HOPS

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ELECTRICITY BALANCING RULES

Zagreb, December 2023

Pursuant to Article 52, paragraph 9 of the Electricity Market Act (*Official Gazette* nos. 111/2021, 83/2023), with the approval of the Croatian Energy Regulatory Agency, Class: 391-43/23-01/16, Reg. No: 371-06-23-6, of 7 December 2023, the Management Board of the Croatian Transmission System Operator Plc. hereby adopts the

ELECTRICITY BALANCING RULES

I. GENERAL PROVISIONS

Article 1

(1) These Electricity Balancing Rules (hereinafter: Rules) secure the implementation of the following EU regulations:

- EU Commission Regulation 2017/2195 dated 23 November 2017 on establishing a Guideline on Electricity Balancing (Text with EEA relevance), EU Official Gazette L 312/6 dated 28/11/2017 (hereinafter: EB GL Regulation),

- EU Commission Regulation 2017/1485 dated 2 August 2017 on establishing guidelines for transmission system operation (Text with EEA relevance), EU Official Gazette L 220/1, 25. August 2017 (hereinafter: SO GL Regulation),

- EU Parliament and Commission Regulation 2019/943 dated 5 June 2019 on internal electricity market (Text with EEA relevance), EU Official Gazette L 158/54, 14 June 2019.

(2) Hrvatski operator prijenosnog sustava d.d. (Croatian Transmission System Operator Plc.) (hereinafter: transmission system operator) hereby defines:

- Products and services,
- Pre-qualification procedures,
- Contractual relations,
- Procurement of balancing capacity and balancing energy ,
- Settlement of balancing services and price determination method for balancing capacity and balancing energy,
- Contractual relations and responsibility for system imbalances,
- Imbalances settlement method and prices taking into account rules for substitute load curves application,
- Financial settlement of imbalances,
- Publication of data and information,
- Complaints resolution procedure,
- Terms and conditions for the provision of balancing services,
- Terms and conditions for balance responsible parties,
- Settlement rules in the event of suspension and reactivation of market activities.

(3) These Rules shall apply to all electricity market participants and all transmission and distribution grid users.

Article 2

Wholesale electricity market rules specify the following requirements from Article 18 of the EB GL Regulation:

- Defining rules allowing balance responsible parties to trade and thus acquire appropriate market position,
- Balance responsible parties are required to deliver each change in their market position the connecting transmission system operator,
- Consequences of non-compliance with the terms and conditions applicable to balance responsible parties.

II. DEFINITIONS

Article 3

(1) The terms used in these Rules shall have the meanings defined by the EU regulations and laws of the Republic of Croatia regulating energy industry, electricity market and regulation of energy activities, as well as regulations passed pursuant to EU regulations and national laws.

(2) In addition to the terms referred to in paragraph 1 above, the following terms used in these Rules shall have the meanings specified below:

1. *"aggregator"* – *legal or physical person connecting different technical facilities in a group with the aim of participating in the balancing market, whose facilities are connected to transmission and/or distribution grid. Aggregator shall be deemed independent if not connected with a supplier and/or a buyer of the aggregated grid user,*
2. *"next calendar year"* – *calendar year for which balancing service prices are being defined, year following current calendar year,*
3. *"balancing energy price"* – *unit price for balancing energy expressed in EUR/MWh,*
4. *"reserve power price"* – *unit price for availability of balancing capacity expressed in EUR/MWh,*
5. *"bid divisibility"* – *transmission system operator's ability to use only a portion of the bids of the balancing service provider for balancing energy or balancing capacity, either in terms of activation or duration,*
6. *"voluntary bid"* – *bid for balancing energy sent by any pre-qualified balancing service provider of balancing energy,*
7. *"active power assistance"* – *as provided for in Article 21, paragraph 1, point c of the EU Commission Regulation 2017/2196 of 24 November 2017 on establishing the network code on electricity emergency and restoration,*
8. *"dominant balancing service provider"* – *balancing service provider from whom the transmission system operator procures products and services procured with prior approval of the Croatian Energy Regulatory Agency pursuant to Article 52, paragraph 35, and Article 86, paragraph 1, subparagraph 27 of the Electricity Market Act (Official Gazette 111(2021, 83/2023),*
9. *"balancing energy"* – *energy used by the transmission system operator to balance the power system,*

10. *"correction of balance group market position"* – *calculation of energy quantities due to which balancing group's market position needs to be changed as a result of activation of balancing energy and/or energy required to meet the demand of other system services,*
11. *"merit order list"* – *list of bids for balancing capacity and/or balancing energy in merit order, from the lower to the highest price, to be chosen from activation of balancing capacity and/or activation of balancing energy services,*
12. *"bidding method"* – *procedure used for choosing bids on balancing capacity and balancing energy market,*
13. *"settlement of balancing energy"* – *settlement between the transmission system operator and the balancing service provider for balancing energy activated from balancing capacity , settlement between the transmission system operator and market participant for balancing energy procured at the electricity market, settlement between two or more transmission system operators for cross-border procurement of balancing energy,*
14. *"settlement of imbalances"* – *financial mechanism of settlement whereby balance responsible parties/balance groups are being charged or receive payments for its imbalances,*
15. *"settlement interval"* – *time period for which the settlement is conducted,*
16. *"settlement period"* – *time period for which the imbalance needs to be settled,*
17. *"imbalance"* – *difference between realisation and market position of a balance group in one settlement interval,*
18. *"system imbalance"* – *imbalance on points of separation with the neighbouring transmission system operators calculated by the Transmission System Operator as a difference between planned and realised power flows on cross-zonal transmission lines,*
19. *"realisation"* – *difference between total delivery and takeover of electricity quantity of a balance group in one settlement interval,*
20. *"submission of bids"* – *right and obligation of the balancing service provider to submit balancing capacity and balancing energy bids which result from contractual relations regarding the provision of balancing services with the Transmission System Operator,*
21. *"bid"* – *offer for balancing capacity and/or balancing energy on balancing capacity and/or balancing energy market,*
22. *"bidder"* – *balancing service provider submitting a bid for balancing capacity and/or balancing energy,*
23. *"balancing service provider portfolio"* – *consists of one or more regulation units and/or regulation groups, each balancing service portfolio represents one balancing service provider,*
24. *"bid selection conformation"* – *conformation issued by the transmission system operator to the bidder for bids accepted and contracted in the procurement procedure via public tendering for the provision of balancing capacity and/or balancing energy which is a legal basis for settlement and charging of balancing service,*
25. *"previous calendar year"* – *calendar year preceding current calendar year,*
26. *"pre-qualification procedure"* – *procedure whereby the compliance of a regulation unit or a group with the demands of the Transmission System Operator are checked, namely, the pre-qualification procedure developed and implemented by*

the Transmission System Operator for the purpose of checking criteria stipulated in articles 155, 159 and 162 of the System Operation Guideline,

27. *"connecting transmission system operator" – transmission system operator in charge of scheduling area where all balancing service providers and balance responsible parties have to obey terms and conditions related to balancing,*

28. *"eligible expenditure of the balancing service provider" – objective, legitimate and apparent costs of balancing service provision in the previous calendar year,*

29. *"balancing product" - a group of stipulated characteristics of balancing energy takeover/delivery by the balancing service provider pursuant to articles 25 and 26 of the EB GL Regulation,*

30. *"balancing service provider" – participant in the balancing market who has met the preconditions defined through the pre-qualification procedure and has signed Balancing Service Agreement with the Transmission System Operator,*

31. *"regulation unit" – one or more technical units connected to the transmission and/or distribution grid at the common connection point, meeting technical requirements in terms of provision of balancing services,*

32. *"regulation group" – one or more regulation units connected to the transmission and/or distribution grid in more than one connection point, meeting technical requirements in terms of provision of balancing services,*

33. *"frequency control and power exchange area" – part of a synchronous area or a whole synchronous area physically separated from other control areas by metering points on interconnecting lines, managed by at least one transmission system operator (hereinafter: control area),*

34. *"balancing capacity" – capacity reserved for balancing the system, namely, power quantity the balancing service provider consented to reserve and submit balancing energy bids for to the transmission system operator for the duration of the contractual relationship,*

35. *"frequency restoration reserve with automatic activation" – active power reserve for restoration of system frequency to the nominal frequency and to the default power exchange with automatic activation,*

36. *"frequency restoration reserve with manual activation" – active power reserve for restoration of system frequency to the nominal frequency and to the default power exchange with manual activation,*

37. *"frequency containment power reserve" – available active power reserve for system frequency containment following an power system imbalance,*

38. *„balance responsible party" – electricity market participant responsible for imbalance of a balance group which has signed a Balance Responsibility Agreement with the Transmission System Operator (hereinafter: balance group manager),*

39. *"current calendar year" – calendar year for which balancing service prices are being determined,*

40. *"technical unit" – basic, technically indivisible generation, consumption or generation-consumption unit as well as energy storage unit used by the balancing service provider to guarantee the service,*

41. *"balancing market" – one of the electricity markets, including all types of the procurement of balancing services in all time frames,*

42. *"market position"* – *difference between electricity sales (including exports) and purchase (including imports) of a balance group in a settlement interval including correction of balance group market position,*
43. *"system balancing"* – *all activities and all procedures on all time levels whereby transmission system operator continually secures power system frequency control within the predefined stability range,*
44. *"timeframe for the submission of bids"* – *time frame in which bidders can submit balancing energy bids.*

III. CONTRACTING AND SECURING BALANCING SERVICES

Article 4

(1) In terms of this Rules, following is referred to as balancing services:

- Securing frequency containment reserve (hereinafter: FCR balancing capacity),
- Securing frequency restoration reserve with automatic activation (hereinafter: aFRR balancing capacity) and balancing energy or balancing energy,
- Securing frequency restoration reserve with manual activation (hereinafter: mFRR balancing capacity) and balancing energy or balancing energy.

(4) Balancing services: aFRR and mFRR balancing capacity and/or balancing energy referred to in paragraph 1 above shall be defined, procured and activated separately for positive and for negative direction of activation.

(5) FCR balancing capacity referred to in paragraph 1 above shall be defined and procured on a single-take basis, symmetrically for both, positive and negative direction of activation.

(6) Balancing Services Agreements shall be concluded with the transmission system operator by all individual grid users or the aggregator, independent aggregator, closed distribution system operator, citizen energy community and renewable energy community with proof of technical qualifications for it.

(7) All participants referred to in paragraph 4 above, who have concluded a Balancing Services Agreement with the transmission system operator shall be defined as balancing service providers and shall submit bids for balancing capacity in the contracted period to the transmission system operator.

Article 5

(1) Technical qualifications of a potential balancing market participant for the provision of an individual balancing service shall be proved in the pre-qualification procedure.

(2) Pre-qualification procedure for potential balancing service provider for aFRR and mFRR balancing capacity for the purposes of operational implementation shall be additionally defined by rules for conducting a pre-qualification procedure for the provision of balancing services aFRR and mFRR balancing capacity and balancing energy or balancing energy.

(3) Pre-qualification procedure for potential balancing service provider for FCR balancing capacity for the purposes of operative implementation shall be additionally defined by rules for conducting a pre-qualification procedure for the provision of reserve power for FCR balancing capacity.

(4) Grid user shall notify its supplier and/or purchaser, as well as connecting system operator before entering into pre-qualification procedure. All interrelations grid user and supplier and/or purchaser shall solve bilaterally.

(5) Grid user connected to distribution system shall obtain distribution system operator approval for the provision of balancing services before entering into the pre-qualification procedure.

(6) Distribution system operator shall, for the grid user referred to in the above paragraph, check technical qualification necessary for the grid user's provision of balancing service to the transmission system operator.

(7) Rules set out in paragraphs 2 and 3 herein shall have at least the following:

- application form for conducting capability tests for providing a specific balancing service,
- testing of communication requirements for providing balancing services,
- the process of testing the capabilities of regulation units and/or groups for providing a specific balancing service,
- reports on the conducted capability tests for providing a specific balancing service, and
- certification of qualification for providing a specific balancing service.

(8) Transmission and distribution system operators shall collaborate during the issuance of conformation referred to in paragraph 5 above to the grid user and throughout the implementation of pre-qualification procedures referred to in paragraphs 2 and 3 above in order to enable regulation units or groups located in the distribution system to provide active power reserves pursuant to Article 182 of the SO GL Regulation.

(9) The rules referred to in paragraphs 2 and 3 above shall be published on the websites of the transmission system operators.

Article 6

(1) A potential balancing market participant intending to provide balancing services shall submit an application form to the transmission system operator, which is published on the website of the transmission system operator.

(2) The procedure for submitting the application form shall be regulated by the rules referred to in paragraphs 2 and 3, Article 5 herein.

(3) Testing of communication systems and testing the capabilities of regulation units and/or groups to provide a specific balancing service shall be conducted according to the rules referred to in paragraphs 2 and 3, Article 5 of these Rules.

(4) Following the testing of communication systems and the testing of regulation units and/or groups capability to provide a specific balancing service, the transmission system operator shall produce a report on the conducted capability tests and a certification of qualification to provide a specific balancing service and delivers them to the potential participant in the balancing market.

(5) Upon receipt of the conformation of qualification to provide a specific balancing service, the potential participant in the balancing market and the transmission system operator may enter into a Balancing Service Agreement.

Article 7

(1) Balancing Service Agreement shall contain at least the following:

- *Data on parties to the agreement,*

- *Characteristics of the service,*

- *Physical locations of control units of balancing service provider in the electricity system,*

- *Proof of technical capability for the provision of balancing service,*

- *Transferral of the obligation of balancing service provision to other balancing service providers,*

- *Settlement and payment method,*

- *Conditions and amount of penalties for non-performance of the agreement,*

- *Conditions and amount of financial guarantee,*

- *Method of complaint resolution,*

- *Method of dispute resolution.*

(2) Balancing Service Agreement forms shall be published by the transmission system operator on its web page.

Article 8

(1) Balancing services shall be procured in a transparent and non-discriminatory way by implementing the procurement procedure via public tendering conducted periodically (monthly, weekly, daily, and/or intra-daily) with at least the following pre-determined requirements:

- *Identification, technical and financial parameters of a balancing product,*

- *Period for which the bidding is conducted – intra-daily (continuous, one hour time block or time blocks in separate consecutive hours), daily, weekly, monthly,*

- *Method of bid submission,*

- *Time of bid submission,*

- *Bid specification – bid can be positive or negative, divisible or indivisible,*

- *Method of bid selection,*

- *Required power reserve quantity,*

- *Method of transferral of the obligation of balancing service provision.*

(2) Requirements referred to in paragraph 1 above shall be published on the web pages of the transmission system operator.

