ENERGY STAR® Program Requirements
Product Specification for Room Air Conditioners

Eligibility Criteria
Draft 3 Version 3.0

Following is the **Draft 3 Version 3.0** ENERGY STAR Product Specification for Room Air Conditioners. A product shall meet all of the identified criteria to earn the ENERGY STAR.

1) **Definitions:** Below are the definitions of the relevant terms in this document. Unless otherwise specified, these definitions are consistent with the definitions in the DOE test procedure at 10 CFR 430, Subpart B, Appendix F.

   A. Room Air Conditioner (RAC): A consumer product, other than a "packaged terminal air conditioner," which is powered by a single phase electric current and which is an encased assembly designed as a unit for mounting in a window or through the wall for the purpose of providing delivery of conditioned air to an enclosed space. It includes a prime source of refrigeration and may include a means for ventilating and heating.

      a. Casement-only: A RAC designed for mounting in a casement window with an encased assembly with a width of 14.8 inches or less and a height of 11.2 inches or less.

      b. Casement-slider: A RAC with an encased assembly designed for mounting in a sliding or casement window with a width of 15.5 inches or less.

      c. Reverse Cycle: A RAC that employs a means for reversing the function of the indoor and outdoor coils such that the indoor coil becomes the refrigerating system condenser, allowing for heating of the air in the conditioned space; similarly, the outdoor coil becomes the evaporator, utilizing outdoor air as a source of heat.

      d. Through the Wall (TTW): A RAC without louvered sides. These units may also be referred to as "built-in" units.

      e. Electromechanical: A RAC that measures room temperature with a thermostat that undergoes a physical change (dimensional, phase change, etc.) relative to temperature, and utilizes mechanical rotary, switch, or similar user controls for cooling output, fan speed, desired temperature, or other features.

> **Note:** In support of the revisions being proposed for the Energy Saver Mode and Filter Reminder criteria, EPA is adding a new definition for RACs with electromechanical controls. EPA was unable to identify an existing industry definition and so developed a definition of electromechanical based on stakeholder input. EPA welcomes comment on the proposed definition.

   B. 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.

   C. Energy Efficiency Ratio (EER): The ratio of cooling output (measured in BTU per hour) to electrical energy input (measured in Watts).

   D. Louvered Sides: Exterior side vents on a RAC enclosure to facilitate airflow over the outdoor coil.

   E. Packaged Terminal Air Conditioner (PTAC): A wall sleeve and a separate unencased combination of heating and cooling assemblies specified by the builder and intended for mounting through the wall. It includes a prime source of refrigeration, separable outdoor louvers, forced ventilation, and heating availability energy.

F. Portable Air Conditioner: A single package air conditioner typically mounted on wheels for the purpose of moving the unit from place to place within a building or structure.

2) **Scope:**

A. Included Products: Products that meet the definition of a Room Air Conditioner as specified herein are eligible for ENERGY STAR qualification, with the exception of those products listed in Section 2.B.

B. Excluded Products: PTACs, portable air conditioners, and models with electric resistance heat as the primary heat source are not eligible for ENERGY STAR qualification under this specification. Products that are covered under other ENERGY STAR product specifications are not eligible for qualification under this specification.

3) **Core Qualification Criteria:**

A. Energy Efficiency Ratio (EER): EER shall be greater than or equal to the Minimum EER (EER_{MIN}) as calculated per Equation 1.

Equation 1. Calculation of Minimum EER

$$EER_{MIN} = EER_{BASE} - EER_{Adder\_Connected}$$

where,

EER_{BASE} *is the base EER, per Table 1, 2 or 3*

$EER_{Adder\_Connected}$ *is the EER connected allowance, per Table 4*

Table 1: Units Without Reverse Cycle

Capacity (BTU/hour)	EER_{BASE} (units with louvered sides)	EER_{BASE} (units without louvered sides)
< 6,000	11.2	10.4
6,000 to 7,999		
8,000 to 10,999	11.3	9.8
11,000 to 13,999		
14,000 to 19,999	11.2	
20,000 to 27,999	9.8	
≥ 28,000		

