ALPACA Allocation Algorithm Description

for Establishing an

aFRR Balancing Capacity Cooperation based on the Probabilistic Method
according to Art 33(6) EBGL

Version	Short description	Date
1.0	Go-live version	30. 7. 2025

List of Abbreviations

Abbreviation	Description
aFRR	Automatic Frequency Restoration Reserves
ALPACA	Allocation of Cross-zonal Capacity and Procurement of aFRR Cooperation Agreement
BSP	Balancing Service Provider
CET/CEST	Central European (Summer) Time
CPOF	Capacity Procurement Optimisation Function
EBGL	Electricity Balancing Guideline
GCT	Gate Closure Time
GOT	Gate Opening Time
SOGL	System Operation Guideline

Overview

The exchange and procurement of balancing capacity for automatic Frequency Restoration Reserves (hereafter "aFRR") in ALPACA is organised via a common Capacity Procurement Optimisation Function (hereafter "CPOF"). The local tendering platforms in each country send the bids received from the balancing service providers (BSP) to the CPOF for common procurement. After the optimisation is done, the CPOF sends the results to the local tendering platforms.

For the common procurement and exchange of balancing capacity as illustrated in Figure 1, the common and harmonised rules and processes must be defined, and the algorithm of the CPOF must be developed. The optimisation takes into account inter alia the cross-zonal capacity limits on the Austrian-Czech border as well as on the German-Czech border. The current German and Austrian procurement cooperation will use the same CPOF algorithm.

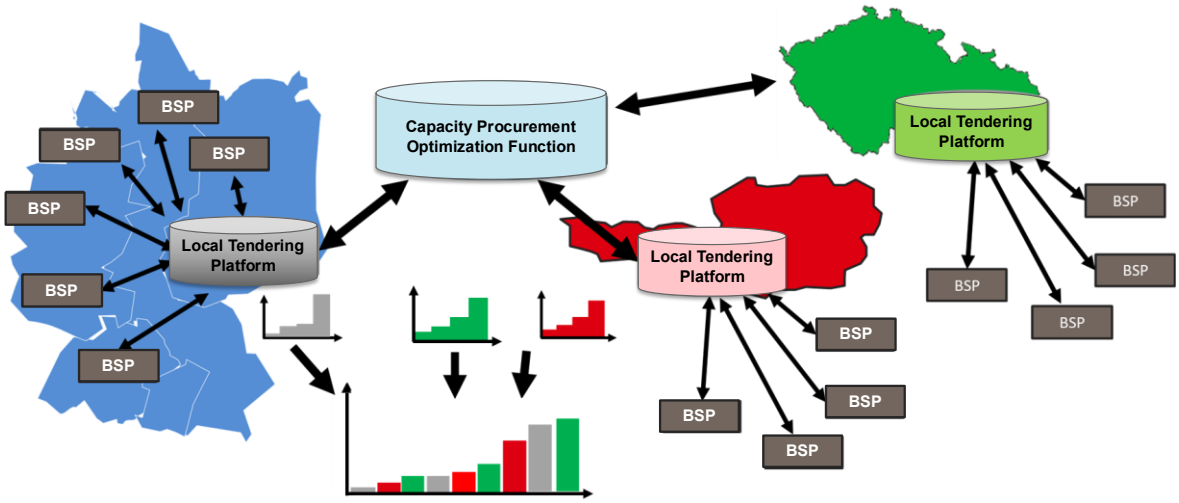

Figure 1: Overview of the common procurement

Common and harmonised rules and processes

The procurement is organised on a calendar daily basis on the previous day with defined deadlines for gate opening (D-7, 10:00 CET/CEST), gate closure (D-1, 9:00 CET/CEST) and informing the BSPs about the results (D-1, 9:30 CET/CEST). In each calendar daily auction, six different four-hour blocks are tendered, while balancing capacity in an upward and downward direction is procured separately.

If the aFRR demand of one (or more) countries cannot be covered by the common procurement, these countries follow national rules and processes.

