

ENTSO-E

Electricity Balancing Cost Report

30 June 2022



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 2021 while keeping an overview of cumulative costs since the previous reports (i. e. 2018–2020).

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.

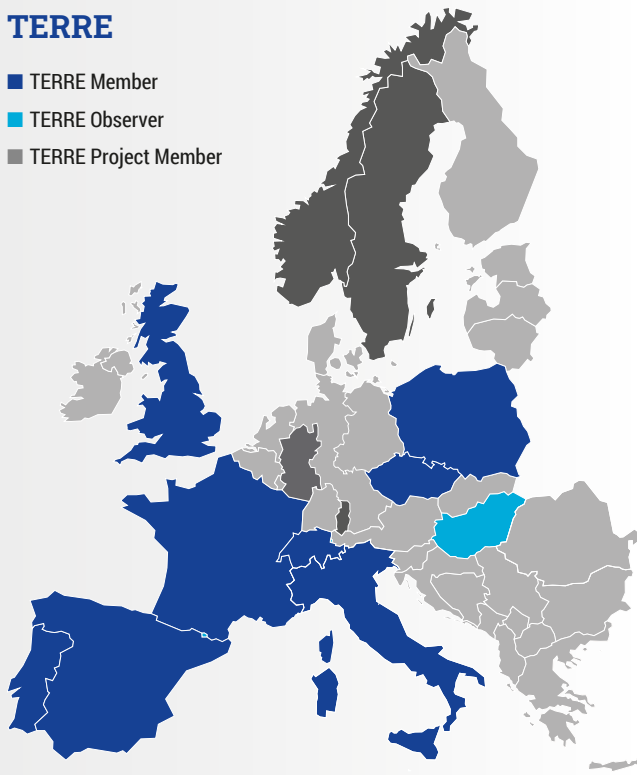


1.1 Description of the RR-Platform: the TERRE project

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.

TERRE

- TERRE Member
- TERRE Observer
- TERRE Project Member



The TERRE member TSOs (countries) are:

- › Swissgrid (CH)
- › ČEPS (CZ)
- › REE (ES)
- › RTE (FR)
- › National Grid ESO (GB)
- › 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 utilize 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 2021 were:

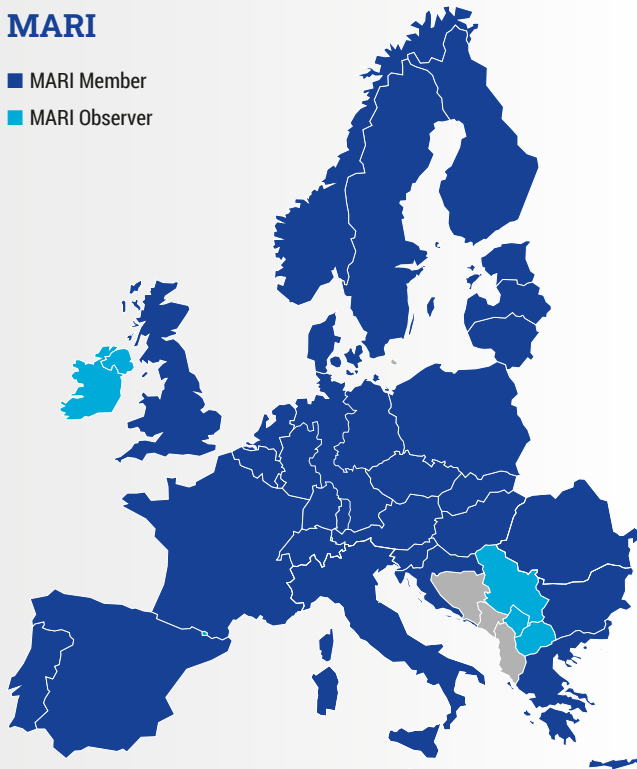
- › Platform evolutions and algorithm optimization: The year 2021 marks the first full year of operations with five TSOs exchanging RR products in Region 1 and one TSO (CEPS) still in isolated mode in Region 2 until the connection of PSE. Based on the historic market data available since the launch of 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 performed an amendment to the RR Implementation Framework, approved by national authorities in July 2021.
- › 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 finalized. 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 will be finalized in Q1 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.

