ENERGY STAR Program Requirements
Product Specification for Smart Home Energy Management Systems

Eligibility Criteria
Draft 2 Version 1.0

This document specifies the eligibility requirements for the **Draft 2 Version 1.0** ENERGY STAR Smart Home Energy Management Systems (SHEMS) program. SHEMS packages shall meet all of the identified criteria to earn the ENERGY STAR.

1   INTRODUCTION

The intent for this specification is to recognize smart home system packages designed to actively recognize and act on opportunities to save energy and help end users manage their energy in a way that saves them money and makes their lives easier. This includes but is not limited to 1) providing reliable occupancy detection linked to savings strategies that shut off or power down equipment when no one is home, 2) limiting standby power of connected devices, and 3) providing feedback to users about the energy impact of their settings.

The ENERGY STAR SHEMS specification is tailored to current market circumstances in terms of the smart home devices it addresses. As the market and technology continue to evolve, it is expected this program will grow to provide a national framework for complete home energy management services that work seamlessly with the grid. The intent is for the ENERGY STAR certified SHEMS package to be customizable and scalable to function with multiple device options, including devices beyond the minimum requirements in this specification.
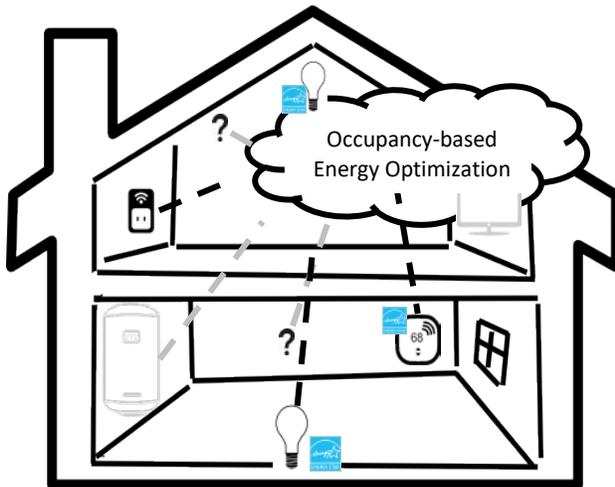

Figure 1: Simple illustration of the basic elements of an ENERGY STAR Smart Home Energy Management System Package

Required minimum devices are shown with black dotted lines, optional devices in gray, and the cloud denotes the core service capability, occupancy-based energy optimization.

2   DEFINITIONS

A) <u>Smart Home Energy Management System (SHEMS) Package</u>: For purposes of ENERGY STAR, a SHEMS package is the combination of a service and devices that are designed to work together to deliver occupancy-based optimization of energy use and that meets all of the device and service

29 requirements outlined in the Eligibility Criteria below. A SHEMS package may include devices with
30 energy saving or grid services potential beyond what is required for ENERGY STAR certification
31 (particularly those identified below as Optional Encouraged Devices). A SHEMs package must be
32 marketed as a complete offering but may be sold separately. A SHEMS package may be a subset of
33 a larger home automation platform that provides other services.

34 a) Service: A combination of software, algorithms, and user interfaces that is useful to the building,
35   its occupants, and other parties. A SHEMS service refers specifically to the service offered as
36   part of a SHEMS package which provides for occupancy-based energy optimization strategies.

37 b) Platform: A service offering encompassing multiple packages intended to serve consumer's
38   interests such as security, health, safety etc. For instance, Company X offers a platform through
39   which a consumer could select a variety of packages.

40 c) Installation: An individual instance of a platform consisting of one or more packages as used in a
41   single dwelling.

42 d) Smart Home Service Provider: The company that owns the brand which consumers see when
43   they interact with their SHEMS package and is able to provide package data and analysis of field
44   data to EPA for the ENERGY STAR program.

45 **Note:** In response to a stakeholder request for clarity on what is included in the ENERGY STAR
46 certification, EPA has included partner commitments and refined definitions in the Draft 2 specification.
47 The definitions for SHEMS and package were combined to be clear that what is being labeled is the
48 package, a combination of the service and devices.

49 B) Device: A piece of physical equipment connected to a SHEMS, including the following device types:

50 a) Sensor: A device that detects or measures a physical property and records, indicates,
51   communicates, or otherwise responds to it. Sensors may be embedded in other devices.

52 b) Hub: A dedicated device which provides network connectivity, protocol translation, and, in some
53   cases, additional instruction between products included in a SHEMS package. For instance, an
54   alarm panel or gateway may serve as a hub. This can be anything that would not reasonably be
55   expected to be in a home other than to support the SHEMS and possibly other functions of a
56   platform. Thus, a Wi-Fi router or router/modem combination whose primary function is to provide
57   internet service to the dwelling would not be considered a hub. Smart home systems do not
58   necessarily need to include a hub. Hubs can be wired, wireless, or a combination.

59 c) Persistent Occupancy Device: A device that detects room, space or dwelling level occupancy and
60   is always present in the home. This could be a sensor integrated into another product or a
61   standalone sensor (e.g. a passive infrared sensor) or mechanism that can detect and
62   communicate dwelling or space occupancy (e.g. alarm control pad). Door sensors which only
63   report when a door opens and closes do not qualify as persistent occupancy devices.

64 d) Transient Occupancy Device: A device that detects room, space or dwelling level occupancy that
65   is not always present in home. This could be a sensor integrated into a portable product or a
66   standalone device like a garage door remote.

67 e) Smart Plug: A household voltage (120V or 240V) wall outlet or device which is placed between a
68   standard outlet and a device's power plug or incorporated into the outlet itself and can be
69   controlled by a wireless remote or app using Wi-Fi, Bluetooth, or other wireless communications
70   protocols. Most advanced smart plugs offer the ability for preset timed events, surge protection,
71   and current draw feedback.

