PICASSO

KPI REPORT

7/2023-12/2024

Content

1. Terms, acronyms and definitions

Acronym	Complete Name	Description
AAP	Average Available Power	Average volume of balancing energy that can be activated by the requesting TSO from balancing energy bids as a sum of volumes of BEBs
aFRR	automated Frequency Restoration Reserve	Automatic FRR means FRR that can be activated by an automatic control device
aFRR IF	aFRR Implementation Framework	A framework developed by TSOs in Europe for the implementation of a European platform for the exchange of balancing energy from frequency restoration reserves with automatic activation, in accordance with Article 21 of Commission Regulation (EU) 2017/2195, which establishes a guideline on electricity balancing (EBGL).
AOF	Activation Optimisation Function	Function that ensures the activation of the merit order from CMOL through an optimization cycle with a fixed interval of less than 10 seconds, using the requests and constraints received from each participating TSO in real-time. The optimization function must adhere to the following high-level principles in a single optimization step leading to a global optimum: Control FRCE to zero, Demand aFRR Compensation, Minimize Activation Cost, Operational Safety.
API	Automatic Programming Interface	An intermediary that enables different software applications to interact and share data, functionalities, or services without having access to each other's internal workings.
APL	Activation Price Limit	Price determined only based on the AOF output, without considering the LFC output (approach that was used for CBMP determination before update of pricing methodology in 2024).
BE	Balancing Energy	The energy activated by TSOs to maintain the balance between injections and withdrawals in real time.
BEB	Balancing Energy Bid	The proposal made by a market participant to provide or absorb balancing energy as needed by the TSO.
BSP	Balancing Service Provider	Balancing Service Provider (BSP) in the European Union Internal Electricity Market is a market participant providing balancing services to its Connecting TSO, or in case of the TSO-BSP Model, to its Contracting TSO. Each TSO is responsible for procuring balancing services from BSPs in order to ensure operational security.
BZ	Bidding Zone	The largest geographical area within which market participants are able to exchange energy without capacity allocation.
CBMP	Cross Border Marginal Price	Represents the price of the highest price bid of a standard product which has been selected to cover the energy need for balancing purposes between borders. The AOF computes the balancing energy price per LFC area. In case there is no congestions between adjacent areas, the price will be the same in these areas. In case there is a congestion – there will be a price split (principally like the day-ahead market)
CMOL	Common Merit Order List	The complete set of bids that is used in the optimizer of the platform. The list of orders returned by the algorithm in merit order - cheapest first.
CZC	Cross Zonal Capacity	The capability of the interconnected system to accommodate energy transfer between bidding zones.

Acronym	Complete Name	Description
EBGL	Electricity Balancing Guideline	Regulatory framework and set of guidelines designed to ensure the efficient and reliable operation of electricity grids within the European Union. Key aspects of the Electricity Balancing Guideline include market integration, cross-border cooperation, transparency and non-discrimination, security of supply, market design, flexibility and integration of renewable energy.
FRCE	Frequency Restoration Control Error	The instantaneous difference between the actual and the reference value for the power interchange of a control area, taking into account the effect of the frequency bias for that control area according to the network power frequency characteristic of that control area, and of the overall frequency deviation. The calculation of FRCE serves the purpose of attributing responsibility to TSOs for any discrepancies in their respective systems. The ultimate objective of FRCE is to achieve a balance where FRCE equals zero, but aFRR often comes with a certain time delay, as per the FAT. Thus a certain level of FRCE is inevitable and is often seen as more or less a corrected ACE. Looking ahead, there is a prospective evolution where ACE would transform into FRCE, and subsequently, the FRCE would undergo further adjustment. There are ongoing efforts to refine the accuracy of these metrics.
IF	Implementation Framework	The major regulatory document describing the aFRR platform and market. The implementation of the balancing platforms are required by the EBG, which doesn't describe how they should work. It requests all TSOs to make a proposal how to design the platform. It was conformed by regulatory bodies. There is one framework per platform.
LFC	Load-Frequency Control or Load-Frequency Controller	Automatic control device designed to reduce the FRCE to zero. Physically this is a process computer that is usually implemented in the TSOs control centre systems (SCADA/EMS). The LF Controller processes FRCE measurements every 4-10s and provides - in the same time cycle – automated instructions to aFRR providers that are connected by telecommunication connections. This is a control scheme created to maintain balance between generation and demand, to restore the frequency to its set point value in the synchronous area and, depending on the control structure in the synchronous area, to maintain the exchange power to its reference value. It performs the following functions: - be responsible for the frequency limitation process ; - maintain power exchange at the programmed value; - cooperate to restore the frequency to its set value after a disturbance; - be responsible for accounting for involuntary power deviations within its territory.
TSO	Transmission System Operator	Entities operating independently from the other electricity market players that are responsible for the bulk transmission of electric power on the main high voltage electric networks. TSOs provide grid access to the electricity market players (i.e. generating companies, traders, suppliers, distributors and directly connected customers) according to non-discriminatory and transparent rules. In order to ensure the security of supply, they also guarantee the safe operation and maintenance of the system. In many countries, TSOs are in charge of the development of the grid infrastructure too.
VWAP	Volume weighted average price	Average price of bids weighted by the respective bid volumes

2. Introduction

The Commission Regulation (EU) 2017/2195 of 23 November 2017 (from here on referred to as the EB Regulation) lays down the guidelines for creating an integrated balancing market and thus, among other, obliges all Transmission System Operators (hereinafter "TSOs") to establish the European platform for the exchange of balancing energy from frequency restoration reserves with automatic activation (hereafter "aFRR platform"). Consequently, in line with Article 21(4) all TSOs had to develop the Implementation Framework setting the rules for the implementation of aFRR platform.

According to Article 13(1) of the Implementation Framework for a European platform for the exchange of balancing energy from frequency restoration reserves with automatic activation (hereafter referred to as the "aFRRIF"), all member TSOs of PICASSO project shall monitor, evaluate, and report the implementation and operation aspects of the aFRR-Platform at least on a yearly basis. This document presents the operational results for July 2023 until and including December 2024including the methodology for the calculation and/ or evaluation individual key performance indicators in line with the provisions of Article 13(1) aFRRIF.

3. The scope of the KPI Report

This report covers the operational period from July 2023 to December 2024 which covers the period after the first operational year and unifies the reporting period to calendar years for future reports. For TSOs which accessed the platform during the reporting periods, only full months of operation are covered by the report (e.g. accession on 20th June -> first reported month is July).

The following key performance indicators (hereinafter "KPI") are included in the report in line with the provisions of the aFRRIF (Article 13.1):

a) *„the implementation progress and roadmap in accordance with Article 5;*
b) *the usage of elastic aFRR demand pursuant to Article 3(4), including the part of the elastic demand that has been satisfied; the part of elastic demand that has not been satisfied; and the influence of satisfying the elastic demand on the balancing energy price determined pursuant to Article 30(1) of the EB Regulation*
c) *the amount of aFRR balancing energy requested by each participating TSO in relation to the total volume of balancing energy pursuant to Article 29(12) of the EB Regulation;*
d) *the frequency and volume of deviations between the activation of bids by each participating TSO and the selection of bids by the AOF as referred to in paragraph 3(b) and (c), pursuant to Article 29(5) of the EB Regulation;*
e) *the impact on the economic surplus of minimising the volume of selected standard aFRR balancing energy product bids for balancing energy pursuant to Article 11(2)(b);*
f) *aggregated information and detailed statistics on the bids which were declared as unavailable by TSOs in accordance with Article 9;*
g) *the efficiency of the pricing method for aFRR pursuant to Article 30 of the EB Regulation;*
h) *the availability of cross-zonal capacity for the aFRR exchange on the platform;*
i) *the results of the survey conducted in accordance with Article 16(2)(a)."*

4. Key performance Indicators of the operation of aFRR balancing platform

4.1. aFRR IF 13(1)(a): The implementation progress and roadmap in accordance with Article 5

According to Article 5(5) of aFRRIF, the accession roadmap should be published, and in particular, any information on national derogations shall be updated when new information becomes available. The accession roadmap shows the implementation progress of each TSO and gives stakeholders current information on the development. This information is provided based on National Implementation Roadmaps and reported at least twice per year at ENTSO-E website.

After all TSOs have connected to the aFRR-Platform, the roadmap under this paragraph is not mandatory for the Report or depending on the decision of Steering Committee of PICASSO project regarding to Article 5(5) of aFRRIF.

The latest published version (April 2025) of Accession roadmap for PICASSO can be found on PICASSO website on ENTSO-E. Direct link: https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Network%20codes%20documents/Implementation/picasso/PICASSO_Accession_Roadmap_APR_2025.pdf

4.2. aFRR IF 13(1)(b): The usage of elastic aFRR demand pursuant to Article 3(4), including the part of the elastic demand that has been satisfied; the part of elastic demand that has not been satisfied; and the influence of satisfying the elastic demand on the balancing energy price determined pursuant to Article 30(1) of the EB Regulation

According to Article 3(4): *"A participating TSO may submit an elastic aFRR demand for positive or negative balancing energy within one market time unit. In such case, a participating TSO shall respect the following high-level principles:*

a) The power threshold of the elastic aFRR demand shall be equal to or higher than the aFRR capacity requirement, resulting from the application of the ratio between aFRR and mFRR of the FRR capacity requirement determined for the relevant LFC block pursuant to the FRR dimensioning rules as defined in Article 157 of the SO Regulation.

b) *The elastic aFRR demand shall not be used in such a way that it imposes a cap on balancing energy prices for all LFC areas or bidding zones."*

The usage of elastic aFRR demand is represented by three different parameters:

i. The total aggregated volume of elastic aFRR demand submitted to the platform by the requesting TSO. Data is shown in MWh.
ii. The total aggregated volume of elastic aFRR demand submitted to the platform by the requesting TSO which is satisfied. Data is shown in MWh.
iii. The total aggregated volume of elastic aFRR demand submitted to the platform by the requesting TSO which is not satisfied. Data is shown in MWh.

This KPI and sub-KPIs are calculated separately for the upward and downward (elastic) demand. Note that the results are shown in the report for the TSOs that actually implemented elastic demand, and for the months from the implementation of elastic demand onwards (that is, starting August 2024). In the review period, the values are therefore shown only for ELIA.

TSO using elastic demand	Total Elastic Demand (MWh)		Total Satisfied Elastic Demand (MWh)				Total Non-Satisfied Elastic Demand (MWh)			
	Positive	Negative	Positive		Negative		Positive		Negative	
ELIA	11 002	- 11 796	9 626	88 %	- 11 617	98 %	1 376	12 %	- 179	2 %

Table 1 - Overall amount of elastic aFRR demand submitted to the platform by each TSO using elastic demand in MWh

ELIA	Direction	Jul 23	Aug 23	Sep 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	Jun 24	Jul 24	Aug 24	Sep 24	Oct 24	Nov 24	Dec 24	**Average**
Total Elastic Demand (MWh)	Positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11 002	11 002
	Negative	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-11 796	-11 796
Total Satisfied Elastic Demand (MWh)	Positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9 626	9 626
	Negative	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-11 617	-11 617
Total Non-Satisfied Elastic Demand (MWh)	Positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 376	1 376
	Negative	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	- 179	- 179

Table 2 - Monthly amount of elastic aFRR demand submitted to the platform by ELIA in MWh

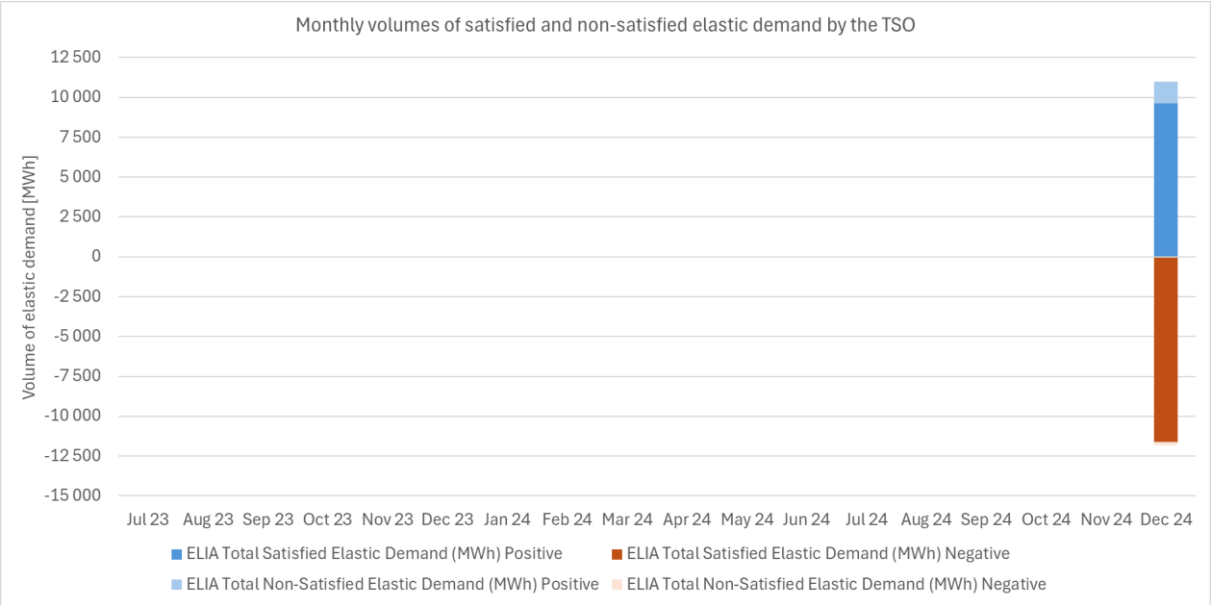


Figure 1 - Monthly amount of elastic aFRR demand submitted to the platform by ELIA in MWh

The evaluation of the impact of the elastic demand satisfaction is done based on the comparison of two scenarios: Actual results (considering elastic demand) and Parallel results (shadow run for all demand considered as inelastic). The comparison is made for Activation Price Limits, which corresponds to prices based on the AOF output.

