

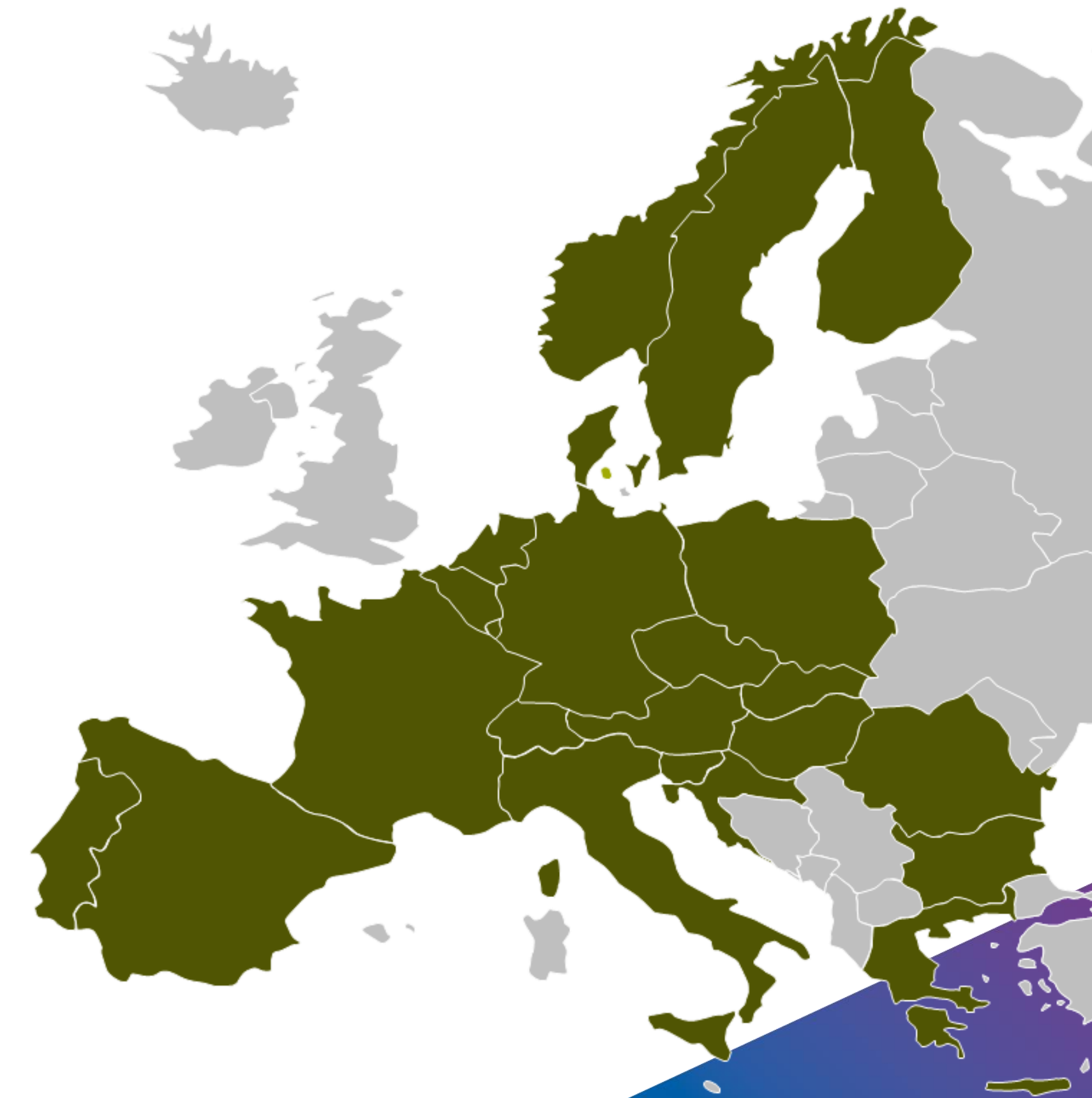
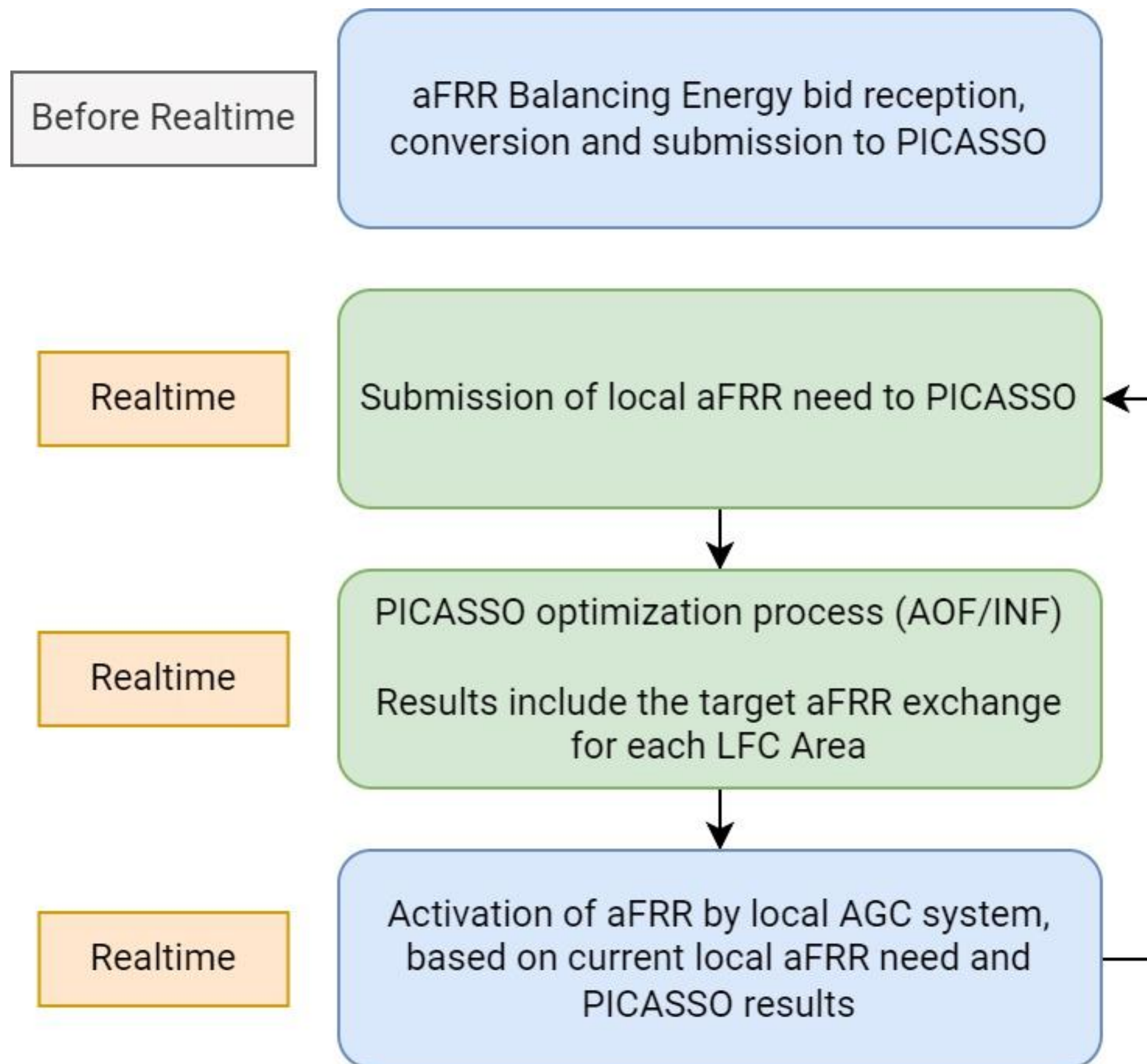
Workshop:
*High level design for the
participation in MARI &
PICASSO platforms*

