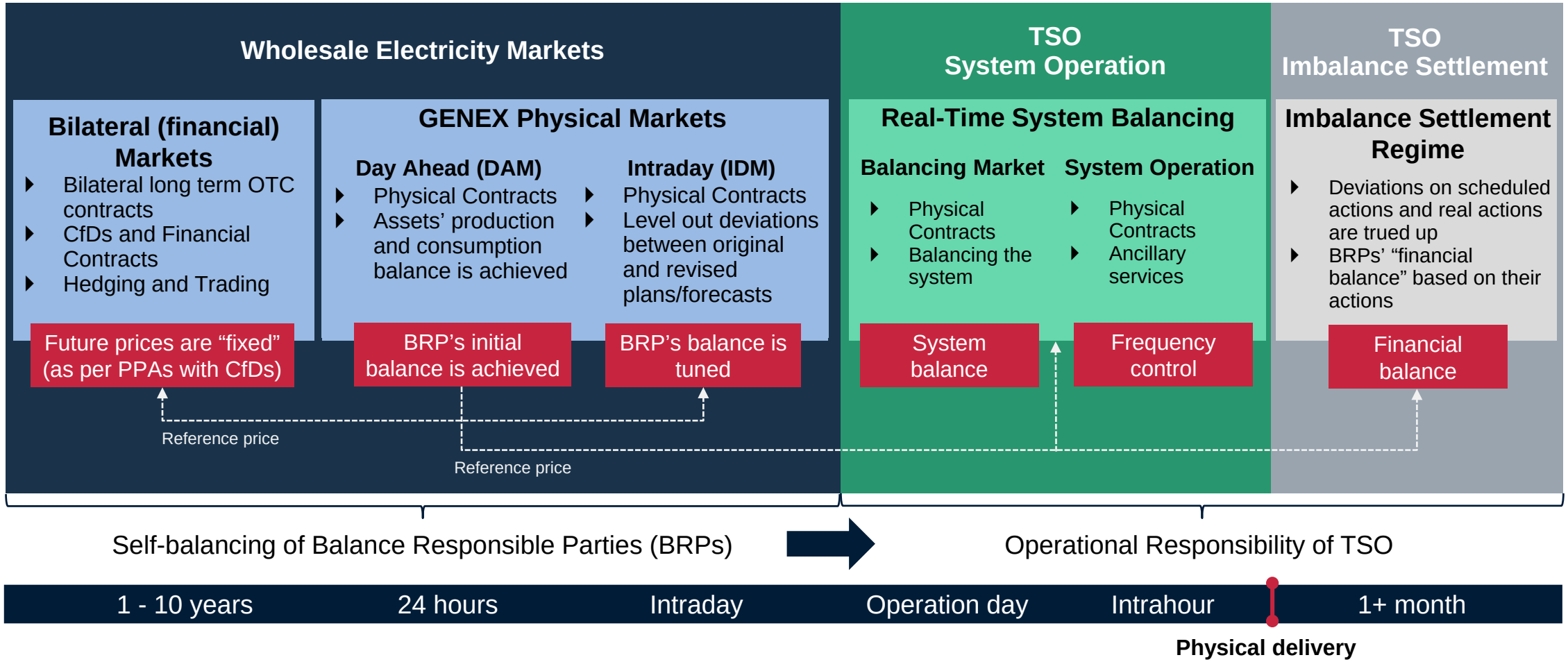
Georgia Electricity Market reform

Training balancing market

19th October 2020

Introduction

The target model contains several power market segments for individual purposes



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Roles and responsibilities

Role of BRPs & BSPs

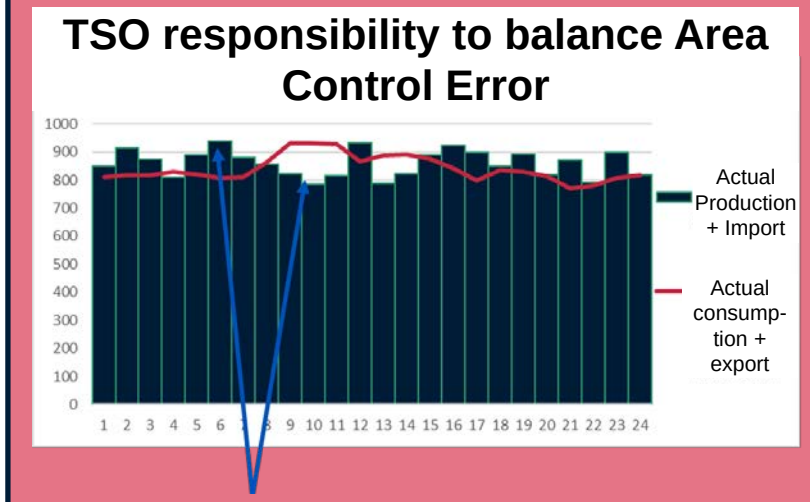
Generic definitions as proposed in the EC's New Market Design: *"Balance Responsible Party means a market participant or its chosen representative financially responsible for its imbalances in the electricity market*"

All market participants shall **aim for system balance and shall be financially responsible for imbalances** they cause in the system. They shall either be balance responsible parties or they may delegate their responsibility to a balance responsible party of their choice.

A BSP is a BRP that offers balancing services to the TSO via resources that he controls. The terms and conditions for becoming a BSP is set by the TSO and regulated in an agreement between the BSP and the TSO.

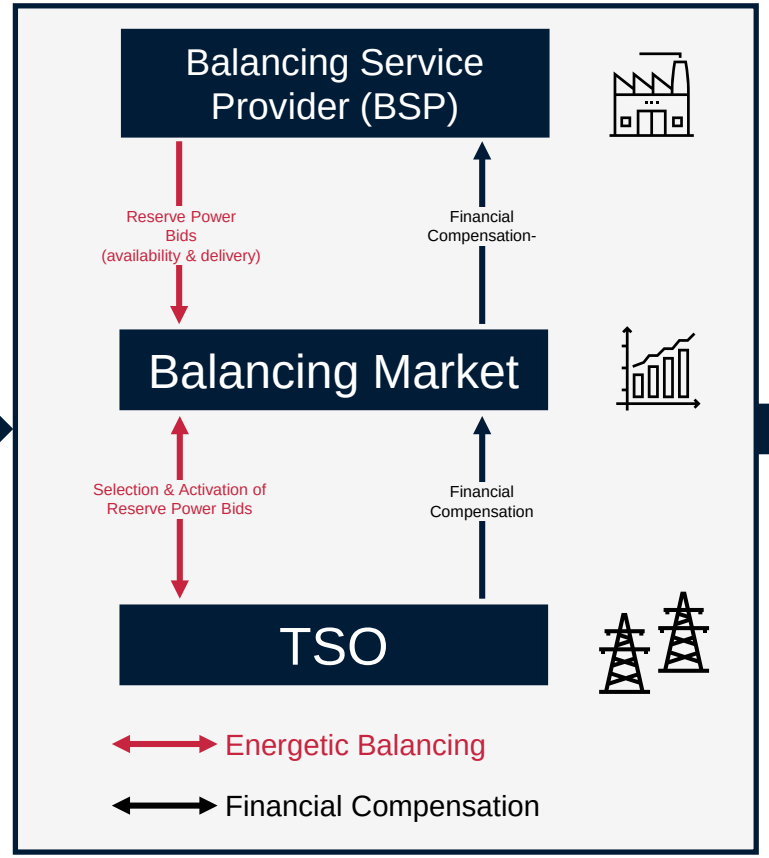
The TSO is responsible for balancing the system using the newly established balancing market

Residual aggregate imbalance

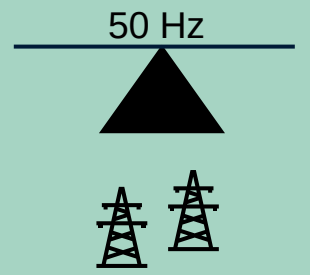


TSO's responsibility is to observe and assume responsibility for aggregate system imbalance remaining at real-time, so that power reaches (technically) safely to the consumers

Real-time balancing



System Balance



System in balance

TSO makes use of the balancing services procured through the balancing market to keep the system balanced

Why balancing?

Why balancing?

- Keep the **system frequency** within quality limits

- Trade positions can **differ** from real-time positions for all kinds of reasons
  - Forecasting errors, Unplanned generation outages, Self-dispatch imperfections, Congestion