Each country must procure a specified minimum amount of balancing capacity that is located in the same country ("core share"). This core share needs to fulfil the provisions of Article 167 of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereafter "SOGL") and Annex VII of SOGL. TSOs can choose a higher core share.

The procurement of aFRR balancing capacity involves a common optimisation via the CPOF. At the border between the Czech Republic and Germany and the border between the Czech Republic and Austria, TSOs will determine the maximum amount of exchanged balancing capacity according to the probabilistic methodology in accordance with Article 33 (6) EBGL.

The settlement of the procured balancing capacity is based on the offered balancing capacity prices ("pay-as-bid").

Summary
Calendar daily procurement
Separate procurement of aFRR in upward and downward directions
Six 4h-blocks
GOT: D-7 10:00 CET/CEST
GCT: D-1 09:00 CET/CEST
Publication of results: D-1 09:30 CET/CEST
Minimum bid size: 1 MW (1 MW increment)
Bid divisibility: Divisible bids
Pricing of bids: Pay-as-bid

Algorithm for the exchange and procurement of balancing capacity

The exchange and procurement of balancing capacity is based on a common optimisation via the CPOF. The algorithm shall minimise total procurement costs of the specified products, subject to constraints and additional rules and shall provide information about the awarded bids.

With the rules outlined in this proposal, the target function of the CPOF to be minimised is the total procurement costs, i.e., the sum of the awarded capacity of each bid multiplied by the respective balancing capacity price according to pay-as-bid.

The constraints of the CPOF are as follows:

1. "The sum of the accepted quantity in all countries shall be larger than or equal to the sum of balancing capacity demands in all participating countries."

   → The CPOF needs to accept sufficient bids to cover total demands.

   Example:
   Total demand is equal to 2000 + 200 + 100 MW = 2300 MW. The sum of accepted bids shall not be smaller than 2300 MW. Together with the objective of minimising costs, the algorithm shall find the combination of awarded bids that satisfies this requirement at minimum cost.
   Figure 2 shows an example of individual bids submitted in three different regions (A, B, C) that are ordered according to their balancing capacity price. The bold solid line shows the sum of the demand of the three regions. Each bid to the left of this line will be awarded. Note that in this example, the last bid (B5) will only be partially awarded up to the volume that is needed to cover the total demand.

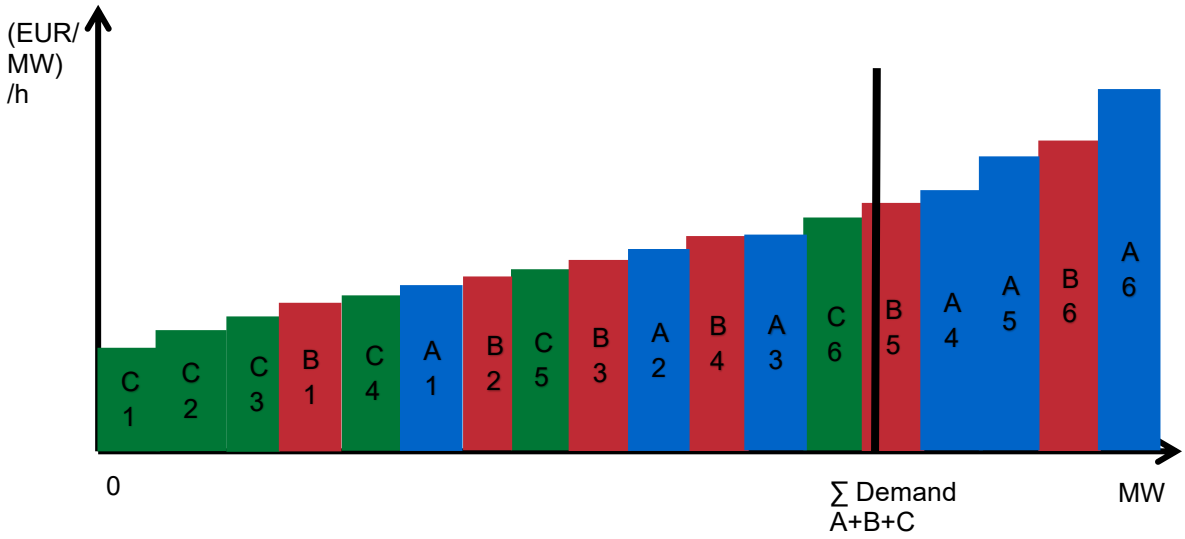

Figure 2: Example of optimal procurement with demand constraint

2. "For each participating country, the accepted quantity shall be larger than or equal to the core share of each LFC Block (…)."

