



SPECIAL REPORT:
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**WHAT YOU NEED TO KNOW BEFORE
DESIGNING A NEW OR EXPANDING AN
EXISTING CULTIVATION FACILITY.**



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Launching a cannabis cultivation facility is a daunting endeavor. In the early stages, a cultivator must consider not only regulations, finances and scheduling, but also the major undertaking of facility construction or retrofit. With so many factors at play, one of the primary challenges for cannabis companies is knowing where to start and who to turn to for guidance.

At Surna, we help cultivators get their cultivation facilities online by providing controlled climate systems and support with a deep expertise in compliance and safety. It's our No. 1 priority to help you produce the healthiest plants with the largest yields possible.

We've been working with cultivators for years, helping them build new grows and/or repurpose existing facilities. Our work in mechanical systems touches every design discipline, including architectural, plumbing and electrical, as well as every aspect of a grow, including lighting, irrigation and harvest, so we have a comprehensive understanding of what it takes to launch a facility. The most common questions we're asked include: What is the first step when building a facility? Who should be on the planning and construction team? What is the overall process like?

A successful grow must begin with a solid foundation—a functional, clean facility with the proper design where your plants can thrive. That's why we have developed this "Build Your Grow" guide, the third edition of educational resources we've released to help cultivators find early success.

Once again, we turned to experts with industry experience, including architect Daniel Istrate, project director Luz Elena Parra and Surna's own co-founder and senior technical adviser, Brandy Keen, to provide insights into how companies can navigate this process and spot common oversights. For example, it's essential not to overlook the importance of climate control systems built specifically for cannabis cultivation, or the need to establish controls specific to your region and climate. In other words, one size does not fit all. This guide provides tips to avoid these and other common pitfalls in design and construction.

Cultivating plants requires a delicate balance of many elements, including light, nutrition and the surrounding environment. Climate control is dependent on an even more delicate balance of temperature, humidity and ventilation. Getting the foundation right from the start is essential, and by sharing these practical guidelines, we hope to help this dynamic industry continue to grow and thrive. ●

TONY MCDONALD
PRESIDENT AND CEO, SURNA



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CRITICAL CONSIDERATIONS WHEN LAUNCHING A CULTIVATION FACILITY

Whether acquiring an existing facility or building a new space, both single-location and multi-facility operators can **MITIGATE CHALLENGES WITH CAREFUL PLANNING AND THE RIGHT TEAM.** BY **BRANDY KEEN**

Construction of cultivation facilities presents many unique challenges for any construction team in any market. However, the exacting requirements of cannabis cultivation facilities have no parallel in any industry, which means the process of constructing the “perfect” facility is in a constant state of evolution, and deep expertise remains limited.

While our industry continues to evolve and gain experience, its

incremental expansion on a state-by-state and country-by-country basis means that each new market often brings a new set of design and construction professionals with limited or no experience in cultivation facilities—both within the municipality and on the facility operator’s own construction team. Operators entering the industry with their first facility in a new market can be at a disadvantage because they don’t have any experience on which to draw as it relates to building



a commercial cultivation facility. And while multi-facility operators have the luxury of relying on experience with previous facilities, their businesses face the same challenges as single-facility cultivators on a magnified scale.

Facility design and construction challenges for multi-state operators expand beyond the construction of one specific facility and impact the entire business, from budgeting to brand identity. Management of capital expenditures is exceptionally important when multiple facilities are being constructed. Cost overruns on a single facility are painful enough, but they can be devastating when multiplied across markets. Operating expenses also must be predictable and further refined with each new facility that is brought online. And cultivation processes must be consistent in order to maintain brand consistency and predictable yields across all markets. But there are solutions and strategies to mitigate these common challenges.

BUILDING NEW VS. ACQUIRING USED

Cultivators who operate in multiple markets typically have a strategy of both acquisition and new construction. This usually leads to a hodgepodge of design decisions. With acquisitions, the cultivator is stuck with what the previous owner chose to build.

Acquisitions also require a deep-dive review of the infrastructure already in place to ensure that the facility will work the way the new owner wants it to operate. The most critical component (and the most difficult to evaluate) is the climate-control system and whether it can handle the latent loads resulting from the new owner's irrigation strategies at the desired parameters, as well as identification of biosecurity risks inherent to the mechanical design.

