ENERGY STAR® Lamps ("Light Bulbs")
Product Specification Framework
March 2011

Please send comments to lamps@energystar.gov

I. Introduction

This specification framework is intended to outline EPA's reassessment of the ENERGY STAR lamp programs and describe ways in which the programs may be combined and revised to account for changes in the market. Included in this document are EPA's initial thoughts on eligible products, test protocols, and revisions to program requirements. After each section is a set of questions designed to facilitate discussion with stakeholders and further EPA's understanding of the light bulb product category.

Stakeholders are encouraged to provide feedback on the concepts presented in this document. Communication between EPA and industry stakeholders is critical to the success of the ENERGY STAR program, especially in this early stage of the specification development process. Any and all creative suggestions for improvements to the basic ENERGY STAR approach outlined in this document will be considered for inclusion in future specification drafts. Program representatives are available for additional technical discussions with interested parties at any time during the specification development process. Please send a message to lamps@energystar.gov or to Alex Baker at baker.alex@epa.gov to arrange a meeting.

EPA encourages stakeholders to review this document in conjunction with the ENERGY STAR Version 4.2 specification for CFLs and Version 1.3 of Integral LED Lamps, as the current specifications will serve as a starting point for development of the Lamps Version 1.0 specification.

II. Scope

Purpose of this Section: Clearly-defined product types are particularly important since ENERGY STAR requirements may be tailored to specific product types or product functions. It is also important to identify product types that are *not* eligible for ENERGY STAR qualification for reasons such as the use of proprietary technologies, limited availability of performance data, lack of differentiation regarding product efficiency, presence in market segments outside of the scope of the ENERGY STAR program, or presence in niche markets where limited market transformation potential exists.

Preliminary Approach: EPA is seeking an appropriate balance between providing consumers with easy replacement options for light bulbs in existing light fixtures, and allowing for innovative energy-saving lighting solutions. While this section addresses the scope of existing ENERGY STAR lamp specifications it is not intended to limit the scope of the new lamp specification scope to CFL and LED technologies.

a) Product types not under consideration:

- Lamps requiring external ballasts or drivers
- Linear "T" shape lamps (T-8, T-5, etc.) with integral ballasts/drivers

b) Product types eligible under existing ENERGY STAR lamp specifications: The existing lamp specifications address integrated CFL and LED lamp types outlined below.

i. Lamp shapes:

The Integral LED Lamp specification addresses the specific shapes listed below defined by ANSI C79.1-2002, includes an allowance for "non-standard" shapes (shapes not represented in current ANSI standards) and excludes lamps intended to replace linear fluorescent or high-intensity discharge (HID) lamps.

- Omni-directional A, BT, P, PS, S, T
- Directional BR, ER, K, R, MR16, PAR16, PAR20, PAR30S (short neck), PAR30L (long neck), PAR38
- Decorative B, BA, C, CA, DC, F, G

The CFL specification includes self-ballasted (integrated) lamps in the following shape & sizes, in addition to bare lamps.

- Medium ("Edison" or E26) or candelabra (E12) based lamps, which may have a translucent cover over the bare fluorescent tube.
- Medium ("Edison" or E26) based lamps which have a reflector that may be open or enclosed.
- Medium ("Edison" or E26) based circline lamps with a maximum diameter of nine inches and square lamps with a maximum side length of eight inches.

ii. Base types: While the Integral LED Lamps specification allows for the use of any base included in ANSI/IEC C81.61-2003 American National Standard for Electric Lamp Bases, the CFL specification only allows for E26 and E12 bases, and the Residential Light Fixture program only included scope for GU24 based self-ballasted CFLs. EPA seeks to examine which bases should be considered for inclusion in the scope of the ENERGY STAR Lamps specification.

c) Eligible product types questions for discussion:

1. The LED lamp specification currently requires replacement lamps to fit the ANSI C79.1-2002 shapes, while the CFL specification does not. Are there CFL types that should be subjected to the same dimensional limits? What are the technical challenges and costs associated with meeting this requirement? Please share supporting data.
2. What products, if any, are missing from the scope under consideration that EPA should consider?
3. What product development trends in the lamp industry should be considered that may have an impact on the proper categorization of lamps?

III. Energy Efficiency, Performance, and Quality Features

Purpose of this Section: This section describes EPA's proposals to enhance and update the requirements in the existing lamp specifications.

a) Energy Efficiency: Energy efficiency is the core performance criterion for ENERGY STAR products. Federal standards for general service lamps begin to take effect in 2012, and phase in through 2014. While the standards will decrease the savings baseline, substantial savings will remain available, in excess of 50%, meaning that there is a continued and significant role for ENERGY STAR in providing efficiency guidance to consumers.

i. Luminous efficacy: EPA seeks to balance energy efficiency levels with cost effectiveness and market share to determine the proper levels.

ii. Power factor: EPA intends to examine current power factor requirements and explore the feasibility and cost effectiveness of applying the same power factor requirements to all technologies. Efficiency and power factor requirements for lamps will remain an important component of the lamps specification. EPA will work with stakeholders to evaluate the cost versus efficiency benefit of more stringent power factor requirements.

