in 2016, Fluence Bioengineering sponsored Cannabis Business Times’ first “State of the Cannabis Lighting Market” report. Our message to readers in that first report delivered a bold prediction: “In the same manner as the semiconductor industry reshaped business, compound semiconductors (specifically LEDs) will transform the cultivation world.”

Now, 24 months later, we can validate that prediction. Compound semiconductors have transformed the cultivation world, especially commercial cannabis. As you will discover from this report, LED adoption has exponentially grown. More growers are using LEDs in their indoor or greenhouse operations throughout all growing stages than ever before.

Fluence Bioengineering is proud to be a thought leader in horticulture lighting, and it is our goal to continue to refine our understanding of plant photobiology to address the ever-increasing demands of and innovation in cultivation operations.

Our focus at Fluence is you, the cultivator. Our mission: to enable you to succeed with solutions based on science and research. We thrive by helping clients make informed decisions and achieve their cultivation and business growth objectives.

To help ensure our clients’ success, we collaborate with strategic partners and research institutions to discover innovative ways lighting systems can be used to produce quantifiable and repeatable results. We conduct numerous controlled environment experiments to better understand how photosynthetic photon flux density (PPFD), spectral composition and photoperiodic light treatments can increase yield and quantitatively alter cannabinoid profiles and terpene expression.

Our recent acquisition by Osram brought together purpose-built horticulture technology with a global lighting leader that shares our mission to be a global innovation leader. Osram has armed us with substantial resources to continue advancing LEDs and to invest in new technologies to help advance cannabis cultivation practices. We are dedicated to helping growers deliver higher quality products and establish themselves as leaders in the developing controlled environment agriculture industry.

But we aren’t in this lighting game alone. For the industry to continue to innovate and support cultivators in their efforts to produce the best possible crops, we need more information on cultivators’ strategies, challenges, concerns and goals. Essentially no cumulative data had existed about the cannabis lighting market, until now.

Fluence is proud to be the exclusive sponsor of Cannabis Business Times’ third-annual “State of the Cannabis Lighting Market” report. With three years of data, lighting trends can now be identified, making this year’s report the most comprehensive yet. We support CBT’s efforts to share scientific knowledge and industry trends, as we believe the data in this report will give cultivators meaningful insights into the future of profitable cannabis cultivation.

Dave Cohen
CEO
Fluence Bioengineering

The Importance of Research

Agricultural and Industry Advancements have helped us discover why light is so beneficial to plant production and that its manipulation can improve plant growth and increase yields. To craft lighting plans, cannabis cultivators often ask: What is my photosynthetically active radiation (PAR) levels be? What is the ideal spectrum? Is my Daily Light Integral (DLI) timed right? Indeed, cultivation business owners and operators have become savvier about light quality’s importance to their crops’ health, yields, and cannabinoid and terpene contents. They commonly seek evidence of a lighting product’s effectiveness before they buy—that’s according to the third-annual Cannabis Business Times’ “State of the Cannabis Lighting Market” report, where 72% of research respondents rated “scientific research supporting product development” as “important” or “very important” to lighting purchase decisions.

This year’s report offers Cannabis Business Times’ most in-depth lighting market research to date. With three years of data, trends have begun to emerge, from lighting types used (for example, more cultivators said they are using LEDs across all cannabis growth stages, compared to previous studies) to vertical farming practices (which showed an 18 percentage-point jump from 2016), and more.

In addition to the raw data, you’ll find practical information on how to conduct lighting tests (S. 10), how growers can work with utility companies to obtain maximum rebates (S. 13), and The Design Light Consortium’s first-ever baseline standard for horticulture lighting manufacturers and how it can help utility companies and growers (S. 14).

Thanks to Fluence Bioengineering’s generous support for (the third consecutive year), Cannabis Business Times was again able to partner with nationally recognized research company Readex Research to study cultivators throughout North America about their lighting usage and related practices. And thank you, Cannabis Business Times’ readers, for participating in this important research project.
**Lighting**, 33%

**PORTION OF GROWERS IN 2018 WHO SAID THEY WERE PLANNING ON IMPLEMENTING LED LIGHTING DURING THE FLOWERING PERIOD WITHIN THE NEXT 12 MONTHS**

