Innovative self-cooling, thermoelectric system developed

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Spanish researchers at the UPNA/NUP-Public University of Navarre have produced a prototype of a self-cooling thermoelectric device that achieves "free" cooling of over 30ºC in devices that give off heat. It is a piece of equipment that acts as a traditional cooler but which consumes no electricity because it obtains the energy it needs to function from the very heat that has to be dissipated.

The researchers want to apply this system to power converters and transformers present in power stations that produce renewable electrical power employing, for example, wind, solar photovoltaic, solar thermoelectric and hydraulic energy.David Astrain-Ulibarrena, of the UPNA/NUP's Department of Engineering, Mechanics, Energy and Materials and head researcher in the project, explains what the system consists of: "When these devices are functioning, they heat up and need to be cooled down.In many cases, heat exchangers with fans are used which naturally need to be powered externally and consume a certain amount of electrical power. What we do is take advantage of the heat flow emitted by the power converter and transformer to produce the electrical power needed to make the fans work. That way we achieve the cooling of the device and control its temperature, but without any energy cost."

Taking advantage of residual energy

This self-cooling thermoelectric application is one of the lines of action

of the GETER (Thermoelectric generation with residual heat energy) project, whose overall aim is to develop thermoelectric generators that allow the heat energy of a low thermal level to be converted into electrical energy; in other words, residual heat flows of temperatures of less than 250ºC. "The best future perspectives regarding thermoelectric generation have to do with making use of free heat sources, like residual heat flows, " says ProfAstrain. These are very frequent heat sources (in Spain, 40% of primary energy is wasted in the form of residual heat) which are difficult to make use of with the conventional systems for producing electrical power, like steam and gas turbines."

Thermoelectric generation has been widely used for mid and high temperatures (from 250ºC to 1,200º C) in military and aerospace uses. The thermoelectric generator that powers the rover Curiosity on Mars is a prime example because of its topicality. The GETER project of the Public University of Navarre aims to adapt this technology to low temperatures and to optimize its application for civilian purposes.

Within the framework of this project, the research team has developed and experimentally validated a computational model that has shown that it can obtain up to 1 kW of electrical power for every cubic metre of an industrial flue.

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