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

- MARI Member
- MARI Observer



All MARI member TSOs (countries) are:

- › APG (AT)
- › Elia (BE)
- › Swissgrid (CH)
- › ČEPS (CZ)
- › 50Hertz, TenneT DE, Amprion, TransnetBW (DE)
- › Energinet (DK)
- › Elering (EE)
- › IPTO (GR)
- › REE (ES)
- › Fingrid (FI)
- › RTE (FR)
- › National Grid ESO (GB)¹
- › 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 $\frac{1}{8}$ attributed to membership, $\frac{5}{8}$ to consumption and $\frac{2}{8}$ 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 $\frac{2}{8}$ of the establishment cost attributed to participation but they will bear the $\frac{1}{8}$ attributes to membership and $\frac{5}{8}$ 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.

¹ It has been confirmed that NGESO will exit from the MARI Project. The corresponding Agreement and formal exit process is currently being drafted.



The most important events involving MARI during 2021 were:

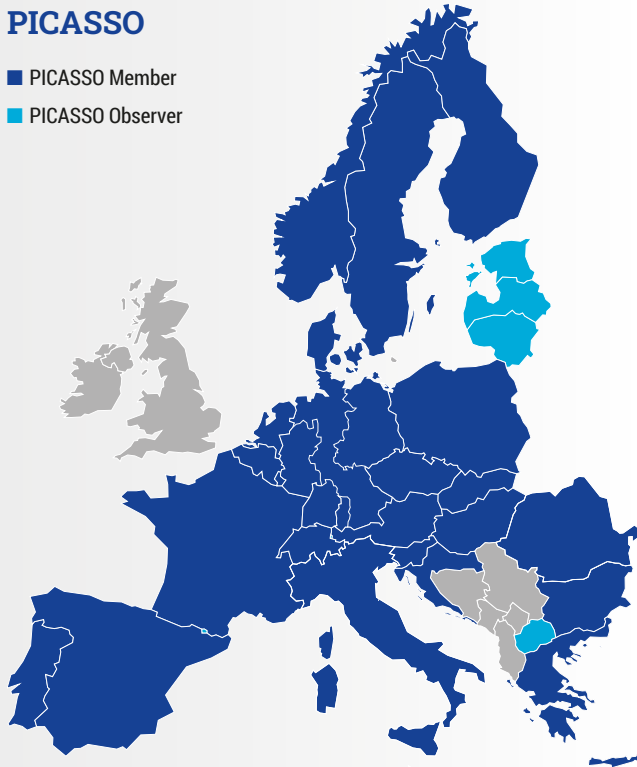
- › Stakeholder workshop on 02 December 2021 on the market and technical design and accession roadmap of MARI.
- › European Balancing Implementation Group meetings took place online on the 18 March, 9 April, 17 June, 14 October and 10 December.
- › Finalisation of the design of V1, V2 and V3.1 of the MARI platform.
- › Completion of Factory Acceptance Testing for V1, V2 and V3.1.
- › Completion of Inter-Operability Testing V1 and completion of the User Acceptance Testing for V1 and V2.
- › All hosting environments (for testing and production) were installed throughout 2021.
- › On 1 December 2021 the MARI and TERRE Steering Committees approved the Agreement on the Transfer and Co-ownership of the Intellectual Property Rights relating to the LIBRA Software.
- › MARI SC approved the TSO-TSO Invoicing Agent Agreement on behalf of the MARI, Picasso and IGCC projects.
- › Update of Manual of Procedures for Transparency Reporting closed and detailed design finalized. A gap solution was agreed to bridge the time during which not all functionalities are available on the ENTSO-E Transparency Platform.
- › The 2nd and 3rd update of the Accession Roadmap were published on the [ENTSO-E roadmap](#)
- › The high-level architecture design for the ECP network was finalised.
- › As part of the CSO Notification Process, the affected TSO procedure and CSO Deliverables were approved by MARI SC and provided to CSO WG in October 2021.
- › MARI submitted the technical amendments to the mFRR IF in September 2021.
- › The Testing Task Force transitioned into a Testing Working Group due to the increased scope of the tasks under the testing group.
- › The budget 2021 has been closed and the planned budget 2022 has been approved.

