



PROSPIANT



WHITE PAPER

**CANNABIS GREENHOUSE GROWING
VS. WAREHOUSE/INDOOR GROWING**



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SUMMARY

GREENHOUSE OR WAREHOUSE. AN AGE-OLD QUESTION

People often assume that indoor-grown cannabis operations have more advantages than greenhouse-grown operations –or vice versa.

Growing indoors gives operators more control over environmental factors like light, temperature, and humidity. While this increase in environmental control can be helpful, the truth is that there is no clear-cut answer as to what facility type is better or which one has the most benefits.

There are best practices, but there is no best way to cultivate cannabis. Many aspects of a cultivation operation are unique, and different growers have different goals, resources, and products.

Another important thing to remember is that sometimes plants can be fickle and unpredictable, which can make blanket statements like “indoor growing operations are more successful” unhelpful.

When weighing the pros and cons of growing in a greenhouse against growing in a warehouse, it is vital to consider the subjective factors that are unique to your cultivation operation. These factors include:

- Cannabis strains you plan to grow
- The climate in your location
- Your current and potential resources

Another critical thing to consider should be how practical each facility type would be for you. Someone that would like to start a growing operation in the middle of a big city is unlikely to go with a greenhouse.

Practicality is also essential when you consider costs and upkeep. Typically, short-term costs are higher with a greenhouse, and long-term costs are lower. With an indoor space designed for growing cannabis, usually, the opposite is true.

This whitepaper will get you started on your research to help you make an informed decision about what facility type to use. Also, you can always reach out to others in your network and get their options and advice.

WHAT IS AN INDOOR GROW?

What makes a facility an indoor grow is that it offers protection from the outdoors and has the ability to control its environment.

An indoor grow can cultivate cannabis year-round with four to six harvests per year, whereas with outdoor production you may get one to two. There's a broad definition of what exactly constitutes an indoor grow and there is a range of facilities that can be included in this classification.



These categories can be broken down into four primary groups consisting of hybrid and sealed greenhouses, along with single and multi-tier warehouses.

