

METHODOLOGY ON CROSS-ZONAL CAPACITY CALCULATION AND ALLOCATION WITH THIRD COUNTRIES

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1. GENERAL TERMS

- 1.1. The Methodology on Cross-Zonal Capacity Calculation and Allocation with Third Countries (hereinafter referred to as “the Methodology”) is set to define:
 - 1.1.1. Rules for determination and allocation of Maximum transfer capacity and Net transfer capacity between Lithuanian energy system (hereinafter referred to as “Lithuanian ES”) and Belarusian energy system (hereinafter referred to as “Belarusian ES”);
 - 1.1.2. Rules for determination and allocation of Net transfer capacity between Lithuanian energy system and Russia (Kaliningrad Region);
- 1.2. The methodology is set to achieve the following goals:
 - 1.2.1. to ensure the operational safety of the interconnected energy systems;
 - 1.2.2. to ensure the implementation of the safeguards provided for in Paragraph 1 of Article 4 of the Republic of Lithuania Law on Necessary Measures of Protection against the Threats Posed by Unsafe Nuclear Power Plants in Third Countries, stating that access to the electricity market of the Republic of Lithuania shall not be allowed for electricity from the third countries in which unsafe nuclear power plants operate, except for electricity necessary to ensure the reliability of the electric power system of the Republic of Lithuania.
- 1.3. The methodology applies to:
 - 1.3.1. Lithuania-Belarus cross-zonal transfer capacity calculation during annual, monthly, D-2 and D-1 planning;
 - 1.3.2. Lithuania-Belarus cross-zonal transfer capacity calculation in real time;
 - 1.3.3. Lithuania-Belarus cross-zonal transfer capacity calculation during D-1 planning.
- 1.4. LITGRID is responsible for calculation and allocation of Lithuania-Belarus and Lithuania-Russia (Kaliningrad Region) cross-zonal transfer capacity.
- 1.5. The cross-zonal capacities calculated in the methodology may not be used for the import of electricity from unsafe nuclear power plants and for placing it on the electricity market.

2. DEFINITIONS

- 2.1. For the purposes of this Methodology, the following definitions shall have the following meaning:
 - BRELL Loop** - transmission grids of the power systems of the Baltic States, the Republic of Belarus and the Russian Federation (Central and North-Western parts);
 - BRELL TSOs** - TSOs operating in BRELL Loop;
 - Common Grid Model** - data set agreed between BRELL TSOs describing the main characteristic of the power system (generation, loads and grid topology) and rules for changing these characteristics during the capacity calculation process;
 - D-1** - the day prior to the day on which the energy is delivered;
 - D-2** - the day before the day prior to the day on which the energy is delivered;
 - LITGRID** - LITGRID AB, electricity transmission system operator of the Republic of Lithuania;
 - N-1 Situation** - the situation in the transmission system in which a single contingency has happened;

NTC - cross-zonal Net transfer capacity is the maximum permissible cross-zonal transfer capacity for electricity trade;

Russia (Kaliningrad Region) - the part of the Russian power system located in the Kaliningrad Region.

TSO - electricity transmission system operator;

Cross-Border Interconnection - a physical transmission link (e. g., link lines), connecting two power systems;

Technical flow - physical flow of electricity through the Lithuania-Belarus cross-border interconnection, consisting of the following components:

- a) Balancing energy bought by a TSO from other TSOs, used to compensate for the imbalance in the Baltic ES;
- b) Electricity flows between energy systems for the purpose of electricity exchange, including electricity transit, shall be carried out in accordance with the joint agreements of the transmission system operators of the Baltic capacity calculation region on the calculation and allocation of capacity of the connecting links;
- c) Transit and ring electricity flows between third country operators due to the configuration of the existing synchronous zone energy system grid infrastructure;
- d) Electricity flows required to ensure synchronous zone frequency control and emergency response.

TTC - Total Transfer Capacity. This is the maximum possible transfer of active electricity across a cross-border interconnection in accordance with national operational safety standards;

3. LITHUANIA-BELARUS CROSS-ZONAL TOTAL TRANSFER CAPACITY (TTC) CALCULATION PRINCIPLES

3.1. The TTC calculation of the cross-border interconnection between Lithuanian ES and Belarusian ES (hereinafter referred to "Lithuania-Belarus") shall be carried out in accordance with national regulations and standards in order to ensure stable synchronous operation with neighbouring energy systems.