With new construction, educating design professionals with little to no expertise as it

relates specifically to cannabis cultivation can be a long and costly process, especially if engineering mistakes are made as a result of misunderstanding certain requirements.

In new facilities, the architect is responsible for understanding the cultivator's needs as it relates to the size of cultivation spaces, support spaces, number of employees, construction material preferences and exterior space requirements, to name a few. While certain design components are going to be required across all commercial buildings (American with Disabilities Act (ADA) compliance, for instance), cultivation facilities have very specialized architectural requirements, and individual operators have a very specific laundry list of architectural requirements that serve their own unique processes.

Mechanical design is the engineering discipline that requires the most specialized expertise in new facilities. It has the most influence on the ultimate success or failure of the facility. HVAC design also has major implications on capital and operating expenditures. Managing the climate and doing accurate load calculations in any indoor cultivation facility is exceptionally challenging. Added to that are the specific desires of the cultivation team, which can include ventilation strategies, biosecurity, climate parameters and irrigation schedules. These can all influence load calculations and design decisions, as well as the direct impact that mechanical design has on other engineering disciplines (civil, electrical and structural for instance).

KEY TEAM MEMBERS

Thus, for all the reasons noted above, Surna has found that the two most critical engineering and design disciplines are typically architectural and mechanical (HVAC), both for accurately assessing infrastructure in acquired facilities and eliminating the learning curve in



Retaining an architect and a mechanical engineer experienced in cannabis cultivation who understand the nuances involved in building a facility is essential to success. (Pictured: Rair Systems, based in Michigan, during construction)

new facility design. Whenever possible, cultivators would do well to retain an architect and a mechanical engineer experienced in cannabis cultivation who can work across multiple states or provinces, so the core team stays intact as cultivation facilities are constructed in new markets. This ensures familiarity, not just with cultivation in general but also with the cultivator specifically, and creates a core team that can build on previous experience with no learning curve or re-education required.

Many mechanical engineering firms can deliver electrical and plumbing designs, as well. However, electrical and plumbing disciplines

+ **OPERATING EXPENSES ALSO MUST BE PREDICTABLE AND FURTHER REFINED WITH EACH NEW FACILITY THAT IS BROUGHT ONLINE.**



don't require the cannabis specialization that mechanical does, so familiarity with the cannabis industry and with the cultivator's specific preferences for electrical and plumbing are generally less critical to success.

While it's extremely beneficial to bring the core mechanical engineering and architectural team along on each new project to ensure that design expertise is carried over to each new facility, it can also be helpful to identify general contractors with some direct experience within the municipality where the facility is being constructed. Local contractors usually already will have a relationship with the inspectors and

plan reviewers, and will have insight into the nuances of how the municipality operates.

It's not always feasible for every contractor on the site to be local, but some local experience at the contractor level is advantageous. A combination of cannabis and cultivator experience at the design level and local experience at the construction level tends to strike a good balance for navigating the requirements of the individual municipalities.

Constructing cultivation facilities across multiple jurisdictions can be an obstacle to developing construction budgets and consistent operational expenses across mar-

kets. There are the obvious differences like variances in labor rates and cost of electricity to consider, as well as the less apparent considerations like freight costs and access to qualified contractors. On the operational side, often cultivators in individual markets are given autonomy for cultivation decisions, such as climate parameters, lighting selections and irrigation strategies. The inability to standardize on cultivation methodology precludes the ability to standardize on facility design decisions, which will result in substantial variance in capital expenditures during the construction process, as well as energy costs and other operational expenses.

To surmount these challenges, identifying a central point of responsibility for developing cultivation and irrigation strategies to make decisions around climate parameters, water use and lighting decisions, and to liaise with the facility design and construction team can be enormously helpful to streamlining the design process and managing capital and operating expenses by extension. This is easier said than done, as developing and standardizing those strategies is an iterative process, and it usually takes many years to perfect the exact cultivation "recipe." (That's not to say that cultivators shouldn't strive for continuous improvement once their recipe is developed, but identifying what those improvements look like is the role of an R&D or test area, not a production area.)