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

- PICASSO Member
- PICASSO Observer



All PICASSO member TSOs (countries) are:

- › APG (AT)
- › Elia (BE)
- › ESO (BG)
- › Swissgrid (CH)
- › ČEPS (CZ)
- › 50Hertz, TenneT DE, Amprion, TransnetBW
- › Energinet (DK)
- › IPTO (GR)
- › REE (ES)
- › Fingrid (FI)
- › RTE (FR)
- › MAVIR ZRt. (HU)
- › HOPS (HR)
- › Terna (IT)
- › TenneT NL (NL)
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- › Transelectrica (RO)
- › SvK (SE)
- › ELES (SI)
- › 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 $\frac{1}{8}$ attributed to membership, $\frac{5}{8}$ to consumption and $\frac{2}{8}$ 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 $\frac{2}{8}$ of the establishment cost attributed to participation, but they will bear the $\frac{1}{8}$ attributes to membership and $\frac{5}{8}$ to consumption.

The most important events for PICASSO during 2021 were as follows:

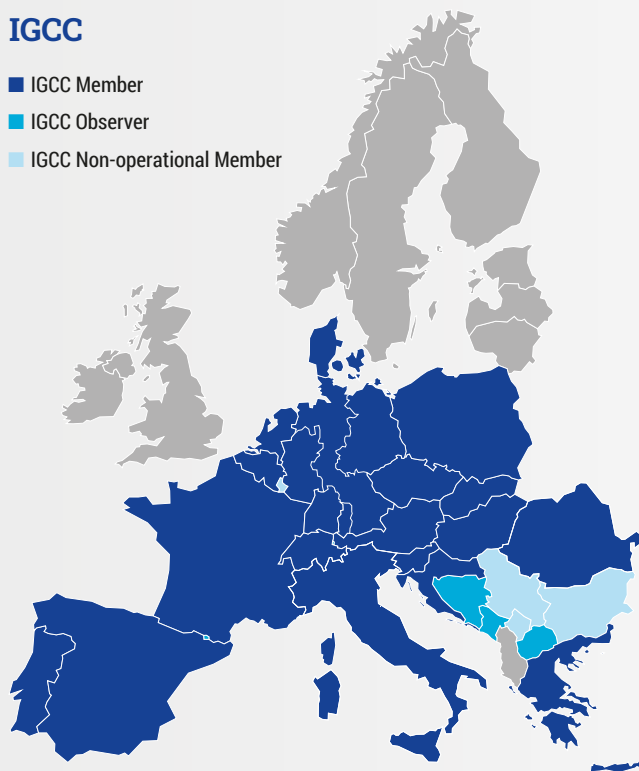
- › The project identified TSOs that will join the platform prior to the legal implementation deadline and initiated tasks to coordinated mitigation of incompliance to the IF data publication requirements.
- › In preparation of the platform go-live in early 2022 a LIP (Local Implementation Project) monitor was set up to organize testing and platform accessions.
- › European Balancing Implementation Group meetings took place online on 9 April, 17 June, 14 October and 10 December.
- › To cope with the upcoming operation phase of the project, OPSCOM and OWG were established. Furthermore, operational procedures and support processes were structured in the Operational Handbook.
- › The notification process has been initiated.
- › The testing of the platform and TSOs connecting the platform in the first waves has been planned and started.
- › The PICASSO project initiated the creation of a platform wide security approach together with ENTSO-E.
- › The fourth version of the PICASSO accession roadmap was published in October 2021.
- › One stakeholder workshop together with MARI took place on 2 December 2021 focussing on the recap of the platform designs as well as accession and go-live planning.
- › The budget 2021 has been closed and the planned budget 2022 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.

