



HOW TO SET UP A COMMERCIAL GROW OPERATION

Roadmapping your commercial-scale indoor farm planning & buildout



Indoor farms allow growers to harvest all-year-round in a controlled environment. Commercial operations range in size from thousands to hundreds of thousands of square feet, and are used to grow crops ranging from leafy greens, to cannabis, to tomatoes. And while controlled environment agriculture (CEA) is increasing in popularity, it still poses unique startup and design challenges in comparison to other verticals.

This guide offers a comprehensive overview of things to keep in mind when planning your facility design, construction and startup. It is important to note that every buildout journey is unique, and the order in which you tackle each step to setting up your commercial grow operation will vary.

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The design of your cultivation facility is essentially separated into two phases: pre-planning and planning. Pre-planning involves everything you will do before you can start choosing equipment and grow systems. You will need a budget, goals, funding, a location, and more before finalizing design selections in the facility.

GOAL AND BUDGET SETTING

Before you do anything, you will need to establish your goals and set a budget. And while these may change once you actually obtain your funding, you'll need to start somewhere.

Establishing CapEx and OpEx expectations will, at minimum, require a lot of research. And depending on your experience, it may require expenditures associated with engaging experts right from the start.

If you aren't already, you should become familiar with the industry you'll be serving and network with other growers. For example, you might attend a trade show event for cannabis cultivation to gather information packets from vendors and listen in on experts' panels. Or you might join a Facebook group for CEA and ask other members for advice and recommendations. You should also subscribe to industry magazines and newsletters.

Perform a market analysis of the area you plan to serve. What crop(s) are in demand? What barriers to entry exist? Who is your audience, and how can you reach them? What key metrics will you measure (yield per square foot, variable costs, plant quality, etc.)?

You should also consider plans for scalability. Some cultivators will buy a facility or land with enough

room to add grow spaces later on, opting to build out in phases. It's important to consider these plans in the beginning, as trying to expand an established grow without the space for it will force you to decide between running multiple locations, starting from scratch somewhere else, or stunting the growth of your business.

TALK TO AN ATTORNEY

Any entrepreneur looking to start a business that requires a significant initial investment should consult with a lawyer familiar with the industry they wish to enter. A reputable legal representative can help in a number of areas including operating agreements with partners, investor agreements and pitch decks, vendor contracts, taxes, compliance, insurance, and other protections.

This is true if you are building an indoor farm of any kind, and is doubly so if you are entering the cannabis space.

While laws and regulations vary from state-to-state, cannabis is still considered a federal Schedule I substance under the Controlled Substances Act. This makes cannabis a risky business, but consulting with an experienced lawyer can help you navigate state and local legislature and help protect you against potential legal risks.



"Use of well-drafted agreements to balance risk between the various parties involved in the commercial grow setting is key. Sharing risk will align all the parties' interest and increase the likelihood of a positive outcome for all."

– Adam Massaro, Partner, [Ackerman LLP](#)



DEVELOP A TEAM

It takes two to make a thing go right, but it takes a team to make it out of sight. No matter your own expertise or the skill of your cultivators, you should be prepared to recruit a team that is capable of launching your business and supporting its daily operations. Keep the following positions in mind:

- Cultivation Director or Horticulture Expert
- Operations Manager
- Trimmers, Harvesters, and Processors
- Maintenance Staff
- Sales and Marketing
- Office Administrator
- Human Resources
- Security and Compliance Officer
- CPA/Accounting and Bookkeeping

Some operations, especially smaller grows, will combine or outsource positions. For example, you might merge HR, marketing, and office administration into one role. Or you may choose to hire a company to provide [preventative maintenance and repair services](#) for you.

Note, these are just some of the positions you should consider. Every team is different, so plan according to your facility's unique needs.

LICENSING

Both the federal and state governments regulate the production of agricultural products. The permits, licenses, and registrations you will need will depend on what crops you plan to produce. Consult with your attorney to find out where you should start.

For cannabis growers, the licensing process is more intense, and it differs from state-to-state. Keep in mind that in most states, you will need separate licenses for cultivation, processing, retail, etc. [Cultivation license costs](#) vary greatly between states.

FUNDING

Starting a commercial grow requires a significant initial investment. Before you can even begin putting plants into your facility, you will need to invest in the building, its design, an environmental system, lights, grow benches, and much more. Business owners cultivating traditional crops like mushrooms, tomatoes, leafy greens, etc. can apply for a loan through a bank or credit union just like any other startup.

