



# **ENERGY STAR Connected Thermostats Draft Version 1.0**

**Stakeholder Webinar and Discussion  
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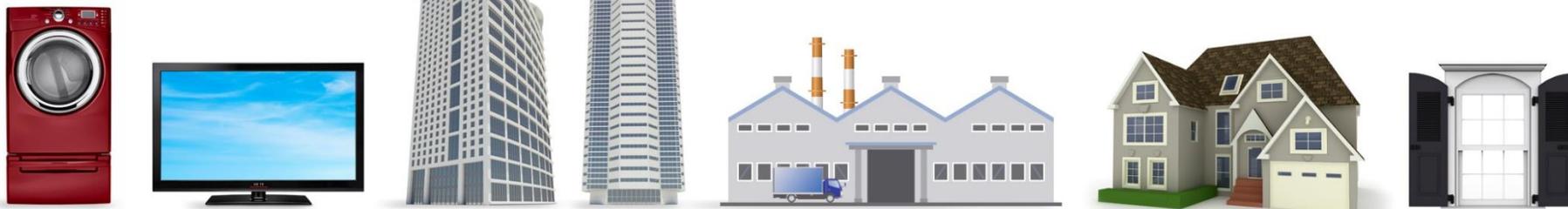


## Agenda

- Welcome & Introduction
- What is ENERGY STAR?
- Background – Programmable Thermostats & Climate Controls
  - Prescriptive Requirements → Product Usability → Comparative Data Analysis
- Two concurrent efforts:
  - Metric
  - Specification
- Q&A

# ENERGY STAR

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 a rigorous third-party certification process.





# ENERGY STAR Program Overview



**ENERGY STAR® is the simple choice for energy efficiency.** For more than 20 years, EPA's ENERGY STAR program has been America's resource for saving energy and protecting the environment.

From 1993 to 2013 Americans have purchased more than 300 million products that earned the ENERGY STAR across **more than 70 product categories**. That's more than 4.8 billion products, about 58 million vehicles off the road, and **\$30 billion saved!**

ENERGY STAR. The simple choice for energy efficiency.



**Today,**  
this little blue label  
does all the hard work  
of certifying outstanding  
energy efficiency in:

**70**

**Product  
Categories**



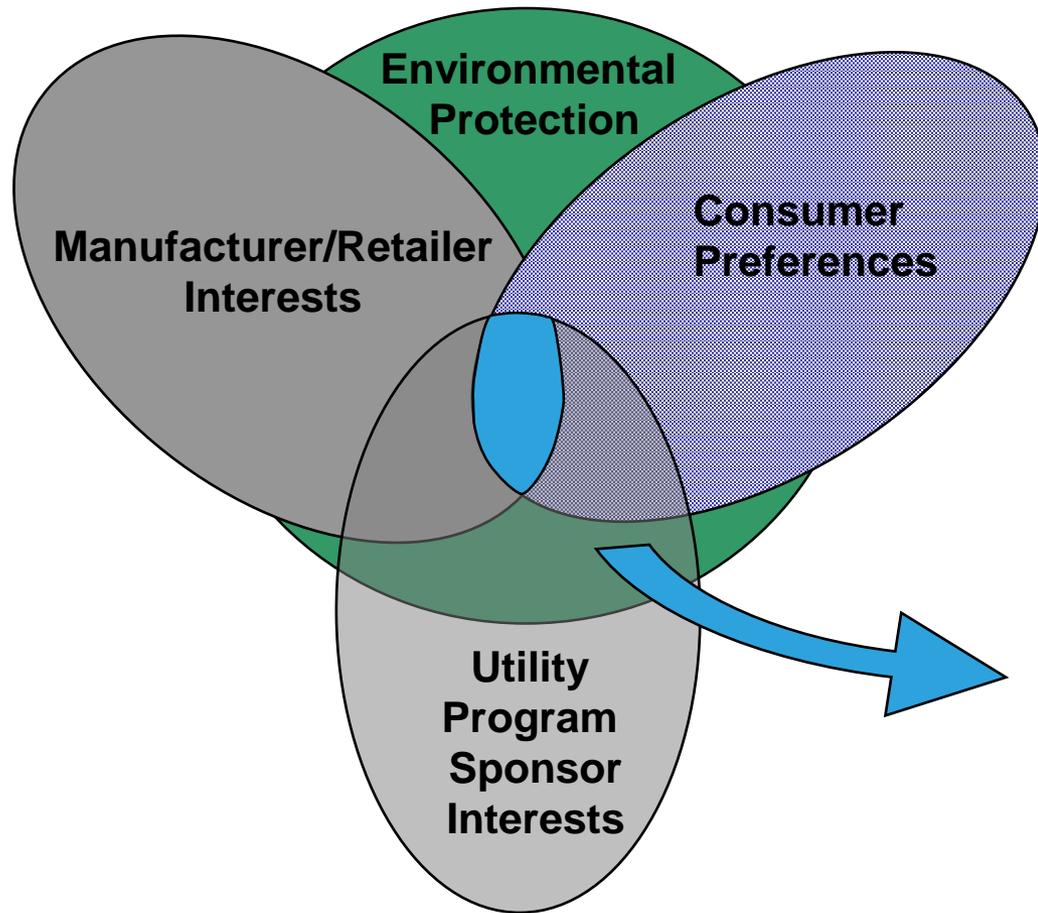
Every single day,  
consumers choose  
**ENERGY STAR**  
products more than

