Itron

Getting More Out of Demand Management:

Integrating Demand Response and Energy Efficiency

CONTENT

Introduction....2
Why DR and EE Are a Natural Fit....3
Key Program Technologies....4
Benefits to Utilities....6
Benefits to Program Participants....7
Opportunities and Complexities....7
Measurement & Verification....9
Getting Started....9
Conclusion....9

INTRODUCTION

Does your utility have regulatory incentives to invest in energy efficiency (EE), but also see value in developing capacity resources? Are you investing in demand response (DR) but want to explore ways to attract more participants and subsidize cost-effectiveness through energy efficiency? Or have you been tasked to improve customer engagement in conjunction with existing programs—perhaps to prevent ceding the relationship with your customer to a third party? Finally, do you need help transforming a traditional one-size-fits-all DR program into a solution that meets the needs of a two-way grid?

If your utility is like most others, you have traditionally managed these drivers by offering your customers a mix of siloed programs that aren't meeting today's requirements. These programs might include:

- A mail-in rebate for programmable thermostats that may generate energy savings but doesn't provide DR benefits
- A bring your own device (BYOD) Wi-Fi thermostat pilot that isn't delivering measurable energy savings, has DR that doesn't meet your operational requirements and is not scaling beyond early adopters
- A one-way DR program that doesn't allow more sophisticated outcomes, like locational dispatch or integration with time of use (TOU) rates
- A time-of-use rate with low adoption and limited operational value
- Behavioral demand response, which isn't proven to be reliable or sustainable, and cannot be monetized in capacity markets

As you may have experienced firsthand, marketing several demand management programs at the same time can cause customer confusion,* making recruitment and retention more challenging and expensive. Just as unfortunate, overlapping DR, EE and customer engagement programs can increase the complexity of measurement and verification as analysts struggle to parse their effects.

*Exploring the Relationship Between Demand Response and Energy Efficiency: A Review of Experience and Discussion of Key Issues; Dan York, Ph.D., and Martin Kushler, Ph.D.; March 2005.

It might seem there's no way out. But in fact, there is one clear solution that unlocks all the customer, utility and grid value streams for all customer classes. And your utility peers are already leveraging it and proving the benefits.

The solution lies in combining all of the programs above into a single coordinated initiative: **An integrated demand response and energy efficiency program based upon two-way connected thermostats.**

A DR/EE program will deliver:

- An enhanced customer experience, providing customers comfort, convenience and control
- Device-enabled price response, allowing customers to set it and forget it
- Customer choice in devices, device type and channel of acquisition
- The highest levels of cost-effectiveness
- More clear and consistent messaging for customers, utilities and regulators
- Success at scale, delivering progress towards critical demand management goals
- The highest operational value available in mass-market programs

In this document, we'll share key insights and considerations for combining your programs to yield high-quality demand response, measurable and substantial energy efficiency, and engaging customer experiences.

WHY DR AND EE ARE A NATURAL FIT

Most consumers understandably can't differentiate demand response from energy efficiency, as both are tools designed to reduce the demand for energy. This makes confusion a likely outcome when customers are presented with multiple thermostat programs from their utility. For the same reason, it makes the two a natural fit.

From a utility perspective, the key difference between the two is the sustainability, predictability and precision that is required for successful demand response, but not for energy efficiency. A DR resource needs to be as reliable over time as a generator or transmission line to successfully defer those capital investments. But when we're already installing a Wi-Fi thermostat as part of a demand response program, why not also use the device to deliver an important outcome like energy efficiency? And now as distributed energy resources (DERs) become more prevalent, along with dynamic pricing, the lines between DR and EE are blurring further.

Pulling all this together, the following are three primary reasons why demand response and energy efficiency programs go hand in hand.

Mutually Reinforcing Participant Recruitment

Priming customers with messaging around energy efficiency and conservation helps end-users to better understand the value proposition of other opt-in programs that reduce energy demand, including demand response. The unsolicited (opt-out) messages from a behavioral reporting program are an ideal recruitment tool to promote customers into a more cost-effective device-enabled program.

