Indoor Climate Control: Challenges, Necessities, and Best Practices
Getting the Most Out of Your Business

Maximize productivity, quality, volume

Minimize expense
Getting the Most Out of Your Garden

Light

Climate Control

Nutrients
Parameters of a Perfect Climate

Temperature Control  Humidity Control  CO₂ Supplementation
Temperature Control

78°F - 84°F
What Happens if Temperature Isn’t Right?

- Improper transpiration of moisture
- Improper metabolism
- Improper nodal spacing
- Increased vulnerability to pests/pathogens
- Decreased yields
- Compromised quality and flavor
Inevitable Challenges With Temperature Control

A cannabis garden is considered a high-heat environment
  think: server farms

Consistency is key

Fluctuations in ambient conditions

Most cooling systems are only made to run when warm outside

Early lifetime failures of cooling system

Equipment providers/system designers lack experience with cannabis cultivation
Temperature Control Equipment

Air Conditioning (HVAC)

Chilled Water Systems

Point-Source Heat Removal
Maintaining Your Garden’s Temperature

Method: Air Conditioning (HVAC)

Pros:
• Very common usage
• Service technicians common
• Generally affordable

Cons:
• Not intended for this purpose
• Wears out quickly due to hard use
• Inefficient
• Difficult to incorporate redundancy
• Ducting hospitable to mold growth
• Frozen evaporators common
• Add-ons required for cold weather use
Maintaining Your Garden’s Temperature

Method: Chilled Water System
(Industry is behind the curve)

Pros:
• Energy efficiency
• Redundancy
• Dehumidification
• Use in extreme temperatures
• Versatility
• Heat processing is always done with water

Cons:
• Less commonplace in gardens
• Historically cost prohibitive (recent technology updates have made it more affordable)
Maintaining Your Garden’s Temperature

Method: Air Cooling Lights

Pros:
• Low cost evacuation of heat produced by lighting

Cons:
• Large, invasive ducting
• Noise pollution
• Dirty glass
• CO₂ loss
• Introduction of pests, pathogens
• Hard to quantify heat removal
• Heat removal varies based on outdoor conditions
Maintaining Your Garden’s Temperature

Method: Water-Cooled Reflectors

Pros:
• Point-source heat removal
• Helps eliminate need for additional ambient cooling
• Significantly reduce energy consumption
• Reuse warm water to help heat “flips” without sharing air between rooms

Cons:
• New technology
How to Size a Cooling System for Your Grow

Wattage, wattage, wattage
- 3.41 BTUs per watt direct heat
- ballasts

Insulation levels

Ambient heat load

CO₂ source

Oscillating fans, pumps, occupancy

Contact a provider that has experience in cannabis cultivation
Humidity in Your Grow

40% - 60%
What Happens if the Humidity Isn’t Right?

Too much humidity = opportunity for mold & mildew growth

Too much or too little humidity = improper transpiration of moisture/nutrient processing

- Decreased yields
- Decreased potency
- Decreased quality
Inevitable Challenges with Humidity Control

Variables in the garden:

Ambient humidity
Watering schedules
Strains
Maturity level
How well-sealed is the garden
Quantifications - All water to plant will end up in air
Humidity Control Equipment

- Traditional HVAC
- Chilled Water Systems
- Venting
- Dehumidifiers
Inevitable Challenges with Humidity Control Equipment

Traditional HVAC provides dehu while the system is running
When lights are off, no HVAC is needed = nighttime spikes

Venting can lead to introduction of contaminants

Dehumidifiers = extra power consumption

Likely that supplemental dehumidification is needed
Plants transpiring water = high humidity

Properly quantifying how much dehu you’ll need
Find a supplier who is experienced in cannabis cultivation
How to Size a System for Your Grow

How much dehumidification is your existing system providing?

How many pints/day are you watering your plants?

Ambient conditions/average ambient humidity levels

Even in sealed environment, humidity will impact the grow
1,300-1,800 ppm

Elevated Levels
What Happens if the CO₂ Isn’t Right?

Why?

400 PPM = Atmospheric Normals

Plant consumes carbon and turns it into plant material

In sealed environment, plants consume all CO₂ and stop growing
Sealed environments require supplementation to atmospheric normals (at minimum)

Elevated CO₂ levels = plant steroid
CO₂ Control

Fresh Air  Bottles  Burners
Inevitable Challenges with CO$_2$ Control Equipment

Bottles are expensive

Burners introduce more heat to the already “high-heat” environment

Fresh air leaves a lot to be desired, introduces pests, may add humidity, can’t be controlled/optimized
Getting the Most out of Your Grow

Find a company with experience
- first question should NOT be square footage

Choose an energy efficient solution

Consider ALL of the variables

Size for the worst case scenario

Add redundancy/have a backup plan

Environmental controls/alarms
Questions?

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