Demand response models with correlated price data: a robust optimization approach

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Abstract— In the electricity industry, the processes through which consumers respond to price signals embedded in tariffs by changing their consumption patterns is generally referred to as demand response. In such a context, consumers are offered an opportunity to maximize the surplus derived from electricity usage by actively scheduling consumption over time periods with potentially different energy prices. The objective of this work is to analyze the role of correlation in prices of successive periods over which consumption is to be scheduled, in a demand response context. We use robust optimization techniques to propose an optimization model for consumption scheduling when prices of different periods are highly correlated, and also suggest approaches to correctly incorporate real-world correlated price data to this model. Positive results from quantitative case studies indicate that it is of great importance to employ a solution approach that correctly models correlation among prices when scheduling consumption.

Index Terms— Demand response; Correlated data; Robust optimization; Principal component analysis