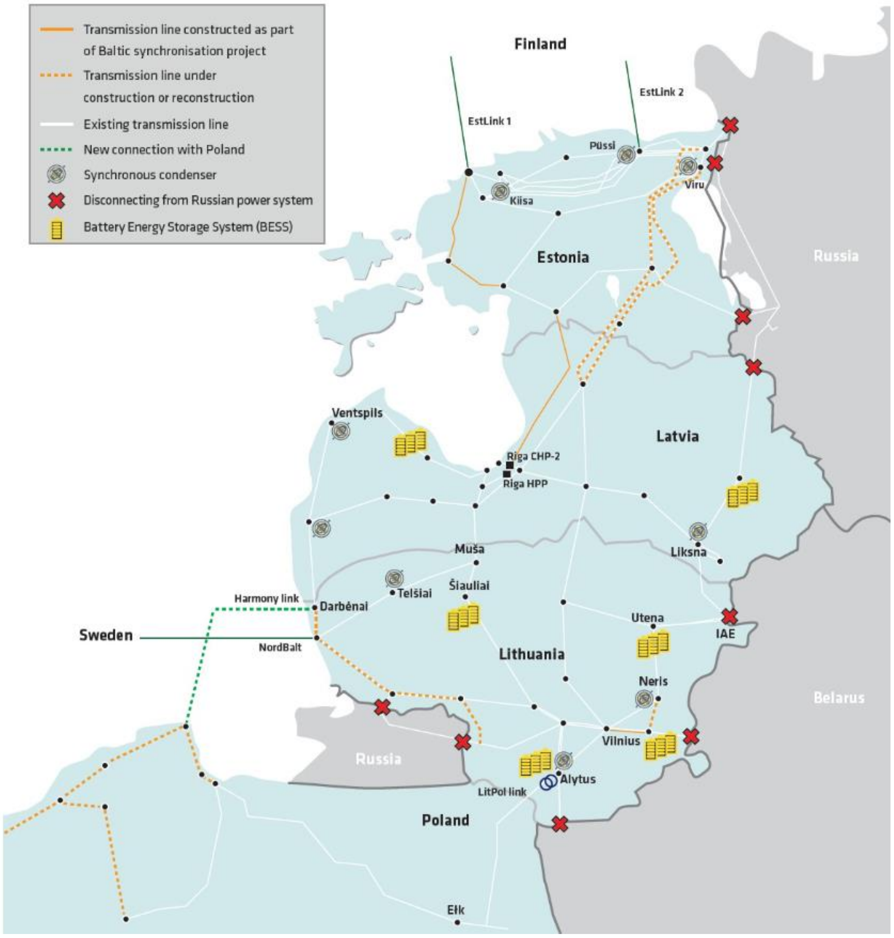

Figure 2: Baltic grid after synchronisation with Continental Europe.

Based on TSOs operational experience it is known that an outage of a given circuit will give a higher loading on a remaining parallel circuit, than an outage of a line on another tower.

The examples below assume that all lines are in service. And then contingencies between the biding zones are simulated to see how the power flows would redistribute on the remaining lines.

First on Table.1 and on Table.2 the situation between EE-LV and LV-LT bidding zones was simulated. First with no contingencies meaning all border elements are in service and after that contingencies were taken into account.

When considering one of the contingencies of Table.1 or Table.2, it can then be shown how the flow redistributes on the rest of the bidding-zone cross-border elements. From Table.1 and Table.2 it can be deducted that the total power flow across the remaining available cross-border lines when contingencies are considered stays the same keeping in mind that deviation of couple of MW can occur due to grid losses. This means that all the power flow from the disconnected line redistributes on the remaining cross-border lines. Thus, showing that all direct exchange of power flow between the two bidding zones will cross this bidding-zone border.

Table.1

EE-LV border					Sum flow on LV-LT
Contingency	Flow on Kilingi_Nomme-R.TEC-2	Flow on Tartu-Valmiera	Flow on Tsirgulina-Valmiera	Sum Flow on EE-LV	
No contingency	247.4	196.4	199.7	643.5	188.8
Kilingi_Nomme-R.TEC-2	0	391.8	248.6	640.4	188.0
Tartu-Valmiera	381.6	0	262.0	643.5	189.3
Tsirgulina-Valmiera	314.6	323.0	0	637.5	189.0

Table.2

LT-LV border						Sum flow on LV-EE
Contingency	Flow on Grobina-Klaipeda	Flow on Viskali-Musa	Flow on Liksna-Ignalinos	Flow on PL.HES-Panevezys	Sum Flow on LT-LV	
No contingency	-101.4	58.5	126.2	105.5	188.8	643.5
Grobina-Klaipeda	0	-16.5	119.5	88.8	191.8	643.5
Viskali-Musa	-70.1	0	133.8	124.00	187.8	643.5
Liksna-Ignalinos	-86.6	94.4	0	182.9	189.7	643.5
PL.HES-Panevezys	-86.5	94.6	175.4	0	183.6	643.5

On Table.3, Table.4, Table.5 the situation when generation in one bidding zone was increased by 50 MW and in the other bidding zone generation was decreased by 50 MW to see the relation of flow changes on bidding zone borders.

