Department of Energy
Washington, DC 20585

September 29, 2008

Mr. Donald S. Clark, Secretary
Federal Trade Commission
Office of the Secretary
Room H-135 (Annex N)
600 Pennsylvania Avenue, N.W.
Washington, D.C. 20580

Dear Mr. Clark:

Re: Lamp Labeling, Project No. P084206

As a follow-up to my letter of September 3, 2008, I am providing responses to specific questions posed in the FTC ANOPR. These responses pertain only to solid-state lighting and not other light sources.

FTC Question: *Should the Commission continue to require manufacturers to have a ''reasonable basis'' for their energy representations on current labels? Or, should the Commission require a specific test procedure, such as existing DOE test procedures (10 CFR Part 430, Subpart B, Appendix R), for measuring the energy characteristics represented on labels?*

DOE Response: For the purposes of solid-state lighting, DOE strongly suggests that the FTC require manufacturers who label such products to use only IES LM-79, *Approved Method for the Electrical and Photometric Testing of Solid-State Lighting Devices.*

Conventional testing procedures, currently used for fluorescent and metal halide sources, are inappropriate for SSLs. Unlike conventional lighting, SSL products are a combination of several components, including a light-emitting diode (LED) array, an electronic driver that modulates power input and a heat sink that helps dissipate heat from the light source. Both the driver and the heat sink are integral parts of the SSL luminaire and lamp.

Developed in conjunction with DOE's SSL Program, IES LM-79 is the only national test procedure that has undergone the rigorous review that is typical of such standards. Further, it is specifically designed to measure the photometric properties of SSL luminaires and integral lamps. LM-79 can be used to calculate reproducible measurements of total luminous flux (lumens), electrical power (watts), luminaire efficacy, luminous intensity distribution (directionality) and chromaticity (color) of solid-state lighting. An integrated LED lamp refers to an LED device with an integrated driver and a standardized base, e.g., a replacement for incandescent lamps with a screw base or GU24 base. An LED luminaire refers to a complete LED lighting unit consisting of a light source and driver, together with parts to distribute light, to position and protect the light source and to connect the light

source to the power supply circuit. The light source itself may be an LED array, an LED module, or an LED lamp.

FTC Question: *What changes, if any, should the Commission make to the information on current lighting labels?*

DOE Response: In general, the labeling requirements should be updated to address the significant technological changes in lighting and growing consumer interest in energy efficiency. The growing trend away from incandescent lighting raises buyer issues related to energy use, color, and lifetime. These elements should be strongly considered for all lighting.

Regarding solid-state lighting, DOE has recently initiated a labeling program in which manufacturers would agree to voluntarily label LED fixtures and replacement lamps. This program is called **SSL Quality Advocates**. When instituted (our target date is November 2008, it will entail a voluntary pledge by light-emitting diode (LED) luminaire and source manufacturers and others in the lighting marketing channel to provide lighting buyers a consistent set of performance metrics in a clear and simple format.

For luminaires, the metrics include lumen output, luminaire efficacy, power input, color temperature and color rendering index. To comply with the pledge, the manufacturer must test its products, using absolute photometry, in accordance with IES LM-79

We were happy to learn from the FTC ANOPR that FTC "now has the authority to require energy disclosures for consumer products that use lighting technologies not currently specified in the law (e.g., solid-state lighting such as LED products)." The Department would like to assist the Commission by coordinating its efforts on the voluntary SSL Quality Advocates Program to parallel the more formal FTC labeling program, and to serve as an interim consumer labeling procedure until the FTC program is adopted.

FTC Question: *Should the Commission consider requiring descriptors other than those already required (i.e., lumens, watts, and hours)? For example, should the Commission consider operating costs (e.g., dollars per year or dollars per mega lumen-hour), light quality (e.g., color temperature and color rendering index), lifecycle costs, an efficacy factor, or some other metric of energy use? If so, why?*

DOE Response: In keeping with our response on the requirement of a specific test procedure, DOE strongly suggests the use of "luminaire efficacy" rather than "source efficacy" as the proper photometric measure for solid-state lighting (both replacement lamps and luminaires).

