INVESTIGATION IN SOLAR HOT WATER SYSTEMS

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माँ आद्याशक्ति की मधुर याद में एवं माननीय
बाबा नागपाल जी के चरणों में सादर समर्पित

dedicated to

my honourable Guru

Dr. M.L. Devgun

CERTIFICATE

It is certified that the thesis entitled "Investigation in solar hot water system" being submitted by Mr. R.S. Mishra is worthy of consideration for the award of the degree of Doctor of Philosophy and is a record of the original bonafide research work carried out by him under my guidance and supervision. The results contained in this thesis have not been submitted in part or full to any other University or Institute for award of any degree or diploma.

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PREFACE

The use of renewable sources of energy particularly solar energy has been a priority programme of Government of India. A large number of solar energy water heating systems with varying capacities have been installed throughout the country. These systems are based on natural flow as well as forced circulation of fluid in the collector loop. Experience confirms that the systems based on natural circulation has low thermal efficiency, warm water in the storage tank cools down rapidly mainly due to back flow of water from hot storage tank through the collector during off sunshine hours. Considering this problem the author, encouraged by the supervisor, undertook the challenging task of devising such systems which can prevent this long standing problem of natural circulation solar water heating systems. During the execution of this task, basic problems such as thermosyphonic mass flow rate, stratification etc., were studied in detail and a sound theory for preventing reverse flow in water heating system was established. Some very important results obtained during these studies have been presented in this thesis.

Another type of problem inhibiting the popular use of solar water heating system is the cost of delivered useful energy which has to be estimated with a proper economic analysis. A detailed economic analysis backed up by

numerical calculations for Indian market conditions and Delhi type of climate has been presented in this thesis. It was observed that the cost of solar energy comes out to be more than the cost of electrical energy which has been highly subsidised in the alternate systems.

To make solar energy economically acceptable, alternative systems have been suggested and their performance studied in detail. These new systems not only come out to be less expensive but also have no corrosion problems. The work presented in this thesis, therefore, may lead to new designs of solar water heating systems acceptable to the users in terms of performance both technically and economically.

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