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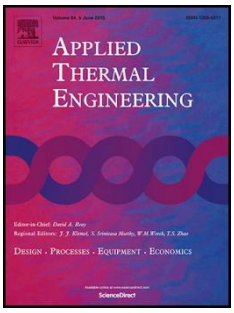

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Performance Study of a Solar Absorption Power-Cooling System

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Highlights

- A novel solar absorption power-cooling system with a scroll device was proposed.
- Increasing the absorber temperature is beneficial for power production.
- Increasing the evaporator temperature is unfavorable for cold production.
- Increasing the condenser temperature is unfavorable for both outputs.
- A better system performance in Seville but a higher solar fraction in Chennai.

Abstract – A combined power and cooling cycle can be driven by low grade solar heat to service power and cooling demands in buildings. By operating this cycle to match the building demands the overall annual performance is improved. In the present study, the annual performance of a solar driven ammonia-water absorption power and cooling system with a biomass auxiliary was investigated for Seville, Spain and Chennai, India. A scroll expander was considered for the generation of power. The solar water heating system comprises of an area of 450 m^2 south facing evacuated tube collectors inclined at 37^o and 13^o (Seville and Chennai respectively) and a buffer tank volume of 18 m^3. The effect of heat source temperature, cooling water inlet temperature and the chilled fluid inlet temperature on the cycle has been studied. The monthly energy based performance of the system operating between 6.00 and 18.00 hours for the two locations was also evaluated. The yearly efficiency of the scroll expander is between 59% and 63% whereas the annual system efficiency varies in the range of 6 – 8% while the annual solar contribution changes between 23-30% depending on the location of the system and evaporator temperature.

1. Introduction

The renewable energy outlook by the International Energy agency [1] highlights the benefits of deploying renewables to include reduction of pollutants, enhancing energy security, lowering fossil-fuel import bills and fostering economic development. Spain is one of the largest importers of fossil fuel [2] despite being one among the European countries with decent annual solar insolation levels. In spite of being the fourth largest importer of oil globally, India is experiencing a severe energy shortage. For India to continue its economic growth a reliable supply of indigenous and clean energy is necessary [3]. Therefore a renewable solution to space cooling and power production will go a long way in reducing the overdependence in the imported fossil based fuels in these two countries.