

A close-up, low-angle shot of a cannabis plant. The leaves are serrated and dark green, with some lighter green areas where the sun hits. The stems are thin and woody. The background is a soft, out-of-focus green.

Resource Use Efficiency in the Cannabis Industry

November 2022

 Regennabis

 HAWTHORNE™

SPECIAL ACKNOWLEDGEMENTS

Bob Gunn, founder and CEO of Seinergy, for his contributions to the content and research findings within this report. Seinergy connects growers with utilities to apply custom energy grant funding to the nascent and rapidly evolving industry. For more information, visit seinergy.com.

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EXECUTIVE SUMMARY

In no time in history has the need for resource-use efficiency been greater. From the undeniable and devastating impacts of climate change to increased demands on our planet's resources brought on by a growing population, our global community has passed an inflection point. While much focus has been on what governments can do to effectuate improvement, industries can play a major role in altering our trajectory. In fact, many companies have emerged as leaders in this charge, particularly in terms of carbon emissions. But in order to truly change course, all companies, in all industries, from all sectors, must reimagine their operations through a resource-use efficiency lens. For longtime companies, this may be challenging. For emerging sectors, such as cannabis, this poses a great opportunity, especially considering this industry's projected growth path not only in the U.S. but globally as well.

In late 2021, a report by Seattle-based analytics firm, Headset, forecasted that legal cannabis sales in the United States were projected to surpass \$30 billion in 2022.* Although the U.S. cannabis market currently is in a downturn, mostly due to oversupply in key states where cannabis is legal and regulated, the expectation is that the industry will see future expansion as more states consider legalizing the cultivation, production and sale of medical or recreational marijuana.

It's important to note the social impact of increased legalization throughout the country, too. According to a Brookings Institute report, historically, a consistent target for the nation's criminal cannabis laws have been communities of color.** Despite cannabis usage rates between whites and non-whites being similar, "Black Americans are arrested for cannabis offenses at a rate of nearly 4:1, compared to whites. And in a nation with nearly 700,000 cannabis-related arrests each year (a number that was over 800,000 a few years ago), these policies affect an enormous number of Americans."

*<https://mjbizdaily.com/us-cannabis-sales-could-top-30-billion-by-2022/>

**<https://www.brookings.edu/blog/how-we-rise/2020/06/23/marijuanas-racist-history-shows-the-need-for-comprehensive-drug-reform/>

As another article rightly points out, even though marijuana has been decriminalized and legalized in many states, without federal approval, “business owners say they are heavily taxed by states and do not have the relief of filing federal tax deductions. The financial squeeze results in a tremendous profit cut for the business owners. It also creates a tough environment for Black entrepreneurs in cannabis because it requires more liquid funds to operate in the marijuana industry.”*

Policy goals of legalization and shifting illicit operators into a regulated market, therefore, should not be undermined by overaggressive and costly regulations. Already, we have seen improved sustainability practices by creating a pathway from illicit operations toward the regulated market. More improvements can be made over time. Creating high-cost burdens to entry from costly regulations and mandates may further marginalize operators and push them to stay in the illicit market.

The question is long past whether cannabis should be a legitimized industry. The focus now must be on opportunities in these still-early stages to help create an industry that is economically, socially and environmentally sustainable.

This starts with creating resource-efficiency standards and regulatory frameworks that are grounded in meaningful and consistent data across the sector. Meaningful in terms of identifying data that are unique to the cannabis industry; and consistent in terms of reporting on the same set of data points in order to manage, monitor and compare performance and impacts within a company and across the industry year over year. In the absence of federal or even unified standards across states where cannabis is legal and licensed, many cannabis companies do not track sustainability data nor report it to independent third parties. Private organizations and nonprofits - including media outlets centered on covering the cannabis industry - have attempted to gather industry data. However, there is no consistency in data, leaving the information relatively useless in terms of monitoring, comparing and establishing benchmarks from which effective regulations can be adopted.

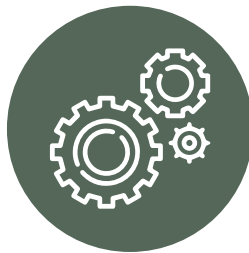
*<https://thegrio.com/2022/03/06/black-participation-cannabis-industry-uphill-battle/>

More importantly, the hodgepodge approach to legalization has created large gaps in sustainability practices among cannabis companies, leading to missed opportunities in shaping resource-use efficiencies throughout the industry. Regulation and reporting, therefore, must go hand in hand—and neither can begin without first establishing clear data standards and understanding where we are today.