ELIA	Scenario	Jul 23	Aug 23	Sep 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	Jun 24	Jul 24	Aug 24	Sep 24	Oct 24	Nov 24	Dec 24	Average
APL Positive (EUR/MWh)	Actual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	162,65	163
	Parallel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	167,57	168
	Difference	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,92	5
APL Negative (EUR/MWh)	Actual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13,54	14
	Parallel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13,38	13
	Difference	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0,15	0

Table 3 - Volume-averaged APL per month for ELIA (€/MWh)

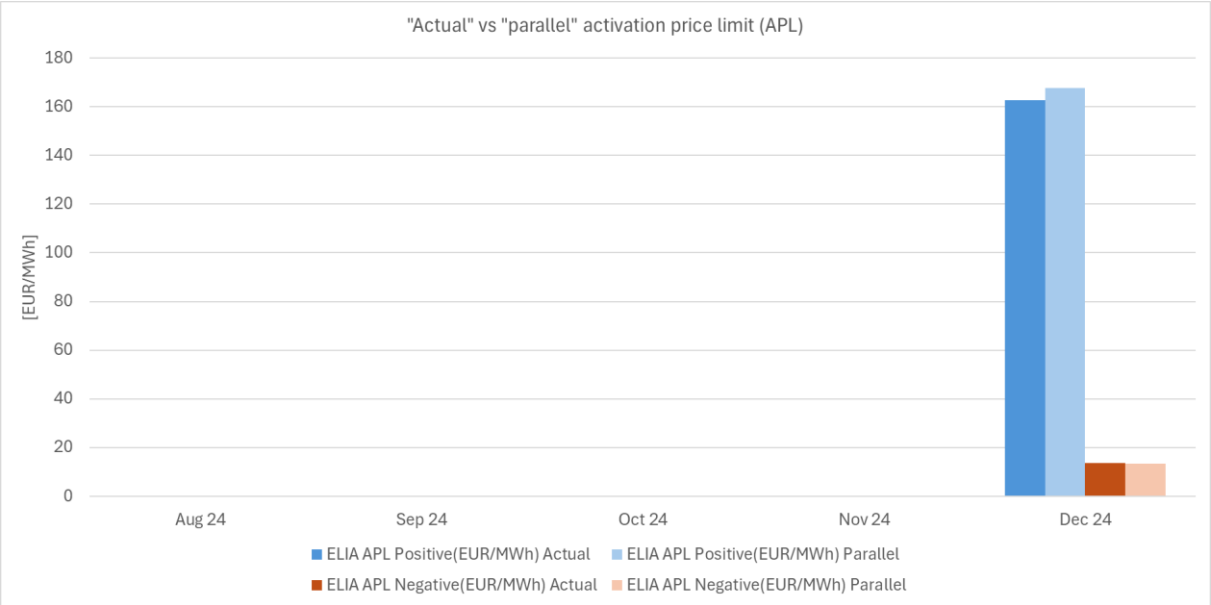


Figure 2 - Volume-averaged APL per month for ELIA (€/MWh)

4.3. aFRR IF 13(1)(c): The amount of aFRR balancing energy requested by each participating TSO in relation to the total volume of balancing energy pursuant to Article 29(12) of the EB Regulation

According to Article 29(12) of EB Regulation: "*Each requesting TSO may request the activation of balancing energy bids from the common merit order lists up to the total volume of balancing energy. The total volume of balancing energy that can be activated by the requesting TSO from balancing energy bids from the common merit order lists is calculated as a sum of volumes of:*

(a) balancing energy bids submitted by the requesting TSO not resulting from sharing of reserves or exchange of balancing capacity;
(b) balancing energy bids submitted by other TSOs as a result of balancing capacity procured on behalf of the requesting TSO;
(c) *balancing energy bids resulting from the sharing of reserves under the condition that the other TSOs participating in the sharing of reserves have not already requested the activation of those shared volumes.*"

For the demonstration of the results for this KPI, the total available volume is represented as a sum of volumes of balancing energy bids pursuant to Article 29(12) of the EB Regulation, including bids that have been procured by other TSOs on behalf of the respective TSO. As aFRR is commonly dimensioned and procured within Germany, the average volume requested and submitted by each of the German TSOs is combined into one number.

As this KPI focuses on the average volume that is available as part of the common merit order list (CMOL), the amounts may deviate from locally procured volumes.

To make requested and available volumes comparable, all values are shown as average power in MW.

TSO	Average requested power (MW)		Average available power* (MW)	
	Positive	Negative	Positive	Negative
APG	67	-43	207	-209
ČEPS	41	-45	198	-208
DE	224	-182	2161	-2169

TSO	Average requested power (MW)		Average available power* (MW)	
	Positive	Negative	Positive	Negative
ELIA	51	-54	131	-355
ENDK1	50	-61	129	-195
SEPS	11	-32	108	-131
TERNA	164	-257	412	-435
TNL	106	-99	483	-1236

Table 4: Yearly amount of average aFRR requested power requested by each participating TSO in MW

*To make requested and available volumes comparable, all values are shown as average power in MW. Average volume of balancing energy is for the Table 1 and 2 and in the Figures 1, 2 and 3 considered as aFRR Band.

APG	Direction	Jul 23	Aug 23	Sep 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	Jun 24	Jul 24	Aug 24	Sep 24	Oct 24	Nov 24	Dec 24	Average
Average requested power (MW)	Positive	72	67	64	61	70	57	60	76	63	79	67	78	67	66	51	58	69	76	67
	Negative	-40	-37	-31	-47	-48	-45	-45	-39	-47	-46	-43	-47	-45	-43	-58	-42	-43	-34	-43
Average available power (MW)	Positive	200	201	201	201	201	201	201	201	201	201	201	201	202	216	226	226	226	226	207
	Negative	-201	-201	-208	-201	-208	-201	-201	-201	-201	-201	-202	-202	-201	-216	-226	-227	-226	-227	-209

Table 5: Monthly amount of average aFRR requested and available power (APG) in MW

ČEPS	Direction	Jul 23	Aug 23	Sep 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	Jun 24	Jul 24	Aug 24	Sep 24	Oct 24	Nov 24	Dec 24	Average
Average requested power (MW)	Positive	35	50	49	39	43	35	41	41	58	43	35	43	31	30	35	43	39	46	41
	Negative	-56	-43	-49	-66	-48	-55	-62	-51	-45	-53	-54	-48	-43	-35	-33	-27	-26	-22	-45
Average available power (MW)	Positive	153	146	164	161	183	181	225	233	225	210	194	188	165	172	207	240	252	264	198
	Negative	-201	-201	-207	-200	-207	-201	-201	-201	-216	-225	-210	-182	-187	-182	-212	-221	-227	-256	-208

Table 6: Monthly amount of average aFRR requested and available power (ČEPS) in MW

DE	Average available power (MW)		Average requested power (MW)	
Direction	Negative	Positive	Negative	Positive
Jul 23	-2082	2129	-205	225
Aug 23	-2132	2110	-167	232
Sep 23	-2141	2096	-220	183
Oct 23	-2194	2158	-176	250
Nov 23	-2176	2103	-136	262
Dec 23	-2124	2065	-152	232
Jan 24	-2269	2165	-144	266
Feb 24	-2228	2156	-186	217
Mar 24	-2228	2121	-229	193
Apr 24	-2180	2150	-232	231
May 24	-2191	2157	-194	212
Jun 24	-2100	2176	-192	223
Jul 24	-2128	2214	-178	222
Aug 24	-2122	2221	-185	206
Sep 24	-2089	2215	-190	218
Oct 24	-2174	2260	-175	197
Nov 24	-2262	2211	-168	234
Dec 24	-2231	2191	-148	219
Average	-2169	2161	-182	224

Table 7: Monthly amount of average aFRR requested and available power (DE) in MW

ELIA	Average available power (MW)		Average requested power (MW)	
Direction	Negative	Positive	Negative	Positive
Jul 23	-	-	-	-
Aug 23	-	-	-	-
Sep 23	-	-	-	-
Oct 23	-	-	-	-
Nov 23	-	-	-	-
Dec 23	-	-	-	-
Jan 24	-	-	-	-
Feb 24	-	-	-	-
Mar 24	-	-	-	-
Apr 24	-	-	-	-
May 24	-	-	-	-
Jun 24	-	-	-	-
Jul 24	-	-	-	-
Aug 24	-	-	-	-
Sep 24	-	-	-	-
Oct 24	-	-	-	-
Nov 24	-	-	-	-
Dec 24	-355	131	-54	51
Average	-355	131	-54	51

Table 8: Monthly amount of average aFRR requested and available power (ELIA) in MW

ENKD1	Average available power (MW)		Average requested power (MW)	
Direction	Negative	Positive	Negative	Positive
Jul 23	-	-	-	-
Aug 23	-	-	-	-
Sep 23	-	-	-	-
Oct 23	-	-	-	-
Nov 23	-	-	-	-
Dec 23	-	-	-	-
Jan 24	-	-	-	-
Feb 24	-	-	-	-
Mar 24	-	-	-	-
Apr 24	-	-	-	-
May 24	-	-	-	-
Jun 24	-	-	-	-
Jul 24	-	-	-	-
Aug 24	-	-	-	-
Sep 24	-	-	-	-
Oct 24	-	-	-	-
Nov 24	-189	120	-60	50
Dec 24	-200	138	-63	50
Average	-195	129	-61	50

Table 9: Monthly amount of average aFRR requested and available power (ENDK1) in MW

SEPS	Average available power (MW)		Average requested power (MW)	
Direction	Negative	Positive	Negative	Positive
Jul 23	-	-	-	-
Aug 23	-	-	-	-
Sep 23	-	-	-	-
Oct 23	-	-	-	-
Nov 23	-	-	-	-
Dec 23	-	-	-	-
Jan 24	-	-	-	-
Feb 24	-	-	-	-
Mar 24	-	-	-	-
Apr 24	-	-	-	-
May 24	-	-	-	-
Jun 24	-	-	-	-
Jul 24	-	-	-	-
Aug 24	-	-	-	-
Sep 24	-	-	-	-
Oct 24	-	-	-	-
Nov 24	-	-	-	-
Dec 24	-131	108	-32	11
Average	-131	108	-32	11

Table 10: Monthly amount of average aFRR requested and available power (SEPS) in MW

TERNA	Average available power (MW)		Average requested power (MW)	
Direction	Negative	Positive	Negative	Positive
Jul 23	-	-	-	-
Aug 23	-432	383	-250	164
Sep 23	-447	426	-257	156
Oct 23	-432	395	-279	149
Nov 23	-447	404	-266	161
Dec 23	-432	418	-253	160
Jan 24	-432	431	-256	172
Feb 24	-426	426	-236	187
Mar 24	-	-	-	-
Apr 24	-	-	-	-
May 24	-	-	-	-
Jun 24	-	-	-	-
Jul 24	-	-	-	-
Aug 24	-	-	-	-
Sep 24	-	-	-	-
Oct 24	-	-	-	-
Nov 24	-	-	-	-
Dec 24	-	-	-	-
Average	-435	412	-257	164

Table 11: Monthly amount of average aFRR requested and available power (TERNA) in MW

TNL	Average available power (MW)		Average requested power (MW)	
Direction	Negative	Positive	Negative	Positive
Jul 23	-	-	-	-
Aug 23	-	-	-	-
Sep 23	-	-	-	-
Oct 23	-	-	-	-
Nov 23	-	-	-	-
Dec 23	-	-	-	-
Jan 24	-	-	-	-
Feb 24	-	-	-	-
Mar 24	-	-	-	-
Apr 24	-	-	-	-
May 24	-	-	-	-
Jun 24	-	-	-	-
Jul 24	-	-	-	-
Aug 24	-	-	-	-
Sep 24	-	-	-	-
Oct 24	-	-	-	-
Nov 24	-1065	452	-88	119
Dec 24	-1402	513	-109	94
Average	-1236	483	-99	106

Table 12: Monthly amount of average aFRR requested and available power (TNL) in MW

