Multi-agent based model for microgrid ancillary services provision

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In multi-vector smart grids, different energy networks (like power and heat) and subsystems (RES, CHP, storage, loads, and so on) features can lead to fruitful exploitation of mutual support. To this purpose, while implementing optimization procedures for grid services (e.g. Demand Response), at first an abstract cognitive model is required to fit and represent OT side interactions (power sharing and field actuations) and the related IT side communications; then emulation with laboratory equipment in local environment is necessary to test operations (in terms of timing and operation flows) before field campaigns. In this work, both control architecture and communication protocols have been analyzed and tested to adopt a flexibility strategy based on nature inspired (meta-heuristic) algorithms based on Multi-Agents paradigm. This led to a power flows management procedure to fulfill hierarchical and peer multiple targets (efficiency, cost, others), with a special focus on the scalability of the implemented model.