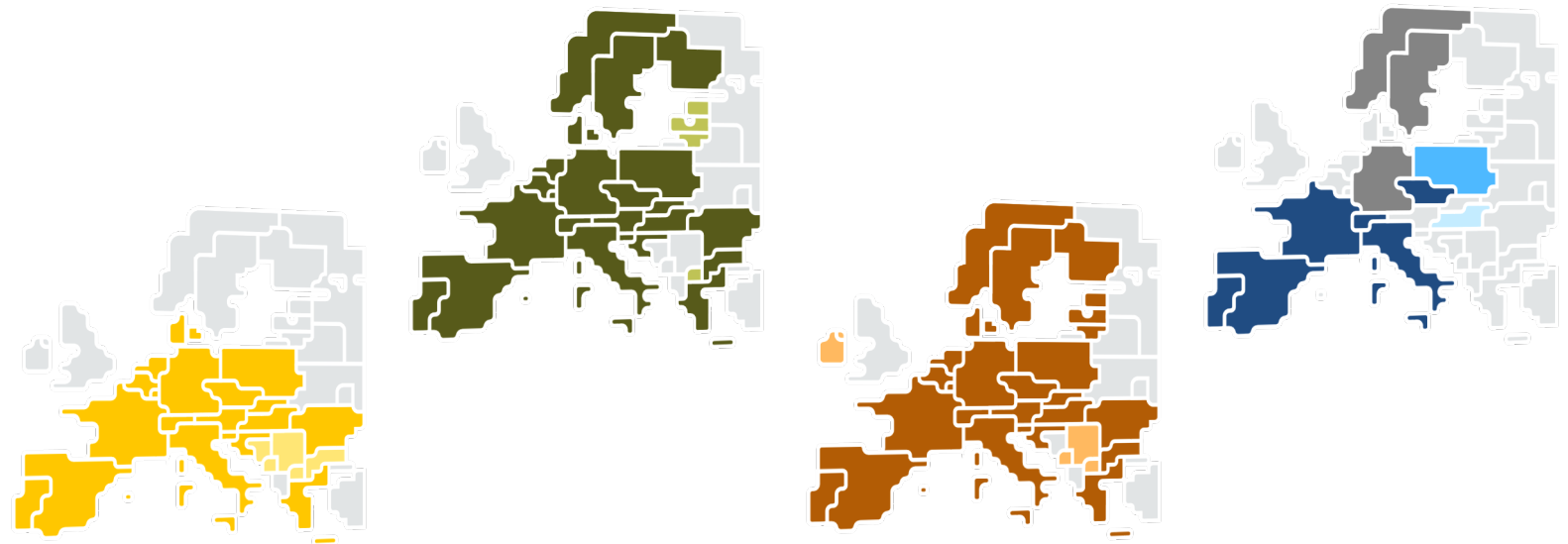




Update on Balancing Platforms

July 5th, 2023
Market Stakeholder Committee



Introduction

Background and Motivation

Regulatory background

- Entry into force of Guideline Electricity Balancing on 2017/12/18
- Entry into force of Clean Energy Package on 2019/06/25

Target model based on Guideline Electricity Balancing


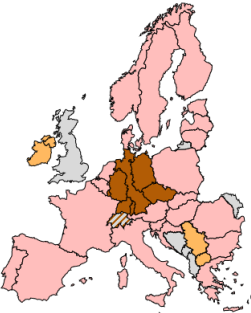
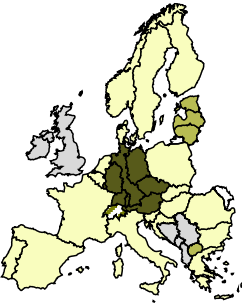

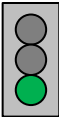
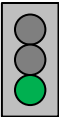
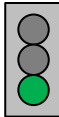
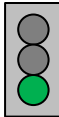
- European domestic market for balancing energy
- Separate procurement of balancing capacity and energy
- Marginal pricing (at least) for balancing energy
- Minimum requirements for balancing capacity cooperations

Additional requirements based on Clean Energy Package

- Regional sizing of reserves
 - Facilitation of balancing capacity procurement
- » (Voluntary) regional projects may have facilitated early implementations.
- » But European projects (balancing platforms) facilitate target model according to GL EB.

Introduction

Overview on current status of European Balancing Platforms

	IGCC	MARI	PICASSO	TERRE
Balancing service	IN	mFRR	aFRR	RR
Participants				
Target area	Continental Europe	Europe	≥ Continental Europe	≥ RR TSOs
Go-live	24/06/2021 & operational since 01/10/2011	05/10/2022*	22/06/2022*	29/09/2020*
Status				
Highlights	Economic surplus of around ~790 Mio. € in 2022	Cross-border exchange of >2.5 GWh between DE and CZ until April 2023	Economic surplus of 166 Mio. € until June 2023	Economic surplus of 766 million € in 2022.

