

# Designing and Building a Greenhouse: *Traditionally Non-Traditional*

By Thad Humphrey

WHEN CONSIDERING AN EXPANSION OR RENOVATION, MAKE SURE TO PLAN AHEAD AND ANALYZE YOUR OPTIONS.



About three years ago, I decided to take my sixteen years of experience as a process mechanical engineer and apply it to the greenhouse industry. In my previous work life, I was accustomed to more traditional practices of design and construction filled with lots of codes and protocol around every corner. As I've grown as an engineer within the greenhouse industry, I've seen a wide array of approaches to designing and building (not necessarily in that order).

Coming into our industry I have been struck by two huge revelations:

1. Greenhouses are complex buildings!
2. Many greenhouses are built without the benefit of an integrated plan set — this doesn't happen in any other industry that I know of.

Being that I honed my writing skills within the world of technical reports, I don't always care to write things in paragraph form. Let's face it: The more you have to read, the less likely you're going to read it all.

So rather than delicately stitch my discussion points together with flowing streams of conscious thought, I thought I'd just get to the point and create a kind of road map (or descriptive punch list if you will) of what I feel are some of the basics to approaching a greenhouse project.

## Define your Market

If you're considering building a greenhouse, we'll assume you have an idea of what you want to grow. Make sure you've defined your market and determined if there's long-term opportunity for





growth with good potential for strong margins before you invest, as a properly outfitted modern greenhouse facility is expensive.

## Define the Best Environment to Grow your Crops

*Research growing environment alternatives.* There's a wealth of information out there along with a variety of ways to heat, cool, humidify, light, irrigate, etc. Consult professional growers, universities, system integrators and publications to help focus on critical environmental variables and prioritize them.

*Consider current and future needs.* The type of environment chosen to meet current needs could potentially limit growth or cost a premium to expand at a later date. Build in success to your plan by diversifying the growing-related environment. An example could be that maybe last year you grew bedding plants but this year it's lettuce, and the system you previously installed may not be ideal for your new crop.

## Evaluate Suitable Process Equipment and Structure Alternatives

*What's the best way to control your greenhouse environment and growing process?* Before you guess, educate yourself. There may be newer technology available to you that you are unaware of such as newer energy efficient products.

*Integrate the process!* A consistent environment will yield a consistent product and reduce crop loss. Sophisticated equipment and controls can improve process efficiency

*Consider current and future needs by diversifying the growing-related environment.*

while keeping overhead costs low. Consult with an experienced systems integrator to understand your environmental control options. Champion growers integrate before they build.

*Put the process first.* Investigate equipment to fit your growing needs and then select a structure that's most conducive to meeting process demands.

*Simplify the process.* The fewer the variables, the easier things are to control and maintain.

*Select environmental systems to produce the healthiest plants.* Healthy plants can increase your turns, which can improve your return on investment. Don't underestimate the importance of key process variables such as even distribution of light, heat, and water or protecting your facility from pathogens.

*Recognize equipment impact on growing space.* Determine how the equipment encroaches on the growing area (such as shadowing, edge effects, striping, etc.) and maximize your usable growing space to increase your profit potential per square foot (such as analyzing the cost impacts of growing on benches versus on the floor).

*Consider optimizing your current space before building new construction.* But only if it accommodates the process you want.

*Accommodate process expansion.* Understand equipment limitations and expandability.

## Calculate Your Payback

*Determine the complete cost to own and operate each piece of major equipment in addition to structure alternatives.* Don't forget to factor in costs for installation, commissioning, operations and maintenance. Anticipating these will help you avoid the potential pitfall of inexpensive products with high operations and maintenance costs, and may help you discover high efficiency equipment with a reasonable payback period.

*Energy costs affect your bottom line.* Estimate annual energy requirements and recognize the cost as a variable. The more efficient your system is, the less rising energy costs will affect your profit margin.