IGCC

- IGCC Member
- IGCC Observer
- IGCC Non-operational Member



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)
- › MAVIR ZRt. (HU)
- › Terna (IT)
- › Creos Luxembourg (LU)
- › TenneT NL (NL)
- › 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 2021 were:

- › The establishment of a common European platform for operating the imbalance netting process has been officially achieved by the legal deadline of 24th June 2021, following the successful completion of all requirements as defined in the guideline on electricity balancing ([EB Regulation](#) Art. 22).
- › Accession: Two TSOs became operational in 2021 leading to a total number of 21 operational TSOs in IGCC. The growing number of participating TSOs enabled total energy savings to reach more than 2,700 GWh per quarter, corresponding to a value of quarterly savings of 118 million euros in Q4 2021:
 - ADMIE (Greece) on 22 June
 - Transelectrica (Romania) on 17 December.

1.5 Summary of the costs

Category	2018		2019		2020		2021		2022 forecast	
	Establishing & amending	Operating	Establishing & amending	Operating	Establishing & amending	Operating	Establishing & amending	Operating	Establishing & amending	Operating
	[K €]	[K €]	[K €]	[K €]	[K €]	[K €]	[K €]	[K €]	[K €]	[K €]
RR-Platform (All TSOs)	2,790	0	5,178	0	1,737	1,710	900	1,586	(1,857)*	1,567
mFRR-Platform (All TSOs)	315	0	565	0	1,958	0	8,347	0	5,773**	335**
aFRR-Platform (All TSOs)	166	0	317	0	480	0	653	0	6,069**	591**
IN-Platform (All TSOs)	0	0	0	0	35	0	45	0	348	27
Total	3,271	0	6,060	0	4,210	1,710	9,945	1,586	13,975	2,520

* TERRE project expects revenues resulting from the payment of MARI and Nordic TSOs for the transfer and co-ownership of Intellectual Property Rights relating to the LIBRA Software of € 3,137,000 resulting in a positive forecast (income).

** 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 2021

The following table provides an overview of total actual common costs in 2021:

Actual costs 2021			Costs of establishing (€)		Costs of operating (€)
RR-Platform common costs	All TERRE TSOs' costs	1.a	900,491.00	1.b	1,586,385.00
mFRR-Platform common costs	All MARI TSOs' costs	2.a	8,347,573.41	2.b	0.00
aFRR-Platform common costs	All PICASSO TSOs' costs	3.a	653,400.00	3.b	0.00
IN-Platform common costs	All IGCC TSOs' costs	4.a	45,136.60	4.b	0.00

2.2 Costs of establishing and amending the European balancing energy platforms in 2021

1.a RR-Platform

The actual costs for establishing and amending the RR-Platform in 2021 were:

TERRE	2021 (€)
Costs for establishing	900,491.00
IT Development	594,175.00
Optimisation module	319,020.00
Data management	173,155.00
Hosting	0.00
IT Monitoring	0.00
Finance service	0.00
Testing	102,000.00
Central project team	306,317.00
PMO	183,567.00
Business analyst	44,050.00
IT adviser	78,700.00
Other consultancy	0.00

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 2021					
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	69,216.00	125,168.00
France	RTE	1	440,971	214,666.00	390,510.00
Italy	Terna	1	286,027	155,820.00	283,158.00
Poland	PSE	1	132,839	97,641.00	0
Portugal	REN	1	46,353	64,794.00	117,100.00
Spain	REE	1	233,172	135,746.00	246,537.00
Switzerland	Swissgrid	1	62,617	64,320.00*	128,369.00
United Kingdom	National Grid ESO	1	303,902	162,609.00	295,542.00
Hungary	MAVIR ZRt.	0		0	0
TOTAL		8	1,563,878	900,491	1,586,385.00

* 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.a mFRR-Platform

The actual costs for establishing the mFRR-Platform in 2021 were:

MARI	2021 (€)
Total Costs for establishing	8,347,573.41
mFRR algorithm design & development *	3,476,365.00
Hosting	29,460.53
PMO support	685,573.00
Business analyst	20,422.96
Legal support TSO agreements	65,037.50
Procurement costs	38,541.93
Testing Task Force and Technical Working Group Convener	84,731.25
Connection Coordinator	63,750.00
Change Control Advisor	273,377.04
Support & Maintenance	40,300.00
ECP Costs	77,945.00
IT Licenses	378,000.00
Testing Services	514,069.20
Publication in ENTSO-E's Transparency Platform	0.00

Clarifications:

- › All (additional) MARI development costs, including costs reported here, and costs for support and maintenance, ECP, IT Licenses and Testing Services will be re invoiced in 2022.
- › The € 29,460.53 for hosting costs is only the costs to be paid by NGESO as agreed in the Exit deal (pending formalisation). The remaining hosting costs are included in the budget for 2022 and beyond.



