Sustainable Cannabis Grow Room Design

root ENGINEERS

The cannabis cultivation industry is maturing rapidly, and businesses will continue to become larger and more competitive. As a result, companies must increasingly prioritize efficient and sustainable practices that will impact profit margins in both the short and long term.

Key Takeaways

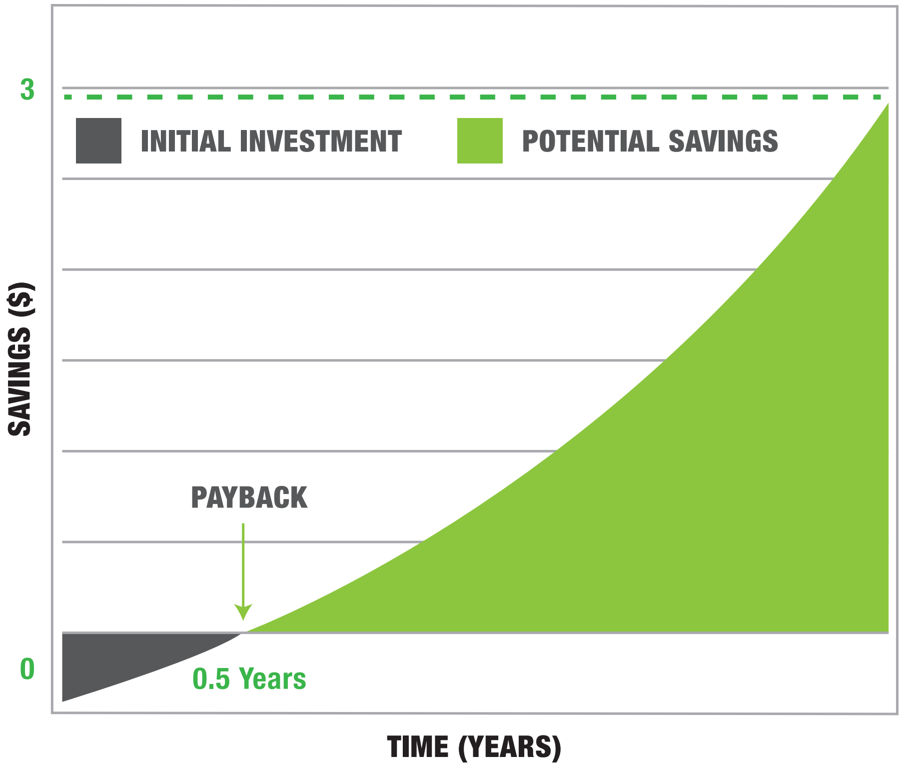
- The “payback period” for HVAC equipment is often overlooked
- Considering a range of equipment options ensures a comprehensive base for decisions
- Looking past initial equipment costs and toward long-term efficiency can pay for itself quickly

The popularity of indoor grow operations for cannabis production means that substantial operating costs go into providing optimal conditions for plant growth.

The cannabis market is showing considerable year over year growth, and as market pressures intensify, growers are quickly realizing that a number of indoor grow practices directly impact their profitability.

Variables such as heating, ventilation and air conditioning (HVAC), water usage, and electrical systems directly impact productivity and an operation's bottom line. The team at Root Engineers understands the impact HVAC systems can have on manufacturing productivity and costs, and have developed in-house expertise to identify and develop customized HVAC solutions for grow rooms. The cannabis cultivation industry is maturing rapidly, and it is assumed that cultivation businesses will continue to become larger and more competitive. As a result, companies must increasingly prioritize efficient and sustainable practices that impact profit margins in both the short and long term.

HVAC equipment "payback period" is often overlooked when assessing profitability. The payback period is an integral concept that impacts the bottom line: a certain sum of money is sunk into the initial equipment investment, the operating cost is compared to that of an alternative (over some set amount of time), and the difference in long-term value is revealed. Systems with higher initial costs, as compared to alternative HVAC systems, may appear less attractive to investors, but after long-term operating costs are considered, these systems may be a more financially sound decision in the end. Perhaps even more surprising is that systems with some of the highest initial costs, which one may assume would mean high quality, are often the least efficient. Root Engineers leverages their expertise in energy modeling, construction economics, and system design to bring a professional approach to choosing an HVAC system. By simulating several different systems within the common parameters of a single project, we can directly assess each system's relative worth, in the exact circumstances we expect them to see. We share these results, discuss other factors or desired features, and then allow each client to make a fully-informed decision that fits their unique needs.



Only considering initial investment tends to shroud actual, long-term value.

First, we will compare five-year costs of four popular grow room HVAC systems.

