ASSOCIATION OF HOME APPLIANCE MANUFACTURERS

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Via E-Mail

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U.S. Environmental Protection Agency
ENERGY STAR Appliance Program
appliances@energystar.gov

Re: ENERGY STAR Program Requirements Product Specification for Residential Refrigerators and Freezers, Eligibility Criteria, Draft 2, Version 5.0

Dear Ms. Stevens:

On behalf of the Association of Home Appliance Manufacturers (AHAM), I would like to provide our comments on the ENERGY STAR Program Requirements Product Specification for Residential Refrigerators and Freezers, Eligibility Criteria, Draft 2, Version 5.0.

AHAM represents manufacturers of major, portable and floor care home appliances, and suppliers to the industry. AHAM's membership includes over 150 companies throughout the world. In the U.S., AHAM members employ tens of thousands of people and produce more than 95% of the household appliances shipped for sale. The factory shipment value of these products is more than $30 billion annually. The home appliance industry, through its products and innovation, is essential to U.S. consumer lifestyle, health, safety and convenience. Through its technology, employees and productivity, the industry contributes significantly to U.S. jobs and economic security. Home appliances also are a success story in terms of energy efficiency and environmental protection. New appliances often represent the most effective choice a consumer can make to reduce home energy use and costs.

AHAM supports EPA and the Department of Energy (DOE) in their efforts to provide incentives to manufacturers, retailers, and consumers for continual energy efficiency improvement, as long as product performance can be maintained for the consumer. AHAM continues to be concerned about EPA's proposed new approach to setting maximum annual energy use levels utilizing a hyperbolic tangent methodology, which is a significant change.

I. Definitions

EPA proposes a definition for "built-in refrigerator/refrigerator-freezer/freezer." The proposed definition is the same as the DOE definition found in 10 C.F.R. 430.2. AHAM supports inclusion of a definition for built-in refrigerator/freezers, and agrees that the definition should be identical to DOE's definition. But EPA should cite to that definition, as well as all other

definitions that are identical to DOE's definitions, instead of copying and pasting it into the specification. Citation to definitions is the best way to ensure consistency and harmonization with DOE definitions at all times—it ensures that as DOE definitions change, ENERGY STAR definitions also change to mirror them. To achieve consistency, the relevant definitions must be identical to each other at all times. Without such consistency and uniformity there will be significant confusion for manufacturers and for consumers. Furthermore, it is illegal for manufacturers to make energy representations based on anything other than DOE's applicable test procedures and regulations. For these reasons, EPA should simply cite to these definitions rather than attempt to restate them in the specification. Stating anything in addition to or different from DOE's regulations may, intentionally or unintentionally, change the meaning of those regulations, which are the foundation of the ENERGY STAR specifications.

II. Qualification Criteria

A. Hyperbolic Tangent Approach and Functional Adders

EPA proposes to set qualification criteria for refrigerator/freezers in Version 5.0 using a hyperbolic tangent approach. In addition, EPA stated that it also plans to set qualification criteria in Version 6.0 using the hyperbolic tangent approach. EPA also proposed functional adders for products with through-the-door ice service and for some built-in products.

AHAM strongly opposes the hyperbolic tangent approach—it is a costly and unnecessary change from the current approach under which EPA sets maximum annual energy use based on a percentage more efficient than the federal standards. DOE, through its lengthy, thorough, and long-existing rulemaking process for appliance efficiency standards, has established separate product classes and standards for good reasons. And DOE's regulations implement Congressional intent. DOE's standards are and should be the foundation for the ENERGY STAR program. EPA cannot use an approach that would vary from the approach DOE takes to regulating covered products. To do so ignores the extensive analysis DOE has done to formulate standards for those products which includes a careful balancing of energy savings, consumer choice, product functionality, and manufacturer burden per the National Appliance Energy Conservation Act of 1987 (NAECA). EPA's reliance on the fact that the ENERGY STAR program is "voluntary"—a claim that becomes less viable as the program becomes more successful, and a claim about which Congress has signaled its reservations when it enacted 42 U.S.C. § 6294a(c)(7) in 2005—does not permit this departure. In that enactment, Congress declared that, while voluntary, the program's purpose is to promote "products . . . that meet the highest *energy conservation standards*." U.S.C. § 6294a(a) (emphasis added). In employing the hyperbolic tangent approach to determine qualification levels, EPA has effectively ignored the energy conservation standards DOE established under NAECA.

In addition, the hyperbolic tangent approach disfavors some units that comply with DOE standards. Nowhere in the 2005 enactment did Congress recognize EPA's authority to set qualification levels that ignore or undermine DOE's determination as to products that provide consumer utility. The ENERGY STAR program should remain squarely focused on encouraging private-sector innovation for energy efficiency. As we have previously commented, AHAM opposes treating larger models differently than other products. And the hyperbolic tangent will

do just that. It will also limit consumer choice rather than "enhance public awareness of the Energy Star label . . . [and] preserve the integrity of the Energy Star label." 42 U.S.C. §§ 6294a(c)(2), (3). It is not EPA's role, even in a "voluntary" program, to set design requirements for products.

Furthermore, the hyperbolic tangent approach adds significant and unnecessary complexity to an already complex regulatory agenda for refrigerator/freezers and interferes with manufacturers' product design required to comply with DOE's 2014 standards. Moreover, setting ENERGY STAR levels for 2013 and 2014 and ensuring, upon the change in the federal standards in 2014, that there is no increase in the stringency of the ENERGY STAR levels and that the levels account for changes to measured energy in the new test procedure, will be near impossible if EPA adopts the hyperbolic tangent approach. EPA has not yet developed a crosswalk to a hyperbolic tangent curve for 2014, which, given normal product development timelines, is essential to ensure a fair, accurate, and predictable impact across the industry. Any hyperbolic tangent curve created for 2014 could not be based on previous data due to the implementation of the new test procedure. Add to this the confusion consumers will experience in comparing pre-2014 products to models manufactured to meet the 2014 standards.

Accordingly, AHAM strongly opposes a hyperbolic tangent approach for Versions 5.0 and 6.0. EPA should instead return to a percentage increase approach, which will minimize the already daunting cumulative regulatory burden and uncertainty being placed on refrigerator/freezers.

Under a percentage increase approach, there is no need for functional adders for through-the-door ice service. DOE has already accounted for through-the-door ice in its standards for product classes that include through-the-door ice. EPA is introducing unnecessary complexity with the proposed hyperbolic tangent approach which then requires various adders to do what DOE has already done in the standards. Instead of trying to replicate DOE's conclusions, EPA should use DOE's standards as the foundation for the ENERGY STAR criteria, just as it always has done. This would eliminate the need for complicated functional adders for through-the-door ice service.

EPA also proposes to incorporate an adder for refrigerator-freezers classified as built-ins. AHAM fully supports the incorporation of a built-in adder, even under a percentage increase approach. In DOE's recent final rule setting new refrigerator and freezer energy efficiency standards for 2014, DOE recognized the unique consumer utility provided by built-in products, as well as these products' additional technical challenges to achieve continuing increases in energy efficiency. Built-in refrigeration products have inherent functional differences from conventional free-standing products. These lead to lower efficiency, or higher energy consumption, for built-ins with comparable insulation, refrigeration system components, and structural characteristics as their free-standing counterparts. The unique consumer utility and the technical challenges in achieving continuing increases in energy efficiency should be addressed in the Version 5.0 and Version 6.0 ENERGY STAR specifications. An adder for built-ins in Versions 5.0 and 6.0 is consistent with DOE's analysis for the 2014 standards.

In addition, AHAM asks that EPA grant adders for built-in all-refrigerators and for built-in freezers. Built-in all-refrigerators and built-in freezers received unique equations for the 2014

standards. The inherent functional differences from free-standing products outlined above exist not just with regard to the built-in refrigerator-freezers for which EPA proposed an adder, but also with regard to built-in all refrigerators and built-in freezers. Accordingly, there is no reason why EPA should not allow an adder for those products, as well. That adder should be different for built-in freezers than for built-in all-refrigerators because the proposed changes to upright and automatic defrost freezer criteria are, as a percentage, the most stringent EPA proposes. As we have previously commented, issues with meeting these stringent ENERGY STAR levels prior to 2014 will be difficult and, for built-in freezers, the issues are compounded.

