Truck turns its own heat into power

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A 195-year-old discovery is behind a new system that will save vehicles hundreds of litres of fuel and reduce their carbon emissions by as much as 2 to 3 tonnes per year.

Working with automotive manufacturer Scania, researchers from Sweden's KTH Royal Institute of Technology have been testing semi trucks equipped with a system that converts exhaust heat into power—through a process called thermoelectric generation (TEG). The voltage produced by the system can power the truck and reduce the strain on the engine, explains researcher Arash Risseh.

The TEG system operates on the principle of the thermoelectric effect, by which differences in temperature are converted into voltage—a phenomenon discovered in 1821 by German physicist Thomas Johann Seebeck, and often referred to as the "Seebeck effect".

"Most fuel energy is not used to drive a truck forward," Risseh says. "Some 30 percent of this unused energy is lost as heat from the exhaust pipes."

A truck that generates 440kW would see about 132kW of energy disappear in the form of heat coming out of the exhaust pipes, he says. "That's enough to power a typical passenger vehicle."

Capturing this excess energy takes a load off the truck's generator, and in turn, the engine, Risseh says. That means better fuel efficiency and lower emissions.

The Seebeck effect requires a temperature differential—cool on one end of the circuit and hot on the other, which means a truck must rely on a coolant in order to stimulate the voltage. Cooling the circuit is easier with natural alternatives, such as seawater for a ship's engines. Ships also make good candidates for TEG because their buoyancy offsets the constraints of weight and volume that road vehicles face, he says.

TEG is also regarded as a potential energy saver in data centres that are located in cold climates. Near the Arctic circle in northern Sweden, a data centre that uses 1 Terawatt hour per year could potentially recover 1 Gigawatt per year—a savings of some EUR 100,000, he says.

Provided by KTH Royal Institute of Technology