

ENERGY STAR Smart Home Energy Management Systems (SHEMS): Draft 1 Stakeholder Meeting

April 12 2019
CTA Arlington, VA



Outline

- Welcome
- Development process
- Specification overview
- Next steps
- Break
- Field Method overview
- Adjourn

Introducing ourselves

- Co-leads
 - **Taylor Jantz-Sell** – ENERGY STAR lighting lead for 10+ years. Coordinating ENERGY STAR products smart home strategy and new initiatives like SHEMS.
 - **Abigail Daken** – ENERGY STAR technical lead for connected product criteria, smart thermostats, and many other product categories. Focus areas include HVAC, water heating and connected.



The ENERGY STAR Brand

EPA's ENERGY STAR identifies the most energy-efficient **products**, **buildings**, **plants**, and **new homes** – all based on the latest government-backed standards.

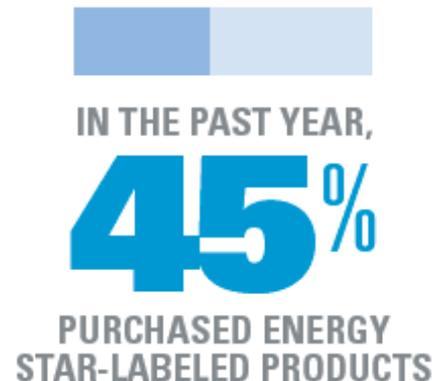
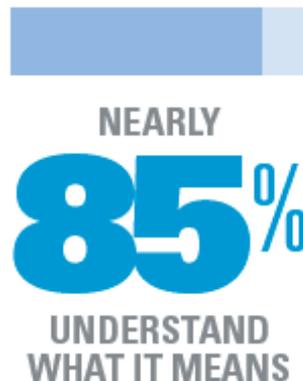
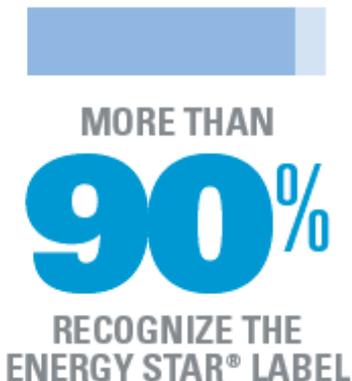
Today, every ENERGY STAR label is verified by a rigorous third-party certification process.





Brand Preference and Loyalty

In American Households:

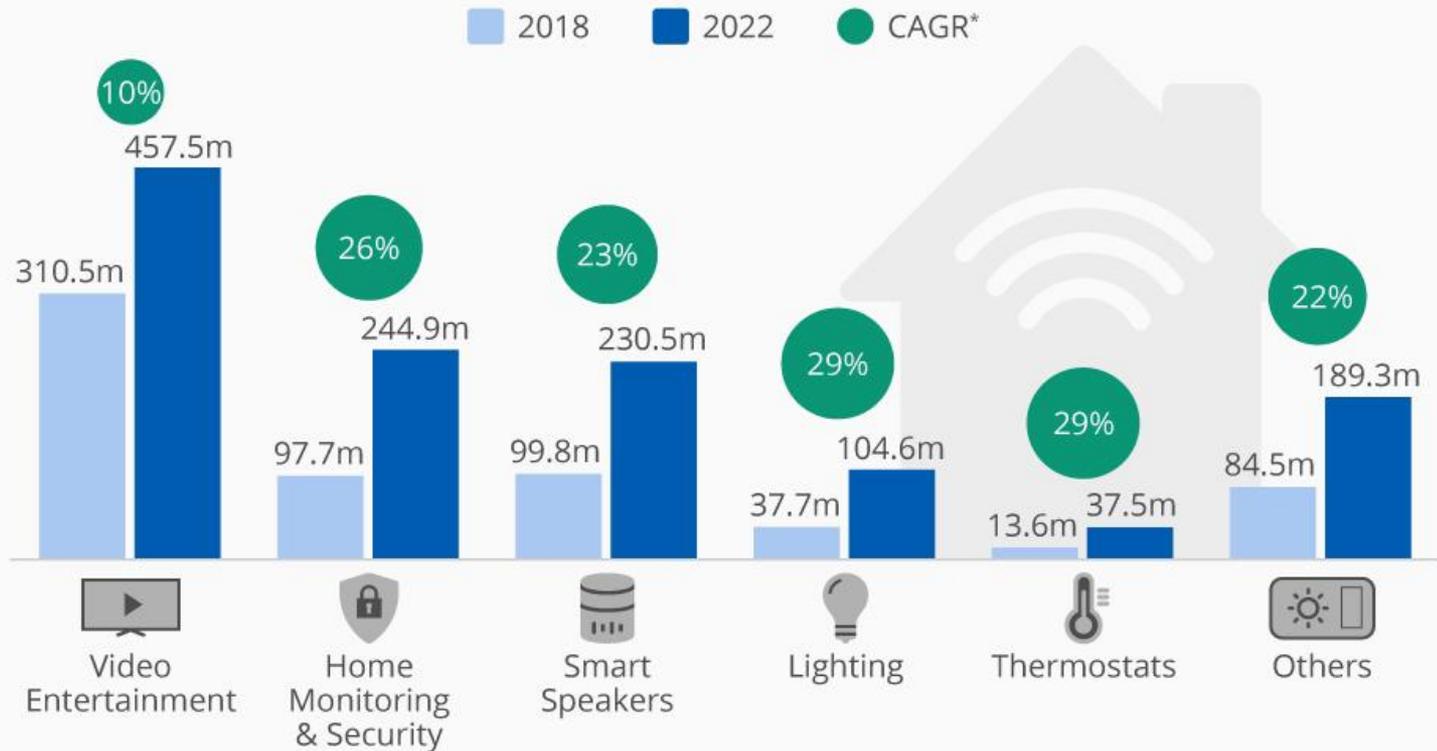


U.S. EPA
2017

Estimated growth of smart home tech

Smart Home Technology Poised for Blockbuster Growth

Forecast of worldwide smart home device shipments, by category (in million units)



