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**DESIGN OF A GREENHOUSE ROOF GLAZING
SYSTEM**

M/1043

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DESIGN OF A GREENHOUSE ROOF GLAZING SYSTEM

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ABSTRACT

The objective of this diploma project is the discovery of greenhouse glazing system. In order to fully understand the concept and be able to design a glazing system I had to do research to understand the operation and even see through patents what is done by other designers nowadays.

Firstly a general research concerning greenhouses was conducted in order to gain knowledge about basic things. Afterwards an analysis starting from the fundamental level of the greenhouse design took place in order to discover basic functions and characteristics to be considered. Later on a deeper literature survey was carried out in order to acquire further knowledge about the latest changes and releases in greenhouse glazing systems design. It includes production methods, anatomy and materials used today.

Despite the fact that I faced things I was never taught before, I worked slowly and steadily, gained the understanding of things and ended in a solution and a possible new unique design of a greenhouse glazing system. Although I didn't do any construction and experimentation, it is in my future plans to try it and see the outcome.

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ABBREVIATIONS

Symbol	Description
nm	Nanometer
μm	Micrometer
Q	Rate of heat
ΔT	Temperature difference
A	Surface area
U	Insulating value
Hz	Frequency, hertz
UV	Ultra violet
IR	Infra red
NIR	Near infra red
t	transmittance
a	absorbance
e	reflectance
US PAT	U.S. patent

CHAPTER 1:

INTRODUCTION

1.1. OBJECTIVES

The high energy consumption of greenhouses constitutes the main cost parameter of the greenhouse cultures and at the same time comprises a serious environmental burden. Despite this, only a small part of energy that is consumed in the greenhouse is used towards the heating of the plants, while the bigger part, up to 80%, is lost in the environment, mainly through the covers of the greenhouse. Studies showed that this problem cannot be solved with the cover materials used today (PE, PVC, glass, resins strengthened with glass, etc.) due to the fact that their thermal characteristics which determine the energy losses through them are of marginal significance. Besides, the conventional systems of heating that are used today for greenhouses are exceptionally energy consuming resulting therefore in the worsening of the problem.

The objective of the project is the development of an innovative greenhouse installation that is characterized by lower energy operational requirements. For this aim:

1. New cover materials will be developed with improved insulating properties (Advanced Covering Materials), for limiting the abovementioned heat losses through the cover. Such materials will have to be translucent to solar radiation which is essential for the photosynthesis of plants. These materials will be evaluated through analytical calculations of the total saving of energy that is achieved in the greenhouse through their use while taking into account their cost of production.
2. The new cover material has to be able to co-op with an auxiliary Infrared Radiation heating system. Through the use of the alternative system of direct heating it is expected on one hand to save the energy that is spent today for

heating the air of the greenhouse as a means to heat up the plants through air heat transport and on the other hand to lower the losses of energy through the covers to the environment since with the direct heating of plants the temperature of the cover of the greenhouse remains perceptibly lower (4-6°C) than the temperature of the cover when conventional heating is used.

3. By making use of the new cover material that will be developed and judged as the most suitable and the system of direct heating of plants through the use of Infrared Radiation, the proposed innovative greenhouse will be manufactured and installed in laboratorial scale for experimental operational evaluation and quantification of the energy consumed.

1.2. TERMS AND CONDITIONS

It is anticipated that the proposed work will contribute substantially in the development of greenhouses with lower operational cost and environmental burden. For this reason some of the work might not to be disclosed until the IPRs are resolved.