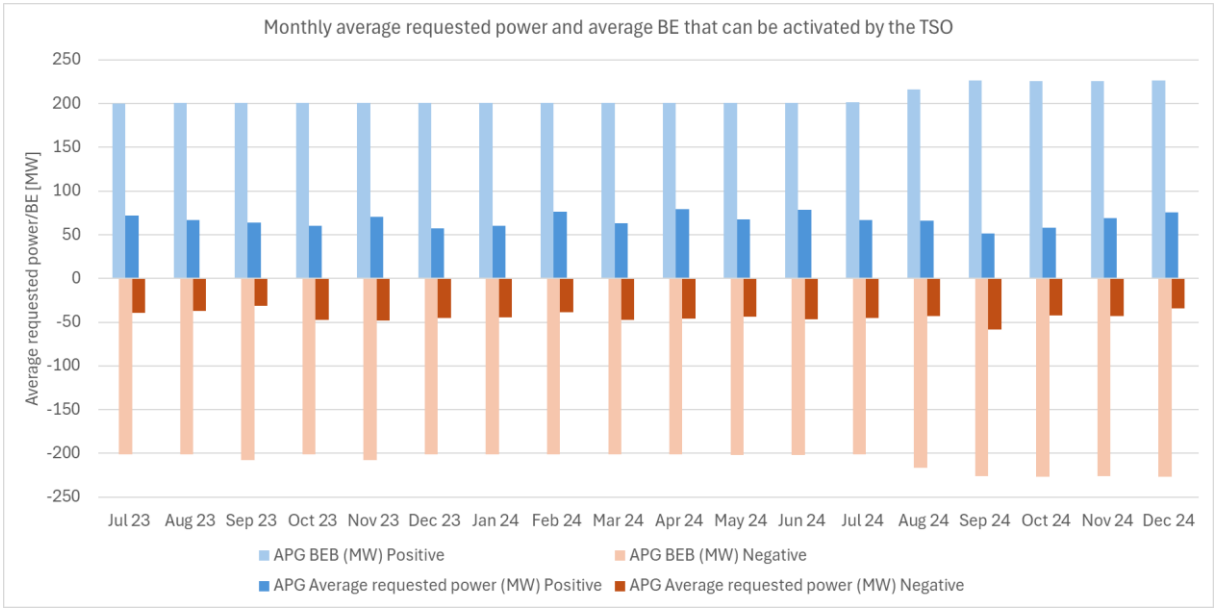


Figure 3: Monthly amount of average aFRR requested power and BE that can be activated by APG in MW

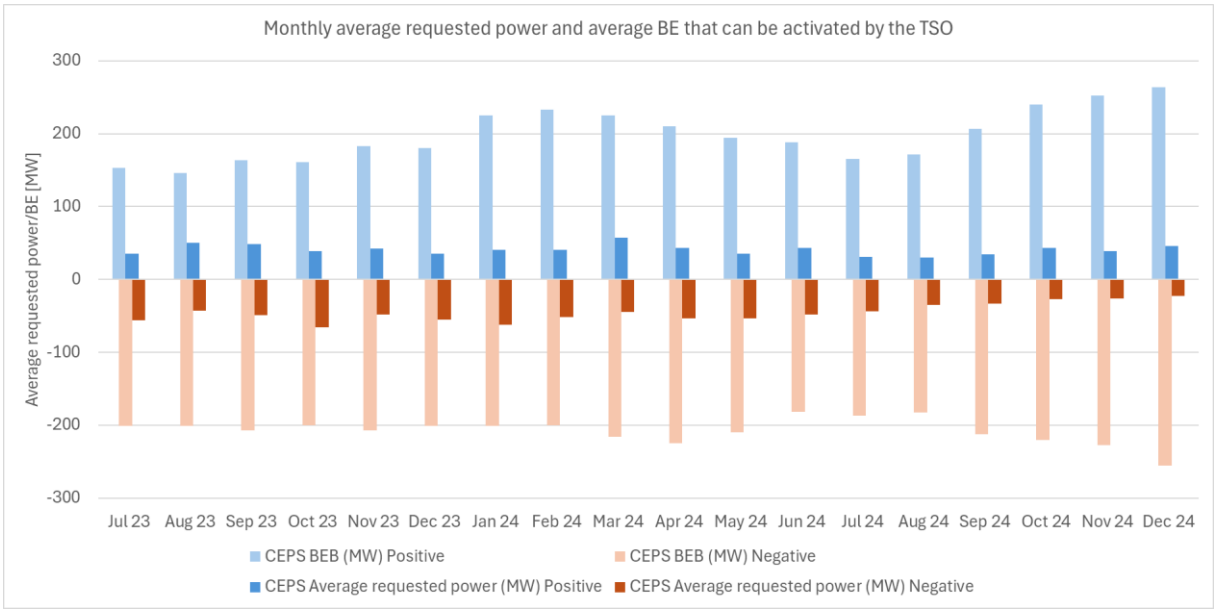


Figure 4: Monthly amount of average aFRR requested power and BE that can be activated by ČEPS in MW

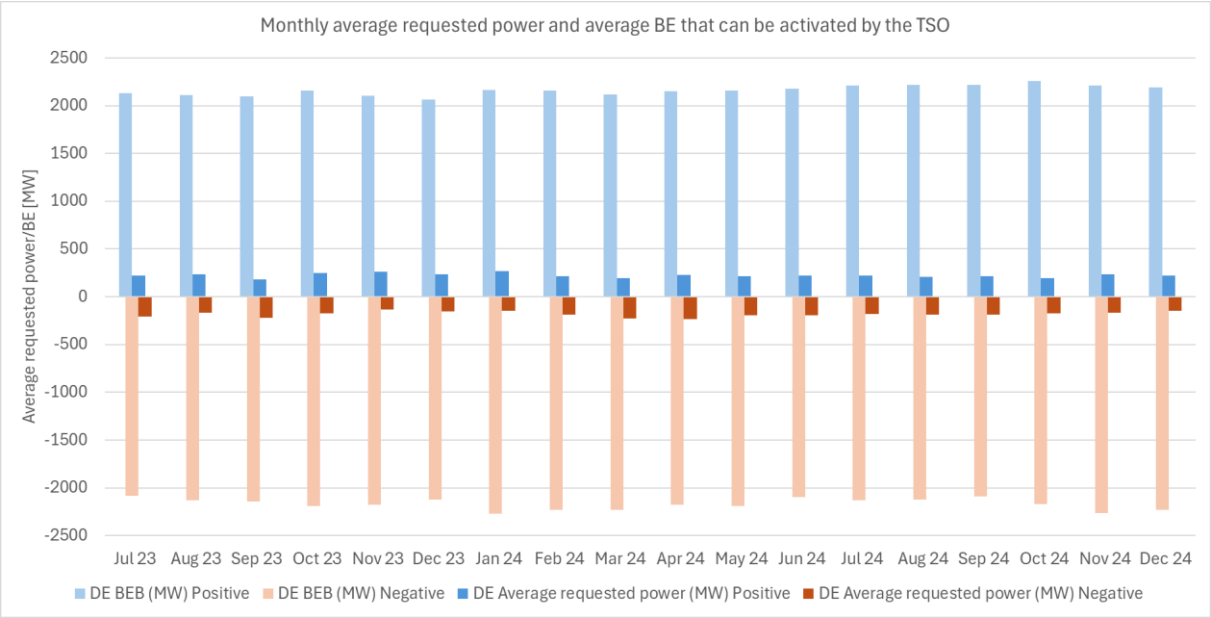


Figure 5*: *Monthly amount of* average *aFRR requested power and* BE that can be activated *by* DE *in MW

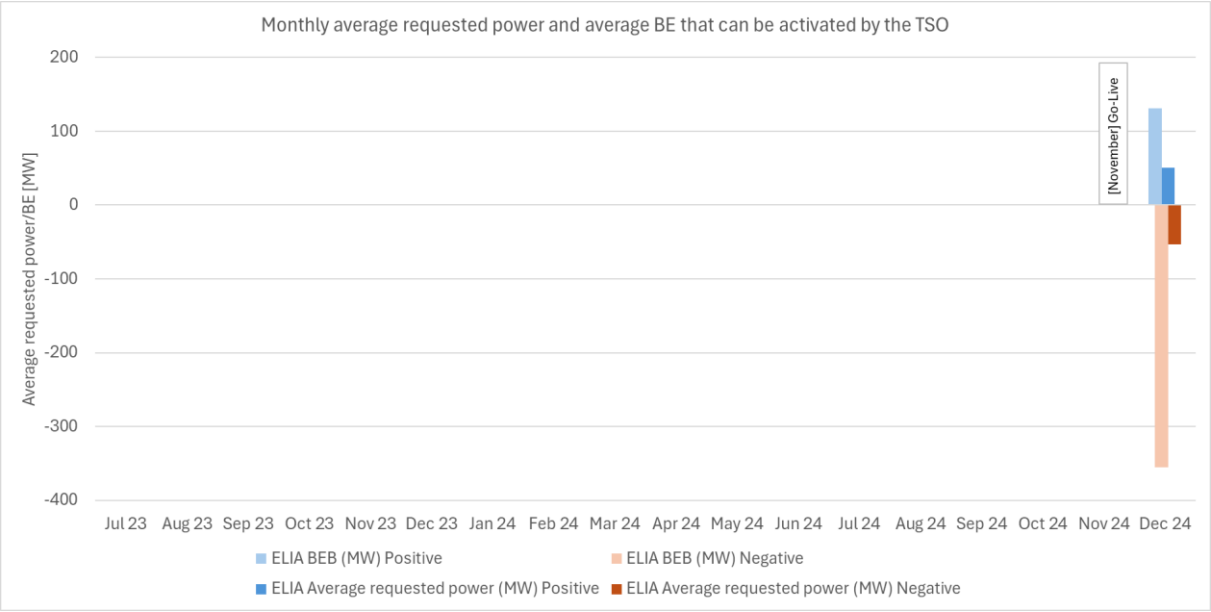


Figure 6: Monthly amount of average aFRR requested power and* BE that can be activated *by ELIA in MW

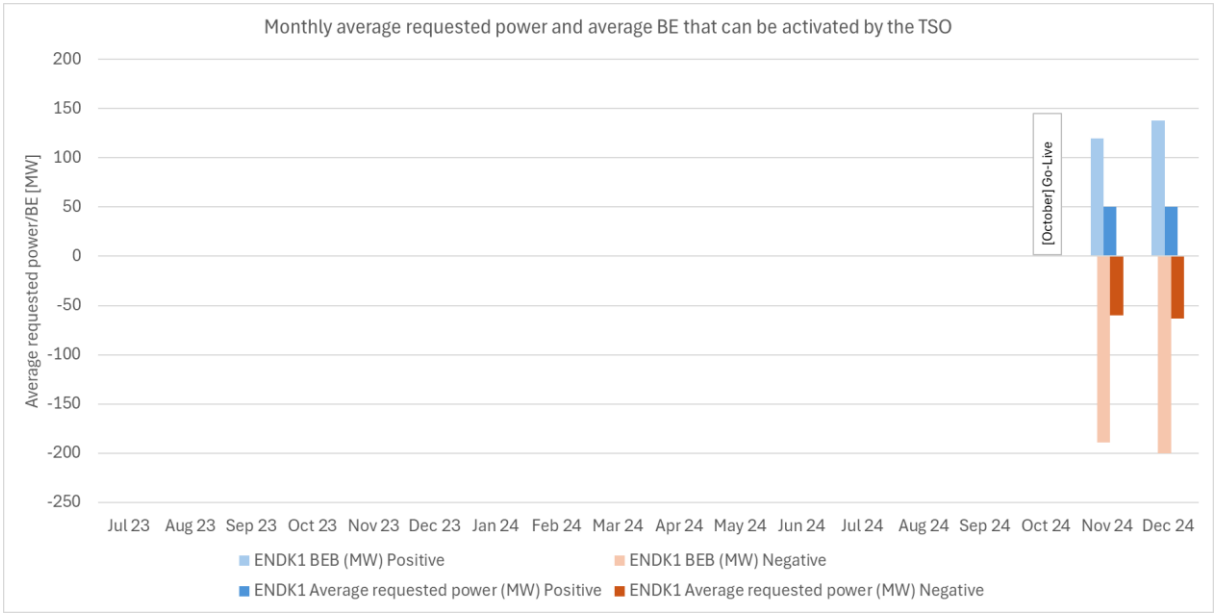


Figure 7: Monthly amount of average aFRR requested power and* BE that can be activated *by ENDK1 in MW

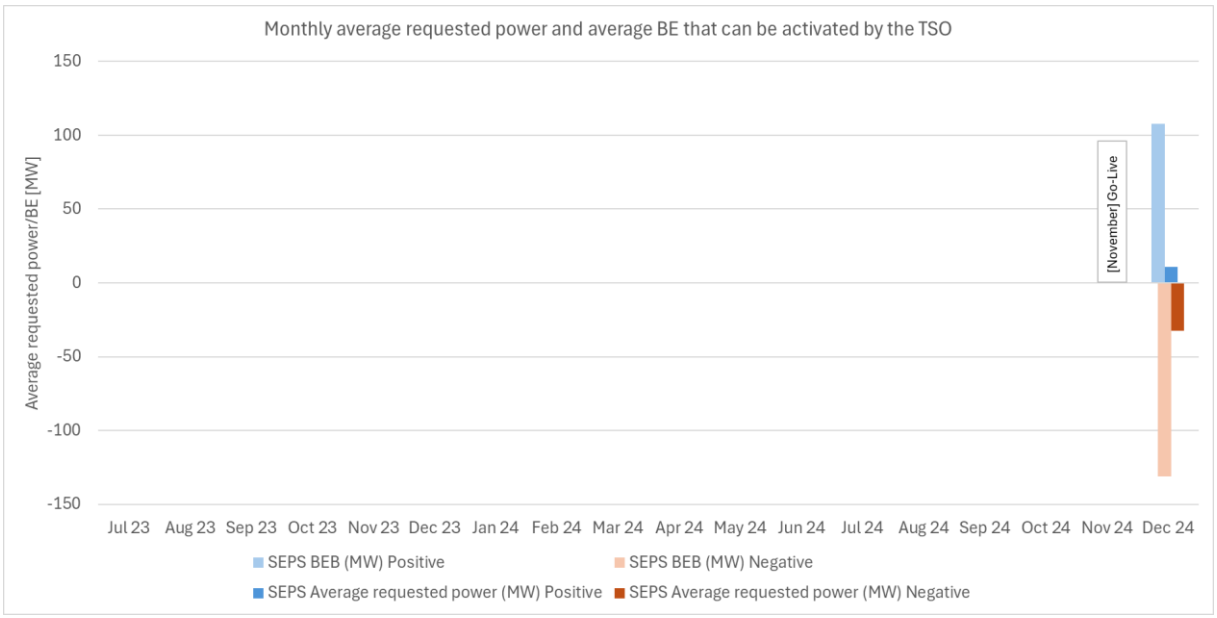


Figure 8: Monthly amount of average aFRR requested power and* BE that can be activated *by SEPS in MW

