

DATE : November 13, 2014

SUBJECT : ENERGY STAR® Luminaires 2.0 Comments

ENERGY STAR Team –

Attached are TERRALUX comments and research for the Luminaire 2.0 standard. This document is split into two sections. 1) Proposal & Comments 2) Supporting Research.

1) PROPOSAL & COMMENTS

PROPOSAL – ENERGY STAR is proposing to include Surface-mount / Flush-mount Retrofit kits into the Luminaire 2.0 standard

TERRALUX COMMENT

TERRALUX proposes the following retrofit requirements for the Surface-mount / Flush-mount fixture types. These fixtures include half-pipe and half-moon style wall-sconces, round and square flush-mount ceiling fixtures, and close-to-flush ceiling fixtures. We propose to base retrofit kit criteria of non-directional luminaires on the existing ENERGY STAR Luminaires v1.2, with the following specifications :

General Application	Minimum Light Output	Minimum Source Efficacy	Minimum Warranty / Rated Life	CCT / CRI	Safety Certification	Source Distribution	Other
Retrofit Kits for Incandescent or CFL lamped Wall Sconces	≥250 lumens per head for wall sconce*	Replaceable LED light engine ("source") efficacy shall meet or exceed the values detailed below as determined by comparing the in situ (installed in the luminaire. T _b value to the source's LM-82 test report.	≥5 years ≥36,000	Unchanged from existing ENERGY STAR® luminaire standard	UL8750 – LED Component UL1598C – LED Retrofit	Hemispherical distribution (Wall or Ceiling) : ≥80% between 0-90 ° *	LED lamp replacements must be line-voltage connected and not rely on existing /unknown ballast
Retrofit Kits for Incandescent or CFL lamped Ceiling Surface Fixture	≥800 lumens for flush mount*	≥70 lm/w*	Existing sockets / lamp holders must not be utilized to make electrical connection.				

*Measured at the Source

PROPOSAL - ENERGY STAR is proposing to remove word 'Residential' from specifications.

TERRALUX COMMENT

Terralux is supportive of this change, as the current definition of residential can potentially extend into parts of many commercial buildings like Multifamily, Dormitories, Hotels, and more.

As ENERGY STAR® specification is a mark of high performance, high quality products, we also support raising the requirements on surface-mount and flush-mount fixtures to the commercial standard.

- 36,000 hour rated life
- 5 year warranty minimum
- Power Factor $\geq .9$

These fixtures are most typically used in common area spaces with runtimes typically 24x7, requiring longer rated life and increased warranty. Additionally, corridor circuits typically have many fixtures and a Power Factor requirement is important to protect building power quality.

PROPOSAL – ENERGY STAR is proposing to remove start time requirement

TERRALUX COMMENT

Terralux is supportive of removing this requirement. LED Driver technology supports instant-on products and testing is not necessary. This is a basic customer expectation and manufactures are providing this. 3rd party verification is not required.

PROPOSAL – ENERGY STAR is proposing to remove Zonal Lumen Requirements

TERRALUX COMMENT

Terralux proposes to keep Zonal Lumen Requirements in place. These requirements allow for consistently performing products in the market for specific applications.

PROPOSAL – ENERGY STAR is proposing Performance Scaling testing and requirements

TERRALUX COMMENT

Terralux is supportive of performance scaling testing. LED lighting electronics have well known efficiencies. Warmer light is less efficacious than cooler light in a predictable manner.

By requiring the manufacturer to test the worst case LED scenario, typically the warmest die and/or highest CRI, the cost and burden of testing 5 or more additional CCTs can be reduced.

When the LED MFG and Driver are the same across all CCTs for a given product, there is little need to test all CCTs. Photometric patterns and efficacy will all improve with cooler CCTs.

There is virtually no risk to the ENERGY STAR program, only cost burden placed on manufacturers.

PROPOSAL – ENERGY STAR is proposing to increase Efficacy levels for Luminaires

TERRALUX COMMENT

Terralux is supportive of raising efficacy levels for Downlights and Downlight Retrofit Kits. Reasonable efficacy levels are as follows :

- Increase fixture efficacy from 42 lumens/watt to 55 lumens/watt.

Terralux is supportive of raising efficacy levels for Non-Directional Luminaires. Reasonable efficacy levels are as follows :

- Increase source* efficacy from 65 lumens/watt to 70 lumens/watt.

*Replaceable LED light engine (“source”) efficacy shall meet or exceed the values as determined by comparing the in situ (installed in the luminaire) Tb value to the source’s LM-82 test report.

PROPOSAL – ENERGY STAR is proposing to modify the definition of LED Engine.

TERRALUX COMMENT

Following the ANSI RP-16 definition for LED Engines is appropriate, but considerations should be made for integrated optic specification and retrofit kits. Not all LED engines will require secondary optic system, especially if they are designed for retrofit type applications where the fixture provides secondary optical system. Terralux proposal for definition modification :

“and any optic necessary for the specified application.”

