

Network Code Balancing

Main Concepts and Final Target Model

07 May 2013

Disclaimer:

Presentation based on DRAFT Version of the NC Balancing!
NC Balancing is work in progress.



Reliable Sustainable Connected

- **Process Overview**
- **Target Models & Transitory Period**

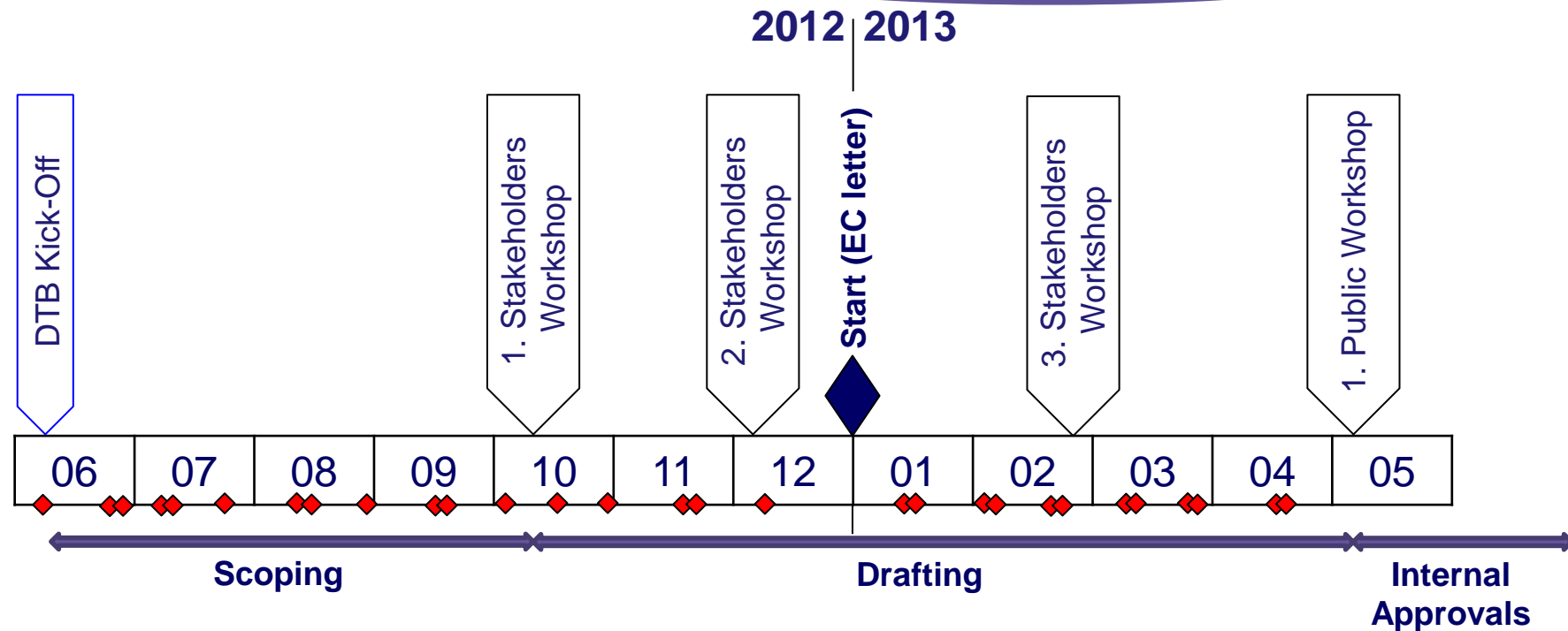
Key Concepts of NC EB

- **Coordinated Balancing Area and Area Consistency**
- **TSO-TSO Model**
- **Reserve and Energy Products**
- **Procurement of Energy Reserves**
- **Transfer of Obligations of Energy Reserves**
- **Use, Allocation & Reservation of Capacity**
- **Settlement**
- **Central Dispatch Systems**



Process Overview

Overview Meetings



- ◆ DT had 18 meetings so far (including Kick-Off)
 - 3 Stakeholder Advisory Group Meetings held in Brussels
 - Several bilat. meetings with Stakeholder Associations, EC, ACER
 - 1st Public Workshop on 7th of May (together with NC LFC-R)

Drafting Team

- DT consists of 16 people.
 - Also, we have an excellent geographical representation in order to consider different practical experience.
 - Full support and effort of DT members needed (50% of their time is reserved for DT EB development purposes)!
 - As almost no blue prints are available (compared to e.g. Operational Security, CACM, etc.) drafting the NC EB was/is very challenging.
- Hence, Stakeholder involvement was and is very important!
- An open approach for Stakeholder cooperation was chosen and is established!

*Balancing Code
Drafting Teams
Members*



- A very proactive approach was chosen regarding stakeholder involvement
- Several discussions, Telco's and workshops with ACER, EC and other Stakeholders have been organised and conducted
- Discussion of early drafts with Stakeholders (more than 150 comments after 3rd EBSAG meeting)

→ It was (and still is) very challenging to keep pace!

Drafting is guided by the FWGL

- NC Drafting based on understanding of the mechanisms established by the FWGL
- Continuous cross-checking ensures consistency & highlights potential deviation at an early stage

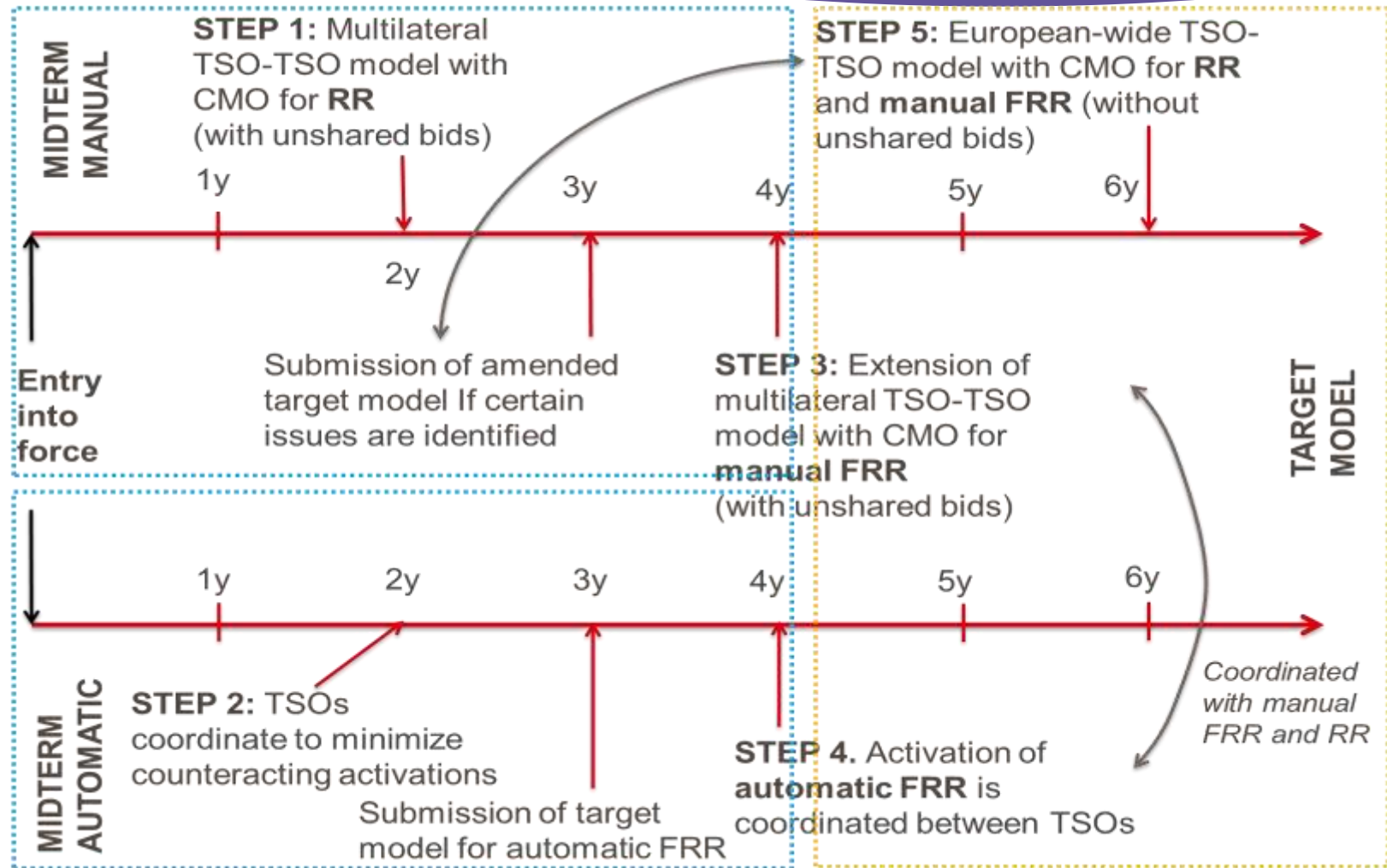
→ Currently only few discrepancies identified (ca. 6/200) which are currently analysed and will be resolved by the DT EB in cooperation with ACER

Article	Published by NC	NC Article Title	Page no.
The Network Code on Electricity Balancing shall provide that ENTSO-E or NEMOs or TSOs directly or relevant second to the Agency, without delay, all the relevant information and documents related to the opening of any approval or filing procedure to NEMOs, as provided for in Sections 1.5, 2.2, 3.2, 3.3.1, 3.3.2, 3.4.1, 4.2 and 4.3 of these Framework Guidelines. The Network Code on Electricity Balancing shall also require relevant NEMOs to inform the Agency of the outcome of any approval or filing procedures.			
2 General principles			
2.1 General principles pursuant to the Network Code on Electricity Balancing			
The specifications for national balancing reserve and balancing energy procurement and cross-border balancing exchanges shall pursue the following objectives: - safeguarding operational security; - fostering competition, non-discrimination and transparency in balancing markets; - facilitating wider participation of demand response and renewable sources of energy; - increasing overall social welfare and efficiency; - promoting cross-border balancing exchanges.	●	Article 9 - General Objectives of the Balancing Market	3
In addition, it shall be ensured that these specifications are consistent with any relevant provisions in the relevant national legislation.			
2.2 Role of TSOs in balancing			
The Network Code on Electricity Balancing shall clearly specify the roles and responsibilities of TSOs regarding electricity balancing.	●	Article 11, Role of TSOs	4.3
TSOs are responsible for organising balancing markets and shall strive for their integration, keeping the system in balance in the most efficient manner and following the general objectives defined in Section 2.1 above.	●	Article 11, Role of TSOs	5
The Network Code on Electricity Balancing shall require that each TSO is responsible for procuring the required balancing services from BSPs and is not allowed to offer the balancing services itself except, subject to NEMO's approval, if a system exception is threatened due to insufficient bids from BSPs.	●	Article 11, Role of TSOs	2.2
The Network Code on Electricity Balancing shall define common principles for the procurement of reserves and balancing energy in order to ensure that: - it is non-discriminatory, fair, objective, transparent and market based; - it is able to foster liquid balancing markets and avoid undue entry barriers for new entrants; - undue distortions within the internal market and in particular between adjacent markets that use different procurement mechanisms are avoided.	●	Article 9 - General Objectives of the Balancing Market, Article 11 refers to Article 9	2c
2.3 Terms and conditions related to balancing			
The Network Code on Electricity Balancing shall require that TSOs, in their responsibility with which relevant active terms and conditions related to balancing is accordance with the Network Code on Electricity Balancing and European and national legislation.	●	Article 13, Terms and conditions for balancing	5
The Network Code on Electricity Balancing shall require that BSOs and BPPs. The Network Code on Electricity Balancing shall provide that TSOs are responsible for defining the requirements to be applied to BSOs, in the case of non-compliance with technical and contractual requirements, within the terms and conditions.	●	Article 13, Terms and conditions for balancing	4

