

FLUCTUATING SENSIBLE AND LATENT LOADS



Challenge

Several characteristics, combined with the applied changes to the indoor horticultural environment (IHE), including watering and light cycles, result in variations of humidity and cooling loads, and load ratios which are sizeable and recurring. These characteristics include:

1. Plants have natural circadian rhythms, and different plants and even different species within the same plant have different rhythms.
2. Growers using these natural rhythms have begun to manipulate the environment to maximize the positive plant growth characteristics while minimizing the negative.
3. The plants inside the IHE may pass through various growth stages; each with different rhythms and or grower applied manipulations.

To maximize growth potential, eliminate problem plant conditions and maximize grower IHE manipulation flexibility, equipment is required to outperform standard HVAC unit capabilities.

Controlling the environment can be energy intensive. The added energy demand can result in operators compromising space conditions and crop potential in order to reduce cost of operation.

Dehumidification systems often deliver air that is colder than required, resulting in the need for expensive standard reheat, or spaces that cannot be maintained at the desired conditions.

Solution

Equipment that is designed for the rigors of the application

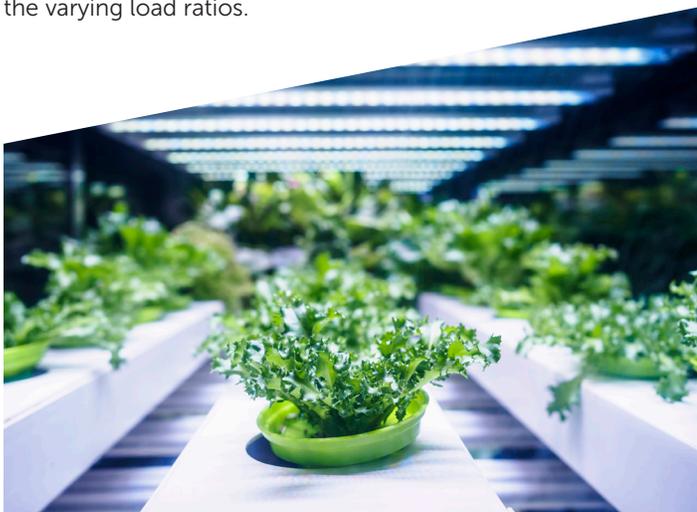
The SolutionAir GRW equipment provides:

- + Continuous, independent, and precise temperature control +/- 1 °F
- + Continuous, independent and precise humidity control
- + Application specific energy recovery reheat systems to ensure sufficient reheat for all growing conditions
- + Application specific transition control logic to prevent the IHE from passing through undesirable temperature or humidity conditions when transitioning between user setting groups
- + Designed specifically for the horticultural application to optimize energy use to minimize lifetime costs
- + Energy efficient conditioning capable of reducing operating costs by as much as 50% or more when compared to standard space conditioners.

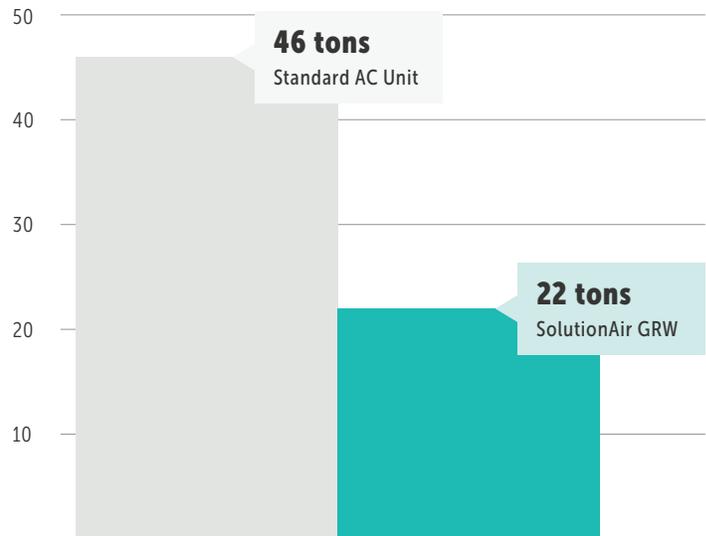
Varying moisture loads from watering, plant stage of life, and time of day

The moisture load in the horticultural environment will typically be larger than most other conditioned spaces and will also have a different cooling to dehumidification ratio. In addition, unlike comfort applications with relatively constant loads, an IHE typically has highly varying loads throughout the growing cycle. Typical comfort application HVAC units control a room for either temperature or humidity, but not both. Therefore, dehumidification may come as a by-product of controlling the temperature, and vice versa.

Temperature and humidity conditions within the growing room fluctuate from a number of factors which can include watering, evaporation, plant transpiration and lighting. This type of environment requires a system that is capable of independently controlling the room's temperature and humidity to meet the varying load ratios.



Capacity needed to condense 125 gallons/12 hr (tons)



In order to precisely meet the room's fluctuating temperature and humidity requirements, the SolutionAir GRW provides:

- + Multiple independent, variable-capacity circuits designed to provide high efficiency continuous operation to match all of the loads within the IHE.
- + Dehumidification capacities allowing for control of the IHE to dew points of 60 °F (16 °C) or more for cooling dominated IHE, and to 42 °F (6 °C) or less for dehumidification dominated IHE.
- + Variable cooling capacities that include energy recovered negative cooling (heating) to match the cooling requirements of the IHE.
- + Hot gas reheat system capable of raising the treated air temperature higher than the return temperature.

The SolutionAir GRW equipment utilizes independent circuiting specifically designed to effectively treat cooling and dehumidification efficiently, by reducing the overall unit capacity required to remove moisture. A standard AC unit may require 46 tons to remove 125 gallons of water in a 12 hour period where the SolutionAir GRW unit will only need 22 tons to remove that same amount of moisture in the same period and under the same conditions.

This capacity reduction saves on cooling energy costs, fan energy requirements, unit weight and, subsequently, the structure to support the unit.

The high capacity, variable, hot gas reheat system is capable of raising the treated air temperature as much as 25 °F (14 °C) higher than the return temperature. This system not only assures that the cooling matches the load requirements, but is also capable of providing heat to offset the cooling effects of transpiration when there is insufficient heat from lighting. As a full energy recovery system, operating costs are reduced in comparison to alternative systems.