3.2. The Lithuania-Belarus TTC calculation for the interconnector Lithuania Belarus shall be carried out by assessing the following criteria:

3.2.1. Technical flow:

- a) The balancing energy purchased and sold by the TSO from other TSOs to compensate for the imbalance in the Baltic ES;
- b) Electricity flows between electricity systems for the purpose of electricity exchange, including electricity transit, shall be carried out in accordance with the joint agreements of the transmission system operators of the Baltic capacity calculation region on the calculation and allocation of capacity of the connecting links;
- c) Transit and ring electricity flows between third country operators due to the configuration of the existing synchronous zone energy system grid infrastructure
- d) Electricity flows required to ensure synchronous zone frequency control and emergency response;

3.2.2. Lithuania-Belarus cross-zonal technical capacity.

LITHUANIA-BELARUS CROSS-ZONAL TTC CALCULATION DURING ANNUAL, MONTHLY, D-2 PLANNING

3.3. The technical flow during annual, monthly, and D-2 planning is calculated:

3.3.1. The total sum of components of the technical flow Lithuania-Belarus cross-border interconnection a), b), c), defined in Item 3.2.1., in is calculated according to Formula 1:

$$P_{tech.met} = \frac{\sum_{i=1}^n P_{(i)}}{n} \text{ (Formula 1)}$$

Where:

$P_{tech.met}$ - average annual sum of components a), b), c) of the Technical flow in Lithuania-Belarus cross-border interconnection set in Item 3.2.1., MW;

$P_{(i)}$ - average actual physical flow in Lithuania-Belarus cross-border interconnection of the previous calendar year on the i-th hour to the side of Lithuanian ES, which was influenced by:

- The balancing energy purchased and sold by the TSO from other TSOs to compensate for the imbalance in the Baltic ES;
- electricity exchange between the Baltic energy systems, including electricity transit, carried out in accordance with the joint agreements of the transmission system operators of the Baltic capacity calculation region on the calculation and allocation of capacity of the connecting links;
- Transit and ring electricity flows between third country operators due to the configuration of the existing synchronous zone energy system grid infrastructure (if the direction of physical flow to the side of Belarusian ES $P_{(i)}=0$ MW), MW;

3.4. Component d) of the Technical flow is calculated according to formula 2, considering the Lithuania-Belarus cross-zonal capacity, which is necessary to ensure the synchronous zone frequency management and the elimination of accidents through the Lithuania-Belarus cross-border interconnection:

$$P_{rez}=P*k \text{ (Formula 2)}$$

Where:

P_{rez} - Component d) of the Technical flow Lithuania-Belarus cross-border interconnection, MW;

P- reserve from neighbouring energy systems required to ensure synchronous zone frequency management and elimination of accidents through Lithuania Belarus cross-border interconnection is determined according to Formula 2a:

$$P=P_{max}-P_{LT} \text{ (Formula 2a)}$$

Where:

P_{max} - the largest planned source of active power for the following calendar year (the maximum throughput of the direct current connection to the Lithuanian ES side or the maximum discharge of the largest generator to the transmission grid is assessed), MW;

P_{LT} - the frequency restoration reserve, which needs to be ensured in the Lithuanian ES for the next calendar year, MW;

k - reserve distribution coefficient via Lithuania-Belarus cross-border interconnection (0.53).

3.5. The technical Lithuania-Belarus cross-zonal capacity is calculated using the Common grid model, according to Formula 3, considering the planned power lines disconnections:

$$TP = \min ((P_{stat} * 0.8); (P_{n-1} * 0.92); P_{n-1term.}; P_U; P_{Un-1} P_{dyn}) \quad (\text{Formula 3})$$

Where:

TP - Technical transfer capacity of Lithuania-Belarus cross-border interconnection;

($P_{stat} * 0.8$) - maximum active power flow through the Lithuania-Belarus cross-border interconnection in the case of a normal scheme according to the static stability criterion, considering the 20 % reliability ratio

($P_{n-1} * 0.92$) - maximum active power flow through the Lithuania-Belarus cross-border interconnection in the N-1 situation according to the static stability criterion, considering the 8 % reliability ratio

($P_{n-1term.}$) - maximum active power flow through the Lithuania-Belarus cross-border interconnection in the N-1 situation, considering the thermal capacity of the power lines;

(P_U) - maximum active power flow through the Lithuania-Belarus cross-border interconnection in the case of a normal scheme, considering the 15 % voltage reliability ratio;

(P_{Un-1}) - maximum active power flow through the Lithuania-Belarus cross-border interconnection in the N-1 situation, considering the 10 % voltage reliability ratio;

(P_{dyn}) - maximum active power flow through the Lithuania-Belarus cross-border interconnection, considering the dynamic stability criterion

3.5.1. Calculation of the technical capacity of the Lithuania-Belarus cross-border interconnection shall also include assessment of information on the Belarusian ES grid limitations, provided by the Belarusian TSO.

