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

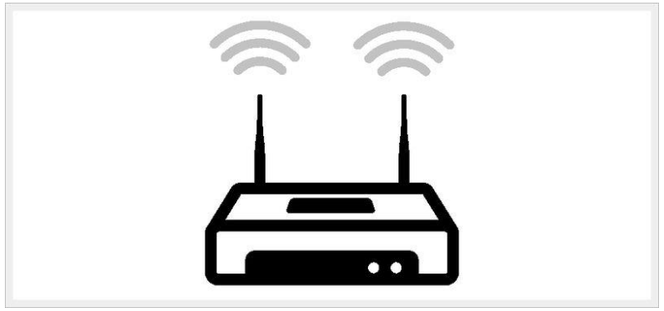
- ENERGY STAR and Smart Home Energy Management Systems (SHEMS)
  - Abigail Daken and Taylor Jantz-Sell - U.S. EPA ENERGY STAR
- Operation of Smart Home Systems – Insights from Alarm.com
  - Gustaf Lonaeus - Alarm.com
- Smart Home Systems and Utility Programs – Data, Savings, and Challenges
  - Lara Bonn - Vermont Energy Investment Corporation
  - 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



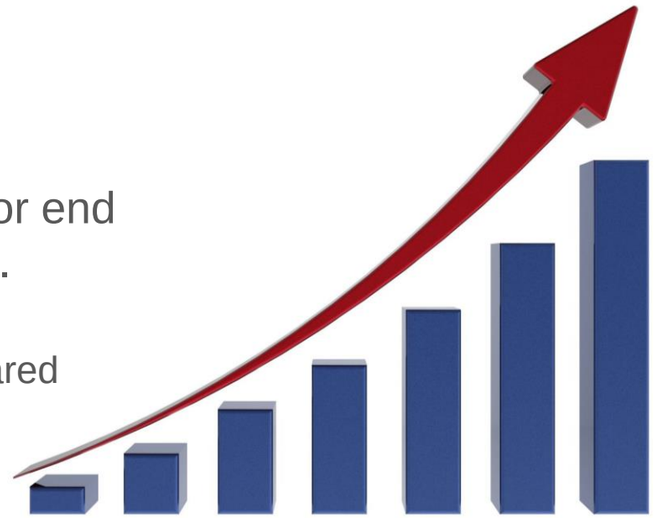
EPA's ENERGY STAR Smart Home Strategy: Bring Energy Savings Along for the Ride

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?

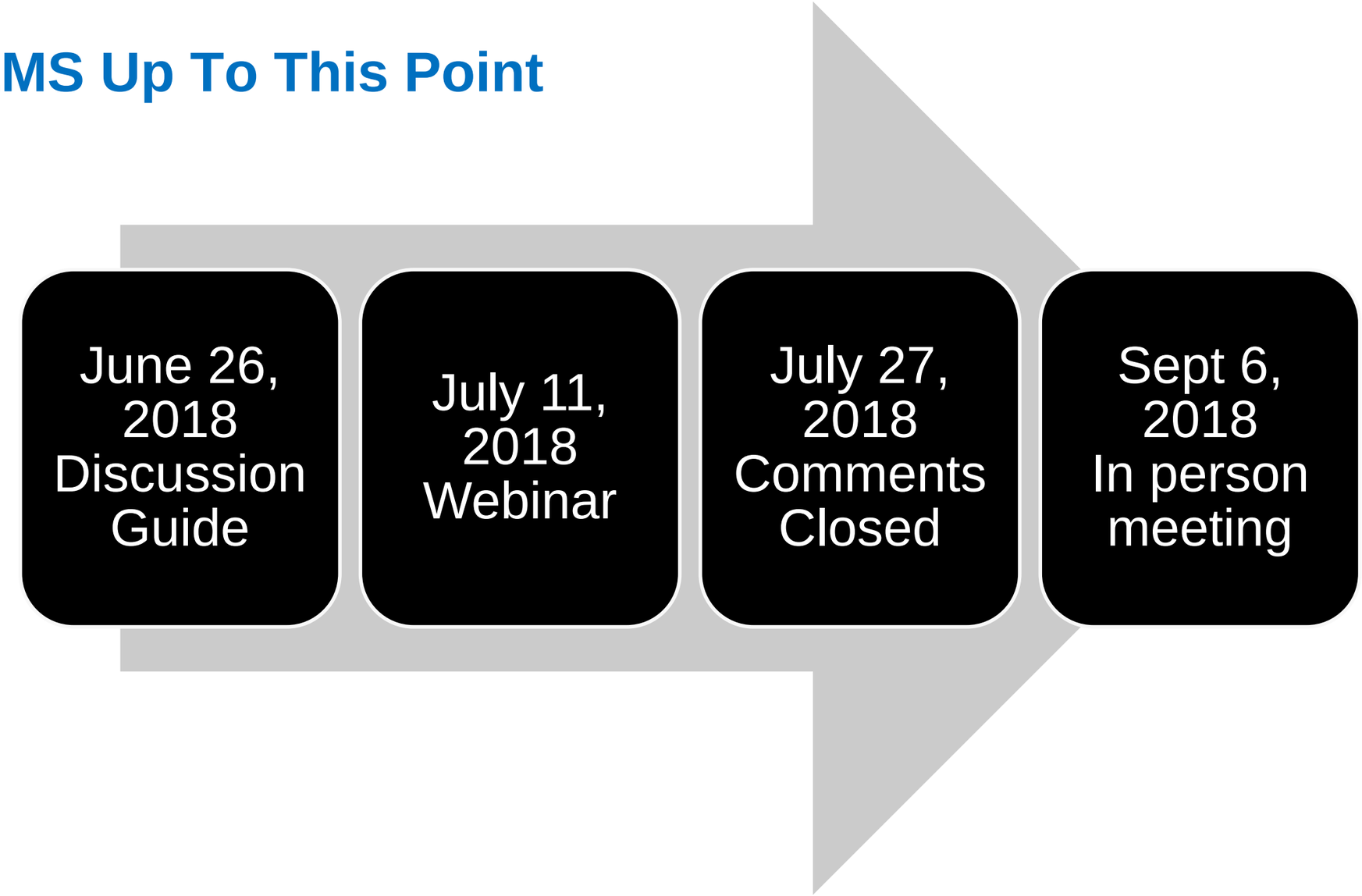
- Device **shipments growing**: 22 million (2016) to 96 million (2026)
- **Service providers are easing barriers** for adoption, proving a central point for end users and an relationship that allows for ongoing evaluation and improvement.
  - Connectivity among a system of products represents an opportunity 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