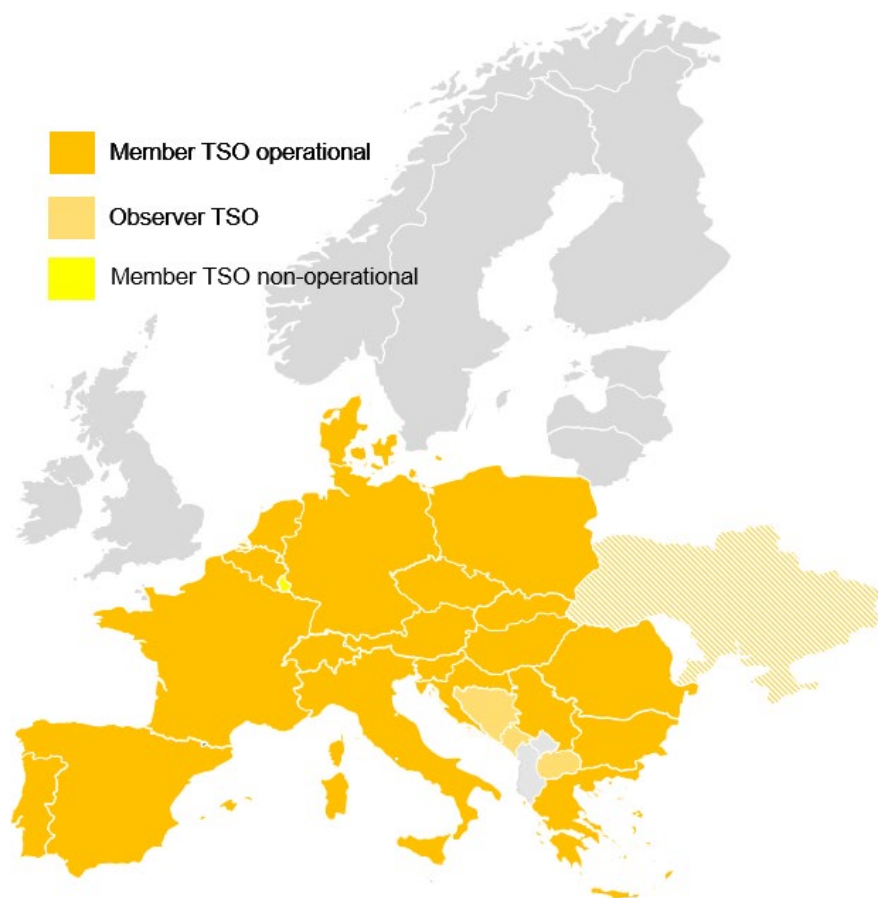
* Date as of when cross-border exchanges were possible due to neighboring TSO joining. Technical go-live of platform was earlier.

- » European domestic market (at least) for balancing energy has been established in 2022.
- » European market design has significantly changed the local procurement rules.

Market Results

Important achievements in IGCC

- All TSOs with the obligation to connect as a result of the EB Regulation are connected to IGCC*
- IGCC is the first Balancing Platform to achieve this objective.



- IGCC has 27 members in total. out of which
 - 24 are operational members and
 - 3 are observers
- With the go-live of ESO in March, all EU-TSOs are connected and can net their imbalances.
- Historical evolution (starting in 2010):



- Total economic surplus in 2022 of 789 Mio. €, all-time high of netted imbalances of 1.15 TWh in March 2023.
- Around 73 % of the theoretic netting potential is utilized in the IGCC region.

Manually Activated Reserves Initiative (MARI)

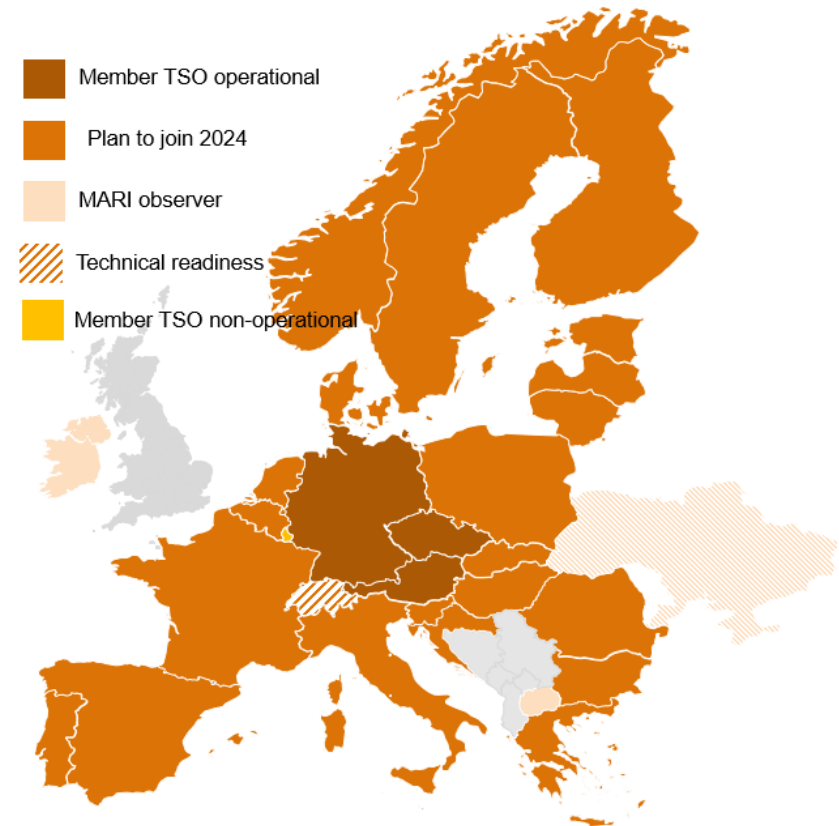
Overview

- Project “Manually Activated Reserves Initiative” (MARI) has been set up already in 2017 to provide the basis for a European mFRR platform.
 - Currently, 29 TSOs from 26 countries have joined the project (Creos as non-operational member only).
- Start of dry-run (CEPS) on 18/07/2022
- Technical go-live on 15/09/2022
- First TSOs (CEPS and German TSOs) joined on 05/10/2022
- Go-live of APG in June 2023

Relevant Features

- Counter activation of mFRR balancing energy for economic optimization
- One common standard product in Europe with some national specialties (due to unit-based vs. portfolio-based bidding)
- 100 % availability since Go-Live
- Cross-border exchange of >2.5 GWh between DE and CZ until April 2023

» Road to individual TSOs go-live will also continue in 2023



MARI

Updated Accession Roadmap

- The accession of member TSOs to mFRR-Platform (MARI) is planned in accordance with the following accession roadmap.
- MARI member TSOs and ENTSO-E share this accession roadmap for informative purposes only and does not, in any case, represent a firm, binding or definitive position of MARI on the content.
- The content is subject to change as the implementation progresses and new information becomes available.
- In particular, feasibility of the present accession roadmap may depend on final detailed accession planning and possible operational and/or technical constraints that would result in the maximum number of parallel accessions.

