Insight

Time to Save: How Time-of-Use Rates Reduced Peak

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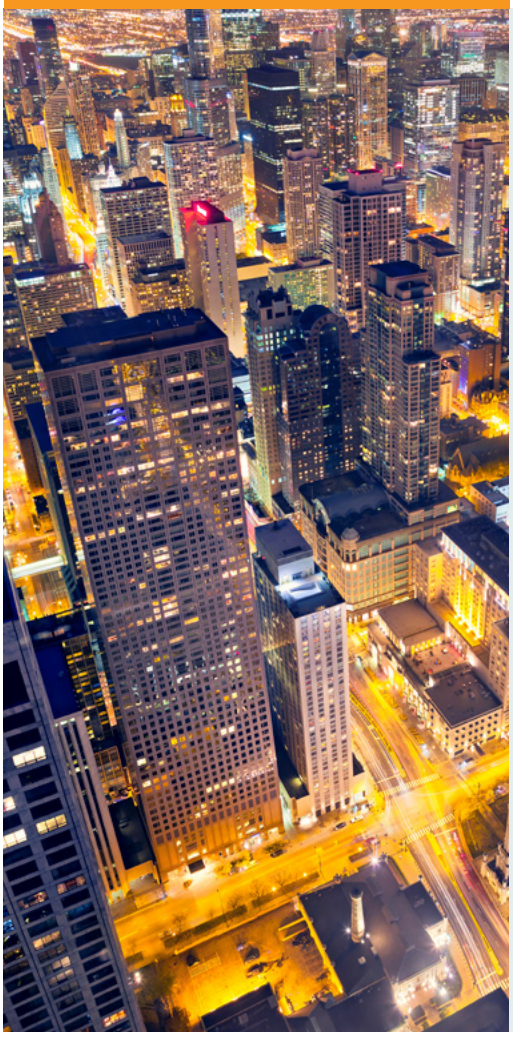

Shareables

1. Increased penetration and capabilities of smart meters enables alternative rate designs.
2. Time-of-use rates can reduce system peak while holding utility revenues constant.
3. Utilities can optimize rate design with other demand-side management or distributed energy resources (DER) to achieve defined targets.

Technology Enables Alternative Approaches to Rate Design

The growing penetration and increased capabilities of smart meters are creating opportunities for more widespread implementation of alternative rate designs that more effectively communicate to customers when it is less costly to consume energy. Rate design can be a component of an overall demand-side management (DSM) and DER plan that can address system needs and reduce costs while achieving the primary goal of rate design: to effectively balance the costs of providing a service with the revenues recovered from the customers using that service.[1]

[1] The principles and goals of rate design have been fundamentally shaped by the work of James Bonbright, who identified three primary objectives of rate design: 1) a revenue requirement which provides a fair return to the utility; 2) charging customers on the basis of the cost to serve them; and 3) discouraging excessive use of the service while allowing for economically justifiable usage. See James C. Bonbright, Principles of Public Utility Rates (New York: Columbia University Press, 1961), 292.

Case Study: Finding a Revenue-Neutral Way to Reduce System Peak and Cost

System peak drives system cost, requiring more expensive generation capacity and more physical infrastructure. Consequently, utilities are exploring mechanisms to reduce peak load and thereby provide cost savings to all customers.

ICF worked with a utility to identify the best option for reducing peak load while maintaining revenue neutrality. The analysis consisted of two initial steps: 1) an extensive review to understand the utility's business and cost structure, customer base, load, and technical challenges; 2) detailed analyses to identify load management options. We determined that out of a set of DSM options including direct load control, demand response (DR), and energy efficiency programs, a time-of-use (TOU) rate would realize the greatest peak load reductions, at the lowest cost, and in the shortest timeframe. This finding was partly driven by the fact that the utility had already installed smart meters for the customers that accounted for a significant share of both peak load and total electricity consumption.

After identifying a TOU rate as the preferred mechanism, we analyzed the utility's data to optimize the on- and off-peak time periods, the price differential for those time periods, the bill impacts for participating customers, and the overall system cost.

Finally, ICF created a marketing plan and supported the pilot rollout of the TOU program to promote customer participation.

Table 1 outlines the results of the analysis whereby the implemented TOU rate reduced system peak load by six percent while maintaining revenue neutrality.

TABLE 1: TOU RESULTS

	Results
Ratio of On-Peak to Off-Peak Price	2
TOU Off-Peak Discount	21%
Estimated On-Peak Consumption Change	-6%
Estimated Off-Peak Consumption Change	+2%
Estimated Revenue Impact	0%
Potential System Peak Load Reduction (MW)	95

Ongoing Rate Design Reform Will Drive the Need for Similar Analyses

The peaking nature of load creates both a challenge and an opportunity in the corresponding variability in the cost to generate and supply electricity. The disproportionate impact of system peaks on system costs means that reliable peak reduction can have an outsize impact on cost. Consequently, a growing number of utilities are actively investigating opportunities to transition toward rate designs that lower overall system costs while simultaneously achieving cost

allocation and recovery that is stable, predictable, and equitable.

It is critical for utilities to understand how the energy price signals provided by TOU rates and other rate designs will impact system cost, cost allocation and recovery, and other objectives. Analyses similar to the approach outlined in the case study can provide value in a number of ways:

- Building a business case for leveraging advanced metering infrastructure (AMI) by demonstrating applications that increase system efficiency and decrease system cost
- Optimizing rate design with other DSM or DER to achieve defined targets (e.g. total electricity consumption, peak demand reductions, energy intensity, etc.)
- Evaluating revenue impacts of various designs

About the Authors

Mike Alter is an associate at ICF as part of the Distributed Grid Strategy team. His primary focus is on how utilities can more fully incorporate distributed energy resources (DER) into future distribution system planning. His work includes accounting for DER growth scenarios in utility load forecasts, the ability of the distribution system to host additional levels of DER without requiring significant system upgrades, and how utilities can more proactively identify opportunities for DER to defer or replace a traditional utility project. Mt. Alter holds a dual B.A. in Economics and Political Science from Rutgers University and an M.A. in Public Policy from the Harvard Kennedy School of Government.

Haider Khan has 13 years of experience in econometric and energy modeling, simulation, and optimization for utility analytics including demand side management, energy efficiency, and renewable energy. Mr. Khan leads work in energy efficiency analytics and policy, conducting residential, commercial, and industrial energy modeling, data analytics, econometric modeling, software development for energy savings estimation, and DSM program implementation support. He earned his B.S. in Mechanical Engineering from University of Engineering & Technology and his M.S. in Mechanical Engineering from Oklahoma State University.

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