Article 9

(1) Bidders offer balancing capacity price in EUR/MW.

(2) Transmission system operator shall, pursuant to the method of bid selection, comparing required and offered quantities and offered balancing capacity prices, create a merit order list starting with the lowest bid.

(3) Following the completion of the bidding procedure, transmission system operator shall notify all bidders of the bidding results and shall send certificate of acceptance to bidders whose bids were accepted.

(4) Balancing service providers whose bid is accepted is obliged to secure balancing capacity and submit balancing energy bids to the transmission system operator for the amount of balancing capacity from the relevant bidding procedure.

(5) When submitting balancing energy bids referred to in paragraph 4 above bidders shall offer balancing energy price in EUR/MWh.

(6) The provider of FCR balancing capacity shall not submit offers referred to in paragraphs 4 and 5 above.

Article 10

(1) Balancing service provider whose bid has been accepted shall have the right to transfer the obligation referred to in Article 8, paragraph 4 herein, to other pre-qualified balancing service provider.

(2) Transfer of obligation referred to in paragraph 1 above shall be allowed until one hour before the beginning of the delivery at the latest.

(3) Transfer of obligation referred to in paragraph 1 above shall be allowed if the following requirements have cumulatively been met:

- *Balancing service provider transferring the obligation and the balancing service provider to which the obligation is transferred shall submit a request for the transfer of obligation pursuant to the Balancing Service Agreement,*

- *The transfer of the obligation referred to in paragraph 1 herein shall not breach operating limitations set out in chapters 1 and 2, part IV, Section VIII of the SO GL Regulation.*

(4) In the event of accepting the transfer of obligation referred to in Article 9, paragraph 4 herein, the transmission system operator shall confirm the transfer of obligation by delivering a confirmation to both the balancing service provider transferring the obligation and the balancing service provider taking over the obligation, within the deadline specified in paragraph 2 of this Article.

(5) In the event of non-fulfilment of the requirements referred to in paragraph 3 herein transmission system operator shall be able to reject the request for transfer of obligations.

(6) In the event of rejection of transfer request transmission system operator shall send an explanation for rejection to the relevant balancing service providers.

(7) Interrelations of balancing service providers and transmission system operators relating the transfer of obligation of balancing service provision is defined in detail in the Balancing Service Agreement.

(8) The mutual relations between the transmission and distribution system operators related to the provision of balancing services of distribution grid users shall be regulated by a mutual relations agreement designed to organize relations for the purpose of provision of balancing services by distribution grid users.

Article 11

(1) Balancing services which cannot be procured pursuant to Article 8 herein shall be contracted by the transmission system operator with the dominant balancing service provider.

(2) The transmission system operator and the dominant balancing service provider shall contract the provision of balancing services in the amounts needed, at regulated prices, and according to parameter values in accordance with the Rules for determining marginal prices for securing balancing capacity for the provision of balancing services which constitute Annex 2 to these Rules.

(3) The regulated prices, referred to in paragraph 2 above, for the provision of balancing services for the upcoming calendar year shall be determined as the average of the regulated prices calculated based on Annex 2 of these Rules for the previous, current, and upcoming calendar year, rounded to two decimal places, for each balancing service individually.

Article 12

(1) For the balancing services referred to in Article 11 of these Rules, by 30 September of the current calendar year for the upcoming calendar year, the transmission system operator shall submit to the Croatian Energy Regulatory Agency (hereinafter: the Agency):

- *A justified request for the procurement of balancing services that cannot be ensured on market principles, with an assessment of the possibility of securing them on market principles,*

- *The required amounts of balancing services for the upcoming calendar year determined in the manner prescribed in Annex 2 to these Rules,*

- *The values of variable parameters determined as prescribed in Annex 2 to these Rules,*

- *All documentation necessary for the verification of secured amounts of balancing services and the values of variable parameters, in a manner and format agreed with the Agency, and*

- *A report on the achievement and costs of providing balancing services for the period covering the previous calendar year and the first six months of the current calendar year, in a manner and format agreed with the Agency.*

(2) The dominant balancing service provider shall, upon the request of the transmission system operator and within a deadline set by the transmission system operator, provide the data and documentation necessary for the submission of data and preparation of documentation referred to in paragraph 1 above.

Article 13

(1) Each balancing service provider shall provide the transmission system operator with information on the availability of regulation units and/or regulation groups, by amount and direction, and the unit price for activation, after the closing time of the electricity market for the day-ahead and upon a change in availability.

(2) Every balancing service provider, although not obligated to ensure balancing capacity and submit balancing energy bids to the transmission system operator as per Article 9, paragraph 4 of these Rules, may submit balancing energy bids to the transmission system operator in accordance with paragraph 1 above. Such bids of balancing energy shall be defined as voluntary bids.

(3) In case of a shortage of balancing energy, in order to meet the prescribed criteria for the security of the power system and the safe supply of end consumers, the transmission system operator shall retain the right to activate unused regulation units and/or regulation groups prequalified to provide balancing services as described in paragraph 1 above.

IV. SYSTEM BALANCING

Article 14

(1) Transmission system operator shall balance the system to secure operational safety.

(2) Balancing service providers that ensure FCR balancing capacity shall ensure automatic activation of the contracted balancing capacity amounts depending on the operational power system frequency.

(3) In the event of lack or surplus of electricity in the Croatian power system, transmission system operator shall secure balancing energy in a settlement interval as follows:

- *Through activation, purchase and/or sales, of balancing energy from the balancing service provider through contracted balancing capacity,*
- *Through activation, purchase and/or sales, of balancing energy from the balancing service provider based on voluntary bids for balancing energy,*
- *Through purchase and sales from other transmission system operators,*
- *Trough purchase and sales of electricity on market principles from electricity market participants and on the wholesale electricity markets.*

Article 15

(1) Transmission system operator shall forward bids for balancing energy to joint European platform for exchange of standard balancing products pursuant to Articles 19 to 22 of the EB GL Regulation.

(2) Transmission system operator shall activate bids for balancing energy pursuant to Article 29 of the EB GL Regulation based on joint optimisation function for activation.

(3) In the event of inaccessibility and/or unavailability of one or more joint European platforms for exchange of standard balancing products or available balancing energy in them, transmission system operator shall be able to activate balancing energy using all locally and/or cross-border available balancing mechanisms respecting the merit order list of all currently available balancing energy bids.

(4) In the event of inaccessibility and/or unavailability of one or more joint European platforms for exchange of standard balancing products or available balancing energy in them, balancing service provider with the dominant balancing market position in the Republic of Croatia shall submit bids for balancing energy with prices of up to the amount defined in the Rules for defining marginal balancing energy prices attached as Appendix 1 to these Rules.

Article 16

(1) In the event of a insufficiency of balancing energy to meet the safe power system operation and end customer security of supply criteria, transmission system operator shall be able to procure balancing energy on the wholesale electricity markets according to the minimum cost criteria in a transparent and non-discriminatory way as follows:

- *On the electricity exchange and/or*
- *Through direct electricity purchase and sale of electricity on demand to all market participants with a concluded Agreement on Purchase and Sales of Balancing Energy with transmission system operator*

(2) All market participants who have signed an Agreement on purchase and sales of balancing energy with transmission system operator shall have the right to participate in direct purchase and sales of electricity.

(3) Agreement on Purchase and Sales of Balancing Energy shall contain at least the following:

- *Data on parties to the agreement,*

- *Subject matter of the agreement,*

- *Address and method of invoice submission,*

- *Pricing method,*

- *Settlement and payment method,*

- *Conditions and amount of penalties for non-performance of the agreement,*

- *Conditions and amount of financial guarantee,*

- *Method of complaint resolution,*

- *Method of dispute resolution,*

- *Data on duration and termination of the agreement, as well as its termination period.*

(4) Form for the Agreement on purchase and sales of balancing energy shall be published on the web pages of the transmission system operator.

Article 17

(1) In collaboration with other transmission system operators, with the aim of minimising system balancing costs, transmission system operator shall establish joint balancing mechanisms.

(2) In collaboration with other transmission system operators, transmission system operator shall secure mechanism of voluntary mutual assistance in terms of active power.

(3) Transmission System Operators shall contractually define mutual rights and obligations relating to mechanisms referred to in paragraphs 1 and 2 above.

Article 18

(1) The balancing energy settlement principles shall be as follows:

- *Settlement shall be conducted separately for each individual settlement interval, separately for each direction pursuant to Article 14 herein,*

- *Settlement shall be based on determined quantities from balancing energy activation request, on physically delivered balancing energy and unit prices from the bids of the balancing energy of the balancing service providers,*

- *The calculation of the contractual penalty for undelivered balancing energy shall be based on the determined quantities of the balancing energy activation request, the physically delivered balancing energy, and the unit prices from the bids of the balancing service providers.*

(2) Method for settlement of balancing energy shall be defined by:

- *Balancing Service Agreement,*

- *Agreement on Purchase and Sales of Balancing Energy,*

- *Agreements with other transmission system operators.*

Article 19

(1) Transmission system operator shall measure and record balancing energy amounts referred to in Article 14 herein, as well as system imbalance in points of separation from the neighbouring transmission system operators.

(2) Based on metered quantities and unit prices of balancing energy in each settlement interval the transmission system operator shall calculate the following:

- *Total system imbalance and activated balancing energy per settlement interval,*

- *Financial obligation of the transmission system operator for accrued balancing energy per settlement interval.*

Article 20

(1) In each settlement interval system imbalance shall be calculated according to the formula below:

$$E_{Odstupanje,i} = E_{Ostvareno,i} - E_{Planirano,i}$$

where the elements of the equation shall be as follows:

$E_{imbalance,i}$ – energy quantity which represents the difference between realised and planned and cross-zonal exchange of the Croatian regulatory area in a settlement interval *"i"*, in MWh,

$E_{Planned,i}$ – total energy quantity of the planned cross-zonal exchange of the Croatian control area in a settlement interval *"i"* , which is negative during electricity imports in the system, in MWh,

$E_{realised,i}$ – total energy quantity of the realised cross-zonal exchange of the Croatian control area in a settlement interval *"i"* which is negative during electricity imports in the system, in MWh.

(3) Total activated balancing energy in the Croatian control area in a settlement interval *"i"* ($E_{URukp,i}$) shall be calculated according to the formula below:

$$E_{URukp,i} = \left| E_{URukp+,i} \right| - \left| E_{URukp-,i} \right|$$

where the elements of the equation shall be as follows:

$E_{URukp+,i}$ – total quantity of positive balancing energy in a settlement interval *"i"* in MWh,

$E_{URukp-,i}$ – total quantity of negative balancing energy in a settlement interval *"i"* in MWh.

(4) Balancing energy ($E_{URukp,i}$) referred to in paragraph 2 above shall refer exclusively to energy intended for balancing of the Croatian control area, and it comprises:

- Balancing energy from activated aFRR balancing capacity (both positive and negative),
- Balancing energy from activated mFRR balancing capacity (both, positive and negative),
- Balancing energy purchased on the electricity market,
- Balancing energy secured through agreements with other transmission system operators.

(5) System imbalance of control area shall be considered negative when:

$$E_{imbalance,i} + E_{URukp,i} > 0$$

(6) System imbalance of control area shall be considered positive when:

$$E_{imbalance,i} + E_{URukp,i} < 0$$

V. RESPONSIBILITY FOR IMBALANCES

Article 21

(1) Balance group manager shall be responsible for imbalance which is defined as a difference of the total realisation of all balance group members and total market position of all balance group members in a settlement interval.

(2) Balance group manager and the transmission system operator shall conclude an Imbalances Responsibility Agreement regulating responsibility of a balancing group manager for the imbalances of the balance group.

(3) Mutual relations between a balance group manager and balance group members of a balancing group shall be defined by Wholesale electricity market rules.

Article 22

(4) Obligations of a balance group manager shall be the following:

- To settle financial obligations resulting from the settlement of balance group's imbalances pursuant to the Imbalances Settlement Agreement concluded with the transmission system operator,
- To provide additional financial guarantee at the discretion of the transmission system operator, in an amount determined pursuant to the preliminary imbalance settlement process and/or an assessment of the financial obligations of the balance group referred to in Article 36 herein,

- To immediately notify transmission system operator about the change of its name and headquarters and changes in the balance group membership.

Balance Responsibility Agreement

Article 23

(1) Balance Responsibility Agreement shall regulate the following:

- Rules and obligations of the balance group manager and the transmission system operator,
- Method of calculation and settlement of the total financial obligation of the balance group manager resulting from imbalances.

(2) Balance Responsibility Agreement shall contain the following:

- Data on parties to the agreement,
- Subject of the agreement,
- Invoice delivery method,
- Calculation and payment method,
- Conditions, method of calculation and amount of financial guarantee of the balance group's manager,
- Confidentiality terms for sensitive data obtained directly or indirectly during the procedure of settlement of imbalances and their exclusive use for imbalances' settlement,
- Method of complaints resolution,
- Method of disputes resolution,
- Data on duration and termination of the agreement and the termination period.

(3) Form of Balance Responsibility Agreement form shall be published on the internet pages of the transmission system operator.

VI. SETTLEMENT OF IMBALANCES

Article 24

Attribution of metering points to balance groups

(1) Documents regulating attribution of metering point to balance groups shall be as follows:

- Balance group membership agreement,
- End customer supply agreement,
- Electricity purchase agreement,
- Balancing Service Agreement
- Network usage agreement,
- Aggregation agreement,

- Citizen energy community membership agreement,
- Renewable energy community membership agreement,
- Agreement on the exchange of metering data between transmission and distribution system operator,
- Other agreements which can establish balance group membership.

(2) Metering points between:

- Transmission and distribution system of the Republic of Croatia,
- Transmission system of the Republic of Croatia and the neighbouring systems,
- Distribution system of the Republic of Croatia and the neighbouring systems,

shall be considered points of separation of the above mentioned systems.

(3) Electricity taken-over and delivered on a metering point shall be calculated into imbalances of a balance group to which the metering point belongs.

Metering Points Registry

Article 25

(1) Transmission system operator shall be responsible for the Metering Points Registry in the transmission network.

(2) Distribution system operator is responsible for the Metering Points Registry in the distribution network.

(3) All changes in the registries shall be entered by relevant transmission or distribution system operator pursuant to data on coming into force (beginning of validity period), changes or termination of the agreement referred to in Article 24 paragraph 1 herein.

(4) The Registry shall contain at the least the following data:

- basic data on a metering point:
    1. metering point ID,
    2. system user category,
    3. system user ID,
- data on metering point attachment to a balance group:
    1. member of a balance group to which the metering point belongs for the direction of delivery into the system,
    2. member of a balance group to which the metering point belongs for the direction of takeover in the system
    3. legal base for the attachment,
    4. date of agreement coming into force.
- exceptionally, additional data on the affiliation of the settlement metering point in accordance with the wholesale electricity market rules.