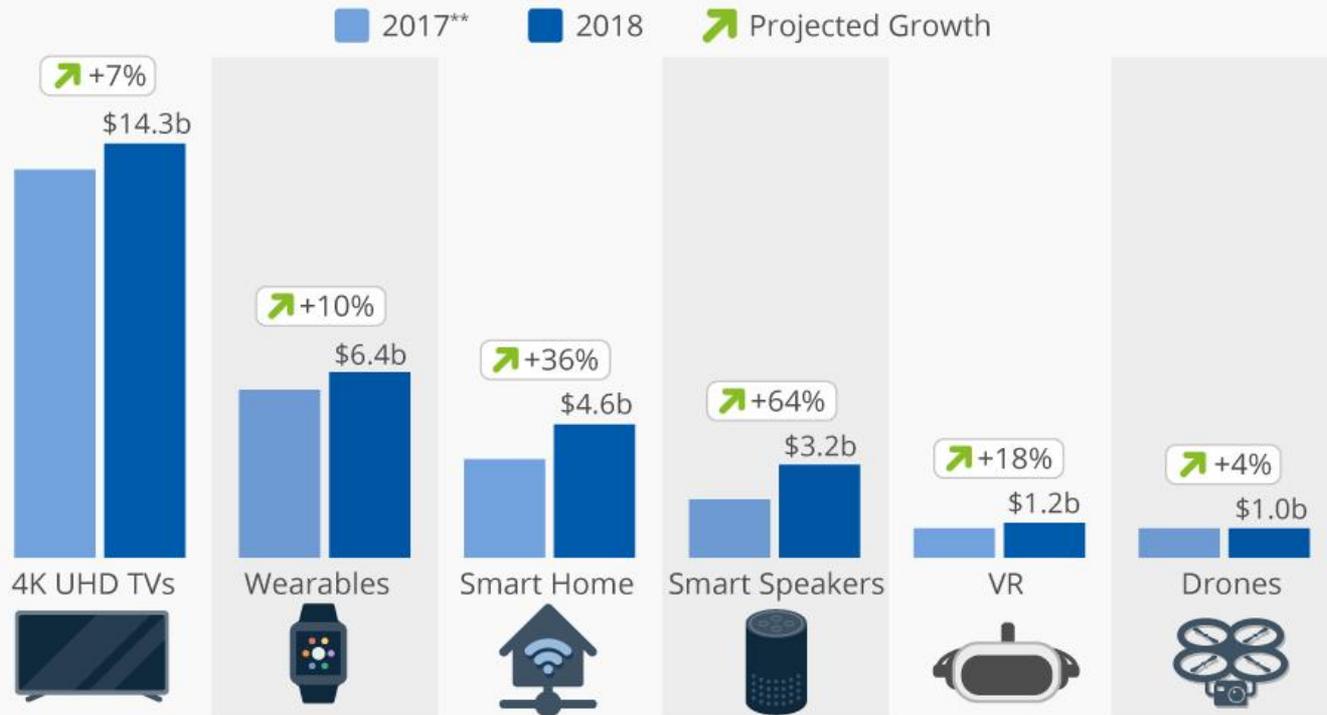
* Compound annual growth rate, i.e. the average annual growth rate for each category between 2018 and 2022

Source: IDC

Estimated growth of smart home tech

How Big Are the "Next Big Things" in Tech?

Estimated revenue from sales of emerging tech products in the United States in 2018*



* estimates as of July 2018 ** calculated based on growth rates given by CTA
 Source: Consumer Technology Association





Introduction

Program intent:

- Recognize smart home system packages that save energy and deliver cost savings and convenience by:
 - providing reliable vacancy detection linked to savings strategies that shut off or power down equipment when no one is home
 - limiting standby power of connected devices
 - providing feedback to users about the energy impact of their settings
- Designed to evolve with a rapidly changing market



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

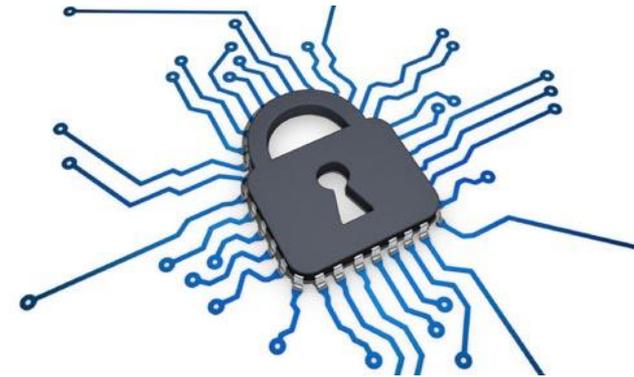
As the market for "smart" products and systems grows, EPA aims to help drive and optimize energy savings through their use.