MARI actual costs 2021				
Country	Participants	Member State	Consumption (Nrg_105a) [GWh]	Amount per TSO for MARI [€]
Austria	APG	1	61,852	235,019.95
Belgium	Elia	1	81,725	273,138.35
Bulgaria	ESO	1	28,939	171,889.56
Croatia	HOPS	1	15,300	145,728.60
Czech Republic	ČEPS	1	57,997	227,625.65
Denmark	Energinet	1	31,152	176,134.31
Estonia	Elering	1	7,139	130,074.98
Finland	Fingrid	1	80,759	271,285.42
France	RTE	1	440,971	962,207.80
Germany	Amprion	0.36311	187,865	450,758.21
	TenneT DE	0.30506	157,831	390,783.77
	TransnetBW	0.13055	67,544	210,488.46
	50Hertz	0.20128	104,138	283,563.26
Greece	ADMIE	1	53,363	218,737.18
Hungary	MAVIR ZRt.	1	37,541	188,389.00
Italy	Terna	1	286,027	665,009.86
Latvia	AST	1	6,482	128,814.78
Lithuania	Litgrid	1	9,750	135,083.15
Luxembourg	Creos Luxembourg	1	6,367	52,983.67
Netherlands	TenneT NL	1	105,332	318,418.88
Norway	Statnett	1	113,709	334,486.83
Poland	PSE	1	132,839	371,180.06
Portugal	REN	1	46,353	205,291.36
Romania	Transelectrica	1	43,569	199,951.34
Slovak Republic	SEPS	1	24,987	164,309.23
Slovenia	ELES	1	13,026	141,366.85
Spain	REE	1	233,172	563,628.74
Sweden	Svenska Kraftnät	1	127,496	360,931.64
Switzerland	Swissgrid	1	62,617	(229,574.64)*
United Kingdom	National Grid ESO	1	303,902	370,292.52
TOTAL		27	2,929,743	8,347,573.41

- › The cost sharing key for MARI was adjusted per July 2021 for general project costs and per April 2021 for all other costs, following the agreed Exit deal with NGESO Above cost calculations are based on the actuals of Q1 and Q2, and of Q3 and Q4 with the respective cost sharing principle.
- › 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 includes the costs that will be 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 less for 2021 than the amounts as presented above.

3.a aFRR-Platform

The actual costs for establishing the aFRR-Platform in 2021 were:

PICASSO	2021 (€)
Total Costs for establishing	653,400.00
PMO support	210,182.93
Senior Project Lead	270,000.00
Testing Coordinator	173,400.00
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 2021				
Country	Participants	Member State	Consumption (Nrg_105a) [GWh]	Amount per TSO for PICASSO [€]
Austria	APG	1	61,852	20,463.74
Belgium	Elia	1	81,725	23,659.06
Bulgaria	ESO	1	28,939	15,171.76
Croatia	HOPS	1	15,300	12,978.79
Czech Republic	ČEPS	1	57,997	19,843.91
Denmark	Energinet	1	31,152	15,527.58
Finland	Fingrid	1	80,759	23,503.74
France	RTE	1	440,971	81,421.09
Germany	Amprion	0.36311	187,865	38,360.48
	TenneT DE	0.30506	157,831	33,315.94
	TransnetBW	0.13055	67,544	18,151.04
	50Hertz	0.20128	104,138	24,297.47
Greece	ADMIE	1	53,463	19,098.82
Hungary	MAVIR ZRt.	1	37,541	16,554.85
Italy	Terna	1	286,027	56,508.13
Luxembourg	Creos Luxembourg	1	6,367	4,736.23
Netherlands	TenneT NL	1	105,332	27,454.75
Norway	Statnett	1	113,709	28,801.66
Poland	PSE	1	132,839	31,877.52
Portugal	REN	1	46,353	17,971.70
Romania	Transelectrica	1	43,569	17,524.07
Slovak Republic	SEPS	1	24,987	14,536.33
Slovenia	ELES	1	13,026	12,613.16
Spain	REE	1	233,172	48,009.74
Sweden	Svenska Kraftnät	1	127,496	31,018.43
Switzerland	Swissgrid	1	62,617	(19,910.84)*
TOTAL		22	2,602,470	653,400.00