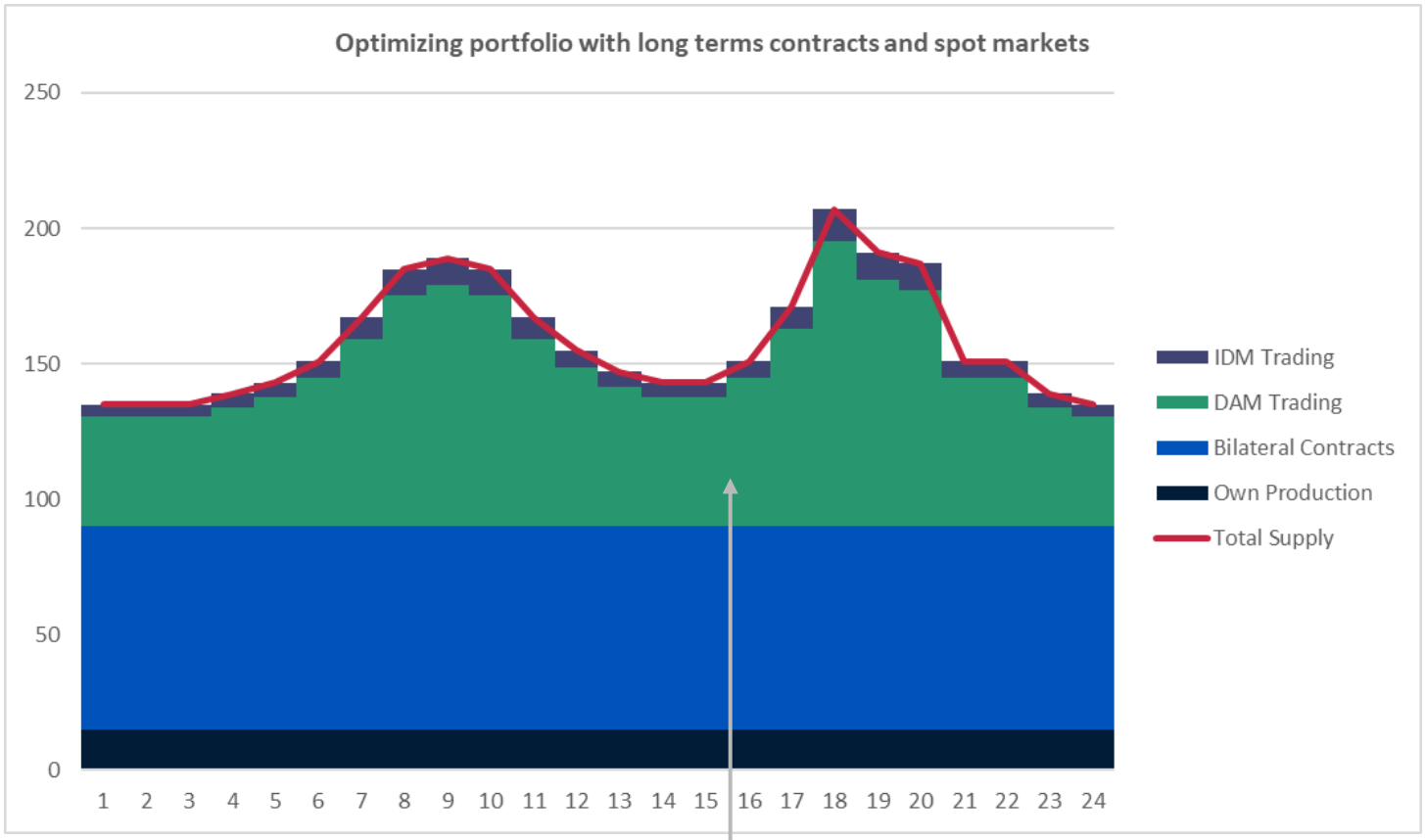
- A **balancing mechanism** is required that handles any deviations between trade positions and real-time positions of all market parties

- A balancing mechanism requires that **imbalances** can be allocated to and settled with accountable parties

- For this reason, **balance responsibility** is a necessary obligation for each market participant

The BRPs are maintaining balanced portfolios through the different market segments

- The BRPs need to **forecast and execute the portfolio** balancing activity as their daily routine & responsibility
- BRPs need to decide how to sell or cover their needs for electricity in the different market segments
- Own production and bilateral long term contracts will provide a base line of their planning
- Organised spot markets allow for **self-balancing** before physical delivery
- Residual system balancing is done by the TSO using the balancing market



Buying the difference between long-term contracts and estimated total supply from DAM/IDM = **self balancing**

Portfolio management with self-dispatching in the short-term markets opens new opportunities for BRPs

Self-Dispatch & Portfolio Management

- Management of own assets (generation and consumption)
- Determination of dispatch position based on own economic criteria
- Provides commercial independence
- Financially responsible for imbalances
- Portfolio Management needed

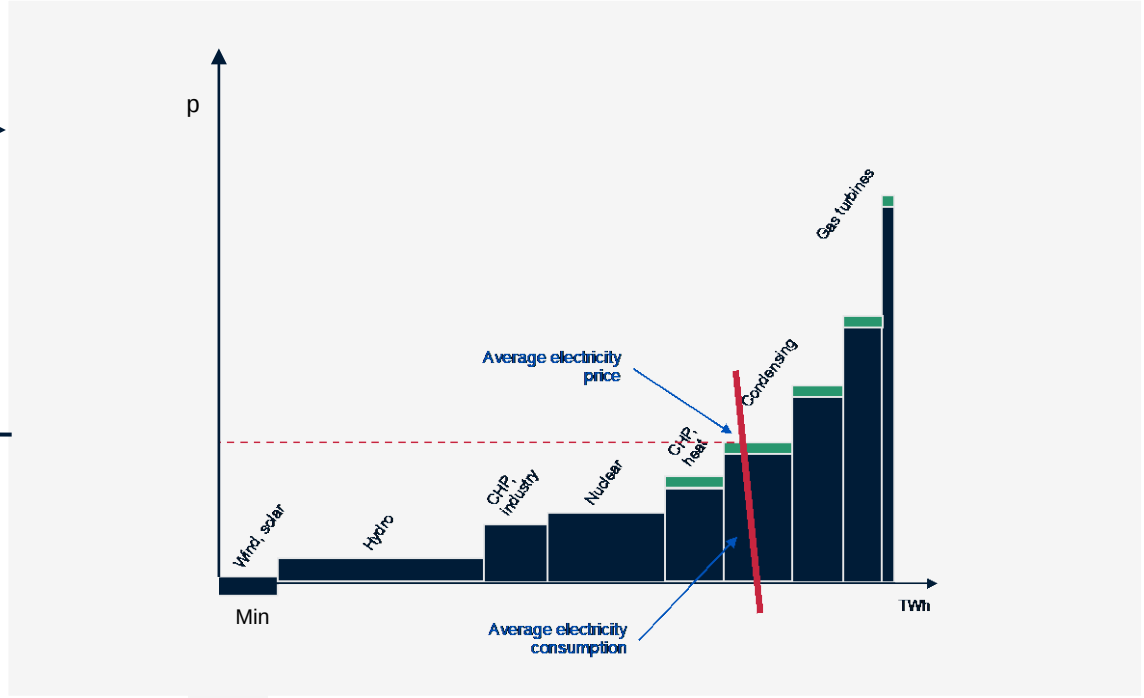
Day-Ahead Market price

< Marginal generation cost

- Purchasing energy is more attractive than own production
- Purchasing as much as possible, as it is cheaper than producing myself
- No energy production

> Marginal generation cost

- Own generation is cheaper than purchase from the market
- Use of own generation as much as possible
- Sell as much as possible, as it will give good profits

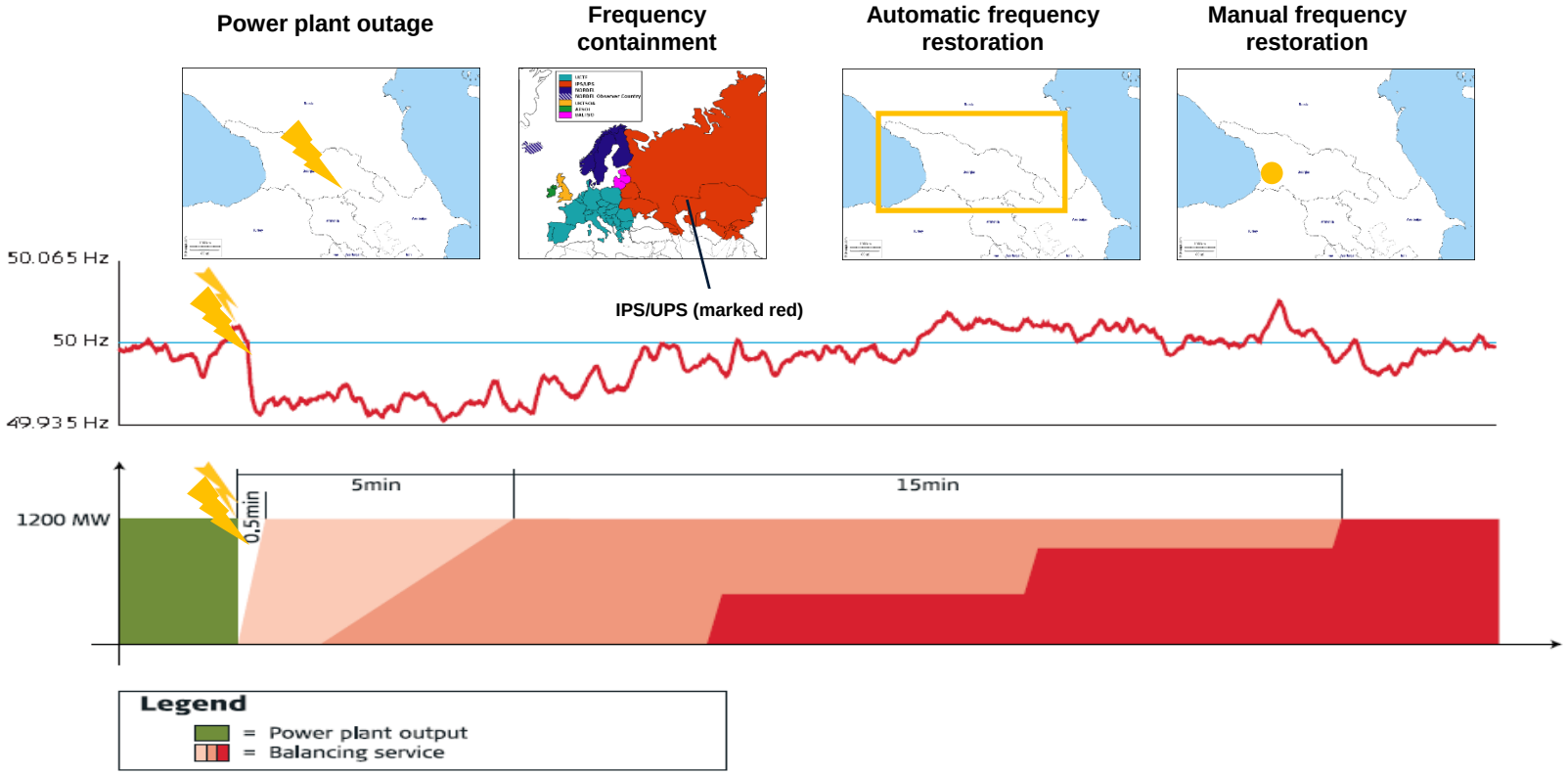


- A market-based Merit Order List is determined from all placed sell and buy bids. Since any activation is strictly based on ranking it is ensured that least-cost generation units are used
- Last activated bid sets the price for all production needed to meet demand
- Market structure incentivises marginal price bidding of participants

