

Horticultural Lighting: Draft 1 Guide and Key Questions

The DLC would like your input!

If you have ideas, comments, or suggestions for how to address these issues (or any others), please send a DLC Comment Form with supporting technical justification to info@designlights.org. These key questions apply to the **Draft Technical Requirements for Horticultural Lighting Products** released for stakeholder input on April 13, 2018:

Key Questions: Existing Industry Efforts

The DLC's goal is to encourage the growth of a market for quality, energy-efficient horticultural lighting solutions. Since the DLC Member efficiency programs are the primary customers for DLC requirements and QPLs, energy savings will be a key consideration in this pursuit. However, the DLC seeks to understand the needs of many potential users, such as manufacturers, growers, specifiers, academics, and others. As with work in the Solid-State Lighting (SSL) or Networked Lighting Control (NLC) market sectors, the DLC realizes that products that reduce consumed watts but do not meet other market needs will be less successful and save less energy.

- The science of providing for plants' needs with artificial light is still developing. The DLC acknowledges the importance of allowing growers to experiment with varying "light recipes," while ensuring that positive energy outcomes are delivered.
- Wherever possible, the DLC seeks to base its specifications and requirements on consensus-built industry efforts. Specifically, the DLC is aware of and intends to remain engaged in the ASABE efforts (X642 and X644 in the ES-311 committee) to define standardized testing and evaluation methods, and the IES efforts (TM-33) to generalize photometric data formats for non-traditional applications.
- The DLC is interested in the potential for an industry-accepted labeling program to standardize the presentation of certain key performance data on brochures and specification sheets, and welcomes commentary on the merits of the varying proposals currently circulating.

Key Question: The DLC seeks feedback on any industry efforts underway that should be considered. These include standardization of terms and definitions, and of labeling conventions.

Key Questions: Technical Requirements - General

- In interviews with some stakeholders, it was suggested that there may be a market for fixtures that operate on direct current electricity (DC). While the DLC's general-illumination and networked lighting controls efforts are working to incorporate DC and Power-over-Ethernet (PoE) approaches, the DLC seeks commentary on its proposal that only products intended to operate from AC line-voltage will be eligible in the first iteration of the horticultural requirements.
 - In market research conducted in support of this development effort, very few products were identified as intended to operate on DC distribution systems, suggesting that this potential market is, at least for the moment, relatively small.
- Roughly 30% of surveyed products in the DLC's background research appear to use a fan for active cooling – a much higher rate than the general SSL applications the DLC currently addresses. Longevity of an incentivized product is important to the DLC's Members, so the DLC is looking to better understand the reliability implications of this new element.

Key Questions: The DLC seeks feedback on A) whether to allow products with fans, and B) if the answer to A is yes, how to assess the lifetime and reliability of those products in a way that gives certainty similar to established LED flux maintenance and driver longevity assessments. Feedback on these questions will be most compelling if they include robust engineering justifications and fleet reliability data.

- Some designs feature pumped liquid coolant loops integrated with fixtures. Although these systems are intriguing, there are complications when including them in this effort. The DLC seeks comment on its proposal to disallow these designs in the first version of the requirements for the following reasons:
 - While integrated-fan, external forced-air, and liquid-cooled approaches are all mentioned in Annex B of the ASABE X642 testing protocol, the confounding variables involved with testing of liquid-cooled and external-forced air-cooled fixtures in integrating spheres and goniophotometers do not give the DLC confidence in their repeatability and uniformity among test laboratories. As standardization of these approaches matures, the DLC will re-evaluate its stance accordingly.
 - These systems have complicated interactions on the overall energy consumption of a facility, including direct effects to the HVAC system that

are dissimilar to those of traditional lighting products. DLC Members have expressed that they need more time to understand and properly assess these systems, to ensure appropriate program measures are developed.

- The DLC proposes to use component-level testing, i.e. LM-80 and TM-21, as a means of extrapolating flux degradation due to a) the established practicality of its use in general illumination products, and b) the lack of an established testing base of whole-fixture LM-84 approaches in the existing horticultural lighting market. However, the DLC has heard concerns that both the increased sensitivity of plants and the harsh environment of indoor cultivation are distinct enough that whole-product testing may be desirable to provide the best possible longevity estimates.

