PROJECT

HEATRECAR

Reduced Energy Consumption by Massive Thermoelectric Waste Heat Recovery in Light Duty Trucks

Funding: European (7th RTD Framework Programme)
Duration: Nov 2009 - Dec 2012
Status: Complete with results
Total project cost: €4,240,834
EU contribution: €2,513,250

Call for proposal: FP7-SST-2007-RTD-1
CORDIS RCN: 93604

Background & policy context:

The consumption of automotive fuel due to electricity demand on board vehicles has been steadily increasing. This is likely to remain so in the years to come. It currently amounts to several percent of the overall petrol consumption for road transportation in Europe.

The basic principle addressed in this project consists in directly converting the heat in the exhaust line into electricity, thereby alleviating or even eliminating the alternator. Previous projects have led, up to now, to insufficient efficiencies. But with increasing prices of fossil fuels and ever more stringent constraints on CO2 emissions the need for direct conversion of heat into electricity has gone up.

Objectives:

The main objective of the HEATRECAR project is to reduce the energy consumption and curb CO2 emissions of vehicles by massively harvesting electrical energy from the exhaust system and re-use this energy to supply electrical components within the vehicle or to feed the power train of hybrid electrical vehicles. The recovery of the thermal energy will be performed by novel, laboratory available thermoelectric materials which are able to work at the adequate high temperatures and exhibit high performance.

Methodology:

The consortium obtained performance figures with thermo elements making conversion efficiency of 10% a reality at laboratory scale. With other new materials currently under investigation at the same laboratory, efficiencies of up to 20% may be envisioned in the future.

The consortium aimed to:

- Automate the production process so as to come up with sufficiently low prices;
- Design, optimise and produce a prototype system to be tested on a 3.5 ton diesel truck.

Partners from four Member States will combine their forces in:

- researching thermo-elements and modules (FRAUNHOFER-IPM);
- automation of the production process (TGEN);
- electric and electronic development (SIEMENS, BOSCH);
- heat transfer issues (VALEO) and;
- system approach, vehicle integration and testing (FIAT-CRF).
The HEATRECAR base case is a thermo electric generator producing 1.3 KWe at 100 km/h. If applied to the whole European fleet of trucks and with systems easily scaled up to 5 KWe, the overall diesel fuel savings could reach 5 Mt of oil per year. The reduction in CO2 emissions ranges from 20 to 70 g/km of CO2 per vehicle, equivalent to 15 Mt CO2/yr.

Parent Programmes:
FP7-TRANSPORT - Transport (Including Aeronautics) - Horizontal activities for implementation of the transport programme (TPT)

Institute type: Public institution
Institute name: The European Commission
Funding type: Public (EU)

Lead Organisation:

Centro Ricerche Fiat - Societa Consortile Per Azioni
Address: Strada Torino, 50
          10043 ORBASSANO (TO)
          Italy

Organisation Website: http://www.crf.it
EU Contribution: €380,510

Partner Organisations:

Robert Bosch GmbH
Address: Robert-Bosch Platz
          70839 Gerlingen-Schillerhoehe
          Germany

Organisation Website: http://www.bosch.com
EU Contribution: €350,430

Fraunhofer Gesellschaft Zur Foerderung Der Angewandten Forschung E.V.
Address: HANSASTRASSE 27C
          80686 MUNCHEN
          Germany

Organisation Website: http://www.fraunhofer.de
EU Contribution: €489,375

Valeo Systemes Thermiques
Address: 8 rue Louis Lormand
          BP 513 LA VERRIERE - LE MESNIL SAINT D
          France

Organisation Website: http://www.valeo.com
EU Contribution: €468,870
**Technologies:**

- Electric vehicle batteries (and energy management)
- Vehicle energy management systems

**Development phase:** Research/Invention

**Key Results:**

Reduction of energy consumption and curbing CO2 emissions of vehicles. This is done by harvesting electrical energy from the exhaust system. This energy is reused to supply electrical components within the vehicle and/or to feed the power train of hybrid electrical vehicles. The recovery of the thermal energy is done through thermoelectric materials, able to work efficiently under high temperatures.

**Innovation aspects**

Development of novel thermoelectric materials, capable of operating efficiently under high temperatures.

**Technical Implications**

The issue of waste heat recovery, and specifically the thermoelectrics, have become very important. This can be concluded from the various sustainable concepts and research projects, that have been demonstrated and (partly) successfully implemented in the past years.

**Policy implications**

Greening aspects. Electrical energy is harvested from the vehicle's exhaust system. This harvested energy is then reused to supply electrical components.

**Strategy targets**

Innovating for the future (technology and behaviour): A European Transport Research and Innovation Policy
Transport electrification, Vehicle design and manufacturing

Transport mode: Road transport
Transport sectors: Freight transport
Transport policies: Decarbonisation, Environmental/Emissions aspects, Societal/Economic issues
Geo-spatial type: Other