B. Five Percent Connected Allowance

EPA proposes a 5% allowance for smart appliances. We strongly support the 5% allowance for smart appliances as outlined in our petition with efficiency advocates and environmental and consumer groups. The ENERGY STAR program will be a stronger and better program into the future as it recognizes the benefits of smart appliances and its efforts to jump start the development of the Smart Grid. The purpose of the 5% allowance for smart appliances is to give a percentage allowance to appliances if they meet the threshold for connectivity. Thus, if a unit as a whole achieves connected status, it should obtain the 5% allowance not just a 5% allowance for the base model of that unit. The original intent behind the 5% connected allowance was to be an adjustment incentive for Smart Grid enabled appliances as a whole. AHAM continues to strongly recommend that the connected allowance be a percentage adjustment for the whole unit including any adders as illustrated in Equation 2 below.

Below are the recommended changes for the adjustment of the 5% connected allowance.

1) Qualification Criteria:

A. Energy Use Requirements

a. Annual Energy Consumption (AEC) shall be less than or equal to Maximum Annual Energy Consumption (AEC_{MAX}), as calculated per Equation 1.

Equation 1. Calculation of Maximum Annual Energy Consumption Requirement

$$AEC_{MAX} = AEC_{BASE} + \sum_{i=1}^{n} AEC_{ADD\_i}$$

where,

AEC_{BASE} *is the annual energy consumption base allowance, per Table 1; and*

$AEC_{ADD\ i}$ *is an annual energy functional adder, per Table 1*

Equation 2. Calculation of Maximum Annual Energy Consumption Requirement with 5% Connected Allowance.

$$AEC_{MAX}^{Connected} = 1.05(AEC_{MAX})$$

where,

$AEC_{MAX}^{Connected}$ *is the annual energy consumption base allowance with 5% Connected allowance*[1].

C. Significant Digits and Rounding

EPA proposed revised language for significant digits and rounding in part 3.C of Draft 2 of the specification. The proposed language is an attempt to harmonize with DOE's regulatory requirements for refrigerator and freezer rounding procedures. AHAM agrees that significant digit and rounding procedures should be harmonized with DOE's regulatory requirements. But harmonization is not enough—EPA's requirements must be identical to DOE's requirements. Thus, it would be better for EPA to simply cite to the requirements in 10 C.F.R. 430.23 rather than to restate them in the specification.

It is illegal for manufacturers to make energy representations based on anything other than DOE's applicable test procedures and regulations. Accordingly, EPA need only state that qualification for ENERGY STAR must be based on the values reported to DOE in the manufacturer's certification report and appearing on the FTC EnergyGuide label. That approach will not only provide clarity and consistency for regulated parties, but also for consumers who will see the same values on the EnergyGuide label and ENERGY STAR Qualified Product List. If EPA believes that clarification on significant digits and rounding are required, it should address that concern with DOE, and DOE should issue guidance if it determines guidance is necessary after consulting with stakeholders. EPA cannot unilaterally clarify DOE's regulations through an ENERGY STAR specification. Stating anything in addition to DOE's regulations may, intentionally or unintentionally, change the meaning of those regulations, which are the foundation of the ENERGY STAR specifications.

AHAM understands that there may be some confusion about the concept outlined in 3.C.d. In order to address that confusion, it appears EPA is restating DOE's regulations in different language. Instead, if EPA wishes to specifically highlight the requirements regarding the nearest significant digit, it should instead cite the DOE regulation and then, if it deems necessary, follow it by quoting exactly DOE's language to provide additional clarity.

III. Connected Product Criteria

EPA proposes that products that meet the proposed criteria in Section 4 of the specification would be eligible to earn a 5% allowance. The allowance is intended to serve as an incentive to help jump start the market for refrigerators with smart grid functionality. AHAM strongly supports EPA's decision to incorporate smart grid functionality and to provide a 5% allowance consistent with the Joint Petition from industry, efficiency advocates and environmental groups. AHAM has made recommendations for changes provided in track changes format to Section 4 of the draft specification which is attached and further explained below. (Attachment I).

[1] Product must be qualified using the final and validated "connected" test procedure to use the allowance.

A. Section 4

The first paragraph of Section 4 provides an overview; however, additional language is needed for clarification on the discussion for the system under consideration. AHAM proposes to include the following in order to define the system boundaries: "The connected refrigerator is an appliance that provides all the necessary hardware and software for communications." For further clarification, below is a diagram to illustrate the connected refrigerator system boundaries.

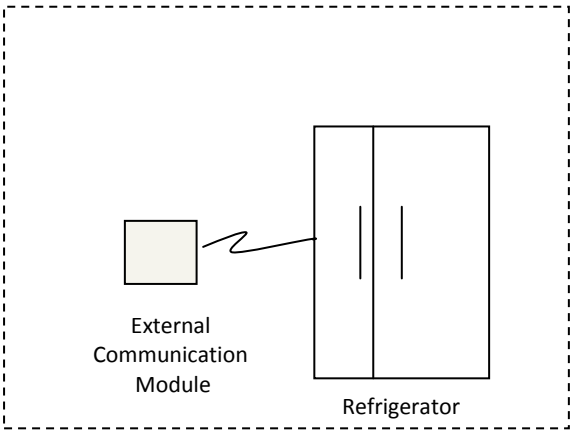
Possible
Connections
for
Connected Refrigerator
System

Internet
Router

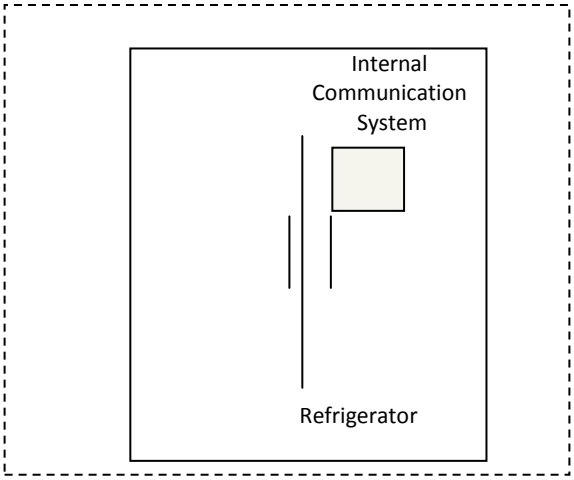
Smart
Meter

HEM

Connected Refrigerator System might get information from one or more of these typical connection devices



Connected Refrigerator System with external comms



Connected Refrigerator System with internal comms

i. *Section 4.A*

EPA proposes to title this section "Home Energy Management (HEM) Functionality." This title is confusing. When defining the system boundaries as above, it should not be the intent to include home energy management functionality in this standard, only the ability to connect and communicate with a home energy manager external to the system under consideration. A more accurate title might be "Connectivity to Support Home Energy Management."

ii. *Section 4.A.1*

EPA proposes language stating "the data shall represent energy consumed by the product in watt-hours for intervals of 15 minutes or less." AHAM supports the clarification regarding when updates should occur and propose the following additional language: "The data shall represent energy consumed by the product in watt-hours for update intervals of 15 minutes or less per manufacturer specifications." Manufacturers can best determine the calculations based on the frequency of the measurement.

For further clarification, power feedback can be provided on the product itself without transmitting and this provides flexibility to manufacturers. Transmission should therefore not be a requirement of the specification.

B. Section 4.B—Delay Defrost Capability

EPA proposes to include two 4-hour peak load periods for the delay defrost capability. The second peak is not necessary as the product provides the capability to move the peak time as needed. A second peak doubles the restricted time when defrost can occur in a 24-hour period and eliminates one-third of a day that is available to defrost. A larger window for defrost provides for more randomization and better grid response. Manufacturers have indicated four hours per day is the maximum defrost that should be automatically deferred without impacting performance and reliability of the product. Two peaks create an eight hour delay problem—one third of the day would be walled-off from defrost. This is an unacceptable result.

If a more customized approach is desired for each region, it would be preferable for the utility to incentivize consumers to make adjustments to their local needs through real time pricing structures.

This section also needs additional clarification on the interface between Section B and Section C. The delay defrost capability identified in Section B must be disabled in order for the product to respond to a signal as identified in Section C for demand response. The specification should provide explanation regarding interaction between these two capabilities. If section B is not disabled when a signal comes in per Section C, then there could potentially be twelve hours per day unavailable for defrost.

EPA proposes to include a 24 hour clock requirement for the product in the specification. The 24 hour clock requirement and peak shifting input interfaces is driving unexpected costs into the

product (clock, battery, etc). If some level of connectivity is assumed, the system can read time after the outage. This assumed level of connectivity should be clarified in the specification.

In the event of a power outage, the product would go back to default settings and the consumer would have to set the clock if the product has one. The consumer must have some reasonable level of interaction with the product to accommodate this feature.