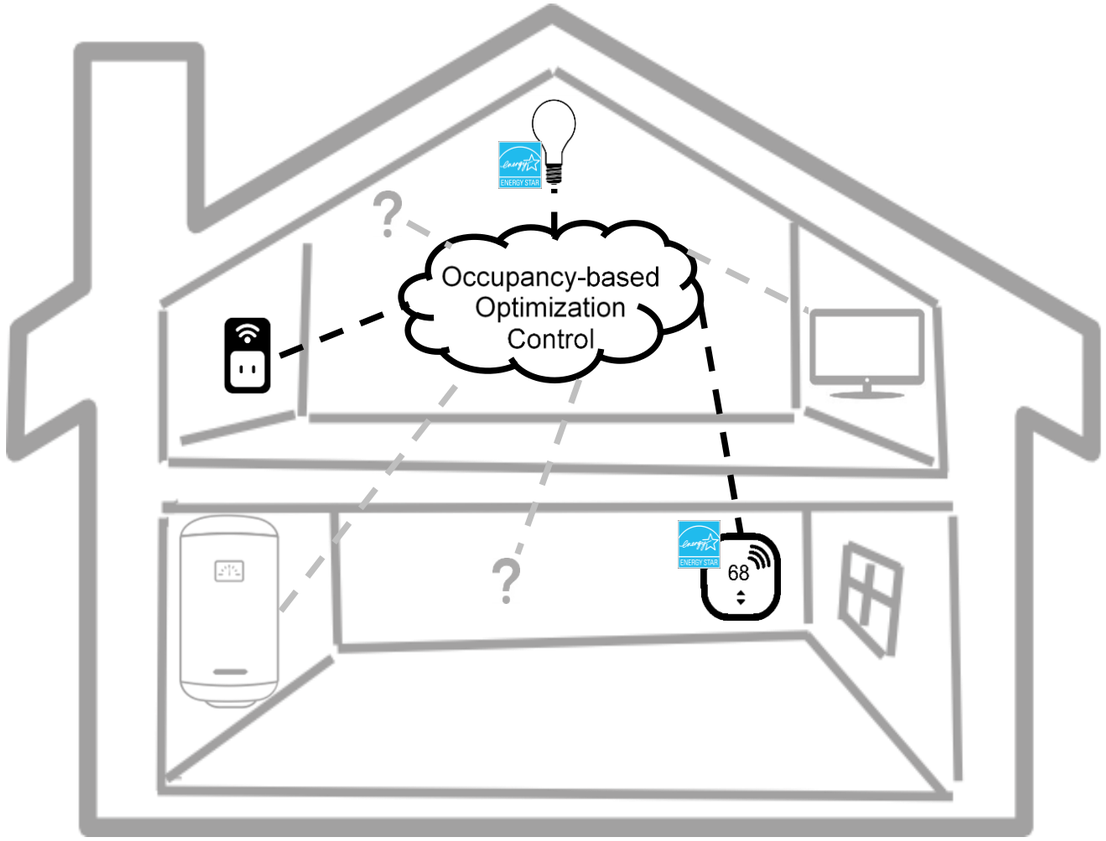
EPA understands there can be security risks associated with smart products and systems. Recognizing that this is not our area of expertise, we do not intend to take the lead on developing security standards in the smart home market. To the extent that sound security standards arise, EPA may point to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

SHEMS Up To This Point



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!