(5) Relevant system operator shall keep the registry in a manner which enables determination of the sequence of changes in the Metering Points Registry and revision of:

1. Entries into the registry (history of changes in the registry),

2. Validity date of individual data from the registry (status history).

Change of metering point attachment to a balance group

Article 26

(6) The change in the affiliation of the metering point to a balance group member shall be associated with a change of supplier and/or purchaser of electricity, change of aggregator, change of status in terms of market participant status, change of status related to participation in an energy community/group of active consumers, and other changes in the documents specified in Article 24, paragraph 1 herein that affect the balance affiliation of the metering point, and is recorded with a change in the metering points registry.

Balance group's market position

Article 27

(1) Market position of a balance group ($E_{market position BG}$) in MWh is the difference between contracted sales (including exports) and contracted purchase (including imports) of electricity on a wholesale market of all balance group members in a settlement interval *"i"* together with pertinent effects of activation of balancing energy, and is calculated according to the formula below:

$$E_{market\ position\ BG,i} = E_{sale,ug,i} - E_{purchase,ug,i} + E_{sale,ur,i} - E_{purchase,ur,i} + E_{sale,correction,i} - E_{purchase,correction,i}$$

where the elements of the equation shall be as follows: $E_{sale,ug,i}$ – total electricity sales according to contracted schedules of all balance group members in a settlement interval *"i"* in MWh,

$E_{purchase,ug,i}$ – total electricity purchase according to contracted schedules of all balance group members in a settlement interval *"i"* in MWh,

$E_{sale,ur,i}$ – correction of the balance group market position for sales resulting from activation of balancing energy and energy required to meet the needs of other system services provided by balancing energy provider and/or provider of other system services of all balance group members in a settlement interval *"i"* in MWh,

$E_{purchase,ur,i}$ – correction of the balance group market position for purchase resulting from activation of balancing energy and energy required to meet the needs of other system services provided by

balancing energy provider and/or provider of other services of all balance group members in a settlement interval "i" in MWh,

$E_{sale,correction,i}$ — correction of the balance group market position for sales resulting from activation of balancing energy and energy required to meet the needs of other system services when balancing energy provider and/or provider of other services is also an end user of a transmission or a distribution system (directly) or an independent aggregator in a settlement interval "i" in MWh,

$E_{purchase,correction,i}$ — correction of the balance group market position for purchase resulting from activation of balancing energy and energy required to meet the needs of other system services when balancing service provider and/or provider of other system services is also an end user of a transmission or a distribution grid (directly) or an independent aggregator in a settlement interval "i" in MWh.

(2) Electricity market operator defines the market position for each individual balance group in each settlement interval based on the last approved contracted schedules of the balance group members, and data on purchase and sales of balancing energy and energy required to meet the needs of other system services, as well as based on the correction of balance group market position when balancing energy is secured by grid user directly or an independent aggregator or closed distribution system operator, submitted by the transmission system operator to the electricity market operator pursuant to the Wholesale Electricity Market Rules.

(3) Market position of a balance group is the basis for calculation of balance groups' imbalances.

Article 28

(1) Calculation of realisation of balance group's members is also conducted in the event of force majeure, operation disturbances and/or emergency operation of the transmission and/or distribution network pursuant to these Rules.

(2) Calculation of imbalances of a balance group is also conducted in the event of force majeure, operation disturbances and/or emergency operation of the transmission and/or distribution network pursuant to these Rules.

Settlement of balancing group imbalances in the first (monthly) imbalance settlement

Article 29

(1) Imbalances of individual balancing group in the first (monthly) imbalances settlement shall be calculated by electricity market operator.

(2) Settlement interval in the first (monthly) imbalance settlement process shall be 15 minutes, and the settlement period shall be one calendar month*.*

(3) Imbalance calculation process shall be made for the entire settlement period in the month following that settlement period.

(4) Balance group imbalances ($E_{imbalance\ BG,i}$) shall be calculated for each settlement interval "*i*" as a difference between the balance group's realisation ($E_{realisation\ BG,i}$) and balance group's market position ($E_{market\ position\ BG,i}$) according to the formula below:

$$E_{imbalance\ BG,i} = E_{realisation\ BG,i} - E_{market\ position\ BG,i}$$

where the elements of the equation shall be as follows:

$E_{realisation\ BG,i}$ — sum of realisation of all balance group members in a settlement interval "*i*" in MWh,

$E_{market\ position\ BG,i}$ — balance group market position in a settlement interval "*i*" in MWh.

(5) Realisation of a balance group member ($E_{realisation\ of\ BG\ member,i}$) in MWh for a settlement interval "i" shall be calculated according to the formula below:

$$E_{reasliation\ of\ BG\ member,i} = E_{delivered\ by\ BG\ member,i} - E_{taken\ over\ from\ BG\ member,i}$$

where the elements of the equation shall be as follows:

$E_{delivered\ by\ BG\ members,i}$ — quantity of total electricity delivered into power system by a member of a balance group in a settlement interval "*i*" in MWh,

$E_{taken\ over\ from\ BG\ member,i}$ — quality of total electricity taken over from power system by a member of a balance group in a settlement interval "*i*" in MWh.

(7) Electricity takeover and delivery data for a metering point equipped with interval meter shall be determined pursuant to the system operator's Grid Code.

(8) For metering points not equipped with interval meters, electricity takeover and delivery realised in a settlement period shall be determined pursuant to the Grid Code of the system operator.

(9) Total electricity delivered into the power system by a balance group member in a settlement interval "*i*" ($E_{delivered\ by\ BG\ members,i}$) in MWh shall be calculated as follows:

$$E_{delivered\ by\ BG\ member,i} = \sum_{n=1}^{M} E_{n,i}$$

where the elements of the equation shall be as follows:

$E_{n,i}$ — data on realised electricity delivery in a metering point „*n*" in MWh for a settlement interval "*i*",

M – the total number of metering points belonging to that balance group member pursuant to paragraph 6 above.

(10)   Total electricity taken over from the power system by a balance group member in a settlement interval "i" ($E_{taken\ over\ from\ BG\ member,i}$) shall be calculated as follows:

$$E_{taken\ over\ from\ BG\ member,i} = \sum_{n=1}^{M} E_{n,i} + E_{nko,i}$$

where the elements of the equation shall be as follows:

$E_{n,i}$ – data on realised electricity takeover in a metering point „n" in MWh for a settlement interval "i",

M – the total number of metering points belonging to that balancing group member pursuant to paragraph 6 above,

$E_{nko,i}$ – data on realised electricity takeover by a balancing group member pursuant to paragraph 7 above for a settlement interval "i" in MWh.

Transmission system operator and distribution system operator balance group imbalances in the first (monthly) imbalance settlement process

Article 30

(1) Transmission system operator's balance group imbalances shall be calculated by the electricity market operator for each individual settlement interval and shall be defined as difference between actual transmission system losses and part of a transmission system operator's market position referring to the procurement of electricity for covering transmission system losses.

(2) Distribution system operator's balance group imbalances shall be calculated by the electricity market operator for each individual settlement interval and shall be defined as a difference between realisation and distribution system operator's market position referring to the procurement of electricity for covering distribution system losses.

Article 31

(1) For the purposes of the first (monthly) imbalance settlement process distribution system losses for each settlement interval shall be calculated pursuant to the Rules for application of standard load profiles and shall be considered to be electricity taken over as per article 29, paragraph 9 herein.

(2) Realisation of the transmission system operator's balance group in the first (monthly) imbalance settlement process shall be calculated for each individual interval and as a difference between total electricity delivered into the transmission grid and total electricity taken over from the transmission grid, whereby electricity is delivered or taken over in points of separation from the distribution grid, at points of separation from transmission grid of the neighbouring transmission system operators, and in metering points of transmission grid users.

Calculation of the correction of balance group market position

Article 32

(1) Settlement period and settlement interval for the calculation of the correction of balance group market position are the same as in the calculation of imbalances.

(2) Quantities for the calculation of the correction of the balance group market position for individual balance group shall be determined by the transmission system operator in accordance with the delivered balancing energy and energy to meet the needs of other system services pursuant to article 27, paragraph 1 herein.

(3) The transmission system operator shall calculate the correction of balance group market position for individual grid users and grid users within the portfolio of an independent aggregator based on the proportion of the change in the operating point of each regulation unit in the total acknowledged activated balancing energy of the independent aggregator's portfolio in a specific settlement interval.

(4) The transmission system operator shall provide data on the correction of balance group market position of individual grid users to the electricity market operator and the supplier directly affected by the activation of an end customer who participates in demand management independently or through an independent aggregator.

The method for determining compensation to the supplier directly affected by the activation of demand side response

Article 33

(1) End customer who participates in provision of balancing services independently or through an independent aggregator shall pay compensation to their supplier, who is directly affected by the activation of demand management, pursuant to Article 28 of the Electricity Market Act (Official Gazette NN 111/2021, 83/2023).

(2) The amount of energy that the end customer, referred to in paragraph 1 above, shall compensate to their supplier shall correspond to the amount of their correction of balance group market position referred to in Article 32, paragraph 4 herein in the direction of sales for each settlement interval.

(3) The marginal unit price of the compensation referred to in paragraph 1 above shall be determined as follows:

$$P_{compensationa_{gr,i}} = \begin{cases} P_{CROPEX_{DA,i}} & for\ P_{CROPEX_{DA,i}} > 0 \\ 0 & for\ P_{CROPEX_{DA,i}} < 0 \end{cases}$$

where the elements of the equation shall be as follows:

$P_{compensationa_{gr,i}}$ – the price at which the end customer shall pay compensation to the supplier directly affected by the activation of demand management in the settlement interval „*i*", expressed in EUR/MWh.

$P_{CROPEX_{DA},i}$ – the price of electricity on the day-ahead market at the Croatian Power Exchange Ltd. (http://www.cropex.hr) during the settlement interval „i", expressed in EUR/MWh.

Settlement of balancing group imbalances in the second (annual) imbalance settlement process

Article 34

(1) Settlement interval in the second (annual) imbalance settlement process shall be a calendar month, and the settlement period shall be a calendar year.

(2) In the second (annual) imbalance settlement process the difference between metered realisation pursuant to the General conditions for system use and electricity supply and realisation in the first (monthly) imbalance settlement pursuant to the Rules for application of standard load profiles shall be calculated.

(3) In the second (annual) imbalances settlement process the realisation of distribution system losses is used.

(4) The calculation of imbalances for the entire settlement period of a calendar year shall be conducted in the year following the settlement period for which the settlement is made.

(5) Imbalances of individual balance groups in the second (annual) calculation of imbalances process shall be calculated by the electricity market operator based on realisation data of balance group members and data on actual losses in the distribution and the transmission system delivered by the distribution and the transmission system operator.

(6) In the second (annual) imbalances settlement process the realised monthly $(E_{realisation,j}^{II})$ electricity takeover and/or delivery in individual metering points ("*i*"), as well as monthly distribution system losses for each individual settlement interval of the second imbalances calculation (calendar month) of the settlement period (calendar year) shall be calculated by the distribution system operator pursuant to the Rules for application of standard load profiles.

(7) Balance group imbalance in the second (annual) imbalance settlement process is a sum of imbalances of all metering points belonging to the balancing group:

$$E_{imbalance\ BG}^{II} = \sum_{j=1}^{N} E_{imbalance,j}^{II}$$

where the elements of the equation shall be as follows:

$E_{imbalance,j}^{II}$ – determined monthly imbalance of a metering point „*j*" within the second (annual) imbalance settlement process

N – total number of metering points which belonged to the balance group in the relevant month.

(8) Imbalance of a metering point in a calendar month equals to a difference between realisation in the second (annual) imbalances settlement process and the first (monthly) imbalance settlement:

$$E_{imbalance,j}^{II} = E_{realisation,j}^{II} - E_{realisation,j}^{I}$$

where the elements of the equation shall be as follows:

$E_{ostvarenje,j}^{II}$ — determined (calculated) monthly realisation of a metering point within the second (annual) imbalance settlement,

$E_{ostvarenje,j}^{I}$ — determined (calculated) data on monthly realisation in a metering point within the first (monthly) imbalance settlement.

(9) Distribution system operator balancing group imbalances in a calendar month shall correspond to the difference between realisation in the second (annual) imbalance settlement and the first (monthly) imbalances settlement:

$$E_{realisation\ BG\ DSO}^{II} = E_{realisation\ BG\ DSO}^{II} - E_{realisation\ BG\ DSO}^{I}$$

where the elements of the equation shall be as follows:

$E_{realisation\ BG\ ODS}^{II}$ — determined (calculated) monthly realisation within the second (annual) imbalance settlement process,

$E_{realisation\ BG\ ODS}^{I}$ — determined (calculated) data on monthly realisation within the first (monthly) imbalance settlement process.

(10) In the event of changed data on realised electricity takeover and/or delivery in metering points on the interface of the transmission system operator in relation to the first imbalance settlement process, imbalance of the transmission system operator's balance group in one calendar month equals the difference between realisations, calculated pursuant to Article 28 herein in the second (annual) imbalance settlement and the first (monthly) imbalance settlement process:

$$E_{imbalance\ BG\ TSO}^{II} = E_{realisation\ BG\ TSO}^{II} - E_{realisation\ BG\ TSO}^{I}$$

where the elements of the equation shall be as follows:

$E_{realisation\ BG\ TSO}^{II}$ — determined (calculated) monthly realisation within the second (annual) imbalance settlement process,

$E_{realisation\ BG\ TSO}^{I}$ — determined (calculated) monthly realisation within the first (monthly) imbalance settlement process.

(11)　　　In the event of a change in the data on actual delivery and/or takeover of electricity in the metering points at the interface between the transmission system operator and the distribution system operator, compared to the first imbalances settlement process, the transmission system operator is required to officially and without delay provide the corrected data to the distribution system operator.

Data delivery in the first (monthly) and the second (annual) imbalances settlement process

Article 35

(1) Pursuant to article 29, paragraph 5 herein, realisation of balance group members in each settlement interval of a settlement period for metering points in the transmission grid shall be calculated by the transmission system operator.

(2) Pursuant to article 29, paragraph 5 herein, realisation of balancing group members in each settlement interval of a settlement period for metering points in the distribution system shall be calculated by the distribution system operator.

(3) The sum of realisation of all balance group members for metering points in the distribution grid, including distribution system losses, shall be equal to realised exchange on the interface of the transmission system operator and distribution system operator in each settlement interval in a settlement period.