- 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

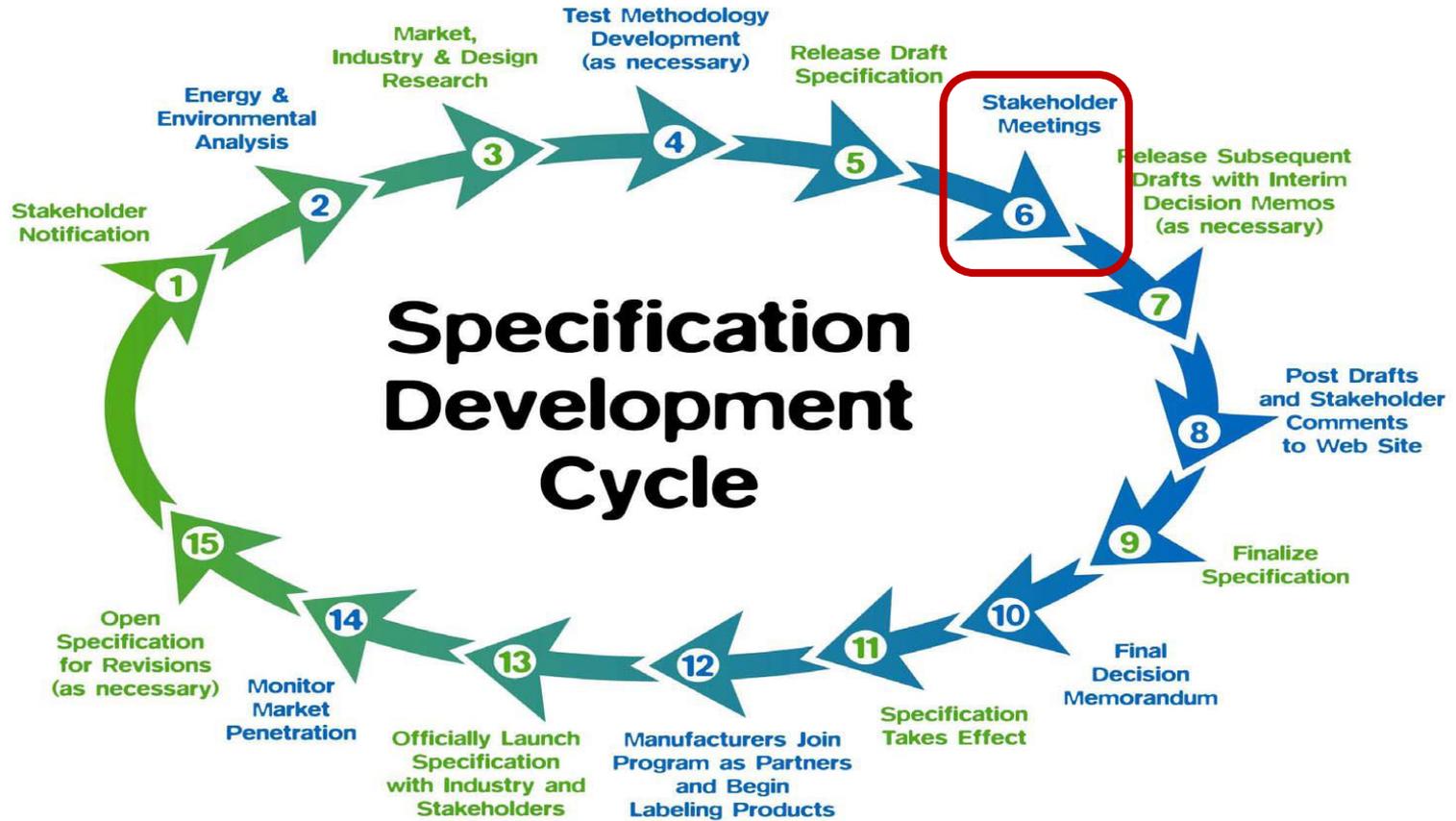
Devices + Occupancy Info + Automated Services = Energy Savings

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.



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Specification Overview

- ~~1. Introduction~~
2. Definitions
3. Scope
4. Eligibility Requirements
5. Test Requirements
- ~~6. Effective Date~~
7. Future Revisions



2. Definitions

- **Smart Home Energy Management System (SHEMS):** A combination of devices and services that manages the energy use of connected devices in a home.
 - As defined in Draft 1, SHEMS consist of a subset of interrelated components of the smart home market, including:
 - Smart Home Service Providers
 - Service and Device Packages
 - Platforms
 - Installations

2. Definitions: Who?

- **Smart Home Service Provider:** The company that owns the brand which consumers see when they interact with their smart home energy management service and is able to provide package data and analysis of field data to EPA for the ENERGY STAR program.
- The ENERGY STAR SHEMS partner:
 - manages certification, uses ENERGY STAR logos in accordance with use guidelines, and submits data (though backend service suppliers can submit data on their behalf)



