Appendix No. 3

Business Terms of the OTE, a.s. for the Power Sector

June 2021

ALGORITHM AND DAY-AHEAD MARKET EVALUATION PROCEDURE

Contents

1   TERMS

1.1   Active accepted offers / demands – matched offers / demands that are an integral part of the algorithm's valid solution, i.e. they have been matched;

1.2   Day-ahead market (DT) evaluation algorithm – an algorithm allocating the volume of electricity accepted for each accepted offer and for each accepted demand on DT, in every trading hour of the particular delivery day;

1.3   ATC - available transfer capacity**;**

1.4   ID RMP (RUT)- registration number of the electricity and / or gas market participant in CS OTE**;**

1.5   Flow Based **-** Capacity calculation method based on physical flows**;**

1.6   Curve of offers – a discrete aggregated curve consisting of degrees arisen from blocks of offers gradually put together at a particular hour of the delivery day from all placed offers according to the price in ascending order and independently from the offer it belongs to;

1.7   Curve of demands – a discrete aggregated curve consisting of degrees arisen from blocks of demands gradually put together at a particular hour of the delivery day from all placed demands according to the price in descending order and independently from the demand it belongs to;

1.8   Local price – a marginal price obtained from isolated matching of all offers and demands in just one market area, i.e. disregarding the allocated tradable transmission capacity;

1.9   Marginal (market clearing) price – the price of the last accepted offer found after the matching of offers and demands at a particular hour of the delivery day; it is equal to or lower than the price of the last accepted demand;

1.10   Method of matching of demands (for buy) and offers (for sale) – the determination of balancing points in the intersection of offer and demand curves for every hour of the delivery day, on the basis of which marginal prices and traded (accepted) volume for demands (buy) and offers (sale) are determined, i.e. a set of offers (for sale) and demands (for buy), i.e. that succeeded in matching in every hour of the delivery day;

1.11   Offer / demand – a set of all elements of offer / demand pursuant to OTE, a.s. Business Terms for Electricity, as amended (hereinafter the "Business Terms");

1.12   Indivisible condition – a condition of acceptance at a particular hour of the delivery day of the minimal electricity volume in the element of the offer / demand in Segment No. 1 by the DT evaluation algorithm;

1.13   NP - Balance of the market area of the Czech Republic;

1.14   Area price – a marginal price obtained from matching of all offers and demands of just one market area;

1.15   Limited condition – a condition of indivisibility of element of offer / demand;

1.16 Rules of division – the rules defining the process of assignment of volume to individual elements of offers and demands after obtaining the price in the intersection of curves for a specific hour of the particular delivery day;

1.17 Element of offer / demand – an offer for sale / demand for purchase of a specific electricity volume at a specific trading hour of a particular delivery day of a DT participant for minimum / maximum price;

1.18 System price – a marginal price arisen from matching of offers and demands of all participating market areas at the same time;

1.19 Market area – a market area defined in the Energy Regulatory Office's Decree on the Electricity Market Rules, pricing principles for services of the Market Operator and execution of some other provisions in accordance with the Energy Act, as amended.

1.20 EUPHEMIA – an algorithm to calculate daily results of the day-ahead coupling market CZ-SK-HU-RO. EUPHEMIA is a branch-and-bound algorithm designed to solve the problem of coupling spot markets

1.21 QP – a Quadratic optimization program.

1.22 Hourly Orders – as hourly orders are considered offers / demands with no constraint. All not constrained offers/ demands are transformed to EUPHEMIA as hourly orders

1.23 Block Orders – as block orders are considered offers and demands with defined constraint (indivisibility condition) and/or profile block offers and demands and/or flexible hourly offers and demands. All elements of all constrained offers /demands are transformed to EUPHEMIA block orders.

1.24 Group of linked block orders – separate group of mutually linked profile block orders of one participant for a particular delivery day, starting from the first level of linkage;

1.25 Paradoxically rejected orders – block orders for buy/sale and/or profile block offers and demands and/or flexible hourly offers and demands unmatched due to volume indivisibility constraint even if their price is lower/higher or equal to the marginal price;

1.26 Social welfare – is defined as: consumer surplus + producer surplus + congestion revenue across the region. It is the objective function of evaluation algorithm – solution with maximal welfare is the final solution.

2 ALGORITHM AND DAY AHEAD MARKET EVALUATION PROCEDURE

2.1 A list of offers / demands valid and submitted to the DT pursuant to Business Terms for the delivery day is acquired, which is determined for evaluation of one or more market areas and, subsequently, offer and demand curves are created, acceptance of offers / demands is determined,marginal prices are calculated and unrounded and rounded NP values for individual business hours of delivery. In the case of more market areas, capacity constraints obtained from TSOs (especially ATC or Flow-Based parameters) are taken into account..

2.2 Block orders price limit is determined as follows:

    2.2.1   In case of offers / demands with volume indivisibility set on the element level of offer / demand the block order price limit is equal to price limit of the relevant element of the offer / demand (hour and segment)

    2.2.2   In case of profile block offers / demands and/or flexible hourly offers / demands the price limit of the block offers / demands is equal to the price limit of a particular offer / demand.

