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SUBJECT: Philips HADCO comments on Revised Draft Criteria of Outdoor Area and Parking Garage SSL Luminaires.

Philips HADCO appreciates the opportunity to continue working with the DOE and to comment on this important initiative.

General Comments

HADCO regards ENERGY STAR® as a voluntary guideline to promote energy efficient lighting products. However, there are a growing number of utilities, municipalities, engineers, lighting designers, consultants, and others who include ENERGY STAR as a requirement in their specifications and ordinances, and they regard it as a de-facto "standard".

While we understand that it is not the intent of the DOE for this to happen, it is nevertheless a reality in today's outdoor lighting market. To avoid conflicts and confusion, we urge the DOE to harmonize with lighting standard setting organizations, in particular the Illuminating Engineering Society of North America (IESNA) and the National Electrical Manufacturer's Association (NEMA).

For example, in the document "Fitted Target Efficacy (FTE) Algorithm" on page 2 in step 18 it states that the highest scores will be for "…those distributions approximating rectangles." The classification definitions in the IESNA Lighting Handbook specify distribution requirements (example: Type V, short), none of which include rectangular shapes. This creates the possibility for fixture manufacturers to be penalized by the FTE metric for non-rectangular distributions while meeting IESNA classifications.

NEMA is currently engaging Congress on the Outdoor Lighting Bill that will include standards for an efficacy or lumens per watt (LPW) metric. This Task LPW that includes an Energy Effectiveness Factor (EEF) is based upon existing IESNA classifications, but it differs from the FTE metric.

These examples illustrate how the lack of harmonization causes issues in light of existing standards and legislation.

Optical Challenges

From an optical design point of view, rectangular lighting distributions would require an additional initial lumen burden in order to "fill in the corners". Alternatively, rectangular distributions could be created with higher beam angles of light exiting the fixture. Both of these conflict with the intent to promote energy efficiency, and the later also exacerbates the issue of light pollution and light trespass. Higher angles result in light leaking into the night time sky as well as light leaking over into neighboring properties.

Another optical design challenge is the conflict due to typical Light Emitting Diodes or LEDs producing Lambertian radiation patterns that are conical, not rectangular. Starting with rectangular radiation pattern LEDs would assist optical design for fixtures, but these LEDs do not exist nor are we aware of any plans by LED manufacturers to provide them.

Questions Regarding the FTE Algorithm

What is the significance of using coordinates (-8, -6) & (8, 6) and 0.1 by 0.1 grid spacing to end up with 19,200 calculation points?

Why use 30:1 max:min uniformity as a criterion?
The IESNA sets uniformity standards for various applications and 30:1 max:min is high; typically 10:1 or lower is required. By setting the value too high you penalize LED fixtures with better (lower) uniformity and reward non-optimal fixtures.

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An FTE Example

HADCO used the FTE calculator on numerous types of Area and Roadway fixtures including post tops and arm mounts. The calculator was very easy to use and intuitive. Provided herein is one example of FTE calculations on post top fixtures.

The fixtures in this example are a HADCO LED refractive globe fixture and a competitor's clear textured acorn globe LED fixture. Both were designed for Type V distributions per the IESNA definition and have similar initial lumen output values. The HADCO fixture is available with clear composite or solid metal roof while the competitor's fixture is only available with solid metal roof.

