



ENERGY STAR® Pool Pumps Connected Functionality Discussion Document August 2012

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

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

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

Framework Document Feedback

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

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

Programmatic Framework

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

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

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

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

Standards and Definitions

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

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

Level of Requirement

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

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

Proposed Connected Functionality Requirements

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

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

2. Criteria

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

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

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

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

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

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

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

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

1. Unique ID
2. All programmable settings, including program schedules
3. Current operational status (e.g. off, on-low, on-high, RPMs)
4. Per day run time and gallons pumped (for prior 7 days)
5. Scheduled Demand Response (DR) and/or load management events
6. Data representative of the product's 15-minute interval energy consumption, during pumping operation only

Note: EPA developed this initial list of data reporting attributes as a starting point based on what is currently offered in the market place and what could benefit the consumer. Stakeholder feedback is encouraged to help develop and refine this list, as well as to discuss any challenges or opportunities there may be when reporting data to a home energy management system. The intent of consumption reporting and energy management functionality is to enable simple, actionable energy use feedback to consumers intended to drive reduced energy consumption and cost savings.

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

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

In regards to requiring standards-based communications, EPA has identified and has been tracking standardization activities related to Smart Grid and Home Area Network (HAN) communications. Although Smart Grid standardization activities continue under aggressive timelines, EPA believes standardization has reached a level of maturity to justify requiring it in connected Pool Pumps.

In regards to standardization associated with modular communications, EPA is tracking the Consumer Electronic Association's CEA-2045 draft standard and believes there are significant benefits associated with its use in Connected Pool Pumps, including availability of a modular form-factor that enables consumer-installable communications flexibility, including, wired, powerline communications, and wireless communications. CEA is also developing a certification program for both products that include CEA-2045 modularity and for the universal modules that enable communications in these products. The certification program will ensure that certified products demonstrate a required base level of Demand Response functionality. EPA is interested in stakeholder feedback on the suitability of CEA-2045 as well as any other standards-based approaches to modular communications. In addition, EPA is interested in stakeholder feedback on the impacts and benefits of added criteria requiring the MCI communication module be included with the pool pump product at the time of sale (or shortly after) or leaving the port open at the time of sale. Comments and feedback on these communication criteria are welcome.

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

Product Criteria Verification

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

Comment Submission

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