(4) Realisation of the transmission system operator's balance group shall be calculated by the transmission system operator.

(5) Values of sampling load curves for losses in the distribution grid in the first (monthly) imbalances settlement process for each settlement interval *"i"* shall be calculated by the distribution system operator.

(6) Realization of losses in the distribution grid for the purpose of the second (annual) imbalance settlement process shall be calculated by the distribution system operator pursuant to the Rules for application of the sampling load curve and shall be considered electricity that was taken over as per Article 29, paragraph 9 herein.

(7) The distribution system operator and the transmission system operator shall deliver data on realisation of balance group members expressed in MWh/h and rounded to three decimal places to the electricity market operator.

(8) Distribution system operator and transmission system operator shall be responsible for the accuracy of data delivered for the purpose of imbalance settlement process.

(9) Deadline for the delivery of data on realisation of members of balance groups in the first (monthly) imbalances settlement process is the sixteenth (16th) day of the month following the settlement period to which the data refers.

(10)　　　Deadline for the delivery of data referred to in Article 37, paragraphs 4 and 5 and data on total monthly balancing energy cost provided for in Article 20, paragraph 3 and data whereby the market position is corrected as provided for in Article 27, paragraph 1 is the sixteenth (16th) day of the month following the settlement period to which the data refer.

(11)   Deadline for the delivery of data for the purpose of the second (annual) imbalance settlement process is the nineteenth (19th) day of the month for previous months in the calendar year for which the settlement is being made.

(12)   Deadline for the delivery of data on the realisation of balancing group members in the second (annual) imbalance settlement process is the nineteenth (19th) January in the year following the settlement period (calendar year) to which the data refer.

(13)   Delivery of data required for imbalances settlement process shall be regulated by an agreement defining mutual relations between the transmission system operator and the electricity market operator, as well as distribution system operator and electricity market operator pursuant to the Wholesale electricity market rules.

(14)   Relations in the points of separation of the distribution system operator and the transmission system operator shall be regulated by an agreement on the exchange of metering data between the transmission and distribution system operator pursuant to the General conditions for system use and electricity supply.

(15)   Realisation of individual balance groups shall be calculated in each settlement interval of a settlement period by the electricity market operator.

(16)   Electricity market operator shall send to the transmission system operator total realisation of balancing group members as a result of the realisation in the distribution network and in the transmission network.

Preliminary data delivery in the first (monthly) imbalance settlement and preliminary calculation of financial guarantee adequacy

Article 36

(1) The transmission system operator shall continuously monitor the adequacy of the financial guarantee amounts from contracts on Balance Responsibility Agreement as provided for in Article 23 herein, based on preliminary imbalances settlement process or the calculation of the preliminary financial obligation of the balance group.

(2) The transmission system operator shall conduct a daily assessment of the financial obligation of the balance group using all available data including: contractual schedules submitted by the electricity market operator, unvalidated metering data, data from the balancing energy settlements, and historical performance data of market participants.

(3) The electricity market operator conducts a preliminary imbalance settlement process for the current settlement periods: from 1st – 15th day of the calendar month; from the 16th to the last day of the calendar month.

(4) The electricity market operator shall conduct a preliminary imbalances settlement process based on preliminary unvalidated data, as provided for in paragraph 3 above:

- on the purchase and sale of balancing energy and energy required to meet the needs of other system services, and correction of balance group market position when balancing energy is provided by a grid user directly or by an independent aggregator, which shall be supplied by the transmission system operator pursuant to Article 27, paragraph 2 herein and Article 20, paragraphs 4 and 5 herein,

- realisation of balance group members determined pursuant to Article 29 and Article 35, paragraphs 1, 2, 7 herein which shall be supplied by the distribution system operator pursuant to the corresponding provisions of the Rules for the application of standard load curves,

- realisation of balance group members determined pursuant to Article 29 and Article 35, sections 1, 2, 7 herein which shall be supplied by the transmission system operator,

- the latest correct versions of the contractual schedules of balance group members and balance group managers delivered by the balance group managers for the period from the 1st to the 15th day of the calendar month and for the period from the 16th to the last day of the calendar month.

(5) The deadline for the submission of data referred to in paragraph 4 above is the second (2nd) day after the end of each period referred to in paragraph 3 above.

(6) Within two (2) days after the expiration of the deadline referred to in paragraph 5 above, the electricity market operator shall deliver the preliminary imbalances settlement to the transmission system operator.

(7) If the last day of the deadline referred to in paragraphs 5 and 6 above falls on a Saturday, Sunday, public holiday, or another non-working day in the Republic of Croatia, the deadline shall expire on the first subsequent working day.

(8) The transmission system operator shall check the adequacy of the financial guarantee referred to in paragraph 1 above according to the calculations provided for in paragraph 2 and/or paragraph 3 above. If the total financial obligation of the balance group manager for the previous settlement periods and the preliminary financial obligation for the current settlement period (section 2 and/or 3 above) exceeds by twenty percent (20%) the amount of financial guarantee provided in accordance with valid Balance Responsibility Agreement, transmission system operator may request additional financial guarantee.

(9) Within a fixed deadline of three (3) days from the day of receiving the request electronically from the transmission system operator as provided for in paragraph 8 above, the balance group manager shall provide an additional financial guarantee in the form of a cash deposit. It is considered that the balance group manager has received the request from the transmission system operator two (2) days after the day on which the transmission system operator sent it to the balance group manager by email to the email address specified in the Balance Responsibility Agreement.

(10) If the balance group manager does not comply with paragraph 9 above, the Imbalances Responsibility Agreement shall be terminated by law the day after the expiration of the three (3) day deadline from the day the request was received from the transmission system operator as provided for in paragraph 9 above.

VII. FINANCIAL SETTLEMENT OF IMBALANCES

The price of imbalances in the first imbalance settlement

Article 37

(1) Imbalance settlement shall be conducted by applying the imbalance price which is for the duration of the imbalance settlement equal for all balancing group managers, and is of equal amount for both, positive and negative imbalances.

(2) Weighted average price of activated positive balancing energy from frequency control reserves in a settlement interval *"i"* equals:

$$C_{EU+,i} = \frac{E_{aFRR+,i} \cdot C_{aFRR+,i} + E_{mFRR+,i} \cdot C_{mFRR+,i}}{E_{aFRR+,i} + E_{mFRR+,i}}$$

where the elements of the equation shall be as follows:

$E_{aFRR+,i}$ – total quantity of realised positive balancing energy activated from aFRR in a settlement interval *"i"* in MWh,

$E_{mFRR+,i}$ – total quantity of realised positive balancing energy active from mFRR in a settlement interval *"i"* in MWh,

$C_{aFRR+,i}$ – weighted average price of realised positive balancing energy activated from aFRR frequency control reserve in a settlement interval *"i"* in EUR/MWh:

$$C_{aFRR+,i} = \frac{\sum_{n=1}^{N} E_{aFRR+,n,i} \cdot C_{aFRR+,n,i}}{\sum_{n=1}^{N} E_{aFRR+,n,i}}$$

where the elements of the equation shall be as follows:

N – number of aFRR balancing service providers,

$E_{aFRR+,n,i}$ – total quantity of realised positive balancing energy activated from aFRR from the *"n"th* provider in a settlement interval *"i"* in MWh,

$C_{aFRR+,n,i}$ – weighted average price of realised positive balancing energy activated from aFRR from the *"n"th* provider in a settlement interval *"i"* in EUR/MWh:

$$C_{aFRR+,n,i} = \frac{\sum_{j=1}^{M} E_{aFRR+,n,i,j} \cdot C_{aFRR+,n,i,j}}{\sum_{j=1}^{M} E_{aFRR+,n,i,j}}$$

where the elements of the equation shall be as follows:

M – number of activated positive balancing energy bids activated from aFRRfrom the *"n"th* provider in a settlement interval *"i"*

$E_{aFRR+,n,i,j}$ – quantity of realised balancing energy activated from aFRR from the *"j"th* bid of the *"n"th* provider in a settlement interval *"i"* in MWh,

$C_{aFRR+,n,i,j}$ – price of *"j"th* bid of the *"n"th* provider in a settlement interval *"i"* in EUR/MWh.

$C_{mFRR+,t}$ – weighted average price of balancing energy activated from mFRR in a settlement interval *"i"* in EUR/MWh:

$$C_{mFRR+,i} = \frac{\sum_{n=1}^{N} E_{mFRR+,n,i} \cdot C_{mFRR+,n,i}}{\sum_{i=1}^{N} E_{mFRR+,n,i}}$$

where the elements of the equation shall be as follows:

N – number of mFRR balancing service providers,

$E_{mFRR+,n,i}$ – total quantity of realised positive balancing energy activated from mFRR from the *"n"th* provider in a settlement interval *"i"* in MWh,

$C_{mFRR+,n,i}$ – weighted average price of realised positive balancing energy activated from mFRR power reserve from the *"n"th* provider in a settlement interval *"i"* in EUR/MWh:

$$C_{mFRR+,n,i} = \frac{\sum_{j=1}^{M} E_{mFRR+,n,i,j} \cdot C_{mFRR+,n,i,j}}{\sum_{j=1}^{M} E_{mFRR+,n,i,j}}$$

where the elements of the equation shall be as follows:

M – number of positive balancing energy bids activated from mFRR from the *"n"th* provider in a settlement interval *"i"*

$E_{mFRR+,n,i,j}$ - quantity of realised balancing energy activated from mFRR from the *"j"th* bid of the *"n"th* provider in a settlement interval *"i"* in MWh,

$C_{mFRR+,n,i,j}$ - price of *"j"th* bid of the *"n"th* provider in a settlement interval *"i"* in EUR/MWh.

(3) Weighted average price of activated negative balancing energy from frequency control reserves in a settlement interval shall equal:

$$C_{EU-,i} = \frac{E_{aFRR-,i} \cdot C_{aFRR-,i} + E_{mFRR-,i} \cdot C_{mFRR-,i}}{E_{aFRR-,i} + E_{mFRR-,i}}$$

where the elements of the equation shall be as follows:

$E_{aFRR-,i}$ – total quantity of realised negative balancing energy activated from aFRR in a settlement interval *"i"* in MWh,

$E_{mFRR-,i}$ – total quantity of realised negative balancing energy activated from mFRR in a settlement interval *"i"* in MWh,

$C_{aFRR-,i}$ – weighted average price of realised negative balancing energy activated from aFRR in a settlement interval *"i"* in EUR/MWh:

$$C_{aFRR-,i} = \frac{\sum_{n=1}^{N} E_{aFRR-,n,i} \cdot C_{aFRR-,n,i}}{\sum_{n=1}^{N} E_{aFRR-,n,i}}$$

where the elements of the equation shall be as follows:

N – number of aFRR balancing service providers,

$E_{aFRR-,n,i}$ – total quantity of realised negative balancing energy activated fromaFRR from the *"n"th* provider in a settlement interval *"i"* in MWh,

$C_{aFRR-,n,i}$ – weighted average price of realised negative balancing energy activated from aFRR of the *"n"th* provider in a settlement interval *"i"* in EUR/MWh

$$C_{aFRR-,n,i} = \frac{\sum_{j=1}^{M} E_{aFRR-,n,i,j} \cdot C_{aFRR-,n,i,j}}{\sum_{j=1}^{M} E_{aFRR-,n,i,j}}$$

where the elements of the equation shall be as follows:

M – number of activated negative balancing energy bids activated from aFRR from the *"n"th* provider in a settlement interval *"i"*,

$E_{aFRR-,n,i,j}$ – quantity of realised negative balancing energy activated from aFRR from the *"j"th* bid of the *"n"th* provider in a settlement interval *"i"* in MWh,

$C_{aFRR-,n,i,j}$ – price of *"j"th* bid of the *"n"th* provider in a settlement interval *"i"* in EUR/MWh.

$C_{mFRR-,i}$ – weighted average price of realised negative balancing energy activated from mFRR in a settlement interval *"i"* in EUR/MWh:

$$C_{mFRR-,i} = \frac{\sum_{n=1}^{N} E_{mFRR-,n,i} \cdot C_{mFRR-,n,i}}{\sum_{n=1}^{N} E_{mFRR-,n,i}}$$

where the elements of the equation shall be as follows:

N – number of mFRR balancing service providers.

$E_{mFRR-,n,i}$ – total quantity of realised negative balancing energy activated from mFRR from the *"n"th* provider in a settlement interval *"i"* in MWh,

$C_{mFRR-,n,i}$ – weighted average price of realised negative balancing energy activated from mFRR of the *"n"th* provider in a settlement interval *"i"* in EUR/MWh:

$$C_{mFRR-,n,i} = \frac{\sum_{j=1}^{M} E_{mFRR-,n,i,j} \cdot C_{mFRR-,n,i,j}}{\sum_{j=1}^{M} E_{mFRR-,n,i,j}}$$

where the elements of the equation shall be as follows:

M – number of activated negative balancing energy bids activated from mFRR from the *"n"th* provider in a settlement interval *"i"*,

$E_{mFRR-,n,i,j}$ – quantity of realised negative balancing energy activated from mFRR from the *"j"th* bid of the *"n"th* provider in a settlement interval *"i"* in MWh,

$C_{mFRR-,n,i,j}$ – price of *"j"th* bid of the *"n"th* provider in a settlement interval *"i"* in EUR/MWh.

(4) In a settlement interval *"i"*, when neither positive nor negative balancing energy is activated values of non-performed balancing energy activation from frequency control reserves shall be:

$$C_{EU0,i} = C_{CROPEX_{DA},i}$$

where the element of the equation shall be as follows:

$C_{CROPEX_{DA},i}$ – electricity price on the day-ahead market at the Croatian electricity exchange Ltd. (http://www.cropex.hr) in a settlement interval *"i"* in EUR/MWh.

(5) When system imbalance of control area , in a settlement interval *"i"*, is negative single price for imbalance shall be:

$$C_{1,i} = \begin{cases} (1+p) \cdot max\{C_{EU+,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR+,i}| > 0 \\ (1-p) \cdot min\{C_{EU-,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR+,i}| = 0 \; i \; |E_{FRR-,i}| > 0 \\ (1+p) \cdot max\{C_{EU0,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR+,i}| = |E_{FRR-,i}| = 0 \end{cases}$$

where the elements of the equation shall be as follows:

p – coefficient of financial neutrality $\in [0,1]$,

$C_{CROPEX_{DA},i}$ – electricity price on day-ahead market at the Croatian electricity exchange Ltd. (http://www.cropex.hr) in a settlement interval "*i*" in EUR/MWh,

$E_{FRR+,i}$ – total quantity of realised positive balancing energy activated from both, aFRR and mFRR in a settlement interval *"i"* in MWh,

$E_{FRR-,i}$ – total quantity of realised negative balancing energy activated from both, aFRR and mFRR in a settlement interval *"i"* in MWh.