If the customer is not a good candidate for a device or doesn't respond to marketing, then utilities can promote the customer out of paper reports and into a digital behavioral program.

Improved Program Design

Management of demand response and energy efficiency on a single software platform enables coordinated customer and program information so that a utility can speak to its customers with a unified voice. Disjointed messaging regarding the need to shift or curtail usage versus the need to reduce total consumption leads to customer confusion, frustration and ultimately the potential for reduced participation and impact.

Our recommended device program includes behavioral messages with insights that are actionable with the click of a button. These behavioral insights are fueled by the optimal combination of meter, customer and thermostat telemetry data, and served up on a mobile app that customers not only enjoy engaging with but are willing to spend their own hard-earned money to purchase. Instead of hoping a customer consistently responds to a robocall to provide the capacity savings a utility requires (as with behavioral DR), utilities can depend upon device control and incentives to ensure optimal load impact in a more surgical fashion.

Average consumers are showing greater interest in managing their energy use. With an integrated program, we capitalize on this interest by providing a compelling value proposition and making it easy to get and stay engaged.

Opening New Communication Channels

Trends suggest that mobile applications, which serve as portals for customer engagement, may be how customers themselves prefer to interact with their utilities. Deep analytics built into a consumer engagement portal track engagement with every touch of the screen, allowing a utility to measure, improve and personalize, presenting offers that have the greatest likelihood of being persuasive. In an integrated DR/EE program, the customer engagement portal also serves as the ideal medium for bundling with other types of home services and consumer offerings. As reported in the J.D. Power 2015 Electric Utility Residential Customer Satisfaction Survey, proactive customer communications—including when a utility calls, emails, or sends a text message—are only reaching 7.3% of customers.* What's more, customers want as much as twice the volume of communication from their utility that they currently get.** A portal with compelling tools and useful information that draws customers back regularly is a new and promising medium for utilities to keep in contact with their customers. Since demand response and energy efficiency are related, they interact with one another in ways that must be anticipated in order to be leveraged. Since energy efficiency can reduce the total amount of demand response available, utilities need systems to predict that interplay so they can file their program to get credit for both DR and EE savings (even as the two interact and change each other).

*JD Power: Communicating with Customers and Higher Price Satisfaction Increase Overall Satisfaction for Residential Electric Utilities

**Utility Dive: For top utilities, customer satisfaction hinges on empowerment

KEY PROGRAM TECHNOLOGIES

Critical technologies that provide the infrastructural foundation to any successful DR/EE program include connected thermostats, load control switches, a customer engagement portal and enterprise software.

The Connected Thermostat

Delivering demand response and energy efficiency together is best done with a Wi-Fi connected thermostat, which also provides utilities a treasure trove of valuable data. With connected thermostats, you don't need an AMI network in order to gather key customer insights, including:

1. **Thermostat runtime**, which produces household thermodynamics, including how quickly the home heats or cools relative to internal and external temperatures, when the HVAC system is on or off, allowing optimal DR and EE utilization
2. **Thermostat settings**, including household preferences to support more personalized recommendations
3. **Air conditioning load**, on install, enabling calculations of kW and kWh savings
4. **Tip feedback**, which, because the tips are actionable and there is household-level data, allows the utility to see how customers respond, enabling program optimization

These are just four examples of many insights that can be gleaned from thermostat data, with or without an AMI deployment. These insights can optimize demand response, energy efficiency and the customer experience.