Cannabis cultivators have less access to funding as banks cannot provide loans to cannabis-related businesses. The Secure and Fair Enforcement (SAFE) Banking Act has been introduced as a means for

protecting financial institutions from punishment for servicing businesses operating within the legal frameworks of the state, but as of February 2022, it has only passed the House, and must now pass the Senate and be written into law by the President. Put short, we have a way to go before funding becomes more accessible to cannabis facilities. Private investment is the primary means by which cannabis operations are currently funded.

Some private lenders will work with cannabis businesses, but you should be prepared to carefully vet potential lenders to [avoid predatory loans](#). Other sources for funding include private investors, hedge funds, or even crowdsourcing.

REAL ESTATE

When planning an indoor commercial grow operation, you can choose to either build your facility from the ground up or retrofit an existing structure.

Many growers opt to **purchase land to build** their facilities from the ground up. This option allows you to design things exactly the way you'd like within certain constraints (like budget). Some important things to research before buying land:

- Local codes and restrictions
- Zoning
- Power and water infrastructure
- Wastewater regulations

While it may sound simple at first, make no mistake: **retrofitting a space** will still require a lot of work and planning. While it may go a little faster to retrofit an existing building, it's generally just as expensive overall, and requires just as much (if not more) design and engineering as a new build. There are also a number of things your construction team will need to check to make sure the building is ready for use. Here are just a few examples:

- Is the building consistent with current building codes? Will major changes need to be made to

bring it up to code associated with the change in use?

- Will structural changes be required to accommodate the change in use?
- What size electrical service is on the building?
- What will the costs and lead time be to upgrade to a service sufficient to support the power-intensity of CEA?
- What size water service is on the building? What upgrades will need to be made?
- How will you properly dispose of waste water?

These are all items that you should have assessed prior to purchasing the building to help determine what will need to be done to make the building usable, as well as the estimated cost to do so.

Regardless of which route you find makes the most sense for your business, **you should work with a real estate agent who has had other commercial cultivation clients before**. An experienced agent will be more likely to find real estate options that could support an indoor farm.

UTILITIES ASSESSMENT

Indoor farms require a lot of electricity, even with the most energy efficient equipment. You will need to provide power to your lights, HVAC system, irrigation system, building automation systems and security, and anything else that requires an outlet for use.

Just as you would have an inspector check a new home for any issues, you should also have a professional size the electrical service. An experienced MEP engineer will work with you to assess your utilities infrastructure to ensure you have adequate power and water for operating an indoor farm. They will also help you obtain power upgrades if necessary.

Furthermore, you can have a utility audit performed. This is an assessment of your electrical usage with the purpose of finding areas to save energy and money. [Foresight](#), for example, offers utility audits to help identify opportunities for energy-savings and incentives (rebates).

PLANNING AND DESIGN

Now that you have a solid business plan, it's time to begin planning your facility, commission designs, submit permits, and get building.

COORDINATION AND DESIGN PROJECT MANAGEMENT

Every design and equipment decision that is made during the design of your facility will affect something else.

"During the planning and design phase, Owners should also determine the approach used to complete the project," says Andrew Speraneo, Project Manager of [Fager-McGee Commercial Construction](#). "Will the project utilize a Design-Build approach, a Design-Bid-Build approach or a Construction Manager at Risk (CMAR) approach? These are the three main delivery methods typically utilized for completing a construction project. Selecting the project's approach is an important decision that will directly impact both the construction schedule and budget. The Design-Bid-Build approach takes time to complete, so if time is of the essence on your project, a Design-Build or CMAR approach should be utilized. Every project is different, and each method has its pros and cons. That's why developing a construction team with experience, that you can trust to walk you through all of this, is vital to the success of the project."

Decisions around lighting and benching/racking will have a direct impact on heating, ventilation, and air conditioning (HVAC) and on architectural, structural and electrical decisions. Mechanical design will have a direct impact on electrical, plumbing and structural design. Irrigation systems will have a direct impact on building automation and wastewater design. And real-life implementation of the designs will need to be coordinated in the field as well.

These are just a few examples of how critical it is that the design team working on your facility be well-coordinated, with a central point of responsibility directing traffic. Sometimes this is the General Contractor (GC), sometimes it's the architect, and sometimes it's a project manager designated by the business owner.

But no matter what, **no decision should ever be made in a vacuum**. All design decisions should be coordinated on a regular basis to ensure that there are no conflicts in the field.

ARCHITECTURE AND FLOOR PLANS

Before you can begin hanging lights and moving plants in, you will need a well-designed facility in which to outfit. Remember that **plants have needs that differ from humans**, so don't just choose any architect you find on Google.

