



The Smart Home Interface: A Tool for Comprehensive Residential Energy Efficiency

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Introduction

In this brief, NEEP outlines the potential combination of two currently independent trends in residential energy efficiency: (1) the rise of the smart energy home and (2) residential benchmarking and labeling efforts. Currently, states, efficiency programs, and other stakeholders are pursuing both strategies to reduce energy use in the residential sector, but these efforts are being managed separately. In this brief, we walk through several opportunities for smart home and home labeling efforts to leverage each other for additional savings impact.

Background

Comprehensive energy efficiency in the residential sector has long been a challenge to achieve. Throughout the Northeast and Mid-Atlantic, there are millions of households with unique priorities, schedules, needs, configurations, and homeowner motivations. While efforts such as building codes and appliance standards can make a huge difference to ensure new buildings and equipment meet a minimum level of efficiency, in order for our region to meet the goal of 80 percent carbon reduction by 2050,¹ a great deal more work is necessary to address existing residential building stock and to find ways for more homes to make significant efficiency improvements.

One of the major challenges our industry faces is that energy efficiency is competing against numerous higher priority issues for consumers. Energy bills often sit towards the bottom of a list of monthly household concerns, even while home improvements and the desire for a comfortable and safe home rise to the surface for many, and concerns about climate change and the environment rise to the surface for some.² Finding new ways to motivate action towards residential efficiency improvements is incredibly important. Pairing energy efficiency labeling and smart home efforts may offer new avenues towards increased efficiency.

Why Label?

Home energy labeling is rooted in a long-held theory in energy efficiency: that visibility into energy usage will help people save energy.³ In practice, the energy savings gained through awareness can

¹ Relative to 2001 levels, NEEP's mission, <http://www.neep.org/about>

² Shelton Group Energy Pulse 2015

³ Variety of sources, including: <https://aceee.org/files/proceedings/2012/data/papers/0193-000244.pdf>, <http://www.energycollection.us/Energy-Metering/Advanced-Metering-Initiatives.pdf>, and a list on page 34: <http://mn.gov/commerce-stat/pdfs/card-report-energy-efficiency-behaviorial-prog.pdf>



occur in many ways. In the most straightforward and potentially unlikely cases, occupants of a space may not have realized how badly their building was performing; once that information was available, they may begin to make behavioral and physical improvements. In other cases, transparency on energy performance may get into the hands of someone looking to purchase or rent a space; this information could change how they make that decision.

With energy bill disclosures for renters, for example, prospective tenants would know what they were getting into before they signed a lease and may use that information to negotiate. For home purchases, if energy performance is shared with a prospective home buyer—enabled through a platform such as the Home Energy Labeling Information eXchange (HELIX)⁴—this could impact the listing price. As transparency becomes more commonplace, it could offer a source of motivation for home sellers. If a home was not selling because of its poor energy performance, that may motivate the seller to take steps to improve the home’s energy performance before re-listing the property. In a benchmarking situation, having a consistent and tangible understanding of where many buildings stand can help inform the schedule for upgrades or be used as the starting point to reach sustainability or energy goals. In addition, transparency could enable potential operational efficiency.

Information about a building’s energy performance can be useful for many aims, but for the thousands of homes currently being scored or labeled, are we truly maximizing the impact of that effort?

The Smart Home User Interface

Behavioral science has established that residential energy consumers are not preoccupied with their energy bills (on average spending only eight minutes a year reading and reacting to the paper bill),⁵ with only a select few consumers inherently motivated to find active ways to save energy at home.⁶ Smart home devices offer an opportunity to overcome these behavioral and motivational barriers. When a homeowner purchases and installs a smart home product, the first set-up step is typically downloading a smartphone-based app that will monitor and control the device, and, in some cases, provide feedback on energy information in a home. This is true whether the product is a smart thermostat, water heater, lightbulb, software using the smart meter, or most other smart home products. What these apps have that a utility bill cannot replicate is that as individuals use their smart home devices, they are looking at their app to do so.

