ENTSO-E

Electricity Balancing Cost Report 2023

30 June 2023

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ENTSO-E Mission Statement

Who we are

ENTSO-E, the European Network of Transmission System Operators for Electricity, is the **association for the cooperation of the European transmission system operators (TSOs)**. The 39 member TSOs, representing 35 countries, are responsible for the **secure and coordinated operation** of Europe's electricity system, the largest interconnected electrical grid in the world. In addition to its core, historical role in technical cooperation, ENTSO-E is also the common voice of TSOs.

ENTSO-E **brings together the unique expertise of TSOs for the benefit of European citizens** by keeping the lights on, enabling the energy transition, and promoting the completion and optimal functioning of the internal electricity market, including via the fulfilment of the mandates given to ENTSO-E based on EU legislation.

Our mission

ENTSO-E and its members, as the European TSO community, fulfil a common mission: Ensuring the **security of the interconnected power system in all time frames at pan-European level** and the **optimal functioning and development of the European interconnected electricity markets**, while enabling the integration of electricity generated from renewable energy sources and of emerging technologies.

Our vision

ENTSO-E plays a central role in enabling Europe to become the first **climate-neutral continent by 2050** by creating a system that is secure, sustainable and affordable, and that integrates the expected amount of renewable energy, thereby offering an essential contribution to the European Green Deal. This endeavour requires **sector integration** and close cooperation among all actors.

Europe is moving towards a sustainable, digitalised, integrated and electrified energy system with a combination of centralised and distributed resources.

ENTSO-E acts to ensure that this energy system **keeps consumers at its centre** and is operated and developed with **climate objectives** and **social welfare** in mind.

ENTSO-E is committed to use its unique expertise and system-wide view – supported by a responsibility to maintain the system's security – to deliver a comprehensive roadmap of how a climate-neutral Europe looks.

Our values

ENTSO-E acts in **solidarity** as a community of TSOs united by a shared **responsibility.**

As the professional association of independent and neutral regulated entities acting under a clear legal mandate, ENTSO-E serves the interests of society by **optimising social welfare** in its dimensions of safety, economy, environment, and performance.

ENTSO-E is committed to working with the highest technical rigour as well as developing sustainable and **innovative responses to prepare for the future** and overcoming the challenges of keeping the power system secure in a climate-neutral Europe. In all its activities, ENTSO-E acts with **transparency** and in a trustworthy dialogue with legislative and regulatory decision makers and stakeholders.

Our contributions

ENTSO-E supports the cooperation among its members at European and regional levels. Over the past decades, TSOs have undertaken initiatives to increase their cooperation in network planning, operation and market integration, thereby successfully contributing to meeting EU climate and energy targets.

To carry out its **legally mandated tasks**, ENTSO-E's key responsibilities include the following:

- Development and implementation of standards, network codes, platforms and tools to ensure secure system and market operation as well as integration of renewable energy;
- Assessment of the adequacy of the system in different timeframes;
- Coordination of the planning and development of infrastructures at the European level (Ten-Year Network Development Plans, TYNDPs);
- Coordination of research, development and innovation activities of TSOs;
- Development of platforms to enable the transparent sharing of data with market participants.

ENTSO-E supports its members in the **implementation and monitoring** of the agreed common rules.

ENTSO-E is the common voice of European TSOs and provides expert contributions and a constructive view to energy debates to support policymakers in making informed decisions.

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1. Introduction

All transmission system operators (TSOs) report to the regulatory authorities on the costs of establishing, amending and operating the European balancing energy platforms for the exchange of balancing energy from frequency restoration reserves and replacement reserves and for the imbalance netting process ('EB Cost Report'), in accordance with Article 23(1) of Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing ('EB Regulation'). These European balancing energy platforms are the RR-Platform, the mFRR-Platform, the aFRR-Platform and the IN-Platform, in accordance with Articles 19–22 of the EB Regulation.

This report will cover the detailed reporting of the respective year 2022 while keeping an overview of cumulative costs since the previous reports (i. e. 2018 – 2021).

Costs directly related to each European balancing energy platform shall be clearly and separately identified and auditable.

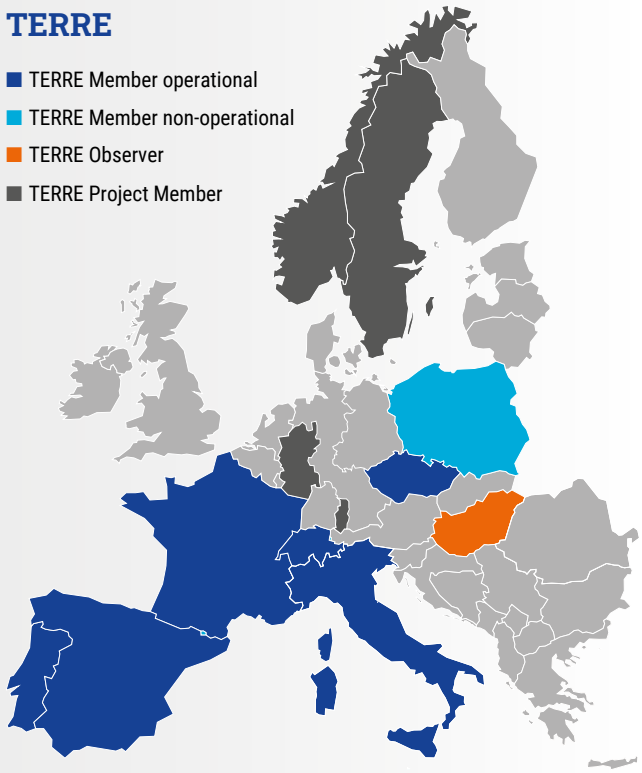
ENTSO-E has endorsed four implementation projects to establish the European balancing energy platforms pursuant to the EB Regulation.

The main targets of the projects are:

- To design, implement and operate the European balancing energy platforms in compliance with the relevant regulation, including the Electricity Regulation, the EB, SO and CACM Regulations, and methodologies pursuant to those regulations, including the implementation frameworks for the European balancing energy platforms;
- To enhance the efficiency of balancing in Europe and integrate balancing markets, promoting the possibilities for exchanging replacement reserves (RR), frequency restoration reserves with manual activation (mFRR) and frequency restoration reserves with automatic activation (aFRR) balancing energy, or for performing the imbalance netting process, while contributing to operational security.

1.1 Description of the RR-Platform: the TERRE project

The Trans-European Replacement Reserves Exchange ('TERRE') is the implementation project endorsed by all TSOs through ENTSO-E's Market Committee on 27 October 2016 to establish the European platform for the exchange of balancing energy from replacement reserves, i. e. the 'RR-Platform' pursuant to Article 19 of the EB Regulation.



