



Research Article

# ENERGY COMPARISON OF THE OPTICS AND TRACKING SYSTEM FOR EVACUATED SOLAR THERMAL COLLECTOR BY USING RAY TRACING ANALYSIS<sup>†</sup>

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## ABSTRACT:

Evacuated tube solar collector is one of the feasible alternatives for heating demand application such as absorption chiller. They are mostly suitable for supplying outlet temperature up to 100°C. In this paper, we present a tracking evacuated tube solar collector with semi-parabolic reflector to improve the efficiency of glass tube solar collector. Firstly, the ray tracing analysis is employed to design the suitable optics for non-tracking glass evacuated tube solar collector. Next, the intensity and beam pattern on heat absorber of each optics is determined to select the appropriate optics. Then, to compare the energy between non-tracking and tracking solar tube collectors with reflector system, the total power on heat absorber and the total power per installation area during the daytime are figured out by using the sun position referring to the solar equation. According to the analysis, the presented tracking evacuated glass tube solar collector with reflector can drastically increase the power on heat absorber and power per installation area especially in the morning and evening. This model can be used to understand and predict the efficiency of the prototype for the better evacuated tube solar collector.

**Keywords:** evacuated tube solar collector; ray tracing analysis; solar thermal

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## 1. INTRODUCTION

Due to Thailand's renewable energy development plan coupled with the global warming and oil price crisis, solar energy becomes one of the renewable sources that play a crucial role in the economic development of Thailand. However, the research and development on solar energy is still modest in quantity compared to other countries. To keep pace with the rapid growth in solar technology and rising energy demand, the evacuated tube solar collector is focused in this study as an indispensable component in renewable thermal cooling system [1].

Compared to conventional flat plate collectors, evacuated tube solar collectors have lower heat losses thanks to the vacuum envelope surrounding the heat absorber fins [2–3]. The evacuated tube solar collector operates by transferring thermal energy from the heat absorber fins to the working fluid within the heat pipe [4].

In order to promote the solar energy utilization for heating demand application such as solar absorption chiller in Thailand, the evacuated tube solar thermal collector should be developed to increase concentration's efficiency, improve thermal quality, lower the manufacturing cost and higher the energy per installation area [5].

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