⁴ <http://www.neep.org/initiatives/energy-efficient-buildings/green-real-estate-resources/helix>

⁵ Accenture study: <https://www.greentechmedia.com/articles/read/customers-spend-8-minutes-a-year-interacting-online-with-their-utility#gs.cbs3AtI>

⁶ Only 27% of people are consistently motivated to prioritize efficiency, according to Shelton Groups’ Energy Pulse 2015



Imagine a smart thermostat that was purchased through a utility rebate program. Once installed, the occupants would download and connect their smartphone app to the device itself. A smart thermostat, which in many cases can save significant energy,⁷ can also present the user with several digestible pieces of information, including weather data, system use and analytics, and potentially even demand response or load shifting messages. This information is all presented through the single app interface, henceforth referred to as a *smart home interface*. Some of this information, such as weather forecasts, may be useful for stand-alone reasons; some users may check the weather data to determine what to wear or whether or not to bring an umbrella.

Smart device manufacturers work to delight their users by providing useful information in compelling and easy to digest packages. At a minimum, however, users will engage with the app to elicit the desired outcome from the smart devices: to lower the temperature, turn on the lightbulb, or see if their garage door was left open. Even if the initial fascination with the new gadget wears off, the utilitarian role of the app to perform a function remains. As more and more apps are created and may confuse the user, so too are more partnerships built to keep the user experience streamlined. Newer trends such as voice control can simplify the user experience while still captivating attention.

The engagement tendencies that smart device users take may fall into two categories—engaging to interact with the end product or engaging for interest—but both easily lend themselves to help increase awareness and visibility to energy labeling, benchmarking, or other scores.

Key Strategy: Making it Easy.

Home energy labeling, such as the U.S. Department of Energy (DOE)'s Home Energy Score, is intended to motivate low-scorers to invest in their home in order to achieve a higher score, resulting in a more efficient home. Typically, however, the actual label (i.e. your home is a four out of 10) comes at the end of an assessment; if homeowners do not act upon the recommendations to increase their score immediately, the actual rating paperwork is likely tucked away in a less-than-prominent location. A smart home user interface, however, provides an excellent platform to provide visibility and a reminder of the score. By providing a reminder of the home score, smart products may help motivate homeowners to invest in a retrofit and re-scoring to demonstrate improvement.

In order for home labeling and benchmarking efforts to leverage the smart home device user interface, discussions and partnerships are necessary. The easiest starting point is cases where one program administrator (PA) is offering both a smart product promotion and a labeling program.

⁷ Smart Thermostats certified by the ENERGY STAR program demonstrate that across their deployed base, they reach at least a climate-zone weighted average of 8% heating and 10% cooling run time reduction of HVAC equipment as compared to standard thermostat operation



To start, that PA would work with the smart product manufacturer to negotiate an app overlap, push notifications, or “energy information” center where information about the score or other efficiency efforts can live. Behind the scenes, the application programming interfaces (APIs) of the smart home product and the program data seeking visibility would link together. Even simpler, the offerings could be connected via an RSS feed. In that way, when a PA selectively sends out notifications on a new offering, opportunity, or partnership, that information can be sent to the smart home interface. This is similar to the information that may be included in an email blast or bill insert, but on an app that is likely to gain more visibility. While customer privacy is a chief concern for utilities and smart home manufacturers alike, linking information will become easier as efforts to make energy information more transparent are successful.

In this approach, customer consent to get this information is critical. Because of the connected nature of these products, if a device is already installed when this information is linked, it is relatively easy to push out a new simplified “terms and conditions” message asking customers to opt-in to receiving this information. If the message is for a new product, including the language in the initial set-up would be even easier. This approach could be applied to any connected device in the home, even something like a smart TV. With a simple message of “your local utility is committed to helping you reduce your energy use. Please click accept if you agree to get occasional educational information about ways to save energy,” opt in rates may be relatively high.