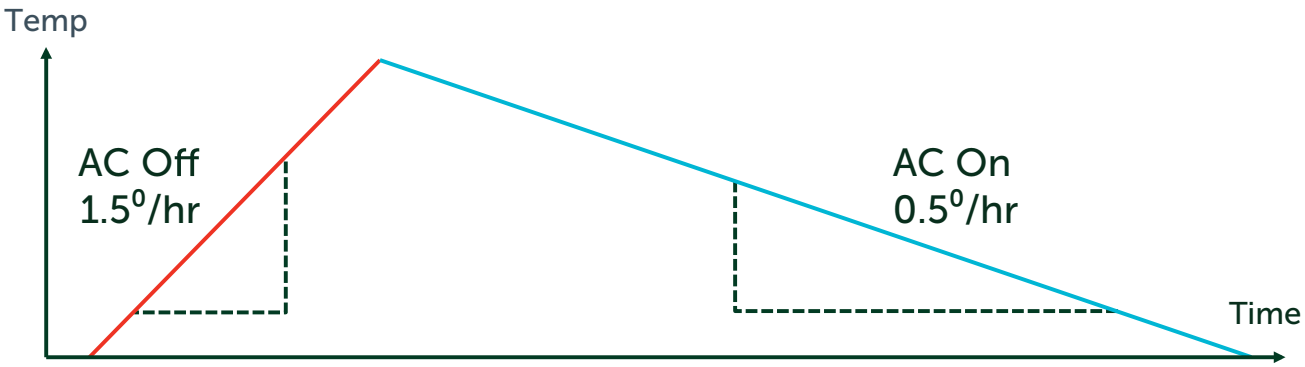
Not only do connected thermostats provide greater comfort and convenience to customers, provide in-depth device data and enable personalized, compelling insights, but consumers see them as a value-add offering from their utility. A broad base of customers—not just early adopters—are demonstrating high interest in connected thermostats. According to Parks Associates, by the end of 2015 nearly half of all thermostats sold will be smart. Increasingly, they are being sold in retail stores and through the HVAC channel, purchased by consumers showing proactive interest.* A top-tier demand management program provider can not only utilize direct install thermostats, but can also acquire and leverage third party devices.

The Load Control Switch

Field data shows that while there are obvious advantages to a connected thermostat, it's not the ideal solution for all circumstances. For renters or multi-dwelling units, a switch is often the more efficient long-term play. It's also a better tool to reach different sources of load, like water heaters and pool pumps. Finally, to reach high levels of market penetration in a demand management program, having an external switch option is critical. Many customers do not want to have an installer come inside their home and another segment may want to minimize their level of effort while participating.

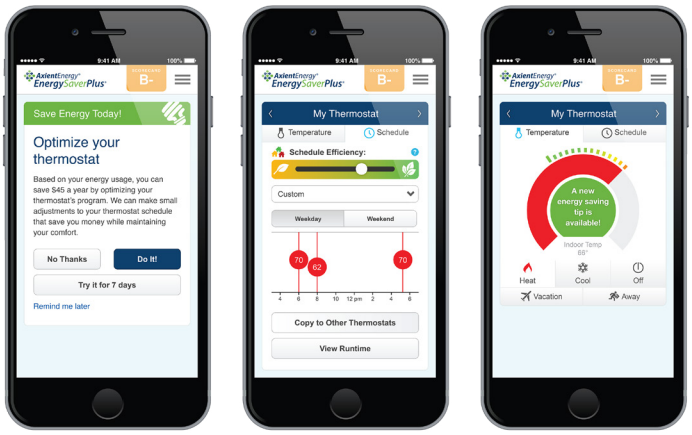
With device-driven programs, utilities can reach the best megawatts in a very high percentage of their service territory.

*Greentech Media: Smart Thermostats Begin to Dominate the Market in 2015



Two-way device data enables the development of a thermodynamic model of the home with monthly billing data alone, producing new customer insights. In this example, insights include:

- **DR** – Cycling strategy must preserve comfort and load shape in this home, which takes a long time to cool down
- **EE** – When recommending temperature settings in tips, don't let this home get too hot
- **Customer Engagement** – Recommend an AC tune-up to improve efficiency



Customer engagement enabled by connected thermostats is often the key to opening productive channels of communication with the majority of customers who have limited engagement with their utility.

