Baltic LFC block FRR dimensioning forecast 2024-2031

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Contents

1 Purpose of the document

This document is developed by Baltic TSOs (Litgrid, AST, Elering) to provide information about long term forecast of frequency restoration reserves (FRR) capacity volumes for the Baltic Load Frequency Control (LFC) block for period 2024-2031. The forecasted capacity of FRR reflects Baltic LFC block demand and will be procured in common Baltic Balancing capacity market.

2 Method

FRR capacity estimates provided in this document are based on Baltic LFC block concept document FRR dimensioning principles1. The method takes into account the historic imbalances, outage rates of HVDC and large power plants.

The distribution of FRR capacities for each LFC area reflects the general sharing of procurement costs of shared FRR capacities. The capacities will be procured in the Baltic capacity market, where the FRR capacities can be located in any Baltic LFC area taking into account the available allocated capacities of cross-borders and the LFC area FRR reserve requirement.

3 Assumptions

Throughout the calculations several assumptions have been considered to investigate the FRR capacity dimensioning forecast between 2024 and 2031:

- Only imbalances caused by renewable energy sources (RES) have been considered to have an influence on increase of area control error (ACE). Base ACE remained unchanged;
- 2021 has been considered as the base year for the analysis;
- Baltic LFC block considers a symmetrical automatic frequency restoration reserves (aFRR) demand, where largest value between aFRR downwards and upwards prevails as the aFRR need;
- It has been considered that a shift from 60 min to 15 min market time unit (MTU) will reduce only manual frequency restoration reserves (mFRR) needs by 20%;
- Considering the possible inaccuracies in the forecast, a range of FRR values have been assessed based on the 1st, 5th, 95th, 99th percentile results. Where 1st and 99th percentiles evaluate high reserve case and 5th and 95th percentile – low reserve case.

4 Input data

As an input data for the analysis, the data from each Baltic TSO has been gathered regarding the foreseen development of RES from 2024 to 2031, Elering and AST has used RES capacity increase data provided in ten-year network development plan, Litgrid has used latest RES capacity increase forecast data (August 2022). The summarized data is provided Table 1.

[1] https://www.litgrid.eu/uploads/files/dir566/dir28/dir1/13_0.php
https://elering.ee/sites/default/files/2021-01/Baltic%20Load-Frequency%20Control%20concept%20document.pdf
https://www.ast.lv/sites/default/files/editor/Baltic_Load_Frequency_Control_concept_document.pdf

Table 1 RES installed capacity increase based on Baltic power system estimations in MW.

Lithuania								
Year	2024	2025	2026	2027	2028	2029	2030	2031
Wind On-Shore	*1590*	*1800*	*2200*	*2700*	*3000*	*3300*	*3600*	*3600*
Wind Off-Shore	0	0	0	0	*700*	*700*	*1400*	*1400*
Sun	*2160*	*2880*	*3600*	*3680*	*3760*	*3840*	*3920*	*4000*
Latvia								
Year	2024	2025	2026	2027	2028	2029	2030	2031
Wind On-Shore	*200*	*243*	*285*	*327*	*369*	*411*	*495*	*545*
Wind Off-Shore	0	0	0	0	*0*	*0*	*495*	*495*
Sun	*58*	*71*	*90*	*108*	*126*	*144*	*180*	*207*
Estonia								
Year	2024	2025	2026	2027	2028	2029	2030	2031
Wind On-Shore	*326*	*326*	*326*	*576*	*576*	*576*	*716*	*716*
Wind Off-Shore	0	0	0	0	*0*	*0*	*350*	*350*
Sun	*716*	*818*	*920*	*950*	*980*	*1010*	*1040*	*1070*
Baltics								
Year	2024	2025	2026	2027	2028	2029	2030	2031
Wind On-Shore	*2116*	*2369*	*2811*	*3603*	*3945*	*4287*	*4811*	*4861*
Wind Off-Shore	*0*	*0*	*0*	*0*	*700*	*700*	*2245*	*2245*
Sun	*2934*	*3769*	*4610*	*4738*	*4866*	*4994*	*5140*	*5277*

