Lucidity Lights, Inc. response to:
ENERGY STAR™ Specification for Lamps, Version 1.0, Draft 2

One Broadway, Floor 14
Cambridge, MA 02142

August 23, 2012

Ms. Taylor Jantz-Sell
ENERGY STAR™ Lighting Program
U.S. Environmental Protection Agency

Dear Ms. Jantz-Sell;

Lucidity Lights, Inc. is developing a next generation energy efficient lighting technology. We have not yet become an ENERGY STAR™ Partner, but plan to complete that step in the near future. We are pleased to have this opportunity to provide comments on the ENERGY STAR™ Specification for Lamps, Version 1.0, Draft 2.

We have reviewed the complete Specification and identified a number of areas where we believe additional discussion is warranted. We look forward to discussing our concerns with ENERGY STAR™ and other ENERGY STAR™ Partners in order to develop a Specification that will best serve lighting users in the United States.

Efficacy Requirements for Non-Spiral, Omnidirectional, Lamps with ANSI Standard Shapes

Customers have expressed a preference for lamps that have the same size and shape as incandescent lamps. This preference is reflected in the ANSI Standard Shape Requirements in the ENERGY STAR™ Specification for Lamps. However, standard shape CFLs and other developing technologies often have lower efficacy than a spiral shape CFL of the same light output. In spite of this lower efficacy, the customer preference for standard shape lamps can lead to enhanced customer acceptance of high efficacy replacement lamps, and standard shape lamps should therefore not be discouraged in the new ENERGY STAR™ Specification.

We therefore agree with TCP's letter of November 29, 2011, that the efficacy requirements for non-spiral, non-dimmable omnidirectional lamps should be 55 lm/W; and non-spiral, dimmable omnidirectional lamps, the requirement should be 50 lm/W; though we would limit these relaxed specifications to lamps with ANSI Standard shapes.

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For the same reasons, we also agree with TCP's letter of November 29, 2011 that the efficacy requirements for Directional lamps should be 42 lm/W for non-dimmable lamps, and 40 lm/W for dimmable lamps; though again we would limit these relaxed requirements to lamps with ANSI Standard shapes.

Rated Life Requirements

This test specifies: "*All directional and semidirectional lamps, and all omnidirectional lamps ≥ 10 watts, shall be tested in accordance with the Elevated Temperature Life Test*." The Elevated Temperature Life Test is described in Annex A.

Options B and C of the Elevated Temperature Life Test require that the lamps be operated in a local ambient temperature of 55°C ± 5°C. Option A specifies that the lamp be operated base-up in a Halo® model H7UICAT incandescent downlight housing or EPA-approved substitute, where that housing is itself operated in an ambient temperature of 30°C ± 5°C. While the interior temperature of the downlight housing is not specified, we assume that it will be 55°C ± 5°C so as to be consistent with Options B and C.

While we agree with the goal of increasing the reliability in general, and the life target in particular, conducting a life test in an ambient temperature of 55°C has serious implications that we do not believe have been sufficiently discussed.

A general rule of thumb for electronic system life is that each 10°C change in temperature changes the mean life of that system by a factor of two. Under ENERGY STAR® Program Requirements for Compact Fluorescent Lamps, Version 4.2, life tests of omnidirectional CFLs are conducted in a life test facility that has an ambient temperature of 25°C. 55°C is 30°C higher than 25°C, and, over the range of temperatures being considered, changes in the internal temperature of the ballast will generally follow changes in the ambient temperature outside the ballast. Therefore, using this rule of thumb, an LED driver that has a life of 15,000 hours in an ambient of 55°C would be expected to have a life of 120,000 hours in an ambient of 25°C (15,000 hours x 2 x 2 x 2), while a CFL ballast that has a life of 10,000 hours in an ambient of 55°C would be expected to have a life of 80,000 hours in an ambient of 25°C (10,000 hours x 2 x 2 x 2).

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These are exceeding long life times for low cost consumer products. The most temperature sensitive component in LED drivers and CFL ballasts is the electrolytic energy storage capacitor used to store 60 Hz energy and therefore reduce 120 Hz ripple on the internal DC bus. At the very minimum, a different, and perhaps much more expensive energy storage capacitor may be required to meet the requirements of the new Elevated Temperature Life Test. Other driver/ballast components may also have to be upgraded to pass the test. It is unreasonable to expect that LED or CFL replacement lamps could be produced at the same cost as they are today if the expected life for both is increased by a factor of eight!

We therefore agree with the position stated by NEMA in their Draft 1 letter of December 9, 2011 that:

> "*It appears that Energy Star is trying to address consumer behavior through product design, which is out of their scope. Manufacturers design products to operate in particular applications and use labeling to tell consumers where the lamps should or shouldn't be used. Requiring elevated temperature testing on all products is, by definition, requiring all products to be designed (and in some cases redesigned) to meet the worst case scenario. This is a manufacturer's decision, and if this is a concern for Energy Star, we suggest they address this issue through consumer education rather than de facto product design standards."*

With regard to at least the Elevated Temperature Life Test, we also agree with the comment made by Philips in their Draft 1 letter of December 8, 2001, namely:

> "*As proposed, the new Energy Star Product Specification for Lamps, Version 1.0 Draft specifications presents a barrier for the progression and adoption of energy saving light sources. It substantially raises the bar for CFL-I, which is a mature technology. This draft will eliminate most of the CFL-Is and exclude the HID lamp technology from the Energy Star program. For the few products that can comply with the specification, it will increase the cost of the products at the expense of the consumer with little or no added value*."

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Run-Up Time

The Run-Up Time Requirement for CFLs that specifies 100% stabilized light in ≤ 90 or 60 seconds, depending on whether the lamp is "covered" or "not covered" far exceeds any customer expectation. We agree with the position stated by Philips in their Draft 1 letter of December 8, 2011, that the requirement should be no higher than 80% of stabilized light. This would be consistent with the fact that the human eye is designed to detect visible light over 12 orders of magnitude, as discussed in the IESNA Lighting Handbook, Ninth Edition.

The 100% stabilized light requirement also means that if LEDs were required to be tested under this requirement, many of them would fail, not because LEDs need time to warm up like a CFL does, but because the output of LED drivers may drift more than 0.5% after the first 60 seconds of operation thus delaying the time when light stabilization occurs[1]. Since the Specification claims to be technology neutral, all tests must be applied to all lamp types, except for lamp types that clearly will always pass the test. That requirement is not met for LEDs under the current Run-Up Time requirements.

Rapid Cycle Stress Test

We agree that lamps are often operated for less than 3 hours per start in residential applications, and that short life under these conditions has caused many consumers to become disillusioned with CFLs. We therefore support the requirements for the Rapid Cycle Stress test in the Draft 2 Specifications.

Start Time Test Procedure – Annex D

This procedure, as written, cannot be used with some developing technologies or CFLs because they do not have an "initial plateau" as shown in Example 1 of the Annex. The test procedure would be more useful if it were based on a specified percentage of the stabilized light value.

The same test procedure specifies a 10X oscilloscope probe. This is unnecessarily restrictive. If a 100X or 200X probe were used with a properly adjusted oscilloscope, would that invalidate the test?

[1] IES LM-79-08, Section 5.0

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The test procedure also specifies that the Trigger Level should be set to 10 volts. This should be specified as the trigger voltage at the probe tip, so it is not mistakenly taken to mean at the oscilloscope input.

Sincerely,

Victor Roberts
Vice President of Technology
Lucidity Lights, Inc.