C. Section C

i. *Section C.1.a.ii*

EPA proposes language in this section to remove the option to shift ice maker energy. The original intent for the 13% energy reduction was to provide an additional option to allow product without ice-making to meet the requirements of the specification, not to be a replacement for the delay of ice-making. Prior studies have shown that the average energy consumption to make ice fully aligns with this 13%, but the amount varies from household to household and product to product; therefore, AHAM strongly urges EPA to add ice-making back into the specification as is the original intent of the petition and how the Pacific Northwest National Lab study in this area assumed would occur.

ii. *Section C.1.b*

EPA proposes to include language that "the product is not required to respond if the product is defrosting when the signal is received and the signal requests a load reduction start time that is less than 10 minutes from the time the signal is received." This sentence is confusing and needs clarification.

We support the exception to ensure that a defrost cycle is not interrupted by a delay load signal in the middle of a defrost cycle. However, the duration of a defrost cycle varies depending on type of refrigerator and on conditions of the evaporator coils. Therefore, the exception cannot specify a time to ensure a defrost cycle is not interrupted by a delay load signal. It should specify the state of the defrost cycle. Changes to the specification have been made recommending an alternative way to phrase this exception (Attachment I). AHAM proposes the following language: "the product is not required to respond to a delay load signal if the signal requests the delay load period to begin while the product is defrosting."

D. Section D.1—Communications, Open Access, and Information to Consumers

AHAM proposes that "Connected Product Criteria," should utilize standards that have been reviewed under the Smart Grid Interoperability Panel (SGIP) process and judged acceptable by the manufacturer. Other open, non-proprietary standard development organizations should also be utilized. The SGIP is an open and collaborative process among major stakeholders for the smart grid coordinated by the National Institute for Standards and Technology (NIST) and includes a rigorous process for review. Standards that do not meet this level of review through an open process should not be included in this specification. In addition, AHAM proposes

adding text to 4D(1) to clarify that in the case of modular communications, this recommendation applies only to the communications functionality external to the system, as defined in Section 4.0, and not to the interface between a communications module and its associated host appliance.

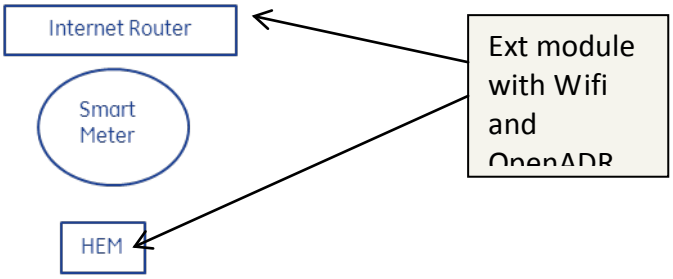
EPA proposes, in Section D.1, to provide an exception to providing a modular interface for demand response functionality which is confusing and the intent for the exception is not clear. By providing the exception, the language in the specification seems to indicate that if the interface is compliant with any standard from the listed organizations (NIST, ANSI, ISO) the module itself is not necessary. This approach is not consistent with the intent to provide the consumer with a product that is operational upon receipt. Such an approach is very limiting and may not enable communications with a HEM thus disabling Sections 4A & 4D and potentially impact 4B based on the architecture selected by the manufacturer (see diagram).

AHAM has always supported the use of open protocols and supported the use of standards developed through the SGIP process and welcome the other standards bodies provided in the specification. AHAM has evaluated the use of U-SNAP (current being integrated into CEA 2045) module for application to appliance products and the industry has declined to use the product for reasons related to consumer confusion and additional costs (which would include societal costs if utility provides the module). Please reference the AHAM paper titled "Assessment of Communication Standards for Smart Appliances: the Home Appliance Industry's Technical Evaluation of Communication Protocols" completed in October 2010 and the diagram below.

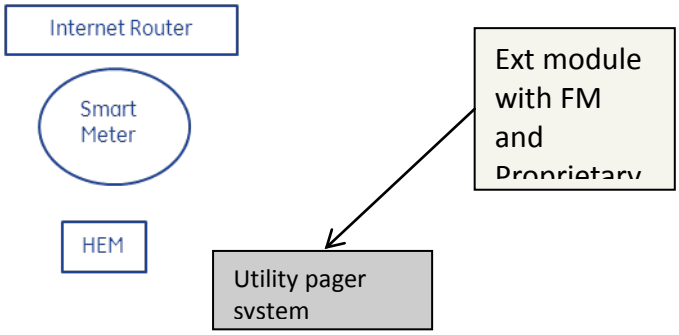
The CEA Modular Communications Interface should be approved by the SGIP to ensure interoperability as would be required for all other standards. EPA should not take on the role and responsibilities of the SGIP and its collective expertise in this area.

This diagram illustrates an original product design with Wifi and OpenADR versus replacing in the lower diagram with a module utilizing FM and proprietary protocols for which the product was not originally designed. Per EPA's definition in Section 4.D. a device can provide a communication method to enable 4C that is no longer compatible with 4A, B, or D.

Original design complies with Section 4A, 4B, 4C and 4D



By swapping out the module required to one that meets the minimum specified by 4C, it is possible to no longer be compliant with Section 4A, 4B and 4D
4A – cannot talk to HEM
4B – can't get time from internet
4D – remote no longer possible by original architecture…



i. *Section D.1.a*

EPA proposes to subtitle this section "HEM" under "Communications." However, this subtitle is confusing. It should not be the intent to include home energy management functionality in this standard, only the ability to connect and communicate with a home energy manager external to the system under consideration. A more accurate title might be "Support for Home Energy Management" or "Connectivity with Home Energy Manager".

IV. Effective Date

EPA proposes an effective date for Version 5.0 of January 1, 2013. The effective date must allow for the statutorily required 270 day lead in period prior to the effective date of this significant revision. (*See* 42 U.S.C. 6294a(c)(7)). That lead-in period is critical to allow manufacturers enough time to design, manufacture, market, and distribute products that meet the new specification. (*Id.*). The lead-in period is especially important for the ENERGY STAR

version that will introduce smart capabilities, where significant customer and consumer education will be required.

V. Future Specification Revisions

EPA states that it "is planning to review and revise the refrigerator and freezer specification in 2013 to develop new levels, where necessary. It is anticipated that these levels could become effective in September 2014, harmonizing with the timing of DOE's new standards for residential refrigeration products. . . EPA will . . . consider levels for a Version 6.0 specification through a subsequent specification development process, allowing additional time for consideration and discussion with stakeholders on efficiency opportunities beyond the 2014 standard levels."

AHAM agrees that EPA should use a separate specification revision process to revise the qualification criteria to account for the 2014 standard levels. There are, however, significant timing issues that must be addressed.

The magnitude of the change to the standards and test procedure in 2014 is the biggest it has been since energy labeling began. The work is not just on the part of manufacturers, but trade partners as well. The required change is very difficult to accomplish during the peak buying season, which is the summer months (roughly April through September, but it may vary) because of production schedules and promotions, as well as other factors. The fact that the transition will occur during this period (September 2014), only further increases the magnitude of the change.

In an attempt to minimize unnecessary and costly duplicative requirements, AHAM has sought permission from DOE to allow for the option of testing and rating models under the new test procedures and standards beginning on or after January 1, 2014. There will also be coordination required with FTC regarding labeling. In the event DOE grants our request for early compliance, EPA should facilitate the ability to comply early with the Version 6.0 levels and closely coordinate this early compliance with the DOE's and the FTC's efforts in this area.

Although we appreciate that EPA encourages early compliance with its specifications (i.e., allows compliance as soon as the specification is published), that will not be enough in this case. In order to design, manufacture, and market products by January 1, 2014, that are capable of meeting the revised standards, and also the ENERGY STAR requirements, manufacturers will need to know what the Version 6.0 qualification criteria will be prior to the January 1, 2014, date. If EPA does not finalize its Version 6.0 requirements until that time, manufacturers may not be able to design products to meet those requirements, resulting in lost energy savings. Accordingly, we request that EPA publish a final specification for Version 6.0 by about April 2013, which gives EPA, DOE, and stakeholders one full year to work out the details of that specification. We encourage EPA and DOE to exercise their statutory discretion to provide more lead time in order to "tak[e]into account the timing requirements of the manufacturing, product marketing, and distribution process" for refrigerator/freezers. These products are under significant cumulative regulatory burden over the next several years, including the Version 5.0 specification which will go into effect only a little over a year before EPA proposes to initiate a

second revision to the specification. (*Id.*). EPA and DOE can, and should, help to mitigate that burden by providing extra lead time for the Version 6.0 specification.

