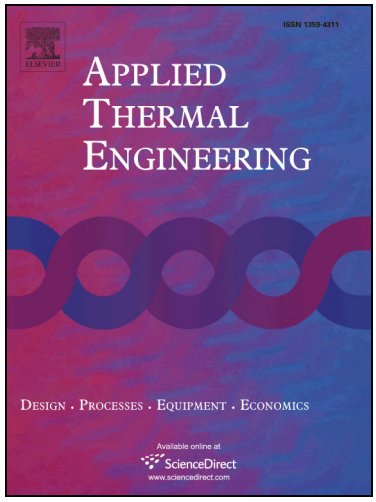

Research Paper

A parametric study of a concentrating integral Storage solar water heater for domestic uses

Jaji Varghese, Samsher, K. Manjunath

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A parametric study of a concentrating integral Storage solar water heater for domestic uses

Jaji Varghese[1], Dr.Samsher[2], Dr.Manjunath.K[3]

[1](Department of Mechanical Engineering, Aryabhat Institute of Technology, Delhi, India),

[1]corresponding author: email:jajivarghese18@gmail.com

[2, 3](Department of Mechanical Engineering, Delhi Technological University, India)

Abstract

A parametric study of a concentrating integrated collector storage solar water heater was undertaken. The concentrator used was the Compound Parabolic Concentrator (CPC), an optical non-imaging device, a wider acceptance angle was used (64◦) so that only occasional tracking is needed making this suitable for household purposes. The reflective concentrator was supported on a wooden cradle which comprised the two parabolas of the compound parabolic concentrator. Unlike conventional CPC systems with a large number of smaller diameter tubes, here is a single larger diameter drum was positioned at the focus of the CPC. Experimental studies were carried out and the mean collector efficiency computed on the model with an air gap introduced in the side walls (arms of the CPC). The parametric study of the design by EES at solar noon was in good agreement with the collected experimental results. The maximum thermal efficiency of the collector was 38% and the maximum water temperature attained was 53°C.

Keywords – household, batch water heater, compound parabolic, solar water heater, air gap

1.0 Introduction

Integral or batch solar water heaters (BSWH) are well insulated weather-tight enclosures containing one or more tanks painted black. The enclosure has its south facing exposed to sun's rays fitted with clear glass or plastic, so as to allow the rays to enter directly on the tank and warms the "batch" of water within. It is generally tilted at an angle approximately equal to the geographic latitude of the site, so as to have a maximum incidence of solar radiation. The first batch heater was built around 1890 by Clarence Kemp, an ingenious Baltimore businessman. It brings down the cost of the system considerably due to the absence of a separate storage tank. Unlike