LFC and Reserve Prequalification Framework for Synchronization of Power Systems with Continental Europe

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Abstract

This paper presents a comprehensive analysis of the Load Frequency Control (LFC) framework essential for the Electric Power Systems (EPSs) synchronization with the Continental Europe (CE). The primary objective of this study is to ensure and maintain the stability and reliable operation of autonomously functioning individual EPSs by analyzing the technical requirements and prequalification procedures for Frequency Containment Reserves (FCR) and LFC reserves.

Numerical simulations were employed to assess the behavior of EPSs following the loss of a defined amount of active power, with the goal of ensuring operational reliability and preventing the activation of Under Frequency Load Shedding (UFLS). The study evaluated the technical requirements for LFC reserve units, including their capability to remain connected to the grid during system disturbances and to provide the necessary frequency support.

Furthermore, the research examined the prequalification procedures required for reserve units to be eligible to deliver FCR and LFC services, aiming to define a consistent and technically robust framework for qualification across EPS entities.

The paper details the technical requirements for FCR, Frequency Restoration Reserves (FRR), and Replacement Reserves (RR), as well as the dimensioning, procurement, and activation processes.

Special focus is given to the prequalification procedures for Balancing Service Providers (BSPs) and the role of Limited Energy Reservoir (LER) providers. The integration of these actors ensures flexibility and reliability in reserve activation.

The paper concludes that successful synchronization with CE depends on coordinated system management, adherence to quality targets such as Frequency Restoration Control Error (FRCE), and the development of competitive balancing markets.

Keywords

Balancing service provider, Frequency restoration control error, Frequency restoration reserve, Limited energy reservoir, Load frequency control, Restoration reserve, Synchronous area.