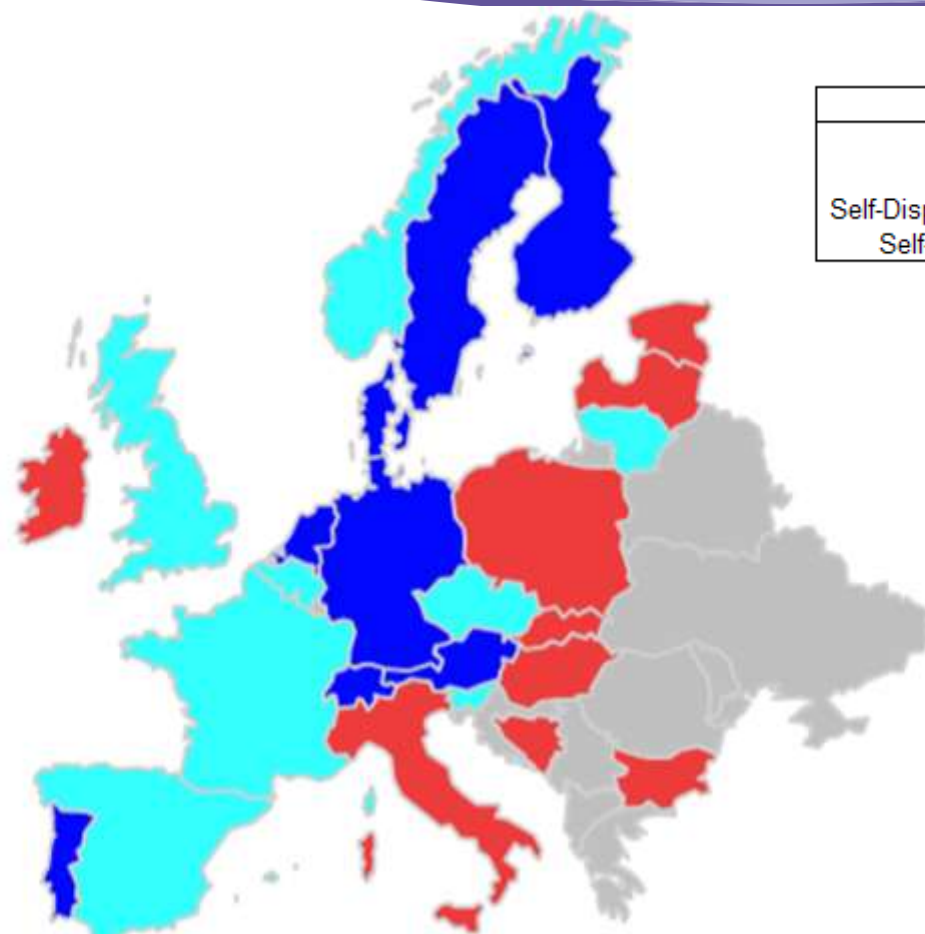


Target Model & Transitory Period

Target Models and Transitory Period (Article 57: Targets)



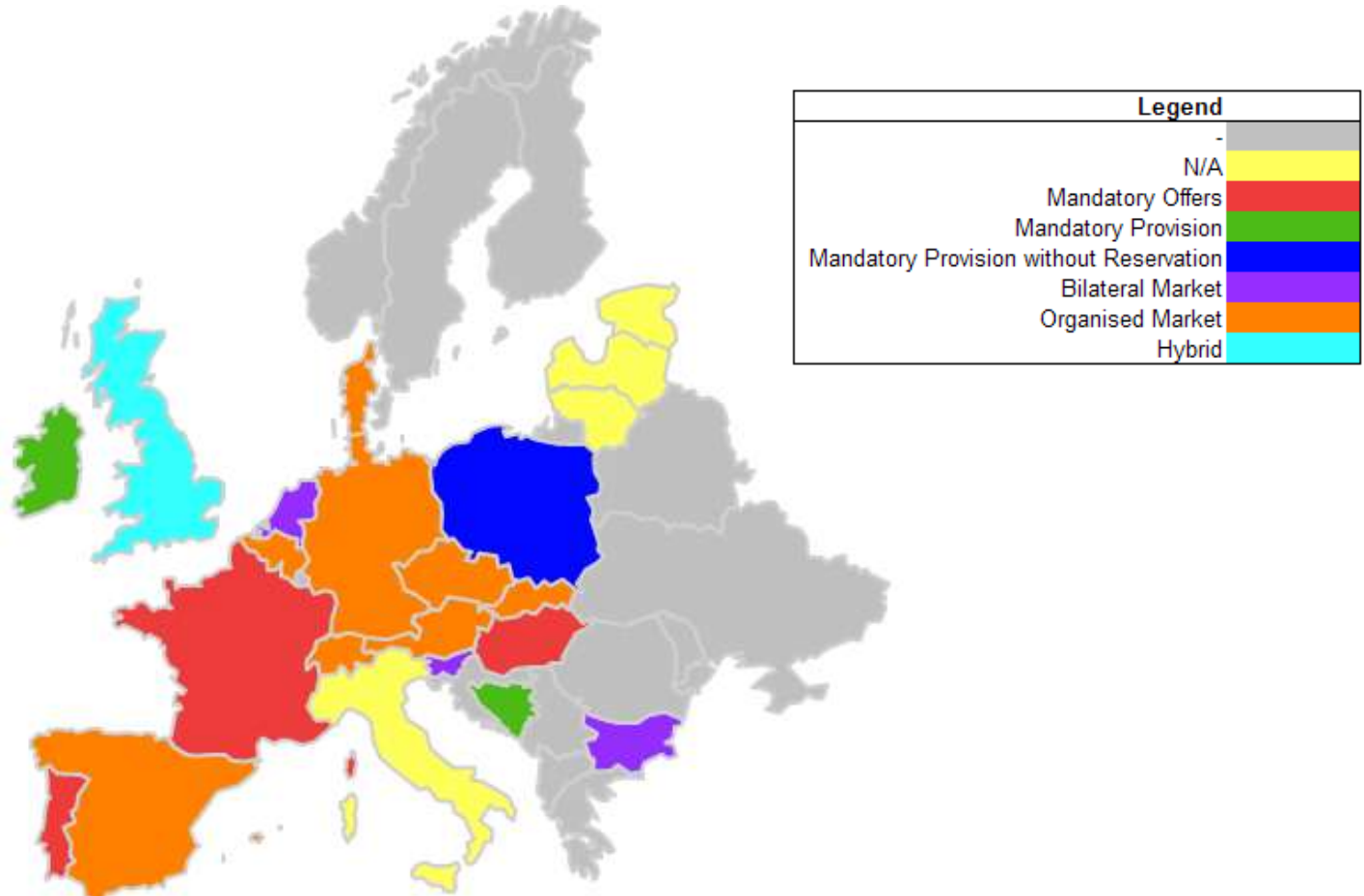
Balancing Processes in Place



Legend	
-	Central Dispatch
Red	Self-Dispatch - Portfolio Based
Blue	Self-Dispatch - Unit Based
Cyan	Self-Dispatch - Unit Based

- Different market systems in place!

FRR (Automatic) – Capacity – Procurement Schemes



- Different procurement schemes are currently in place across Europe!



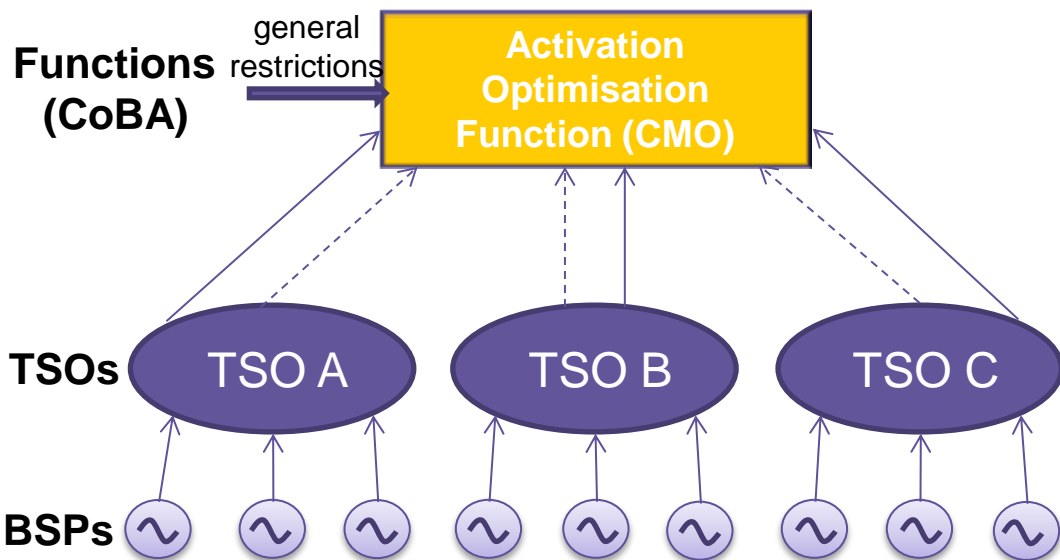
Key Concepts of NC EB

- **Chapter 1:** General Provisions
- **Chapter 2:** The Electricity Balancing System
- **Chapter 3:** Procurement of Balancing Services
- **Chapter 4:** Use, Allocation and Reservation of Cross Zonal Capacity for Balancing Services
- **Chapter 5:** Settlement
- **Chapter 6:** Algorithm Development
- **Chapter 7:** Reporting
- **Chapter 8:** Targets and Transitional Arrangements
- **Chapter 9:** Final Provisions



TSO-TSO Model

TSO-TSO Model example: FRRa Balancing Energy



- > Commercial information: bids, offers for Balancing Energy
- > Individual restrictions: unshared bids, specific products,...
- > General restrictions: (LFC&R), grid constraints (PTDFs, AMFs,...), available capacities (after IDGT, reserved capacities,...)

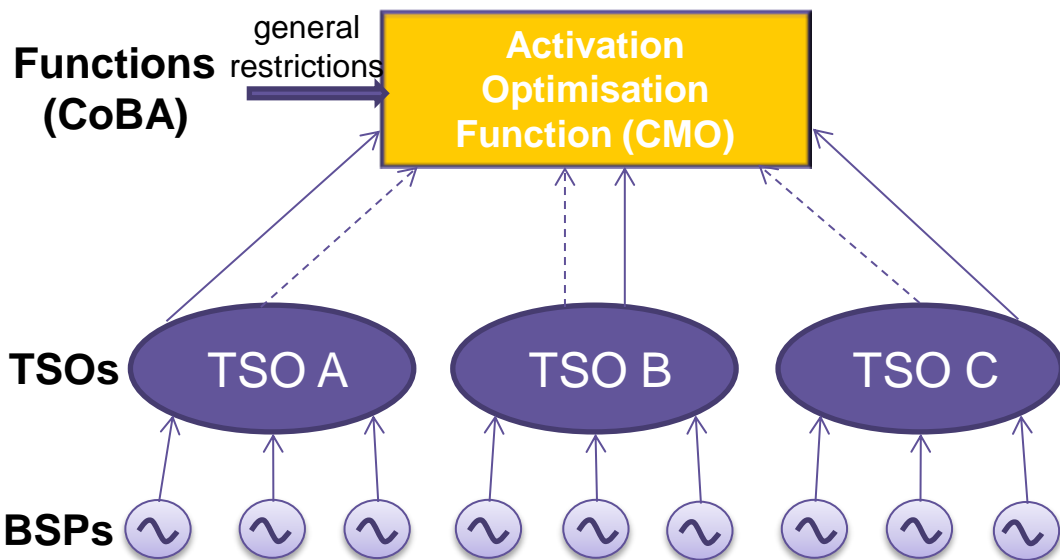
Principle Handling:

- Every few seconds TSOs submit current demand to AOF (e.g. 2-4 seconds)
- Considering commercial information, individual and general restrictions optimisation process is conducted
 - No restrictions → same price
 - With restriction → different prices
 - “online market coupling process”
- Controllers of CoBA TSOs receive “correction” signals (virtual tie-lines) for physically applying the results.
 - Hence, local merit orders are “corrected”

Error Handling:

- In case of CMO breakdown (IT, VTL, communication) no influence on SoS because activation according to local merit order (just without CMO correction)

TSO-TSO Model example: FRRa Balancing Energy



Clear responsibilities:

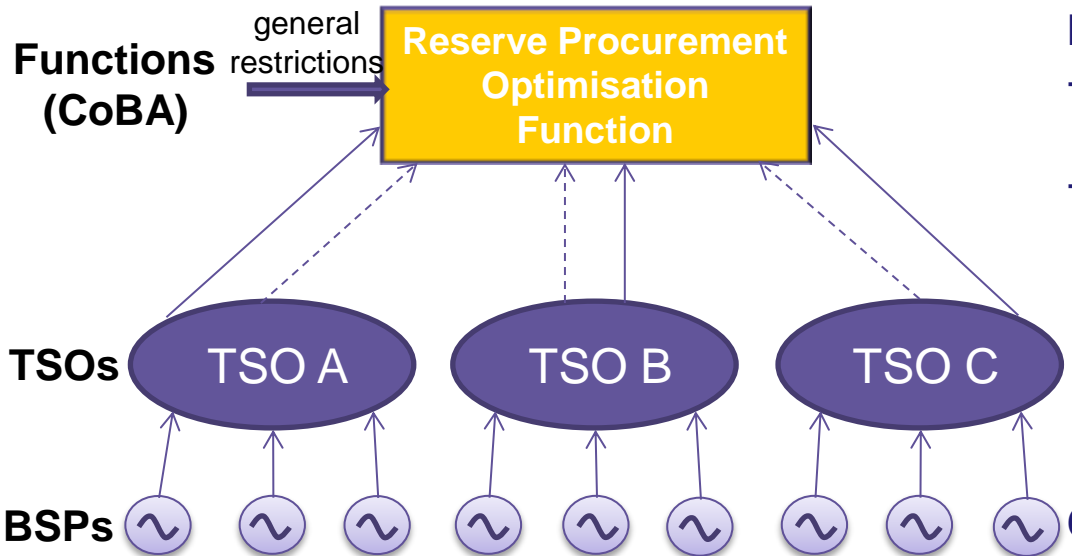
- Connection TSO has the necessary information to control the system at all times
 - Even in case of external activation the processes are the same (activation out of TSOs MOL by TSOs system controller)
- Prequalification by Connection TSO
- Monitoring by Connection TSO
- TSO-BSP settlement by Connection TSO
- Common TSO-TSO settlement processes

Maximising benefits:

- Because of coordinated usage of available capacities (reservation, after IDGT,...), AOF and related processes:

→ **Welfare optimal solution achievable!**

TSO-TSO Model example: FRRa Balancing Reserves



Principle Handling:

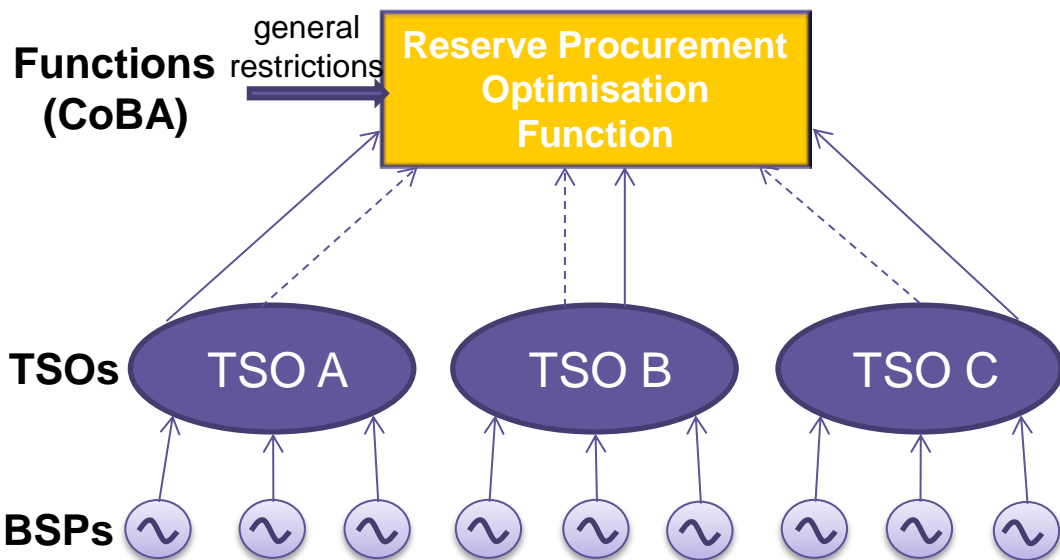
- Every TSO submits reserve requirements to RPOF (e.g. weekly, monthly, yearly)
- Considering commercial information, individual and general restrictions optimisation process is conducted
 - No restrictions → same price
 - With restriction → different prices
 - “market coupling process”

Clear responsibilities:

- Prequalification by Connection TSO
- Monitoring by Connection TSO
- TSO-BSP settlement by Connection TSO
- Common TSO-TSO settlement processes
- Rather easy and coordinated fulfilment of LFC&R obligations

- Commercial information: bids, offers for Balancing Reserves
- Individual restrictions: unshared bids, specific products,...
- General restrictions: LFC&R, grid constraints (PTDFs, AMFs,...), available capacities (reserved capacities,...)

TSO-TSO Model example: FRRa Balancing Reserves



Maximising benefits:

- Because of coordinated usage of available capacities (reservation,..), AOF and related processes:
→ **Welfare optimal solution achievable!**

Consistency:

- Fully consistent with Balancing Energy schemes
 - Same (similar) settlement, monitoring, error handling principles

Fairness:

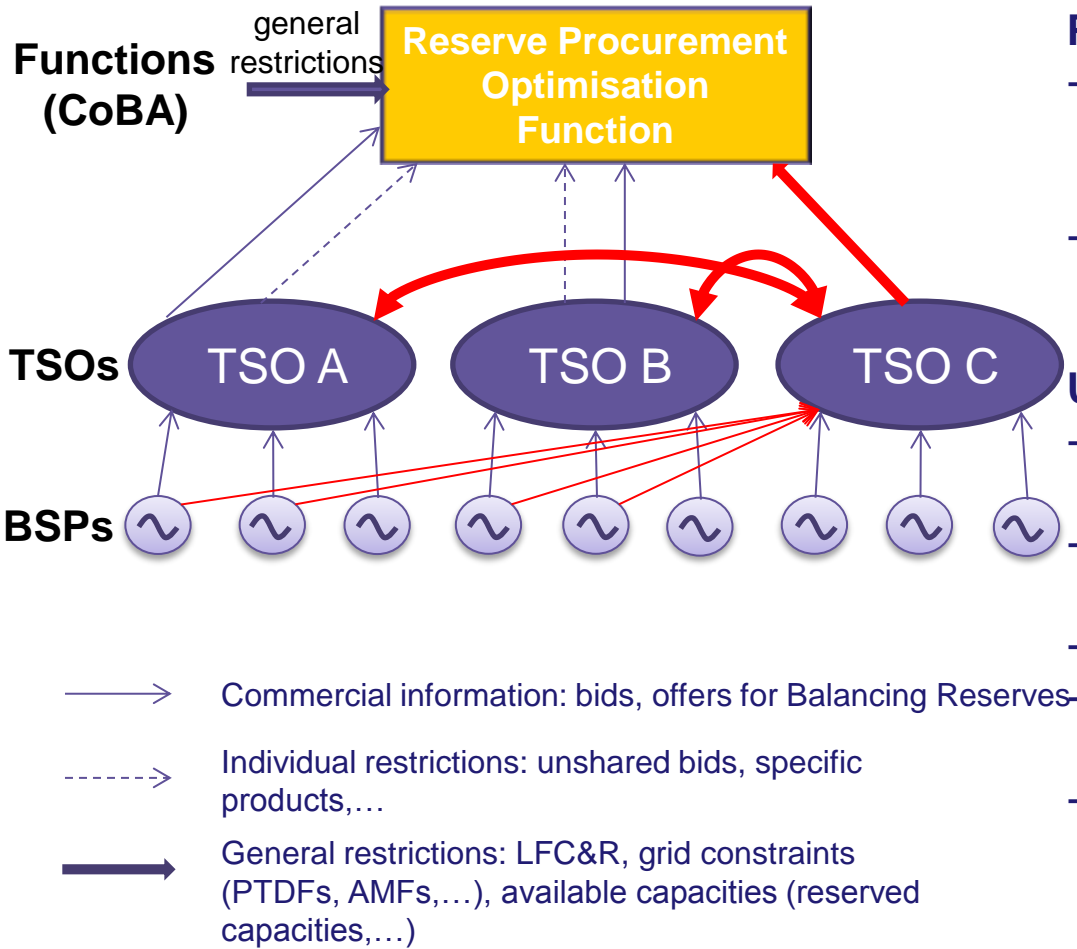
- Common cost/benefit sharing principles necessary

Drawbacks:

- Huge coordination efforts necessary! (e.g. procurement horizon)

- Commercial information: bids, offers for Balancing Reserves
- Individual restrictions: unshared bids, specific products,...
- General restrictions: LFC&R, grid constraints (PTDFs, AMFs,...), available capacities (reserved capacities,...)

TSO-BSP Model example: FRRa Balancing Reserves (TSO C performing TSO-BSP reserve procurement)



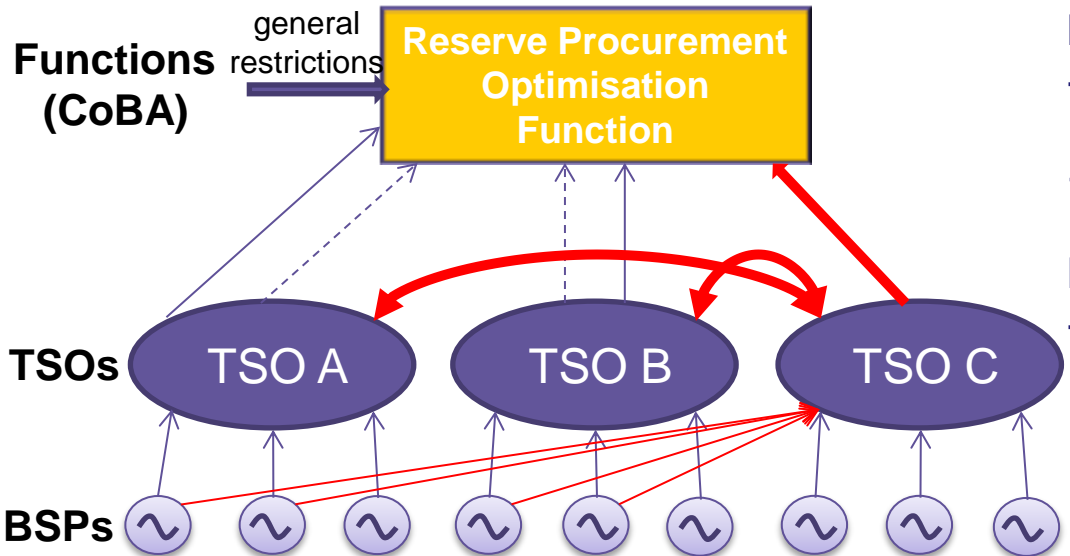
Principle Handling:

- BSP from different countries may join reserve procurement process of TSO C based on prior consent of TSO A, TSO B
- VTL integration from BSPs to foreign TSO necessary (number, complexity)?

Unclear responsibilities:

- Who is performing monitoring, prequalification, settlement
- Fulfilment of LFC&R obligation more complicated
- How to use reserved capacities?
- In case of outage Connection TSO has problems but with information, tools?
- BSP might have several (bilateral) reserves obligations; to whom to bid balancing energy?
 - At least all Balancing Energy bids to be placed at Connection TSO!

TSO-BSP Model example: FRRa Balancing Reserves (TSO C performing TSO-BSP reserve procurement)



Maximising benefits:

- Because of uncoordinated usage of available capacities (reservation,...):
→ **No overall welfare optimal solution possible**

Fairness:


- Cost/benefit sharing principles more complicated
 - How to “avoid” that TSO C reserves cheapest resources from A, B for their drawback?

