SIERRA ENERGY

221 First Street, Davis, CA 95616
530.759.9827 • 530.759.9872 fax
SierraEnergyCorp.com

July 10, 2015

Air Resources Board
1001 I Street
Sacramento, CA 95814
(Comment submitted electronically via ARB website)

RE: Technology and Fuels Assessment Overview

Dear Air Resources Board:

Sierra Energy appreciates the opportunity to provide comments regarding the draft report developed by the Air Resources Board ("ARB"), Heavy Duty Technology and Fuels Assessment: Overview ("Heavy Duty Report" or "Report"). As further described in this letter, Sierra Energy is engaged in business activities in both the locomotive and hydrogen production sectors. As a result of these activities, Sierra Energy is aware of industry conditions and market opportunities of importance to the Heavy Duty Report. Based on this expertise, this letter provides three recommendations relating to the Heavy Duty Report that may be summarized as follows:

- ARB should initially focus its ZEV initiatives in the locomotive sector on short line railroads;
- ARB should consider and evaluate renewable natural gas as an important source for hydrogen fuel; and,
- ARB should resume the SB 1505 rulemaking to ensure that the state's increasing demand for hydrogen results in the most significant greenhouse gas ("GHG") emission reductions that are feasible.

The remainder of this letter describes Sierra Energy's activities in the locomotive and hydrogen production sectors, and provides support for these recommendations.

Sierra Energy's Expertise

Sierra Energy and Sierra Northern Railway are both companies within the Sierra Industrial Group. Sierra Energy is a waste gasification and renewable energy company founded in Davis, California in 2004. Sierra Northern Railway was formed in August 2003 through the merger of two Northern California shortline railroads: the Sierra Railroad Company and the Yolo Shortline Railroad. As a result, Sierra Energy has relevant experience and capabilities that range from the conversion of methane-emitting municipal solid waste ("MSW"), to the reduction of emissions from locomotives, to the feasibility of integrating fuel cell tenders into the locomotive industry.

Sierra Energy's FastOx Gasifier is a robust and flexible technology, capable of processing MSW, hazardous waste, medical waste, construction and demolition waste, and other waste streams. The application of Sierra Energy's waste gasification technology reduces the air, soil and water pollution created by landfills; and produces clean, low carbon energy and fuels for power and transportation.

Sierra Energy is currently installing a modular, community-scale waste gasification system at U.S. Army Garrison Fort Hunter Liggett in Monterey County. Sierra Energy's technology was selected by the US Department of Defense's ("DoD") Environmental Security Technology Certification Program to help improve DoD energy security, reduce waste and energy costs, drastically reduce greenhouse gas emissions, and help meet the U.S. Army's net-zero initiatives. The project has also received grant support from the California Energy Commission to convert the resulting syngas into Fischer-Tropsch diesel fuel for transportation applications. Sierra Energy is actively exploring methods to convert its syngas into hydrogen fuel.

Sierra Northern Railway has been at the forefront of reducing emissions from locomotives. Ken Beard is President and CEO of Sierra Northern Railway. Ken is also President of the California Shortline Railroad Association. Shortline railroads are typically exempted from state regulations by federal preemption. Nonetheless, Sierra Northern Railway is a leading reducer of emissions in the industry and has worked with local air districts on multiple innovative projects to retrofit locomotives and reduce emissions.

Recommendations

1. ARB SHOULD INITIALLY FOCUS ITS ZEV INITIATIVES IN THE LOCOMOTIVE SECTOR ON SHORT LINE RAILROADS.

As noted in the Heavy Duty Report, "The path to near-zero is not as clear in the off-road sector… This is occurring because off-road emissions standards are not uniform between horsepower categories and are not as stringent as on-road emissions standards… This is also the case with locomotives, which will meet locomotive Tier 4

standards that are unique to such engines without the use of SCR or PM filters." Report at p. 27-28. However, the Report also notes that, "Locomotives are a good example of an off-road technology where additional reductions are possible… Other technologies such as battery tender or fuel cells in a tender or in a locomotive may be possible, but have not yet been demonstrated." Id. at p. 28. As a result, "Staff sees the battery or fuel cell tender concept as an important technology to demonstrate." Id. at p. 13.

