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Bring Your Own Device Program Approaches

Part of P182's "You Ask, We Investigate" Webcast Series
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Guest Speakers:
Jim Eber, Commonwealth Edison,
Peter Klint, Eversource Energy

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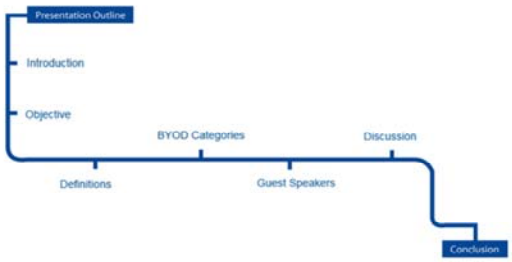
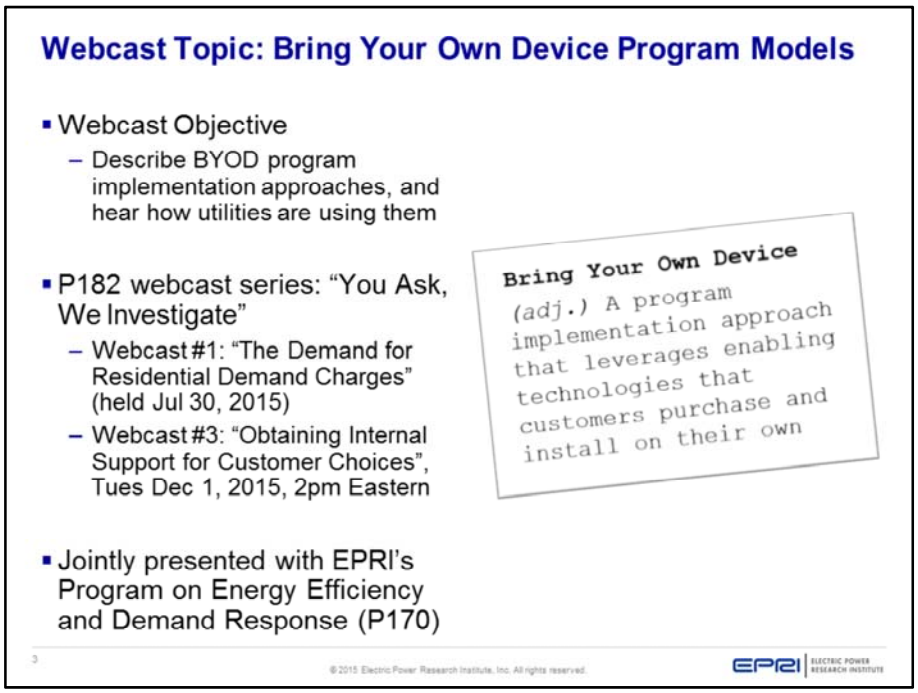
Outline

- Webcast objective
- Intro: the era of the changing customer
- Categories of BYOD
- Guest Speakers
  - Jim Eber, Commonwealth Edison
  - Peter Klint, Eversource Energy
- Wrap-up: Pros and cons
- Discussion





The objective of this webcast is to describe Bring Your Own Device (BYOD) program implementation approaches, and learn how utilities are using them.

This webcast is the second in a Program 182 webcast series called "You Ask, We Investigate". The topic of BYOD was chosen by P182 members in early 2015 through a voting process. It is being presented jointly with EPRI Program 170 (Energy Efficiency and Demand Response).

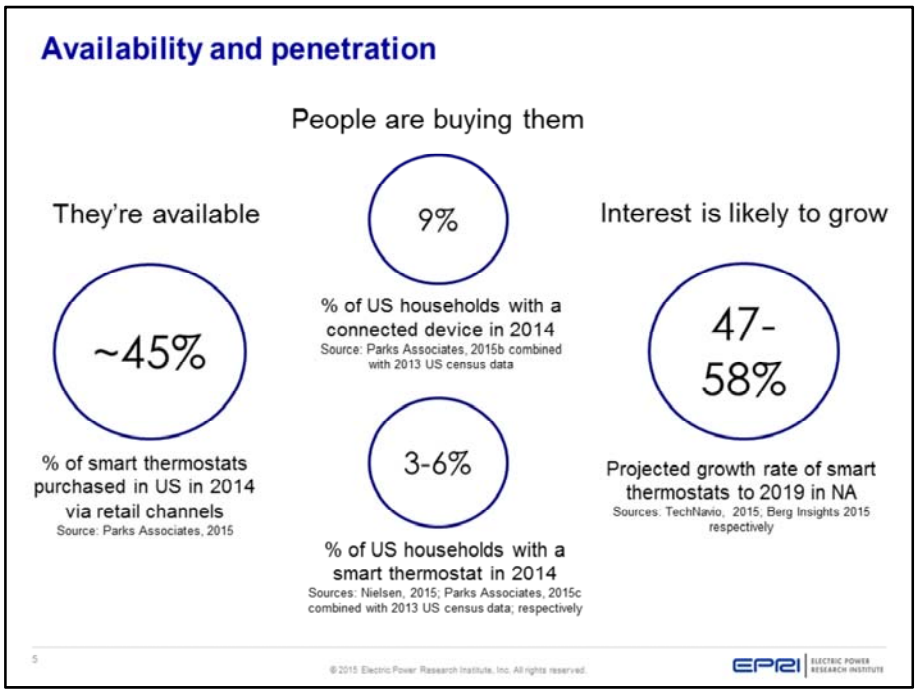
BYOD program implementation models are those that make use of enabling technologies that customers purchase and install on their own. This can be a utility taking advantage of a population of devices already installed with their customers, or it can involve a campaign where utilities work with vendors to promote various enabling technologies. There are also different variants of BYOD for demand response programs, as well as for energy efficiency programs.

There is a lot of interest in our industry regarding the topic of 'the changing customer'.

In many ways, the customer experience is now being redefined. Customers want choice; they want to receive information through the channels of their choosing; there is an expectation that information, products and services need to be instant or on demand; and the choices available need to be personalized and relevant to each individual customer.

This new consumer expectation is in large part being driven by players with new models and new capabilities that are appealing to customers—the Amazons, Googles, Ubers, and PayPals of the world. In many ways, utilities are now being held to the same standard.

At the same time, there is a world of new connected technologies that are available to customers—smart thermostats, home energy management systems, connected water heaters, communicating lighting technologies. These are technologies that may appeal to customers because of the new opportunities for comfort, convenience and control that they offer. They can also enable customers to become active participants in the grid—in effect enabling customers as grid resources—and they represent new opportunities for customer engagement.



How prevalent are connected devices? This slide presents a few statistics that have been gleaned from various market research resources. As a disclaimer, in some cases the full reports were not available, nor were some of the approaches used to arrive at the numbers. Regardless, they have been summarized to provide a high-level picture of connected device availability and penetration.

Connected devices are available for consumers to buy on their own. One estimate suggests that, of the smart thermostats purchased in the US in 2014, approximately 45% were purchased via retail channels—that is, the customer buying the devices on their own. [1]

People are buying them. Considering connected devices in general, one estimate suggests that nine percent of U.S. households had at least one device in 2014 [2]. Other estimates suggest between four and 13 percent of U.S. consumers had at least one smart home device in 2014 [3 & 4, respectively].

With regard to smart thermostats in particular, estimates suggest three to six percent of U.S. household had a smart thermostat in 2014 [5 & 6, respectively].

The penetration of connected devices is starting, but a lot of the buzz relates to suggestions

that **interest is likely to grow**. Growth rates in North America by 2019 have been estimated to be 47 to 58 percent [7 & 8, respectively]. Furthermore, a survey of consumers found millennials were most excited about in-home connected devices [9], even though this group is at the moment the least likely to be able to afford them or be home owners, which can affect purchase decisions. However, it seems reasonable that the potential for growth is large with this cohort, as both their income and housing status will change as the group ages.