THE SPECTRUM OF GREENHOUSE THROUGH TO INDOOR WAREHOUSE GROW



**THE HYBRID
GREENHOUSE**



**SEALED
GREENHOUSE**



**SINGLE TIER
WAREHOUSE**



**VERTICAL
WAREHOUSE**

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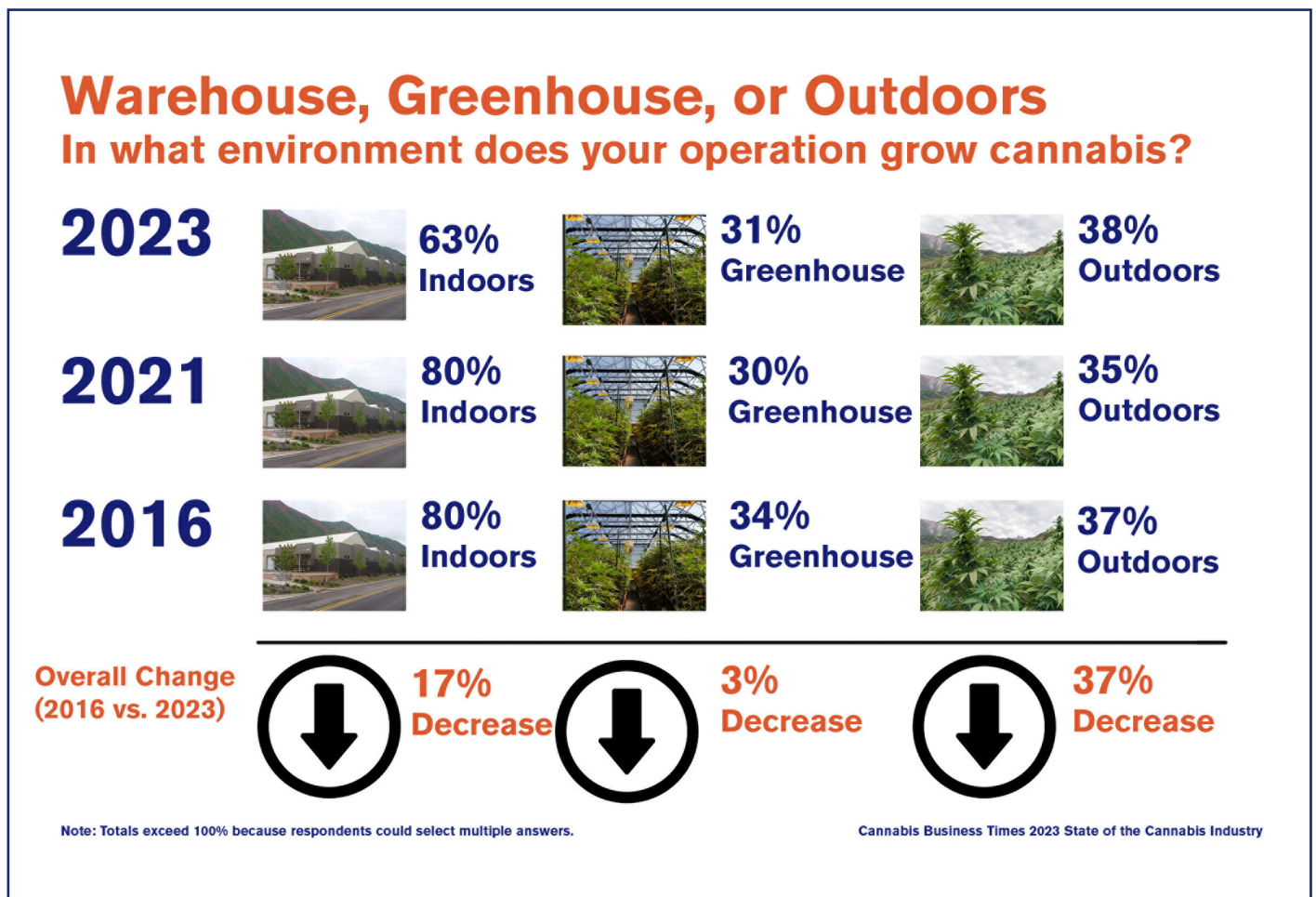
WHAT TYPE OF INDOOR GROW STRUCTURE WILL SUIT MY OPERATION?

When choosing what style of indoor cannabis grow system to construct for your particular operation, an array of factors will drive the verdict.

You must weigh the balance of capital and operational costs while being honest about your capabilities to manage the “plant factory” you’re purchasing. Indoor grows don’t run themselves.

Some decisions may be made based on geographic climate and your specific state’s regulations. The degree to which the environment is controlled is often associated with the desired final product—boutique flower requires greater care than extracted oil.

There is no one-size-fits-all approach to cannabis cultivation construction, and what is successful today may not be profitable tomorrow. Staying adaptable to the changing market forces is critical.



Indoors, Greenhouse, or Outdoors: A Closer Look Where does your operation grow cannabis?

Indoors: purpose built	40%
Indoors: retrofit	25%
Greenhouse: hoop house	13%
Greenhouse: hybrid (indoor facility with glass roof)	7%
Greenhouse: semi-sealed/sealed	7%
Greenhouse: retrofit	4%
Greenhouse: passive	6%
Greenhouse: evaporative pad and fan	4%
Outdoors	38%

Totals exceed 100% because participants could select all that apply
Cannabis Business Times 2023 State of the Cannabis Cultivation Industry Report

QUALITY CONTROL

In the cannabis marketplace where quality is king, indoor-grown cannabis commonly sells for twice as much as outdoor-grown. This is due to superior quality control during cultivation.

In the greenhouse space, cannabis typically sells between these two ranges, with polytunnels towards the lower end and controlled environment glasshouses near the top.

Even though high-quality greenhouses and warehouses can grow the same quality cannabis, they do so in different ways.

Warehouses grow using all artificial grow lighting, typically done with HPS or LED technology. This contrasts with greenhouses, which utilize natural sunlight through a translucent roof, and commercial light deprivation greenhouse systems when darkness is desired.

Greenhouses may still use artificial lights during low solar seasons, but not nearly as many as warehouse facilities.