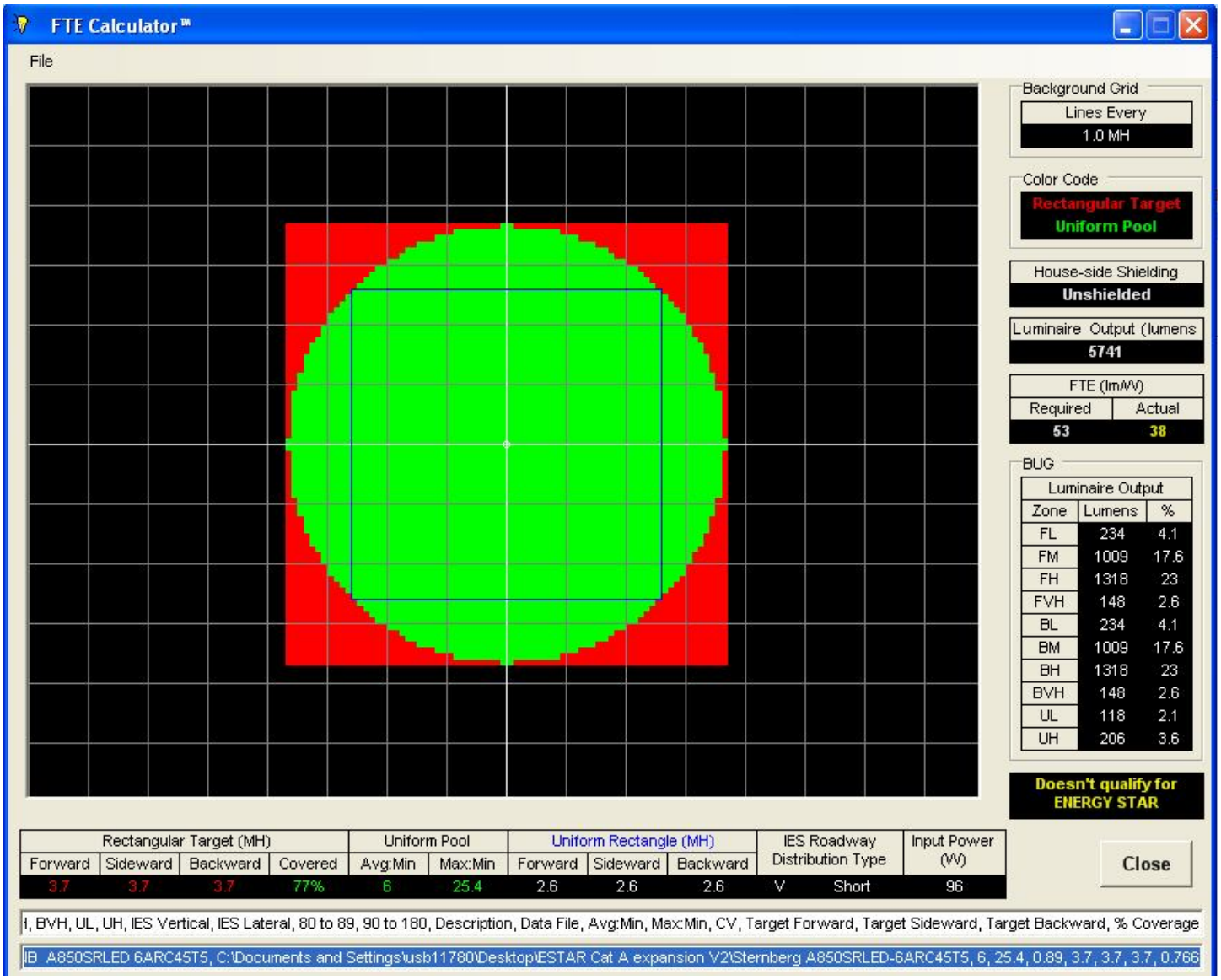

Figure 1. Competitor fixture performance per the FTE calculator.