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2016-2018 Difference</th>
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</thead>
<tbody>
<tr>
<td>T5 (high output/HO) lights (or other HO fluorescents)</td>
<td>37%</td>
<td>38%</td>
<td>28%</td>
<td>▼ 9 pts.</td>
</tr>
<tr>
<td>high-pressure sodium (HPS) lights</td>
<td>33%</td>
<td>34%</td>
<td>25%</td>
<td>▼ 6 pts.</td>
</tr>
<tr>
<td>metal halide (MH) lights - quartz</td>
<td>23%</td>
<td>24%</td>
<td>12%</td>
<td>▼ 6 pts.</td>
</tr>
<tr>
<td>compact fluorescent lights</td>
<td>17%</td>
<td>16%</td>
<td>4%</td>
<td>▼ 12 pts.</td>
</tr>
<tr>
<td>sulphur plasma lights</td>
<td>17%</td>
<td>18%</td>
<td>N/A</td>
<td>▼ 1 pts.</td>
</tr>
<tr>
<td>magnetic induction lights</td>
<td>16%</td>
<td>17%</td>
<td>N/A</td>
<td>▼ 1 pts.</td>
</tr>
<tr>
<td>other</td>
<td>8%</td>
<td>8%</td>
<td>7%</td>
<td>▼ 1 pts.</td>
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**22% PORTION OF GROWERS IN 2017 WHO SAID THEY WERE PLANNING ON IMPLEMENTING LED LIGHTING DURING THE FLOWERING PERIOD WITHIN THE NEXT 12 MONTHS**

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</tr>
</tbody>
</table>

**Lighting Used in Propagation**

- **TBs** were the third-most popular lighting type—a drop among responders reported using them in this year’s study (down from 37% in 2016).
- High-pressure sodium (HPS) lights also experienced a drop among growers during vegetation: a quarter (25%) of research participants said they used HPS lights in 2018 versus 31% in 2016.

**Lighting Used in Vegetation**

- Nearly a third (32%) said they use quartz and/or ceramic metal halide (MH) lights during this growth stage—a drop of 11 percentage points from 2017. (CFT did not calculate net MH responses in 2016.)
- TBS were the third-most popular lighting type—a drop of 26 percentage points from 2016.
- More than a third (37%) still perceive the technology as unproven (down from 43% in 2017, no data for 2016), while more than a quarter (29%) of those not planning on adding LEDs felt the return on investment (ROI) was too long (28% in 2017, no data for 2016).

**Lighting Used in Flowering**

- Despite some doubters, a third (33%) of growers who currently do not use LED lighting felt the return on investment (ROI) was too long (28% in 2017, no data for 2016).
- Despite the data showing LED rise across the board, LEDs are still too expensive for some: 46% of 2018 respondents who do not use LEDs for the cannabis flowering stage (the only stage for which study participants were asked this question) and do not plan to within the next 12 months (or are unsure) cited initial cost as the main factor preventing them from converting (compared to 59% in 2017, no data for 2016).
- More than a third (37%) still perceive the technology as unproven (down from 43% in 2017, no data for 2016), while more than a quarter (29%) of those not planning on adding LEDs felt the return on investment (ROI) was too long (28% in 2017, no data for 2016).

**Lighting Used in Propagation**

- Nearly half (47%) of this year’s research participants said they use LEDs during this propagation period, compared to 21% in 2016. This represents a 26 percentage point increase over two years. However, T5 (high output/HO) lights (or other HO fluorescents) are still used by a slim majority of growers (51%), compared with 65% in 2016 and 63% in 2017.
- Growth Stage: Vegetation
  - In vegetation, LED use was the most common among lighting types among research participants: 46% of growers reported using LEDs during this growth stage, climbing from 17% in 2016. Nearly a third (32%) said they use quartz and/or ceramic metal halide (MH) lights during this growth stage—a drop of 11 percentage points from 2017. (CFT did not calculate net MH responses in 2016.)
  - TBS were the third-most popular lighting type—a drop of 26 percentage points from 2016.
  - High-pressure sodium (HPS) lights also experienced a drop among growers during vegetation: a quarter (25%) of research participants said they used HPS lights in 2018 versus 31% in 2016.

