Targeted Demand Management

Reduce the Need for New Investments in Transmission and Distribution Infrastructure

Traditionally deployed across an electric utility's entire service territory, demand response has most often been leveraged as a cost-effective substitute for peaking generation to ensure reliability when system demand is highest. Today, it is playing an expanded role in keeping rates low and lights on. Many utilities are beginning to look at geographically targeted demand response deployments as cost-effective alternatives to transmission and distribution infrastructure upgrades for local reliability.

Despite modest growth in overall energy consumption, growing peak demand in certain geographies combined with aging delivery infrastructure has many utilities faced with the need for significant investments in new or upgraded lines, substations and transformers, all of which could lead to higher rates. Fortunately, emerging regulatory models and technology advancements are opening the door for utilities to use demand response and other distributed energy resources to mitigate that need for new investment. These non-wires alternatives enable utilities to maintain reliability while keeping rates low, demonstrating a commitment to sustainability and engaging customers with tools to manage their energy use.

The model is called "targeted demand management," and it's forging ahead in states such as New York and California.

HOW TARGETED DEMAND MANAGEMENT WORKS

Our electric delivery system is typically subdivided into two categories: transmission, which carries energy over long distances at high voltage from generators to areas of need, and distribution, which carries energy over shorter distances at lower voltage to the end user. Targeted demand management can be used to reduce the need for investment in both categories of infrastructure.

The transmission system is said to face a "constraint" when the least-cost dispatch of generators to meet system load would cause too much power to flow over one or more of the system's transmission lines. When faced with a constraint, system operators deviate from a purely economic dispatch and instead call for output from generators closer to load, even if those generators' output is more expensive. In the short term, this results in load paying higher prices in these constrained areas, or "load pockets." In the long term, it requires that system planners ensure that sufficient generation or transmission is built in these load pockets to maintain system reliability. Targeted demand management can reduce peak load in these areas to trim the short run costs of dispatching more expensive generators and to mitigate the long run need to invest in new transmission or local generation.

At the distribution level, utility systems consist of many different components: substations, transformers and switches, just to name a few. Each of these components has a rated capacity that dictates the maximum load it can serve. Distribution networks are built with future load growth in mind, but eventually, and particularly in areas of high or unexpected load growth, individual components must be upgraded, either as they reach the end of their useful life or as load from the customers they serve threatens to exceed their rated capacity. Targeted demand management, by slowing that load growth and reducing stress on equipment, can defer significant capital expenditures on distribution system upgrades.

INCREASING INTEREST IN TARGETED DEMAND MANAGEMENT

Three trends are driving the emerging enthusiasm for targeted demand management: (1) peak load growth accompanied by relatively little growth in overall usage, (2) technological advances that are lowering the cost of distributed energy resources and (3) efforts to reform the regulatory model to incentivize utilities to operate a cleaner, more economically efficient grid.

Peak Load Growth

Many parts of the country are seeing projected growth in energy use flatline, a result of energy efficiency measures and demographic changes. However, U.S. Energy Information Administration projections suggest many utilities are still poised to experience growth in peak demand. Since local peaks drive the need for transmission and distribution infrastructure, the reduction in overall load growth alone offers little relief. Utilities still see transformers and substations at risk of exceeding their capacity and thus requiring an upgrade. Worse, for those utilities who face little or no growth in energy use, this additional investment must be recovered by charging customers higher rates per kilowatt hour rather than by relying on increased volume of sales.

Technological Advancements

Today's home is becoming increasingly fitted with distributed energy resources (DERs). As DERs become more effective and affordable, consumers are installing solar panels on their rooftops, electric vehicle chargers in their garages and Wi-Fi connected thermostats in their living rooms. Access to lower-cost and more flexible DERs opens the possibility of nonwires alternatives in places where they might not have been feasible with older technologies.