Last updated on 20 April 2023 based on latest information available.

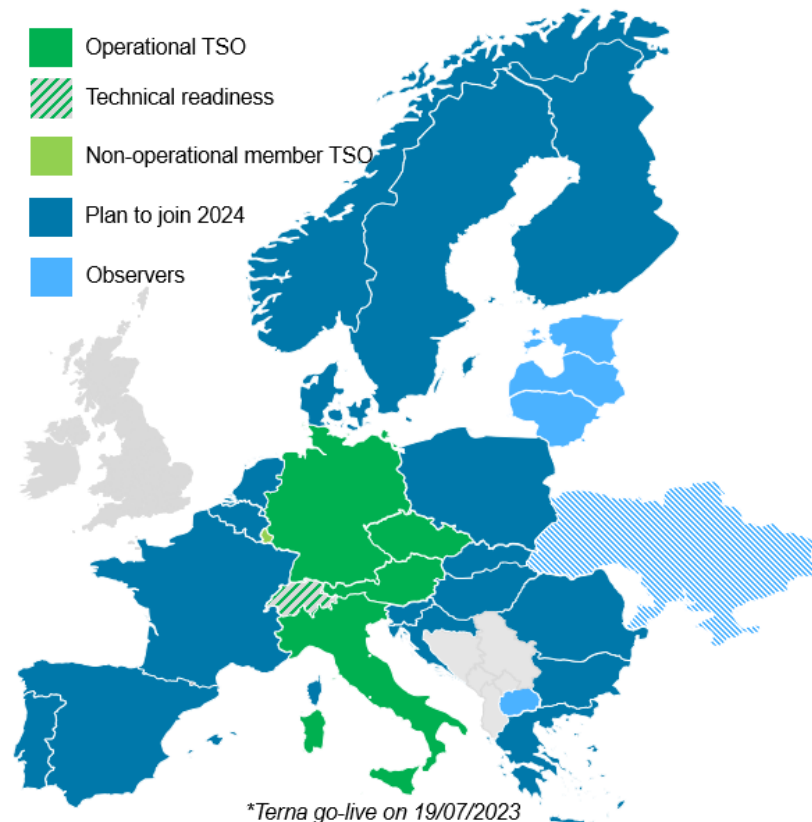
mFRR-Platform Accession Roadmap			2023												2024																		
			1	2	3	4	5	6	7	8	9	10	11	12	Q1	Q2	Q3	Q4															
mFRRIF	5.4.(b)(ii)	AOF																															
	5.4.(b)(ii)	TSO-TSO Settlement																															
	5.4.(b)(vi)	Testing functions & mFRR operation																															
mFRR-Platform	5.4.(b)(iii)	TSOs Interoperability tests																															
	5.4.(b)(iv)	Operational tests (parallel run)																															
	5.4.(b)(v)	TSOs Connection / Go-live																															
	5.4.(b)(vi)	mFRR-Platform Go-live																															
Country	Derogation deadline ¹	TSO																1	2	3	4	5	6	7	8	9	10	11	12	Q1	Q2	Q3	Q4
Germany		50Hz/Amprion/ TenneT GmbH/ TransnetBW																															
Greece	24.7.2024	IPTO ²																															
Austria		APG																															
Latvia	24.7.2024	AST ³																															
Czech republic		CEPS																															
Estonia	24.7.2024	ELERING ³																															
Slovenia		ELES																															
Belgium	24.7.2024	Elia ⁴																															
Denmark	24.7.2024	Energinet ⁵																															
Bulgaria	30.6.2024	ESO ⁶																															
Finland	24.7.2024	Fingrid ³																															
Croatia	24.7.2024	HOPS ⁷																															
Lithuania	24.7.2024	LITGRID ³																															
Hungary	24.7.2024	MAVIR ⁸																															
Poland	24.07.2024	PSE ⁹																															
Spain	24.07.2024	RE ¹⁰																															
Portugal	24.07.2024	REN																															
France	24.07.2024	RTE ¹¹																															
Slovakia	24.07.2024	SEPS ¹²																															
Sweden	24.07.2024	SVK ³																															
Netherlands		TenneT BV ¹³																															
Italy	24.7.2024	Terna ¹⁴																															
Romania	01.03.2024	Transelectrica ¹⁵																															
EEA																																	
Norway	24.07.2024	Statnett ³																															
Non-EU Member State																																	
Switzerland		Swis sqrid ¹⁵																															

Platform for the International Coordination of automated Frequency Restoration and Stable System Operation (PICASSO)

- The “Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation” (PICASSO) has been endorsed by all TSOs in 2017 as implementation project for the European aFRR platform pursuant to GL EB.
- Currently, 26 TSOs from 23 countries have joined the project. 4 TSOs and ENTSO-E are observers.
- Successful go-live on June 1st. 2022 with CEPS as first operational member, earlier than required by the regulation
- First exchange of energy on June 22nd 2022, after APG and the 4 German TSOs joined the platform
- The remaining Member TSOs will gradually join the platform

