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INTERNATIONAL SMART GRID ACTION NETWORK

Power Transmission & Distribution Systems

Active System Management by DSOs

Executive Summary

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Executive Summary

The energy transition aims to reduce greenhouse gas emissions, enhance energy efficiency, and increase the share of renewables in the energy mix. Since much of this renewable energy is expected to come from wind and solar, the power grid will face new complexities in its planning and operation due to the uncertain and highly variable generation patterns of these sources. Further compounding the challenge, the ongoing electrification of industries, transport and heating will add additional loads to already stressed grids.

Distribution System Operators (DSOs), due to their proximity to end-users and their role in managing the growing number of distributed energy resources (such as solar PV and electric vehicles), are central to addressing these challenges. To maintain system stability, accommodate local peaks, ensure voltage regulation, and manage congestion, DSOs will need to implement a more active approach to local system management.

This paper aims to provide insights into how DSOs can leverage active system management to cost-efficiently and securely manage their grids. These insights stem from a series of interactive workshops held with members of the International Smart Grid Action Network (ISGAN), complemented by case studies from literature, findings from research projects, and real-world experiences shared by ISGAN members.

The paper discusses three key topics in detail:

1. **Market-Based Flexibility Procurement by DSOs:**
   The design of flexibility procurement faces several challenges, particularly for low-voltage flexibility. One of these challenges is the lack of adequate prequalification processes. There is a need for further analysis to evaluate the implications of ex-post versus ex-ante product prequalification. Additionally, innovative baseline methodologies are required to cater to new flexibility services and products, as well as to new types of flexibility service providers and flexible resources. Finally, aggregation models should be put in place, tailored to market frameworks, the types of products and services offered, and the types of FSPs (Flexibility Service Providers) and flexible resources involved.

2. **Supporting Grid Tools for Active System Management:**
   It is evident that solutions for medium- and high-voltage grids cannot be directly applied to low-voltage (LV) grids, which often require simpler and more scalable approaches. To improve LV grid management, DSOs need increased visibility of LV grid needs and improved monitoring capabilities, including digital meters for all LV flexibility users. Enhanced modeling and estimation of flexibility impacts, improved congestion forecasting capabilities, and more detailed data on the specifications of connected flexibility sources are essential to address these needs.

3. **Applicability of Flexibility Mechanisms and their trade-off with Investments:**
   While grid investment needs are substantial, the effective use of flexibility mechanisms can significantly reduce these requirements. DSOs must select the most suitable flexibility mechanisms based on economic and operational efficiency. There is no “one-size-fits-all” solution; multiple, complementary mechanisms will be necessary to address diverse DSO needs and facilitate the energy transition.

By addressing these conclusions, DSOs can better navigate the challenges associated with flexibility. Overall, we can conclude that the challenge of integrating flexibility in the DSO sphere is complex, necessitating additional guidance and research on how to correctly trade-off between different flexibility mechanisms and grid investments. This includes developing appropriate criteria, methodologies, and quantification methods.

Key factors to be considered in this assessment are the economic viability, encompassing the costs and benefits of the solutions, which calls for a societal cost-benefit analysis. This analysis should account for the opportunity cost of alternatives to flexibility. Additionally, the reliability and availability of flexibility (including market liquidity) are crucial factors. Moreover, compatibility with current and future regulatory contexts should also be considered. Furthermore, the methodology should account for long-term economic and environmental impacts. Finally, the expected user engagement with the proposed solutions and the experience of DSOs should be factored in.

In conclusion, integrating flexibility in the DSO domain is a multifaceted challenge that will require ongoing effort to ensure an effective and sustainable energy transition.

For more details, read the full discussion paper:

Active System Management by DSOs - Discussion paper