



ENERGY STAR® Pool Pumps Connected Functionality Discussion Document August 2012

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9 On November 29, 2011, the U.S. Environmental Protection Agency (EPA) released a Residential Pool
10 Pumps Framework Document noting interest in promoting and encouraging smart grid connected
11 functionality in pool pumps, as EPA believes it is a feature that will be of great interest to utilities and
12 consumers. It is important to EPA that ENERGY STAR products be future-oriented and flexible. At a
13 basic level, smart grid functionality involves the capability to receive, interpret and act upon certain
14 demand response signals. EPA is interested in highlighting products with connected functionality on the
15 ENERGY STAR Qualified Product List (QPL), so that consumers, rebate program administrators and
16 other interested stakeholders are better able to identify and advance those products into the marketplace.
17 Given the value proposition ENERGY STAR represents for consumers, EPA believes the connected
18 functionality in an ENERGY STAR qualified product should enable utility direct load controls as well as
19 more consumer oriented functionality. This discussion document details our initial thoughts on potential
20 additional requirements that pool pumps would need to meet to be recognized as 'Connected' on the
21 ENERGY STAR QPL.

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23 Along with the release of the Draft 1 Version 1.0 specification for Pool Pumps, EPA and the U.S.
24 Department of Energy (DOE) have developed this ENERGY STAR Pool Pumps Connected Functionality
25 Discussion Document to engage stakeholders in further discussions regarding the development of
26 potential connected functionality criteria and a testing procedure. When a final set of connected
27 functionality criteria are developed, EPA intends to incorporate connected functionality criteria into the
28 ENERGY STAR Pool Pumps specification. The timeline for finalizing the connected functionality criteria
29 is independent of the specification development timeline and will continue even as the pool pump
30 specification is completed, though the initial goal is to create criteria for release with the Version 1.0
31 specification, which is scheduled for completion in January 2013.

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33 EPA will host a conference call on **September 28, 2012** to discuss the ideas and strategies presented in
34 this document with stakeholders. Written comments are also welcome and should be submitted to
35 poolpumps@energystar.gov no later than **September 25, 2012**.

36 37 38 **Framework Document Feedback**

39 On November 29, 2011, EPA released a Residential Pool Pumps Framework Document prompting
40 stakeholders to provide information to EPA on connected functionality and the potential feature set
41 including demand response, load control, consumption reporting, and remote management.

42
43 The following are the main issues on which EPA received comments from stakeholders:

44 45 ***Programmatic Framework***

46 EPA received feedback that it would be challenging for the ENERGY STAR program to properly address
47 smart grid and connected functionality. Primary concerns raised included that the technologies are not
48 yet present and proven in the market place as typically required by ENERGY STAR, smart grid does not
49 necessarily provide direct energy saving benefits to the consumer, and there is no mechanism in the
50 industry to test and verify the claimed benefits.

51
52 EPA believes that by engaging stakeholders early in the development process, the ENERGY STAR
53 program can play a key role in facilitating and accelerating market adoption of connected products. EPA
54 and DOE are currently in the process of developing connected functionality criteria and testing
55 procedures for Residential Climate Controls, Refrigerators/Freezers, and Room Air Conditioners.
56 Connected functionality feature sets are crafted on a per product basis to include a balance of both near-
57 term direct consumer benefits, and longer term, broader, societal, and grid benefits. For connected pool
58 pumps, near-term direct consumer benefits include communications to enable home energy management

59 functionality, remote management, and scheduled operation to increase convenience and to tailor
60 operation to periods of low cost.

61
62 EPA proposes that qualified pool pump products meeting the connected functionality criteria would be
63 recognized as 'Connected' on the ENERGY STAR QPL, so that they can be easily identified by
64 consumers and interested utilities. EPA plans to initially qualify products based on literature reviews until
65 a connected functionality test procedure is available. EPA also seeks to promote open access and
66 interoperability in products with connected functionality through the use of standards-based
67 communications and the release of Application Programming Interfaces (APIs). EPA looks forward to
68 working with stakeholders to develop connected functionality criteria for pool pumps, as well as education
69 materials on the associated benefits.