Another difference is that warehouses are much more insulated as compared with greenhouses. Greenhouses typically use heat in the colder months and nights, whereas warehouses may have to use cooling all year long depending on their climate to counter the heat from HPS lights.

However, warehouses commonly experience humidity problems with their HVAC cooling systems as traditional warehouse equipment is designed for people instead of plants and cannot remove enough water (the facility’s latent load is too high).

Greenhouses can overcome humidity issues by having more air exchanges, over one a minute in some scenarios.

ENERGY EFFICIENCIES

Getting started in cannabis is tough, only the most efficient survive. Decisions made on day one have huge impacts on utility costs for years to come.

It is no secret the cannabis industry is a monstrous energy leach, as in Colorado where cannabis consumes 2% of the state’s electricity.

Warehouses do excel at insulating their spaces from the outside elements.

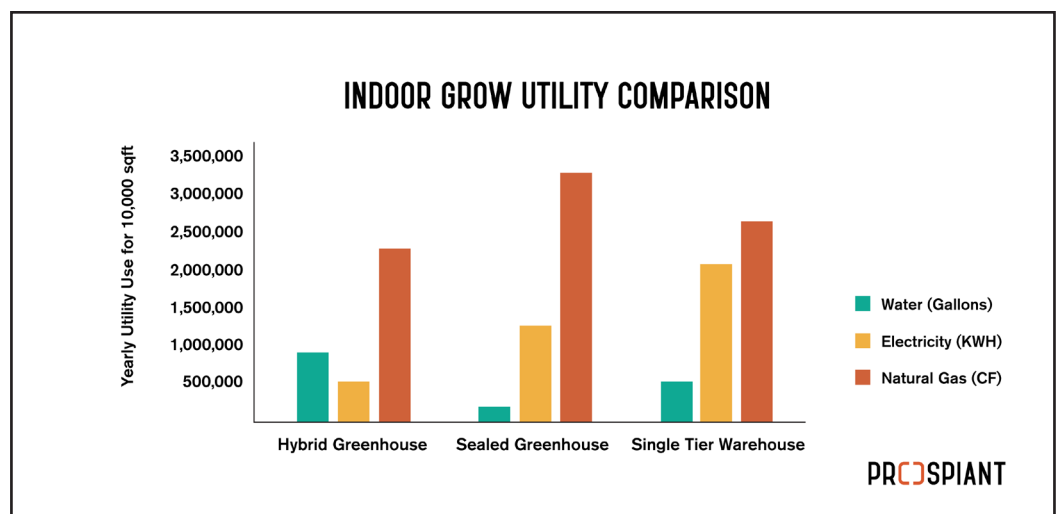
Greenhouses experience loss of heat during the winter months and solar gain in the summer. To combat low insulation, controlled-environment greenhouses use energy retention curtains and waste heat from grow lights to supplement their heating systems.

During the summer, greenhouses use efficient evaporative cooling systems that take advantage of water’s natural heat of vaporization, cooling the greenhouse without extensive electricity use.

The hybrid greenhouse uses more water than its sealed counterparts. This is due to two primary factors. The first is that it is unable to collect condensate, or the plant’s transpiration, which can account for 80% of what is irrigated.

One aspect is that the hybrid greenhouse uses water to cool via its fan and pad system. This means the hybrid vail uses water resources as opposed to electricity.

An evaporative pad system can use as much water as irrigation when being used in a dry climate.



Another aspect that surprises many users is the amount of heating used for an indoor grow. This heating is required because our plants, in many ways, act as evaporative coolers by bringing liquid water up through their roots and transpiring it as a gas through the stomata.

In addition, this water vapor released into the air is typically removed from the environment via cooling, meaning that water vapor condenses on a cold surface, further cooling the air. To prevent the grow environment from becoming too cold additional heat is needed.

The primary user of electricity is from grow lighting, particularly in warehouse grows where sunlight is not accessible. Steps can be taken to increase the efficiency of this lighting by using LEDs and even focusing on high-efficiency red diodes.

At the end of the day, to eliminate this energy cost, sunlight can be used in greenhouses where often in the summer grow lighting will not be turned on where DLIs of 30+ are enjoyed.