   → The CPOF shall not accept less quantity of one country than the core share of this country prescribes.

   Example:
   The core share is 100 MW for a country with a demand of 200 MW. The locally accepted quantity in this country needs to be at least 100 MW. Together with the objective of minimising the costs, the algorithm shall find the combination of awarded bids that satisfies this requirement at minimum cost.
   Figure 3 shows an example of individual bids submitted in three different regions (A, B, C) that are ordered according to their balancing capacity price – except for the shaded bids that are necessary to be procured in order to satisfy the core share of each region. The core share is satisfied by the bids with the lowest capacity prices in each region. The bold solid line shows the sum of the demand of the three regions. Each bid to the left of this line will be awarded. Note that in this example, the last bid (C5) will only be partially awarded up to the volume that is needed to cover the total demand.

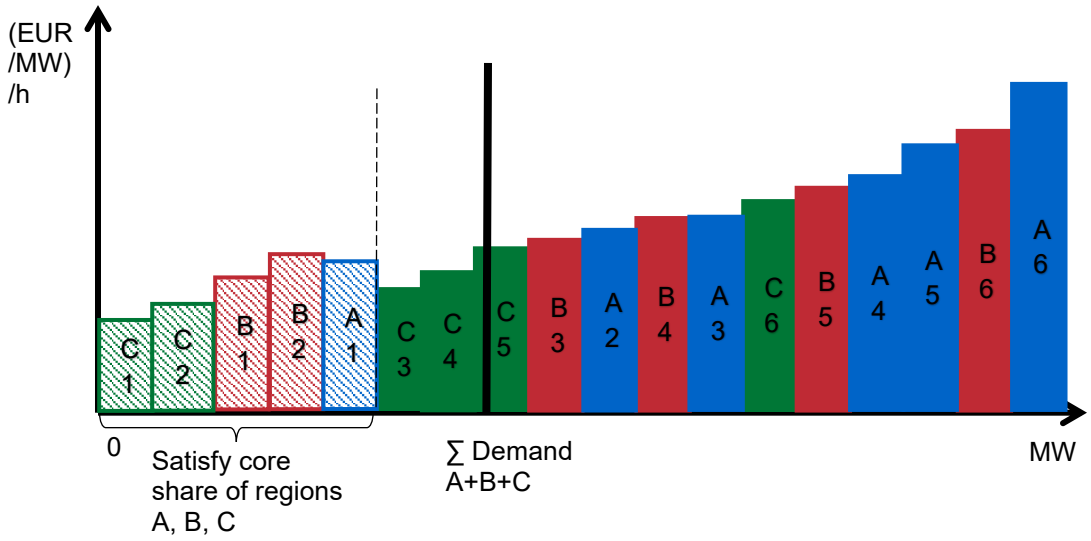

Figure 3: Example of optimal procurement with core share constraint

3. "The limit for an amount of balancing capacity which can be procured by one country in another country shall be respected. These limits are defined as the maximum amount of balancing capacity which may be exchanged across each border of a country to its adjacent countries, separately for directions, products (positive and negative aFRR), and validity periods."

   → The maximum exchange limits restrict cross-border procurement via the respective borders.

   Example:
   Figure 4 shows an example of individual bids submitted in three different regions (A, B, C) that are ordered according to their balancing capacity price

– except for bids C5 and C6 that cannot be awarded due to an active maximum transfer limit from region C. Thus, the total demand needs to be additionally served from bids A4 and part of A5. The bold solid line shows the sum of the demand of the three regions, and the dotted line shows the bids that need to be awarded. Each bid to the left of the dotted line will be awarded – except for bids C5 and C6. Note that in this example, the last bid (A5) will only be partially awarded up to the volume that is needed to cover the total demand.