References

[1] Parks Associates. (2015, July 15). Over 40% of thermostats sold in 2015 will be smart thermostats (Web log post). Retrieved from http://www.parksassociates.com/blog/article/pr0715-smart-thermostats

[2] Arrived at by using estimate from Parks Associates, 2015b that 13% of U.S. broadband households had adopted a smart home control product in 2014, and combining this with 2013 census data that 73% of U.S. households have a broadband subscription.

Parks Associates 2015b. The Future of Smart Technology—What Consumer's [sic] Want. Retrieved from https://eepartnership.org/wp-content/uploads/2014/07/Tom-Kerber.pdf

[3] Acquity Group, 2014. The Internet of Things: The Future of Consumer Adoption. Retrieved from https://www.acquitygroup.com/news-and-ideas/news/article/detail/2014-state-of-the-internet-of-things-study-from-accenture-interactive-predicts-69-percent-of-consumers-will-own-an-in-home-iot-device-by-2019

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[5] Nielsen, 2015. Consumer Energy Sentiments Report. Retrieved from http://www.nielsen.com/us/en/insights/news/2015/as-thermostats-get-smarter-will-consumers-think-more-about-energy-efficiency.html

[6] Arrived at by using estimate from Parks Associates, 2015c that 8% of U.S. broadband households owned a smart thermostat in 2014, and combining this with 2013 census data that 73% of U.S. households have a broadband subscription.

Parks Associates. (2015c, Apr 14). Eight percent of U.S. broadband households own a smart thermostat (Web log post). Retrieved from https://www.parksassociates.com/blog/article/pr-april2015-SPEER

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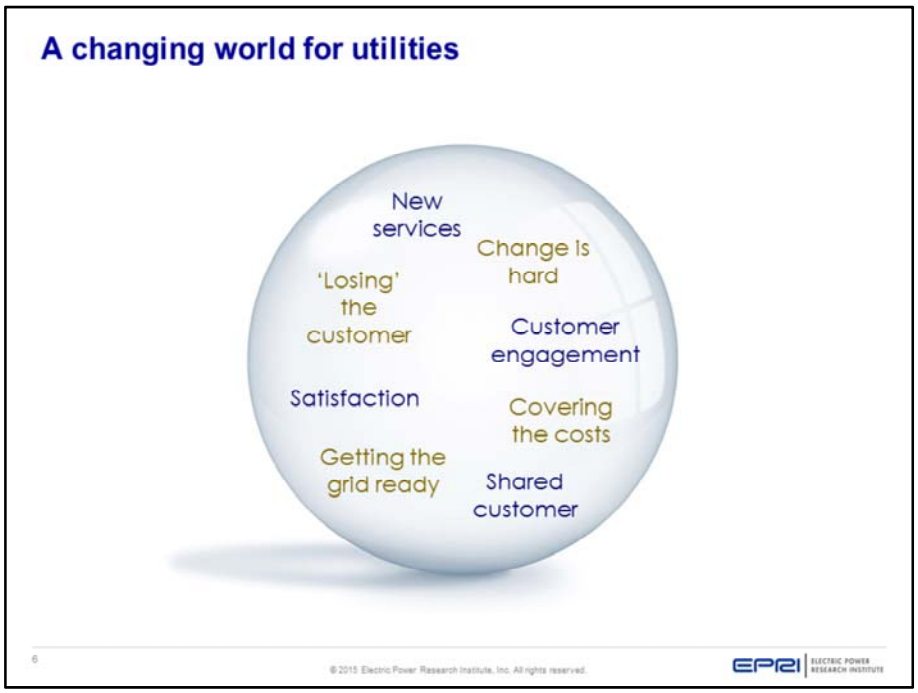
[8] Berg Insights. (2015, Jan 12). The number of homes with smart thermostats doubled in 2014. (News Archive). Retrieved at http://www.berginsight.com/News.aspx?m_m=6&s_m=1

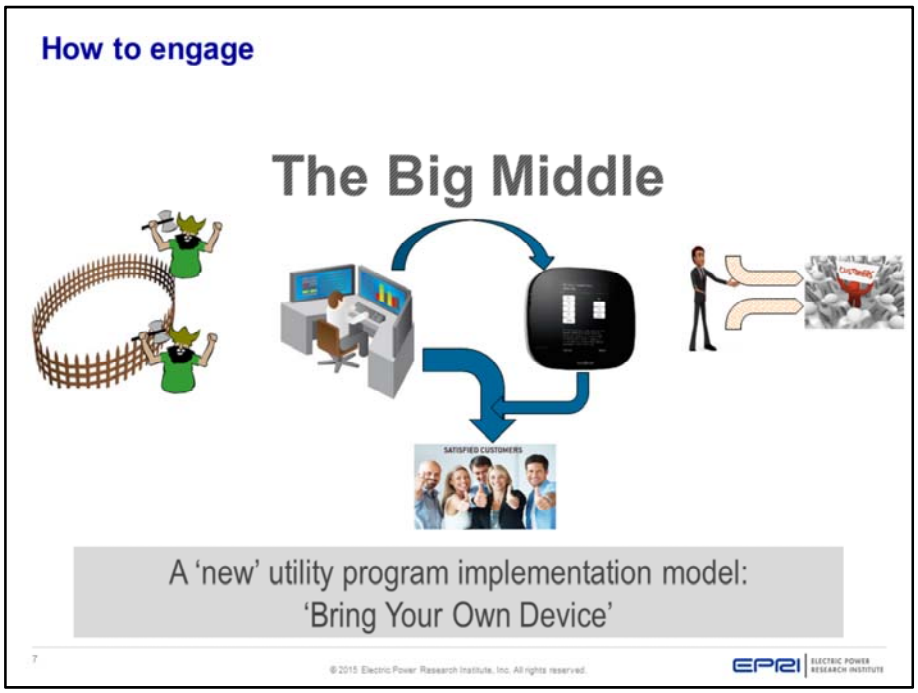
[9] Greenough, 2015. The American Smart Home: How the Smart Home Market will Evolve in the US (slide deck). Retrieved at http://www.businessinsider.com/the-american-smart-home-market-2015-slide-deck-2015-8



What does all this mean for utilities?

Much of the industry discussion relates to the challenges associated with all of the changes that are coming—potentially losing the customer relationship, ensuring the grid is ready for enabling technologies and distributed energy resources in general, the associated costs, etc.

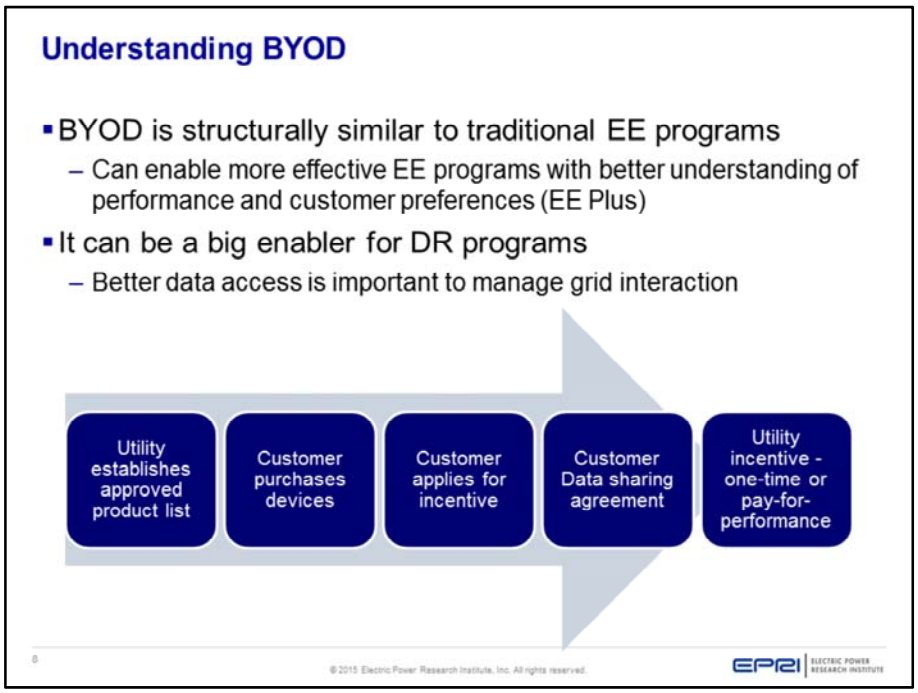
At the same time, however, it is recognized that there also exists a lot of opportunity—the potential to provide new services to the customers with new revenue streams, new avenues for demand and energy savings, new ways of engaging with the customers that could lead to increased satisfaction levels, etc.