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

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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Efficiency Vermont

SEPTEMBER 2018

Smart Homes – A Vermont Perspective

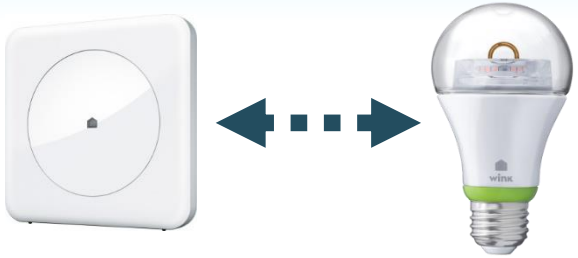
Lara N. Bonn

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

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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

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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

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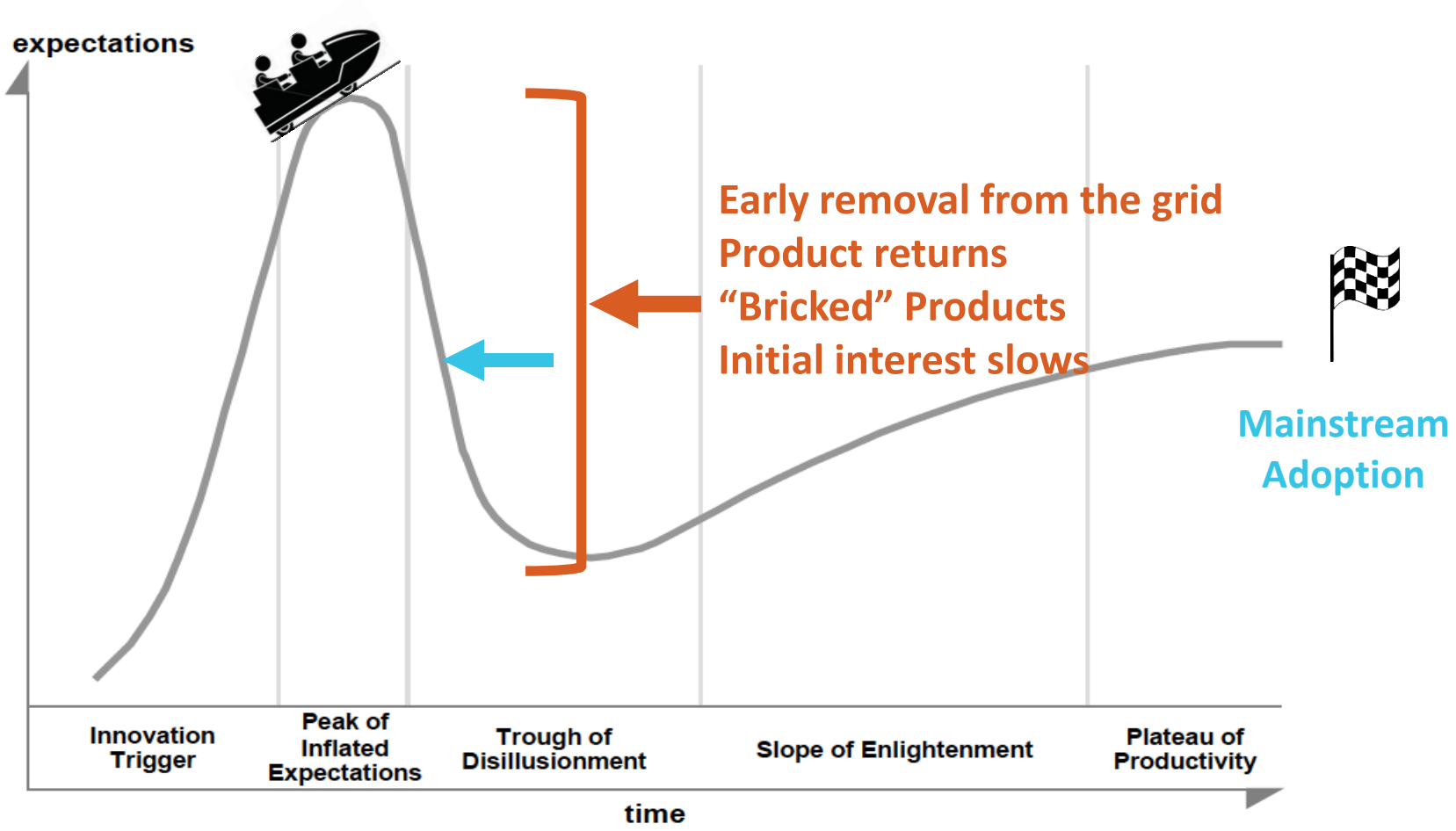
Smart Homes - Challenges