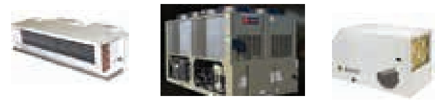
We start by making some assumptions surrounding the common basic parameters and requirements that each system must meet. These parameters are important in themselves, but the key here is making sure that all the systems are being compared in a meaningful, “apples to apples” way. We have constructed a hypothetical example to help guide us through this process:

- **Grow space is 6,282 square feet, located in Sacramento, California.**
- **Indoor climate is to be maintained at 75°F and 50% relative humidity.**
- **Building shell is code minimum in accordance with ASHRAE 90.1, and all spaces sealed from outside air.**
- **High Pressure Sodium lighting, assumed at 41 watts per square foot.**
- **Drip irrigation with reclaimed condensate.**
- **Plants transpire (emit, as vapor) 3.75 gallons of water, per 100 square feet, per day.**
- **Room schedules: Flower room is 12 on/12 off, Vegetation room is 18 on/6 off, Mother/Clone rooms operate 24/7.**
- **Only grow areas are to be modeled.**

Knowing the baseline of what each system must be able to accomplish, several options are chosen for comparison, as shown in the figure (next page):

SYSTEM #1
Residential Air Handlers with DX Condensing Units and Stand-alone Dehumidifiers

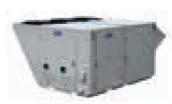
SYSTEM #2
Basic Fan Coils with Chilled Water and Stand-alone Dehumidifiers



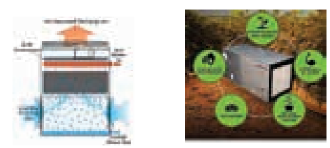
COMPARISON OF

- First Cost
- Annual Energy Cost
- Maintenance Cost
- Payback

SYSTEM #3
High Efficiency Packaged Unit with Modulating Compressors and Hot Gas Reheat for humidity control



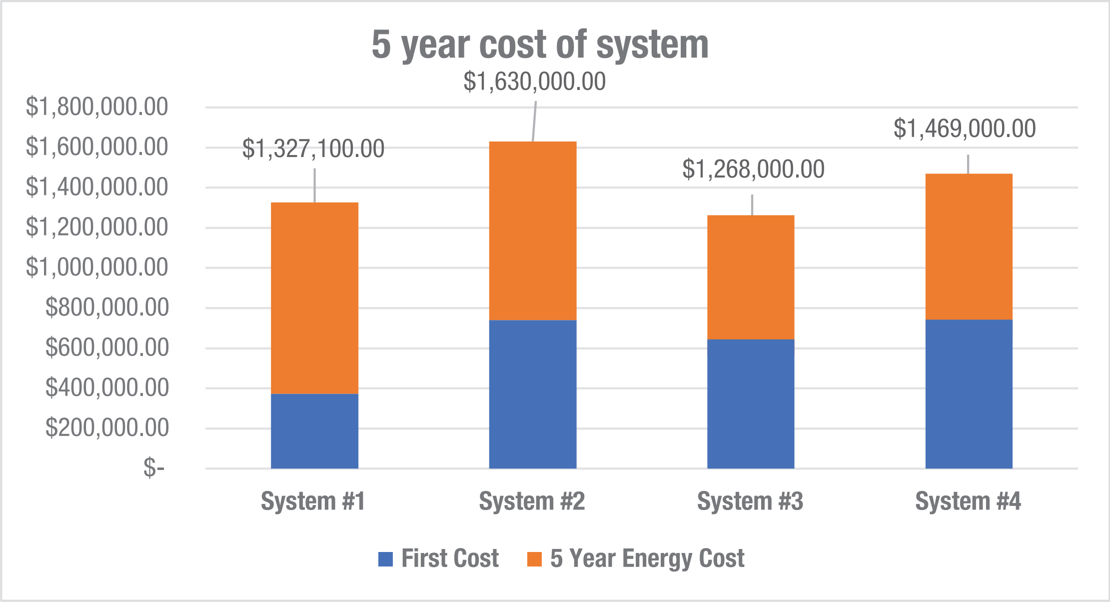
SYSTEM #4
High-end Heat Pumps with Cooling Tower and Hot Gas Reheat for humidity control



For simplicity, we can think of these four options as broad approaches to a solution:

1. **System #1 has a low initial construction cost, is modular, and very straightforward. This makes it incredibly popular, despite some unavoidable inefficiencies. This will be the baseline to which we compare the other systems.**
2. **System #2 is commonly marketed as a "one size fits all" approach, offering avoidance of design work in exchange for a high initial cost and some inefficiencies.**
3. **System #3 is higher-end equipment, geared fully toward efficient operation.**
4. **System #4 is very high-end, with strong performance and plenty of extra features.**

We run simulations on how each system will work to keep the appropriate temperature and relative humidity, noting technical differences and implications for other factors. For example, System #1 relies on residential air handling units alongside standalone dehumidifiers. While this system has a low initial cost and is easy to install, these two pieces of equipment tend to give fluctuating temperatures while they "chase" their setpoints back and forth. This lowers efficiency and provides less stable conditions, ultimately expending more energy for a lower-quality crop. The simulation yields an initial cost of $372,000, an annual energy cost of $191,000, and a 5-year cost of $1,327,000. Carrying this methodology to the other three systems, we find the following, and can start to form some conclusions:



The Results: Total five-year costs of all four systems. Note that this does not account for other important factors such as backup redundancy or extra features.