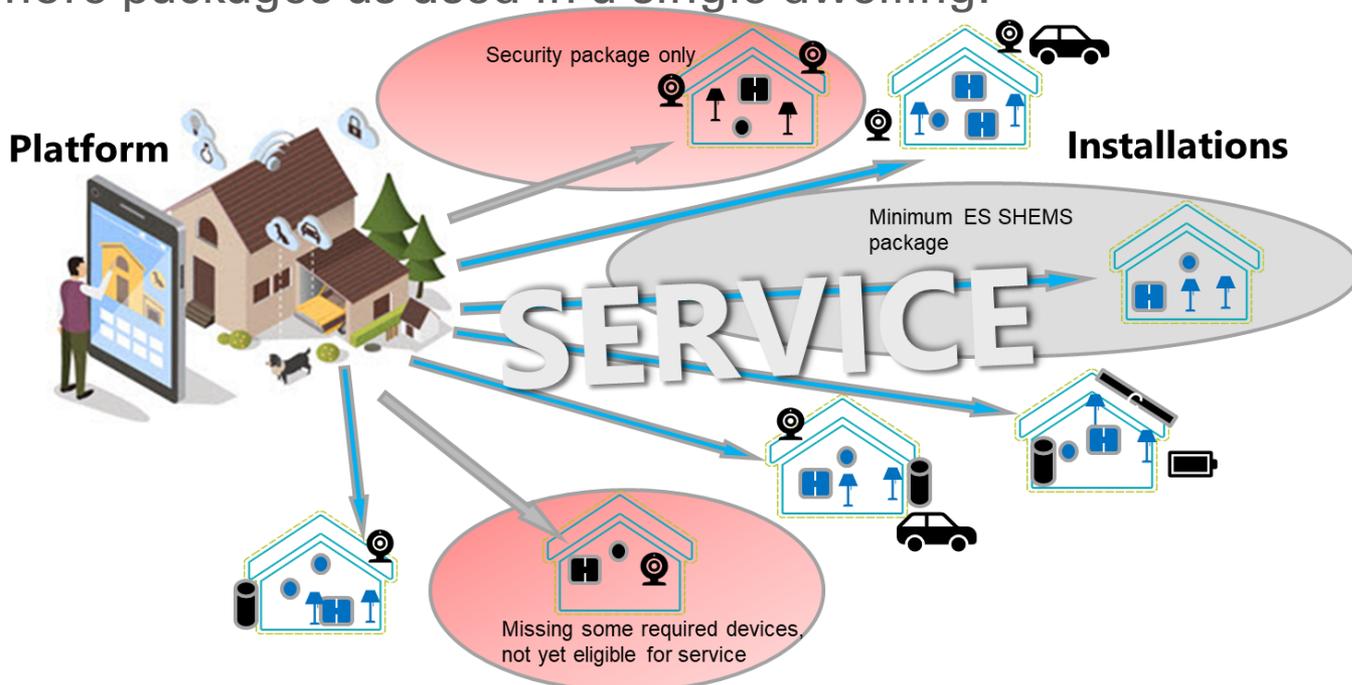


2. Definitions: What?

- **Service and Device Package (Package)**: A combination of a service and devices marketed and sold together. An ENERGY STAR certified SHERMS package shall deliver occupancy-based optimization and meet all of the device and service requirements identified in the Eligibility Criteria.
 - **Service**: A combination of software, algorithms, and user interfaces that is useful to the building, its occupants, and other parties. A SHERMS service refers specifically to the service offered as part of a SHERMS package which provides for occupancy-based energy optimization strategies.
 - **Device**: A piece of physical equipment connected to a smart home service

2. Definitions: What else?

- **Platform:** A service offering encompassing multiple packages intended to serve consumer's interests such as security, health, safety etc. For instance, Company X offers a platform through which a consumer could select a variety of packages.
- **Installation:** An individual instance of a platform consisting of one or more packages as used in a single dwelling.