PICASSO Part II

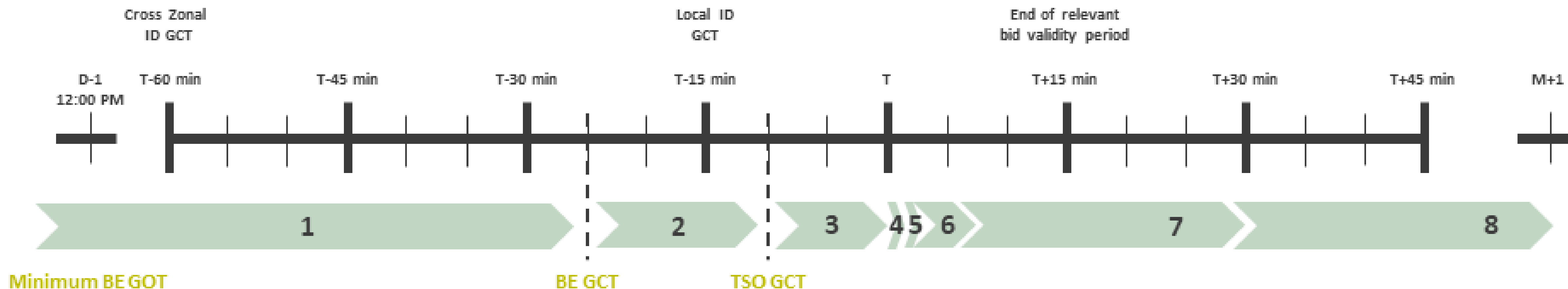
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Market Design and Monitoring Dept.

02/02/2023

PICASSO Process



PICASSO Timeline

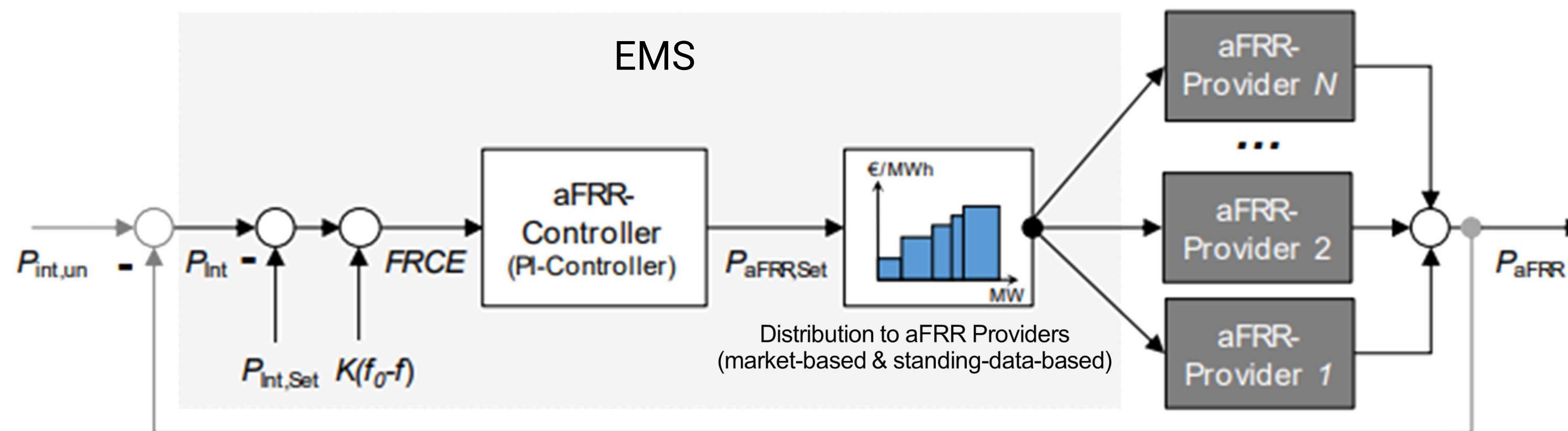


1. BSP bids submission to IPTO (until BSP BE GCT)
2. IPTO processes (indicatively, LMOL creation & submission to PICASSO) (until TSO GCT)
3. PICASSO platform processes (indicatively, bid validation, CMOL creation) (before BE delivery time)
- 4-6. Realtime processes (executed constantly within the 15' period for which bids are valid):
 4. PICASSO AOF execution
 5. IPTO aFRR activation request to BSEs via AGC
 6. aFRR activation by BSEs
7. Data Publication (transparency data, indicatively exchanged volumes and cross-border marginal prices)
8. Settlement and invoicing (PICASSO – IPTO and BSE – IPTO)