The Customer Engagement Portal

In successful integrated DR/EE programs, utilities combine connected thermostats with attractive, user-friendly and mobile-optimized customer engagement portals. With this offering, customers can control their thermostats on the go, accessing comfort and convenience wherever they are from a diversity of devices including desktops, laptops, smartphones and tablets. These feature-rich portals offer numerous benefits to both customers and the utility alike, including:

- **Customized analysis and insights** transforming data into graphical insights, including DR event status, usage analysis, bill analysis and normative comparisons, that inform and drive action.
- **Actionable tips engine** sending customers recommendations that are relevant, personal and actionable with one click of a button within the app, with acceptance triggering an immediate implementation of the solution. The tips engine can include personalized estimates of energy savings and drive customers to measurable efficiency savings.
- **Personalized thermostat optimization** allowing customers to monitor the status of their home remotely, program the schedule of their thermostat, and quickly and easily adjust temperature and mode.
- **Automated response to TOU programs** allowing customers to set preferences and have their HVAC system automatically respond to prices or peak events, resulting in significant savings.

Enterprise Software

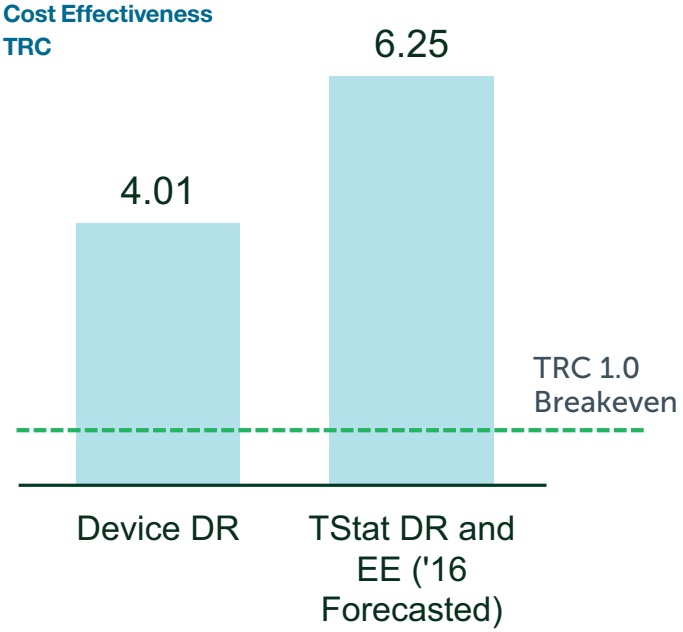
For ease of program administration, utilities need software that facilitates the implementation of a demand response program and also offers ongoing integrated energy efficiency and other customer engagement capabilities. By managing all these initiatives on one software platform, utilities have a single view of their customers that allows them to coordinate activities to reduce confusion and maximize outcomes.

Utilities also need advanced predictions and targeted dispatch as they consider more complex demand management outcomes, such as:

- Performance-based incentives from their regulators
- Economic dispatch
- Participation in capacity markets, with additional value from ancillary services such as synchronized reserves
- Offsetting renewable intermittency
- Load shed during cold weather events
- Harnessing third-party devices

Legacy demand response automation server (DRAS) systems and oneway devices may not provide the data and control to move demand resources into these higher value outcomes. Working with an industry expert, you can develop a strategy to transition to a more sophisticated demand response management system platform over time.

2012 – 2016 PHI Demand Management Program Cost Effectiveness
TRC



-MD PSC Case No. 9155 filed 21 Sept 2011; table Es-5 page 11 "All Rate Payers" Test

-2016 component of results forecasted

BENEFITS TO UTILITIES

Programs that deliver demand response, energy efficiency and customer engagement in one offering to customers provide tremendous benefits to utilities, especially in terms of cost-effectiveness.

A 2012-2015 study of demand management program cost-effectiveness at Pepco Holdings, Inc. (PHI) produced impressive Total Resource Cost (TRC) forecasts for a thermostat-based DR and EE program starting in 2015. While the DR-only program yielded a high TRC (4.01), adding EE benefits increases that TRC to 6.25. Thus the combined return is almost double the DR-only. Through the same recruitment, truck roll and device installation, utilities can layer in additional benefits and thereby significantly increase TRC.