› 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.

4.a IN-Platform

The costs for establishing in 2021 only relate to the costs for PMO support.

IGCC	2021 (€)
Costs for establishing	45,136.60
PMO support	45,136.60

Clarifications:

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

2.3 Costs of operating the European balancing energy platforms in 2021

1.b RR-Platform

The RR-Platform entered in operation on 6 January 2020. Costs of operating the TERRE platform in 2021 were € 1,586,385.00.

TERRE	2021 (€)
Operational costs	1,586,385.00
Optimisation module	338,721.00
Data management	249,196.00
Hosting	706,807.00
IT Monitoring	255,516.00
Financial service	36,144.00
Testing	0.00

2.b mFRR-Platform

The mFRR-Platform is planned to be ready for TSO connection by end Q2 2022. Thus, no operational costs were incurred in 2021.

3.b aFRR-Platform

The aFRR-Platform is planned to be ready for TSO connection in Q2 2022. Thus, no operational costs were incurred in 2021.

4.b 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 2021.

2.4 Cost forecast for 2022

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

Cost forecast 2022		Costs of establishing and amending (€)			Costs of operating (€)	
			Establishing	Amending		
RR-Platform common costs	All TERRE TSOs' costs	1.e	(3,137,142.00)*	1,280,000.00	1.f	1,567,417.00
mFRR-Platform common costs	All MARI TSOs' costs	2.e	3,459,696.89***	1,769,759.76	2.f	26,878.60**
aFRR-Platform common costs	All PICASSO TSOs' costs	3.e	4,860,698.00***	598,100.00	3.f	53,757.20**
IN-Platform common costs	All IGCC TSOs' costs	4.e	0.00	348,425.00	4.f	27,000.00

* The TERRE project expects revenues resulting from the payment of MARI project for the transfer and co-ownership of Intellectual Property Rights relating to the LIBRA Software) of €3,137,142 to result in a positive forecast (income).

** All other operational costs for MARI and Picasso in 2022 are Regional costs and thus reported in the next chapter.

***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 2022

1.e RR-Platform

The cost forecast for establishing and amending the RR-Platform in 2022 is:

TERRE	2022 (€)
Costs for establishing	(3,137,142)*
MARI-LIBRA Software IPR	(3,137,142)*
Costs for amending	1,280,000.00
IT Development	900,000.00
Optimisation module	200,000.00
Data management	450,000.00
Hosting	0.00
IT Monitoring	0.00
Finance service	0.00
Testing	250,000.00
Central project team	330,000.00
PMO support	180,000.00
Business analyst	42,000.00
Senior IT adviser	108,000.00
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 € 1,280,000 for 2022 to amend the platform: € 380,000 for project management and € 900,000 for IT developments and testing. In 2022, the TERRE project expects revenues resulting from the payment of MARI project for the transfer and co-ownership of Intellectual Property Rights relating to the LIBRA Software of € 3,137,142, resulting in a positive forecast (income) for the costs for establishing and amending in 2022 of € 1,857,142. This leaves a reserve of € 2,577,016 out of the € 12,993,850 envelope, for 2022 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 reimbursement from MARI and Nordic TSOs to TERRE for the transfer and co-ownership of Intellectual Property Rights relating to the LIBRA Software.

- › 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.e mFRR-Platform

The mFRR-Platform is planned to become operational in Q3 2022. The development of the release to be provided after this date is here categorised as 'cost of amending the platform'.