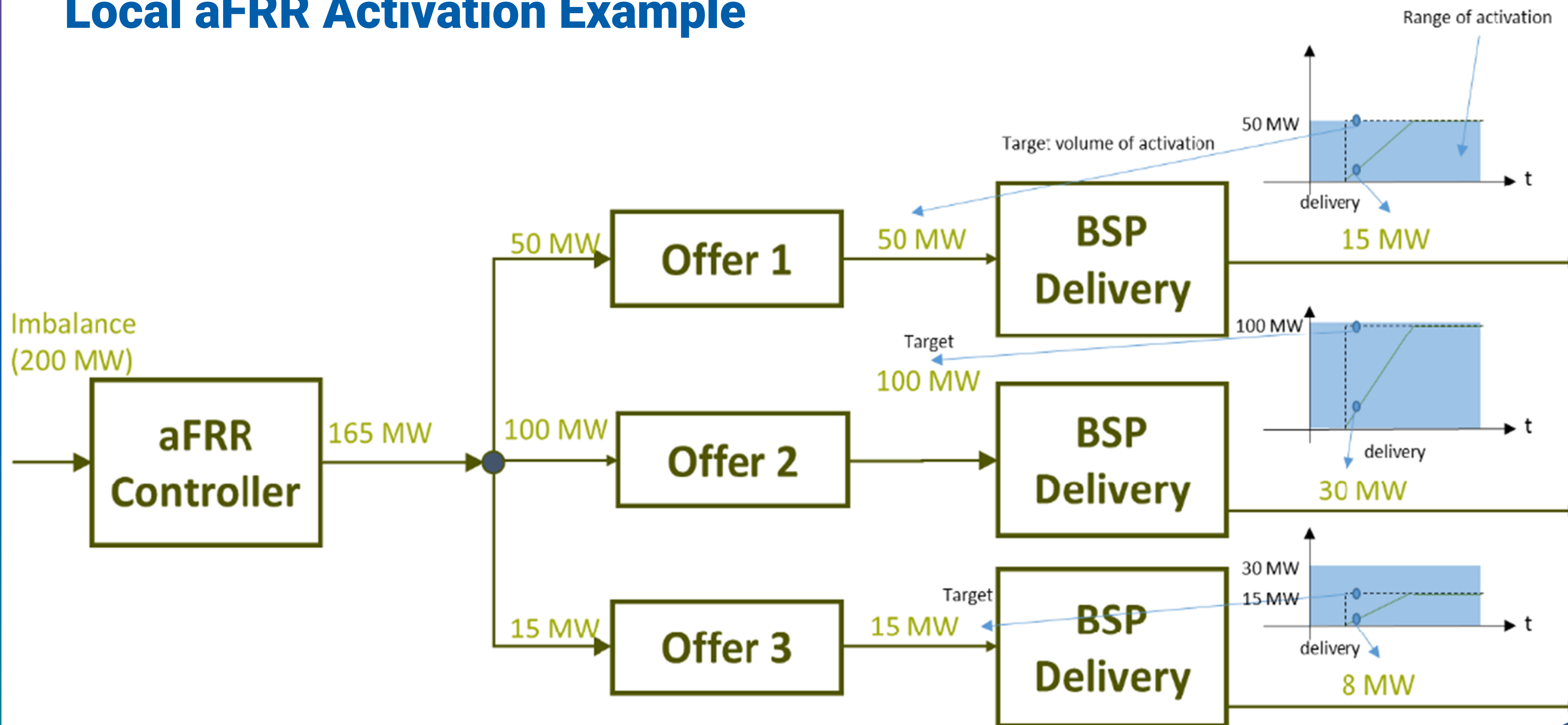
- BSP BE GOT: ISP bidding GOT - 13:00 D-1 CET
- BSP BE GCT: At least 20' before aFRR delivery time (not finalized, it must allow completing all IPTO processes before TSO GCT)
- TSO GCT: 10' before aFRR delivery time

aFRR activation - Principles

- Each LFC Area operates a real time aFRR controller (AGC)
- The AGC receives the LFC input, which represents the aFRR which needs to be activated (additionally to already activated aFRR) in order to control the measured power balance of the LFC Area
- Before PICASSO, the AGC input reflects local aFRR needs (plus a correction to account for IGCC)
- The AGC outputs a set-point value for aFRR activation for every aFRR provider (BSE) participating in aFRR
- The aFRR need is distributed among the aFRR providers according to their bids and standing data
- The set-point value is sent to the aFRR providers who activate aFRR as requested