The TERRE member TSOs (countries) are:

- Swissgrid (CH)
- ČEPS (CZ)
- REE (ES)
- RTE (FR)
- Terna (IT)
- PSE (PL)
- REN (PT)

The following TSO (country) is an observer: MAVIR ZRt. (HU); ENTSO-E is also an observer. In addition, 3 TSOs are TERRE project members: Svenska Kraftnät (SE), Amprion (DE), and Statnett (NO). The term 'project member' was intentionally distinguished from the terms operational and non-operational members. Project Members joined the TERRE Project for the sole purpose of participating in the development, operation and management of the IT Solution (LIBRA) and obtaining the intellectual property rights of the IT Solution in order to utilise and continue to develop it for Regional IT Solutions in the case of the Nordics TSOs or for the mFRR IT solution.

Other relevant TERRE information

The TERRE Cooperation Agreement is the agreement between all TERRE member TSOs and entered into force on 18 October 2019. In terms of costs, as specified in the implementation framework for the RR-Platform ('RRIF'), the costs associated with the establishing, amending and operation of the RR-Platform are broken down into:

- Common costs resulting from RR-Platform development, costs required for external support to the project and the Project Management Office (PMO) costs. These costs are required for establishing, amending and operating the RR-platform.
- The historical costs will include all the common costs incurred from January 2017, excluding the PMO costs.

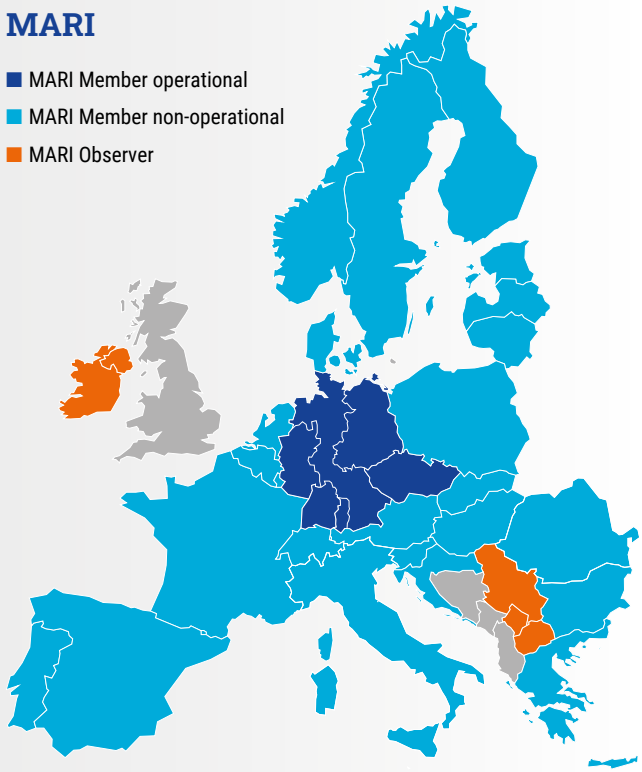
The most important events involving TERRE during 2022 were:

- Platform evolutions and algorithm optimisation: The year 2022 marks the second year of operations with five TSOs exchanging RR products in Region 1 and one TSO (ČEPS) still in isolated mode in Region 2 until the connection of PSE. Based on the historic market data available since the launch of the platform of the RR-platform, the TERRE project has been able to assess, design and implement needed evolutions to improve the optimisation of the algorithm and operational processes.
- RRIF amendment and Public Consultation: In order to reflect the evolutions of the platform, the TERRE project submitted a 2nd amendment to the RR Implementation Framework, this amendment is under RR National Regulators' review.
- Cross-project cooperation: TERRE project has continued cooperating with MARI and Nordic LIBRA projects to identify synergies on the intended adaptations as well as make use of the lessons learned of the TERRE project and the RR platform operations in order for these to be adopted in the more recent projects. In 2021, an Agreement on the Transfer and co-ownership of the Intellectual Property Rights (IPRs) relating to 'LIBRA Software' was finalised. This agreement sets out the framework and governance mechanisms within which the Parties wish to cooperate, including the mutual rights and obligations of the Parties with respect to the grant of co-ownership rights to LIBRA from the TERRE Members and the Project Members to the MARI Members. The signature process of this agreement has been signed in Q2 2022.
- TERRE project members: In April 2021, the TSO National Grid ESO (Great Britain) has given notice to the TERRE Steering Committee on their will to exit the TERRE project, as part of the decision on Brexit and in line with the provision included in the Cooperation Agreement. After the settlement of all operational, financial, and legal terms including contractual framework, National Grid ESO exit officially the TERRE project in December 2022 through an official decision from the project's Steering Committee.

1.2 Description of the mFRR-Platform: the MARI project

The Manually Activated Reserves Initiative ('MARI') is the implementation project endorsed by all TSOs through ENTSO-E's Market Committee on 7 September 2017 to establish the European platform for the exchange of balancing energy from frequency restoration reserves with manual activation, i. e. the 'mFRR-Platform' pursuant to Article 20 of the EB Regulation. MARI went in operation in 2022 by starting a dry-run (connection of ČEPS only) on 18 July 2022 and achieving market go-live on 5 October 2022 (connection of ČEPS and German TSOs).

All MARI member TSOs (countries) are:



- APG (AT)
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- ČEPS (CZ)
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- Energinet (DK)
- Elering (EE)
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- RTE (FR)
- HOPS (HR)
- MAVIR ZRt. (HU)
- Terna (IT)
- AST (LV)
- Litgrid (LT)
- Statnett (NO)
- TenneT NL (NL)
- REN (PT)
- PSE S.A. (PL)
- Transelectrica (RO)
- SvK (SE)
- ELES (SI)
- SEPS (SK)
- Creos Luxembourg (LU)
- ESO (BG)

In addition, the following TSOs (countries) are observers: Eirgrid (IE), SONI (NI), MEPSO (MKD) and EMS (SRB); ENTSO-E is also an observer.

Other relevant information of MARI

As MARI started before entry into force of the EB Regulation, the project initially applied a Memorandum of Understanding (MoU) on a contractual basis. MARI's second MoU replaced the first MoU signed 5 April 2017 and was applicable from 11 September 2018 (the last signature date of the Parties) until the MoU was replaced by the platform's cooperation agreements, which came into force on 1 July 2020.

In terms of costs, as specified in the implementation framework for the mFRR-Platform ('mFRRIF'):

- Each member TSO shall bear its own national costs and is solely responsible (i. e.: no joint and several liability) for the due payment of all the costs related to the technical infrastructure necessary for the successful usage of the mFRR-Platform.
- The cost sharing principle may apply to costs incurred since 1 January 2018 and shall apply to costs incurred after the approval of the mFRRIF. Any costs incurred before 1 January 2018 shall not be considered as historical costs.
- The cost sharing key is for $^1/_8$ attributed to membership, $^5/_8$ to consumption and $^2/_8$ to participation in the project.
- In the event that several TSOs are operating in a Member State (as is the case in Germany), the Member State's share of the costs shall be distributed among those TSOs proportionally to the consumption in the TSOs control areas.
- Per July 2020, the Cost Sharing Key for MARI was adjusted to reflect the following:
  i. Creos Luxembourg joined as a 'non-participating' TSO, meaning they will not bear the $^2/_8$ of the establishment cost attributed to participation but they will bear the $^1/_8$ attributes to membership and $^5/_8$ to consumption;
  ii. ESO joined as a participating TSO and will thus bear all costs as divided among the other participating TSOs.
- Per July 2021, the Cost Sharing Key for MARI was adjusted to reflect exit of NGESO.