3.6. Lithuania-Belarus cross-zonal TTC to the side of Lithuanian ES during annual, monthly, D-2 planning is calculated according to Formula 4:

$$TTC_{BY>LT} = \min [TP; (P_{tech.met} + P_{rez})], \quad (\text{Formula 4})$$

Kur:

$TTC_{BY>LT}$ - Lithuania-Belarus cross-zonal TTC in direction to Lithuanian ES;

$P_{tech.met}$ - average annual sum of components a), b), c) of the Technical flow in Lithuania-Belarus cross-border interconnection, calculated according to Formula 1, MW;

P_{rez} - Component d) of the Technical flow through Lithuania-Belarus cross-border interconnection, calculated according to Formula 2, MW;

TP - Technical transfer capacity of Lithuania-Belarus cross-border interconnection, calculated according to Formula 3, considering the planned power lines disconnections (the annual planning uses the arithmetic mean of the hourly technical throughput for the following year; the monthly planning uses the arithmetic mean of the hourly technical throughput for the following month, the D-2 planning uses the arithmetic mean of the hourly technical throughput for the planned day) and information provided by the Belarus TSO on restrictions in Belarus ES network, MW.

3.7. The Lithuania-Belarus cross-zonal TTC in direction to Belarus ES during the annual, monthly, and D-2 planning is calculated according to Formula 3, considering the planned power lines disconnections.

3.8. Litgrid informs BRELL TSOs about the values of Lithuania-Belarus cross-zonal TTC during annual, monthly, D-2 planning according to the valid mutual agreements.

LITHUANIA-BELARUS CROSS-ZONAL TTC CALCULATIONS DURING D-1 PLANNING

3.9. The sum of components of the technical flow Lithuania-Belarus cross-border interconnection b) and c), defined in Item 3.2.1., during D-1 planning for each hour is calculated:

3.9.1. By modelling physical power flows in the BRELL ring;

3.9.2. Modelling of physical power flows is performed using a Common grid model. The Common grid model is formed in accordance with the rules of electricity and energy exchange planning in the BRELL ring and the requirements of the ENTSO/E Common grid model exchange standard;

3.9.3. The Technical flow in the Lithuania-Belarus cross-border interconnection during D-1 planning is calculated on the basis of D-2 planning data in accordance with the planning rules of electricity and energy exchange planning in the BRELL ring and the planning data of the Baltic Transmission System Operators. D-1 balances used in planning according to the balance scenario presented in Table 1.

Table 1.

Electricity system	Monday (business day)	Tuesday-Friday	Saturday	Sunday	Public holidays
1. Lithuania, Latvia, Estonia	Balance plan for last Friday	Balance plan for the previous day	Balance plan for the last Saturday	Balance plan for the previous day	Balance plan for the last Sunday or the closest last public holiday
2. Russia*	D-2 balance plans	D-2 balance plan	D-2 balance plan	D-2 balance plan	D-2 balance plan
3. Belarus*	D-2 balance plans	D-2 balance plan	D-2 balance plan	D-2 balance plan	D-2 balance plan

- If no D-2 balance plans from Russia and Belarus have been submitted due to the time difference of the last hours, the missing hours of the D-2 balance plans of Russia and Belarus will be equal to the last indicated hour.

3.9.4. If the total Baltic ES balance according to Table 1, including direct current connections and import from Kaliningrad ES at the relevant hour does not equal 0 MW, adjustments are made to the Baltic ES balances for the relevant hour to bring the total Baltic ES balance to 0 MW:

3.9.4.1. When the total Baltic ES balance is in surplus, in which case the generation of surplus Baltic ES is reduced proportionately, the proportion of the generation reduction is determined according to formula 5:

$$P_{(i)} = B_{(i)} / B_{\text{sum}} \quad (\text{Formula 5})$$

Where:

$P_{(i)}$ - i-th reduction ratio factor of Baltic energy system, which is in surplus;

$B_{(i)}$ - i-th Baltic energy system balance, which is in surplus (difference between generation and demand, assessing the direct current connections), MW;

B_{sum} - sum of Baltic ES balances, which are in surplus, MW.