Hype cycle of technology adoption

- 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

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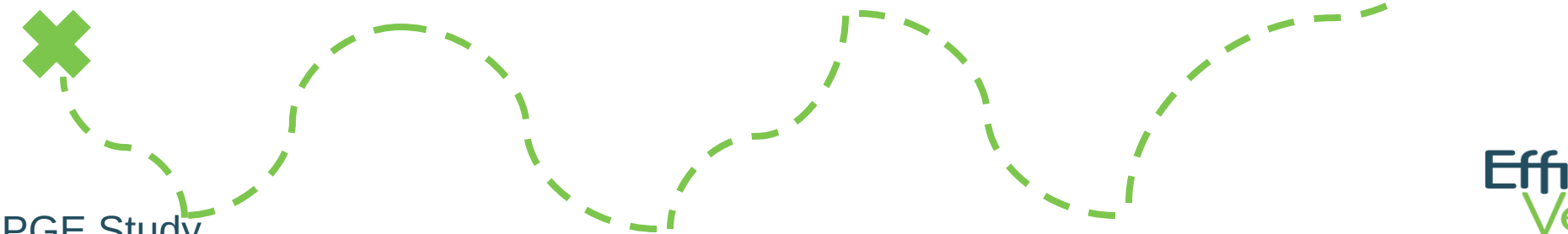
Broad Themes on Ways to Save

- 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)

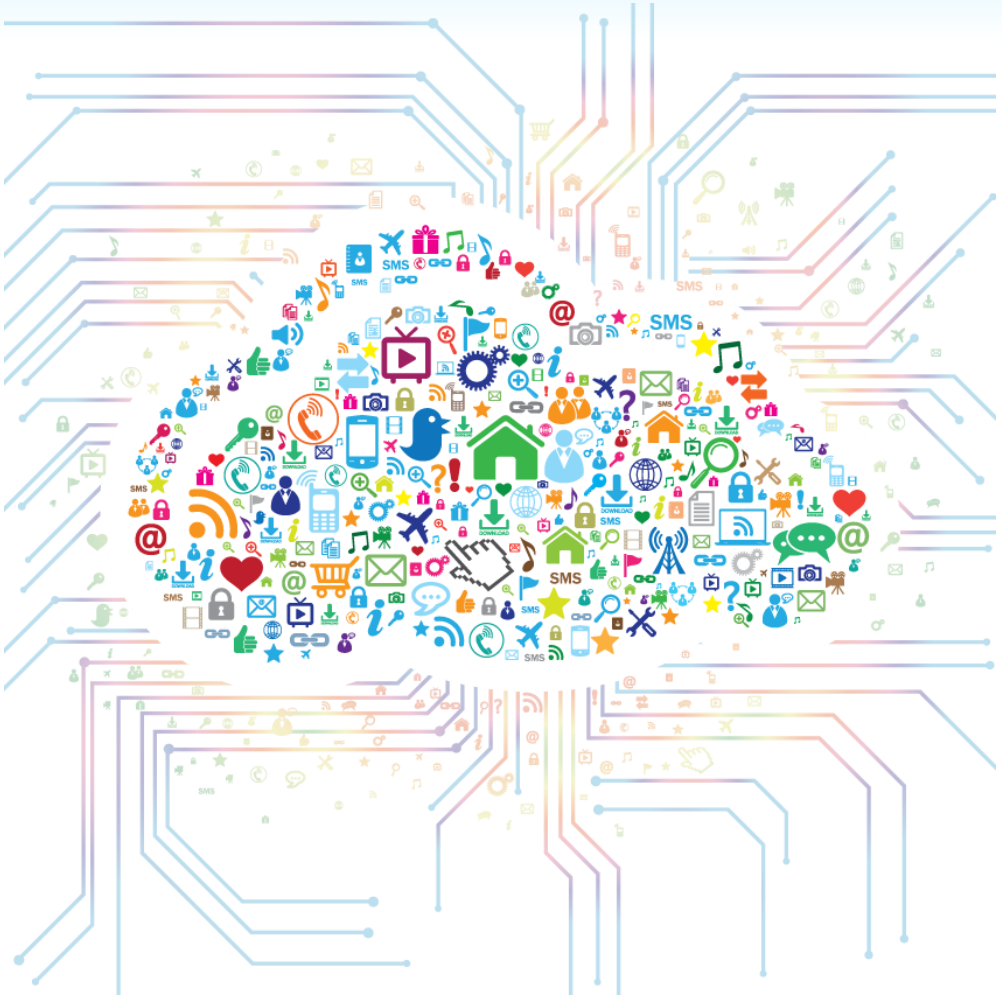


Credit: LBNL & PGE Study

Efficiency Vermont

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!



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Thank you!