2.3 Demands and offers without limited conditions (hourly orders) are processed at a particular trading hour according to the following criteria:

    2.3.1   An Hourly Order for sale is rejected when the Market Clearing Price is lower than the order (lowest) price limit.

    2.3.2   An Hourly Order for purchase is rejected when the Market Clearing Price is higher than the order (highest) price limit.

    2.3.3   An Hourly Order for sale is executed when the Market Clearing Price is higher than the order (highest) price limit.

    2.3.4   An Hourly Order for purchase is executed when the Market Clearing Price is lower than the order (lowest) price limit.

    2.3.5   An Hourly Order (Offer / Demand) may be partially executed if and only when the Market Price is equal to the price limit of that order.

    2.3.6   An Hourly Order (Offer / Demand) is not executed for a quantity in excess of the volume limit specified in the Order.

2.4 Block orders are processed at a particular trading hour according to the following criteria:

    2.4.1   A block offer / demand is not matched when the average of the rounded Market Clearing Prices over the relevant hours and weighted by the corresponding volume limits is lower / higher than the price limit of this block order. An block order can only be matched at all hours simultaneously, for a quantity equal to the hourly volume limits specified in the offer;

    2.4.2   All block orders can only be either executed fully, or rejected fully. Because of this constraint – called the "fill or kill constraint" some block orders can be rejected even if they are in the money (offer price limit is below the average market price), in which case they are called "Paradoxically rejected orders".

    2.4.3   Flexible hourly order is executed as at the hour that is assigned to the order by the algorithm only with the process of matching;

    2.4.4   Orders within the group of linked block orders are matched according to the following criteria:

        2.4.4.1   Parent block order must be matched with at least the same effective acceptance ratio of matched volume as its child block order;

        2.4.4.2   Parent block order can be matched even if it is "not in the price range", provided that the yield for all its child block orders is of such amount that it compensates the loss of this parent block order "not in the price range" ;

2.4.4.3 Child block order, which is "not in the price range" cannot be matched even if its parent block range shows the yield that would compensate for the loss incurred for this child block order.

2.4.5 Orders within the exclusive group of the profile block offers / demands are matched according to the criteria, where the sum of effective acceptance ratios of matched volume for all profile block offers / demands within the particular exclusive group must not exceed the value of 100%;

2.5 A marginal price resulting from matching of offers and demands in just one market area is a local price.

2.6 If the intersection of the offer curve and the demand curve is on the horizontal offer curve and there is no valid offer with an indivisible condition for this price, the volume of electricity earmarked for division shall be proportionately distributed for this price among valid offers. If the intersection of the offer and the demand curves is on the horizontal demand curve, the electricity volume for division shall be proportionally distributed among valid demands for this price.

2.7 For the purpose of proportional distribution of the offered electricity volume among blocks of demand or the demanded electricity volume among blocks of offers, the volume of electricity earmarked for distribution shall be divided by total electricity volume offered or demanded for a particular marginal price and, subsequently, each block shall be allocated the result of the said division multiplied by the volume for one block.

2.8 An evaluation algorithm proceeds step by step:

2.8.1 At the first step, algorithm solves a market coupling QP without fill or kill constraints, hence allowing all block orders to be partially matched. By chance, the solution of this problem might satisfy the fill or kill condition for all block orders and is therefore a feasible solution of the market coupling problem. In this case, the solution that has been found is the optimal solution;

2.8.2 Otherwise, algorithm gradually forces the partially matched block orders to be either fully rejected or fully matched in subsequent steps, in order to obtain a solution to the market coupling problem which respects all fill or kill constraints;

2.8.3 At a given step, two situations can occur:

2.8.3.1 Algorithm has produced a solution in which some block orders are either fully matched or rejected and some block orders are partially matched. This solution has been computed by solving the initial QP, but in which some block orders have been forced to be matched or rejected (as the result of some previous steps). Since it contains partially matched orders, it is called a partial solution. The property of this solution is that its objective value is an upper bound of the social welfare of any solution that could be produced by extending this partial solution into a feasible solution by adding further constraints. Two sub-cases can occur:

2.8.3.1.1 If the upper bound associated to this partial solution is smaller than the welfare of the best feasible solution found so far, algorithm will discard this partial solution and won't consider it anymore;

2.8.3.1.2 Otherwise, algorithm will select a block order partially matched and create two new steps to be analyzed: in the first of these new steps, the selected block is forced to be matched, and in the second one it is forced to be rejected.

2.8.3.2 Algorithm has produced a solution in which all block orders are either fully matched or fully rejected (even those that were not forced to). In this case, algorithm must still check whether there exist prices that are compatible with this solution and the constraints (which is done by verifying that all market and

network constraints are satisfied). Two sub-cases can occur:

    2.8.3.2.1   If such prices exist, algorithm has found a feasible solution. If this solution is better than the best one found so far, it is marked as such;

    2.8.3.2.2   If no such prices exist, then a new step is created with a transformed problem containing additional constraints to exclude this non feasible solution.