Common concerns with device-based programs are that not enough customers will opt in to meet program goals, or that certain customers won't be able to participate. For the following reasons, we believe that these are not obstacles in implementing these programs:

- As our data from programs at PHI and Southern Maryland Electric Cooperative have shown, program participation of greater than 50% is achievable for an opt-in switch and thermostat program. We believe this can increase by adding EE capabilities to the connected thermostat and if the behavioral reports are used to promote customers into the program.
- Bring your own device programs empower another pool of customers to participate in the program—one that is already disposed toward engagement with their energy consumption.
- There are several approaches, including switch programs or thermostats leveraging community Wi-Fi, to make device programs extremely cost effective in multi-family units.
- Besides benefitting from improved cost-effectiveness, utilities find that it is easier to recruit and retain customers in demand response programs with the added value from a thermostat that also has energy efficiency capabilities. Additionally, EE messaging primes a program customer for DR. A more useful and value-producing experience for customers overall makes the program "stickier."

Moreover, since the energy efficiency tips provided to customers are actionable, utilities know in real time from device telemetry how customers are choosing to engage with and act on them. The real-time feedback of device-based energy efficiency stands in contrast to the amorphous nature of home energy report programs, which rely on broad surveys and long-term data analysis to develop a 20,000-foot level understanding of customer engagement habits. Integrated DR/EE programs help utilities know their customers better and act accordingly.

The costs of a combined demand response and energy efficiency program can be further lowered through a variety of means. Leveraging third-party devices in a bring your own device program eliminates the need for an expensive truck roll and installation. Utilities can also leverage trade channel providers like Pro1 to provide the installation. Cellular and paging fees can be eliminated by choosing a lower-cost communications network such as Wi-Fi, and the cost of Wi-Fi devices continues to fall. Two-way data serves to reduce free-riders, so that utility payments to customers are accurately based upon event participation.

EPRI estimates that the integration of demand response and energy efficiency programs has the potential to reduce demand for electricity by 14-20% below projected levels during peak periods.*

*EPRI: Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S. (2010 - 2030)

BENEFITS TO PROGRAM PARTICIPANTS

Just as integrated demand management programs offer advantages to utilities, program participants also benefit at every stage of their involvement.

Choosing Their Level of Involvement

Since one size doesn't fit all, Integrated DR/EE programs often give customers thermostat options, multiple channels of engagement and incentives and control options to fit their lifestyle.

Actively Participating

Customers are incentivized to access the utility-offered portal because it adds value and convenience, helping them control the temperature of their home no matter where they are. Once they are on the portal, they receive personal, relevant and actionable advice to reduce their consumption and save money on their bill. With the in-depth thermostat data provided to the utility, recommendations can be specific and savings estimates precise, with no more vague "up to" language or generic tips. Customers can implement tips immediately at the touch of a button, with no gap between processing a cost-saving insight and acting on it.

Even without AMI, near real-time Wi-Fi device data enables customers to participate in capacity-saving, performance-based incentive models, such as peak-time rebate, critical-peak pricing and time-of-use pricing. A recent study by The Brattle Group found that enabling technology can boost the capacity impact of price response demand management programs by 90%.*

Reaping the Rewards

With the help of personalized, relevant and actionable advice that can produce HVAC savings of 10-15%, participants in integrated DR/EE programs receive bill savings with real budget impact—up to $100-150 per year.

*The New Direction of Home Energy Management, Ryan Hledik (The Brattle Group), May 7, 2014, Comverge Utility Conference, New Orleans, LA.

OPPORTUNITIES AND COMPLEXITIES

Bring your own device, the small business customer class and dynamic pricing are three potential additions to DR/EE programs that can further increase cost-effectiveness and customer engagement.

Bring Your Own Device

Bring your own device, or BYOD, is one way to lower program costs and thereby increase the cost-effectiveness of integrated demand response and energy efficiency programs.* By taking advantage of third-party devices (primarily Wi-Fi connected thermostats) that are already installed in their customers' homes, utilities reduce deployment costs, increase their program footprint and offer more device choices and participation options. With advantages for both utilities and consumers, BYOD is a very natural convergence with DR/EE.

