

BOARD MEETING DATE: March 5, 2021

AGENDA NO. 5

PROPOSAL: Execute Contracts for Hydrogen Infrastructure Projects and Fuel Cell Microgrid Study

SYNOPSIS: Research and development in the area of hydrogen infrastructure and microgrids is important as fuel cell technology transitions from light- to medium- and heavy-duty vehicles. These actions are to support High Flow Bus Fueling Protocol Development with Frontier Energy Inc. in an amount not to exceed \$25,000, support California Heavy-Duty Hydrogen Infrastructure Research with National Renewable Energy Laboratory (NREL) in an amount not to exceed \$25,000 and support California Hydrogen Systems Analysis with University of California, Davis (UC Davis) in an amount not to exceed \$50,000 from the Clean Fuels Program Fund (31). The University of California, Irvine Advanced Power and Energy Program (UCI APEP) proposes a study to identify and quantify the steps required for wider deployment of microgrids using fuel cell technology. This action is also to execute a contract with UCI APEP to study fuel cell microgrid technology in an amount not to exceed \$370,000 from the Clean Fuels Program Fund (31).

COMMITTEE: Technology, February 19, 2021; Recommended for Approval

RECOMMENDED ACTIONS:

1. Authorize the Executive Officer to:
 - A. Execute a contract with Frontier Energy, Inc., to Support High Flow Bus Fueling Protocol Development in an amount not to exceed \$25,000 from the Clean Fuels Fund (31);
 - B. Execute or amend a contract with NREL to Support California Hydrogen Heavy-Duty Infrastructure Research in an amount not to exceed \$25,000 from the Clean Fuels Program Fund (31);
 - C. Execute a contract with UC Davis to Support California Hydrogen Systems Analysis in an amount not to exceed \$50,000 from the Clean Fuels Program Fund (31); and

- D. Execute a contract with UCI APEP to study fuel cell microgrid technology in an amount not to exceed \$370,000 from the Clean Fuels Fund (31).

Wayne Natri
Executive Officer

MMM:NB:JI:SH:LHM

Background

The deployment of hydrogen infrastructure is gaining more demand to support increasing fuel cell vehicles and secure the resiliency and reliability of the electricity system. The following four projects include hydrogen infrastructure related research and studies of microgrids using fuel cell technology.

High Flow Bus Fueling Protocol Development

Fueling methods are currently under development worldwide and are targeting several different conditions at the outlet of the dispenser, including gaseous hydrogen at 700 bar, 500 bar, 350 bar, cryo-compressed, as well as liquid hydrogen, depending on the size and vocation of the vehicle fleet and proximity to other hydrogen demands. The DOE H2@Scale program released a Cooperative Research and Development Agreement (CRADA) Call Area of Interest (AOI) 1: Fueling Components for Heavy-Duty Vehicles. Frontier Energy submitted a proposal with multiple partners including SoCalGas, Shell and NREL to model, test and validate the application of the mass-compensated Formula Protocol for high flow bus fueling. The mass-compensated formula was originally developed and applied to passenger car fueling.

California Heavy Duty Hydrogen Infrastructure Research

A team of California public agencies (CARB, CEC, Governor's Office of Business and Economic Development (GO-Biz), South Coast AQMD) and national laboratories formed a research partnership in 2017 focused on near-term hydrogen infrastructure development, deployment, and operation needs in California and was awarded DOE H2@Scale CRADA funds that year. Many of these partnerships had been in place for years through individual CRADA agreements and work scopes. The research partnership framework was intended to continue beyond that project for a long-lasting strategic partnership with the DOE, agencies, and national laboratories. As California has begun in earnest to expand its light-duty focus to include the medium- and heavy-duty fuel cell electric vehicle market, the research partnership submitted a project proposal to DOE's H2@Scale CRADA Call AOI 1: Fueling Components for Heavy-Duty Vehicles to build upon existing momentum and to advance the H2@Scale vision and the State of California's goals by developing a heavy-duty hydrogen reference station, fueling performance test device concepts and heavy-duty hydrogen station capacity model.