Table 2: Units With Reverse Cycle

Capacity (BTU/hour)	EER_{BASE} (units with louvered sides)	EER_{BASE} (units without louvered sides)
< 14,000		9.8
≥ 14,000		9.2
< 20,000	10.4	
≥ 20,000	9.8	

Table 3: Casement Units

Casement Type	EER_{BASE}
Casement-Only	10.0
Casement-Slider	10.9

Table 4: Connected Allowance[1, 2]

Product Type	$EER_{Adder\_Connected}$
All RAC types covered in Tables 1, 2 and 3	0.05 x minimum EER_{BASE}

[1] Product must demonstrate "connected" functionality as specified in Section 4 and in accordance with Section 5. Note: As noted in Section 5, to use the allowance the RAC must be qualified using final and validated ENERGY STAR test method (not yet developed; see discussion in Section 5).

[2] Calculated allowance shall be rounded down to nearest tenth of an EER before being applied in Equation 1.

Note: The minimum energy efficiency ratio (EER) levels shown in Tables 1, 2 and 3 are consistent with earlier RAC Version 3.0 drafts. However, the structure of Section 3 has been revised to incorporate a "connected" allowance that EPA is proposing in Draft 3. It is envisioned that products that meet all of the final "connected" criteria -- including both consumer oriented functionality proposed in Section 4A and the demand response (DR) functionality discussed (but not yet proposed) in Section 4B of this document, and demonstrated using the future ENERGY STAR test method discussed in Section 5 -- could use an allowance equivalent to 5 percent of the product's base EER requirement. This new proposal is reflected in Table 4 and Equation 1.

EPA intends this allowance to serve as an incentive to help jump-start the market for connected appliances, provide immediate convenience and energy savings opportunities, as well as future-oriented DR capabilities. In the meantime (prior to when the new ENERGY STAR test method is available), qualified RACs with "connected" features, as specified in Section 4, would be highlighted on the ENERGY STAR Qualified Product List (QPL).

As an example of how this allowance would work: A traditional 8,000 BTU/hr RAC window unit would need to have an EER of at least 11.3 to qualify for ENERGY STAR under the proposed Version 3 requirements. A "connected" RAC would be eligible for an allowance of up to 0.5 EER (11.3 x 0.05, rounded down to nearest tenth) and so would need to have a minimum EER of 10.8 to qualify for ENERGY STAR. As mentioned above, products must demonstrate the DR functionality (TBD; see discussion in Section 4B) using the final and validated ENERGY STAR test method in order to use the allowance.

B. Energy Saver Mode:

a. Product shall have an "Energy Saver Mode," which may be consumer override-able. In this mode, fan operation shall occur only in conjunction with compressor operation, with the following exceptions:

i. The fan may continue to run for a period not exceeding 5 minutes after the compressor is switched off.

ii. After the above period, when the compressor is off, the fan may be cycled on for up to 17% of the total cycle time to facilitate accurate control of room temperature. For example, the fan may run for 1 minute then cycle off for at least 5 minutes or the fan may run for 2 minutes then cycle off for at least 10 minutes. Manufacturers may use other fan run durations, but fan run time shall not exceed 17% of total cycle time.

b. Products, excepting electromechanical RACs as defined in Section 1, shall default to "Energy Saver Mode" each time the unit is turned on.

C. Filter Reminder:

Products, excepting electromechanical RACs as defined in Section 1, shall have a filter reminder that provides visual notification recommending the filter be checked, cleaned or replaced, as applicable. The filter reminder may be based on operating hours, sensing technology, or other means.

Note: In response to stakeholder comments, EPA has clarified the Energy Saver Mode requirement to make clear that RACs must default to "Energy Saver Mode" each time the product is turned on. This mode may be consumer override-able, but the override needs to be reset the next time the RAC is turned on with Energy Saver mode reactivated.