The most important aspect in testing SSLs is to compare products that are alike. Pre-SSL procedures allowed for separate testing of lamps (or light bulbs) and fixtures. This approach is called relative photometry. Separately tested fixtures and lamps could be combined to calculate a luminaire's performance. Such procedures were deemed appropriate because these lamps were interchangeable and not integral to the entire fixture. Since LED arrays often cannot be conveniently removed from the luminaire, and because removal often affects the performance of LEDs, the IES decided during the course of the development of its LM-79 test procedure that SSL luminaires must be tested as an integral unit, complete with light source, using "absolute photometry." The scope of LM-79 includes the testing of integrated replacement lamps.

FTC Question: *Should the Commission consider labels that address light quality? If so, what attributes should they convey (e.g., color temperature and color rendering index)? Which of these attributes are most important for consumers?*

DOE Response: The advent of compact fluorescent lighting in the residential market has taught us that color temperature, or the color of visible light, is an important distinguishing characteristic. This will be particularly true for solid-state lighting, in which the range of color temperatures is rather broad and can be utilized for many specific purposes. DOE recommends that the FTC employ *ANSI C78-377-2008, Specification for the Chromaticity of Solid-State Lighting Products*, which specifies recommended chromaticity (color) ranges for white LEDs with various correlated color temperatures (CCTs).

FTC Question: *Do recent or impending changes in technology affect whether and how the Rule should be modified? If so, which technologies would affect modification and how?*

DOE Response: As stated above, the introduction of solid-state lighting into the market place is an important new advancement in technology. Not only does this type of lighting have an enormous potential energy savings impact, up to 10 percent of the nation's building electrical use, its versatility and long life provide equally attractive buyer options. However, since solid-state lighting is so fundamentally different than traditional lighting sources, we are concerned that lighting buyers have an accurate picture of what they are purchasing. Therefore, the FTC should strongly consider a mandatory labeling program for solid-state lighting that at a minimum includes lumen output, luminaire efficacy, power input, color temperature and color rendering index.

FTC Question: *What other information (other than that required by the Rule), if any, are manufacturers currently providing to consumers through packaging disclosures and other advertising to convey characteristics of light bulbs, such as energy use, lighting level, light quality, lamp lifetime, and total lifecycle cost?*

DOE Response: The criteria for ENERGY STAR qualified CFLs require the following attributes of the product be included on the packaging:

- Model number
- Wattage
- Lumen output (see chart below)
- Average rated lifetime
- Correlated Color Temperature
- Warranty (based on application type and standard average usage; see chart below)
- Contact information (800 number, address, or Web address)
- Equivalency to incandescent (if required)
- Minimum Starting Temperature
- Electromagnetic interference
- Known incompatibility with controls and application exceptions
- Mercury labeling

ENERGY STAR QUALIFIED CFL/INCANDESCENT EQUIVALENCY CHART	
A-Shaped Incandescent bulb (Watts)	**Typical Luminous Flux (Lumens)†** *† Lumens must be 100 hr, initial values for CFLs* *Note: excludes globes, reflectors, or decorative CFLs. Lumens for 3-way lamps correspond to maximum equivalency shown.*
25	Minimum of 250
40	Minimum of 450
60	Minimum of 800
75	Minimum of 1,100
100	Minimum of 1,600
125	Minimum of 2,000
150	Minimum of 2,600
30-70-100	Minimum of 1,200
50-100-150	Minimum of 2,150

ENERGY STAR Qualified CFL Warranty and Lifetime Statements Chart *Residential Use Only*	
ENERGY STAR Qualified CFL Rated Lifetime	**Number of Years Claim** *(Based on minimum use of 3 hours/day)*
6,000 hours	5 years
8,000 hours	7 years
10,000 hours	9 years
12,000 hours	11 years
15,000 hours	13 years

Beyond these requirements, CFL manufacturers typically also include comparison statements of lifetime ("Lasts 13 times longer than standard bulbs"), Savings claims (Save up to $108 in energy costs per lamp) and descriptors of CCT (Soft White).

