California Energy Commission
Public Interest Energy Research (PIER) Program
Energy Innovations Small Grant Transportation

Super-compound Engines Enable Multifuel Vehicles to Match Efficiency of Diesel-powered Vehicles

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PIER Transportation Research
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Fact Sheet

The Issue

Light-duty truck fuel economy has improved less than one mile per gallon in the last 25 years. Light-duty truck engines historically have poor efficiency, converting only 20 percent of gasoline into useful work. Multifuel compound engine technologies make it possible to increase efficiency, as well as displace conventional gasoline by using other fuels, such as natural gas. Existing multi-fuel engines in the light-truck segment use low-compression ratio, non-turbocharged, nonhybrid technologies that have poor light-load efficiency. To achieve broader use of natural gas vehicles, these vehicles should be multifuel capable. Detailed models are necessary to establish whether this technology is feasible.

Project Description

This research will determine the feasibility of multifuel super-compound engines for use in light-truck transportation. Unlike conventional engines, a super-compound engine uses one cylinder to help power an adjacent cylinder. The project will focus on light-load engine operation, where the vast majority of transportation fuel consumption occurs. The results will be used to validate commercial and private engine models based on the tested engines. The target performance for the project is a 30 percent increase in light-load efficiency for a 2.0 liter (L) General Motors Ecotec engine. The models will then be modified to a proprietary supercharged compound configuration of the same engine and used to establish efficiency estimates for the proposed designs. This is the best possible evaluation short of physical prototyping and testing. The project results may provide solid justification for funding physical prototypes and testing.

2.0L 4 Cylinder GM Ecotec Engine
Photo Credit: http://www.circletrack.com

Anticipated Benefits for California

This project supports the Public Interest Energy Research Program's objectives to help

bring to market advanced transportation technologies that reduce greenhouse gas emissions and air pollution beyond applicable standards, and that benefit natural gas ratepayers.

The super-compound technologies investigated in this project would have the unique ability to improve total compression and expansion ratios based on fuel type. This will achieve higher efficiency and power when using higher octane natural gas and ethanol fuels. These technologies could allow multi-fuel vehicles to achieve the efficiency of diesel technologies for the first time.

The anticipated benefits of this project include:

- Establish feasibility of a 30 percent increase in light-duty truck engine performance with piston compounding technologies.
- Forty percent savings in carbon emissions from gasoline, ethanol, or natural gas-powered vehicles.

Project Specifics

Energy Innovations Small Grant Agreement Number: 500-98-014-06, Project 326
Recipient: David Onstenk
City/County: Napa/Napa County
Application: Nationwide
Amount: $95,000
Term: November 2010 to November 2011

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