Once a central strategy across all facilities is developed, the facility design strategy surrounding that cultivation process is simplified as a result. This means that typical lighting selections, climate parameters, rough HVAC loads and at least a basic skeleton of floorplans are generally understood at the very beginning of the design process. Understanding these major components allows for greater understanding of infrastructure requirements at an earlier stage, which allows for faster evaluation of available real estate, more accurate early-stage budget development, and fewer coordination delays during facility design and construction.

MITIGATING LOCAL CHALLENGES

Dealing with different municipalities for permitting and inspection is another area of the facility design and construction process that can be



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In new facilities, the architect is responsible for understanding the cultivator's specific needs and adapting to planned cultivation parameters. (Pictured: Rocky Mountain Marijuana Inc. based in Alberta, Canada)

particularly onerous for multi-facility cultivators. The permitting and inspection process is different from municipality to municipality, and relevant building codes can vary significantly, as well. In new markets, a lack of familiarity with cannabis cultivation can mean an exceptionally easy permitting process because the plan reviewers may not know exactly what they're looking at (or an exceptionally burdensome permitting process for the same reason).

On the design side, engineering disciplines will pull the relevant codes for the municipality in which they're working and ensure their designs meet those requirements. It's in the permitting and execution of the design when things can get tricky. For example, operators may breeze through permitting in one municipality and go through round after round of plan-check comments in another, even with nearly identical designs. In one municipality, waste nutrient water may be disposed of down the drain, and

in another, wastewater retention and treatment might be required. One municipality may require a certain amount of ventilation in cultivation spaces for occupancy or economization, and another may allow for a largely sealed cultivation environment. And the list goes on.

To ensure the smoothest possible permitting and construction process, cultivators should ensure their engineering partners have included responses and corrections to all plan-check comments, as well as construction administration, in their design contracts. This ensures that coordination with the municipality and the construction team will be seamless and ongoing, with no surprise engineering costs during permitting and construction. The more experienced the design professional, the better, as they will understand how to compose responses to individual municipalities to satisfy objections or demonstrate that the intent of the

code is being met when the plan checker is in uncharted territory.

With the right combination of partners and teammates, any cultivator has the tools to be successful in a competitive market. With the right team, even first-time commercial cultivators can minimize construction delays and budget overruns and build a facility focused on maximizing the value of capital expenditures and minimizing operational expenses. However, despite the distinct challenges of operating in multiple markets, multi-facility operators have an added competitive edge. With disciplined focus and by leveraging their own experience as well as the experience of their design and construction teammates, operators of multiple facilities have a playbook for turning their own unique challenges into big opportunities. ●

Brandy Keen is co-founder and senior technical advisor for Surna.

There is not a one-size-fits-all solution for cannabis cultivation facilities. Architects can help integrate an individual building's unique needs. (Pictured: A facility by Ascendant Management)



AN EXPERIENCED ARCHITECT can help ensure success by visualizing the whole project, avoiding common oversights and more.

Whether you're building from the ground up or repurposing existing space, a successful grow facility launch takes teamwork.

Your architect is a critical member of that team. Far from being limited to building aesthetics, your project's architect melds the disparate aspects of facility design and function into one successful whole.

Architect Daniel Istrate, founder of Phoenix-based Kontexture, approaches cultivation facility projects holistically. With numerous grow facilities under his belt in three states—and six current projects underway—Istrate understands what it takes to successfully launch a grow facility.

VISUALIZING THE WHOLE PROJECT

With all the parts and players involved in facility projects, unintentional conflicts between systems and plans can occur. Istrate explains that knowledgeable architects help ensure that your cultivation facility's components—from lighting and mechanical systems to space planning and exteriors—work together.

"Growing facilities are very particular kinds of buildings," Istrate says. "They're very different from a house or office building, where the same recipe can be used over and over." A successful cultivation launch ultimately rests on how well your facility's unique needs integrate.

"Lighting is definitely important, but it seems to be the one thing everybody is overly obsessed with. That's just one aspect to consider," Istrate says. Space planning, room adjacency and workflow all add efficiencies that maximize manpower, reduce plant movement, limit contamination and improve margins.