**Lighting Used in Flowering**

- In flower, the research found that HPS remains the most-used lighting type in cannabis cultivation: 51% of growers said they use them, a 6 percentage point lead over the next closest fixture, LED; 45% of growers reported using light emitting diodes, a newer lighting technology more commonly referred to as LEDs: It is the only lighting technology that different plant growth stages require different lighting strategies. While nearly all research participants agree on the PAR levels needed during various growth stages, little consensus exists as to which lighting strategy is best for each stage.
- While cultivators’ lighting preferences still vary; however, this year’s research showed an increase in the number of cultivators using light emitting diodes, a newer lighting technology more commonly referred to as LEDs: It is the only lighting technology to see double-digit increases during all growth stages between 2016 and 2018.
- Growth Stage: Flower
  - Nearly half (47%) of this year’s research participants said they use LEDs during this growth stage, compared to 21% in 2016. This represents a 26 percentage point increase over two years. However, T5 (high output/HO) lights (or other HO fluorescents) are still used by a slim majority of growers (51%), compared with 65% in 2016 and 63% in 2017.
  - High-pressure sodium (HPS) lights also experienced a drop among growers during vegetation: 11% of growers said they use them, a 5 percentage point drop over the last year. (Down from 37% in 2016).
  - Nearly a third (32%) said they use quartz and/or ceramic metal halide (MH) lights during this growth stage—a drop of 11 percentage points from 2017. (CFT did not calculate net MH responses in 2016.)
Lighting Challenges

anticiipating cultivators cited various challenges as their top concerns when it comes to lighting, including managing heat loads (78% of respondents cited this as their greatest lighting challenge), managing energy costs (95%), choosing the right lighting type for each growth stage (33%), adjusting lights to the environment (7%), and ensuring consistent lighting across crops (6%).

The most common challenge cultivators face in lighting, however, has nothing to do with how fixtures interact with the environment. Over a fifth of cultivators (21%) said their greatest lighting challenge was figuring out lighting’s exact impact on plant growth and terpene/cannabinoid content.

Where Do Cultivators Find Lighting Information?

As markets mature, cannabis cultivators are turning to trusted information sources to help them address those challenges. Industry publications are the only consensus pick in trusted sources of lighting information, with more than half of study participants (57%) ranking trade magazines in their Top 3 information sources. Just under half (46%) rank colleagues/industry peers in their Top 3 sources of lighting information, while industry researchers and studies are among the Top 3 for 42% of growers.

The availability of resources outside of industry peers and dedicated cannabis blogs (which 21% of growers said was among their Top 3 information sources) is a fairly new reality. Until recently, scientific information that is currently available in lighting, however, has nothing to do with how fixtures interact with the environment. Over a fifth of cultivators (21%) said their greatest lighting challenge was figuring out lighting’s exact impact on plant growth and terpene/cannabinoid content.

What is your cannabis cultivation operation’s greatest challenge when it comes to lighting?

lighting’s impact on plant growth and terpene/cannabinoid content (42%)
managing heat load (40%)
managing energy costs (35%)
adjusting lights to environment (33%)
ensuring consistent lighting across the crops (33%)
customizing spectrum (31%)
light placement in cultivation areas (18%)
automation (13%)
other (9%)
no answer (7%)

*2018 results are based on the 114 research participants who grow cannabis indoors and/or greenhouses using supplemental lighting.

10% of survey respondents say the availability of lighting is highly regarded by cultivators. As markets mature, cannabis cultivators are turning to trusted information sources to help them address those challenges. Industry publications are the only consensus pick in trusted sources of lighting information, with more than half of study participants (57%) ranking trade magazines in their Top 3 information sources. Just under half (46%) rank colleagues/industry peers in their Top 3 sources of lighting information, while industry researchers and studies are among the Top 3 for 42% of growers.

CANNABIS BUSINESS TIMES | NOVEMBER 2018
UTILITY REBATES: GROWING AWARENESS

Vertical Farming
Vertical farming is another way growers can maximize crop space and yields, despite state regulations limiting square-footage, and more growers are leveraging vertical racking systems today than in previous years. In 2016, 21% of cultivators said they used vertical rakes (they were not asked to specify which growth stage). In 2017 and 2018, researchers asked during which growth stages they used vertical racking (vegetation or flowering). This year, 38% of respondents said they use vertical racks during vegetation and 18% use them in flowering (compared to 31% during vegetation and 13% in flowering in 2017). Looking to the future, 22% of research participants who are not using vertical racking in the vegetative stage plan to do so within the next year, as do 19% of those not currently racking in the flowering stage.