We would like to work with EPA and DOE closely on these important implementation issues.

VI. Draft Test Method to Validate Demand Response, Rev. Feb-2012

A. Section 3—Definitions

DOE proposes to define a "Utility Equivalent Communication Device" as a device capable of communicating with the connected appliance and emulating signals sent from a utility. DOE also proposes to define a "Communication Module (Appliance)" as a built-in or external device that enables appliance bi-directional communication with a utility or equivalent communication device. AHAM requests clarification as to the difference between the "Utility Equivalent Communication Device" in the first definition and a "utility or equivalent communication device" as defined in the second mentioned definition.

B. Section 4—Test Requirements

i. *Section 4.A*

DOE states that "[u]nless otherwise specified, all test conditions and requirements shall be identical to 10 CFR Part 430, Subpart B, Appendices A1 and B1, Section 2." Immediately following this statement, DOE provides input power requirements for Europe, Australia, New Zealand, and Japan in addition to North America in Table 1. This is contradictory to DOE's regulations, which are referenced in this part of the proposed test procedure. The current DOE regulations mandate 115 volts through incorporation by reference to HRF-1-1979, which states:

> The electrical power supply is to be 115V± 1%, 60 Hz at the product service connection. The actual voltage is to be reported as measured at the product service connection with the compressor motor operating.

(10 C.F.R. 430, Subpart B, Appendix A1, section 2.6(c) and Appendix B1, section 2.4(c)). Further, the DOE test procedure is not setup to be powered by 230 volts and an ENERGY STAR test procedure is not the proper place for DOE to amend its test procedures. If DOE wishes to expand the range of input power requirements to include a more international scope, it should amend the refrigerator/freezer test procedure through the appropriate notice and comment rulemaking process. The title of Table 1 uses descriptors such as "nameplate" and "1500 watts," which is the only time those descriptors are used in the document, and is only further evidence that Table 1 is out of place in this document. Leaving Table 1 in the test procedure will only cause confusion.

ii. *Section 4, B through E*

In Section 4, Parts B through E, DOE proposes definitions for Ambient Temperature, Relative Humidity, Radiation Shield, and Watt Hour Meter.

DOE takes two different approaches in describing the test requirements for Ambient Temperature and Watt Hour Meter. For Watt Hour Meter, EPA references specific sections in the DOE test procedure, which is the approach AHAM fully supports. For Ambient Temperature, DOE recites what is said in the test procedure without reference. Citation to requirements contained in the DOE test procedure is the best way to ensure consistency and harmonization with DOE regulations at all times—it ensures that as DOE test requirements change, ENERGY STAR test requirements also change to mirror them. To achieve consistency, the relevant test requirements must be identical to each other at all times. Without such consistency and uniformity there will be significant confusion for manufacturers and for consumers. AHAM strongly encourages EPA to reference the DOE test procedure in all cases where applicable.

DOE proposes to include a test requirement for Relative Humidity. During the March 8 webinar, DOE explained that the reason for Relative Humidity now being a test requirement is because of the DOE's experimental testing to identify a reliable method to predict the defrost cycle. AHAM is opposed to including additional test requirements, which will increase test burden, for a procedure which is recognized as unsuitable and is only DOE's best guess as to how to induce a defrost cycle. In addition, most energy test rooms do not currently have the capability to tightly control relative humidity, and so adding this requirement to the test procedure would require significant investment in energy test facilities.

C. Section 5.2—Communication Setup

DOE proposes steps for the communication setup. Missing from the steps for communication setup is any mention of security settings. There should be a statement instructing any security settings be setup per the manufacturer's instructions.

There should be a general statement, stating the communication setup be done per the manufacturer's instructed setup.

D. Section 6—DOE Baseline Test

i. *Section 6.1.A*

DOE proposes recording the typical compressor duration, D_{comp}, and compressor cycle interval, I_{comp}, which are defined in this section. D_{comp} and I_{comp} are not mentioned anywhere else in this document other than when being defined in Section 6.1.A. What is the purpose of defining and recording these values if they are never used?

ii. *Section 6.1.D*

DOE proposes recording the maximum internal refrigerator and freezer compartment temperatures. AHAM requests clarification as to why to the maximum temperatures must be recorded. The procedure is not going from defrost to defrost, so it is unclear how the intervals would be derived.

iii. *Section 6.1.A, B, D*

Parts A, B, and D are performance, not energy requirements. Capturing this data, therefore, is irrelevant for the purposes of this test procedure.

E. Section 7—Delay Appliance Load Test

i. *Section 7, Note*

The following section from the AHAM Smart Refrigerator Test Procedure 2011 regarding icemakers needs to be included to confirm ice making is shut off during delay load operation.

7. Ice Making Delay Load Appliance Capability Test.

Confirmation of smart capability

7.1. Initiate ice maker cycling. This may be with or without water hook-up, depending on the design of the ice making system.

7.2. Calculate the next occurrence of the ice maker harvest. Pick a 4-hour window that would include this next ice maker cycle.

7.3. Initiate a "delay appliance load capability signal" (this cannot be during a harvest) using smart signal simulation hardware.

7.4. Verify no ice maker cycling occurs during this 4-hour test window.

ii. *Section 7.1.A and D*

There is an inconsistency in Section 7.1.A in the description of products with manual defrost or off-cycle defrost. Off-cycle defrost is basically defrosting every off cycle. The procedure then states to send the DAL signal and skip to step C. In step D, it says to verify no defrost cycle occurs, but in step A, it was established the off-cycle defrost occurs every off-cycle. This system is naturally going to defrost every off-cycle. At the end of Section 7.1.D, the following statement should be added, "(not applicable for manual or cycle defrost)."

The scope of "off cycle defrost" is unclear. It should not apply beyond the freezer defrost. There are food safety concerns for restrictions on refrigerator evaporator defrost cycles. If the scope is intended to include refrigerators, then AHAM has a question of the intent, as heaters are not typically employed and there would not be a strong energy savings argument. In fact,

skipping off cycle defrost on a heater-less refrigerator coil would lead to more energy being required for the cycle.

iii. *Section 7.1.B*

The steps outlined in this section may have no impact in triggering a defrost cycle. Typically, door openings impact the defrost after the impending defrost, not the next defrost. Further, there is a risk in performing all of this guess work in that it will increase the energy measured during the test. Section 7.1.B should be removed because the energy impacts are not insignificant and it would be inconsistent with the rest of the procedure.

iv. *Section 7.1, Note*

DOE proposes several potential methods for predicting a defrost. DOE states that "[t]o verify that defrost is delayed with a DR signal, there must be a reliable method that predicts the defrost cycle. The final method must minimize test burden and the potential for circumvention, while clearly identifying and predicting defrost cycles at independent test labs."

Although we understand DOE's interest in verifying that defrost is delayed with a DR signal, it is impossible to define one procedure for predicting a defrost that would apply across all products and manufacturers. Because DOE does not and cannot know the proprietary algorithms each individual manufacturer uses for triggering a defrost cycle, the steps outlined in Section 7.1 may or may not induce a defrost cycle depending on each individual algorithm. Section 7.1.B should, thus, be removed. DOE itself stated the futile nature of creating a standard method for inducing a defrost cycle when it said, "it was not possible to consistently initiate defrost on the UUT."

F. Section 8.1.C—Temporary Appliance Load Reduction Test

Internal temperature is not defined. Would internal temperature be measured by the average across thermal couples and across time? This is not necessary and it was not in the original draft. The purpose was to measure the energy consumption during the periods not the temperature fluctuation during the periods.

Similar to the comments in Section 6.A, the internal temperatures are not mentioned anywhere in this document other than in this line, so why measure them?

EP_{TALR} also is not defined. DOE should define this term if needed, but it is unclear why this variable is needed and to what it is being compared.

G. Section 9—Consumer Override

DOE recognizes that the consumer override is an integral feature that consumers will find valuable and necessary. DOE also notes that it is "hesitant to include it as a feature required for testing as it will increase test burden. Consumer override is a feature, which DOE believes

manufacturers will address during the development process." DOE and EPA request feedback from stakeholders on the importance and possible inclusion of consumer override testing.

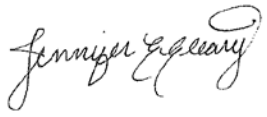
AHAM agrees that there is no need for the consumer override capability to be tested.

H. Section 10—Calculations

Section 10 specifies various calculations that would be applied during other points in the test procedure. To ensure the utmost clarity, the calculations should instead be provided where they are applied in the test procedure rather in a separate section. For example, the calculation for EP_{TALR} should be in Section 6.1.C.

