The Budding Energy Impact of Indoor Horticulture

Indoor horticulture energy usage is projected to grow substantially over the next several years, driven in large part by the legalization of medical and recreational cannabis. As of July 2018, a total of 31 US States and the District of Columbia have legalized medical and recreational cannabis. In October 2018, Canada will legalize recreational cannabis use nationwide. This rapid shift in many parts of North America is driving much of the continent’s energy load growth. This rapid shift in many parts of the United States is driving much of the nation’s energy load growth. The Northwest Power and Conservation Council projects that indoor cannabis growing operations alone will add as much as 300-350 megawatts by 2020 in the Pacific Northwest, about 1.5% of total regional electricity demand. In Colorado, Xcel energy says 45% of its load growth is due to indoor cannabis cultivation operations. This is a brand-new industry, and right now, it’s the Wild West out there. Energy performance metrics are not standardized. Grow lights are exempt from building codes and efficiency standards in most jurisdictions. Standard methods of test have not been published. How can we ensure that this fast-growing and energy-intensive industry adopts best practices in this environment?

**ENERGY EFFICIENCY SAVINGS UP IN SMOKE**

**Snapshot: Definitions and Standards**

Independent third-party guidelines and standards are emerging, enabling utility programs, building codes, and policymakers to adopt clear, consistent language and metrics around indoor horticulture energy use.

**AVAILABLE NOW:**

- ANSI/ASABE S640 – Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms)
- X644 – Performance Measures of Lighting Systems for Plants
- **PLANT SENSITIVITY (MCCREE) CURVE, PAR, PBAR**
- **Source:** Nelson & Bugbee
- **X644 – Performance Measures of Lighting Systems for Plants**
- **ANSI/ASABE S640 – Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms)**
- ANSI/ASABE S641 – Performance Measures of Lighting Systems for Plants

**IN DEVELOPMENT:**

- Independent third-party guidelines and standards are emerging, enabling utility programs, building codes, and policymakers to adopt clear, consistent language and metrics around indoor horticulture energy use.

**Snapshot: Energy Codes**

The building codes that indoor horticulture facilities must obey vary from city to city, and state to state. In most cases, these codes focus more on sizing, security, hygiene for the growing and handling of produce, and heat, ventilation, and air conditioning than on energy. For their part, the energy regulators tend to focus on lighting. Jurisdictions are just beginning to consider indoor horticulture code requirements specific to the unique nature of the indoor horticulture industry.

- **CALIFORNIA:** The California Department of Food and Agriculture requires cannabis production licenses to use renewable energy sources for at least 42% of power consumed at the site.
- **CONNECTICUT:** The Connecticut Technical University has some energy-efficiency requirements for indoor horticulture.
- **MASSACHUSETTS:** The Massachusetts State Cannabis Control Commission has set a maximum lighting power density of 65W/ft² or 55W/ft² for operations under 5,000 sf. Properly enforced, this nearly mandates the use of LEDs in indoor horticulture in the state.
- **OREGON:** Oregon energy code measures are pending related to minimum photon efficiency and suitable air ventilation in indoor horticulture operations.
- **WASHINGTON STATE:** The Washington State and Seattle energy codes require that lighting fixtures used for plant growth or maintenance have a tested photosynthetic photon flux (PPF) per watt of at least 1.25 µmol/s (Light Deprivation) or 2.5 µmol/s (Sungrown).

**Note:** the following codes are considered indoor (Efficient), Indoor (Inefficient), and Outdoor (Inefficient) for the purposes of this report. The energy codes for indoor horticulture are subject to change in the near future.

**Side-by-side comparisons of HPS (left) and LED (right) lighting (SMUD Indoor Horticulture Lighting Study, 2017)**

**ENERGY INTENSITY COMPARISONS**

<table>
<thead>
<tr>
<th>Site Type</th>
<th>Energy Intensity</th>
<th><strong>2017</strong></th>
<th><strong>2018</strong></th>
<th><strong>2019</strong></th>
<th><strong>2020</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Typical</strong></td>
<td><strong>Outdoor</strong></td>
<td><strong>Indoor (Efficient)</strong></td>
<td><strong>Indoor (Inefficient)</strong></td>
<td><strong>Greenhouse</strong></td>
<td><strong>Data Center</strong></td>
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<td><strong>Site EUI</strong></td>
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<td><strong>Site Efficiency</strong></td>
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**Note:** These metrics reflect lighting only.

**Snapshot: Voluntary Programs**

The rapid growth of a new industry, and the unique nature of the indoor horticulture industry in particular, means there are vast opportunities for energy efficiency in this space. Utility programs are a key way to encourage producers to use efficient equipment and practices. Certification, competition, and recognition programs are growing in number and impact. The utility incentive programs are limited to incremental equipment cost and are often in the $0.20-$0.25/kWh range.

- **UTILITY TECHNICAL ASSISTANCE:** Several utilities and energy-efficiency organizations will pay for most or all of the cost to study energy-efficiency opportunities in new construction. Examples: Energy Trust of Oregon, National Grid, Xcel Energy, Tacoma Power.
- **UTILITY INCENTIVE PROGRAMS:** Some utilities provide programs specifically tailored to cannabis producers, while others encourage these projects in existing C&I programs. Incentives are limited to incremental equipment cost and are often in the $0.20-$0.25/kWh range.
- **VOLUNTARY RECOGNITION AND CERTIFICATION PROGRAMS:** Multiple organizations are working to create third-party labels, certifications, and competition programs so that efficient producers can stand out in the market. For example, the non-profit Resource Innovation Institute’s free Cannabis Power Score energy benchmarking tool enables producers to confidentially compare themselves to their peers. This score has been used as a metric to score entries at the Cultivation Classic growers competition.

**CANNABIS LEGALITY ACROSS NORTH AMERICA**

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**Newbuilding's Institute**

**PACIFIC NORTHWEST CANNABIS ENERGY LOAD FORECAST**

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