Drawbacks:

- Consistency problems, huge coordination effort necessary

→ **Nevertheless, TSO-BSP model for reserves shall be possible according to NC EB for interim periods!**

- Commercial information: bids, offers for Balancing Reserves
- Individual restrictions: unshared bids, specific products,...
- General restrictions: LFC&R, grid constraints (PTDFs, AMFs,...), available capacities (reserved capacities,...)



Coordinated Balancing Area and Area Consistency (Chapter 2)

Goals and Requirements for the Definitions

Clarity of Definitions

- Differences between Areas should be clear
- Definitions should include all aspects of LFC&R and Balancing
- Inconsistencies with other Codes have to be avoided

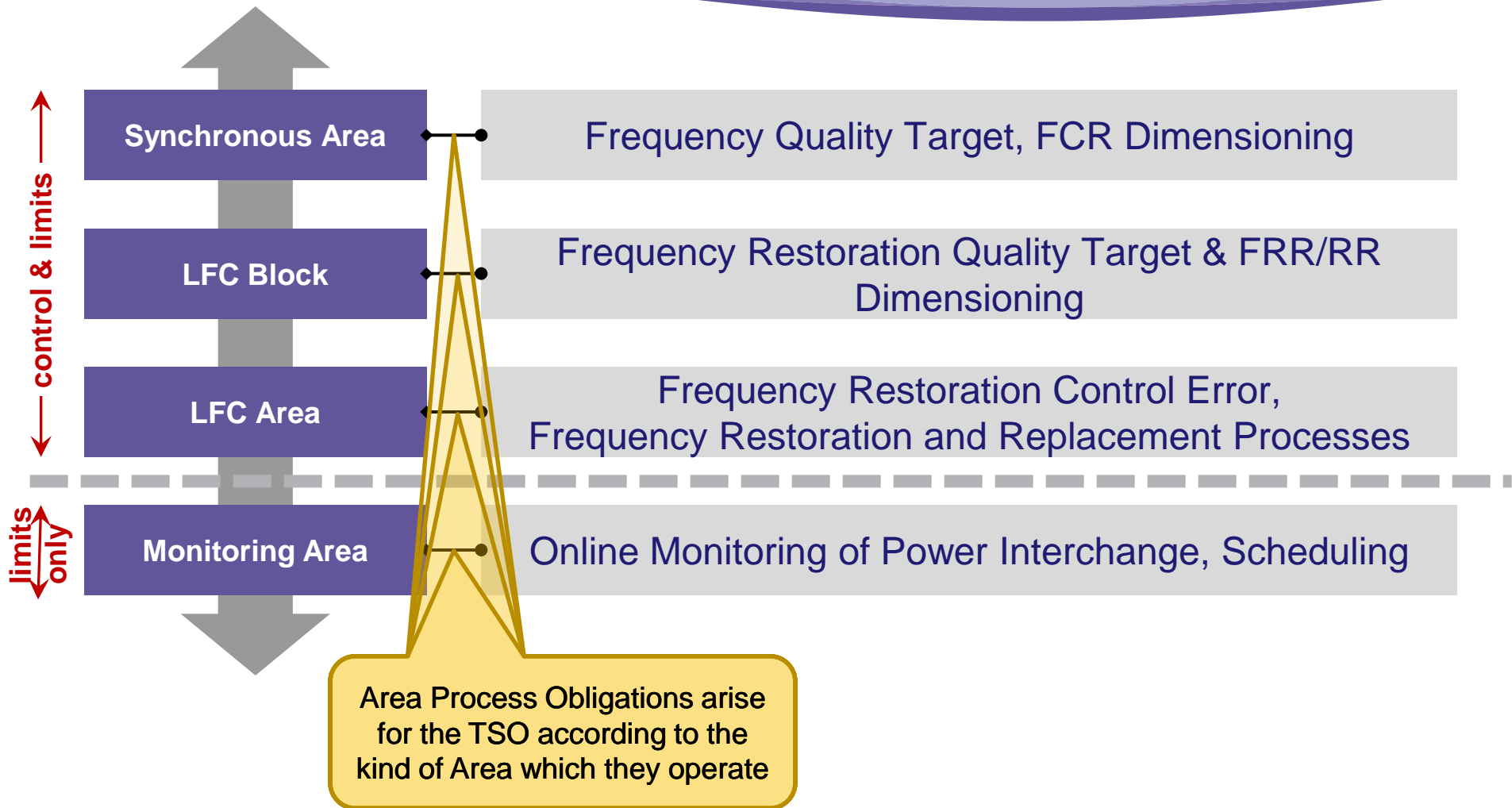
Clarity of Responsibilities

- Attachment of responsibilities to different Area Types (consistent with definitions)
- Assignment of each TSO to an Area and its responsibilities shall be clear and not conflicting (between Codes and Areas)

Clarity of Choices

- Processes for the association of a TSO to an Area have to be clearly defined
- **Areas should be able to accommodate today's control and market structures to foster flexibility and harmonisation**

Area Definitions in LFC&R



Area Definition in Balancing: Coordinated Balancing Area

Concept of a Coordinated Balancing Area

- TSOs are obliged to cooperate in a so called **Coordinated Balancing Area (CoBA)** with one or more TSOs
- Each CoBA includes the exchange of one (or more) Standard Product(s) and Imbalance Netting
- Flexibility on the way to reach the FWGL targets is ensured by not detailing which cooperation is to be done with which TSO
- Sharing and Exchange of Balancing Reserves is not mandatory, but possible
- CoBAs for Balancing Reserves (if established) can be smaller than those for Balancing Energy
- Functions are performing central tasks

Area Definition in Balancing: Coordinated Balancing Area

May exchange Balancing Services between
Coordinated Balancing Areas, already
exchanged within them

Coordinated Balancing Area 1

Coordinated Balancing Area 2

Cooperation per Balancing Service/product

Cooperation per Balancing Service/product

TSO 1

...

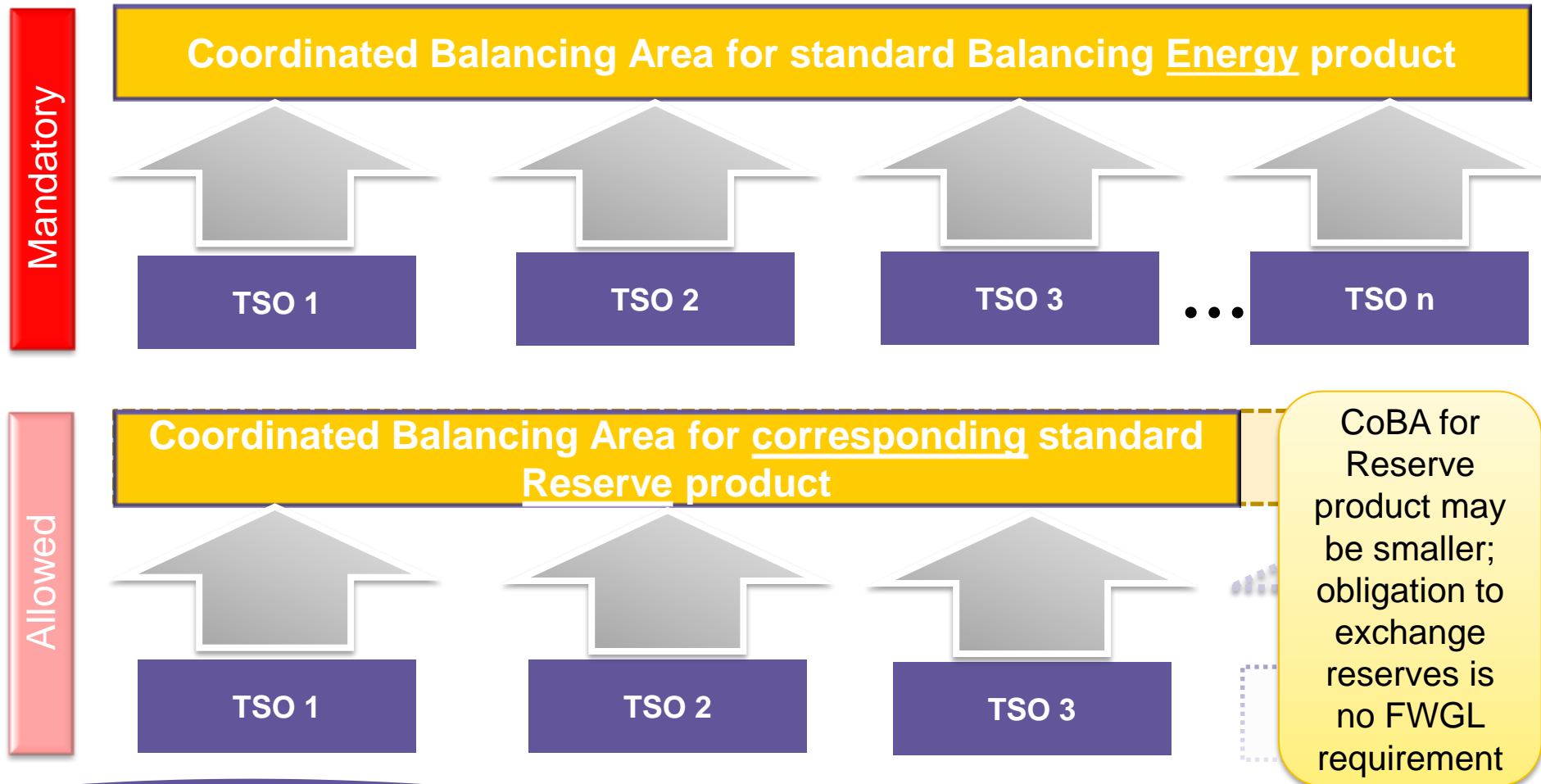
TSO n

TSO m

...

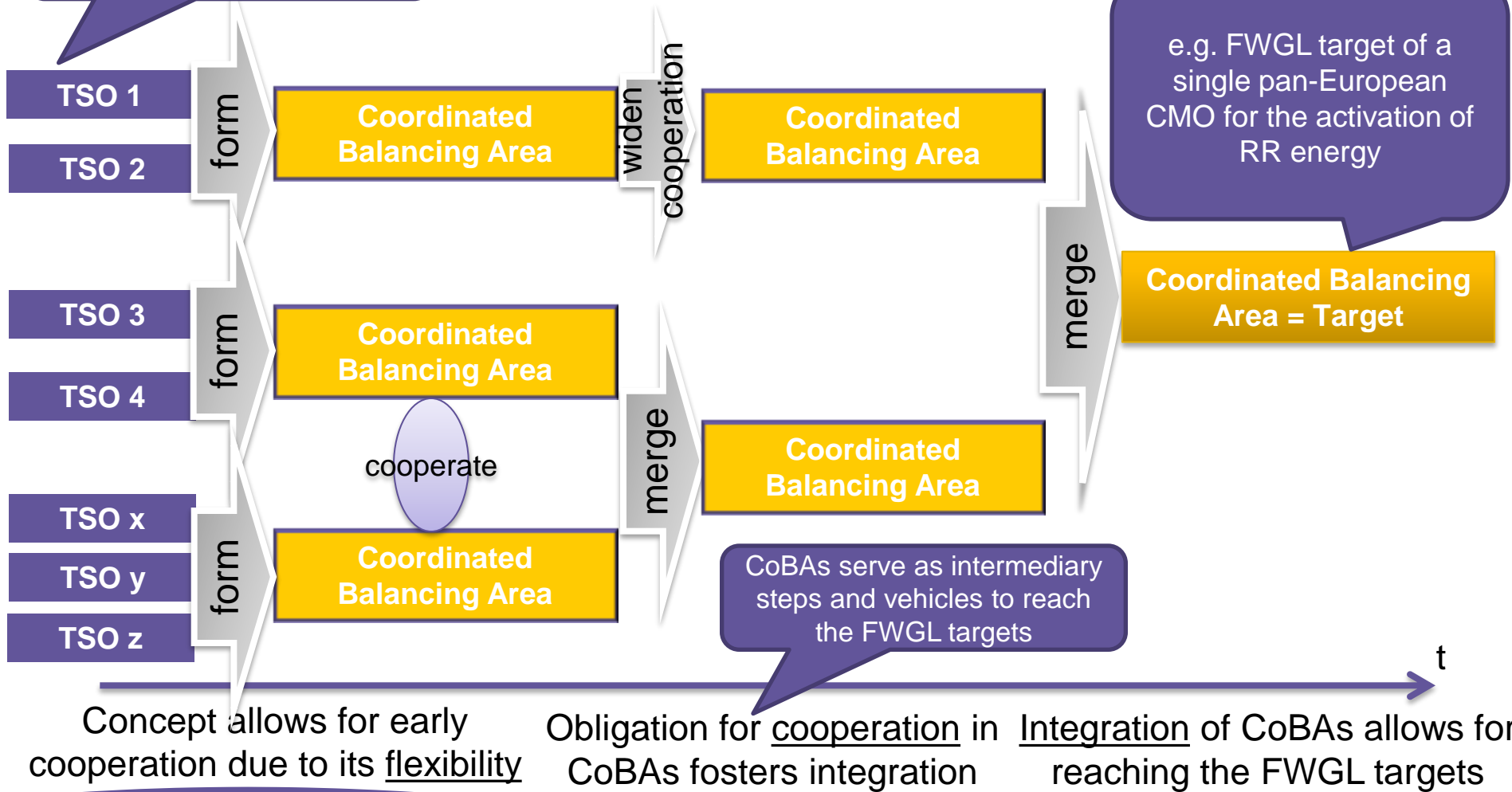
TSO x

Area Definition in Balancing: Coordinated Balancing Area



Coordinated Balancing Areas: Promoting Integration & Flexibility

TSOs may cooperate with different TSOs in CoBAs for different products



Link between proposed Area Definitions

Coordinated Balancing Area

Obligation to cooperate at regional level

LFC Area or
Monitoring Area

LFC Area or
Monitoring Area

...