When generation in EE bidding zone was shifted up and generation in LV bidding zone was shifted down from Table.3 it can be deducted that the sum of bidding zone border changes by the same amount as generation shift which in this case was 50MW. Keeping in mind that deviation of couple of MW can occur due to grid losses. The same situation occurs when generation shift by 50MW is done between LV and LT bidding zones, see Table.4. And when generation shift is done in EE and LT bidding zone it can be seen from Table.5 that all the flow goes through EE-LV and LV-LT bidding-zone borders

Table.3

EE-LV border				
	Flow on Kilingi_Nomme-R.TEC-2	Flow on Tartu-Valmiera	Flow on Tsirgulina-Valmiera	Sum Flow on EE-LV
Before Gen shift	247.4	196.4	199.7	643.5
After Gen shift	267.6	209	214.8	691.4

Table.4

LT-LV border					
	Flow on Grobina-Klaipeda	Flow on Viskali-Musa	Flow on Liksna-Ignalinos	Flow on PL.HES-Panevezys	Sum Flow on LT-LV
Before Gen shift	-101.4	58.5	126.2	105.5	188.8
After Gen shift	-91.3	79.2	132.2	117.8	237.9

Table.5

EE-LV and LT-LV border					
	Flow on Kilingi_Nomme-R.TEC-2	Flow on Tartu-Valmiera	Flow on Tsirgulina-Valmiera		Sum Flow on EE-LV
Before Gen shift	247.4	196.4	199.7		643.5
After Gen shift	266.5	209.8	215.00		691.4
	Flow on Grobina-Klaipeda	Flow on Viskali-Musa	Flow on Liksna-Ignalinos	Flow on PL.HES-Panevezys	Sum Flow on LV-LT
Before Gen shift	-101.4	58.5	126.2	105.5	188.8
After Gen shift	-92.4	78.4	132.4	120	238.3