Cultivation
*2016 results are based on 114 research participants who grow only indoor and/or in greenhouses using supplemental lighting.

**2017 results are based on 294 research participants who grow indoors or in greenhouses without supplemental lighting were excluded from the final report.

Does your operation use vertical rack systems for cannabis flowering?

<table>
<thead>
<tr>
<th></th>
<th>5 tiers</th>
<th>4 tiers</th>
<th>3 tiers</th>
<th>2 tiers</th>
<th>1 tier</th>
<th>No answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>2%</td>
<td>1%</td>
<td>6%</td>
<td>39%</td>
<td>35%</td>
<td>0%</td>
</tr>
<tr>
<td>2017</td>
<td>2%</td>
<td>2%</td>
<td>4%</td>
<td>12%</td>
<td>15%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Does your operation use vertical rack systems for cannabis vegetation (not including propagation)?

<table>
<thead>
<tr>
<th></th>
<th>5 tiers</th>
<th>4 tiers</th>
<th>3 tiers</th>
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<td>2018</td>
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</tbody>
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HOW TO DESIGN AND RUN A
CONTROLLED EXPERIMENT

A guide to help you conduct side-by-side testing to determine impacts on yields and other plant characteristics.

BY JAMES EAVES, PH.D.

Given the shortage of proven cultivation knowledge and data, the big opportunity lies in learning faster than the competition. One critical skill for accomplishing that is knowing how to design an experiment. This article explains that process using a lighting research project as a case study. The project was based on a research partnership between Greenseal Cannabis Company, Voltserver Inc. and Université Laval. Several lighting companies also contributed, including BIOS Lighting, Fluence Bioengineering, Illumitex and P.L. Light Systems.

Experimental Design
A controlled experiment is the process of manipulating conditions and collecting data to answer a question. For example, will increasing CO₂ from 1,000 ppm to 1,100 ppm increase yields? The “design of experiments” (DOE) is the process of planning the experiment to ensure that you are generating the right data (and enough of it) to answer your question.

Developing a Hypothesis
The DOE process starts with a question to which the answer is important to your business. Each experiment we perform is the output of a structured process for identifying and ranking potential research opportunities. We identified lighting as a top opportunity because it is:
- one of the grower’s largest capital expenses;
- likely the single most important factor for yields and quality; and
- there’s been almost no rigorous academic cannabis lighting research.

Literature Review
We started by reviewing the research (academic and industry) on the topic. For instance, spectrum research for other plants indicates that a grower could harm the plant’s development by excluding certain wavelengths, but otherwise suggests that if a light provides a broad spectrum (like a multivitamin), then the plant will take what it needs. But we wanted to know: How do spectrum quality differences across full-spectrum lights impact yields?

Regarding the impact of intensity, researchers documented in a 2008 study published in the journal Physiology and Molecular Biology of Plants that cannabis net photosynthesis increased with light intensity up to a PPFD (photosynthetic photon flux density, a measure of light intensity) of as much as 2,000. This is about five times more intense than a double-ended HPS mounted 36 inches above the canopy. This suggested the possibility of substantially increasing yields by substantially increasing light intensity.

Yet the researchers did not answer our question because research has also shown that measuring changes in net photosynthesis is not a reliable way to estimate changes in final yields. One industry study by Fluence Bioengineering, however, did find substantial yield increases resulting from higher PPFD. So, our second question we wanted to address was: What is the relationship between high light intensity and yields?

Research Methods
A well-defined research question makes it easy to define the data you need to answer the question confidently (in a statistical sense). For instance, imagine you increase CO₂, and your yields increase by 5 grams per square foot. How confident are you that increasing CO₂ increased yields? If yields typically vary by roughly 4 grams from one harvest to the next, then maybe you wouldn’t feel confident. If the typical variation was 1 gram, then you should be more confident. Then if you increased CO₂, but also happened to change the process for taking clones, you might wonder how much of the yield increase was caused by the CO₂ and how much by the new cloning method. My point is that if your question is well defined, then there is a standard protocol you can follow to help you feel confident about the final answer implied by your experimental results.

We wanted to measure the impact of light intensity and spectrum on yields. We decided to manipulate these factors by using several different types of commercially available lights that vary in intensity and spectrum. These included double-ended HPS, broad-spectrum LEDs and purple LEDs. Eight different models in all provided varying spectrums and intensities at the canopy that ranged from around 450 PPFD to an average PPFD of nearly 2,000. Light intensities were measured using a quantum sensor.

