

ENERGY STAR[®]

Residential Refrigerators and Freezers

Version 5.0 Specification Framework Document
Stakeholder Webinar
July 25, 2011

Agenda



Introduction – Welcome/Goals	Amanda Stevens, U.S. EPA
Refrigerators & Freezers Version 5.0 Framework Document: Summary & Discussion	
- Scope - Revisions to the Maximum Annual Energy Use	Ryan Fogle, D&R International
- Other Considerations: Unintended Consequences	Amanda Stevens, U.S.EPA
- Other Considerations: Smart Grid Functionality	Doug Frazee, ICF International
Conclude & Next Steps	Amanda Stevens, U.S.EPA

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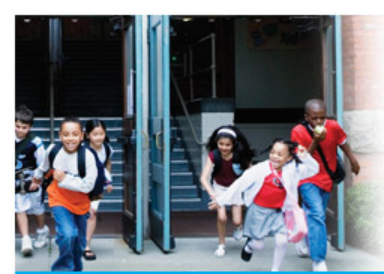


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Meeting Goals



1. Present EPA's reassessment of current ENERGY STAR Refrigerator and Freezer Requirements
2. Facilitate stakeholder discussion of this assessment and possible resulting modifications to the ENERGY STAR requirements
3. Solicit stakeholder feedback on outstanding issues/questions identified
4. Address stakeholder questions about process and/or changes
5. Discuss next steps and timeline



Program Updates



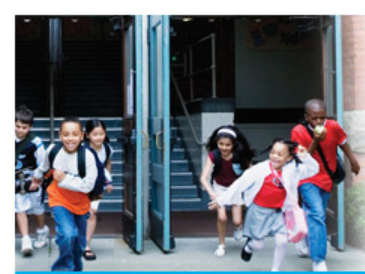
- 2009 Memorandum of Understanding (MOU) clearly defines roles and responsibilities:
 - EPA is lead for brand management including setting and revising specifications.
 - 20 specification revisions expected to be completed in 2011
 - DOE provides technical support, including product testing and test procedure development.
 - 8 test procedures expected to be completed in 2011
- Third Party-Certification began January 1, 2011
 - Over 250 refrigerators and freezers have been third-party certified as of July 2011
 - More information available at www.energystar.gov/testingandverification

Residential Refrigerators & Freezers

Current Version 4.1 Criteria



Product Category	Current ENERGY STAR Level (% Less Energy than Min. Standard)	Criteria Last Changed
Full-Size Refrigerators and Refrigerator-Freezers	20%	April 2008
Full-Size Freezers	10%	January 2003
Compact Refrigerators, Refrigerator-Freezers, Freezers	20%	January 2003