Istrate explains that architects examine all these concerns. At Kontexture, Istrate uses 3D computer-aided design software to give facility plans life. "We try to work with engineers who also use that software," he explains. When structural, mechanical, elec-

LAUNCHING A CULTIVATION FACILITY: ARCHITECT INSIGHTS



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Ceiling height measurements, whether building new or retrofitting a facility, need to account for components like duct work and lights. (Pictured: Rocky Mountain Marijuana Inc. in Alberta, Canada)

trical and plumbing plans communicate, conflicts get resolved before construction starts.

"This also really helps clients wrap their mind around the project," Istrate says. "A 3D drawing helps them to visualize."

AVOIDING COMMON MISTAKES

Even when architects and engineers collaborate, results ultimately depend on the cultivator. Transparency regarding budgets and business plans helps avoid costly mistakes. "We cannot stress that enough," Istrate says. "Clients need to discuss budget with architects and engineers early on. Then we can work backward from that. Design and space allocation, planning, properly sized rooms and mechanicals—the money can go in the right places."

The earlier you involve your architect, the better. "Sometimes people come to us and say the equivalent of 'We have all the mechanicals figured out, we just need you to put a shell on top of our operation,' but in reality there's a lot of considerations,"

Istrate says. Something as simple as ceiling heights, for example, can surprise owners and rule out building retrofits when plants, duct work and lights just can't fit.

Other critical considerations include truck access, employee traffic and adequate power—a special concern for remote locales. Solar gain due to building orientation and exterior materials affects insulation decisions and other needs. "Metal absorbs lots of heat, so you have to fight it inside," Istrate says. "Many times, the architect is the only one thinking that if you use the wrong envelope, it adds to the mechanical load."

Emphasizing plant count above all else is one big mistake Istrate sees. "With an inexperienced architect focused on plant count, you can end up with

undersized veg rooms, undersized dry and cure rooms, smaller trim and packaging rooms—all of which limits output," he says. "You need to look at it in direct proportion to the rest."

SPECIAL CONSIDERATIONS FOR HVAC

"HVAC is the most complex system of the entire operation," Istrate says. "Its importance can't be overstated." Growers launching new facilities often want to replicate systems they're used to, but that can be a mistake. "What works for your Bay Area, Calif., grow, where you need to remove humidity, won't work in Arizona's climate, where you need to cool and filter the air, or in Illinois where you need to heat it first," he says.

Just as HVAC compensates for

transpiration and light-generated heat in grows, the system must offset external factors, too. Your architect evaluates how climate conditions, building exposure, exterior materials, neighboring structures and other factors intertwine to affect your HVAC choices. "It's almost a recipe like when you're making a stew, making sure you add all the right ingredients," Istrate says. "It's really a case-by-case basis to know what works best."

As part of that recipe, Istrate recommends installing redundant mechanical systems so you're covered if failures occur. "Have some redundancies in your flower rooms so if something goes out, the other systems can work to keep the temperatures and humidity at a constant level," he advises.

BUILDING THE RIGHT PROJECT TEAM

Istrate recommends always having someone with extensive grow-facility experience on your architectural or engineering team. "Everyone has to start somewhere," he says. "But you need to be sure that you have someone on the team who knows to ask the right questions or have the right answers when asked.

"In an ideal world, the engineers and the architect should both have experience, but the architect at least can find a team or bring in an MEP [mechanical, electricity, plumbing] with a lot of experience," he says. He advises looking for architects who advertise cultivation facility work or checking with your local American Institute of Architects chapter for leads.

"Interview them and see their depth of knowledge and the engineers they associate themselves with," Istrate says. "The owner should understand the architect is there to ultimately help them have a successful project." ●

“HVAC IS THE MOST COMPLEX SYSTEM OF THE ENTIRE OPERATION.”

— DANIEL ISTRATE, FOUNDER, KONTEXTURE



A proper HVAC system with the appropriate number of air exchanges is essential to prevent plant contamination. (Pictured: Onyx Agronomics)

LAUNCHING A CULTIVATION FACILITY: **DESIGNING FOR CANNABIS**

How a smart layout and the proper HVAC system can prevent contamination and costly mistakes

As a project engineer and manager, Luz Elena Parra's most important role is examining architects' and engineers' layout drawings for cultivation and processing facilities and recommending how they can improve the layouts, budgets and more.