LFC Area or
Monitoring Area

Link
established
in Balancing
Code

Link
established
in LFC&R
Code

Responsibility: Area Process Obligations

TSO 1

TSO 2

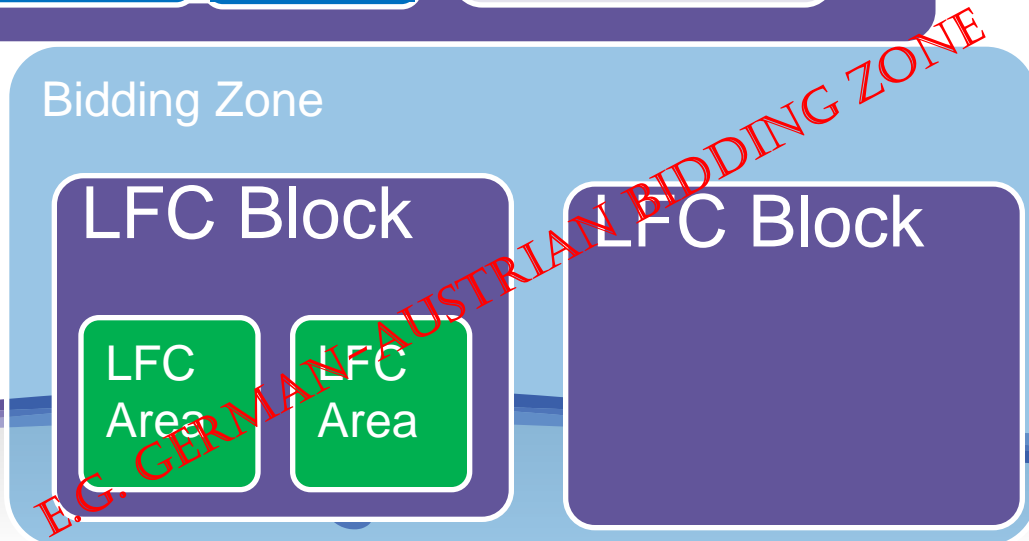
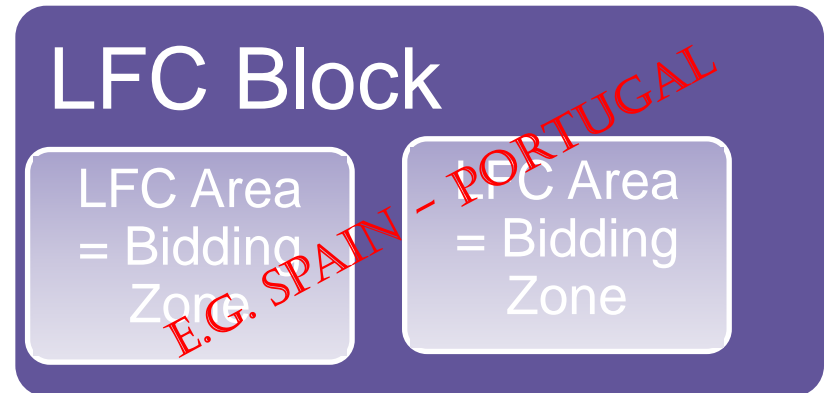
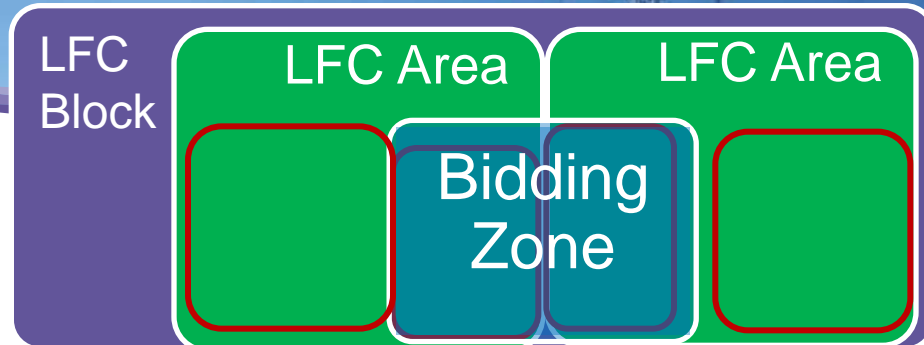
...


TSO n

NC EB uses
the term
“Relevant Area”
to describe the
Area controlled
by an individual
TSO

Relationship with other Areas – Various settings are possible

The Area Definition Proposals are flexible enough to accommodate today's market and control structures





Chapter 3, Section 1

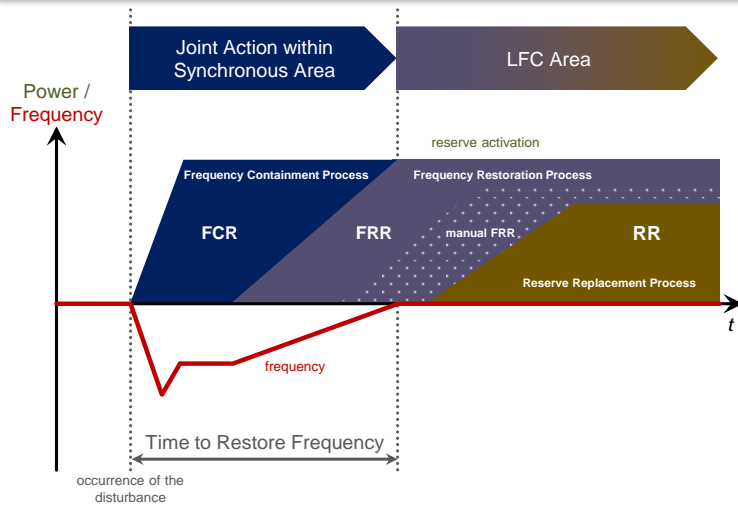
Reserve and Energy Products

Reserve and Energy Products



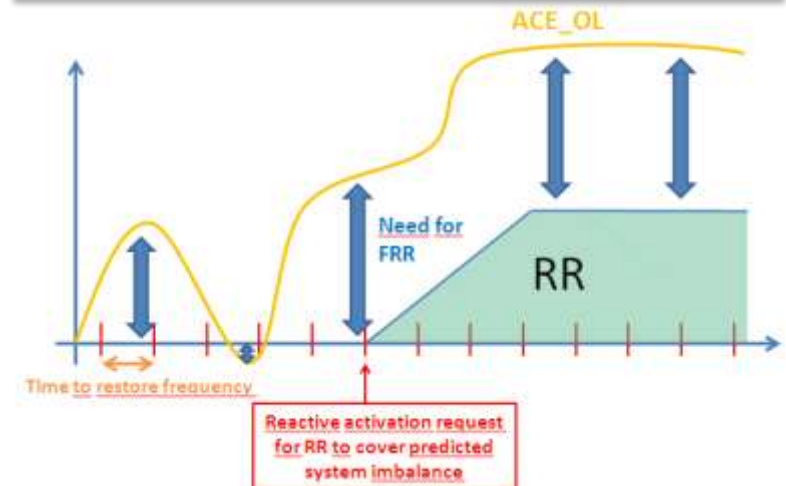
What for?

Restore the system balance



Anticipate potential imbalances

In the absence of incentives for BRP to help to restore system imbalances



Deal with

FCR

FRRa

FRRm

RR

Meet the needs of the TSO for system balance

Flexible products

Compliant with requirements from NC
LFC&R
(and Ad Hoc Team Deterministic
Frequency Deviation)

Include constraints from BSP

Open to conventional,
RES, demand sources

Competition

Open

Transparent

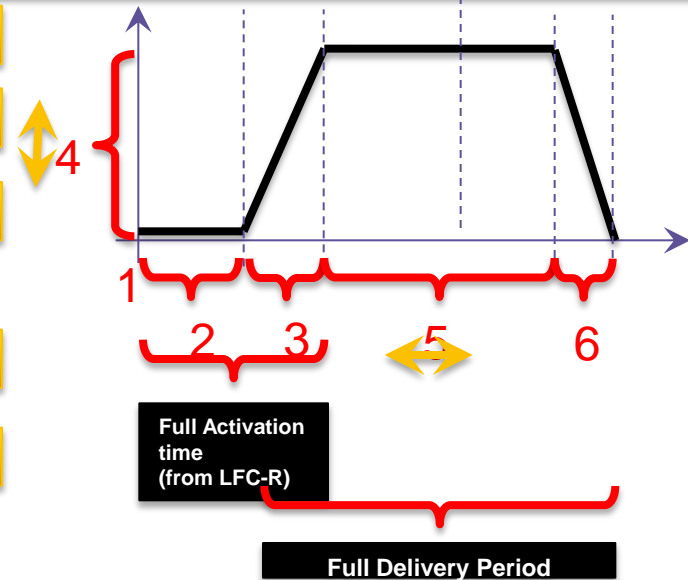
Non discriminatory

Reserve and Energy Products

Standard Products

1- Request time	2- Preparation period
3- Ramping period	4- Min & max bid size
5- Min & max delivery period	6- Deactivation period
Mode of activation	Divisibility
Location	Validity period