72 f) Smart Power Strip: A multi outlet device (similar to a traditional power strip 120V or 240V) placed
73   between a household power outlet and more than one device's power plugs. The smart power
74   strip's multiple outlets can be controlled individually or in a group by a wireless remote or app with
75   external communication using Wi-Fi, Bluetooth, or other wireless communication protocols. Smart
76   power strips incorporate either automated energy savings based on user interaction, or the ability
77   to set timed events, or other trigger technologies such as Geo Fencing or IFTTT. Smart power

| 78 | | strips included in ENERGY STAR SHEMS packages must have the ability to monitor and report |
| 79 | | energy use data from each outlet or the group of outlets per section 4.3B). |

    g) <u>Home Energy Sub Metering System</u>: A system that can measure or estimate energy usage at the circuit breaker panel, offering the ability to monitor energy usage for individual circuits to account for their actual energy usage. This may include smart fuse boxes and systems that use current transducer (CT) clamps or similar means to non-invasively measure power in household circuits.

    h) <u>Connected Thermostat (CT)</u>: A device that controls heating, ventilation, and air-conditioning (HVAC) equipment to regulate the temperature of the room or space in which it is installed and has the ability to communicate with sources external to the HVAC system. For connection, the CT device may rely on a Wi-Fi home area network and an internet connection that is independent of and not part of the CT Device. An ENERGY STAR Certified Connected Thermostat meets the requirements in the <u>current Connected Thermostats specification</u>.

    i) <u>ENERGY STAR Certified Light Meeting Connected Criteria (Smart Light)</u>: A <u>lamp</u>, <u>luminaire</u>, or <u>retrofit kit</u> certified to the latest ENERGY STAR specification as meeting the optional connected criteria.

C) <u>Plug Load</u>: Plug loads are a category of equipment that is usually plugged into an outlet. This term generally excludes loads that are attributed to major end uses (HVAC, lighting, water heating, etc.)

D) <u>Occupancy-Based Optimization</u>: Using information on occupancy to serve consumers' desires with the least energy possible, for instance by reducing idle power or reducing the amount of time energy-using devices are on. Optimization algorithms may also use predictive information about when occupancy is likely to change, based on learning.

E) <u>Occupancy Sensing</u>: A method (or methods) to detect whether a space has a person and/or animal in it, and potentially how many. Occupancy may be sensed on a room by room basis or for an entire dwelling, and may be sensed using dedicated sensors, sensors in a product with a different primary purpose (thermostat, light fixture), system-based techniques such as geofencing or the arming of an alarm panel, or a combination of these techniques. It may include information about how long the home has been or will be unoccupied which may affect optimization.

F) <u>Automated Actions</u>:

    a) <u>Explicitly generated (by a hard trigger)</u>: Actions for devices initiated by a user through an intentional input, e.g. setting up a schedule (home, away, vacation, sleep), rule, or action through an app e.g. setting up geofencing to control devices, commanding a voice assistant, arming a security system, or actively pressing a button on a device in home. (For the purpose of this specification this excludes action on a suggested event).

    b) <u>Implicitly generated (by a soft trigger)</u>: Actions for devices initiated by the service based on occupancy and possibly other information, without explicit user input. This can be a machine learning scenario where a service detects new patterns and adjusts a users' schedule or simply that the service detects that the home is vacant and triggers energy saving actions on behalf of the users. This can also include a notification to the user that they can override but if ignored the service would carry out the action, unlike a suggested action where a user must grant permission for the service to take the action.

    c) <u>Suggested (by service-suggested trigger)</u>: Actions for devices that are suggested by the service based on occupancy and other information, where the service requires a user to confirm in order to take the action.

> **Note**: In response to Draft 1, EPA received comments that service providers may not uniformly categorize suggested and implicitly generated events. Since this program hypothesizes energy saving differentiation to come largely from suggested and implicitly generated events, it is essential that service providers are recording and categorizing triggers consistently for reporting and evaluation purposes. EPA is open to suggestions to make definitions clearer to avoid inconsistency.

G) <u>Demand Response (DR)</u>: Changes in electric usage by demand-side resources from their normal

127   consumption patterns in response to changes in the price of electricity over time, or to event signals
128   designed to induce lower electricity demand at times of high wholesale market prices or when system
129   reliability is jeopardized[1].

130   H) <u>Time of Use Pricing (TOU)</u>: as identified by the U.S. DOE Smart Grid program,[2] TOU refers to a time-
131   based electricity rate program that applies to usage over broad blocks of hours where the price for
132   each period is predetermined and constant.

133   I)   <u>Interface Specification</u>: A document or collection of documents that contains detailed technical
134   information to facilitate access to relevant data and product capabilities over a communications
135   interface

136   J)   <u>States or modes</u>:

137   a)   <u>Idle state</u>: A state which the device enters automatically when the device:

138   (1)   is installed and interconnected in accordance with provided instructions,

139   (2)   experiences no direct or remote user interaction (e.g., smart phone app, web interface,
140   occupancy detection), and

141   (3)   sufficient time has elapsed to allow the device to enter a low power state, as applicable. For
142   example, the screen has dimmed or turned off automatically.

143   b)   <u>Standby State:</u> The lowest power state which cannot be switched off (influenced) by the user and
144   that may persist for an indefinite time when the device is connected to the main electricity supply
145   and used in accordance with the manufacturer's instructions. The device may require user
146   interaction, such as toggling a power button, in order to enter a standby state.

147   K) <u>Open Standards</u>: Communication with entities outside the SHEMS that use, for all communication
148   layers, standards including but not limited to:

149   • included in the Smart Electric Power Alliance Catalog of Standards,[3] and/or

150   • included in the NIST Smart Grid Framework Tables 4.1 and 4.2, and/or

151   • adopted by the American National Standards Institute (ANSI) or another well-established
152   international standards organization such as the International Organization for
153   Standardization (ISO), International Electrotechnical Commission (IEC), International
154   Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE)
155   or Internet Engineering Task Force (IETF).