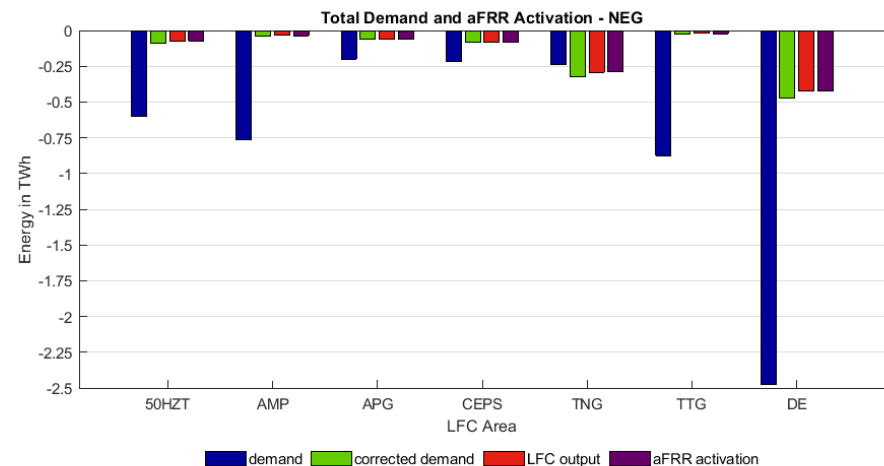
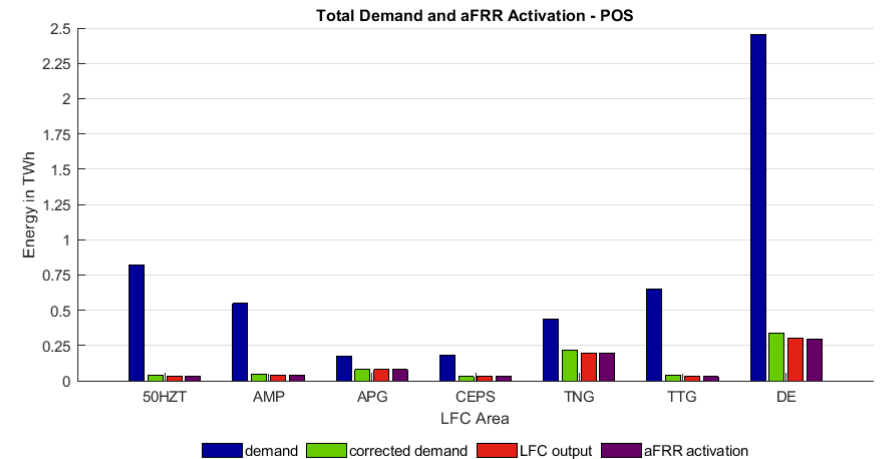
Relevant Features

- The PICASSO Platform establishes a European domestic energy market for aFRR energy, based on a common standard product.
- Using a market time unit of 4 seconds. the PICASSO optimizer has performed ~ 4,125,000 market clearings in 2022 with **100 %** availability.
- Since Go-live of the platform an economic surplus of more than 166 Mio.€ was realized (without additional demand satisfaction)
- In mean, the whole PICASSO region forms one uncongested area during 48% of all optimization cycles, resulting in a full price convergence



* based on the current accession roadmap which includes additional information and risks on the planning

- Graph shows the aggregated energy amounts for the 6 PICASSO LFC areas and the German LFC-block covering the period from 1.11.2022 until 30.4.2023.
- The effect of the optimization steps is clearly visible:
 - The aFRR-demand (blue) submitted to the platform is for most of the LFC areas much higher than the corrected demand (green) calculated by the platform (-> Netting within the PICASSO region and the IGCC)
 - There is a decrease visible between the corrected demand (output of PICASSO), the local LFC output and the activated aFRR by the BSP due to the dynamic behavior of the involved components.
 - The negative aFRR for TNG demonstrates most obviously the “CMOL”-effect: bids in the area of TNG are cheaper, the corrected demand is higher than the original demand.



PICASSO

Updated Accession Roadmap

- The accession of member TSOs to aFRR-Platform (PICASSO) is planned in accordance with the following accession roadmap.
- PICASSO member TSOs and ENTSO-E Share this accession roadmap for informative purposes only and it does not, in any case, represent a firm, binding or definitive position of PICASSO on the content.
- The content is subject to change as the implementation progresses and new information becomes available.
- In particular, the feasibility of the present accession roadmap may depend on final detailed accession planning and possible operational and/or technical constraints that would result in the number of parallel accessions.

aFRR-Platform Accession Roadmap Last updated on 28/04/2023 based on latest information available.

	2023												2024			
	1	2	3	4	5	6	7	8	9	10	11	12	Q1	Q2	Q3	Q4
aFRRIF																
5.4.(b)(ii) AOF (done)																
5.4.(b)(ii) TSO-TSO settlement (done)																
5.4.(b)(vi) Testing functions & aFRR operation (done)																
5.4.(b)(iii) TSOs interoperability test (done)																
5.4.(b)(iv) Operational test (parallel run) (done)																
5.4.(b)(v) TSOs Connection to aFRR platform / Go-live																
5.4.(b)(vi) aFRR-Platform Go-live (done)																