In addition, EPA amended the fan cycling criterion based on manufacturer feedback that for larger units that are more likely to be placed in larger rooms, additional fan run time may be needed to accurately monitor room temperature. The maximum ratio of 1 minute fan-on to 5 minutes fan-off was retained, but additional flexibility has been added so that manufacturers may use shorter, longer or variable fan-on durations, so long as this maximum ratio is met.

Note: EPA believes there may be some interaction between the default Energy Saver Mode and a product's DR response (possible approaches for structuring DR criteria are discussed in Section 4). Some increase in fan use (beyond what is allowable in Section 3B, as part of Energy Saver Mode) may be desirable when the product responds to limit its energy use during a DR event. EPA recognizes the need to ensure the two sections are structured so that they are consistent with one another. To this end, EPA encourages stakeholder feedback on this as DR criteria are further considered and developed.

Based on stakeholder feedback that filter reminders are difficult, if not impossible, for electromechanically controlled RACs to provide, EPA has amended the Filter Reminder requirement such that it does not apply to electromechanical RACs. Similarly, EPA also amended the Energy Saver Mode requirement to clarify that electromechanical RACs are required to have an Energy Saver mode but are not required to default to Energy Saver mode each time the RAC is turned on (since electromechanical RACs use a mechanical switch to select Energy Saver mode, rather than an electronic switch).

D. Significant Digits and Rounding:

a. All calculations shall be carried out with directly measured (unrounded) values. EER shall be rounded to the nearest 0.1 Btu per watt-hour, as specified in 10 CFR 430.23(f).

b. Compliance with the specification limits shall be evaluated using values rounded to the nearest 0.1 Btu per watt-hour.

c. 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 (0.1 Btu per watt-hour) and as specified in 10 CFR 430.23(f).

Note: EPA is proposing revised language in Section 3D to reference RAC rounding procedures found in 10 CFR 430.23(f) and to further harmonize with DOE regulatory requirements. To this end, the new language also specifies that compliance with the ENERGY STAR EER levels be evaluated using EER values rounded to the nearest 0.1 Btu per watt-hour.

E. 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 RAC shall have the following capabilities. 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 shall not adversely impact the product's operation, e.g., at minimum, the product shall protect against extreme temperatures in the conditioned space.

Note: Consistent with the principle of enhanced consumer value and in response to the petition EPA received from a joint coalition of industry and efficiency advocates in early 2011, EPA has continued to evaluate how best to address and encourage smart grid functionality in ENERGY STAR specifications. EPA appreciates the feedback it has received from manufacturers and other industry stakeholders over the last few months. The proposed criteria in this section contain a number of changes from what had been proposed in Draft 2. Draft 3 builds closely upon the "Connected" criteria proposed by EPA in the recent Draft 1 Version 5.0 specification for residential refrigerators and freezers, which was developed with significant input from appliance manufacturers and other stakeholders.

EPA is proposing to refer to this bundle of demand response (DR) functionality and consumer-oriented enhancements, as "Connected." EPA feels this better reflects the current scope of the proposed specification in Section 4 and will facilitate better consumer understanding of the near term value while supporting infrastructure that provides consumers the option of leveraging their product's DR capabilities to save money on their energy bill is built. These additional criteria will provide consumer value through remote management and energy consumption reporting. Through interoperability with other devices and applications, consumers can enable tools that help reduce their RAC energy usage, through feedback and automation.

Draft 3 reflects EPA's intention to leverage two complementary options for advancing "Connected" functionality in RACs. Products meeting all of the final criteria in Section 4 would be eligible to earn an allowance, as discussed earlier in this document, once the necessary ENERGY STAR test method is available. This allowance is intended to serve as an incentive to help jump-start the market for RACs with smart grid functionality, in recognition of the broader electric power system gains and the consumer value proposition associated with a connected appliance that can interface with an energy management system. The allowance is structured to ensure products that are eligible for this credit deliver immediate value to consumers through connected functionality such as alerts and energy consumption reporting. EPA also plans to highlight products with "connected" functionality on the ENERGY STAR QPL, so that consumers, rebate programs and other interested stakeholders can better identify and advance these products into the market.