FTC Question: *What changes, if any, should the Commission make to the requirements for the format of lighting disclosures (size, format, color, graphical presentation, etc.)? If appropriate, please provide examples of recommended label designs.*

DOE Response: DOE has adopted a format for its **SSL Quality Advocates Program** that we would like to share with the FTC as an appropriate first step in labeling solid-state lighting. A copy of the draft label is found below. We are finding that the more graphical the nature of the label, the more readable it is for consumers. You will note on the **SSL Quality Advocates** label that we use a chart to depict color.

In addition, it is our opinion that the label itself should be kept relatively simple and contains the most basic information required by buyers to make an informed choice. If more detailed additional information is appropriate, it should be restricted to "off product" labeling, such as on cut sheet, product informational manuals, or on packaging. This is assuming the FTC enabling legislations allows for such things.

FTC Question: *Should the Commission require a uniform label with specific text styles, sizes, etc. (e.g., an ''EnergyGuide'' label for lighting packages)?*

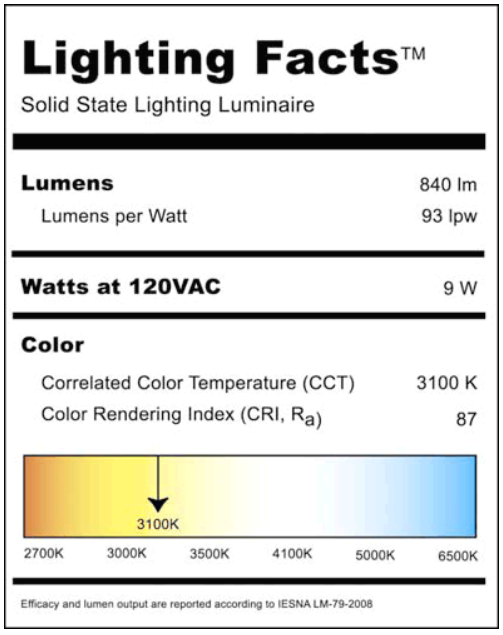
DOE Response: While the types of information may differ from lighting product to lighting product, our recommendation is that FTC requires a uniform label.

FTC Question: *If the Commission were to conduct consumer research on alternative label designs, what questions should be explored?*

DOE Response: For solid-state lighting, DOE would like to work with the FTC to determine the most appropriate way to convey lighting "color" to the consumer. Correlated Color Temperature (CCT) which has traditionally been used by professional lighting designers, is a difficult concept to grasp for the more casual buyer because incandescent products have typically only come in one color. However, since the range of colors possible with solid-state lighting is large, it would be appropriate to devise a reporting system more appropriate for the average residential lighting buyer.

FTC Question: *ENERGY STAR is a voluntary labeling program covering high efficiency products and administered by the* Environmental *Protection Agency (EPA) and DOE. What issues, if any, does the ENERGY STAR program raise with regard to the Commission's consideration of labeling alternatives? Are there any potential conflicts between ENERGY STAR requirements and possible changes to Commission label requirements?*

DOE Response: Since ENERGY STAR is primarily a market differentiator, the FTC label will not necessarily conflict with ENERGY STAR unless the information provided on the FTC label is different from that required for ENERGY STAR. For example, if FTC adopts a labeling procedure for solid-state lighting, but employed source efficacy rather than luminaire efficacy, the two labels would be in conflict. In addition, it is important that the FTC require the same test procedures that DOE has established for both the ENERGY STAR CFL and solid-state lighting programs to assure that lighting buyers are receiving consistent information.



It should be noted here that the ENERGY STAR criteria for lighting products extends beyond the efficiency of the product. Other "quality" attributes are included in the various criteria. These include minimum product lifetimes, minimum light levels, and minimum starting times. All of these were included to ensure that consumers purchase quality products when they choose one with the ENERGY STAR label.

