

# **TSO-DSO-Customer coordination for purchasing flexibility system services: challenges and lessons learned from a demonstration in Sweden**

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## **Abstract-**

**This paper presents a real-world implementation of a TSO-DSO-customer coordination framework for the use of flexibility to support system operation. First, we describe the general requirements for TSO-DSO-customer coordination, including potential coordination schemes, actors and roles and the required architecture. Then, we particularise those general requirements for a real-world demonstration in Sweden, aiming to avoid congestions in the grid during the high-demand winter season. In the light of current congestion management rules and existing markets in Sweden, we describe an integration path to newly defined flexibility markets in support of new tools that we developed for this application. The results show that the use of flexibility can reduce the congestion costs while enhancing the secure operation of the system. Additionally, we discuss challenges and lessons learned from the demonstration, including the importance of the engagement between stakeholders, the role of availability remuneration, and the paramount importance of defining appropriate technical requirements and market timings.**

**Index Terms-** active distribution networks, balancing services, congestion management, flexibility markets, real-world demonstration, TSO-DSO coordination.

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