The Draft 2 Version 3.0 RAC specification specified a number of minimum criteria that would need to be met for a RAC to be categorized as "Smart Grid Capable" on the QPL. Based on various comments from stakeholders, EPA has since revised the requirements for Home Energy Management (HEM) Functionality, Communication Standards, Open Access, and Information to Consumers. The proposed revisions are reflected in Sections 4A and 4C of this document. EPA welcomes comments on these proposed revisions.

EPA is not proposing language in Section 4B (Demand Response Functionality) in this draft. Instead, Section 4B includes a note box with discussion that frames the general goal and several potential ways in which DR criteria might be structured. EPA is seeking more feedback from stakeholders to inform the development of DR criteria that will generate grid benefit while ensuring consumers have ultimate control over their product's response to a request to temporary curtail load. After collecting stakeholder feedback, EPA plans to issue proposed DR criteria for stakeholder review and feedback, prior to finalizing the Version 3.0 specification.

A. Home Energy Management (HEM) Functionality:

A "Connected" RAC shall have the following capabilities:

1. *Energy Consumption Reporting:* The product shall be capable of providing feedback on its energy consumption to an energy management system or other consumer authorized device, service or application via a communication link. The energy consumed by the RAC (in watt-hours) shall be reported by the product in intervals of 15 minutes or less. In addition, the product may also provide this feedback to the consumer on the product itself.

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, User Settings, and Messages:* The product shall be capable of providing the following information to an energy management system or other consumer authorized device, service or application via a communication link:
    a. User settings (e.g., temperature setpoint in °F or °C, mode of operation);
    b. Operational status (e.g., room temperature in °F or °C, fan status (on/off), compressor status (on/off))

    The product shall be capable of providing the following information on the product and/or to an energy management system or other consumer authorized device, service or application via communication link:
    a. At least two types of messages relevant to the energy consumption of the product. For example, alerts for room air conditioners might address: reminder to check, clean

or replace filter, notification of energy consumption that is outside the product's normal range.

b. Demand Response (DR) status (e.g., normal operation, delay load, temporary load reduction).

Note: EPA is proposing a number of consumer-oriented features a "connected" RAC must have to be eligible for the allowance. The criteria proposed in 4A have been developed with input from appliance industry stakeholders. EPA believes these enhancements support an important opportunity to empower consumers with new information and control of their appliances and energy costs. As part of a broader trend towards connected homes, appliance manufacturers are introducing communicating appliances that provide new features and services to consumers. EPA focused Section 4A upon a select bundle of features that can unlock new energy savings opportunities as well as consumer convenience. The Agency's intent is to recognize opportunities that can provide consumers with immediate value.

Energy Consumption Reporting: Appliances that monitor and report their energy consumption can enable increased "energy awareness" in residences. When consumers are armed with this information they are empowered to take steps to reduce their consumption. In a Cape Light Compact Pilot, customers in their Residential Smart Energy Monitoring Pilot program received access to an online energy monitoring system. This system monitored only whole-house consumption and provided an on-line dashboard that presented savings information in kWh, dollars, and CO_2 reduction. Despite monitoring only premises metering data, during the pilot participants reduced their home's energy consumption an average of 9.3%.[1] The American Council for an Energy Efficient Economy (ACEEE) 2010 report, *Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review of Electricity Savings Opportunities,* surveys a variety of feedback initiatives that have reduce average household savings by 4-12%, depending on the type of feedback, with greater savings attributed to feedback that is real-time and at an appliance level.

Energy consumption data from an appliance is likely to be the most meaningful to consumers when presented in concert with whole-house consumption and consumption from other principle residential loads such as lighting, hot water heating, and central air conditioning, and when it can be used to generate new insights and personalized tips on steps consumers could take to reduce energy consumption. For the purposes of this specification, requiring that connected room air conditioners report their energy consumption is essentially a small step towards the goal of reduced energy consumption through increased energy awareness. Thus, EPA considered it important to ensure that product energy consumption reporting be accomplished with minimal incremental cost. Therefore, EPA is proposing an energy reporting requirement that does not specify a minimum level of accuracy, but does require in Section 4C that the accuracy be disclosed to third-party developers. Stakeholders have indicated that estimation rather than measurement of energy consumption can provide reporting accuracy on the order of ± 10%, at a nominal incremental cost.

