

ENERGY STAR® Connected Thermostats


Abigail Daken, US EPA

Behavior, Energy and Climate Change 2016
Baltimore, MD
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Learn more at energystar.gov




ENERGY STAR. The simple choice for energy efficiency.




US National Energy Efficiency Policy

- Minimum efficiency standards
 - DOE administers and develops
 - Mandatory
- ENERGY STAR labeling (Binary)
 - EPA and DOE administer jointly
 - Voluntary – product providers decide whether to participate



2

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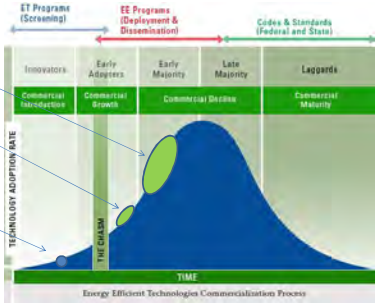


ENERGY STAR's place


ENERGY STAR

ENERGY STAR: Most Efficient

Emerging Tech: The Chasm



Energy Efficient Technologies Commercialization Process



3

ENERGY STAR. The simple choice for energy efficiency.



For more than 20 years, EPA's ENERGY STAR program has identified the most energy efficient **products, buildings, plants, and new homes** – all based on the latest government-backed standards and now, a rigorous third-party certification process.




4

Slide 1

KK12 who is the audience and what is our assigned topic? If these are behavior change people, how can we align our work with changing behavior? Is this the anti behavior change approach-or for some products they do aim to change behavior...

Kaplan, Katharine, 10/12/2016

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ENERGY STAR = Energy Efficiency

ENERGY STAR has become synonymous with energy efficiency.

EPA 5

ENERGY STAR. The simple choice for energy efficiency.

To date, the **ENERGY STAR** program has:

EPA 6

ENERGY STAR. The simple choice for energy efficiency.

To date, the **ENERGY STAR** program has:

- Prevented 2 billion metric tons of greenhouse gas emissions

EPA

ENERGY STAR. The simple choice for energy efficiency.

To date, the **ENERGY STAR** program has:


- Prevented 2 billion metric tons of greenhouse gas emissions
- Saved \$300 billion on utility bills

EPA

ENERGY STAR. The simple choice for energy efficiency.

ENERGY STAR is also the most comprehensive resource available for proven energy efficiency guidance. At energystar.gov:

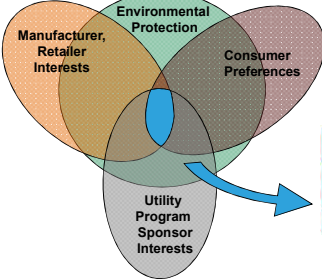
- Consumers can find a broad range of tools to help them save more
- Homeowners can assess and find help improving their homes' efficiency
- Businesses can find tools and resources to help unlock greater energy performance



EPA 9

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ENERGY STAR's Focus




Cost-effective
No Sacrifice in Performance
Government backed
Consumer is Key

EPA 10

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ENERGY STAR Guiding Principles

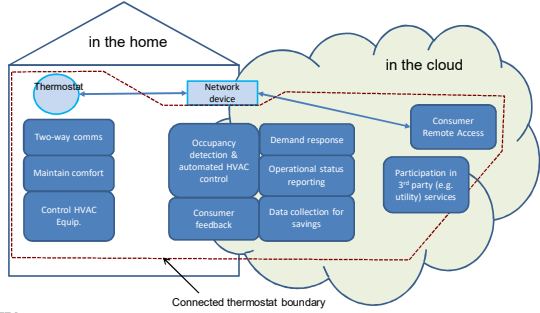
- Significant energy savings on a national basis
- Product performance maintained or enhanced with increased efficiency
- Consumers recover investment in efficiency within a reasonable period of time
- Efficiency can be achieved with one or more technologies and are available from more than one manufacturer
- Energy consumption and performance can be measure and verified with testing
- Labeling would effectively differentiate products and be visible to purchasers



EPA 11

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What do we mean by connected thermostat?