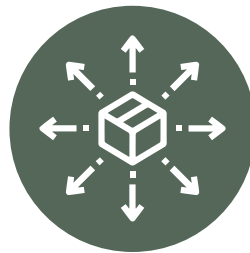
Until then, we can begin to raise awareness about what is currently being done and what more can be done to achieve this ultimate goal. There are six verticals within the industry where effective regulation and reporting can impact the resource-use efficiency of the cannabis industry, particularly in terms of energy, water and waste management:



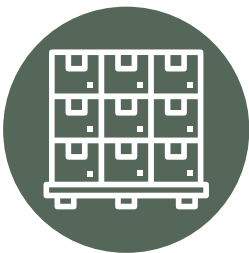
CULTIVATION



MANUFACTURING



DISTRIBUTION



WHOLESALE



RETAIL



DELIVERY

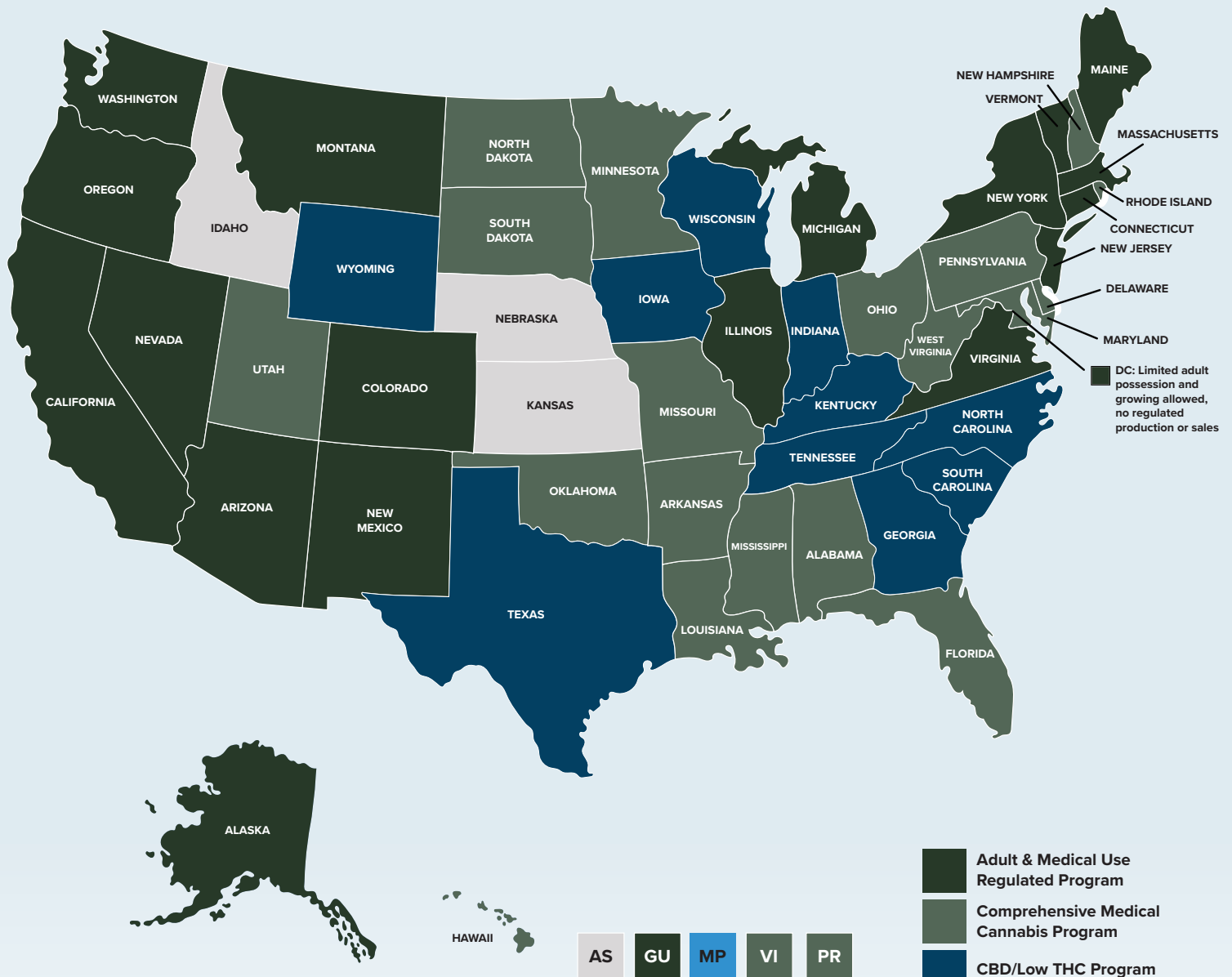


Image source: National Conference of State Legislatures,
<https://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx>

May 2022

STATE REGULATED CANNABIS PROGRAMS

In order for cannabis companies (or any company) to choose more sustainable practices, they must have more sustainable options. The responsibility, therefore, is not solely on the cannabis producers, but also on the product manufacturers and service providers they rely on for the lifecycle of the services they provide and products they grow.

From a business perspective, cannabis cultivators are focused on operating viable businesses. Because cannabis is illegal federally and, as of July 2022, is legally approved in 19 adult-use states, cannabis providers must grow and produce their products within the state where they are located. They cannot distribute their products across state lines. This creates market limitations for growers. Cultivators put much of their efforts and investment into harvesting healthy yields and creating quality products for consumers, all the while trying to keep costs low, enhance profitability and often pay hefty taxes. It goes without saying that reducing the environmental footprint is often secondary to many of these factors. This is where those who supply the cultivators - providers of grow lights, growing media, irrigation systems and the like can play a major role in driving a more sustainable cannabis industry by providing affordable growing products that reduce the environmental impact.