Interview architects/firms who have experience in designing for CEA. They should have a familiarity of grow room layouts, the need for spaces dedicated to large equipment (like irrigation, harvest/processing, and mechanical rooms) and special security measures that affect how a building is designed.

Choosing a [CEA architect](#) provides benefits that go beyond optimizing your facility. Choosing the wrong architect could lead to frustrating and costly construction delays. Or, even worse, you risk getting stuck with an expensive facility that doesn't meet your operational needs.



MECHANICAL, ELECTRICAL, AND PLUMBING

In addition to general building permits issued against architectural design drawings, Mechanical, Electrical, and Plumbing (MEP) permits must also be issued for construction to begin in most municipalities. MEP engineers provide a number of services needed to prepare an indoor farm for operation. Involve an experienced engineering team as soon as possible in the planning process. A [good MEP engineer](#) will consider the entire operation when implementing a design. They should coordinate closely with architects, other design engineers, and construction teams throughout the planning and building stages. **Direct cultivation experience is an absolute must when selecting MEP engineers.**

Mechanical engineers design, specify, provide permits and support construction projects primarily related to HVAC. They perform complex load calculations to ensure the climate system is properly sized and configured to handle the intense heat and moisture loads inside grow rooms. In addition to ensuring that the cultivation climate is appropriate, mechanical designs are also critical for cultivation operations from the perspective of biosecurity, odor control, and energy use.

For a hyper-optimized system layout, some mechanical engineers offer computational fluid dynamic (CFD) analysis services. This uses 3D modeling software to more accurately simulate temperature, air flow, and humidity throughout the grow space, making it possible to test various modifications to your climate system with airflow patterns and in-room equipment and plants considered, before purchasing or installing any equipment.

Electrical engineers are, of course, responsible for designing the electrical system within the facility. Not only do their designs indicate overall power infrastructure requirements to prepare the building to support energy-intensive grow systems, but they also provide the design roadmap for electricians to follow when installing the electrical systems in the building.

Plumbing engineers provide designs that take into account the unique irrigation and waste removal needs of indoor agriculture and integrate them with the base building plumbing systems.

STRUCTURAL ENGINEERING

Structural engineers evaluate the structural load on a building and ensure that it's structurally sound to support the additional equipment associated with cultivation operations. Usually, this is roof-mounted HVAC or electrical equipment. Their services are most critical in retrofit applications, but they are sometimes consulted by the architect in new designs as well.

CIVIL ENGINEERING

Civil engineers get involved in any project that has a direct impact on public infrastructure, such as sewage treatment, waterways or roads and bridges. In the case of cultivation operations, this usually means waste water disposal and site drainage, and could extend to traffic patterns and access in especially large facilities.

LIFE SAFETY DESIGN

Life safety must also be considered in cultivation facility design, and the fire code can vary quite a bit from municipality to municipality. It's very important that you consult the fire marshal's office in your municipality during the design of the facility to ensure that there are no unpleasant surprises during inspection. Sometimes, interpretation of the fire code and related requirements can be somewhat subjective depending on the fire marshal in your area. Fire safety is one consideration, but something many cultivators overlook is what the fire marshal's expectations will be associated with CO₂ safety, as most CEA cultivators will be using supplemental CO₂ in their facility. Life safety requirements will need to be closely coordinated with electrical, plumbing, mechanical and building automation designers.

LIGHTING

[Commercial grow lights](#) vary in cost, output, light spectrums, quality, and energy consumption. You may even qualify for a rebate, depending on which lighting selection you choose and the rebate programs in place in your area.

The two most common types of light fixtures used in commercial grows are Light Emitting Diode (LED) and High Intensity Discharge (HID). There are a number of differences between the two, but HID lights are generally less expensive up front and utilize higher wattage to achieve PPFd goals, while LEDs are more energy efficient and less intense, while allowing for adjustment of spectrum. Work with your lighting vendor to determine:

- How many lights you will need in each room
- What type, wattage and spectrum will be best for each stage of growth
- What heights they recommend for mounting
- The layout and spacing of each fixture for maximum efficiency and to achieve the target PPFd to the plant canopy

It is important that you begin your lighting selection early on in the facility design process as it will influence architectural, HVAC/mechanical, electrical, and life safety design coordination.



WATER PURIFICATION

Having a clean, consistent supply of water is essential for growing a consistent product. Water purification allows you to remove particulates, pathogens, and debris. For this reason, many growers choose to purify their water supply before it's introduced to their plants. There are two ways of achieving this:

- Filtration
- Disinfection

There are many water filtration options including screen filters and membrane filters, commonly called reverse osmosis (RO).