Remote Management: EPA is specifying that connected RACs include remote management capabilities similar to what is controllable on the appliance itself. For example, this could include the ability to turn the RAC off during an unplanned "away" period, and return it to a comfort setting in advance of a planned "home" period. Consumer research has indicated that consumers have interest in having the ability to control lighting, appliance and thermostats with computers or mobile phones (see for example, Parks Associates 2010 Residential Energy Management Survey[2]). One pilot study involving demand responsive RACs found study participants valued remote access to their RACs.[3]

Operational Status, User Settings and Messages: EPA believes it is essential that consumers retain ultimate control over their appliances' operation. Connected appliances will need to provide consumers with information on the product's Demand Response (DR) status so that consumers have the option of overriding a RAC's DR event. Also, notification of DR status will alert consumers that it is a DR event and not an operational issue with the RAC. For RACs, EPA has specified that RAC DR status be either provided on the interface of the product and/or reported via a communication link to a home energy management system or other consumer authorized device, service or application. EPA believes having the product's user settings and product's operational status available to HEM devices and/or applications

could provide added-value for consumers. For example, an external device or application might use the user setting information together with the RAC's energy consumption being collected and reported, to provide consumers with new insights into how much energy is being used to operate the RAC at different settings and temperature set points and then message specific tips for energy and cost savings by adjusting settings. Alternatively, a device or application might leverage product data and remote management capabilities to automatically manage the RAC to generate savings thru decreased energy use.

Section 4A also specifies that products provide consumers with at least two messages related to the energy consumption of the product. These could be provided either on the product or via a communication link to an external device (e.g., a consumer's smartphone, computer, or separate in-home energy display). The language provides several examples including a check filter reminder and notification of unusual energy consumption. When consumers receive a filter check notification, they could take corrective action to clean or replace the filter to help keep the product at peak operating efficiency. A message might also be designed to alert consumers (or some third party, authorized by consumers to receive this information) that the energy consumption is outside of the normal range. Upon receipt of such an alert, the consumer could take corrective action, such as de-icing, repair or replacement of a malfunctioning appliance.

EPA is interested in stakeholder feedback on the proposed consumer-oriented features.

[1] http://www.capelightcompact.org/library/2010/08/3.31.10-Residential-Smart-Home-Energy-Monitoring-Final-Evaluation-342 Report.pdf
[2] http://greentechadvocates.com/2011/01/26/automation-is-appealing-to-consumers-research-firm-says/
[3] New Approaches to Residential Demand Response, http://www.energyefficiencymatters.org/new-approaches-to-residential-demand-response/

B. Demand Response (DR) Functionality:
TBD - *See discussion below. EPA is seeking further input from stakeholders before proposing DR criteria.*

Note: Air conditioning represents a large portion of the demand on the electricity grid during summer months. Once supporting infrastructure is in place, it is expected that consumers could opt to enroll products such as RACs in appliance DR programs that provide direct monetary benefits for enrollment and/or their participation in a certain number of DR events. In addition, the ability to curtail appliance loads in response to grid conditions (e.g., through price and/or DR signals that request temporary load reductions) could improve grid reliability and reduce capital investment and electricity procurement costs; those savings could benefit all consumers if they are passed on through lower rates.

For example, Con Edison's Residential Smart Appliance Program is a DR program that a residential consumer can opt into, enrolling eligible appliances (including a minimum of two RACs).[1] Con Edison provides each enrolled consumer with a supporting home energy management system. Participants receive $10 for each enrolled RAC and $10 for the combination of other enrolled appliances. Consumers retain the ability to override Con Edison's adjustments to the enrolled appliances, but must agree to participate in 80 percent of event hours (on average, Con Edison notes it reduces the power to enrolled appliances 3-5 times each summer for about 6 hours per event).