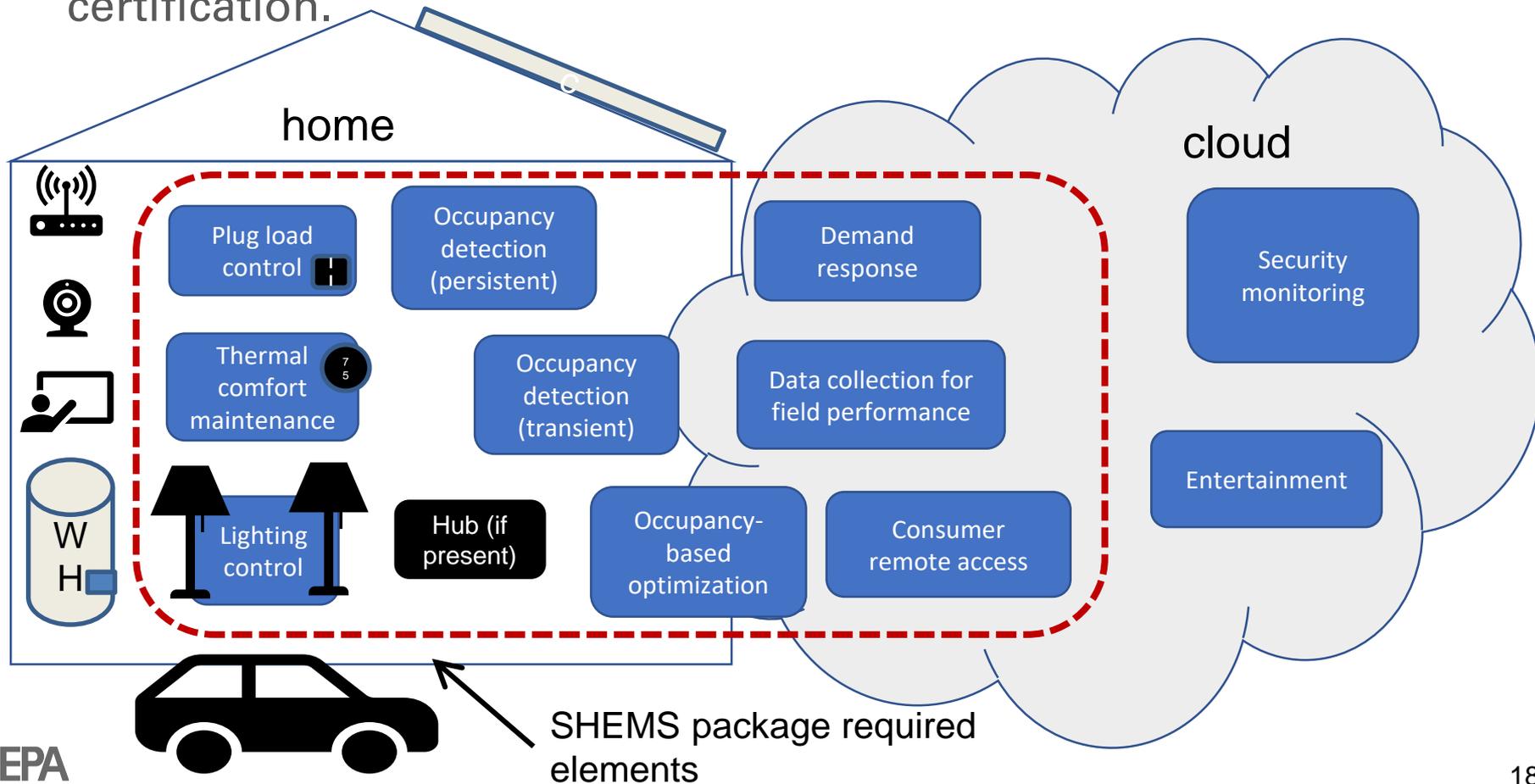
2. Definitions: Automated Actions

- **Explicitly generated (by a hard trigger):**
Actions for devices initiated by a user through an intentional input, e.g. setting up a schedule, rule, or action through an app.
- **Implicitly generated (by a soft trigger):**
Actions for devices initiated by the service based on occupancy and possibly other information, without explicit user input.
- **Suggested (by service-suggested trigger):**
Actions for devices that are suggested based on occupancy and other information, where the service requires a user to confirm in order to take the action.



3. Scope

Included Products: Only packages that meet the definition of a SHEMS, as specified herein, are eligible for ENERGY STAR certification.





Questions

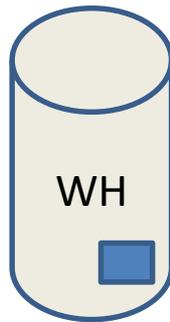
4. Eligibility Criteria: 5 Elements

4.1 Required Base Services

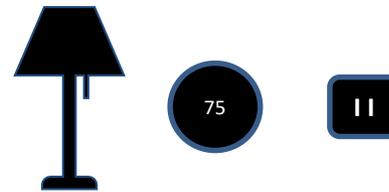


Optimize

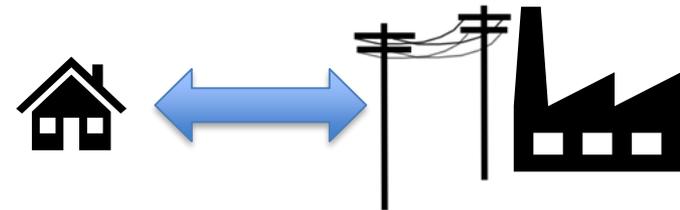
4.2 Additional Platform Capabilities



4.3 Required Devices



4.4 Grid Services



4.5 Field Data Reporting



4.1 Required Base Services: Occupancy

ENERGY STAR SHERMS shall receive and use a minimum set of occupancy data to synthesize custom actions for the installation.

- **using ≥ 1 persistent device with constant wired power or ≥ 2 solely battery-powered devices**



This requirement could be met by one wired thermostat with occupancy detection, two battery-powered infrared detectors, or one bulb with occupancy detection screwed into a line-voltage socket.

4.1 Required Base Services: Automated Optimization

Produce energy-saving device control actions through hard, soft, and suggested triggers, specifically:

- Basic user control of required devices (hard trigger);
- Scheduling (hard trigger). Default schedules are recommended;
- Automated device control through occupancy detection (soft trigger); and
- suggest energy savings actions (service-suggested trigger).



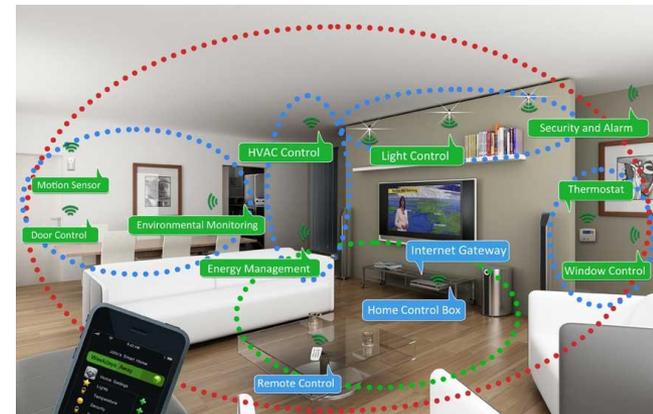
4.1 Required Base Services: Energy Information

Allow the end user to access information relevant to their energy consumption.