Common at synchronous area level

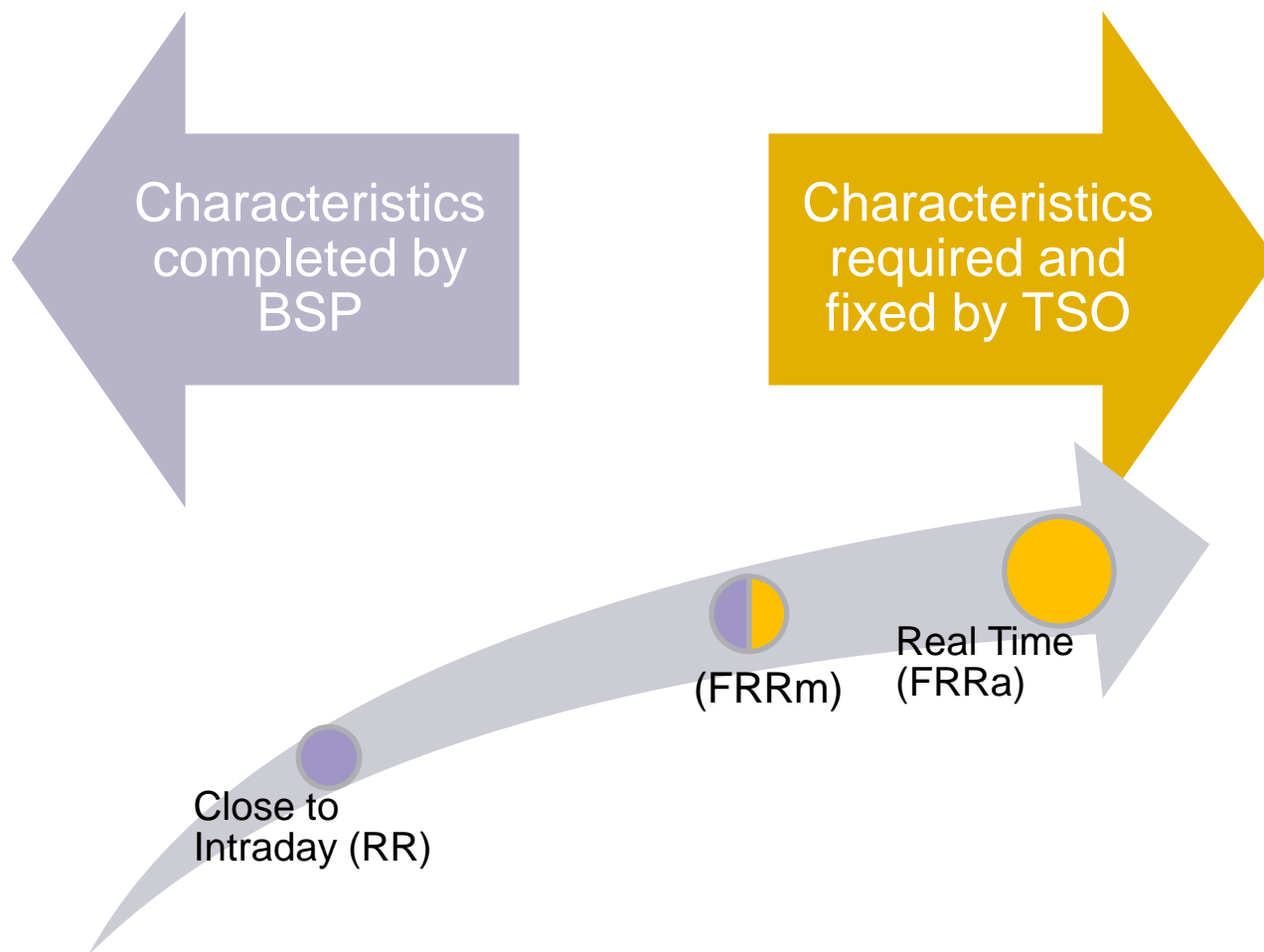


Specific Products

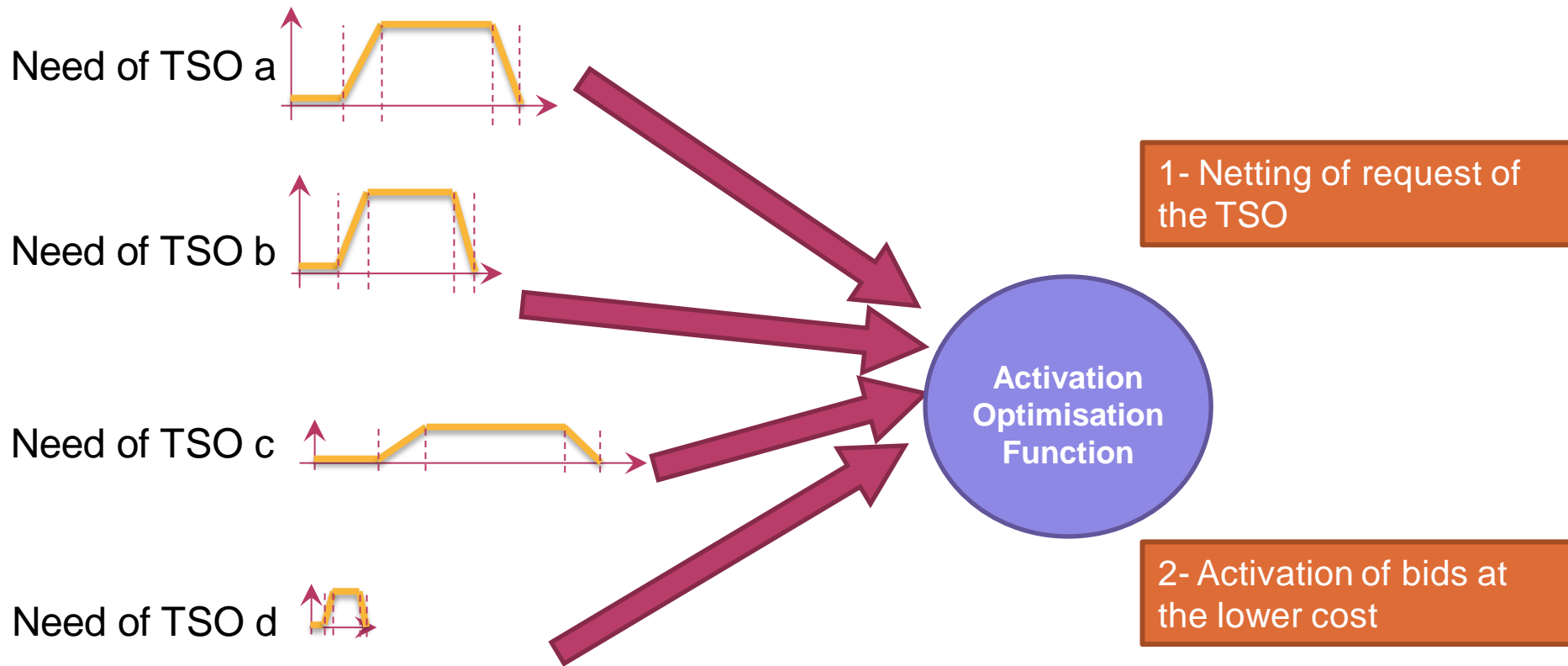
Additional or other characteristics


Control area level

Reserve and Energy Products



Reserve and Energy Products – activation, example for RR products





Chapter 3, Section 2

Procurement of Balancing Reserves

Technical

NC LFC&R:

Determine required **volumes** and **distribution of reserves** to ensure operational security

- Dimensioning of reserves
- Technical limits for exchange, sharing and cross-border activation of reserves

Technical requirements to ensure **safe exchange / sharing / cross-border activation of reserves**

- Need for available transmission capacity
- Fall-back solutions,...



Market

NC Electricity Balancing:

Provision of required reserve volumes (within the limits for distribution set by NC LFC&R)

Optimized activation of reserves (energy) available in the system

Mechanisms to ensure the **available transmission capacity** for sharing / exchange / XB activation of reserves

What is the approach prescribed in the NC?

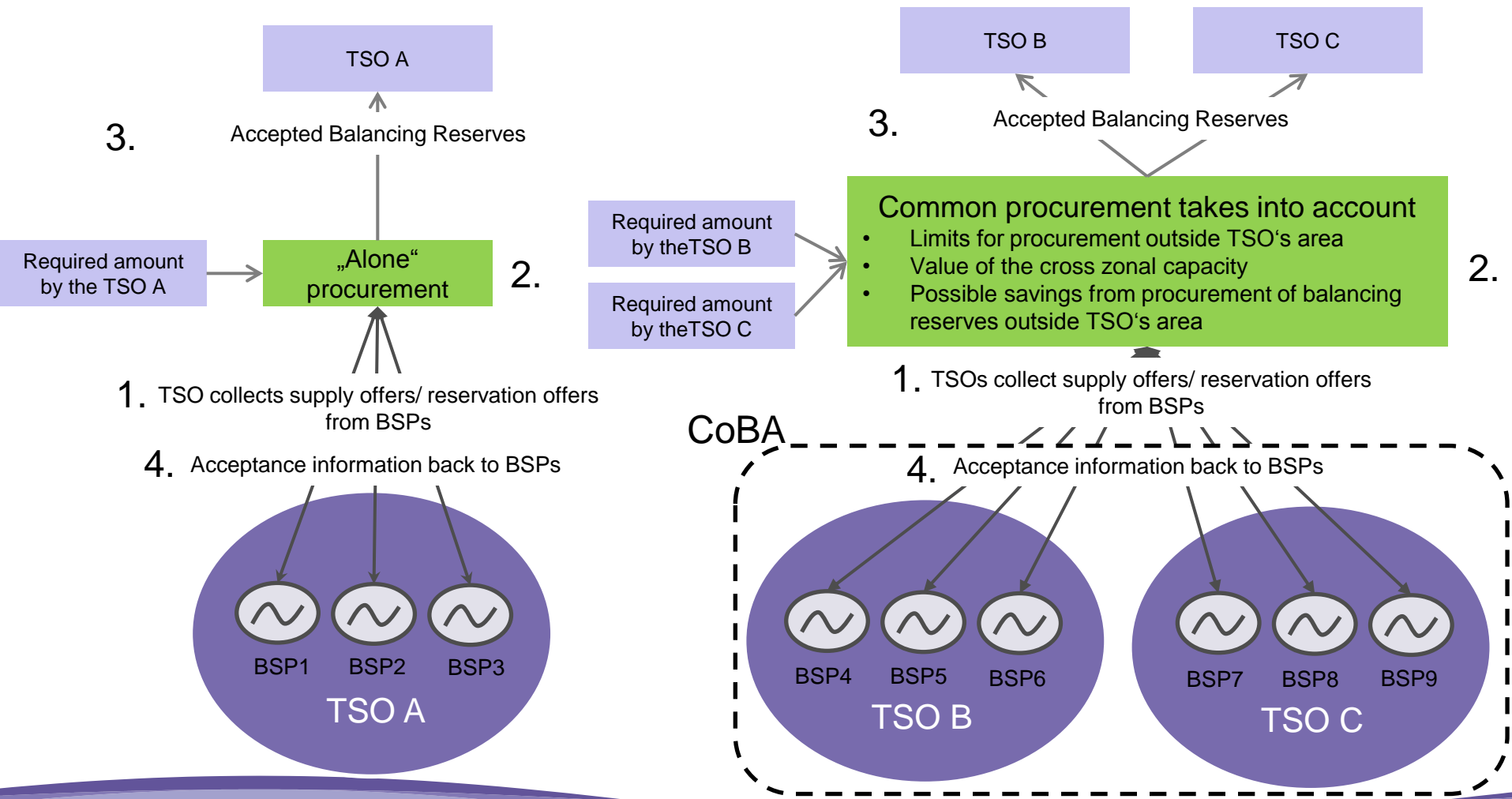
- **Terms and conditions related to Balancing defines rules for procurement of Balancing Reserves**
- **Exchange or sharing of Balancing Reserves is not mandatory but optional**
- **If exchanging or sharing TSOs have to use Standard Balancing Reserve Products and establish a Coordinated Balancing Area**
- **TSO-BSP model is allowed as an intermediate step**

- **Contract for a longer contract period than 12 months has to be approved by NRA**
- **FRR and RR reserves have to be procured separately for upward and downward direction, NRA might approve common procurement under certain conditions prescribed in the NC**
- **BSP's counterparty is a TSO in its area (TSO – TSO model)**
- **BSP has the possibility to transfer its obligation to deliver a Balancing Reserve to other BSP(s) under certain conditions**
- **Secondary market with Balancing Reserves is possible but not mandatory**

Exchange or sharing of Balancing Reserves

- **TSOs establish a Coordinated Balancing Area for a standard balancing reserve product to be exchanged or shared**
- **Harmonise necessary rules**
- **Each TSO defines an amount which can be procured outside its relevant area taking into account limits set by NC LFC&R**
- **TSOs analyse a need for reservation of Cross Zonal Capacity and if necessary they secure it**
 - Approaches are listed in chapter 4 of the EB NC
- **The procurement is performed**

Comparison of a procurement without CoBA and within CoBA



Transfer of obligations of Balancing Reserves

1- Procurement

Market based

Non discriminatory

Foster competition

Required amount
by the TSO B

Required amount
by the TSO C

TSO B

TSO C

3. Accepted Balancing Reserve Bids

Common procurement takes into account

- Limits for procurement from other area
- Value of the cross zonal capacity
- Possible savings from procurement of balancing reserves in other area

2.