Based on discussions with RAC manufacturers, EPA is aware there are a number of different approaches that might be used to achieve a load reduction. These include:
- cycling off compressor and/or fan for some fraction of period;
- raising the set point and thereby reducing RAC compressor and/or fan run time;
- utilizing variable speed technology (e.g., compressors); or
- some combination thereof.

For RACs, EPA anticipates such load reduction would mainly shift energy use from a critical time period to a non-critical time of the day (other products, such as lighting, are able to shed load without shifting it to

another time of the day). Some end-use residential loads (like a dishwasher or clothes washer) are more discretionary and could be shifted from one time to another with little impact or inconvenience for consumers. For RACs, since many utilities' peak electricity demand tends to coincide with the hottest days of the year, RAC use is likely to be less discretionary. Therefore, the potential for load reductions from RACs need to be considered carefully to also ensure consumers' comfort is not adversely affected. Additionally, at a minimum, consumers need to be able to opt-out and override their RAC's response to a DR event.

Based on the Smart Appliance petition received, further research, and conversations with stakeholders, EPA identified several possible options, discussed below, for structuring criteria for RAC DR functionality. EPA is seeking additional feedback from stakeholders on how best to structure these criteria.

Option A - Specifying a minimum set of responses that provide some reduction in energy use during the delay period

In 2011, a joint coalition of industry and efficiency advocates submitted the Smart Appliance petition to EPA and DOE. The petition recommended definitions for two RAC-specific minimum DR capabilities, summarized below:

1) A delay appliance load (DAL) capability to reduce RAC energy consumption at least 25% relative to the baseline, for a period of up to four-hours, in response to a signal from a system operator.

2) A temporary appliance load reduction (TALR) capability to reduce RAC energy use by at least 80% relative to the baseline for up to 10 minutes, in response to a signal from a system operator.

For testing purposes, both DAL and TALR energy use reductions would be compared to the baseline energy use measured in the DOE RAC test method (Appendix F).

Based on research and initial feedback from stakeholders, EPA has identified drawbacks and advantages with this approach. EPA's main concern is whether a load reduction that can be verified in the lab will provide a similar response in the field. As an example, consider the following test scenario and use case:

- **Test Scenario:** During the DOE test, the RAC compressor runs 100% of the time. (Note: DOE test measures RAC full-load performance and specifies conditions of 80°F dry bulb (50% relative humidity) indoors, and 95°F dry bulb (and 40% relative humidity) outdoors.) Under these laboratory test conditions the RAC responds to DAL signal by reducing its energy use 25% by, in this case, running compressor 75% of the time.
- **Use Case:** The same RAC is installed in a small, well insulated room. On a 90°F day, the compressor runs about 50% of the time to maintain a 76°F room temperature. Under a DAL response, the compressor would need to run no more than 75% in order to comply with 25% DAL criteria. Thus, there is effectively no response by this RAC and the expected DR benefit is not delivered.

EPA recognizes, however, that DR events that target residential AC are most likely to occur on hot, summer afternoons; therefore, the DOE test method, which tests units at maximum capacity (100% run time), may be a reasonable proxy of real-world conditions during such DR events. However, emergency DR events may also be trigged by a failure or constraints in generation, transmission, or distribution, in which case the need for load curtailment may be independent of the outdoor temperature. EPA encourages stakeholders to share data on typical loading of the installed base of RACs during high summer peak demand.

On the other hand, EPA notes there are also several advantages to Option A. Since the responses are expressed in terms of a percent reduction, this pathway will likely provide manufacturers with the most flexibility to decide how best to achieve these reductions. Incentives could be created and tied to higher levels of reduction, encouraging innovation and development of products that exceed these minimum capabilities.