Utilities are now determining how to deal with these new realities.

On one theoretical extreme, a utility could be protective of its customers, trying to keep vendors and their new technology offerings at bay. On the other, they could realize that new technologies will reach the customer anyway, and take a laissez-faire attitude, dealing with any consequences later.

Realistically, there is a lot of room in between these two options, and it can be argued that BYOD implementation models generally fit within this 'big middle'.



Relating to the concept of the 'big middle', utilities are trying to determine what works and what does not.

BYOD models are fairly new from a demand response or grid integrative perspective. However, the utility industry has in effect used a BYOD approach for energy efficiency programs for some time. For example, traditional energy efficiency programs can involve a list of certified products, and customers can receive an incentive if they choose to purchase from that list. The customer is free to purchase the product on their own through various channels (contractors, retailers if applicable, etc.), they submit their incentive application, and they receive their incentive. So in many ways, traditional EE programs are the original examples of BYOD implementation models.

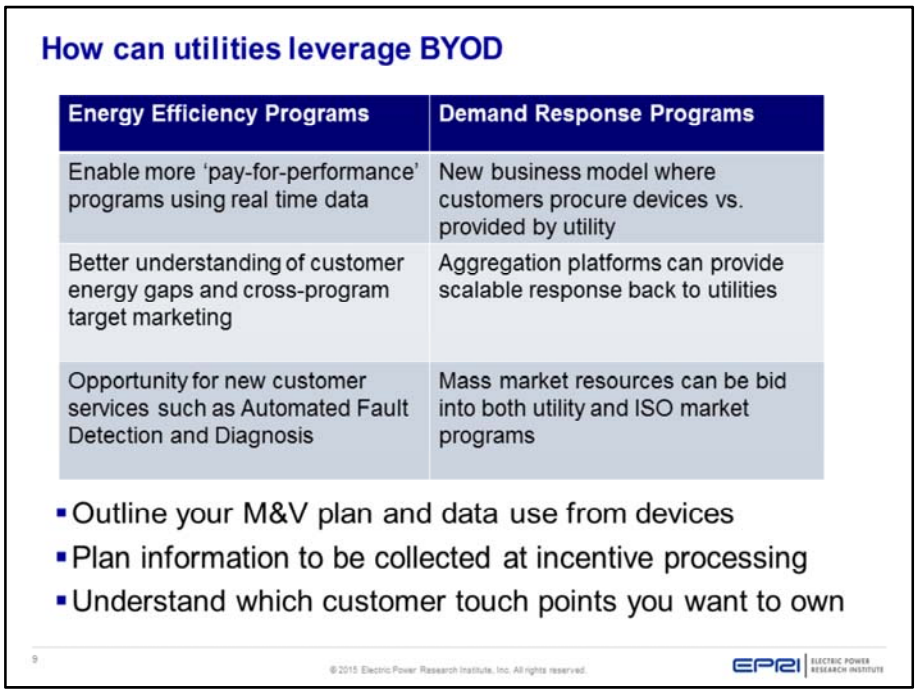
Connected devices represent an opportunity for improved energy efficiency programs—'EE Plus'—by using device data to understand device and program performance, customer preferences, and to enable cross-program opportunities (for example, using thermostat data to provide HVAC-related information and services to customers).

And while connected devices and BYOD implementation approaches represent large opportunities for EE programs, they can be an even bigger enablers for DR programs. Traditional DR programs involve utility-installed devices, which requires customer

recruitment, installation, and ongoing customer support. BYOD approaches can offer important utility benefits, such as reduced recruitment and installation costs.

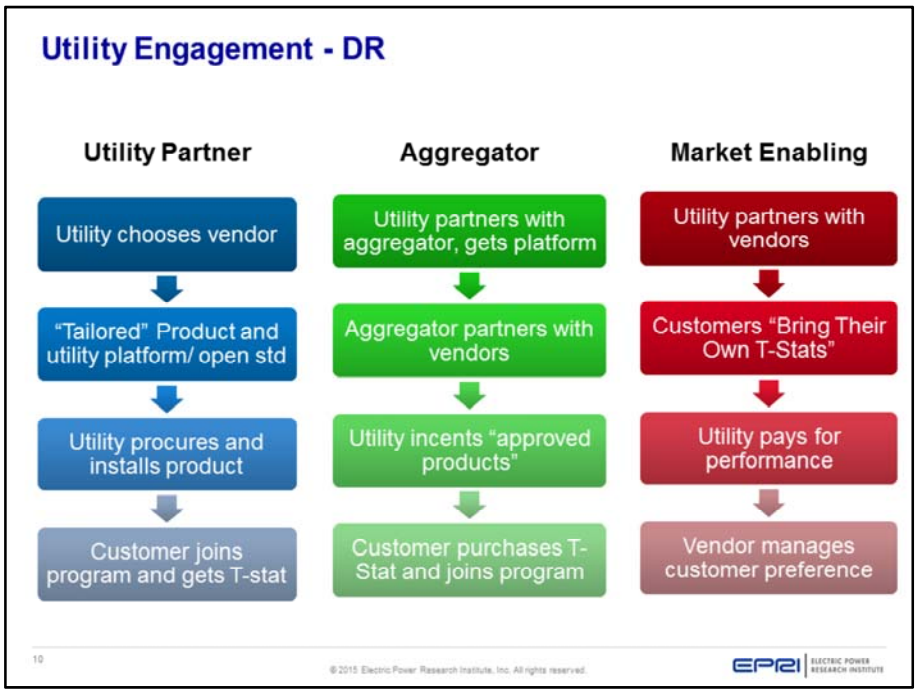
While there are variations on the BYOD process, a simplified version is outlined in this slide. Regarding the final step, the utility could provide a one-time incentive, or an ongoing 'pay for performance' incentive given the connected devices' constant data feeds that can be used to assess performance.

Indeed, this access to data is an important aspect of BYOD programs, both from an M&V perspective, as well as from a grid interaction/grid management perspective.



This slide summarizes some of the ways BYOD programs can be leveraged by utilities.

In terms of what to be prepared for, it is important to have an M&V plan outlining how device data is intended to be used, and how utility customer account information can be linked to device ID and data.