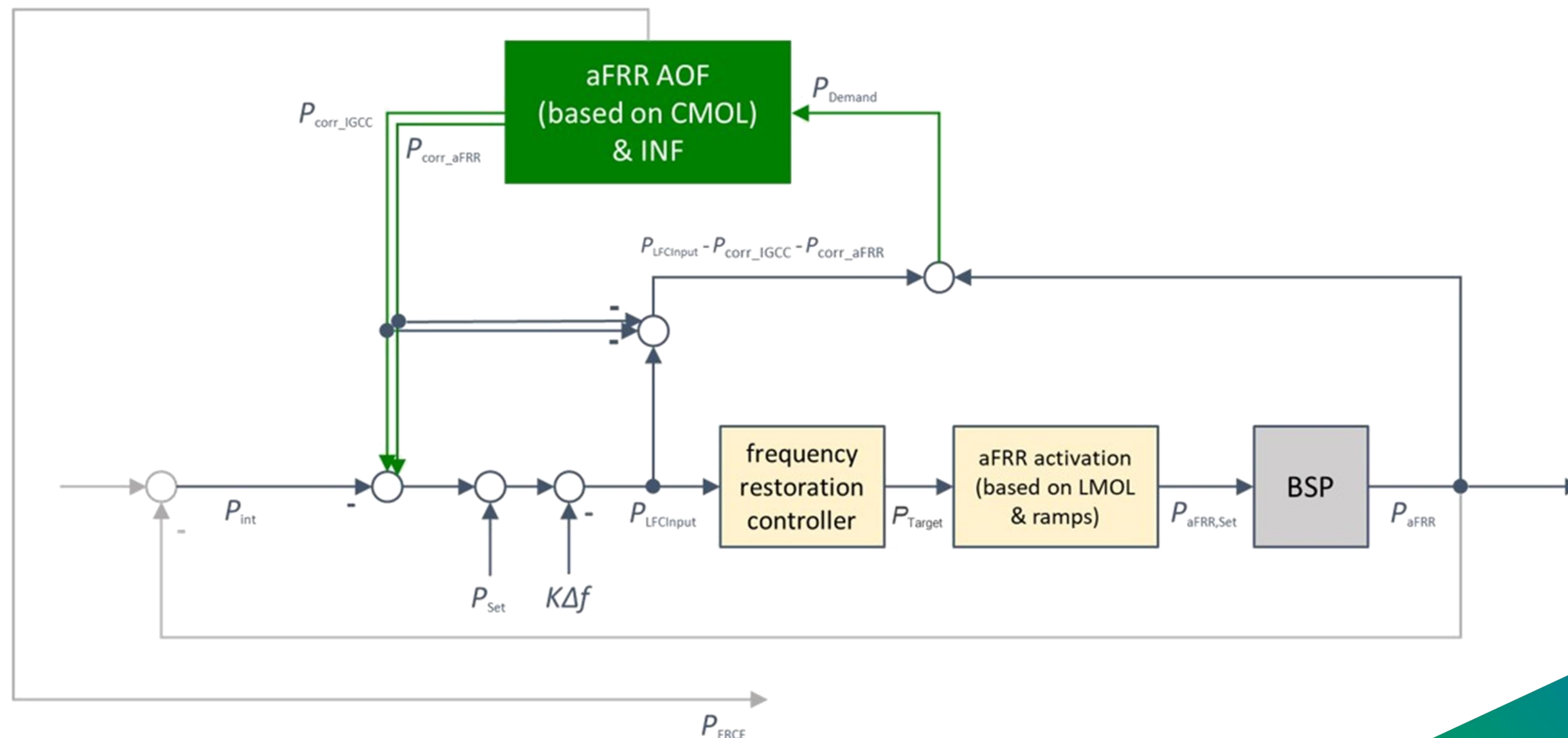


Local aFRR Activation Example



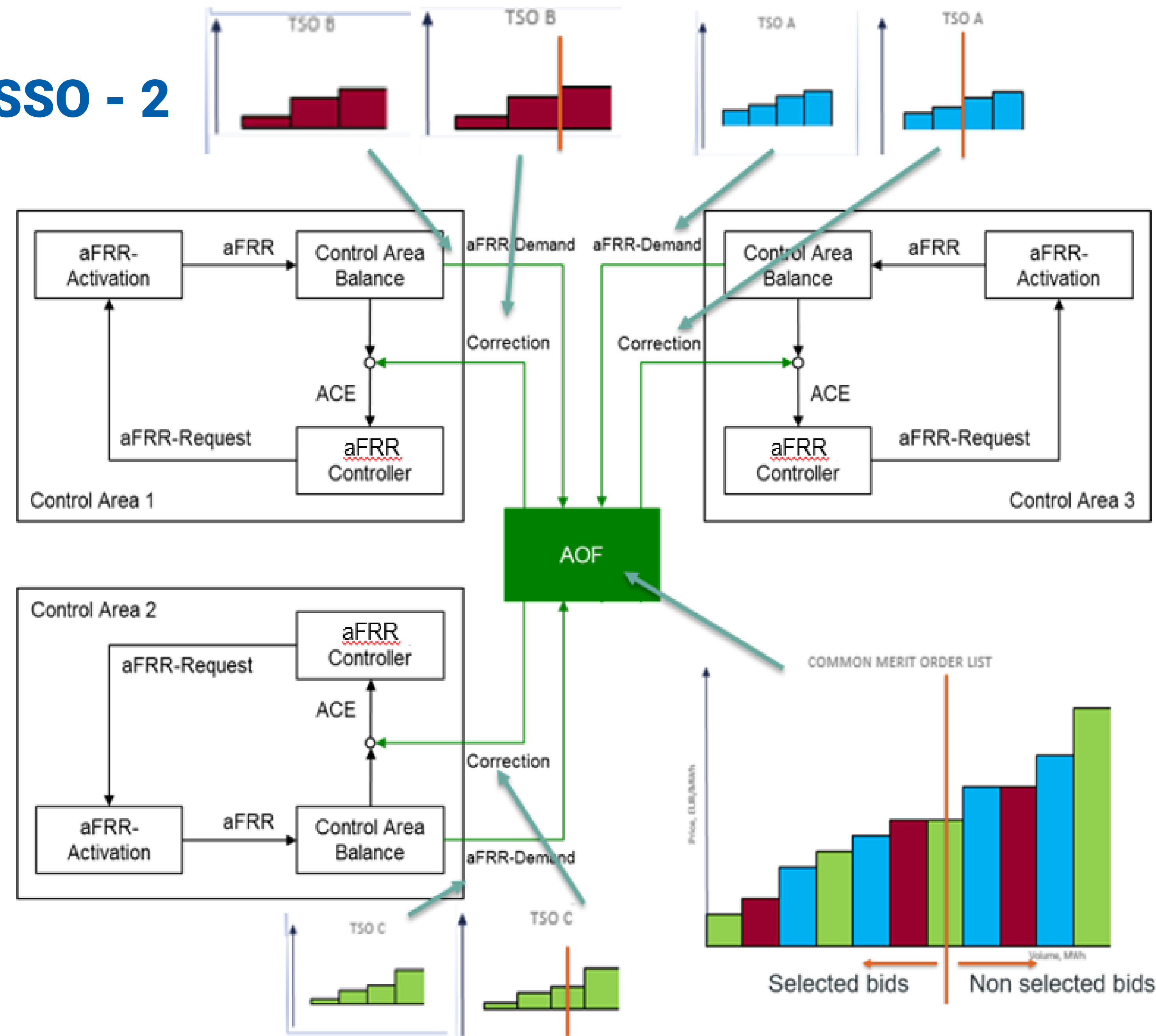
aFRR activation under PICASSO - 1

- Under PICASSO, the local aFRR demand will be “corrected” with an additional value (P_{corr}) that reflects the target aFRR exchange for the LFC Area
- To facilitate this, IPTO calculates and sends to PICASSO the local aFRR Demand before every PICASSO Control Cycle (PICASSO control cycle duration = 4 sec)
- After executing the optimization function (AOF), PICASSO responds with the correction signal to the IPTO AGC controller
- PICASSO sends a separate correction signal for IGCC and PICASSO



