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Energy Trading Strategy of Community Shared Energy Storage

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Summary

One of the challenges of renewable energy is its uncertain nature. Community shared energy storage (CSES) is a solution to alleviate the uncertainty of renewable resources by aggregating excess energy during appropriate periods and discharging it when renewable generation is low. CSES involves multiple consumers or producers sharing an energy storage system. This work presents an optimal strategy for CSES operators and community members to determine their optimal energy trading strategy based on social welfare maximization. Energy communities contain diverse resources, demand patterns, and constraints. The Alternating Direction Method of Multipliers (ADMM) technique is an iterative nature that decomposes the original problem into smaller sub-problems and enables parallel processing of these sub-problems. The final decomposed subproblems enable community agents to determine their optimal strategies independently decreasing the solving time, speeding up convergence to the optimal solution, and improving scalability. The performance of the proposed model is evaluated by a case study. The presented model demonstrates that by leasing the capacity of CSES, community members could decrease their energy supply costs. Moreover, the CSES can supply the required charging and discharging power of community members from the local grid.

Highlights

- Decentralized energy trading model introduced for energy community and CSES, ensuring fair pricing compared to the main grid, motivating consumer participation.
- Proposed model allows surplus energy injection, peak-time energy supply, and benefits both PV-generating and non-PV-generating consumers, with potential for increased profit, but optimal trading strategies must consider leased power capacity for CSES.

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