(6) When system imbalance of control area control area, in a settlement interval *"i"*, is positive single price for imbalance shall be:

$$C_{1,i} = \begin{cases} (1-p) \cdot min\{C_{EU-,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR-,i}| > 0 \\ (1+p) \cdot max\{C_{EU+,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR-,i}| = 0 \; i \; |E_{FRR+,i}| > 0 \\ (1-p) \cdot min\{C_{EU0,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR+,i}| = |E_{FRR-,i}| = 0 \end{cases}$$

(7) When a control area, in a settlement interval *"i"*, did not have any imbalance, single price for imbalance shall be:

$$C_{1,i} = \begin{cases} (1+p) \cdot max\{C_{EU+,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR+,i}| > 0 \; i \; |E_{FRR-,i}| = 0 \\ (1-p) \cdot min\{C_{EU-,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR+,i}| = 0 \; i \; |E_{FRR-,i}| > 0 \\ (1+p) \cdot max\{C_{EU+,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR+,i}| > 0 \; i \; |E_{FRR-,i}| > 0 \\ max\{C_{EU0,i}; C_{CROPEX_{DA},i}\} & za \; |E_{FRR+,i}| = |E_{FRR-,i}| = 0 \end{cases}$$

(8) In the event of temporary unavailability of $C_{CROPEX_{DA,}i}$ price referred to in paragraphs 4,5, and 6 above and price referred to in paragraph 7 above, instead of $C_{CROPEX_{DA},i}$ average price realised in regional energy exchanges BSP (http://www.bsp-southpool.com) and Hungarian electricity exchange HUPX (http://www.hupx.hu) shall be used, expressed in EUR/MWh.

(9) In the event of temporary unavailability of $C_{CROPEX_{DA,}i}$ price referred to in paragraphs 4,5, and 6 above and price referred to in paragraph 7 above, instead of $C_{CROPEX_{DA},i}$ average price of day-ahead electricity price at the Croatian electricity exchange Ltd. (http://www.cropex.hr) in the nearest characteristic settlement interval (work day, Saturday, Sunday) shall be used.

(10) The value of financial neutrality coefficient *"p"* is calculated in order to make up for the actual system balancing energy cost on the level of settlement period. The financial neutrality coefficient shall be determined in an iterative procedure with step 0,01 within the margin of minimum 0 to maximum 1. Iterative procedure shall be halted when the sum total of financial obligations of all balancing group managers with financial neutrality coefficient in the current iteration, on the settlement period level, pursuant to Article 40, paragraph 2 herein in EUR, shall be lower or equal to the financial obligation of the transmission system operator on the settlement period level for engaged balancing energy pursuant to Article 17, paragraph 3 herein in EUR. The last financial neutrality coefficient calculated shall be used in imbalance settlement.

(11) By way of derogation from paragraph 10 above, should a negative price of the positive and/or negative balancing energy occur in a settlement interval „i" ($C_{EU+,i}$ and/or $C_{EU-,i}$), in that particular settlement interval the value of financial neutrality coefficient shall be zero.

(12) For the purpose of calculation of weighted average prices referred to in paragraphs 2 and 3 above, in each settlement interval *"i"* all activated balancing energy bids shall be used to meet the balancing needs of the Croatian control area.

The price of imbalances in the second imbalance settlement process

Article 38

(1) Unit price in the second imbalance settlement process in a settlement interval is equal for both, positive and negative imbalances, and shall be calculated as follows:

$$C_{2,j} = \frac{\sum_{i=1}^{n_j} E_{ODS,i} \cdot C_{CROPEX_{DA},i}}{\sum_{i=1}^{n_j} E_{ODS,i}}$$

where the elements of the equation shall be as follows:

$E_{ODS,i}$ – values of the distribution system load curve rules of application of the sampling load curve in a settlement interval *"i"* in MWh which the distribution system operator sends to the electricity market operator by

the nineteenth (19th) of the month following the settlement period to which the values of the distribution system load curve refer,

$C_{CROPEX_{DA},i}$ – shall be determined pursuant to Article 37 herein,

n_j –number of settlement intervals in a settlement period *"j"* (calendar month) in which the available price is $C_{CROPEX_{DA},i}$.

(2) Electricity market operator shall by the twenty-first (21st) of the current month publish unit price in the second imbalance settlement process on its internet pages for the preceding month.

Article 39

All prices and financial amounts determined by these Rules are rounded to two decimal places.

Delivery of the first (monthly) and the second (annual) imbalance settlement

Article 40

(1) In the first (monthly) imbalance settlement electricity market operator shall by the eighteenth (18th) of the month following the settlement period deliver:

- to the transmission system operator and the Agency imbalance settlement of each balance group for the relevant settlement period,
- to the balance group manager imbalance settlement for his balance group as well as imbalance settlement per balance group member for each settlement interval.

(2) The imbalances settlement in the first (monthly) imbalances settlement shall include the following:

- the amount of positive or negative imbalance of a balance group for each settlement interval calculated pursuant to article 29, paragraph 4 herein,
- unit prices for balancing energy settlement process for positive or negative imbalances for each settlement interval,
- financial obligation of the balance group manager for each settlement interval which shall be calculated as a product of the imbalance amount and relevant imbalance price,
- total financial obligation of the balance group manager for settlement period which equals the sum of financial obligations in all settlement intervals.

(3) In the second (annual) provisional imbalance settlement, electricity market operator shall by the twenty-first (21st) of the current month deliver to the balance group manager provisional imbalance amount of his balance group per balance group member for each settlement interval of previous settlement interval (calendar month).

(4) Electricity market operator shall by the twenty-first (21st) January in the year following the settlement period (calendar year) to which the settlement refers, deliver to the balance group manager provisional imbalance amount of his balance group per balance group member for the previous settlement interval (calendar year).

(5) Electricity market operator shall by the eighteenth (18ᵗʰ) of February in a year following the settlement period (calendar year) to which the settlement refers, deliver to all balance group managers and to the transmission system operator the second (annual) and final imbalance settlement report.

(6) The imbalances settlement report in the second (annual) imbalance settlement process referred to in paragraphs 4 and 5 above shall include the following:

- the amount of balance group imbalance for each settlement interval,
- unit prices for balancing energy settlements for both, positive and negative imbalance for each settlement interval,
- financial obligation of the balance group manager for each settlement interval which shall be calculated as a product of the imbalance amount and relevant imbalance price,
- total financial obligation of the balance group manager for a settlement period which equals the sum of financial obligations in all settlement intervals.

(7) Transmission system operator, distribution system operator and electricity market operator shall send to the Agency the data set out herein by the deadline, and in the format and form harmonised with that of the Agency.

Invoicing

Article 41

(1) If the total financial obligation for balance group imbalances within a settlement period is negative, transmission system operator shall issue an invoice to the balance group manager.

(2) If the total financial obligation for balance group imbalances within a settlement period is positive, the balance group manager shall issue an invoice to transmission system operator.

(3) Invoices referred to in paragraphs 1 and 2 above shall within the first (monthly) imbalances settlement process be issued by the twentieth (20th) of the month following the settlement period (month) for which the settlement is made.

(4) Invoices referred to in paragraphs 1 and 2 above shall within the second (annual) imbalances settlement process be issued immediately upon the delivery of the final imbalances settlement report by the electricity market operator.

(5) Imbalances settlement of a balance group shall be a component part of each invoice.

(6) The invoice matures fifteen (15) days within invoice issuing.

VIII. RESOLUTION OF COMPLAINTS

Article 42

(1) Issued invoice referred to in article 41 herein can be disputed by the balance group manager by filing a complaint to the transmission system operator within eight (8) days from the date of invoice receipt, only in the event when the transmission system operator has, when issuing the invoice based on imbalances data provided by the electricity market operator, miscalculated the financial obligation of the balance group manager. Complaints filed for any other reason shall be forwarded to the electricity market operator for competent handling. It shall be considered that the balance group manager has received the relevant invoice from the transmission system operator two (2) days after the day on which the transmission system operator sent the same invoice to the balance group manager by email to the email address specified in the Imbalance Responsibility Agreement.

(2) Market position of a balance group referred to in article 27 herein, and/or imbalances settlement referred to in article 40, paragraphs 1, 3 and 4 herein, can be disputed by the balance group manager by filing a complaint to the electricity market operator within ten (10) days from the delivery date of the first (monthly) imbalances settlement and the second (annual) estimated imbalances settlement.

(3) The complaint shall be intelligible and shall contain everything necessary to ensure its implementation, particularly: the title of the body which it is submitted to, claimant's company name, first and last name of the person filing the complaint, seal and signature of the responsible person, and legal basis for filing the complaint.

(4) Claimant referred to in paragraph 2 herein shall state reasons for contestation in the complaint and attach documents proving groundness of the complaint. Should the complaint lack elements required for its handling, or should it be unintelligible or incomplete, an official shall invite the claimant in a statement to complete the complaint within three (3) days, also notifying the claimant of legal consequences. If the claimant should not proceed pursuant to the statement, the transmission system operator shall issue a decision discarding the complaint. Should the complaint be inadmissible or untimely or made by unauthorised person, transmission system operator shall issue a decision discarding the complaint.

(5) In the event of a complaint filed as per paragraph 2 herein, within five (5) working days from the delivery of the written complaint to the electricity market operator:

- The transmission system operator shall give its response regarding the accuracy of the realisation pursuant to article 35, paragraphs 1 and 4 herein, and regarding the accuracy of purchase and sales data of balancing energy activated from aFRR and mFRR, as well as energy to meet the needs of other services pursuant to Article 27, paragraphs 1 and 3 herein,
- The transmission system operator shall respond to the distribution system operator regarding the accuracy of the data on energy exchange at the interface between the transmission and distribution network within one (1) working day from the day of receiving a written request from the electricity market operator. This response is needed after the initial data provision to the distribution system operator for the calculation of realizations, following which the distribution system

operator must verify the accuracy of the realizations pursuant to Article 35, paragraph 2, and the compensatory settlement data pursuant to Article 35, paragraphs 5 and 6 herein.

(6) Complaints validly filed pursuant to paragraph 1 above and referring to the first (monthly) imbalance settlement shall postpone the maturity and settlement of financial obligation of the balance group's manager as per invoices issued.

(7) Complaints referred to in paragraph 2 above referring to the first (monthly) imbalances settlement shall not postpone the maturity and settlement of financial obligation of the balancing group's manager as per invoices issued.

(8) Electricity market operator shall within fifteen (15) days from the date of reception of the complaint referred to in paragraph 2 of this article make a decision of its acceptance or rejection.

(9) By way of derogation from the provisions above, in cases where the electricity market operator, as the ECO balance group manager, disputes the market position of a balance group as provided for in the Article 27 herein and/or the imbalance settlement as provided for in the Article 40, paragraphs 1, 3, and 4 herein, it shall be considered that they have submitted a request for the correction of inaccuracies in the imbalance settlement, which is delivered to the transmission and/or distribution system operator for action pursuant to the provision of paragraph 10 above.

(10) The distribution system operator and the transmission system operator shall be authorized and obliged, in any case including when no complaint has been lodged under paragraph 2 above, to officially and without delay, in case of submitting incorrect data as per paragraph 5 above to the electricity market operator, deliver corrected data referred to in paragraph 5 above, in accordance with the deadlines prescribed for the complaint procedure in this article.

(11) The electricity market operator shall be authorized and obliged, officially and without delay, in case of the delivery of incorrect imbalance settlements to the balance groups managers, to correct the imbalance settlement concerning the balance groups affected by the inaccuracies, in accordance with the deadlines prescribed for the complaint procedure by this article.

(12) In the event of acceptance of a complaint referred to in paragraph 2 and in the event referred to in paragraph 11 above, the electricity market operator shall correct the imbalance settlement concerning the balance groups affected by the accepted complaint, which shall become final and shall serve as the basis for issuing a new invoice and harmonisation of financial relations between the transmission system operator and the managers of the balance groups affected by the accepted complaint.

(13) No objection shall be permitted to the final settlement in the second (annual) imbalance settlement process under Article 40, paragraph 5 herein, except in exceptional cases when a discrepancy between the settlements and accepted complaints on the first and/or second informational settlement is unequivocally determined.

Article 43

(1) The balance group manager shall be authorized to file a complaint against the application of these Rules pursuant to the Electricity Market Act.

(2) Filing a complaint to the Agency regarding the application of these Rules shall not delay the due date and execution of the balancing group manager's obligations to pay the invoice.

IX.   AVAILABILITY OF DATA

Article 44

(1) For Croatian control area transmission system operator shall publish data on electricity system balancing on the joint ENTSO-E Transparency Platform which results from the Commission Regulation (EU) 543/2013 dated 14 June 2013 on submission and publication of data in electricity markets and amending Annex 1 to the Regulation (EC) No 714/2009 of the European Parliament and of the Council, Regulation SO GL and Regulation EB GL.

(2) The transmission system operator shall submit to the Agency data on the realization and costs of balancing services referred to in Article 4 of Appendix 2 to these Rules by the 25th day of the current month for the previous month, in a format and form agreed with the Agency.

(3) The transmission system operator shall provide the Agency, upon its request, with explanations, data, and documentation necessary for monitoring the application of Appendix 2 to these Rules.

(4) The dominant balancing service provider shall provide the Agency, upon request, with explanations, data, and documentation for the purposes of monitoring the application of Appendix 2 to these Rules.

X. AMENDMENTS

Article 45

(1) Transmission system operator shall monitor the application of these Rules and prepare amendment to these Rules.

(2) Should the amendments to these Rules become necessary transmission system operator shall, on its own initiative, or on the suggestion of the Agency, initiate the amendment procedure.

Article 46

Explanations and interpretation of the Rules shall be given by the transmission system operator.

XI. TRANSITIONAL AND FINAL PROVISIONS

Article 47

(1) Settlement interval for calculation of imbalances pursuant to Article 29, paragraph 2 herein and Articles 2 and 3 of Appendix 1 to these Rules is one hour up until the fulfilment of the requirements stipulated by Article 53 of the Regulation EB GL.

(2) The preliminary calculation of the adequacy of the financial guarantee referred to in Article 36 herein shall begin to be applied upon meeting the technical conditions for the delivery of preliminary unvalidated data stipulated by Article 36, paragraph 3 herein, or no later than July 1, 2024.

(3) The procurement of balancing services for FCR balancing capacity referred to in Article 4, paragraph 3 herein shall be applied as of January 1, 2025.

(4) For balancing services for which prices for the current calendar year and/or the previous calendar year do not exist, the price shall be calculated as the average price for available calendar years.