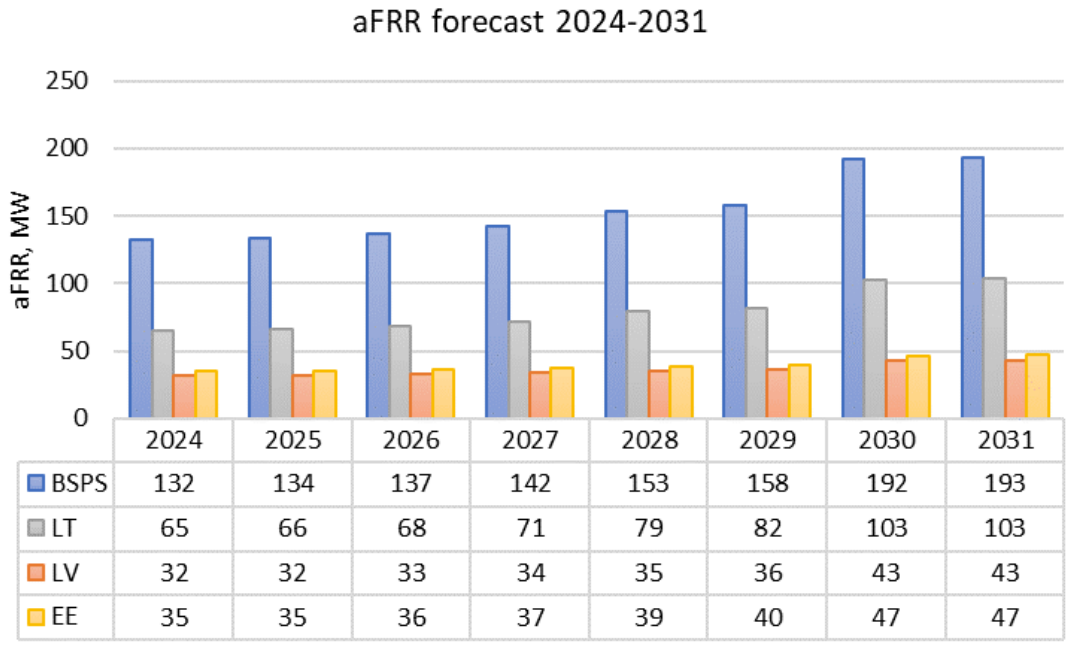
4.1 aFRR forecast

The aFRR capacity is dimensioned to balance the variations in the power system due to load variation, inadvertent non-observance of schedules by producers, and prediction errors of RES production. The aFRR is activated via automatic controllers that monitor the system ACE. The aFRR capacity will be calculated based on the recommendation of Continental Europe Synchronous Area Framework Agreement (CE SAFA) Policy 1[2] statistical approach. The activated aFRR is replaced by mFRR activations for longer system imbalances.

Figure 1 represents the forecast of aFRR capacity needs in Baltic LFC block. It is expected that reserve amount gradually increases. Based on calculation results it is foreseen that the aFRR capacity needs in 2024 will be 132 MW in the Baltic LFC block, where in 2031 the capacity needs increase up to 193 MW of aFRR upwards and downwards.

Highest aFRR capacity increase is expected in Lithuania LFC area from 65MW in 2024 up to 103MW in 2031.

[2] https://eepublicdownloads.entsoe.eu/clean-documents/SOC%20documents/SAFA_for_RG_CE/SAFA_for_RG_CE_-_03_-_Annex_01_-_Policy_on_Load-Frequency_Control_and_Reserves_220607.docx

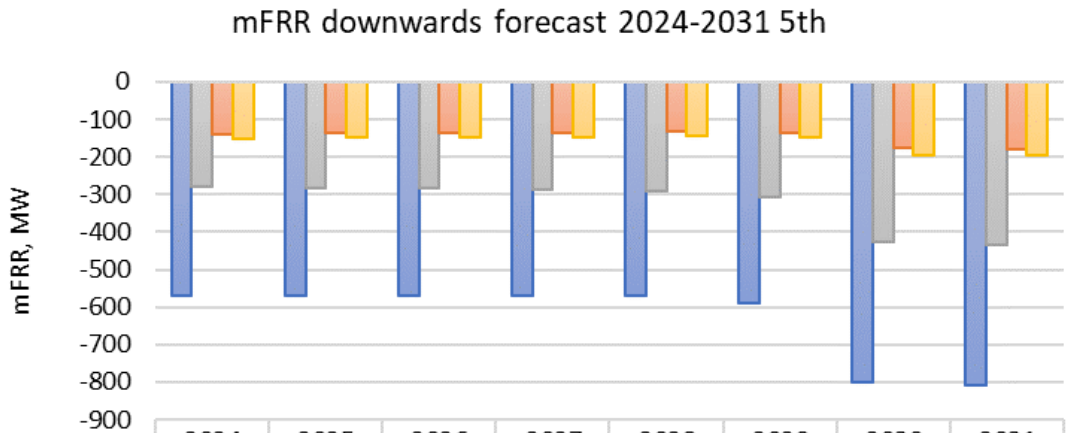


	2024	2025	2026	2027	2028	2029	2030	2031
BSPS	132	134	137	142	153	158	192	193
LT	65	66	68	71	79	82	103	103
LV	32	32	33	34	35	36	43	43
EE	35	35	36	37	39	40	47	47

