# Mastering Your Mechanical System for Optimal Growth

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Moderator: Ricardo Baca, Grasslands

CANNABIS SUSTAINABILITY SYMPOSIUM

# MECHANICAL DESIGN AND CONSERVATION:

# THE MOST IMPORTANT DECISION YOU'LL MAKE

Brandy Keen

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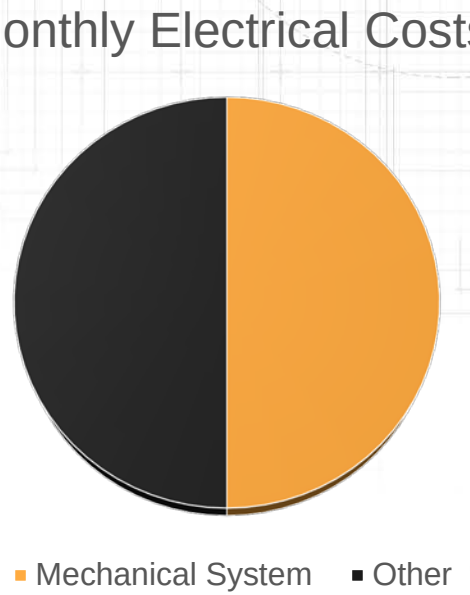
# First costs-Challenges related to sustainability

- Large capital investment (usually the most significant outside of real estate)
- Fixed budgets and improper planning
  - Graduating from small scale to large scale
- Lack of understanding in engineering community (affordable efficiency)
- Optimism related to positive cash flow

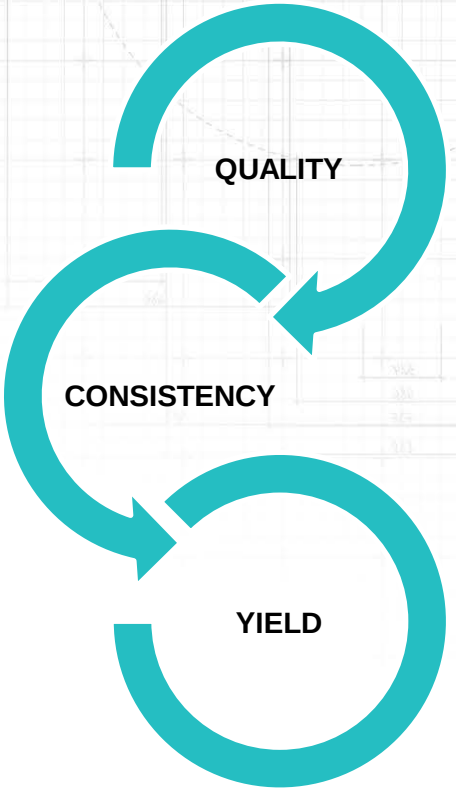
# Energy use

- Electrical consumption-top 3 recurring monthly expenses
- Mechanical system typically half of electrical consumption (average)
- Difference between infrastructure and consumption



# Sustainability: what I get for what I use

- Quantity and Quality
  - Poor environmental quality is the single biggest contributor to failed crops
  - Poorly managed environments will have negative impact on yields
    - Temperature
    - Humidity
    - Contamination
- Consistency
  - External stressors on the plant will result in variances in physiology
    - Terpenes, CBD, THC, Visual Quality, Odor
    - Extraction volume
  - External stressors include temperature, humidity, lighting, airflow, nutrients, etc.
    - External stressors have “entourage” effect
    - Changes to one requires changes to all
    - Consistency is key



# Example facility

- Poorly designed at outset
  - Inconsistent temperatures
  - High humidity
  - "Band aids"
- Redesign
  - Free cooling (water side economizer)
  - Heat recovery
  - 4800 kW vs 2000 kW (connected)
  - 4000 kW vs 1600 kW (operating)
  - Consistent temperatures
  - Correct humidity
  - Redundancy
  - Lower first costs

# QUESTIONS?

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# Mastering Your Mechanical System for Optimal Growth

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2018

# SunTrac Introduction

## SunTrac USA

Is a manufacturing company based in Tempe, Arizona, established in 2014. We manufacture a patented hybrid climate system that pairs with name brand high-efficiency residential & commercial HVAC systems to boost efficiency and lower energy usage. We help offset compressor activity with solar absorption to lower energy consumption by the compressor.

