

Cost-Efficient Power Balancing: Towards Joint Reserve Dimensioning and Procurement

Ibtissam Hamdane^{1,2}, Emily Little¹, Virginie Dussartre¹, Paul Plessiez¹, Albert Banal-Estanol^{3,4}, Olivier Massol²

¹Réseau de Transport d'Electricité, Paris, France. ²Laboratoire de Génie Industriel, Gif-sur-Yvette, France. ³City University, London, United Kingdom. ⁴Universitat Pompeu Fabra, Barcelona, Spain

Extended Abstract

[Download file](#)

Abstract Summary

Short-term power system balancing refers to the process through which Transmission System Operators (TSOs) maintain the instantaneous equilibrium between electricity generation and consumption. As electricity cannot be stored at a large scale in real time, any imbalance between supply and demand must be continuously corrected to preserve system frequency and ensure secure operation. To manage the risk of imbalance, operating reserves, namely **automatic Frequency Restoration Reserves (aFRR)** and **manual Frequency Restoration Reserves (mFRR)**, can be described as adjustments in production or consumption under a specific speed and for a specific duration.

Our work focuses on two key steps in the balancing process: **reserve dimensioning and reserve procurement**. Reserve dimensioning consists in determining the volumes of aFRR and mFRR required to cover the future system imbalances, while reserve procurement refers to the regular tendering process through which the TSO secures the availability of these volumes from Balancing Service Providers (BSPs) in exchange for capacity remuneration.

Building on recent literature promoting dynamic reserve dimensioning and the adaptation of procurement mechanisms, **this study investigates a novel set of cost-efficiency strategies for a joint dimensioning and procurement of aFRR and mFRR**. These strategies include (i) a *cost-aware reserve dimensioning* approach that replaces fixed-risk coverage targets with a joint optimization of reserve volumes and procurement costs, (ii) the *endogenous allocation of aFRR and mFRR* volumes instead of rule-of-thumb splits between reserve types, and (iii) *adaptations of procurement design* to facilitate the participation of new flexibility providers.

Insights from the joint analysis of reserve dimensioning and procurement show that **dynamic methodologies leveraging BSPs submitted bids and economic criteria can improve the efficiency of reserve allocation**. The results also highlight that **balancing costs strongly depend on the bidding format** during procurement and activation.

Presenting Author Biography