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Providing Utility to Utilities: The Value of Information Systems Enabled Flexibility in Electricity Consumption

by

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Abstract:

As the transition to renewable energy sources progresses, the integration of such sources makes electricity production increasingly fluctuate. To contribute to power grid stability, electric utilities must balance volatile supply by shifting demand. This measure of demand response depends on flexibility, which arises as the integration of information systems in the power grid grows. The option to shift electric loads to times of lower demand or higher supply bears an economic value. Following a design science research approach, we illustrate how to quantify this value to support decisions on short-term consumer compensation. We adapt real options theory to the design—a strategy that IS researchers have used widely to determine value under uncertainty. As a prerequisite, we develop a stochastic process, which realistically replicates intraday electricity spot price development. With this process, we design an artifact suitable for valuation, which we illustrate in a plug-in electric vehicle scenario. Following the artifact's evaluation based on historical spot price data from the electricity exchange EPEX SPOT, we found that real options analysis works well for quantifying the value of information systems enabled flexibility in electricity consumption.

Keywords: Demand Response, Load Shifting, Design Science Research, Electricity Spot Price Model, Real Options.

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