

Smart Rates: Central to the Grid of the Future



The Situation Today

Utilities and regulators know that the price of power on the wholesale market fluctuates with demand. Consumers generally are not exposed to these rate fluctuations. If they were, consumers could save money on power bills while helping utilities meet the challenges of operating the distribution system efficiently and integrating distributed generation from intermittent resources like rooftop photovoltaics (PV).

NEW RATES FOR NEW ENERGY RESOURCES

Some 1.8 million U.S. households have their own solar generation facilities, according to the Energy Information Administration. Fewer than 10 years ago – 2010 – that number was 137,600.

Not surprisingly, regulators have been grappling with the loss of revenue to utilities and the need for rates that help utilities maintain necessary infrastructure to back up that intermittent, distributed generation without shifting costs to those ratepayers who don't have PV on their roof tops. Net metering – the practice of paying utility customers for the power they feed back onto the grid – has been under review in several U.S. states during the past year.¹

Legacy net metering policies can lead to a subsidy effect, where those customers who don't have rooftop PV must pay higher rates to keep utility distribution systems operating. In effect, non-generating customers subsidize customers with home-based generation. Often, legacy net metering policies pay utility customers retail rates for the power they produce, which can mean utilities are paying those consumers more than they'd pay energy wholesalers.

Advanced metering infrastructure enables regulators to help utilities compensate customer-sited generation in a more equitable fashion. One option to accomplish this is through demand charges that calculate highest demand for a period of time – such as one hour or one half-hour – during a billing cycle. Then, customers pay a rate based on consumption during that peak period along with their standard charges and volumetric rate.³ This approach rewards customers for keeping consumption profiles relatively flat while giving utilities a way to recover more cost-to-serve expenses from those with distributed generation and lower volumetric charges in their bills.

MAKING THE MOST OF UTILITY ASSETS

When utilities can reduce peaks and even out load profiles, they make more efficient use of their generation and distribution assets. Peak reductions can positively impact capacity constraints and can help utilities defer capital investments.

“Pilot programs have shown smartly designed residential time-of-use (TOU) and other time varying rate structures can effectively shift power consumption away from peak demand and drive significant savings for both customers and utilities,” noted a January 2019 Utility Dive article. Ahmad Faruqui, principal of The Brattle Group energy consultancy, has calculated that for every 10 percent increase in the peak-to-peak price ratio, residential utility customers reduce peak consumption some 6.5 percent.⁴

THE TECHNOLOGY

Advanced metering infrastructure includes three elements: smart meters that have computing and communications capabilities, networking infrastructure and software to manage the system. An advanced meter – like any meter – is the main demarcation point between a consumer and the utility. It represents the point at which the energy conversation with the customer begins.

Without AMI, information from meters usually is available to customers and utilities on a monthly basis only. The time lag between consumption and meter reading schedules makes it hard for consumers to link behavior with their power bills, resulting in the potential for unpleasant bill surprises and consumer frustration.

At the same time, utilities with monthly reads have only a rear-view-mirror perspective of what transpired at the grid edge with no visibility into distribution system loading or voltage performance along the entire length of the circuit. This requires utilities to base decisions solely off predictive analysis rather than direct measurement. Utilities also have no rate-based way to incent consumers to shift consumption away from peaks, which means they must rely on costly peaking plants or spot-market buys.

Advanced metering facilitates smart, time-varying rates that reflect the true cost of energy and delivery charges in a deregulated environment, empower consumers to save money and help utilities make the most of their assets by incentivizing off-peak consumption. AMI supports smart rates with the following functions:



FREQUENT INTERVAL DATA

Because advanced metering connects utilities to customers via a stable network infrastructure, utilities can bring data back in any interval. Most utilities with AMI bring residential and commercial data back in 15-minute increments. This enables utilities to verify system performance compliance with time-based data and do a variety of operational activities, such as seeing the loading on transformers and tracking voltage at the grid edge. This results in a more robust ability to plan capital investments to address system issues along with enabling potentially faster timelines for renewables to interconnect with the grid.



INFORMATION TO INFORM CUSTOMER CHOICES

AMI can be made available to customers on a near real-time basis to help consumers make more informed decisions about energy use, along with establishing billing and usage alerts to avoid surprises. The data can also be utilized to identify problems with appliances that are causing increased energy use.



DEMAND MANAGEMENT

Some AMI meters can be fitted with demand-management technology that allows customers to choose a level of energy use they don't want to exceed, then pick which appliances in the premises will automatically respond when demand approaches that threshold. This allows customers on demand rates to more effectively manage their energy costs.