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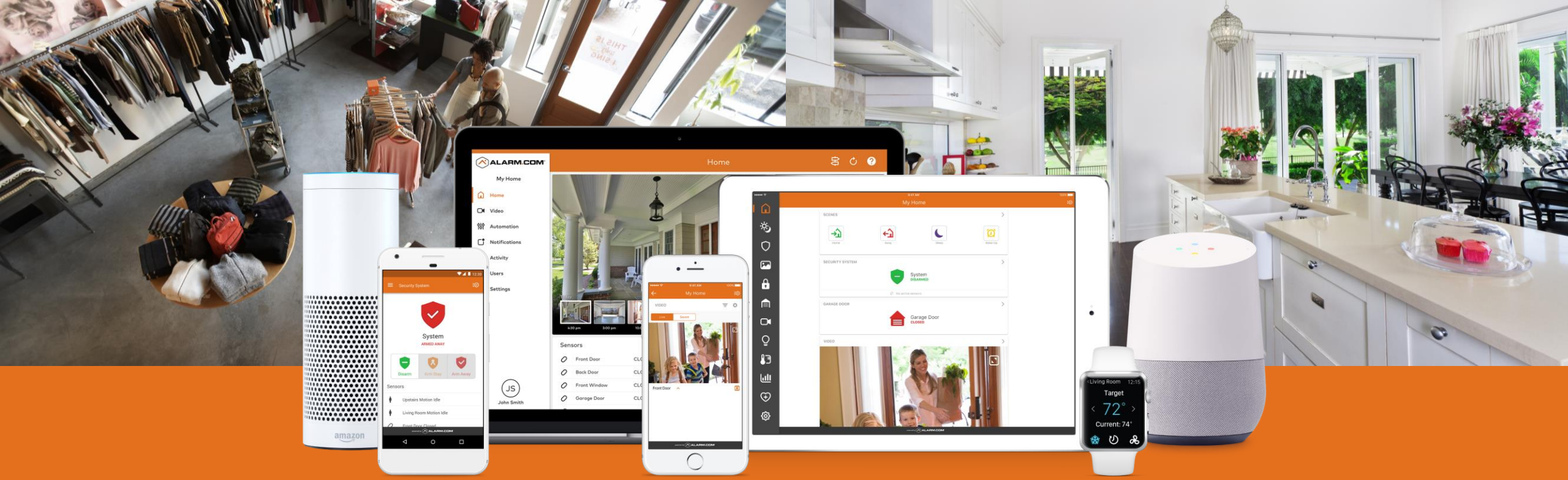

Smart Home Session – Alarm.com Overview

Gustaf Lonaeus

ALARM.COM®

5.5 Million Subscribers

Tens of Millions Connected Devices

Over 30 Billion Data Points

In the last year alone

Largest Platform for Intelligently Connected Properties

powered by ALARM.COM®

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

Unified Experience

iOS · WATCH · tv · Google Play · android · amazon fireTV · amazon echo

Intelligent Solutions

Security · Access · Video · Energy · Lights · Garage · Water

Internet of Things Ecosystem

AeoTec · AXIS COMMUNICATIONS · DSC · FORTREZZ · interlogix · GE | JASCO · Kwikset · legrand · LiftMaster · LUTRON · NORTEK SECURITY & CONTROL · Qolsys · QUALCOMM · rachio · RAIN BIRD · SCHLAGE · SKYBELL · WATER CORPORATION · verizon · Westinghouse · Yale

