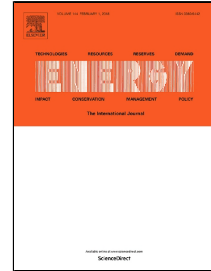


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# A transactive energy modelling and assessment framework for demand response business cases in smart distributed multi-energy systems

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## Highlights

- Transactive energy modelling and assessment for demand response business cases
- Flexible and scalable modelling of aggregation for distributed multi-energy systems
- Includes a novel, modular and extensible transactive energy value mapping model
- Consumer/retailer-aggregator profit sharing model introduced
- Demonstrated on a real case study of a smart district

## Abstract

The energy trilemma, together with energy system liberalisation and development of smart grid technologies, are increasing interest in and the potential of distributed multi-energy systems (DMES), for instance from districts or communities, to provide demand response (DR). However modelling and assessment of such systems is not straightforward given the complex physical and commercial aspects, including the effect of aggregation and relationships between retailers/aggregators and the districts in which DR resources are situated. Given this motivation, this paper introduces a novel and powerful ‘transactive energy’ modelling and assessment framework for DMES. The framework includes: a DMES stochastic optimisation model with a flexible and scalable approach for modelling aggregation useful for both technical and economic analysis; a modular and extensible value mapping methodology for identifying transactive energy price signals and cash flows for different energy system actors; a profit sharing model; and an economic assessment model based on fundamental cost-benefit analysis. The framework is illustrated through analysis of DR business cases on a real district in France. Possible extensions of the transactive energy value mapping approach to upstream and downstream activities and to different energy sectors, as well as the advantages of using the framework in regulatory and policy design, are discussed.

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