70 71 **Standards and Definitions**

72 EPA received comments from stakeholders that connected functionality is not well defined in the market
73 place and is lacking standardization.

74 EPA recognizes that the lack of standardization is a barrier to entry for many manufacturers and believes
75 the ENERGY STAR program can play a role in helping to encourage adoption of open standards through
76 ENERGY STAR recognition. Specifically, EPA is considering a requirement that products with connected
77 functionality include a standardized modular communication interface (MCI) that uses only standards-
78 based open communications for the MCI. Products that meet these criteria are likely to enable low-cost
79 consumer upgradeability for Home Energy Management (HEM) and/or Smart Grid interconnection. EPA
80 may consider more robust criteria in the future as relevant standardization efforts mature.

81 82 **Level of Requirement**

83 Stakeholders commented that connected functionality should not be a requirement for ENERGY STAR
84 qualification.

85 As currently proposed, the Version 1.0 Pool Pump specification allows pool pumps without connected
86 functionality to qualify for ENERGY STAR. EPA is developing optional criteria for ENERGY STAR
87 qualified pool pumps that wish to also be recognized as 'Connected' on the ENERGY STAR website.
88 EPA is interested in feedback on the Agency's plan to recognize connected functionality on the qualified
89 product list and the proposed scope of the connected functionality requirements. EPA's initial approach
90 for incorporating connected functionality into the specification and proposed requirements are provided
91 below.

92 93 **Proposed Connected Functionality Requirements**

94
95 **1. Scope** - Connected functionality criteria will apply to pool pumps capable of multi-speed, or
96 variable-speed operation, and scheduled operation, through the use of controls that are either
97 integrated into and/or sold with the pool pump. Connected functionality will not be a requirement
98 for pool pumps to qualify as ENERGY STAR. However, qualified products that meet all sections
99 of the optional connected functionality criteria will be recognized in the ENERGY STAR Qualified
100 Products List as 'Connected' pool pumps.

101
102 **Note:** Stakeholder feedback indicated that pool controls come in various form factors including integrated
103 controls, integrated but detachable, and external but sold with the pump. EPA's intention is to ensure that
104 this specification acknowledges and includes all ways that controls are packaged and sold with the pump.
105 Comments or feedback on the scope of the connected functionality criteria are welcome.

106 107 **2. Criteria**

108
109 a. Pool Pump Scheduling Capability – the pool pump shall be delivered with consumer
110 configurable scheduling functionality with the following **minimum** capabilities:
111 i. Ability to set a weekday and weekend schedule.
112 ii. Two schedule periods per day.
113 iii. Two speeds available per schedule period
114 iv. On/off capability per schedule period
115

116 **Note:** EPA has proposed these minimum scheduling capabilities as a baseline that will enable the pool
117 pump to automatically perform the bulk of its energy consumptive pumping during non-peak hours or
118 when energy availability and pricing are favorable. It also allows users that need to pump during peak
119 hours to automatically set the pump to run at low speeds during those periods. EPA encourages
120 feedback on this scheduling capability section.

- 121
- 122 b. Peak Period Avoidance – the pool pump controller shall be delivered with a default
123 schedule that limits high speed (above half speed) run-times to outside of the traditional
124 peak load periods of 6 – 10 a.m. and 3 – 7 p.m. The consumer shall be able to modify
125 the default schedule, without limitation.
126

127 **Note:** EPA would like feedback on the impact of setting the as-shipped schedule such that the high speed
128 cleaning occurs outside of two peak load periods – a winter morning peak load period and a summer
129 evening peak load period. Limiting high-speed cleaning to outside of the morning winter peak load period
130 may provide both grid and consumer benefits in southern regions that have both a large installed base of
131 pools running year round, and a significant penetration of electrical resistance heating that drives winter
132 peaks on cool mornings.
133

134 Similarly, limiting high-speed cleaning to outside of the evening Summer peak period may provide both
135 grid and consumer benefits in many regions that have late afternoon to early evening peaks driven by
136 residential air conditioning use.