- Per January 2022, the Cost Sharing Key for MARI one-off costs was adjusted to reflect the updated consumption data and the updated division between German TSOs.
- The 2022 Cost Sharing Division for recurring costs was determined following the approval of the October Accession Roadmap, in line with the Agreements. The recurring cost sharing keys are calculated in line with the Agreements and EBGL. TSOs start sharing recurring costs from 6 months prior to their (planned) accession date.

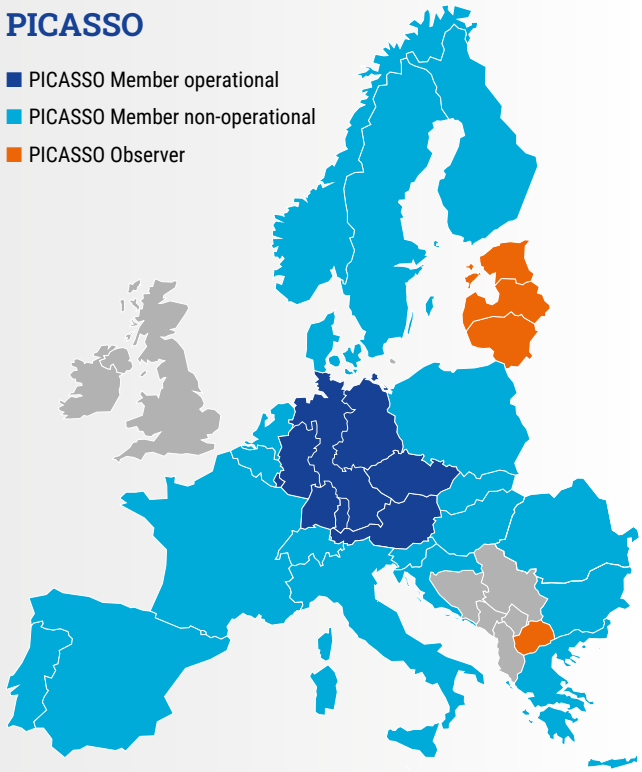
The most important events involving MARI during 2022 were:

- The fourth and fifth update of the accession roadmap have been published on ENTSO-E website.
- MARI algorithm description has been published on ENTSO-E website.
- Detailed description of bid structure and linking in MARI has been published on ENTSO-E website.
- European Balancing Implementation Group meetings took place on 11 March 2022, 26 April 2022, 30 June 2022, 6 October 2022 and 1 December 2022.
- Dry run of MARI (connection of ČEPS only) on 18 July 2022
- Technical go-live of MARI on 15 September 2022
- Market go-live of MARI on 5 October 2022 (connection of ČEPS and German TSOs)
- Public description of MARI activation optimisation function has been published on ENTSO-E website.
- MARI/PICASSO go-live event on 2 December 2022 in Brussels
- Stakeholder workshop together with PICASSO on 8 December 2022 focusing on exclusive bids and first operational experiences.

1.3 Description of the aFRR-Platform: the PICASSO project

The Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation ('PICASSO') is the implementation project endorsed by all TSOs through ENTSO-E's Market Committee on 9 November 2017 to establish the European platform for the exchange of balancing energy from aFRR, i.e. the 'aFRR-Platform' pursuant to Article 21 of the EB Regulation. PICASSO went in operation in 2022 with the first connection of ČEPS on 1 June 2022. German and Austrian TSOs connected on 22 June 2022 resulting in first energy exchanged.

All PICASSO member TSOs (countries) are:



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- Energinet (DK)
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- SEPS (SK)
- Creos Luxembourg (LU)

In addition, the following TSOs (countries) are observers: Elering (EE), Litgrid (LT), AST (LV), MEPSO (MKD); ENTSO-E is also an observer.

Other relevant information of PICASSO

As PICASSO started before entry into force of the EB Regulation, the project initially applied a Memorandum of Understanding (MoU) on a contractual basis. Anticipating the entry into force of the EB Regulation, PICASSO's first MoU was signed on 24 July 2017. On 1 October 2018, a second MoU was signed, which was applicable until it was replaced by the platform's framework for cooperation agreements, which came into force on the 1 July 2020 and consists of a principle agreement common to all European balancing energy platforms, an operational agreement and common service provider agreements.

In terms of costs, as specified in the implementation framework for the aFRR-Platform ('aFRRIF'):

- Each member TSO shall bear its own national costs and is solely responsible (i.e., no joint and several liability) for the due payment of all the costs related to the technical infrastructure necessary for the successful usage of the aFRR-Platform.
- The cost sharing principle may apply to costs incurred since 1 January 2018, and shall apply to costs incurred after the approval of the aFRRIF. Any costs incurred before 1 January 2018 shall not be considered as historical costs.
- The cost sharing key is for $^{1}/_{8}$ attributed to membership, $^{5}/_{8}$ to consumption and $^{2}/_{8}$ to participation in the project.
- In the event that several TSOs are operating in a Member State (as is the case in Germany), the Member State's share of the costs shall be distributed among those TSOs proportionally to the consumption in the TSOs control areas.
- Per July 2020, the Cost Sharing Key for PICASSO was adjusted to reflect the following:

  i. Creos Luxembourg joined as a 'non-participating' TSO, meaning they will not bear the $^{2}/_{8}$ of the establishment cost attributed to participation, but they will bear the $^{1}/_{8}$ attributes to membership and $^{5}/_{8}$ to consumption.

