

Prosumers' optimal DER investments and DR usage for thermal and electrical loads in isolated microgrids

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Abstract— Recently, driven by the increasing concern regarding electricity supply resiliency, literature has paid attention to Microgrids (MGs) and their technical performance to ensure a reliable supply, although few papers have addressed the economic behavior of isolated MGs. Recent European Projects have launched the proposal of a local market based approach to operate the isolated MG. One of the main concerns of such an approach is whether the small size of such markets may lead to strategic behaviors, although it depends on the number and size of local market agents. This paper presents a mathematical modeling, formulated as a Mix Complementarity Problem (MCP), of the economic planning and operation of isolated MGs, able to represent the impact of agent's strategic behavior through the explicit consideration of conjectures. Although identifying the value of such conjectures for each particular MG is out of scope of this paper, a case study is conducted to analyze the impact on investments and local prices. Besides, it includes a temperature model for buildings, able to consider its thermal inertia and allowing prosumers to take advantage of its Demand Response (DR) capabilities regarding its thermal and electricity needs. The paper conducts different case studies to illustrate its impact.

Index Terms— Energy Management; Renewable Sources; Energy Storage; Microgrid Isolated Operation; Demand Response; Microgrid Local Market; Building Thermal Model.

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