As with filtration, there are many ways to disinfect the water supply. Some examples include the use of ultraviolet radiation (UV), and oxidizers like Ozone. Choosing the right solution is a matter of preference and budget.

IRRIGATION

While smaller operations may be able to make do with manual watering, medium and large grows are much more efficient when they incorporate an irrigation system into the facility design. This is true not just for the labor associated with plant watering, but for the overall consistency of the process, which ensures consistency in costs associated with irrigation and fertigation as well as consistency of yield and quality.

There are several options for irrigation systems. The most common methods include:

- Drip Irrigation
- Ebb & Flow or Flooding
- Hydroponics
- Aeroponics

Drip systems deliver specified amounts of water to individual plants using a timer or volume meter in order to provide the estimated ideal amount of water. Drip systems are used most commonly with a substrate such as dirt, coco fiber, or rockwool.

Ebb and Flow systems are a type of hybrid hydroponic irrigation that allows benches to be flooded with water and plant nutrients intermittently. They are then drained, and the runoff is either cycled back through the system or disposed of. This is used most commonly with rockwool cubes.

Hydroponic systems deliver water and nutrients by submerging the plant roots directly into tanks of water, forgoing the use of more traditional grow media such as soil or rockwool.

Aeroponic systems use a similar approach to hydroponics, but instead deliver water and nutrients to the roots periodically through misting rather than through total submersion.

FERTIGATION

Fertigation is the process of **automating the injection of nutrients into the water supply**. Automating this process keeps your recipe consistent.

There are two main ways of automating this process: inline delivery and batch delivery.





Inline delivery is the automated introduction of nutrients directly into the irrigation line. Nutrients are fed into the line one at a time at the desired rate until the final recipe is achieved. With this system, there is no need for intermediate tanks and storage tanks.

With **batch delivery**, the nutrients are automatically fed into a storage tank where they are mixed with water. Once ready, this mixture is used to irrigate the crop.

WATER RECLAMATION

If possible, you can offset the cost of water by recycling the irrigation stream.

Or, you can capture the condensate collected by the HVACD system. In most cases, the water that is formed on the cooling coils of the HVACD is discarded. This condensate can be as pure as distilled water. If properly captured it can be fed into the water purification system and offer substantial water savings.

BENCHING AND RACKING

Grow benches and racking systems are necessary for efficiently, and cleanly, organizing your plants within a grow space. Few growers keep their plants in containers directly on the floor. Doing so makes organizing and servicing plants a hassle, and it can add unnecessary hours to your labor.

There are many [benching and racking options](#) available on the market.

Stationary benches and racks are the most straightforward option. They are secured in place, and aisles are created on either side to form walking paths between rows of plants. Due to their simplistic design, stationary benches and racks typically have a smaller price point, but they require more horizontal square footage than other options as access aisles will be required for every bench or rack.

Rolling benches are a staple in the cannabis industry and in greenhouses. These benches are mounted to the ground at the feet, but have mobile table tops that can be easily pushed from side to side to create temporary aisles. Some rolling benches can be outfitted for Ebb & Flow irrigation. This method is for cultivation in a single tier, but maximizes floor space as the mobile nature of the bench allows for a “floating” aisle for access to each row of plants.

Track benches and multi-tier racks are similar to rolling benches in that they can be pushed from side to side. However, track benches are not mounted in place at the feet, but are rather installed within small tracks in the floor that allow growers to have full table mobility. This makes it easy to create aisles at any point in the grow, maximizing the use of the space. Mobile grow racks are typically operated by a crank that pushes the rack – and its neighbors – to one side or another. These benches and racks can often be outfitted for Ebb & Flow irrigation as well.

Cloning and drying racks are a necessary part of any commercial cannabis cultivator’s arsenal. Clone racks provide a multi-tier shelving solution for storing young plants as they develop. Drying racks can be used to make the drying and curing process

easier, providing a place for personnel to easily hang harvested herbs or cannabis flower to dry.

CONTROLS, DATA COLLECTION AND AUTOMATION

Irrigation, CO₂ delivery and ventilation, fire systems, lighting, and HVAC systems must all be controlled somehow. Variances in the sophistication of the systems and how you’d like to operate them will **determine the level of sophistication required by the controls in the facility.**



During the early planning of your facility, you must decide what your goals are.

- Do you want to invest the bare minimum in the facility with the understanding that operating costs will be higher than with more sophisticated or energy efficient systems? Do you want to invest in the most precise and most energy and labor efficient systems, leading to greater capital expenditures but lower operating expenses? Or are your goals somewhere in between?
- How much visibility do you want in the operation of the facility when you're not present?
- How much data do you want to collect about your operation to drive long-term operating decisions?

