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The solar domestic water heating system in the six Moroccan climate zones

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Abstract

Morocco has adopted a national energy strategy for the promotion of renewable energy and the energy efficiency. The building's sector is an area targeted by this strategy, since it is one of the major energy consumers in the Moroccan level. With a 25% share of final consumption countries (ADEREE) Its consumption is set to increase further in the future years. In addition the building is a strategic energy sector taking into account the long life of buildings. In this perspective, in order to establish a regulatory and legal framework governing the energy efficiency in the building sector, this regulation was based on several steps among them, the establishment of a climate zoning based on the degrees of heating-days and zoning .This zoning has left Morocco in six climatic zones. In this context, the present work aims to make a contribution in packaging useful climate data for the evaluation of the building thermal requirements, specifically the production of hot water. To achieve this goal, we developed a solar radiation calculation model for the six Moroccan climate zones based on the model of "Capderou". However, from these data, was developed another model for calculating the water heater solar performances and the production of domestic hot water in these different zones. This model is based on the platform "ENERBAT" Laboratory "LERMAB" at the University of Nancy Lorraine.

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Keywords: Solar radiation, Capderou, the six Moroccan climate zones , metrological parameters, solar collector AF24VE2, efficiency, ECS, Modeling

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1. Introduction

Morocco has the choice to strengthen locally his energy production capacity, and to open the way in promising investment regarding energy supply. It is also necessary to pursue resolutely the efforts to make alternatives and renewable energies as the key of vault of the national energy policy (Extracted from royal Speech).

Nomenclature

a_1	Collector thermal losses coefficient (W/m²K)
a_2	Collector thermal losses coefficient (W/m²K)
D_h	Diffuse solar radiation on horizontal surface (W/m²K)
G_h	Global solar radiation on horizontal surface (W/m²K)
h	Height of sun (°)
I_h	Direct solar radiation on horizontal surface (W/m²)
J	Number of the day
Lat	Latitude (°)
n_0	Optical collector efficiency
T_m	Collector average temperature
T_{ext}	Collector outdoor temperature
T_l	The linke turbidity factor

Morocco has an exceptional solar field which overtakes 2500h of the sunshine in the year, this solar energy is particularly well adapted to the production of the domestic hot water, this sector represents between 10 % to a 20 % of the Primary energy consumption of a building. Many effort have been made to study this technology or there are a considerable potentialities of growth of the market for water heaters solar energy, in this regard we developed a study of domestic water heating for six Moroccan Climatic Zones using the AF24VE2 technology based EnErbat platform of Nancy city.

1.1. The solar Moroccan radiation

The Moroccan territory was subdivided into homogeneous climatic zones. Further the saved climatic data are based on the 37 meteorological stations over 10 years for the period of1999-2008. The Subdivision of these climatic zoning based on daily needs of heat and air conditioning.

The map of final climatic zoning includes six climatic zones, confined by respecting the administrative limits. For an easy and effective application, these zones are climatically represented by the following cities [1] .

Table 1. The Moroccan climatic zoning (ADEREE).

Climatic zone number	City
Zone 1	Agadir
Zone 2	Tangier
Zone 3	Fez
Zone 4	Ifrane
Zone 5	Marrakech
Zone 6	Errachidia