ZINEG

Leibniz Universität Hannover

Landwirtschaftskammer Niedersachsen

The Low Energy Greenhouse

Greenhouse with Maximum Thermal Insulation -
Climate Control based on Thermal Storage Management

K. Knösel, H.-J. Tantau, Leibniz Universität Hannover
Biosystems- and Horticultural Engineering Section

Objectives

- minimizing carbon dioxide emission of heating
  - thermal storage for using solar energy
  - integration of thermal storage management into climate control system
- minimizing electrical input for fans and pumps
- increased plant quality

Materials & Methods

- two high insulated greenhouse compartments (480 m^2 area, semi closed, (Fig. 1))
- double glazed roof, anti reflex coated, argon filled
- four layer outer sidewalls (PMMA)
- three layer thermal screen
- low temperature heat exchangers
- thermal day-night storage system (Fig. 2)
  - heat pump, 8.7 kW (9 W m^{-2}, elec.)
  - warm and cold water storage (52 L m^{-2})
- high accuracy measurements, data logging device
- cultivation of potted plants

Fig. 1: ZINEG greenhouse with warm and cold water storage, finished May 2010

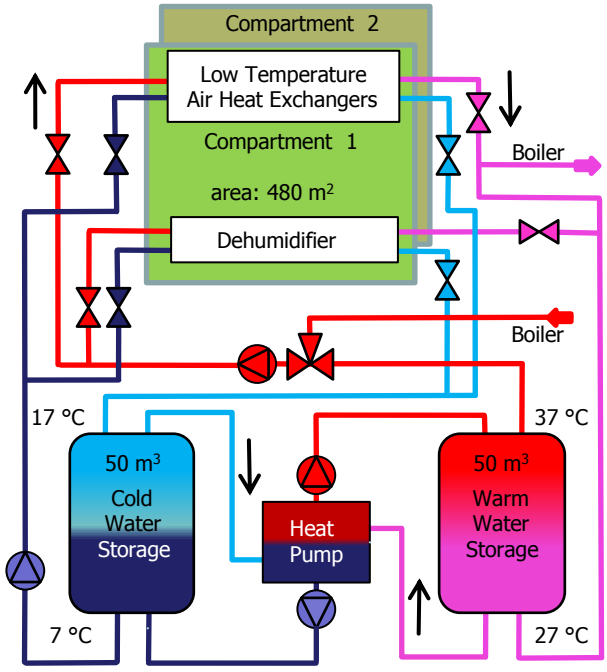

Fig. 2: ZINEG thermal storage system with heat exchangers and dehumidifier

Ongoing Work

- systems analysis and modelling
  - energy fluxes
  - evaporation and transpiration
  - condensation
  - short time storage and heat fluxes
- identification of critical states
  - micro climate conditions → plant quality
  - high air humidity → plant diseases
  - heat pump and fans → high electrical input
- design of storage management algorithms

Starting the storage system

- September 2010

Project grant:
Sponsored by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Rentenbank managed by the Federal Ministry of Food, Agriculture and Consumer Protection with assistance of the Federal Agency for Agriculture and Food

Contact details:
knoesel@bgt.uni-hannover.de
tantau@bgt.uni-hannover.de