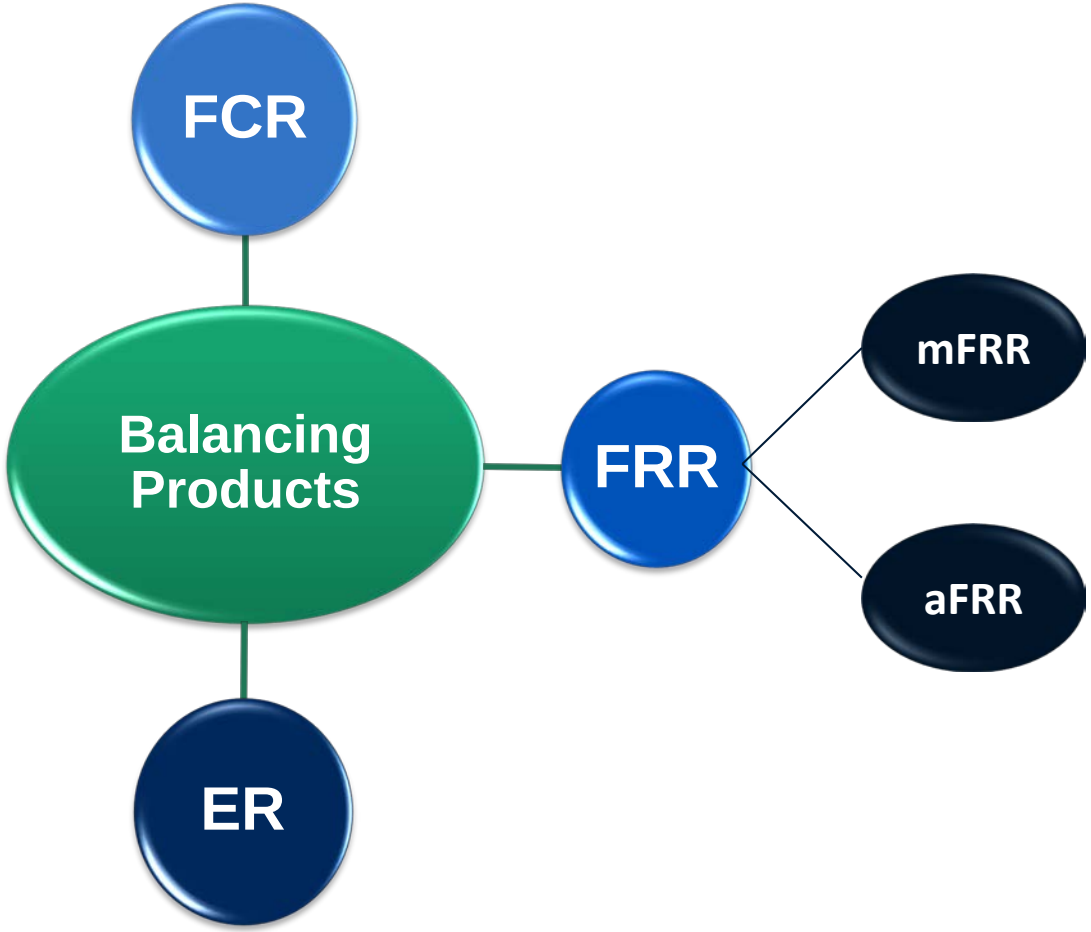
Balancing Market Products

Load-Frequency-Control in IPS/UPS: How are TSOs organized to maintain balance?

Technically, this is achieved within the synchronous electricity grid of the IPS/UPS by a three-stage regulation procedure (frequency containment, frequency restoration, reserve replacement). The following example is of a power station failure in Georgia. In the entire region (IPS/UPS – red region in map), FCR is activated directly. After 30 seconds, aFRR is automatically called up in Georgia, and replaced after 15 minutes by mFRR, in this example provided by other power stations in Georgia.



Balancing Products



FCR - Frequency Containment Reserve

FRR - Frequency Restoration Reserve

aFRR - Automatic Frequency Restoration Reserve

mFRR - Manual Frequency Restoration Reserve

ERf - Fast Emergency Reserves

ERs - Slow Emergency Reserves

Two product categories will be provided by BSPs under the new market-based approach

Balancing Capacity

- **Purpose**
  Contractual requirement that ensures that TSO has sufficient balancing energy at its disposal when needed
- **Allocation of Balancing Capacity Costs**
  - Balancing capacity costs are allocated to all system users via application of the system services tariff

Balancing Energy

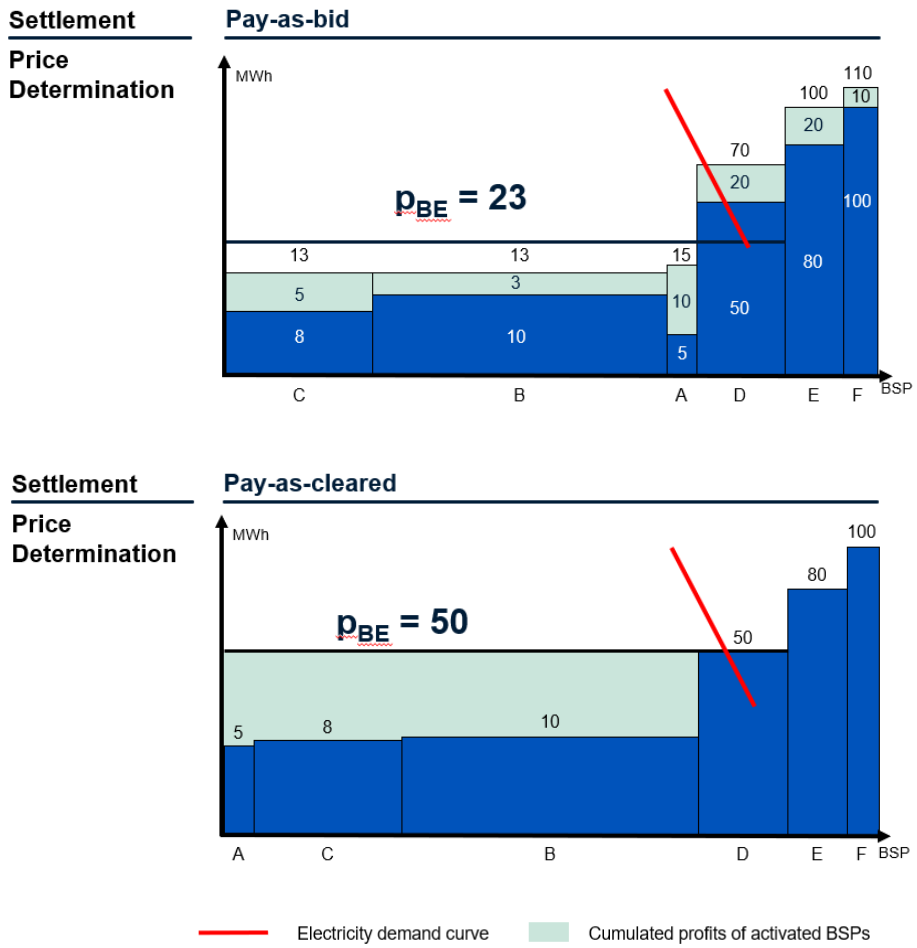
- **Purpose**
  Real-time adjustment of balancing resources to maintain the system balance and restore system frequency
- **Allocation of Balancing Energy Costs**
  - Imbalance Settlement serves to allocate the balancing energy costs to the BRPs relative to their energy imbalances

Balancing products are procured for both upward and downward regulation for FCR, aFRR, mFRR

Different pricing mechanisms apply for balancing capacity and balancing energy

Balancing Capacity
• Remuneration according to the pay-as-bid principle • Pricing mechanism based on total costs • Prices reflect total cost • Fixed Price Components as Investments can be compensated

Balancing Energy
• Remuneration according to the pay-as-cleared principle • Pricing mechanism based on marginal costs • Good approximation of the full value of requested balancing energy



Balancing Group – Base set-up

Basic set-up of the market roles

BRP Agreement with GSE
(Calculated imbalance will be settled through this account)

1 : n (One BRP can have more than 1 Balancing Group)