156   • CTA-2045

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157 **Note:** EPA welcomes stakeholder feedback regarding additional important open standards to identify.

158 EPA received comments requesting clarification for several of the definitions above. The following
159 definitions have been revised accordingly in Draft 2: SHEMS and Service and Device Package were
160 combined; Device; Sensor; Hub; Plug Load; Smart Power Strip; Occupancy-Based Optimization; Demand
161 Response; Idle State; Standby State; and Open Standards.

162 EPA has added a proposed definition of "time of use pricing" for clarity and welcomes feedback on this
163 proposal.

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[1] Modified slightly from Federal Energy Regulatory Commission, https://www.ferc.gov/industries/electric/indus-act/demand-response/dr-potential.asp
[2] Modified slightly from Smart Grid, https://www.smartgrid.gov/recovery_act/time_based_rate_programs.html.
[3] https://sepapower.org/knowledge/catalog-of-standards/catalog-of-standards-complete-list-of-entries/

164 **3 SCOPE**

164 **3 SCOPE**

165 A) Included Products: Only packages that meet the definition of a SHEMS package, as specified herein,
166 are eligible for ENERGY STAR certification. A SHEMS package may be one distinct package offered
167 by a platform that also provides other smart home services such as home automation, entertainment,
168 home awareness, elder care, or security.

169 B) Excluded Products: SHEMS that are unable to collect the required data for the Method to Determine
170 Field Performance.

171 C) Diagrams

172 **Figure 2: Illustration of SHEMS Package**

173 Minimum device and function requirements are shown inside the red dotted boundary, including at least one
174 ENERGY STAR certified thermostat and two lighting devices, one of which shall be ENERGY STAR certified.
175 Refer to section 4 for detailed information. Persistent occupancy sensing may be a stand-alone additional device
176 or integrated into another required device.

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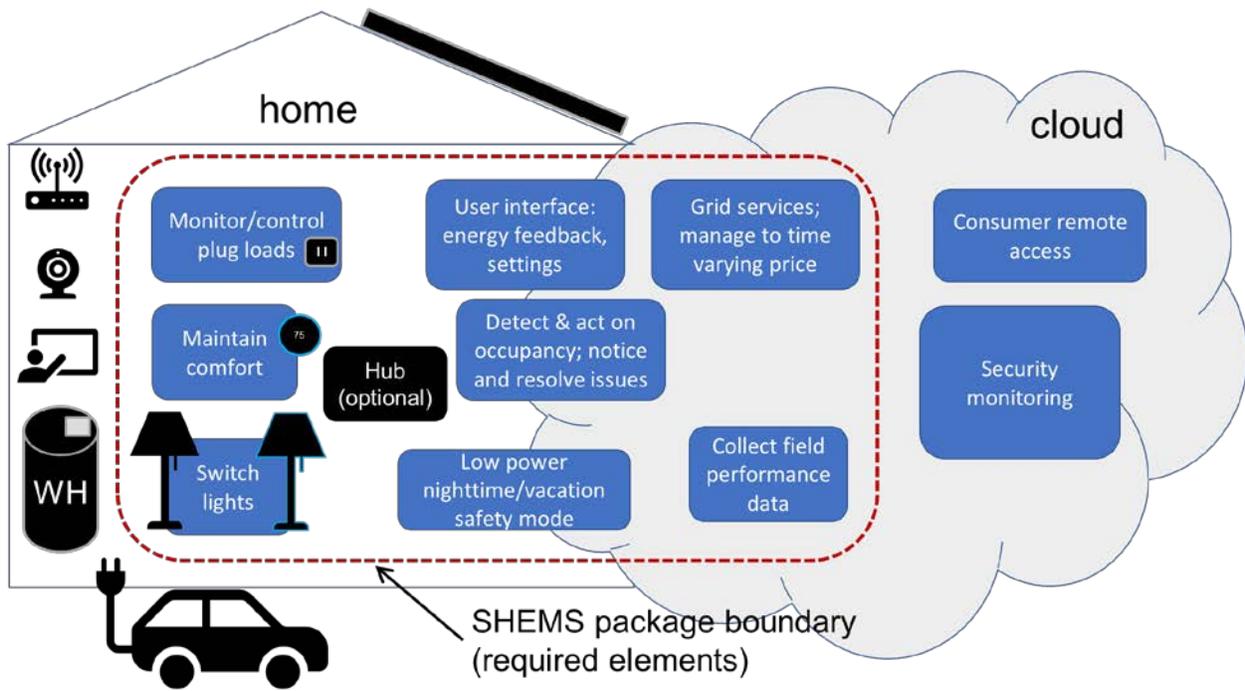
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Figure 3: Illustration of installations of various packages in a platform
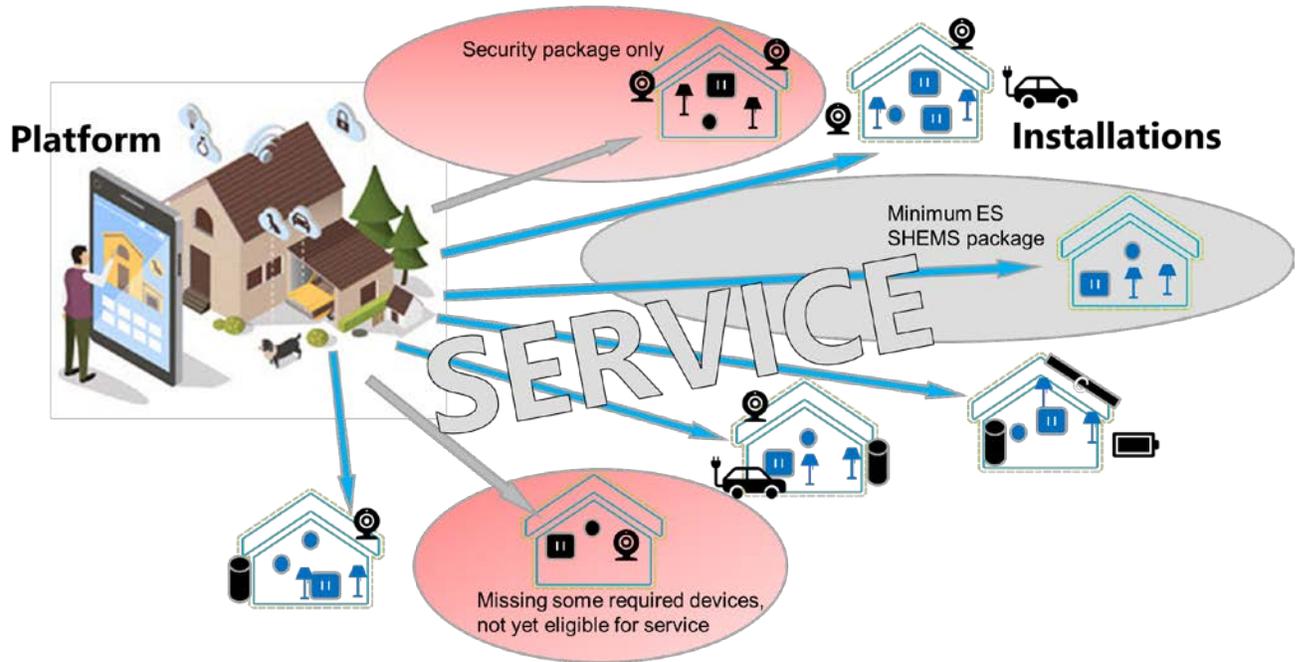
4   ELIGIBILITY CRITERIA