FTC Question: *Should the Commission consider issuing labeling requirements for consumer lighting products other than those currently covered by the Rule? If so, which lamp types should be included?*

DOE Response: As discussed above, DOE recommends that the FTC mandate a consumer label for solid-state lighting fixtures and replacement lamps, and that this label conform to testing procedures that DOE is employing in its ENERGY STAR and **SSL Quality Advocates** Program, the latter of which is described above.

FTC Question: *If the Commission should consider labeling requirements for other lamp types, are there adequate test procedures in place to measure light output, energy use, life, and any other characteristics of these products that may be relevant to FTC labeling requirements? If so, what are they?*

DOE Response: DOE has worked closely with industry standards organizations to develop the appropriate test procedures for solid-state lighting, including IES LM 79 and ANSI C-78, described above. DOE also has worked with IES to develop a test procedure that assesses the lumen maintenance of LED devices, which is a measure of how quickly luminous flux degrades over time. This test procedure will be adopted by IES on September 30, 2008, and is known as IES LM 80, *Approved Method for Measuring Lumen Depreciation of LED Light Sources.* LM 80 specifies procedures for testing lumen depreciation of LEDs, LED modules, and LED arrays, providing a basis for estimating their related effective useful lives. There are also several other test procedures that relate to product performance, safety, and installation that are being used by this industry.

DOE would be happy to work with the FTC to develop procedures for using LM 80 as a basis for estimating the lifetimes of products. For example, DOE could share with the FTC a test procedure it has developed for extending the results of LM 80 tests (which are conducted on products not yet installed in luminaires) to products installed in luminaires.

FTC Question: *If the Commission should consider labeling requirements for other lamp types, are there any issues that would affect labeling for those products? If so, what are those issues and how should the Commission address them?*

DOE Response: On June 2, 2008, EPA issued ENERGY STAR criteria for solid-state lighting that are in direct conflict with the DOE criteria, which was announced in September 2007, and which will become effective on September 30, 2008. DOE believes the EPA criteria to be technically inferior and less rigorous than the DOE criteria. Further, the test procedures that EPA employs have not undergone the vetting process that is customary with such industry standards. DOE will be happy to discuss these issues further at the appropriate juncture.

We appreciate your consideration of these issues and we look forward to working with you on this very important topic.

Sincerely,

James Brodrick, Ph.D.
SSL Program Manager
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

REPORTING LED LUMINAIRE PRODUCT PERFORMANCE

An Initiative for
Better Solid State Lighting

Next Generation Lighting Industry Alliance
with the
U. S. Department of Energy

July 2008

REPORTING LED LUMINAIRE PRODUCT PERFORMANCE

A joint committee of the U.S. Department of Energy (DOE) and the Next Generation Lighting Industry Alliance (NGLIA) has undertaken an effort to assure and improve the quality of solid state lighting (SSL) products. This brochure on LED Luminaire Performance reporting is the initial outcome of that effort. The ultimate goal is to develop an expanded community of *SSL Quality Advocates* throughout the supply chain who are committed to support and implement continuous improvement of SSL product quality.

The rapid growth of SSL has resulted in an increasing number of new products on the market for various lighting applications. While some of these are excellent introductions and showcase the energy-savings potential for SSL, quite a few under-performing products are also appearing in the market. Such products can discourage the early adopters of this new technology, significantly delay market penetration, and may thus disadvantage the entire industry. This situation also occurred in the early days of compact fluorescent lighting, inhibiting market acceptance of CFL products and negating significant potential energy savings in subsequent years.

To avoid, or at least reduce, this problem in emerging markets for solid state lighting, DOE urges manufacturers to agree, as a foundation of product quality, on accurate and consistent ways to report product performance, whether it is in product labeling, product packaging, product literature, press releases, or manufacturer data sheets.

DOE and NGLIA recommend that a minimum set of critical parameters, described below, be reported by luminaire manufacturers to accurately reflect the performance of their products. While not formal standards or requirements at this time, ideally these recommendations would be uniformly adopted for LED lighting product sold in the United States. These recommendations currently apply only to LED lighting, and this document refers only to self-contained replacement lamps, light engines, and full luminaire products, not packaged LED devices.[1] Luminaire recommendations are intended to better inform designers, contractors, and other professionals about the performance they can expect from a lighting product and its suitability for the intended application. Some subset of these critical parameters, in a simplified form, may also be suitable for the retail market.