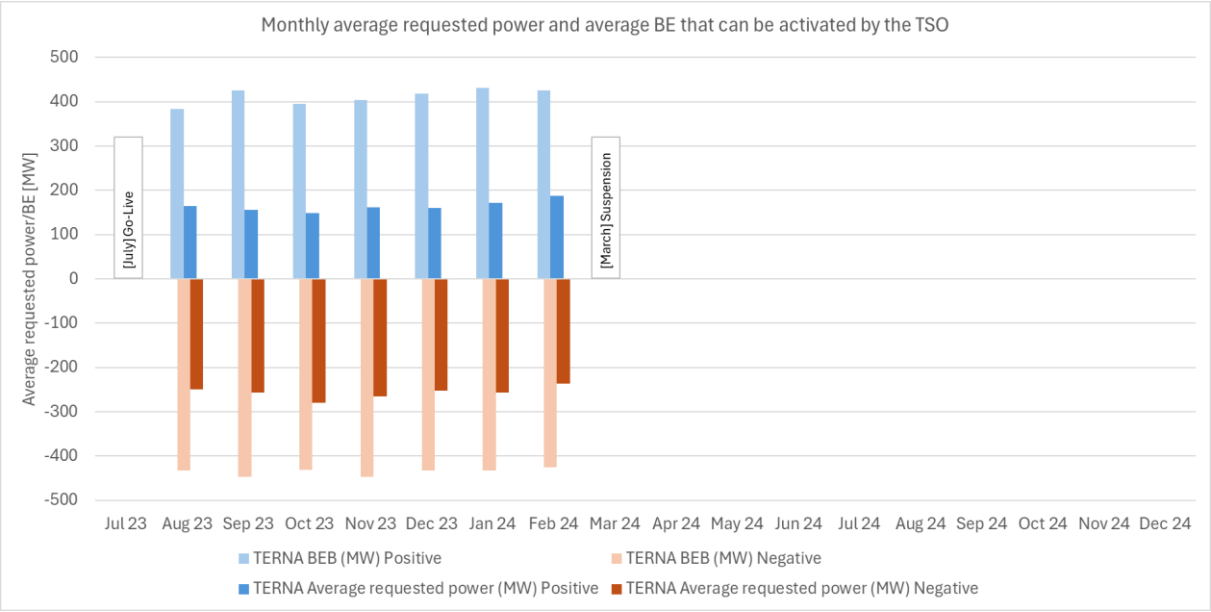


Figure 9: Monthly amount of average aFRR requested power and* BE that can be activated *by TERNA in MW

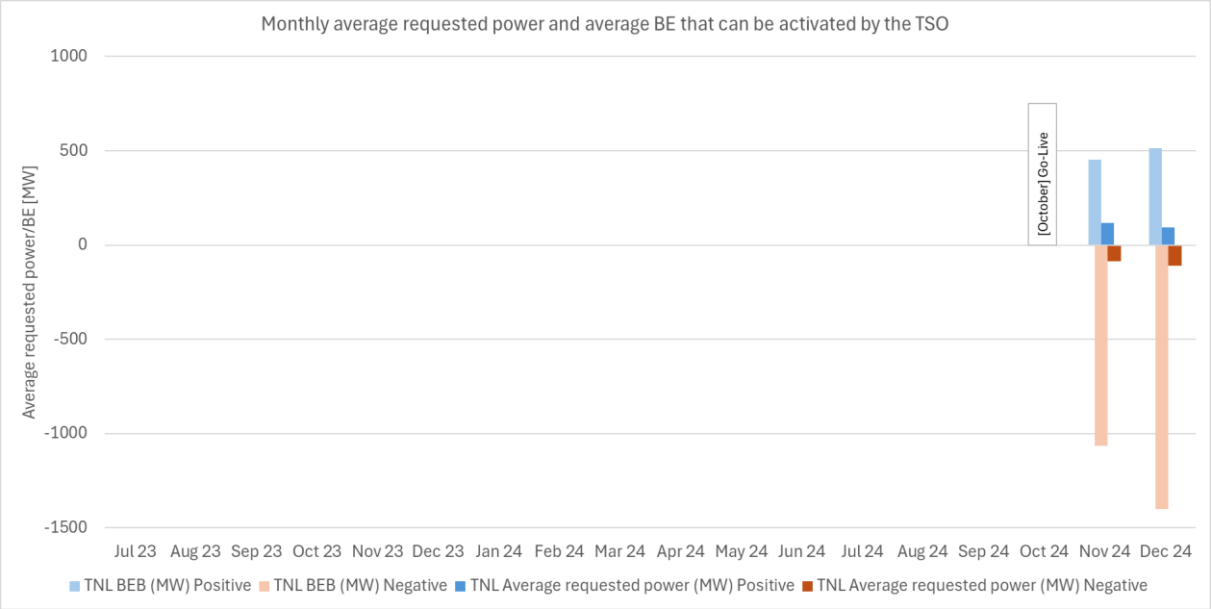


Figure 10: Monthly amount of average aFRR requested power and* BE that can be activated *by TNL in MW

4.4. aFRR IF 13(1)(d): The frequency and volume of deviations between the activation of bids by each participating TSO and the selection of bids by the AOF as referred to in paragraph 3(b) and (c), pursuant to Article 29(5) of the EB Regulation

According to Article 29(5) of EB Regulation: "*In the event that the activation of balancing energy bids deviates from the results of the activation optimisation function, the TSO shall publish the information about the reasons for the occurrence of such deviation in a timely manner.*"

Due to the application of the control demand model, the actual volumes of standard aFRR balancing energy product bids requested by TSOs from their BSPs may deviate from the volumes of selected standard aFRR balancing energy product bids as determined by AOF. These deviations depend on the local characteristics of the load frequency controllers but cannot be prevented completely. The volume of occurred deviations per TSO participating in PICASSO is shown in in Table 13 and Figure 11.

The absolute deviations are strongly impacted by the magnitude of the selected volume in each LFC area and thus by the structure of the CMOL. To compensate this effect, the deviations are additionally shown in relation to the total volume selected by the AOF in each LFC Area. This relative deviation is mainly impacted by the dynamic behaviour of the load frequency controllers. However, it must be considered that LFC areas may use different settings of the LFC controllers and differences in the local implementation to quantify this amount do also contribute to differences in the relative deviations between TSOs.

TSO	Volume of absolute deviations in MWh	Volume of absolute deviations in relation to volume selected by AOF MWh
50HZT	114 924	31,8%
AMP	95 158	33,6%
APG	204 738	42,7%
CEPS	148 292	45,1%
ELIA*	13 203	50,8%
ENDK1*	26 699	34,2%
ENDK2*	2 484	8,1%
SEPS*	5 060	41,2%
TERNA*	1 469 337	49,0%
TNG	318 251	25,9%
TNL*	90 586	47,3%
TTG*	58 259	40,1%
Total	2 546 990	41,3%

Table 13: The volume of absolute and relative deviations of each participating TSO in accordance with Article 13.3 of aFRR IF

* The data for this TSO/LFC Area cover only the full operational months after accession to PICASSO and not the whole reporting period.

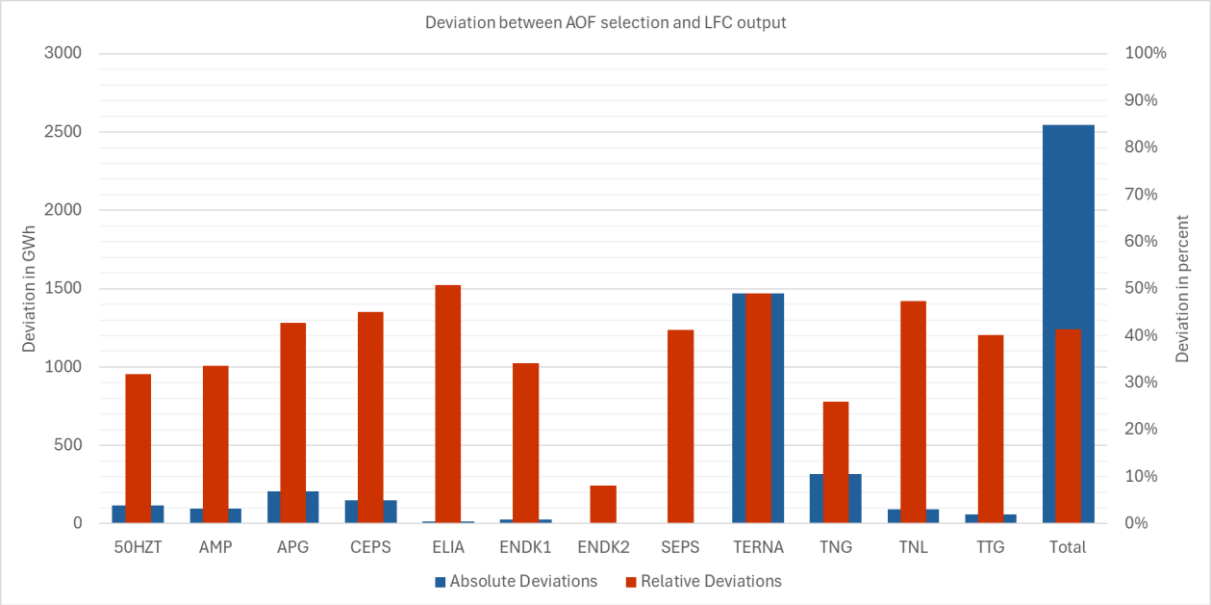
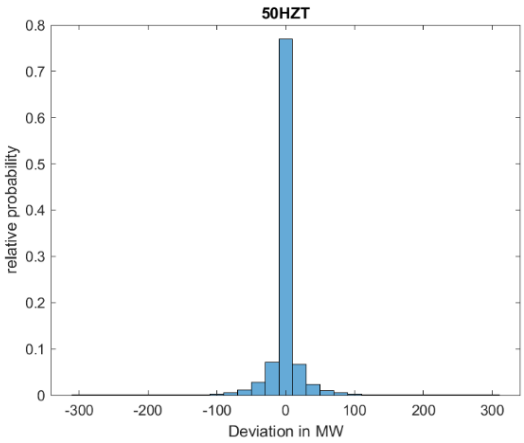
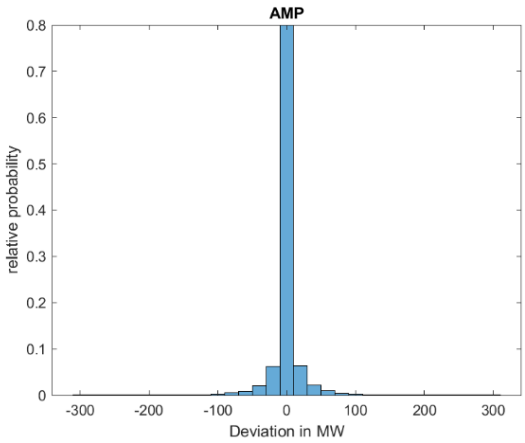
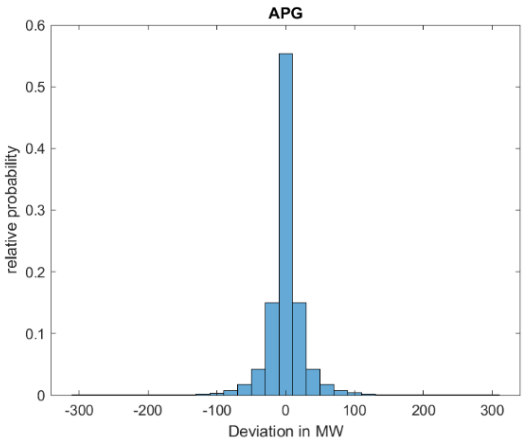


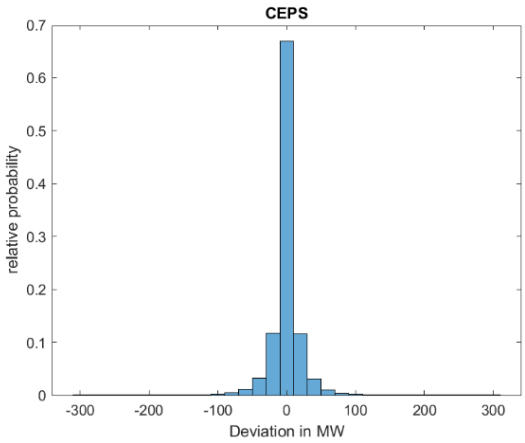
Figure 11: The absolute and relative volume of deviations of each participating TSO

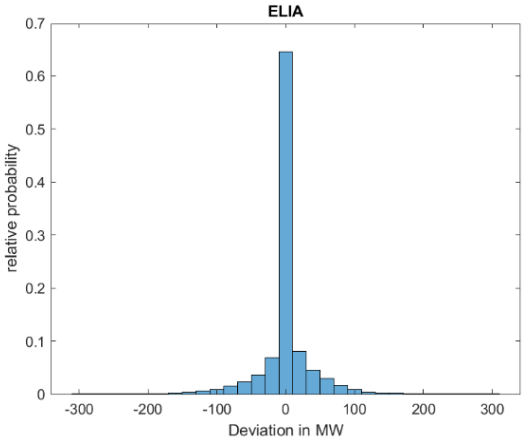
To evaluate the frequency of deviations between the activation of bids by each LFC and the bid selection by the AOF, the deviations are grouped in 20 MW intervals. The frequency of the occurrence of each interval is shown as a histogram plot per LFC area in Figure *12*.