Sierra Energy is in agreement that there are significant opportunities in the locomotive sector for the development and deployment of fuel cell tenders. As staff is aware, locomotives are far less constrained than heavy-duty trucks by space and weight issues thus the larger and heavier footprint of fuel cells is not problematic. Locomotive engines are electrically powered and travel on pre-determined routes on tracks between stations with infrastructure capabilities thus further enabling fuel cell technologies.

In addition to these factors, shortline railroads are particularly well-suited for fuel cell tenders. California shortline railroads:

1. Operate primarily or exclusively within the state of California;
2. Have shorter routes to travel;
3. Have lesser rates of locomotive utilization than national locomotives; and,
4. Are part of California's clean energy economy.

For all of these reasons, California's shortline railroads provide the optimal proving ground for ZEV and other demonstration projects in the locomotive sector.

2. ARB SHOULD CONSIDER AND EVALUATE RENEWABLE NATURAL GAS AS AN IMPORTANT SOURCE FOR HYDROGEN FUEL.

Renewable natural gas is an optimal source of renewable hydrogen and should receive special attention in the fuels section of the Heavy Duty Report, particularly the portions of the Report pertaining to low carbon and renewable hydrogen. Renewable natural gas ("RNG") is a broad term that refers to gaseous fuel, primarily methane that is produced by the fermentation of organic matter. RNG includes biogas and synthetic natural gas that is generated from organic waste or other renewable sources. For fuel cell applications, RNG can be upgraded to methane that meets pipeline or other applicable natural gas specifications. The use of RNG fulfills multiple California policy goals by 1) capturing and destroying methane, a highly potent short-lived climate pollutant from landfills; 2) displacing petroleum and natural gas; 3) converting waste streams such as separated municipal solid waste (separated MSW) into fuel thereby reducing soil and water impacts; and 4) stimulating California's clean energy economy.

Fuel cells are already utilizing hydrogen-rich RNG at multiple facilities with substantial potential for expansion. The U.S. Department of Energy (DOE) estimates that U.S. RNG resources have the capacity to produce about 5 GW of power at 50 percent electrical efficiency.[1] DOE has determined that most of RNG resources are located near the major demand centers for hydrogen generation for fuel cell electric vehicles (FCEVs) and power generation from stationary fuel cells.[2]

Already, nearly a dozen municipal wastewater treatment plants in California and New York use anaerobic digestion and fuel cells to generate power. Microsoft has developed an off-the-grid data center in Cheyenne, Wyoming, powered by a 300-kW fuel cell that utilizes RNG from wastewater. Microsoft has announced plans to locate smaller data facilities and fuel cells near stranded RNG rather than investing in the electrical infrastructure required by larger data centers.[3]

Sierra Energy's FastOx Gasifier utilizes separated MSW as its feedstock to generate RNG. DOE estimates the potential of U.S. landfills to produce methane at 12.4 million metric tons of methane annually, enough hydrogen to refuel 13 million FCEVs a day.[4] Once ARB completes its rulemaking under SB 1505, RNG from MSW could fulfill the mandate that 33 percent of hydrogen gas sold at fueling stations be derived from renewable sources.

Morry Markowitz, the President of the Fuel Cell and Hydrogen Energy Association recently developed the following summary of other projects utilizing renewable hydrogen:

1. *Orange County, California's wastewater treatment plant successfully demonstrated a fuel cell tri-generation system using a biogas-powered fuel cell to generate not only power and heat, but also a stream of hydrogen gas in a two-year pilot project, producing power and heat, and routing renewably-generated gas at a publicly-accessible hydrogen fueling station located at the facility.*

---

[1] Power Point Presentation of Sunita Satyapal, National Renewable Energy Laboratory, Expanding the Use of Biogas with Fuel Cell Technologies, Biogas with Fuels Cells Workshop, June 11, 2012, *http://energy.gov/sites/prod/files/2014/03/f11/june2012_biogas_workshop_satyapal.pdf* (last viewed July 9, 2015).