**800,000** times





# ENERGY STAR's Focus



- Cost-effective
- No Sacrifice in Performance
- Government backed

**Consumer is Key**

# Specification Development Cycle





## Important Process Elements

- Consistency
- Transparency
- Inclusiveness
- Responsiveness
- Clarity

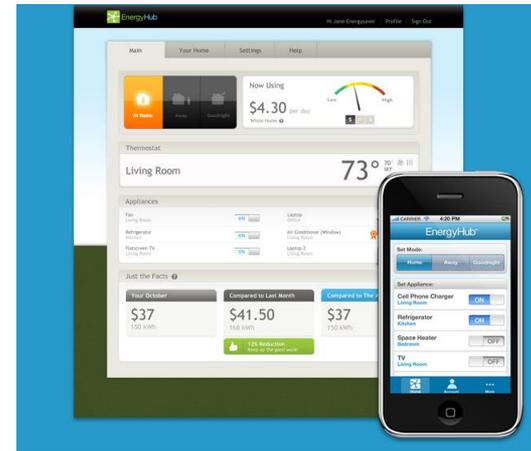


## Background – Programmable Thermostats and Climate Controls

- Programmable Thermostats – Sunset in December 2009
  - Energy savings depended upon use of an aggressive setback schedule.
  - Many consumers who didn't like the default schedule used permanent hold rather than customize the schedule
  - Presence of product in home not well correlated with energy savings
- Climate Controls – Began shortly thereafter
  - Included ease of use test plus prescriptive hardware/software requirements.
  - Lab test for ease of use, as a proxy for energy efficiency, was questioned
  - EPA rebooted and launched a spec. dev. effort that is new in approach and name, Connected Thermostats.

## Introduction – Framing the Opportunity

- Potential for significant energy savings
- New product types & business models have emerged
- Measuring CT savings being done today, but with no standardized methodology; savings claims vary widely





## ENERGY STAR CTs – Why a new approach?

- EPA recognized that CTs were breaking new ground with many entities claiming significant energy savings.
- No standard methodology for calculating savings
- Varied strategies for generating savings
  - Behavioral
  - Occupancy sensing
  - Thermal modeling
  - Automation
  - Integration with other connected devices
  - Weather optimization
- Common denominator was ***not ease of use, not consumer engagement, or a default setback schedule*** – rather it was the energy savings itself!