Control and Treatment Groups
Next, we needed to grow individual tables of plants under the different lights. Our reference group, or control group, would be plants grown 36 inches under double-ended HPS lights. The other table-light combinations are called treatments. The environmental conditions for each treatment and the
control are kept as similar as possible, except for the lights.

Randomization
To account for the fact that clone health and potential will vary, we randomly assigned clones to each table. This is called randomization.

Number of Replicates
This brings us to one of the most critical steps in the DOE process: How many times should we grow groups of plants under each light? In other words, should we have one table growing under Light A or more? This is the number of repetitions of the experiment, and to be sufficiently confident about your final results, you need a sufficiently high number. Otherwise, it’s impossible to rule out that some other confounding factor (e.g., Treatments 2 and 3 randomly stocked with healthier clones) drove your results. (Note: This is one way to calculate the number of repetitions to conduct. An experienced consultant may be able to help configure the number of times most suitable to a cultivator’s particular environment.)

To select the number of replicates, researchers commonly use the following formula:

\[ n = \frac{2 \beta^2 \sigma^2}{\Delta^2} \]

Where: \( n \) is the required sample size (e.g., the number of plants per treatment), \( \beta \) is the Type II error (in the formula) and \( \sigma \) is a Type I error (in the formula). A Type I error (a “false positive”) occurs when we detect differences that don’t actually exist, whereas a Type II error occurs when we fail to detect a difference that does exist. \( \Delta \) is the minimum difference you’d like to be able to detect confidently, and \( \sigma \) is the standard deviation of the difference in outcomes (i.e., differences in yields) observed across similar past experiments.

Example
The possibility of a Type I error (\( \sigma \)) is typically set at 5%, while 10% or 20% is typically used for a Type II error (\( \beta \)). No theorem tells us it’s-just-convention. Suppose we used 5% and 20%, respectively. From growing the same cannabis strain under similar conditions in the past, we estimated the standard error in yields to be 30 grams. If you do not have past data to use, you have two other options: You can use data from other researchers for comparable experiments, or you can do a pilot study to create your own estimate. Finally, assume you want to be able to detect a yield difference as small as 60 grams per table.

Step 1: The first step is to find \( n \). An easy way is to use the TVIN function in Excel. The function takes two inputs: \( a \) and the “degrees of freedom.” The calculation for the degrees of freedom changes with your experimental design, but if you’re completely randomizing your plants, then you can use the number of plants per treatment as an estimate. So suppose you have 64 plants per treatment, then you would input

\[ TVIN(64, 6) \]

which gives you 1997.

Step 2: Find \( n \) by inputting

\[ TVIN(2\times(6), 64) = TVIN(12, 0.2, 64), \]

which gives you 0.847.

\[ n \approx \frac{4.40 \times 18.87 \times 0.847}{2} \]

For this so, we would expect need five replicates per treatment. In other words, for each light table combination, we needed to repeat the experiment a minimum of five times.

Control
There are many ways to conduct experiments—by changing multiple factors at once and conducting a statistical analysis, or changing a single factor and observing its impact on the plant environment. In our experiment, we chose to manipulate a single factor: light intensity. So to help maintain similar growing environments across the tables, we kept them all in the same room and minimized light from spilling over from one table to another using panda film. We added fans and kept one side of the tables open to increase airflow. We monitored temperature, humidity, CO2 levels and fertigation. Since plants that grow faster will consume more water and nutrients, we’ve recently added tensiometers (which measure soil moisture) and data loggers, so we can be sure that watering occurs when a treatment’s soil moisture reaches a certain threshold. You will also want to employ a CO2 meter to ensure it is being distributed to the crop adequately during the trial.

Results
Our experiment’s results run counter to the current industry paradigm. In our facility, using HPS lights at 36 inches provides around 450 PPFD. The exact PPFD depends on the spillover from other tables. But the highest yields in our experiment resulted from using a full-spectrum LED that provided an average PPFD of nearly 2,000. Specifically, we have been able to increase yields from between 40% and 70% above our control by increasing light intensity up to nearly 2,000 PPFD. This lighting configuration uses more electricity compared to HPS, but for every dollar we spend on more electricity to increase light intensity, we increase the value of our yields by as much as 8% CAD.

