

Cooling production for air conditioning purpose involves indispensably the use of energy. Over 95% of all cooling devices are compressor chillers powered by mechanical energy. Depletion of fossil fuel resources force to seek for technical solutions powered by renewable energy sources.

The use of solar energy to power the air conditioning systems is extremely interesting issue, due to the fact that the maximum cooling demand occurs during maximum solar energy gains, ie. in the summer. Devices that can be directly used to change solar energy into cooling are thermoelectric modules, also known as Peltier modules. Thermoelectric modules consist of two ceramic plates, between which p-n and n-p junctions are placed alternately. Thanks to this special construction the module connected to the power transport heat from one side to the other. This happens as a result of Peltier effect. Thermoelectric modules are therefore a kind of heat pump.

The aim of this project is to develop the methodological guidelines and conduct Life cycle assessment (this analysis is used to determine the impact of a product or process for the use of natural resources, human health and ecosystem quality) to analyze thermoelectric solar cooling systems, that are used to produce cooling for air conditioning purpose. Thermoelectric modules are semiconductor devices consisting of two ceramic tiles between which alternately arranged p- and n-type semiconductors are placed. Peltier effect which occurs in the device enables to transport heat from one side of the module to another. In this study, it is very important to determine allocation factors which determine what energy and material inputs are related to cooling production, and what with the acquisition of heat, which can be used to heat domestic hot water.

The first phase of the research will include study of various model combinations of cooling system in laboratory conditions - these is particularly to investigate different ways of heat transfer on both sides of the module, and to investigate the possibility of supply Peltier module with photovoltaic cells in Polish climatic conditions. The next stage of research is to calculate (based on the results obtained in the first stage of the study) the environmental impact indicators in relation to the entire life cycle of the system.

In recent years the techniques using solar energy to power the cooling systems are the subject of many studies. Thermoelectric solar systems powered directly by DC from photovoltaic panels are one of using and developing techniques. Studies that have currently being conducted on the thermoelectric solar systems for the production of cold are focused on technical aspects. There is a lack of information on the impact of such systems' performance on the environment.