Alternative Energy

Edited by

A.K.M. Mohiuddin

Asif Hoda

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

A.K.M. Mohiuddin and Asif Hoda
Alternative Energy
A.K.M. Mohiuddin and Asif Hoda
Include index
Bibliography: p.

ISBN 978-967-418-158-1

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

Table of Contents

Chapter 16

Optimization and economic analysis of a solar assisted heat pump drying system.

M.N.A. Hawlader, S. M. A. Rahman* and K.A.Jahangeer*

Department of Mechanical Engineering, International Islamic University Malaysia

*Department of Mechanical Engineering, National University of Singapore

ABSTRACT

A solar assisted heat pump drying system has been designed, fabricated and tested. The performance of the system has been investigated under the meteorological conditions of Singapore. This paper presents an economic optimization of a solar assisted heat pump drying system. Economic viability of solar energy heating systems is usually made by comparing the cost flows recurring throughout the lifetime of the solar and conventional alternative systems. Therefore, the optimum variables by using simulation program and pay back period of the system are presented in this paper. Effect of load and different economic variables on pay back period is also investigated. From optimization, it was found that the optimum combination of air collector area, evaporator collector area, drying temperature, and air mass flow rate are about 1.25 m2, 2 m2, 500C and 0.036 kg/sec, respectively, which provides around 90 % of the total load. Economic analysis shows that system has a sufficient amount of savings during the life cycle with a minimum payback period of about 4.37 year.

INTRODUCTION

Growing concern about the depletion of conventional energy resources has provided impetus for considerable research and development in the area of alternative energy sources. A solar assisted heat pump dryer found to be one of the solutions while exploring for alternative energy sources. The heat pump system is used for drying and water heating applications with the major share of the energy derived from the sun and the ambient. A solar assisted heat pump dryer has been designed, fabricated and tested. The performance of the system has been investigated under the meteorological conditions of Singapore. The conversion of solar energy for useful applications requires considerable initial investment compared to the conventional system. In the majority of solar processes, a source of auxiliary energy is required so that the system includes both solar and conventional equipment to meet the desired load. Solar systems are, normally, characterized by a higher initial investment followed by lower operating costs. It is, therefore, necessary to determine whether such an investment is economically viable. A number of