CHALLENGES
In the Indoor Horticultural Environment

Environmental control within the indoor horticultural environment (IHE) is possibly the single most important factor for reducing disease, optimizing growth potential and harvest yield. Precision control of this environment presents several challenges. This paper outlines the challenges encountered in the indoor horticultural environment, and the solutions the SolutionAir GRW can provide.

CHALLENGE:
Fluctuating Sensible and Latent Loads

+ Plants require varying watering cycles through their growth phases to maximize crop yield. These growing cycles, combined with scheduled temperature and humidity changes and the effects of lights on/lights off, generate large transient changes in the IHE that need to be precisely controlled.
+ The changing sensible and latent loads and load ratios vary more significantly than traditional HVAC requirements.
+ Standard comfort cooling equipment is not designed for the rigors of the modern IHE and may not be able to provide adequate environmental control.

CHALLENGE:
Clean Air

+ Plants are sensitive to pests, bacteria, viruses, and molds such as aphids, bacterial soft rot, mosaic virus and grey mold. Introducing contamination to the environment can have disastrous results on the crop.

CHALLENGE:
Energy Efficient Operation

+ Purchased energy can be the largest facility cost of an IHE. With continuous operation and control, the energy consumption for environmental control can be 25% of revenue.
+ Controlling input cost is imperative, especially in markets that are rapidly becoming more competitive.

CHALLENGE:
Year Round Control, Regardless of Ambient Conditions

+ Indoor horticultural environments, for high value crops, are typically operated year round. The cooling and dehumidification demands of the IHE do not change with the external seasons; the same precise temperature and humidity control is required regardless of the outdoor temperature.
+ The changing sensible and latent loads and load ratios vary more significantly than typical HVAC applications.
+ Maintaining precision control of constantly changing loads requires specialized equipment.

CHALLENGE:
Failsafe, Dependable Operation

+ Environmental control is critical; dependable operation is required all day, every day throughout the year.
+ Equipment failure can result in catastrophic degradation of operational capacity and potential crop loss.

SOLUTION:

Fluctuating Sensible and Latent Loads

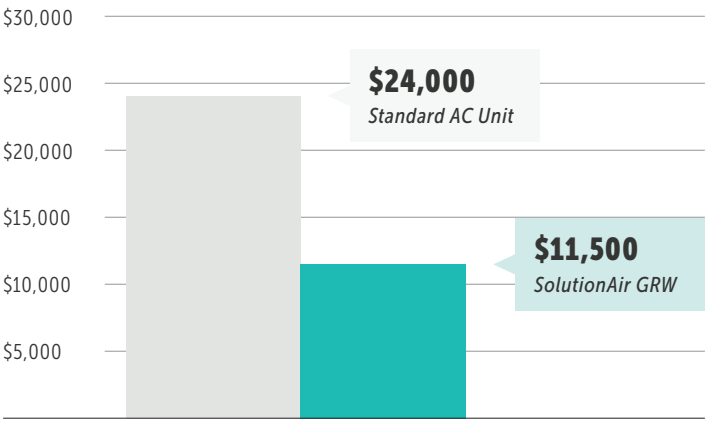
An IHE is not a natural environment. Growers are manipulating the growing environment with lighting, watering, nutrition, and environmental control to maximize yield.

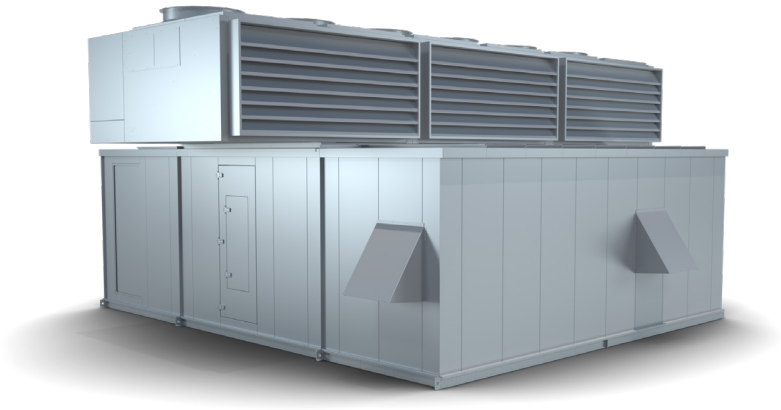
Research has shown that large temperature and humidity fluctuations can have serious detrimental impacts on the crop. Since dehumidification is normally an uncontrolled by-product of the typical cooling process, standard comfort cooling does not have the ability to precisely control temperature and humidity to the levels required in a high performance IHE.