SMART RATE BENEFITS



REDUCED ENERGY COSTS FOR CONSUMERS

Flat-rate pricing means that customers pay the same rate for power regardless of the cost to generate it. Customers can't shift usage to take advantage of lower-priced electricity rates. When customers can choose to use energy during lower-priced times of day, studies show that they can save money. A 2008 pilot at New Jersey's Public Service Electric & Gas resulted in a 5-percent peak impact for those with no supporting technology and a 21-percent impact for those consumers using a smart thermostat. During critical peak events, the load impact from study participants with no supporting technology was 19 percent, while participants with smart thermostats delivered 47-percent load impact. Average savings for 86 percent of study participants was \$160 during the pilot.⁵

Similar results occurred in Arkansas. According to material produced by Oklahoma Gas & Electric, 92 percent of Arkansans who enrolled in the utility's SmartHours variable peak pricing or time-based rate plans saved money, with an average of savings of more than \$140 annually.⁶ The utility offers a SmartHours "best-bill guarantee." Through it, OG&E will credit the customer's account the difference if the SmartHours cost for electricity exceeds what the customer would have paid on the rate he or she had before signing up for the program.⁷



RATES CUSTOMERS PERCEIVE TO BE FAIR

When the Sacramento Municipal Utility District tested time-based rates in 2012, customers offered a chance to participate in the study opted in. Among those offered the opportunity to participate in the pilot, 16.4 percent offered a time-of-use (TOU) rate signed up for it and 18.8 percent offered critical-peak-pricing (CPP) chose it. Two thirds of customers who became pilot participants by default and 85 percent of those who opted-in said they understood why SMUD offered such rates.

Roughly 40 percent of customers who became study participants by default and 57 percent who opted into the program agreed with the statement, "my current pricing plan is better than my old pricing plan." Approximately half of the default program participants and 75 percent of the opt-in respondents agreed with the statement, "I want to stay on my pricing plan." Nearly 60 percent of the default customers and 80 percent of the opt-in respondents felt their city "would be better off if everybody was on my pricing plan."⁸



INFORMED, EMPOWERED CONSUMERS

Pacific Gas & Electric offers personalized rate comparisons available to customers online. Comparisons are based off each customer's historic AMI data rather than estimates or customer-class profiles. This enables customers to see how a new rate would impact their energy costs. The landing pages launching this customized rate comparison also cover several rate plans offered by the utility. Five out of the six plans listed are time-based.



DEFERRED INVESTMENTS FOR UTILITIES

Because time-based rates can help reduce peaks and shift consumption to off-peak hours, they also can help utilities more efficiently run their systems and delay investments in new capacity. When Oklahoma Gas & Electric tested its Variable Peak Pricing (VPP) rate in 2011, utility managers calculated that if 20 percent of residential customers choose that rate, the utility would be able to avoid investing in a planned 210 MW peaking plant.



MORE EQUITABLE RATES FOR SELF- GENERATING CUSTOMERS

Across the U.S., regulators have been examining net energy metering (NEM) rates that compensate customers with their own generation resources, such as rooftop photovoltaic systems. Often, customers are paid for each kWh they generate at the retail rate the customer would have paid without distributed generation. When rates are volumetric, that means DG customers reduce their consumption and power bills, and the burden of paying for fixed costs of the grid is born by customers without DG. In other words, customers with no self-generation subsidize those customers who have self-generation resources.

In September 2019, the Brattle Group released research on how much of that subsidy non-DG customers pay based on the experience of 16 utilities in 14 states. "The NEM subsidies range in \$20-\$100/customer/month across all utilities, representing roughly 25 percent to 200 percent of the monthly bills for residential DG customers of these utilities," the report authors wrote.¹⁰ Demand rates that add a demand ratchet onto DG customers bill are one way to alleviate the inequity of the subsidies. Demand charges require AMI to be accurately applied.

¹ <https://insideclimatenews.org/news/11062019/rooftop-solar-net-metering-rates-renewable-energy-homeowners-utility-state-law-changes-map>

² <https://www.utilitydive.com/news/an-emerging-push-for-time-of-use-rates-sparks-new-debates-about-customer-an/545009/>

³ <https://www.utilitydive.com/news/will-the-countrys-first-mandatory-residential-demand-charge-slow-the-massa/515189/>

⁴ Ibid.

⁵ https://www.edf.org/sites/default/files/a_primer_on_time-variant_pricing.pdf

⁶ <https://www.oge.com/wps/wcm/connect/a7695017-8833-494e-9b18-cdea57759fd3/2016+Arkansas+Residential+SmartHours+5-18-16.pdf?MOD=AJPERES&CACHEID=a7695017-8833-494e-9b18-cdea57759fd3>

⁷ file:///C:/Users/Owner/Downloads/SmartHours+Savings+Tips%20(1).pdf

⁸ https://www.smartgrid.gov/files/SMUD-CBS_Final_Evaluation_Submitted_DOE_9_9_2014.pdf

⁹ https://www.edf.org/sites/default/files/a_primer_on_time-variant_pricing.pdf

¹⁰ <https://www.sciencedirect.com/science/article/pii/S1040619019301861?dgcid=author>