Finally, the results of our tests showed that spectrum doesn’t appear to matter much for yields when comparing full-spectrum lights. Thus, at Greenleaf, rather than focusing on which spectrum (e.g.,purple versus blue) will make you more money, we’ve decided to focus our efforts on improving our HVAC systems to ensure it is being distributed to the crop adequately during the trial.

Utilities are critical business partners, you know how to work with them.

BY DEREK SMITH

Despite historical tensions between cannabis cultivators and utilities, cultivation operators can benefit significantly by developing close working relationships with their power providers. As margins become squeezed by competitive pressures, winning profit from your property often starts with cutting energy expenses.

Retracking cultivation facilities for energy efficiency can drive more than 50 percent savings on energy, and utilities often subsidize technology upgrades. These incentives can be worth hundreds of thousands of dollars. Yet, Cannabis Business Times recently found that 49 percent of growers using LED lights didn’t seek to understand incentive opportunities from their utilities, leaving money on the table.

On the flip side, a 2017 survey of 50 Washington and Oregon cannabis growers conducted by the Northwest Power and Conservation Council found that 32 percent of respondents want to work with their local utilities to make their operations more efficient. However, only 9 percent of respondents had been contacted by their utilities, indicating that it may be necessary for growers to initiate first contact.

Regardless of how you come together—once you do, consider these four tips to maximize the value of your utility relationship.

1. Understand your power needs and your utility’s capabilities before signing on a power utility agreement. On your operation, think carefully about the technology you’ll use (e.g., lighting type(s)) and size your HVAC systems accordingly to ensure you don’t overspend or underspend.

2. In most cases, utilities want to sell you power and treat you equally. Energy Trust of Oregon works closely with its grower customers to model savings from a variety of technologies and also help them learn from the other growers’ experiences. That said, be aware that some utility companies or executives may have a bias against the cannabis industry or concerns about serving it because of federal issues. For example, Efficiency Maine is currently denying incentives to cannabis producers.

3. However, if you do pay into the utility system, you should receive the benefits that come with doing so. Meaning, if incentives are available to other rate-paying customers who are making energy-efficient choices, those incentives should also be available to you. Demand that you are treated like any other customer.

4. Invite your utility representatives to your facility and help them understand your business. Your utility partner may be willing to invest their own resources in exploring ways for you to use less energy and save money. For example, Amplified Farms partnered with its utility, Sacramento Municipal Utility District (SMUD), to test LEDs and find electricity savings.

The reality is that utilities are critical suppliers with which you need clear communications to protect your investments—if your power goes down, or if your environmental conditions aren’t ideal, your plants and profits will be impacted. Many service providers, such as Resource Innovation Institute, can help if you need assistance in maximizing your relationship with your utility.

COGENERATION AND COMBINED HEAT AND POWER (CHP)

Cogenration (co-gen) through combined heat and power (CHP) is the simultaneous production of electricity, heat and carbon dioxide.

JAMES SAVS, Ph.D., is an agricultural economist and professor at Michigan State University. He is also the Head of Innovation at Greenleaf Cannabis Company, which uses advanced vertical farming methods to grow cannabis in Stratford, Ontario, Canada. He is an executive director of the Resource Innovation Institute (Resouricinnovation.org), a nonprofit whose mission is to promote and quantify energy and water conservation in the cannabis industry.

SPECIAL REPORT
STATE OF THE LIGHTING MARKET

TIPS FOR WORKING WITH YOUR UTILITY

S12 | CANNABIS BUSINESS TIMES | NOVEMBER 2018

S13 | CANNABIS BUSINESS TIMES | NOVEMBER 2018
Cassie Neiden: Why will you first tell us a bit about the DesignLights Consortium’s mission? Damon Bosetti: Utilities are accountable to their rate payers and to their government regulators, oftentimes at the state level. These utilities need to show prudence for how they’re spending those efficiency program dollars. So, they may maintain in-house staff who can evaluate performance claims in efficacy, but to come up with a custom calculation for every single product that comes across their desks for efficacy incentives would be a real time consumer and duplicative. So what we do at the DesignLights Consortium is create these standards, called a Qualified Product List (QPL), which is a list of products that meet minimum requirements. We’ve been doing that for many years with general illumination. Utilities can show that efficient products are being incentivized to the regulators and prove they’re spending their rate payers’ money wisely, all toward the policy goals of achieving more energy efficiency every single year.