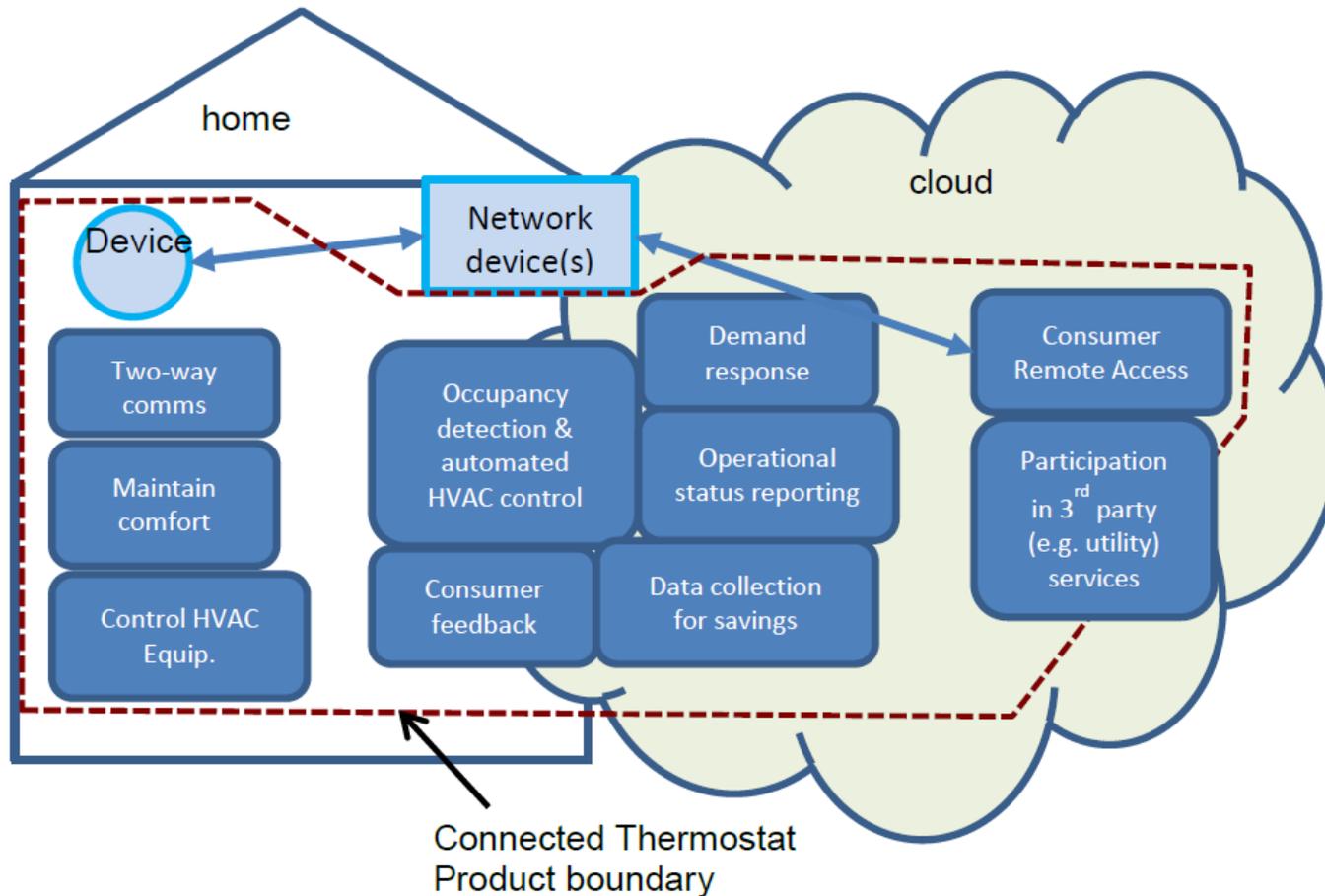
## ENERGY STAR CTs – What new approach

- In the emerging Internet of Things, EPA recognized that CT savings could be modeled using only:
  - publically available weather data, and
  - data reported by the CT itself
- In effect, CT products are able to self-report energy savings



# What is a Connected Thermostat Product?

A blend of local hardware and cloud services





## ENERGY STAR CTs - EPA Goals

- Significant realized & verified energy savings
- Provide labeling opportunities for both CT manufacturers and service providers
- Provide utilities with a tool to meet Energy Efficiency goals.
- Ensure the methodology limits stakeholder burden while accurately ranking relative energy savings of CTs
- Recognize continuous improvement
- Robust participation by:
  - CT manufacturers
  - Service Providers
  - EEPS
  - Utilities
- Prominence of ENERGY STAR CTs in the marketplace