Country	Derogation deadline	TSO	2023												2024			
			1	2	3	4	5	6	7	8	9	10	11	12	Q1	Q2	Q3	Q4
EU:																		
Austria		APG																
Belgium ¹	24.07.2024	Elia																
Bulgaria	30.06.2024	ESO																
Croatia	24.07.2024	HOPS																
Czech republic		CEPS																
Denmark ²	24.07.2024	Energinet																
Finland ²	24.07.2024	Fingrid																
France	24.07.2024	RTE																
Germany		50Hz AMP, TNG, ITG																
Greece	24.07.2024	ADMIE																
Hungary	24.07.2024	MAVR																
Italy	24.07.2023	Terna																
Netherlands ³	24.07.2024	Tennet BV																
Poland	24.07.2024	PSE																
Portugal		REN																
Romania	01.03.2024	Transelectrica																
Slovakia	24.07.2024	SEPS																
Slovenia		ELES																
Spain	24.07.2024	REE																
Sweden ²	24.07.2024	SVK																
EEA:																		
Norway ²	24.07.2024	Statnett																
Non-EU:																		
Switzerland ⁴		Swissgrid																

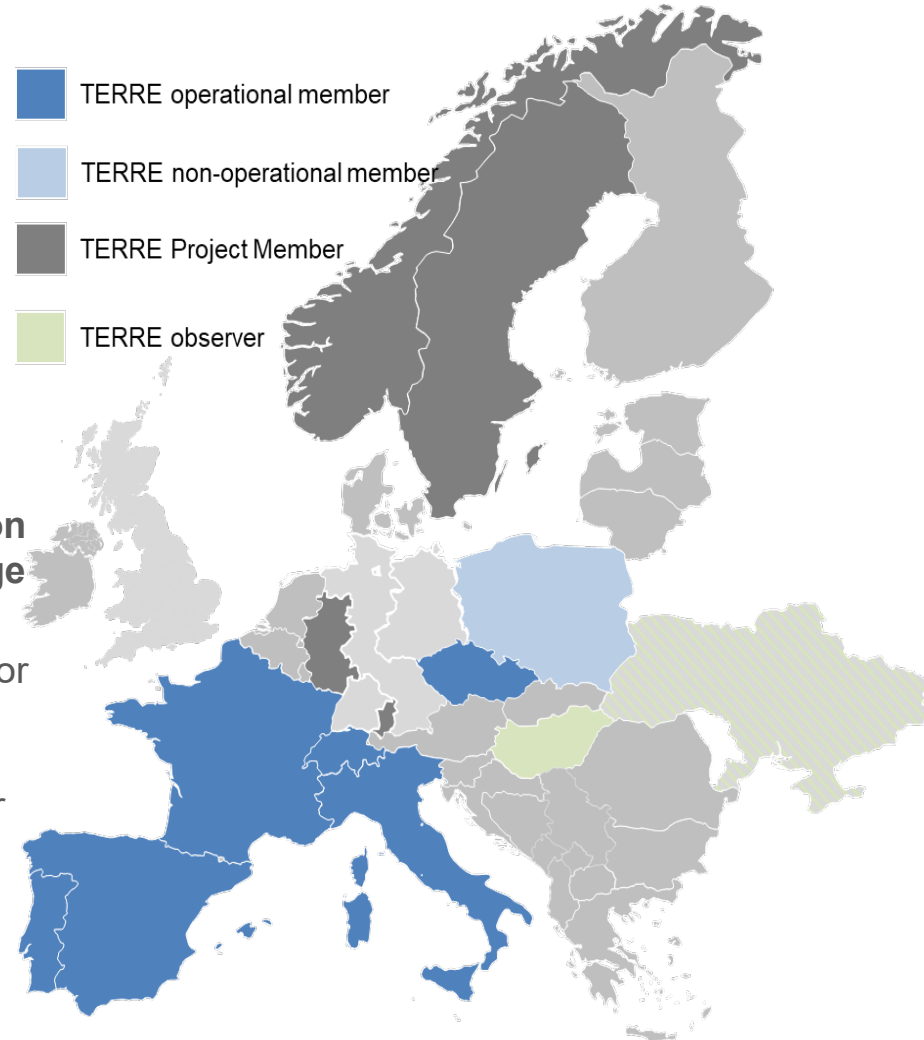
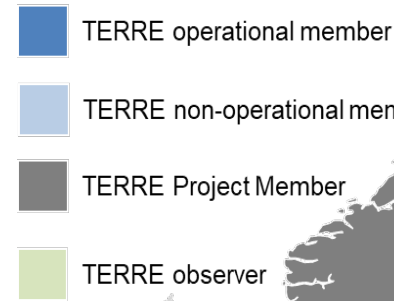
	5.4.(b)(i)	National terms and conditions development
	5.4.(b)(i)	National terms and conditions entry into force
	5.4.(b)(iii)	Interoperability tests between TSO and aFRR-Platform
	5.4.(b)(v)	TSO connection to aFRR-platform / Go-live
	5.4.(b)(vii)	EBGL Article 62 Derogation considered/requested/granted (new deadline listed)

1) A first version of the T&C has entered into force early May when local bidding has been adapted and a second one will enter into force when ELIA will connect to PICASSO. 2) The plan presented in this roadmap shall be regarded as a preliminary, non-binding estimate. The planned connection time is expected in Q2 2024. 3) TenneT NL aims for implementation and go-live by July 2024 and has been granted a derogation until then. However, there is a real risk that the final derogation will take place even later than the requested derogation period. If TenneT takes these risks into account, TenneT expects to participate in the summer of 2025 to participate in the aFRR platform and TenneT will enter into discussions with relevant stakeholders if it becomes clear that the risks already in the planning manifest themselves. 4) The technical readiness of Swissgrid has been acknowledged. The participation of Switzerland in the aFRR-Platform is regulated based on article 1.6 and 1.7 of the EB Regulation and currently the subject of litigation by Swissgrid at the Court of Justice of the European Union.

