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Title: Expected Meteorological Conditions, the Day-Ahead Electricity Market Outcome, and the Demand for Utility Supplied Electricity: Evidence from New York City

Abstract: The increasing utilization of distributed energy resources (DER) such as rooftop solar has brought about environmental benefits but has also reduced the accuracy of the load forecasts that system operators use to optimize the resources of the power grid. This occurs because the displacement of grid supplied electricity with DER such as rooftop solar is dependent on the time of day as well as meteorological conditions. The North American Reliability Corporation (NERC), the not-for-profit organization in North America charged with establishing reliability standards, believes that higher DER penetration levels could contribute to ramping and system balancing challenges. Recent events in Japan, North America, and Europe are consistent with this view.

Using data from New York City, this paper presents an econometrically based method to ameliorate the challenge posed by DER. Archived meteorological forecasts (e.g. forecasted cloud cover) and the system operator's load forecast are used as regressors in a time-series econometric model in which the actual hourly utility supplied load for New York City is the dependent variable. The estimation makes use of ARCH/ARMA methods as well as a measure of the wholesale price (adjusted for fuel costs) that proxies the expectations of market participants. The analysis presented in this paper indicates that the load forecasting issues associated with DER are easily addressed using time-series econometric methods. Indicative of this, the errors in the model's out-of-sample predictions are substantially smaller than the errors in the system operator's load forecasts. The results are also consistent with the view that day-ahead wholesale markets for electricity are informationally efficient.

Key words: Distributed Energy Resources, Electricity Balancing, Load Forecasting, Duck Curve