*Calculate payback of design alternatives.* Perform a net present worth (payback) analysis to calculate the financial impacts of each process alternative on your pocket book. Select cost-effective equipment that maximizes crop yield and minimizes risk. Understand the payback period of an efficient system so you can invest with confidence.

*Don't forget your budget!* Compare your payback analysis to what you can afford. Value engineer your process to streamline costs if necessary.

## Design Before you Build

*Develop a layout that best accommodates the growing process equipment you selected.* Consult with a diverse team to understand the limitations of the equipment and structure.

*Recognize design elements and order of construction within the integrated plan set.* New construction typically requires: earthwork (site preparation and grading), utilities (typically buried and installed prior to structure), structures (concrete work, foundations and buildings), process equipment and controls installation. Staging of construction assures your project stays on track.

*Accommodate growth.* Designate area for potential future expansion. Provide utility transmission and distribution stub outs



*Traditional construction specifications often require the installer to have anywhere from three to 10 years of direct experience working with the equipment they are installing.*

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and additional space in the mechanical room for more equipment.

### Schedule your Project

In the world of construction, surprises mean project costs will likely go up. Greatly reduce unforeseen conditions by mapping out the entire construction process from site mobilization to substantial completion of the work so your project is completed on time and your investment can start paying you back.

### Purchase Equipment and Structure

*Control your liability.* Try to minimize manufacturer coordination and maximize the manufacturer's responsibility for equipment performance by going with packaged or integrated systems.

*Customer support matters.* The value of having an expert manufacturer or integrator with a good reputation for supporting their products ensures you'll get answers when you need them so you can keep production on track.

### Install with Qualified Builders

*Manage your risk.* Install with qualified, discipline-specific builders familiar with the products of construction to reduce construction cost and keep your project on schedule.

*Consider hiring a general contractor (GC).* Growers often don't use traditional licensed contractors and therefore don't have a GC to manage the construction. This makes the owner inherently responsible for project coordination, which can significantly increase their liability during construction as they become the mediator between all subcontractors. Consider letting an experienced GC be liable for both their work and subcontractors' work so you can return to focusing on running your business during construction.

*Experience matters.* Traditional construction specifications often require the installer to have anywhere from three to 10 years of direct experience



working with the equipment they are installing. Screening contractors based on experience will save you money, keep things on track and prevent excessive troubleshooting due to lack of experience.

## Commission Your System

*What is commissioning?* The bulk of the commissioning effort deals with the process of assuring systems are designed, installed, tested, operated and maintained according to the system operational requirements. This should be performed on-site with a qualified representative that is intimately familiar with the specific equipment being commissioned.

*Ensure construction is substantially complete.* Don't attempt to commission a system prior to substantial completion. Prematurely operating a system that isn't properly commissioned may void warranties and damage your system.

*Experience is critical to getting your system online.* Budget for a manufacturer's representative or builder specifically suited to test and operate the equipment (five to 10 years experience) to ensure it performs within specifications and meets warranty installation conditions.

## Maintain Your Facility

*Collect manufacturer operations and maintenance information.* Documentation is typically available for major equipment and structure-related products. Make sure you have your installation and operations manuals readily available.

*Maintain a basic stock of recommended spare parts.* The last thing you want is to put your crops at risk because you're waiting for an inexpensive spare part you could have ordered in advance and had on site to resolve your problem. Also, make sure your installation and operations manuals have a list of common spare parts for each major piece of equipment.


## Learn from Your Mistakes

*Critique the growing space you created.* Revisit lessons learned from your previous construction so you don't make the same mistake twice. Was it a good or bad experience?

In conclusion, next time you

decide to renovate, expand or build a new greenhouse, don't run out and buy a huge bottle of meds to get rid of your anticipated headache from being "traditionally non-traditional" about the approach to projects.

Plan ahead by defining your needs, analyzing your options and decide what you're going to build

with confidence because you did your homework and know what you're getting into. 

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