Key Questions: The DLC seeks feedback on the proposed approach of using component-level testing and extrapolation methods to assess degradation of flux output. The DLC is aware that the alternative of whole-product testing presents an increased cost to manufacturers, and appreciates stakeholder feedback on how to best manage the balance between rigor and certainty in the performance of fixtures vs. the time and cost to test at the whole-fixture level.

- When speaking with testing laboratories, the DLC learned that, while measurement and verification of each other's results in the 400-700nm (PAR) emission band was covered by existing "round robin" approaches currently in use, the complete ASABE band of 280-800nm is not yet verified in the same way. This is one of the reasons that the DLC will not make threshold requirements depend on ex-PAR (i.e. <400nm or >700nm) emissions in this revision of the requirements. The DLC seeks comment on a proposed policy to require any laboratory wishing to produce reports for use in these requirements and QPL, to begin cooperation in a similar mutual test scheme. This serves the goal of building the industry-wide testing infrastructure to enable further reliance on all measured data across the full ASABE wavelength band.

Key Questions: Technical Requirements – Product Categories

- Facility geometry, amount of available natural light, requirements of plant biology, and grower-specific economics may lead to varying products being best for a given user. While the DLC cannot create requirements for every possible situation, output is a useful differentiator for many types of users. DLC Members are also likely to use the differing efficacies of varying incumbent sources as a guideline for incentive funding levels.

- Low-output fixtures may be used for supplemental or sole-source lighting, depending on application variables. The field of incumbent technologies range from low-wattage HID to fluorescent to occasional use of CFL or incandescent sources.
- High-output fixtures can also be used as supplemental or sole-source lighting, but generally have a smaller set of incumbent technologies – high-output HID, including HPS and MH single- and double-ended lamps.

Key Questions: The DLC seeks feedback on the proposed category structure. If additional categories are suggested, the DLC requests that commenters include recommendations and justifications for performance criteria that would differentiate each category.

Additionally, the DLC seeks feedback on an appropriate break-point between “high” and “low” output products.

- The DLC proposes to use μmol of photosynthetic photon production (i.e. flux output within PAR, 400-700nm) per joule of electrical energy consumed as the primary efficiency metric and threshold performance requirement for the QPL (“PPE”). The threshold values of PPE are a balance among incumbent sources, technically achievable SSL performance, and the need to allow an energy budget for ex-PAR (i.e. <400nm or >700nm) experimentation in this young and rapidly growing field of research.

Key Questions: The DLC seeks feedback on A) the choice of PPE as a key threshold metric, and B) the specific choices of PPE values for the varying categories. If different values or measurements are suggested, the DLC requests that commenters include recommendations for uniformly testable parameters that would allow for selection and comparison between products. If suggested thresholds are below known non-LED incumbent performance, the DLC requests commentary on how energy savings for efficiency program implementation could be justified.

- Spectral tuning of output flux may allow users to obtain ever-finer control over their growing parameters. While the scientific data regarding these “light recipes” are still nascent, the DLC wishes to encourage standardized communication about this feature. To that end, the DLC seeks comment on its proposed multi-channel testing and results display policy. The DLC is especially considering how to balance the burden of generating useful product information with that of processing it into a state useful to end users.

- Reporting with ASABE X642-based (LM-79) testing of whole-product and single-channel modes for a fixture is the most technically complete method, but does add to the testing burden to qualify a product.
- Allowing for an alternative approach using calculations based on various component-level details may reduce testing burden for manufacturers, but increase confusion for end users of the QPL.

Key Questions: The DLC seeks feedback on the proposed approach to tunable products. The DLC requests that alternate proposals consider A) what testing would be required, B) what supplemental documentation to the testing the DLC would require for assessment and qualification purposes, and C) what information it would be most useful for the DLC to include on the QPL for users to understand the range of performance the product can achieve.