The SolutionAir GRW is purpose built for your application with a number of key features that allow it to precisely control the IHE's rapidly varying loads and load ratios.

+ Independent temperature and absolute humidity control: The GRW has the ability to change dehumidification capacity and cooling capacity independently, allowing the equipment to match the demands of the environment.
+ Extreme operating ranges: Optimized energy efficient dehumidification over the large ranges of IHE operating conditions can require significant variations in discharge dew point. The SolutionAir GRW is capable of controlling the IHE's dew points from near freezing to above 60 °F.
+ Advance IHE controls: Temperature, humidity and light detection combined with application specific operating parameters allow the GRW to anticipate and react to changes in load and load ratios before the space conditions change, rather than reacting in response to changes in the space conditions.
+ Multiple variable capacity independent refrigeration circuits: Turning capacity on and off in an IHE can have an immediate impact on space conditions. Precision control requires continuous operation. Continuous operation, in an environment with fluctuating loads, requires variable capacity. The GRW has multiple independent variable capacity circuits for precise, continuous control.

Annual Energy Cost to Dehumidify 125 Gallons/Day





SOLUTION:

Clean Air

The IHE requires strict air quality control to ensure that crops are always at their healthiest. The GRW is designed with features to minimize the introduction of contaminated air and maintain a clean, hygienic unit.

+ Full recirculation with available ULPA filtered outside air intake
+ Low leakage cabinet to prevent outside air infiltration
+ Designed to prevent internal condensation in non-drain-pan protected areas, providing added protection against contaminant growth inside the unit

SOLUTION:

Energy Efficient Operation

The environmental cooling and dehumidification equipment in an IHE operates up to to eight times as many hours as standard cooling systems. In addition, because of the extreme loads in the IHE, the capacity density is often twice that of commercial spaces, or even greater. The result is potentially very high energy costs.

The SolutionAir GRW is designed to provide an energy efficient process. The independent control of cooling and dehumidification loads significantly reduces, or eliminates, over treatment of the space, and the associated wasted energy

In addition to process efficiency, system efficiency is vastly improved with these design features:

+ Enhanced efficiency refrigeration control
+ Variable capacity circuits
+ Energy efficient condenser fans with premium efficiency variable speed motors
+ High capacity reheat system
+ Energy efficient blowers and blower motors

SOLUTION:

Year Round Control, Regardless of Ambient Conditions (-40 °F/ 110 °F)

Standard cooling systems are typically designed for three seasons. Commercial cooling equipment often rely on the use of minimally treated outdoor air for free cooling. Dehumidification is an uncontrolled by-product of the cooling process. This is undesirable for a modern IHE in which repeatable precision control of both temperature and humidity is the key to success.

The SolutionAir GRW is designed to have the same cooling, dehumidification, and reheat performance from the hottest summer day, to the coldest winter night. Our state of the art Environmental Chamber laboratory tests products to ensure the units are capable of consistent operation at ambient temperatures down to -40 °F (-40 °C) and up to 110 °F (43 °C).

SOLUTION:

Failsafe, Dependable Operation

Environmental control failure of the IHE is not merely an inconvenience, it can be disastrous. SolutionAir understands critical environments and has designed the GRW to significantly reduce the chances of a catastrophic loss of capacity. The GRW design features that contribute to fail safe operation include:

+ Multiple independent refrigeration circuits with multiple independent compressors on each circuit when possible.
+ Redundant direct drive blowers and fans.
+ Detect + Protect™ advanced monitoring system. The GRW monitors conditions to detect a potential failure before it happens. Monitoring includes:
  - Refrigeration operation
  - Refrigerant charge
  - Compressor, blower and condenser motor operating temperatures
+ Electronic expansion devices.