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 carbafuran, 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, and wildlife. 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).

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 growth steps are as follows (2):

- **Germination:** The seed begins to sprout.
- **Seeding:** 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?

### 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).**

### 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 use renewable energy to power the amount of light needed for the plants. The amount of light a cannabis plant gets is very essential 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.

### References
4. Growing marijuana uses 1 percent of America's Total Electricity, industry says. (n.d.).