(5) By connecting the transmission system operator to one of the common European platforms for the exchange of standard products for balancing, the balancing energy settlement stipulated by Article 18 herein shall be carried out based on the activation request of the transmission system operator.

Article 48

In a crisis situation or circumstances provided for by Energy Act or the Commission Regulation 2017/2096 dated 24 November 2017 on establishing a network code on electricity emergency and restoration, transmission system operator, with the approval of the relevant Ministry, may partially or completely temporarily suspend these Rules.

Article 49

Legal entities performing public service of special interest for the Republic of Croatia, as stipulated by a Decision of the Government of the Republic of Croatia, may, instead of the financial guarantee provided by these Rules or the contracts based on it, provide another type of financial guarantee that has the characteristics of an enforceable document as provided for in the provisions of the Execution Act, which is acceptable to the transmission system operator.

Article 50

The transmission system operator shall publish on its website the rules for conducting prequalification procedures referred to in Article 5, as well as the contract forms referred to in Article 7, paragraph 2, and Article 16, paragraph 4 herein no later than six (6) months after these Rules come into force, and the form for the Balance Responsibility Agreement referred to in Article 23, paragraph 3 herein by 1 March, 2024.

Article 51

The transmission system operator and balance group managers shall align existing contractual relationships with these Rules by 1 April, 2024. For this purpose, balance group managers shall, within eight (8) days from the electronically delivered written request of the transmission system operator and at its discretion, sign an annex to the existing agreement or a new agreement; otherwise, the transmission system operator shall have the right to terminate the Balance Responsibility Agreement.

Article 52

Procedures initiated before the coming of these Rules into force shall be completed pursuant to the Rules on the balancing of the electricity system (HOPS 11/2019) and Methodology for determining prices for the provision of ancillary services (HOPS 10/2020).

Article 53

(1) These Rules shall come into force on the fifteenth (15) day following their publication on the internet pages of the Transmission System Operator (www.hops.hr).

(2) With the coming into force of these Rules, Rules on the balancing of the electricity system, Methodology for determining prices for balancing energy settlement (11/2019) shall cease to be valid, excepting the provisions pursuant to which the following is conducted:

- the first monthly imbalance settlement for January, February, and March 2024,

- the second (annual) imbalance settlement for the calendar year 2023,

- the second (annual) settlement for January, February, and March in the calendar year 2024.

(3) Upon the entry into force of these Rules, the Methodology for determining prices for providing ancillary services (HOPS 10/2020) shall cease to be valid in the part concerning balancing services.

In Zagreb, 14 December 2023

President of the Management
Board

Igor Ivanković, Ph.D

Appendix 1

Rules for defining marginal balancing energy prices

Article 1

Calculation of unit marginal balancing energy price in a settlement interval for increase and decrease of generation within the scope of activation of aFRR and mFRR shall be based on the calculation of reference price for balancing energy in a settlement interval *"i"*.

Article 2

(1) Reference price ($C_{ur,i}$) for balancing energy for each settlement interval *"i"* shall be expressed in EUR/MWh, and shall be calculated according to the following formula:

$$C_{ur,i} = CROPEX_{DA}, i$$

where the elements of the equation shall be as follows:

$CROPEX_{DA}, i$ – electricity price for the relevant settlement interval "i" on the day-ahead market at the Croatian electricity exchange CROPEX (http://www.cropex.hr) in EUR/MWh,

i – settlement interval.

(2) In the event of temporary unavailability of prices on day ahead market at the Croatian electricity exchange ($CROPEX_{DA}, i$) referred to in paragraph 1 above or isolated operation of the Croatian electricity exchange (CROPEX), balancing energy reference price in a settlement interval „i" shall equal:

$$C_{ur,i} = \frac{SIPX_i + HUPX_i}{2}$$

where the elements of the equation shall be as follows:

$SIPX_i$ – electricity price for the relevant settlement interval *"i"* at day ahead market at the regional energy exchange BSP (http://www.bsp-southpool.com) expressed in EUR/MWh,

$HUPX_i$ – electricity price for the relevant settlement interval *"i"* on day ahead market at the Hungarian energy exchange HUPX (http://www.hupx.hu) expressed in EUR/MWh.

(3) In the event of temporary simultaneous unavailability of prices or isolated operation of both exchanges referred to in Article 2, the reference price for balancing energy in the settlement interval *"i"* shall be equal to the value of the reference price for balancing energy in the settlement interval that occurred 7 days prior to the respective settlement interval.

Article 3

(1) Values of unit marginal prices for each settlement interval *"i"* shall be expressed in EUR/MWh, rounded to two decimal places and calculated according to the following formulae:

Service		Unit marginal price
Balancing energy from aFRR	positive balancing energy	$C_{aFRR+,i} = C_{ur,i} + k_{aFRR+} \cdot |C_{ur,i}|$
	negative balancing energy	$C_{aFRR-,i} = C_{ur,i} - k_{aFRR-} \cdot |C_{ur,i}|$
Balancing energy from mFRR for balancing	positive balancing energy	$C_{mFRR+,i} = C_{ur,i} + k_{mFRR+} \cdot |C_{ur,i}|$
	negative balancing energy	$C_{mFRR-,i} = C_{ur,i} - k_{mFRR-} \cdot |C_{ur,i}|$
Balancing energy from mFRR for system safety	positive balancing energy	$C_{mFRR,SS,i} = C_{ur,i} + k_{mFRR,SS} \cdot |C_{ur,i}|$

where the elements of the equation shall be as follows:

k_{aFRR+} – price coefficient for positive balancing energy from aFRR,

k_{aFRR-} – price coefficient for negative balancing energy from aFRR,

k_{mFRR+} – price coefficient for positive balancing energy from mFRR for balancing,

k_{mFRR-} – price coefficient for negative balancing energy from mFRR for balancing,

$k_{mFRR,SS}$ – price coefficient for positive balancing energy from mFRR for system safety.

(2) Coefficient values referred to in paragraph 1 above for each settlement interval are given in the Table below:

k_{aFRR+}	0,4
k_{aFRR-}	0,4
k_{mFRR+}	0,3
k_{mFRR-}	0,3
$k_{mFRR,SS}$	0,4

Appendix 2

Rules for determining marginal prices for securing balancing capacity for the provision of balancing services

Article 1

This Appendix stipulates the method for determining the prices of balancing services procured from the dominant balancing service provider to achieve the following objectives:

- reliable transmission system operation in accordance with professional rules and the state of technical equipment

- stimulating operational efficiency of the transmission system operator and the development of the balancing services market

- fostering cooperation with other system operators

- enabling stable and predictable business conditions for the transmission system operator

- enabling stable and predictable business conditions for the dominant provider of ancillary services

- setting prices for balancing services based on the recognized costs of providing balancing services by the dominant provider of ancillary services to the transmission system operator.

I. BALANCING SERVIES AS DEFINED BY THIS ANNEX

Article 2

The balancing services under this Annex shall include:

- FCR balancing capacity determined by the amount [MW] and unit price [EUR/MW] in the relevant hour,

- aFRR balancing capacity determined by the amount and direction of available power reserve [MW] and unit price [EUR/MW] in the relevant hour,

- mFRR balancing capacity determined by the amount and direction of available power reserve [MW] and unit price [EUR/MW] in the relevant hour.

The characteristics of the necessary balancing products for each balancing service shall be determined by the transmission system operator.

Article 3

The dominant balancing service provider shall meet technical conditions as provided for in the Rules for conducting prequalification procedures referred to in paragraphs 2 and 3 of Article 5 herein, depending on the type of balancing service provided.

Article 4

The transmission system operator shall determine the needs for balancing services for the upcoming calendar year, which shall be contracted with the dominant balancing service provider, in accordance with the following principles:

1. required amounts of FCR, aFRR, and mFRR shall be contracted pursuant to the SO GL Regulation.

2. the amounts contracted with the dominant balancing service provider pursuant to item 1 above, may be reduced by amounts planned to be provided on market principles.

Article 5

The transmission system operator and the dominant balancing service provider shall contract the provision of balancing services in amounts required and according to the parameter values specified herein and the Methodology for determining tariff items for electricity transmission.

II. TOTAL AMOUNT OF CONTRACTED BALANCING SERVICE QUANTITIES IN THE PREVIOUS CALENDAR YEAR

Article 6

(1) The total amount of FCR balancing capacity K_{FCR} in the previous calendar year contracted with the dominant balancing service provider shall be determined according to the following formula:

$$K_{FCR} = \sum_{j=1}^{N_h} P_{FCR,j}$$

where the elements of the equation shall be as follows:

$P_{FCR,j}$ - contracted amount of FCR balancing capacity in the relevant hour j [MW]
N_h - number of hours in the previous calendar year.

(2) The total amount of aFRR balancing capacity in the positive direction $K_{1,aFRR+}$ in the previous calendar year contracted with the dominant balancing service provider shall be determined pursuant to the following formula:

$$K_{1,aFRR+} = \sum_{j=1}^{N_h} P_{aFRR+,j}$$

where the elements of the equation shall be as follows:

$P_{aFRR+,j}$ - contracted amount of aFRR balancing capacity in the positive direction in the relevant hour „*j*" [MW].

(3) Total amount of aFRR balancing capacity in the negative direction $K_{1,aFRR-}$ in the previous calendar year contracted with the dominant balancing service provider shall be determined according to the following formula:

$$K_{1,aFRR-} = \sum_{j=1}^{N_h} P_{aFRR-,j}$$

where the elements of the equation shall be as follows:

$P_{aFRR-,j}$ - contracted amount of aFRR balancing capacity in the negative direction in the relevant hour "*j*" [MW].

(4) Total amount of mFRR balancing capacity for balancing in the positive direction $K_{2,mFRR,ur+}$ in the previous calendar year contracted with the dominant balancing service provider shall be determined according to the following formula:

$$K_{2,mFRR,ur+} = \sum_{j=1}^{N_h} P_{mFRR,ur+,j}$$

where the elements of the equation shall be as follows:

$P_{mFRR,ur+,j}$ - contracted amount of mFRR balancing capacity for balancing in the positive direction in the relevant hour "*j*" [MW].

(5) Total amount of mFRR balancing capacity for balancing in the negative direction $K_{2,mFRR,ur-}$ in the previous calendar year contracted with the dominant balancing service provider shall be determined according to the following formula:

$$K_{2,mFRR,ur-} = \sum_{j=1}^{N_h} P_{mFRR,ur-,j}$$

where the elements of the equation shall be as follows:

$P_{mFRR,ur-,j}$ - contracted amount of mFRR balancing capacity for balancing in the negative direction in the relevant hour "*j*" [MW].

(6) Total amount of mFRR balancing capacity for system safety in the positive direction $K_{3,mFRR,sig}$ in the previous calendar year contracted with the dominant balancing service provider shall be determined according to the following formula:

$$K_{3,mFRR,sig} = \sum_{j=1}^{N_h} P_{mFRR,sig,j}$$

where the element of the equation shall be as follows:

$P_{mFRR,sig,j}$ - contracted amount of mFRR balancing capacity for system safety in the positive direction in the relevant hour "*j*" [MW].

III. BALANCING SERVICE PRICE DETERMINATION METHOD

Article 7

(1) The amounts of fixed parameters required for determining the prices of balancing services shall be specified in Appendix A, which is an integral part of this Appendix.

(2) The method for determining the values of variable parameters required for determining the prices of balancing services shall be specified in Appendix B, which is an integral part of this Appendix.

(3) Parameters referred to in Appendix B to this Appendix for which there are no recorded values for the entire previous calendar year shall be determined based on the average value of the recorded parameter values in that previous calendar year.

Article 8

(1) Price of FCR balancing capacity c_{FCR} shall be calculate according to the following formula:

$$c_{FCR} = \frac{T_{FCR,1} + T_{FCR,2} + T_{FCR,3} + T_{FCR,4} + T_{FCR,5}}{K_{FCR}}$$

where the elements of the equation shall be as follows:

$T_{FCR,1}$ cost of investment in FCR balancing capacity [EUR]

$T_{FCR,2}$ cost of additional equipment for FCR balancing capacity [EUR]

$T_{FCR,3}$ cost of reducing the lifespan of units participating in providing FCR balancing capacity [EUR]

$T_{FCR,4}$ cost of more frequent maintenance of units participating in providing FCR balancing capacity [EUR]

$T_{FCR,5}$ cost of planning, operational management, and settlement of FCR balancing capacity [EUR].

(2) Cost of investment in FCR balancing capacity $T_{FCR,1}$ shall be calculated according to the following formula:

$$T_{FCR,1} = \frac{C_{HE} \cdot P_{FCR,j}}{t_{go} \cdot \frac{u_{go}}{100} + t_{po} \cdot \frac{u_{po}}{100} + t_{so} \cdot \frac{u_{so}}{100}} \cdot \left(1 + \frac{R}{100}\right)$$

where the elements of the equation shall be as follows:

C_{HE} cost of investing in the construction of a pumped-storage hydro power plant [EUR/MW]

R return on equity [%]

t_{go} lifespan of structure and hydro-mechanic equipment [year]

t_{po} lifespan of primary(rotating) equipment [year]

t_{so} lifespan of secondary equipment (metering, management, protection and communication) [year]

u_{go} share of construction and engines in investment[%]

u_{po} share of primary (rotating) equipment in investment [%]

u_{so} share of secondary equipment in investment [%].

(3) Cost of additional equipment for FCR balancing capacity $T_{FCR,2}$ shall be calculated according to the following formula:

$$T_{FCR,2} = n_{FCR} \cdot \left[\frac{C_{FCR}}{t_{so}} \cdot \left(1 + \frac{R}{100}\right) + T_{oFCR}\right]$$

where the elements of the equation shall be as follows:

C_{FCR} cost of installation of additional equipment for FCR balancing capacity [EUR/technical unit]

n_{FCR} number of technical units which have participated in providing aFRR balancing capacity in the previous year

T_{oFCR} cost of FCR balancing capacity maintenance per technical unit [EUR/technical unit].

(4) Cost of reducing the lifespan of aggregates participating in the provision of FCR balancing capacity $T_{FCR,3}$ shall be calculated according to the following formula:

$$T_{FCR,3} = P_{FCR,j} \cdot \frac{C_{HE} \cdot \frac{u_{po}}{100}}{t_{po}} \cdot \left(1 + \frac{R}{100}\right) \cdot \frac{1}{n_{FCR}}$$

(5) Cost of more frequent maintenance of technical units participating in the provision of FCR balancing capacity $T_{FCR,4}$ shall be calculated according to the following formula:

$$T_{FCR,4} = \frac{u_{odrS}}{100} \cdot \frac{1}{n_{FCR}} \cdot \sum_{i=1}^{n_{FCR}} T_{s,i}$$

where the elements of the equation shall be as follows:

u_{odrS} share of more frequent maintenance [%]

$T_{s,i}$ total permanent cost of all units "i" in regulation group, permanent cost includes cost of regulation group maintenance, cost of regulation group decommissioning, cost of gross salaries, other personnel costs, cost of join functions and other operating costs [EUR].

