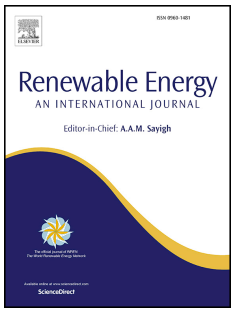
Accepted Manuscript



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PII: S0960-1481(17)30558-X

DOI: 10.1016/j.renene.2017.06.052

Reference: RENE 8919

To appear in: *Renewable Energy*

Received Date: 16 February 2017

Revised Date: 2 June 2017

Accepted Date: 14 June 2017

Please cite this article as: Tripathy M, Yadav S, Panda SK, Sadhu PK, Performance of building integrated photovoltaic thermal systems for the panels installed at optimum tilt angle, *Renewable Energy* (2017), doi: 10.1016/j.renene.2017.06.052.

Performance of building integrated photovoltaic thermal systems for the panels installed at optimum tilt angle

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Abstract

Building integrated photovoltaic (BIPV) thermal technology is an emerging area of recent development which can be implemented to make net zero energy building. In this technology, PV panels serve as structural elements and air duct is provided below the PV panel for air flow in order to increase both electrical and thermal efficiencies. In this study, HDKR (*Hay, Davies, Klucher, Reindl*) model based insolation corresponding to optimum tilt angle of the panel is used in energy equilibrium equation for developing mathematical model of BIPV thermal system. Different mass flow rate of air through the duct with series combination is taken for evaluating the electrical and thermal performance of both semi-transparent and opaque BIPV thermal system installed at optimum tilt angle. Both electrical and thermal output increases with increase in mass flow rate and the output converges at certain value. The results also indicate that the semi-transparent BIPV thermal systems are more efficient than opaque BIPV thermal system for all values of tilt angle of PV panel. Room temperature of BIPV thermal system having mass flow rate of 1 *kg/s* through the duct are presented for different state capital of India at their respective optimum tilt angle.

Keywords: *BIPV thermal system; Optimum tilt angle; Electrical efficiency; HDKR model; Energy equilibrium equation.*

1. Introduction

The energy consumed in buildings accounts for around 30%-40% of the world's energy consumption, making buildings the largest energy consumer [1]. Most of the energy used in buildings are from fossil fuel and that increases the issues of sustainability and environmental impact [2]. Because of this, use of cleaner and more sustainable resources in the form of