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

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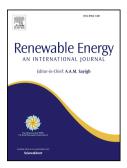
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ACCEPTED MANUSCRIPT

1	Performance of building integrated photovoltaic thermal systems for the
2	panels installed at optimum tilt angle
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9	Abstract
10	Building integrated photovoltaic (BIPV) thermal technology is an emerging area of recent
11	development which can be implemented to make net zero energy building. In this technology,
12	PV panels serve as structural elements and air duct is provided below the PV panel for air flow in
13	order to increase both electrical and thermal efficiencies. In this study, HDKR (Hay, Davies,
14	Klucher, Reindl) model based insolation corresponding to optimum tilt angle of the panel is used
15	in energy equilibrium equation for developing mathematical model of BIPV thermal system.
16	Different mass flow rate of air through the duct with series combination is taken for evaluating
17	the electrical and thermal performance of both semi-transparent and opaque BIPV thermal
18	system installed at optimum tilt angle. Both electrical and thermal output increases with increase
19	in mass flow rate and the output converges at certain value. The results also indicate that the
20	semi-transparent BIPV thermal systems are more efficient than opaque BIPV thermal system for
21	all values of tilt angle of PV panel. Room temperature of BIPV thermal system having mass flow
22	rate of 1 kg/s through the duct are presented for different state capital of India at their respective
23	optimum tilt angle.
24	Keywords: BIPV thermal system; Optimum tilt angle; Electrical efficiency; HDKR model;
25	Energy equilibrium equation.
26	1. Introduction
27	The energy consumed in buildings accounts for around 30%-40% of the world's energy
28	consumption, making buildings the largest energy consumer [1]. Most of the energy used in
29	buildings are from fossil fuel and that increases the issues of sustainability and environmental
30	impact [2]. Because of this, use of cleaner and more sustainable resources in the form of

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