Graphical schemes of the grid

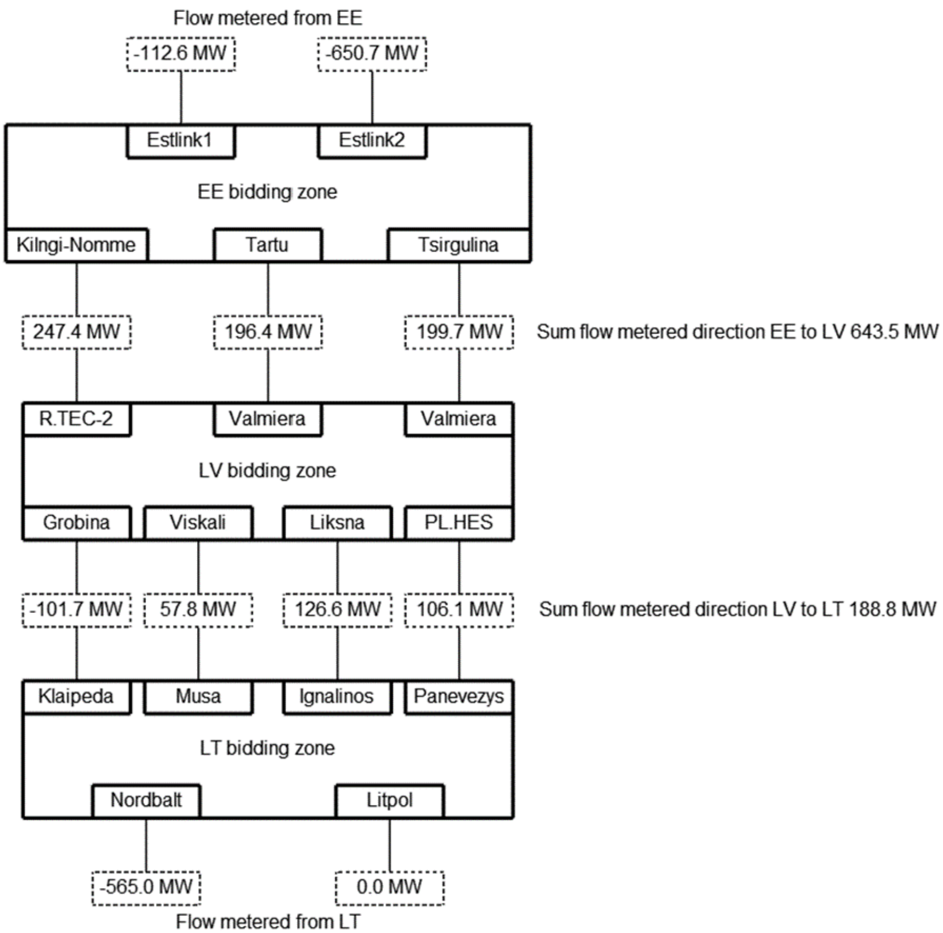

Figure 3: EE-LV border no contingency

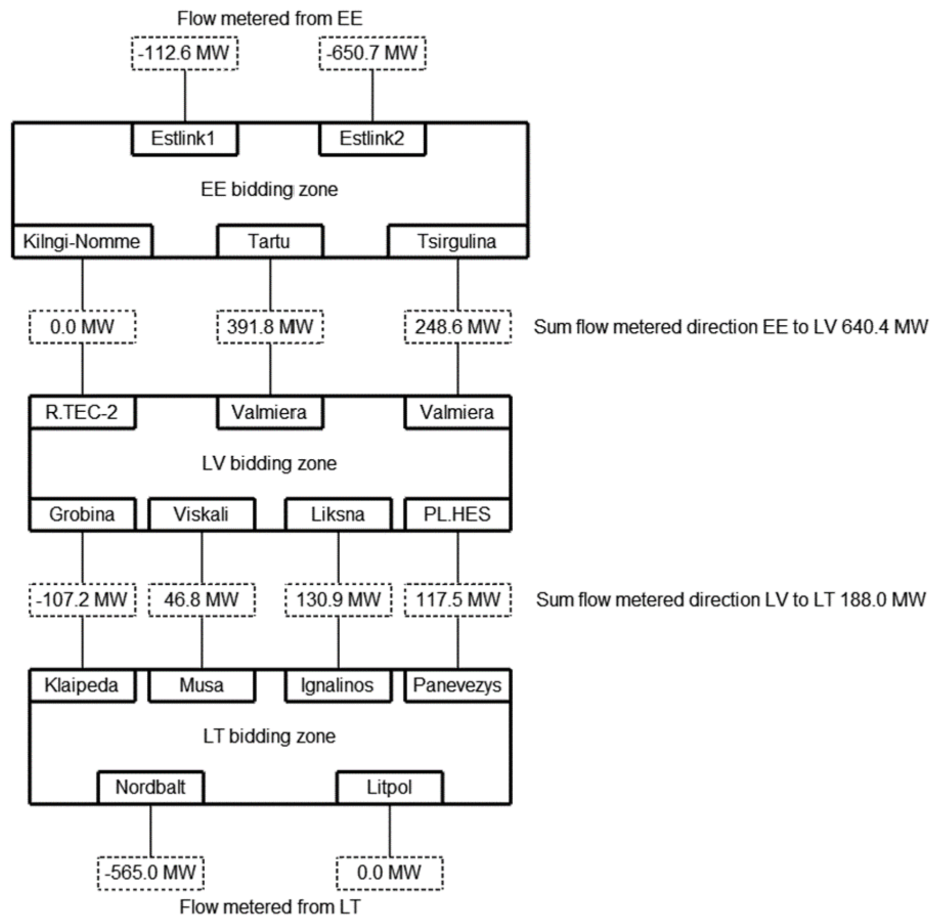

Figure 4: EE-LV border Kilingi-Nomme-R.REC-2 contingency

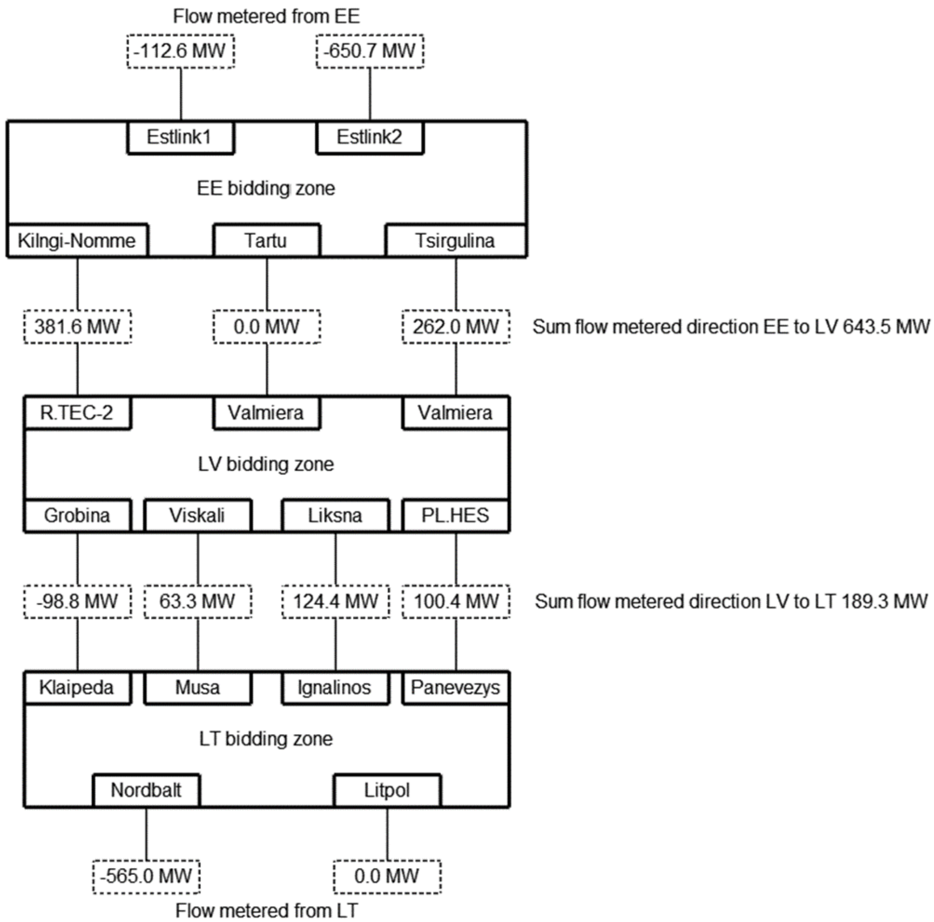

Figure 5: EE-LV border Tartu-Valmiera contingency

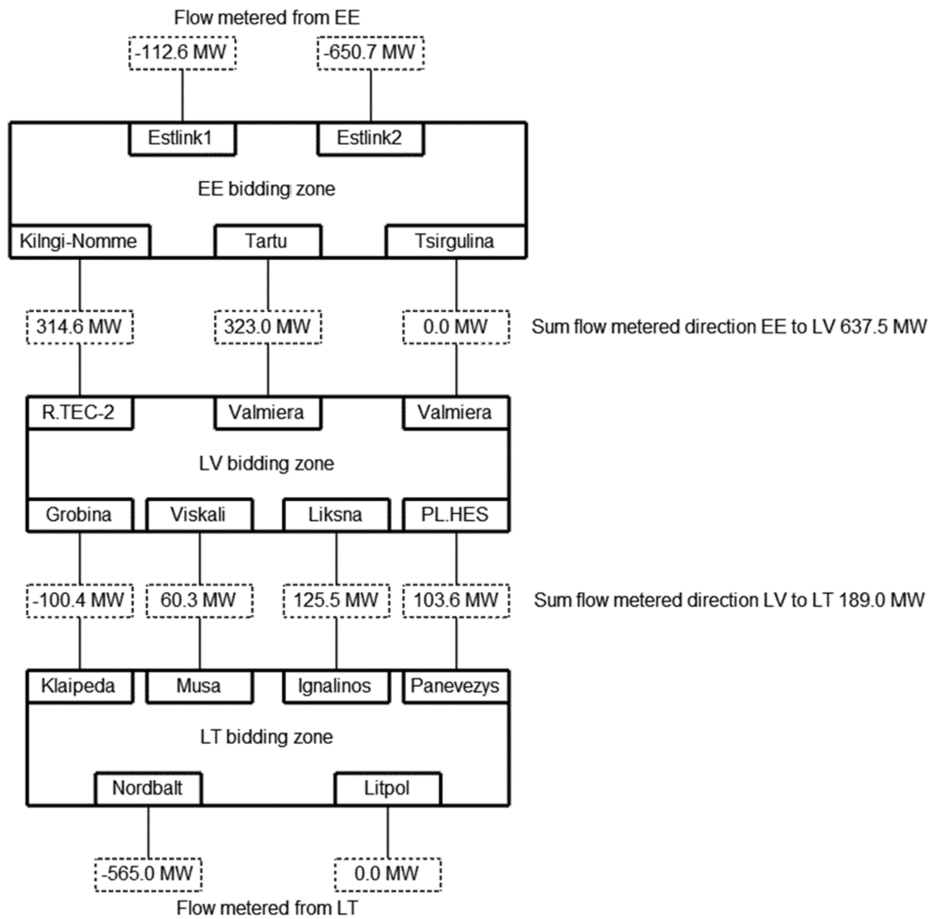

