White Paper

The Swiss Army Knife of Future Utility Programs

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Shareables

- Optimization algorithms in smart thermostats can save at least 8 - 10% in heating and cooling energy.

- Smart thermostats in one pilot program reduced runtimes up to 95% during demand response events while maintaining a customer satisfaction rate of 86%.

- Smart thermostat data can be combined with propensity modeling to "micro target" participation in energy efficiency and/or demand response programs.

Executive Summary

No longer far-off visions or science fiction fodder, the Internet of Things (IoT) and smart homes are quickly becoming a present reality for customers and utilities ready to embrace the increased connectivity, convenience, and savings offered by a new generation of smart devices. The promise of new "smart" programs is significant, including energy and cost savings, demand savings, and improved customer engagement with an outlook toward the fully connected smart home.

21st Century Thermostats: Smarter Than Ever

While savings from thermostats is influenced by how occupants set the temperature, connectivity and various algorithms (e.g., that take into account occupancy, weather, etc.) can help thermostats automate savings. Studies have found that these "smart" thermostats can save between 8% and 22% for heating and 13% to 23% for cooling[1]. Recognizing the impact that occupant choices and interactions can have on energy savings, the EPA requires thermostat manufacturers to submit both laboratory and aggregated field data that demonstrates a minimum savings of 8% for heating and 10% for cooling in order to qualify as an ENERGY STAR Smart Thermostat, with currently only seven thermostats qualified for the title.[2]

Beyond energy savings that can be claimed when installing the device, smart thermostats provide a versatile out-of-the box platform for demand response, revenue generation, grid optimization and customer engagement. This puts utilities in a great position to adopt this technology as part of energy- and cost-saving programs for their customers.

Rethinking Traditional Demand Response

Smart thermostats can provide utilities new or supplemental paths into demand response. By recruiting customers who already have the thermostats installed in their home, such as through an existing energy efficiency program, utilities can enjoy lower acquisition costs by avoiding additional labor and material expenses associated with a dedicated installation. Additionally, by monitoring the runtimes, temperature, and humidity levels of each home during an event, utilities can maximize the load shed of each home on an individual basis. For example, utilities can capture deeper savings from homes with efficient envelops versus those with inefficient envelops, without sacrificing customer satisfaction or increasing opt-outs. In fact, in a recent pilot conducted by ICF, smart thermostats were able to reduce runtimes by up to 95% during summer demand events while maintaining a customer satisfaction of 86%.

Pathway to Deeper Customer Engagement

While the annualized energy and peak demand savings associated with a relatively low cost measure is very exciting for most utilities, the real magic lies in granular data acquisition, control and optimization algorithms, and the connection to the cloud. This provides utilities with a platform for more accurate virtual home audits, home automation, and more personalized customer engagement. For example, ICF is using advanced analytics with smart thermostat data to identify homes with large potential for savings and then targeting these customers for participation in other utility offerings (Exhibit 1).

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[1] Miziolek, Claire, et.al. (April 27, 2017). Smart Thermostats: Paving the Way for Smart EM&V PowerPoint slides presented at the 2017 EM&V Forum Spring Meeting, Washington, DC. Retrieved from http://www.neep.org/sites/default/files/EM%26V%20Spring%20Meeting_Smart%20Thermostats_FINAL.pdf

[2] https://www.energystar.gov/productfinder/product/certified-connected-thermostats/results

Key Takeaways

The groundwork for smart thermostat programs has already been laid with successful pilots and this technology is poised to take off as customers embrace the benefits of connected and intelligently controlled devices. Smart thermostats not only provide customers and utilities with energy and demand savings, but they also serve as the foundation for building a fully connected smart home. Further, the data from smart thermostats can be turned into insights that better guide utility marketing efforts and can provide smarter control of thermostats during demand events that maximize load shed while minimizing opt outs.