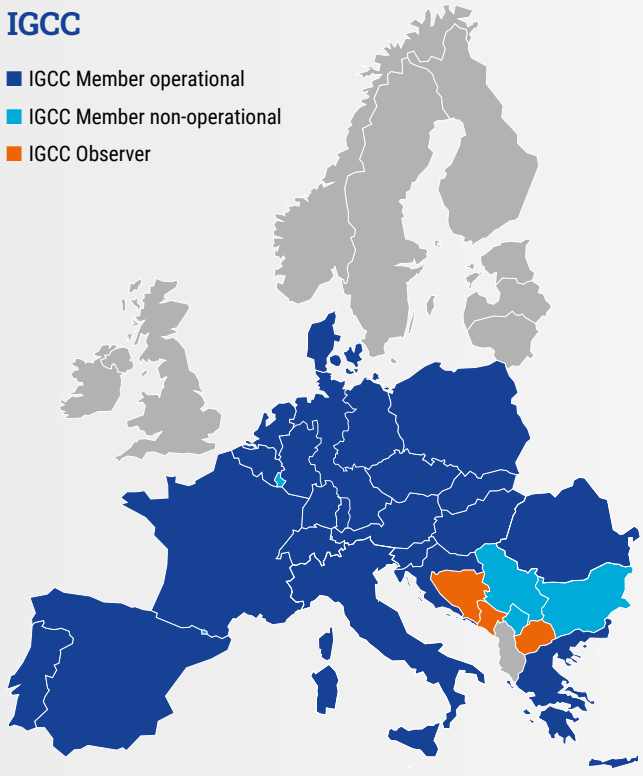
- Per January 2022, the Cost Sharing Key for PICASSO one-off costs was adjusted to reflect the updated consumption data and the updated division between German TSOs.
- The 2022 Cost Sharing Division for recurring costs was determined following the approval of the October Accession Roadmap, in line with the Agreements. The recurring cost sharing keys are calculated in line with the Agreements and EBGL. TSOs start sharing recurring costs from 6 months prior to their (planned) accession date.

The most important events for PICASSO during 2022 were as follows:

- The fifth and sixth version of the accession roadmap have been published on ENTSO-E website.
- PICASSO algorithm description has been published on ENTSO-E website.
- European Balancing Implementation Group meetings took place on 11 March 2022, 26 April 2022, 30 June 2022, 6 October 2022 and 1 December 2022.
- Go-Live of PICASSO (connection of ČEPS only) on 01 June 2022
- The German and Austrian TSOs accession and successful first exchange of aFRR via PICASSO
- MARI/PICASSO go-live event on 2 December 2022 in Brussels.
- Stakeholder workshop together with MARI has been organised on 8 December 2022.
- The budget 2022 has been closed and the planned budget 2023 has been approved.

1.4 Description of the IN-Platform: the IGCC project

The International Grid Control Cooperation ('IGCC') is the implementation project endorsed by all TSOs through ENTSO-E's Market Committee on 11 February 2016 to establish the European platform for the imbalance netting process, i.e. the 'IN-Platform' pursuant to Article 22 of the EB Regulation.



All IGCC member TSOs (countries) are:

- APG (AT)
- Elia (BE)
- ESO (BG)
- Swissgrid (CH)
- ČEPS (CZ)
- 50Hertz, TenneT DE, Amprion, TransnetBW (DE)
- Energinet (DK)
- ADMIE (EL)
- REE (ES)
- RTE (FR)
- HOPS (HR)
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- PSE (PL)
- REN (PT)
- Transelectrica (RO)
- ELES (SI)
- SEPS (SK)
- EMS (SRB)

In addition, the following TSOs (countries) are observers: NOSBiH (BiH), MEPSO (MKD) and CGES (MNE); ENTSO-E is also an observer.

Other relevant information of IGCC

- The IGCC Cooperation Agreement is the agreement between all IGCC member TSOs and entered into force on 19 January 2016. A fifth amendment of the IGCC Cooperation Agreement was made on 11 December 2019, aiming to align the agreement with existing EU Regulation.
- In terms of costs, as specified in the implementation framework for the IN-Platform ('INIF'):
- Each member TSO shall bear its own national costs and is solely responsible (i.e.: no joint and several liability) for the due payment of all the costs related to the technical infrastructure necessary for the successful usage of the IN-Platform.
- The cost sharing principle shall apply to costs incurred after the approval of the INIF. All TSOs agree not to share any costs incurred before the approval of the INIF.

The most important events involving IGCC during 2022 were:

- The establishment of a common European platform for operating the imbalance netting process has been officially achieved by the legal deadline of 24 June 2021, following the successful completion of all requirements as defined in the guideline on electricity balancing (EB Regulation Art. 22).
- Accession: EMS (Serbian TSO) became operational in 2022 leading to a total number of 22 operational TSOs in IGCC. The growing number of participating TSOs enabled to reach a record of more than 11 TWh of avoided aFRR activation in 2022. And, due to the increase of prices during the year, financial savings reached more than 788 in 2022.

1.5 Summary of the costs

	Category		RR-Platform (All TSOs)	mFRR-Platform (All TSOs)	aFRR-Platform (All TSOs)	IN-Platform (All TSOs)	Total [K €]
2018	Establishing & amending	**[K €]**	2,790	315	166	0	**3,271**
	Operating	**[K €]**	0	0	0	0	**0**
2019	Establishing & amending	**[K €]**	5,178	565	317	0	**6,060**
	Operating	**[K €]**	0	0	0	0	**0**
2020	Establishing & amending	**[K €]**	1,737	1,958	480	35	**4,210**
	Operating	**[K €]**	1,710	0	0	0	**1,710**
2021	Establishing & amending	**[K €]**	900	8,347	653	45	**9,945**
	Operating	**[K €]**	1,586	0	0	0	**1,586**
2022	Establishing & amending	**[K €]**	748	6,729*	4,234*	123	**11,834**
	Operating	**[K €]**	1,586	115*	491*	41	**2,233**
2023 forecast	Establishing & amending	**[K €]**	1,100	6,585*	1,011*	165	**8,861**
	Operating	**[K €]**	1,560	1,188*	775*	54	**3,577**

* Please note that the 2022 costs for MARI and PICASSO cover both common and regional costs and are thus reported in respectively chapter 2 and 3.

2. Chapter A: Common costs resulting from the coordinated activities of all TSOs participating in the European balancing energy platforms

All the common costs indicated below are to be shared between TSOs in accordance with the rules specified in the respective implementation frameworks.

2.1 Actual costs of 2022

The following table provides an overview of total actual common costs in 2022:

Actual costs 2022			Costs of establishing [€]		Costs of operating [€]
RR-Platform common costs	All TERRE TSOs' costs	1.a	748,438.70	1.b	1,586,401.40
mFRR-Platform common costs	All MARI TSOs' costs	2.a	6,144,368.92	2.b	0.00
aFRR-Platform common costs	All PICASSO TSOs' costs	3.a	3,552,821.49	3.b	0.00
IN-Platform common costs	All IGCC TSOs' costs	4.a	123,216.72	4.b	40,899.33

2.2 Costs of establishing and amending the European balancing energy platforms in 2022

2.2.1 RR-Platform

The actual costs for establishing and amending the RR-Platform in 2022 were:

TERRE	2022 [€]
Costs for establishing	**748,438.70**
IT Development	**522,549.40**
Optimisation module	193,458.00
Data management	176,091.40
Hosting	0.00
IT Monitoring	0.00
Finance service	0.00
Testing	153,000.00
Central project team	**225,889.30**
PMO	141,269.60
Business analyst	42,248.10
IT adviser	33,971.50
Other consultancy	8,400.00

Clarifications:

- The 'Optimisation module' covers the support from the external provider for the design and the development of the AOF of the RR Platform.
- The 'Data Management' covers the support from the external provider for the design and the development of the data management module of the RR Platform.
- The 'Testing' covers the support from PSE for the UAT of the RR platform.
- The 'PMO' considers all PMO support for all groups.
- The 'Business analyst' is an external business analyst engaged to collect the RR requirements and support functional design of the RR IT solution.
- The 'IT adviser' is an external IT project manager engaged to coordinate the different providers and TSOs for the design, development, amendment and testing of the RR IT solution.