Figure 6: EE-LV border Tsirgulina-Valmiera contingency

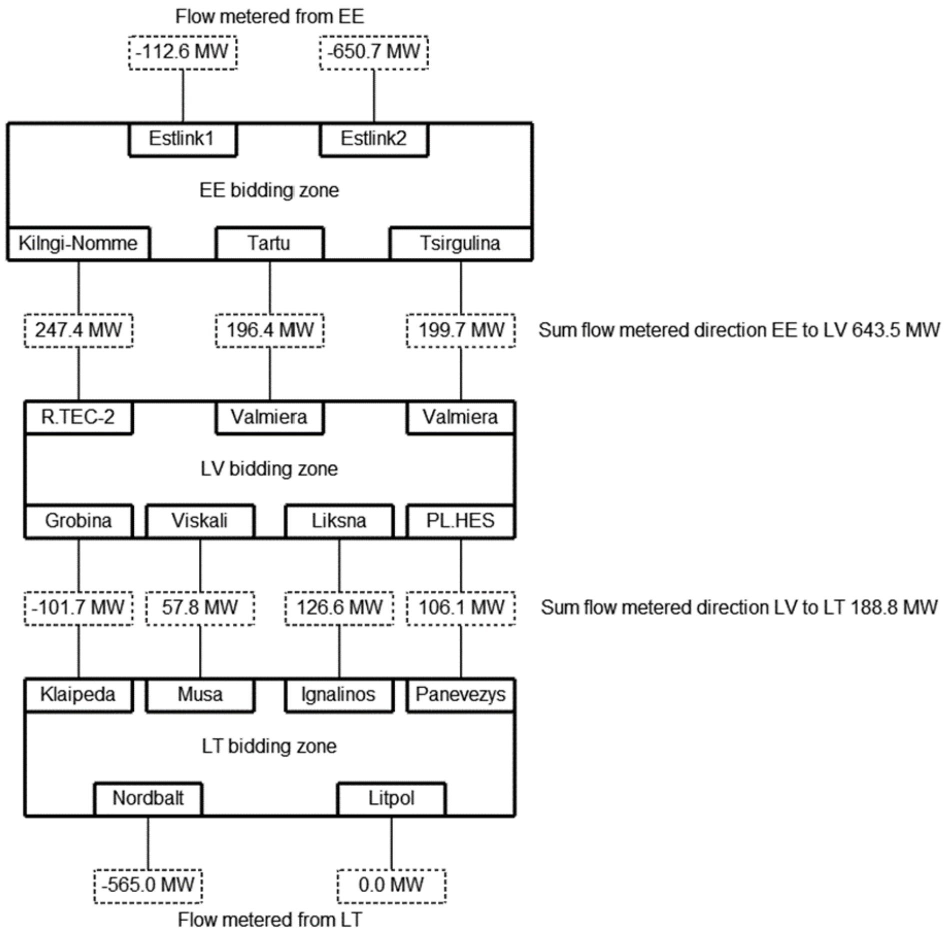

Figure 7: LT-LV border no contingency

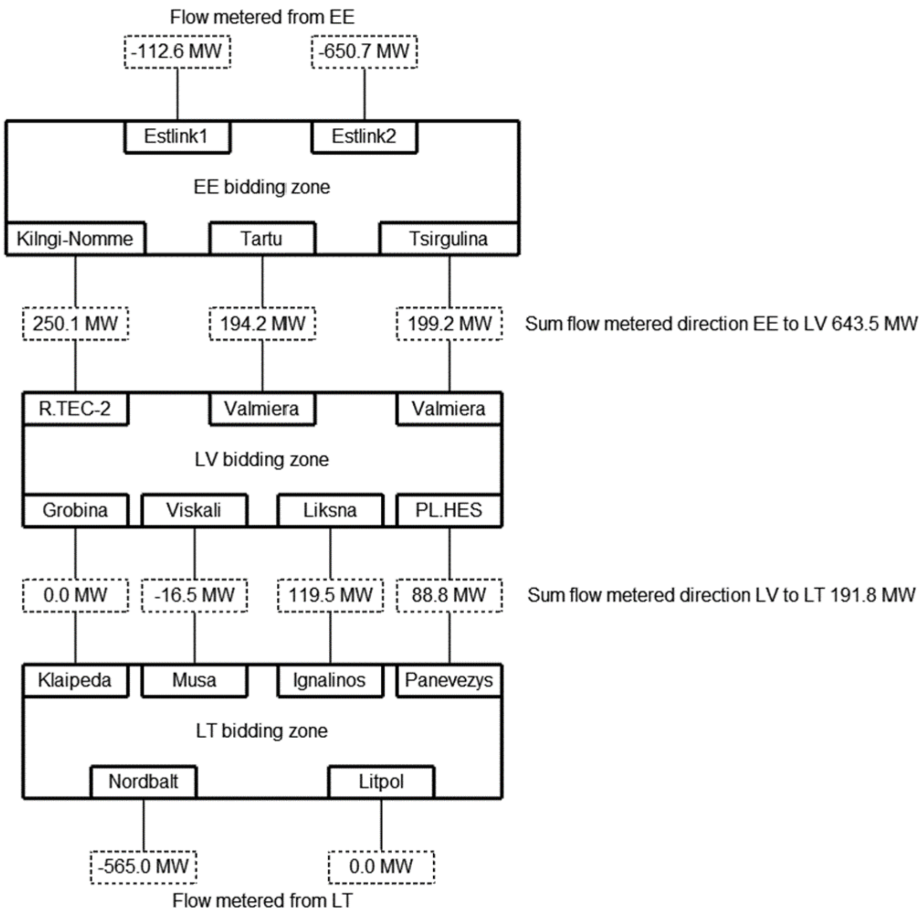

Figure 8: LT-LV border Grobina-Klaipeda contingency

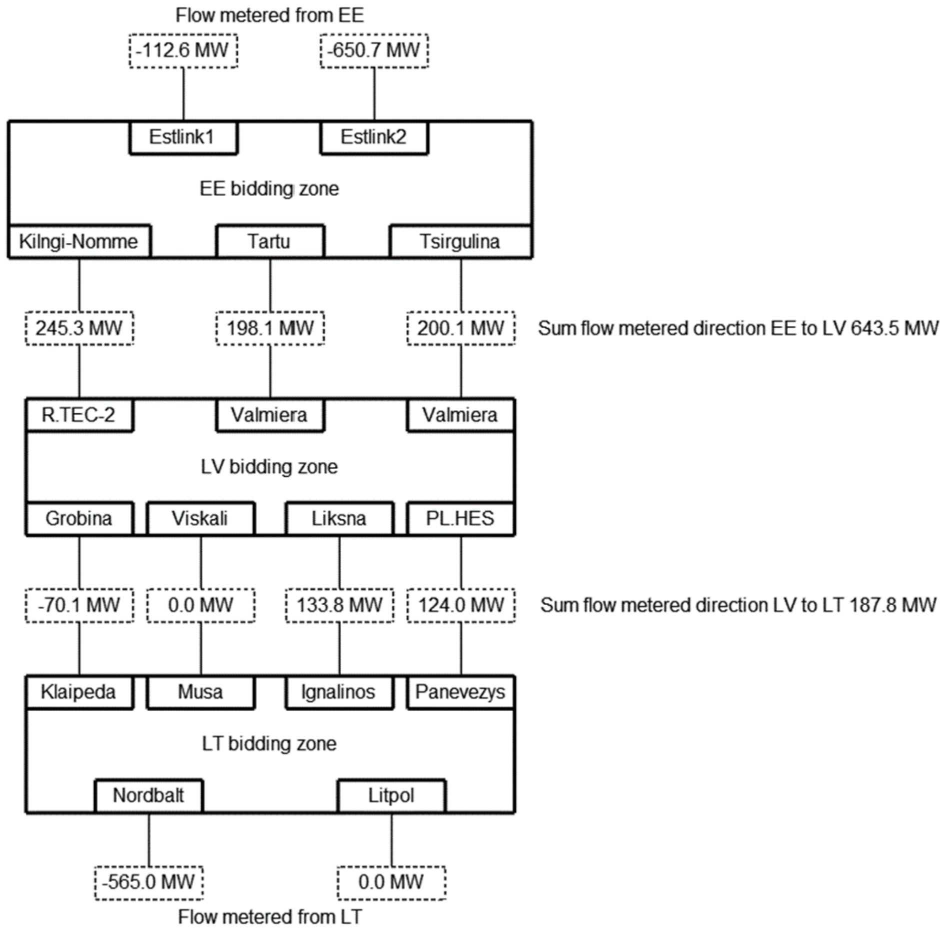

Figure 9: LT-LV border Viskali-Musa contingency

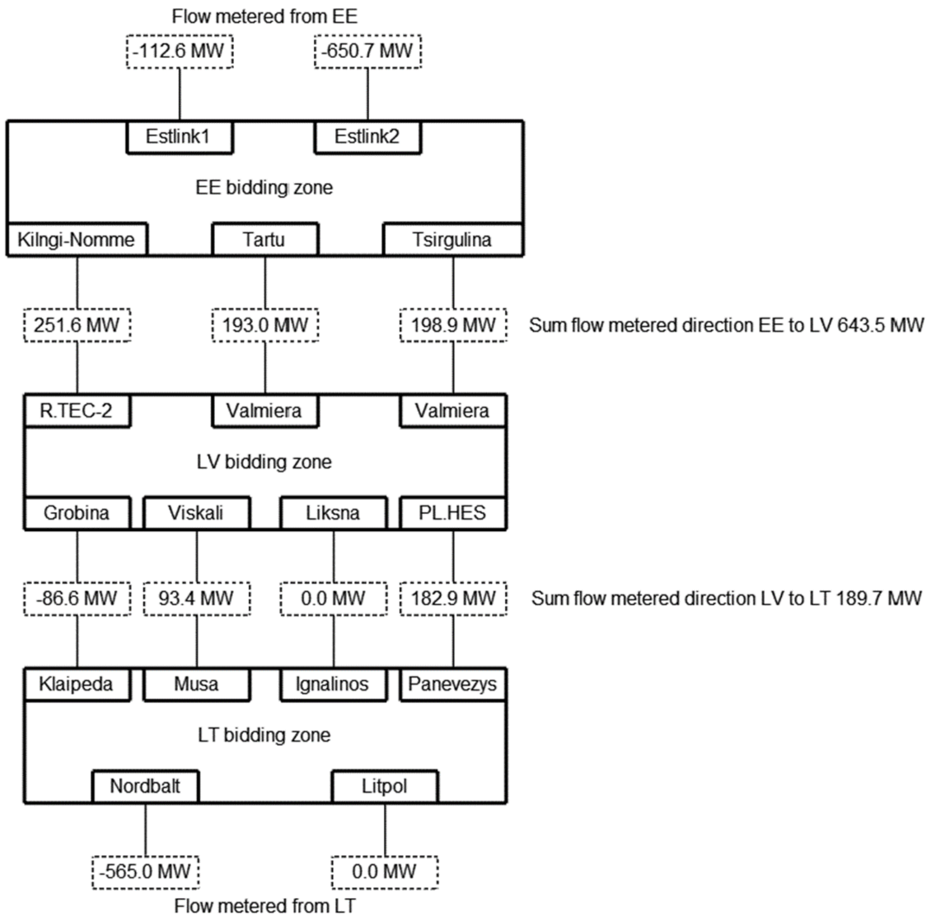

