Recognizing Smart Home Energy Management Systems

ENERGY STAR® Products Partner Meeting
September 6, 2018
3:30 p.m.

Abigail Daken, U.S. EPA
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Agenda

• ENERGY STAR and Smart Home Energy Management Systems (SHEMS)
  o Abigail Daken and Taylor Jantz-Sell - U.S. EPA ENERGY STAR
• Operation of Smart Home Systems – Insights from Alarm.com
  o Gustaf Lonaeus - Alarm.com
• Smart Home Systems and Utility Programs – Data, Savings, and Challenges
  o Lara Bonn - Vermont Energy Investment Corporation
  o Brad Piper - Lockheed Martin
• Next Steps and Working Groups
Why ENERGY STAR?

• Consumers and utilities are interested in this space, but also bewildered
• ENERGY STAR is a known and trusted label, backed by impartial, publicly available specifications and test methods
• Part of EPA’s brand promise is to make difficult decisions about energy savings simple, as with automated SHEMS energy savings
• Offering a uniform national platform allows for smoother, more coordinated, deployment of incentive programs
• ENERGY STAR SHEMS can be a win for the companies that offer them, for the consumers that want them, and for the environment
ENERGY STAR and the Smart Home: Looking Back

• 2011 → present: optional “connected” criteria in product specifications (11 product types)
  – Interoperability, use of open standards
  – Energy use reporting
  – Demand response
  – Standby power limits

• Smart Thermostats (not optional) - data reporting to service provider is key to demonstrating savings

• ENERGY STAR specifications for many natively networked products, such as consumer electronics and IT equipment handled differently
EPA’s ENERGY STAR Smart Home Strategy: Bring Energy Savings Along for the Ride

As the market for "smart" products and systems grows, EPA aims to help drive and optimize energy savings through their use.

- Guide energy characteristics of smart products and systems
- Explore system models and ways to work with Service Providers
- Leverage the ENERGY STAR brand and position to push energy efficient behaviors and practices into the connected and smart home market
Why Smart Home Energy Management Systems and Why Now?

• **Device shipments growing**: 22 million (2016) to 96 million (2026)

• **Service providers are easing barriers** for adoption, proving a central point for end users and an relationship that allows for ongoing evaluation and improvement.
  – Connectivity among a system of products represents an opportunity for savings and enhanced customer experience: Better user experience of energy saving modes, Shared occupancy information, Co-optimization of related systems (e.g., lighting and window shades)

• **Occupancy information is low hanging fruit** for energy savings in these systems

• **Additional opportunities exist** for sharing information and energy management through connected and coordinated systems (e.g., demand response, load shifting, distributed energy resources balancing solar PV, battery storage, EV charging, etc.)
A Quick Note on Security

EPA understands there can be security risks associated with smart products and systems. Recognizing that this is not our area of expertise, we do not intend to take the lead on developing security standards in the smart home market. To the extent that sound security standards arise, EPA may point to them in ENERGY STAR specifications as appropriate.
SHEMS Up To This Point

- June 26, 2018 Discussion Guide
- July 11, 2018 Webinar
- July 27, 2018 Comments Closed
- Sept 6, 2018 In person meeting
ENERGY STAR Smart Home Energy Management Systems

Concept

- Hardware + Occupancy Info + Automated Services = Energy Savings
Scope: Potential ENERGY STAR SHEMS

• Proposed elements of a basic package:
  1) ENERGY STAR certified smart thermostat,
  2) ENERGY STAR certified lighting,
  3) Devices and/or capabilities that address energy used by miscellaneous electrical loads (MELs),
  4) The ability to detect occupancy (alarm pad, geofencing, remote sensors or sensors built into other devices)
  5) Energy optimization algorithms and ability to collect data about optimization

• Add-ons for additional savings, e.g., water heater controller, pool pump controller, connected ESTAR Room AC, automated shades, EV charger, etc.
How Might this Work?