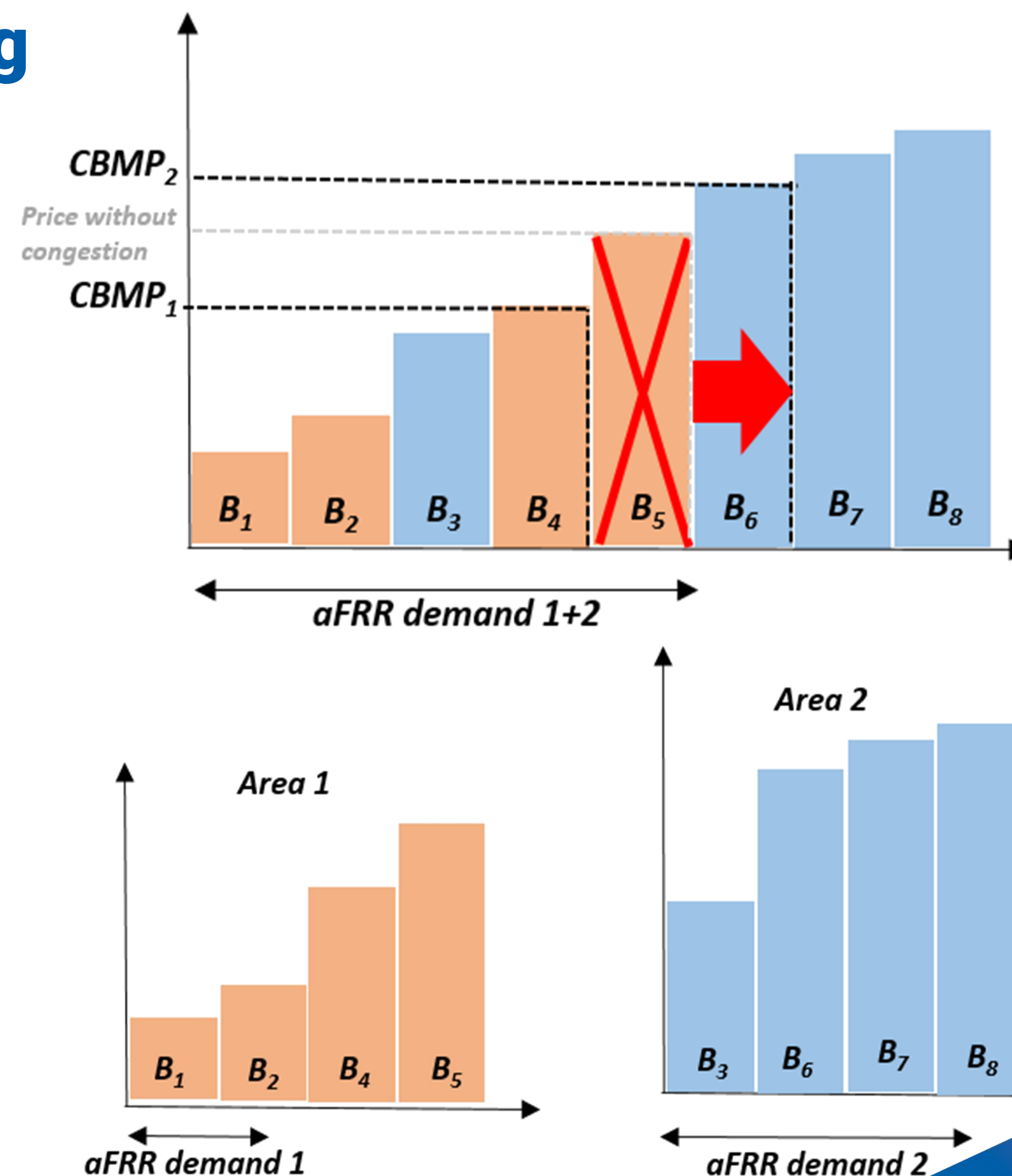
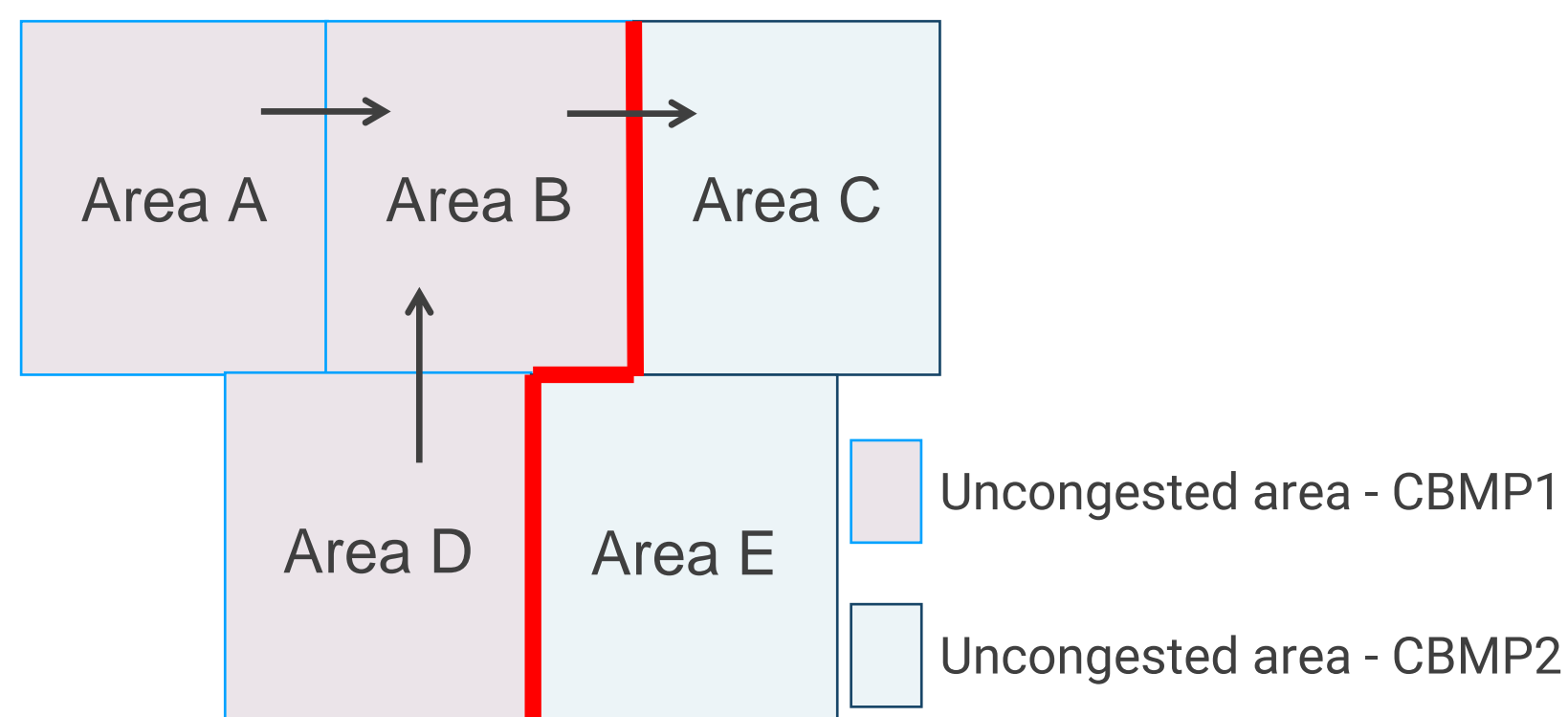
aFRR activation under PICASSO - 2

- PICASSO AOF inputs include the available aFRR bids, cross border capacity and the aFRR Demand of each participating TSO
- The PICASSO AOF determines the aFRR exchange between LFC Areas that:
 - ✓ maximizes aFRR demand satisfaction of all LFC Areas
 - ✓ minimizes the total aFRR activation avoiding counteracting activation
 - ✓ maximizes the economic surplus
 - ✓ keeps the aFRR exchange between LFC Areas to a minimum
 - ✓ respects the available cross zonal capacity between LFC Areas
- In case of disconnect from PICASSO, the correction values for PICASSO / IGCC shall be zero. The local AGC system shall continue to activate the local BSEs according to the local aFRR needs and aFRR bids

