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Title: Enhancing Household-Level operational decision making with Machine Learning

Agent-based modeling (ABM) presents an effective framework for analyzing complex and highly interconnected systems such as the electricity market. With the ongoing energy transformation, understanding the individual decisions of actors such as households with PV-storage systems (PVS), heat pumps (HP), and electric vehicles (EV) is crucial. However, ABMs for the electricity market on a national level with complex interconnected actors face scalability limitations with regard to their individual decision making. Though, aggregating actors into representative entities and applying a single decision strategy fails to consider the diversity of individual decision-making processes. Moreover, this oversimplified approach neglects the influence of the varying attributes of the individual actors.

To solve this problem, we propose leveraging machine learning (ML) techniques to address these requirements while controlling the scalability challenge. The main idea is to utilize ML methods to learn and predict the aggregation of individual actor decisions. Central to our approach is a uniform forecasting of aggregated demand time series for all actor types, i.e., PVS, HP, and EV. The underlying demand time series result from applying optimization models specific to each actor type. The results show similarly good predictions for PVS, HP, and EV. This method enables a more nuanced understanding the individual impact of decision-making processes of households on a national level.