

**HIGHER TECHNICAL INSTITUTE
MECHANICAL STUDIES DEPARTMENT**

DIPLOMA PROJECT

**PERFORMANCE TESTING OF THERMOŚYPHON
SOLAR WATER HEATER**

By

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SOLAR WATER HEATER**

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Project Report

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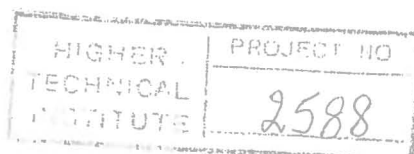
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TO MY FAMILY AND TO
MY FREINDS COSTA,
DEMITRI, CHRIS AND
TO A SPECIAL GIRL
NAMED MARIA.

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SYMBOLS

The symbols given in ISO 9459-1 and the following symbols apply.

a_1, a_2, a_3	Collector performance coefficients
C_{pw}	Specific heat capacity of water
H	Solar irradiation at collector aperture MJ/m
m	Mass flow rate Kg/S
Q_{col}	Solar energy collected by the collector MJ
Q_{load}	Energy content of hot water load MJ
T_a	Ambient air temperature ^o C
T_c	Cold water temperature ^o C
T_d	Temperature of water drawn off from the store
T_f	Final temperature ^o C
T_h	Hot water temperature ^o C
T_i	Collector inlet temperature ^o C
U	Overall heat loss coefficient of collector
U''	Combined heat loss coefficient of collector and store W/cm K
U_s	Store heat loss coefficient W/K

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PERFORMANCE TESTING OF A THERMOSYPHON SOLAR WATER HEATER

Written by: Georgiou George

Summary

The objectives of this project are:

- 1) To study the ISO standard on the procedures for performance characterisation and yearly performance prediction of solar water heating systems.
- 2) To identify the parameters affecting the performances of a thermosyphon solar water heating system.
- 3) To carry out experimental tests and investigate the performance characteristics of a thermosyphon solar water heater, using the method described in ISO 9459-2.
- 4) To analyse the test results and, if possible, compare them with simulation results.

The tests were conducted at the Applied Energy Research of the Ministry of Commerce, Industry and Tourism.

INDRODUCTION

The benefits obtained by the utilization of solar energy, were recognized by humans at their earliest stages of civilization. This is evident from history documents were for example the Greek philosopher Socrates, is seen to teach his student how to build and orient their houses in order to have better exploitation of solar energy.

During the last decades the demand for more energy has increased dramatically. As a result of this, the rate of consumption of the finite sources of conventional fuels has also increased and their prices are continuously rising. These and other factors as the environmental pollution, caused by the conventional sources of energy, have forced scientists to find ways of effective utilization of the renewable, non polluting and plentiful source of solar energy. Therefore, today a lot of designs exist for the collection and conversion of solar energy so that, it can be used to produce electricity, heat spaces, drive vehicles and in quite a lot of other applications.

The most common use in Cyprus is the heating of water for domestic use, which is be found in Cyprus from the ancient years. However the adoption of specific and more efficient methods of heating up the water are located near the 1900 a.s with the use of the turkish bath called the "hamman". The existance of such a bath in a house was a privilege for the owner.

In 1940's the well known hot water wood cautery (a closed cylinder with an intergrater combustion chamber underneath were pieces of wood were

used for combustion). Near 1955 the first hot water electric heater appears in the Cyprus market. However, its high cost constrained its expanded usage, in those years.

In 1968 the common domestic thermosyphonic systems were imported from developed countries. Since the demand for it increased and some Cypriot manufacturers started to produce and install them. Solar water heating with Thermosyphon Solar Water Heating Systems are considered a very attractive application of solar energy, and in many locations it is an economically competitive option. These are mainly the reasons for which thermosyphonic water heating systems have gained popularity in many countries. In Cyprus, for example, it is estimated that there are more than 130,000 units in operation, which means one solar water heater for every five people on the island. According to construction and housing statistics for 1987, about 87% of new buildings have been equipped with solar water heaters, as compared to 69% in 1982. The cost effectiveness of a thermosyphon solar water heater is dependent upon to major factors: the cost of convectional sources of energy used for domestic water heating and the solar fraction of the hot water load supplied by solar energy. However, the solar fraction is dependent upon meteorological conditions, collector type, collector area and arrangement, annual load and load consumption profits, which differ from place to place.