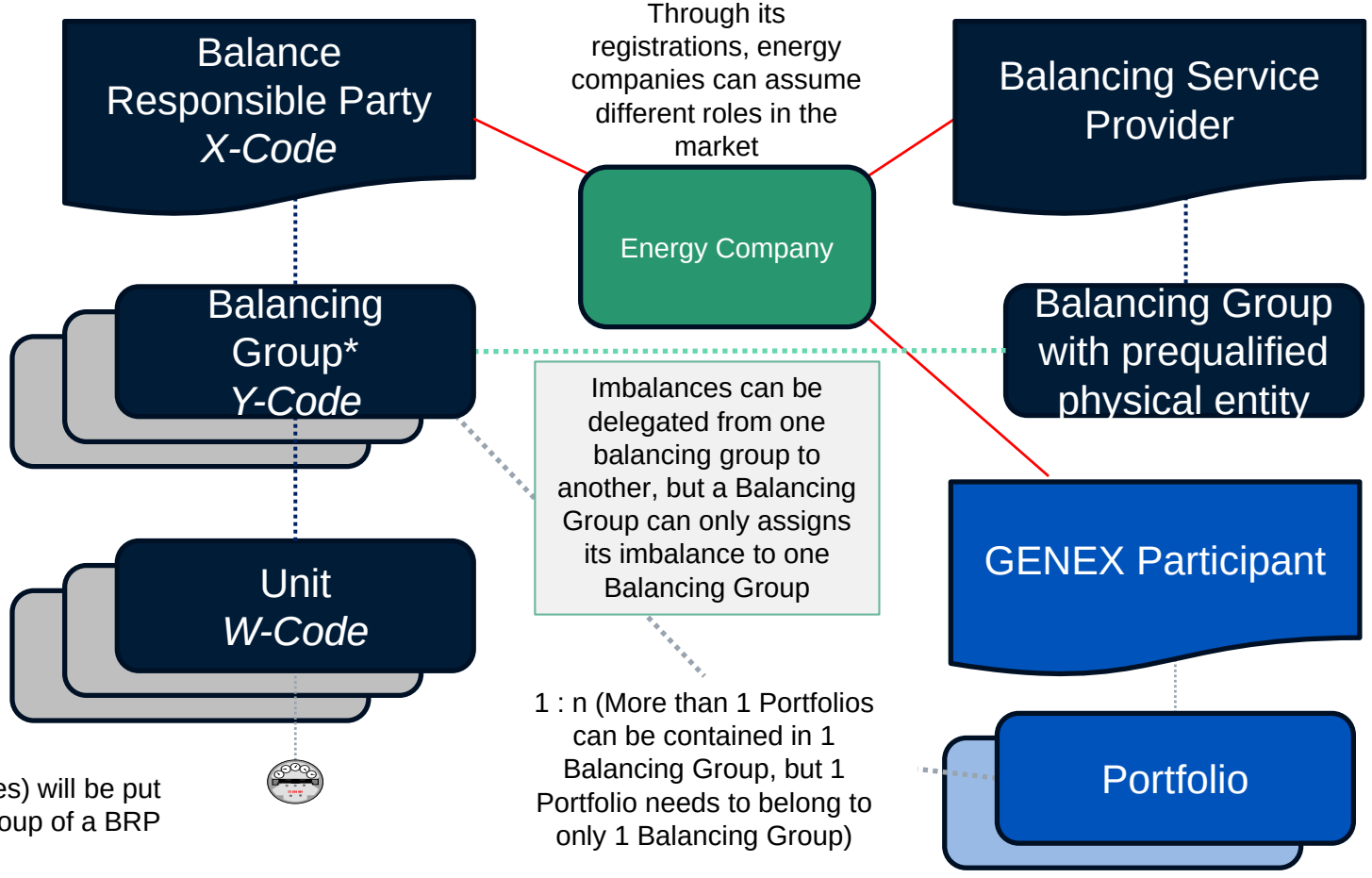
Registered at GSE

1 : n (One Balancing Group can be assigned the imbalance of more Balancing Groups)

Definition of physical entity (consumer, generator)

1 : n (meter point ID)

*Specified power plants (resources) will be put mandatorily to a separate balancing group of a BRP



BSP Agreement with GSE
(Procured balancing capacity and energy will be settled through this account)

1 : n (One BSP can have more than 1 Balancing Groups with 1 prequalified entity (for each product) in each)

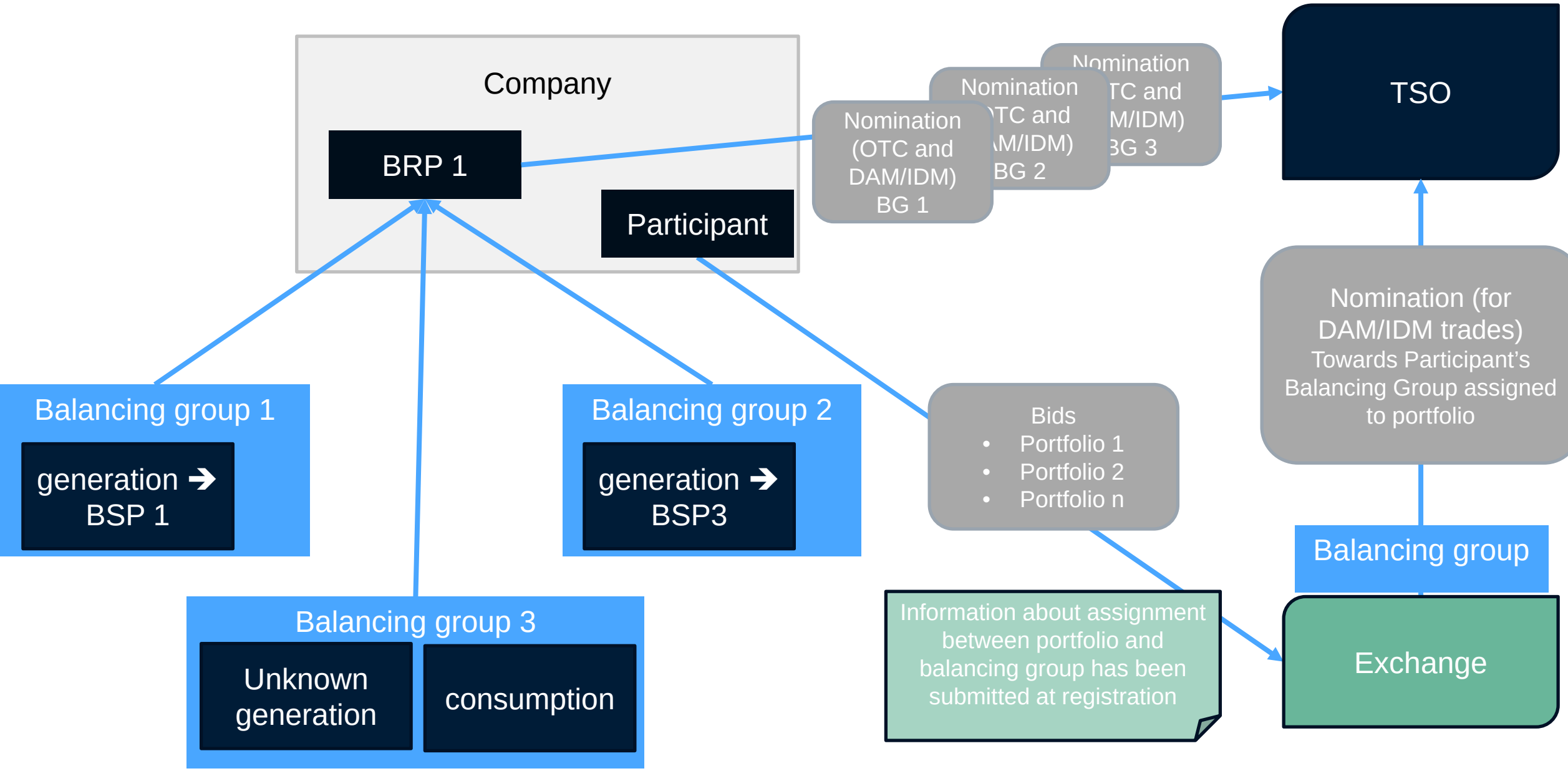
Participant Agreement with GENEX
(DAM/IDM results will be settled through this account)

1 : n (One Participant can have more portfolios)

Registered at GENEX

Registration for certain role | Assignment of Balancing Groups | Nomination | Assignment of imbalance | Role of a company

High-level view at nominations



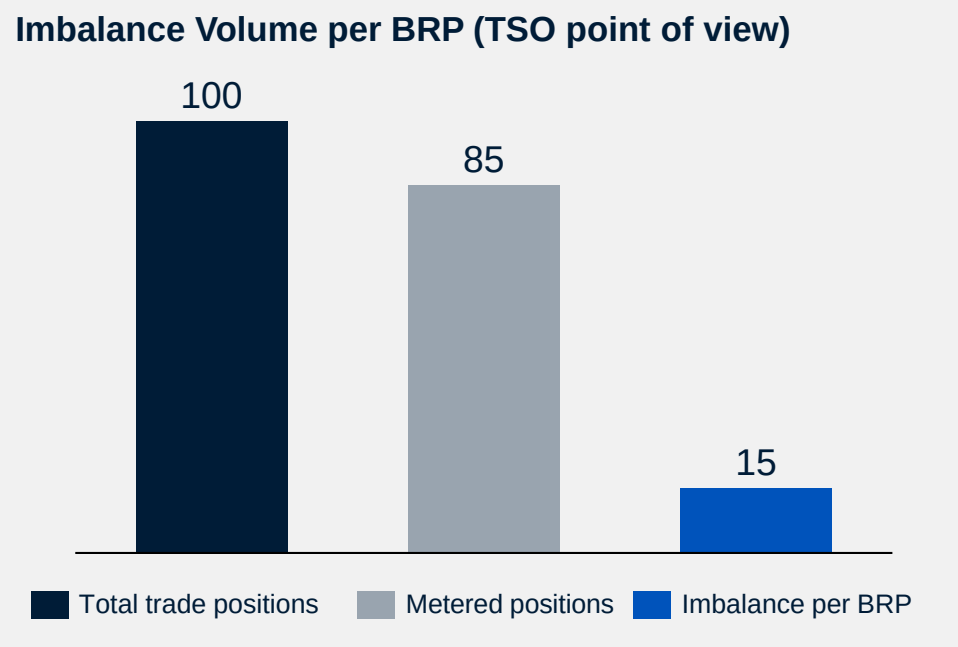
Settlement and Pricing

The imbalance settlement process aims at incentivising BRPs to avoid system imbalances

