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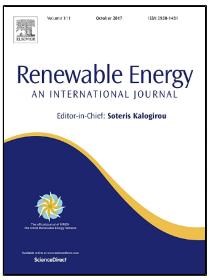

Energetic performance assessment of solar water heating systems in the context of their energy labeling

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ABSTRACT

The present work investigates the suitability of a new method for the calculation of the performance indicators of domestic solar water heating systems, within the framework of the European Directive implementation for energy labeling of water heating devices. The various methodology approaches suggested by the directives for the calculation of the expected energy yield from the solar thermal products are being analyzed. The presence of significant issues of reliability and objectivity is being brought out, particularly with regard to the SOLCAL method, which is used for the estimation of the expected energy yield of a thermal energy system, by means of the characteristics of each individual component which the system consists of. A detailed documentation and experimental validation of a new method for the estimation of the expected energy yield of a solar only water heater is outlined. The performance of the proposed method is assessed based on an extensive experimental investigation, whereby discrepancies of the order of 7% or less were obtained for the daily energy yield. From the comparison of performance of the new method against that of the SOLCAL method it is inferred that the former constitutes a reliable alternative choice in the context of energy labeling.

Keywords: Solar thermal systems, performance indicators, energy labelling

Nomenclature

A	Collector aperture area, m^2
a_1	Heat loss coefficient of collector, $W/(m^2 \cdot K)$
a_1	Temperature dependence of the heat loss coefficient of collector, $W/(m^2 \cdot K^2)$
$(AU)_C$	Overall heat loss coefficient of the collector field, W/K
$(AU)_s$	Overall heat loss coefficient of the solar tank, W/K
c_{pw}	Specific heat capacity of water, J/K
D_p	Inner Pipe Diameter, m
e	Discrepancy between different methods, %
f_1	Coefficient of the characteristic equation of the system, m^2
f_2	Coefficient of the characteristic equation of the system, MJ/K
H	Daily solar radiation, J/m^2
I	Solar irradiation, W/m^2
k	Incidence angle modifier of collector, -
L_p	Length of the pipe, m
$(MC)_C$	Effective thermal capacity of the collector, kJ/K