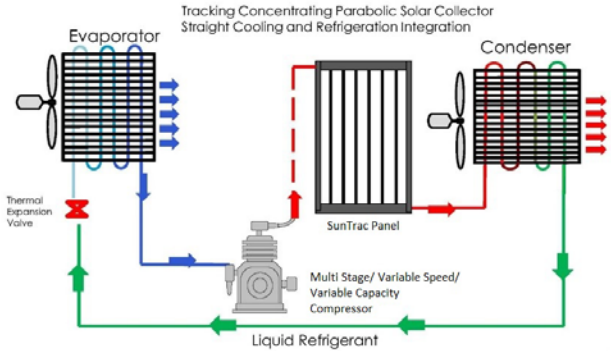
## SunTrac Partners & Vendors

**SunTrac USA** is an OEM with the following HVAC industry leaders & product suppliers to provide world-class solutions:

- **Emerson Climate Technologies/Copeland**
  - Variable Speed & Capacity Scroll Compressors
  - OEM engineering, support & collaboration
- **KMC Controls**
  - HVAC System Sensors, Actuators, and Controls
  - OEM engineering, support & collaboration
- **Nidec/Control Techniques**
  - Variable Frequency Drives & Controls
  - OEM engineering, support & collaboration
- **Goodman Manufacturing / Daikin**
  - International Sales and Distribution
  - Factory-Direct Residential & Commercial A/C Systems
  - Focus on High Performance Technologies
- **Trane Inc**
  - Factory-Direct Residential & Commercial A/C Systems
  - Focus on High Performance Technologies

# SunTrac Hybrid Climate Systems

**The Technical Description:** The SunTrac Hybrid Climate System is a renewable energy method of adding heat and pressure to the refrigeration cycle which results in a decreased/displaced compressor workload, saving electricity. This solar thermal system displaces a portion of the mechanical energy used by various compressor types, including; single speed compressors w/VFD's, variable capacity, multi-stage, and variable speed compressors. With SunTrac providing upper-end heat and pressure, the compressor can then operate at low stage, low range or low capacity, while delivering full and part-load cooling requirements. This creates significant energy savings.




# Mastering your HVAC for Optimal Growth

## Importance of HVAC in Indoor Grow Operations

With the surge in commercial grade indoor cultivation, it has given rise to HVAC mechanical systems as an integral component to the operational scope. From temperature control to humidity management, maintaining the perfect climate is crucial.

As cultivators, agriculturists, horticulturists, and alchemists, your main area of expertise and focus is the intricate craft of farming. This means knowing your soil, water saturation, nitrogen levels, light spectrums and exposure rates, the list goes on.

Knowing exactly what your plants requires, doesn't mean you can know everything about the mechanical aspects of HVAC, or what is out there as far as products, applications and best-practices. And why should you?? That's why, as professionals, we lean on others with expertise and experience.

But how can you be confident in the person or company that is specifying the equipment and solution for your facility? Especially when HVAC can account for **50-60%** of a building's energy consumption?

# What to look for in a contractor

## Mechanical Contractor

- Understanding and experience with indoor grow operations
  - humidity, light generated heat load, grow cycling, airflow
- Knowledge  & expertise with high efficiency/critical equipment
  - Critical temp units, high efficiency/variable speed technology
  - Custom applications and equipment
  - Renewable and Sustainable Options in the market
- Skilled mechanical and engineering team
- Referrals/References

# What to look for in equipment

## High Efficieny & Critical Load Equipment

- Operational efficiency: EER vs Cost and Warranty
- Critical systems and robust equipment for strenuous use/applications
- Understand viable sustainable or high efficiency options for your application
- Application of equipment and how it integrates with your grow operation
- Short term vs long term investment: cheap equipment vs quality & sustainability
- Redundancy of equipment: 1 large system vs several smaller units
- Scalability of solution: Can you grow your solution easily as you increase capacity?

# Sustainability & Energy Efficiency

Geothermal / Ground Source Heat Pump

Ice Energy / Ice Battery

Solar Thermal/ Concentrating Solar Power

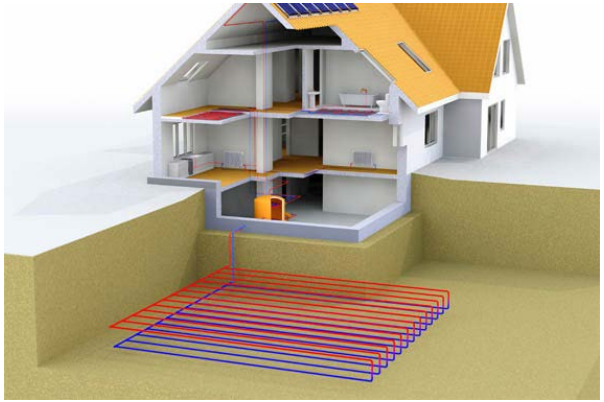
Variable Speed/Variable Capacity Systems