## Program Outline

- Recognition for CTs that save energy in the field
- To earn the ENERGY STAR:
  - “CT device” must meet criteria that enables savings
  - Partner must periodically report aggregate consumer savings for each CT product
  - “CT product” includes the CT device and a service component
- Service Provider is the ENERGY STAR partner



# Metric for periodic reporting

- Ranks CTs based on consumer savings
- Uses only CT data plus outdoor temperature history
- Preserves consumer privacy
- Protects proprietary information
- Practical to calculate



## Metric (cont)

- Evaluates HVAC system run time reduction relative to baseline run time
- Step 1 – model the home's relationship between HVAC run time and outside temperature
- Step 2 – extract heating and cooling comfort baseline temps from the home's CT data
- Step 3 – calculate the home's baseline run time
- Step 4 – metric is % run time reduction
- Step 5 – average over a large number of homes



## Estimating kWh savings using metric

- The baseline used to derive run time reduction may over-estimate savings, however
- A metric score could be developed for typical thermostat behavior (nationally or in a subset of the population)
- For instance, perhaps a particular connected thermostat product scores 25% run time reduction, and typical thermostat behavior scores 15% run time reduction
- The difference between these represents actual savings
- The difference could be used to estimate savings
- The approach EPA is pursuing allows regions with different baseline thermostat behavior to estimate savings in their particular region



## Data Privacy

- Metric will be calculated by service providers using standardized methods provided by EPA
- EPA intends to post a statement on our consumer-facing web site explaining why there is no consumer privacy risk:
  - Certification is based solely on aggregate savings data
  - No personally identifiable information (PII) is supplied



## Labeling with the ENERGY STAR

- Connected thermostats have several interfaces – user should see a label regardless of how they interact with the CT
- EPA seeks to encourage point of sale labeling (where relevant)
- Draft 1 proposed requirements:
  - Smartphone apps and web interfaces must bear the ENERGY STAR electronically.
  - Main menu screen on CT device must bear the ENERGY STAR at least briefly unless the CT device has a physical label
  - Dedicated CT devices must use the ENERGY STAR on product packaging, and may use it on the device itself
  - For ENERGY STAR Connected Thermostat products that are part of a broader product, e.g. home security system, labeling shall clearly indicate that only the CT device is certified.



## Verification

- ENERGY STAR certified products participate in verification testing, typically 10% of models per year
- Certification bodies run verification testing on behalf of EPA, pulling products from retail shelves or randomly from warehouse stock
- For connected thermostats
  - Regular submission of metric data ensures persistence of savings
  - CT devices will participate in verification testing



## Eligibility Criteria – CT Device Requirements

- In the absence of connectivity, retain the ability for residents to locally:
  - view the room temperature,
  - view and adjust the set temperature, and
  - switch between off, heating and cooling.
- Meet requirements set out in the table below:

Parameter	Performance Requirement	Applicable Products
Droop	$\leq 0.5^{\circ}\text{F}$	All
Operating differential	$\leq 2^{\circ}\text{F}$	
Static temperature accuracy	$\pm 0.5^{\circ}\text{F}$	
Network Standby average power consumption <sup>1</sup>	$\leq 2\text{ W average}$	



## Eligibility Criteria – CT Product Requirements

- CT must maintain the following capabilities through firmware and software changes:
  - Ability for consumers to set and modify a schedule.
  - Automatic determination of occupants' presence in the home (e.g., through direct sensing of motion, or indirectly via geolocational devices such as smart phones).
  - Provision of feedback to occupants about the energy impact of their choice of settings.
  - Ability for consumer to access information relevant to their HVAC energy consumption, e.g., HVAC run time.
  - Basic demand response functionality using open standards.