To certify as ENERGY STAR, the SHEMS packages offered by a service provider must facilitate energy management via occupancy-based optimization control of, at minimum, the connected devices as outlined below and meet the specified service capabilities and grid response criteria. In addition, field performance must be reported as detailed by the ENERGY STAR SHEMS Method to Determine Field Performance. The SHEMS shall maintain these services and capabilities through subsequent firmware and software changes. Furthermore, any SHEMS package marketed or sold by the service provider must continue to meet all requirements in the specification for the SHEMS to maintain certification. The SHEMS service provider shall maintain documentation that demonstrates compliance to these requirements.

Note: EPA has made slight modifications to the section above to clarify requirements applying to the SHEMS package. EPA welcomes feedback on this clarification.

4.1 Required Base Services: The SHEMS shall perform the following services:

A) Provide a remote consumer interface (e.g. application, website, display) that allows end users to control all the devices connected to the SHEMS package from outside the dwelling.

B) Receive and utilize a minimum set of occupancy data, specifically:

   a) include at least one persistent device with constant wired power or at least two solely battery-powered persistent devices; *This requirement could be met by one wired thermostat with occupancy detection, two battery-powered infrared detectors, or one bulb with presence detection screwed into a line-voltage socket.*

   b) detect and communicate occupancy to the SHEMS package;

   c) synthesize occupancy information for the installation; and

   d) send commands to devices connected to the SHEMS package, including but not limited to: reduce lighting loads to the levels specified in 4.1(G), turn off any smart power strips or plugs,

206   and turn off or change modes of other devices connected to the SHEMS.

207   **Note:** EPA has revised 4.1B)d) above in Draft 2 in response to a stakeholder request to specify the
208   minimum set of occupancy-based commands an ENERGY STAR SHEMS must perform.

209   C) By default, produce energy-saving device control actions through hard, soft, and suggested triggers,
210   specifically by (at least one action through each method below):

211   a) facilitating user-established rules and schedules (hard trigger). An energy saving default schedule
212   is a recommended feature;

213   b) implementing control algorithms to automatically modify the operation of the devices in the
214   package to save energy while maintaining positive user experience based on occupancy
215   information and machine learning of user behavior, i.e. patterns, preferences and user input (soft
216   trigger); and

217   c) identifying and suggesting energy savings events or actions to promote energy savings while
218   maintaining positive user experience based on occupancy information and machine learning of
219   user behavior, i.e. patterns, preferences and user input (service-suggested trigger).

220   D) Allow the end user to access information relevant to their energy consumption, including the energy
221   consumption or average power of all connected devices, which the service shall be capable of
222   collecting and displaying across time intervals no greater than one day. Estimated energy use based
223   on device settings is permitted. *Examples include but are not limited to: real-time energy use data by*
224   *device, package, platform or dwelling (including meter data); daily, weekly, monthly or annual energy*
225   *performance, comparison with previous periods or similar dwellings, etc.*

226   **Note:** In response to comments EPA has clarified the requirements in 4.1C) that SHEMS perform, by
227   default, *at least one* action per method. However, it is up to the service provider to determine the
228   appropriate combination and implementation of the various triggers for their customers. Additionally,
229   recognizing that user preferences may lead to deviations from these requirements, the Agency has
230   clarified that these actions be produced by default. User changes to system preferences should be
231   captured in the field data collected.

232   In response to Draft 1, several stakeholders expressed confusion regarding the level of detail required for
233   user access to energy consumption. EPA has modified the requirement above to set clearer expectations
234   and welcomes feedback on this change. One stakeholder suggested adding "including access to meter
235   data if available" to the energy reporting requirements. EPA has included utility meter data in the list of
236   examples in Draft 2, but due to the variability in utility data availability EPA does not believe it would be
237   necessary or practical to require systems with access to meter data to display that data to users.

238   E) Allow users to configure system preferences, provide feedback, and to adjust how responsive the
239   system is to detected occupancy.

240   F) Provide a resolution and user notification process for when occupancy detection is not working
241   properly; e.g. notifications through email, SMS and or on main access portal until resolved.