The cost forecast for common costs for establishing and amending the mFRR-Platform in 2022 is:

MARI	2022 (€)
Total	5,229,456.65
Costs for amending	1,769,759.76
mFRR algorithm design & development	711,788.00
PMO support	328,218.50
Legal support TSO agreements	50,000.00
External Convener & Consultant	115,784.38
Connection Coordinator	93,125.00
Testing Services	333,932.40
Change Control Advisor	136,911.48
Costs for establishing	3,459,696.89
mFRR algorithm design & development	542,114.00
Hosting & IT monitoring	1,111,106.13
PMO support	328,218.50
Legal support TSO agreements	50,000.00
Procurement costs	78,000.00
External Convener & Consultant	115,784.38
Connection Coordinator	93,125.00
Change Control Advisor	136,911.48
Support & Maintenance	255,855.00
ECP Costs	137,800.00
Testing Services	333,932.40
Establishment Invoicing Services	233,450.00
Public Documentation	23,400.00
Security Audit	20,000.00

Clarifications:

- › The 'PMO support' considers all PMO support for all groups.
- › Costs before go-live have been reported as 'costs for establishing'. All costs after the first go-lives (in July 2022) have been reported as 'costs for amending'. It might be the case that the actual division of expenditure between post- and pre-go-live will be somewhat different (e.g. for costs such as Connection Coordinator, Change Control Advisor and Testing Services where costs are linked to time material).
- › The budget for the Change Control Advisor and Security Audit are estimates pending the final offer.



3.e aFRR-Platform

The cost forecast for establishing and amending the mFRR-Platform in 2022 is:

PICASSO	2022 (€)
Total	5,458,798.00
Costs for establishing	4,860,698.00
Finance Service	237,850.00
PMO support	70,000.00
Senior project lead	90,000.00
Test Coordinator	45,050.00
PICASSO/IGCC Secretary	72,000.00
IT Development	4,345,798.00
Costs for Amending	598,100.00
PMO support	140,000.00
Senior project lead	180,000.00
Test Coordinator	90,100.00
IT Development	188,000.00

Clarifications:

- › The 'PMO support' considers all PMO support for all groups.
- › Costs before go-live have been reported as 'costs for establishing'. All costs after the first go-lives (in July 2022) have been reported as 'costs for amending'. It might be the case that the actual division of expenditure between post- and pre-go-live will be somewhat different (e. g. for the test coordinator).
- › 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.

4.e IN-Platform

The cost forecast for establishing and amending the IN-Platform in 2022 is:

IGCC	2022 (€)
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 2022

1.f RR-Platform

The cost forecast for operating the RR-Platform in 2022 is:

TERRE	2022 (€)
Operational costs	1,567,417.00
Optimisation module	390,000.00
Data management	255,257.00
Hosting	630,500.00
IT Monitoring	255,516.00
Financial service	36,144.00
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.f mFRR-Platform

The mFRR-Platform is planned to be in operation and ready for TSO connection by Q3 2022.

The common Operational costs for 2022 are as follows:

MARI	2022 (€)
Financial Services	26,878.60

All operational costs for MARI in 2022 are Regional costs and thus reported in the next chapter.

3.f aFRR-Platform

The aFRR-Platform is planned to enter in operation and be ready for TSO connection by Q3 2022.

The common Operational costs for 2022 are as follows:

Picasso	2022 (€)
Financial Services	53,757.20

All other operational costs for Picasso in 2022 are Regional costs and thus reported in the next chapter.

4.d IN-Platform

In 2022, the settlement services for the IN-Platform will be performed 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	2022 (€)
Operational costs	27,000
Financial service	27,000

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

3.1 Cost forecast 2022²

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 2022.