The difference between scheduled transactions and actual (metered) behaviour is the BRP's imbalance

TSO charges BRPs with an imbalance price based on their imbalance & the overall costs of system balancing

Imbalance Settlement incentivises BRPs to reduce their imbalance in future



Calculation of imbalance volumes

Calculation of imbalance prices

Imbalance Settlement

Imbalance Volume is netted Energy Flows per BRP Balancing Group within an ISP (1/2)

Imbalance Description

“ The sum of the trades of a BRP (buy and sell) to others should match the net energy infeed/withdrawal over the connections for which the BRP carries responsibility. In order to assess this, the following volumes are therefore defined:

- $E_{p,n}$ – A notified position (scheduled position) reflecting the final net volume of commercial transactions on all timescales on organized markets or between BRP’s
- $E_{alc,n}$ – An allocated value (usually based on metered values or profiled values), reflecting the net volume of physical generation and consumption over the connections for which the BRP is responsible for the Imbalances
- $E_{adj,n}$ – An adjusted volume reflecting the Activation of Balancing Energy Bids from the associated with this BRP, at least at Balancing Energy Bid level

Imbalance Equation

$$E_{imb,n} = E_{alc,n} - E_{p,n} + E_{adj,n}$$

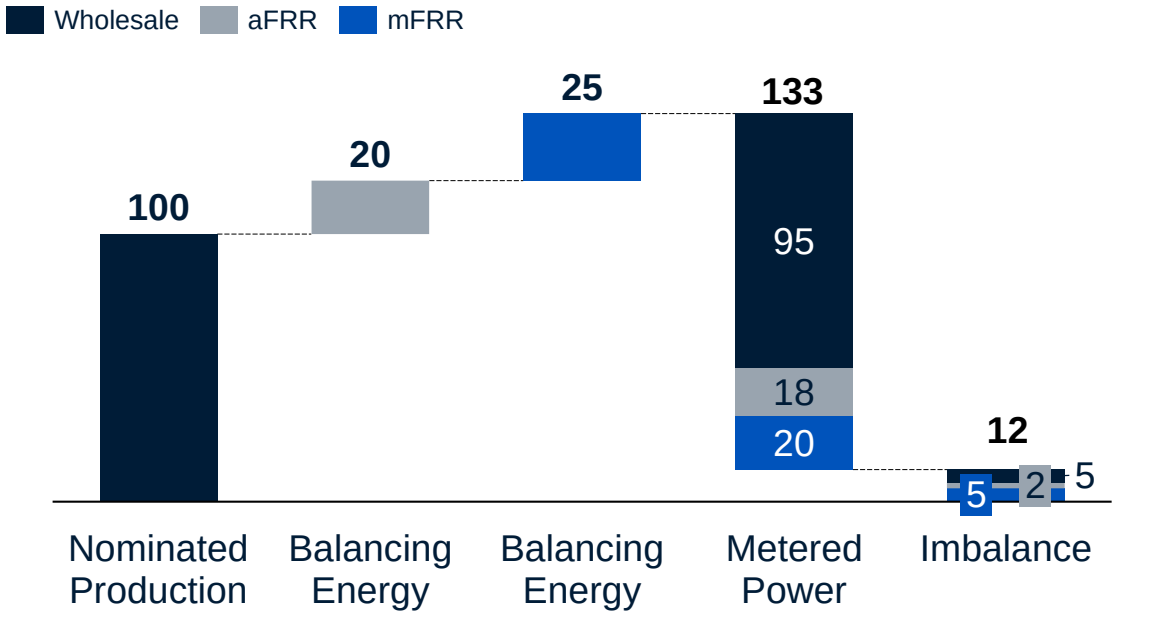
BRP Imbalance per ISP is either

- short (-),
- long (+) or
- neutral (0)

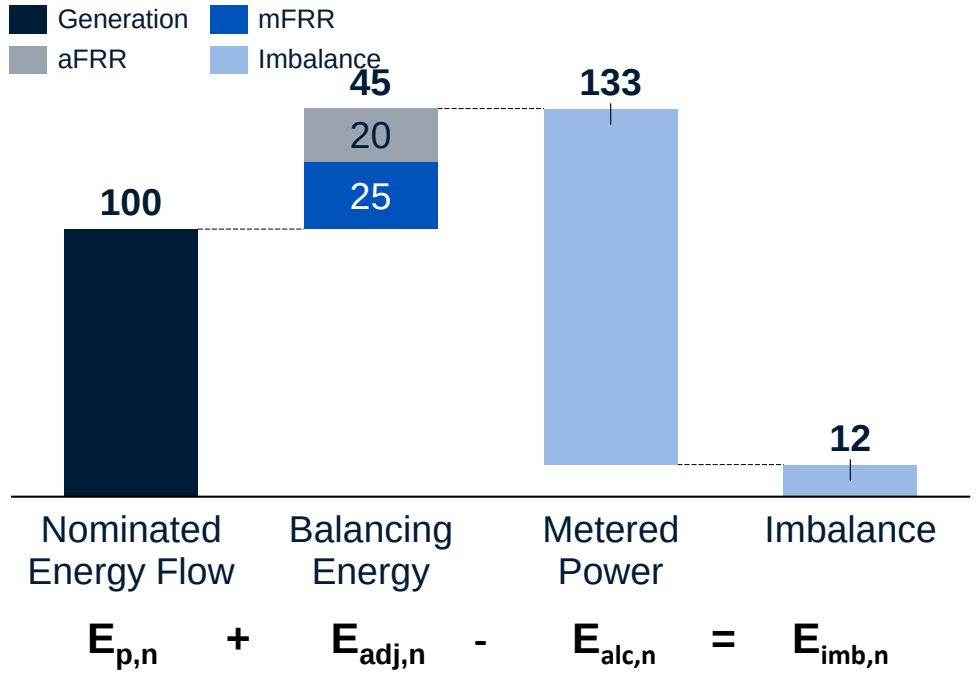
A BRPs imbalance per ISP is either short (-) or long (+). Alternatively, a BRP might have no imbalance.

Imbalance Volume is netted Energy Flows per BRP Balancing Group within an ISP (2/2)

What the BRP does



What the TSO sees



$$E_{p,n} + E_{adj,n} - E_{alc,n} = E_{imb,n}$$

The imbalance of each BRP is accounted for in one total system imbalance per ISP.

The imbalance settlement price is calculated for each ISP

Net Transaction Result per ISP

- To balance the system the total Net Transaction Result must be settled by the TSO for each ISP.
- The total Net Transaction Result reflects all physically requested delivery commitment bids of each product per ISP. That means there is a Net Transaction Result for each Product (e.g. aFRR, mFRR)

$$NTR_{BE,ISP} = \sum NTR_{BP,ISP} = \sum Income_{BE,ISP} - \sum Expenses_{BE,ISP}$$

- The Net Transaction Result for the total volume of requested delivery commitment bids of a balancing product in both directions is calculated as:

$$NTR_{BP,ISP} = \sum |Q_{BP,ISP,POS}| * p_{BP,ISP,POS} + \sum |Q_{BP,ISP,NEG}| * p_{BP,ISP,NEG}$$

Imbalance Settlement Price

Imbalance pricing ensures adherence to the performance criteria security-of-supply and market efficiency. The proposed approach is designed to:

- Establishes adequate economic signals which reflect the imbalance situation
- Ensures that imbalances are settled at a price that reflects the real time value of energy
- Provides incentives to BRPs to be in balance or help the system to restore its balance

The approach leads to an imbalance settlement price p_imb per ISP defined as:

$$\mathrm{p}_{imb} = \frac{\mathrm{NTR}_{BE,ISP}}{Q_{imb,ISP}}$$

Financial flows for a BRP Imbalance must also take the system state into account

Imbalance Price

The imbalance price is calculated using the following formula:

$$p_{imb} = \frac{\mathrm{NTR}_{BE,ISP}}{Q_{imb,ISP}}$$

After calculating the reference price, the BRP imbalance must be assessed relative to the system state for the ISP

Imbalance Effect of a BRP on the System

TSOs system state	BRP Imbalance		
	short (-)	neutral (0)	long (+)
Neutral (0)	Imbalance price paid from BRP to TSO	0	Imbalance price paid from TSO to BRP
Short (-)	Imbalance price paid from BRP to TSO	0	Imbalance Price paid from TSO to BRP
Long (+)	Imbalance Price paid from TSO to BRP	0	Imbalance price paid from BRP to TSO