242   G) Provide a vacation or nighttime safety mode to automate lighting load to operate one or multiple lights
243   minimally while away, using no more than 0.03 kWh per day while the feature is activated.

244   H) Recognize and identify required and encouraged devices certified in the package by type (e.g. light,
245   outlet, thermostat, etc.) once connected.

246   **4.2 Additional Required Platform Capabilities**

247   A) Ability to connect to at least one water heater controller or connected water heater which is currently
248   available on the market.

249   B) Ability to control devices based on relative or absolute time of use energy prices, determined either
250   through user input or by integrating with utility programs, and to help users manage energy use in the
251   home to minimize energy costs. For systems relying on user input, the user should be able to enter

252   time of use rate information both during system configuration and at any point while connected to the
253   service.

254 **Note:** EPA received requests from two stakeholders that the requirements for controlling a connected
255 water heater and time of use control capability listed in 4.1A) and 4.2B) be made optional. EPA also
256 received comments from several stakeholders expressing support of these capabilities.

257 As the most ubiquitous flexible load in homes today, storage water heaters are a high priority for grid
258 services and can also be leveraged for energy savings based on occupancy-based control. A utility
259 stakeholder expressed that it would be highly valuable for a SHEMS to integrate with water heaters, and
260 that the new CTA-2045 standard should make this a standard, scalable process and having the SHEMS
261 specification include a mandatory connection to water heaters would increase the possibility that a utility
262 could incentivize the use of a SHEMS. As such, EPA has maintained the requirement. EPA seeks to
263 encourage to the greatest extent possible integration and use of water heater control as part of ENERGY
264 STAR SHEMS. EPA is aware that connected water heater models may be limited at this time. As such,
265 the option for compatibility with commercially available add-on water heater controllers as well as
266 connected water heaters was included to allow service providers additional flexibility.

267 Regarding time of use pricing, data published by the Energy Information Administration (EIA)[4] indicates
268 that over 4.7 million residential utility customers nationwide were enrolled in time of use pricing as of
269 2017. A recent report from Northeast Energy Efficiency Partnership (NEEP)[5] cited a statistic from the
270 Advanced Energy Economy that there were 7.95 million customers in the U.S. on some type of time-
271 varying rate at the end of 2016. Maryland leads the nation with more than 75 percent of residential
272 customers in time-differentiated rates. In California, the leader in both residential solar and ownership
273 rates of electric vehicles, residential TOU rates will be the default option for the 22.5 million residential
274 customers of the California Investor Owned Utilities starting in 2019. The NEEP report notes "Because of
275 the large presence of [distributed energy resources] on the California grid, the consumer benefit for a
276 HEMS [home energy management system] that can manage various loads and pair them with low rates is
277 very significant." Given the expected increase in enrollment in time of use pricing, and conversations with
278 several companies already providing this service, EPA has maintained the requirement that service
279 providers support optimization based on energy use prices that are either entered by the user or through
280 integration with the utility.

281 EPA also received requests to include connectivity with EV charging equipment in the list of required
282 additional capabilities. EV chargers are included in the list of encouraged devices, and service providers
283 will be required to report on such capabilities but the capabilities themselves are not required due to the
284 immaturity of the market.

285 EPA received several requests for reporting additional data about ENERGY STAR SHEMS packages and
286 services, including reporting any standards implemented for customer privacy, cyber security, and
287 demand response. EPA believes that this information will be helpful to utility stakeholders and to
288 consumers in choosing a certified SHEMS to incentivize or purchase and intends to include fields
289 reflecting this information in the list of certified packages which is made available on the ENERGY STAR
290 website. EPA would appreciate input as to relevant standards which should be listed.

291 **4.3 Connected Device Requirements**

292 A) <u>Required devices</u>: Any package marketed as an ENERGY STAR certified SHEMS shall include the
293   following devices. (Note: since actual installations may vary, only those installations that include the
294   required devices will be analyzed as part of the compliant population.)

295   a) At least one ENERGY STAR certified smart thermostat;

296   b) At least two lighting load control devices, consisting of:

297   • Two ENERGY STAR certified smart lights; or
298   • One ENERGY STAR certified smart light and one smart light switch capable of

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[4] U.S. EIA Annual Electric Power Industry Report, 2017. https://www.eia.gov/electricity/data/eia861/
[5] https://neep.org/smart-energy-home-driving-residential-decarbonization

| 299 | | measuring lighting load. |

300   c) At least one of the following plug load control or monitoring offerings;

301   • One smart power strip;
302   • One or more smart plugs; or
303   • Home energy sub metering system.

304   d) any additional devices needed to fulfill the required service capabilities, such as a hub or
305   occupancy devices.

306   **Note:** Stakeholders expressed confusion regarding the requirements for the marketing and sale of
307   required devices. EPA has revised 4.3A) above and added partner commitments in recognition of the fact
308   that devices can be sold separately or integrated piecemeal. We welcome further feedback. EPA is
309   aware that a variety of business models exist and will not seek to specify a mode by which the required
310   devices must be sold or installed as long as the ENERGY STAR certified SHEMS package as marketed
311   is comprised of at least the minimum required devices (and only complete installations are included for
312   purposes of analysis).

313   B) Device-specific requirements: All smart switches, plugs, smart power strips, submetering devices or
314   SHEMS-specific hubs or control panels marketed with the certified SHEMS package shall comply.

315   a) Lighting Load and Plug Load Management Devices: Smart light switches, smart plugs, smart
316   power strips, or sub metering devices included in a SHEMS package shall have the ability to
317   communicate energy consumption of their respective loads to the SHEMS.