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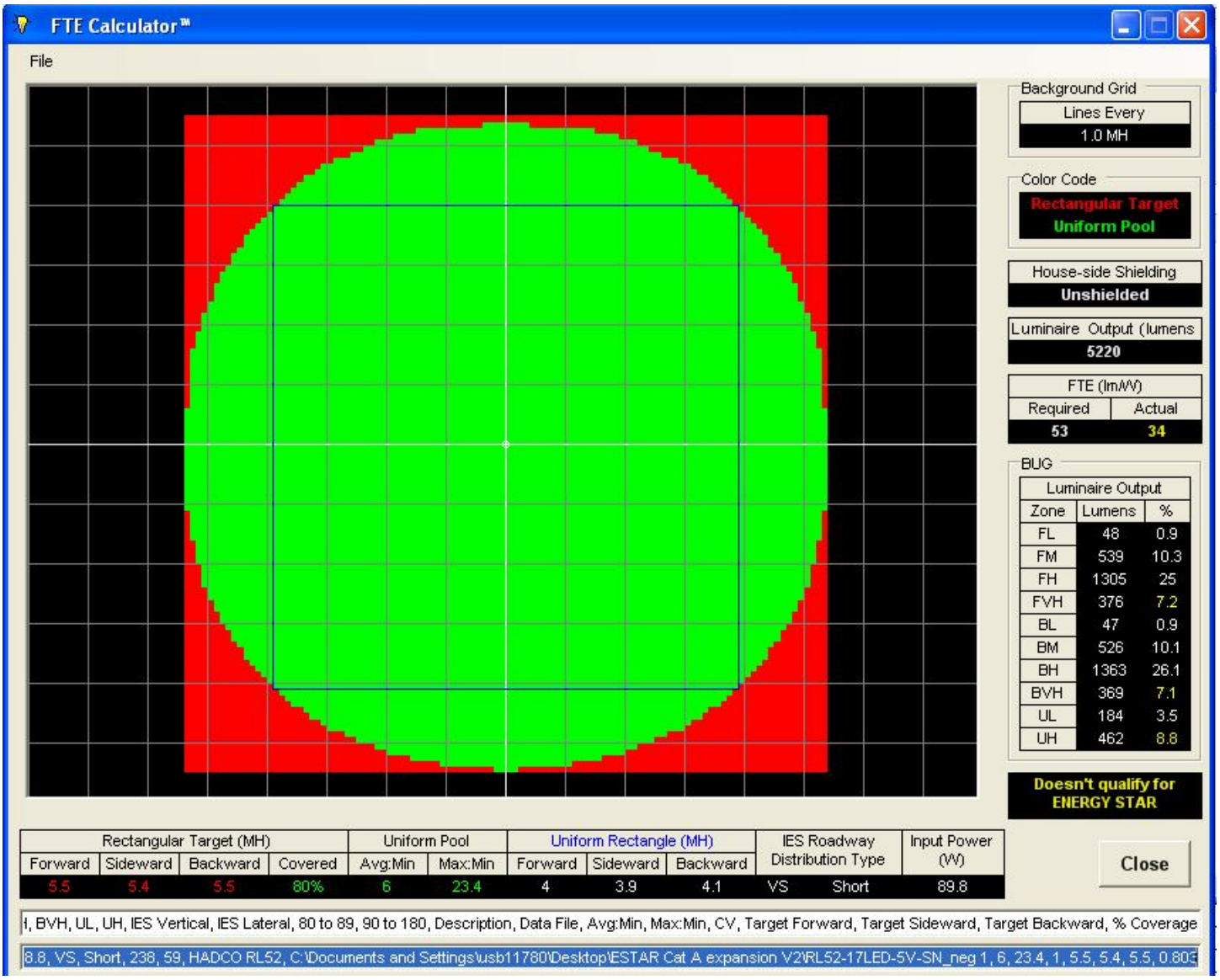

Figure 2. Philips HADCO fixture performance per the FTE calculator. This is the solid metal roof version.

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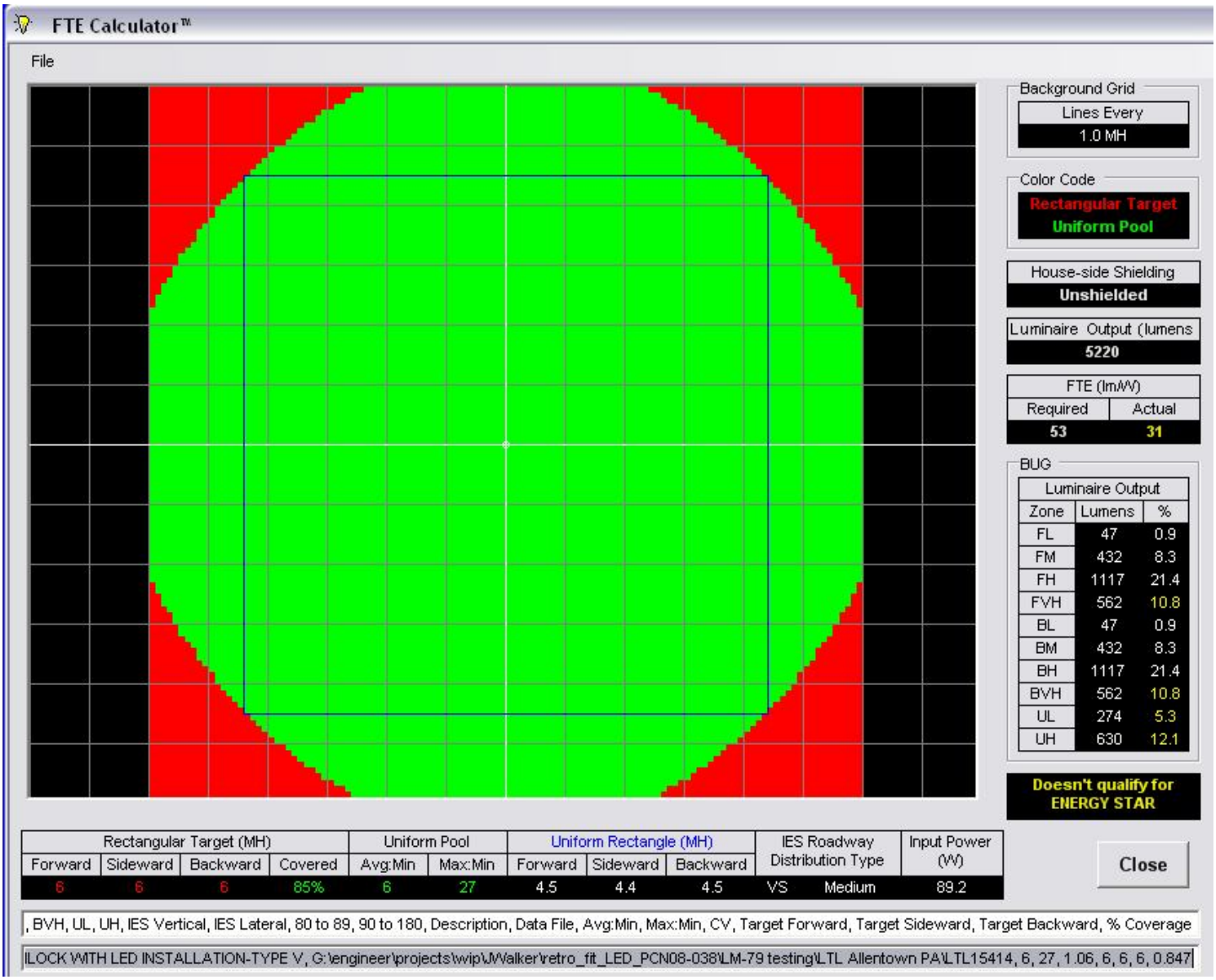