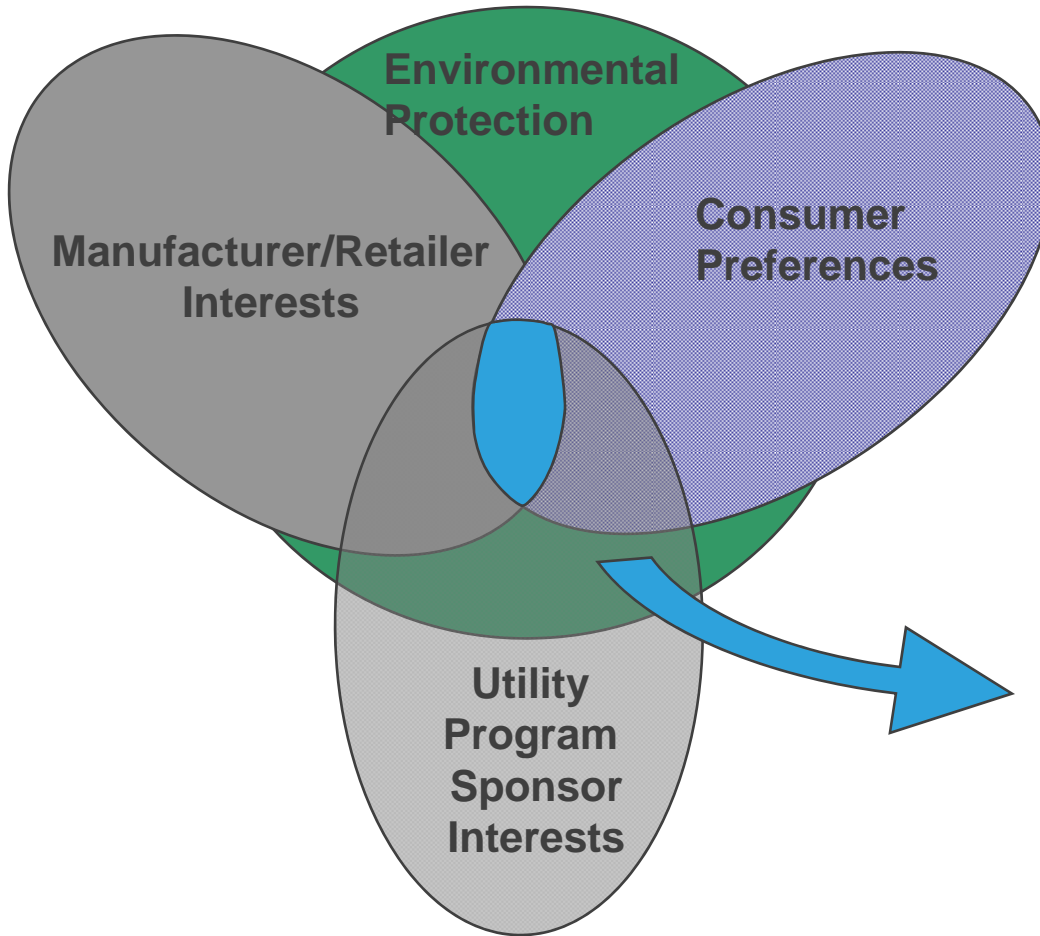


Maintaining Brand Integrity through Regular Spec Revisions



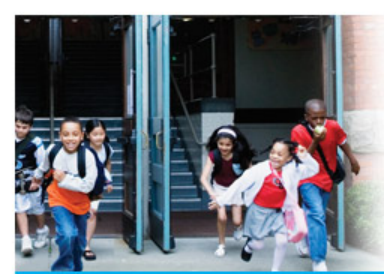
- MOU trigger for specification reviews
 - “For appliances and other product categories with longer-lived product models, specifications will be reviewed for a possible revision at a **minimum of every three years** or once the market share for ENERGY STAR qualifying products reaches **about 35%**.”
- Source: www.energystar.gov/mou
- Market share for ENERGY STAR qualified refrigerators was approximately 36% in 2009
 - Additional factors driving specification revisions:
 - Federal Standards
 - Innovation

ENERGY STAR Overview



- Cost-effective
- No Sacrifice in Performance
- Govt backed

Consumer is Key



ENERGY STAR Guiding Principles



- ENERGY STAR criteria are designed to balance a varied set of objectives, including:
 - Significant energy and/or water savings
 - Cost effective
 - Energy consumption that can be measured and verified with testing
 - Equivalent or enhanced functionality and performance
 - Achievable through several technology options; at least one of which is non-proprietary
 - Label provides meaningful differentiation

Specification Development Cycle



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Anticipated Scope of Revisions *For Full Size Refrigerators*



- EPA is considering changes to the criteria for full-size refrigerators with automatic defrost
- Total ENERGY STAR market share was approximately 36% in 2009
 - ENERGY STAR 2010 USD still being cleaned; initial look suggests significantly higher market share in 2010
- Vast majority of certain refrigerator configurations are ENERGY STAR qualified, e.g., internet survey of products available at major retailers showed:
 - 78-98% of side-by-side refrigerators
 - 87-98% of bottom-freezer refrigerators
 - 36-55% of top-freezer refrigerators

Anticipated Scope of Revisions

Other Categories



- Available data on other product categories indicates that market share is still relatively low

Product Category	Estimated ENERGY STAR Market Share (%)
Manual and Partial Defrost Full-Size Refrigerators	13
Full-Size Freezers	17
Compact Refrigerators	3
Compact Freezers	5

- However, standards for these categories will be raised in 2014, leaving EPA two options:
 - Strengthening the criteria in advance of 2014
 - Sun-setting certain product categories

EPA seeks feedback on whether the Agency should consider revisions to the product categories mentioned in the table based on anticipated advances in the market in response to the 2014 standards. Or, alternatively, whether some of these product categories should be sunset in 2014 when new standards are in place.