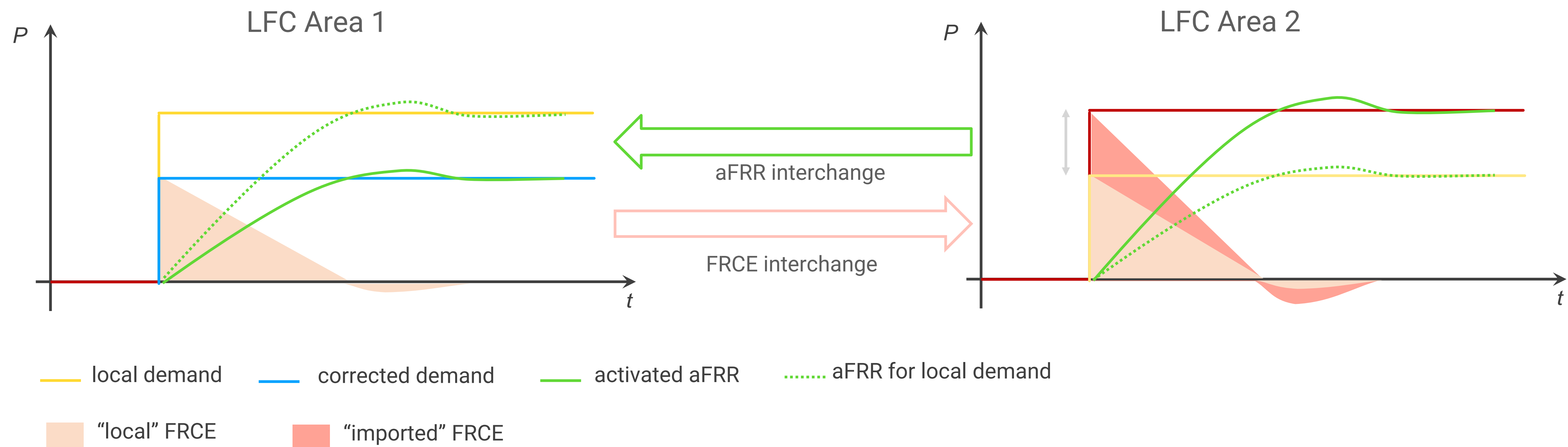


PICASSO AOF Bid Selection & Pricing

- Marginal pricing (pay-as-cleared)
- The Marginal Price (MP) represents the price of the highest price bid of a standard product which has been selected to cover the energy need for balancing purposes within a specified area.
- The AOF will compute the balancing energy price (Cross-Border Marginal Price – CBMP) per LFC Area:
 - ✓ In case there is no congestions between adjacent areas, the CBMP 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)