These decisions will lead you to lighting, HVAC, and irrigation systems, each requiring varying levels of sophistication in the systems that control them.

SECURITY

While general security surveillance may be beneficial for most businesses, **it is an absolute necessity for cannabis grow operators.** In fact, your cultivation license requires it. Security system requirements vary from state-to-state.

For example, cannabis cultivators in [Michigan](#) must utilize "a video surveillance system that, at a minimum, consists of digital or network video recorders, cameras capable of meeting the explicit recording requirements, video monitors, digital archiving devices, and a color printer capable of delivering still photos."

On the other hand, [Oklahoma](#) has more vague security stipulations for cannabis cultivators, stating "Commercial licensees shall implement

appropriate security measures to deter and prevent the unauthorized entrance into areas containing marijuana and the theft and diversion of marijuana."

No matter what you're cultivating, and what is required by your state or municipality, you should take sufficient measures to protect your business and your staff. In November/December of 2021, a [string of violent robberies](#) targeting cannabis businesses in the San Francisco Bay area caused an estimated loss of \$5 million. While there will always be threats, you can take precautions.

Many growers try to camouflage their facilities, making them look like an indiscernible warehouse from the outside. Fencing, alarms, cameras, and even armed guards can all enhance your facility's security. You should also be prepared to provide training to staff regarding security procedures and authorized entry protocols.

EQUIPMENT COMMISSIONING

Cultivators often make the mistake of thinking that they can start cultivating the day they receive their Certificate of Occupancy. Unfortunately, this is almost never the case. Once your facility has been outfitted, it will be time for system commissioning.

There are a number of complex industrial systems utilized in your cultivation facility, each of which will need to be commissioned to ensure it's fully operational. Some of them will need to be commissioned in parallel, or for which successful commissioning may be dependent on other systems. For instance, lighting systems must be operational before temperature control systems can be started up, and dehumidification performance can't be accurately measured or fine-tuned until there is an

adequate humidity load. The building automation system may control everything from irrigation to HVAC, or you may have discrete controls that operate each system independently.

Be sure you understand who will be responsible for commissioning before purchasing your equipment. Some vendors will leave it up to you to find a contractor for installation and commissioning and very few will offer support throughout the process. Surna Cultivation Technologies provides system start-up and testing support of the HVAC and controls systems we sell. During this process, we will send our field technicians to the facility site to ensure that everything is running as intended. This all helps to make for a smooth startup.

OTHER

You have a facility. You have lights. You have irrigation and HVAC systems in place. Everything has been commissioned and you're ready to go. Now it's time for the exciting part: get growing!

There are a number of things you will need such as seeds, grow media (soil, fertilizer, nutrients, rockwool etc.), trimmers and other tools, gloves and possible personal protective equipment (PPE), trellis netting, and packaging. And never overlook the consumables required to maintain the facility itself—filter replacements, bulb changes, irrigation emitters and pump seals just to name a few.

Looking for recommendations? As mentioned earlier, it's a good idea to attend an industry event to meet vendors and see what is available on the market. Other growers are usually happy to offer their input too. Also, stay on the lookout for special discounts on products sponsored in industry newsletters and magazines.



CHOOSE EXPERTS

If you've reached the end of this guide, then you've probably picked up on a recurring theme: always choose vendors **who are experienced in CEA!**



Plants are not people. They require environments designed for agriculture, not comfort. Don't let your business become the guinea pig for someone trying to enter a new market. This applies to engineers, architects, lawyers, real estate agents, general contractors, lighting companies, HVAC equipment manufacturers, and everyone in between. We have seen the results of working with inexperienced vendors, and it often creates a costly and aggravating experience for the cultivator.

Don't just take our word for it. It is a best practice to compare your options before signing any contracts. Interview multiple companies. Pay attention to the questions they ask you, and don't be afraid to ask them about alternative options to what they've initially presented.

We understand that may sound daunting; there is so much involved in planning a facility as it is. But what if there was a team that could help provide a more comprehensive facility design solution?

Surna Cultivation Technologies is an industry-leading CEA facility design provider. We have been helping cultivators for over 15 years, and we offer a variety of products and services to help you design the facility of your dreams including architectural design, MEP engineering, controls and automation, lighting and benching, and so much more. Our designs are guided by your budget and goals, so you can grow with confidence.

For more information, visit surna.com today, where our team of experts are ready to understand your goals and discuss your options.



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