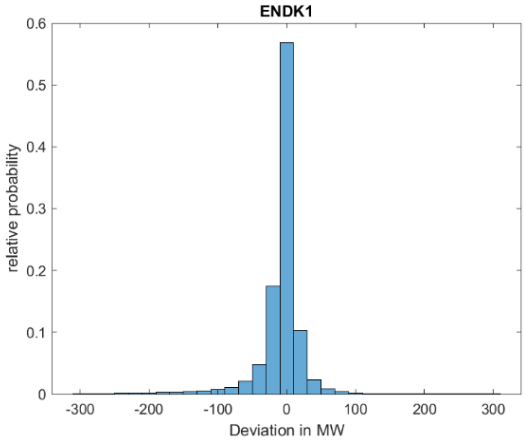












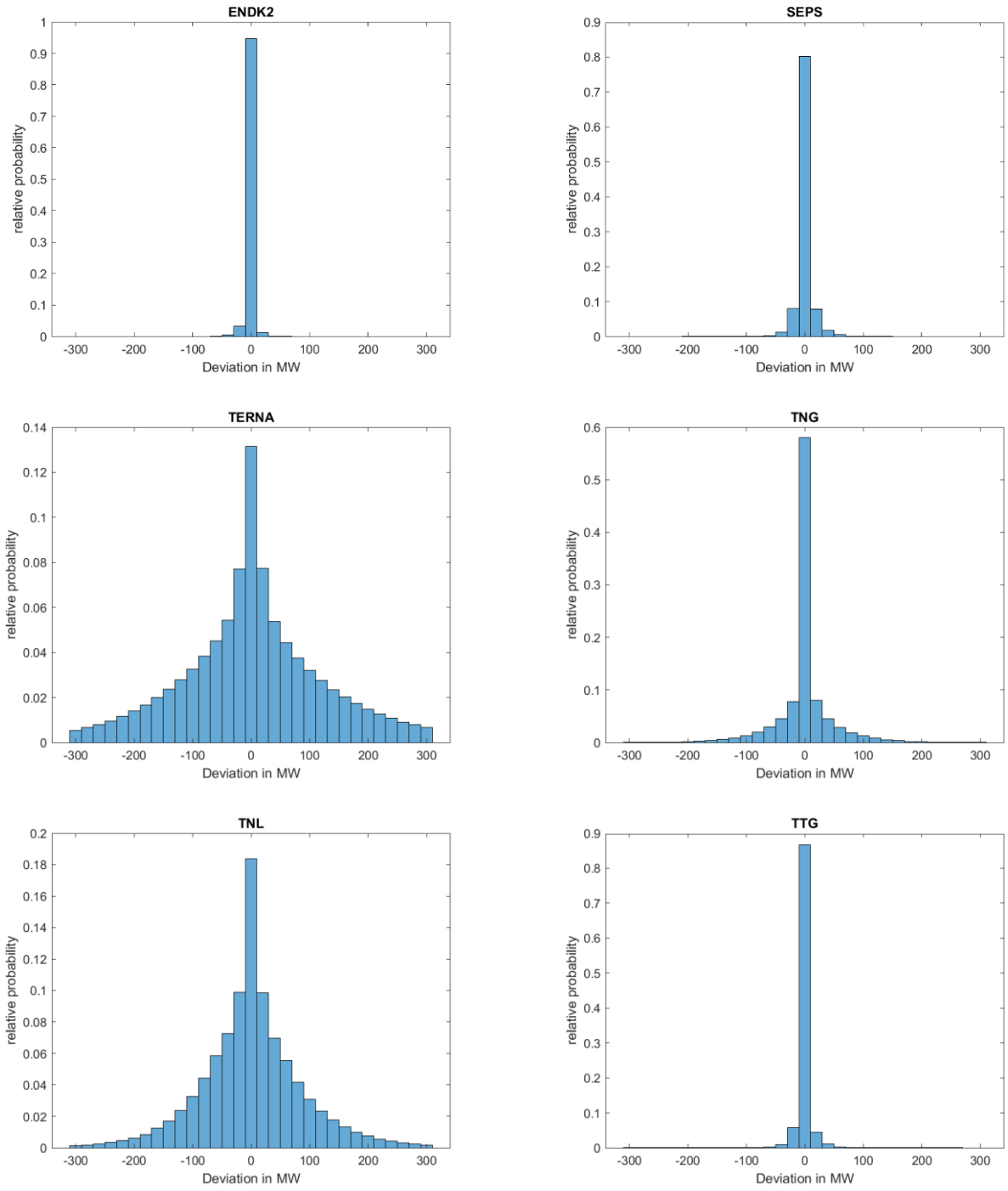


Figure 12: Frequency of Deviations per LFC area as Histograms

As seen from the figures above, in all LFC areas the deviations are smaller than +/- 10 MW most of the time. The probability of higher deviations depends mostly on the MOL structure and LFC settings.

It needs to be considered that the shown deviations are not equal to “non-AOF-volumes” that require remuneration of bids at a bid-price that is higher than the Cross-Border-Marginal Price. The deviations between bids activated by the LFC and bids selected by the AOF can be divided in differences in the activation phase, deactivation phase and imperfect activation (over- or undershooting LFC output). See for detailed explanations the aFRR IF explanatory document.

As per aFRR IF 13.4 a comparison of different control models and an analysis of the options to minimise the reported deviations was also expected as part of this report. However, this is postponed to the KPI Report about the calendar year 2025 (to be published in 2026), as per ACER Opinion 03-2025 on the first amendment of the ENTSO-E Monitoring Plan, to allow more TSOs to access the platform and gathering additional operational experience.

4.5. aFRR IF 13(1)(e): The impact on the economic surplus of minimising the volume of selected standard aFRR balancing energy product bids for balancing energy pursuant to Article 11(2)(b)

According to Article 11(2) of the aFRR IF the prioritized objectives functions of the optimisation algorithm are listed as follows:

(a) First priority: maximise satisfaction of the aFRR demand of individual LFC areas;
(b) Second priority: minimise the volume of selected standard aFRR balancing energy product bids;
(c) Third priority: maximise the economic surplus;
(d) Fourth priority: minimise the amount of the automatic frequency restoration power interchange on each aFRR balancing border.

For this KPI, the economic surplus generated by the PICASSO platform has first been calculated by comparing the consumer rent, producer rent and congestion rent of the aFRR market to a (hypothetical) reference scenario in which the same bids and demands are considered but no cross-border exchange of aFRR is performed. For this calculation, the same method is applied as in the ENTSO-E Balancing Report 2023 and 2024. It must be considered that:

- economic surplus generated by the additional satisfaction of demands that would not have been satisfied without PICASSO is not considered in these numbers, since the price of these volumes is not unambiguous,
- economic surplus from the aFRR interchange within the control block of Germany is not considered, even though it is also controlled by the PICASSO platform.

The economic surplus is shown per month and participating country in Figure 13. The total economic surplus for July 2023 – December 2024 equals 243.6 Mio Euro.

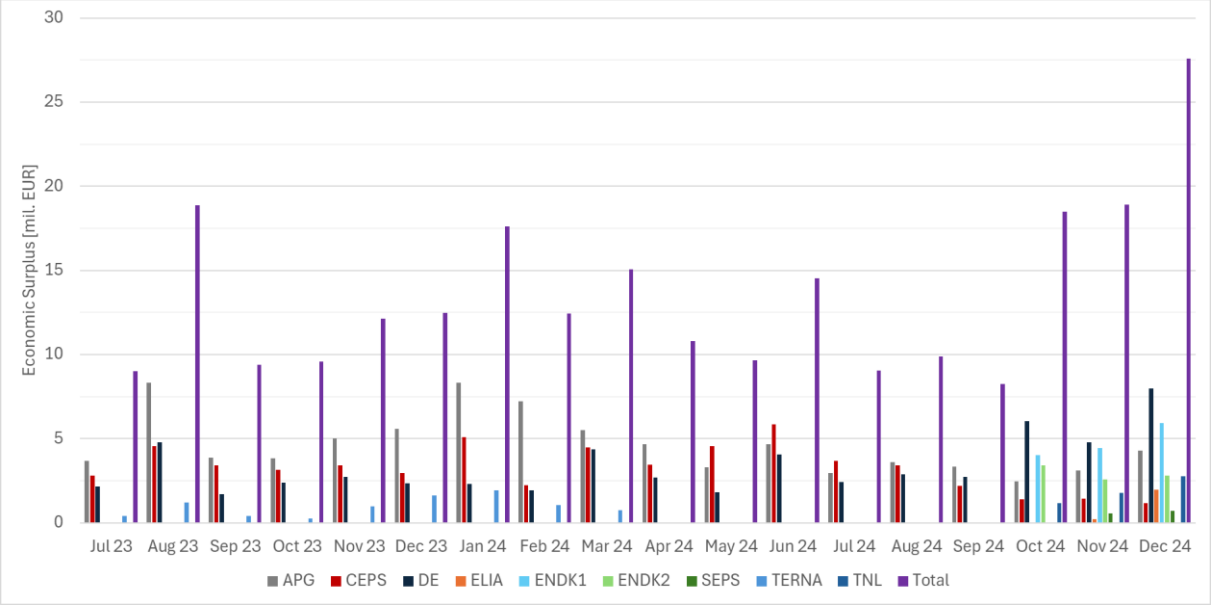


Figure 13: Economic surplus of the PICASSO platform

This economic surplus is then compared to the surplus in a hypothetical scenario in which the volumes of selected standard aFRR energy bids is not minimised and the parallel selection of positive and negative bids within the same uncongested area for economic reasons is not prevented by the AOF. The additional economic surplus in this scenario is shown in Figure 14.

In the period between 7/2023 and 12/2024 of the PICASSO platform operation this hypothetical additional surplus yielded 1 211 377 €, which is 0,5 % of the total economic surplus.

This analysis show that the gain of the additional surplus from not minimizing the volume of selected standard aFRR balancing energy product bids is very limited and does not exceed the risk of technical burdens and impact on the original purpose of balancing energy market, which is providing an ancillary service through activating the minimum amount of balancing energy necessary for the efficient elimination of power imbalances. The effect of minimizing the volume of selected standard aFRR balancing energy product bids will continue to be monitored by TSOs.

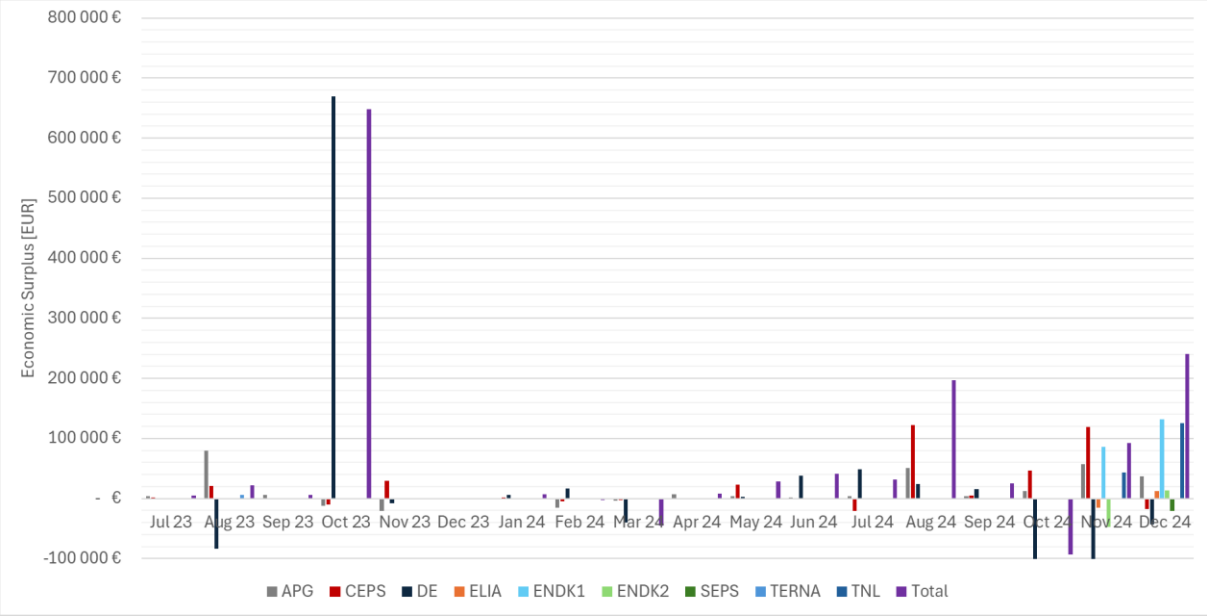


Figure 14: Additional economic surplus of the PICASSO platform when not minimising the selection of bids

4.6. *aFRR IF 13(1)(f): Aggregated information and detailed statistics on the bids which were declared as unavailable by TSOs in accordance with Article 9*

Article 9 (2) of the aFRRIF allows TSOs to change the availability status of bids in accordance with Article 29 (14) of EG Regulation. However, none of the TSOs that have participated on the PICASSO platform during the time period of this report have implemented the respective process and thus, no changes of the availability status have been registered.