(6) Cost of planning, operational management and calculation of FCR balancing capacity $T_{FCR,5}$ shall be calculated according to the following formula:

$$T_{FCR,5} = \left(T_{FCR,1} + T_{FCR,2} + T_{FCR,3} + T_{FCR,4}\right) \cdot \frac{k_r}{100}$$

where the element of the equation shall be as follows:

k_r coefficient of the cost of planning, operational management and calculation of balancing services [%].

Article 9

(1) Price of aFRR balancing capacity in the positive and negative direction $c_{1,+}, c_{1,-}$ shall be calculated according to the following formula:

$$c_{1,+} = \frac{T_{11,+} + T_{12,+} + T_{13,+} + T_{14,+} + T_{15,+} + T_{16,+} + T_{17,+}}{K_{1,aFRR+}}$$

$$c_{1,-} = \frac{T_{11,-} + T_{12,-} + T_{13,-} + T_{14,-} + T_{15,-} + T_{16,-} + T_{17,-}}{K_{1,aFRR-}}$$

where each of the costs shall be distributed as per direction:

$T_{11,+/-}$ cost of investment in aFRR balancing capacity [EUR]

$T_{12,+/-}$ cost of additional equipment for aFRR balancing capacity [EUR] $T_{13,+/-}$ cost of reducing lifespan of technical units participating in providing aFRR balancing capacity [EUR]

$T_{14,+/-}$ opportunity cost due to reduced efficiency of technical units participating in providing aFRR balancing capacity [EUR]

$T_{15,+/-}$ cost of more frequent maintenance of technical units participating in providing aFRR balancing capacity [EUR]

$T_{16,+/-}$ opportunity cost due to night shifts, as well as work during Saturdays, Sundays, and other non-working days, of technical units participating in providing aFRR balancing capacity [EUR]

$T_{17,+/-}$ cost of planning, operational management, and settlement of aFRR balancing capacity [EUR].

(2) Cost of investment in aFRR power reserve in the positive direction $T_{11,+}$ and in the negative direction $T_{11,-}$ shall be calculated according to the following formula:

$$T_{11,+} = u_{aFRR+} \cdot \frac{C_{HE} \cdot \max(P_{aFRR+,j})}{t_{go} \cdot \frac{u_{go}}{100} + t_{po} \cdot \frac{u_{po}}{100} + t_{so} \cdot \frac{u_{so}}{100}} \cdot \left(1 + \frac{R}{100}\right)$$

$$T_{11,-} = u_{aFRR-} \cdot \frac{C_{HE} \cdot \max(P_{aFRR-,j})}{t_{go} \cdot \frac{u_{go}}{100} + t_{po} \cdot \frac{u_{po}}{100} + t_{so} \cdot \frac{u_{so}}{100}} \cdot \left(1 + \frac{R}{100}\right)$$

$$u_{aFRR+} = \frac{\max(P_{aFRR+,j})}{\max(P_{aFRR+,j}) + \max(P_{aFRR-,j})}$$

$$u_{aFRR-} = 1 - u_{aFRR+}$$

(3) Cost of additional equipment for aFRR balancing capacity in the positive direction $T_{12,+}$ and in the negative direction $T_{12,-}$ shall be calculated according to the following formula:

$$T_{12,+} = u_{aFRR+} \cdot n_S \cdot \left[\frac{C_{so}}{t_{so}} \cdot \left(1 + \frac{R}{100}\right) + T_{oS}\right]$$

$$T_{12,-} = u_{aFRR-} \cdot n_S \cdot \left[\frac{C_{so}}{t_{so}} \cdot \left(1 + \frac{R}{100}\right) + T_{oS}\right]$$

where the elements of the equation shall be as follows:

C_{so} cost of installation of additional control equipment [EUR/technical unit]

n_S number of technical units which have participated in the provision of aFRR balancing capacity in the previous calendar year

T_{oS} cost of a FRR power reserve maintenance per technical unite [EUR/technical unit].

(4) Cost of reducing the lifespan of technical units participating in providing aFRR balancing capacity in the positive direction $T_{13,+}$ and in the negative direction $T_{13,-}$ shall be calculated according to the following formula:

$$T_{13,+} = u_{aFRR+} \cdot \frac{\max(P_{aFRR+,j}) \cdot C_{HE} \cdot \frac{u_{po}}{100}}{t_{po}} \cdot \left(1 + \frac{R}{100}\right) \cdot \frac{1}{n_s} \cdot \sum_{i=1}^{n_s} K_{S+,i}$$

$$T_{13,-} = u_{aFRR-} \cdot \frac{\max(P_{aFRR-,j}) \cdot C_{HE} \cdot \frac{u_{po}}{100}}{t_{po}} \cdot \left(1 + \frac{R}{100}\right) \cdot \frac{1}{n_s} \cdot \sum_{i=1}^{n_s} K_{S-,i}$$

$$K_{S+,i} = \begin{cases} \left(1 + \frac{t_{radS+,i}}{t_{rad,i}}\right) & , t_{rad,i} \geq t_{proj} \\ 0 & , t_{rad,i} < t_{proj} \end{cases}$$

$$K_{S-,i} = \begin{cases} \left(1 + \frac{t_{radS-,i}}{t_{rad,i}}\right) & , t_{rad,i} \geq t_{proj} \\ 0 & , t_{rad,i} < t_{proj} \end{cases}$$

where the elements of the equation shall be as follows:

$t_{radS+/-,i}$ number of hours of participation of technical units in providing aFRR balancing capacity in the positive/negative direction [h]

$t_{rad,i}$ total number of operating hours of technical units in the previous calendar year [h]

t_{proj} projected annual operating hours of technical units [h].

(5) Opportunity cost due to reduced efficiency of production of technical units participating in providing aFRR balancing capacity in the positive direction $T_{14,+}$ and in the negative direction $T_{14,-}$ shall be calculated according to the following formula:

$$T_{14,+} = C_{px} \cdot \frac{\Delta\eta}{100} \cdot \sum_{i=1}^{n_s} \left(W_i \cdot \frac{t_{radS+,i}}{t_{rad,i}} \right)$$

$$T_{14,-} = C_{px} \cdot \frac{\Delta\eta}{100} \cdot \sum_{i=1}^{n_s} \left(W_i \cdot \frac{t_{radS-,i}}{t_{rad,i}} \right)$$

where the elements of the equation shall be as follows:

C_{px} average electricity price in the previous calendar year [EUR/MWh]

$\Delta\eta$ estimated efficiency loss due to lower loading of technical units relative to optimal production characteristics [%]

W_i electricity generation of technical unit in the previous calendar year [MWh].

(6) Cost of more frequent maintenance of technical units participating in providing aFRR balancing capacity in the positive direction $T_{15,+}$ and in the negative direction $T_{15,-}$ shall be calculated according to the following formula:

$$T_{15,+} = \frac{u_{odrS}}{100} \cdot \frac{1}{n_S} \cdot \sum_{i=1}^{n_s} \left(T_{s,i} \cdot \frac{t_{radS+,i}}{t_{rad,i}} \right)$$

$$T_{15,-} = \frac{u_{odrS}}{100} \cdot \frac{1}{n_S} \cdot \sum_{i=1}^{n_s} \left(T_{s,i} \cdot \frac{t_{radS-,i}}{t_{rad,i}} \right)$$

(7) Opportunity cost due to night shifts, as well as work during Saturdays, Sundays, and other non-working days, incurred by technical units participating in providing aFRR balancing capacity in the positive direction $T_{16,+}$ and in the negative direction $T_{16,-}$ shall be calculated according to the following formula:

$$T_{16,+} = u_{aFRR+} \cdot k_{oHE} \cdot \left(C_{pV} - C_{pN} \right) \cdot (W_{noć} + W_{ndiv})$$

$$T_{16,-} = u_{aFRR-} \cdot k_{oHE} \cdot \left(C_{pV} - C_{pN} \right) \cdot (W_{noć} + W_{ndiv})$$

where the elements of the equation shall be as follows:

C_{pN} average electricity price from 0:00-6:00 every day of the previous calendar year [EUR/MWh]

C_{pV} average electricity price from 9:00-13:00 and 17:00-22:00 every day of the previous calendar year [EUR/MWh]

k_{oHE} factor of unavailability of hydropower potential due to physical limitations of the reservoirs of the regulation group

W_{ndiv} electricity production of regulatory groups, which participate in providing the respective service, during Saturdays, Sundays, and other non-working days [MWh]

$W_{noć}$ electricity production of regulatory groups, which participate in providing the respective service, during night-time operation [MWh].

(8) Cost of planning, operational management, and settlement of aFRR balancing capacity in the positive direction $T_{17,+}$ and in the negative direction $T_{17,-}$ shall be calculated according to the following formula:

$$T_{17,+} = \left(T_{11,+} + T_{12,+} + T_{13,+} + T_{14,+} + T_{15,+} + T_{16,+}\right) \cdot \frac{k_r}{100}$$

$$T_{17,-} = \left(T_{11,-} + T_{12,-} + T_{13,-} + T_{14,-} + T_{15,-} + T_{16,-}\right) \cdot \frac{k_r}{100}$$

Article 10

(1) Prices for mFRR power reserve for system balancing in both, positive and negative directions shall be calculated according to the following formula:

$$c_{2,+} = \frac{T_{21,+} + T_{22,+} + T_{23,+} + T_{24,+} + T_{25,+} + T_{26,+}}{K_{2,mFRR,ur+}}$$

$$c_{2,-} = \frac{T_{21,-} + T_{22,-} + T_{23,-} + T_{24,-} + T_{25,-} + T_{26,-}}{K_{2,mFRR,ur-}}$$

where costs shall be distributed according to the direction:

$T_{21,+/-}$ cost of investing in mFRR for balancing [EUR]

$T_{22,+/-}$ operational costs and costs of preventive and corrective maintenance due to providing mFRR for balancing [EUR]

$T_{23,+/-}$ cost of reducing the lifespan of technical units in hydroelectric plants participating in providing mFRR for system balancing [EUR]

$T_{24,+/-}$ cost of reducing the lifespan of regulatory groups (units) in thermal power plants participating in providing mFRR for balancing [EUR]

$T_{25,+/-}$ opportunity cost due to night work, as well as work during Saturdays, Sundays, and non-working days, of technical units participating in providing mFRR for balancing [EUR]

$T_{26,+/-}$ cost of planning, operational management, and accounting for the provision of mFRR for balancing [EUR].

(2) Cost of investing in mFRR balancing capacity for balancing in the positive direction $T_{21,+}$ and in the negative direction $T_{21,-}$ shall be calculated according to the following formula:

$$T_{21,+} = u_{mFRR,ur+} \cdot \max(P_{mFRR,ur+,j})$$
$$\cdot \left(\frac{K_{2HE,+}}{K_{2,mFRR,ur+}} \cdot \frac{C_{HE}}{t_{go} \cdot \frac{u_{go}}{100} + t_{po} \cdot \frac{u_{po}}{100} + t_{so} \cdot \frac{u_{so}}{100}} + \frac{K_{2TE,+}}{K_{2,mFRR,ur+}} \cdot \frac{C_{TE}}{t_{TE}} \right)$$
$$\cdot \left(1 + \frac{R}{100} \right)$$

$$T_{21,-} = u_{mFRR,ur-} \cdot \max(P_{mFRR,ur-,j})$$
$$\cdot \left(\frac{K_{2HE,-}}{K_{2,mFRR,ur-}} \cdot \frac{C_{HE}}{t_{go} \cdot \frac{u_{go}}{100} + t_{po} \cdot \frac{u_{po}}{100} + t_{so} \cdot \frac{u_{so}}{100}} + \frac{K_{2TE,-}}{K_{2,mFRR,ur-}} \cdot \frac{C_{TE}}{t_{TE}} \right)$$
$$\cdot \left(1 + \frac{R}{100} \right)$$

$$u_{mFRR,ur+} = \frac{\max(P_{mFRR,ur+,j})}{\max(P_{mFRR,ur+,j}) + \max(P_{mFRR,ur-,j})}$$
$$u_{mFRR,ur-} = 1 - u_{mFRR,ur+}$$

where the elements of the equation shall be as follows:

C_{TE} cost of investment in thermal power plants [EUR/MW]

t_{TE} life span of thermal power plants [year]

$K_{2HE,+/-}$ mFRR balancing capacity for balancing from hydro power plants in positive/negative direction [MW]

$K_{2TE,+/-}$ mFRR balancing capacity for balancing from thermal power plants in positive/negative direction [MW].

(3) Operational costs and costs of preventive and corrective maintenance due to providing mFRR balancing capacity for system balancing in the positive direction u $T_{22,+}$ and in the negative direction $T_{22,-}$ shall be calculated according to the following formula:

$$T_{22,+} = \frac{u_{odrT}}{100} \cdot \frac{1}{n_T} \cdot \sum_{i=1}^{n_T} \left(T_{s,i} \cdot \frac{t_{radT+,i}}{t_{rad,i}} \right)$$
$$T_{22,-} = \frac{u_{odrT}}{100} \cdot \frac{1}{n_T} \cdot \sum_{i=1}^{n_T} \left(T_{s,i} \cdot \frac{t_{radT-,i}}{t_{rad,i}} \right)$$

where the elements of the equation shall be as follows:

u_{odrT} share of costs for more frequent maintenance [%]

n_T number of technical units that participated in providing mFRR balancing capacity for balancing in the previous calendar year

$t_{radT+/-,i}$ number of hours of participation of technical units in providing mFRR balancing capacity for balancing in the positive/negative direction in the previous calendar year [h].