137 EPA is also interested in understanding whether default settings should limit pump operation entirely
138 during these two peak load periods. Stakeholders are encouraged to provide comment on whether this
139 would be a viable option, potential impacts on pool cleaning performance, and any other opportunities for
140 energy savings to the consumer. Stakeholders are also encouraged to comment on how to implement
141 default settings that provide peak load shedding.
142

143 In addition, EPA believes that consumer control is important to ensuring a quality consumer experience,
144 hence the requirement that consumers have the ability to modify the default schedule. EPA welcomes
145 comments or feedback on this specific proposal and any other details regarding consumer interactivity
146 and control over connected functionality features.

- 147
- 148 c. Energy Management – the product shall be capable of recording the following data and
149 settings changes and transmitting them upon request to connected devices external to
150 the pool pump controller. Settings changes shall be recorded when they occur, or at
151 least once every 24-hours, in the absence of change:

- 152 1. Unique ID
- 153 2. All programmable settings, including program schedules
- 154 3. Current operational status (e.g. off, on-low, on-high, RPMs)
- 155 4. Per day run time and gallons pumped (for prior 7 days)
- 156 5. Scheduled Demand Response (DR) and/or load management events
- 157 6. Data representative of the product's 15-minute interval energy consumption,
158 during pumping operation only
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160 **Note:** EPA developed this initial list of data reporting attributes as a starting point based on what is
161 currently offered in the market place and what could benefit the consumer. Stakeholder feedback is
162 encouraged to help develop and refine this list, as well as to discuss any challenges or opportunities there
163 may be when reporting data to a home energy management system. The intent of consumption reporting
164 and energy management functionality is to enable simple, actionable energy use feedback to consumers
165 intended to drive reduced energy consumption and cost savings.
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Note Cont: Consistent with The Green Button Initiative (GBI) <http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/GreenButtonInitiative>, EPA is considering criteria for 15-minute energy consumption reporting in Watt-hours. Stakeholder feedback is requested on the appropriateness of this criterion for pool pumps. In addition, EPA is considering adopting GBI's standardized energy consumption reporting format and asks for stakeholder comments on the applicability of the single data format concept.

EPA acknowledges stakeholder feedback requesting that, in lieu of energy consumption reporting, products be permitted to report real-time power consumption. EPA believes that energy consumption reporting is a better value to report to consumers. Stakeholders are encouraged to provide feedback on standardization efforts for both power usage and energy consumption reporting, and how more flexible criteria might be crafted to allow power consumption reporting without compromising usefulness of the reported data. Also, EPA is looking to minimize data recording as to not drive phantom loads, but is interested in stakeholder feedback as to whether capture of energy consumption data only during pumping operations is adequate to characterize pool pump energy consumption for the consumer.

- d. Remote Management and Load Control – the product shall respond to the following remote control commands from authorized devices or software applications within 5 seconds. This criteria assumes receipt of the signal within 1 second of its transmission:
1. Time Synchronization
 2. Schedule Synchronization
 3. Pump Control (on/off, speed)

Note: EPA recognizes the importance of remote management for consumer convenience, energy management, and interconnection with the Smart Grid. The above criteria are intended to ensure pool pump controllers with connected functionality are able to respond effectively to remote commands, interconnect with the Smart Grid, and synchronize with remote devices and time sources in order to accurately follow programmed schedules. EPA welcomes comments on the remote management and load control section.

- e. Communications – the product shall use a standards-based modular communications interface to enable communications to/from external apps, devices, and systems. Communication module(s) shall be easy to install by the pump operator. EPA requires for all communication layers associated with the modular interface, the use of standards:
- Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,¹ and/or
 - Included in the NIST Smart Grid framework Tables 4.1 and 4.2, and/or
 - Adopted by the American National Standards Institute (ANSI) or another well-established international standards organization such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE), or Internet Engineering Task Force (IETF)
- *EPA may consider more robust criteria in a future revision as relevant standardization efforts mature.