TERRE actual costs 2022					
Country	**Participants**	**Member State**	**Consumption (Nrg_105a) [GWh]**	**Amount per TSO Costs for establishing and amending [€]**	**Amount per TSO Costs for operating [€]**
Czech Republic	ČEPS	1	57,997	69,435.00	150,168.00
France	RTE	1	440,971	219,052.00	487,056.00
Italy	Terna	1	286,027	158,520.00	350,758.00
Poland	PSE	1	132,839	98,674	0
Portugal	REN	1	46,353	64,886.00	139,925.00
Spain	REE	1	233,172	137,871.00	304,263.00
Switzerland	Swissgrid	1	62,617	63,342.00*	154,232.00
Hungary	MAVIR ZRt.	0		0	0
TOTAL		**7**	**1,259,976**	**748,438.70**	**1,586,401.00**

* The CAPEX share of Swissgrid is blocked in a bank account, to reflect the status on Swissgrid participation as provided for in EB Regulation Art. 1(6) and 1(7). If Swissgrid is not allowed by the European Commission, in accordance with article 1 of EB Regulation, to permanently participate, then Swissgrid's financial contribution deposited in a blocked bank account will be released to the benefit of Swissgrid.

2.2.2 mFRR-Platform

The actual costs for establishing the mFRR-Platform in 2022 were:

MARI	**2022 [€]**
Total common cost for establishing	**6,144,368.92**
mFRR algorithm design & development *	1,851,286.17
Hosting	1,184,772.80
PMO support	881,499.36
External consultant	38,480.00
Legal support TSO agreements	8,256.50
Procurement costs	8,586.90
Technical Working Group Convener	199,494.43
Connection Coordinator	157,876.57
Change Control Advisor & Test Owner	189,445.67
Support & Maintenance	289,026.00
ECP Costs	87,300.00
Public documentation	17,440.00
Testing Services	1,089,567.40
Security audit	48,105.00
Invoicing services	76,225.62
Go-live workshop	17,006.50

Clarifications:

- In 2022, the 2020 and 2021 MARI development costs, including costs reported here, and costs for support and maintenance, ECP, IT Licenses and Testing Services were also re-invoiced. The amounts paid by TSOs in 2022 are therefore higher than the 2022 project budget.
- The PMO support considers all PMO support for all groups, including the support for the joint MARI – PICASSO Legal WG and the PICASSO Budget Management TF.

MARI actual costs 2022				
Country	**Participants**	**Member State**	**Consumption (Nrg_105a) [GWh]**	**Amount per TSO for MARI [€]**
Austria	APG	1	66,028	183,136.49
Belgium	Elia	1	83,284	208,100.20
Bulgaria	ESO	1	31,120	132,634.92
Croatia	HOPS	1	16,572	111,588.80
Czech Republic	ČEPS	1	61,189	176,135.83
Denmark	Energinet	1	32,460	134,573.94
Estonia	Elering	1	8,257	99,559.66
Finland	Fingrid	1	82,981	207,662.43
France	RTE	1	444,680	730,930.79
Germany	Amprion	0.36311	185,383	336,240.43
	TenneT DE	0.30506	155,746	291,581.35
	TransnetBW	0.13055	66,651	157,327.15
	50Hertz	0.20128	102,762	211,741.22
Greece	ADMIE	1	51,735	162,459.41
Hungary	MAVIR ZRt.	1	41,282	147,336.66
Italy	Terna	1	301,804	524,232.57
Latvia	AST	1	6,652	97,237.37
Lithuania	Litgrid	1	11,409	104,119.94
Luxembourg	Creos Luxembourg	1	6,396	39,975.63
Netherlands	TenneT NL	1	113,368	251,623.74
Norway	Statnett	1	124,264	267,386.09
Poland	PSE	1	152,002	307,514.82
Portugal	REN	1	48,810	158,227.38
Romania	Transelectrica	1	49,641	159,429.97
Slovak Republic	SEPS	1	26,016	125,251.39
Slovenia	ELES	1	13,776	107,543.37
Spain	REE	1	242,843	438,934.63
Sweden	Svenska Kraftnät	1	127,372	271,882.72
Switzerland	Swissgrid	1	(61,501)	(171,359.21)
TOTAL		**26**	**2,654,483** (2,715,984)*	**6,144,369**

* Amount including Swissgrid

› The amount under Swissgrid between brackets will be deposited on the blocked bank account. The share of common costs for Swissgrid is transferred to a blocked bank account for costs occurring from July 2020. TSO Transnet BW maintains Power of Attorney over this blocked bank account. If Swissgrid is not allowed by the European Commission to participate, in accordance with article 1 of EB Regulation, then Swissgrid's financial contribution deposited in a blocked bank account will be released to the benefit of Swissgrid.

› The overview above excludes the 2020 – 2021 costs that were re-invoiced in 2022 (i. e. MARI development costs, and costs for support and maintenance, ECP, IT Licenses and Testing Services). TSOs will have thus been invoiced more in 2022 than the amounts as presented above.

2.2.3 aFRR-Platform

The actual costs for establishing the aFRR-Platform in 2022 were:

PICASSO	2022 [€]
Total costs for establishing	**3,552,821.49**
PMO support	212,440.98
Senior Project Lead	271,144.43
Testing Coordinator	141,038.94
IT Development	2,867,925.31
TSO – TSO Invoicing Cost	60,271.83
Legal Support TSO agreements	0

Clarifications:

- The 'PMO support' considers all PMO support for all groups.
- The costs for legal support are borne by MARI.