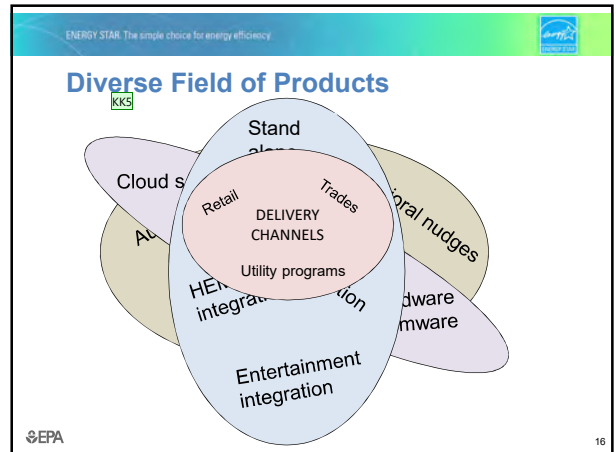
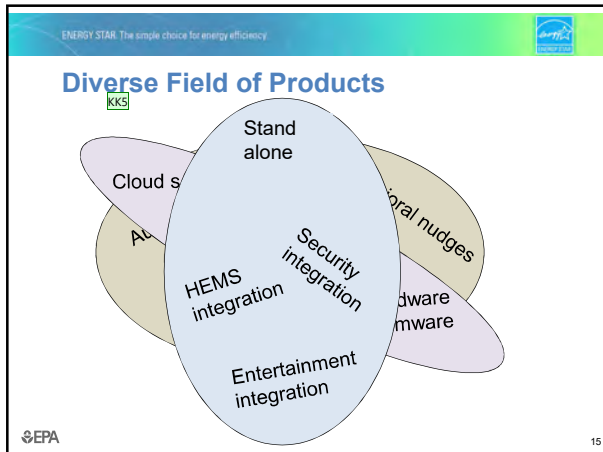
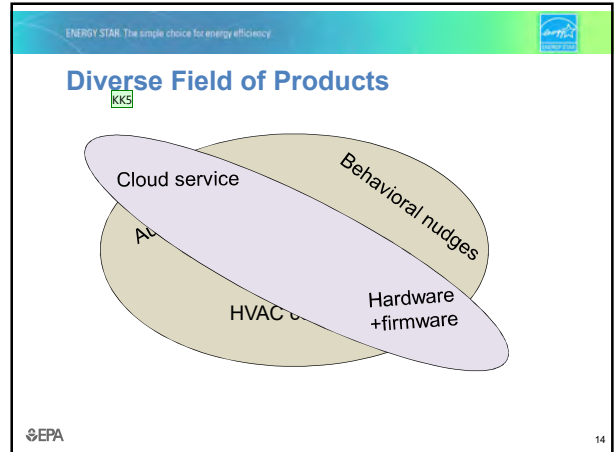
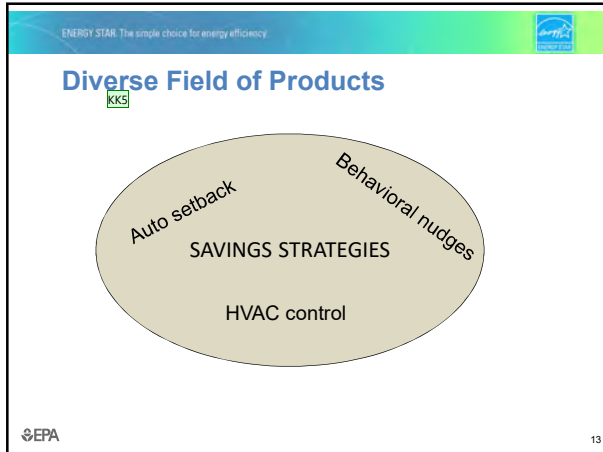


in the home

in the cloud

Connected thermostat boundary

EPA 12



Slide 13

KK5 suggest consistency in headers-size and use of caps
Kaplan, Katharine, 10/12/2016

Slide 14

KK5 suggest consistency in headers-size and use of caps
Kaplan, Katharine, 10/12/2016

Slide 15

KK5 suggest consistency in headers-size and use of caps
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Slide 16

KK5 suggest consistency in headers-size and use of caps
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No uniform method to back CT Provider Savings Claims

- (thermostats) Control Half of your home's energy bill
- 14% savings 26% savings 22% savings
- Saved an average of 11.3% of AC-related energy
- customers in the US saved an average of 23% on their heating and cooling costs

•Utility Not Required: xxxxx Saves 6% on Summer Electricity Bills
 •\$100 annual savings for consumers
 •Saving consumers 10 – 15%
 •4kW Demand Savings per Home
 •9000+ MWh in Energy Savings

EPA 17

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The Service and its Energy Use

- Fundamental service: HVAC systems control for comfort
 - Use the least energy to do so, by the way
 - And make it convenient
- **Large** savings potential
- How to measure energy saved?