Figure 10: LT-LV border Liksna-Ignalinos contingency

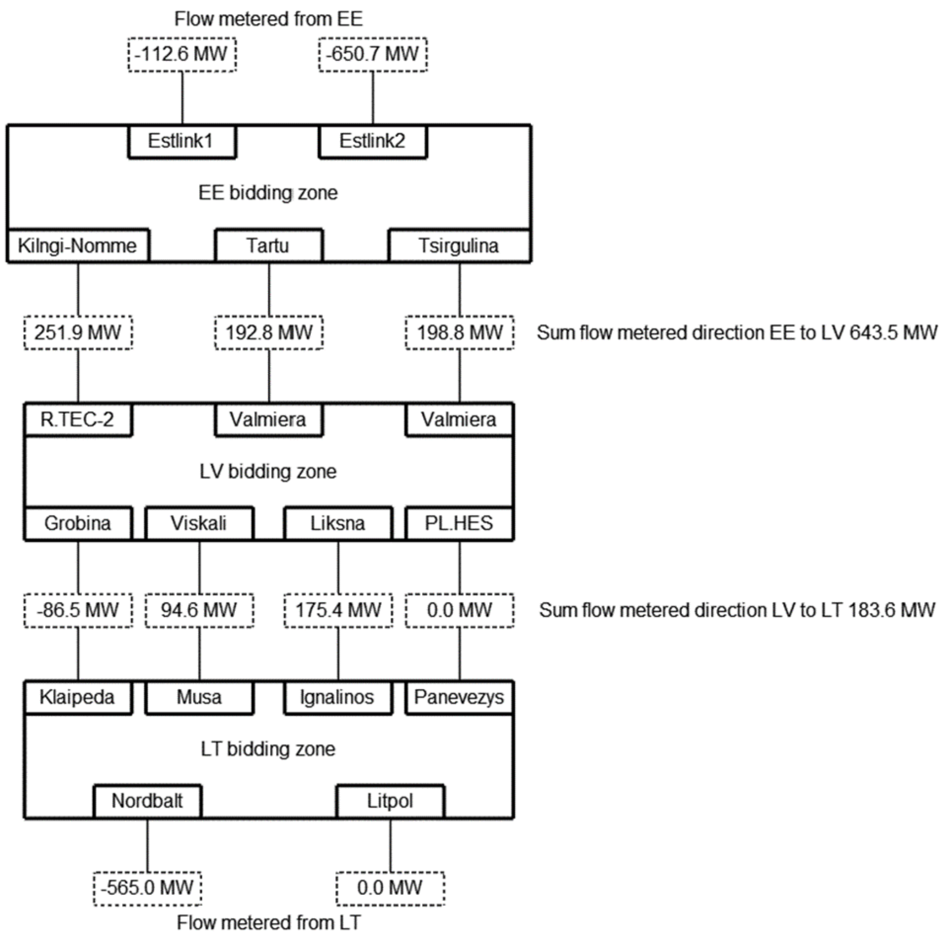

Figure 11: LT-LV border PL.HES-Panevezys contingency

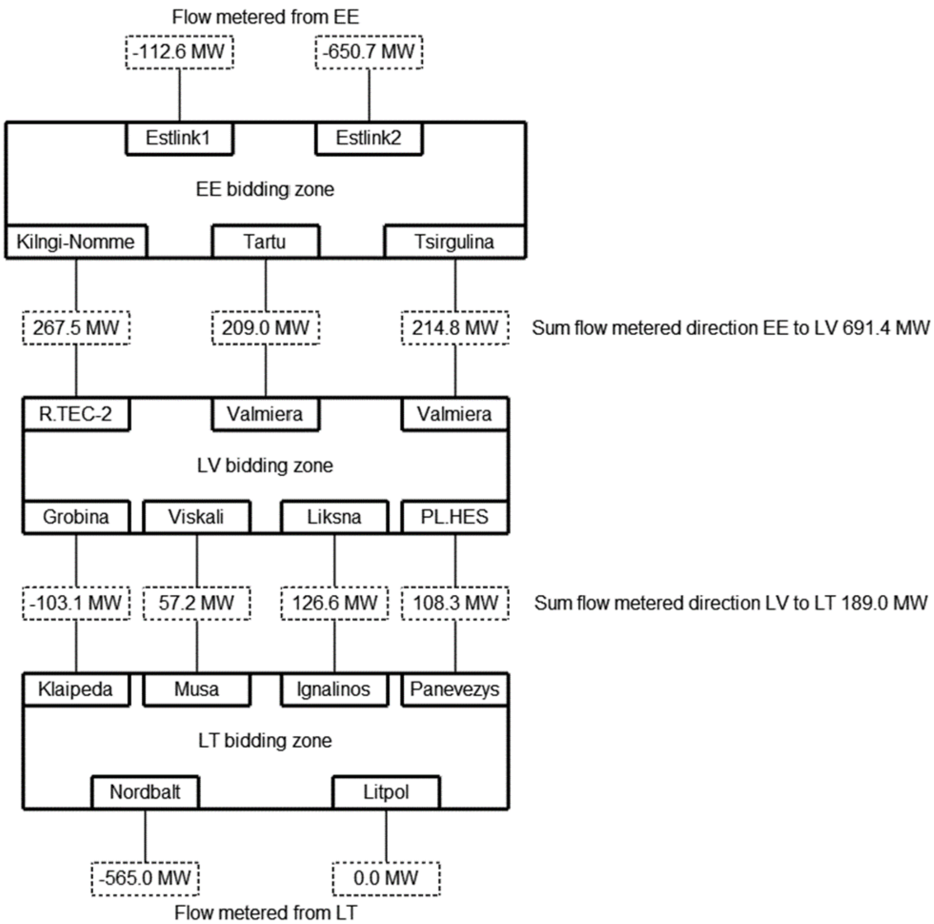

Figure 12: EE-LV border generation shift by 50 MW

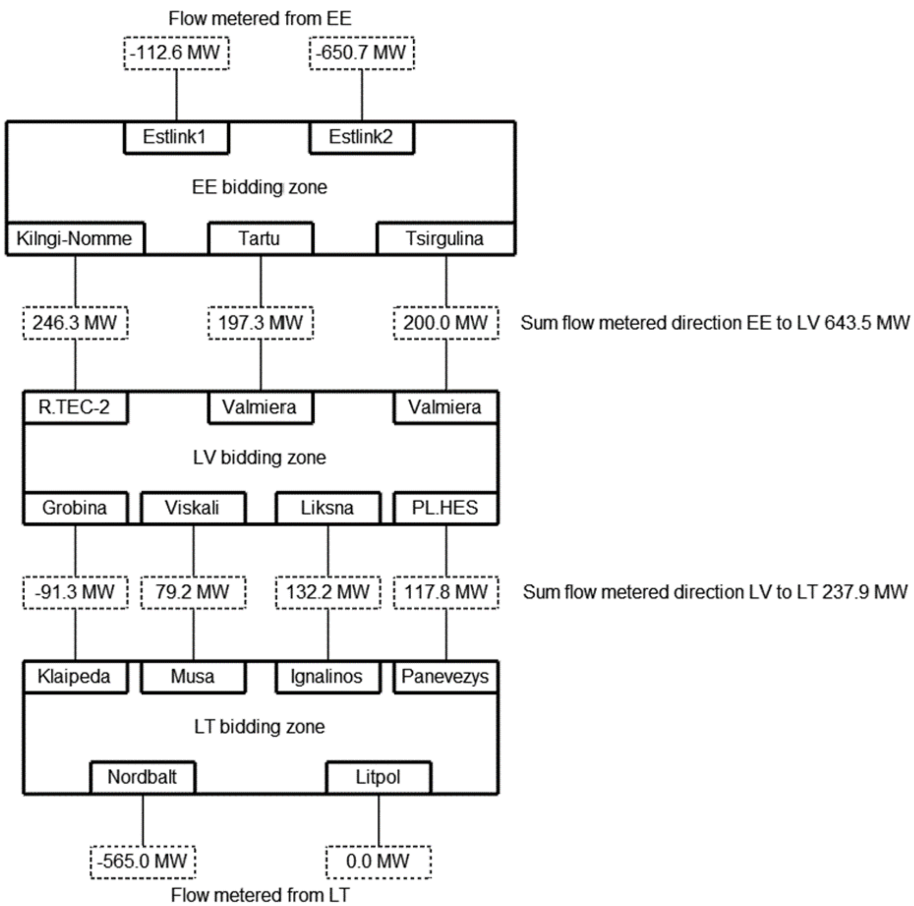

Figure 13: LT-LV border generation shift by 50 MW

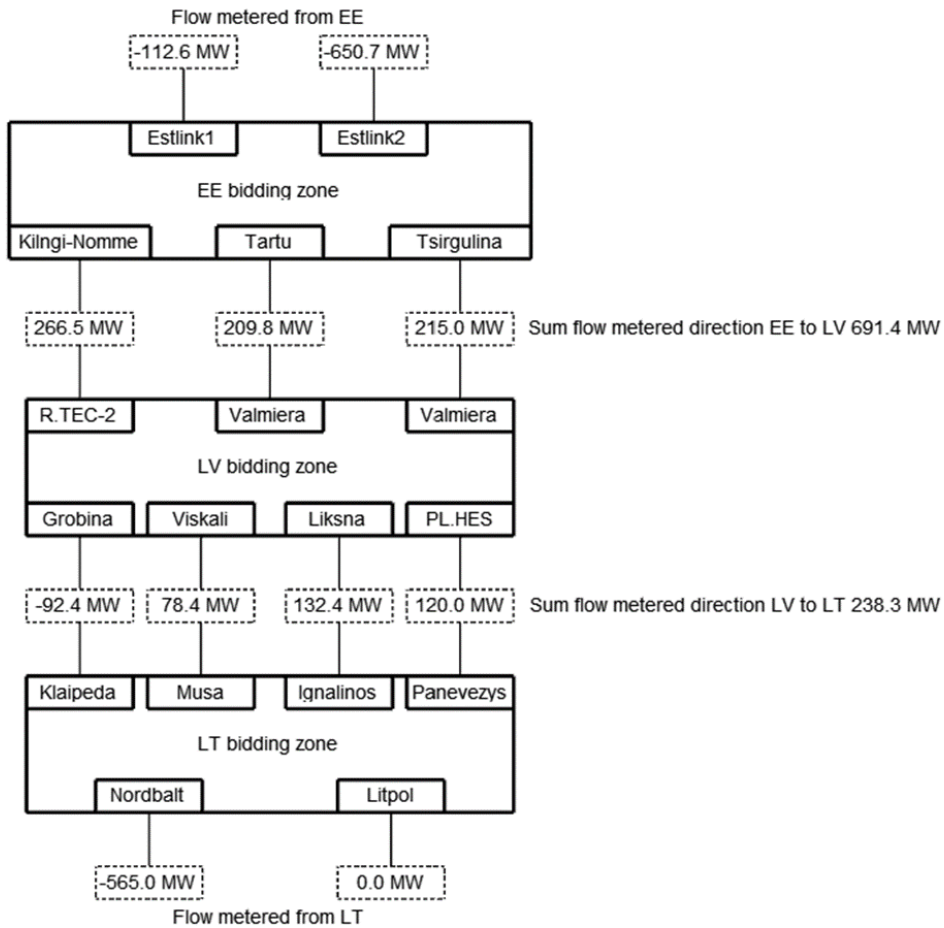

Figure 14: EE-LV-LT border generation shift by 50 MW

Conclusion

In this analysis it has been shown that power exchanges between the Baltic internal bidding zones results in power flows on only one cross-border and does not create any loop flows. Based on these results, flow-based capacity calculation approach does not offer any benefits while determining cross-zonal exchanges and capacities. Baltic CCR TSOs, in accordance with Article 20(7) of the CACM Regulation, intends to apply CNTC as it is demonstrated that a flow-based approach is not more efficient in terms of capacity calculation and allocation taking into account market perspective and operational security. And given the fact that CNTC approach has been already established in the Baltics and market participants and are being used. In case of application of flow-based approach in capacity calculation all market participants and TSOs would need to make investments to be ready with the new solution and as of no benefit is gained from FB for Baltics there is no reason to make these investments currently.