• Service provider has a package that meets the key criteria

• Shares details for meeting key criteria with EPA
  1) Hardware models included in package, potentially with interchangeable options
  2) Methods of sensing occupancy
  3) Energy optimization strategies based on occupancy

• Compiles and submits to EPA summarized data based on a defined sample (biannual) for verification of actualized savings
Thoughts on Data Reporting

• Populations of installations to be analyzed: all customers with every basic element of package connected to platform

• For the population, report statistics such as
  1) Average number ENERGY STAR certified smart thermostats per installation,
  2) Average number of ENERGY STAR certified connected lighting products (bulbs or fixtures) per installation,
  3) Average number of MEL control devices per installation,
  4) Average number and characterization of other add-on hardware,
  5) Decile bins and mean hours subject to optimization per installation (ideally capture the range, i.e., deep optimization vs. shallow), and
  6) Average number of user override or opt out events per installation.
Potential Evaluation Method

- Typically, ENERGY STAR products are tested in labs to yield energy consumption performance.
- In this case, behavioral interactions with users are critical to achieve savings and, therefore, EPA anticipates relying on field data.
- Similar to the method used for ENERGY STAR Smart Thermostats, data could be submitted twice a year to demonstrate continuing product savings.
Key Topics/Questions to Keep in Mind

1. What kind of data is available, relevant, and reasonable to collect and analyze for this purpose?

2. What strategies can save energy during an unoccupied hour? Do we know which ones are the best?

3. What information would utilities need to be ready to adopt such a program? How can we get that information (pilots, data agreements, etc.)?

4. How do we deal with promising opportunities that exist in some homes, but not most, e.g., electric water heaters, electric vehicle supply equipment, etc.?

5. Which products would stakeholders want to know are connected to the system? E.g., is there value in knowing about dog feeders or battery operated cameras?
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From NEEP

Check out their other great resources!

<table>
<thead>
<tr>
<th>Smart Product</th>
<th>Energy savings</th>
<th>Demand response</th>
<th>Load shifting</th>
<th>DER integration</th>
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<tbody>
<tr>
<td>Smart Thermostat</td>
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<td>Smart Water Heater</td>
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<td>Smart Appliances: Inflexible timing (refrigerators, stoves, ovens, small appliances)</td>
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<td>Smart Appliances: Flexible timing (clothes dryers, clothes washers, dishwashers)</td>
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<td>Smart TV</td>
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<td>Smart plug, outlet, or switch</td>
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<td>Smart Hub</td>
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<td>In-Home Display</td>
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<td>Energy Portal</td>
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<td>Smart Home Platform</td>
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<td>Smart Lighting</td>
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**Hot**

**Warm**
EPA’s Next Steps and Opportunities for Engagement

• Establish working groups
  – drop your card or write down a contact
  – email to all stakeholders after the meeting

• EPA to formulate a Draft 1 specification based on discussions, public comments, and follow-up

• Follow along at www.energystar.gov/SHEMS
Intention of Working Groups

• EPA anticipates each working group to be a diverse combination of invested stakeholders
  – Manufacturers,
  – Energy Efficiency Program Sponsors,
  – Service Providers,
  – Researchers, etc.

• Members are not limited to those in this room right now

• EPA appreciates your time investment and expertise to deliver a program with a strong foundation. At least 2X a month Sept-Dec 2018 (then reassess)

• Goal: to resolve pending questions/decisions which will inform a Draft 1 specification and beyond
Working Groups’ Focus Areas

1. Utility pilots / data needs
   - What utility pilots or data are needed for utilities to support a SHEMS program?

2. Miscellaneous energy loads
   - How important is managing MELS with occupancy information and what strategies would lead to the most energy savings?

3. Occupancy detection methods
   - Which occupancy detection methods (or features) would be sufficient for this type of program?