In the case of a labeling effort, PAs maintain databases of the homes and customers who have received scores. Working with smart device vendors, that data could be uploaded to hold a static pixel position, perhaps on the app’s home page, to add visibility to the score. In the case of high scoring homes, this information could reassure homeowners of the sound investments they’ve made. In the case of lower scoring homes, the reminder of that score could be psychologically motivating. Homeowners may not be motivated towards action at the time of the initial score, but continual reminders of poor performance may eventually trigger action, especially if circumstances around finances or other home investments change resulting in a more favorable scenario for efficiency upgrades. Hypothetically, the image of the score could be a button that directs users to home performance information and a contact mechanism to follow through. This could increase the ease and uptake of home performance upgrades and result in deeper home efficiency.



Artistic rendering of a hypothetical smart home app with overlaid information of home energy score. Images from nest.com and colorado.gov.



Behavioral Efficiency Enabled through the Smart Home?

Another perspective and opportunity enabled through the smart home user interface is to assist in the persistence of behavioral energy efficiency. Program evaluations⁸ have shown that when behavior comparative norming programs, such as those offered by Opower, stop sending information, the persistence of savings eventually drops off. When integrated into a smart home interface, the timetable to provide information may be longer (perhaps as long as a homeowner uses the product). Longer engagement may end up saving costs for a program administrator, as well as eliciting longer-lasting behavioral efficiency improvements. Instead of waiting for monthly bills, different efficiency messages can be sent and tested at different times with greater exposure. More tailored information about homes enabled through some smart home devices, such as vacation home or primary residence and comparable HVAC equipment, can help create a more appropriate comparison group.

Static Scores vs. Dynamic Energy Monitoring?



Real time energy visualization, image from powerley.com

There is an inherent disconnect between a static score or label that is generated at one point in time and smart home products that have near-real time information on energy use and potential savings within a home. Smart products have figured out how to visualize real-time information and are incorporating more dynamic diagnostics into their offerings, but a more comprehensive, whole-home assessment or performance score completed by a professional can find inefficiencies that no one smart home product can. These scores are very important and insightful, providing specific insights into your home and identifying opportunities for improvement; more visibility on them could motivate action. For example, a smart home device might show a decrease in your energy use with your current building envelope, but a more intensive score, though static, will show you that you have the potential to significantly improve your building envelope. These static scores may point out the bigger home investments that you need to bring your home to the next level of efficiency, while smart product insights may show you how you can make the most with what you currently have. Both perspectives are important, save energy, and can work together.

⁸ Including those summarized in: Keep the Change: Behavioral Persistence in Energy Efficiency Programs <https://library.cee1.org/content/2017-iepec-paper-keep-change-behavioral-persistence-energy-efficiency-programs/>, CEE Behavior Program Summary: <https://library.cee1.org/content/2017-behavior-program-summary-public-version/>, and <https://library.cee1.org/content/2017-cee-behavior-insights-and-tools-public/>



Built in A/B Testing

A final benefit to this approach is the potential to run A/B or randomized control trial testing within populations that own smart home devices. If a program is trying to demonstrate, for example, that providing a home energy score leads to more retrofits being completed, PAs could look at all smart product users in their service territory and compare how those with scores perform compared to those without. Especially as devices such as smart thermostats are getting closer to providing insights akin to a remote audit, this comparison could be more insightful than a billing analysis or even smart meter data. Going further, PAs could compare homes that had a score added to their smart home interface to those with just a score at time of assessment to see which resulted in more retrofits. Other opportunities to show influence include tracking calls or clicked links through the smart home interface. If bringing more customers into home performance upgrades is the goal of labeling efforts, smart products can help make that case for success.

Conclusion

The need for achieving deeper energy savings through improved home performance is an integral part of states reaching their carbon-reduction goals. With this persistent need, discussions on the integration of separate efforts to measure and motivate residential energy efficiency are just beginning. Smart home products and devices can help by enabling control or feedback for energy savings within a home and potentially they can also be leveraged for their unique position in captivating attention. This may be one of the few instances that homeowners' preoccupation with their smart phones may actually be a good thing.

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