

## GREENHOUSES AS A MANAGEMENT OBJECT

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### Annotation

In the article, the developed equations allow us to determine the number of radiators to be installed by calculating the amount of heat needed for a greenhouse. This allows you to intelligently control the heating system in the greenhouse.

**Keywords:** Greenhouse air temperatures, infiltration and exfiltration of air, disorganized air exchange, several interventions, energy balance.

Nowadays, greenhouses are increasingly used, regardless of the climatic conditions of the area, to provide favorable environmental conditions for the growth and development of plants. In addition to protection from solar radiation, wind, rain and snow, the temperature inside the greenhouse increases during the day due to solar radiation. Since the growth rate doubles when the temperature rises by 10 °C to a certain limit, higher temperatures are important for the economical production of cash crops in greenhouses and some pretentious species require heating greenhouses both at night and during the day. To predict the temperature that naturally occurs in a greenhouse and the energy needed to reach the desired temperature requires an understanding of its thermal behavior. This, in turn, requires knowledge of how to transfer energy through the greenhouse. Modeling the thermal aspects of a greenhouse is a powerful tool for forecasting and ensuring appropriate environmental conditions for growing plants under glass. It can be argued that technical solutions can improve the actual negative economic situation with agricultural geothermal projects in Uzbekistan. Modeling is the right approach to many emerging issues that affect greenhouse design and, consequently, the use of geothermal energy to heat greenhouses. The simulation allows us to study climate change and other influencing parameters, as well as demonstrate the capabilities of geothermal heating systems in greenhouse heating.

Unlike growing outdoors, greenhouse growing conditions can be influenced by a number of interrelated factors. The temperature and humidity of the air can be adjusted using fans, humidifiers and a heating system; the concentration of CO<sub>2</sub> in the air can be increased using flue gases or pure CO<sub>2</sub>, in the most complex greenhouses, the level and duration of solar radiation can be influenced by a screen or additional lighting. In addition, it is now possible for many crops to control the root environment in terms of temperature and availability of water and nutrients. Among the factors influencing the greenhouse climate, it is possible to distinguish the light, temperature, ventilation, infiltration, condensation, humidity, etc. interacting with each other. Several interventions, such as heating, ventilation and dimming,

affect mainly one specific parameter, but also change several others. For example, heating affects temperature, but also affects saturation deficiency, and ventilation affects both temperature and saturation deficiency, vapor pressure deficiency, which is considered the difference between saturation and actual vapor pressure, and also changes the concentration of CO<sub>2</sub>.

In order to make the most rational decision in regulating the parameters affecting the climate in the greenhouse, it is important to take into account not only the needs of plants, but also the costs of maintaining the microclimate. This economic factor should ensure minimum energy consumption costs.

When solving the problem of climate control, it is necessary to take into account the various parts of the greenhouse and the contents of the greenhouse. This includes the thermal balance and reaction of the crop, the air in the greenhouse, the coating of the structure and the soil in the greenhouse. The thermal balance of a greenhouse is a multidimensional quantity that consists of heat transfer to and from the greenhouse to the environment. The parameters involved in the physical process of the greenhouse are in an energy balance with the environment and, all together, are in an energy balance with the environment of the greenhouse.

## LIST OF LITERATURE

1. P. Salgado and J. B. Cunha, "Hierarchical fuzzy climate modeling in greenhouses", Control Engineering Practice, Volume 13, No. 5, pp. 613-628, 2005.
2. M. Bugamsa and M. Ramdani, "Adaptive fuzzy control strategy for greenhouse microclimate", International Journal of Automation and Control, volume 12, No. 1, p. 1, 2018.
3. J.-T. Ding, H.-Y. Tu, Z.-L. Zang, M. Huang and S.-J. Zhou, "Precise control and prediction of Dendrobium candidum growth conditions in greenhouses", Computers and Electronics in Agriculture, volume 151, pp. 453-459, 2018.
4. L. Occhipinti and G. Nunnari, "Synthesis of climate regulator in greenhouses using AI-based methods", in proceedings of the 8th Mediterranean Electrotechnical Conference on Industrial Applications in Power Systems, Informatics and Telecommunications (MELECON 96), pp. 230-233, Bari, Italy, May 1996.
5. P. Salgado and P. Afonso, "Decomposition of a fuzzy greenhouse model", in Proceedings of the 2006 IEEE Conference on New Technologies and Production Automation, pp. 1095-1100, Prague, Czech Republic, May 2006.