



New test methodologies to analyse direct expansion solar assisted heat pumps for domestic hot water

Jorge Facão^{*}, Maria João Carvalho

National Energy and Geology Laboratory (LNEG), Estrada do Paço do Lumiar 22, 1649-038 Lisbon, Portugal

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Abstract

Since there are not specific standards for testing direct expansion solar assisted heat pumps for domestic hot water, new testing methodologies are proposed supported by laboratory experiments. Two methodologies were developed for performance measurement: modified BIN method and long term performance prediction with a TRNSYS model validated with specific experimental conditions. The long term performance prediction is a methodology similar to the already obtained for solar thermal systems. A system was tested in Lisbon during one year, covering almost all possible local weather conditions. The hot water tapping test cycle used was in agreement with recent standards EN16147:2011 or EN15316-3-1:2007. The influence of average daily air temperature, dew point temperature and solar irradiation was analysed. The seasonal performance factor was calculated for two cities in Portugal (Lisbon and Porto) and for additional four cities in Europe (Davos, Athens, Helsinki and Strasburg). The establishment of a procedure to calculate the seasonal performance of this kind of systems is very important according to the directive 2009/28/EC of the European Parliament and of the Council.

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1. Introduction

The energy in the actual economical context presents more and more expensive and rare. The performance of a heat pump increases with increasing the low temperature medium in the evaporator. Assisting the heat pump with solar energy promotes the global efficiency of the system. Then the principal objective in the interaction is to reduce the primary energy consumption for the same level of comfort and to reduce the initial investment and maintenance costs.

The principle of the heat pump has been known since the middle of the nineteenth century; however there was a little incentive to develop them in a time of cheap and abundant energy coming from fossil fuel (Dinçer and Kanoglu, 2010). The heat pumps are thermal machines which move the heat from cold source to hot sink, using a relatively small amount of high-quality drive energy. They could be classified according to different points of view. According to the thermodynamic cycle there are two main groups: vapour compression heat pumps and absorption heat pumps, although there are other cycles more specific. Electric motor or combustion engine are normally used to drive the compressor in vapour compression cycle. In absorption heat pumps the mechanical work is only to drive a small hydraulic pump. Heat pumps are generally classified by their respective heat sources and sinks. Depending on cooling requirements, various heat source

^{*} Corresponding author. Address: Solar Energy Laboratory, National Energy and Geology Laboratory (LNEG), Estrada do Paço do Lumiar 22, 1649-038 Lisbon, Portugal. Tel.: +351 210924600; fax: +351 217163688.
E-mail address: jorge.facao@lneg.pt (J. Facão).