  2.8.4   During the course of its execution, algorithm might sometimes increase the number of steps that it has yet to consider (e.g. sub-cases **Chyba! Nenalezen zdroj odkazů.**~~2.8.3.1.2~~ and **Chyba! Nenalezen zdroj odkazů.**~~2.8.3.2.2~~) or reduce it (sub-case **Chyba! Nenalezen zdroj odkazů.**~~2.8.3.1.1~~ and **Chyba! Nenalezen zdroj odkazů.**~~2.8.3.2.1~~). When there remains none, this means that algorithm has finished and has found the best possible solution. Possibly, algorithm will reach the time limit although there remain some partial solutions that were not analyzed. In this case, algorithm will output the best solution found so far without being able to prove whether it is the very best possible one;

2.9   The goal of the algorithm is to achieve the following:

  2.9.1   The degree of social welfare generated by the matched orders is maximal

  2.9.2   Orders and prices are coherent

  2.9.3   The power flows induced by the matched orders, resulting in the net positions do not exceed the capacity of the relevant network elements.

2.10   **Detailed description of the match up algorithm is available to the DT participants in document "EUPHEMIA Public Description" in the business system of CS OTE.**

2.11   Based on the outputs provided by the algorithm, the NP_{round}^{OTE} value calculated for the given trading hours in the CS OTE system will be calculated as the arithmetic rounding of the unrounded NP value obtained from the DT evaluation algorithm to 1 decimal place (MWh). Subsequently, in the CS OTE system for these given trading hours and with respect to the value of NP_{round}^{OTE}, the agreed quantity will be redistributed to specific offers of market participants and the preliminary agreed quantities of electricity of individual short-term market participants will be determined to 1 decimal place (MWh).

2.12   After successful preliminary redistribution of the agreed quantity to specific offers of market participants in the Czech market area according to point 2.11, the CS OTE system shall determine for each trading hour the deviation of the ΔNP balance caused by the NP_{round}^{OTE} difference and the sum of rounded values determined by the algorithm:

$$\Delta \text{NP} = \text{ABS}(\text{NP}_{\text{round}}^{\text{ALG}}) - \text{ABS}(\text{NP}_{\text{round}}^{\text{OTE}})^{-} \text{ (MWh), where}$$

NP_{round}^{ALG} - - Rounded value of the NP of the market area for a given trading hour, which is calculated by the Algorithm as the sum of the algorithm-determined rounded cross-border flows to 1 decimal place in the given market area (MWh);

2.13   **If the deviation according to point 2.12 is zero, the agreed quantities of electricity of individual short-term market participants according to point 2.11 for a given trading hour are considered final, if this is not the case, the imbalance of the ΔNP balance determined in**

accordance with point 2.12 and the agreed adjustment of the agreed quantities of electricity of short-term market participants for the given trading hour will be settled on the basis of the procedure below:

2.13.1   If the Czech Republic is an import (NP_{round}^{OTE} value is negative) and the value of ΔNP is positive, ΔNP is included in the fully agreed standard offer for sale with the largest agreed quantity and price closest to the regional price in the given hour (purchase offer amount is reduced by absolute amount of the imbalance - ABS ΔNP)[1]

2.13.2   If the Czech Republic is an import (NP_{round}^{OTE} value is negative) and the ΔNP value is negative, ΔNP will be included in the fully agreed standard purchase offer with the largest agreed quantity and price closest to the MCP price in the given hour (purchase offer quantity will be reduced by absolute amount of the imbalance - ABS ΔNP).[2]

2.13.3   If the Czech Republic is an export (NP_{round}^{OTE} value is positive) and the ΔNP value is negative, ΔNP is included in the fully agreed standard offer for sale with the largest agreed quantity and price closest to the regional price in the given hour (the offer amount is reduced by the absolute amount of the imbalance - ABS ΔNP).[2]

2.13.4   If the Czech Republic NP is export (NP_{round}^{OTE} value is positive) and ΔNP value is positive, ΔNP will be included in the fully agreed standard purchase offer with the largest agreed quantity and price to the nearest regional price in the given hour (the offer quantity will be reduced by the absolute amount given imbalance – ABS ΔNP).[2]

2.14   In the event that there are no standard offers in the system and it is necessary to redistribute the imbalance of the ΔNP balance at a given hour within the block offers, partially agreed block offers will be created

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[1] If there are only block matched buy and sell offers, the same procedure applies as for standard sell offers. If there are multiple standard bids with the largest matched quantity and price closest to the MCP price in a given hour, the bid for sale that was previously entered into the system will be selected. In the case of an identical bid insertion time stamp, the bid of the participant with the lowest PID will be selected.

[2] If there are only block matched buy and sell offers, the same procedure applies as for standard buy offers. If there are multiple standard purchase offers with the largest matched quantity and price closest to the MCP price in a given hour, the purchase offer that was previously entered into the system will be selected. In the case of an identical bid insertion time stamp, the bid of the participant with the lowest PID will be selected.