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## EDUCATION AND RESEARCH IN THE FIELD OF GEOTHERMAL HEAT PUMPS IN THE CENTRE OF SUSTAINABLE DEVELOPMENT AND ENERGY SAVINGS WGGIOS AGH IN MIEKINIA

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### Introduction

The Centre of Sustainable Development and Energy Savings of the Faculty of Geology, Geophysics and Environmental Protection of AGH University of Science and Technology in Miekinia conducts educational activities in the field of renewable sources of energy, geothermal heat pumps especially (Figure 1). Growing interest in using the renewable energy sources (RES) is reflected upon the interest in such a discipline of studies. Since 2012, when the Centre was open ca. 8000 people (including students, pupils, local governments and communities) were educated here.

The Centre is heated by heat pumps with ground sources which are simultaneously use by students for practice and measurements. There are didactic heat pumps with temperature and pressure sensors and electric meters to be used by students during measurements. The Centre is in disposal of self-constructed Thermal Response Test device for thermal parameters measurements. In the Centre other renewable sources of energy are also explored.

In a stand for testing ground-source brine heat pumps for central heating and hot domestic water preparation research are conducted on the COP heat pump efficiency in accordance with the PN-EN 14511 standard. The Centre works on the prototyping of new, innovative heat pumps.



**Figure 1.** The main building of the Centre of Sustainable Development and Energy Savings of the Faculty of Geology, Geophysics and Environmental Protection of AGH University of Science and Technology in Miekinia, Poland



### **Education in the Centre**

The educational and scientific activity of the Faculty of Geology, Geophysics and Environment Protection, AGH University of Science and Technology (AGH-UST), Krakow, Poland, is closely related to the subject-matter of renewable energy sources (RES). As interest of this field of science increased firmly, there were the specialty “Renewable energy sources” established in the AGH University of Science and Technology in 2003. And it was the first that specialty in Poland. There was also launched the “Ecological Energy Sources” specialty, both for first (engineering) and second (master) degree.

The education in the Centre is provided in the several RES technologies like solar energy (both thermal and photovoltaics), biomass, wind energy, etc., but the emphasis is given to geothermal energy and heat pumps. The primary heat source for the building is based on 4 ground heat pumps, which supply heat to the building and are an expanded research station. It creates the opportunity for students to have their observation and measurements on working system. There are didactic heat pump stands as well (Figure 2).



*Figure 2. Students during measurements of heat pump efficiency*

The education is not only directed to students. Many people benefited from education in the field of geothermal heat pumps and other renewable energy sources: pupils, local communities, NGOs, energy consultants, foreign guests, etc. The Centre has also a mobile laboratory (“OZE BUS”) which can go to local communities to promote principles of renewable sources of energy.

### **Research**

In the Centre research in the field of geothermal and air heat pumps are carried out, i.e. efficiency of compressor heat pumps is determined. Within national fund, a stand for testing ground-source brine heat pumps for central heating and hot domestic water preparation was built. The stand also allows testing the parameters of the cooling system of the tested heat pump. The Centre cooperates with geothermal heat pump industry for R&D projects.

### **Conclusions**

The Centre of Sustainable Development and Energy Savings of the Faculty of Geology, Geophysics and Environmental Protection of AGH University of Science and Technology in Mielnik conducts research and educational activities in the field of geothermal energy and heat pumps.