4.7. *aFRR IF 13(1)(g): The efficiency of the pricing method for aFRR pursuant to Article 30 of the EB Regulation and the availability of cross-zonal capacity for the aFRR exchange on the platform*

The efficiency of the pricing method pursuant to Article 13(1)(f) of aFRR Implementation Framework is corresponding with the provisions of “Entso-E definition of performance indicators in accordance with ACER Decision 03/2022 on the amended Pricing Methodology in accordance with Article 30(1) of Commission Regulation (EU) 2017/2195 establishing a guideline on electricity balancing“. Therefore,

the performance indicators methodology used for the purpose of the Quarterly Pricing Reports was also used for the purpose of this Key performance indicator report prepared on a yearly basis. The availability of cross-zonal capacity for the aFRR exchange on the platform is reported in this under chapter 4.8.

The Article 30 of the EB Regulation is a basis for the development and implementation of the Balancing Pricing Methodology. Balancing Pricing Methodology was adopted by ACER on 24. 1. 2020 as first amended by the ACER decision 03/2022 published in February 2022. The Balancing Pricing Methodology introduced a transitory upper price limit of 15 000 EUR/MWh and a transitory lower price limit of - 15 000 EUR/MWh for the first 4 years of the European balancing platforms' operations, until July 2026. Second amendment of the methodology came with the ACER decision 09/2024 published in July 2024. This amendment introduces changed methodology of the CBMP setting and the price limit updates.

The measurement of the efficiency of the pricing method for aFRR is based on three indicators defined in article 9(4) of the amended Balancing Pricing Methodology that are reported on yearly basis:

a) monthly average values of used and available cross-zonal capacity for the exchange of balancing energy per each bidding zone border and direction;

b) 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;

c) 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;

4.7.1. Average percentage of submitted and activated standard balancing energy bids compared the upper (and lower) transitional price limit

This PI calculates the average percentage of all submitted (CMOL) and selected standard balancing energy bids on a monthly basis. In total, 20 values are to be reported per platform: five values (50%, 75%, 90%, 95% and 99%) in upward and respectively in downward direction for a) submitted and b) selected balancing energy bids. In summary, this indicator is calculated as:

1. Submitted upward balancing energy bids with prices higher than [50%, 75%, 90%, 95%, 99%] of the transitional price limit
2. Submitted downward balancing energy bids with prices lower than [50%, 75%, 90%, 95%, 99%] of the transitional price limit
3. Selected Upward balancing energy with prices higher than [50%, 75%, 90%, 95%, 99%] of the transitional price limit
4. Selected Downward balancing energy with prices lower than [50%, 75%, 90%, 95%, 99%] of the transitional price limit

Legal reference according to Article 9(4) of the common methodology for the pricing of balancing energy and cross-border capacity.

	Positive aFRR					Negative aFRR				
Threshold	**50%**	**75%**	**90%**	**95%**	**99%**	**50%**	**75%**	**90%**	**95%**	**99%**
July 2023	7,12%	4,87%	4,54%	4,41%	4,34%	7,13%	5,38%	5,07%	4,97%	4,71%

	Positive aFRR					Negative aFRR				
Threshold	**50%**	**75%**	**90%**	**95%**	**99%**	**50%**	**75%**	**90%**	**95%**	**99%**
August 2023	6,62%	4,54%	4,37%	4,31%	4,28%	5,87%	4,34%	4,11%	4,07%	3,88%
September 2023	6,77%	5,01%	4,81%	4,77%	4,74%	6,13%	4,84%	4,60%	4,54%	4,34%
October 2023	6,29%	4,41%	4,19%	4,13%	4,05%	6,83%	5,59%	5,32%	5,25%	5,04%
November 2023	5,87%	3,65%	3,40%	3,34%	3,31%	5,92%	4,74%	4,36%	4,24%	4,08%
December 2023	5,57%	3,93%	3,74%	3,71%	3,69%	5,88%	4,44%	3,99%	3,90%	3,78%
January 2024	5,26%	3,58%	3,37%	3,32%	3,31%	5,14%	4,09%	3,63%	3,52%	3,38%
February 2024	5,62%	3,68%	3,38%	3,32%	3,32%	5,39%	4,27%	3,74%	3,60%	3,46%
March 2024	6,32%	4,28%	3,81%	3,77%	3,76%	5,84%	4,28%	3,80%	3,67%	3,56%
April 2024	6,79%	4,93%	4,62%	4,58%	4,56%	5,93%	4,23%	3,72%	3,64%	3,56%
May 2024	6,80%	5,18%	4,92%	4,90%	4,85%	6,36%	4,68%	4,25%	4,13%	4,05%
June 2024	8,41%	6,93%	6,56%	6,52%	6,42%	7,43%	5,60%	5,19%	5,09%	5,04%
July 2024	7,78%	7,06%	6,64%	6,61%	6,51%	7,02%	5,60%	5,13%	4,99%	4,92%
August 2024	7,84%	7,21%	6,95%	6,90%	6,77%	7,71%	6,17%	5,76%	5,56%	5,50%
September 2024	8,37%	7,49%	7,13%	7,06%	6,91%	7,69%	5,85%	5,31%	5,13%	5,06%
October 2024	8,48%	6,22%	5,92%	5,88%	5,78%	6,03%	4,64%	4,25%	4,09%	4,03%
November 2024	5,93%	5,00%	4,75%	4,71%	4,63%	4,98%	4,06%	3,70%	3,54%	3,48%
December 2024	6,99%	5,82%	5,45%	5,37%	5,28%	5,00%	3,96%	3,56%	3,42%	3,34%

Table 14: PICASSO – Average percentage of submitted bids over certain price limits

	Positive aFRR					Negative aFRR				
Threshold	**50%**	**75%**	**90%**	**95%**	**99%**	**50%**	**75%**	**90%**	**95%**	**99%**
July 2023	0,039%	0,012%	0,005%	0,005%	0,004%	0,038%	0,021%	0,015%	0,015%	0,014%
August 2023	0,148%	0,026%	0,026%	0,026%	0,025%	0,093%	0,035%	0,032%	0,032%	0,032%
September 2023	0,004%	0,002%	0,001%	0,001%	0,001%	0,012%	0,006%	0,005%	0,005%	0,005%
October 2023	0,032%	0,018%	0,012%	0,008%	0,006%	0,014%	0,008%	0,008%	0,008%	0,007%

	Positive aFRR					Negative aFRR				
Threshold	**50%**	**75%**	**90%**	**95%**	**99%**	**50%**	**75%**	**90%**	**95%**	**99%**
November 2023	0,025%	0,009%	0,007%	0,007%	0,007%	0,029%	0,023%	0,021%	0,021%	0,021%
December 2023	0,043%	0,033%	0,033%	0,033%	0,033%	0,007%	0,002%	0,001%	0,001%	0,001%
January 2024	0,040%	0,029%	0,029%	0,028%	0,028%	0,011%	0,005%	0,003%	0,003%	0,003%
February 2024	0,008%	0,006%	0,003%	0,003%	0,003%	0,009%	0,005%	0,004%	0,004%	0,004%
March 2024	0,106%	0,031%	0,018%	0,016%	0,015%	0,034%	0,011%	0,007%	0,007%	0,007%
April 2024	0,093%	0,076%	0,034%	0,034%	0,034%	0,064%	0,029%	0,023%	0,023%	0,023%
May 2024	0,046%	0,037%	0,033%	0,033%	0,033%	0,070%	0,040%	0,033%	0,032%	0,032%
June 2024	0,540%	0,497%	0,484%	0,484%	0,482%	0,076%	0,045%	0,039%	0,035%	0,035%
July 2024	0,179%	0,143%	0,122%	0,120%	0,116%	0,027%	0,012%	0,005%	0,005%	0,005%
August 2024	0,161%	0,143%	0,137%	0,137%	0,135%	0,049%	0,021%	0,017%	0,017%	0,017%
September 2024	0,046%	0,041%	0,031%	0,029%	0,029%	0,017%	0,006%	0,005%	0,004%	0,004%
October 2024	0,010%	0,010%	0,007%	0,006%	0,006%	0,012%	0,005%	0,004%	0,003%	0,003%
November 2024	0,018%	0,007%	0,007%	0,007%	0,007%	0,002%	0,001%	0,000%	0,000%	0,000%
December 2024	0,031%	0,008%	0,003%	0,003%	0,003%	0,187%	0,056%	0,044%	0,044%	0,043%

Table 15: PICASSO – Average percentage of selected bids over certain price limits

4.7.2. Volume weighted average price of the most expensive balancing energy bids

The VWAP of the last 5% of the submitted bids per platform, per direction and per participating TSO is calculated on a monthly basis. Each balancing platform provides two values per connected TSO, one for upward and one for downward direction. Calculation of VWAP as defined in Quarterly Pricing Reporting (see here) is as following:

1. VWAP of the last 5% of the upward balancing energy bids submitted per TSO connected to the platform
2. VWAP of the last 5% of the downward balancing energy bids submitted per TSO connected to the platform

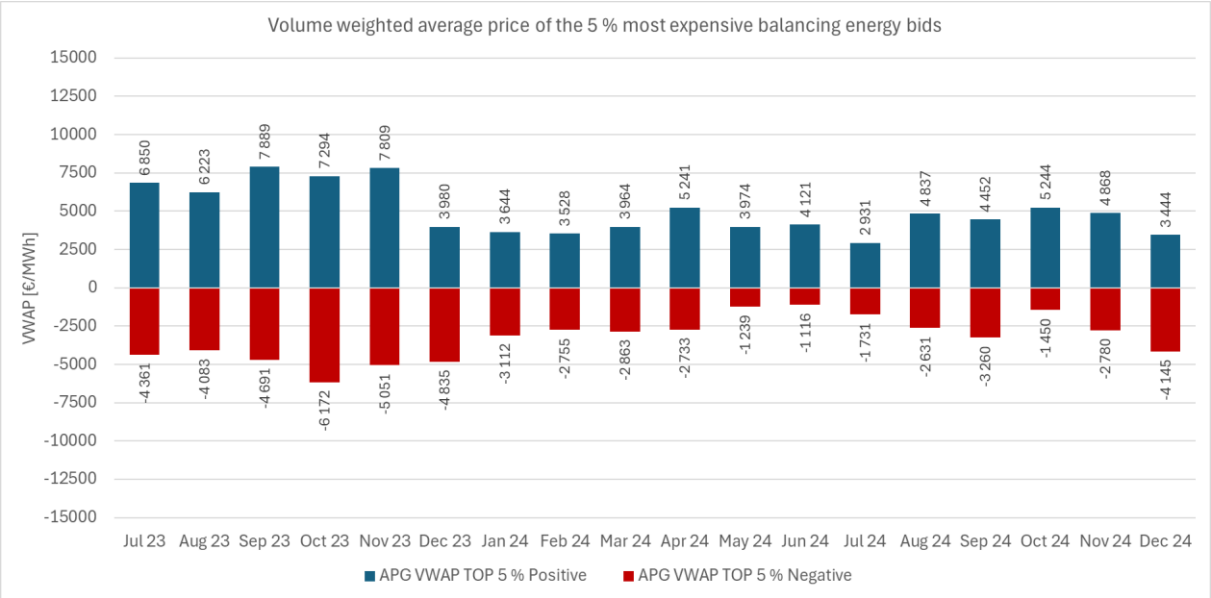


Figure 15: PICASSO – VWAP of the 5% most expensive aFRR bids submitted [EUR/MWh] APG

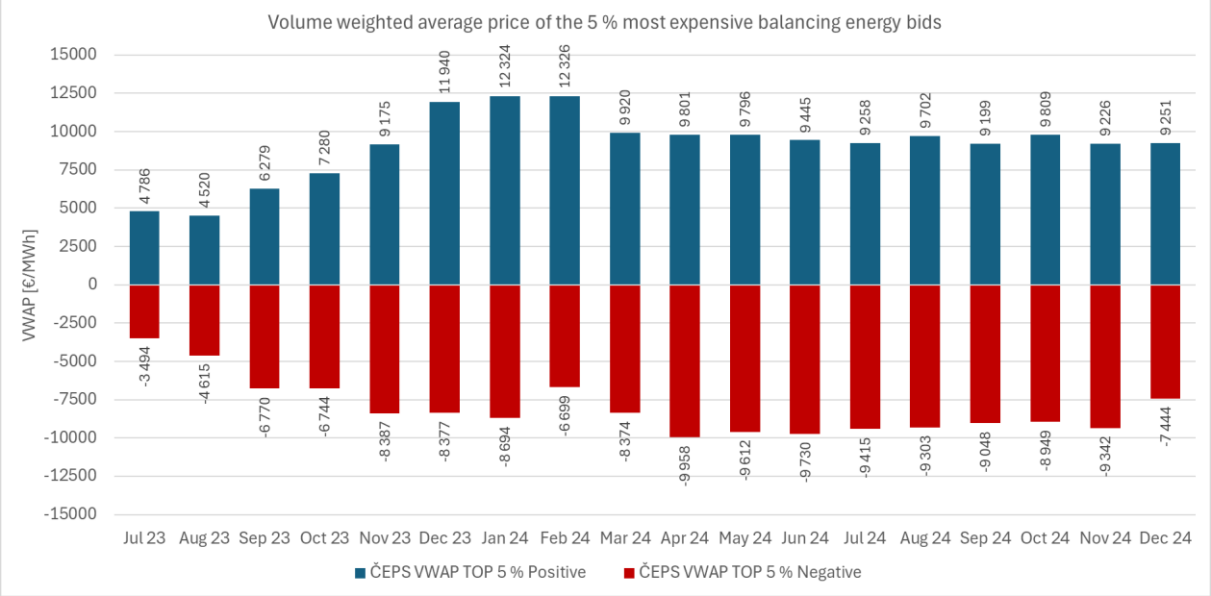


Figure 16: PICASSO – VWAP of the 5% most expensive aFRR bids submitted [EUR/MWh] ČEPS