Advanced Cloud Platform

powered by ALARM.COM

Partner Ecosystem – EnergyStar Devices Blue

Panel Lineup


Interlogix Simon 3


Interlogix Concord


Interlogix NX


Interlogix Simon XT


Qolsys IQ Panel


DSC Impassa


Interlogix Simon XTi


Interlogix Simon Xti-5


2GIG Go!Control 2


DSC Powerseries Neo


2GIG GC3


Qolsys Gen 2


ADC SEM


2GIG Vario

Energy


ADC Smart Thermostat


Trane Z-Wave Tstat


2GIG CT-30


2GIG CT-100


TBZ48D


Linear Tstat


Radio Tstat CT-110


Radio Tstat CT-32


Nest


Jasco Energy Metering Module


Aeotec Energy Meter


Aeotec Energy Switch


Heavy Duty Smart Switch

ADC Temp Sensor

Lighting & Water


GE Light & Appliance Module


Linear Dimmer Light Module


Evolve Light & Appliance Module

Evolve Wall Switch


Evolve Wall Outlet


GE Wall Switch


GE Wall Outlet


Linear Wall Switch


Linear Wall Outlet


GoControl Smart Light


Qolsys IQ Light Blub


Zipato RGBW Blub

Aoetec Bulb

DynaQuip Water Valve

FortrezZ Water Valve

Rachio

Locks & Access

Liftmaster MyQ Control Panel

Liftmaster MyQ Gateway

Liftmaster MyQ Universal Retrofit

Linear Garage Controller

Schlage Deadbolt

Schlage Lock

Schlage Lever

Yale Lever

Yale Touchscreen Lever

Yale Touchscreen Deadbolt

Yale Deadbolt

Yale Push Button Deadbolt

Yale Push Button Deadbolt

Kwikset Lever

Kwikset Deadbolt

Kwikset Deadbolt

Kwikset Touchscreen Deadbolt

Video & Apps

Skybell

Wi-Fi Fixed IP Camera

Mini-Dome IP Camera

Pan/Tilt IP Camera

Outdoor Wi-Fi IP Camera

Outdoor PoE IP Camera

Commercial Grade Cameras

1 Channel Video Server

ADC SVR

ADC Image Sensor

Apple Watch

iPhone

Android

Amazon Fire

Apple TV

Amazon Echo

Google Home

Suite of Services

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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

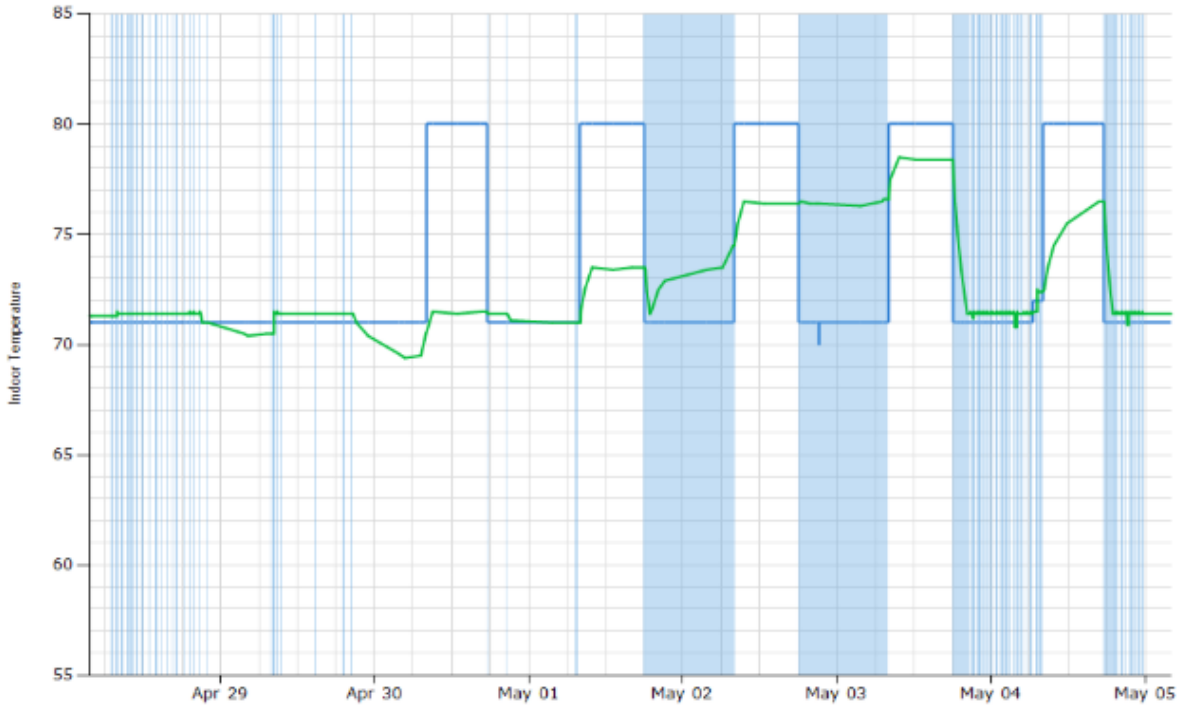
- *Alarm.com subsidiary provides Demand Response to more than 30 utilities leveraging devices from over 14 platforms*
- *Thermostats installed as part of security solution are available for DR*
- *Standard process for Alarm.com customers to enroll, review and participate in DR programs*

