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A local electricity market mechanism for flexibility provision in industrial parks involving heterogenous flexible loads

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Abstract-

Industrial parks allow industries to share infrastructure and thus saving money, finally redounding in improving the economy of many countries worldwide. Given the objectives of carbon neutrality imposed by different entities, it results mandatory promoting energy efficiency in industrial parks. Aligning with such objective, encouraging industries to provide energy flexibility becomes essential. In the electricity sector, such flexibility can be provided through optimally managing local assets such as energy storage and flexible loads. However, flexibility provision should be promoted by implanting proper pricing mechanisms. This paper focuses on this issue by developing a local market clearing mechanism for industrial parks, whose main novelty redounds in the inclusion of a fair pricing mechanism through which industries are paid by flexibility provision. Different types of flexible loads are considered and modelled (i.e. curtailable, interruptible and deferrable), so that the new proposal is suitable for leveraging fully capabilities of industrial flexible loads. The whole pricing mechanism is raised as a bi-level game-based model, by which local energy and flexibility prices are revealed in a coordinated way. Challenges brought by the inclusion of binary variables (needed for modelling some types of flexible loads) are solved by proposing a Mixed Integer Linear Programming, being therefore solvable by off-the-shelf solvers. A case study is presented to validate the new proposal as well as highlight some important aspects related to local markets in industrial parks and its practical implantation.

Index Terms- Energy efficiency; Energy flexibility; Industrial park; Local electricity market

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