4. What counts as an “away” hour
   - What is a simple and practical way to characterize an hour with effective energy optimization?
Contact Information

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Daken.Abigail@epa.gov

Taylor Jantz-Sell, U.S. EPA
Jantz-Sell.Taylor@epa.gov
Smart Homes –
A Vermont Perspective

Lara N. Bonn
Director of Emerging Technologies and Services
Who is Efficiency Vermont?

• Statewide energy efficiency utility
• Sustainable energy solutions for all Vermonters
  – Education
  – Services
  – Rebates and financing
Efficiency Vermont’s Efforts

2014 HEMS Product Catalog
2015 HEMS, Smart Lighting, & Outlet Control Study
  • Map, define, & measure energy use of DIY HEMS & smart lights
  • Catalogue consumer use of smart outlets
  • Results: Participants dimmed lights 38% of the time & HOU reduction potential

Smart T-stat Efforts
  • 2014/2015 Multi-year Nest Pilot
  • Launched smart t-stat rebate 2016 & moved to ENERGY STAR only rebate 2017
  • Started Enhanced Services Pilot (i.e. Seasonal Savings with Nest) in 2018
Efficiency Vermont’s Efforts – Cont’d

Advanced Res Intelligent Eff Study (ARIES) Pilot
• Launched in 2018 with ~400 households – Sense devices
• Determine behavior savings through digital engagement paired with energy efficiency program messaging & surveys
• Device level identification
• Preliminary Results - potential savings up to 8% per house

STAT Pilot
• Tool that includes algorithm to identify thermal shell savings potential in a home using smart t-stat data (leakiness score)
• 2018 pilot ongoing now
Smart Homes – Savings Now & Soon

Opportunities:
- Grid interactive, rates & load management
- Active control
- Passive adjustments
- Interactive info & data
- Behavior shifts
- Storage & transportation
- Optimizing performance & wholistic system optimization
- House assessments
- Product operability
- Specific product feedback
- Engagement through non-energy benefits: time of engagement, health, safety, security, etc
- And more

Key Facets:
- Who: Utilities, Customers, Public Sector, Industry, (manus, suppliers, contractors, service professionals, etc)
- What: Individual or grouped or system impact
- What services: Product > Installed System > Interacting System > Interacting Home
- How: Hardware, Software, Service
Smart Homes - Challenges

- Myriad of devices
- Customer & device adoption & longevity
- Communication protocols
- Overwhelming ways to engage
- Continued performance or waning interest once installed
- System interaction or performance
- And more

Hype cycle of technology adoption
Broad Themes on Ways to Save

- Reduce superfluous service (turn off lights)
- Use free service (open shades for light)
- Reduce useful service (dim lights)
- Shift useful service to a different time (dryer to night)
- Take advantage of storage
- Reduce wasted energy (reduce standby power)

Credit: LBNL & PGE Study
The Next Frontier

- Promising initial pilots, need more!
- Big opportunity to assess opportunities in many ways, but with whole in mind, especially in advanced control; both in the home and on the grid
- Stakeholders need to be engaged for best design & behavior impact
- Equity needs to be part of the conversation
- EM&V next generation is critical
- Additional discussion & research needed by all of you!
Thank you!

Lara N. Bonn
lbonn@efficiencyvermont.com
802-540-7853
Smart Home Session – Alarm.com Overview

Gustaf Lonaeus
Largest Platform for Intelligently Connected Properties

powered by ALARM.COM

5.5 Million Subscribers

Tens of Millions Connected Devices

Over 30 Billion Data Points

In the last year alone
Alarm.com Installers

7,000 Authorized Providers

SECURITY DEALERS – CPI, Frontpoint, Brinks, ADT
BUILDERS – DR Horton, Toll Brothers
RENTAL PROPERTIES – HomeAway, Invitation Homes
HVAC DEALERS – Mass Save

