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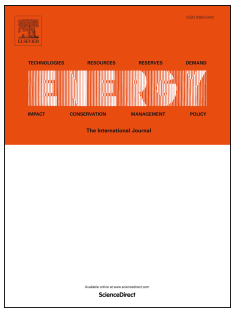

A novel approach to multi energy system operation in response to DR programs; an application to incentive-based and time-based schemes

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A Novel Approach to Multi Energy System Operation in Response to DR programs; an Application to Incentive-based and Time-based schemes

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Abstract

Today, energy hubs (EH) are widely used as the new power delivery methods which can interact as a key role to response the conventional DR programs, even for inelastic loads by integrating electricity, natural gas and other forms of energy. This paper presents an EH operation optimization problem in response to both the time-based DR (TBDR) and incentive-based DR (IBDR) programs. To this end, an integrated responsive load model is employed to illustrate the load modifications due to price changes (pertaining to TBDR programs) and incentives/penalties (pertaining to IBDR programs). The proposed model, tends to maximize the customer's benefit, while, minimizing the EH operation cost by optimal deciding on the purchased energy carriers as well as the converter/storage systems' schedule with respect to the modified purchased energy patterns, satisfying DR schemes. Further, to evaluate the performance of the proposed model, available DR programs for both TBDR and IBDR programs are examined through a comprehensive case study. Results show that, the responsive load demand is curtailed or shifted as a response to DR schemes from the upstream network perspective (considering the modified purchased energy by the EH), while the actual energy consumption remains unchanged from the customers' perspective.

Index Terms

Demand response, Demand elasticity, Energy hub, Multi energy system, Optimization.

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