4.1 Required Base Services

- Remote user access
- User notification for system failures
- User customization
- Vacation or nighttime safety mode
- Device recognition





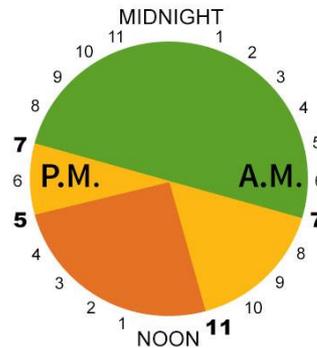
4.1 Required Base Services: Questions

4.2 Additional Required Platform Capabilities

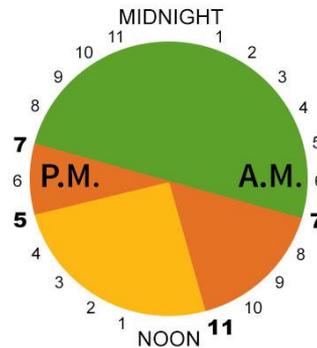
SHEMS are required to support the following capabilities which provide valuable energy management:

- Ability to connect to and optimize a water heater or water heater controller
- Ability to leverage time of use energy pricing in optimization

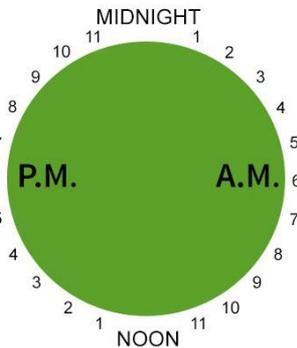
Summer - Weekdays
(May 1 - Oct 31)



Winter - Weekdays
(Nov 1 - Apr 30)



Weekends & Statutory Holidays



6.5¢ Off-peak
per kWh* Demand is lowest

9.5¢ Mid-peak
per kWh* Demand is moderate

13.2¢ On-peak
per kWh* Demand is highest





4.2 Additional Required Platform Capabilities: Questions

4.3 Connected Device Requirements

Thermostat	Connected lighting and Lighting Control Devices	Load Measurement Device

Note: EPA has included the products above as examples and is not specifically highlighting any of the brands shown.

4.3 Optional Encouraged products

- Service providers are strongly encouraged to include additional products subject to the occupancy-based optimization control of the ENERGY STAR certified SHEMs package. E.g.
 - Connected water heater controller or ENERGY STAR Certified Connected Water Heater.
 - Automated window coverings certified by the Attachments Energy Rating Council (AERC) for Energy Performance (EP) – Automation at aercenergyrating.org
 - *ENERGY STAR certified room air conditioner, refrigerators, freezers, clothes washers, clothes dryers, EV chargers, pool pumps
 - Solar PV inverters
 - Battery storage



*product meets optional ENERGY STAR connected criteria where applicable

Note: inclusion of products not covered by another ENERGY STAR program in a SHEMS package does



4.3 Device specific requirements

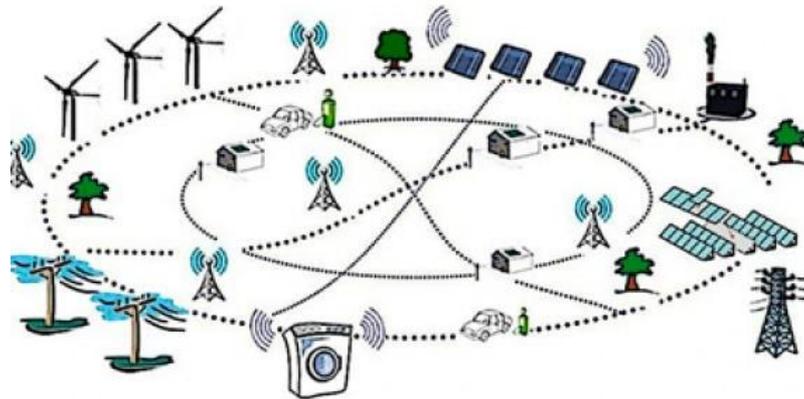
Device	Power Limit (Idle or standby as applicable)	Energy Communication Requirement
Smart plug, smart power strip, or sub metering device	1.0 watt idle power	Report energy consumption of connected loads to the SHERMS
Smart lighting control	0.5 watt standby power	
SHERMS-specific Hub or control panel	Standby or idle power shall be reported	-



4.3 Device specific requirements: Questions

4.4 Grid Service Criteria

- To enable the SHERMS to manage a home's response to grid requests, the platform shall offer an interconnection specified by an interface specification, application programming interface (API) or similar that enables Demand Response (DR) functionality.
- Consumers shall be able to override any grid request.
- Description of the SHERMS service provider's DR capabilities/services shall be provided





4.4 Grid Service Criteria: Questions



4.5 Field Performance:

- Service providers: report aggregated statistical data every six months according to the ENERGY STAR SHEMS Method to Determine Field Performance.
- More information to follow in discussion of the Method to Determine Field Performance.

ENERGY STAR® SHEMS Data Reporting Template

All data shared via this template is understood to be confidential and will not be shared publicly except as part of aggregated statistics for the entire ENERGY STAR SHEMS program. Any data made available to the EPA will be anonymized.

Data Submission Information								
Service Provider								
Relevant consumer-facing service brands		List						
ENERGY STAR Package ID Numbers		List						
Start date of Analyzed Period		MM/DD/YYYY						
End Date of Analyzed Period		MM/DD/YYYY						
	Q1	Q2 (Median)	Q3	Mean	Standard Error	Units	Precision	Data type
Program Performance (Required)								
Total installations served by the platform						Installations	1	Whole number
Total Installations in the Population						Installations	1	Whole number



4.5 Field Performance: Questions



5. Test requirements (& Certification Elements)

- ✓ Package validation (material review)
- ✓ Standby/idle power tests
 - Non-ENERGY STAR Devices:
 - Configure connected functionality and confirm functionality
 - Standard IEC test method for idle/standby power
 - Hub testing:
 - Confirm compatibility with required devices and basic functionality
 - Measure network idle power
- ✓ Data Reporting Template with 6 months of field data



5. Test requirements: Questions

7. Future revisions

- Performance metric and required level
- On the look out for communications standards for security or communications platforms
- Additional capability requirements for grid services





7. Future revisions: Questions



Next Steps*

The specification, method, and data template will be developed together

- Draft 1 Comment Period Closes May 3
- Draft 2: June goal
- Final Draft – July
- Final – August
- Smarthomesystems@energystar.gov
- www.energystar.gov/SHEMS





Break – come back to talk Method



Method to Determine Field Performance Agenda

- Why field data?
- Defining the data to analyze
- Data elements
- Required data reporting capabilities (in spec)
- Data privacy and confidentiality
- Future Metric
- Next steps

Why field data?