Figure 3. Philips HADCO fixture performance per the FTE calculator. This is the clear composite roof version.

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FTE Example Results and Observations

Here are some statistical results from this example:

Fixture	Input Power (W)	Lumen Output (lumens)	Rectangular Target (MH) & Coverage	Uniform Pool Avg:Min	Uniform Pool Max:Min	LPW per FTE calculator	LPW per IESNA .ies file
Competitor	96	5741	3.7 x 3.7 x 3.7, 77%	6	25.4	38	59.9
HADCO – solid roof	89.8	5220	5.5 x 5.4 x 5.5, 80%	6	23.4	34	58.1
HADCO – clear roof	89.2	5220	6 x 6 x 6, 85%	6	27	31	58.5

Even though the competitor fixture has higher LPW per the FTE calculator, all three fixtures have comparable "traditional" LPW values – and the HADCO fixture achieves this while consuming less input power and with less lumen output.

The HADCO clear roof photometric (.ies) file was generated by a DOE-approved independent test lab per LM-79-08; the HADCO solid roof .ies file was generated in HADCO's environmentally controlled lab following LM-79-08 procedures. Our lab is compliant to ANSI (American Nationals Standards Institute) and NIST (National Institute of Standards and Technology) standards and it undergoes annual review. The lab is recognized to participate in UL's Client Test Data Program and ETL's Satellite Program.

Per the .ies file, it seems that the competitor's fixture was not tested per LM-79-08 and it definitely was not tested by a DOE-approved independent test lab. It does appear to have been tested using absolute photometry. It is curious that this fixture performs better per this FTE calculator even though it was not tested per LM-79-08 considering that LM-79-08 is required for SSL ENERGY STAR.

The HADCO fixtures also cover larger areas more effectively. You would need 1.5 – 2 times as many competitor fixtures to cover the same area illuminated by one HADCO fixture. The FTE metric only evaluates a single fixture at a time when the vast majority of outdoor lighting applications require multiple fixtures, which is why applications tools such as AGi32 are typically used for layouts.

Therefore, in this example the FTE metric penalizes a fixture with a more effective optical design that consumes less power and covers a greater area. This contradicts the objective of promoting energy efficient lighting products.

Summary

While Philips HADCO supports DOE efforts to promote energy efficient products, we encourage a harmonization with existing standards set by lighting industry groups as well as harmonization with existing lighting legislation. This will facilitate market adoption and alleviate confusion. It will also encourage optical performance improvements and will promote energy efficiency without requiring disruptive fixture / optical designs or disruptive LED device changes to achieve rectangular distributions that meet a different metric. LED market transformation is already happening by applying best practices, coordinating technological improvements, and enhancing existing lighting industry standards. We look forward to the DOE continuing to facilitate LED fixture market growth and engaging manufacturers including Philips HADCO in this effort.

Submitted on behalf of Philips HADCO
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