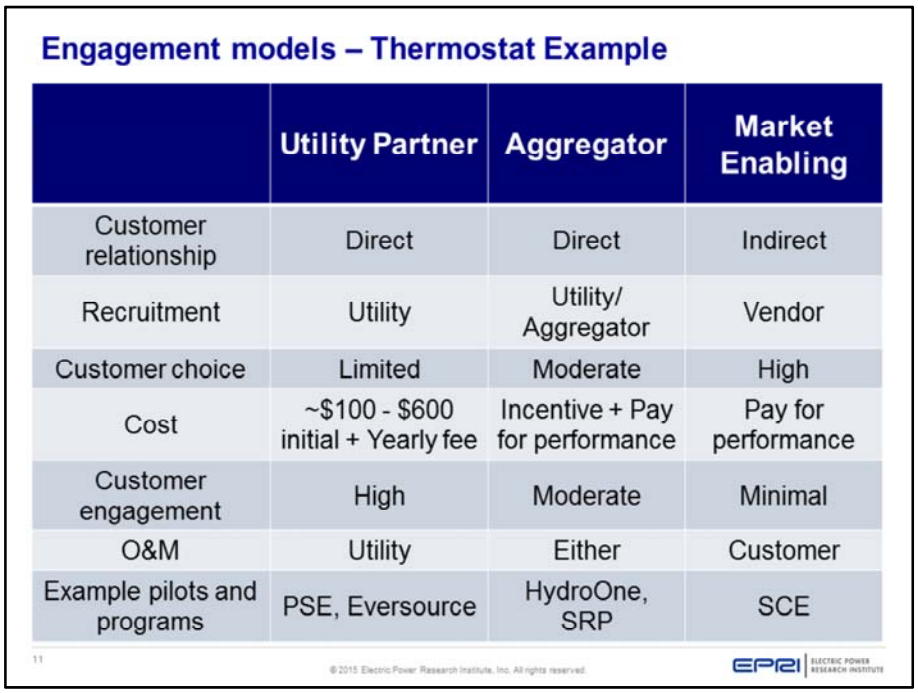


From a utility engagement perspective, there are multiple models for program implementation. This slide suggests three broad categories, focusing on demand response programs:

Utility partner: the traditional direct install approach, where the utility chooses the vendor, procures the product (usually one device), and has the devices installed with customers.

Aggregator: where multiple devices can be aggregated to a common platform to supply the demand response. This could be either a direct install or a BYOD model.

Market enabling: the utility partners with specific vendors, and the vendors bring their customers to the utility. In this case, the recruitment costs are much lower but it is important to make sure the right data are coming back to the utility.

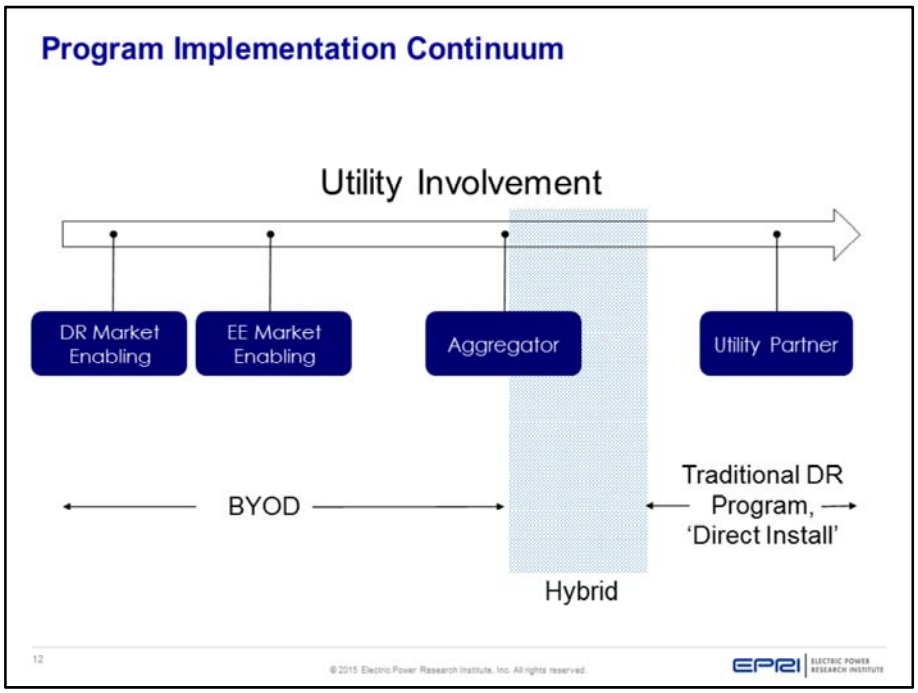


Engagement models – Thermostat Example

	Utility Partner	Aggregator	Market Enabling
Customer relationship	Direct	Direct	Indirect
Recruitment	Utility	Utility/ Aggregator	Vendor
Customer choice	Limited	Moderate	High
Cost	~$100 - $600 initial + Yearly fee	Incentive + Pay for performance	Pay for performance
Customer engagement	High	Moderate	Minimal
O&M	Utility	Either	Customer
Example pilots and programs	PSE, Eversource	HydroOne, SRP	SCE

In this slide, examples of each of the three engagement models are illustrated.

It should be noted that the customer relationship is different in each of these models—especially in the Market Enabling model, where the utility's relationship with the customer tends to be more indirect. This need not always be the case, however, as the level of customer interaction desired can be decided with the vendor in the early stages of program design.



Looking at these categories in another way, program implementation can be thought of as a continuum with regard to the level of utility involvement.

In the DR Market Enabling model, utility involvement with the customers is relatively low, as the utility is in effect outsourcing customer recruitment, installation and technology support. The same goes applies for the EE (or 'EE Plus') Market Enabling model. In either case, if the utility has access to which customers are part of the program, or they are receiving data from the devices, there is still an opportunity to reach out and interact with customers.

The Aggregator can be either a direct install, a BYOD, or a hybrid of the two, where the utility is able to pick and choose where they interact with the customer.

At the other end of the continuum is the direct install program, where the utility is involved in every aspect of the program, and has many opportunities for customer interaction.

Guest Speakers

Peter Klint, Eversource Energy

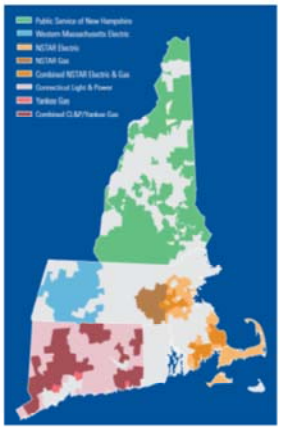
Program Manager, Emerging Technology Energy Efficiency

EPRI
Communicating Thermostat
Program Overview

September 16, 2015

Eversource Overview

EVERSOURCE ENERGY



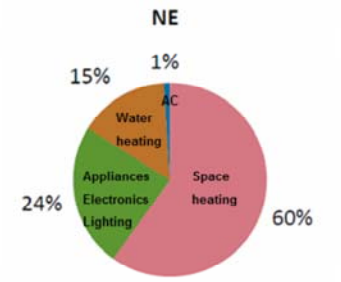
Total customers (electric and gas)

- Massachusetts
  - 1.6 million customers
  - ~$300 million EE programming
- Connecticut
  - 1.4 million customers
  - ~$160 million EE programming
- New Hampshire
  - 500,000 customers
  - ~$20 million EE programming