EPA 18

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The Service and its Energy Use

- Fundamental service: HVAC systems control for comfort
 - Use the least energy to do so, by the way
 - And make it convenient
- **Large** savings potential KKG
- How to measure energy saved?
 - Lab test

EPA 19

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The Service and its Energy Use

- Fundamental service: HVAC systems control for comfort
 - Use the least energy to do so, by the way
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- How to measure energy saved?
 - Lab test
 - Rely on features (programmability)

EPA 20

Slide 19

KK6 isn't it- can we measure the efficiency delivered or the energy saved?
Kaplan, Katharine, 10/12/2016

Slide 20

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Kaplan, Katharine, 10/12/2016

ENERGY STAR. The simple choice for energy efficiency.

The Service and its Energy Use

- Fundamental service: HVAC systems control for comfort
 - Use the least energy to do so, by the way
 - And make it convenient
- Large** savings potential
- How to measure energy saved?
 - Lab test
 - Rely on features (programmability)
 - Providers now **HAVE DATA** reflecting user choices and interactions!

EPA 21

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Hardware + Service is the ENERGY STAR product

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Service Provider is the ENERGY STAR Partner

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Earning the ENERGY STAR

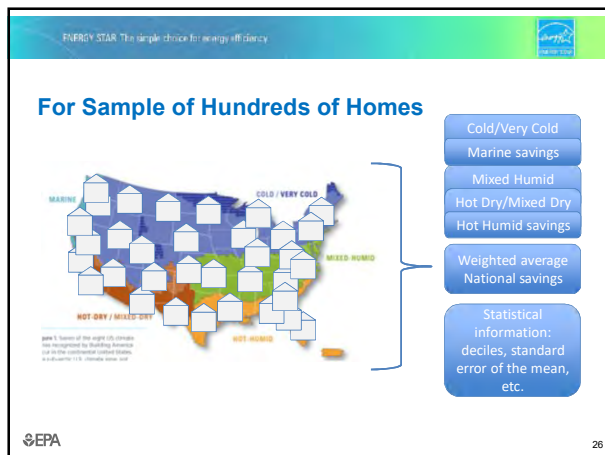
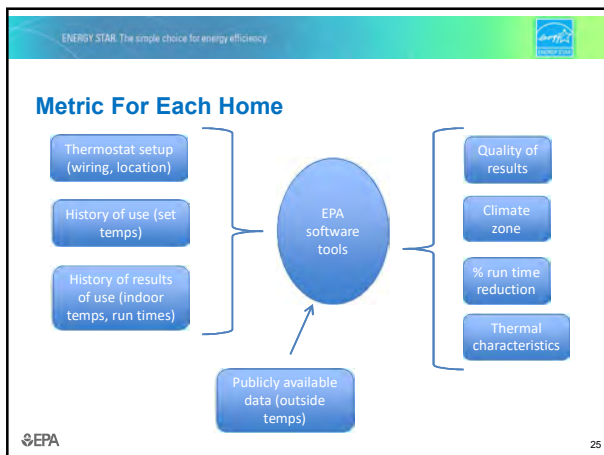
- Thermostat device passes basic tests
- Thermostat product demonstrates basic capability
- Demonstrate field savings using EPA software tools to analyze and aggregate data from hundreds of US homes