PICASSO actual costs 2022				
Country	**Participants**	**Member State**	**Consumption (Nrg_105a) [GWh]**	**Amount per TSO for PICASSO [€]**
Austria	APG	1	66,028	112,981.46
Belgium	Elia	1	83,284	127,560.62
Bulgaria	ESO	1	31,120	83,487.81
Croatia	HOPS	1	16,572	71,196.58
Czech Republic	ČEPS	1	61,189	108,892.97
Denmark	Energinet	1	32,460	84,620.23
Finland	Fingrid	1	82,981	127,304.96
France	RTE	1	444,680	432,901.15
Germany	Amprion	0.36311	102,762	127,894.31
	TenneT DE	0.30506	185,383	200,966.85
	TransnetBW	0.13055	155,746	174,755.01
	50Hertz	0.20128	66,651	95,956.96
Greece	ADMIE	1	51,735	100,905.74
Hungary	MAVIR ZRt.	1	41,282	92,073.84
Italy	Terna	1	301,804	312,186.43
Luxembourg	Creos Luxembourg	1	6,396	25,590.83
Netherlands	TenneT NL	1	113,368	152,978.99
Norway	Statnett	1	124,264	162,184.42
Poland	PSE	1	152,002	185,620.17
Portugal	REN	1	48,810	98,434.18
Romania	Transelectrica	1	49,641	99,136.51
Slovak Republic	SEPS	1	26,016	79,175.73
Slovenia	ELES	1	13,776	68,833.99
Spain	REE	1	242,843	262,371.22
Sweden	Svenska Kraftnät	1	127,372	164,810.52
Switzerland	Swissgrid	1	(61,501)	(105,610.54)
TOTAL		**22**	**2,628,165** (2,689,666)*	**3,552,821.49**

* Amount including Swissgrid

› The amount under Swissgrid between brackets will be deposited on the blocked bank account. The share of common costs for Swissgrid is transferred to a blocked bank account for costs occurring from July 2020. TSO Transnet BW maintains Power of Attorney over this blocked bank account. If Swissgrid is not allowed by the European Commission, in accordance with article 1 of EB Regulation, to participate then Swissgrid's financial contribution, deposited in a blocked bank account, will be released to the benefit of Swissgrid.

2.2.4 IN-Platform

The costs for establishing in 2022 only relate to the costs for PMO support.

IGCC	2022 [€]
Costs for establishing	**123,216.62**
PMO support	54,631.00
JAO invoicing – one-off costs	68,585.62

Clarifications:

› The 'PMO support' considers all PMO support for all groups. It is performed by external consultants.

› The JAO invoicing – one-off costs reflect the implementation for JAO's support to perform invoicing for TSOs exchanges.

2.3 Costs of operating the European balancing energy platforms in 2022

2.3.1 RR-Platform

The RR-Platform entered in operation on 6 January 2020. Costs of operating the TERRE platform in 2022 were € 1,586,401.40

TERRE	2022 [€]
Operational costs	**1,586,401.40**
Optimisation module	326,404.00
Data management	252,179.50
Hosting	641,691.40
IT Monitoring	323,910.50
Financial service	42,216.00
Testing	0.00

2.3.2 mFRR-Platform

Operational costs will only become common costs for operations once all TSOs have accessed the platform. For that reason, there were no common cost for operations in 2022. In the 2021 report it was reported that the TSO – TSO Invoicing costs qualified as common cost for operating the platform. However, this was an error and has been corrected as such in this version of the report.

2.3.3 aFRR-Platform

Operational costs will only become common costs for operations once all TSOs have accessed the platform. For that reason, there were no common cost for operations in 2022. In the 2021 report it was reported that the TSO-TSO Invoicing costs qualified as common cost for operating the platform. However, this was an error and has been corrected as such in this version of the report.

2.4.4 IN-Platform

The operation of the IN-Platform is covered by the normal operations of the Host TSO (TransnetBW) for operating their system, maximising the efficiencies of using the infrastructure and personnel of an existing TSO and thus minimising costs for all TSOs, including the Host TSO. Thus, no operational costs were incurred in 2022, except JAO invoicing services fees which reflect the invoicing performed by JAO since June 2022.

IGCC	2022 [€]
Operational costs	**40,899.33**
JAO invoicing – Service fees	40,899.33

2.4 Cost forecast for 2023

In 2022, two platforms (the RR-Platform and IN-Platform) are to be considered already as established. Consequently, costs are differentiated between for 'establishing' and for 'amending' the platforms. The following table provides an overview of total cost forecasts for 2023:

Cost forecast 2023		Costs of establishing and amending [€]			Costs of operating [€]	
		Establishing		Amending		
RR-Platform common costs	All TERRE TSOs' costs	1.e	0	1,100,500.00	1.f	1,560,066.00
mFRR-Platform common costs	All MARI TSOs' costs	2.e	0	5,981,158.14**	2.f	0*
aFRR-Platform common costs	All PICASSO TSOs' costs	3.e	0	530,150.00	3.f	0*
IN-Platform common costs	All IGCC TSOs' costs	4.e	0	165,000.00	4.f	53,758.00

* Operational Costs are expected to remain regional costs for operations until at least 2024.

** This only concerns common costs for establishment. Regional costs for establishment (as included in the total amount reported in 1.5) are reported in the next chapter. The cost calculation of regional cost for establishment and operations was executed prior to the replanning of accessions as reported in the April 2022 Accession Roadmaps of MARI and PICASSO. This calculation will be formally re-executed with the October 2022 Accession Roadmap and reported accordingly in the next EB Cost Report.

2.5 Cost forecast for establishing and amending the European balancing energy platforms in 2023

2.5.1 RR-Platform

The cost forecast for establishing and amending the RR-Platform in 2023 is:

TERRE	2023 [€]
Costs for amending	**1,100,500.00**
IT Development	**792,500.00**
Optimisation module	170,000.00
Data management	382,500.00
Hosting	0.00
IT Monitoring	0.00
Finance service	0.00
Testing	240,000.00
Central project team	**308,000.00**
PMO support	132,000.00
Business analyst	66,000.00
Senior IT adviser	60,000.00
Other consultancy	50,000.00
Publication in ENTSO-E's Transparency Platform	0.00

The RR-Platform became operational on 6 January 2020. The project approved a budget of € 1,100,500 for 2023 to amend the platform: € 308,000 for project management and € 792,000 for IT developments and testing.

This leaves a reserve of € 1,100,500, for 2023 onwards

Clarifications:

- The 'Optimisation module' covers the support from the external provider for the additional developments of the AOF of the RR-Platform.
- The 'Data Management' covers the support from the external provider for additional developments of the data management module of the RR-Platform.
- The 'Testing' covers the support from PSE for the UAT of the RR platform.
- The 'PMO support' considers all PMO support for all groups.
- The 'Business analyst' is an external business analyst engaged to collect the RR requirements and support the functional design of the RR IT solution.
- The 'Senior IT adviser' is an external IT consultant engaged to coordinate the different providers and TSOs for the development and testing of the RR IT solution.

2.5.2 mFRR-Platform

The cost forecast for common costs for establishing and amending the mFRR-Platform in 2023 is:

MARI	2023 [€]
Total costs for amending	**5,981,158.14**
mFRR algorithm design & development	1,820,128.84
Hosting	1,840,566.67
PMO support	717,600.00
Legal support TSO agreements	91,743.00
Procurement costs	78,000.00
Technical Working Group Convener	191,100.00
Connection Coordinator	186,250.00
Change Control Advisor & Test Owner	181,769.63
Support & Maintenance	5,000.00
Testing Services	869,000.00

As the mFRR-Platform became operational in 2022, the common cost for establishment are solely cost for amending the platform.

Clarifications:

- The 'PMO support' considers all PMO support for all groups, including the support for the joint MARI – PICASSO Legal WG and the PICASSO Budget Management TF.
- The budget for the IT PMO, Procurement Costs, Development Costs, Testing Services are (partly) estimates pending the final offer and/or extension of the current services.