318   b) Idle and Standby Power Requirements:

319   **Table 1: Device Power Limits**

Device	Power Limit (Idle or standby as applicable)	Method of measurement (as applicable)
Smart plug, smart power strip, or sub metering device	1.0 watt standby power	IEC 62301, Ed. 2.0, 2011-01, Household electrical appliances – Measurement of standby power, subject to clarifications in sections 5E).
Smart lighting control	0.5 watt standby	
SHEMS-specific Hub or control panel[6]	Network connected idle power shall be reported	Instructions in section 5F).

320   (1) The standby power requirements for ENERGY STAR products which may satisfy the
321   minimum SHEMS device requirements are listed below. These products are addressed in
322   separate specifications, so while the standby power requirements below are accurate as of
323   the development of this specification they may change independently. Please visit the
324   ENERGY STAR partner webpages for the relevant products to find the current requirements.

325   • ENERGY STAR certified connected thermostat: ≤ 3.0 watts average standby power.[7]

326   • ENERGY STAR certified lamp meeting connected criteria: ≤ 0.5 watts standby power.

327   • ENERGY STAR certified luminaire, including ventilating fans with light kits: ≤ 0.5 watts
328   standby power for luminaires meeting connected criteria; ≤ 1.0 watts standby power for
329   luminaires meeting connected criteria and having energy saving features such as integral

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[6] Includes all equipment necessary to establish connectivity to the SHEMS service provider's cloud, except those that
can reasonably be expected to be present in the home independently of the SHEMS service, such as Wi-Fi routers
and smart phones.
[7] Includes all equipment necessary to establish connectivity to the CT service provider's cloud, except those that can
reasonably be expected to be present in the home, such as Wi-Fi routers and smart phones.

| 330 | motion sensors or occupancy sensors. Power supplies for multiple luminaires may draw |
| 331 | up to 1.5 watts in standby mode. |

332   • ENERGY STAR [certified ceiling fan light kit](#): reported separately in the list of certified
333   products.

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334 **Note:** EPA received requests to indicate an intent to revisit standby requirements in future versions, and
335 to include the standby power requirements of all required devices to give stakeholders a better idea of the
336 combined standby power of the minimum package. EPA has responded to the first request in Future
337 Criteria Revisions, section 7B). EPA intends to use field data and feedback from service providers and
338 other stakeholders to develop a performance level, to enable a more stringent performance requirement
339 and delivered energy savings. EPA has also included the above list of the current standby power
340 requirements in applicable ENERGY STAR specifications for reference.

341 EPA has also made small revisions to the table above to clarify which test method(s) apply to which
342 devices.

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343 C) <u>Optional Encouraged Devices</u>: Service providers are strongly encouraged to build their SHEMS to be
344   capable of optimized control of the following devices, which are listed in order of priority based on
345   their energy saving and grid services potentials. Compatibility with such products will be highlighted
346   on the ENERGY STAR listing for the certified SHEMS. Examples include:

347   • Connected water heater controller or ENERGY STAR Certified Connected Water Heater.
348   • *ENERGY STAR certified EV Service Equipment
349   • Automated window attachments certified by the Attachments Energy Rating Council
350   (AERC) for Energy Performance (EP) – Automation at aercenergyrating.org
351   • *ENERGY STAR certified room air conditioner
352   • *ENERGY STAR certified refrigerators
353   • *ENERGY STAR certified freezers
354   • *ENERGY STAR certified clothes washers
355   • *ENERGY STAR certified clothes dryers
356   • *Additional ENERGY STAR certified light bulbs and fixtures
357   • *ENERGY STAR certified pool pumps
358   • *Other (as developed) ENERGY STAR certified products
359   • Battery storage
360   • Solar inverters
361
362 *product must meet optional ENERGY STAR connected criteria where applicable

363 *Note: inclusion of products not covered by another ENERGY STAR program in a SHEMS package does*
364 *not grant such products the right to use the ENERGY STAR marks.*

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365 **Note:** In response to Draft 1, EPA received suggestions to add connected Dehumidifiers and Energy
366 Recovery Ventilators (ERV) to the above priority list. Since there are no ENERGY STAR connected
367 criteria for these products, they have not been included specifically at this time. However, EPA has added
368 an item for additional products certified to ENERGY STAR connected criteria that may be developed in
369 the future. EPA has also revised the description to clarify the purpose of the Optional Encouraged
370 Devices section and ranked the devices roughly in order of priority.

371 EPA also received a request to include windows with automated integrated dynamic glazing in the list of
372 encouraged devices. At this time the ENERGY STAR specification for windows does not address
373 dynamic glass but the specification revision process that will commence this summer will open the
374 discussion. EPA believes that leveraging the existing ENERGY STAR product specification process is the
375 best path forward and, if addressed in a future specification, windows, doors and skylights with dynamic
376 glass and connected criteria would automatically be included in the list of encouraged products.

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377 **4.4 Grid Service Criteria**

378　A) Grid Communications and Access: The SHEMS shall be capable of implementing a demand
379　　 response event for at least one device in the package. The platform shall offer an interconnection
380　　 specified by an interface specification, application programming interface (API) or similar
381　　 documentation that, at a minimum, enables DR functionality. Providers are encouraged to use open
382　　 standards to meet this criterion, for example by offering an OpenADR virtual end node (VEN) in their
383　　 cloud or locally in the home.

384　B) Consumer Override: Consumers shall be able to override their SHEMS' response to any grid request.
385　　 The override shall last no more than 72 hours.

> **Note:** EPA is specifying that user overrides of grid requests shall last no longer than 72 hours. In
> response to stakeholder requests for clarification, EPA has also indicated that SHEMS shall be capable of
> implementing a demand response event to at least one device in the package.

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389　C) Capabilities Reporting:

390　　 a) List DR protocols supported by the SHEMS.

391　　 b) Indicate if the only option for DR services is through the service provider's cloud.