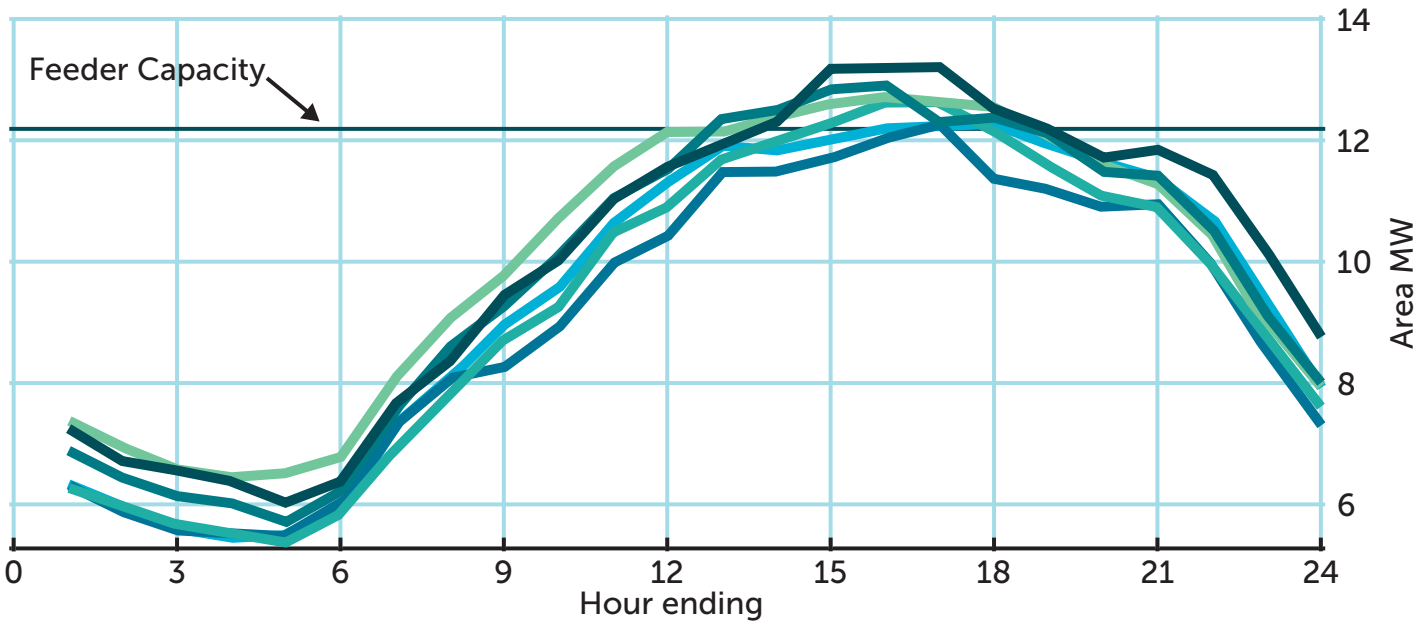
Regulatory Reform

Regulators around the country are recognizing that it's time for an update to the decades-old regulatory compact that emphasizes and rewards utility investment in central station generation and delivery infrastructure. Many states are exploring the increased use of performance-based ratemaking or shared savings models that financially reward utilities for making economically efficient decisions like employing targeted demand management in cases where it is less expensive than distribution upgrades. These ratemaking approaches make the utility and its customers better off by reducing the total cost of delivered electricity—allowing customers to benefit from lower rates and shareholders to benefit from greater returns. In addition to deferring infrastructure investments, DERs provide a host of household and societal benefits such as convenience, comfort, lower consumption and reduced pollution.

THE DISTRIBUTED ENERGY RESOURCE LANDSCAPE

When it comes to crafting a successful non-wires alternative, utilities must assemble the right mix of DERs and deploy them in a way that maximizes their respective strengths. Based on detailed hourly load projections in their targeted areas, utilities can identify the periods in which they expect to see load in excess of their delivery capacity. The duration, magnitude and timing of these "excess load events" will inform the utility's choice of DERs and how to optimally dispatch them—whether demand response, energy efficiency, solar, storage or a combination of all of above.