## Metric Performance

Metric	Performance Requirement	Applicable Products
Average annual % run time reduction, heating (HS)	≥ TBD	All
Average annual % run time reduction, cooling (CS)	≥ TBD	
Average resistance heat utilization for heat pump installations (RU)	Reported in 5°F outdoor temperature bins from 0 to 60°F	

- Metric performance will be set to ensure advice to consumers is good – e.g. 5% real savings would give good payback
- Requirements typically tightened over time through revisions every 2-5 years



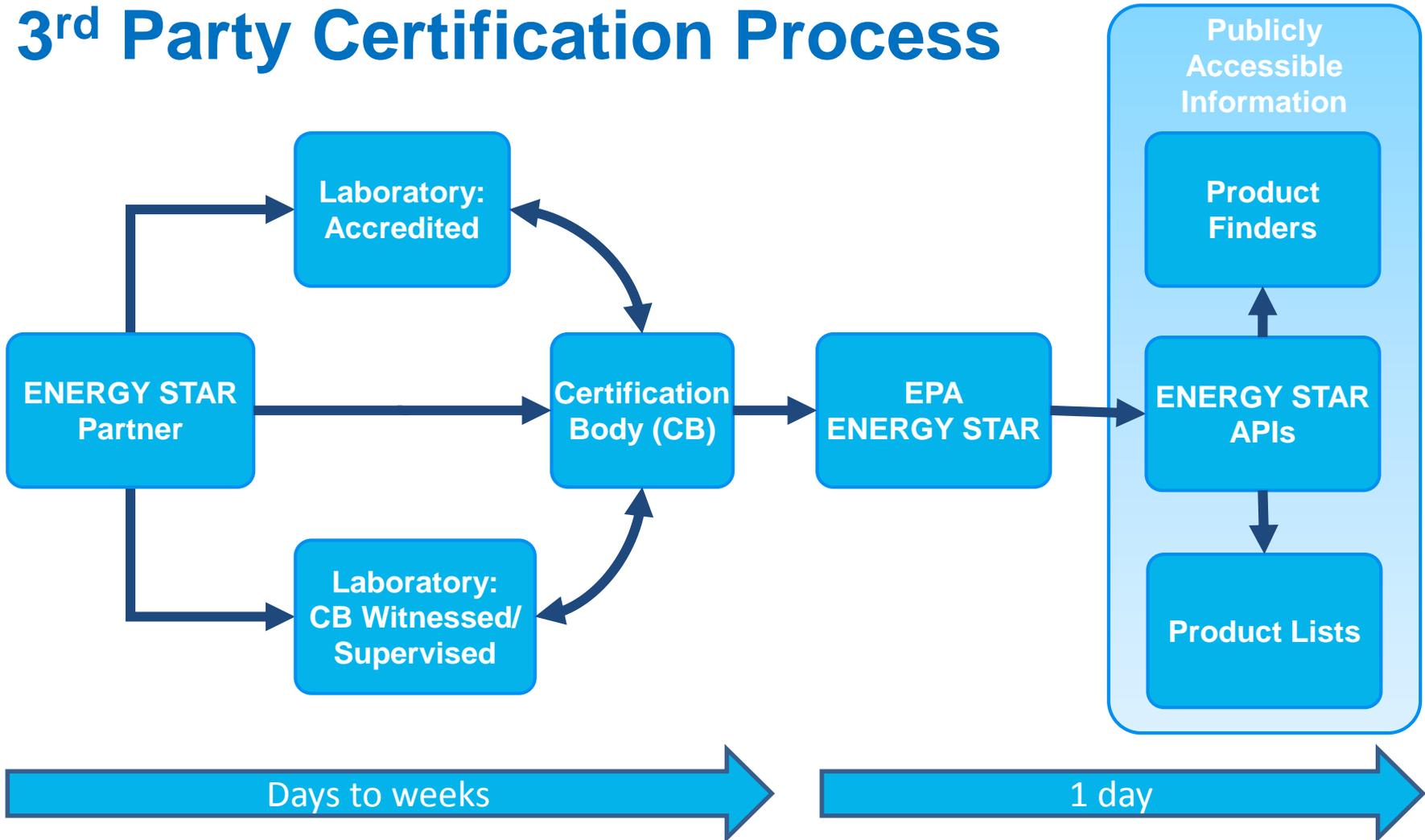
## Test Method

- EPA has not yet finalized the test method but will do so after the metric is completed.
- Similar to most other electronics specifications, standby energy use will be measured using IEC 62301, Ed. 2.0, 2011



# ENERGY STAR Products

## 3<sup>rd</sup> Party Certification Process





## Contact Information

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