As your utility may already be contemplating, there are complexities inherent in this approach. From a business process standpoint, questions that a utility and its partner must address include:

- **How to manage the new enrollment and unenrollment processes** If BYOD customers' enrollment in DR/EE programs is managed on the utility website, how can customers be driven there? If customers are given the ability to enroll from the BYOD vendor's portal that they are accustomed to visiting, how will you handle integration with this vendor, including the greater exchange of utility customer data and the privacy and security concerns associated?
- **Whether the utility-branded portal will control the device** If so, how do you plan to get customers over the inertia and into the utility app versus the app associated with their device? How can you motivate them to use a different tool for controlling their thermostat? If you don't use the utilitybranded portal for BYOD thermostat control, how will you get some of the additional energy efficiency measures, such as gamification and tips, in front of customers?
- **Who the customer should call for different customer service issues** How will you anticipate and manage this certain source of confusion? Customers will need to know the types of issues that need to be directed to their utility, to the bring your own device manufacturer, to the device installer (for instance, an HVAC contractor), or to the store where they bought the device.

As you can see, even basic business processes need to be rethought and retooled for successful integration with BYOD. In addition, utilities should be aware that different BYOD vendors often have different restrictions, including length of event, number and frequency of events, and even a potential per-event cost. Advanced systems available today can help utilities forecast what each individual BYOD resource can provide, value them accordingly and understand the optimal way to dispatch these different resources to deliver quality megawatts at the best cost.

*A caveat: In today's market environment, BYOD programs across the country struggle to achieve more than a 1-2% market penetration. We hope that improves but also realize the current constraints. If a utility needs a lot of megawatts, and quickly, it is still necessary to roll trucks and install devices. For now, think of BYOD as a useful supplement to a utility-driven device-based program.

Small Business Segment

A DR/EE program can be an excellent way to engage with the traditionally underserved small business customer segment. The program is a compelling offering to small business owners, as it includes a demand response incentive, energy efficiency savings and tools to quickly and easily manage their energy consumption remotely.

To reach the small business segment successfully, utilities must evaluate the following:

- Recruitment processes, including higher-touch marketing with face-to-face sales
- The professionals implementing these programs, who should be trained to understand the small business segment's goals and motivations
- The technology that supports these programs, including multiple cycling options to maintain customer comfort, device and connectivity options that fit within tenant and landlord agreements, and enrollment and control features for businesses with multiple locations (a novelty for programs that traditionally serve single-family homes in the residential sector)

Clear communication on the advantages and interactions of demand response and energy efficiency is critical for this segment. As stated in the National Action Plan for Energy Efficiency – Coordination of Energy Efficiency and Demand Response, "Sophisticated business customers who are clear on the benefits of energy efficiency can be uncertain about the purposes and benefits of demand response. Coordinated programs will stand a better chance of succeeding if customers are clear about the benefits of both types of resources."* Once they address these considerations, utilities can find many advantages in deploying DR/EE programs to the small business segment.

Dynamic Pricing

Layering price response into DR/EE programs can also be very effective, especially as a tool to meet the flexible resource requirements of the modern two-way grid. With device-enabled dynamic pricing, customers reduce their risk while saving money. They achieve this by adjusting their automated responses to price signals, becoming more informed and better engaged. At the same time, this automation also allows the utilities to use the rates in a more predictable and surgical fashion. When compared to TOU rates, behavioral demand response or even peak-time rebates, utilities with device-enabled price response get happier customers and a proven resource of the highest operational value.

With a communicating DR/EE device in place, a price response component can be added to a program without the need to roll another truck. This applies if the device to be used is utility-installed or part of a BYOD program. However, if it is part of a BYOD program, utilities must determine if they need all of their vendor portals to know about the dynamic pricing configurations and implement this within their systems, or if price response components are built into the utility web portal and communication with direct-installed devices and bring your own devices is feasible. If the latter is the case, how does this synchronize with standalone BYOD portals that may not be programmed with the different pricing schemes? These are issues, again, that utilities should work with a trusted demand management provider to resolve.

