Innovation type:
Model

TRL: 4

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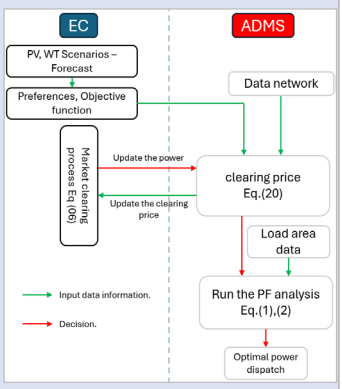
Target group:

Actor/ purpose	x
DSO, TSO	x
Technology provider	x
Member organisation	
Market operator	x
Research/ Consultancy	x
Teaching	



The conceptual model to integrate the multi-EC with flexible loads in the distribution system.

Optimal Power Management of Multi-energy Community Considering The Local Energy Market

Challenge

The integration of prosumers and DER aggregators into local energy markets (LEMs) poses several operational and strategic challenges. Firstly, as the number of microgrids and DERs increases, the computational burden on central control systems grows, leading to inefficiencies in market clearing processes. Another critical issue is the coordination between the Distribution Market Operator (DMO) and the DSO, particularly in handling excess energy or meeting load requirements. Lastly, optimizing voltage and reactive power (Volt-VAR) while maintaining system reliability adds to the complexity, as DERs must be controlled in a way that balances operational flexibility, cost efficiency, and system stability. These challenges underline the need for robust and efficient management systems in LEMs.

Solution

To address these challenges, this study proposes an ADMS that integrates existing components with a distributed energy resource management system. The ADMS focuses on maximizing energy efficiency and reliability while reducing operational costs. By leveraging a distributed algorithm, it achieves equilibrium in the market, preserves privacy, and optimizes voltage and reactive power (Volt-VAR) control. Additionally, the ADMS enhances coordination between DMOs and DSOs to streamline energy transactions, even during excess energy or high-demand periods. It also incorporates dynamic pricing mechanisms to mitigate risks associated with price uncertainties and ensures the effective management of physical constraints within the distribution network.

Potential

The distributed system offers significant potential for enhancing privacy in local energy markets by allowing prosumers and energy communities to make decisions locally without sharing sensitive data. It minimizes the exposure of private information, such as energy consumption and generation patterns, by limiting data exchanges. This decentralized approach fosters trust among participants and ensures that market operations remain secure. By maintaining privacy while optimizing energy transactions, the algorithm supports a scalable and efficient integration of distributed energy resources.

Reference in CINELDI

Y. Zahraoui, S. Gros, I. Oleinikova: "Optimal Power Management of Multi-energy Community Considering The Local Energy Market", IEEE Annual conference of the industrial electronics society, IECON 2024, 3- 6 November 2024.