[2] Ibid.

[3] Jason Verge, Microsoft Opens Zero-Carbon Methane-Powered Data Center In Wyoming, Data Center Knowledge, November 7, 2014, **http://www.datacenterknowledge.com/archives/2014/11/07/microsoft-opens-zero-carbon-methane-powered-data-center-wyoming/ (last viewed July 9, 2015).**

[4] Satyapal Power Point.

2. *Vancouver, Canada, using landfill gas (LFG). In addition to producing power, a nearby hydroponic greenhouse uses the fuel cell's waste heat, while renewable hydrogen is exported for vehicle fueling or industrial applications. Facilities with biomass waste can also benefit from fuel cell power generation.*

3. *Gills Onions (California), America's largest onion processor, converts 75 percent of its onion processing waste into low-emission, carbon-neutral power via a 600-kilowatt (kW) fuel cell. The biogas-powered system provides baseload power to the facility and uses byproduct heat to support the processing of onion waste in the anaerobic digester. The company says it saves about $700,000 annually in electricity costs and eliminates $400,000 in annual costs associated with hauling onion waste to farm fields.*

4. *The Blue Lake Rancheria Tribe (California) also takes advantage of local biomass, converting sawdust from a timber operation into hydrogen-rich synthesis gas in an integrated biomass-to-fuel cell power system.*[5]

3. ARB SHOULD RESUME THE SB 1505 RULEMAKING TO ENSURE THAT THE STATE'S INCREASING DEMAND FOR HYDROGEN RESULTS IN THE MOST SIGNIFICANT GREENHOUSE GAS ("GHG") EMISSION REDUCTIONS THAT ARE FEASIBLE.

Passed in 2006 as a cornerstone of California's planned hydrogen economy, SB 1505 mandates that the ARB:

> *"(A)dopt regulations that will ensure that state funding for the production and use of hydrogen fuel, as described in the California Hydrogen Highway Blueprint Plan, contributes to the reduction of greenhouse gas, criteria air pollutant, and toxic air contaminant emissions, and would require these regulations to meet minimum requirements, as specified."*

As stated in the SB 1505 at Section 1(l):

> *"According to the California Hydrogen Highway Blueprint Plan, the absence of specific goals for reducing emissions and using renewable resources to produce hydrogen fuel might actually increase greenhouse gas and particulate matter emissions relative to petroleum fueled vehicles."*

[5] Morry Markowitz, "Fuel Cells: Opening New Markets for Today's Energy Resources," Blog posted on the Energy Collective, June 8, 2015, http://www.theenergycollective.com/mmarkowitz/2236691/fuel-cells-opening-new-markets-today-s-energy-resources (last viewed July 9, 2015).

This same concern is properly reflected in ARB's recently released Short-Lived Climate Pollutant Concept Paper:

> *"As we increase the number of facilities producing and using renewable supplies of natural gas, hydrogen, or any other potential source of methane emissions in a cleaner energy economy, we must also take steps to minimize potential methane leaks from those facilities.*[6]

SB 1505 was intended to enable the production of hydrogen from clean and reliable sources, and to ensure that hydrogen production from natural gas did not result in increased fugitive methane emissions. ARB commenced its rulemaking in 2007 and held a series of workshops. The last rulemaking workshop, scheduled to be held on April 19, 2010, was cancelled without explanation and never rescheduled.[7] ARB has missed several January 1, 2010, deadlines established by the bill that are now codified at Health and Safety Code §§43868-43869. As part of its overall GHG reduction strategy and consistent with state law, ARB should resume and complete its SB 1505 rulemaking.

Conclusion

Thank you for your consideration of our input. Please contact our attorney, Graham Noyes of Keyes, Fox & Wiedman, if any further input would be helpful. We look forward to continuing to participate in this proceeding.

Sincerely,

Michael Hart

Cc: Graham Noyes
Gerard Achtelick

---

[6] Air Resources Board, Short-Lived Climate Pollutant Reduction Strategy at 18.
[7] See http://www.arb.ca.gov/msprog/hydprod/hydprod.htm and related links (last viewed June 12, 2015).