392　D) Additional Capabilities Summary: A ≤ 250-word summary description of the SHEMS service
393　　 provider's DR capabilities/services shall be submitted. In this summary, EPA recommends noting the
394　　 following, as applicable:

395　　 a) DR services that the SHEMS has the capability to participate in such as load dispatch, ancillary
396　　　 services, price notification and price response.

397　　 b) Whether individual installations can be directly addressed via the interface specification, API or
398　　　 similar documentation, rather than the service provider managing groups as a whole.

399　　 c) Support for locational DR, e.g. to ZIP code(s), feeder(s), or other locational groupings.

400　　 d) Feedback about DR response: e.g. verification/M&V, override notification.

401　　 e) Measures to limit consumer comfort impacts, if any.

402　　 f) DR response configurability/flexibility by the consumer and/or DR program.

403　　 g) Whether any device in the SHEMS complies with the 2016 California Energy Commission Title
404　　　 24, Part 6 Joint Appendix 5.

> **Note:** One stakeholder recommended EPA require that service providers provide specific information
> about use of their systems for demand response (DR), rather than recommending such reporting. This
> information includes protocols to address DR requests to the SHEMS, and whether this can only be done
> through the service provider's cloud. The stakeholder indicated that this specific information is needed to
> verify that SHEMS meet the requirements of the specification, and for utilities and aggregators to know
> how useful the SHEMS will be to them. EPA has added section 4.4C) Capabilities Reporting above to
> indicate the Demand Response information that partners will be expected to submit during the
> certification process in addition to the capabilities summary.

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413　**4.5 Field Performance:**

414　To maintain certification and facilitate evaluation, service providers shall demonstrate SHEMS
415　performance in the field by reporting aggregated statistical data every six months to the ENERGY STAR
416　program according to the ENERGY STAR SHEMS Method to Determine Field Performance.
417
418　The platform must be capable of collecting certain data from each installation. This includes but may not
419　be limited to:
420　　 • Each installation shall have a unique ID independent of its evolution over time;
421　　 • Start and end date of service;
422　　 • Information about devices attached to the platform, including the total number, how many lighting
423　　　 and thermostats are ENERGY STAR certified, and the number of smart outlets connected;

424   •   The number of away hours each week of each trigger type named in section 4.1C);

425 *Note:* Field data will be submitted to an EPA contractor. EPA will only have access to anonymized data,
426 will only share aggregated and anonymized general information publicly, and will refrain from sharing
427 non-anonymized data publicly without further stakeholder discussion. Further, EPA will neither collect nor
428 share any customer-specific data.

429 **Note:** EPA has included the permanent note above and clarified that the number of away hours of each
430 type refers to the event trigger type. EPA welcomes feedback regarding this clarification.

431 5   TEST REQUIREMENTS:

432 A) Assure that the application associated with the package delivers the required service capabilities with
433   a representative package containing the required minimum devices;

434 B) Software updates: Software and firmware updates may not adversely affect product savings.
435   Software or firmware changes that alter the principle that savings rest upon, or which are expected to
436   reduce savings, require recertification of the SHEMS.

437 C) Significant Digits and Rounding:
438   a) All calculations shall be carried out with directly measured (unrounded) values.

439   b) Directly measured or calculated values that are submitted for reporting on the ENERGY STAR
440   website shall be rounded to the nearest significant digit as expressed in the corresponding
441   specification limit.

442 D) Test Methods: the following methods shall be used to demonstrate ENERGY STAR certification.

443   **Table 2: Test Methods for ENERGY STAR Certification**

ENERGY STAR Requirement	Applies to	Test Method Reference	Sample Size
Standby State Power	Non-ENERGY STAR lighting control and plug load devices	IEC 62301, Ed. 2.0, 2011-01, Household electrical appliances – Measurement of standby power, subject to clarifications in section 5E).	One unit
Network Connected Standby or Idle State Power	SHEMS hubs	Test instructions in section 5F).	One unit
SHEMS Field Performance	SHEMS Package	ENERGY STAR SHEMS Method to Determine Field Performance, V1.0	A minimum of 30 installations

444 **Note:** One stakeholder expressed support for the testing requirements and suggested a few
445 modifications: removing the term "energy harvesting," which is not defined, and testing not the lowest
446 power state but the idle state which the device would enter in most use cases. EPA considered this
447 suggestion but is opting to maintain standby power requirements for which there exist easily-implemented
448 test methods that are known to give comparable results for different products.

449 Several stakeholders expressed confusion regarding which entity would perform the idle and standby
450 power testing. EPA requires all testing for ENERGY STAR products to be performed by accredited or
451 supervised laboratories, which applies to the device standby/idle power limits in the SHEMS specification.
452 If you are interested in this process, please visit www.energystar.gov/3rdpartycert for more information. In
453 Draft 2, EPA has clarified that the component devices will be tested in a laboratory and not as they are
454 installed in homes and has removed the term "energy harvesting".

455 EPA has made small clarifications to the requirements and test methods above to ensure that testing
456 requirements are clear. These clarifications include moving the requirement to assure that the application
457 associated with the package delivers the required service capabilities – with additional clarification "with a
458 representative package containing the required minimum devices;" to the top of this section where it was
459 mistakenly only included under the hub testing in Draft 1. EPA has also added sample size to the table to
460 indicate the number of units of each model which must be procured for testing.

461 EPA welcomes feedback regarding the clarity of this table.

462 E) Implementation of IEC 62301 for non-ENERGY STAR Device Testing

463 *Note: This test is not applicable to devices that are powered solely by batteries or are otherwise not*
464 *powered by a direct source.*

465 a) Configure and provision the Device's connected functionality, including enrollment for applicable
466 services and updating to latest version of firmware.

467 b) Test Conduct – Measure energy consumption at the power input to the Device using the sampling
468 method, section 5.3.2 of IEC 62301, Edition 2.0 2011-01.