Bosetti: How does the DesignLights Consortium go about creating these standards? Neiden: What was your intention? The goal is to have the QPL populated with this first fixture listing sometime in mid-November and then work through the backlog of currently available products that will need to be qualified and listed.

Neiden: How will these standards be updated and adjusted, and when can we expect them to change? Bosetti: We are committing ourselves to a two-year major cycle, and then there’ll be a 12-month minor cycle within it. The major cycle is going to be the next time the efficacy requirements change. The efficacy requirements will not change for 24 months, starting from Oct. 1. At this point, we’re setting a new baseline with 400-500nm, 500-600nm, 600-700nm, and 700-800nm bins reported alongside the total.

Neiden: What are your thoughts on the use of the QPL? Bosetti: The QPL was designed to be a tool for end users. The QPL is essentially a list of products that meet all the minimum requirements that we’ve set forth. If a grower wants to use a particular brand or manufacturer, they can look at the QPL to see if it meets the requirements. If it does, they can go ahead and make a purchase with confidence that the product meets the requirements.

Neiden: As the DLC was developing this horticultural QPL list, what was your approach? Bosetti: Our approach was to develop a list that was as comprehensive as possible while still adhering to the minimum requirements set by the DLC. We worked closely with industry partners to ensure that the list included a wide range of products that would be useful to growers.

Neiden: How would a grower use the QPL list? Bosetti: A grower could use the QPL list to identify products that meet their specific needs. For example, a grower might be looking for a product that produces a specific spectrum of light. They could use the QPL to find products that meet those specifications.

Neiden: What’s the role of the QPL list in the overall design of the DLC’s horticultural lighting requirements? Bosetti: The QPL list is a critical component of the DLC’s horticultural lighting requirements. It provides growers with a resource for identifying products that meet the minimum requirements set forth by the DLC. By using the QPL, growers can be confident that the products they purchase are of high quality and will meet their needs.

Neiden: What are the benefits of having a QPL list for the horticultural industry? Bosetti: The QPL list provides several benefits for the horticultural industry. It helps to ensure that products are of high quality and meet the minimum requirements set forth by the DLC. It also provides a resource for growers to identify products that will meet their specific needs. This can help to accelerate the adoption of horticultural lighting and ultimately lead to more energy-efficient and effective lighting solutions.

Neiden: Why did you decide to focus on horticultural lighting QPLs? Bosetti: We decided to focus on horticultural lighting QPLs because there was a clear need for a standardized list of products that meet the minimum requirements set forth by the DLC. By creating such a list, we could help to accelerate the adoption of horticultural lighting and ultimately lead to more energy-efficient and effective lighting solutions.

Neiden: Why did you focus on horticultural lighting QPLs? Bosetti: We focused on horticultural lighting QPLs because there was a clear need for a standardized list of products that meet the minimum requirements set forth by the DLC. By creating such a list, we could help to accelerate the adoption of horticultural lighting and ultimately lead to more energy-efficient and effective lighting solutions.

Neiden: How would you describe the DLC’s horticultural lighting requirements? Bosetti: The DLC’s horticultural lighting requirements are designed to be as comprehensive as possible while still adhering to the minimum requirements set forth by the DLC. We worked closely with industry partners to ensure that the requirements included a wide range of products that would be useful to growers.

Neiden: What’s the goal of the QPL list? Bosetti: The goal of the QPL list is to provide growers with a resource for identifying products that meet the minimum requirements set forth by the DLC. By using the QPL, growers can be confident that the products they purchase are of high quality and will meet their needs.

Neiden: What’s the future of the QPL list? Bosetti: The future of the QPL list is bright. We expect that the list will continue to grow and evolve as the horticultural industry evolves. We will continue to work closely with industry partners to ensure that the list includes a wide range of products that will meet the needs of growers.

Neiden: What are the potential benefits of having a QPL list for the horticultural industry? Bosetti: The potential benefits of having a QPL list for the horticultural industry are numerous. It provides growers with a resource for identifying products that meet the minimum requirements set forth by the DLC. It also provides a resource for growers to identify products that will meet their specific needs. This can help to accelerate the adoption of horticultural lighting and ultimately lead to more energy-efficient and effective lighting solutions.