¹ http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

215 **Note:** EPA believes that a standards-based modular communication interface (MCI) will enable open
216 access, interoperability, and low-cost interconnection using standardized modules to support a wide
217 variety of communication protocols. The MCI approach presents an opportunity for different stakeholder
218 groups to leverage connected product capabilities, including utilities and service providers.
219

220 In regards to requiring standards-based communications, EPA has identified and has been tracking
221 standardization activities related to Smart Grid and Home Area Network (HAN) communications.
222 Although Smart Grid standardization activities continue under aggressive timelines, EPA believes
223 standardization has reached a level of maturity to justify requiring it in connected Pool Pumps.
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225 In regards to standardization associated with modular communications, EPA is tracking the Consumer
226 Electronic Association's CEA-2045 draft standard and believes there are significant benefits associated
227 with its use in Connected Pool Pumps, including availability of a modular form-factor that enables
228 consumer-installable communications flexibility, including, wired, powerline communications, and wireless
229 communications. CEA is also developing a certification program for both products that include CEA-2045
230 modularity and for the universal modules that enable communications in these products. The certification
231 program will ensure that certified products demonstrate a required base level of Demand Response
232 functionality. EPA is interested in stakeholder feedback on the suitability of CEA-2045 as well as any
233 other standards-based approaches to modular communications. In addition, EPA is interested in
234 stakeholder feedback on the impacts and benefits of added criteria requiring the MCI communication
235 module be included with the pool pump product at the time of sale (or shortly after) or leaving the port
236 open at the time of sale. Comments and feedback on these communication criteria are welcome.

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- 238 f. Open Access – To enable interconnection with the product for purposes of Energy
239 Management and Load Control, the following shall be made available to interested
240 parties:
- 241 i. Documentation regarding the accuracy of energy consumption reporting; and
 - 242 ii. An interface specification, API or similar documentation, that enables access to
243 the Energy Management and Load Control capabilities described in this section.
244
- 245 g. Information to Consumers – If additional modules, devices, and/or infrastructure are part
246 of the configuration required to activate the product's communications capabilities
247 specified in Section 2c, prominent labels or other forms of consumer notifications with
248 instructions shall be displayed at the point of purchase and in the product literature.
249 These shall provide specific information on what consumers must do to activate these
250 capabilities (e.g. *"This product requires installation of a network module to enable
251 interconnection with the Smart Grid, Energy Management System, and/or with other
252 external devices, systems or applications."*)
253

254 **Product Criteria Verification**

255 Compliance with connected functionality will be made through examination of the product and/or product
256 documentation. Additionally, the demand response functionality will need to be verified using an
257 ENERGY STAR test method that will be developed by DOE. DOE welcomes feedback on any designs,
258 applications, or elements that should be considered in the development of the Demand Response test
259 method process to verify demand response functionality. As with other ENERGY STAR connected
260 products, DOE seeks prototype connected products for participation in its test procedure development
261 process. DOE will be reaching out to manufacturers to begin discussions regarding demand response
262 and test method development.

263 **Comment Submission**

264 Interested stakeholders are encouraged to send written comments to EPA by **September 25, 2012** and
265 attend the stakeholder meeting scheduled for **September 28, 2012** to discuss the connected functionality
266 opportunity in greater detail. All EPA correspondence and specification development documents will be
267 posted to the ENERGY STAR Product Development Web page at www.energystar.gov/newspeccs. In
268 addition, all written comments received by EPA will be posted here unless requested otherwise by the
269 submitter.

270 Stakeholders with questions regarding the specification can contact Christopher Kent, EPA, at (202) 343-
271 9046 and kent.christopher@epa.gov or Erica Porras, ICF International, at (202) 862-2972 or
272 Erica.porras@icfi.com. For test method questions, please contact Ashley Armstrong, DOE at
273 Ashley.Armstrong@ee.doe.gov.