Scope Clarification

For Wine Refrigerators and Beverage Centers



- In V5.0, EPA intends to clarify that wine refrigerators and beverage centers are not currently part of the program
 - Consistent with the current FAQ on the ENERGY STAR website
- Some stakeholders have expressed interest in the inclusion of wine refrigerators and beverage centers
 - Further data/information needed to demonstrate differentiation among models in market and savings opportunity

EPA seeks stakeholder feedback on the possibility of extending the ENERGY STAR label to wine refrigerators, beverage centers, or other such products. Specifically, EPA is seeking information/data on the following: *Annual U.S. shipment data and market trends, data on the energy use of products in the market and shipment weighted energy use; test procedure availability; information on technologies that can be applied to improve efficiency; and the price premium associated with more efficient products.*



Drivers for Version 5.0 Revision



- Market share surpassed the 35% market trigger in 2009
 - Preliminary data suggests it was driven higher in 2010 (in part, driven by SEEARP rebates)
- Many products are available that exceed the current ENERGY STAR minimum efficiency levels
 - In 2010, 23% of full-size refrigerators added to the ENERGY STAR QPL exceeded minimum standards by 25% or more
 - There are qualified refrigerators on the market that exceed minimum standards by as much as 35%
 - Cost effectiveness of higher efficiency levels



Drivers for Version 5.0 Revision



- Need to more effectively designate top performers
 - Vast majority of side-by-sides and bottom-freezers in retail stores, are ENERGY STAR.
 - ENERGY STAR retailer partners have expressed concern to EPA about this
- Current structure undermines program's objectives
 - Many product classes obscures increased energy demand associated with certain product configurations
 - Side-by-side and bottom freezers (nearly all available models are ENERGY STAR) have a larger energy allowance per cu-ft and are larger in size, than top-freezers



Version 5.0 Objectives

For Energy Use Criteria



- (1) To better enable consumers to identify the most efficient refrigerators, irrespective of configuration;
- (2) To address disproportionately high market share for certain energy-intensive configurations; and
- (3) To address concerns that refrigerators with high absolute energy consumption can qualify for ENERGY STAR.



Version 5.0 Approach

Under Consideration



- EPA is considering a new approach that would better differentiate refrigerators, irrespective of configuration, based on annual energy use
 - Recognizing utility with through the door ice/water service, incorporate a “functional adder” (in kWh/year) for this feature
- Refrigerators could be segmented into three sizes, with progressively more challenging requirements:
 - ≤ 28 cu-ft (AV)
 - 28 to 33 cu-ft (AV)
 - ≥ 33 cu-ft (AV)



Version 5.0 Approach

Under Consideration



- Within the size segments, maximum energy use criteria could be expressed as a linear function of AV
- EPA's intention is to continue allowing all full-size refrigerators to be eligible for the ENERGY STAR
 - However, EPA has concerns about how much energy use can be credibly considered energy-efficient and good for the environment.
 - EPA plans to factor this into consideration for the largest units

Version 5.0 Approach

Under Consideration



ENERGY STAR Product Class	DOE Product Class	Description	Maximum Annual Energy Use (kWh/year)
Refrigerator-freezers and Refrigerators; Automatic Defrost; and No Through the Door Ice Service	3	Refrigerator-freezers—automatic defrost with top-mounted freezer without through-the-door (TTD) ice service	$AV \leq 28.0$: TBD $28.0 < AV < 33.0$: TBD $AV \geq 33.0$: TBD
	3A	Refrigerators with automatic defrost	
	4	Refrigerator-freezers—automatic defrost with side-mounted freezer without TTD ice service	
	5	Refrigerator-freezers—automatic defrost with bottom-mounted freezer without TTD ice service	
Refrigerator-freezers; Automatic Defrost; and Through the Door Ice Service	5A	Refrigerator-freezers—automatic defrost with bottom-mounted freezer with TTD ice service	$AV \leq 28.0$: TBD $28.0 < AV < 33.0$: TBD $AV \geq 33.0$: TBD
	6	Refrigerator-freezers—automatic defrost with top-mounted freezer with TTD ice service	
	7	Refrigerator-freezers—automatic defrost with side-mounted freezer with TTD ice service	



Version 5.0 Approach

Feedback Sought



EPA welcomes stakeholder feedback on the objectives and approach described in this section.

EPA welcomes stakeholder suggestions on alternative approaches to meet the discussed objectives.