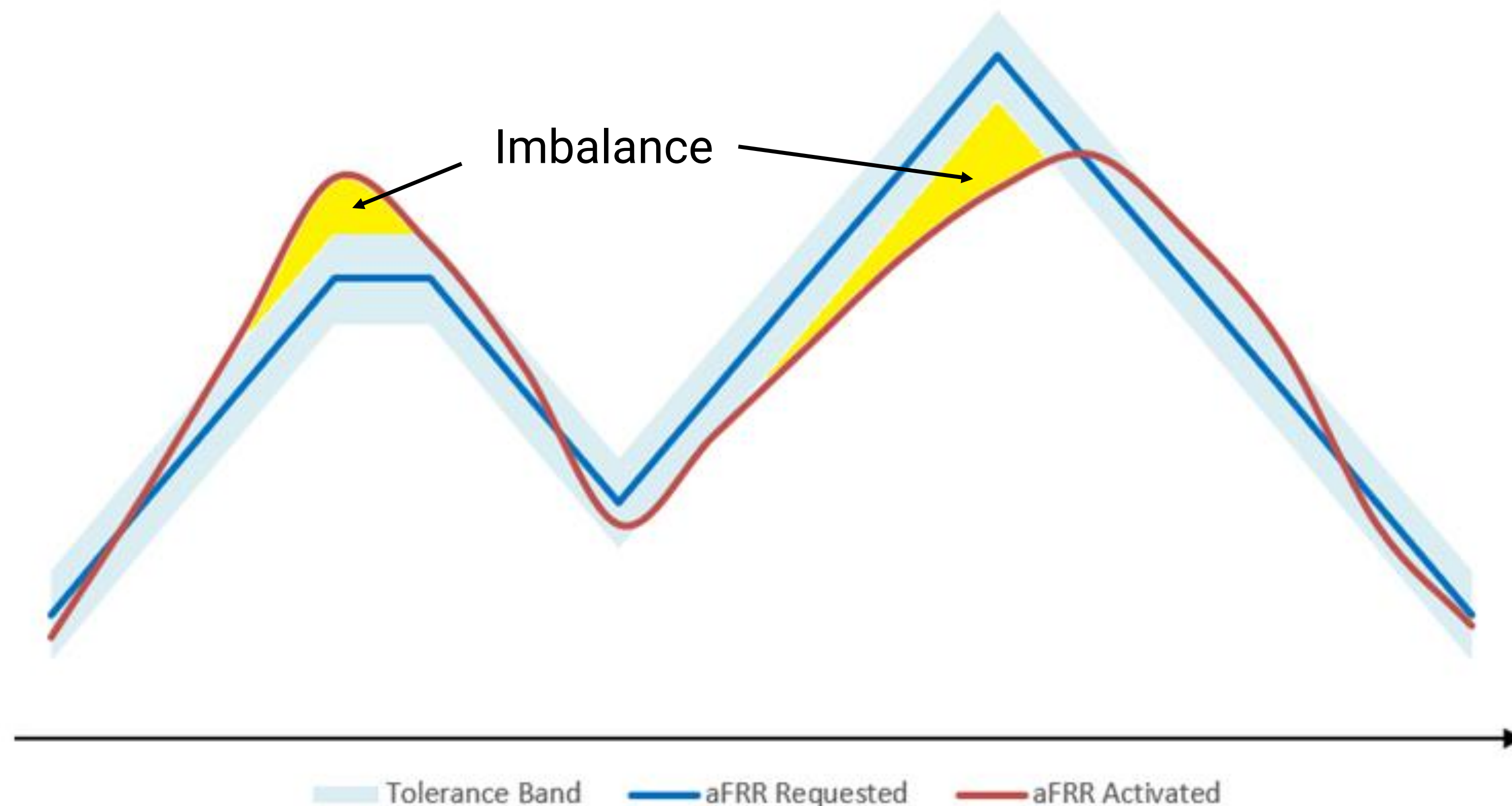


aFRR Interchange Example



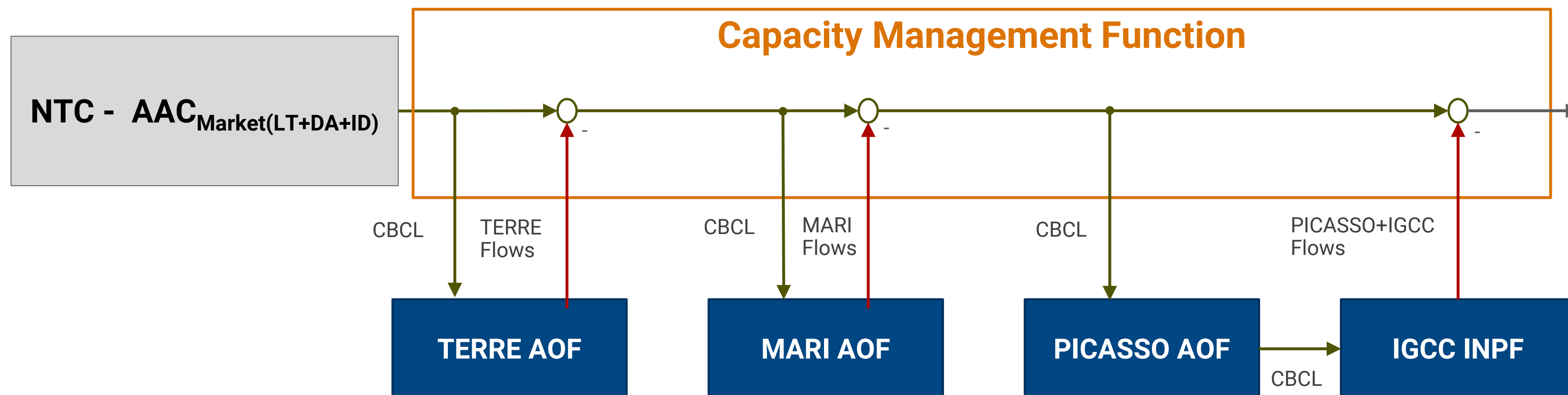
Local aFRR Activation Profile

- BSEs should follow the profile of the requested activations as closely as possible.
- IPTO may set a tolerance band around the requested activation profile and monitor that the delivered profile by the BSEs is within the prespecified tolerance band.
- Deviations of the delivered profile exceeding the tolerance band (yellow area in the graph below) are considered imbalances and non-compliance charges could apply



Cross Border Capacity Limits

- PICASSO respects the aFRR Cross Border Capacity Limits (CBCLs) as submitted by IPTO in real time, separately per aFRR balancing border
- The CBCLs reflect the available cross-border balancing capacity after the Intraday Market and considering all cross-border schedules, as well as the activation in MARI
- For each border, the CBCL is provided separately by the two TSOs that are responsible for the adjacent LFC Areas. PICASSO will use the minimal value of the CBCL received. This implies that each TSO can unilaterally set effective additional limits for the interchange on this borders
- In the future, the CBCLs will be sent through a Capacity Management Module (CMM). The CMM will go-live later than the PICASSO go-live
- For operational security reasons, the CBCLs can be further reduced, temporary additional restrictions for the whole LFC Area can be specified ("Profile Limits") and limitations can even be placed on borders that are not under IPTOs responsibility ("affected TSO Procedure")

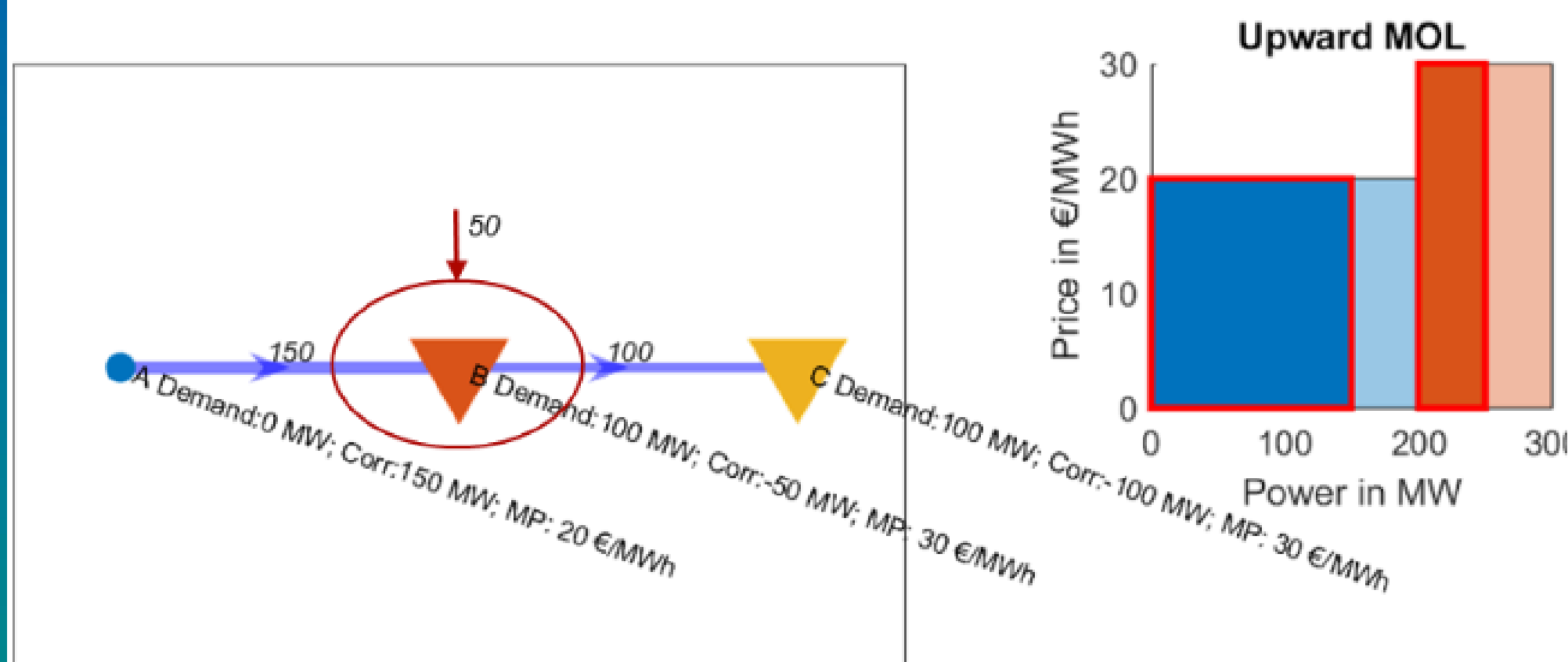


Cross Border Capacity Limits – Profile Limits

- Profile limits are temporary restrictions that act as a limit to the total flow on a predefined set of borders
- Profile limits are submitted in real time and can either be set to limit the total flow for PICASSO or IGCC or both
- Profile limits may be “net profiles” or “directed profiles”:
 - A “net profile” limits the net position of an LFC area And does not block transit flows
 - A “directed profile” limits the total import or export of an LFC Area without taking account flows in the opposite direction. Directed profile limits can be used to effectively limit transit flows.

