



Bringing Efficiency to Light<sup>SM</sup>

# **Topics in Lighting of Cannabis Grow Facilities**

2018-11-30

# Who Are You, Anyway?

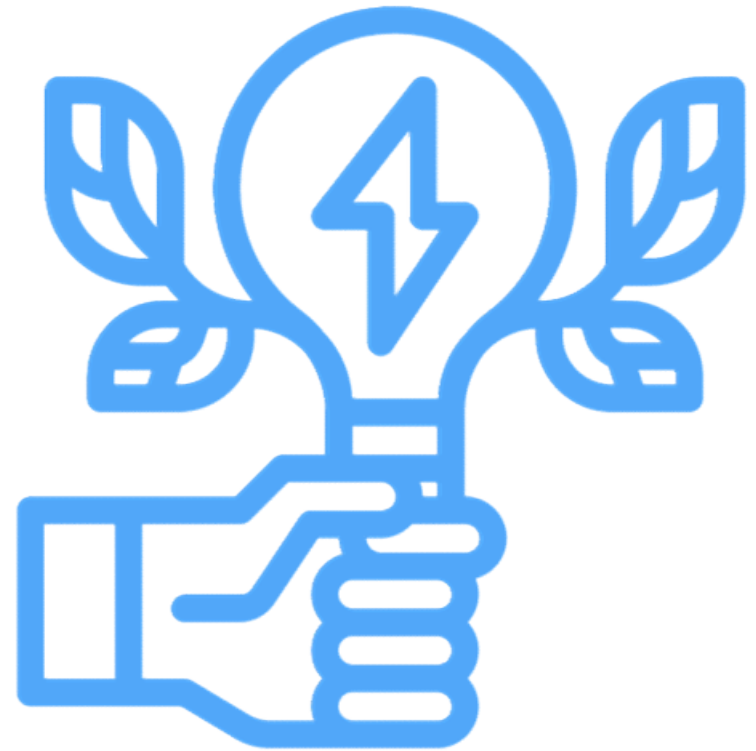
- Proud residents of Medford Square
- Small nonprofit
  - “20 people with a blog”
- We help utilities show prudence when choosing what to incentivize for efficiency programs
- General lighting, networked lighting controls, and now, networked fixtures



Wikipedia

# Why Hort Fixtures? Energy!

- Controlled Environment Agriculture (CEA) uses energy, and lighting is a big piece of that
- DLC member utilities need to get a handle on this load
- Industry is in the early stages, with rapid tech and product changes occurring
  - Performance claims have some . . . issues



# But They're Just Light Fixtures, Right?

Hort	Photosynthetically Active Radiation (400-700 nm)
Human-Based	Visible Light (380-770 nm)
Hort	Photosynthetic Photon Flux ( $\mu\text{mol/s}$ )
Human-Based	Luminous Flux (lumen)
Hort	Spectral Quantum Distribution ( $\mu\text{mol/s/nm}$ )
Human-Based	Spectral Power Distribution ( $\text{W/nm}$ )

Hort	Photosynthetic Photon Flux Density ( $\mu\text{mol/s/ft}^2$ , $\mu\text{mol/s/m}^2$ )
Human-Based	Illuminance (ft-cd, lux)
Hort	Photosynthetic Photon Intensity Distribution ( $\mu\text{mol/s/sr}$ )
Human-Based	Luminous Intensity Distribution ( $\text{lm/sr}$ )
Hort	Photosynthetic Photon Efficacy ( $\mu\text{mol/J}$ )
Human-Based	Efficacy ( $\text{lm/W}$ )



# Is LED Up To The Job?

- Baseline: most efficient existing product – the 1,000W HPS
- DOE / Navigant study: overnight potential savings of 40% to switch CEA fleet to LED
- A-B studies of HPS-LED in cannabis grow rooms have begun – see SMUD study linked here.
  - “Life . . . finds a way”:
  - Biological systems are chaotic, and it’s difficult to truly isolate a single variable. But, yields have been within normal ranges.



# How Does This Help Today?

- Any listed product will be **at least** 10% more efficient than 1,000 HPS.
- Compare product performance in a standardized format
- Collect third-party-verified performance for better future decisions
- Set an automatic upward efficacy “ratchet” every two years



# How Might This Help Tomorrow?

- Publish statistics on market-wide product trends
- Potential “Premium” quality for the top 25% of products
  - Spectral minimums crucial, though
- Different categories
  - Top, intracanopy, supplemental, sole-source, etc.
- Different spectra
  - YPF? PSS?



# What Don't We Know?

- Is Far Red universally useful to plants? In what amounts / timing / application?
- What role should UV play?
- How does dimming work with plant biology?
- What are the “mixes” of various wavelengths that will be important?
- ???







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**Thank you!**