Figure 1 aFRR forecast in Baltic LFC Block

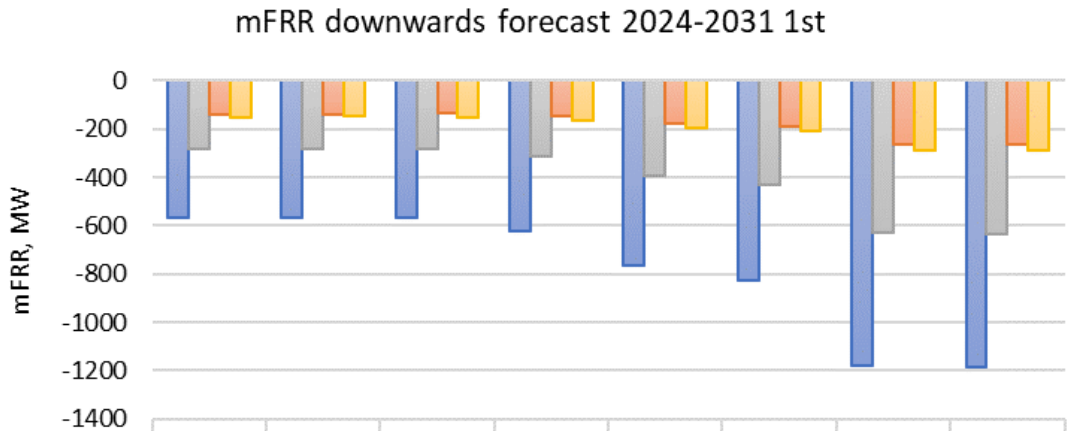
4.2 mFRR downwards forecast

The mFRR capacity is managed by the TSO operators to cover reference incidents and long-term imbalances in the power system to free up aFRR capacities for short-term imbalances. mFRR downward is needed to cover excessive generation or missing load in the power system.
mFRR downwards capacity needs displayed in Figure 2 and Figure 3 are defined for two cases low reserve and high reserve. Capacity values gradually increase in both scenarios, where in 2024 it is foreseen that the need of mFRR downwards capacity will be -568 MW in both cases, however in 2031 the values range between -809 (low reserve case) and -1187 MW (high reserve case).
Highest mFRR downward capacity increase is expected in Lithuania LFC area from -279MW in 2024 up to a value between -432MW and -635MW in 2031.



	2024	2025	2026	2027	2028	2029	2030	2031
BSPS 5th	-568	-568	-568	-568	-568	-589	-799	-809
LT 5th	-279	-282	-283	-285	-293	-306	-427	-432
LV 5th	-138	-137	-136	-135	-131	-136	-177	-179
EE 5th	-150	-149	-149	-148	-144	-147	-195	-197

Figure 2 mFRR downwards forecast 5th percentile in Baltic LFC block



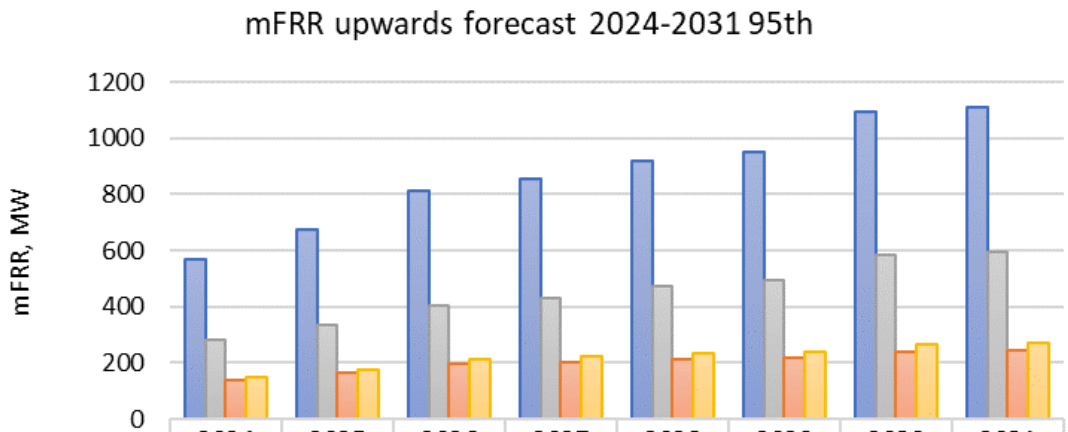
	2024	2025	2026	2027	2028	2029	2030	2031
BSPS 1st	-568	-568	-568	-622	-766	-824	-1177	-1187
LT 1st	-279	-282	-283	-312	-395	-428	-629	-635
LV 1st	-138	-137	-136	-147	-177	-190	-261	-263
EE 1st	-150	-149	-149	-162	-195	-206	-287	-289

