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Transforming waste heat directly into electricity

Thermoelectric generators can utilise the smallest temperature differences

With car engines, when heating homes and in industrial processes, part of the energy used is emitted as heat to the surroundings. Thermoelectric generators, however, are able to exploit this energy reservoir, which has previously been largely untapped. Across 24 pages, the new BINE Themeninfo brochure entitled "Thermoelectrics: power from waste heat" (1/2016) presents the technical principles, ongoing research projects and promising application areas.

Thermoelectrics works in two directions: it can convert heat directly into electricity or, as a so-called Peltier element, use electrical power to generate cooling energy. Put simply, thermoelectric elements consist of two different conductive materials whose electrical contacts are located in different temperature ranges. The difference between the two temperatures creates an electrical voltage and thus power. These days the elements are able to generate up to 1,000 watts. New materials will be able to process larger temperature differences and thus generate even greater outputs. The major advantage of thermoelectric elements is that they work vibration-free, silently and with no moving parts. They therefore require relatively low maintenance and have long service lives.

Until now, thermoelectric elements have been particularly used in aerospace, for example in the Mars rover Curiosity, in energy-autonomous and maintenance-free sensors, for cooling electrical equipment and in silent hotel fridges and camping cool boxes. In future, the elements could play a greater role in the automotive industry, for example for supporting on-board power supplies and for utilising industrial waste heat.

For this BINE Themeninfo brochure, Dr. Jan König from the Fraunhofer Institute for Physical Measurement Techniques coordinated a group

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The BINE Projektinfo brochure, which can be obtained free of charge from the BINE Information Service at FIZ Karlsruhe, is available online at www.bine.info or by calling +49 (0)228 92379-0. The brochure cover and an additional image can also be downloaded from the press section in this web portal.

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