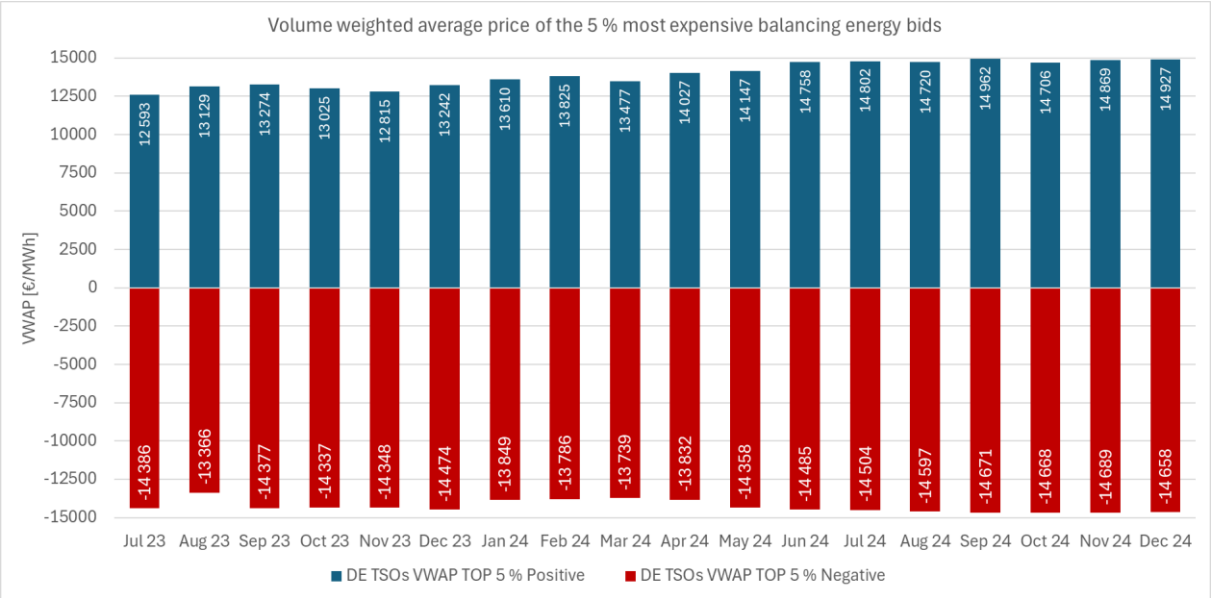


Figure 17: PICASSO – VWAP of the 5% most expensive aFRR bids submitted [EUR/MWh] DE TSOs

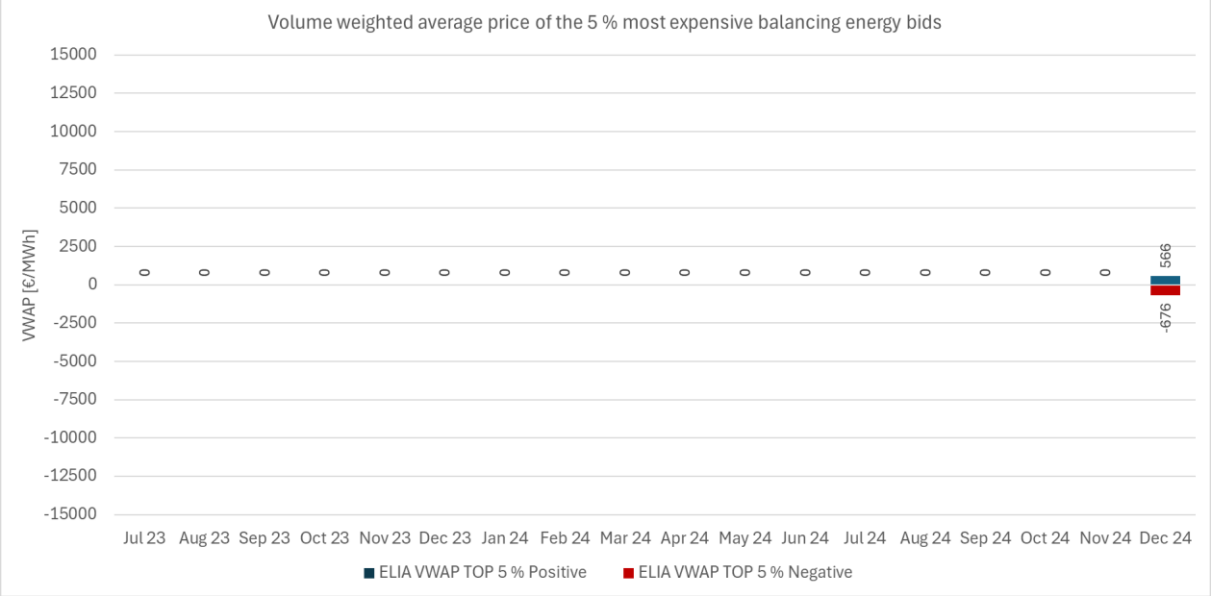


Figure 18: PICASSO – VWAP of the 5% most expensive aFRR bids submitted [EUR/MWh] ELIA

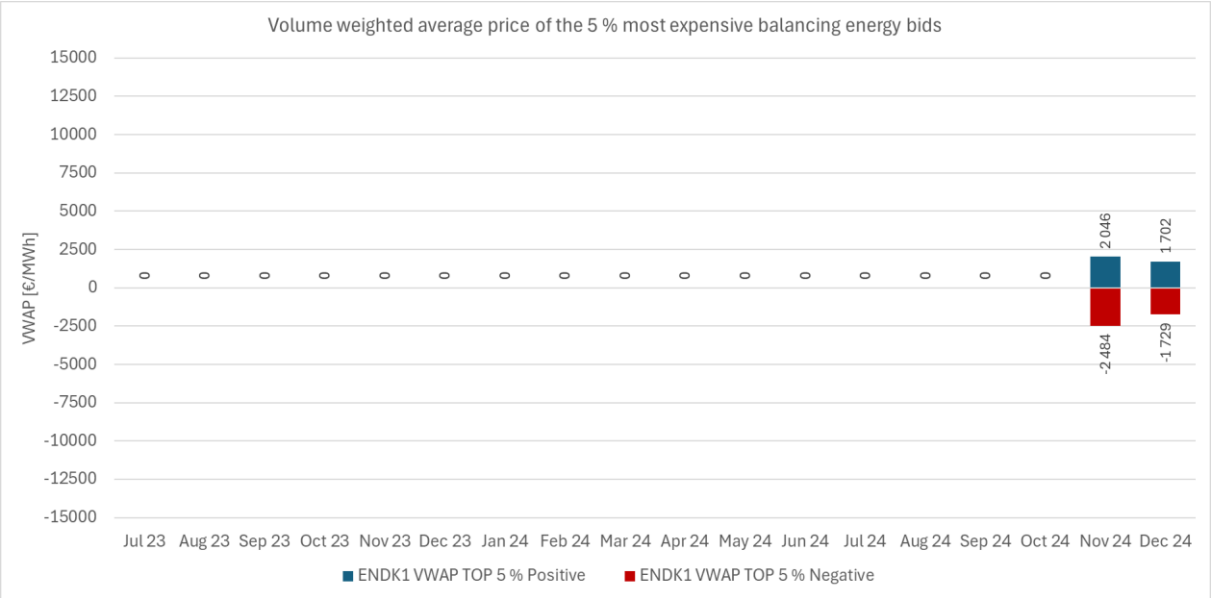


Figure 19: PICASSO – VWAP of the 5% most expensive aFRR bids submitted [EUR/MWh] ENDK1

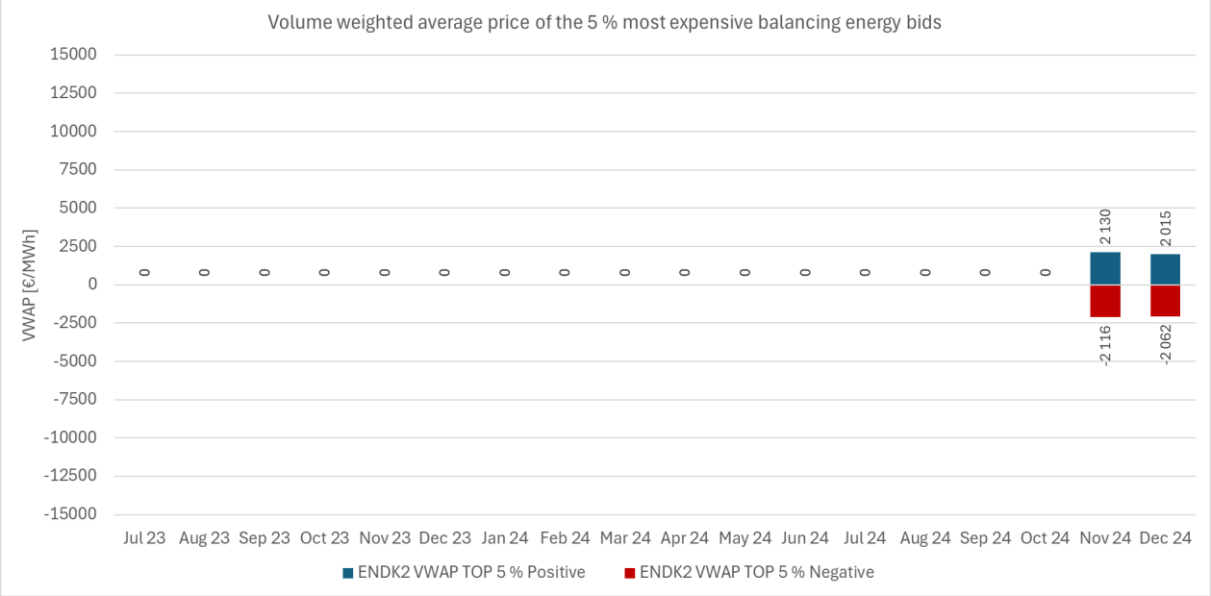


Figure 20: PICASSO – VWAP of the 5% most expensive aFRR bids submitted [EUR/MWh] ENDK2

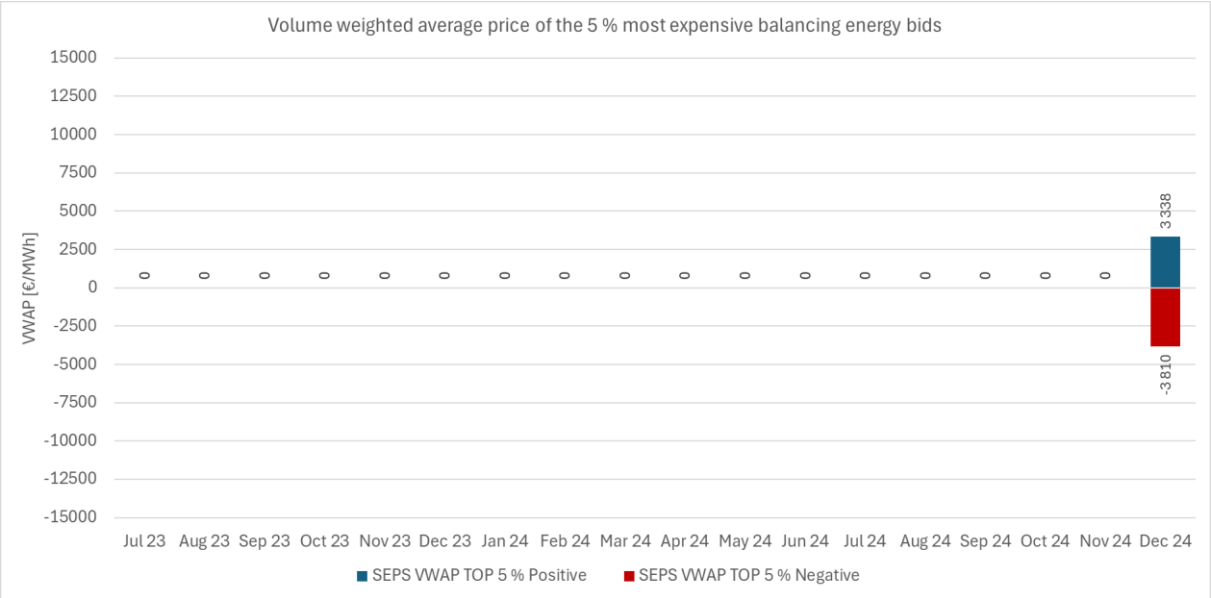


Figure 21: PICASSO – VWAP of the 5% most expensive aFRR bids submitted [EUR/MWh] SEPS