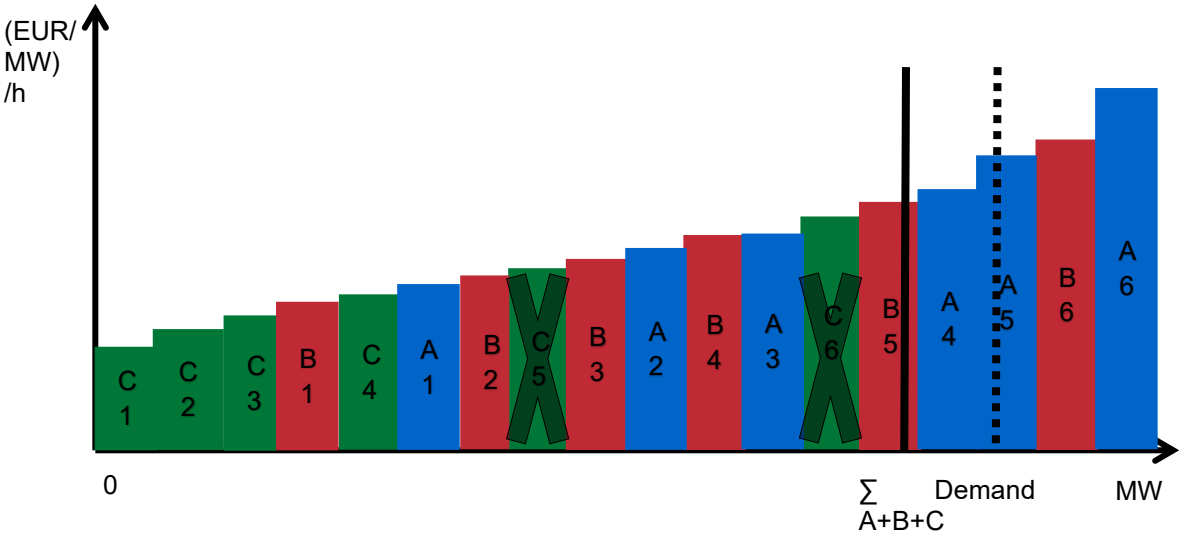

Figure 4: Example of optimal procurement with active maximum transfer limit

4. "It shall not be possible that one country is at the same time importing and exporting the same product (positive or negative aFRR). This constraint should prevent transit procurement. (…)"

   → Transit procurement occurs when balancing capacity is procured not directly across the border of two regions but via a third region.

   Example:
   With some simplification, it can be said that the price level in Country A is very high, medium in Country B and low in Country C. The maximum exchange limit between countries A and C is zero. Therefore, country B is exporting to country A. Country C could export to country B to reduce the price level there, but this is forbidden, as this would result in a transit procurement from C for A via B (compare Figure 3.