AHAM appreciates the opportunity to submit comments on the ENERGY STAR Residential Refrigerators and Freezers Draft 1.0 Version 5.0 Specification and would be glad to further discuss these matters.

Best Regards,



Jennifer Cleary
Director, Regulatory Affairs

ATTACHMENT I

ENERGY STAR® Program Requirements
Product Specification for Residential Refrigerators and Freezers

Eligibility Criteria
Draft 2 Version 5.0

Following is the **Draft 2 Version 5.0** product specification for ENERGY STAR residential qualified refrigerators and freezers. A product shall meet all of the identified criteria to earn the ENERGY STAR.

Note: This Draft 2 Version 5.0 specification contains EPA's proposed revisions for residential refrigerators and freezers. Please send comments via email to appliances@energystar.gov no later than March 23, 2012.

1) **Definitions:** Below are the definitions of the relevant terms in this document. Unless otherwise specified, these definitions are identical with definitions in the DOE test procedures at 10 CFR 430, Subpart B, Appendix A1 and B1 or in 10 CFR 430.2.

   A. Electric Refrigerator: A cabinet designed for the refrigerated storage of food, designed to be capable of achieving storage temperatures above 32°F (0°C) and below 39°F (3.9°C), and having a source of refrigeration requiring single phase, alternating current electric energy input only. An electric refrigerator may include a compartment for the freezing and storage of food at temperatures below 32°F (0°C), but does not provide a separate low temperature compartment designed for the freezing and storage of food at temperatures below 8°F (-13.3°C).

   B. Freezer: A cabinet designed as a unit for the freezing and storage of food at temperatures of 0 °F (-17.8°C) or below, and having a source of refrigeration requiring single phase, alternating current electric energy input only.

   C. Electric Refrigerator-Freezer: A cabinet which consists of two or more compartments with at least one of the compartments designed for the refrigerated storage of food at temperatures above 32 °F (0°C) and below 39°F (3.9°C), and with at least one of the compartments designed for the freezing and storage of food at temperatures below 8 °F (-13.3°C) which may be adjusted by the user to a temperature of 0 °F (-17.8°C) or below. The source of refrigeration requires single phase, alternating current electric energy input only.

   D. Adjusted Volume (AV): The sum of the fresh food compartment volume in cubic feet, and the product of an adjustment factor and the net freezer compartment volume.

   E. Compact refrigerator/refrigerator-freezer/freezer: Any refrigerator, refrigerator-freezer or freezer with total volume less than 7.75 cubic feet (220 liters) (rated volume as determined in Appendix A1 and B1 of 10 CFR § 430 subpart B) and 36 inches (0.91 meters) or less in height.

   F. Built -in refrigerator/refrigerator-freezer/freezer: Any refrigerator, refrigerator-freezer, or freezer with 7.75 cubic feet or greater total volume and 24 inches or less depth not including doors, handles, and custom front panels; with sides which are not finished and not designed to be visible after installation; and that is designed, intended, and marketed exclusively (1) to be installed totally encased by cabinetry or panels that are attached during installation, (2) to be securely fastened to adjacent cabinetry, walls or floor, and (3) to either be equipped with an integral factory-finished face or accept a custom front panel.

   G. Basic Model: All units of a given type of product (or class thereof) manufactured by one manufacturer,

having the same primary energy source, and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency.

Note: EPA is proposing a new definition for a built-in refrigerator, refrigerator-freezer or freezer, to support the built-in allowance being proposed in Section 3. This proposed definition is identical to DOE's built-in definition located in 10 CFR 430.2. EPA has also added clarifying language (lines 14-16), that unless otherwise specified definitions are identical with those in the DOE test procedures for refrigerators, refrigerator-freezers, and freezers (10 CFR 430, Subpart B, Appendix A1 and B1).

In Draft 2, EPA is also proposing to remove the definition for System Operator since the revised criteria in Section 4 no longer reference a System Operator.

EPA welcomes comment on these proposed changes.

2) Scope:

A. Included Products: Products that meet the definition of an electric refrigerator, electric freezer, electric refrigerator-freezer, and/or compact refrigerator/refrigerator-freezer/freezer, as specified herein and the definition of a consumer product as specified in 10 CFR § 430.2 are eligible for ENERGY STAR qualification.

B. Excluded Products: Commercial models, refrigerators and refrigerator-freezers with total refrigerated volume exceeding 39 cubic feet, and freezers with total refrigerated volume exceeding 30 cubic feet are not eligible for ENERGY STAR. Products that are covered under other ENERGY STAR product specifications (e.g. Commercial Refrigerators) are not eligible for qualification under this specification. Wine refrigerators, or other products not meet the definition of an electric refrigerator, electric freezer, or electric refrigerator-freezer are not eligible for qualification under this specification.

Note: In Draft 2, EPA has retained the changes proposed in Draft 1 that clarified wine refrigerators are not currently eligible for qualification. EPA has also included additional clarification that products that do not meet the definition of an electric refrigerator, electric freezer or electric refrigerator-freezer, are not eligible. No additional changes are being proposed in this section.

3) Qualification Criteria:

A. Energy Use Requirements

a. Annual Energy Consumption (AEC) shall be less than or equal to Maximum Annual Energy Consumption (AEC_{MAX}), as calculated per Equation 1.

Equation 1. Calculation of Maximum Annual Energy Consumption Requirement

$$AEC_{MAX} = AEC_{BASE} + \sum_{i=1}^{n} AEC_{ADD\_i}$$

where,

AEC_{BASE} *is the annual energy consumption base allowance, per Table 1; and*

AEC_{ADD_i} *is an annual energy functional adder, per Table 2*

Table 1: Annual Energy Consumption Base Allowances

Product Type	Annual Energy Consumption Base Allowance, AEC_{BASE} (kWh/year)
Full-Size Refrigerators and Refrigerator-freezers	
• Refrigerators and Refrigerator-freezers with manual defrost • Refrigerator-freezers with partial automatic defrost • Refrigerator-freezers with automatic defrost and top-mounted freezer • All Refrigerators with automatic defrost	250 x tanh(0.050 x *AV* - 0.1) + 175
• Refrigerator-freezers with side-mounted freezer	235 x tanh(0.050 x *AV* - 0.1) + 270
• Refrigerator-freezers with bottom-mounted freezer	255 x tanh(0.045 x *AV*) + 230
Compact Refrigerators and Refrigerator-Freezers	
• Compact refrigerators and refrigerator-freezers	255 x tanh(0.045 x *AV*) + 230
Full-Size and Compact Freezers	
• Compact and Full-Size Upright freezers with manual defrost	330 x tanh(0.025 x *AV*) + 198
• Compact and Full-Size Upright freezers with automatic defrost	430 x tanh(0.025 x *AV*) + 284
• Compact and Full-Size Chest freezers	380 x tanh(0.025 x *AV*) + 115

Table 2: Annual Energy Functional Adders

Description	Product Type	Annual Energy Consumption Allowance, AEC_{ADD_i} (kWh/year)
Through-the-Door Ice Service	• Refrigerator-freezers with top-mounted freezer	30
	• Refrigerator-freezers with bottom-mounted freezer	40
	• Refrigerator-freezers with side-mounted freezer	35
Connected	All product types in Table 1[1]	0.05 x AEC_{BASE}
Built-in	• Refrigerator-freezers with top-mounted freezer • Refrigerator-freezers with bottom-mounted freezer	22
	• Refrigerator-freezers with side-mounted freezer	45

[1] Product must be qualified using the final and validated ENERGY STAR Program Requirements Product Specification for Residential Refrigerators and Freezers Test Method to Validate Demand Response to use the allowance.

Note: In Draft 1, EPA proposed an adder for through the door (TTD) ice service, recognizing there is some additional energy use associated with this feature, and to enable the most energy efficient models with this functionality to qualify as ENERGY STAR. Based on stakeholder feedback, in Draft 2, EPA is providing some additional energy use for the through-the-door ice adders for bottom-freezers and side-by-sides. For bottom-freezers, EPA is proposing to increase the adder from 30 to 40 kWh per year. For side-by-sides, EPA is proposing to increase the adder from 30 to 35 kWh per year. By increasing the adder levels for these two types of refrigerator-freezers, the proposed changes accommodate a number of additional higher efficiency models with TTD.