The initial five recommended parameters for performance reporting are:

- Luminaire efficacy
- Light output of the luminaire
- Measured input power
- Correlated color temperature
- Color rendering index

To provide lighting purchasers more product information, other metrics may be considered in the future, such as those related to reliability, product consistency, or construction. While standardization may make these recommendations obsolete, it is often sufficient simply to ensure that results are completely and consistently reported and accompanied by adequate background information to allow buyers to make a fair comparison among the products available for purchase.

[1] For definitions of the various SSL product levels, please refer to ANSI/IESNA RP-16-05 Addendum a, "Nomenclature and Definitions for Illuminating Engineering," May 2008.

Reported *component-level* measurements are, with a few exceptions, adiabatic or nearly so; that is, they are taken over a short interval so as not to appreciably change the temperature of the LED chip during the measurement. As a result, component-level performance figures are generally optimistic and may differ significantly different from those that would be obtained under normal operating conditions.

Manufacturers of luminaires should insist on good component specifications, including thermal performance and lifetime characteristics, from their suppliers, but should also be aware that this information is not sufficient to describe the finished product. One of the most common misrepresentations of luminaire product performance is simply reporting the device performance without accounting for the influence of driver and luminaire design.

The following recommended parameters apply to all embodiments of LED products that include a driver—the "Lamp" and "Luminaire"— but manufacturers must use care in comparing lamp measurements to full luminaire results. Luminaire measurements, unlike component-level measurements, have generally been standardized with the issuing of IESNA Standard LM-79-2008. It is important to note that this standard specifies *absolute* photometry.

Luminaire Efficacy *(Lumens per Watt) is a specific measure of the net useful light output from the luminaire for a given power input.* Properly measured, Luminaire Efficacy combines both the light source system efficacy and luminaire efficiency, allowing for a true comparison of a luminaire regardless of the light source. Luminaire efficacy is the preferred metric for LEDs because it measures the net light output from the luminaire divided by power into the system, accounting for driver, optical, and thermal losses. Methods for measuring luminaire efficacy of solid state lighting fixtures and lamps are defined in the IESNA standard, LM-79-2008.

Reported efficacy values for a given product can vary greatly depending on how light output and power use measurements are taken. For example, light output could be measured from a light source alone, from an entire luminaire, or within a specific test area. Input power could be specified alternatively as into the light source alone, into a ballast plus source, into a power supply with driver electronics, or at the 120 VAC wall plug. The energy-efficiency community has traditionally compared light sources based on system efficacy, rated lamp lumens divided by power into the system that includes source and driver. This doesn't work for LEDs because there are no standard LED lamp packages or lamp ratings, and, perhaps most importantly, because LED performance depends on the thermal, electrical, and optical design of the system or luminaire.

Light Output of Luminaire *is the total lumens output by a luminaire (as a whole).* For SSL products, luminaire light output must be determined by measuring the output of the entire luminaire (including the LED device, thermal management, fixture, and optics) in an integrating sphere or goniophotometer using absolute photometry.

Measured Power *is the total power consumed by a luminaire measured in Watts*. In all cases, the luminaire power should be measured upstream of power supply/driver. For example, for a luminaire that includes a wall plug, the measured power is at the wall socket input. For a luminaire wired directly to 120 VAC, the measured power is at the 120 VAC input.

Correlated Color Temperature (CCT) *for an SSL luminaire ideally should be determined through integrating sphere testing of the whole luminaire.* If this test result is not available, the CCT value for the LED device used in the luminaire can be reported, but reports must indicate that the CCT value was measured at the LED device level. The CCT of the luminaire may differ from the CCT of the device for any of several reasons:

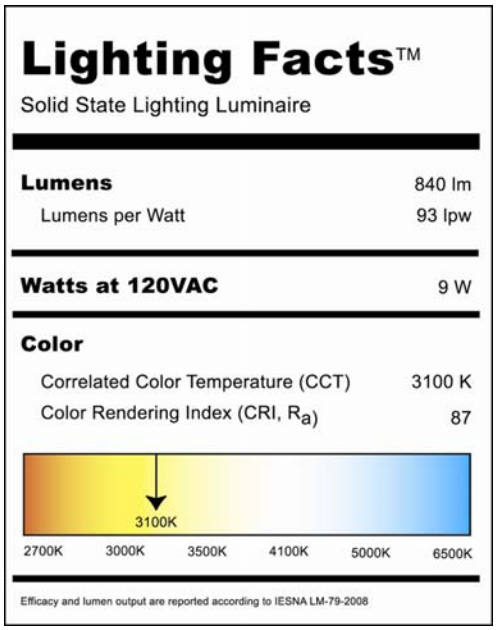
- Operating currents and temperatures can affect the color temperature of an LED device.
- Reflective surfaces or a translucent enclosure on the fixture can change the CCT.
- An array of LED sources may include multiple devices with different CCT values.

Ideally, both Color Coordinates in the CIE 1931 *x,y* Chromaticity diagram and Correlated Color Temperature (CCT in degrees Kelvin) should be reported using ANSI C-78-377-2008, Specifications for the Chromaticity of Solid-State Lighting Products, because there can be confusion about what CCT means, especially if the coordinates are well off the Planckian locus.

Color Rendering Index *(CRI) should be measured according to the standard R_a method used for conventional sources.* As with other measurements, the CRI should be measured for the luminaire in normal steady-state operation to account for any effects of temperature or luminaire design on color.

AN INVITATION TO JOIN *SSL QUALITY ADVOCATES*

This brochure is the first step in an ongoing effort to enhance the quality of SSL products. The DOE is developing a pledge program to expand the community of *SSL Quality Advocates* committed to quality improvement. Luminaire manufacturers who join agree to add a simple *Lighting Facts*™ label to the product, packaging, or accompanying literature specifying the minimum parameters. Similar reporting recommendations will soon be available for source manufacturers. Other *SSL Quality Advocates*, including those who purchase or specify, agree to ask that their suppliers adhere to these recommendations. Please watch DOE's SSL Quality Adovcates website at www.lighting-facts.com, for forthcoming information on how your company can participate by taking the *SSL Quality Pledge*.



The Lighting Facts™ *label provides a quick and simple summary of the critical parameters for a luminaire described in this brochure.*

Solid State Lighting

Quality Advocates

Take the Voluntary SSL Quality Pledge

The rapid growth of solid state lighting (SSL) has brought many new lighting products to the market. Most are excellent introductions and showcase the energy-savings potential for SSL. But some, unfortunately, misrepresent their performance.

Poor or misrepresented products can discourage the efforts of early adopters of the new technology, significantly delay market penetration, and may disadvantage the entire industry.

As a foundation of product quality, the DOE urges manufacturers to voluntarily provide lighting buyers a consistent set of performance metrics in a clear and simple format. For luminaires, the metrics include lumen output, luminaire efficacy, power input, color temperature, and color rendering index.

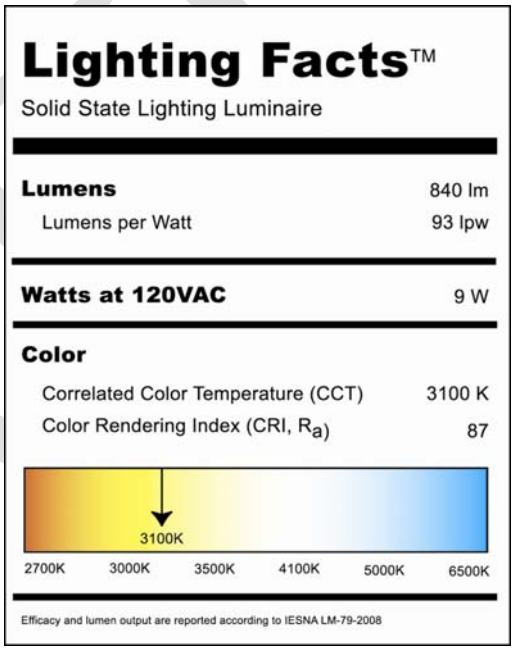
Lighting accounts for about 25% of energy consumption in commercial buildings and 12% of residential energy consumption. SSL can potentially save half of lighting energy, making it an attractive near-term opportunity.

