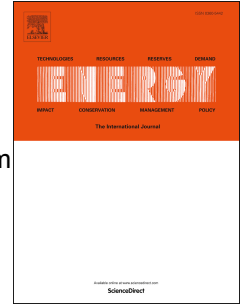


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Arbitrage opportunities for distributed multi-energy systems in providing power system ancillary services

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Abstract

This paper addresses the potential multi-energy arbitrage opportunities for distributed multi-energy systems that arise from shifting the supply across input energy vectors and across plant components. This allows flexible decrease/increase of the electricity input from the grid to provide power system ancillary services, while maintaining the end-use energy demand at a constant level and thus without affecting the consumers' comfort. The benefits of the distributed multi-energy system participation in providing ancillary services for the reserve market are assessed by means of specifically defined *multi-energy profitability maps*. A novel indicator is introduced to quantify the electricity reduction that corresponds to the maximum profit of the distributed multi-energy system during the provision of the ancillary service. Numerical results that show the effectiveness of the proposed approach and the profitability map usage for a trigeneration system are discussed on two selected illustrative cases. From these cases, it is possible to identify the variety of conditions leading to the maximum profitability of the ancillary service provision in function of the economic parameters (availability fee and exercise fee) and of the amount of input electricity reduction. The most significant result is that, depending on the availability and exercise fees, the maximum profit may be obtained in some cases for an input electricity reduction lower than the maximum

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