In response to stakeholder comments, EPA is also incorporating an adder for refrigerator-freezers classified as "built-ins," as defined in Section 1. Built-in refrigeration products are designed to blend in with kitchen cabinetry. Appliance manufacturers have indicated there are additional technical challenges to making them more energy efficient and that many built-in products already incorporate advanced design options to improve efficiency such as variable speed compressors and vacuum insulation panels. In response, EPA reviewed its data on the energy use and efficiency of built-in refrigerators, refrigerators-freezers and freezers. The most efficient built-in refrigerator-freezer in the data set achieves a 26% reduction in energy use from the current Federal standard while most products just meet the current ENERGY STAR V4.1 requirements, using 20% less energy than the applicable Federal standard. EPA did not find any built-in refrigerator-freezer on the market that would meet the Draft 1 proposed levels. Therefore, EPA is proposing an allowance of 22 kWh per year for refrigerator-freezers with bottom mount freezers, which enables a number of built-in refrigerator-freezer models ranging from 10 to 21 cu-ft to be able to earn the ENERGY STAR. For refrigerator-freezers with a side mounted freezer, EPA is proposing an allowance of 45 kWh per year that will enable a number of built-in side-by-side models that range in size from 21 to 24 cu-ft to be eligible for qualification. The adder has been developed to balance the program's objective of helping consumers identify models with superior energy performance with our interest in preserving consumer choice by not excluding products with certain features. Using its data set, EPA also found that a number of built-in refrigerators and built-in full-size upright freezers, from different manufacturers, meet the proposed levels. Therefore, the Agency is not proposing built-in adders for these product types in Version 5.0.

EPA also received feedback from stakeholders both supporting and expressing concerns over the proposed allowance for connected functionality. EPA views this adder proposed for Version 5.0 as a temporary step that will cost consumers little, if anything, as the proposed allowance for connected is offset by strengthened ENERGY STAR energy efficiency requirements plus additional near-term benefits, and can be further offset by longer-term societal and grid benefits that could be enabled by new demand response functionality. EPA has structured the criteria and allowance to ensure that all products earning the ENERGY STAR -- including models that use this temporary incentive in order to meet the energy criteria -- will continue to deliver significant, reliable and quantifiable energy savings for consumers, while preserving consumer choice of different configurations and features. Since this incentive is designed to help "jump start" the market, EPA does not envision the connected allowance will become a permanent part of this specification.

EPA welcomes stakeholder feedback on the changes being proposed in Draft 2.

B. Determination of Adjusted Volume: Adjusted Volume (AV) shall be calculated using the following:

Refrigerator Adjusted Volume = Fresh Volume + (1.63 x Freezer Volume)

Freezer Adjusted Volume = 1.73 x Freezer Volume

C. Significant Digits and Rounding:

a. All calculations shall be carried out with directly measured (unrounded) values. Annual energy use shall be rounded to the nearest kilowatt-hour per year, as specified in 10 CFR 430.23(a)(5) and 430.23(b)(5).

b. The Maximum Annual Energy Consumption specification limit, as determined by Equation1, shall be rounded off to the nearest kWh per year. If the equation calculation is exactly halfway between the nearest two kWh per year values, the Maximum Annual Energy Consumption shall be rounded down to the lower of these values.

c. Compliance with specification limits shall be evaluated using values rounded to the nearest kilowatt-hour per year.

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

Note: EPA is proposing revised language in Section 3C to reference DOE refrigerator and freezer rounding procedures found in 10 CFR 430.23(a)(5) and 430.23(b)(5) and to further harmonize with DOE regulatory requirements. To this end, the new language in 3C(a) specifies that annual energy use be rounded to the nearest kWh per year, as specified in the CFR. The language in 3C(c) specifies compliance with the specification limits be evaluated using values rounded to the nearest kWh per year. In 3C(b), EPA is adding additional clarity that the ENERGY STAR Maximum Annual Energy Use Consumption limit, as determined by Equation 1 in the specification, must be rounded to the nearest kWh (if the calculation is exactly halfway between two whole numbers, the Maximum Annual Energy Use must be rounded down to the lower of these values). EPA welcomes feedback on the proposed changes.

D. Model Numbers: Model numbers used for ENERGY STAR qualified product submissions shall be consistent with Federal Trade Commission (FTC) and Department of Energy (DOE) submissions.

4) Connected Product Criteria:

To be eligible for the Connected allowance, a refrigerator, refrigerator-freezer, or freezer shall have the following capabilities. The connected refrigerator is an appliance that provides all the necessary hardware and software for communications. The product must continue to comply with the applicable product safety standards – the addition of the functionality described below shall not override existing safety protections and functions. Any reduction in load cannot adversely impact the product's operation, ~~e.g., food preservation~~.

Note: EPA appreciates all of the stakeholder feedback received on the proposed Connected criteria that address: home energy management (HEM) functionality, delay defrost capability, demand response (DR) functionality, communication standards, open access and information to consumers. In response to comments received, EPA is proposing a number of changes in Sections 4A through 4D, described below.

A. ~~Home Energy Management (HEM) Functionality~~: Connectivity to Support Home Energy Management

A Connected refrigerator, refrigerator-freezer, or freezer shall have the following capabilities:

1. ~~*Energy Consumption Reporting*~~*Representation of Energy Consumption:* In order to enable simple, actionable energy use feedback to consumers, the product shall be capable of transmitting interval energy consumption data to an energy management system or other consumer authorized device, service or application via a communication link. The data shall represent energy consumed by the product in watt-hours for update intervals of 15 minutes or less per manufacturer specifications. In addition, the product may also provide energy use feedback to the consumer on the product itself. On-product feedback, if provided, may be in units and format chosen by the manufacturer (e.g., $/month).

2. *Remote Management:* The product shall be capable of receiving and responding to consumer authorized remote requests, via a communication link, similar to consumer controllable functions on the product. The product is not required to respond to remote requests that would compromise performance and/or product safety as determined by the product manufacturer.

3. *Operational Status & Messages:* The product shall be capable of providing the following information to the consumer either on the product or to an energy management system or other consumer authorized device, service or application via a communication link:
    a. Demand Response (DR) status (e.g., normal operation, delay load, temporary load reduction), and
    b. At least two types of messages relevant to the energy consumption of the product. For example, messages for refrigerators, refrigerator-freezers and freezers, might address: door left open notification, a notification that product lost power, a reminder to clean refrigerator coils, or report of energy consumption that is outside the product's normal range.

Note: In response to a stakeholder comment, EPA has specified that a refrigerator, refrigerator-freezer or freezer transmit interval (15-minute or less) energy consumption information in units of watt-hours. This standardization of energy use reporting can provide greater reporting consistency among different end-use devices but does not affect how energy-usage feedback is conveyed to consumers. EPA believes it is important that appliance manufacturers and other 3rd parties have the flexibility to decide how feedback on energy consumption can be most meaningfully communicated to consumers (i.e., kWh per day, $ per day, $ per year, etc.).

EPA acknowledges stakeholder feedback requesting that, in lieu of energy consumption reporting, products be permitted to report real-time power consumption. EPA is interested in further stakeholder 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.

EPA has also incorporated language that in addition to transmitting this information via a communication link, the product may also provide energy use feedback to the consumer on the product itself. In response to feedback on the proposed Draft 3 ENERGY STAR Room Air Conditioner specification (published January 23, 2012), EPA has added language to Section 4(A)1 to help clarify that this feedback could be in any unit or format selected by the manufacturer.

Another stakeholder recommended EPA specify remote requests in Section 4A(2) be "consumer authorized." EPA agrees that consumers should retain ultimate control over the product's operation including any remote requests sent, and has incorporated this suggested language to 4A(2).

EPA welcomes feedback on these proposed changes and clarifications.

B. Delay Defrost Capability

A Connected refrigerator, refrigerator-freezer, or freezer with automatic defrost shall have a delay defrost capability ~~active by default~~, where the consumer can input or the product itself shall identify, the time of day, and the product shall automatically move the defrost function outside of two 4-hour peak load periods; 6am to 10am and 3pm to 7pm. The product shall provide the consumer with the option to modify the scheduling of this functionality in order to, for example: respond to a short term request from the utility, or align defrost avoidance periods with on-peak periods for their utility. ~~In the event of a power outage of 24-hours or lesser duration, after power is restored the product shall not require any interaction from the consumer to maintain this defrost deferral feature with the same settings as prior to the power outage.~~

Exception – A refrigerator, refrigerator-freezer or freezer with manual defrost or partial automatic defrost is not required to comply with the Delay Defrost Capability.