EPA seeks data and information on best practice designs for minimizing additional energy use associated with through the door ice and water service, to help inform the selection of an appropriate kWh/year functional adder for this feature.



Version 5.0 Approach

Under Consideration



- Federal minimum standards likely to change in early 2014
- EPA is considering setting out-year criteria, to be effective 2-3 years after the initial criteria change
 - Approach enables EPA to better leverage stakeholders' time and Agency resources, while providing manufacturers with increased certainty on future ENERGY STAR levels

EPA welcomes comment on the Agency's consideration of setting out-year criteria through this specification revision.

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Preventing Unintended Consequences



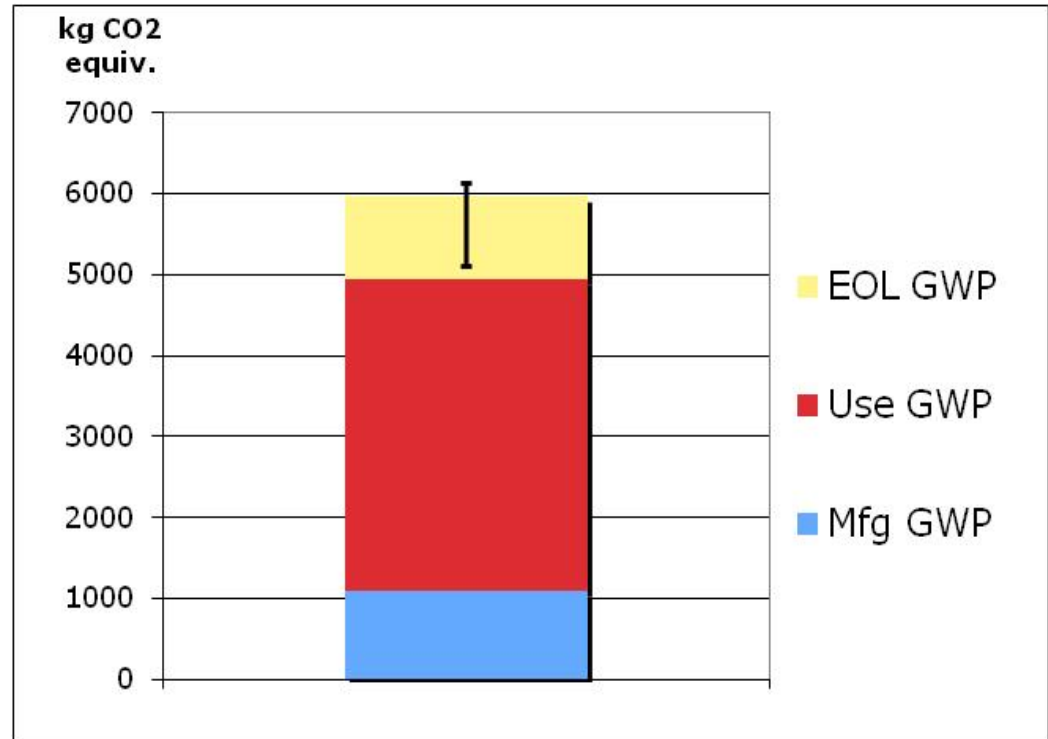
- To guard against possible unintended consequences where ENERGY STAR is recommending a product with high greenhouse gases (GHG), EPA has screened many product categories for emissions outside the use-phase
 - Economic Input-Output Life Cycle Analysis (EIO-LCA)
 - End of Life (EOL) GHG emissions associated with foam and refrigerant, examined relying on data from EPA Vintaging Model, which estimate U.S. consumption and emissions of ozone-depleting substances and their substitutes.
- For refrigerators, this research showed that manufacturing and EOL emissions are relatively significant when compared with use-phase emissions



Life-Cycle Global Warming Potential Typical Full-Size Refrigerator in U.S.



- Common foam blowing agents are potent greenhouse gases:
 - HFC 245fa (1030 GWP)
 - HFC 134a (1430 GWP)
 - HCFC 141b (725 GWP)
 - lesser extent
- No laws in US requiring recycling/recovery
 - Voluntary initiatives like EPA RAD



Note: EOL GWP estimate is based on the recovery of refrigerant and no recovery of the foam-blowing agent (HFC-245fa). Upper limit of bar for EOL GWP represents a scenario where neither the refrigerant or foam are recovered, while the lower bar represents recovery of both refrigerant and foam at technologically feasible rates.



