Development and performance analysis of compound parabolic solar concentrators with reduced gap losses—‘V’ groove reflector

Rachel Oommen a,*, S. Jayaraman b

a Avinashilingam University, Coimbatore-641043, Tamil Nadu, India
b SRK Vidyalaya College of Arts and Science, Coimbatore-641020, Tamil Nadu, India

Received 8 March 2001; accepted 8 March 2001

Abstract

A system has been developed to use compound parabolic concentrators to collect solar energy and to generate steam. A CPC reflector profile with a V groove at the bottom of the reflector to reduce the gap losses was designed with a half acceptance angle of 23.5° for a tubular absorber of OD 30 mm. Five troughs fabricated with fiberglass substrate pasted over with UV stabilized self-adhesive aluminized polyester foil having high specular reflectivity joined together side by side comprise the CPC module with an aperture area of 2.04 m². Copper tubes coated with NALSUN selective coatings and enclosed by borosilicate glass envelope act as absorbers. The reflector absorber assembly housed in a single glass wool insulated wooden box forms the CPC collector. Using water as the heat transfer fluid efficiency tests were carried out with different inlet temperatures. In situ steam generation testing and possible application to steam cooking were also carried out. A theoretical modeling was developed by setting up different heat balancing equations and a reasonable agreement between theoretical computed values and the experimental values was observed. © 2002 Published by Elsevier Science Ltd.

1. Introduction

Compound parabolic concentrators for a flat absorber, which consists of curved segments, is one which forms parts of two parabolas. Many improvements in the design and performance of the CPC collector have been made since its invention in
1974 [1]. The CPC reflector profile for a tubular absorber is such that the reflector touches the absorber at the cusp region. This results in conductive heat losses. So a gap between the tubular absorber and the reflector has to be created to prevent conductor heat losses from absorber to metallic reflector, and also for providing a glass envelope around the absorber, which will improve the thermal efficiency of the CPC module at high temperatures. However, the gap between the absorber and
دریافت فوری
متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات