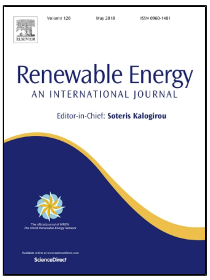
Accepted Manuscript



A Novel Merging Tubular Daylight Device with Solar Water Heater – Experimental Study

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PII:	S0960-1481(18)30337-9
DOI:	10.1016/j.renene.2018.03.031
Reference:	RENE 9900
To appear in:	*Renewable Energy*
Received Date:	19 August 2017
Revised Date:	10 March 2018
Accepted Date:	13 March 2018

Please cite this article as: Mohamed M. Marmoush, Hegazy Rezk, Nabila Shehata, Jean Henry, Mohamed R. Gomaa, A Novel Merging Tubular Daylight Device with Solar Water Heater – Experimental Study, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.03.031

A Novel Merging Tubular Daylight Device with Solar Water Heater – Experimental Study

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Abstract

Tubular daylight device (TDD) and solar water heater (SWH) are two power saving solutions that are commonly employed individually in residential and industrial premises. This paper proposed a novel merged power saving system consisting of TDD and SWH in one model, which is the first attempt to integrate these two systems. The idea of merging the TDD with SWH is based on utilizing the existing area around the TDD to implement the SWH around the TDD tube through a serpentine collector. The main purpose for such integration is to enhance solar energy saving, space area saving, and to decrease the fabrication cost. The illumination and thermal performance of the new proposed model were tested and analysed experimentally in different seasons in Cairo - Egypt to assess its performance in practical use. The obtained results indicated that the merged system succeeded in transferring an acceptable illumination rate and increasing the water temperature. The transferred internal illuminance has reached approximately to 6.5 W/m^2 that fulfils the required needs of lighting. Additionally, the system increased the water temperature up to 62 ºC, with a performance instantaneous efficiency that reached 21.17% which is very satisfactory. Furthermore, the performance of thermosyphon SWH with different serpentine collector coil number of turns has been evaluated. The results proved that, the collector number of turns has significantly affected the SWH performance in a directly proportional relation.

Keywords

Tubular Daylight Device; Solar Water Heater; Energy Efficiency.

NOMENCLATURE	
A	Area (m^2)
Cp_w	Water specific heat, 4.186 (kJ/kgK)
D	Diameter, m
I_b	solar beam irradiance (W/m^2)
I_{bh}	solar beam irradiance on horizontal plan (W/m^2)
I_d	solar diffuse irradiance (W/m^2)
I_s	Hourly solar irradiance (W/m^2)
L	Length (m)