Possible Steps for Version 5.0



- As a result, EPA is looking more closely at opportunities to reduce GHG associated with foam-blowing agents
- Already:
 - Low GWP alternatives exist and are increasingly being used
 - Cyclo-iso pentane blends
 - HFO-1234ze (more recently introduced)
 - Alternatives have long been widely used around the world
 - Multiple manufacturers have already switched to low-GWP foam agents for products on US market
 - Incremental costs relatively low
- EPA is considering a requirement that ENERGY STAR refrigerators be manufactured with low-GWP foam blowing agent (e.g., 100-year GWP \leq 25).



Feedback Sought



EPA welcomes stakeholder comment on a potential requirement that ENERGY STAR qualified refrigerators be manufactured with low-GWP foam-blowing agents.

EPA also seeks stakeholder feedback on both the current and anticipated market availability of refrigerators that meet lower energy use requirements and do not contain high-GWP foam-blowing agents.

EPA is exploring the extent to which meeting this requirement could be demonstrated through participation in any existing initiatives and welcomes stakeholder feedback on this.

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Smart Grid – What is it?



- A set of investments that will bring the century-old electric power grid into the 21st century, using information to move electricity more efficiently, reliably, and affordably.
- The smart grid holds promise to also benefit the environment by:
 - increasing utilization of intermittent renewable generation
 - facilitating the greater use of electric vehicles and energy storage
 - saving energy by shifting energy use away from peak periods where transmission and distribution losses are the greatest
 - enabling new energy savings opportunities (i.e., through real-time, disaggregated, feedback on energy-use to consumers).
- Once requisite infrastructure is in place, *smart grid enabled appliances* will be able to access and leverage energy information, to tailor their operation to when energy is cheaper or cleaner.

Smart Grid Enabled Appliances



- General characteristics of a smart grid enabled appliance:
 - Bi-directional communications
 - Can schedule energy-use (grid connectivity not required) and/or in respond to grid conditions (e.g., via price or event-based signal)
 - Measures and reports its energy consumption
 - In addition, connectivity will enable other customer convenience, and energy-saving features and functionality, such as service reminders, appliance fault notifications, opportunities for remote management, etc.
- Full realization of benefits is contingent on additional infrastructure:
 - Advanced Metering Infrastructure (AMI), aka “smart meters”
 - Grid interconnection with Home Area Networks (HAN)
 - Appliance demand response (DR) programs
 - Variable electricity pricing, e.g. Time of Use (TOU)

Smart Grid Functionality



- EPA is evaluating how best to address and encourage smart grid functionality in ENERGY STAR specifications, in a manner consistent with principle of enhanced consumer value and in response to the Smart Grid Petition EPA received from a joint coalition of industry and efficiency advocate stakeholders.
- For Version 5.0, EPA intends to propose an allowance equivalent to 5 percent of the minimum energy performance level, in recognition of the broader electric power system improvements that smart grid enabled refrigerators and freezers could enable.
- EPA is also considering a possible complementary approach (also proposed recently in the room air conditioner specification revision), of highlighting products as “Smart Grid Capable” on the Qualified Product List (QPL).



Smart Grid Allowance: *An Illustrative Example*



	Current ENERGY STAR (kWh/year)	Smart Grid Functionality Allowance (kWh/year)	ENERGY STAR with Smart Grid (kWh/year)
Top-Freezer (18 cu-ft)	387	19	406
Bottom Freezer (21.5 cu-ft)	462	23	485
Side-by-Side (23.5 cu-ft)	561	28	589
Upright Freezer (16 cu-ft)	601	30	631

EPA requests stakeholder comment on this proposed approach to facilitating the deployment of smart grid functionality in refrigerators and freezers, including EPA's intent to propose a 5% allowance for refrigerators and freezers with smart grid functionality and highlight products with this functionality on the QPL.



Defining Smart Grid Functionality



- Regardless of approach, it is important to define a scope of functionality that is consistent with ENERGY STAR principles.
- At a basic level, smart grid functionality involves the capability to receive, interpret and act on certain DR signals. This is the foundation for the definition advanced by stakeholders in the Smart Grid Petition.
- EPA believes smart grid functionality in an ENERGY STAR qualified appliance should enable more consumer oriented functionality. EPA proposed an initial list in the 7/11/2011 Framework Document and has continued to refine this through ongoing discussions with stakeholders.
 - Note: Based on these ongoing discussions, EPA has updated the list of Smart Grid “Items for Comment & Discussion.” Revised questions are presented throughout the text boxes in this section of the webinar presentation.