Note: EPA is proposing that the delay defrost capability in Section 4(B) cover, at a minimum, two 4-hour peak load periods: the 3-7pm period specified in Draft 1, and a new 6-10am period. EPA has added the 6-10am avoidance period so that a product also avoids defrosting during morning hours when winter peak periods tend to occur. EPA is proposing this change in response to comments received from the Electric Research Power Institute (EPRI) who expressed concern that this capability, as proposed in Draft 1, would benefit summer peaking utilities but would also increase the load during winter-peak times. EPRI also noted that approximately one-third of utilities in the U.S are winter peaking, i.e., they have their highest annual peaks in early morning winter hours. Therefore, EPA has specified a second peak-load avoidance period; EPA is also proposing that products provide consumers with the option to modify the pre-set schedule (in Draft 1, this capability was optional).

In consideration of the morning peak period, EPA also considered an alternative option of specifying a product's defrost could occur only during a certain window of time (e.g., 12 Midnight – 5am), which would also allow the product to avoid defrosting during both peak times but provides a more narrow window (5 hours vs. 16 hours) for defrost to occur. EPA welcomes feedback on whether this would be preferred by stakeholders.

For clarify, EPA has also added language specifying this capability is applicable only to products with automatic defrost.

C. Demand Response (DR) Functionality:

A Connected refrigerator, freezer or refrigerator-freezer shall have the capability to receive, interpret and act upon consumer-authorized signals by automatically adjusting its operation depending on both the signal's contents and settings from consumers. At a minimum, the product shall be capable of providing the following:

1. *Delay Appliance Load Capability:* The capability of the product to respond to a signal by providing a moderate load reduction for the duration of a delay period. ~~.~~ ~~not to exceed 4 hours.~~
    a. Upon receipt of signal and in accordance with consumer settings, except as permitted below, the product shall:
        i. shift its defrost cycle(s) beyond the delay period, and
        ii. either shift ice maker cycles beyond the delay period or reduce average energy consumption during the delay period by at least 13% relative to that consumed during an average load over a 24-hour period as defined by the DOE test procedure (10 CFR Part 430 Subpart B, Appendix A1 and/or B1), and may shift this energy consumption beyond the delay period.

        ~~ii. reduce its average energy consumption during the delay period by at least 13% relative to that consumed during an average load over a 24-hour period as defined by the DOE test procedure (10 CFR Part 430 Subpart B, Appendix A1 and/or B1).~~

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b. Exception – The product is not required to respond to a delay load signal if the signal requests the delay load period to begin while the product is defrosting. ~~if the product is defrosting when the signal is received and the signal requests a load reduction start time that is less than 10 minutes from the time the signal is received~~.

c. Default settings - The product shall ship with default settings that enable at least a 13% load reduction for at least 4 hours. The product may allow the consumer to modify the duration of this delay period.

d. Consumer override - The consumer shall be able to override the product's Delay Appliance Load response before or during a delay period. Override should last no longer than 24 hours.

e. The product shall be able to provide at least one Delay Appliance Load response in a rolling 24-hour period.

2. *Temporary Appliance Load Reduction Capability:* The capability of the product to respond to a signal by providing an aggressive load reduction for a short time period, typically 10 minutes.

a. Upon receipt of signal and in accordance with consumer settings, except as permitted below, the product shall restrict its average energy consumption during the load reduction period to no more than 50% of that consumed during an average load over a 24-hour period as defined by the DOE test procedure (10 CFR Part 430 Subpart B, Appendix A1 and/or B1).

b. Exceptions – Under the following conditions, the product is not required to restrict its average energy consumption by providing a Temporary Appliance Load Reduction response:
   i. If a signal is received during a defrost cycle, that defrost cycle may finish. However, no additional defrost cycle(s) shall occur during the time period, and/or
   ii. If there is a consumer-initiated function such as a door opening or ice/water dispensing during the load reduction period.

c. Default settings - The product shall ship with default settings that enable at least a 50% load reduction for a time period of least 10 minutes. The product may allow the consumer to modify the duration of this time period.

d. Consumer override - The consumer shall be able to override the product's Temporary Appliance Load Reduction response before or during the load reduction period.

e. The product shall be able to provide at least one Temporary Appliance Load Reduction response in a rolling 24-hour period.

Note: EPA received comments from a number of stakeholders that have supported EPA's proposal to help facilitate the market for smart grid or demand-response ready residential refrigerators and freezers. One stakeholder commented that residential appliances, including refrigerators, have the potential to address a wide range of demand response (DR) needs, but that the need and value of each type of service varies regionally (based on local circumstances), seasonally, and over time as grid needs change. To this end, they suggested the specific demand response types and levels indicated in this document might be better presented as a collection of minimum requirements. EPA's intention with Section 4C has been to establish a set of minimum capabilities. EPA has added language that relays this more explicitly by specifying that products, at a minimum, need to be able to provide the two responses detailed in this section -- Delay Appliance Load Capability (DAL) and Temporary Appliance Load Reduction Capability (TALR). Also in response to this comment, EPA has also added language specifying that more broadly, products must be able to receive, interpret and act upon a signal, responding based on the signal's content and consumer preferences; EPA notes this proposed language is consistent with "Smart Appliance" petition's definition of a "smart appliance."

A stakeholder further indicated that presently, utility signals issued that may result in end-use products altering their load fall broadly into categories such as: start load-shed, stop load-shed, and price-alerts. Standardized Temporary Appliance Load Reduction or Delay Appliance Load signals that include start times and event duration components do not currently exist. In light of this feedback, EPA has revised language in Section 4C to refer to Temporary Appliance Load Reduction and Delay Appliance Load as capabilities and responses, rather than signals.

EPA has added clarification that a product must be capable of sustaining a DAL response for at least 4 hours and a TALR response for at least 10 minutes. Since these are intended to be minimum responses, EPA feels the language should not prevent manufacturers from providing products that can provide longer response times. EPA also incorporated clarification that a product must ship with default DAL settings that provide at least a 13% load reduction for at least 4 hours and default TALR settings that provide at least a 50% load reduction for at least 10 minutes. Optionally, manufacturers could provide consumers the ability to modify the default time duration limits.

An exemption to the DAL response was incorporated to address a scenario where product is defrosting when a signal is received requesting near-immediate load reduction.

In response to comments received from a stakeholder, EPA removed the reference to a system operator as the originator of signals requesting that the product shed load. Although system operators are considered to be the primary entity that will issue these signals, it may be potentially limiting and not necessary to specify in the context of this specification.

EPA also modified the TALR criteria to only specify the product's response in terms of a 13% load reduction. Removing the option of moving ice making and instead, only specifying a 13% load reduction, provides a more technology-neutral approach.

Finally, EPA clarified that the 24-hour responsiveness requirement is intended to be a "rolling clock" rather than a 1-per calendar-day minimum capability. That is, if a product responds to a signal received at 11:45pm and provides TALR, it would not be required to respond to subsequent request for a TALR received prior to 11:45pm the following day.

EPA welcomes stakeholder comment on the proposed changes in Section 4C.

D. Communications, Open Access & Information to Consumers

1. *Communications:*

a. Support for Home Energy Mangement (HEM) – Communications that enable HEM functionality (Section 4A) may use built-in or external modular communication hardware that is manufacturer approved. The connected product must include all necessary hardware and software for communication with the HEM ~~communications.~~ If modular communication is used, at least one compatible module shall either ship with the product or be provided to the consumer at the time of sale, or within a reasonable amount of time after the sale. These module(s) shall be easily user installable.

~~b. DR – Communications that enable DR functionality (Section 4C) may use built-in or modular communication hardware. If modular communication is used, at least one compatible module shall either ship with the product, be provided to the consumer at the time of sale, or within a reasonable amount of time after the sale. These module(s) shall be easily user installable.~~

~~Exception– For DR functionality, communication modules, if used, do not need to ship with product, be provided at the point of sale or within a reasonable amount of time after sale if, for all communication layers associated with the modular interface, the product uses only:~~

- ~~Standards included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards, and/or~~
- ~~Standards being considered for inclusion in the SGIP Catalog of Standards, and/or~~
- ~~Standards 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) or Internet Engineering Task Force (IEFT).~~

~~c.~~b. EPA ***recommends*** for all layers of HEM and DR communications, built-in or external modular, the use of:

- Standards included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,[1] and/or
- Standards being considered for inclusion in the SGIP Catalog of Standards, and/or
- Standards 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) or Internet Engineering Task Force (IEFT).