Hawthorne Gardening Company, whose product development and services are not only focused on helping growers deliver yields but also on energy, water and waste efficiency, is well placed to deliver to a more sustainable industry.

HAWTHORNE'S AREA OF FOCUS:



WATER EFFICIENCY Water Use and Reclamation, Wastewater Reduction



WASTE DIVERSION Compostable Growing Media, Packaging Waste Disposal



POLICY DEVELOPMENT Advocacy for Standardization and Regulation across the Grow Cycle



ENERGY EFFICIENCY LED Lighting, Maximum Efficiency HVAC Systems, Dehumidification, Airflow



TECHNICAL AND DESIGN SERVICES Knowledge, Support, and Services to Optimize Grow Operations

For the purposes of this report, we focus on cannabis cultivation since it is the first phase of the cannabis-production lifecycle and is resource-intensive. This critical phase is where there is the greatest opportunity to reduce consumption through innovative practices and the creation of standards, federal regulation and reporting. At the center of this topic is the growing debate between indoor and outdoor cultivation and the many assumptions that have been made in the absence of clear data.

While many claims have been made about indoor growing through news outlets, it bears noting once again that data is not reported by the industry. Organizations such as Resource Innovation Institute (RII) do their best to collect and publish data and make the best of what is available, but the data is challenging to come by, is self reported, suffers from sampling bias and lacks academic and statistical rigor. This data challenge reflects the state of infancy in the industry, with companies such as Hawthorne beginning to tackle the sustainability challenges.

Nevertheless, existing data—though scarce and disparate—provides a starting point.



INTRODUCTION

The goal of this report is to initiate a framework and critical context for meaningful discussions on resource-use efficiency in the cannabis industry, particularly in relation to indoor growing, a growing method that is experiencing increased activity, scrutiny and opportunity. These discussions can inform decisions that will enable growers and product providers to operate more resource-efficient grow operations.

Ultimately, we are laying the groundwork for building a cannabis industry that is economically, socially and environmentally sustainable.

Because the cannabis industry involves multiple verticals, as detailed in the Executive Summary, this report focuses on the first phase of cannabis production: cultivation.

We know that this report is only the beginning of an ongoing discourse among industry leaders, individual growers, product providers, lawmakers, sustainability experts and other stakeholders to drive the conversation toward action. As such, this report takes a high-level approach with the hope of inspiring deeper-level discussions, such as those that resulted from the live conference hosted by Regennabis on May 5, 2022, at the United Nations in New York City.

A black and white photograph of an indoor cannabis cultivation facility. The image shows rows of cannabis plants growing in a controlled environment with white vertical support structures and overhead lighting fixtures.

I. ADDRESSING MISCONCEPTIONS ABOUT INDOOR CULTIVATION

There has been growing concern in recent years about the environmental impact of indoor cultivation in the United States, particularly in terms of energy. Numerous articles have pointed to excessive carbon emissions while making definitive claims and comparisons about the energy use of indoor cultivation. Given the challenges in accessing reliable and consistent data, such claims are difficult to substantiate, and in some cases are woefully outdated.

Indoor growing will likely increase and rather than dismiss the activity as an energy-intensive practice, we must address the misconceptions; engage in meaningful discourse about sustainable practices; and examine the pros and cons of indoor and outdoor cultivation through a realistic lens.

One media outlet has claimed that America's patchwork approach to legalizing cannabis has helped make cannabis cultivation one of the most energy-intensive crops in the nation. While it is true that the inconsistencies in legalizing cannabis have opened the door to inconsistencies in the industry, the report reflects more of a patchwork approach to understanding indoor cultivation. This is understandable, but it merits addressing these myths so we can effectively move forward in identifying opportunities for resource efficiency. The following are some claims that have been made, followed by our findings and discussion points.

CLAIM 1:

Energy experts claim that 1% of U.S. energy use comes from cannabis grows

Finding:

FALSE

Closer to Reality:

0.4-0.9% of U.S. electricity used is consumed by licensed cannabis businesses.

Discussion Point:

Unlicensed cannabis energy use is not measured and therefore unknown. This brings into question how much of this load is new versus consolidated from disparate illicit sites, and also what the load impacts of the regulated market are compared to the same demand being met from illicit markets.

CLAIM 2:

80% of cannabis is grown indoors

Finding:

FALSE

Closer to Reality:

25% of licensed cannabis canopy is indoor canopy. However this 25% of canopy likely yields closer to 60% of the total licensed cannabis product.

Discussion Point:

It is unclear if the percentage claimed includes an estimate of the illicit market. If so, more data is needed regarding yield per licensed square footage per year for indoor vs. mixed vs. outdoor.

CLAIM 3:

2,000 watts used per square meter (W/m²) of indoor growing

Finding:

FALSE

Closer to Reality:

670-1,100 W/m² is more likely

Discussion Point:

This claim appears to stem from an Evan Mills report that was based on anecdotal observations from cultivation facilities in 2011, which was six years prior to adult-use legalization in California. The energy profiles captured in this report are valuable and serve as a snapshot of the legacy market operations that were based largely in residential structures and with short-term investment objectives. Facilities like these - and the energy profile associated with them - bear little resemblance to modern, commercial, purpose-built facilities of today's licensed growers. Modern facilities use 50% as much energy as cited in these sources, highlighting the need for evidence-based research on energy impacts in the commercial cannabis industry.

