Natural Gas Plug-In Hybrid Drive System
Fact Sheet

Project Specifics

Contractor: Transportation Power, Inc., dba "TransPower"
Partners: Powertech Engines, Inc., Argonne National Laboratory, Southern California Gas Co.
Amount: $2,026,167
Co-funding: $1,126,167 from South Coast Air Quality Management District
Term: July 2014 to December 2017

The Issue

Large road vehicles such as Class 8 trucks make up only a small fraction of the U.S. vehicle population, but consume disproportionately high amounts of fuels while producing significant amounts of toxic pollutants and greenhouse gases. Operating these vehicles on battery-electric power eliminates fuel use and tailpipe emissions entirely. However, past efforts to run large road vehicles on battery power have encountered numerous obstacles, including:

- Weight of battery packs
- Battery costs and limited longevity
- Reduced operating range
- High vehicle capital costs

Current generation battery-electric Class 8 truck in recent tests, showing large number of batteries required. Source: TransPower

In addition, many trucks and other large vehicles equipped with battery-electric propulsion systems have exhibited insufficient power and/or reliability to meet vehicle operator needs. Development of reliable, cost-effective hybrid-electric propulsion systems using natural gas fuel could potentially address all of these obstacles and make electric vehicle (EV) propulsion more economically and commercially viable, while keeping harmful emissions to a minimum by using clean natural gas and employing the engine mainly as an EV "range extender" generator to boost vehicle operating range. Addition of such a range extender could reduce battery weight and costs while increasing operating range. Use of an inexpensive natural gas engine could avoid unnecessary increases in capital costs, while providing improved road performance and lower operating cost per mile than conventional diesel or natural gas trucks.

Project Description

The Natural Gas Plug-In Hybrid Class 8 Truck (NGPH-8) project will result in one of the most advanced hybrid-electric propulsion technologies on the market, merging TransPower's proven "ElecTruck™" battery-electric drive system with an innovative new range extender using a compact, lightweight automotive compressed natural gas (CNG) engine. The engine

will be mated to a compact, advanced generator to produce electric energy that can be used to augment and recharge the vehicle's batteries or to operate the vehicle at modest power levels when the batteries are depleted. Development of the base ElecTruck™ technologies was initiated by TransPower in 2011, with funding support from the California Energy Commission (CEC), South Coast Air Quality Management District (SCAQMD), and U.S. Environmental Protection Agency (EPA). Subsequent funding has been provided by the U.S. Department of Energy and the Ports of Long Beach and Los Angeles as this project has resulted in a string of major innovations such as development of a unique inverter-charger unit and automated manual transmission. Seven demonstration trucks using this technology will be deployed at the Ports of Long Beach and Los Angeles by the end of 2014. Under the NGPH-8 project, one of these electric trucks will be converted to a natural gas hybrid truck in 2015 by adding the CNG engine-based APU subsystem, then re-entered into service so its performance can be compared against the other electric drive trucks as well as conventional diesel and natural gas trucks being used in the port region.

In addition to leveraging significant prior investments in TransPower's core ElecTruck™ products, the NGPH-8 project will augment initial natural gas hybrid R&D being funded by the SCAQMD under a separate contract to TransPower. The research funded under the NGPH-8 project will enable TransPower to upgrade the hybrid configuration to use a new engine – a CNG version of the 3.7 liter engine used in the Ford Mustang and F-150, which was recently certified by the Air Resources Board and which will be available commercially in mid-2014. While this engine was developed for passenger vehicles, when used as a range extender it is expected to enhance the performance of much larger vehicles up to and including the Class 8 trucks targeted by this project. Team member Argonne National Laboratory will perform simulations to help validate engine performance and optimize engine and hybrid system controls. The combining of the SCAQMD funds with those from the NGPH-8 project will allow the manufacturing of two natural gas hybrid trucks using the selected hybrid design, providing ample data for evaluation of performance and benefits.

Anticipated Benefits for California

Use of the zero-emission ElecTruck™ system will help preserve the environment and enhance America's position as a leading force for reducing greenhouse gases and global warming. This will have a particularly beneficial effect in communities adjacent to seaports such as the California port regions, where large numbers of highly-polluting diesel trucks are congregated in very small areas. Widespread use of hybrid-electric propulsion using natural gas engines will also help reduce the nation's dependence on imported oil. The NGPH-8 project will benefit the California economy by creating high-skill jobs within the State in such areas as:

- Power electronics and battery pack assembly
- Electric vehicle integration
- Servicing of hybrid-electric vehicles

Expanding the use of natural gas as a vehicle fuel will benefit California ratepayers in several ways, including helping to insulate ratepayers from increased transportation costs resulting from escalating diesel fuel prices. Moderating transportation fuel costs can help to keep the costs of goods movement from increasing, resulting in lower consumer prices. The benefits of the NGPH-8 project will be felt beyond the trucking industry because the components used in the planned natural gas hybrid system can be used in transit buses, school buses, and many other types of vehicles.