(4) Cost of reducing the lifespan of technical units in hydro power plants participating in providing mFRR balancing capacity for balancing in the positive direction $T_{23,+}$ and in the negative $T_{23,-}$ shall be calculated according to the following formula:

$$T_{23,+} = \frac{K_{2HE,+}}{2 \cdot N_h} \cdot \left(1 + \frac{R}{100}\right) \cdot \frac{C_{HE} \cdot \frac{u_{po}}{100}}{t_{go} \cdot \frac{u_{go}}{100} + t_{po} \cdot \frac{u_{po}}{100} + t_{so} \cdot \frac{u_{so}}{100}} \cdot \frac{1}{n_{T,HE}} \cdot \sum_{i=1}^{n_{T,HE}} K_{T,HE,+,i}$$

$$T_{23,-} = \frac{K_{2HE,-}}{2 \cdot N_h} \cdot \left(1 + \frac{R}{100}\right) \cdot \frac{C_{HE} \cdot \frac{u_{po}}{100}}{t_{go} \cdot \frac{u_{go}}{100} + t_{po} \cdot \frac{u_{po}}{100} + t_{so} \cdot \frac{u_{so}}{100}} \cdot \frac{1}{n_{T,HE}} \cdot \sum_{i=1}^{n_{T,HE}} K_{T,HE,-,i}$$

$$K_{T,HE,+,i} = \begin{cases} \left(1 + \frac{t_{radT+,i}}{t_{rad,i}}\right) & , t_{rad,i} \geq t_{proj} \\ 0 & , t_{rad,i} < t_{proj} \end{cases}$$

$$K_{T,HE,-,i} = \begin{cases} \left(1 + \frac{t_{radT-,i}}{t_{rad,i}}\right) & , t_{rad,i} \geq t_{proj} \\ 0 & , t_{rad,i} < t_{proj} \end{cases}$$

where the elements of the equation shall be as follows:

$n_{T,HE}$ number of hydroelectric plant technical units that participated in providing mFRR balancing capacity for balancing in the previous calendar year

N_h number of hours in the previous calendar year.

(5) Cost of reducing the lifespan of regulatory groups (units) in thermal power plants participating in providing mFRR balancing capacity for balancing in the positive direction $T_{24,+}$ and in the negative direction $T_{24,-}$ shall be calculated according to the following formula:

$$T_{24,+} = \frac{K_{2TE,+}}{2 \cdot N_h} \cdot \left(1 + \frac{R}{100}\right) \cdot \frac{C_{TE} \cdot \frac{u_{po}}{100}}{t_{TE}} \cdot \frac{1}{n_{T,TE}} \cdot \sum_{i=1}^{n_{T,TE}} K_{T,TE,+,i}$$

$$T_{24,-} = \frac{K_{2TE,-}}{2 \cdot N_h} \cdot \left(1 + \frac{R}{100}\right) \cdot \frac{C_{TE} \cdot \frac{u_{po}}{100}}{t_{TE}} \cdot \frac{1}{n_{T,TE}} \cdot \sum_{i=1}^{n_{T,TE}} K_{T,TE,-,i}$$

$$K_{T,TE,+,i} = \begin{cases} \left(1 + \frac{t_{radT+,i}}{t_{rad,i}}\right) & , t_{rad,i} \geq t_{proj} \\ 0 & , t_{rad,i} < t_{proj} \end{cases}$$

$$K_{T,TE,-,i} = \begin{cases} \left(1 + \frac{t_{radT-,i}}{t_{rad,i}}\right) & , t_{rad,i} \geq t_{proj} \\ 0 & , t_{rad,i} < t_{proj} \end{cases}$$

where the element of the equation shall be as follows:

$n_{T,TE}$ number of regulatory groups (units) of thermal power plants that participated in providing mFRR balancing capacity for balancing in the previous calendar year.

(6) Opportunity cost due to night work, as well as work during Saturdays, Sundays, and other non-working days, of technical units participating in providing mFRR balancing capacity for balancing in the positive direction $T_{25,+}$ and in the negative direction $T_{25,-}$ shall be calculated according to the following formula:

$$T_{25,+} = u_{mFRR,ur+} \cdot k_{oHE} \cdot k_{akHE} \cdot (C_{pV} - C_{pN}) \cdot (W_{T,noć} + W_{T,ndiv})$$
$$T_{25,-} = u_{mFRR,ur-} \cdot k_{oHE} \cdot k_{akHE} \cdot (C_{pV} - C_{pN}) \cdot (W_{T,noć} + W_{T,ndiv})$$

where the elements of the equation shall be as follows:

k_{akHE} share of pumped-storage power plants in providing mFRR balancing capacity for balancing in the previous calendar year
$W_{T,noć}$ electricity generation of regulatory groups, which participate in providing the respective service, during night-time operation [MWh]
$W_{T,ndiv}$ electricity production of regulatory groups, which participate in providing the respective service, during Saturdays, Sundays, and other non-working days [MWh].

(7) Cost of planning, operational management, and settlement of providing mFRR balancing capacity for balancing in the positive direction $T_{26,+}$ and in the negative direction $T_{26,-}$ shall be calculated according to the following formula:

$$T_{26,+} = (T_{21,+} + T_{22,+} + T_{23,+} + T_{24,+} + T_{25,+}) \cdot \frac{k_r}{100}$$

$$T_{26,-} = (T_{21,-} + T_{22,-} + T_{23,-} + T_{24,-} + T_{25,-}) \cdot \frac{k_r}{100}$$

Article 11

(1) Price of mFRR balancing capacity for system safety c_3 shall be calculated according to the following formula:

$$c_3 = \frac{T_{31} + T_{32} + T_{33} + T_{34}}{K_{3,mFRR,sig}}$$

where the elements of the equation shall be as follows:

T_{31} cost of investment in mFRR balancing capacity for system safety [EUR]
T_{32} additional maintenance costs due to participation in providing mFRR balancing capacity for system safety [EUR]

T_{33} cost of reserving natural gas transportation capacity for providing mFRR balancing capacity for system safety [EUR]

T_{34} Cost of planning, operational management, and settlement for providing mFRR balancing capacity for system safety[EUR]

(2) Cost of investment in mFRR balancing capacity for system safety T_{31} shall be calculated according to the following formula:

$$T_{31} = max\left(P_{\text{mFRR,sig},j}\right) \cdot \left(\frac{K_{3HE}}{K_{3,mFRR,sig}} \cdot \frac{C_{HE}}{t_{go} \cdot \frac{u_{go}}{100} + t_{po} \cdot \frac{u_{po}}{100} + t_{so} \cdot \frac{u_{so}}{100}} + \frac{K_{3TE}}{K_{3,mFRR,sig}} \cdot \frac{C_{TE}}{t_{TE}} \right) \cdot \left(1 + \frac{R}{100}\right)$$

where the elements of the equation shall be as follows:

K_{3HE} secured mFRR balancing capacity for system security from hydro power plants [MW]

K_{3TE} secured mFRR power reserve for balancing capacity from thermal power plants [MW].

(3) Additional maintenance costs due to participation in providing mFRR balancing capacity for system safety T_{32} shall be calculated according to the following formula:

$$T_{32} = \frac{u_{odrTS}}{100} \cdot \frac{1}{n_{TS}} \cdot \sum_{i=1}^{n_{TS}} \left(T_{s,i} \cdot \frac{t_{radTS,i}}{t_{rad,i}} \right)$$

where the elements of the equation shall be as follows:

n_{TS} number of technical units/regulation groups which participated in providing mFRR balancing capacity for system safety in the previous calendar year

$t_{radTS,i}$ number of hours of participation of technical units/regulation groups in providing mFRR balancing capacity for system safety [h]

u_{odrTS} share of more frequent maintenance costs [%].

(4) Cost of reserving natural gas transport capacity for providing mFRR balancing capacity for system safety T_{33} shall be calculated according to the following formula:

$$T_{33} = I_{ppk}$$

where the elements of the equation shall be as follows:

I_{ppk} fee for reserving natural gas transport system capacity for each regulation group (block) for providing mFRR balancing capacity for system safety [EUR].

(5) The cost of planning, operational management, and settlement for providing mFRR balancing capacity for system safety T_{34} shall be calculated according to the following formula:

$$T_{34} = (T_{31} + T_{32} + T_{33}) \cdot \frac{k_r}{100}.$$

Appendix A. Amounts of permanent parameters required for balancing service price determination

Parameter	Parameter amount	Parameter description
C_{HE}	2.132.191,92 EUR/MW	Cost of investment in pump-storage power plant construction
C_{FCR}	101.532,95 EUR/technical unit	Cost of installation of additional equipment for FCR balancing capacity
C_{so}	101.532,95 EUR/technical unit	Price of additional equipment installation for aFRR balancing capacity
C_{TE}	1.015.329,48 EUR/MW	Cost of investment in thermal power plants
k_{oHE}	0,8	The factor of inability to utilize hydroelectric potential due to physical limitations of power plant reservoirs
k_r	2 %	The coefficient for the cost of planning, operational management, and settlement of balancing services
R	9,9 %	Return on equity
t_a	33 years	Technical unit lifespan
t_{go}	50 years	Lifespan of buildings and hydro-mechanic equipment
T_{oFCR}	609,20 EUR	Cost of FCR maintenance per technical unit
T_{oS}	609,20 EUR	Cost of equipment maintenance for securing aFRR per technical unit
t_{po}	33 years	Lifespan of primary (rotating) equipment

Parameter	Parameter amount	Parameter description
t_{so}	15 years	Lifespan of secondary equipment (metering, management, protection and communication)
t_{proj}	4.000 h	Projected annual number of operating hours of a technical unit
t_{TE}	25 years	Thermal power plant lifespan
u_{go}	55 %	Share of construction and engines in investment
u_{odrS}	30 %	Cost of more frequent maintenance due to aFRR balancing capacity provision
u_{odrT}	30 %	Share of cost of more frequent maintenance due to mFRR balancing capacity provision for system balancing
u_{odrTS}	1 %	Share of cost of more frequent maintenance due to mFRR balancing capacity provision for system balancing
u_{po}	40 %	Share of primary (rotating) equipment in investment
u_{so}	5 %	Share of secondary equipment in investment
$\Delta\eta$	3 %	Estimated efficiency loss due to lower load of the technical unit compared to optimal production characteristics

Appendix B. Method of determining variable parameter values required for determination of balancing service prices

Parameter	Method of determining variable parameter values
C_{pN}	Average electricity price from 0:00-6:00 every day of the previous calendar year on day ahead market on Croatian electricity exchange Ltd. (http://www.cropex.hr)
C_{pV}	Average electricity price from 9:00-13:00 and 17:00-22:00 every day of the previous calendar year on day ahead market on Croatian electricity exchange Ltd. (http://www.cropex.hr)
C_{px}	Average electricity price in the previous calendar year on day ahead market on Croatian electricity exchange Ltd. (http://www.cropex.hr)
I_{ppk}	Fee for reserving natural gas transport system capacity for a specific regulation group (block) for the purpose of providing a reserve power service for manual activation frequency restoration for system security.
$K_{2HE,+/-}$	The mFRR balancing capacity for balancing from hydro power plants in the positive/negative direction, which is determined by multiplying the ratio of the amount of mFRR balancing capacity for s balancing provided by hydro power plants in the previous calendar year to the total provided amount of mFRR balancing capacity for balancing in the previous calendar year in the positive/negative direction, with $K_{2,mFRR,ur+/-}$
$K_{2TE,+/-}$	The mFRR (Manual Frequency Restoration Reserve) balancing capacity for balancing from thermal power plants in the positive/negative direction, which is determined by multiplying the ratio of the amount of mFRR balancing capacity for balancing provided by thermal power plants in the previous calendar year to the total provided amount of mFRR balancing capacity for balancing in the previous calendar year in the positive/negative direction, with $K_{2,mFRR,ur+/-}$
K_{3HE}	The amount of provided mFRR balancing capacity for system safety from hydro power plants, which is determined by multiplying the ratio of the amount of mFRR balancing capacity for system safety provided by hydro power plants in the previous calendar year to the total provided amount of mFRR balancing capacity for system safety in the previous calendar year, with $K_{3,mFRR,sig}$
K_{3TE}	The amount of provided mFRR balancing capacity for system safety from thermal power plants, which is determined by multiplying the ratio of the amount of mFRR balancing capacity for system safety provided by thermal power plants in the previous calendar year to the total provided amount of mFRR balancing capacity for system safety in the previous calendar year, with $K_{3,mFRR,sig}$

Parameter	Method of determining variable parameter values
k_{akHE}	The share of pumped storage hydro power plants in providing frequency restoration reserve in the previous calendar year. Pumped storage hydro power plants, as per these Rules, are HPP Orlovac, HPP Peruća, HPP Zakučac, HPP Dubrovnik, HPP Senj, HPP Sklope, HPP Vinodol, HPP Gojak, HPP Lešće
N_h	Number of hours in the previous calendar year
n_{FCR}	Number of technical units which have participated in the provision of aFRR balancing capacity in the previous calendar year
n_i	Number of technical units i in regulation group
n_S	Number of technical units which have participated in the provision of aFRR balancing capacity in the previous calendar year
$n_{T,HE}$	Number of hydro power plant technical units which have participated in the provision of mFRR balancing capacity for balancing in the previous year
$n_{T,TE}$	Number of thermal power plant technical units which have participated in the provision of mFRR balancing capacity for balancing in the previous year
n_T	Number of technical units which have participated in the provision of mFRR balancing capacity for balancing in the previous year which equals the sum of $n_{T,HE}$ and $n_{T,TE}$
n_{TS}	Number of technical units/regulation groups (units) which have participated in the provision of mFRR balancing capacity for balancing in the previous year
$t_{rad,i}$	The total number of hours of operation of the technical unit/regulation group (block) in the previous calendar year
$t_{radS+/-,i}$	The number of hours of technical unit participation in providing aFRR balancing capacity in the previous calendar year, in the positive/negative direction
$t_{radT+/-,i}$	The number of hours of technical unit participation in providing mFRR balancing capacity in the previous calendar year, in the positive/negative direction
$t_{radTS,i}$	Number of hours of technical unit "" participation in the provision of mFRR balancing capacity for system safety in the previous calendar year

Parameter	Method of determining variable parameter values
$T_{s,i}$	Total permanent cost of all technical units """ in regulation group, permanent cost includes cost of regulation group maintenance, cost of regulation group decommissioning, cost of gross salaries, other personnel costs, cost of joint functions and other operating costs
W_i	Technical unit's """electricity generation in the previous calendar year
$W_{no\acute{c}}$	The base production of electricity of the regulation groups providing the aFRR balancing capacity in the previous calendar year, for the purpose of securing the aFRR balancing capacity from 0:00 to 6:00
W_{ndiv}	The base production of electricity of the regulation groups providing the aFRR balancing capacity in the previous calendar year, for the purpose of securing the aFRR balancing capacity from 7h to 24 h on Saturdays, Sundays and other non-working days
$W_{T,no\acute{c}}$	The base production of electrical energy of the regulation groups participating in the balancing services, during the night operating regime from 0:00 to 6:00 in the previous calendar year.
$W_{T,ndiv}$	The base production of electrical energy of the regulation groups participating in the balancing services during Saturdays, Sundays, and other non-working days from 7:00 to 24:00 in the previous calendar year