Parra, who owns Parra Projects Inc., works with cultivators, ex-

tractors and processors in Canada to ensure they build facilities that align with Health Canada requirements and are eventually approved. The stakes are high: The facility must be built before the license is approved, so it's important to stay within federal regulations.

"Before, let's say three years ago, you applied to Health Canada for the license, and once you got the license, you go and build.



Designing facilities with proper flooring to prevent contamination is essential. Parra recommends a vinyl material that extends up the wall at least 4 inches, like at the Rocky Mountain Marijuana facility in Alberta, Canada, pictured here.

But what Health Canada found was that many people were applying, and not many people were building because it wasn't easy to find the money," she says. "Now we have to build, and once the facility is built, send video evidence capturing readiness, photos and other documents to Health Canada for revision and potential approval."

Parra's priorities must therefore align with

Health Canada's priorities: proper sanitation and security. But the process also begins with reviewing the bottom line.

SMART LAYOUTS

Careful planning is critical to stay within a given budget and avoid costly mistakes. That's why Parra first examines the design to make sure the flow makes sense and that

potential contamination and security problems are mitigated.

"People create these beautiful layouts that probably will not be approved because the flow of the operation could create problems of cross-contamination," Parra says.

Security can be strengthened with a thoughtful layout. Sometimes plans include outside access to final production rooms where cannabis is present, for example, which is not in line with Health Canada recommendations nor standards.

Also, plants should move from cultivation to drying, processing, packaging, storage and shipping in a logical sequence to avoid cross-contamination, and not back and forth through the cultivation area, for example. "When you go from one side of the building to the other side of the building, there is more potential for cross contamination, so the plant needs to be close to the next step," she says.

FUNCTIONAL, NOT FANCY

One common oversight Parra sees in many designs is budgeting for materials that are overly expensive and unnecessary, she says.

"[Some] architects tend to build really fancy things, and we don't really need fancy things. We need a functional, efficient facility," Parra says. "One of the biggest is the HVAC system. I find two [problems]: a system that is not going to be what they need for cleanliness for good manufacturing practices (GMPs), or a system that is oversized that is going to cost a lot of money. [One project] had this system that was really crazy and really expensive, and through my research, I found Surna. I looked at the system, and found it was a more efficient system for half the price. I try to find things that are less expensive and more efficient."

According to Parra, another common material people tend to overspend on is flooring, which Health Canada also examines very closely in the review process.

"The reality is the flooring doesn't need to be fancy," she says. "The flooring needs to be food grade, something used in hospitals and kitchens. [Often] they put in [a material] that is very expensive, that is not durable or that could potentially crack in the future."

For indoor environments, Parra recommends a vinyl material that extends

at least 4 inches up the wall to ensure a smooth, clean environment. In addition to saving money, these materials can prevent disease outbreaks.

"[Many] cultivation areas are sealed concrete, and I am convinced that is not how you should do it," Parra says. "Because the problem with sealed concrete is first it wears out fairly quickly, it can crack, especially [in Canada] with the huge changes in the weather here. Cracks are a huge problem for contamination. But if the concrete cracks and you have flooring on top, there is no issue for the plants. Health Canada pays attention to floors, and if we want to get the facility approved, flooring is big; flooring and walls are very important to get certified."

Unexpected construction costs can also derail budgets. Although not always possible, when hiring a firm, Parra tries to find companies and teams nearby because it often makes the most financial sense.

"If I'm going to build a facility in a town, I want it to be mutually beneficial for the town, so we get the support. The other thing is it's going to be cheaper for the cultivator if we don't have to pay for transportation and other accommodations," she says, adding

that construction companies bill for truck and transportation costs.

PRIORITY: HVAC

Materials and design are important for maintaining clean growing, extraction and processing rooms. But a proper HVAC system with the appropriate number of air exchanges for the space is one of the most crucial defenses and an aspect that is often overlooked.

"Cultivators know what temperature they need the room to be and the humidity, but they don't pay much attention to the air exchanges you need per hour to avoid contamination," Parra says.