Trans European Replacement Reserves Exchanges (TERRE)

Last main milestones

- The “Trans European Replacement Reserves Exchanges” platform include:
 - 6 operational members: REN (Portugal), Red Electrica (Spain), RTE (France), Terna (Italy), Swissgrid (Switzerland), CEPS (Czech Republic)
 - One non-operational member: PSE (Poland) which is expected to connect at mid-2024.
 - Two observers: Mavir (Hungary) and ENTSO-E

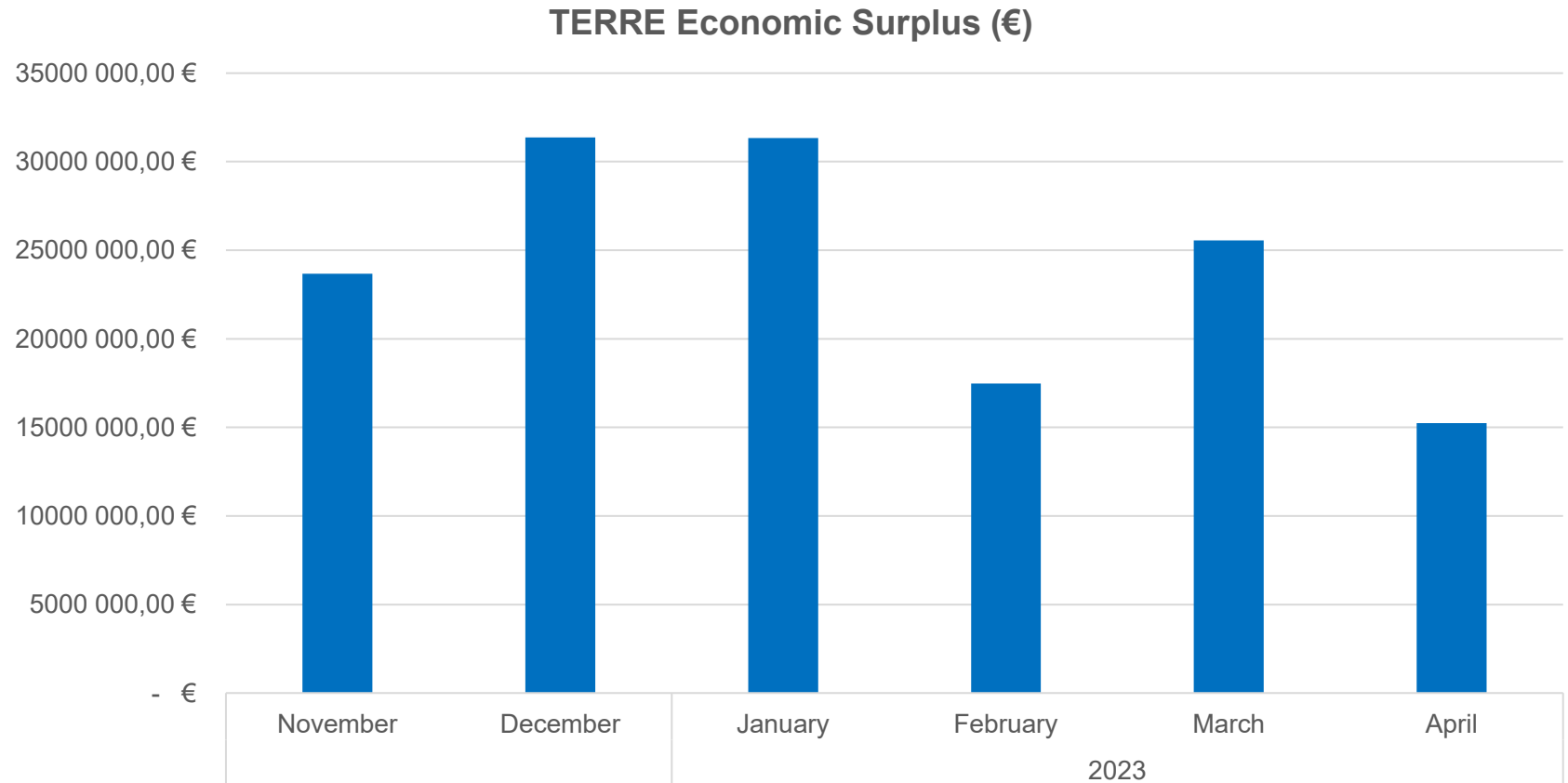


Relevant update

- **ENTSO-E launched a public survey until 30th of June on the change of the number of clearings for the exchange of balancing energy from Replacement Reserves.**
- This survey concerns the presentation of several options for the future RR process implemented in the LIBRA platform. Currently the process is based on 24 gates, but due to the regulation this number of gates must be increased to 48 or 96.
- It is proposed as a preliminary consultation to gather all public stakeholders' feedbacks to select the best option. Another public consultation will follow to amend the Implementation Framework thanks to the chosen option. The proposal has been prepared by all TSOs involved in the TERRE project.

Market Results until End of April 2023

TERRE Economic surplus from November 2022 to April 2023



- TERRE platform is allowing important financial benefits for all countries involved in the project with more than 15 million euros per month since November.