Overview of BRP and BSP settlement

BRP settlement

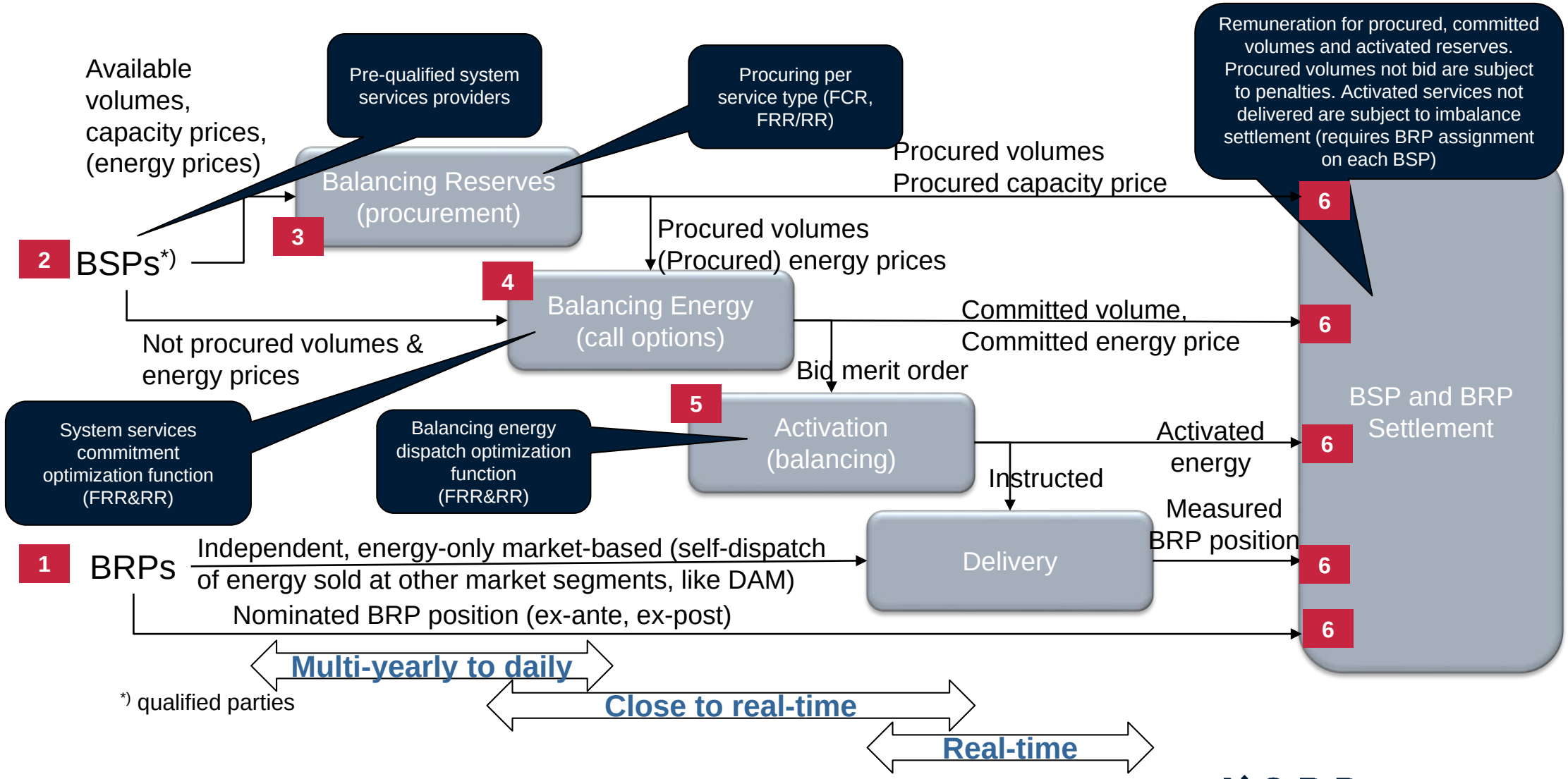
Payment direction	Mitigating imbalance energy	Aggravating imbalance energy
Positive Imbalance Price	Payment towards BRP	Payment towards TSO
Negative Imbalance Price	Payment towards BRP	Payment towards TSO

BSP settlement

Payment direction	Upwards direction	Downwards direction
Positive Balancing Energy Price	TSO pays to BSP	BSP pays to TSO
Negative Balancing Energy Price	BSP pays to TSO	TSO pays to BSP

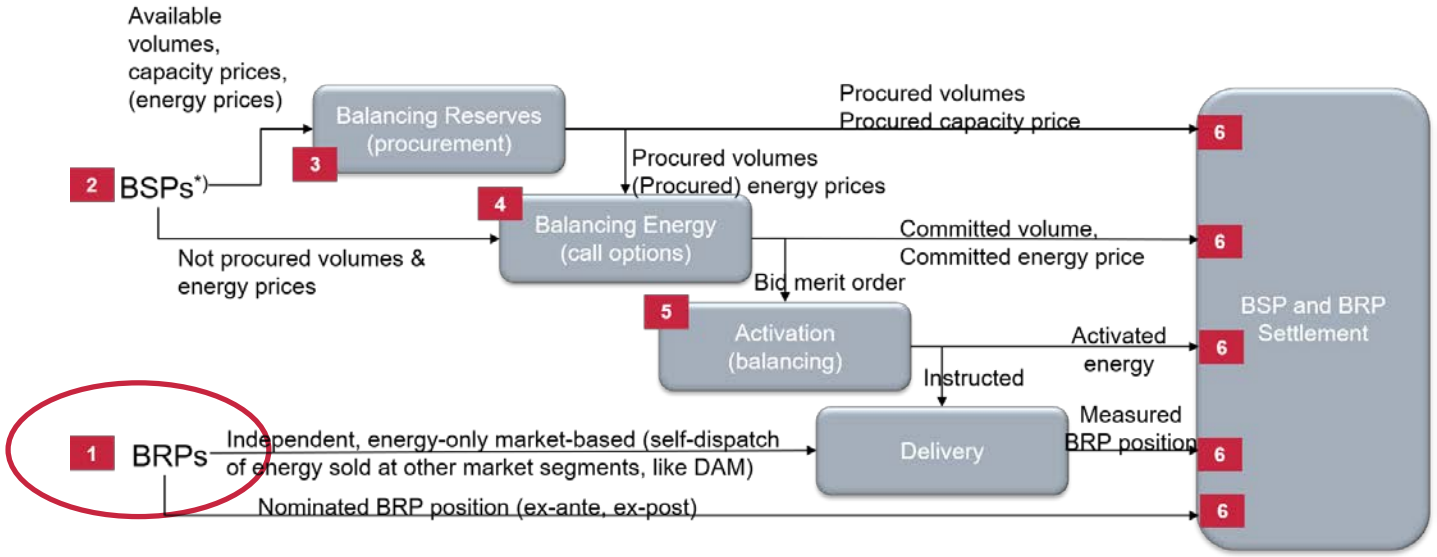
Overview balancing capacity and energy framework

Overview balancing capacity and energy framework



1. BRP Registration

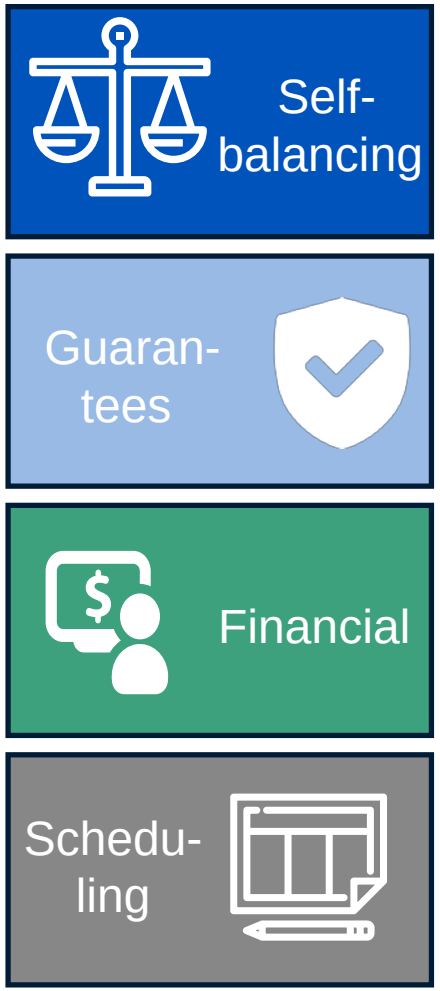
- Each Electricity Market Participant **must register to be a Balance Responsible Party (BRP)** and be designated by the TSO as such that eligible the participation in energy-only and the balancing market
- Each BRP is responsible for at least one **balancing group**. A balancing group is a collection of all energy transactions (generation, consumption, trades) that are grouped together to calculate the relevant imbalance
- Each BRP is **financially responsible** for any imbalance they cause



BRP responsibilities

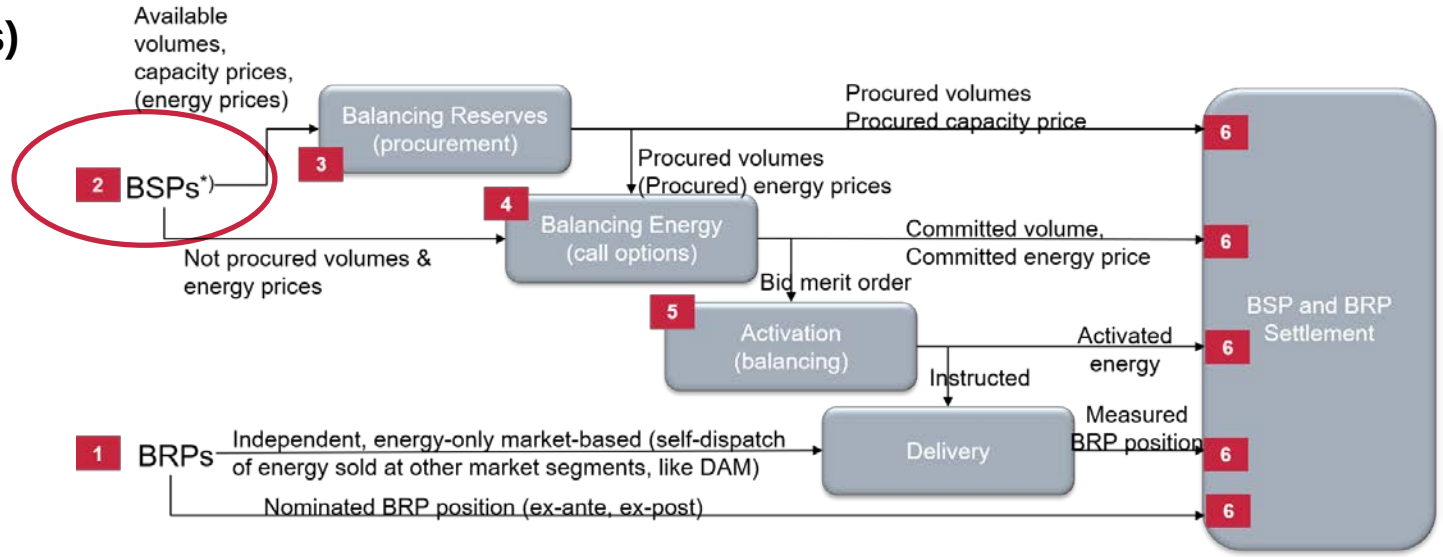
- Each BRP shall strive to be **balanced** for each balancing group and thereby reduces the impact to the total imbalance of the electricity system
- Each BRP is **financially responsible** for any imbalance they cause
- As a requisite precondition for entering into the BRP Agreement, the BRP needs to provide the TSO with a **collateral**, e.g. bank guarantee
- Each BRP is obliged to submit for each day **all his trade plan schedules (TPS)** as well specified nomination document to the TSO
- **Different nomination time frames** exist: Nominations can be submitted in a long-term (D-2), short-term (D-1) and intraday (after the introduction of an intraday market) context
- **Each contained nomination reflects a trade transaction between a BRP's balancing group and a trade partner's balancing group**
- **Each nomination needs to be confirmed by the TSO** to be accounted for imbalance calculation
- For each power plant of defined size a **technical resource plan schedule** (RPS) has to be submitted.