Northeast Perspective

EVERSOURCE ENERGY

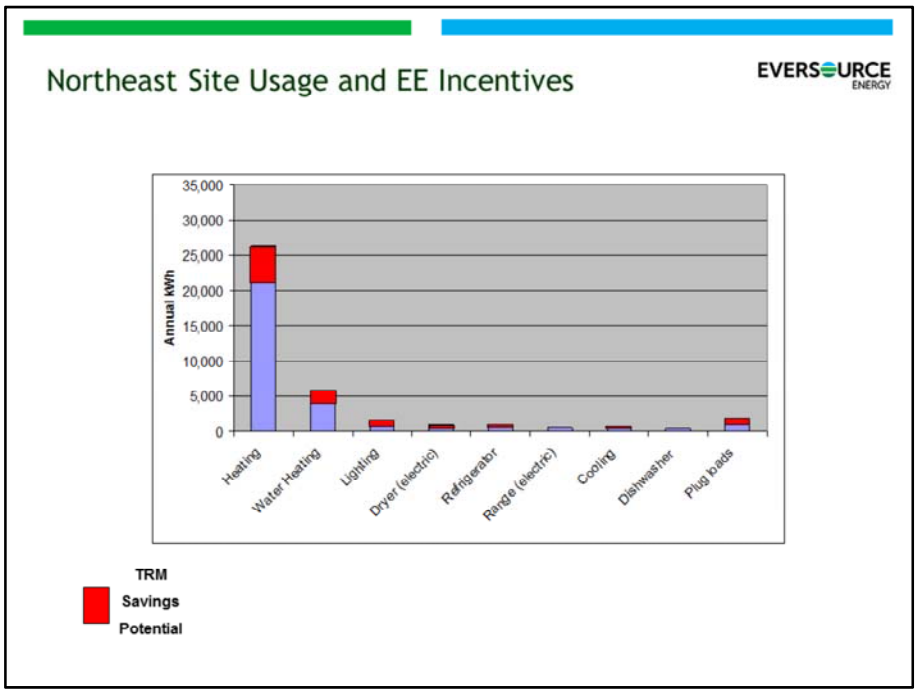
- **Space heating dominates residential site energy consumption**



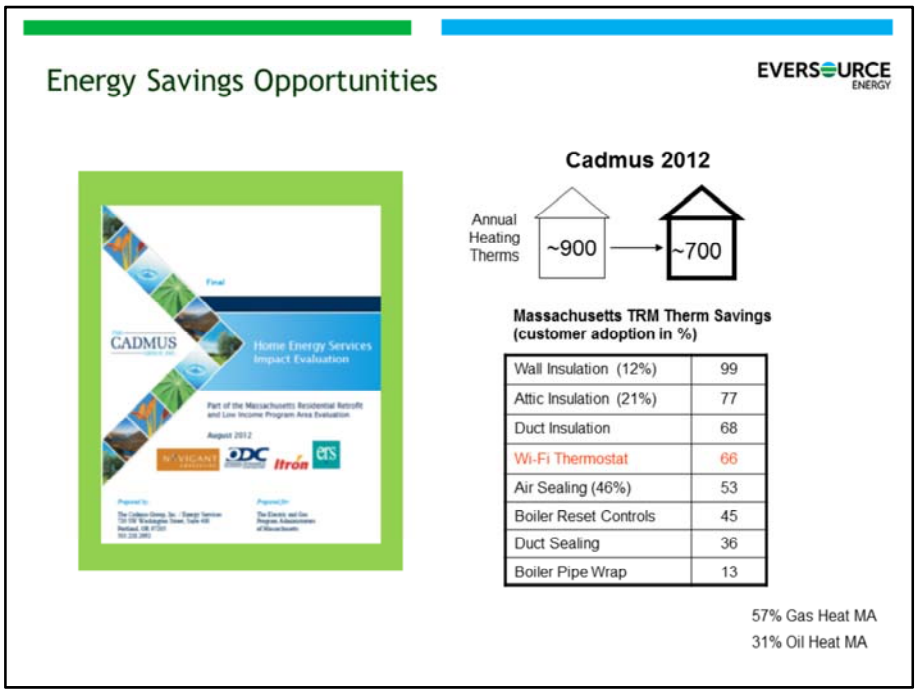
EIA's 2009 Residential Energy Consumption Survey

- **6153 Heating Degree Days - 299 Cooling Degree Days**

In the northeast, space heating is the largest contributor to residential energy consumption.



The largest energy efficiency opportunities in a typical home relates to space heating. The opportunities for energy efficiency relating to cooling are relatively small.



The Massachusetts Technical Research Manual (TRM) provides information on all the energy efficiency measures in Massachusetts.

It is what was used to determine the deemed savings listed in black on the table in this slide (although the deemed savings for the Wi-Fi thermostats is based another Cadmus study).

Eversource is able to claim 66 Therms for Wi-Fi thermostats, which is significant.

They are currently undergoing another evaluation in Massachusetts to determine energy savings attributable to Wi-Fi thermostats.

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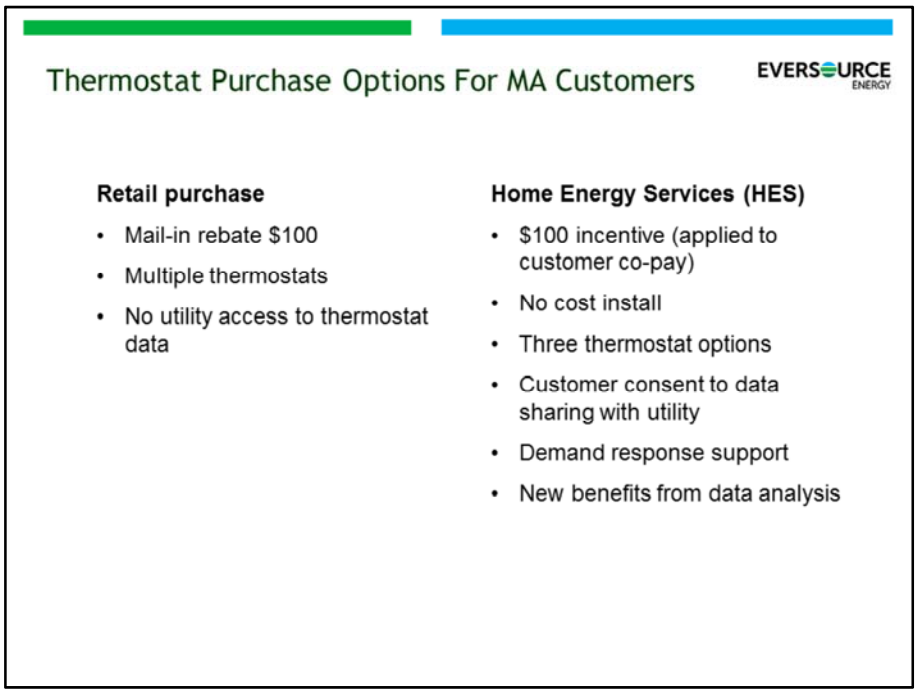


The two program channels for customers to receive Wi-Fi thermostats are through the retail purchase program, or, new this year, through the Home Energy Services program (a home energy audit program).

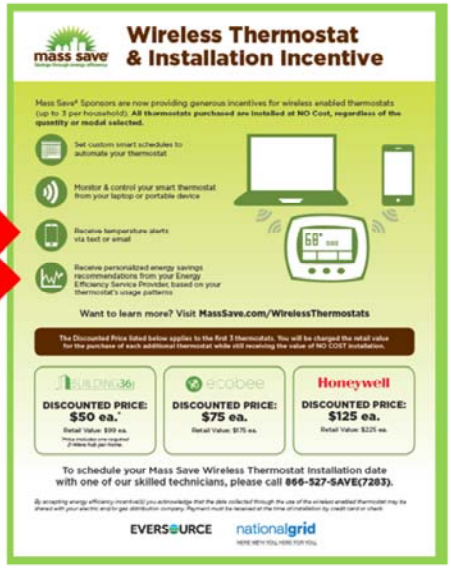
Through the HES program, the customer has their thermostat installed by the auditor. The customers own the data from their thermostats, but they consents to sharing the data with Eversource. Eversource in turn uses the data to provides value-added services as part of the agreement. Also, while there is not yet a demand response program in place, the thermostats are also able to participate in such programs if and when that time comes.