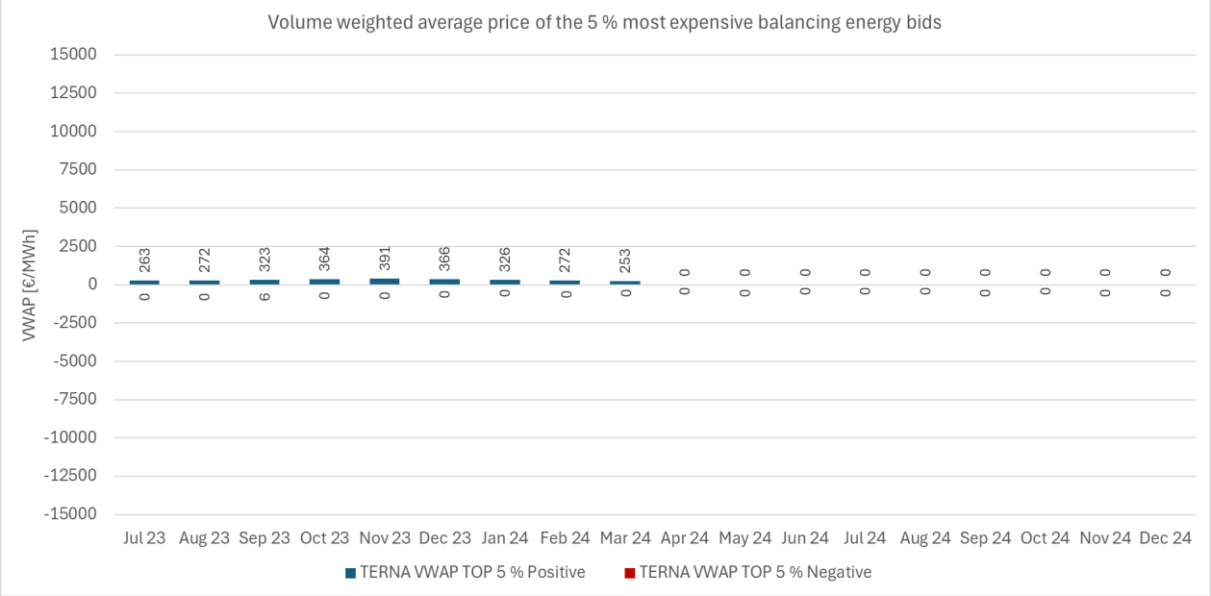


Figure 22: PICASSO – VWAP of the 5% most expensive aFRR bids submitted [EUR/MWh] TERNA

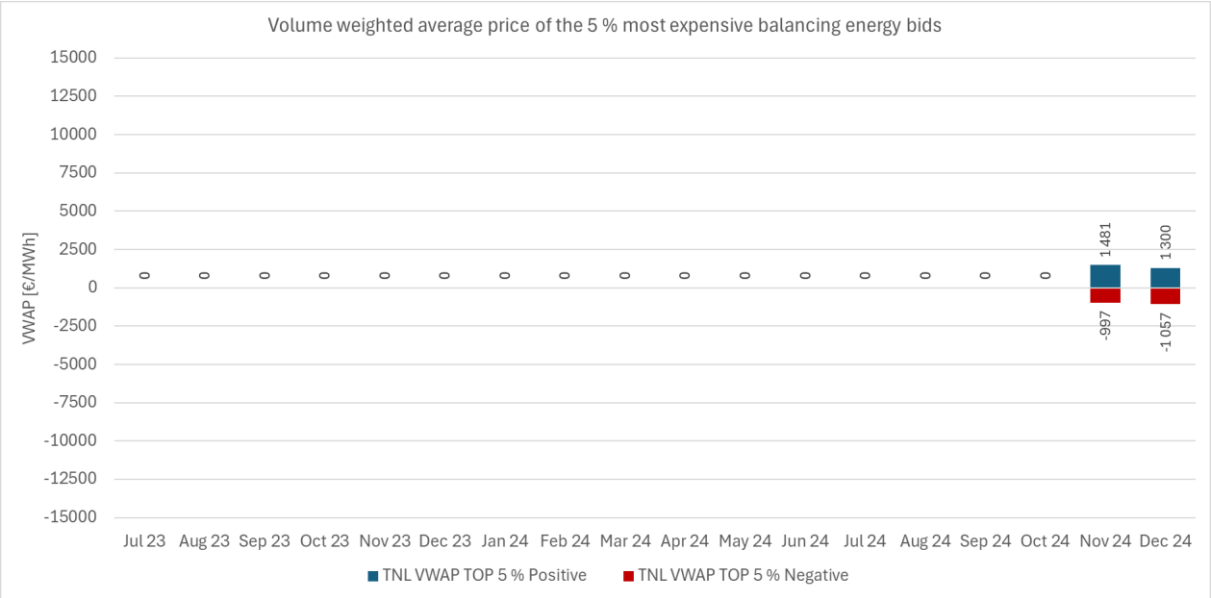


Figure 23: PICASSO – VWAP of the 5% most expensive aFRR bids submitted [EUR/MWh] TNL

4.8. aFRR IF 13(1)(h): The availability of cross-zonal capacity for the aFRR exchange on the platform

4.8.1. Monthly average values of used and available cross-zonal capacity for the exchange of balancing energy

The monthly average values of used and available cross-zonal capacity (CZC) for the exchange of balancing energy are calculated for each balancing energy platform per bidding zone border in both directions. Please note that the calculation of monthly average values does not allow to draw specific conclusions about the availability of CZC in single quarter-hours. Please note also that the use of CZC from A to B does not distinguish between fulfilment of an upward balancing energy demand in B or fulfilment of a downward balancing energy demand in A.

Data are calculated as

1. CZC available per BZ border and direction for the aFRR exchange
2. CZC used per BZ border and direction for the aFRR exchange

	July 2023		August 2023		September 2023		October 2023	
border	Available CZC	Used CZC	Available CZC	Used CZC	Available CZC	Used CZC	Available CZC	Used CZC
AT->CZ	54	14	49	10	156	23	73	6
AT->DE	756	44	324	59	517	45	1494	64
AT->IT	31	3	26	10	20	8	10	3
CZ->AT	51	13	77	10	146	19	27	3
CZ->DE	563	24	340	21	520	26	692	47
DE->AT	471	52	1108	39	782	47	248	38
DE->CZ	515	21	1141	43	1142	30	393	19
IT->AT	187	17	180	42	103	27	46	15

Table 16: PICASSO – Monthly (07/23 – 10/23) average values of used and available CZC for the exchange of aFRR [MW]

	November 2023		December 2023		January 2024		February 2024	
border	Available CZC	Used CZC	Available CZC	Used CZC	Available CZC	Used CZC	Available CZC	Used CZC
AT->CZ	100	16	171	26	143	32	143	31
AT->DE	1018	83	1673	65	1274	86	1121	75
AT->IT	43	16	92	29	105	31	35	13
CZ->AT	144	13	137	18	166	22	192	20
CZ->DE	639	38	551	31	693	40	817	33
DE->AT	482	35	468	53	395	42	348	45
DE->CZ	569	19	345	7	224	12	268	13
IT->AT	218	69	286	60	478	82	609	82

Table 17: PICASSO – Monthly (11/23 – 02/24) average values of used and available CZC for the exchange of aFRR [MW]

	March 2024		April 2024		May 2024		June 2024	
border	Available CZC	Used CZC	Available CZC	Used CZC	Available CZC	Used CZC	Available CZC	Used CZC
AT->CZ	305	32	91	10	70	7	128	10
AT->DE	1028	55	466	43	305	37	261	43
AT->IT	33	5	N/A	N/A	N/A	N/A	N/A	N/A
CZ->AT	438	18	445	25	392	20	680	35
CZ->DE	652	24	831	28	855	35	692	33
DE->AT	452	54	692	65	714	58	558	49
DE->CZ	529	30	545	33	506	21	494	31
IT->AT	427	41	N/A	N/A	N/A	N/A	N/A	N/A

Table 18: PICASSO – Monthly (03/24 – 06/24) average values of used and available CZC for the exchange of aFRR [MW]

	July 2024		August 2024		September 2024		October 2024	
border	Available CZC	Used CZC	Available CZC	Used CZC	Available CZC	Used CZC	Available CZC	Used CZC
AT->CZ	146	11	291	16	323	20	324	22
AT->DE	226	47	400	51	288	54	425	50
CZ->AT	665	26	289	15	425	19	711	23
CZ->DE	588	31	612	32	519	34	608	30
DE->AT	463	47	405	50	292	40	789	46
DE->CZ	474	26	482	20	596	34	614	32

Table 19: PICASSO – Monthly (07/24 – 10/24) average values of used and available CZC for the exchange of aFRR [MW]

	November 2024		December 2024	
border	Available CZC	Used CZC	Available CZC	Used CZC
AT->CZ	485	17	461	13
AT->DE	1411	50	1437	40
BE->DE	145	3	114	27
BE->NL	935	2	740	20
CZ->AT	304	22	199	22
CZ->DE	692	46	501	32
CZ->SK	286	5	199	4
DE->AT	406	41	297	46

	November 2024		December 2024	
border	Available CZC	Used CZC	Available CZC	Used CZC
DE->BE	125	2	115	15
DE->CZ	373	11	284	13
DE->DK1	2012	37	2311	48
DE->NL	608	58	639	47
DK1->DE	560	38	368	19
DK1->DK2	31	6	36	7
DK2->DK1	31	10	36	7
NL->BE	349	3	412	26
NL->DE	485	57	410	71
SK->CZ	775	30	787	37

Table 20: PICASSO – Monthly (11/24 – 12/24) average values of used and available CZC for the exchange of aFRR [MW]

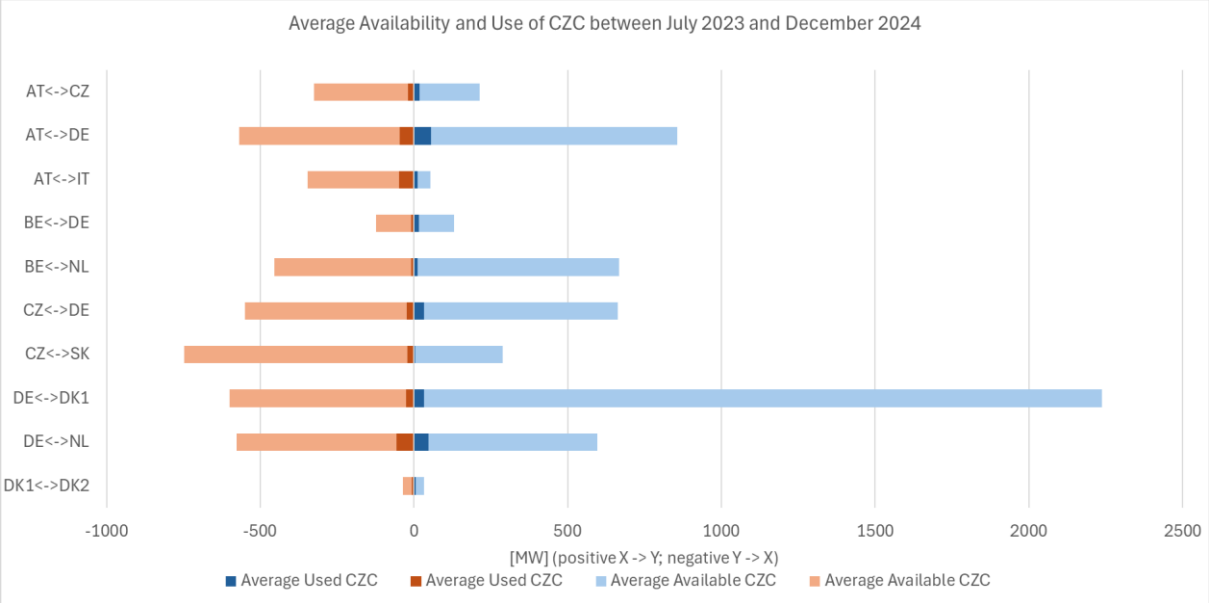


Figure 24: PICASSO – Average used and available cross-zonal capacity for the exchange of aFRR [MW]

4.9. aFRR IF 13(1)(i): The results of the survey conducted in accordance with Article 16(2)(a)

All TSOs shall continuously evaluate the terms and conditions for BSPs in order to identify harmonisation needs.

The stakeholder survey took place between 25th March and 28th June 2024 and the TSO list of prioritized harmonization needs was consulted with stakeholders between 1st December 2024 and 31st January 2025. The key messages can be summarized in two streams which are Clear Communication and Clear Guidelines.

The following 6 “hot” topics were identified and will be further elaborated on TSO side with a priority:

4.9.1. English Publication of T&Cs

Publication of a non-legally binding English version of T&Cs (summarised or full version) following EB GL to enable overview of market conditions for foreign BSPs. National language remains legally binding.

4.9.2. Allowing English for TSO BSP communication

Allowing EU BSPs to be active in other EU countries e.g. by enabling communication in English language. Enables also central communication of BSP from one location for different countries.

4.9.3. IT Harmonisation (IT protocol standards)

Make application of standard protocols mandatory (partly already there on ENTSO-E EDI library).

4.9.4. Harmonisation of [FRR] prequalification process

Define process steps and timings, define harmonised requirements (product and technology wise).

4.9.5. Transferability of Prequalification (PQ)

Transferability of PQ for similar assets. Where applicable, of BSP qualification on national or LFC block level. In case of switching BSP, considering limitations in case of pooling.

4.9.6. Re-Prequalification

Simplify the criteria for the reassessment of pre-qualification in case of no substantial modification but ensure visibility of decommissioning.

The work on harmonization topics 4.9.4 to 4.9.6 will be started once NC DR is released as those are closely related.

Further harmonisation needs, which will be further elaborated in long-term (until 2028) are:

- API Harmonisation
- Activation Methods
- Publication Harmonisation
- Incentive Harmonisation
- Bid Harmonisation
- Settlement Harmonisation