BRP responsibilities



2. BSP Prequalification

- The participation of BSPs in the Balancing market is either **automatically determined by the TSO or by a general BSP prequalification process** that allows new entrants at any time and is conditional to a technical prequalification procedure
- Prequalification implies a technical quality commitment, it **does not imply a volume nor price commitment**
- Pre-qualification **implies a service commitment, conditional to capacity bids** by the BSP (volume, prices) and selection of bids by the TSOs
- **For** participation in **auctions** for contracting of generation capacities, **additional constraints may apply (volume availability, financial requirements)**



1. & 2. Overview of prerequisites for BRP Registration and BSP Prequalification

BRP Registration

- Signed BRP agreement
- Issuance of an EIC
- Assignment of Balancing Groups
- Successful certification to use communication systems
- Provision of a collateral
- Provision of a commercial registration number
- Provision of generation/trader licenses
- Signed confirmation on physical connection to the power grid from connection system operator
- Formal confirmation letter of GSE

BSP Prequalification (registration)

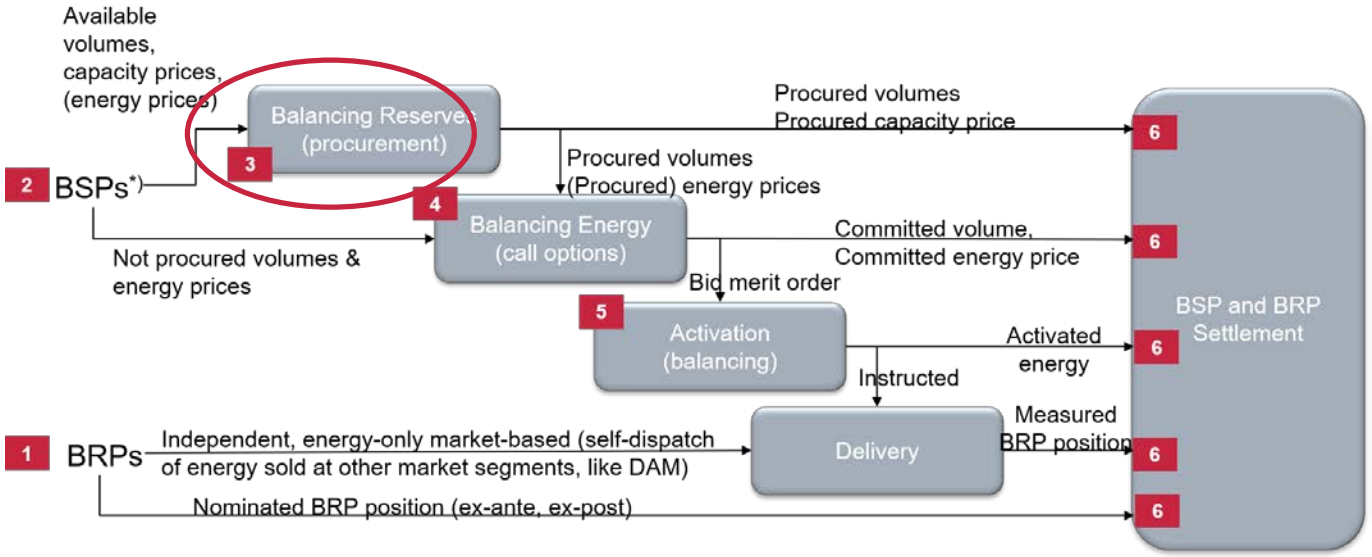
- Signed BSP agreement
- Issuance of an EIC
- Assignment of Balancing Groups
- Successful technical prequalification for respective Reserve Products
- Successful certification to use communication systems

3. Procurement of Balancing Capacity (FCR)

- BSPs bidding for Balancing Capacity auctions need to be **technically prequalified**
- FCR is a **symmetrical** product
- Awarded bids will be further processed by National Control Center
- **Successful bids** for the procurement of Balancing Capacity **receive the price that was bid in the auction for the procured volume (pay-as-bid principle)**
- **Timings of gate opening and closure** of the respective auctions are displayed in the auction calendar published by the TSO

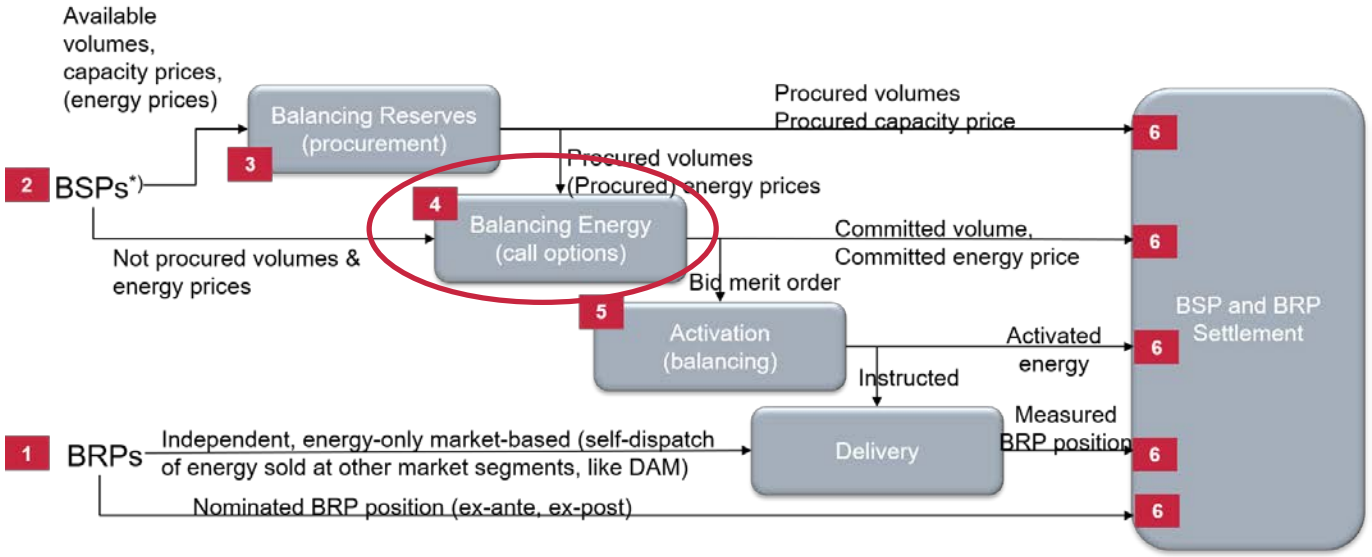
3. Procurement of Balancing Capacity (aFRR and mFRR)

- BSPs bidding for Balancing Capacity auctions need to be **technically prequalified**
- aFRR and mFRR are **asymmetrical** products
- All **procured volumes** (awarded bids during Balancing Capacity procurement) must obligatorily bid in the energy auction (automatic bid in the Balancing Energy auction). This auction is again **open to all prequalified BSPs** (“free bids”) for the respective Balancing Reserve Product
- **Successful bids** for the procurement of Balancing Capacity **receive the price that was bid in the auction for the procured volume (pay-as-bid principle)**
- **Timings of gate opening and closure** of the respective auctions are displayed in the auction calendar published by the TSO