Mass Save Brochure

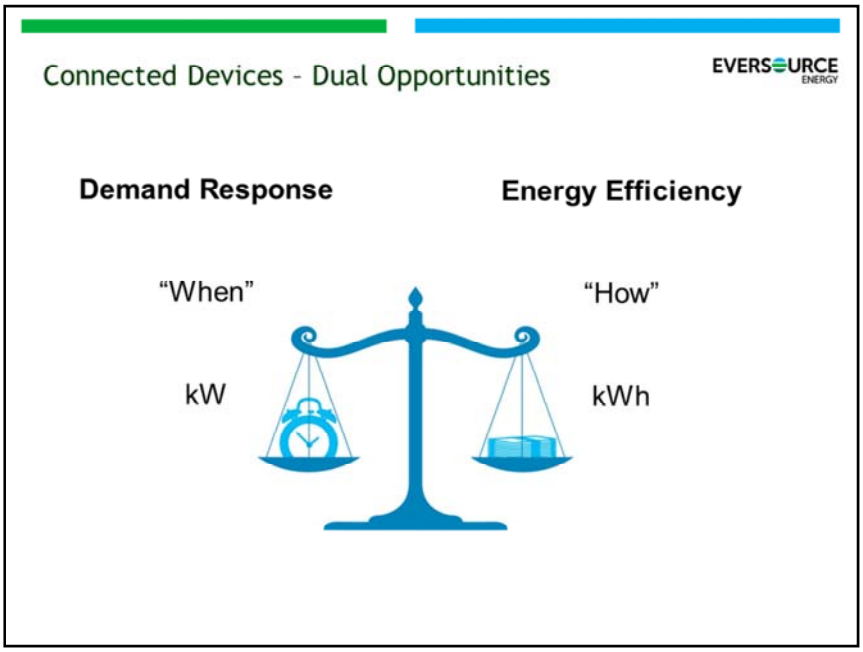
EVERSOURCE ENERGY

Program Launched in Q2 2015 in collaboration with National Grid

New opportunities from data analysis

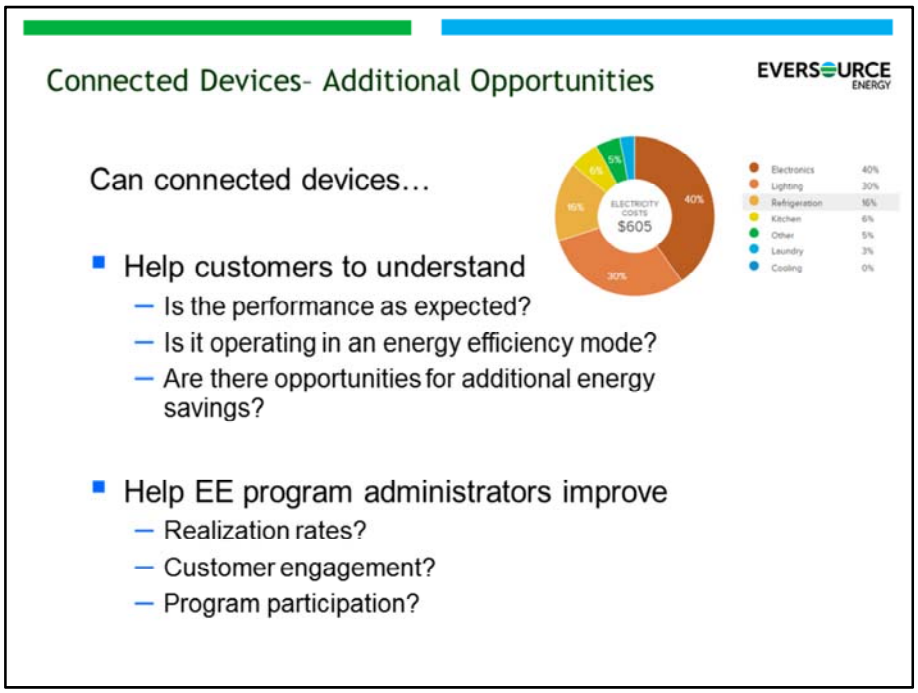


The value-added services that make use of the thermostat data include temperature alerts and the provision of energy conservation recommendations that are tailored to each individual customer.



Demand response can be thought of as about *when* a device is using energy; energy efficiency is about *how* a device is using energy (how much, how efficiently).

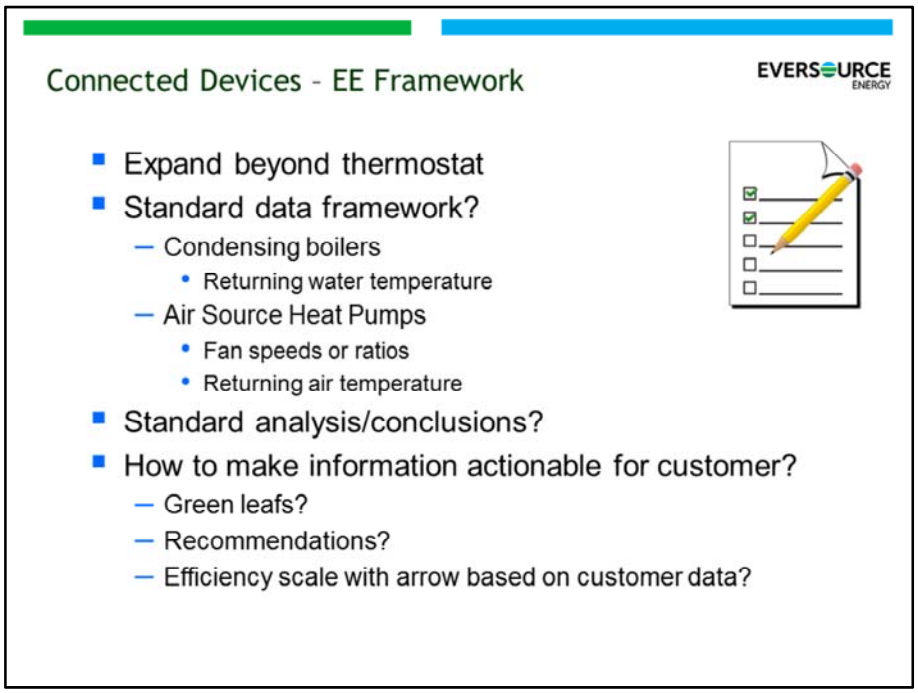
Demand response receives a lot of attention given it is an important capability for utilities. However, energy efficiency can help lead the way into the connected device space for utilities.



One issue with EE and DR programs is realization rates—are devices operating in the field as intended in order to realize energy or demand impacts?

Connected devices may help us to understand this early on, which may help more customers make changes to operate more efficiently.

This depends on the ability to access the data from the devices, but hopefully this will improve things like realization rates and how we engage with customers, and drive up adoption rates of other energy conservation measures, as well.



These benefits are applicable to end-uses and devices beyond just connected thermostats.

One example is condensing boilers. Eversource performed a realization rate study for a condensing boiler program and found that less than half were actually condensing. Had they been able to collect data on returning water temperature, they would have understood right away if the boiler was condensing or not, and would have been able to help the consumer make the required changes to realize the energy savings benefits.

Another example is air source heat pumps. A realization rate study is underway now, and results suggest significant variability in performance. Some of this is relates to how customers can configure the equipment, or how the equipment was installed. If, for example, information regarding fan speed or returning air temperature was known, it might be possible to take corrective actions, or guide the consumer in doing so.