1. TSO collects supply offers/ reservation offers from BSPs

CoBA

4. Acceptance information back to BSPs



BSP4 BSP5 BSP6

TSO B



BSP7 BSP8 BSP9

TSO C

Transfer of obligations of Balancing Reserves

1- Procurement

2- Transfer of obligations

Foster Competition

Non discriminatory

Shorter timeframes

TSOs shall be informed



Selected BSP after procurement of reserves by TSO

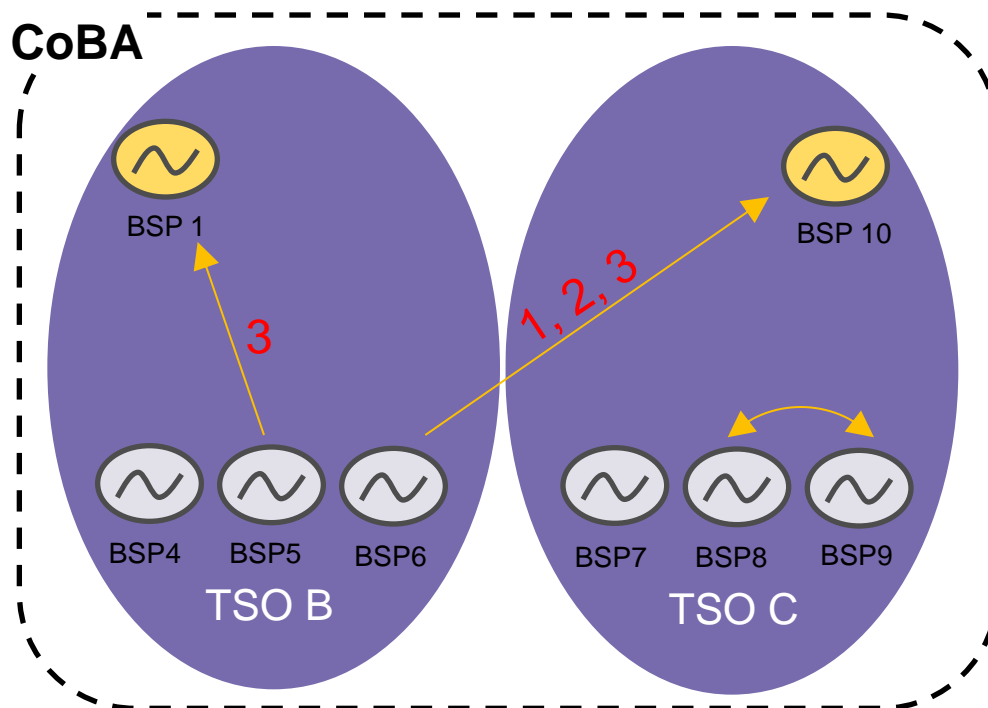



BSP of a CoBA which fulfils with prequalification

Transfer of obligations of reserves takes into account

1. Limits for procurement from other area
2. Value of the cross zonal capacity
3. Fulfilment with qualification process

CoBA



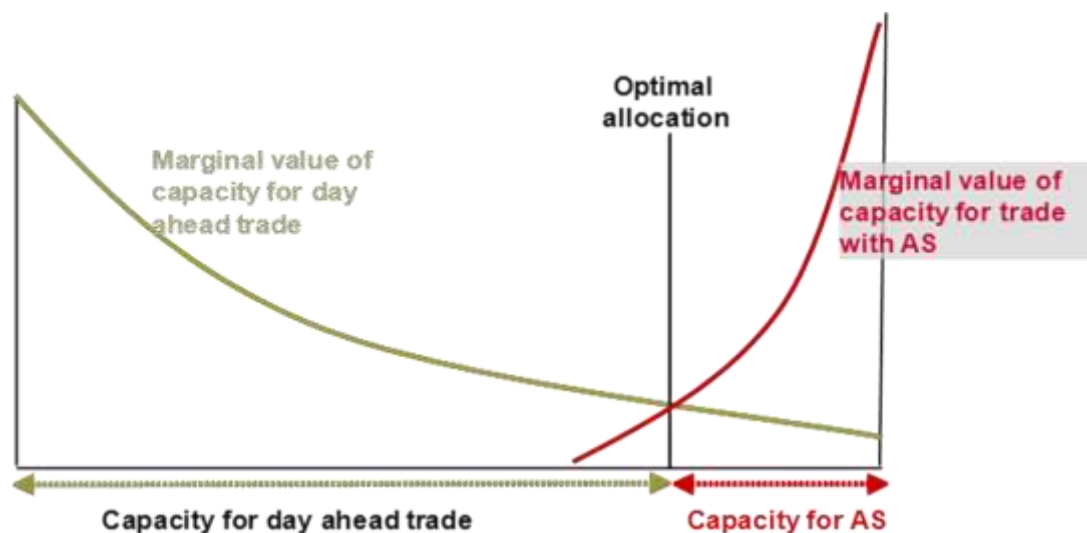


Chapter 4

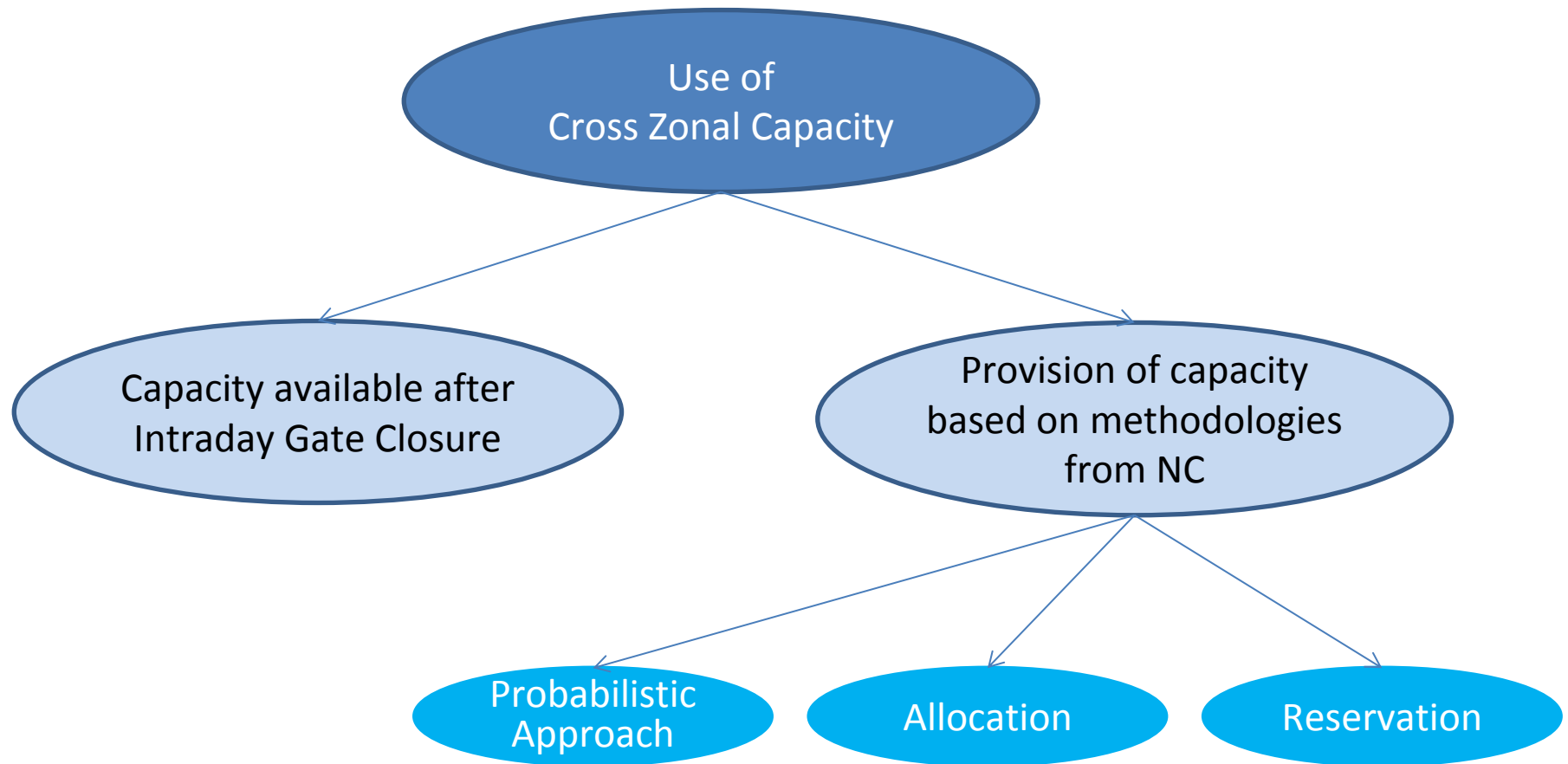
Use, Allocation & Reservation of Capacity

Target of Chapter 4

- **Maximise value of exchange on interconnector capacity**
 - Not endanger the secure operation of the system
 - In line with relevant Codes (CACM, LFC&R)



