

Abstract

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Optimum operational performance of a new stand-alone agricultural greenhouse with integrated-TPV solar panels

This study investigates, analytically, the design of a new stand-alone agriculture Green House (GH) designed to be a self-sufficient of energy and irrigation requirements. This design uses Transparent Photo Voltaic (TPV) for electrical power generation and humidification-Dehumidification process for water production. The paper investigates the effect of the location of the condenser(s) for the cooling system, the condenser bypass and fresh air ratios on the internal micro-climatic conditions of the GH. For the hot climatic conditions of Abu Dhabi, UAE, controlling both the condenser bypass and fresh air ratios can be used to satisfy the required micro-climate conditions for plant growth, minimize the power consumption for refrigeration cycle and maximize the water production. According to the operating conditions, water production ranges between 8.3 and 13 L/m² day which is sufficient for plant needs while the generated electrical power of the TPV is about 10% of the electrical energy requirements which indicates the need for additional PV panels to be installed with the GH system.