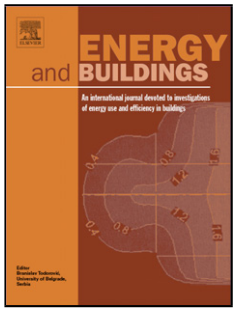

Title: LONG TERM BEHAVIOR OF A GEOTHERMAL HEAT PUMP WITH OVERSIZED HORIZONTAL COLLECTOR

Author: Tudor P. Todoran Mugur C. Bălan

PII: S0378-7788(16)31288-9
DOI: http://dx.doi.org/doi:10.1016/j.enbuild.2016.10.037
Reference: ENB 7096

To appear in: *ENB*

Received date: 20-7-2016
Revised date: 15-10-2016
Accepted date: 21-10-2016

Please cite this article as: Tudor P.Todoran, Mugur C.Bălan, LONG TERM BEHAVIOR OF A GEOTHERMAL HEAT PUMP WITH OVERSIZED HORIZONTAL COLLECTOR, Energy and Buildings http://dx.doi.org/10.1016/j.enbuild.2016.10.037

LONG TERM BEHAVIOR OF A GEOTHERMAL HEAT PUMP WITH OVERSIZED HORIZONTAL COLLECTOR

Tudor P. TODORAN[1], Mugur C. BĂLAN[1*]

[1] Technical University of Cluj-Napoca, Bd. Muncii 103-105, Cluj-Napoca, 400641, Romania

[*] mugur.balan@termo.utcluj.ro

Abstract

This study presents the results of a 3 year experiment concerning the behavior of a geothermal ground-water heat pump used for heating a small residential house. The study is focused on the one side on the ground temperature variation around the horizontal collector oversized by ≈50%, mounted at 1.7 m depth and on the other side on the working conditions and performances of the heat pump itself. It was highlighted that due to the oversizing of the geothermal collector, the ground temperature did not drop below 2°C and ground freezing was avoided. The ground temperature recovered each year during the non-heating season. The heat pump coefficient of performance was determined in the range of (3.18 – 8.59) in different operating periods.

Keywords: geothermal heat pump, geothermal horizontal collector, energy efficiency, ground temperature, experiment

Nomenclature

$a_{1,2,3}$	Interpolation coefficients
c_a [kJ/kgK]	The specific heat of the liquid antifreeze in the circuit of the geothermal collector
c_w [kJ/kgK]	Specific heat of the water in the heating circuit
COP	Coefficient of performance
COP_{HP}	Coefficient of performance of the heat pump
COP_{SYS}	Coefficient of performance of the whole system
DHW	Domestic hot water
Δt_a [K]	The measured temperature difference between the liquid antifreeze temperature on the flow and on the return of the circuit of the geothermal collector
Δt_w [K]	Measured temperature difference between the water temperature on the flow and on the return of the heating circuit
GA	Ground to air heat pump
GC	Geothermal collectors
GW	Ground to water heat pump
h [m]	Mounting depth of the horizontal geothermal collector
HGC	Horizontal geothermal collector
t_{sat} [°C]	Saturation temperature
$\dot{m}_a$ [kg/s]	The measured flow rate of the liquid antifreeze in the circuit of the geothermal collector
$\dot{m}_w$ [kg/s]	Measured flow rate of the water in the heating circuit