- Unlike typical ENERGY STAR products, SHEMS save energy by affecting how people use *other* products
- Only data from real users shows effect of complex behavioral interactions with tech
- Use statistical data
 - Even out household-to-household variation
 - Reveal the effectiveness of the SHEMS



SHEMS Method to Demonstrate Field Performance

- ✓ Defines the population for analysis, data reporting periods, and statistical methods for reporting the required data elements.
- ✓ Identifies required and optional data elements.
- ✓ Shows SHEMS are delivering required devices & services
- ✓ Provides EPA data to judge program impact
- ✓ Aids in the development of a simple, comprehensive metric for savings





SHEMS Method Organization

SHEMS Method main body

- Section 1: Intro
- Section 2: Applicability
- Section 3: Definitions
 - Population, period of analysis, and statistical measures
- Section 4: Procedure (basically, fill out the Template)

Appendix A: Explanation of Template data elements

- Section 1: General explanation of how to interpret and calculate data elements
- Section 2: Program Performance (required)
- Section 3: Savings Metric Development (optional)
- Section 4: SHEMS Market Evolution (optional)



Defining which data to analyze (section 3)

- **Intention in defining population:**
 - Capture all the installations using an ENERGY STAR SHEMS for the whole period of analysis
 - Disregard brief disconnections and reconnections of an installation that will not substantively affect data quality
 - Exclude trial periods and similar
- **Intention in defining period of analysis:**
 - Enough data to derive meaningful insights
 - Cover full year with semi-annual submission



Data from which homes?

- Population for analysis: all installations using an ENERGY STAR certified SHERMS package from a given service provider during the Period of Analysis.
- To be included in the sample for analysis, installations must:
 - Have been connected to the service at the beginning and end of the period of analysis, and
 - Have been connected to the service and collecting subject data for at least 90% of days in the reporting period.





Data elements are organized into three sections

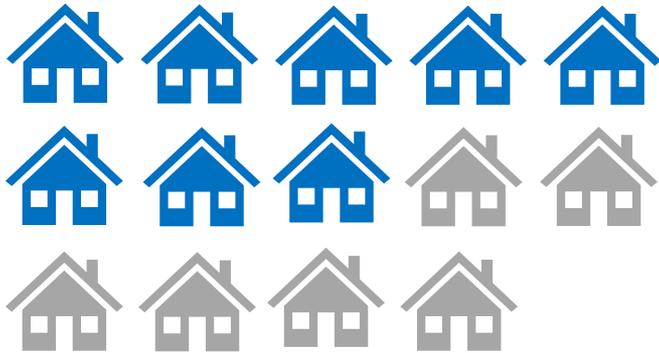
- **Program Performance (Required)**
 - Minimal set of data elements needed to verify that installations comply with the basic SHEMS service and device requirements.
- **Savings Metric Development (Optional)**
 - Additional elements which EPA believes will allow for the development of a metric and would greatly appreciate receiving.
- **SHEMS Market Evolution (Optional)**
 - Additional elements that indicate the level of integration of SHEMS with the grid and other smart home devices, which are of keen interest to many SHEMS stakeholders.



Data elements

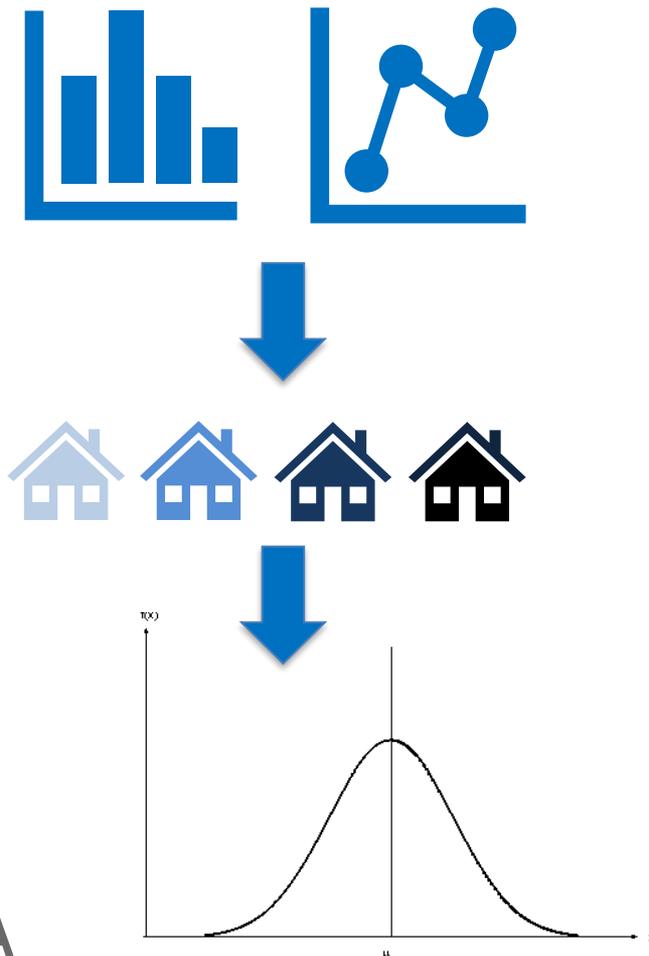
- **Section 2:** Information about total installations and new installations avoid a separate annual data submission requirements (unit shipment data)
- **Section 3:** Do any of these factors affect savings, and differ between service providers, such that we would need to take them into account in developing a savings metric?
- **Section 4:** Many stakeholders were keenly interested in systems with these capabilities, and those where more installations used these capabilities.
- In each section, 2 general types of data elements