Balancing Energy Prices

Balancing Energy Prices

Price incidents (CBMP > 7500 EUR/MWh)

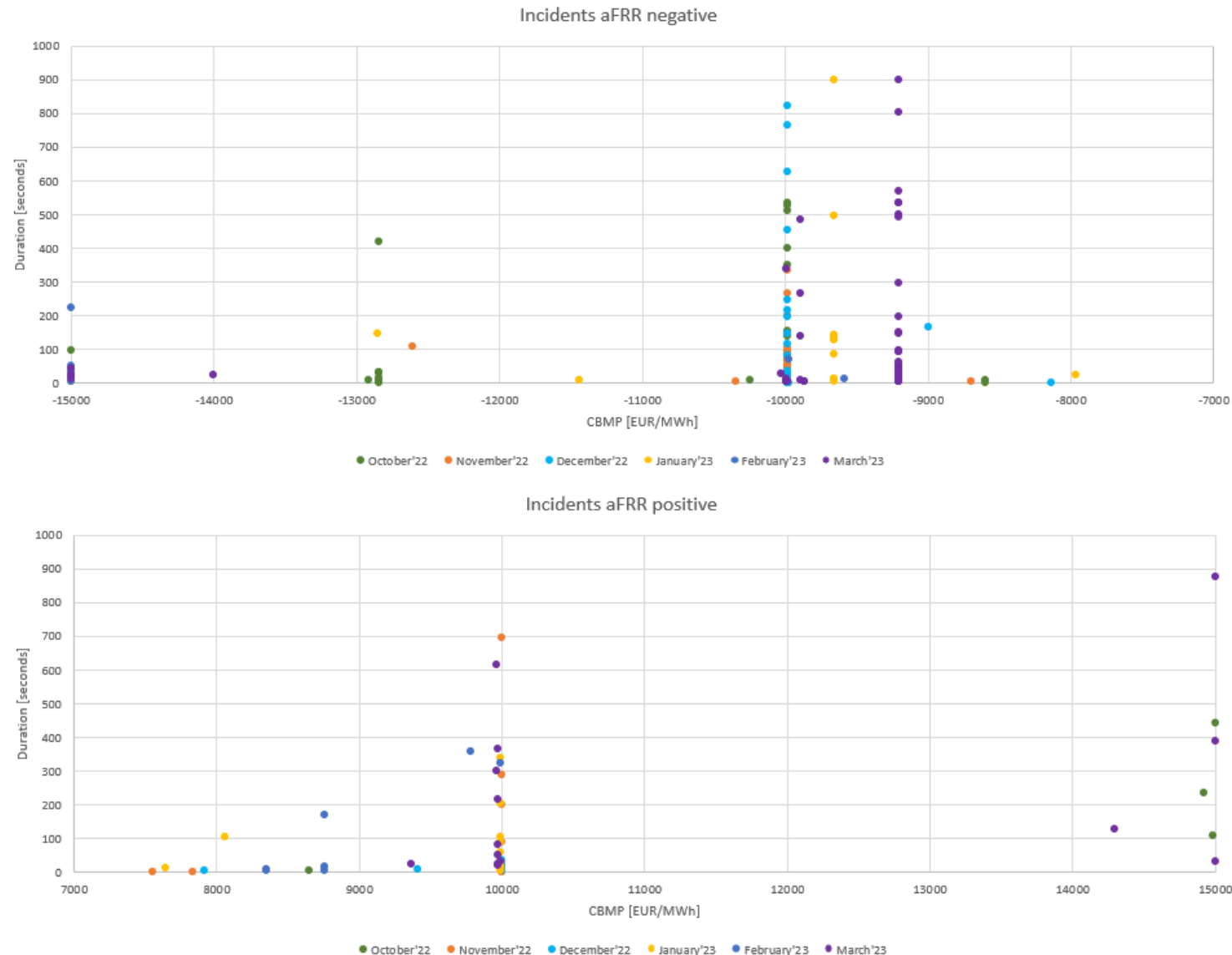
- ACER Decision 03-2022 on the amendment of the pricing methodology
- Provisions on Price limits
 - The transitional upper price limit shall be 15.000 €/MWh and the transitional lower price limit shall be – 15,000 €/MWh;
 - If the harmonized maximum clearing price for the single intraday coupling in accordance with Article 54(1) of Commission Regulation (EU) 2015/1222 increases above 9,999 €/MWh. the transitional upper price limit shall automatically increase by the same amount. In this case. the transitional lower price limit shall be decreased to the same absolute value.
- Reporting Obligations
 - All TSOs shall report to ACER and to regulatory authorities on quarterly basis on the following aspects of the balancing energy price formation during the transitional period
 - monthly average values of used and available cross-zonal capacity for the exchange of balancing energy per each bidding zone border and direction;
 - average percentage of both submitted and activated standard balancing energy bids per product and per direction with prices higher (and lower) than 50 %, 75 %, 90 %, 95 % and 99 % of the upper (and lower) transitional price limit; and
 - volume weighted average price of the last (most expensive) 5 % of the volume of submitted standard balancing energy bids for each European balancing platform per direction and per participating TSO
 - If the cross-border marginal price during the transitional period pursuant to paragraph (3) reaches at least 50 % of the upper or lower transitional price limit, all TSOs shall prepare a joint report and submit it to ACER and all the regulatory authorities within a month following this event. This report shall include an analysis of the event and the indicators of the balancing energy market concentration level including at least Residual Supply Index (RSI). Herfindahl - Hirschman Index (HHI) and the market shares of 5 largest BSPs from the BSPs for which the participating TSOs have forwarded balancing energy bids.

Balancing Energy Prices

aFRR Price Incident Level and Duration

Based on operational data from
01.10.2022 to 31.03.2023

- In total 227 aFRR price incidents occurred during Q4 2022 and Q1 2023
- Average duration of aFRR price incidents (longest incident was 15 min)
 - Negative aFRR: 118 sec
 - Positive aFRR: 151 sec
- Selection of bids at high aFRR prices for just a few OCs.