To achieve consistent access to device data, one vision is that for any connected device class (thermostat, boiler, air source heat pump, etc.), there would be a standard data framework that outlines the type and format of data a device should report. There could also be a framework for analysis that an organization like EPRI could help in creating, that outlines, for example, how if you know metrics A, B, and C about a device, then you can make conclusions X, Y, and Z about its operation or performance. This would allow the

industry to start helping consumers in a standardized fashion to understand how their devices are operating.

Q&A

Q: What do you think would need to happen to achieve this vision of standard data and analysis frameworks? What players need to be a part of that endeavor?

In initial discussions regarding this type of framework, the question always come back: What is the opportunity? In other words, if we had this type of standard data framework, how much energy could be saved?

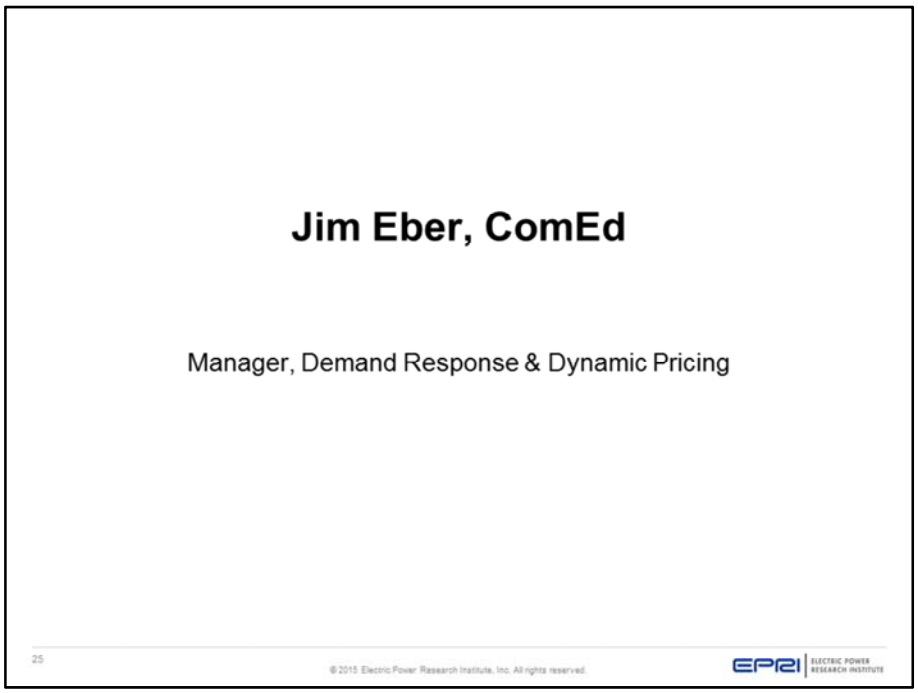
So what might help is a better understanding of how providing customers information based on device data would lead to savings. Consider mobile phones, which give the consumer a lot of information regarding signal, battery life, data used, etc., which helps consumers make decisions on how to use their phones. However, in the case of an air source heat pump or condensing boiler, the consumer does not get much information.

With smart thermostats, there was initial excitement about the data and its potential to helps us understand, at a customer level, why for example a boiler is not running as efficiently as it should. However, that can be a more complicated question to answer (a lot of building science goes into it). But in the future, instead of relying only on clever analysis, hopefully the device or end-use itself can help us be smarter and have sharper analyses.

That is, the actual end-use (the boiler, water heater, heat pump) could help us understand what the issue is. For example, a lot of the poor performance their air source heat pumps was from customers that had set the fan speed too low because they did not like the noise. However, they might have made a different choice if they knew what the energy penalty of that was.

Q: What has been your experience with gaining access to the data from Wi-Fi thermostats installed through the HEC program?

There are three thermostats, and Eversource negotiated access to the data—which probably took too much time of the collaboration discussion. The vendors were willing to share the thermostat data, but at the time, Eversource was not able to clearly articulate what data were critical to them, and how they were going to use it. This was likely the genesis for the data standard framework idea, as it would shorten the negotiation phase if they could have been more specific as to the needs.



For context, ComEd has various demand response incentives and pricing structures in place:

- AC Cycling: a traditional direct load control program, featuring a $20-$40 annual incentive depending on the control strategies (about 70,000 customers)
- Peak Time Saving: new this year, this is an opt-in peak time rebate for customers that have AMI meters (ComEd is close to halfway through a full-scale AMI deployment). Data from meters is used to create a baseline calculation and then incent customers to reduce load from their baseline on peak days. For now, the focus is on summer peak saving opportunities.
- Residential Real Time Pricing: a residential rate structure based on real-time energy market prices, which has been in place for some time.

ComEd has been working to determine how enabling technology like thermostats can be used to enhance the customer's ability to participate in these various programs.

In 2014, ComEd ran a nest pilot that provided a $100 rebate to customers to purchase and install a nest thermostat, as well as sign up for ComEd's AC Cycling program through nest's Rush Hour Rewards service. Approximately 3,000 customers signed up, and ComEd was able to show that event peak reductions were slightly better than with their traditional one-way switch technology that is part of the standard AC Cycling program. The savings

were slightly under 1 kW per home, which was similar but slightly higher than the switch performance. Customer AC resource availability was slightly better as well, in the low 90% range.

On the efficiency side, they found enough energy savings that ComEd's Energy Efficiency group took on the rebate program as of June 2015. The program offered the $100 rebate, and was expanded to include the ecobee and Honeywell Lyric thermostats, as well as nest.

Back on the demand response side, ComEd was not quite ready for a larger BYOD program model open to any thermostat technology for the AC Cycling program. They did, however, expand in 2015 to include Comcast and their Home Automation Package (that uses EcoFactor's thermostat platform and a Computime thermostat). In this case, customers received a $40 rebate to participate in the AC Cycling program for the whole summer. They had two events this past summer and early results suggest similar load reduction results as with the previous summer's nest trial. The experience with both providers has been generally good, and ComEd is processing the learnings to understand how to move forward to enable multiple product providers for their AC Cycling program.

Regarding their Peak Time Savings program, while not a BYOD structure, they did field a randomized controlled trial in the summer of 2015 using multiple devices in conjunction with the rebate. The summer was unfortunately mild, but they were still able to run multiple events, and the data are still being processed. The devices tested included traditional AC load control devices as well as the Honeywell thermostat line. They also included multi-family homes using the ThinkEco room AC control device. Compared to the AC Cycling program, the Peak Time Savings program is intended to enable customers to reduce load during events, and be paid for their performance as more of a voluntary measure. However, ComEd is interested in better understanding how to best enable the customer to enroll their connected devices into programs to automate their savings.

Regarding their residential Real Time Pricing program, ComEd is interested in ways of providing customers with options to enable their equipment to respond as market prices increases. To this end, they worked with the IF app (formerly IFTTT, or 'if this, then that'). They developed a real-time news feed containing the real-time price, and customers can use the feed in an IF recipe, for example, to control their IF-enabled thermostat in the way they choose if the price hits a certain threshold.

Q&A

Q: How do you think BYOD compares to other more traditional program implementation approaches?

On the cost side, going through the customer's thermostat can be a superior approach compared to the utility adding another load control device, such as an AC switch.

Also, maintenance is always an issue with a traditional load control program—switches can break without a utility necessarily knowing about it, and it is expensive to roll trucks to check. With thermostats, it likely that a customer is going to alert the utility if their thermostat isn't functioning, although if the thermostat is functioning but the communications are not, they are not likely to be as responsive. Non-functioning communications is typically the failure mode they see the most with communicating thermostats, as they generally rely on a customer's Wi-Fi connection. However, overall BYOD is still likely a better financial model in terms of maintenance and percentage uptime.