Figure 3 mFRR downwards forecast 1st percentile in Baltic LFC block

4.3 mFRR upwards forecast

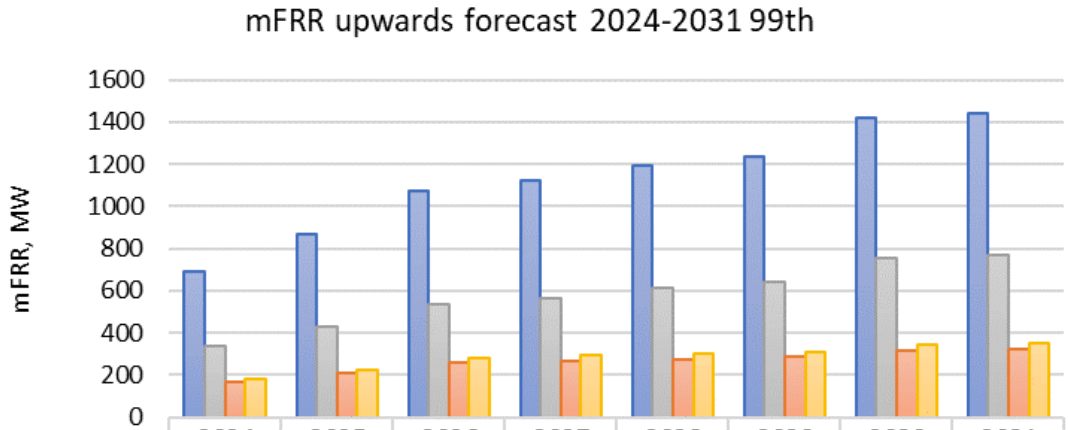
mFRR upwards capacity is needed to cover missing generation or excessive load in the power system. mFRR upwards capacity needs displayed in Figure 4 and Figure 5 are defined for two cases low reserve and high reserve. Values gradually increase in both scenarios, where in 2024 it is foreseen that the need of mFRR upwards capacity will be between 570 (low reserve case) and 689

MW (high reserve case), in 2031 the values range between 1112 (low reserve case) and 1445 MW (high reserve case).
Highest increase for mFRR upward capacity is expected in Lithuania LFC area between 280 MW and 339 MW in 2024 and between 594 MW and 772 MW in 2031.



	2024	2025	2026	2027	2028	2029	2030	2031
BSPS 95th	570	677	815	858	919	953	1093	1112
LT 95th	280	336	406	431	474	495	584	594
LV 95th	139	164	195	203	212	220	242	247
EE 95th	151	178	215	224	233	238	266	271

Figure 4 mFRR upwards forecast 95th percentile in Baltic LFC block



	2024	2025	2026	2027	2028	2029	2030	2031
BSPS 99th	689	870	1074	1123	1193	1238	1419	1445
LT 99th	339	431	535	564	615	643	759	772
LV 99th	168	210	256	266	275	286	315	320
EE 99th	182	228	283	293	303	310	346	352

Figure 5 mFRR upwards forecast 99th percentile in Baltic LFC block

5 Conclusions

1 Baltic TSOs foresee a rapid increase in FRR needs in Baltic LFC block due RES capacity increase from 2024 to 2031.
   a. aFRR needs in Baltics is foreseen to increase from 132 MW to 193 MW.
   b. mFRR upwards needs are foreseen to increase from 570 to 1112 MW for low reserve case (5^{th} and 95^{th} percentile) and from 689 MW to 1445 MW for high reserve case (1^{st} and 99^{th} percentile),
   c. mFRR downwards needs are foreseen to increase from -568 (both cases) to a value between -809 (low reserve case) -1187 MW (high reserve case).

2. All results are heavily influenced by foreseen RES increase, therefore additional increase or decrease in RES development would have an impact to FRR capacity needs in Baltic LFC block.

3. The provided values shall be considered estimated values, while the actual FRR needs for the procurement in common Baltic Balancing capacity market will be calculated based on the actual RES capacities, outage rates and imbalance data following the Baltic LFC block FRR dimensioning methodology that will be developed and published for public consultation by Q1 2023.