Put me in coach: engaging smart home users for energy savings

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Shareables

- Smart home programs offer an opportunity for utilities to both engage customers and provide them tools to manage their home energy use.
- Building Energy Modeling (BEM) and advanced metering infrastructure (AMI) data can be leveraged to offer customized energy saving targets for customers.
- By leveraging data analytics, customer engagement, and connected devices, utilities can help build a roadmap for next generation behavioral-based demand-side management (DSM) programs.

Executive summary

Smart home platforms and connected devices have the potential to help customers manage their energy use. The driving factors for adoption tend to be convenience, comfort, and control. Proper coaching and engagement from the utility can provide customers with noticeable energy reductions through minimal effort.

ICF is testing and implementing several strategies to help smart home adopters save energy and reduce demand. Utilizing an energy target has demonstrated great potential as one tool in the smart home engagement playbook.

Energy target development

Utilities continue to explore different methods for unlocking the potential energy savings behind smart device integration in residential homes. ICF is currently implementing several smart home pilots across the U.S. with varying approaches to capture savings. One pilot is specifically focusing on how behavioral coaching and data-driven engagement—combined with smart home controls and recommendations—can impact energy savings.

In the summer of 2019, ICF launched an innovative campaign within this pilot to give customers a personalized energy saving target. Participants were encouraged to integrate new connections and develop new automations for their devices through a series of tips and best practices

for maximizing savings. Customers who reached their target received a financial incentive.

To set the personalized targets for each customer, ICF developed an innovative approach by integrating hourly BEM with utility AMI data. The analysis began by collecting high-level information—such as number of stories, floor area, vintage, and home type—about each participant's home during enrollment.

These data points were then used to construct a physics-based BEM for each customer with the simulated model consumption serving as an energy benchmark for each home. The benchmark models were created through the National Renewable Energy Laboratory's (NREL) OpenStudio software, a publicly available platform for hourly and sub-hourly building simulation.

An illustrated rendition of a modeled home from OpenStudio is presented in Figure 1.

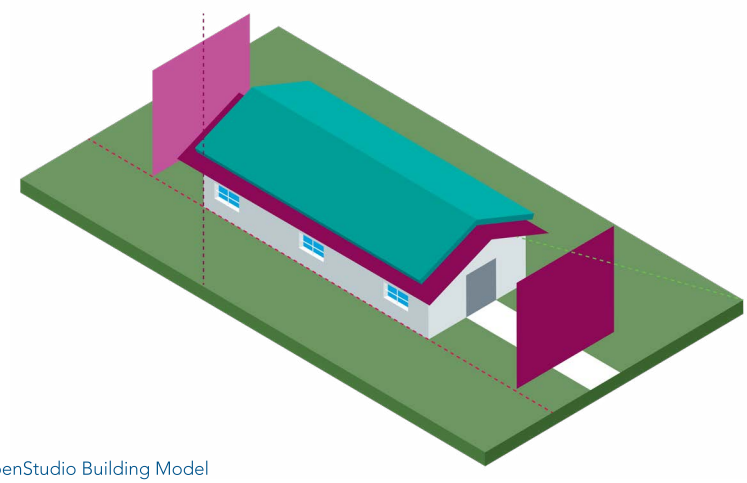

Figure 1: OpenStudio Building Model

The customer-specific models were simulated utilizing actual historical weather data from the baseline period (summer of 2018). The hourly consumption from the benchmark BEM model for each home was compared to the baseline period hourly AMI data provided by the utility. The savings targeted for each customer were then established by grouping the customers based on the comparison between their modeled and metered consumption:

- Customers with lower consumption than their benchmark model received a Tier 1 target of 2% energy savings.
- Customers moderately exceeding their benchmark received a Tier 1 target of 3% energy savings.
- Customers significantly exceeding their benchmark received a Tier 1 target of 4% energy savings.

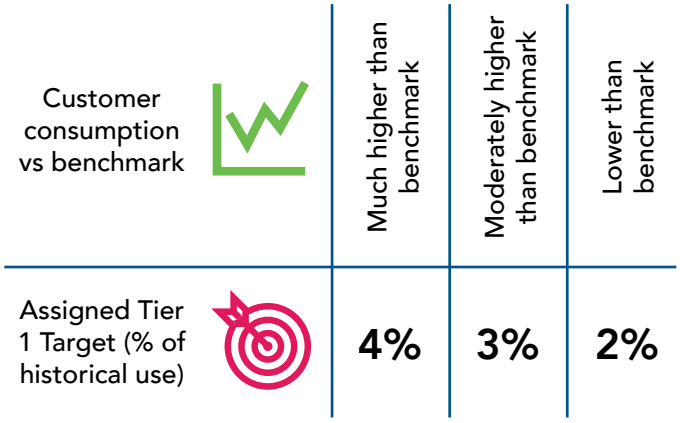

Figure 2: Smart Home Participant Savings Goal Assignment Process

Figure 2 summarizes how the Tier 1 energy targets were established for each participant. In addition, a Tier 2 stretch goal with higher incentives was established for each participant that was twice their Tier 1 target.

Engaging the customer

The ICF-implemented smart home pilot enrolled 630 customers. Each participant received a smart home starter kit including a hub, two motion sensors, two window/door sensors, two smart bulbs, and two plug controllers. The enrollment group was then divided into subgroups to test varying levels of engagement and coaching by ICF.