End to End Partner Support Tools & Services

INSTALLATION & TROUBLESHOOTING
BUSINESS MANAGEMENT
UPGRADE & SALES TOOLS
## Partner Ecosystem

### EnergyStar Devices Blue

<table>
<thead>
<tr>
<th>Panel Lineup</th>
<th>Energy</th>
<th>Lighting &amp; Water</th>
<th>Locks &amp; Access</th>
<th>Video &amp; Apps</th>
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</thead>
<tbody>
<tr>
<td>Interlogix Simon 3</td>
<td>ADC Smart Thermostat</td>
<td>GE Light &amp; Appliance Module</td>
<td>Liftmaster MyQ Control Panel</td>
<td>Skybell</td>
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<td>Interlogix Concord</td>
<td>Trane 2-Wave Tstat</td>
<td>Linear Dimmer Light Module</td>
<td>Liftmaster MyQ Gateway</td>
<td>Wi-Fi Fixed IP Camera</td>
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<td>Interlogix NX</td>
<td>2GIG CT-30</td>
<td>Evolve Light &amp; Appliance Module</td>
<td>Liftmaster MyQ Universal Retrofit</td>
<td>Mini-Dome IP Camera</td>
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<td>Interlogix Simon XT</td>
<td>2GIG CT-100</td>
<td>Evolve Wall Switch</td>
<td>Linear Garage Controller</td>
<td>Pan/Tilt IP Camera</td>
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<td>Qolsys IQ Panel</td>
<td>TB248D</td>
<td>Evolve Wall Outlet</td>
<td>Schlage Deadbolt</td>
<td>Outdoor Wi-Fi IP Camera</td>
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<tr>
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<td>Linear Tstat</td>
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<td>Schlage Lock</td>
<td>Outdoor PoE IP Camera</td>
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<tr>
<td>Interlogix Simon XTi</td>
<td>Radio Tstat CT-110</td>
<td>Linear Wall Switch</td>
<td>Yale Lever</td>
<td>Commercial Grade Cameras</td>
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<td>Linear Wall Outlet</td>
<td>Yale Touchscreen Lever</td>
<td>1 Channel Video Server</td>
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<td>Nest</td>
<td>GoControl Smart Light</td>
<td>Yale Touchscreen Deadbolt</td>
<td>ADC SVR</td>
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<tr>
<td>DSC PowerSeries Neo</td>
<td>Jasco Energy Meter</td>
<td>Qolsys IQ Light Blub</td>
<td>Yale Deadbolt</td>
<td>ADC Image Sensor</td>
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<tr>
<td>2GIG GC3</td>
<td>MeteoTec Energy Switch</td>
<td>Zipato RGBW Bulb</td>
<td>Yale Push Button Deadbolt</td>
<td>Apple Watch</td>
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<td>Qolsys Gen 2</td>
<td>Heavy Duty Smart Switch</td>
<td>Aeotec Bulb</td>
<td>Kwikset Lever</td>
<td>iPhone</td>
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<td>ADC SEM</td>
<td>ADC Temp Sensor</td>
<td>DynaQuip Water Valve</td>
<td>Kwikset Deadbolt</td>
<td>Android</td>
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<tr>
<td>2GIG Vario</td>
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<td>Kwikset Kwikset Touchscreen Deadbolt</td>
<td>Google Home</td>
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Suite of Services
Energy Saving Features

Thermostat schedules and rules
- Sensor left open set backs
- Geolocation driven rules
- Extreme weather setbacks

Switch, light, and large load schedules & sensor triggered rules

Energy data viewing via Green Button, CT clamps
• Alarm.com subsidiary provides Demand Response to more than 30 utilities leveraging devices from over 14 platforms

• Thermostats installed as part of security solution are available for DR

• Standard process for Alarm.com customers to enroll, review and participate in DR programs
Data-Driven Features

Data from Apartment Building, Tysons Corner

- Indoor Temperature
- Run Time

May 1 7 p.m. First hot day of the year. Building-wide air conditioning failure.