2) TERRALUX SUPPORTING RESEARCH

A : Category / General Application

Presently for indoor applications, DLC and ENERGY STAR® programs only cover T8 type replacements, warehouse, refrigerator case lighting, and a few other functional lighting applications such as Track and Downlights. There is presently a significant market gap in surface mount indoor lighting.

In the commercial lighting space, many ceiling and wall mount fixtures provide 24 / 7 illumination throughout building common-areas including: lobbies, hallways and corridors, stairwells, conference halls, etc. It’s estimated that these 2 billion lamps cost \$30 billion to operate annually, and there are presently no efficiency programs or rebate dollars available for buildings to update and upgrade these fixtures to more efficient LED solutions.

Commercial Sector									
Building Type	Number of Buildings	CFL %	# CFL Lamps	Run Time	Annual Run Hours	# Lamps x Run Hours	Avg CFL wattage	kwh	Annual Operating Cost
Education	454,000	10%	206,787,241	11.2	4,088	845,346,241,717	21	0.1012	1,769,133,178
Food Service	349,000	8%	163,139,892	11.2	4088	666,915,877,433	19	0.1012	\$ 1,291,894,049.21
Food Store	266,000	3%	64,407,867	11.2	4088	263,299,361,585	20	0.1012	\$ 544,100,589.63
Health Care - Inpatient	9,000	13%	268,541,203	24	8760	2,352,420,937,093	18	0.1012	\$ 4,365,852,392.85
Health Care - Outpatient	142,000	9%	184,250,257	11.2	4088	753,215,049,253	20	0.1012	\$ 1,487,876,831.37
Lodging	167,000	25%	516,213,763	24	8760	4,522,032,561,103	17	0.1012	\$ 7,939,809,410.55
Offices (Non-medical)	968,000	14%	299,496,435	11.2	4088	1,224,341,427,504	19	0.1012	\$ 2,384,313,349.90
Public Assembly	326,000	21%	435,036,707	11.2	4088	1,778,430,059,615	20	0.1012	\$ 3,554,909,865.27
Public Order and Safety	83,000	6%	125,685,432	11.2	4088	513,802,047,726	18	0.1012	\$ 958,043,302.27
Religious Worship	435,000	8%	169,157,356	11.2	4088	691,515,272,078	20	0.1012	\$ 1,427,439,440.91
Retail - Mall & Non-Mall	772,000	6%	131,601,434	11.2	4088	537,986,664,105	22	0.1012	\$ 1,191,501,489.82
Services	731,000	4%	76,391,912	11.2	4088	312,290,137,348	18	0.1012	\$ 560,533,403.10
Warehouse and Storage	702,000	6%	129,179,052	11.2	4088	528,083,964,139	18	0.1012	\$ 946,899,307.25
Other	93,000	9%	193,508,100	11.2	4088	791,061,114,337	20	0.1012	\$ 1,630,539,905.06
TOTAL	5,497,000	10%	2,069,306,000				19		\$ 30,052,846,516

¹ 2010 U.S. Lighting Market Characterization

Common building types that leverage these types of fixtures, in 24x7 runtimes : Hotels, Multifamily Housing, Commercial Office Buildings, Education and College, In-patient and Out-Patient Medical, Offices (non-medical), Public Assembly, Religious Worship, and Retail.

ENERGY STAR®'s largest product qualification categories are wall and ceiling mount decorative fixtures, and a retrofit kit option is needed.

Fixture efficacy is difficult to achieve in surface mount fixtures using omni-directional sources, yet wattages can still be reduced based on technology improvements over incandescent and pin-based CFL sources. Fixture efficacy is impossible to categorically measure and define for retrofit kits, because these fixtures can vary significantly in appearance, functionality, and output. Instead retrofit efficiency regulation should focus on improving source efficacy. By definition, this will improve the efficacy of the existing fixture.

B : Minimum Light Output

We propose 250 lumens at a minimum for wall sconce and 800 for ceiling surface fixture. This requirement is the lowest level that can effectively replace a 9 watt CFL lamp (wallsconce) or a single 22w circline lamp (ceiling mount), when using a directional LED source.

Additionally, this proposal is in-line with ENERGY STAR® Non-Directional Residential Fixture requirements in Luminaires v1.2.

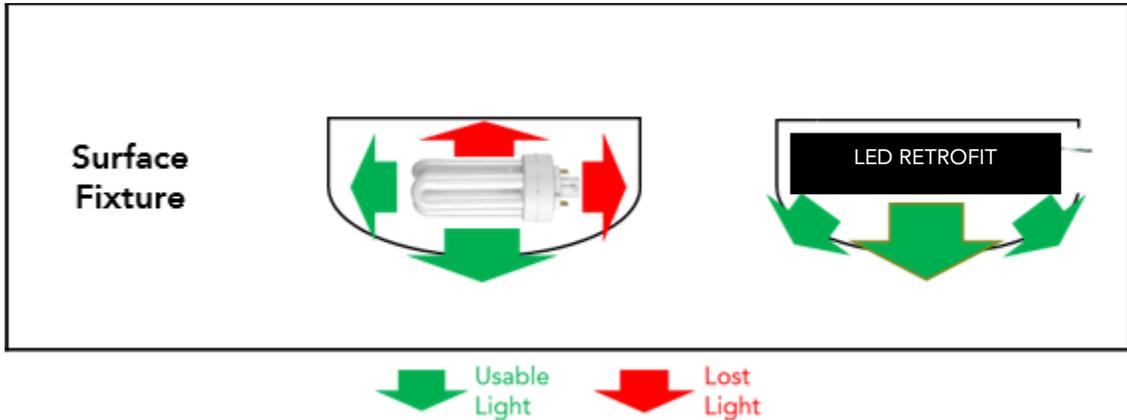
C : Minimum Efficacy

We propose 70 lm/w, using source efficacy.