EnergyHub®

DER and Bring Your Own Thermostat® solutions for the modern utility

Data-Driven Features

Data from Apartment Building, Tysons Corner

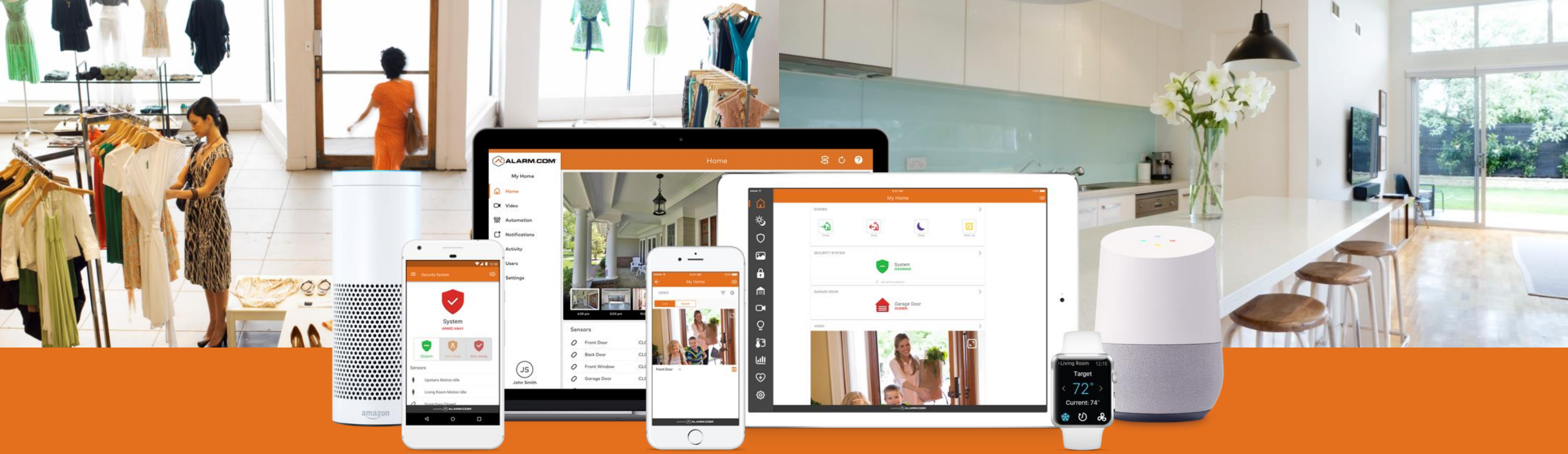


41m 28s	26.5%	1d 19h 33m	72.9°F	66.3°F
Average Cool Cycle Runtime	Period Cool Runtime	Total Cool Runtime	Average Indoor Temperature	Average Outdoor Temperature

- *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 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