CLAIM 4:

In Massachusetts, 10% of energy is consumed by cannabis industry

Finding:

False; incomplete citation.

Closer to Reality:

1%

Discussion Point:

This figure reflects 10% of the state's industrial energy use. Industry use is 9.8% of the state's overall energy use; therefore if cannabis represents 10% of this segment, then cannabis would make up 0.98% (or about 1%) of the state's overall energy use. The underlying data source for this claim has never been disclosed but continues to be perpetuated.

CLAIM 5:

Typical indoor grow consumes same energy as 14 homes

Finding:

Unclear, vague, unattributed

Discussion Point:

This is not a valuable scale for reference. For example, what is meant by a "typical indoor grow"? If the claim is intended to compare the energy intensity (e.g.: kWh per SF) of a commercial cannabis operation to a typical residential building the figure is low. Cannabis operations consume approximately 50 times more power per square foot than a residential building. This then begs the question: why are we comparing cannabis cultivation - an industrial manufacturing process - to a residence? More apt resource comparisons should be made to other manufacturing products in terms of energy and water per \$GDP, or to food in terms of energy and water use per serving. More suitable analogues to cannabis production would be data centers, or citrus production, processes that are both far less efficient from a \$GDP perspective.

CLAIM 6:

Outdoor growing is more energy efficient, using 2.5% of energy needed for indoor; greenhouse cultivation uses 45% of energy needed for indoor.

Finding:

True, if we are only looking at electric energy.

Closer to Reality:

0.4-0.9% of U.S. electricity used is consumed by licensed cannabis businesses.

Discussion Point:

- 1) These figures are derived from the 2018 Cannabis Energy Report, which is based on a small sample of growers' self-reported data.
- 2) These findings appear to be based on kWh/SF annual usage, without regard to annual yields.
- 3) While we expect the annual yields from indoor will partially make up for the discrepancy and will still be higher than mixed light and outdoor, reliable data does not exist to confirm this.
- 4) Also this does not account for yields per square foot, transportation resources or water consumption and pesticide use.



II. INDOOR CULTIVATION: OVERVIEW

Indoor growing of cannabis, like the indoor growing of food, can benefit from a controlled cultivation environment. Challenges, such as the undeniable effects of climate change—from severe weather to fires—as well as water scarcity, due to (and exacerbated by) droughts, and limited arable land space have posed challenges to outdoor cannabis growing and have made indoor cultivation both appealing and practical. This is akin to how indoor food production is seen as viable and beneficial to help address food deserts around the globe.

Water Systems

Hawthorne's Hydro-Logic system reduces water use and nutrient-rich water disposal. It purifies water before nutrients are added for irrigation and then captures surplus nutrient-rich water along with water from the dehumidification process for reuse.

Growing Environment

Air flow, filtration, humidity and ventilation are controlled in the indoor grow. Hawthorne's solutions include products and partnerships, such as the exclusive Quest dehumidifier with the industry's highest-energy efficiency.

Lighting

LED lights — coupled with smart controllers and sensors — reduce energy costs and bolster performance. Hawthorne's Gavita CT1930e generates 5 percent more light output than our high-pressure sodium lights while using 20 percent less energy.

Growing Media

Botanicare CocoPro is a new line of products that enables growers to efficiently manage water use. The substrate material is made from compostable coconut coir in compressed form, which expands to retain water and nutrients.

Resource demands of indoor growing due mostly to energy and water use can be managed through alternative practices in lighting, water filtration, HVAC, dehumidification, and even light placement. Innovations in these categories can help maximize resource efficiency and minimize impact, paving the way in the long term for the indoor agriculture sector as food demand for a growing population continues to increase.

BY THE NUMBERS

4,070

**active cannabis
indoor cultivator
facilities
in the U.S.**

5,395

**active cannabis
indoor cultivator
licenses**

(varying numbers due to
some facilities having
multiple licenses)

47.3

**million sq ft
estimated
indoor space
in the U.S**

Benefits of Indoor vs Outdoor Growing

Indoor cultivation can present numerous benefits compared to outdoor growing, such as the potential for:

- Increased efficiency, making inventory less susceptible to pests, fires, drought and other extreme weather events
- Reduced pest threats decreases the need for chemical pest treatments
- Reduced transportation expense; proximity to market
- Reduced water use
- Higher-quality cannabis, including greater control over certain cannabinoid content, tinctures and flavonoid profiles important for medical-grade cannabis.
- Consistent plant production year-round
- Higher employment; year-round employment
- Greater asset utilization rates; year-round cultivation
- Local tax revenues
- Reduced nutrient usage
- Reduced nutrient runoff
- Greater recapture and recyclability of water

III. RESOURCE USE EFFICIENCY

a. ENERGY

Real progress is being made when it comes to sustainability in indoor cultivation. This progress meets an increasing demand from growers who are looking for ways to be more efficient. Some are already investing in their own resource-efficient equipment, alternative practices and design in an effort to maximize energy efficiency and increase their bottom line.

