

U.S. DOE Hydrogen and Fuel Cell Program Annual Merit Review

State-Funded Hydrogen and Fuel Cell Activities April 30, 2020

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Science and Technology Advancement

South Coast Air Quality Management District

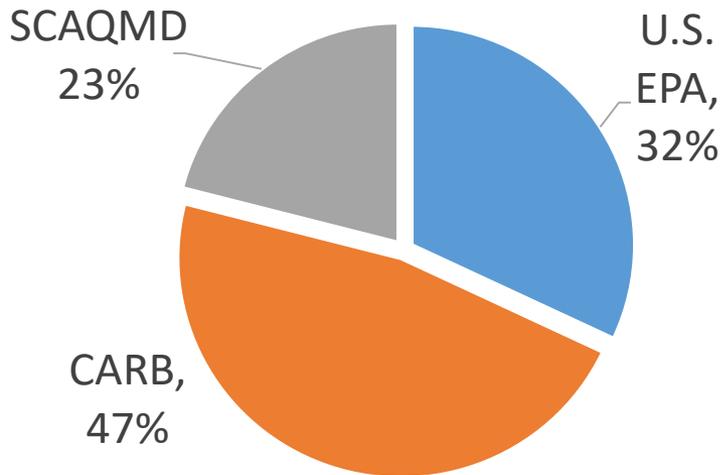
What is the South Coast AQMD?



- **Air pollution control agency**
 - Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino counties
- **Responsibilities**
 - Control emissions from stationary sources (e.g., from power plants, refineries, gas stations, painting facilities, etc.)
 - Monitor air quality and meet federal and state air quality standards
 - Permit and inspect 28,400 affected businesses

Legal Authority and Responsibility

- ~88% of NO_x comes from mobile sources
- Limited local authority over mobile sources



2031 NO_x Emissions: 224 tons/day



CARB
SIP Strategy
*including
Federal
source
reductions*

SCAQMD
control strategy
SCAG Regional
Transportation
Plan and
Transportation
Control
Measures



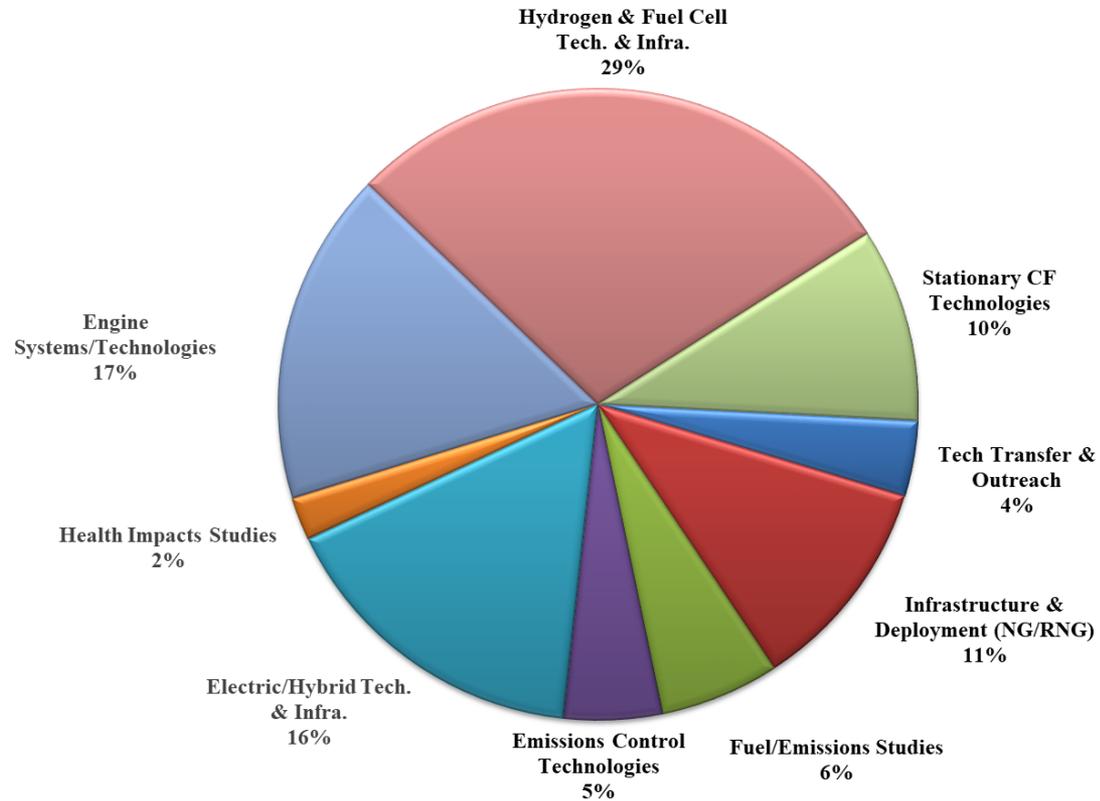
Technology Demonstration Clean Fuels Program