2.5.3 aFRR-Platform

The cost forecast for establishing and amending the mFRR-Platform in 2023 is:

PICASSO	2023 [€]
Total costs for amending	**530,150.00**
PMO support	157,500.00
Senior Project Lead	202,500.00
Testing Coordinator	135,150.00
External Convener + CCA	35,000.00

As the aFRR-Platform became operational in 2022, the common cost for establishment are solely cost for amending the platform.

Clarifications:

- The 'PMO support' considers all PMO support for all groups.
- The external convener + CCA budget is provisional and will require approval if an offer is requested and provided.

2.5.4 IN-Platform

The cost forecast for establishing and amending the IN-Platform in 2023 is:

IGCC	2023 [€]
Costs for amending	**348,425.00**
PMO support	50,000.00
PICASSO/IGCC Secretary	72,000.00
PICASSO/IGCC Change Requests	50,000
JAO Invoicing (one-off costs)	176,425.00

Clarifications:

- The 'PMO support' considers all PMO support for all groups in the IGCC project. This role is performed by external consultants.
- The PICASSO/IGCC Secretary covers the support roles for the joint PICASSO/IGCC Working Groups: Operational Steering Committee (OPSCOM) secretary, Operational Working Group (OWG) convener and Central Change Administrator (CCA). These roles are performed by external consultants as of March 2022.
- In the first half of 2022, the IN-platform will be migrated to the PICASSO platform. As such any Change Request on the PICASSO platform also impacting the IN process will be borne by both PICASSO and IGCC TSO members. An estimated expense of € 50,000 in 2022 for such Change Requests is therefore taken into consideration.
- The settlement services for the IN-platform will be carried out by JAO as of mid-2022. The development costs are estimated to amount to € 176,425.00 and the payment of these one-off development costs will be issued to JAO in 2022.

2.6 Cost forecast for operating the European balancing energy platforms in 2023

2.6.1 RR-Platform

The cost forecast for operating the RR-Platform in 2023 is:

TERRE	2023 [€]
Operational costs	**1,560,066.00**
Optimisation module	366,772.00
Data management	254,421.00
Hosting	615,252.00
IT Monitoring	255,516.00
Financial service	68,105.00
Testing	0.00

Clarifications:

- 'Optimisation module' covers the support from external provider for the maintenance and support of the AOF of the RR-Platform.
- 'Data Management' covers the support from the external provider for the maintenance and support of the data management module of the RR-Platform.
- 'Hosting' covers the support from the external provider for the hosting of the RR IT solution (testing and production environments);
- 'IT monitoring' covers the support from external provider for the IT monitoring service of the RR IT solution;
- 'Financial service' covers the support from the external provider for the Finance service (invoicing process based on TSO–TSO settlement).

2.6.2 mFRR-Platform

Operational costs will only become common costs for operations once all TSOs have accessed the platform. As this is not expected to happen before 2024, there are no common cost for operations expected in 2023. The regional cost for operations are reported in the next chapter.

2.6.3 aFRR-Platform

Operational costs will only become common costs for operations once all TSOs have accessed the platform. As this is not expected to happen before 2024, there are no common cost for operations expected in 2023. The regional cost for operations are reported in the next chapter.

2.6.4. IN-Platform

In 2022, the settlement services for the IN-Platform will be performed by JAO and will amount to circa 27,000, with operations starting in July 2022. No other operational costs are borne by the IGCC project given that the operation of the IN-Platform is covered by the normal operations of the Host TSO (TransnetBW) for operating their system, maximising the efficiencies of using the infrastructure and personnel of an existing TSO and thus minimising costs for all TSOs, including the Host TSO.

IGCC	2023 [€]
Operational costs	**53,758.00**
Financial service	53,758.00

3. Chapter B: Regional costs resulting from the coordinated activities of all TSOs participating in a certain region

3.1 Cost forecast 2023[1]

According to the CSP Agreements for respectively PICASSO and MARI, there are certain costs that are only paid by TSOs 6 months prior to their go-live onwards, meaning costs are not shared by all TSOs and are instead deemed to be regional costs. This results in the following regional costs for 2023.

3.1.1 mFRR Platform

MARI	2023 [€]
Total Regional Costs	1,791,927.00
Operational costs	**1,188,325.26**
Hosting & IT Monitoring	293,816,96
Support & Maintenance	677,413.14
ECP Costs	156,976.17
TSO – TSO Invoicing	60,119.00
Establishment costs	**603,601.74**
Hosting & IT Monitoring	157,195.04
Support & Maintenance	362,422.86
ECP Costs	83,983.83

3.2.2 aFRR Platforms

PICASSO	2023 [€]
Total Regional Costs	1,255,370.00
Operational costs	**774,510.04**
Hosting & IT Monitoring	640,276.92
TSO – TSO Invoicing	59,493.00
Amendment Costs	74,740.12
Establishment costs	**480,859.96**
Hosting & IT Monitoring	430,596.08
Amendment Costs	50,263.88

1 The cost calculation of regional cost for establishment and operations was executed prior to the replanning of accessions as reported in the April 2022 Accession Roadmaps of MARI and PICASSO. This calculation will be formally re-executed with the October 2022 Accession Roadmap and reported accordingly in the next EB Cost Report.

4. Chapter C: National costs resulting from the activities of TSO(s) in a Member State

4.1 Actual costs of 2022

Category A : Representation in meetings

i. Time spent in the identified meetings including time for preparation, reported in euro at the rate of each TSOs

ii. Travel expenses related to the meetings considered in Ai

Category B: National IT implementation IT costs linked to developments and systems for market coupling/ interface between TSO and each platform solely

i. Men/hour spent for development and testing

ii. External costs of development and testing (including directly buying IT tools that are needed for market coupling/for balancing platform matters only)