Heating savings
Cooling savings

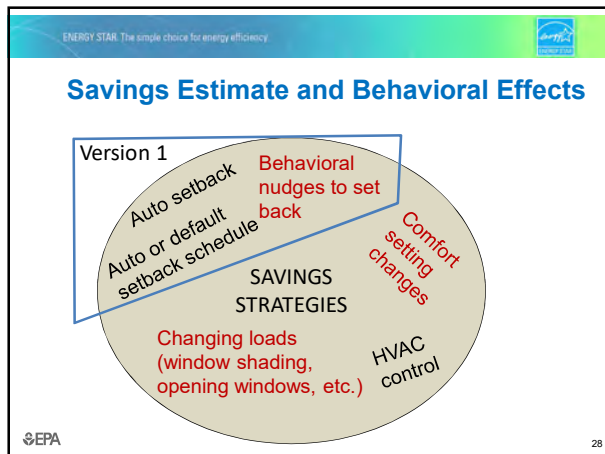
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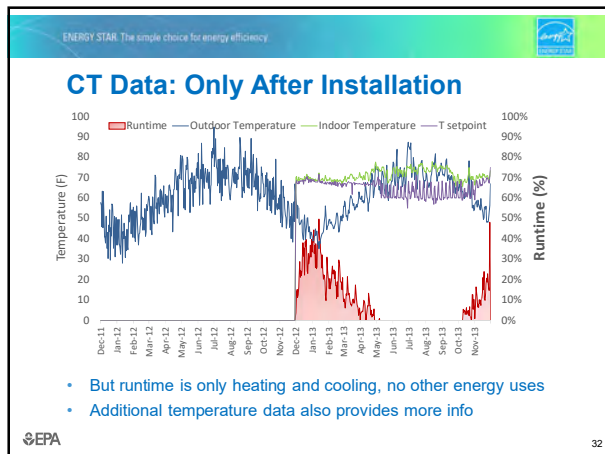
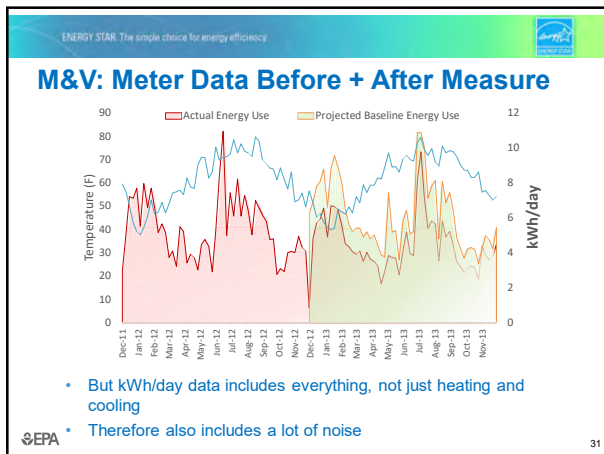
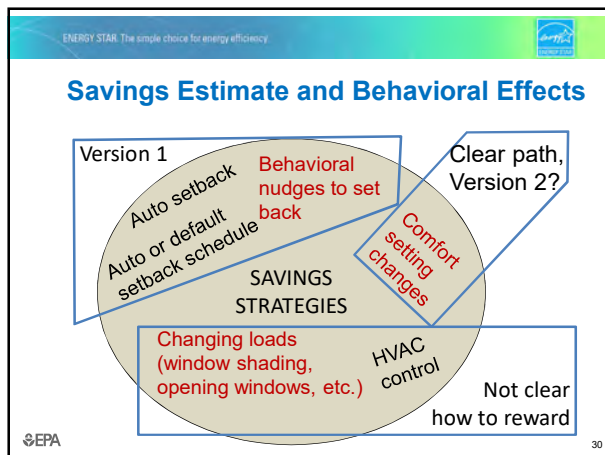
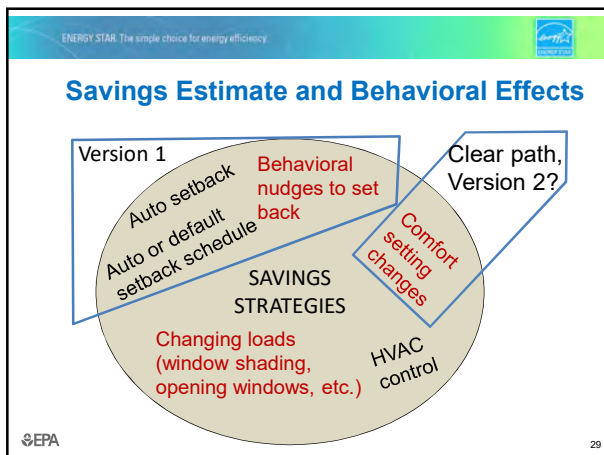
Slide 21

KK6 isn't it- can we measure the efficiency delivered or the energy saved?
Kaplan, Katharine, 10/12/2016



- ENERGY STAR. The simple choice for energy efficiency
- Advantages of proposed approach**
- Not HOW energy savings are achieved, just WHETHER they are
 - Accommodates wide variety of products
 - Can credit savings achieved through services
 - Wide scope for innovation, including behavioral
 - Service providers have access to rich data stream
- EPA
- 27





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All about that Bass Baseline, that is

- Currently: Comfort temperature from indoor temp history, captures setback only
- Possible in the future: Regional indoor temperature, could captures setback and better comfort temperature
- Only a baseline of run time would capture savings from less run time without changing temperature, e.g. shading, night flushing, etc.

