

# Electricity from the exhaust pipe

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Researchers are working on a thermoelectric generator that converts the heat from car exhaust fumes into electricity. The module feeds the energy into the car's electronic systems. This cuts fuel consumption and helps reduce the CO<sub>2</sub> emissions from motor vehicles.

In an age of dwindling natural resources, energy-saving is the order of the day. However, many technical processes use less than one-third of the energy they employ. This is particularly true of automobiles, where two-thirds of the fuel is emitted unused in the form of heat.

About 30 percent is lost through the engine block, and a further 30 to 35 percent as exhaust fumes. Scientists all over the world are developing ways of harnessing the unused waste heat from cars, machines and power stations, in order to lower their fuel consumption.

There is clearly a great need for thermoelectric generators, or TEGs for short. These devices convert heat into electrical energy by making use of a temperature gradient. The greater the temperature difference, the more current TEGs can produce. Researchers at the Fraunhofer Institute for Physical Measurement Techniques IPM are developing thermoelectric materials, modules and systems to harness the residual heat in automobiles.

"The temperatures in the exhaust pipe can reach 700 degrees Celsius or more," says Dr. Harald Böttner, head of the Thermoelectric Systems department. "The temperature difference between the exhaust pipe and a pipe carrying engine cooling fluid can thus be several hundred degrees

Celsius." The thermoelectric converter makes use of this huge differential: Driven by the flow of heat between the hot exhaust fumes and the cold side of a coolant pipe, the charge carriers pass through special semiconductors, thus producing an electric current similar to a batterie. The long-term objective is to make the alternator superfluous and to supply energy to the constantly rising number of power consumers in the car. TEGs could cover a significant proportion of a car's power requirements: "This would make it possible to cut gas consumption by between five and seven percent," says Böttner.

A simple calculation will illustrate how important it is to increase the energy efficiency of cars: There are about 50 million licensed motor vehicles in Germany, each of which is – as a basis for an estimation – on the road for an average of 200 hours a year. If their waste heat was utilized by TEGs during that time, with an output of one kilowatt sufficient to power parts of vehicle electronics, this would add up to ten terawatt hours of energy per annum – a significant contribution. The researchers are still in the experimentation phase at present, but they plan to build the first prototypes very soon.

Source: Fraunhofer-Gesellschaft

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