

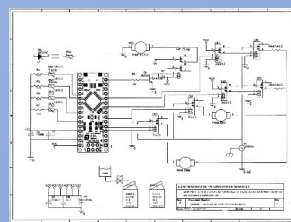
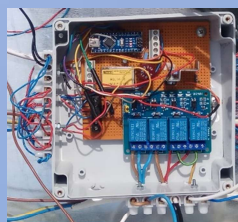
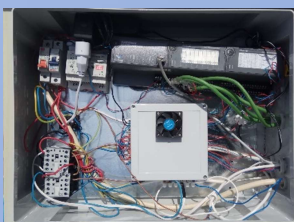


INVESTIGATION OF THE USE OF PV-THERMAL HYBRIDS FOR ELECTRICITY PRODUCTION AND GREENHOUSE HEATING

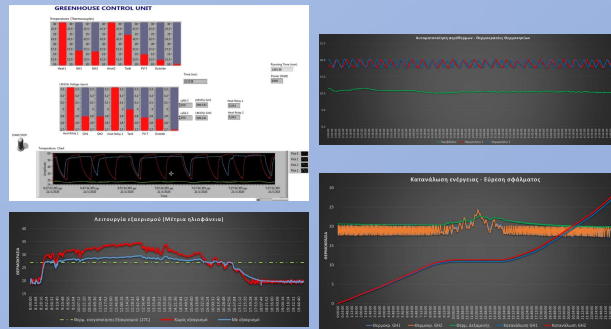
ABSTRACT

The aim of this thesis is to evaluate the use of hybrid photovoltaic PV-T systems for electricity production and greenhouse heating. The first chapters will refer to factors that affect greenhouse operations as well as the conditions that facilitate the cultivation. Next, we will list the most common conventional and alternative central heating systems, that are used nowadays for greenhouse heating. In the fourth chapter, there will be a reference on set up and construction of a PV-T system, qualified for greenhouse heating and the process followed to install and setup the experiment. The fifth chapter focuses on the importance for automation on a greenhouse that uses a relative system, both for functional reasons and for accuracy in the results, for this arrangement. More specifically, an Arduino-Nano microcontroller was used in combination with LM-335z temperature sensors and power relay actuators, to control each electrical appliance. The next chapter provides a complete description of how to gather and save the data using LabView software, as well as managing them to extract useful results. Thesis was complete with the latest chapters, where the results are presented, as well as with a study on the viability of such a system in a greenhouse unit, making use of the collected data from the experimental arrangement.

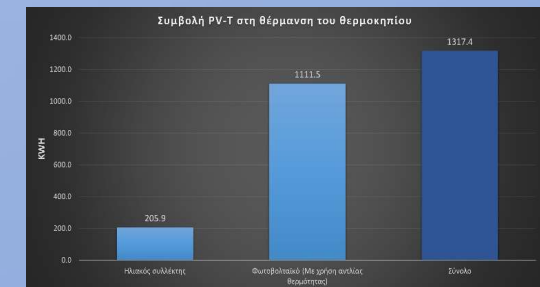
EXPERIMENTAL SET-UP



DATA RECORD LabView



Annual useful energy with the use of a heat pump

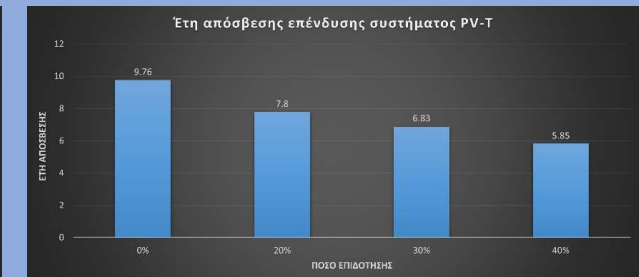


RESULTS

Greenhouse electricity consumption



Sustainability of a PV-T installation in a greenhouse unit



CONCLUSION

The data collected on the sustainability of a PV-T plant in conjunction with a heat pump for greenhouse heating was encouraging. It was estimated that such an installation could be depreciated in just six years, depending on its subsidy rate. The cost of such an installation is quite high compared to a corresponding one, based exclusively on gas boiler. This is because it requires the purchase and parallel use of a heat pump, in order to utilize the solar energy produced by PV photovoltaic cells with the highest possible efficiency. The zero energy cost achieved in this way, however, due to its autonomous and green operation, ultimately makes it sustainable.

Production of useful energy

