

**Proposed Agreement between California Energy Commission  
and  
DOE- National Renewable Energy Laboratory**

**Title:** Natural Gas Vehicle Integration Research  
**Amount:** \$4,250,000.00  
**Term:** 36 months  
**Contact:** Reynaldo Gonzalez  
**Committee Meeting:** 3/16/2011

**Funding**

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Natural Gas	Transportation	Develop and demonstrate advanced fuel-efficient transportation technologies and fuel switching strat	\$4,250,000	\$4,250,000	\$0	0%

**Recommendation**

Approve this agreement with National Renewable Energy Laboratory for \$4,250,000.00. Staff recommends placing this item on the discussion agenda of the June 1, 2011 Commission Business Meeting.

**Issue**

Transportation is the single largest contributor to California's GHG emissions, producing about 39 percent of the state's total emissions. California is also the third largest consumer of transportation fuels in the world, consuming almost 16 billion gallons of gasoline and more than 4 billion gallons of diesel each year. To mitigate these issues, the State Alternative Fuels Plan identifies certain alternative fuels, including natural gas, which can substantially reduce GHG emissions while reducing petroleum dependency. The purpose of this research is to increase the use of natural gas as a transportation fuel by developing advanced natural gas engine technologies that will address regulatory and economic barriers. As a transportation fuel, natural gas could offset over 750 million gallons of diesel per year by 2022. In 2011 dollars, that would be a savings of about \$1.35 billion per year, while reducing greenhouse gas emissions 4 million metric tons per year.

**Background**

The U.S. Department of Energy (DOE) approached the California Energy Commission (CEC) PIER Program and the South Coast Air Quality Management District (SCAQMD) to jointly fund research, development, and demonstration projects to facilitate the deployment of alternative fuel technologies that will lead to reductions in petroleum dependency and greenhouse gas emissions. Under a tight time constraint, the DOE sought the guidance of the CEC, and recognized the CEC's historical leadership in supporting natural gas engine research and development. To define the scope of the research project, the Natural Gas Vehicle Research Roadmap (Pub# CEC-500-2008-044-F) was used as a basis for identifying key RD&D opportunities.

On March 26, 2010, the National Renewable Energy Laboratory released a competitive solicitation that targeted three research areas: Engine Development, Vehicle Integration, and On-Road Development and Demonstration. The goals of the solicitation were consistent with the State Alternative Fuels Plan (CEC-600-2007-011-CTD) which recommends increased use of alternative fuels and efficient vehicle advancements to reduce petroleum dependency and greenhouse gas emissions. Thirty seven proposals were received, evaluated and scored by representatives from DOE, NREL, CEC, and SCAQMD. A notice of proposed award was finalized in November of 2010 and NREL began contract negotiations with recipients through January of 2011.

The total project cost is \$16.98 million, including recipient contractor cost share of \$5.2 million, DOE cost share of \$5 million, and SCAQMD cost share of \$2.9 million.

### **Proposed Work**

Augmenting the original project budget with the CEC funds allowed the scope of the solicitation to be extended and ultimately enabled an additional project to be awarded. The Energy Commission funds will be distributed across all projects, and all deliverables including a final report for all awarded projects will be submitted to the CEC. The Energy Commission PIER staff was involved all aspects of the solicitation process including proposal evaluation and scoring.

The project goal is to develop, integrate, and demonstrate three different compressed natural gas (CNG) engines, which are equipped with a three-way catalyst technology. The three engines will be used in refuse, transit, and Class 8 heavy-duty truck applications and comply with the CARB 2010 heavy-duty emissions standards. NREL will be the principal investigator for the three projects teams described below:

The first project is with Cummins Westport Inc. (CWI) to develop and optimize a spark-ignited 11.9-liter CNG engine suitable for refuse and Class 8 applications. The engine will then be integrated into a variety of chassis configurations followed by in-field testing under different ambient and driving conditions to validate the engine and chassis configurations for refuse and Class 8 applications.

The second project is with Emissions Solutions, Inc. (ESI), who will develop engine hardware and controls to convert a 13-liter Navistar diesel engine to a CNG engine. This will include engine mapping and calibration of the engine management system. The engine will be optimized for Class 8 short- and long-haul applications.

The third project is with Southwest Research Institute (SwRI) to convert an 11-liter Doosan lean-burn CNG engine to a stoichiometric engine and integrate it into a refuse chassis.

The research, including interim findings, will be coordinated with the CalHEAT Research Center (Agreement No. 500-09-019). It is expected that these results will facilitate, in particular, Task 6 of the CalHEAT agreement which seeks to characterize and determine optimum combinations of high efficiency truck technology and alternative fuels which will yield the maximum reductions in fuel use and GHG emissions.

### **Justification and Goals**

This project "[will develop, and help bring to market] advanced transportation technologies that reduce air pollution and greenhouse gas emissions beyond applicable standards, and that benefit electricity and natural gas ratepayers" (Public Resources Code 25620.1.(b)(1)), (Chapter 512, Statutes of 2006)); and

this project "[will develop, and help bring to market] advanced transportation technologies that reduce air pollution and greenhouse gas emissions beyond applicable standards, and that benefit electricity and natural gas ratepayers" (Public Resources Code 25620.1.(b)(1)), (Chapter 512, Statutes of 2006)).

This will be accomplished by:

- Developing natural gas engines having a commercial timing within 3 to 5 years, capable of being certified to CARB 2010 emission requirements.
- Integrating of a natural gas engine and fuel storage system into a commercially viable medium-to heavy-duty chassis and vehicle.
- Demonstrating a fully integrated natural gas vehicle and proving fuel economy and emissions performance benefits, identifying and quantifying operational and/or performance challenges, and documenting in-service performance of developed products.