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Current status

- Draft 3 released October 18, 2016
- Draft 2 Method to Demonstrate Savings released September 30, 2016
 - Software tool to calculate metric is in beta release, expect V1.0 release in November
- Expect to finish at the end of 2016
- The first labeled products should be available early in 2017
- EPA expects to continue to work with stakeholders for years to come to improve the savings metric.

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Backup material

EPA 35

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Connected Status in ENERGY STAR specifications

Specification	Connected Criteria	Demand Response Test Method
Refrig/Freezer	Final	Final
Clothes Dryers	Final	In Development
Clothes Washers	Final	In Development
Room AC	Final	In Development
Dishwashers	Final	In Development
Pool Pumps	Final	Final
Lighting (Lamps and Luminaires)	Final	N/A
Connected Thermostats	In Development	N/A

EPA 36

Slide 35

KK13 conclusion-what do we expect to learn about consumer behavior change? or do we hope to achieve with this spec-crack the biggest energy saving nut? do we think we will learn something that applies to other products that are highly configurable?

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Proposed requirements

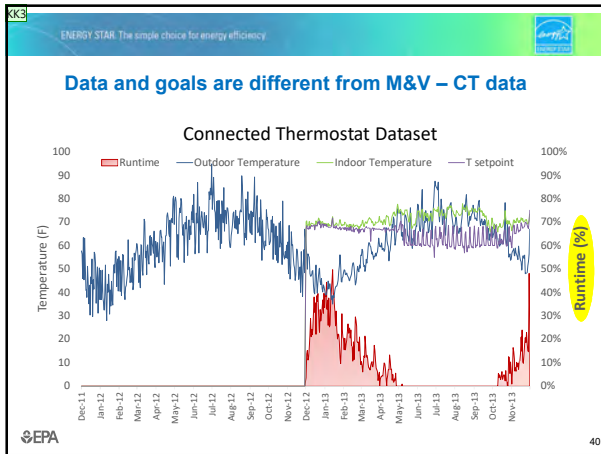
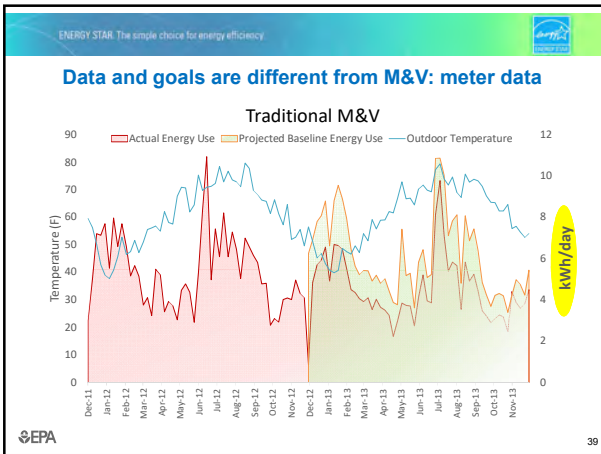
- A few device (hardware) requirements
 - Static temperature accuracy
 - Operates as dumb thermostat when disconnected
- A few product (hardware + software) requirements
 - Feedback to resident of energy impacts of their choices
 - Some ability to react to presence
 - Scheduling
 - Ability to collect data for metric calculation
 - Ability to be used for DR
- Field savings
 - Minimum mean and 20th percentile metric scores
 - (Or demonstrate with a series of studies)
 - Metric scores reported every 6 months for previous heating/cooling season

EPA 37

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Detailed explanation of metric; estimate 7 minutes to present

EPA 38



Slide 40

KK3

in comments tie back to goal of work (and why this approach to data meets that goal vs an M&V goal)

Kaplan, Katharine, 8/22/2016

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Building science – estimating savings for an individual home

- Develop a model for that home that correlates ΔT and HVAC run time during core heating days
 - core heating days have > 1 hour of heating and no cooling
 - ΔT is the difference between indoor and outdoor temperatures
- Define baseline comfort temperatures
- Calculate baseline run time associated with baseline comfort temperatures choices
- CT savings is % run time reduction of actual vs baseline

Special thanks to Marco Pritoni of LBL for his help preparing plots this presentation from Sacramento data

EPA 41