Different ways which TSOs can use capacity for Exchange of Balancing Services

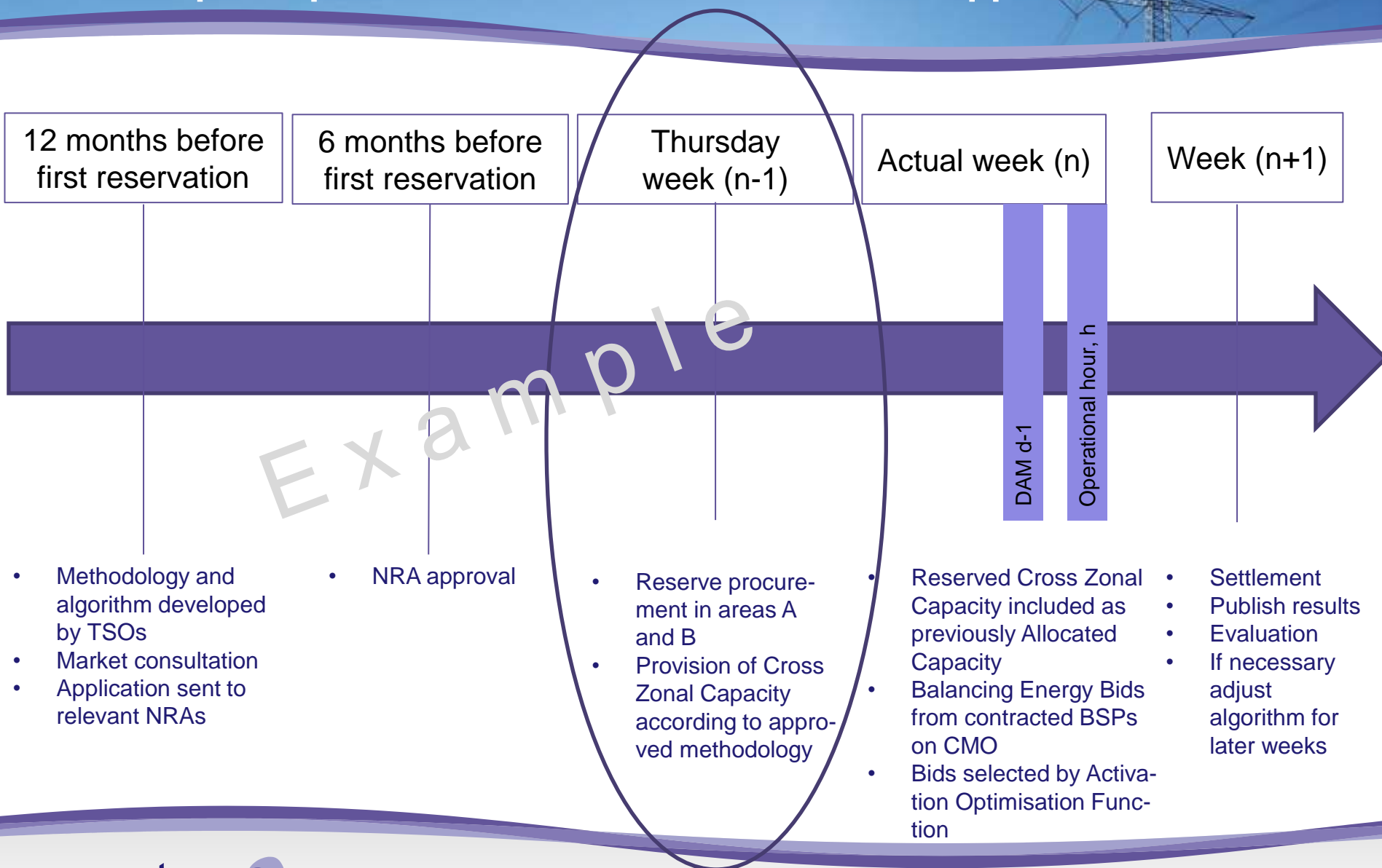




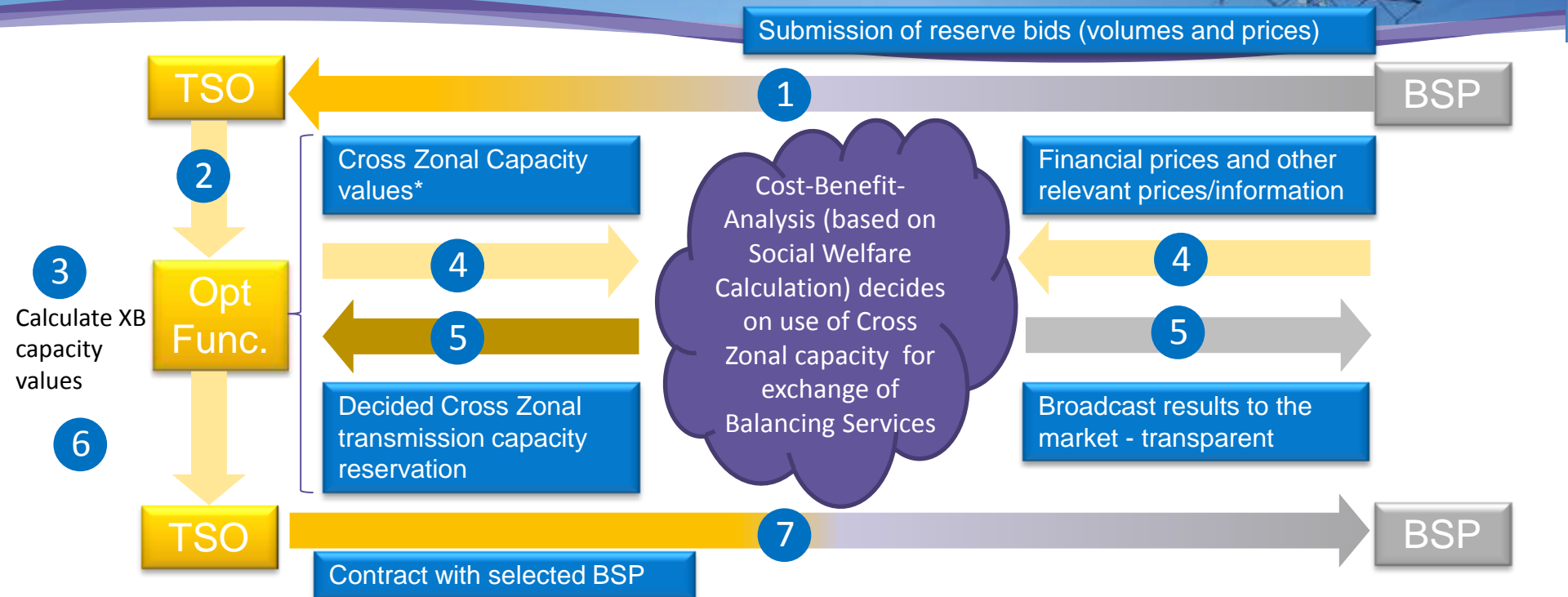
- **For all Capacity provision methodologies:**
 - Capacity is provided to the product where it yields the largest welfare
 - Pricing of capacity consistent with other time frames and products
- **Reservation and co-optimisation can be arranged in multiple ways**
 - Normally based on real or assumed price differences between standard energy and balancing products

Provision of capacity based on reservation methodology

Example of process: short term market based approach



Short term market based reservation – Cross Zonal Capacity reservation based on available price information



1 National TSOs collect reserve bids from national BSPs

2 TSOs submit bids and local reserve needs to common platform

3 Reserve Procurement Optimisation Function calculate XB capacity value (willingness to pay based on spread between reserve bids)

4 Left: submit results of no 3 to Cost-Benefit Analysis

4 Right: collect financial prices and other indicators of price differences in "ordinary" energy market (must be public prices / transparent data)

----- Run the algorithm -----

5 Output: Results of algorithm back to TSOs, how many MW X Zonal capacity will be reserved for exchange of balancing service

5 Broadcast X Zonal capacity reservation results to market

6 Transfer of "clearing results" of balancing reserve bids to national TSOs

7 Contract between TSO and BSP for exchange of balancing reserves (where connecting TSO contracts exchanged volumes nationally in addition to national obligation. Receiving TSO contracts nationally with TSOs less than national obligation)



Chapter 5

Settlement

- **Non discriminatory**
- **Objective, fair, transparent**
- **Effective competition, market**
- **Appropriate (= no perverse) incentives to all**

but:

- **Limited distortion to adjacent markets**
- **Account for regional specificities market design**

- **TSO – BSP**
 - Relevant Area
- **TSO – BRP**
 - Relevant Area
- **TSO – TSO('s)**
 - Coordinated Balancing Area (CoBA)
 - Common Merit Order List (CMOL)
 - Synchronous Area (SA)
 - Between Synchronous Area's

- **Frequency Containment Process (optional)**
- **Frequency Restoration Process**
- **Reserve Replacement Process**
- **Adjustment of requested energy to associated BRP**
- **Per direction, relevant area, time unit, marginal pricing (pay-as-cleared), unless ...**



- **No Connections exempted; based on:**
 - Notified Position
 - Allocated Volume
 - Adjustments
- **Per direction, relevant area, time unit**
- **Encourage BRPs to be balanced as close to the physical reality as possible, or help the system to restore its balance; price aggravating imbalance not less/more than average (=marginal for single pay-as-cleared MOL) balancing energy FRR/RR; other direction open...**



- Frequency Restoration Process (1 to 1, CMOL)
- Reserve Replacement Process (1 to 1, CMOL)
- Unintentional deviations (SA: 1 to n, DC: 1 to 1)

Requires accounting/settlement *intended* deviations:

- Imbalance Netting Process (1 to n, CBA)
- *Frequency deviation (SA:1 to n; DC: n.a.)*
- *Ramping Period or agreed Ramp Rate Process (SA: 1 to n, DC: 1 to 1)*

- **Financial disinterest TSO**
- **Fair and equal distribution of cost/benefit**
- **No perverse incentives**
 - BSP (non-delivery)
 - BRP (gaming)
 - TSO (free-riding)

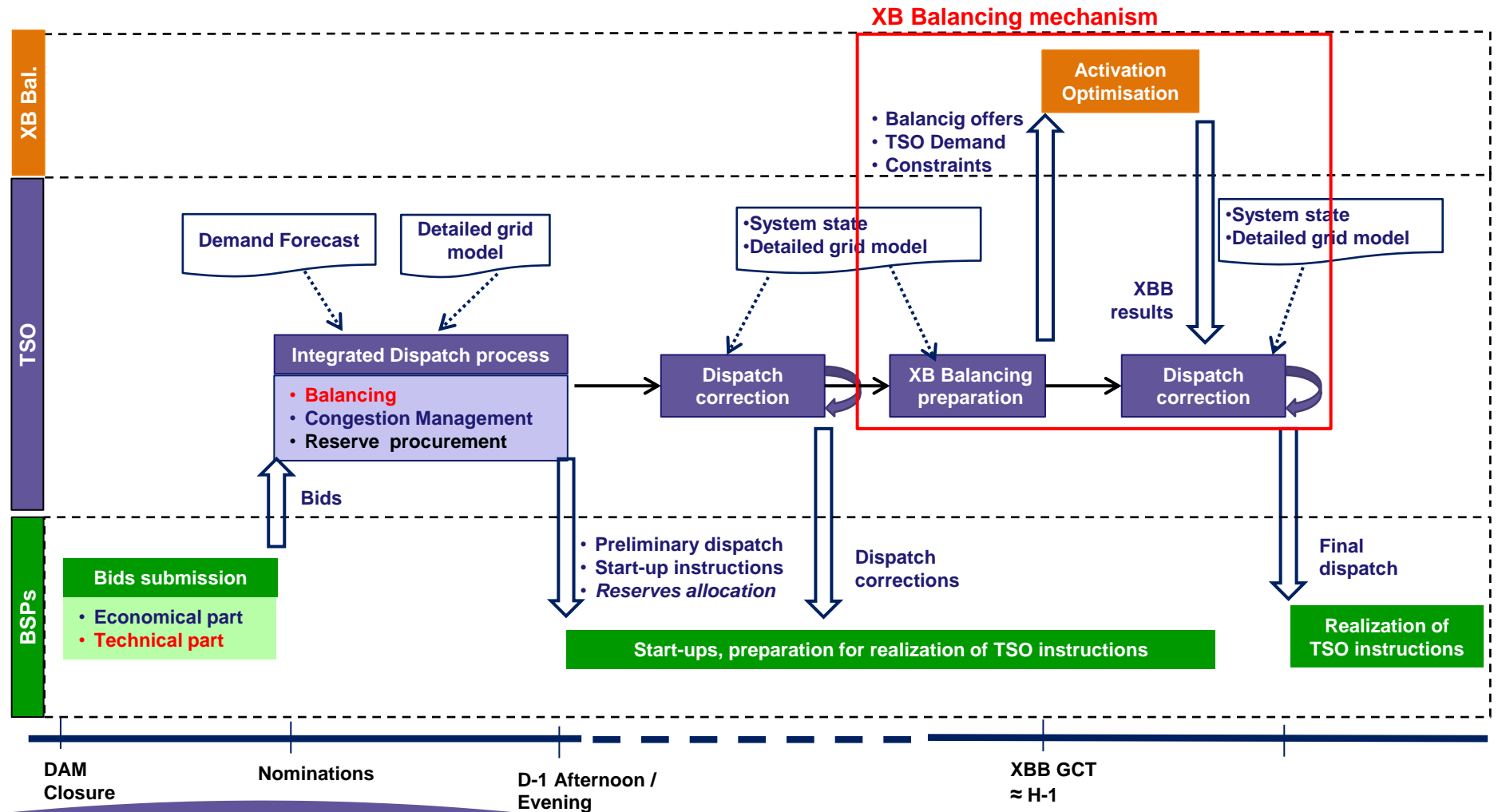


Central Dispatch Systems



- **TSO determines the commitment and load of majority of resources (generators/demand) in whole Relevant Area**
 - based on bids and technical parameters provided by market participants
 - Typical objective: minimisation of energy delivery cost to meet system demand as forecasted by the TSO while complying with operational security requirements
 - Dispatch instruction issued directly to the resources
- **Integrated process of: Balancing, congestion management and procurement of reserves**
- **TSOs from Central Dispatch Systems act as a BSPs towards other TSOs**

Central Dispatch Systems - Balancing





- **Allowance for preparation of Balancing offers by TSO (Art. 16.2)**
 - Based on BSPs' bids, dispatch results, future work plan, system state
 - Creation of feasible offers reflecting real possibilities and cost of their activation
- **Potential allowances for BSPs' bids submission (Art. 22.9)**
 - Bids needed before start of local integrated dispatch process
 - Limited possibilities to change submitted bids, due to on-going dispatch process (only availability of generating unit can be updated)
- **Fair, transparent, non-discriminatory, approved by NRA**

Central Dispatch Systems – Settlements

- **Main principles of settlements (also imbalance settlements):**
 - Incentivise market participants to follow TSO instructions
 - Specific for Central Dispatch Systems
 - Incentivise market participants to restore the system balance
 - Applicable both for Central and Self Dispatch Systems
- **No special settlements provisions for Central Dispatch Systems**