Modular/Segmented HVAC vs Chiller/Large Scale Units

# Geothermal HVAC

## Geothermal / Ground Source Heat Pump

- Utilizes the Earth's temperature to either dissipate or absorb heat
- Upwards of 40-50% HVAC energy reduction
- Renewable/Sustainable Energy
- Applications include:
  - Commercial
  - Residential



# Ice Technology

## Ice Energy – “Ice Batteries”

- Utilizes off-peak energy to create “ice batteries”
- Uses stored ice energy to cool space during day-time
- Can displace 40% of HVAC energy
- Clean Energy Solution
- Applications include:
  - RTUs (Roof Top Unit / Package Units)
  - Split System
  - Mini/Multi-splits

# Solar Thermal / Concentrated

## Solar Thermal / Concentrated Solar Power

- Utilizes the sun's thermal energy in the refrigeration cycle (non-electric)
- Integrates easily with name brand HVAC units
- Can displace 40% of HVAC energy
- Renewable Energy Solution
- Applications include:
  - RTUs (Roof Top Unit / Package Units)
  - Split System
  - Mini/Multi-splits

# Variable Speed / Variable Capacity

## Increased Efficiency with Variable Speed

- Has larger range of operation, allowing for specific demand load
- Soft starting and longer run cycles avoid larger peak demand charges and short-cycling
- Increased efficiency of 20-40% over single-stage/speed equipment
- Clean Energy Solution
- Applications include:
  - RTUs (Roof Top Unit / Package Units)
  - Split System
  - Mini/Multi-splits

# Thank you!

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STERLING PHARMS

Stephen Keen

Managing Partner/Director of Cultivation

# Facility Details

- Boulder, CO
- 4,000 Sq Ft Cultivation (Addt'l 2000 sq ft under construction)
- 150 kW Cultivation Lighting (HID/LED)
- Chilled Water Cooling/Dehu
- Hydronic Heat/Reheat
- Deep Water Culture Hydroponics System
- Fully Operational Approx. 4 Mos

# Facility Design Considerations (Impact on Mechanical System)

- Lighting Type and Density
  - KW of light is primary driver for sensible and latent heat load, which impacts size of mechanical system
- Grow Media
  - Selection of grow media impacts watering volume and waste, which impacts dehumidification load
- Water Use
  - Mechanical system extracts water from the air through the dehumidification process

# Lighting Selection and Use of Space

- High Efficiency DE Top Lighting
  - 9% more PAR per watt with reflector selection
  - Improved light on target over “greenhouse” style fixtures (limited waste/fewer fixtures)
- LED Side Lighting
  - 3 sided canopy vs single plane (with aisles)
  - High intensity/lower watts
  - More overall canopy square footage per square foot of cultivation space
- No wasted HVAC-all light lands on plants

# Grow Media

- Deep Water Culture (Undercurrent)
  - Highly oxygenated nutrient solution, plant roots are constantly submerged, allowing for constant uptake of nutrient
  - No waste through percolation or run off
  - No waste through evaporation
- No load on mechanical system for removing moisture not associated with plant growth

# Mechanical Design Considerations (Impact on Operation)

- System First Cost
- Operating Costs
- Electrical Infrastructure (power upgrade)
- Redundancy
- Use of Condensate
- Environmental Consistency (quality and yields)

# Mechanical Selection: Modular Chilled Water/Heat Recovery/Waterside Economizer

- System First Cost
  - Comparable to typical RTU system
- Operating Costs
  - Winter time operation (water side economizer) reduced compressor running load from 70 kW to 25 kW
  - Heat recovery on chillers allowed for reduction in stand alone dehumidifiers (approx. 20 kW)
- Electrical Infrastructure (power upgrade)
  - Flip allowed for double duty on compressors (reduced infrastructure by 1/3)
  - Heat recovery on chiller bank combined with back up boiler for reheat reduced electrical infrastructure associated with dehumidification
- Redundancy
  - Every component of mechanical system has at least 50% redundancy
- Use of Condensate
  - Condensate is collected, treated, and reused for irrigation
- Environmental Consistency (quality and yields)
  - Fan coil distribution allows for homogenous temperatures without ductwork (additional energy savings)
  - Chilled water system allows for controls flexibility to dial in precisely what we need

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Thank you!