One of the subgroups, which consisted of 200 participants, was selected to participate in an energy target campaign that was launched in June 2019. Customers received an initial email explaining the campaign with their energy target and offering $100 or $150 incentives for reaching their Tier 1 or Tier 2 targets, respectively. Participants also received suggestions to help start the challenge, such as adding new automations to connected thermostat settings when occupancy sensors were triggered, receiving alerts for open doors or windows, and developing "Away" modes on their devices for future trips out of town.

In July, a mid-summer check-in email was sent to participants with a reminder of the two energy targets along with their current energy consumption since the start of the campaign. The check-in email detailed if participants were "on track" to meet their goal or were "falling behind" and were at risk of missing out on earning the incentive. The mid-summer check-in also included three new smart home automation tips.

Halfway through the campaign, 37% of participants were on track to meet their Tier 2 energy saving target, and 63% of participants needed to catch up on their savings to meet either target. Users were coached on new automations to leverage their smart devices, including scheduling smart

bulbs to dim before bedtime and using multipurpose sensors to adjust thermostat settings if a window or door is left open.

In September 2019, all participants were alerted to their final energy savings reduction amounts, if any, and their results in relation to their targets. Customers were then mailed their incentive checks within two weeks.

Early results

While the smart home pilot is still underway, early analysis of the 2019 energy target campaign demonstrated promising results. Of the participants:

- 44% realized some level of energy savings.
- 10% reached their Tier 1 target (between 2% and 3% energy reduction).
- 25% reached their Tier 2 target (between 4% and 5% energy reduction).

The campaign resulted in an average energy savings of 3% to 4% for the 200 participating customers, and the distribution of approximately $8,300 in incentives. While the overall impact evaluation is yet to be completed, these initial savings show promise for leveraging data analytics, customer engagement, and connected devices for next generation behavioral-based DSM programs.

At the end of the campaign, participants were surveyed for feedback on their experience. We found that:

- 90% of survey respondents believed that their target goal was both achievable and easy to understand.
- 50% of survey respondents either integrated a new smart home automation or installed a new smart device as a result of the energy target campaign.
- 60% of survey respondents stated that they would only participate at the current incentive levels, and likely would not engage at a lower value.
- All survey respondents agreed that the utility should continue the energy target campaign in the future.

Conclusion

Utilities should continue to explore customer engagement opportunities such as complex rate engines and artificial intelligence. However, this energy target campaign found that data-driven tactics can produce meaningful results without the need for robust control platforms or committing to a singular product. Therefore, energy targets that harness AMI data and leverage home modeling systems can be an important tool in a utility's smart home engagement playbook by allowing them to connect with their customers in new ways.

About the authors

Elena Vera has over 5 years of experience in project and program management including strategic planning, finance, and customer acquisition. She has helped numerous utility clients in the Mid-Atlantic Region develop, launch, and manage leading-edge programs such as eCommerce and Smart Home. Elena is certified in Lean Six Sigma and holds a bachelor's degree from Salisbury University in Maryland.

David Pudleiner has over 6 years of experience working in the field of building energy analysis, and has worked in both academic and consulting environments. While at ICF, David has contributed significantly to projects in a variety of fields including non-wires alternatives, energy efficiency potential estimation, building energy simulation, and tool development. Since joining ICF, David has helped to launch 8 new tools to improve modeling and analysis methods within the company. He has served as the lead modeler for three non-wires alternatives and four potential studies.

Ahmed Bekhit has over 4 years of experience working in the field of building energy management. At ICF, he has contributed significantly to projects in a variety of fields including EM&V, optimization, energy modeling, and advanced data analytics. Since joining ICF, Ahmed has provided innovative solutions to many ICF clients.

Justin Mackovyak has over 15 years of experience in project and program management including strategic planning, customer acquisition, finance, quality assurance, and technical training. With a background in residential construction, building science, and energy management, he has consulted on numerous award-winning projects for clients such as Baltimore Gas & Electric (BGE), Southern Maryland Electric Cooperative (SMECO), and Pepco Holdings.

Justin leads all energy efficiency, decarbonization, and electrification projects for utility clients in the Mid-Atlantic region. He is a Building Performance Institute (BPI) Certified Building Analyst, Envelope Specialist, RESNET HERS Rater, licensed contractor, and holds a B.S. from the Pennsylvania State University.

David Meisegeier is a vice president and senior technical director at ICF with more than 27 years of experience in energy efficiency, distributed energy resources, and customer engagement for utility programs. His professional skills include: innovating, designing and implementing strategic energy programs; performing market and technology assessments of energy products and systems; and developing information technology solutions. Having previously served as ICF's Residential Sector Lead, David now focuses on helping utilities develop solutions for their rapidly changing landscape including distributed energy resources, customer facing programs, and grid modernization. David has innovated energy programs and solutions that leverage the Internet of Things and mobile technologies, including overseeing development of Power RebateTM – the industry's first mobile rebate app.

David holds a B.S. in Architectural Engineering from Pennsylvania State University and an M.S. in Engineering Management from George Washington University.

Haider Khan has 17 years of experience in econometric and energy modeling, simulation, and optimization for utility and policy analytics including demand side management, energy efficiency, and renewable energy.

Haider leads ICF's Demand Side Management Analytics and Policy team which conducts residential, commercial, and industrial energy modeling; data analytics; econometric modeling; software development for energy savings estimation; application of AI & mathematical optimization; and DSM program planning and implementation support.

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