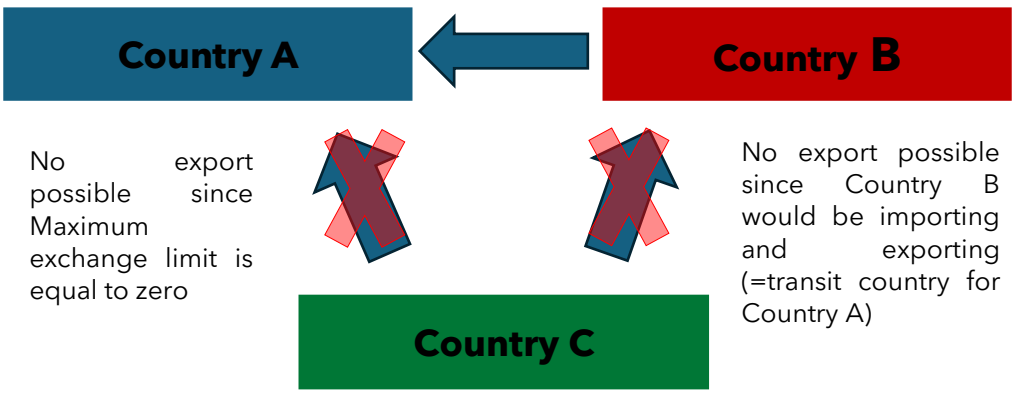

Figure 5: Exchanged capacity without transit procurement

Going more into detail, Figure 6 illustrates a cost-optimal solution for covering the demand of all countries without transits. Demand of Country C can be satisfied by awarding bids C1 to C3. Country B's demand is satisfied with the awarded quantity from bids B1 to B3. Bid A1 is awarded for Country A, but a second bid needs to be awarded to satisfy Country A's demand. In the common merit order list, the next least expensive bids are C4 and B4. Thus, the cost-optimal solution would involve awarding bid C4 to serve demand for Country A.
This, however, is not possible since the maximum exchange limit between Country A and Country C is zero. Bid C4 can also not be procured for Country A via Country B (Country C → Country B → Country A) as in this case, Country B would import and export at the same time (i.e., being a transit country), which would violate this constraint.

Thus, bid C4 cannot be procured and bid B4 needs to be procured to satisfy the constraint of no transit TSOs and cover the demand of all countries.

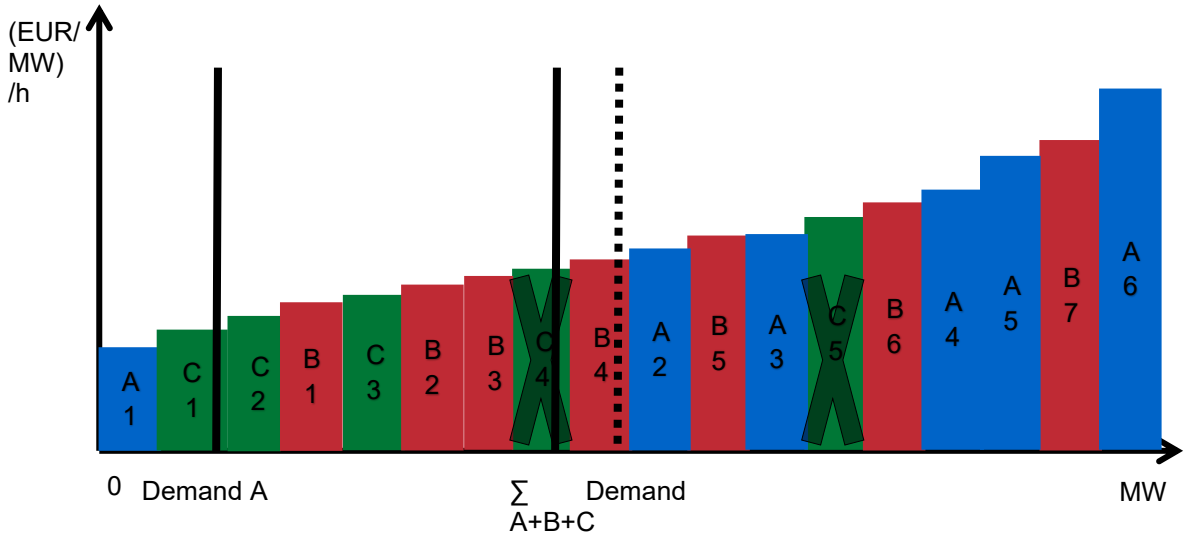

Figure 6: Example optimal procurement without transiting TSO

5. "In case two separate bids have the same balancing capacity price and the Algorithm shall only select one bid (multiple optimal solutions), the selection shall be based on a randomisation algorithm which shall not discriminate against particular balancing service providers and shall prioritise procurement inside the connecting LFC Block."

   →This requirement for the algorithm should select one optimal solution and clearly determine which bids are to be procured.
   Example: There are two optimal solutions with bids that have the same balancing capacity price. The algorithm should randomise between those bids and shall consider whether one solution involves less cross-border procurement.

The procurement costs shall be minimised subject to all the aforementioned constraints, i.e., all constraints must be considered jointly.