

CHOICES FOR TEMPERATURE AND HUMIDITY: CONTROL SYSTEMS

R. Quiring

Conviron 590 Berry St., Winnipeg, Manitoba, Canada R3L 1N2 (Email: reg@conviron.com)

This presentation will focus on the energy impact of different choices for controlling temperature and relative humidity in controlled environments.

Controlled environment chambers and rooms for plant growth require considerable energy for electrical and mechanical functions to provide close control over a wide range of temperature and humidity program conditions. Whether the chamber has self-contained refrigeration or is connected to a central chiller system, a mechanical cooling process takes place.

In phytotrons, careful planning of the entire building heating, cooling and ventilation infrastructure can result in significant energy efficiencies. For a small number of chambers, dedicated central cooling plants may not be practical. Consideration will be given to self-contained air-cooled, water cooled and remote air-cooled refrigeration for these circumstances. Examples of different systems and operating circumstances will shed light on energy considerations when planning a plant growth facility.

Similarly, control of relative humidity involves the use of energy. Generally, removing moisture has a greater impact on energy consumption than adding moisture. In fact, adding moisture by common evaporative methods reduces energy consumption. Options to remove moisture are usually based on chemical desiccants or chilled heat exchangers, which take process air below saturation to condense water vapour out. Examples of each type, operating at several conditions, will illustrate the energy impact.

Ideal designs notwithstanding, operating a facility in the real world with a mix of commercial equipment of different vintages presents a vast range of challenges. Furthermore, research programs can take abrupt changes in direction depending on funding, corporate re-alignment, government policy and changes in scientific staff. Planning and operating a facility with an eye on energy efficiency may be lost from time to time. However, since the energy costs for controlled environments constitute one of the single highest costs after purchase, it is worth understanding the basics of elements impacting energy consumption.