- Established in 1988
- \$1 fee on DMV registrations (\$~12M/yr)
- Stationary source fee (~\$400k/yr)
- Research, develop, demonstrate, and deploy (RD3) clean technologies

- [H&SC Sections 40448.5 and 40512 and Vehicle Code Section 9250.11](#)
- <http://www.aqmd.gov/home/library/technology-research/reports>



2020 Plan Distribution



\$16.1M

SBCTA Rail



San Bernardino County agency orders its first zero-emission train for Redlands rail service

BY [STEVE SCAUZILLO](#)

November 15, 2019 at 4:07 pm

- Michigan State University (MSU) feasibility study
- Approved the hydrogen fuel cell-battery hybrid alternative propulsion technology for implementation as part of the future Arrow Service
- Potential site of joint use hydrogen station, west of 215 fwy, between 10 & 210 fwys
- 2024 Zero Emission in-service goal

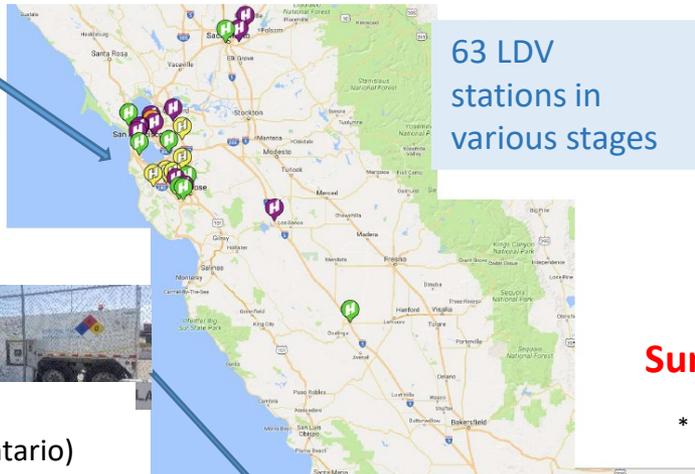


<https://www.gosbcta.com/project/redlands-passenger-rail-project-arrow/>

CA Hydrogen Stations



A.C. Transit



63 LDV stations in various stages

Nel H2 - Proton
 350 bar, 900 kg/day
 2 dispensers
 5 New Flyer-10 min fill
 8 FCB now – 20 min fill



APCI Trailer
 350 bar, 300 kg
 10 fills/day



SunLine Transit

* - SMR production for 10+ years

POLA ZANZEFF
 Equilon (Wilmington & Ontario)
 350 & 700 Bar
 10 Kenworth Class 8 FC Trucks



POLA

POLB

UC Irvine
 Upgrade to LH2 delivery
 800 kg/day, 700 bar LD,
 350 bar FC Bus (at night)

OCTA
 Trillium, APCI LH2 delivery
 350 bar, 1600 kg/day
 10 New Flyer, 36 kg/bus,
 6-10 min fill

CEC NOPA 17-603
 Equilon, Toyota
 350 & 700 bar, 1000 kg/day
 2 dispensers, 10 Toyota CL8 FCT



(Photo: Toyota)



OCTA Liquid Hydrogen Fueling Station

- Trillium CNG with Air Products liquid hydrogen deliveries
- Hydrogen station event for partners January 31, 2020
- Fueling time 6 – 10 minutes/bus with 350 bar
- 280 kg peak back to back fills, 1,450 kg/day
- 10 New Flyer 40' buses in operation
85 kW Ballard fuel cell and 80 kWh Li-FePO4 batteries
- Each bus uses 35.6 kg/day to provide >300 miles range



Zero-Emission Cargo Transport II

Timeline

- Project Award: 10/1/14
- Contractor Kickoff: 12/16/15
- Project Completion: 9/30/19

Budget

- DoE: \$10,000,000
- Funding partners: \$7,467,473
- Contractors: \$3,075,841
- Total Cost: \$20,543,314

Contractors & Projects

- BAE/CTE: Fuel cell range extended drayage truck
- TransPower: Fuel cell range extended drayage truck
- U.S. Hybrid: Fuel cell powered drayage truck
- Hydrogenics: Fuel cell range extended drayage truck
- BAE/GTI: CNG hybrid with Near Zero CNG Engine