Companies such as Hawthorne have invested heavily in new product development and R&D to make a meaningful impact on energy efficiency.

AT A GLANCE: HAWTHORNE ENERGY EFFICIENCY

What's Being Done

- LED fixtures deliver comparable performance to HPS with 20-30% less energy consumed
- Industry leading dehumidification equipment that removed 50% more water per kWh than industry standard. Exclusive Quest dehumidifiers have the highest energy efficiency performance in the industry (up to 9.3 pints per kWh)
- Untouched lighting design capabilities that can reduce lighting loss and capital spending
- Advanced surge protection

What's Next

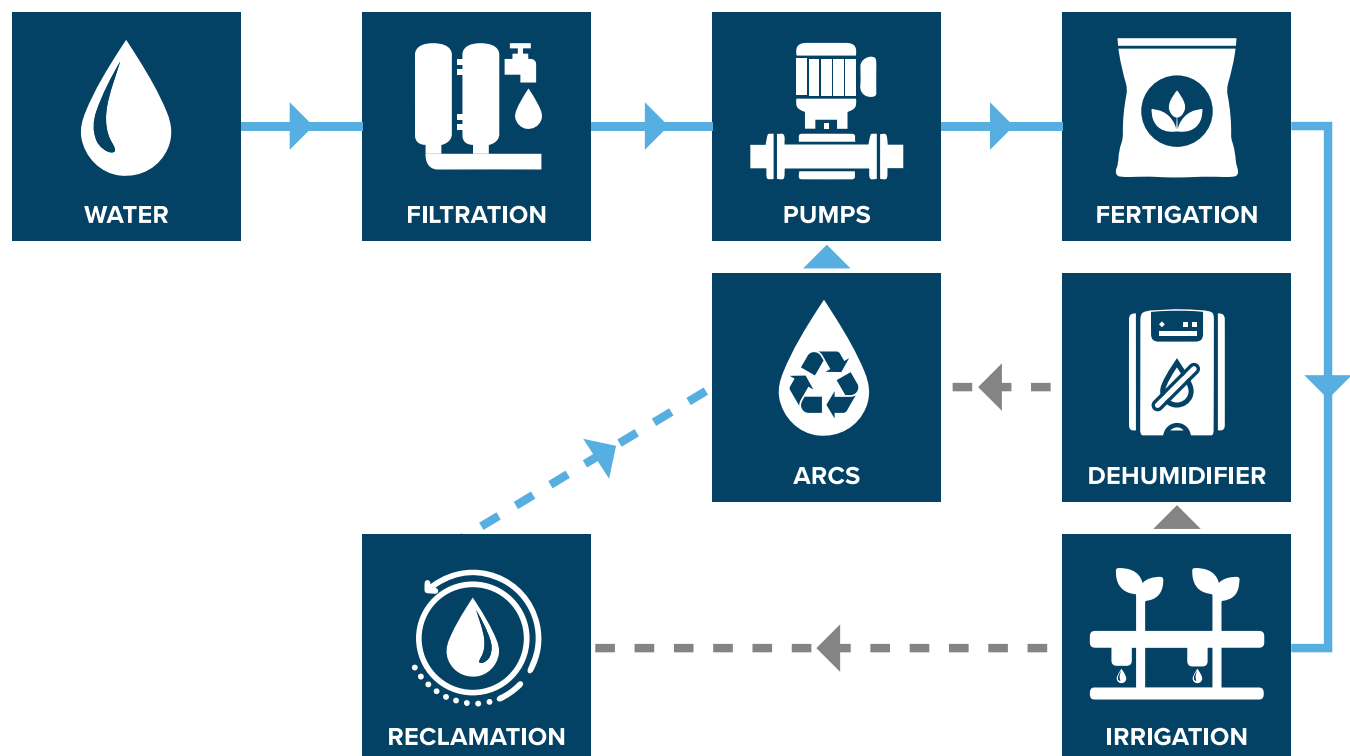
- Focusing all lighting innovations on LEDs
- Increasing LED fixture efficiency from 2.5 umol/J to 3.0+ umol/J
- Improving fan performance through use of electronically commutated motors
- Reviewing lighting portfolio and exploring setting a minimum energy efficiency standard for products

b. WATER

Indoor cannabis cultivation consumes less water than many other manufacturing and cultivation industries. Water use by ranching, mining, fruit, nut and outdoor vegetable production is magnitudes greater than that of cannabis cultivation. Nonetheless, opportunities exist to create more efficient water filtration, dehumidification and HVAC systems, and Hawthorne is investing in solutions to help customers lessen their impacts with regard to water consumption.