We propose to use source efficacy for these fixtures because they can be highly decorative and varied. It stands to reason that if you improve the efficacy of the existing source, you will improve the efficacy of the fixture—especially when combined with the directional distribution requirements. Surface fixtures by design are inefficient, so measuring fixture efficacy for retrofit kits is not relevant. It is more important to improve the efficacy and reliability of the source in the retrofit kit category.

Additionally, our proposal is more stringent than the present ENERGY STAR® 'Residential Non-directional Fixtures' source requirements of ≥ 65 lm/w.

By limiting the retrofit to only Incandescent and CFL based fixtures, LED retrofit can provide a significant increase in efficacy. By using a directional source, fixture efficacy can be dramatically improved.



D : Minimum Rated Life and Warranty

Warranty should follow existing commercial requirements.

Minimum 36,000 hours of rated life

Minimum 5 year warranty

E : CCT / CRI / L70

CCT, CRI, & L70 requirements should follow existing ENERGY STAR® requirements.

F : Primary Use

We propose the following primary use applications for this category:

- Retrofit Kits for Incandescent or CFL lamped Wall Sconces
- Retrofit Kits for Incandescent or CFL lamped Ceiling Surface Fixtures

Example Fixture Types



G : Distribution

We are proposing source zonal lumen requirements of 80% between 0-90°.

For wall and ceiling applications, we have found through independent testing that a “directional” light source is much more efficient than a traditional omnidirectional light bulb.

As illustrated in the Intertek test reports, we compared the same fixture with a directional LED light engine (which produces almost all of its light within the 0-90° zone) and the same fixture with 3 CFL GU24 light bulbs.

The efficiency of the fixture equipped with a directional light engine is 84.4 lm/w while the efficiency of the fixture equipped with light bulbs is only 54.6 lm/w, which means that 45.4% of all the light emitted by the bulbs is trapped inside the fixture.

This is a best-case scenario for a CFL lamp fixture, as this fixture allows the majority of the omni-directional light to escape on a primary or secondary reflection.



Decorative Commercial Surface Mount
3 x CFL Lamp
Fixture Efficacy : 54.6 lm/w



Decorative Commercial Surface Mount
1 x LED Retrofit Kit
Fixture Efficacy : 84.4 lm/w

Even in highly decorative fixtures, that are not very efficient, using a directional light source is significantly more efficient than installing an omni-directional source inside a directional fixture. A fixture with an effective directional source can produce less light output, and therefore consume even less power, in order to produce a similar effect and light output in the decorative wall mounted or ceiling mounted fixture.

H : Retrofit Safety

TERRALUX has found and helped correct many unsafe LED retrofit installations. All ENERGY STAR® Retrofit products should be certified and labeled under UL1598C, LED Retrofit.

Retrofit kits for Sealed fixtures, should be certified UL1598C, for specific sealed fixture types, with appropriate Conditions of Acceptability.

I : Lamp Base and Ballasts

Following the work of CLTC, UC Davis, and California Title 24, we propose the following requirements for retrofit kits, taken directly from the LED Retrofit Kit Specification by CLTC. "LED retrofit kits shall use physical methods to prevent incandescent or CFL lamps from being reinstalled."

Utilities will want to ensure that their rebate dollars stay in place, and cannot be backwards replaced with older, less efficient technology. Lamp holders and ballasts must be removed, and retrofit kits must be line voltage connected.

Additionally, LED retrofit products that utilize the existing CFL ballast cannot accurately claim wattage or efficacy numbers in the field. There is tremendous variation in ballast / LED lamp performance.

J : Thermal Considerations in Enclosed Fixtures

LED retrofit kits qualified for Surface mount fixtures, must be able to withstand the challenging thermal environment of sealed fixtures and elevated ambient temperatures as they are often mounted on or recessed within ceilings.

LED retrofit kits for enclosed fixtures should not need to rely on active cooling devices, such as fans.

K : Other – Requirements

We propose that the new category follow all existing ENERGY STAR® requirements for :

Power Factor, $\geq .9$

Tolerances (Light Output, Efficacy, Allowable CCT, CRI, PF)

Lumen Maintenance Projection Requirements : $\geq 35,000$ hours

Warranty : ≥ 5 years

L : Existing Retrofit Products in the Market

There are presently a wide variety of retrofit kits in the marketplace that serve these fixtures, with high variation in product quality.

A ENERGY STAR® category would help industry specify safe, higher performance retrofit products into the marketplace.



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