PROJECTED PEAK DAY LOAD CURVES



Comparing local peak day hourly load curve projections against feeder capacity reveals the likely duration and shape of "events" that will need to be executed within a TDM program. Utilities must ensure that they have the right mix of DERs committed to confirm that net load does not exceed feeder capacity.

The least-cost non-wires alternatives typically address load first through demand response (DR) and energy efficiency (EE). EE focuses on permanent reductions to the load curve which can help reduce the number and magnitude of excess load events. DR, on the other hand, focuses on discrete and more intense reductions in demand as called for by the utility, and can thus be calibrated and dispatched to contribute as needed to address excess load events as they occur.

Modern technology enables more flexible, fast-acting and reliable DR, and the two-way flow of data enables DR providers to carefully monitor participant comfort and thus call events more frequently than they have in the past. But DR is ultimately limited by the quantity of load under control and customers' willingness to forego consumption. Where load management alone cannot defer investment, utilities might turn to more expensive solar and storage technologies.

Like EE, solar has permanent impacts on the net load curve, but the utility cannot dispatch the resource to ensure its output aligns with their excess load events. Storage provides that functionality but, at least today, at greater cost.

Importance of a Demand Response Management System

Whatever combination of DERs a utility chooses, a modern distributed energy resource management system (DERMS) is a foundational tool in managing and orchestrating these assets. It must allow for targeted dispatch and flexible event control approaches, including direct control, temperature setback and automated responses to price signals, all while accounting for the output of non-dispatchable resources like solar. A targeted demand management program will often require precise load shapes, so a DERMS must also be able to execute control events that deliver a predictable and reliable load shape.

DEVELOPING A DEMAND RESPONSE STRATEGY TO MAXIMIZE MEGAWATT DELIVERY

Since load management is typically the least-cost, most-proven resource when crafting a non-wires alternative, it makes sense to design a solution focused on recruiting substantial quantities of DR capacity. Given the smaller addressable population in a geographically targeted program, this means achieving very high levels of market penetration—often in excess of 50% of the eligible population. This requires a comprehensive marketing strategy and program design that includes: in-depth customer analysis, effective communication channels and sufficient choice among devices and program offerings.

Customer Analysis

Utilities will be best able to recruit customers for a program when they start with a strong understanding of their customers' motivations and likelihood to participate. By reviewing published studies, consulting with experts or conducting their own research, utilities can segment their population and customize their outreach to ensure that the messages they deliver focus on the benefits that resonate with each individual customer, whether that's the environmental, community, financial or convenience benefits of the DR program.

Communication

Today, there are a wide range of communication channels available to keep residential participants informed, both about the initial program offer and ongoing program details. While direct mail has traditionally been the most effective recruitment tool, maintaining a strong web presence and a well-informed call center are equally important. A compelling program will leverage channels that continue to grow in popularity, including text messaging, email, phone applications, social media and web portals. In the long run, utilities need to evaluate the potential efficacy of each channel and determine when to implement each as part of a comprehensive communication strategy.

Customer Choice

Reaching a high volume of customers only helps if the utility offers options that appeal to those customers. Within a direct load control program, utilities should offer their residential customers choice among load control devices—including Wi-Fi-enabled thermostats and switches installed outside of the home—and among control strategies—higher paying options for customers willing to shed more load. Customers should also be able to enroll their own retail-purchased Wi-Fi thermostats into bring your own device (BYOD) utility load control programs.

CONCLUSION

Targeted demand management can serve as a cost-effective, customer-centric and environmentally-friendly substitute for traditional utility infrastructure investments, and thanks to emerging regulatory and technology trends, it is a more viable option now than ever. Demand response is the backbone of most successful non-wires alternative strategies. Utilities will need to design programs that result in high rates of adoption and yield reliable demand response megawatts.

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CORPORATE HQ
2111 North Molter Road
Liberty Lake, WA 99019 USA
Phone: 1.800.635.5461
Fax: 1.509.891.3355