Project Brief

TIP 272b: EPRI P170 Supplemental: Evaluating Smart Thermostats' Impacts on Energy Efficiency and Demand Response

Context

Advances in technology have led to the development of a new generation of programmable communicating thermostats that hold the potential for energy and demand savings at a relatively low cost to electric and gas utilities.

Known as “smart thermostats”, these control devices for space conditioning systems have capabilities beyond just allowing the customer to program temperatures for different times of the day, and days of the week. They allow customers to remotely program their thermostat, often via internet-enabled devices (such as a PC or mobile device) with a consumer-friendly user interface. They enable two-way communication of data outside the building premises (either built-in or expandable), including indoor temperature data, operational sequence of space conditioning equipment, etc. They can also be adapted to receive demand response event signals from utilities.

Industry experience has shown that customer acceptance and usability can be key drivers to a thermostat’s energy or demand reduction potential.

Description

New learning for the industry and the public will come about by addressing the project’s key research questions which are as of yet unanswered: Do smart thermostats result in energy and/or demand savings with residential customers? Other new learnings will be derived in answering secondary research questions relating to the technological characterization of various smart thermostats on the market, and customer interest and uptake.

Project Approach and Summary

Electric and/or gas utilities may participate in the project as either a Host or a Collaborator. Hosts will field a trial in their service territory, answering specific research questions of interest to them. Participation as a Collaborator is intended for utilities that are interested in possibly developing a smart thermostat program in the future, but are not yet ready to field a trial, or for utilities with trials in progress but that are interested in the results of others as well as the technology and market understanding.

The specific implementations will vary based on the eventual trial designs, but the overall primary tasks include:

- A technical review of market-ready smart thermostat technologies, including the development of selection criteria for subsequent trial recommendation
- Guidelines for designing and conducting smart thermostat trials and analyses to measure attributable energy and/or demand impacts
- The development of Host-specific EE and/or DR trial designs and analysis plans, including the trial objectives, sample frame, data acquisition methods, and recruitment plan
- Enabling delivery of demand response signals (if a DR deployment is chosen by Host) with the product vendor
- The set-up of systems to acquire data from the smart thermostats (Host-specific)
- Survey design and administration to assess customer reaction to the thermostats, and self-reports of customer behavior (Host-specific)
- Host-specific evaluations for EE and/or DR impacts after two main seasons (winter and summer) and after one complete test year
- A multi-Host analysis to assess commonalities and divergences amongst the findings, and potentially pool the data to develop a model

Why It Matters

This project will inform gas and electric utilities and the public of the potential energy savings benefits of smart thermostats. For utilities, it may provide a measure of how these thermostats fit into their programs, and key features that might promote energy efficiency and demand response.

Demand response from residential air conditioners has been a target of many utility programs, but the cost of installation of load control devices and the perceived compromise in customer comfort have been large barriers. These thermostats, which are consumer-managed and possibly consumer-procured, may overcome these barriers at a relatively low cost.

Finally, this project offers the opportunity to pool and compare data across different utility and technology contexts, therefore contributing a larger breadth of results than any single one-off evaluation.
Goals and Objectives

Given that smart thermostats can offer better customer usability due to their remote programming capability, the objective of this project is to evaluate the energy and demand savings impacts of smart thermostats, as well as determine how customers perceive and use them.

Deliverables:

All participants receive the following:

- Smart thermostat technology characterization
- Trial design, implementation and analysis guidelines
- Survey instruments
- Results summaries for each Host’s impact evaluations (covering energy/demand impacts, customer interaction with thermostat, and customer preferences)

- Final project report summarizing and comparing results of all Hosts
- In addition, each Host will receive the following for their own trial:
  - A detailed trial design and data acquisition and analysis plan
  - Two detailed interim evaluations (one after each of two testing seasons), and one final report after one year (evaluations include energy/demand impacts, customer interaction with thermostat, and customer preferences)
  - All raw data

(Project brief information from the EPRI Project Abstract)

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Reports & References (Optional)

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Links (Optional)

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