iii. Energy efficiency questions for discussion:

4. EPA is interested in reviewing data on luminous efficacy levels for new omnidirectional and directional lamps.

b) Performance: EPA seeks to develop ENERGY STAR specifications for products that meet consumers' performance expectations. In the case of lighting, existing specifications have numerous program requirements that go beyond efficacy to set minimum performance levels for light quality. With the exception of integral LED A, PAR and MR shaped lamps, ENERGY STAR specifications historically have not included performance requirements with regards to luminous intensity distribution.

i. Luminous intensity distribution requirements: EPA will consider the value of applying luminous intensity distribution requirements to all lamps which carry claims or appear in form factor to replace ANSI standard lamps.

ii. Start time & run up time: EPA will consider tightening existing start and run up time requirements, and applying those requirements evenly to all technologies.

iii. Performance questions for discussion:

5. Would the consumer experience be enhanced by strengthening the existing intensity distribution requirements so as to more closely match current incandescent reflector products? What are the cost and performance tradeoffs in designing these products?
6. Should EPA consider end-of-life cutoff features for LED products rather than allowing the products to continue to degrade in light output? What are the costs and performance trade-offs? Please share supporting data.

c) Quality: Through ENERGY STAR, EPA seeks to provide lamps that are both energy efficient and also meet consumers' performance expectations relative to the technologies that they are replacing. As EPA seeks to use ENERGY STAR to direct consumers to the most efficient options, and in doing so over time help transform lighting markets. This section proposes ways to address consumer dissatisfiers with light bulbs that are currently ENERGY STAR qualified.

i. Color consistency. EPA will consider the value of tightening color performance requirements. Under the current set of program requirements, there is considerable room within the current CFL and LED specifications for wide ranges in color appearance for light bulbs that should appear to match one another. This range of performance has some drawbacks on consumer acceptance, and EPA seeks to reduce this variability by tightening the program requirements.

ii. Color quality: EPA will investigate color quality metrics that appropriately evaluate lamp performance regardless of technology. In recent years, deficiencies of the color rendering index ("CRI") have been identified, especially in regards to the evaluation of color rendering ability of solid state lighting where low CRI scores can in some instances provide better consumer acceptance than high CRI scores.

iii. Life requirements: EPA will examine life requirements in terms of technology neutrality. One of the advantages of currently qualified lighting products is the longer average rated life, which greatly enhances energy savings and provides consumers with a financial savings and return on the investment in products with a higher initial cost. A question that remains outstanding is whether we have found the proper cost/lifetime balance for each technology, LEDs in particular, and whether there could be advantages in re-examining existing program requirements for product lifetime.

iv. Durability metric / Rapid Cycle Stress Test: Evaluate the existing test methods for durability and determine if one test method is appropriate for all technologies, or if unique durability tests need to be developed and used for different technologies.

v. Quality discussion questions:

7. Would increasing stringency of existing color requirements impact the cost of products? Please share supporting data.
8. Is the current CRI metric appropriate for EPA to use in future program requirements?
9. To what extent should CRI be augmented by other measures of color rendering?
10. What color measurement metric would be most easily understood by consumers?
11. What would be the costs and benefits of shortening the "start time" requirement (currently one second)? Please share supporting data.
12. What are the options and tradeoffs associated with improving "run up time"? Please share supporting data.
13. Should EPA adopt a new definition of "life" that more clearly indicates to consumers the expected performance? What are the tradeoffs in terms of cost versus product life? Please share supporting data.

IV. General Topics and Other Questions

i. **Product labeling/packaging:** The existing specifications contain separate sets of packaging requirements, both affected by the new Federal Trade Commission labeling requirements taking effect later in 2011. Product packaging requirements will be revisited. EPA aims to provide consumers with relevant product information regarding features, proper use, benefits, and energy consumption. During this process EPA will evaluate various means to effectively provide proper use and energy consumption information to consumers, leveraging the FTC label where applicable, and similar guidance for lamps without Edison bases.

ii. **Harmonization, where appropriate, with developments in international product energy efficiency standards**. EPA will examine international test procedures for energy efficiency and other key criteria to determine if harmonization would bring benefits in the development of "global" products.

iii. **Other environmental benefits**. EPA will investigate adding restrictions on hazardous substances, as was included in the recently released the ENERGY STAR Luminaires specification.

iv. **Questions for discussion:**

14. How should the performance of dimming products be characterized or measured?
15. Could non-dimmable lamps be designed to be "dimming tolerant", so that if operated on a dimming circuit, their performance would meet consumer expectations? If so, what are the challenges and cost tradeoffs?
16. What requirements should EPA include regarding dimmer compatibility? Are there tests that can be applied? If not, where might they be developed?
17. Under what circumstances would minor product variations necessitate complete unique testing? Please indentify specific product variations and the tests in which unique product testing would or would not be necessary, and why. Please provide supporting data.