Surprising Insights from Electricity Customer Micro Data

Harvard Kennedy School Energy Policy Seminar Series, Spring 2019

Monday, February 11, 2019

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In *Moneyball*, Michael Lewis chronicled how baseball managers began hiring players based on analytics, rather than gut feelings, and how this transformed the Oakland Athletics baseball team. Utilities are ready for the same kind of transformation, according to Pasi Miettinen, President and CEO of Sagewell, Inc. Miettinen called for a more evidence-based approach to utility management and to electricity policy in Monday's energy policy seminar.

Currently, Miettinen explained, many utilities have access to reams of customer usage data provided by smart meters—but most of this data never gets analyzed. In the absence of data analysis, Miettinen said, "many significant decisions are not evidence-based." Instead, he said, "Utilities are run like faith-based initiatives," drawing on assumptions about customer behavior, rather than actual observation. As a result, as utilities pursue goals of serving customers or meeting environmental targets, "billions of dollars in capital allocation" is being largely decided by people who have never looked at the data, Miettinen observed.

With the advent of rooftop solar and electric vehicles, overall usage patterns have been changing, Miettinen said, with peak demand occurring later in the day, and with individual usage potentially varying greatly from household to household, depending on who owns a Tesla, for example, or who has solar panels. These kinds of changes can have big financial impacts. In the greater Boston area alone, the cost of capacity needed to meet daily peaks has increased by $500 million in the past two years, even as the cost of energy itself has fallen. In fact, Miettinen said, buying capacity to cover the peak energy hour costs more than the marginal energy itself for the entire year. At the individual customer level, the cost impact of a Tesla-owning customer who habitually charges during peak hours is tremendously greater than the impact of most other residential customers.

Miettinen went on to give some examples of the kinds of insights that have come from looking more closely at available data. One impact is a potential transformation of how utilities allocate costs among customers. Currently, he explained, most utilities lump customers roughly into large "classes," all of whom get similar rates. For example, residential customers are all often treated as a single class. However, analysis of customer data shows tremendous variation among residential customers in how and when they use electricity, depending on factors like whether customers live in single-family homes, whether they have electric vehicles, whether they have solar power, whether they have a heat pump, and other factors. Furthermore, the data show that a single home may have very different energy use patterns on different days. Given this variability, Miettinen said, "We're not sure that a residential customer class even exists" in any meaningful way.

Another insight had to do with Massachusetts energy efficiency programs. Sagewell (the smart meter data analysis firm founded by Miettinen) used customer meter data to analyze summer peak energy usage reduction from Massachusetts energy efficiency programs, and found that, on average, these produced peak reductions of 5% to 15%--a meaningful result, but far below the estimated nearly 50% peak reduction projected by the Mass Save program—a difference that might well impact the outcome of a cost-benefit analysis of spending on the program.

In another example, Miettinen focused on how data can shed light on how energy efficiency technologies could be used more effectively. In the case of heat pumps (a heating and cooling technology that can provide significant energy savings as compared with oil or gas heat) Miettinen reported that Sagewell's analysis of customer data showed that many ductless heat pumps are being used for air conditioning, but not heating—raising questions about why customers are not using ductless heat pumps for heating and therefore are not displacing fossil fuel heating and reducing their emissions. On the other hand, central ducted heat pumps have been successful in displacing fossil fuel

heating because the old furnaces have been completely removed from the house. In other cases, data can even identify individual customers who may be costing the utility money—for example, targeting EV owners to give them incentives to charge during off-peak hours, or identifying residential customers who could save money for themselves and the utility by installing heat pumps.

In closing, Miettinen called for a transformation in how utilities allocate their costs—from rough and ready top down allocation to calculations based on bottom up analysis. It could "significantly accelerate" economic and environmental benefits, Miettinen concluded.

Miettinen spoke as part of the Kennedy School's Energy Policy Seminar Series, which is sponsored by the Consortium for Energy Policy Research of the Mossavar-Rahmani Center on Business and Government and by the Belfer Center for Science and International Affairs.