Defining Smart Grid Functionality: Demand Response Capabilities



- **Delay Load Capability** enabling a refrigerator to respond to a signal requesting a delay of load for a time duration not exceeding 4 hours. Upon receipt of this signal the refrigerator would shift defrost cycles beyond the delay period and do one of the following: i. shift ice maker cycles beyond the delay period, or ii. reduce average wattage during the delay period by at least 9.6 watts relative to average load over a 24 hour period, and may shift this wattage beyond the delay period.
- **Spinning Reserve Capability** enabling a refrigerator to respond to a signal requesting the start of a reduced load period for a time duration not exceeding 10 minutes. During this period, the refrigerator would need to restrict its average energy consumption to a maximum of 50 percent of the average load over a 24-hour period (unless there is a consumer initiated function, such as door opening or ice or water dispensing).
- Consumers must be able to override their appliance's response to these signals; it is critical consumers retain ultimate control over their appliances.

EPA seeks feedback on the above definitions proposed in the Smart Grid Petition.

EPA also is seeking information on any additional energy use and/or energy savings that may result when a refrigerator or freezer responds to signals requesting reduction or delay in load as defined above and the magnitude of this change in energy use.



Defining Smart Grid Functionality: Consumer Oriented Enhancements



- Bi-directional communication capability, enabling:
 - Communication of energy consumption and related information/data (e.g., cycle selection, status of ice-maker), to consumers
 - Communication of fault conditions (e.g., door left open, maintenance reminders, early warning on failures that warrant service/repair)
 - Remote management (e.g., setting a refrigerator to “Away” / “Energy Saver Mode” while on vacation, being able to turn on ice-maker when still at work, etc.).
 - Uses NIST recommended open-standards for HAN communications



Defining Smart Grid Functionality: Additional, Near-Term Benefit



- Stakeholders have also suggested that in the near-term, products could be designed to automatically schedule load reductions during peak periods (grid connectivity not required).
- This functionality may offer grid benefit as soon as a product is put into service. Also benefits all rate-payers as grid savings are passed on.

EPA requests stakeholder feedback on whether these types of features should be considered in the Version 5.0 specification, how they could be best implemented, and how to ensure consumer satisfaction is maintained.

EPA seeks information on any additional energy use and/or energy savings that may result when a refrigerator or freezer schedules energy use to off-peak periods, in the absence of grid connectivity and the magnitude of this change in energy use.



Appliance Interoperability & Open Access



- In the room air conditioner specification development process, EPA proposed a set of criteria that focused on ensuring authorized 3rd party devices and applications could be used with smart grid products.
 - EPA’s intent in that specification, and for refrigerator/freezers, has been to promote open access, interoperability and consumer choice.
- Appliance manufacturers have expressed concern with 3rd party access, raising possibility of product safety issues and performance degradation that could result from improper use of certain features or capabilities.



Interoperability & Open Access: Feedback Sought



EPA is seeking feedback from stakeholders on how ENERGY STAR can encourage open-access, interoperability and consumer choice, though product specifications, without compromising product performance and safety.

EPA seeks feedback on the possibility of specifying that appliances use NIST recommended open-standards for HAN connectivity.

EPA seeks feedback on what (if any) additional steps might be needed to ensure 3rd parties will be able to issue commands and access data that is outside the scope of these NIST recommended standards, but relevant to energy management?

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Anticipated Timeline for Version 5.0 Spec Revision



July 11, 2011	Framework Document Released to Stakeholders
July 25, 2011	Today's Stakeholder Webinar
August 10, 2011	Written Comments on Framework Document Due
October 2011	Draft 1 Version 5.0 Released , Stakeholder Meeting, Comment Period
December 2011	Draft 2 Version 5.0 Released , Stakeholder Meeting, Comment Period
February 2012	Final Draft Version 5.0 Released , Stakeholder Meeting, Comment Period
March 2012	Final Version 5.0 Published

- EPA welcomes all partner and stakeholder comments by August 10, 2011
- Comments should be submitted in writing to appliances@energystar.gov



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