

BOARD MEETING DATE: March 3, 2017

AGENDA NO. 5

PROPOSAL: Execute Contract to Develop and Demonstrate Medium-Heavy Duty (Class 5-7) Plug-in Hybrid Electric Vehicles for Work Truck Applications 

SYNOPSIS: DOE recently awarded \$2,932,193 to Odyne Systems, LLC, for the development and demonstration of a medium-heavy duty (Class 5-7) plug-in hybrid electric vehicle (PHEV) for work truck applications. Odyne proposes to develop and demonstrate medium-heavy duty (Class 5-7) PHEV work trucks with reduced fuel consumption and fully electrified jobsite functions. Staff proposes to cost-share this project. This action is to execute a contract with Odyne Systems, LLC, for the design, manufacture and demonstration of medium-heavy duty (Class 5-7) PHEV work trucks in an amount not to exceed \$900,000 from the Clean Fuel Fund (31).

COMMITTEE: Technology, February 17, 2017; Recommended for Approval

RECOMMENDED ACTION:

Authorize the Chairman to execute a contract with Odyne Systems, LLC, for the development and demonstration of medium-heavy duty (Class 5-7) plug-in hybrid electric vehicles for work truck applications in an amount not to exceed \$900,000 from the Clean Fuels Fund (31).

Wayne Natri
Executive Officer

MMM:FM:NB:SH

Background

Odyne Systems, LLC, is a clean technology company that develops and manufactures propulsion systems for medium- and heavy-duty plug-in hybrid electric vehicles (PHEVs). Odyne has developed proprietary and patented hybrid technology combining electric power conversion, power control and energy storage technology with standard electric motors, storage batteries and other components. Odyne's plug-in hybrid

technology has been applied to commercial truck applications including bucket trucks, digger derricks and compressor trucks. These development efforts have also benefited from a \$50 million program funded through the DOE and CEC, with programmatic administration by the SCAQMD. The existing development efforts have yielded a modular PHEV system that can be installed on new and retrofit vehicles, as the packaging requirements of the hybrid system need to be taken into account during the vehicle's initial build. Additional engineering efforts are needed to develop a system that has lower emissions, improved performance, quiet jobsite operation, lower fuel consumption and reduced operating and maintenance costs.

Proposal

Odyne proposes to partner with the Freightliner Trucks, Allison Transmission, National Renewable Energy Laboratory (NREL), Oak Ridge National Laboratory (ORNL), Duke Energy, Sempra Energy, AVL, LG Chem and SCAQMD to design, develop and demonstrate a new generation of medium-heavy duty (Class 5-7) PHEV work truck that achieves a significant reduction in fuel consumption versus a conventional vehicle baseline. The plug-in hybrid technology will include idle reduction, launch assist, regenerative braking, in-cab climate controls and exportable power, improving vehicle efficiency while driving and eliminating idling and emissions during operation at a jobsite. This proposal addresses significant improvements in powertrain integration and adaptive control, a higher level of hybridization, fully electric jobsite operation and a low-cost modular battery pack solution through integrated three development streams into a final vehicle.

The development and demonstration project will include the following:

- *Powertrain Development and Optimization:* Odyne, ORNL, Allison Transmission and Freightliner Trucks will develop an integrated PHEV powertrain simulation, develop optimization strategies against real-world vocational duty cycles provided by NREL's analysis of a prior DOE medium-duty heavy-duty (MD-HD) work truck fleet, and validate the resulting system on ORNL's hardware-in-the-loop facility.
- *Battery System Development:* AVL, in conjunction with LG Chem and Odyne, will develop and validate a modular battery system based on commercially available light-duty cells and modules which will meet the performance requirements of the target vocational truck market as established by NREL's analysis of the full-day and full-year work cycles of a vocational MD-HD work truck fleet.
- *Vehicle Integration:* Odyne will work with Freightliner Trucks to integrate the PHEV powertrain, battery system, control systems and electrified jobsite equipment into the medium-heavy duty (Class 5-7) vocational work truck. NREL will provide testing and full cycle analysis of the final test vehicle and will monitor and provide summary results of the evaluation fleet.