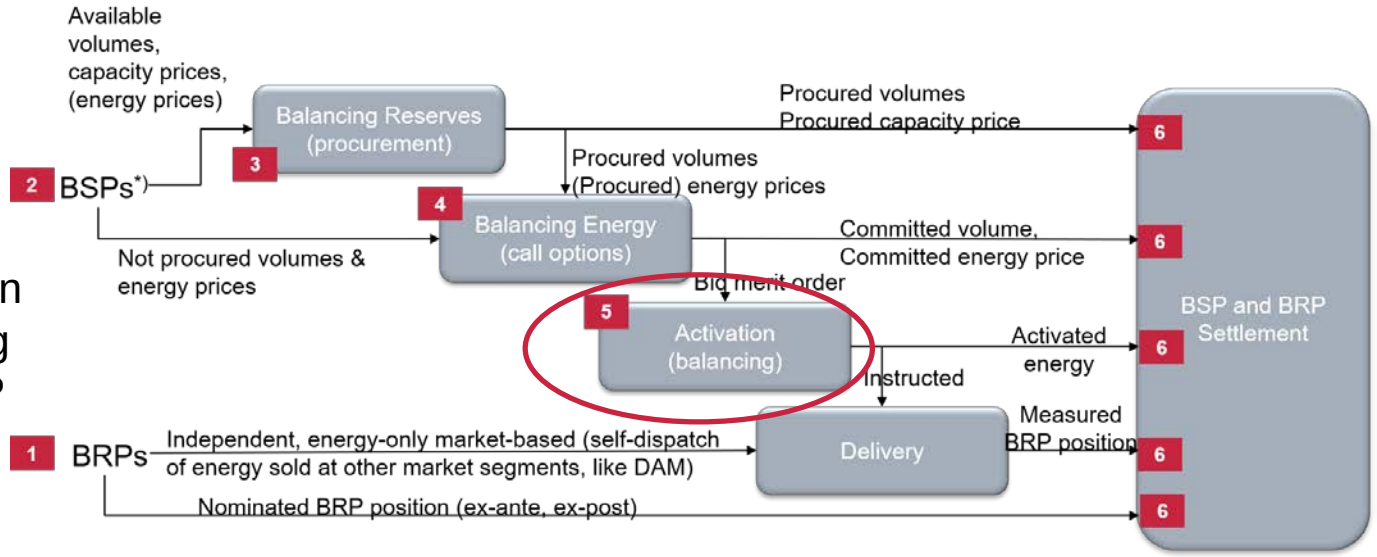
4. Procurement of Balancing Energy

- **All prequalified BSPs** are allowed to participate in respective Balancing Energy auction
- All awarded bids of the capacity auction lead to mandatory bids for the energy auction, the price may be modified only in favour of the TSO
- The TSO receives energy bids for **volumes and energy prices** of aFRR and mFRR
- **Timings of gate opening and closure** of the respective auctions are displayed in the auction calendar published by the TSO
- The remuneration of bids from the procurement of Balancing Energy is according to the **pay-as-cleared principle**



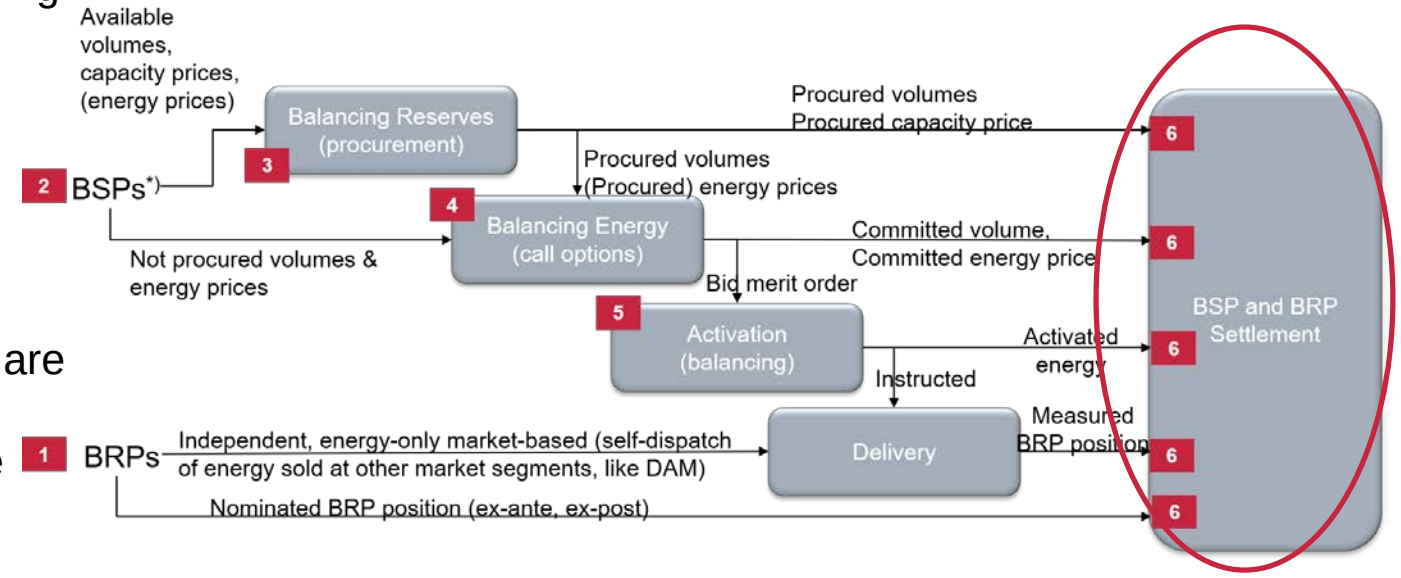
5. Activation optimization

- Activation of bids from the Balancing Energy procurement happens **automatically for aFRR** and **manually for mFRR** and is based on the **Merit Order List** principle (cheapest price is activated first)
- Results from energy auction are physically delivered into the Georgian electricity system:
  - Available upward regulation volumes and prices
  - Available downward regulation volumes and prices
- If a BSP is **unable** to provide the full balancing capacity and/or balancing energy procured, the BSP must **notify** the TSO immediately of their inability to provide this commitment
- If unavailability of the BSP occurs, the BSP receives **no payment** for the entire period for which they were procured to provide balancing capacity for the reserve product
- If the unavailability of the BSP to provide balancing capacity for a reserve product occurs on three separate instances within a 12-month rolling period, the TSO has the right to suspend the BSP from the balancing market



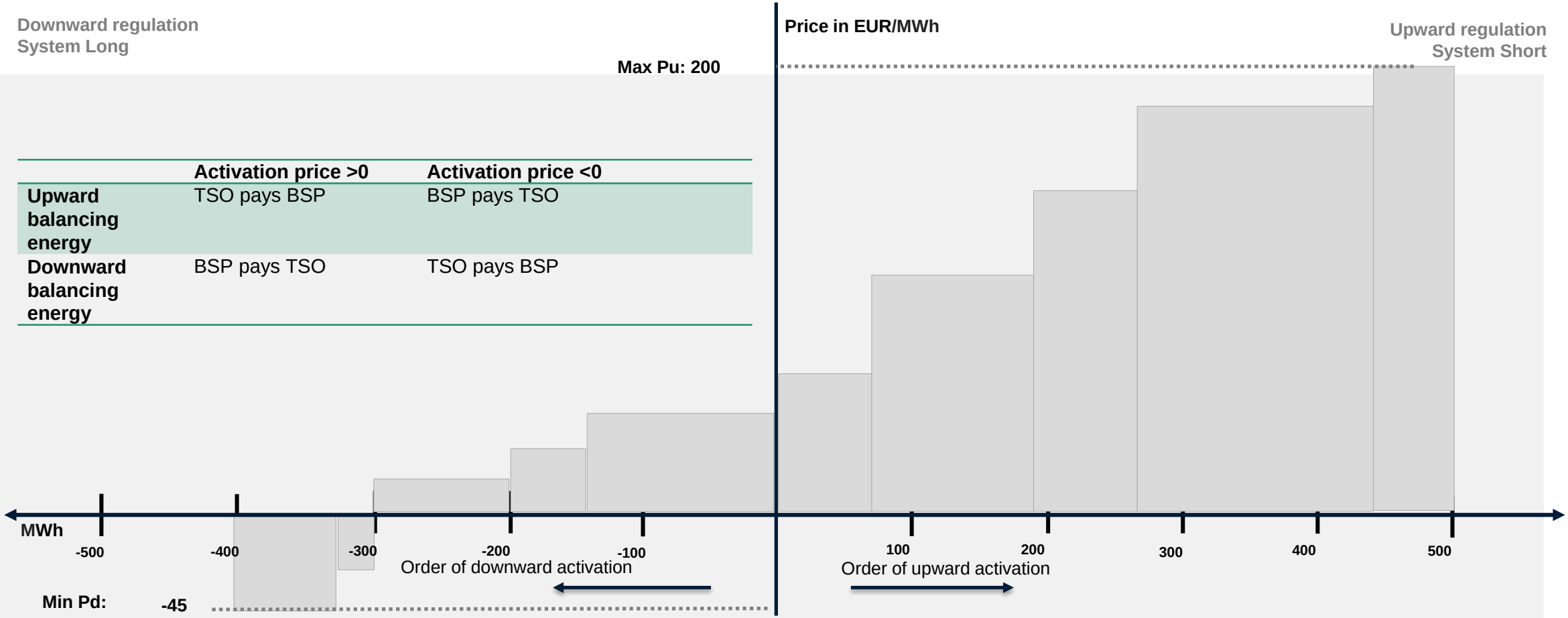
6. Settlement

- Balancing Capacity
  - Successful bids for the procurement of Balancing Capacity receive the price bid in the auction for the procured volume (pay-as-bid principle)
- Balancing Energy
  - The remuneration of activated bids from the procurement of Balancing Energy is according to the pay-as-cleared principle
- Activations
  - Only activated bids are remunerated according to activation profile of product definition and receive marginal price according to pay-as-cleared principle
- Imbalance
  - Activities of BRPs in the market (e.g. delivery and consumption of electricity) are levelled in the imbalance settlement and are either remunerated or charged (depending on their final position) by the imbalance price



Back up

Bid ladder and pricing



	Activation price >0	Activation price <0
Upward balancing energy	TSO pays BSP	BSP pays TSO
Downward balancing energy	BSP pays TSO	TSO pays BSP

Pu: Marginal price paid to BSPs for upward regulation
Pd: Marginal price received from BSPs for downward regulation