3.1.a mFRR Platform

MARI	2022 (€)
Total	852,224.33
Operational costs	308,392.44
ECP Costs	40,934.47
Support & Maintenance	174,156.42
Hosting & IT Monitoring	93,301.55
Establishment costs	543,831.90
ECP Costs	72,185.53
Support & Maintenance	307,114.58
Hosting & IT Monitoring	164,531.78

3.2.b aFRR Platforms

PICASSO	2022 (€)
Total	1,147,877.00
Operational costs	537,395.67
Optimisation module	36,050.57
Hosting & IT Monitoring	501,345.10
Establishment costs	610,481.33
Optimisation module	40,953.43
Hosting & IT Monitoring	569,527.90



² 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 2021

Country	TSO	National costs (€)*
Austria	APG – Austrian Power Grid AG	1,074,935
Belgium	Elia – Elia Transmission Belgium S.A.	N.A.
Bulgaria	ESO – Electroenergien Sistemen Operator EAD	81,250
Croatia	HOPS – Croatian Transmission System Operator Ltd	86,029
Czech Republic	ČEPS – ČEPS, a.s.	475,071
Denmark	Energinet – Energinet	23,831
Estonia	Elering – Elering AS	0
Finland	Fingrid – Fingrid OyJ (Representing also Kraftnat Aland Ab in physical meetings)	90,000
France	RTE – Réseau de Transport d'Electricité, S.A	1,245,600
Germany	Amprion – Amprion GmbH	133,299
	TransnetBW – TransnetBW GmbH	124,032
	TenneT GER – TenneT TSO GmbH	61,887
	50Hertz – 50Hertz Transmission GmbH	27,749
Greece	IPTO – Independent Power Transmission Operator S.A.	127,000
Hungary	MAVIR ZRT. – MAVIR Magyar Villamosenergia-ipari Átviteli Rendszerirányító Zártkörűen Működő Részvénytársaság ZRT.	410,000
Ireland	EirGrid – EirGrid plc	–
Italy	Terna – Terna SpA	1,698,000
Latvia	Augstsprieguma tīkls – AS Augstsprieguma tīkls	78,914
Lithuania	LITGRID – LITGRID AB	0
Luxembourg	CREOS Luxembourg – CREOS Luxembourg S.A.	0
(The) Netherlands	TenneT TSO – TenneT TSO B.V.	276,000
Norway	Statnett – Statnett SF	92,390
Poland	PSE – PSE S.A.	105,986
Portugal	REN – Rede Eléctrica Nacional, S.A.	185,000
Romania	Transelectrica – C.N. Transelectrica S.A.	167,090
Slovak Republic	SEPS – Slovenská elektrizačná prenosová sústava, a.s.	362,662
Slovenia	ELES – ELES,d.o.o	232,429
Spain	REE – Red Eléctrica de España S.A.U	2,932,738
Sweden	Svenska Kraftnät – Affärsverket Svenska Kraftnät	127,900
Switzerland	Swissgrid – Swissgrid AG	2,353,437

* When analysing the national costs, it should be taken into account that the methodology of their calculation has not yet been standardised amongst TSOs, and consequently, they should not be directly compared

Glossary

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

mFRR	Frequency restoration reserves with manual activation	SI	Slovenia
mFRRIF	Implementation framework for the mFRR-Platform	SK	Slovakia
MNE	Montenegro	SLA	Service level agreement
MEPSO	Macedonian Transmission System Operator AD	SO Regulation	Guideline on electricity transmission system operation
MKD	Macedonia	SONI	System Operator for Northern Ireland Ltd
MoU	Memorandum of Understanding	Statnett	Statnett SF
National Grid	National Grid ESO	SVK	Svenska Kraftnät
NL	Netherlands	Swissgrid	Swissgrid AG
NO	Norway	TenneT DE	TenneT TSO GmbH
NOSBiH	Nezavisni operator sustava u Bosni i Hercegovini	TenneT NL	TenneT TSO B.V.
NRA	National regulatory authority	Terna	Terna - Rete Elettrica Nazionale SpA
OST	OST sh.a – Albanian Transmission System Operator	TERRE	Trans-European Replacement Reserves Exchange
PICASSO	Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation	Transelectrica	National Power Grid Company Transelectrica S.A.
PL	Poland	TransnetBW	TransnetBW GmbH
PMO	Project Management Officer	TSO	Transmission System Operator
PSE	Polskie Sieci Elektroenergetyczne	UAT	User acceptance testing
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.		

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.