Country	TSO
Austria	APG – Austrian Power Grid AG
	VÜEN-Vorarlberger Übertragungsnetz GmbH
Belgium	Elia – Elia Transmission Belgium S.A.
Bulgaria	ESO – Electroenergien Sistemen Operator EAD
Croatia	HOPS – Croatian Transmission System Operator Ltd
Czech Republic	ČEPS – ČEPS, a.s.
Denmark	Energinet – Energinet
Estonia	Elering – Elering AS
Finland	Fingrid – Fingrid OyJ (Representing also Kraftnät Åland Ab in physical meetings)
	Kraftnät Åland Ab
France	RTE – Réseau de Transport d'Electricité, S.A
Germany	Amprion – Amprion GmbH
	TransnetBW – TransnetBW GmbH
	TenneT GER – TenneT TSO GmbH
	50Hertz – 50Hertz Transmission GmbH
Greece	IPTO – Independent Power Transmission Operator S.A.
Hungary	MAVIR ZRt. – MAVIR Magyar Villamosenergia-ipari Átviteli Rendszerirányító Zártkörűen Működő Részvénytársaság ZRt.
Ireland	EirGrid – EirGrid plc
Italy	Terna – Terna SpA
Latvia	Augstsprieguma tīkls – AS Augstsprieguma tīkls
Lithuania	LITGRID – LITGRID AB
Luxembourg	CREOS Luxembourg – CREOS Luxembourg S.A.
(The) Netherlands	TenneT TSO – TenneT TSO B.V.
	Britned Netherlands
Norway	Statnett – Statnett SF
Poland	PSE – PSE S.A.
Portugal	REN – Rede Eléctrica Nacional, S.A.
Romania	Transelectrica – C.N. Transelectrica S.A.
Slovak Republic	SEPS – Slovenská elektrizačná prenosovú sústava, a.s.
Slovenia	ELES – ELES, d.o.o
Spain	REE – Red Eléctrica de EspaÑa S.A.U
Sweden	Svenska Kraftnät – Affärsverket Svenska Kraftnät
Switzerland	Swissgrid – Swissgrid AG
Northern Ireland	SONI System Operator for Northern Ireland Ltd

National costs, Category A [€]				National costs, Category B [€]			
TERRE	MARI	PICASSO	IGCC	TERRE	MARI	PICASSO	IGCC
0	104,061	9,860	5,874	0	569,384	348,343	0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	87,562	50,570	See PICASSO	N/A	288,654	56,060	See PICASSO
N/A	12,450	9,430	0	N/A	42,745	40,745	41,400
N/A	35,900	9,600	3,350	N/A	29,200	9,600	0
11,396	33,689	17,360	11,172	177,686	2,957,263	1,697,801	50,328
0	47,000	62,000	6,000	0	0	0	0
N/A	0	0	N/A	N/A	0	0	N/A
0	27,000	13,000	0	0	0	0	0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
53,000	33,000	41,000	0	14,000	193,000	408,000	0
0	217,927	24,909	5,049	0	1,002,072	990,870	13,254
0	45,864	156,948	33,060	0	440,730	577,410	4,350
0	98,522	85,726	30,795	0	711,446	631,211	7,186
0	82,053	149,997	2,280	0	648,957	545,277	
0	14,900	15,800	11,600	0	0	0	85,400
0	16,727	13,686	0	0	16,960	12,755	0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
17,182	33,549	70,803	15,076	257,332	779,676	299,057	3,669
0	0	0	0	0	0	0	0
0	4,914	0	0	0	40,830	0	0
0	10,433	2,397	2,050	0	0	0	0
N/A	0	20,000	0	N/A	38,000	216,000	0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
–	94,000	103,500	–	–	–	–	–
11,019	29,922	15,166	4,522	0	0	0	0
4,376	13,188	10,594	1,028	–	–	–	–
N/A	15,380	14,894	2,500	N/A	554,90	23,670	6,327
N/A	16,854	22,373	6,791	N/A	24,733	18,733	0
0	77,359	41,164	501	0	115,280	116,116	501
316,827	177,459	47,874	35,080	220	0	0	10,380
–	171,000	110,000	–	–	–	–	–
98,000	209,257	176,009	58,800	0	1,502,687	1,281,958	0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Glossary

50Hertz	50Hertz Transmission GmbH
ACER	EU Agency for the Cooperation of Energy Regulators
ADMIE	Independent Power Transmission Operator S.A.
aFRR	Frequency restoration reserves with automatic activation
aFRRIF	Implementation framework for the aFRR-Platform
Amprion	Amprion GmbH
AOF	Activation optimisation function
APG	Austrian Power Grid AG
AST	AS Augstsprieguma tïkls
AT	Austria
BiH	Bosnia and Herzegovina
BE -	Belgium
BG -	Bulgaria
EB Regulation	Guideline on electricity balancing
CACM Reg.	Guideline on capacity allocation and congestion management
CEPS	ČEPS, a.s.
CGES	Crnogorski elektroprenosni sistem AD
CH	Switzerland
CMM	Capacity Management Module
Creos Luxembourg	Creos Luxembourg S.A.
CZ	Czech Republic
DE	Germany
DK	Denmark
EBSG	European Balancing Stakeholder Group
EE	Estonia
Eirgrid	EirGrid plc
Elering	Elering AS
Eles	Eles, d.o.o.
Elia	Elia Transmission Belgium SA
EMS	Akcionarsko društvo Elektromreža Srbije
Energinet	Energinet Elsystemansvar A/S
ESO	Electroenergien Sistemen Operator EAD
ES	Spain
EU	European Union
FAT	factory acceptance testing
FI	Finland
Fingrid	Fingrid Oyj
FR	France
GB	Great Britain
GR	Greece
HOPS	Croatian Transmission System Operator Ltd.
HR	Croatia
HU	Hungary
IE	Ireland
IGCC	International Grid Control Cooperation
INIF	Implementation framework for the IN-Platform
IT	Italy
Litgrid	Litgrid AB
LU	Luxembourg
MARI	Manually Activated Reserves Initiative
MAVIR	ZRt.Magyar Villamosenergia-ipari Átviteli Rendszerirányító Zártkörűen Működő Részvénytársaság
mFRR	Frequency restoration reserves with manual activation
mFRRIF	Implementation framework for the mFRR-Platform

MNE	Montenegro
MEPSO	Macedonian Transmission System Operator AD
MKD	Macedonia
MoU	Memorandum of Understanding
National Grid	National Grid ESO
NL	Netherlands
NO	Norway
NOSBiH	Nezavisni operator sustava u Bosni i Hercegovini
NRA	National regulatory authority
OST	OST sh.a – Albanian Transmission System Operator
PICASSO	Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation
PL	Poland
PMO	Project Management Officer
PSE	Polskie Sieci Elektroenergetyczne
PT	Portugal
REE	Red Eléctrica de España S.A.U.
REN	Rede Eléctrica Nacional, S.A.
RO	Romania
RR	Replacement reserves
RRIF	Implementation framework for the RR-Platform
SRB	Serbia
RTE	Réseau de Transport d'Electricité
SE	Sweden
SEPS	Slovenská elektrizačná prenosová sústava, a.s.
SI	Slovenia
SK	Slovakia
SLA	Service level agreement
SO Regulation	Guideline on electricity transmission system operation
SONI	System Operator for Northern Ireland Ltd
Statnett	Statnett SF
SVK	Svenska Kraftnät
Swissgrid	Swissgrid AG
TenneT DE	TenneT TSO GmbH
TenneT NL	TenneT TSO B.V.
Terna	Terna - Rete Elettrica Nazionale SpA
TERRE	Trans-European Replacement Reserves Exchange
Transelectrica	National Power Grid Company Transelectrica S.A.
TransnetBW	TransnetBW GmbH
TSO	Transmission System Operator
UAT	User acceptance testing

The terms used in this document have the meaning of the definitions included in Article 2 of the EB Regulation and in the respective EB methodologies.

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