California Hydrogen Systems Analysis

The California Hydrogen Systems Analysis will build on and update existing work on carbon neutral hydrogen systems, which is extensive, but will represent a single cohesive analysis and plan for the state. It will include hydrogen's role in transportation, with all light-, medium-, and heavy-duty vehicles, as well as its use in industry and role as an emerging energy storage option for intermittent electric power. UC Davis Institute of Transportation Studies has several analytical tools and models in development that will support a very detailed study of these dynamics, and for the rollout of a hydrogen system over the next 30 years.

Study of Fuel Cell Microgrids

A microgrid is comprised of not only loads, but also the generation of power, with at least one point of connection to the grid, and the capability to island from the grid in the event of a grid outage. As an increasingly important and desired attribute, the islanding capability brings both enhanced reliability and resiliency to the community served and, rather than diesel backup generators powering critical loads, the microgrid can serve all the loads (not just the critical loads) with clean sources of power such as solar panels, batteries and fuel cells. In the proposed project, two targets for emission mitigation are backup generators with the seamless islanding afforded by microgrids powered by fuel cells, and the charging and fueling of battery and fuel cell electric buses at fleet microgrid hubs.

Proposal

High Flow Bus Fueling Protocol Development

This project will apply the SAE J2601 standard mass compensated formula protocol to 350 bar on-board storage systems for heavy-duty vehicles with H35HF (high flow) receptacles. NREL's H₂Fills model will be upgraded and utilized. NREL's high flow heavy-duty fueling dispenser and their heavy-duty vehicle simulator will be utilized for testing. This project will also conduct validation testing at an existing commercial H35HF hydrogen station.

This action is to execute a contract with Frontier Energy to co-fund \$25,000 for the two-year project with a total cost of \$570,500 that will leverage NREL's expertise, modeling capabilities, and high flow heavy-duty testing facilities, as well as in-use testing at Sunline Transit.

California Heavy Duty Hydrogen Infrastructure Research

This project will continue to conduct hydrogen infrastructure research efforts, focused on California heavy-duty hydrogen infrastructure priorities. Tasks in the project include heavy-duty reference station design, fueling performance test device design, and modeling of heavy-duty station capacity.

This action is to amend or execute a joint agreement with NREL to co-fund \$25,000 for the two-year project with a total project cost of \$1.114 million.

California Hydrogen Systems Analysis

This project proposes to:

- Analyze and model hydrogen's role in a carbon-neutral system of transportation, industry and energy storage through 2050;
- Assess existing policies to identify gaps over the next 5-10 years; and
- Study the role of hydrogen storage and other forms of storage including vehicle-to-grid (V2G) and power-to-gas (P2G) in grid serving both fuel cell and battery electric vehicles.

This action is to execute a contract with UC Davis to co-fund \$50,000 for the two-year project with an overall cost of over \$600,000.

Study of Fuel Cell Microgrids

This project proposes to:

- Replace Back-up Generators through Microgrid Deployment (Task 1); and
- Evaluate Zero-Emission Battery and Fuel Cell Electric Bus Microgrid Hubs (Task 2).

Task 1 will address replacing the increased use of diesel and gasoline backup generators with microgrids base loaded with fuel cell power generation and the transition from natural gas to locally sourced hydrogen. This study will: (1) identify alternative technologies that can replace diesel backup generators with a focus on renewable resources, hydrogen, and fuel cells; and (2) estimate the reduction in emissions associated with microgrids powered by fuel cells as an alternative to gasoline and diesel backup generators. In Task 2, the proposed project will address zero-emission bus electric charging and hydrogen fueling hubs by developing a rollout plan to charge and fuel a 100 percent zero-emission fleet of battery and fuel cell electric buses. The analysis will be used to model the evolution of hubs for charging and fueling zero-emission Medium- and Heavy-Duty drayage, utility, and long-haul vehicle microgrid hubs.