In addition, communicating thermostats are something customers are beginning to buy on their own. This can be leveraged to reduce program costs, meaning more funds can be allocated to customer incentives. ComEd typically prefers to provide as much as they can in customer incentives, and then let the customer choose what they would like to invest in to get the most out of the programs.

Q: How does the utility/customer relationship change with a BYOD program approach, versus a direct install program approach?

The way ComEd implemented the pilots (and would likely implement a full program), the customer is still part of a ComEd program—they still get the rebate from ComEd on their bill, the ComEd communications about what to expect, etc. They just use nest and nest's Rush Hour Reward services to affect the load reduction. It is true that the program now involves the added element of a third party entity, and ComEd is assessing the implications of this. Regardless, they also see the trend of more customers buying connected thermostats, and this will likely continue. Therefore, trying to leverage this customer investment makes sense in a lot of ways.

Q: Do you see a difference in how you engage with your customer across the three different product providers (nest, ecobee, Honeywell)?

nest has a high level of interaction with the customer, which is part of what is valuable about their services. Overall, everyone is new to this, so there is a lot of learning happening with regard to how programs work, what the rules are, etc. A lot is starting to shake out.

Honeywell was more willing to let ComEd take the lead with regard to customer-side interaction. As for ecobee, they have not yet work with them on DR.

Q: What has been your experience with gaining access to the data that smart thermostats make available?

The data from the devices can be valuable, in particular data on connectivity, HVAC runtime, and temperature to understand customer experience during events.

When a customer signs up for the program, they give authorization to nest to release some

customer-specific thermostat data to ComEd. In other cases, ComEd also works with nest on the analysis they would like to see, and nest provides that analysis (versus providing the data itself).

Q: How do you perform your impact analyses, particularly of the BYOD pilots/programs?

For the pilot, ComEd has worked collaboratively with nest on the analysis—ComEd is better situated to perform some analyses, and nest is better situated to perform others.

Going forward, if the program was to be expanded and include other product providers, the analysis arrangement will need to be more prescriptive.

Q: Did nest provide ComEd individual customer data, or was it all in aggregate?

When a customer signs up for Rush Hour Rewards via the ComEd pilot, they provide authorization to nest to allow nest to release some individual customer data to ComEd. ComEd received customer-specific information relating to the device connectivity/uptime, which was one of the factors ComEd was most interested in.

All the data provided to ComEd was of course subject to confidentiality agreements, as well as agreements on how the data would be used—ComEd used it only for analysis purposes.

Going forward for any larger program, ComEd's device-level data requirements would be factored into the agreements and negotiations with any product providers.

Q: Did you share your AMI data with the thermostat product providers?

ComEd did not, but they would have allowed them access, providing they had customer consent in place (which could have been obtained when the customer signs up for the program) and a use of data agreement in place—that is, ComEd would want to know what the data would be used for, and constrain that use accordingly.

For the nest pilot, nest did not want access to the AMI data, but were content with ComEd sharing the results of ComEd's analysis. ComEd did all the analysis with regard to demand and energy savings.

Q: Has there been analysis on the type of customer (demographics/psychographics) that finds the BYOD model appealing? Also, could a BYOD program have limited market penetration, particularly with customers for which purchasing and installing a connected thermostat would be a barrier?

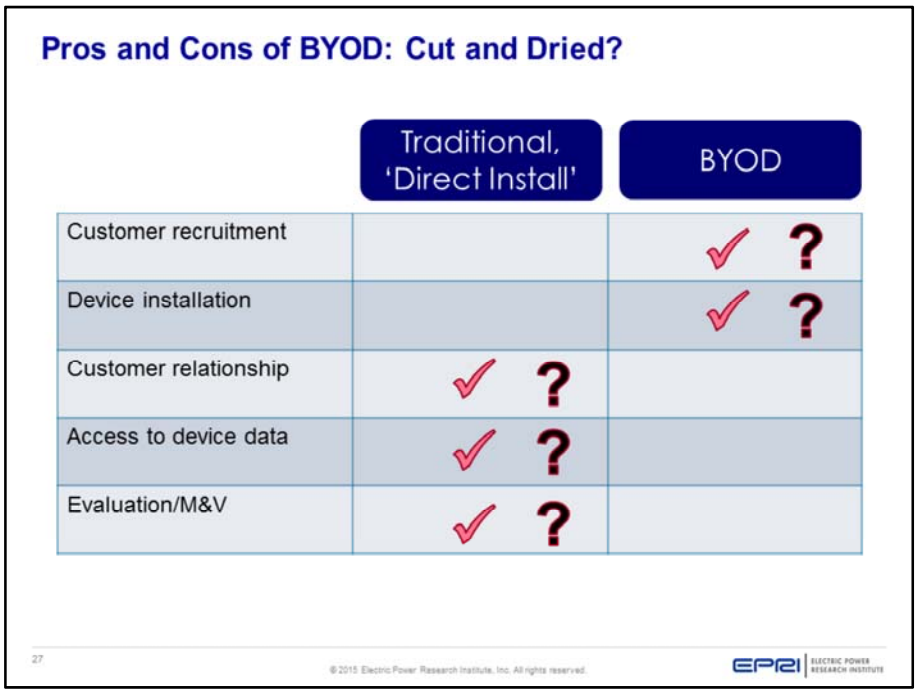
ComEd does not have any analysis regarding which customers might find a BYOD approach appealing.

However, a related point is that high-end connected thermostats are not inexpensive, so such devices are likely not appropriate for all customers.

Also, in terms of penetration, is there room for both BYOD and direct install programs? For example, for customers that do not want to purchase and install a thermostat. Similarly with their Peak Time Savings program (their opt-in peak time rebate program), a customer does not have to have any connected equipment to participate—if they are home, they can choose to participate manually.

So while communicating thermostat will likely continue to penetrate to a substantial level, it will likely be necessary to consider offering lower-end communicating thermostats as well.

Wrap-Up



In summary, which approach 'wins'—direct install or BYOD? There is no cut and dried answer, as it depends on the utility and the program goals.

As discussed, the BYOD approach offers advantages regarding customer recruitment—lower cost and in some cases, more device choice for customers, which could lead to better program uptake with customers groups that may be harder to reach via direct install programs. On the flip side, however, customer recruitment via direct install approaches offers an opportunity to interact with the customer, and also allows for more control over the customer experience.

Similar arguments can be made regarding installation—a BYOD approach means lower installation costs, and potentially a better customer experience in that no installer comes into the home. But a direct install approach allows utilities more control over whether devices are installed properly, which is important for resource verification. And again, the installation phase can be another potential customer touch point to provide an avenue for education and engagement, or a foot in the door for other utility programs.

For this reason, direct install approaches may win out when it comes to the topic of the customer relationship, although again, this is not cut and dried. And recall that even with a BYOD approach, there may still be the opportunity for utilities to engage with customers

when they sign up for the utility program.

Regarding access to the data from the devices, the direct install approach may win out, given that devices are generally more closely tied to the utility, usually via the utility purchase, so data access can often follow. However, as has been discussed, even with BYOD programs there is still the opportunity for utilities to gain access to the device data if it has been planned with the product providers from the beginning, and customer consent language has been included as appropriate. For either a direct install program or a BYOD, it is important to work with product providers and identify upfront in the agreement what device data the utility needs.

Finally, regarding program evaluation, a direct install approach may offer better visibility into which customers are participating in the program, which is necessary for evaluation purposes. But BYOD approaches can provide that same visibility if the utility has access to the device data. Indeed, for either direct install or BYOD programs, access to device data provides the potential, often in real-time, to determine whether customers are participating in the program, whether any EE or DR-related features are properly enabled on their devices, etc. This information can be useful not only for evaluation purposes, but also to make mid-course corrections to help maximize overall program benefits.

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