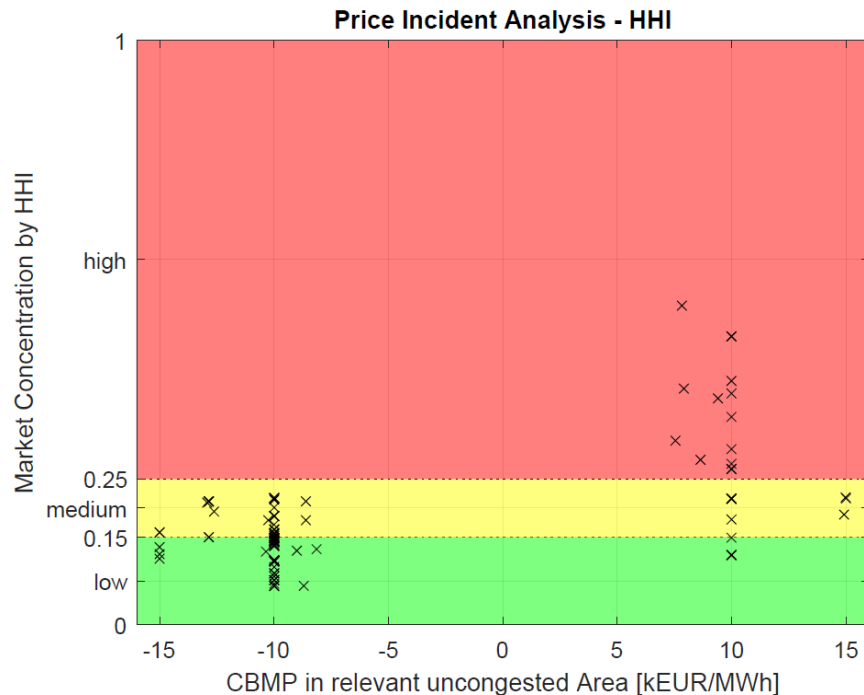
Balancing Energy Prices

aFRR Price incident Market Indicators

Based on operational data from
01.10.2022 to 31.03.2023

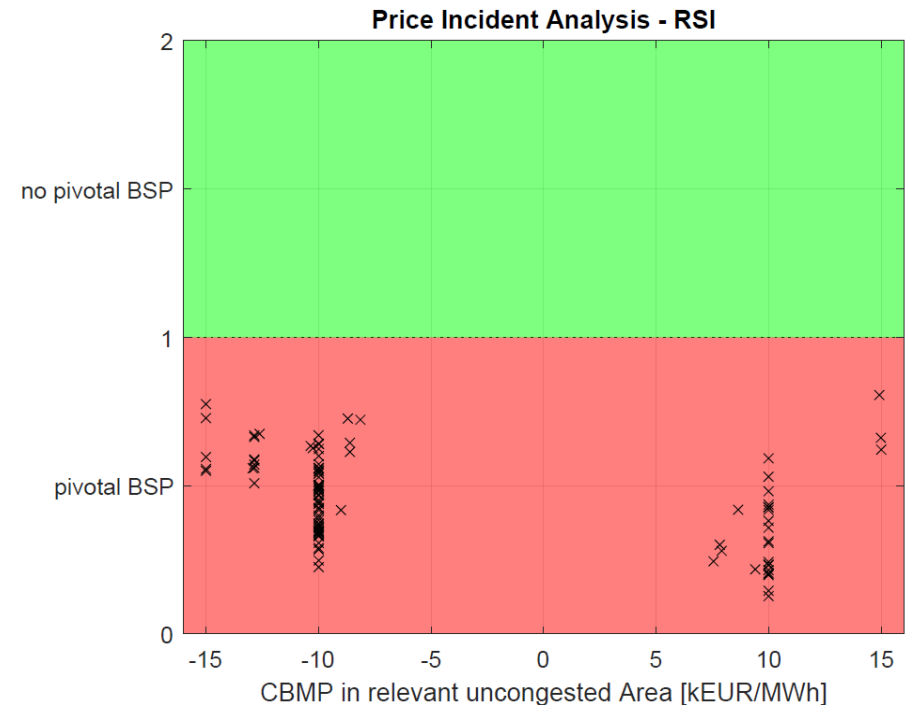
Herfindahl–Hirschman Index (HHI)

- measure of the size of BSPs in relation to the aFRR balancing energy market and an indicator of the amount of competition among them.
- Calculated by squaring the market share of each BSP and then summing the resulting numbers. The result is proportional to the average market share, weighted by market share.



Residual Supply Index (RSI)

- static concentration measure which monitors market power
- measures to which extent the BSPs can meet the current demand with their submitted balancing energy bids.
- The RSI is the ratio of total available capacity less the capacity of the largest firm all divided by the market demand.



- High prices for positive aFRR CBMP are often related to high HHI, but for negative aFRR CBMP there seems to be less correlation with a high HHI.
- During most price incidents it was not possible to satisfy this demand without the BSP with the largest bid volume in the CMOL of the uncongested area

Balancing Energy Prices

mFRR Price incident Market Indicators

- 9 mFRR price incidents during Q1/2023
 - Average duration 15.67 min
 - Each price incident occurred only in a single participating LFC block and thus related to unavailable CZC
 - 8 of 9 mFRR price incidents occurred in negative direction (2x DA, 6xSA)
 - Average price of incidents: -9,449 EUR/MWh
 - 1 of 9 mFRR price incidents occurred in positive direction (SA)
 - Price was 15 kEUR/MWh
- Market indicators
 - RSI for relevant uncongested area <1 during 4 of 9 mFRR price incidents
 - HHI for relevant uncongested area on medium competition level during 2 of 9 mFRR price incidents, else on high competition level