469 (1) Verify ability to control the device over the communication link and operate the device
470 according to its intended function. For example, turn a smart light switch on and then off, or
471 operate a smart plug with a lamp plugged in.

472 (2) Set the device to its lowest power state, then close all apps and web interfaces.

473 (3) Wait five minutes, while taking appropriate measures to allow the device to enter into and
474 remain in standby mode for the duration of the test, e.g.

475 • No additional device-user interactions,
476 • Ensure occupancy sensing devices do not detect occupancy,
477 • Ensure apps and-or web remote interfaces remain closed.
478 • Separately measure and record average energy consumption over a five-minute period.

479 (4) Check measurement stability in accordance with IEC 62301, Edition 2.0 2011-01, section
480 5.3.2.

481 (5) If stability criteria are not satisfied, repeat the test, starting from step 2. b, with the test period
482 extended in five-minute increments (i.e. 10m, 15m, 20m…) as necessary to establish
483 requisite measurement stability.

484 (6) Once stable, repeat the test over two additional test periods, starting from step 2. b.

485 (7) Record energy consumption as the average over the second and third test periods.

486 F) Configuration and testing of hub for network idle energy consumption:
487 a) Follow included instructions to connect all required devices for SHEMS to the hub;

488 b) The following procedure shall be used for measuring the idle power:

489 (1) Reset the power meter (if necessary).

490 (2) Begin recording elapsed time.

491 (3) After 5 minutes have elapsed, set the meter to begin accumulating true power values at a
492 rate of greater than or equal to 1 Hz (1 reading per second).

493   (4) Accumulate power values for 5 minutes and record the average (arithmetic mean) value
494   observed during the 5-minute period.

495   (5) Record measurements in the test report.

6 EFFECTIVE DATE

497 The ENERGY STAR SHEMS specification shall take effect when it is complete. To certify for ENERGY
498 STAR, a SHEMS package shall meet the ENERGY STAR specification in effect on the date it is offered to
499 consumers.

500 **Note**: Stakeholders expressed some confusion regarding when a package is certified and the version of
501 the ENERGY STAR specification to which packages are certified. A package is certified once an EPA
502 recognized certification body confirms that a partner's package meets the specification. When the
503 specification is updated to a new version such as Version 2.0 partners must recertify to maintain
504 certification of their package, which may or may not require retesting.

7 FUTURE CRITERIA REVISIONS

506 EPA reserves the right to change the specification should technological and/or market changes affect its
507 usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the
508 specification are arrived at through industry discussions. In the event of a specification revision, please
509 note that the ENERGY STAR certification is not automatically granted for the life of a SHEMS package.

510 Several topics that are likely to be examined in ongoing work and/or in future revisions have been
511 identified.

512 A) EPA intends to use field data and feedback from service providers and other stakeholders to develop
513   a performance level, to enable a more stringent performance requirement and delivered energy
514   savings.
515 B) EPA will continue to monitor technology development and consider reduction of device standby
516   power to better reflect best practices.
517 C) If occupancy detection methodology or any other key factors indicates substantial variance among
518   certified packages, EPA may consider including requirements to ensure ENERGY STAR SHEMS
519   packages effectively use occupancy detection methods that are proven to deliver more energy
520   savings.
521 D) EPA will continue to monitor the development of industry-developed communications standards for
522   security or communications platforms for passing certain information between devices or the cloud
523   and reference in future revisions those that have broad usage and are demonstrated to be of high
524   quality.
525 E) EPA will monitor the market for helpful specific device control strategies or algorithms to reference,
526   e.g. to support time of use pricing models.
527 F) EPA will explore the services of distributing Demand Response signals (including prices) and of
528   collecting energy reporting data as these are also key to reaching our energy, cost, and climate goals.
529   Future specifications may have additional capability requirements for these services. Energy
530   Reporting is the principle that all (communicating) devices should keep track of their own energy use
531   (via measurement or estimation) and be able to report that data to the local network.

532 G) EPA will assess if other services or devices are of sufficient relevance to our energy goals to also
533   bring into consideration for this specification.

534 H) Home Performance eXtensible Markup Language (HPXML) is a data interchange standard for home
535   performance, including information about the physical structure and the appliances and systems in
536   the structure, including such items as the number of ENERGY STAR certified light fixtures. Its intent
537   is to make home energy raters' jobs easier, by facilitating entry of such information into disparate

538 modeling and tracking systems. In addition, it can be used to feed information to realty databases.
539 There are several ways that SHEMS service providers might interact with HPXML. EPA believes they
540 bear investigation and intends to explore this after Version 1.0 is complete. For more information on
541 HPXML, see http://www.hpxmlonline.com/overview/.

542 I) Since most systems and devices popular in operation today rely on Wi-Fi connection and cloud
543 integration for basic functionality, EPA seeks solutions for a centralized way to recover connectivity
544 among devices when Wi-Fi changes, so you just have to update the Wi-Fi info on a central controller
545 and it then updates that info on all devices connected to the system.

546 J) EPA is interested in standardizing the frequency and accuracy with which device-level energy data is
547 reported to SHEMS and is further interested in identifying and encouraging best practices for
548 representing this data to users.

549 **Note:** Three stakeholders requested that EPA consider lowering standby limits after collecting more
550 market data. One stakeholder suggested EPA set standby limits for Hubs. In response to stakeholder
551 suggestions, EPA has added items to consider in future revisions. In regard to setting network connected
552 standby or idle power limits for hubs, or evaluating cloud-based services against them, EPA believes it is
553 best to monitor hub standby at this time. Accounting for the cloud energy used for home energy
554 management is beyond the scope of this specification development.

555 One stakeholder requested that EPA explore integrating with HPXML. After extensive discussion, it was
556 clear that there were no immediate opportunities that made sense to include at this time. EPA appreciates
557 having HPXML brought to its attention and looks forward to further discussions for future specification
558 versions.