- *Demonstration:* Ten trucks will be demonstrated in operation for a period of 12 months, five by Duke Energy in Duke Energy's service territory (the Carolinas, the Midwest and Florida) and five by Sempra Energy in SCAQMD's jurisdiction. These vehicles will consist of bucket, underground service or similar medium-heavy duty vocational work trucks. If Sempra Energy (including affiliate Southern California Gas Company) cannot commit to locating five vehicles in the designated area, other utilities including Los Angeles Department of Water & Power have expressed interest in fulfilling the commitment of cost-share and SCAQMD deployment.

The goals of the project are to significantly reduce fuel use and emissions, reduce costs through integration of high volume battery modules, system and component cost reductions, and further integration of the hybrid, vehicle and powertrain systems, ultimately leading to air quality benefit and an improved return on investment.

Sole Source Justification

Section VIII.B.2 of the Procurement Policy and Procedure identifies four major provisions under which a sole source award may be justified. This request for a sole source award is made under provision B.2.d.: Other circumstances exist which in the determination of the Executive Officer require such waiver in the best interest of the SCAQMD. Specifically, these circumstances are: B.2.d.(1) Project involving cost sharing by multiple sponsors. The multiple sponsors contributing financially to this project include DOE and Odyne.

Odyne, the PHEV system installer, is the project leader. Odyne offers the plug-in hybrid system on a medium- or heavy-duty truck that delivers greater fuel efficiency both while driving and at the worksite. The company sells its unique modular system for new and retrofit applications direct to truck manufacturers and through a global distribution and service network including Altec, Terex Utilities and selected Allison Transmission distributors.

The vehicle chassis manufacturer, Freightliner, is supporting the project through systems engineering of the PHEV integration and vehicle control system interface. Allison Transmission (key supplier to Freightliner) will play a key role in powertrain optimization, providing a hybrid-integrated transmission controller, advanced shift and transmission technologies and final shift schedule development, helping to maximize fuel reduction. NREL will provide duty-cycle analysis, fuel savings simulation and baseline, and final vehicle dynamometer testing.

ORNL will provide a lead role in powertrain simulation, optimization and test. Odyne has worked with major battery suppliers and has chosen AVL as the energy storage design and integration partner. AVL will utilize LG Chem cells manufactured in Michigan, leveraging the high volume production of this technology in the light-duty sector (e.g., Chevy Bolt and Volt).

Benefits to SCAQMD

The work-truck segment targeted by Odyne is almost exclusively made up of medium- and heavy-duty vehicles. This vehicle weight group is responsible for creating a disproportionate amount of emissions in the South Coast Air Basin, since they represent a relatively small percentage of the vehicle population yet are responsible for the majority of the NOx and particulate matter emissions. This project provides an opportunity to significantly reduce NOx and particulate matter emissions through the introduction of a relatively small number of cleaner transportation technologies. The hybridization and electrification of vehicles in this segment provides one such opportunity to reduce emissions. Additionally, eliminating the need for idling, especially in residential communities, minimizes localized exposure and noise issues.

Advancement of hybrid vehicle technologies is included in the *Technology Advancement Office Clean Fuels Program 2017 Plan Update* under the core category of “Electric/Hybrid Technologies & Infrastructure.” The hybridization of transportation technologies has the potential to lower criteria pollutant emissions and reduce greenhouse gas emissions. This can provide substantial air quality benefits to communities, neighborhoods and schools where these vehicles operate.

Resource Impacts

The total cost for the project is \$6,955,281, with SCAQMD’s proposed cost-share not to exceed \$900,000 from the Clean Fuels Fund (31). The project funding sources are identified below.

Project Partners	Funding Amount	Percent
DOE	\$2,932,193	42
Odyne Systems, LLC	\$1,033,088	15
Freightliner	\$65,000	1
Allison Transmission	\$25,000	1
Sempra Energy (in-kind)	\$1,000,000	14
Duke Energy (in-kind)	\$1,000,000	14
SCAQMD (<i>requested</i>)	\$900,000	13
Total	\$6,955,281	100

Sufficient funds are available in the Clean Fuels Fund (31) for this proposed project. The Clean Fuels Fund (31) is established as a special revenue fund resulting from the state-mandated Clean Fuels Program. The Clean Fuels Program, under Health and Safety Code Sections 40448.5 and 40512 and Vehicle Code Section 9250.11, establishes mechanisms to collect revenues from mobile sources to support projects to increase the utilization of clean fuels, including the development of the necessary advanced enabling technologies. Funds collected from motor vehicles are restricted, by statute, to be used for projects and program activities related to mobile sources that support the objectives of the Clean Fuels Program.