Option B - Specifying a minimum set of product-specific responses (e.g., set point offset)

Rather than specifying a DAL response in terms of a reduction in energy use, criteria could be structured to specify that a RAC respond to a signal by increasing the set point by a specified offset. This option closely parallels the California Title 24 Upgradeable Communication Thermostat effort.[2] In the proposed Upgradeable Setback Thermostat (UST) specification, the UST ships with a default DR cooling offset of +4°F. However, the UST enables consumers to modify the default DR offset either upwards or downwards, but not less than 0°F. A similar approach of adjusting the temperature set point was used in a Con Edison RAC pilot where in response to a signal, the RAC was cycled at 80°F for the duration of the DR event.

Similarly, a default TALR response could specify the compressor not run during the 10 minute reduced load period. Since most of the energy use by a RAC is from the compressor operation, this approach would likely achieve a similar end-result to the TALR capability discussed in Option A.

One drawback with Option B is the prescriptive nature of the minimum default DR responses. In addition, there is not a current test method specifying setup and test conditions. Lastly, since the response specifies only a set point change, it does not provide any predictive information on the resultant load reduction. However, responses to DR requests may be quantified and analyzed using Advanced Metering Infrastructure (AMI).

Option B does not provide information on the associated reduction in energy use during the delay period. Option A provides some information on the anticipated load reduction in the lab, but as discussed above, a similar reduction in load may not be provided in the field. For either approach, changes to a home's load may be measured using AMI.

Option B may provide a better guarantee over the product's response in differing real-world conditions. It may also prove to be easier and less burdensome for manufacturers to test and verify. Further, this option may be more acceptable to consumers since the minimum DAL response is bounded by some specific temperature offset. Under both Options A and B, the RAC response could be adjusted by a consumer (e.g., Option A: consumers could set a max temperature that once reached, would override the RAC's response to the signal; Option B: consumers could adjust the temperature offset to vary their level of participation).

Other approaches

In response to the Draft 1 V5.0 ENERGY STAR specification for refrigerators and freezers (released in November 2011), EPA received comments from the Electric Research Power Institute (EPRI) on the proposed DR functionality for refrigerators and freezers. EPRI noted that in some regions of the country, the two defined capabilities that were proposed [for refrigerators/freezers] may have little or no value, whereas other services may have significant value. Due to this, EPRI suggested EPA avoid trying to predict the specific services that will be needed and instead consider an approach focused on successfully informing devices of grid condition, rather than their particular response. To this end, EPRI suggesting the following definition: "A device capable of receiving information from the grid (e.g. price, events) and responding to this information according to the preferences and configuration of the consumer."

While recognizing that the needs of the grid vary by across different regions of the country (and will change over time), EPA also believes it is appropriate that specification contain some minimum level of response to a DR request to ensure products can not only receive a signal but that the grid can also count on a number of products being able to respond. EPA is seeking feedback from stakeholders on the definition proposed by EPRI and how the suggested approach of informing devices of grid conditions could be integrated in an ENERGY STAR specification. For example, a broader definition such as the one EPRI recommended, might be integrated along with a minimum set of capabilities (e.g., via Option A or Option B).

EPA encourages stakeholder feedback on the potential RAC DR strategies discussed in this section.

Additional considerations

EPA also wants to ensure that the minimum DR response specified for RACs is acceptable for consumers. In other words, the response should not lead to extreme temperature conditions that cause most consumers to routinely override the function or opt-out of a DR program, thereby negating the potential DR benefits and potentially leading to a less positive experience with the product. EPA is still looking for feedback in terms of how a response (e.g., 25% reduction in energy consumption for 4-hours) would affect the room temperature. EPA is also seeking feedback on whether Option A would need to include an automatic override (e.g., if room temperature exceeds a fixed temperature threshold, such as 82°F), and if so, at what temperature that override should be enabled.

EPA is interested in stakeholder feedback on the different options for structuring a minimum set of DR functionalities, discussed above, as well as any additional approaches that should be considered.