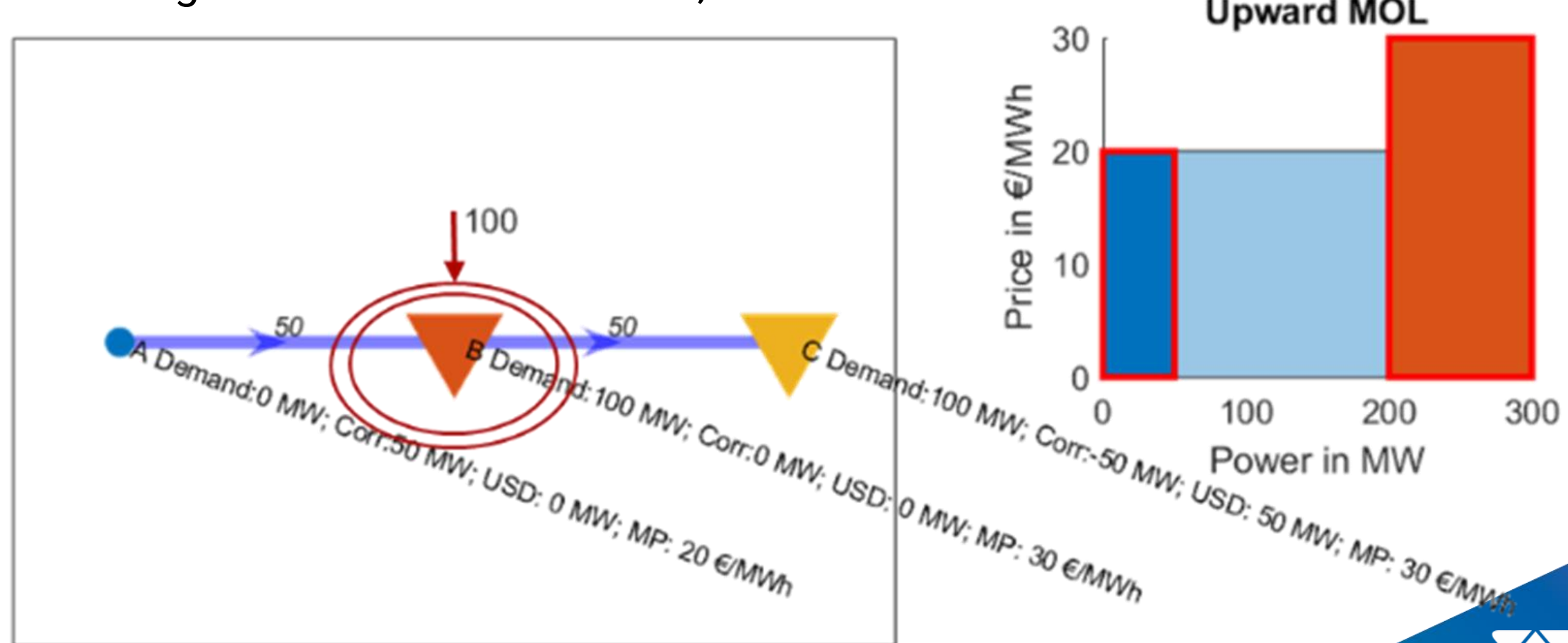
Net Profile Limit

A net profile on around LFC area B limits the total import of B to 50 MW. The transit flow A→B→C which is needed to satisfy the demand in C is not affected.



Directed Profile Limit

A directed import profile around B limits the sum of all flows towards B to 50 MW. Therefore, the flow A→B is limited which also affects the exchange between A and C. Thus, the demand in C cannot be satisfied.



Publication

Type	Obligation	Responsible	Publication
A	disconnection of the aFRR-platform, fall-back utilisation status as well as restoration of operation	TSO	publish on ETP
A	publication of the volumes exchange and prices provided by the AOF	TSO	publish on ETP
A	adjustments to capacity limits	TSO	publish on ETP
A	HVDC	TSO	publish on ETP
A	changes to bid availability	TSO	publish on ETP
M	yearly report on implementation and operation of platform	ENTSO-E	on ENTSO-E website and reported to regulatory authorities
M	Annual public stakeholder workshop	ENTSO-E	on ENTSO-E website and reported to regulatory authorities

Pricing and Settlement – PICASSO-TSO Settlement

- A daily matching process is performed to determine the exchanged aFRR volumes, which will be settled between PICASSO and IPTO
- During volume matching, IPTO compares the sum of aFRR activated under PICASSO within a 15' period, separately per direction (import or export) to the corresponding volume calculated by the CSP (TRANSNET BW). In case of a significant mismatch, an investigation is triggered to solve the issue
- Following volume matching, PICASSO calculates the settlement amounts per 15' period and TSO as the sum of the amounts for the exchange of aFRR balancing energy and the respective congestion income (equal to the aFRR price difference of the importing and exporting areas multiplied with the exchanged aFRR volume)
- The Invoicing Agent (JAO) invoices monthly all participating TSOs, regarding the settlement amounts due for the previous month



Pricing and Settlement – TSO-BSP Settlement

The activated aFRR balancing energy is settled per 15' period and BSE.

It is proposed to settle the aFRR balancing energy as follows:

- The total settlement amount is the sum of the related settlement amounts for each direction for all 1-minute periods within the 15' period
- The settlement amounts for every 1-minute period and BSE are proposed to be calculated as follows:
 1. **Settlement Amount Calculation:** The settlement amount for each aFRR direction equals the settlement volume multiplied by the settlement price
 2. **Volume Calculation:** The settlement volume for aFRR balancing energy in each direction equals the measured volume per direction minus the volume of the mFRR instruction for the relevant 15' period
 3. **Volume Calculation:** The settlement volume per direction cannot be greater than the requested volume per direction. Activated quantities above that limit will be settled as imbalances
 4. **Pricing:** IPTO shall calculate the weighted average price of all Cross-Border Marginal Prices for the 1-minute period, separately per direction (UpCBMPwae, DnCBMPwae)
 5. **Pricing:** The settlement price for upward aFRR balancing energy equals the maximum of UpCBMPwae, and the bid price corresponding to the BSE's settlement volume for upward aFRR balancing energy
 6. **Pricing:** The settlement price for downward aFRR balancing energy equals the minimum of DnCBMPwae, and the bid price corresponding to the BSE's settlement volume for downward aFRR balancing energy

Pricing and Settlement – TSO-BSP Settlement Example

Minute	Settlement Volume in Up direction (kWh)	UpCBMPwae (E/MWh)	BSE Bid Price (E/MWh)	Settlement Price (E/MWh)	Settlement Amount (Euro)
1	350	200	200	200	70
2	210	180	200	200	42
3	140	120	150	150	21
4	70	300	150	300	21
5	30	280	150	280	8.4
6	210	370	200	370	77.7
7	350	340	200	340	119
8	140	200	200	200	28
9	70	280	150	280	19.6
10	90	120	150	150	13.5
11	150	160	150	160	24
12	210	240	200	240	50.4
13	560	350	200	350	196
14	280	320	200	320	89.6
15	140	220	150	220	30.8
15' Period Sums	3000				811



Thank you for Watching!
Questions?