3.9.4.2. When the total Baltic balance is in deficit then the generation of deficit Baltic ESs is proportionally increased, the proportion of generation increase is determined according to formula 6:

$$P_{(i)} = B_{(i)} / B_{\text{sum}} \quad (\text{Formula 6})$$

Where:

$P_{(i)}$ - i-th increasing ratio factor of Baltic energy system, which is in deficit;

$B_{(i)}$ - i-th Baltic energy system balance, which is in deficit (difference between generation and demand, assessing the direct current connections), MW;

B_{sum} - sum of Baltic ES balances, which are in deficit, MW.

- 3.9.5. The sum of components of the technical flow through the Lithuania-Belarus cross-border interconnection b) and c), defined in Item 3.2.1. is determined for every hour according to Formula 7:

$$P_{tech(i)} = P_{BY>LT(i)}; \quad (\text{Formula 7})$$

Where:

$P_{tech(i)}$ - sum of components of the technical flow through the Lithuania-Belarus cross-border interconnection b) and c), defined in Item 3.2.1. for the i-th hour;

$P_{BY>LT(i)}$ - the planned physical power flow through the Lithuania-Belarus cross-border interconnection for the i-th hour is calculated by method of modelling the physical flows according to principles established in Items 3.9.1-3.9.4 (if the physical power flow through the Lithuania-Belarus cross-border interconnection is to the side of Belarusian ES, then $P_{BY>LT(i)}=0$ MW);

- 3.10. Lithuania-Belarus cross-zonal TTC in direction to Lithuanian ES during D-1 planning is calculated for every hour according to Formula 8:

$$TTC_{BY>LT(i)} = \min [TP_{(i)}; (P_{tech(i)} + P_{rez})], \quad (\text{Formula 8})$$

Where:

$TTC_{BY>LT(i)}$ - Lithuania-Belarus cross-zonal TTC to the side of Lithuanian ES for the i-th hour;

$P_{tech(i)}$ - sum of components of the technical flow through the Lithuania-Belarus cross-border interconnection b) and c), defined in Item 3.2.1. for the i-th hour, calculated according to Formula 7, MW;

P_{rez} - components of the technical flow through the Lithuania-Belarus cross-border interconnection a) and d), calculated according to Formula 2, MW;

$TP_{(i)}$ - technical capacity of Lithuania-Belarus cross-border interconnection for the i-th hour is calculated according to Formula 3, considering information provided by the Belarus TSO on restrictions in Belarus ES network MW.

- 3.10.1. Lithuania-Belarus cross-zonal TTC to the side of Belarusian ES during D-1 planning is calculated according to Formula 3, considering the planned power lines disconnections.

- 3.11. Litgrid informs BRELL TSOs about the values of Lithuania-Belarus cross-zonal TTC during D-1 planning according to the valid mutual agreements.

4. LITHUANIA-BELARUS CROSS-ZONAL NTC CALCULATIONS DURING ANNUAL, MONTHLY, D-2 AND D-1 PLANNING

- 4.1. To ensure the implementation of the safeguards provided for in Paragraph 1 of Article 4 of the Republic of Lithuania Law on Necessary Measures of Protection against the Threats Posed by Unsafe Nuclear Power Plants in Third Countries, stating that access to the electricity market of the Republic of Lithuania shall not be allowed for electricity from the third countries in which unsafe nuclear power plants operate, except for electricity necessary to ensure the reliability of the electric power system of the Republic of Lithuania, the net transfer capacity NTC in Lithuania-Belarus cross-border interconnection is set to 0 MW, during the annual, monthly, D-2 and D-1 planning.