System #1 has the lowest initial cost and is easiest to install. Inefficient operation balances out to a mid-range five-year cost.

System #2 is expensive to install, and still expensive to run. This system does have the easiest approach to backup redundancy; despite this, it's wise to be wary of anything marketed as a "one size fits all" approach. Anything intended to work across the board is rarely the best choice for any particular application.

System #3 has a significant initial cost, but the impact of focusing on efficiency is clear. Within the chosen parameters, this is the most profitable system, and is what we would likely recommend. However, taking things like physical installation and backup redundancy into account could still favor an alternative.

System #4 is the most expensive initially, and isn't quite as efficient as #3. Despite this, features like integrated CO_2 distribution and high-quality controls make this a viable choice.

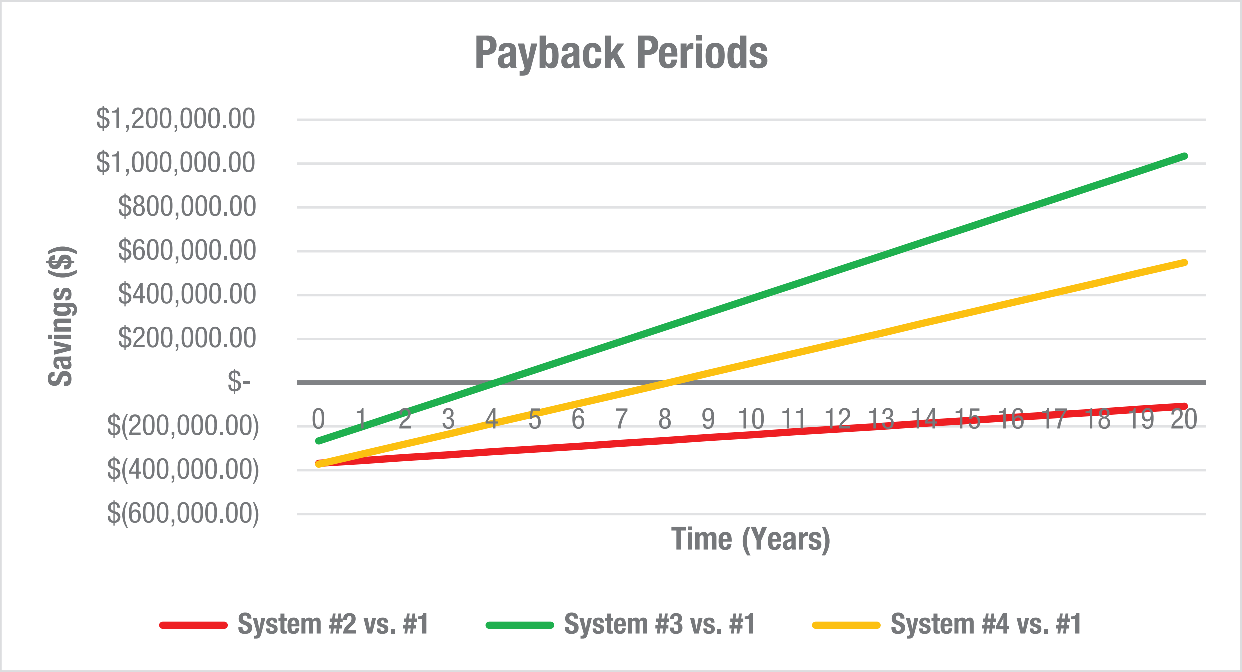
In order to better understand the up-front and long-term financial impact of these systems we must finally calculate payback periods from these total five-year costs. We look at the net cost of system #1 ($1,327,000), the different annual costs, and then find how many years it takes for the lower annual costs to cover the additional initial costs. At the point where a system intersects "$0 Savings", the same amount of money has been spent on either system. After this point, the more efficient system is essentially producing extra profit every year, equal to the difference in annual energy cost. From the table, we can see results:

System #3 (efficiency-focused) pays back in only 4 years due to very low annual and relatively low initial costs.

System #4 (feature-focused) takes close to 8 years to pay back, but does not account for the extra bells and whistles, which could increase product quality and otherwise increase profitability.

System #2 (one size fits all) does not pay for itself, even well past 20 years of operation, when compared to the lowest first cost System #1. This exemplifies the importance of basing decisions off solid data and professional advice, rather than brand marketing or a desire for convenience.

With Root Engineers' analytical approach to HVAC decisions, growers can identify an efficient, competitive edge without compromising quality or safety.



Which would you prefer - #2 or #3?

Considering a range of alternatives ensures a comprehensive base for decisions, and looking past the initial cost can pay for itself quickly.