May 2 9:24 a.m. Alarm.com detects system failure, before residents are uncomfortable.

May 3 11:06 a.m. Customers uncomfortable throughout night. Property managers notify customers there is a system failure and repairs will be made.

May 3 12:30 p.m. System repaired.

Had facilities acted on information at this point, problem could have been resolved more than 24 hours earlier, before residents became uncomfortable.
Thank You!

ALARM.COM®
Home Energy Management (HEMS) Validation Pilots

NYSERDA HEMS Pilot
National Grid MA&RI Smart Lighting Study
LM ENERGY’S HEMS HISTORY

- Multiple Working Group Contributions (2010-)
- First Retail Program Incentive on HEMS (2011-12)
- Conducted Non-traditional Smart Home Manufacturer Survey For NYSERDA (2015)
- NYSERDA HEMS Validation Pilot (2016-2017)
- National Grid MA&RI Smart Lighting Study (2017-2018)
PILOT OVERVIEW'S

NYSERDA
- 50 homes Between Albany and Westchester Counties
- Whole Home Power Monitor, Smart Switches, Outlets, Lamps and Thermostats; Room Level and Whole Home Level Occupancy Sensors
- Test and Evaluate Baseload Simulation Validation Methodology
- Completed

National Grid
- 85 Homes Between MA and RI
- Connected Lamps, Light level (lux) sensors; Room Level and Whole Home Level Occupancy Sensors
- Test and Evaluate Baseload Simulation Validation Methodology
- In Home and Electronic System Trainings
- 12 Month Observation Period
- In Progress
PILOT DEMOGRAPHICS

NYSERDA

- **Survey Size**: 50 Households
- **Electric Utility**:
  - Con Edison: 61%
  - National Grid: 27%
  - Others: 12%
- **Heating Fuel Source**:
  - Gas: 63%
  - Oil: 37%
- **AC System Type**:
  - Central AC: 63%
  - Window AC: 33%
  - None: 4%
- **House Size**:
  - <1,500 Sq Ft: 4%
  - 1,500 - 2,000: 39%
  - >2,000 Sq Ft: 57%
- **Household Size**:
  - 1-2 persons: 31%
  - 3-4 persons: 53%
  - 5+ persons: 16%
- **60% of Households with Children**
- **Participant Gender**:
  - Male: 67%
  - Female: 33%

National Grid MA&RI

- **Survey Size**: 85 Households
- **Participant Gender**:
  - Male: 79%
  - Female: 21%
- **House Type**:
  - Single-Family: 89%
  - Multi-Family: 6%
  - Condo: 5%
- **Household Size**:
  - 1-2 persons: 28%
  - 3-4 persons: 51%
  - 5+ persons: 21%
- **Households with Children**:
  - 37%
  - 30%
  - 33%
- **House Size**:
  - <1,500 Sq Ft
  - 1,500 - 2,000
  - >2,000 Sq Ft
- Collection
- Storage
- Sorting and Syncing Multiple Data Streams
- Calculations
## NYSERDA FINDINGS

### Potential Whole Home and Individual Savings

<table>
<thead>
<tr>
<th>Smart Device</th>
<th>Electricity Savings (kWh/year)</th>
<th>Heating Fuel Savings (Therms/year)</th>
<th>Cost Savings ($/year)</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Thermostat</td>
<td>688</td>
<td>52</td>
<td>$174</td>
<td>No existing setback controls</td>
</tr>
<tr>
<td>Smart Outlets</td>
<td>341</td>
<td></td>
<td>$58</td>
<td>15-minute occupied delay</td>
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<tr>
<td>Smart Lamps or Switches</td>
<td>212</td>
<td></td>
<td>$36</td>
<td>Controls only</td>
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<tr>
<td><strong>Total HEMS Savings</strong></td>
<td><strong>1,241</strong></td>
<td><strong>52</strong></td>
<td><strong>$268</strong></td>
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