Sometimes architects and engineers who are not experienced in designing for cannabis cultivation recommend HVAC systems meant for home, office or industrial use that are not aligned with the specialized requirements needed in plant production and processing. Another common aspect those without cannabis experience overlook is that separate

HVAC systems are needed for each area to avoid cross-contamination. When Parra first reviews the plans, often only one HVAC system is planned for the whole facility.

"Sometimes plans only call for 10 air exchanges per hour, for example, when 30 or 60 are usually necessary," Parra says. "Often, it's difficult to find construction companies with this level of expertise. ...

"The HVAC is my biggest concern when I see a design. You need to pick the right system and a system that has been proven in cannabis. [Otherwise,] the plants are going to get sick. Production is not going to be as efficient as it should be. People bring contamination on their hair and their skin, and the only way to clean this is with a good ventilation system. HVAC problems are very complicated to fix."

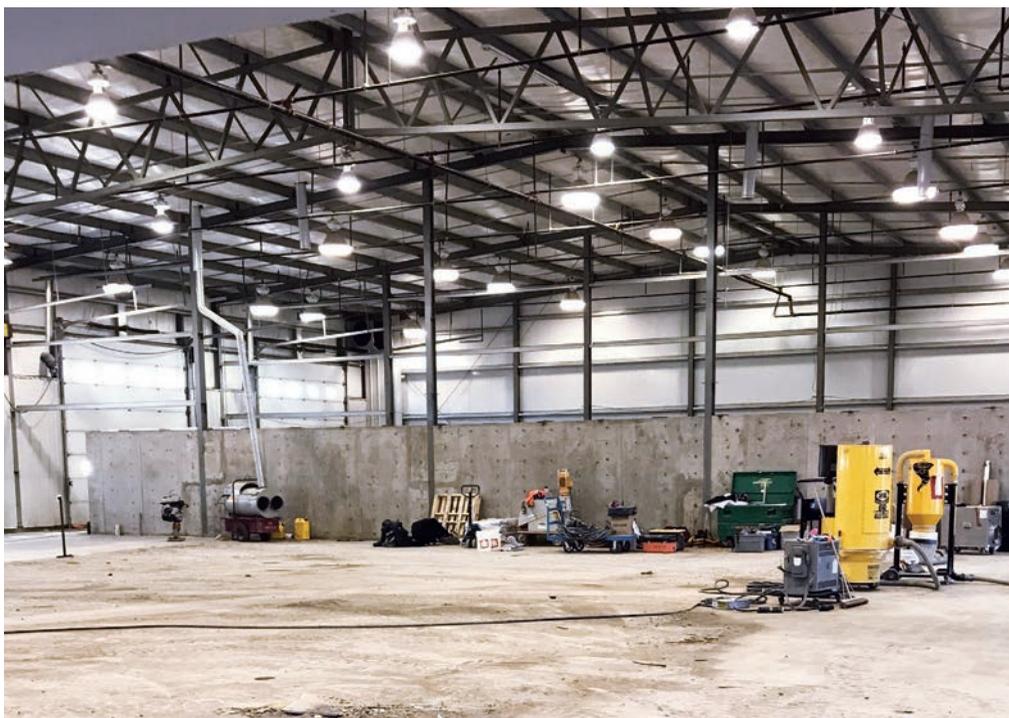
Patience is also important in the planning and construction process. In a fast-moving, evolving industry full of difficult deadlines, this sometimes isn't easy, but it's essential.

"Stop, sit, let's review, because in the end it's going to be faster than if we just start building the facility, and in the middle of the project, find we need to stop, review, and redo," Parra says she advises clients. "And it's obviously more costly than doing it properly from the beginning." ●

Hiring local construction firms can help build goodwill with municipalities and lead to project approvals and support. (Pictured: Rocky Mountain Marijuana Inc. in Alberta, Canada, during construction)

“**THE HVAC IS MY BIGGEST CONCERN WHEN I SEE A DESIGN. YOU NEED TO PICK THE RIGHT SYSTEM AND A SYSTEM THAT HAS BEEN PROVEN IN CANNABIS.**”

– LUZ ELENA PARRA, PARRA PROJECTS INC.



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