California Energy Commission
Fuels and Transportation Division
"NorCAL ZERO"

The deployment of 30 Fuel Cell Electric Trucks (FCETs) in northern California will provide strong evidence of reliability and availability comparable to conventional diesel trucks.

The Issue

High-throughput clusters, like marine ports, concentrate harmful criteria pollutants like diesel particulate matter and oxides of nitrogen. Drayage and other freight movement activities prevalent at these clusters rely predominately on the use of diesel-fueled, heavy-duty vehicles. It is critical to demonstrate the effective operation of a fully integrated zero-emission ecosystem now, starting with drayage and regional-haul trucks at the major marine ports in northern California. This will accelerate the establishment of a comprehensive hydrogen refueling network and associated competitive cost structure to support increased adoption of zero-emission hydrogen FCETs statewide.

Project Innovation and Advantages

The goals of the CEC and CARB Grant Agreements are to advance zero-emission Class 8 on-road technology and the understanding of fleet dynamics when deploying 30 zero-emission trucks and supporting infrastructure. The CEC agreement will fund the construction of a heavy-duty hydrogen refueling station capable of providing fuel for the trucks at 700 bar pressure. CEC funds will also enable the implementation of a workforce development and training program to ensure the successful deployment of these trucks in northern California, which are being funded under a separate agreement with CARB. The project will provide hydrogen with zero carbon intensity, sourced from 52% renewable feedstock. Criteria emissions from the trucks will be eliminated providing a direct public health benefit to the West Oakland neighborhood, identified as an economically disadvantaged community.

Anticipated Benefits to California

General Benefits:

- ***Operate 30 Hyundai Xcient FCETs in commercial operation in northern California for a period of at least six years.*** These trucks will come close to matching the performance of diesel trucks, with regard to total cost of ownership, operating range, available payload capacity, cargo volume, vehicle performance parameters, refueling speed, reliability, and longevity.
- ***Demonstrate economies of scale for future FCET deployments***. Hyundai's FCETs are vertically integrated by the Hyundai Motor Company (HMC), one of the largest automotive Original Equipment Manufacturers (OEM) in the industry. They manufacture the steel for the trucks, and they design and build the bodies and chassis, as well as the fuel cell systems. They are responsible for the integration of all components in the truck and final validation testing. Vertical integration by a large automotive OEM is a key enabler of significant cost reductions and quality control. It's an effective means to leverage supply chain sources to control costs and ultimately achieve diesel truck cost parity.
- ***Build and operate a hydrogen refueling station capable of supporting a 30-truck deployment***. The refueling station will be located on East Bay Municipal Utility District property adjacent to the Port of Oakland. The station will support up to 50 trucks and can be further expanded to handle increases in the number of trucks deployed. It has been designed to fuel at 700 bar pressure in order to provide FCETs with an expanded range of up to 500 miles.
- ***Conduct a Workforce Training program and demonstrate benefits to local employment.*** NorCal Kenworth is a Bay Area company with an excellent reputation leasing, servicing, and repairing trucks in northern California. This proposal features a comprehensive advanced technology training program in support of Bay Area employees.

Specific Benefits

- Job Creation

The NorCAL ZERO project will directly result in California jobs creation and retention. Hyundai is partnering with California-based companies for the service, maintenance, and fueling of commercial trucks. The trucks will be leased to Glovis America, the fleet operator, for six years, retaining created jobs well beyond the grant term. Glovis intends to hire 30 new drivers to operate the trucks being deployed in this project.

Hyundai currently employs more than 4,000 people in California, spread across 15 facilities, working on research and development, improved product designs, quality control, sales and marketing, and finance and investment. In addition to an existing staff of 10 people working exclusively on fuel cells and hydrogen at Hyundai's Michigan facility and the Hyundai-Kia America Technical Center, located in Chino and Pomona, additional personnel will be employed

in Chino, dedicated to developing electric powertrains and the commercial FCET markets in California and the U.S.