AT A GLANCE: HAWTHORNE WATER EFFICIENCY - Hydro-Logic System

(water use, wastewater treatment, water transportation)



What's Being Done

- Wastewater reclamation system that can recapture up to 80% of the water from liquid waste streams
- Industry-leading reverse osmosis that filters water twice with 100% greater efficiency than industry standard practice
- Water soluble and release-controlled fertilizers to improve on liquid nutrients, reducing the need to use large volumes of water

What's Next

- Proving alternative irrigation strategies that minimize the water use in the grow room
- Developing automated nutrient delivery systems that improve upon manual applications that can easily result in overapplication
- Increasing concentration of liquid nutrients to lower the amount of water shipped to growers who prefer liquids over water soluble fertilizers
- Creating best-in-class reverse-osmosis technology that can extract 300% more clean water per gallon than industry standard practice
- Developing wastewater treatment technology that eliminates the need for hauling off-site or locally disposing of wastewater that municipal water systems will not accept



c. WASTE (Management/Mitigation)

Effective waste diversion is another opportunity to reduce resource consumption related to indoor cultivation. Hawthorne is developing ways for growers to manage waste through advancements in growing media and packaging.

AT A GLANCE: HAWTHORNE WASTE DIVERSION

(growing media, packaging waste disposal)

What's Being Done

- CocoPro grow cubes perform as well as stone wool and the media can be composted
- Packaging has been moving away from polystyrene to strictly sustainable materials
- Direct-to-Consumer packaging is being designed to meet Amazon SIOC requirements
- Developing and implementing a compostable package OR easily removed package for ease of composting

What's Next

- Completing the packaging transition across the entire product portfolio
- Increase percentage of post-consumer recycled plastic used in plastic packaging



IV. NEED FOR REGULATION AND CONSISTENT STANDARDS

The need for regulation and consistent standards cannot be overstated; however, we do not have to start from scratch. Already, there are examples of states, cities and companies that have taken a leading role in advancing sustainability in indoor cultivation, which can be used to inform policy and practices. Here are just a few examples:

An aerial photograph of Denver, Colorado, featuring the Colorado State Capitol building in the foreground and the downtown skyline with several skyscrapers in the background under a blue sky with scattered clouds.

Case study 1: City **DENVER, COLORADO**

Denver has committed to reducing greenhouse gas emissions (GHG) 80 percent below 2005 levels by 2050 (80x50 Climate Goal). Commercial buildings represent 35 percent of citywide emissions, and — as cannabis businesses occupy an increasing amount of commercial building space — the city recognizes that the cannabis industry plays an important role in helping to meet these emission reduction targets. In 2016, Denver Department of Public Health & Environment collaborated with local cannabis industry representatives, sustainability practitioners and regional stakeholders to create the Cannabis Sustainability Work Group, whose mission is to promote sustainability in the cannabis industry through education, the development and dissemination of best practices, and the facilitation of dialogue between the cannabis industry, the community and technical experts. The result of that group's work is The Cannabis Environmental Best Management Practices Guide, which provides recommendations for cannabis-specific sustainable practices based on an analysis of existing data from individual case studies and regional and national performance standards as well as individual technical expertise. Issue areas covered in the report: Energy, Water, Waste Management & Diversion, Integrated Pest Management, and Air Quality.



Case study 2: Company **YELLOW DREAM FARM**

Yellow Dream Farm is a family-owned cannabis cultivation, manufacturing and distribution company based in Adelanto, California, that has an established reputation for sustainably grown, high-quality wholesale cannabis. Jeffrey Garber, CEO, has implemented an eco-efficient process at the company's cultivation center, focused on water conservation and recirculation, vertical farming to maximize production per square foot, maximization of nutrients, and lighting efficiency. Yellow Dream Farm's fully-automated state-of-the-art facility provides affordable premium cannabis, which is distributed under in-house brands, such as GoodGood, and white label brands.



Case study 3: Electric Utilities

WASHINGTON STATE UTILITIES, ENERGY TRUST OF OREGON, XCEL ENERGY COLORADO

Since the dawn of cannabis legalization in the U.S. in Colorado and Washington (2014) and Oregon (2015) electric utilities have engaged, collaborated and evolved with the cannabis industry to promote energy efficiency through the use of rate-payer funded energy efficiency incentives. While indoor cannabis cultivation was a new use-case for energy efficiency for utilities, driven by a “duty to serve” customers, the primary utilities in these early-adopter states learned about industry standard practices and offered growers incentives to invest in technology that exceeded these standards. These investments manifest primarily as incentives and rebates for LED and efficient dehumidification. Lighting solutions that can provide an equivalent amount of photosynthetically active radiation (PAR) with fewer watts, or dehumidification equipment that can remove equivalent amounts of water using less energy, are considered energy-efficient. Like any other electric ratepayer, cannabis cultivators can apply to their utility for custom energy efficiency incentives. Leading utilities, such as Puget Sound Energy, Seattle City Light, Snohomish PUD, Avista, The Energy Trust of Oregon, Xcel Colorado and Blackhills Energy Colorado, are early adopters in this space and have steadfastly serviced their cannabis customers year over year. Utilities in second mover states, such as Public Service of Oklahoma, Oklahoma Gas and Electric, DTE Michigan and Consumers Energy Michigan, similarly embraced energy efficiency and have serviced the cannabis industry without discrimination.

Hemp growers have also received similar incentives from electric utilities such as New York State Gas and Electric and Duke Energy North Carolina. A typical LED utility incentive will offset 30-50 percent of the capital cost to the grower, and an estimated \$100 million has been paid from electric utilities to cannabis growers. The estimated power reduction resulting from these utility partnerships is 51MW - the equivalent of 1 small utility scale combined cycle gas power plant.

