Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Departement of the Environment, Transport,
Energy and Communications
Swiss Federal Office of Energy SFOE

MAGNETIC HEAT PUMP WITH GROUND HEAT SOURCE

OPTIMIZED PROTOTYPE

Annual report 2008

Author und coauthors	P.W. Egolf, A. Kitanovski, D. Vuarnoz, C. Gonin, T. Swinnen P. Repetti, A. Orita, J.-L. Beney
Company/Institution	Haute Ecole d'Ingénerie et de Gestion du Canton de Vaud
Address	Route de Cheseaux 1, CH 1401 Yverdon-les-Bains, Schweiz
Phone, e-mail, Internet	+41 24 557 61 57, Peter.egolf@heig-vd.ch, http://www.heig-vd.ch
SFOE project-/contract-number	100'873 / 152'928
SFOE project coordinator	Th. Kopp, head of R&D program heat pumping technologies, co-generation, refrigeration of SFOE
Project duration (start-end)	1 October 2007 – 31 March 2010
Date of report	1 Dezember 2008

SUMMARY

The magnetic heat pumping technology yields a manner of heat production without the utilization of environmental harmful refrigerants. It is based on the magnetocaloric effect, which leads to a heating-up if a magnetization occurs and to a cooling in the opposite case of demagnetization. This physical effect may be used to cool (or freeze), heat or also for a energy conversion from heating energy to mechanical or electrical energy. In this project the development of a prototype heat pump of 8 kW heating power in connection with a ground heat source is realized. Preliminary calculations were performed, which show the potential of such a machine and compare it with that of an analogue conventional heat pump. These show that a magnetic heat pump presents a competitive alternative.

In a more demanded part by the Swiss Federal Office of Energy (SFOE), two different magnetic heat pumps were roughly designed. They contain each a different magnet's assembly. Simply expressed, one machine contains a two-dimensional magnet configuration, whereas the second shows a three-dimensional assembly. It has not yet been definitively decided which principle will be applied, because still efforts are taken to decrease the magnets mass. To obtain an optimal machine, already in these first stages of development different phenomena of magnetism, fluid dynamics and thermodynamics have to be numerically evaluated. Only like this a good coefficient of performance (*COP*) may be expected. The article gives answers on the state-of-the art of the development, already obtained solutions, but also on still existing problems. Furthermore, different contacts with material scientists in the United States, the Netherlands, Russia and China have been established.