EPA may consider more robust criteria in a future revision as relevant standardization efforts mature. **For clarification, in the case of modular communications, this recommendation applies only to the communications functionality external to the system (as defined in Section 4.0) and the communications module and not to the interface between a communications module and its associated host appliance.**

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2. *Open Access:* To enable interconnection with the product for purposes of HEM and DR, the following shall be made available to interested parties:
   a. Documentation regarding the accuracy of the representation of energy consumption power feedback reporting; and
   b. An interface specification, API or similar documentation, that at a minimum allows ~~transmission~~, reception and interpretation of the following information:
      - ~~Energy Consumption Reporting~~ Representation of Energy Consumption
      - Remote Management
      - Operational Status & Messages (if transmitted via a communication link)
      - Demand Response Functionality

3. *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 C, 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."*).

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

Note: Based on stakeholder feedback, EPA revised the criteria for communications and open access. The criteria addressing communications associated with DR functionality have been made more permissive. EPA revised and clarified the language on modular communications, previously listed under Information to Consumers, in Draft 1, and now addressed in Section 4(D)1. EPA has clarified that communications associated with DR and HEM may use either built-in or modular communications. In response to feedback, EPA also clarified a connected product must include all necessary hardware and software for HEM communications. If modular communications are used to enable the HEM functionality, the module must either ship with the product or be provided at time of sale, and be easily consumer installable.

EPA has included similar requirements for communications that enable DR functionality but with additional flexibility. The communication architectures and business models that would support integration of appliances, such as refrigerators, as DR resources are still in development. In Draft 1, EPA specified that the appliance manufacturer supply this module by either shipping the module with the product, providing it at the point of sale, or providing it in a reasonable amount of time (i.e., module is shipped to the consumer at a later date and a consumer plugs it in). HEM and DR communications may use the same communication protocol, though they may also use separate channels (e.g., Wi-Fi for the HEM, and Zigbee SEP 2.0 for DR communications). Based on stakeholder feedback, EPA believes it is feasible that utilities and service providers could supply a communications module that is compatible with their equipment. EPA has addressed this possibility in 4(D)1 through an exemption that specifies a product designed to use modular communications does not need to ship with the communication hardware needed to receive DR signals, as long as it uses only standards-based communications for all layers of the modular interface (e.g., such as CEA-2045 Modular Communications Interface, currently in development). With this pathway, the communication module could be supplied later to the consumer by either a manufacturer, utility, ISO/RTO, or other service provider, in order to activate the product's DR capabilities. Specifying the port use standards-based modular communications will help ensure interoperability with varied communication infrastructure deployment.

In Draft 2, EPA is *recommending* use of standards-based communications (those developed by ANSI or another well established international Standards Developing Organization (SDO)) or standards listed (or being considered for inclusion) in the SGIP Catalog of Standards. As noted in stakeholder comments, the Catalog of Standards is a living document and expected to continue to evolve; at this point in time, some standards that appliances may utilize, such as Smart Energy Profile (SEP) 2.0, have not been finalized and are not listed in the Catalog. EPA plans to consider, in consultation with stakeholders, more robust language in future revisions as relevant standardization efforts mature.

To help advance both interoperability and open access, EPA is specifying that technical documentation (such as an API) be made available to provide interested parties with access to the product's identified data, messages and capabilities, including both HEM and DR functionality specified in Section 4.

EPA welcomes comment on the proposed changes.

5) Test Requirements:

A. One of the following sampling plans shall be used to test energy performance for qualification to ENERGY STAR:

   a. A representative unit shall be selected for testing based on the definition for Basic Model provided in Section 1 above; or

   b. Units shall be selected for testing per the sampling requirements defined in 10 CFR § 429.14.

B. When testing energy consumption of residential refrigerators and freezers, the following test methods shall be used to determine ENERGY STAR qualification:

Table 3: Test Methods for ENERGY STAR Qualification

ENERGY STAR Requirement	Test Method Reference
Energy Consumption (kWh/year)	10 CFR 430, Subpart B Appendix A1 – Residential Refrigerators Appendix B1 – Residential Freezers

C. When determining energy performance for purposes of ENERGY STAR certification, the principles of interpretation, contained in 10 CFR 430.23 (a) (10), should be applied to the test procedure.

D. Compliance with Connected functionality, as specified in Section 4, shall be through examination of product and/or product documentation. In addition, demand response functionality shall be verified using the ENERGY STAR Program Requirements Product Specification for Residential Refrigerators and Freezers Test Method to Validate Demand Response (Rev. Feb-2012) in order to be eligible for the connected allowance.

Note: The proposed test approach for connected proposed in Draft 1 is unchanged. Verification of connected functionality will be through examination of the product and/or product documentation. Additionally, the demand response functionality will need to be verified using the ENERGY STAR test method being developed and validated by DOE. Products must be qualified using the final test method in order to take advantage of the connected allowance. In this Draft 2, Section 5D has been re-structured to be consistent with the format used in the connected test method section of the proposed Draft 3 Version 3.0 ENERGY STAR room air conditioner specification (published January 23, 2012).

DOE has developed a Test Method to Validate Demand Response (Rev. Feb-2012), released with this specification for stakeholder comment. Throughout 2011, DOE requested pre-market Connected R/F units from manufacturers in an effort to validate the proposed Connected R/F test method; however, only one manufacturer provided DOE with a Connected R/F for testing. While DOE is seeking input on this draft test method, DOE will not finalize the test method until it can obtain additional Connected R/F products for testing, to ensure that the test method is applicable to multiple units and technologies.

6) Effective Date: The ENERGY STAR Residential Refrigerator and Freezer specification shall take effect on **January 1, 2013**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

7) Future Specification Revisions: EPA reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that ENERGY STAR qualification is not automatically granted for the life of a product model.

Note:
Future Specification Revision

For a number of product types covered in the ENERGY STAR program for residential refrigerators and freezers, future 2014 Federal standard levels either meet or exceed the proposed Version 5.0 requirements (see table below). Manufacturers will need to comply with these new standards beginning September 15, 2014. In light of this, EPA is planning to review and revise the refrigerator and freezer specification in 2013 to develop new levels, where necessary. It is anticipated that these levels could become effective in September 2014, harmonizing with the timing of DOE's new standards for residential refrigeration products. EPA does not plan to propose levels for 2014, as mentioned in Draft 1, through the current Version 5.0 specification development process. EPA will instead consider levels for a Version 6.0 specification through a subsequent specification development process, allowing additional time for consideration and discussion with stakeholders on efficiency opportunities beyond the 2014 standard levels.

EPA plans to extend the approach used in Version 5.0 when developing Version 6.0. Certain product classes will need to be strengthened or sunset (i.e., at a minimum, where the new Federal standard nearly meets or exceeds the ENERGY STAR Version 5.0 requirement – see Table below). For certain product classes, including compact refrigeration products and full-size freezers, some stakeholders have raised concerns that there may not be additional cost-effective, energy-savings opportunities and that EPA should consider sunsetting certain product types from the program. EPA plans to consider efficiency options and cost-effectiveness for all product types as part of this review. EPA will also review the allowance provided through V5.0 for connected products. Since this incentive has been designed to help provide a "jump-start" to the market, EPA does not view it as a permanent part of the specification.

The Version 6.0 levels will be based on product performance as tested to the new DOE test procedures (Appendix A and Appendix B) that will be used by manufacturers to comply with the 2014 Federal standards. When energy performance data is not publically available, EPA's practice is to build a data set, with manufacturers' and other stakeholders' test data and information. The Agency plans to use available data as well as any supplemental information gathered to inform level setting. EPA is happy to discuss this approach and its data needs with stakeholders in advance of this specification revision.

ENERGY STAR Version 5.0 Requirements vs. 2014 Federal Standard Levels (Per Negotiated Agreement)

Product Type	Proposed V5.0 ENERGY STAR (Draft 2)	2014 Standard Level[1] (Per Negotiated Agreement)
	(% Better than 2001 Federal standards)	
Refrigerator-Freezer with Top Freezer (19 cu-ft)	26%	25%
Refrigerator-Freezer with Bottom Freezer and TTD (25 cu-ft)	30%	20%
Refrigerator-Freezer with Side-Mounted Freezer and TTD (26 cu-ft)	30%	25%
Chest Freezer (compact, manual defrost)	10%	10%
Chest Freezer (full-size 15 cu-ft, manual defrost)	17%	25%
Upright Freezer (full-size 18.5 cu-ft, auto defrost)	21%	30%
Compact refrigerator-freezer (manual defrost)	20%	25%

[1] DOE's final rule with 2014 standard levels is available on DOE's website here:
http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/refrig_finalrule_frnotice.pdf