EXHIBIT 1. DATA COLLECTED BY SMART THERMOSTATS IS A GOLD MINE OF INSIGHTS
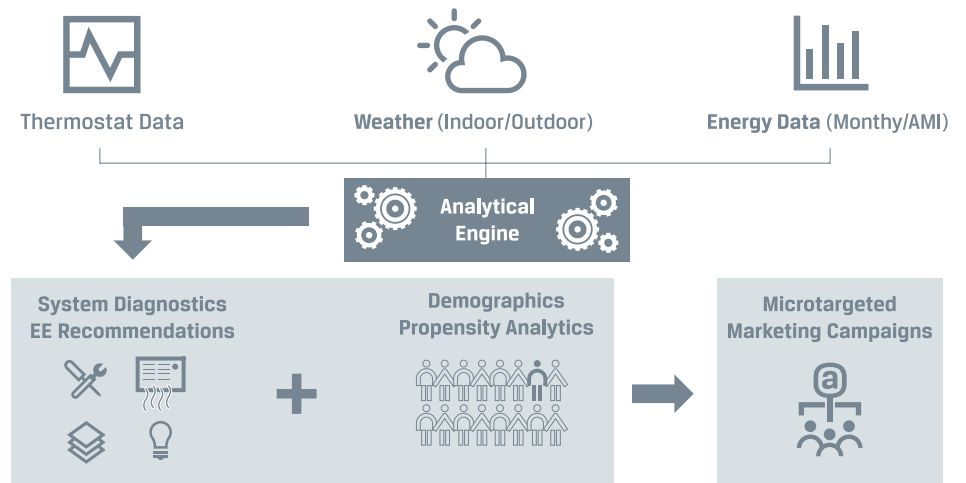
This is accomplished by combining customers' propensity to participate in energy efficiency programs with the more accurate assessment of their savings potential that can be determined from analyzing thermostat data. These insights can be delivered back to the customers in a number of ways including home energy reports, a utility dashboard or the thermostat itself (Exhibit 2).

EXHIBIT 2. DELIVERED INTERACTIVE CUSTOMER INSIGHTS INCREASE PARTICIPATION

Insulation
You have **sufficient insulation in your home**.

Heating, Cooling and Ventilation
Your **air conditioner could use a tune-up.** Contact your HVAC technician or we can connect you with one of our trusted partners.

Air Sealing
Your home seems to be **affected by drafts** and could benefit from professional air sealing.

Shading
It seems that your home gets pretty hot on those scorching sunny days. **Consider installing internal or external shades on your windows** or low E windows.

About ICF

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About the Authors

Justin Mackovyak is an energy efficiency consultant with ICF. With a specialized background in residential construction, he is currently supporting a number of utility-based demand side management programs including Smart Thermostats, Residential New Construction, and Demand Response. Prior to ICF, Mr. Mackovyak worked for several award-winning construction firms in roles ranging from project management to estimating and executive management. Focusing on high-end custom homes, his projects often included the latest building science and energy efficiency techniques. Mr. Mackovyak is a Building Performance Institute (BPI) Certified Building Analyst, Envelope Specialist, RESNET HERS Rater, and licensed home improvement contractor.

Hassan Shaban has 7 years of experience in energy engineering and advanced analytics with applications in demand side energy efficiency, power plant operations and renewable energy production. He has mined and analyzed numerous datasets collected by demand side management programs, smart meters and smart thermostats and has worked on developing and improving different modules in ICF's modeling platforms.

Haider Khan has 13 years of experience in econometric and energy modeling, simulation, and optimization for utility analytics, including demand side management, energy efficiency, and renewable energy. Mr. Khan leads work in energy efficiency and distributed energy resource analytics, conducting residential, commercial, and industrial energy modeling; data analytics; econometric modeling; software development for energy savings estimation; and DSM program implementation support.

David Meisegeier is a Vice President and Senior Technical Director at ICF with more than 24 years of experience in energy efficiency, demand side management and pollution prevention for the residential sector. His professional skills include: design and implementation of strategic energy efficiency and demand reduction programs; market and technology assessments of energy efficient products and systems; and information technology development. Having previously served as ICF's Residential Sector Lead, Mr. Meisegeier now focuses on helping utilities develop solutions for their rapidly changing landscape including distributed energy resources, customer engagement and grid modernization. Mr. Meisegeier has innovated residential programs and solutions that leverage the Internet of Things and mobile technologies, including overseeing development of Power *Rebate*™ – the industry's first mobile rebate app.