

Cannabis Grow Operation Analysis

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Introduction

With the ever-changing ways of societies views, the cannabis industry has been growing exponentially and with that notion comes the factor of illegal growth of cannabis on precious soil restricted for farm use. There is said to be about 15,000 illegal growing operations in the state of California alone. The warrant to all this concern is several different sustainability issues including ecosystem toxification, greenhouse gas emissions, energy use, and water use. There are different kinds of pesticides and chemicals these illegal farmers use to grow the cannabis plant. They can range from rat poison to carbofuran, which is an insecticide banned from use by the EPA and can be deadly when consumed by animals. Marijuana is also very water hungry and requires almost 22 liters per plant per day, which adds up very quickly often exceeding the amount of water flowing in a river, leaving little water sustaining aquatic life. This production uses a lot of energy to get this water distributed to the plants. With the growth of this industry came the increase of water use, energy use, and wildlife mortality. Many of these factors of marijuana grow operations can be and are detrimental to humans, animals and the environment in general, showing a need for a more sustainable way to continue the cannabis industry.

Process Description

The growth cycle occurs in 5 main stages over 4-8 months shown in Figure 1. This indoor process creates a more controlled environment that can speed up the process of Marijuana growth with constant lighting and controlled conditions.

The grow steps are as follows (2):

- **Germination:** The seed begins to sprout.
- **Seedling:** the sprout will develop and begin to produce leaves.
- **Vegetative:** plant becomes larger, and trimming begins to maximize plant yield.
- **Flowering:** the sex of the plant is determined, and males are separated. Plants should be supported to allow buds to develop.
- **Harvest:** flowers are trimmed from the plants and taken to dry.

With the indoor growing process and Marijuana usage on the rise, there is a notable increase in energy used in the industry. How can we reduce this? Or use a renewable alternative?

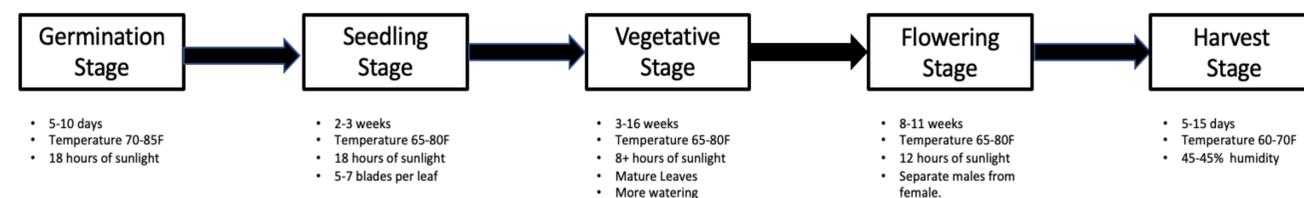


Figure 1: Shows the grow cycle for Marijuana in an indoor setting (2).

Potential Impact Ecosystem Services

- Ecosystem toxification, greenhouse gas emissions, and unsustainable water usage account for a variety of malign effects resulting from a cannabis plantation, harvest, and production of cannabis (1).
- Direct mortality of wildlife occurs through the actual consumption of anticoagulant rodenticide compounds, which even at very low levels of exposure, can result in internal hemorrhaging and organ failure. Non-lethal exposures still frequently result in indirect mortality as a side effect of lowered immunological abilities, development of neurological disorders, and failure of thermoregulatory control (1).
- The industry of indoor cannabis production utilizes highly energy intensive processes and is inefficient. One kg of final product is associated with emissions of 4600 kg of carbon dioxide emissions to the atmosphere (3).



Figure 2. Energy consumption from indoor cannabis growth.

Sensitive Unit

A wide array of factors determine the efficiency and functionality of growing cannabis. Reducing the amount of energy and resources used in the processes can be lowered to reduce greenhouse gas emissions, lower water usage, and reduce chemical use. One factor that would be most sensitive to this process not being more efficient than the current growing operations would be running out of renewable resources.

Using renewable energy as a method of reducing energy used in the growth operations of cannabis would lower the amount of waste accumulated by the current growth process. In the US, cannabis cultivation uses up 1% of the nation's electricity. To put it into visual terms, the energy needed in grow houses used to produce one kilogram of the cannabis flower is equivalent to driving a car across the entire country seven times. This amount of energy used is equivalent to around \$6 billion worth of energy. Using wind energy from wind turbines will be a great way to use renewable energy to power the amount of light needed for the plants. The amount of light a cannabis plant gets is very essential to the development of the plant. Wind turbines would be the most sustainable way to achieve the amount of energy we need. Wind turbines can be very expensive. If the funds are not available to purchase them, it could make the more sustainable growth process less efficient.

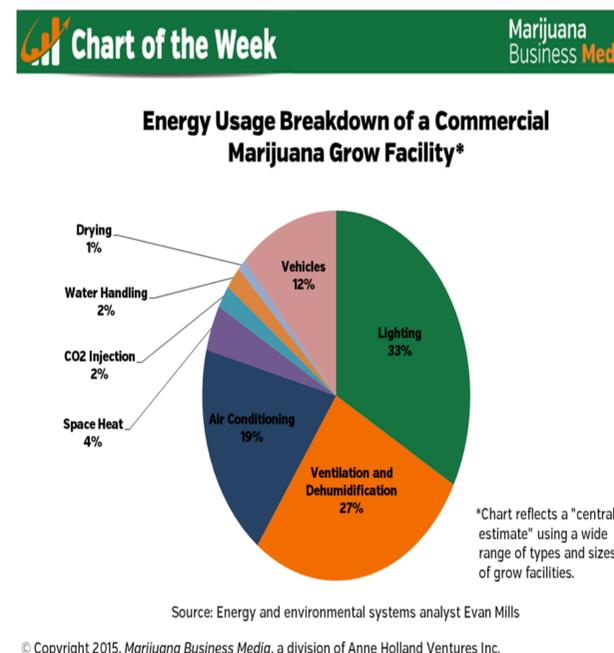


Figure 3: Breakdown of energy usage from cannabis growth

Research

- The cannabis industry is a multi-billion dollar industry that utilizes regular agricultural techniques but also includes high tier production which when totaling out annual cost and energy it amounts to much more than expected. In the past few years as marijuana is becoming more acceptable in societies views there have been many developments to reduce cannabis agricultural waste with techniques such as uses of water catchment and tabling systems to reclaiming and filtering out greywater to reach nearly zero wastewater.
- Since the indoor cannabis growing operations in the US account for 1% of US electricity consumption, equivalent to the power used by 2m average US homes.
- This problem has been partially solved and reduced by the innovation of agricultural LED lights made and researched by Florida-Based lighting science group. The tests conducted on the LED interaction with the cannabis plant allowed for the scientists to find the perfect spectrum of light for photosynthesis to be at 100% efficiency.
- An additional plan to lower the energy used and needed to grow cannabis comes with the other equipment and recourses used for cannabis production. An article made by SWEET (SouthWest energy efficiency project) said "Medium and large-sized grow operations are using chilled water systems to accomplish both cooling and dehumidification, with energy savings of up to 40% compared to the standard practice.". When all these energy efficient practices are in place it can reduce the normal energy cost of a cannabis operation by more than 60%.

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