We should support policies that reward early adopters, such as these, encourage innovation, and support strong local utility incentives. Mandates, such as 36 W/SF, limit grower options and directly undermine utility incentives. While well-intended, certain energy policies are short-sighted and fail to consider the systemic impacts on energy use, including competitive advantages given to illicit operators, increased capital expenditure without financial support and the need for more canopy to satisfy market demand. Furthermore, certain policies are crop discriminatory without justification—applying only to indoor cannabis but not hemp or food cultivation. Instead, we should consider ways to help growers access federal/national tax credits and incentives for items like LEDs, efficient HVAC and other technologies that the solar and electric vehicle and general energy efficiency markets enjoy.

WHAT CAN GROWERS DO NOW?

- **Choose to grow legally**
- **Install energy efficient light fixtures, mainly LEDs, above a 1.9PPE when measured at the lamp**
- **Install energy efficient HVAC and dehumidification equipment**
- **Use the most efficient reverse osmosis systems for inbound water**
- **Capture wastewater/ leachate and reclaim water for reuse**
- **Participate in data collection and reporting programs including voluntary disclosure of resource usage**
- **Build retrofits**
- **Select responsible inputs such as:**
 - **Integrated pest management plan**
 - **Efficient fertilizers**
 - **Optimal irrigation practices**

Critical to this discussion is the need to support and celebrate the transition from illicit to the regulated market, which presents huge energy efficiency opportunities. We know horticulture lighting fixture selection and thoughtful system design drive savings. Use of LEDs are the best indicator of efficiency in a commercial facility, but even if the facility sticks with legacy HPS lighting it can achieve efficiencies through proper maintenance and careful facility design, commonly seen in commercial, licensed facilities. Even at only a 10% LED penetration today, which is the current industry estimate, the transition from residential-scale grows to commercial, purpose-built grows saves as much energy as adding solar to as many as 15 million homes.

But how can business operators even know where to begin?

We can look to precedent. Certification systems such as LEED and ENERGY STAR have been helpful in providing a roadmap for industries to add sustainability features to their operations. Empowering cannabis business operators and encouraging adoption of efficient technologies is not only a program that creates action but it would help educate everyone.

Before we move to certification, there must be an agreement on a standard for data reporting and energy disclosures. Here are examples of the current varying state standards that are emerging: Illinois and Massachusetts are DLC-qualified and set a standard for lighting of 36 W/SF; California set a standard for lighting of 1.9 PPE measured at the lamp per proposed Title 24 energy code. These are thresholds that restrict lighting options for growers (to LED only), which can impact costs and undermine utility rebates. But is this really applicable to the industry? What this could lead to is a grower creating multiple grow rooms to meet the lighting standard, which can result in increased energy usage. Or, in the worst case, it discourages growers from joining the regulated market and leads to an increased need for more space to achieve the same yield. And here's another question to ponder: Should facilities that use 100 percent renewable energy sources be placed under the same burdensome regulations?

Creating a Baseline

Good data leads to good policy. Because indoor cultivation's highest resource demand is energy, we will focus on energy disclosures and policies.

Collecting these three inputs by facility will provide a data foundation for ongoing resource management transparency in the cannabis and indoor agriculture industries.

1) Energy Use Disclosures:

Require annual reporting of the following data points:

- i kWh consumed
 - 1 Grid supplied kWh
 - 2 Alternative generation supplied kWh (e.g. generator); please specify
 - 3 Green energy acquisitions (kWh) in excess of grid supplied energy (e.g.: RECs)
- ii Peak kW (grid supplied and alternative supply)
- iii Therms of Natural Gas and Propane

2) Horticulture Lighting Inventory

Fixture Inventory* (1 line for each fixture/wattage/ function combination)	Function (Veg/Flower/ mixed/other)	Nameplate Wattage	# of Fixtures	Total Wattage Installed (Calculated)
E.g.: "8LT5HO"	Veg	471 watts	200	94,200 watts
E.g.: "HPS-DE"	Flower	1090 watts	600	654,000 watts

3) Water and Wastewater Use Disclosures

- i Gallons of water input to facility per year
- ii Gallons of water recaptured and recycled per year

We recommend a crop-agnostic approach to the above resource-use disclosures, acknowledging social pressures to start with the cannabis industry for resource-use disclosure requirements. When paired with facility characteristics (square feet of canopy, square feet of flowering canopy) and production yields (e.g., grams of dried finished product), valuable performance and efficiency metrics may be determined and compared at the facility level.

Energy Policy Guidelines and Proposal for Controlled Environment Agriculture

Controlled Environment Agriculture, or CEA, is expanding local food and plant medicine availability across the globe. It is also among the most energy-intensive industries in the built environment, thus drawing warranted attention surrounding energy and resource use. Technological developments in lighting, HVAC and renewable energy are producing major advances to improve the industry's energy profile. Policymakers are in a unique position to encourage a better understanding of resource use in the CEA market and lay foundational groundwork for eventual policy engagement. However, caution must be exercised in order to avoid premature regulation from faulty assumptions that might reduce productivity, stifle innovation or even increase energy use locally or in substitute markets. The following principles, concepts and proposed language will help guide policymaker consideration for this nascent and rapidly evolving manufacturing industry.