[1] See: https://conedsmartappliance.com/faq.php and https://conedsmartappliance.com/images/gettingstartedguide.pdf

[2] For more information, see: http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/2011-06-09_workshop/presentations/Upgradeable_Setback_Thermostats.pdf

C. Communication Standards, Open Access, and Information to Consumers

A "Connected" RAC shall meet the following criteria:

1. *DR Communication Standards*: For functionality specified in Section B, the product shall use standards identified by the National Institute of Standards and Technology (NIST) Smart Grid Interoperability Panel.[1]

2. *HEM Communication Standards and Open Access:* For functionality specified in Section A, documentation shall be made available to 3rd party developers regarding the accuracy of energy consumption reporting and to allow transmission, reception, and interpretation of the following information:

   - Energy Consumption Reporting
   - Remote Management
   - Operational Status, User Settings and Messages (if provided to consumers via a communication link)

Note: For DR functionally, EPA is specifying that connected appliance communications use NIST Smart Grid Interoperability Panel (SGIP) identified standards to help ensure robust security and interoperability. For HEM communications, EPA's intent is to help drive open standards, interoperability, and 3rd party access, enabling consumers to leverage innovative energy management applications. SGIP identified standards may also be used for HEM communications, but use of other communication standards is also permitted. While not mandated, EPA encourages the development of common appliance control command sets and use of open standards for HEM communications.

EPA is interested in stakeholder feedback on Section 4C. In particular, does the proposed language deliver on the goals of encouraging open standards, interoperability and 3rd party access? Is there additional specificity (either in this or future specification revisions) that EPA should consider to help drive enhanced interoperability for HEM 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

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

Section B, 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 manufacturer provided external network module to enable interconnection with the Smart Grid, Energy Management System, and/or with other external devices, systems or applications*.").

If the product requires installation of one or more communication modules to enable communications specified in B, these modules must be easily user installable and shall either ship with the product or be provided to consumers by the manufacturer or a manufacturers' authorized representative, in a reasonable amount of time.

Note: So that consumers have the information needed to take full advantage of these connected functionalities, Section 4C(3) specifies that information be provided by manufacturers at the point of purchase and in product literature, informing consumers what additional modules, devices and/or infrastructure is necessary to activate the product's communication capabilities. In addition, EPA has specified that if the product requires the installation of one or more communication modules to deliver the functionality specified in 4B, that the module either ship with the product or be provided to consumers in a reasonable amount of time, by the manufacturer. EPA has allowed this second option, acknowledging the relevant standards (e.g., Smart Energy Profile 2.0) are currently in development and it may be advantageous for manufacturers to provide a mail-in form so consumers receive the module, when available, at no additional cost. In addition, EPA specifies that these modules be easily installable by a consumer.

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 EER testing per the sampling requirements defined in 10 CFR 429.15.

B. When testing energy efficiency of room air conditioners, the following test method shall be used to determine ENERGY STAR qualification:

Table 5: Test Methods for ENERGY STAR Qualification

ENERGY STAR Requirement	Test Method Reference
EER	10 CFR 430, Subpart B, Appendix F

C. Compliance with Energy Saver Mode and Filter Reminder criteria shall be through examination of product and/or product documentation.

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 (still in development) shall be certified using the *TBD* ENERGY STAR test method in order to be eligible for the 5% allowance.

Note: In order to be eligible for the 5% allowance, a RAC must have the DR functionality of its connected features certified using the still-to-be developed ENERGY STAR test method. The remaining features will be certified based on examination of product and/or product documentation. EPA and DOE are also aware that the Associated of Home Appliance Manufacturers (AHAM) has begun work to develop a new test procedure for RAC DR functionality. DOE's efforts to develop the ENERGY STAR test method have been delayed due to the lack of RACs currently available with "connected" functionality. DOE believes it will be most productive for its test procedure development effort if manufacturers and DOE could work together on conducting investigative testing on prototypes as they may become available.

6) **Effective Date:** The ENERGY STAR Room Air Conditioner specification shall take effect on January 30, 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.

Note: EPA anticipates completing the Version 3.0 revision in Spring 2012. Due to this updated schedule, EPA has revised the effective date accordingly, to January 30, 2013.

7) **Future Specification Revisions:** EPA reserves the right to change the criteria 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.