**A study made using geothermal energy to heat and cool an old building**

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1. **Introduction** – The increase in the worldwide population and its energy needs has shown the need of using new types of energy, This paper studies a system of heating or cooling an old building using water from four drilled boreholes, with 100 m , in the vicinity of the building. The water retired from the boreholes goes to a reservoir and from there to a heat pump where it is heated or cooled and then is sent to the building. The system is working but the efficiency is low. Our aim is to improve the system performance in order to spend the least amount of electricity.
2. **Experimental work -** Our first work was to obtain temperature values at different depths. In order to do this we used temperature sensors located at the surface and at 0.2, 0.7, 30 , 50, 75 and 90 m depth. Temperature values are measured with intervals of ten minutes. Temperature values obtained in two boreholes, near Évora, in january and august of 2012 were also used to make comparisons. A temperature of 19 °C was obtained at 30 m depth. In an attempt to obtain the dimension of the aquifer an electric resistivity profile (dipole-dipole) was made.
3. **Model** - A model was made to study fluid temperature variations when it goes from the borehole to the reservoir. We considered heat conduction with loss of heat from the pipes and a boundary condition with temperature changing linearly.
4. **Results and discussion** – Temperature values obtained at 0.70 m depth ( depth of the pipes where water circulates from the hole to the reservoir) show small variations during day and night, but data obtained in holes near Évora show that at this depth seasonal variations are detected. Temperature values at 90 m depth show , from January to April, a small increase related to the temperature rise recorded at the surface.

Water temperature values in the reservoir in winter varies from 8 to 12°C. The pump is located at 0.70 m depth. Temperature values obtained at this depth agree with model data made for temperature variations in the pipes, from the borehole to the reservoir.

1. **Conclusions**  - We suggest to put the pump at 30 m depth in order to obtain temperature values according to the needs.