Managing Optionality

With the flood of optionality that comes along with combining multiple programs, utilities must work with their partners to develop the right balance of choices—in devices, channels and control strategies—to minimize customer confusion.

Offer customer a device choice

Provide easy engagement with devices

Control strategies

- 50% - 75% - 100% Cycling
- Temperature Offsets
- Override
- Pay per Event
- Pre-Cooling
- Adaptive Cycling
- Opt-In / Behavioral

*Coordination of Energy Efficiency and Demand Response

MEASUREMENT & VERIFICATION

Measurement and verification (M&V) for integrated demand response and energy efficiency programs is evolving. On the demand response side, there are multiple acceptable ways in which to measure capacity benefits. The most tried and true of these is random sampling, with 100-200 sites with high-frequency (typically intervals of less than five minutes) data logging. This method works with monthly meter data, one-way paging switches and everything in between. Another DR M&V method is AMI data, from which individual household baselines and premises-level load drop can be calculated. Finally, with two-way runtime data and validated appliance load, individual baselines can be calculated using appliance runtime. This is the newest method and does not yet have universal approval by all of the ISOs.

The energy efficiency side is more complicated. To measure behavioral savings from smart thermostats, the current gold standard is randomized control trials with a treatment and control group. Unfortunately, an effective control group requires using either "recruit and delay" or "recruit and deny" tactics, both of which mean that a customer who has been recruited to a program and is interested in participating must be deferred or rejected altogether.

Though it is the most widely accepted, this is not the only method of energy efficiency M&V. Various states and evaluators have different perspectives for how we can measure savings from connected thermostats. Always check local conditions and evaluators to find the solution that is right for you.

GETTING STARTED

For utilities with existing demand response programs, the good news is that new filings or formalized business cases are usually not needed to improve programs with the addition of two-way thermostats or even customer engagement portals. These program enhancements can be thought of as improvements to existing programs with new marketing channels, better control and better information coming back from customers.

Combining demand response and energy efficiency can be a complicated endeavor. To get started with an integrated program, we recommend working with a vendor who has experience delivering quality demand response at scale and is willing to stand behind the outcomes their solutions deliver. In addition, since demand response is a more targeted and specific outcome to deliver than energy efficiency, with severe operational and market penalties for shortfalls in delivery, seriously consider buying the energy efficiency side of your integrated solution from a vendor with a background in demand response, rather than from a provider that is more recently getting started in DR.

Utilities are operating in a fluid world, with solution innovation, diverse suppliers, rising customer expectations, changing communication standards, and new regulatory mandates. Making the most of this heterogeneous landscape requires a set of constantly evolving, bilateral partnerships and customer tools to help demand resources meet their full potential. A great partner can help you navigate this complexity, manage technology, and get set up for program success from the start.

CONCLUSION

As participants in an integrated demand response and energy efficiency program, customers enjoy comfort, choice and convenience, as well as significant bill savings and the opportunity for more robust DR incentives. Utilities that offer these programs find it easier to recruit and retain engaged program participants, get a better understanding of their customers and are able to optimize their demand response and energy efficiency initiatives as a result of the massive, well-coordinated inputs of data they receive about their customers every day. In almost every market, bundled DR and EE efficiency program portfolios are a win-win for utilities and customers.

FURTHER READING

EPRI – Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S. (2010-2030)

Lawrence Berkeley National Laboratory – Coordination of Energy Efficiency and Demand Response

PJM – Reliability Pricing Model - Demand Response and Energy Efficiency

FERC – Assessment of Demand Response and Advanced Metering

Itron and Southern California Edison – Integrated Demand Side Management Cost-Effectiveness: Is Valuation the Major Barrier to New "Smart-Grid" Opportunities?

Join us in creating a more **resourceful world**.
To learn more visit **itron.com**

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