5. LITHUANIA-BELARUS CROSS-ZONAL TTC CALCULATION IN REAL TIME

5.1. Lithuania-Belarus cross-zonal TTC to the side of Lithuanian ES during real time management is calculated according to Formula 9:

$$TTC_{BY>LT(fakt.)} = \min [TP_{(fakt.)}; (P_{tech(fakt)} + P_{rez})], \quad (\text{Formula 9})$$

Where:

$TTC_{BY>LT(i)}$ - Lithuania-Belarus cross-zonal TTC in direction to Lithuanian ES for the actual hour;

$P_{tech(fakt.)}$ - Components a), b), and c) of the Technical flow through Lithuania-Belarus cross-border interconnection for the actual hour, considering:

- Balancing energy actually purchased and sold by the TSO from other TSOs to compensate for the imbalance in the Baltic ES;
- Actual electricity exchanges between the Baltic energy systems, including electricity transit, carried out in accordance with the joint agreements of the transmission system operators of the Baltic capacity calculation region on the calculation and allocation of capacities of interconnections;
- Actual transit and ring electricity flows between third country operators due to the configuration of the existing synchronous zone energy grid infrastructure

If the direction of actual physical flow is to side of the Belarusian ES, then $P_{tech(fakt)} = 0$ MW;

P_{rez} - Component d) of the Technical flow through Lithuania-Belarus cross-border interconnection, calculated according to Formula 2, MW;

$TP_{(fakt)}$ - Lithuania-Belarus cross-zonal technical capacity for the actual hour is calculated according to Formula 3, MW, considering the actual disconnections of power lines.

5.2. The Lithuania-Belarus cross-zonal TTC in direction to Belarusian ES during real time management is calculated according to Formula 3, considering the planned disconnections of power lines. When carrying out the calculation of the technical capacity of Lithuania-Belarus cross-border interconnection, the information provided by the Belarusian TSO on the Belarusian ES grid limitations is also considered.

6. LITHUANIA-RUSSIA (KALININGRAD REGION) CROSS-ZONAL NTC CALCULATION DURING D-1 PLANNING

6.1. D-1 capacity for electricity trade in Lithuanian direction shall be calculated in accordance with Formula 10:

$$NTC_{RU-LT} = \min((TTC_{RU-LT} - TRM); (G_{RU} - P_{RU})) \quad (10)$$

Where:

NTC_{RU-LT} - Lithuania-Russia (Kaliningrad Region) cross-zonal Net transfer capacity;

TTC_{RU-LT} - Maximum transfer capacity in the Lithuanian direction according to the instruction of parallel operation in the Lithuania-Russia (Kaliningrad Region) cross-border interconnection;

TRM - the transfer reliability limit at the interconnection, jointly set by Lithuanian and Russian TSOs;

G_{RU} - Russian (Kaliningrad Region) production according to D-2 balance plans;

P_{RU} - Russian (Kaliningrad Region) load according to D-2 balance plans.

- 6.2. Cross-zonal capacity of the next day, for trade in electricity in the direction to Russia (Kaliningrad Region), calculated according to Formula 11:

$$NTC_{LT-RU} = TTC_{LT-RU} - TRM \quad (11)$$

Where:

NTC_{LT-RU} - Lithuania-Russia (Kaliningrad Region) cross-zonal Net transfer capacity;

TTC_{LT-RU} - Lithuania-Russia (Kaliningrad Region) cross-zonal maximum Net transfer capacity in the direction of Russia (Kaliningrad Region);

TRM - Lithuania-Russia (Kaliningrad Region) cross-zonal Transfer reliability limit.

- 6.3. If the actual power flow from the Kaliningrad Region on the previous day exceeded the Maximum transfer capacity limits on the Lithuanian-Russian cross-border interconnection or the exchange of net capacity with the Kaliningrad Region due to the actions of market participants is less than the capacity from Kaliningrad to Lithuania allocated for the next day, then the capacity of the cross-border interconnection for the next day in the direction of Lithuania is calculated according to the Formula 12:

$$NTC_{RU-LT} = \min((TTC_{RU-LT} - TRM); (G_{RUactual} - P_{RUactual})) \quad (12)$$

Where:

NTC_{RU-LT} - Lithuania-Russia (Kaliningrad Region) cross-zonal Net transfer capacity;

TTC_{RU-LT} - Maximum transfer capacity in the Lithuanian direction according to the instruction of parallel operation in the Lithuania-Russia (Kaliningrad Region) cross-border interconnection;

TRM - the transfer reliability limit at the interconnection;

$G_{RUactual}$ - Russian (Kaliningrad Region) production according to actual data of the previous day;

$P_{RUactual}$ - relevant Russian (Kaliningrad Region) load according to the actual data of the last business day, Saturday, Sunday or public holiday;

7. IMPLEMENTATION OF THE METHODOLOGY

- 7.1. The methodology shall enter into force upon its approval by the National Energy Regulatory Council and shall apply from 15 September 2021.