FirstElement Fuel (FEF) is a California-based company, whose employees live and work in California. The vast majority of subcontractors employed by FEF, from permitting specialists to engineering firms to construction subcontractors, are California-based companies with employees that live and work in the state. The public agencies (local, regional, and state governments) and utility companies (communication, water, electric, and gas companies) that FEF engages during project development and execution, have employees that live and work in California.

NorCal Kenworth plans on training five of its existing employees to service the FCETs, as well as hire two to three additional employees. These will be permanent California jobs, equipping employees with a unique and desirable skillset.

- Greenhouse Gas Emissions Reduction (ER)

  The NorCAL ZERO project guarantees operation of these trucks for six years. During that period, 24,362 metrics tons carbon-dioxide equivalent (CO2e) are expected to be avoided, as well as 13.14 tons weight emissions reduction (WER).

Emissions Reductions Summary

	Per Truck	Project Entirety
GHG ER	$135.34 \frac{metric\ tons\ CO2e}{year}$	$4{,}060 \frac{metric\ tons\ CO2e}{year}$
Criteria Pollutant ER	$0.073 \frac{tons\ WER}{year}$	$2.19 \frac{tons\ WER}{year}$

- Petroleum Displacement

  During this same period 300,600 gallons of diesel fuel are expected to be displaced annually

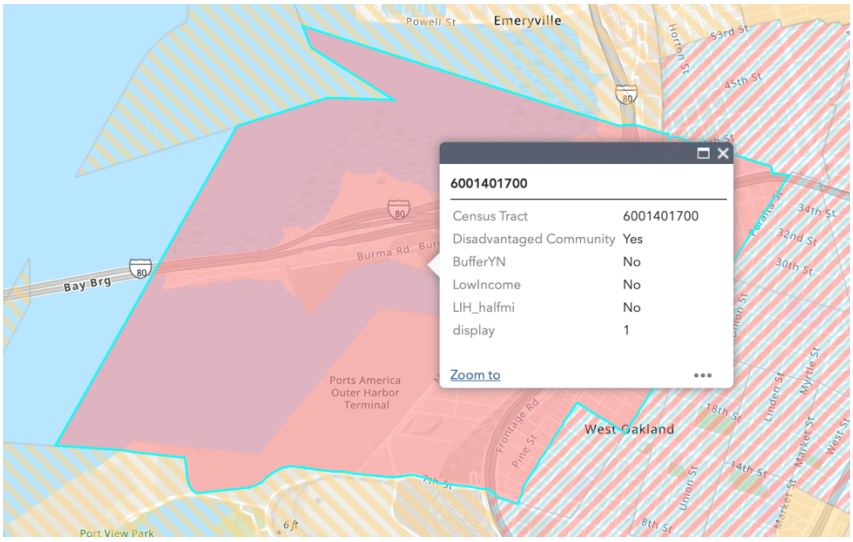
$$Fuel\ Usage_{baseline} = 10{,}020 \frac{gallons\ diesel}{year}$$

$$Petroleum\ Fuels\ Displaced\ Annually = 10{,}020 \frac{gallons\ diesel}{year} * 30 fuel\ cell\ trucks$$

$$= 300{,}600 \frac{gallons\ diesel}{year}$$

- Impact to Low Income and Disadvantaged Communities

  The sites for domiciling the FCETs and the hydrogen refueling station will be located in Census Tract 6001401700, which is classified as a "Disadvantaged Community" as indicated on the California Climate Investments' (CCI) Priority Population Map. The address for the site to domicile the trucks is 10 Burma Road, Oakland, CA 94607. The fueling station will be located on East Bay Municipal Utility District (EBMUD) property, at the intersection of Engineer Road and Wake Avenue, Oakland, CA 94607. All 30 vehicles will operate out of the Port of Oakland.



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Project Location: West Oakland, California

Project Team: Center for Transportation and the Environment, Hyundai Motor Company, FirstElement Fuel Inc., Glovis US, NorCal Kenworth, University of California – Berkeley, Fiedler Group, Macquarie Equipment Capital Inc., West Oakland Environmental Indicators Project, Bay Area Air Quality Management District, and Alameda County Transportation Commission