Data Elements– Type 1



- Number or percentage of installations
- Examples:
 - Total installations in the Population
 - New installations registered during the reporting period

Data Elements – Type 2 (more common)



- Quartiles, mean, standard error
- Note: calculate quantity for EACH installation, then calculate statistics for the population
- Examples:
 - Number of ENERGY STAR thermostats per installation
 - Average scheduled away hours per week per installation
 - Length of time subscribed
 - Change in number of devices in the installation in the past year

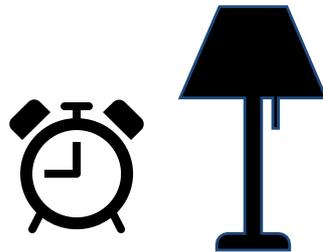
Suggested, explicitly generated, and implicitly generated away hours (Type 2)

- **Goal:** demonstrate occupancy-based optimization performance.
- **Motivation:** program value to consumers and stakeholders; explore occupancy-based energy savings potential.
- **Availability:**
 - Define possible “away hour” triggers as explicit, implicit, or suggested.
 - Record the number of away hours of each type for each installation.



Average on time per light fixture per day (Type 2)

- **Goal:** compare average on time to national averages for residential lighting.
- **Motivation:** demonstrate program savings and value to consumers and stakeholders.
- **Availability:**
 - Time stamp associated with on and off states for connected light fixtures.
 - Detect off time from light switch, not just SHERMS control actions



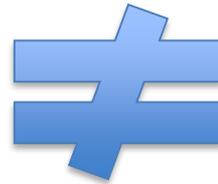
Percent of controllable lighting devices which are scheduled or automated (Type 2)

- **Goal:** assess depth of occupancy-based savings.
- **Motivation:** savings metric development.
- **Availability:**
 - Analysis of user scheduling and automation settings for connected lighting devices.



Example field data issues

- Would prefer to capture total controlled load, not # devices



- BUT, other than the required devices, can't count on additional connected lighting and plug load devices to have power reporting capability

Installations including a connected water heater or water heater controller (Type 1)

- **Goal:** assess the depth of savings available to the SHEMS.
- **Motivation:** monitor market evolution and value to utility stakeholders.
- **Availability:**
 - Identify connected water heater and water heater control devices.



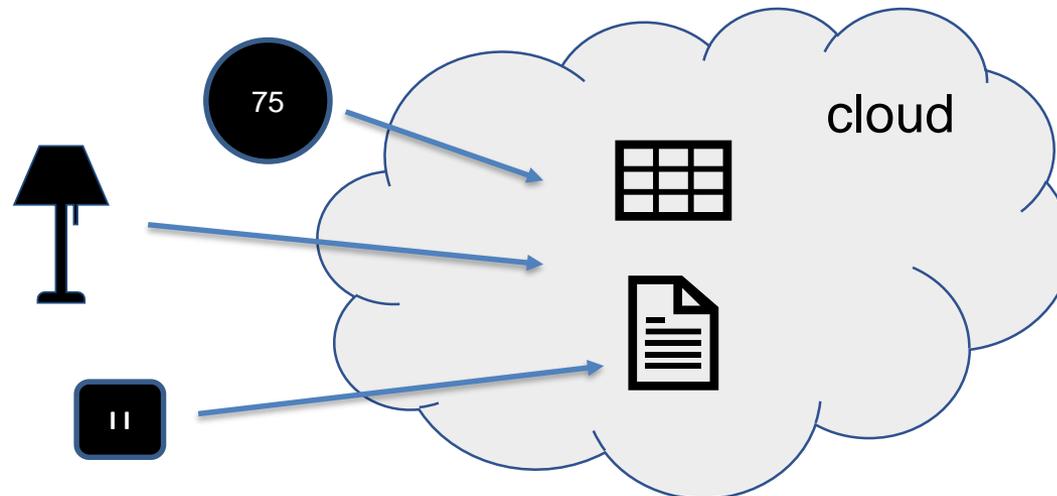
Required Data Reporting Capabilities (spec section 4.5)

- To report data in the Data Template, platform must collect certain data from each installation.
 - Derived directly from the Field Data Method and Template
 - Example: Total System Standby Power
- Please give us feedback!



Whole system standby power (Type 2)

- **Goal:** demonstrate that SHERMS savings exceed additional standby load.
- **Motivation:** program value to consumers and stakeholders.
- **Availability:** Detect standby power, accept device report, or synthesize connected device identification with specification sheets and other sources



Data Privacy and Confidentiality

- Collecting only statistical information protects consumer privacy.
- Field data will be submitted to an EPA contractor.
- To protect the proprietary nature of the data EPA will only have access to anonymized data.





Why Ask for Data to Develop a Metric?

- Metric would be simpler, less proprietary information
- Asking for considerable data to decide how to put a metric together →expect to take years←
- We know a metric WON'T ever predict the savings that any particular installation will achieve
- We hope a metric WILL (for reasonable-sized groups of installations)
 - Differentiate SHERMS with significant savings
 - Reflect which SHERMS save the most



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