Sole Source Justification

Section VIII.B.2. of the Procurement Policy and Procedure identifies 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 interests of South Coast AQMD. Specifically, these circumstances are B.2.d.(1): Projects involving cost-sharing by multiple sponsors. The major sponsors contributing financially to the California Hydrogen Systems Analysis include public and private partners such as Aramco, CEC, GM, Honda, Hyundai, Leighty Foundation, Shell, SoCalGas and Toyota. Participation in the California Hydrogen Systems Analysis project is only possible by sole source contract with UC Davis. The High Flow Bus Fueling Protocol Development and California Heavy Duty Hydrogen Infrastructure Research project were awarded as a

result of a competitive solicitation. The request for sole source award for Study of Fuel Cell Microgrids project is made under provision B.2.d.(8): Research and development efforts with educational institutions or nonprofit organizations. UCI is an educational institution and APEP is an umbrella organization that addresses the broad utilization of energy resources and the emerging nexus of electric power generation, infrastructure, transportation, water resources and the environment. Built on a foundation established in 1970 with the creation of the UCI Combustion Laboratory and the 1998 dedication of the National Fuel Cell Research Center, APEP focuses on education and research on clean and efficient distributed power generation and integration.

Benefits to South Coast AQMD

Supporting hydrogen infrastructure and fuel cell microgrid research projects is consistent with the draft *Technology Advancement Office Clean Fuels Program 2021 Plan Update* under “Hydrogen and Mobile Fuel Cell Technologies & Infrastructure,” “Assessment and Technical Support of Advanced Technologies and Information Dissemination.” and “Stationary Clean Fuels Technologies.” South Coast AQMD supports the development, demonstration and commercialization of zero and near-zero emission vehicles with necessary infrastructure to support those vehicles including microgrids and strives to educate public and private organizations regarding the benefits and characteristics of these vehicles.

Resource Impacts

South Coast AQMD’s support of four hydrogen related research projects will not exceed \$470,000 from the Clean Fuels Program Fund (31).

South Coast AQMD’s support of the High Flow Bus Fueling Protocol Development, provided through an agreement with Frontier Energy, shall not exceed \$25,000 from the Clean Fuels Program Fund (31). Project partners and proposed funding are as follows:

Project Partner	Funding*	Percentage
Fuel Cell Technologies Office, U.S. DOE	\$422,000	74%
SoCalGas	\$80,000	14%
Shell	\$20,000	4%
Sunline, Worthington, Frontier Energy (in-kind)	\$25,500	4%
South Coast AQMD (<i>requested</i>)	\$25,000	4%
Total (not to exceed)	\$572,500	100%

*Subject to partial award; U.S. DOE funding may be scaled.

South Coast AQMD’s support of the California Heavy-Duty Hydrogen Infrastructure Research Partnership, provided through a joint agreement with NREL, shall not exceed

\$25,000 from the Clean Fuels Program Fund (31). Project partners and proposed funding are as follows:

Project Partner	Funding*	Percentage
Fuel Cell Technologies Office, U.S. DOE	\$999,000	90%
CEC	\$25,000	2%
GO-Biz (In-kind)	\$25,000	2%
CARB (In-kind)	\$40,000	4%
South Coast AQMD (<i>requested</i>)	\$25,000	2%
Total (not to exceed)	\$1,114,000	100%

*Subject to partial award; U.S. DOE funding may be scaled

South Coast AQMD's support of the California Hydrogen Systems Analysis, provided through a contract with UC Davis, shall not exceed \$50,000 from the Clean Fuels Program Fund (31). Total project funding over \$600,000 has already been committed by public and private partners such as Aramco, CEC, GM, Honda, Hyundai, Leighty Foundation, Shell, SoCalGas and Toyota.

Project Partner	Funding	Percentage
Aramco, CEC, GM, Honda, Hyundai, Leighty Foundation, Shell, SoCalGas and Toyota	>\$550,000	92%
South Coast AQMD (<i>requested</i>)	\$50,000	8%
Total (not to exceed)	>\$600,000	100%

South Coast AQMD's support of the Study of Fuel Cell Microgrids project shall not exceed \$370,000 from the Clean Fuels Program Fund (31). Proposed funding is as follows:

Project Partner	Funding	Percentage
Port of Long Beach, U.S. DOE, UCI, Anteater Express	\$140,000	28%
South Coast AQMD (<i>requested</i>)	\$370,000	72%
Total (not to exceed)	\$510,000	100%

Sufficient funds are available from the Clean Fuels Program Fund, 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.