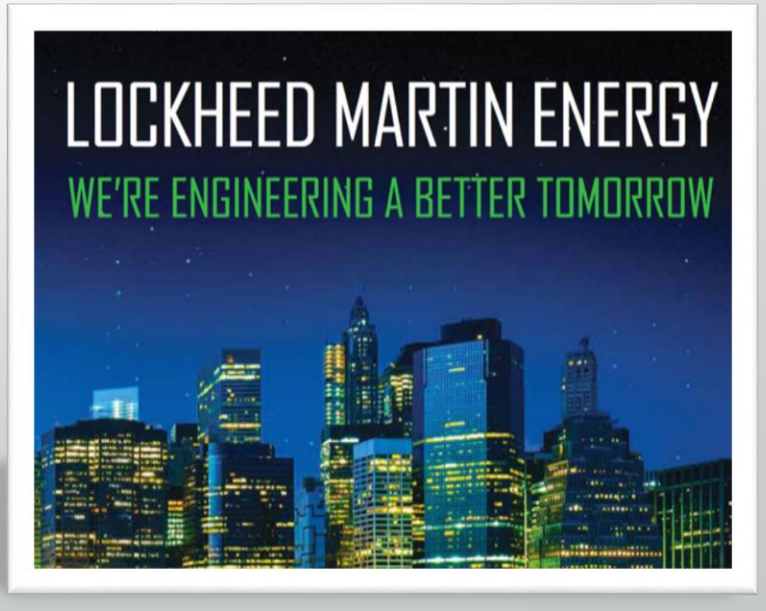
LOCKHEED MARTIN

Brad Piper

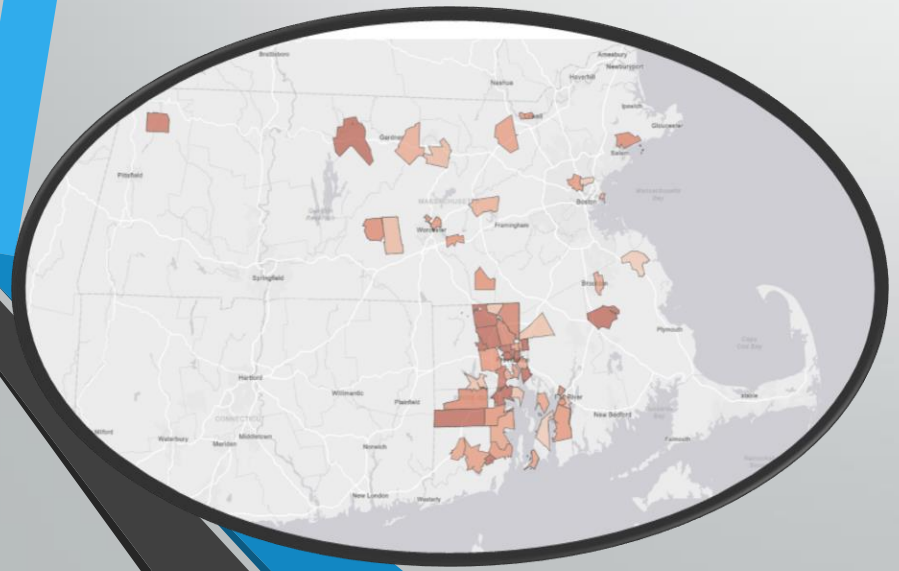
Project Manager

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

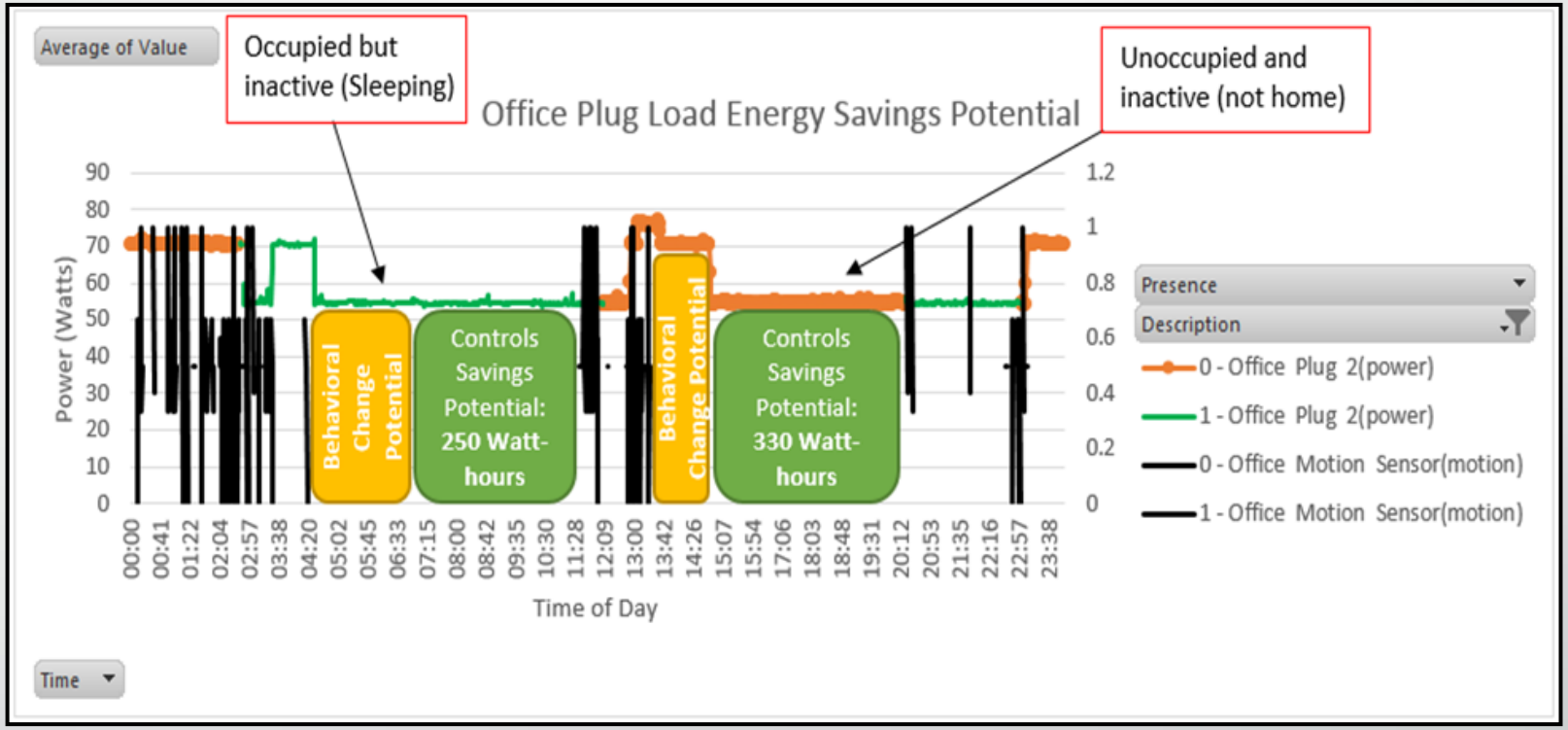
National Grid MA&RI

Survey Size	85 *Households*			
Participant Gender	79% *Male*	21% *Female*		
House Type	89% *Single-Family*	6% *Multi-Family*	5% *Condo*	
Household Size	28% *1-2 persons*	51% *3-4 persons*	21% *5+ persons*	
	58% *Households with Children*			
House Size	37% *< 1,500 Sq Ft*	30% *1,500 - 2,000*	33% *> 2,000 Sq Ft*	

LOCKHEED MARTIN

DATA COLLECTION & MANAGEMENT

- Collection
- Storage
- Sorting and Syncing Multiple Data Streams
- Calculations



LOCKHEED MARTIN

NYSERDA FINDINGS

Potential Whole Home and Individual Savings

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

LOCKHEED MARTIN

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