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Optimisation for Coalitions Formation Considering the Fairness in Flexibility Market Participation

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Summary

Traditionally, the participation in conventional electricity markets used to be limited to large producers and consumers. The final end-users contract their energy supply with retailers, since due to the smaller quantity available for trading, they cannot participate in electricity market transactions. Nowadays, the growing concept of local electricity market brings many advantages to the end-users. The flexibility negotiation considering local areas is an important procedure for network operators and it is incorporating a local electricity market opportunity. A coalition formation model to facilitate small players participation in the flexibility market proposed by the network operator is addressed in this work. The inclusion of Shapley value in the proposed model enables finding the best coalition structures considering the fairness of the coalitions in addition to the potential income achieved by the consumers when selling their flexibility. An optimization model based on differential evolution is also proposed as the way to find the optimal coalition structures based on the multi-criteria specifications.

Highlights

- An optimisation problem to coalition formation for flexibility provision considering the fairness in the coalition criation is considered.
- The fairness is measured considering the standard deviation of the coalition Shapley values.
- The Shapley value, the metric used for fairness measurement, is obtained considering different attributes for each prosumer.
- The optimization process is performed considering an evolutionary algorithm hybrid-adaptive
- differential algorithm.
- The results show a fairness coalitions formation with a maximization of incomes for all considered agents.

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