Fuel Cell Range Extended Drayage Trucks



- Revised ZECT2 project scope from one battery electric and three plug-in hybrid electric to four fuel cell Class 8 drayage trucks (200+ mile ZE range)
- Hydrogenics will provide the fuel cells
- Complete and deliver vehicles in 2021 with 12-month demonstration
- Cummins will cover project cost increase



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H2Freight Project



- CEC GFO-17-603 - Advanced Freight Vehicle and Infrastructure Deployment:
Award to Equilon (dba Shell) for 1,000 kg/day truck refueling to demonstrate zero emission goods movement at ports (H2Freight Project),
with multiple fueling positions at 700 bar
- SCAQMD cost-share to refuel heavy-duty vehicles at 350 bar, supporting fuel cell demonstrations by multiple operators at local ports
- Evaluate fueling protocols, dispenser design, station throughput/reliability, etc.



Zero Emissions Freight

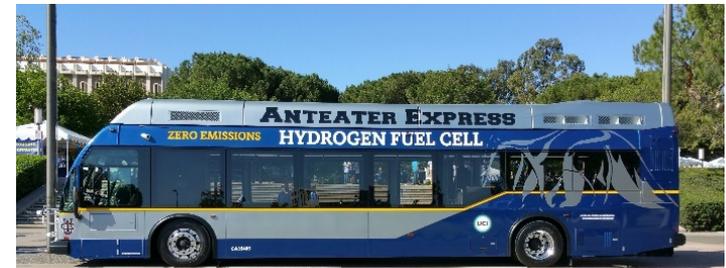
POLA –“Shore to Store” (S2S) Project (\$82.5M total)

- CARB (\$41M) & CEC (\$26M)
- Port of Hueneme
- Develop and demonstrate ten fuel cell trucks (Kenworth – Toyota)
- H2 stations in Wilmington and Ontario (Shell Equilon)
- SCAQMD \$1Million



UC Irvine Hydrogen Station Expansion

- Expansion to 800 kg/day with liquid delivery, increased storage, and four fueling positions
- Public use will continue 24/7, with buses scheduled to refuel at night
- Final design will incorporate state-of-the-art technology
- Co-funding approved & contracts executed:
MSRC \$1M (PON 2018-02)
CEC \$400k (ARFVTP)
SCAQMD \$400k (Clean Fuels)



How can the state help achieve greater penetration of this ZEV technology?

Implementation - Incentive Funding

Program Title	Description	South Coast AQMD Funding Amount
Mobile Source Air Pollution Reduction Review Committee (MSRC)	Implement or monitor programs to reduce motor vehicle air pollution	\$3M Hydrogen Infrastructure Partnership Program Status: \$1M awarded for UC Irvine H2 station upgrade - includes bus fueling at night \$3M remaining for 2019-21 Work Program
Community Air Protection Program (CAPP) Incentives	Approved by Governor as part of state budget each year. Funds projects that reduce emissions in disadvantaged and low-income communities. Supports the goals of AB 617.	Year 2 (SB 856) - \$85.57 million Status: 85% of funds awarded to qualifying projects, 15% remaining for stationary source and other community-identified projects.
Carl Moyer Program	Provides incentives to owners to purchase cleaner-than-required vehicles/equipment, including infrastructure for zero and near-zero emissions vehicles.	\$30.5 million (+ \$4.6 million in local match) Status: Increased funding from AB 1274, all funds awarded in December 2019, begin contracting in Qtr 1 2020.
Volkswagen Environmental Mitigation Program	Intended to mitigate the excess NOx emissions caused by VW actions.	\$165 million to South Coast AQMD (10-yr) Status: Zero Emission Class 8 Freight & Port Drayage (\$90M) solicitation 2020 tbd

California Hydrogen Infrastructure Research Consortium

- U.S. DOE H2@Scale program with national labs, CA GO-Biz, CEC, SCAQMD, and CARB
- Joint agreement led by NREL to continue hydrogen infrastructure research efforts, focused on California near-term priorities
- Project Management Plan 2020 tasks:
 - H2 Station Data Collection
 - Medium/Heavy Duty Fueling Report
 - Hydrogen Contaminant Detection
 - Nozzle Freeze Lock
 - CA Hydrogen integration
 - Technical Assistance



Summary

- Challenges remain to broader adoption of fuel cells in the transit and freight sectors
- Long term needs:
 - Scale-up of hydrogen dispensing and low carbon production
 - Scale-up of multiple supply chains
 - Long term policy support and funding predictability
- Short term needs:
 - Large freight fleets that are already familiar with fuel cell technology
 - Larger transit agencies adopting fuel cell transit
 - Microgrid integrated with hydrogen storage

