

# **Frequency stability services to compensate for low inertia in renewable-dominated power systems**

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## **Abstract-**

**The shift towards non-synchronous generation reduces system inertia, creating operational challenges in power systems worldwide. This inertia challenge depends on the synchronous grid size, generation mix, and the existing portfolio of services procured by the system operators. This study examines how five European countries from different synchronous areas address these challenges, focusing on the market-based procurement of inertia-related services. We provide a theoretical background on why stability service markets are challenging to design due to the interplay between different services and their costs. Further, we use a theoretical market framework to analyze the market design elements and to see how aligned they are with the evolving needs of the power system. Our findings stress the importance of investment incentives for low-carbon technologies and proactive market designs to meet evolving stability needs, offering guidance for power systems integrating a high share of renewables.**

**Index Terms-** Inertia; Frequency ancillary services; Frequency stability service; Electricity markets; Non-synchronous generation

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