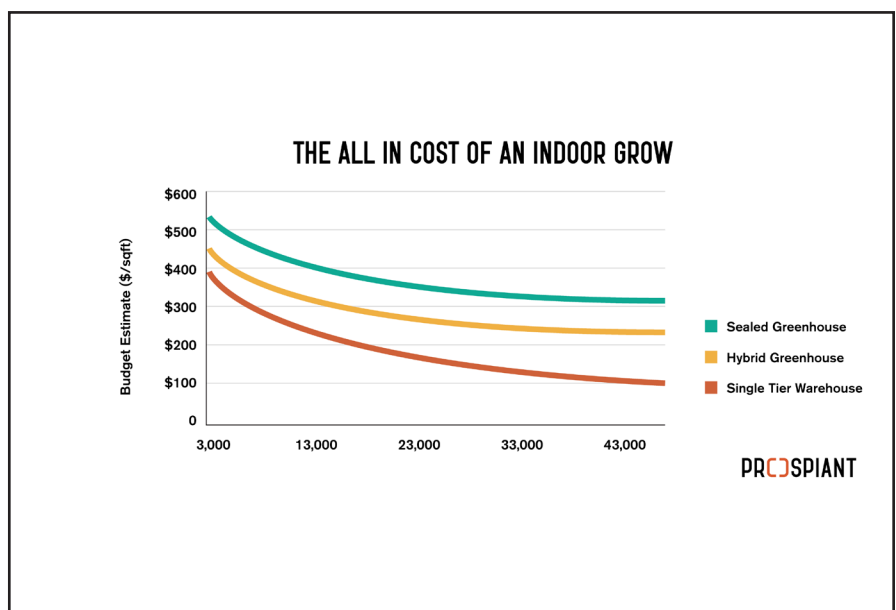
CAPITAL COSTS

Indoor warehouses and controlled environment greenhouses typically produce the same quality and yields of cannabis.

Indoor facilities often can maintain higher environmental control, but greenhouses are able to get natural sunlight, which improves terpene and cannabinoid content. Because selling prices between both cultivation systems are similar, what remains are the capital and operational costs.

When budgeting for a facility, costs per area are often desired. It is important to note that cannabis facilities enjoy economies of scale. This means that a 3,000 sq. ft. facility may be double the cost per sqft as a 15,000 sq. ft. facility, and quadruple that of an acre.

Economies of scale are most notable for general contracting where initial costs for installation, utilities, and design have a significant impact. Facilities scaling up are also able to take advantage of irrigation and HVAC costs, which scale well as a facility increases in size.



The structure and systems for a new facility typically account for 2/3 of the total cost in which land, permitting, utilities, and excavation may account for the other 1/3.

Capital costs for a warehouse include buying/renting a space and retrofitting it or enacting a new build where utilities will need to be pulled. These typically amount to around \$200-\$450 per square foot.



As indoor growers look to add additional tiers of cultivation, they can expect costs to increase by 50%-75% per tier. It should also be noted that single-tier layouts typically use 75%-85% of a room's area whereas multi-tier layouts typically use 67% per tier, meaning a 3-tier grow room may achieve 200% of a room's area as cannabis canopy.

On the greenhouse side, the sealed greenhouse is often twice the capital cost of a hybrid greenhouse. Cannabis greenhouse facilities typically range from \$100-\$500 per square foot. Facilities encompassing multiple hectares appreciate further economies of scale, particularly on the installation and commodity material supply side.

CURRENT TRENDS AND EXPECTATIONS

To best choose a future facility, one must look at what the industry will become. Long-term sell prices for cannabis will continue to fall until a fine balance is met between cannabis supply and demand.

As federal policies become more friendly interstate commerce will become possible and states will no longer need to produce their own cannabis, but instead could import.

This could lead to cannabis being grown in pristine western climates as opposed to the more humid coastal climates of the east and south. In these harsher more humid climates warehouses or sealed greenhouses shine, unfortunately for them, cannabis will likely be grown elsewhere.

Each year cannabis facilities get bigger and bigger, and the cannabis industry will continue to grow, but the number of suppliers may not. Those who stay cultivating in the industry will do it through know-how and efficiency. The future will tell which facility fits these credentials.



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- ✓ Integrate the perfect growing environment
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