Benefits of the voluntary reporting program include:

- Acceleration of market development
- Enhancement of customer satisfaction
- Differentiation of quality and performance leaders in a new lighting technology.

What Is the SSL Quality Pledge?

The SSL Quality Pledge is a joint effort of the Department of Energy (DOE) and the Next Generation Lighting Industry Alliance (NGLIA) to assure and improve the quality of solid state lighting products.



The SSL Quality Pledge is a voluntary pledge by LED luminaire and source manufacturers and others in the lighting value chain to support the performance reporting initiative. Taking the pledge establishes a manufacturer as an industry leader in support of high quality products for next generation lighting. DOE intends to develop similar pledges for others — including but not limited to buyers, contractors, lighting designers, distributors, retailers, utilities, and efficiency organizations — to support the initiative.

Achievements of SSL Quality Advocates will be recognized and publicized. Other agencies, states, utilities, universities, and trade associations are publicly recognizing corporate efforts in reducing energy use.

The pledge form on the reverse side of this document is specifically for manufacturers of luminaires or replacement lamps. Pledges for LED device manufacturers and others will be available soon on the SSL Quality Advocates website – www.lighting-facts.com.

SSL Quality Pledge

Voluntary Pledge for Luminaire Manufacturers

This Pledge expresses the intent of_____to become an ***SSL Quality Advocate.***

(Company Name)

We pledge to support improved quality of LED solid state lighting products.

As a **luminaire manufacturer**, it is our intent to:

- provide clear and consistent labeling of essential performance, measured by industry standards, *IESNA LM-79, Approved Method for the Electrical and Photometric Testing of Solid-State Lighting Devices* and *ANSI C78-377-2008, Specification for the Chromaticity of Solid-State Lighting Products* in the following categories:
    - Lumen output
    - Luminaire efficacy
    - Power input
    - Correlated color temperature
    - Color rendering index.
- Make critical information readily available on product packaging or literature.

The Department of Energy intends to:

- Continue to drive technology development through the SSL R&D program, including support for work related to product quality and reliability
- Continue a variety of initiatives designed to support market introduction, including testing and demonstration programs, information and education through the SSL website, and other vehicles
- Monitor the accuracy of reported performance, on a sampling basis, through its CALiPER testing program
- Publicize accomplishments and results of the SSL Quality Advocates.

The Department of Energy enters into this Pledge under the authority of the section of 912 of the Energy Policy Act of 2005 (Pub. L. No. 109-58, 42 U.S.C. § 15811) and section 646 of the Department of Energy Organization Act (Pub. L. 95-91, as amended; 42 U.S.C. § 7256). This Pledge in no way restricts any of the Parties from participating in any activity with other public or private agencies, organizations, or individuals This Pledge is neither a fiscal nor a funds obligation document. Nothing in this Agreement authorizes or is intended to obligate the Parties to expend, exchange, or reimburse funds, services, or supplies, or transfer or receive anything of value. This Pledge is strictly for internal management purposes of each of the Parties. It is not legally enforceable and shall not be construed to create any legal obligation on the part of either Party. This Pledge shall not be construed to provide a private right or cause of action for or by any person or entity. All agreements herein are subject to, and will be carried out in compliance with, all applicable laws, regulations, and other legal requirements. Companies or other non-Federal signatories agree that they will not claim or imply that their participation in the SSL Quality Pledge that the Federal government approval or endorsement of anything other than its commitment to energy efficiency, will not make any statements or imply that DOE endorses the purchase or sale of products and services or the organization's view, and will not use the DOE seal without appropriate DOE authorization.

On behalf of _____, the undersigned company representative understands and agrees to the terms of the *SSL Quality Pledge*.

Signature:_____ Position:_____

Printed Name:_____ Date:_____