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DIPLOMA PROJECT

AN INVESTIGATION INTO THE THERMAL PERFORMANCE OF FLAT PLATE SOLAR COLLECTORS

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by

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Project Report

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AN INVESTIGATION INTO THE THERMAL PERFORMANCE OF FLAT PLATE SOLAR COLLECTORS

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Summary

The objectives of this project are:

1. To study the ISO standard concerning the performance characteristics of flat plate solar collectors.
2. To identify the parameters affecting the thermal performance of flat plate solar collectors.
3. To curry out experimental tests and investigate the thermal performance characteristic for different types of flat plate solar collectors, using the methods described in the ISO standard.
4. To classify the tested collectors according to their performance.

The tests will be conducted at the Applied Energy Centre of the Ministry of Commerce, Industry Tourism.

INTRODUCTION

In the solar energy industry great emphasis has been placed on the development of "active" solar energy systems which involve the integration of several subsystems: solar energy collectors, heat storage containers, heat exchangers, fluid transports, distribution systems and control systems. The major component unique to active systems is the solar collector.

This devise absorbs the incoming solar radiation, converting it into heat at the absorbing surface and transfers this heat to a fluid, flowing through the collector. The warmed fluid carries the heat either directly to the hot water or space conditioning equipment, or to a storage subsystem from which can be drawn for use at night and on cloudy days.

Of the many solar collector concepts presently being developed, the relatively simple flat plate solar collector has found the widest application so far. Its characteristics are known and compared with other collector types, it is the easiest and least expensive to fabricate, install, and maintain. Moreover, it is capable of using both the diffuse and the direct beam solar radiation.

For residential and commercial use, flat plate collectors can produce heat at sufficiently high temperatures to heat swimming pools, domestic hot water, and buildings. Temperature of 40 to 70 °C are easily attained by flat plate collectors. With very careful engineering using special surfaces, reflectors to increase the incident radiation, and heat-resistance materials, higher operating temperatures are feasible.

A flat plate-plate collector consists of six main components:

1. **Absorber plate**, made of any material which will rapidly absorb heat from sun's rays and quickly transfer that heat to the tubes of fins attached in some manner which produces a good thermal bond.

2. **Tubes of fins**, for conducting or directing the heat transfer fluid from the inlet header of duct to the outlet.

3. **Glazing**, which may be one or more sheets of glass or a diathermanous plastic film or sheet. The purpose of the glazing is to admit as much solar radiation as

possible and to reduce the upward loss of heat to the lowest attainable value.

4. **Insulation**, which minimises downward heat loss from the plate.

5. **Cover strip**, to hold the other components in position and make it all watertight.

6. **Casing**, which surrounds the foregoing components and keeps them free from dust, moisture etc.