Guiding Principles for Energy Policy Consideration for Controlled Environment Agriculture

- Technology is changing the energy profile of the Controlled Environment Agriculture (CEA).
- CEA is a complex crop production process with interrelated systems; a change to any one input may have local or global negative consequences.
- Energy policy must be data driven.
- Energy policy should be implemented at the whole facility level.
- Energy policy interventions should ensure that system output is maintained or improved, and is measured qualitatively and quantitatively with statistically significant, empirical data.
- Mandatory energy disclosure requirements offer accountability, transparency, and empirical data.
- Financial incentives promote the adoption of more energy efficient equipment.
- Renewable energy use and carbon offsets can partially mitigate global impacts of higher resource energy.
- Energy policy must apply to crops and be product agnostic.

Proposed Policy Concepts

- **Postpone regulating energy use through standards in the CEA industry until the industry is properly studied.**
- **Collect valid (statistically significant, unbiased, industry representative) data about facility energy use in CEA.**
- **Establish a workgroup with product manufacturers and cultivators from the industries facing regulation.**
- **Require whole-facility energy disclosures and horticulture lighting disclosures.**
- **Require use of renewable portfolio and/or carbon credit offsets for larger energy users.**
- **Subject larger energy users to more stringent regulation than smaller energy users.**
- **Defer to national standards for individual component efficiency limits (e.g., lighting, dehumidification, fans).**

V. Impact and the United Nations Sustainable Development Goals

The United Nations Sustainable Development Goals (SDGs) will serve as an overarching framework in the nascent cannabis and hemp industry – and with a laser-focus on Environmental, Social & Governance issues - purpose-led players in this industry will be well placed to help solve some of the biggest challenges facing humanity in this ‘Decade of Action’. A flourishing industry can help reduce poverty, eradicate hunger, improve health and well-being, drive industry, innovation and infrastructure, reduce inequalities, improve life below water and life on land, and drive restorative justice.

Further to this normalization and regulation, standardization of cultivation processes – no matter if the grow process takes place outdoors, indoors or in a greenhouse – would substantially impact many of the remaining SDGs – specifically clean water and sanitation, affordable and clean energy, responsible consumption and production and climate action.

A focus on standardization will lead to an increase in research and development, which coupled with education will increase the industry’s social license to operate. Misinformation about cannabis requires extensive education behind efforts to develop and implement evidence-informed policies. Furthermore, the industry is highly energy intensive and can be a leader in renewables and efficiency. For example, the rapid increase in use of LEDs is already driving significant gains in the industry’s overall energy efficiency - and in the broader agriculture industry, too, which is further evidence that Sustainable Development FOR and BY the cannabis industry can deliver positive economic, social and environmental impact.





VI. CONCLUSION

There is a unique and exciting opportunity to help share a resource-efficient cannabis industry as it develops. As with other industries, it is difficult to reverse course once well-intended but uninformed policies are in place, locking sectors into resource-intensive infrastructures and processes. In short, policymakers have a chance to get this right, and in doing so, pave the way for resource-efficient models for indoor growing not only of cannabis but food as well. With increased challenges brought on by the effects of climate change, indoor agriculture, of which cannabis is a subset, demands critical attention. As outlined in this report, identifying standards across the sector, requiring resource disclosures among facilities, then gathering the data to establish incentives, certifications and policies can create a pathway toward sustainability. But this must be done both comprehensively and methodically.

Energy regulation is appearing at state and local levels at an unprecedented rate. Well-intended resource conservation efforts are suggesting policies that increase capital costs, restrict technology choice, and threaten yields for indoor horticulture businesses. Prime examples of these policies either adopted or in development can be cited in Massachusetts, Illinois, Colorado and California. Public discourse—from both the cannabis and the energy community—regarding these issues has not been sufficient. Dozens of other such policies are waiting in the wings in states that are considering legalization or are simply concerned about load growth and the rise in energy use from the indoor horticulture sector. What are the long-term implications for the sector as a whole? How does this impact individual growers?

We must create a mechanism to protect growers and ease the transition to regulated, efficient market operations. Rebates and incentives for technology adoption, such as energy-efficient LED lights, would enable growers to reduce consumption and ease costs.

Innovative solutions already exist. Alternative, resource-efficient models are already being implemented. Growers are hungry for guidance. The sector is ready for collaboration.





VII. APPENDIX: TALKING POINTS

- How efficient is cannabis at converting energy into GDP?
- How does the cannabis resource use compare to food?
- Does regulated cannabis use less resources than legacy cannabis?
- What can policy makers do to support business and resource conservation?
- Are there things we can do now to yield significant progress in making the cannabis industry a leader in sustainability?
- What would a certification system in the cannabis sector look like?
- What metrics should guide the development of a certification system or move the industry further forward in terms of sustainability?
- What about the social equity and governance pieces of cannabis sustainability efforts?



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