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

State-Funded Hydrogen and Fuel Cell Activities
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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 NOx comes from mobile sources
- Limited local authority over mobile sources

2031 NOx Emissions: 224 tons/day

U.S. EPA, 32%
CARB, 47%
SCAQMD, 23%

Federal

State

Regional

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
California H2 Refueling Stations

Snapshot

64 LDV stations in various stages

A.C. Transit
APCI Trailer
350 bar, 300 kg
10 fills/day

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

CEC NOPA 17-603
Equilon, Toyota (w/ FCE tri-gen)
350 & 700 bar, 1000 kg/day
2 dispensers, 10 Toyota CL8 FCT

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

SunLine Transit*

APCI Trailer
350 bar, 300 kg
10 fills/day

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

* - SMR production for 10+ years

Equilon, Toyota (w/ FCE tri-gen)
350 & 700 bar, 1000 kg/day
2 dispensers, 10 Toyota CL8 FCT

(Photo: Toyota)
Light Duty Retail H2 Stations

• Current retail stations
  ➢ 200 kg/day (a couple smaller - legacy)
  ➢ 5+ back to back fills/hour
  ➢ 350/700 bar
  ➢ Retail POS (credit cards)
  ➢ Latest SAE standards
• 21 LD retail stations in our region (2 currently non-operational); SCAQMD co-funded 20 + 1 in development.
  4 additional in development
• CEC grant for three retail LD stations
  ➢ Air Liquide (LAX)
  ➢ H2 Frontier (Burbank)
  ➢ Shell Equilon (Torrance)
Medium & Heavy-Duty Station Parameters

- Optimized for truck application

- Location(s)
  - POLA/POLB
  - Inland Empire - Warehousing
  - Goods movement corridors

- Technology options
  - On-site Renewable production: SMR or Electrolysis
  - LH2 delivery
  - Combined w/ Heat & Power – enhanced efficiency
  - Pipeline connected plus on-site purification w/ PSA
H2Freight Project

- Advanced Freight Vehicle and Infrastructure Deployment: 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.

- CEC $8 Million (GFO-17-603)
  Equilon (dba Shell) $1.4 Million
  Toyota $1.4 Million
  SCAQMD $1.2 Million
POLA – Zero Emissions Freight “Shore to Store” (S2S) Project ($82.5M total)

- CARB ($41M) & CEC ($26M)
- Port of Hueneme
- Develop and demonstrate ten fuel cell trucks
- H2 stations in Wilmington and Ontario
- SCAQMD $1 Million
Orange County – UCI Hydrogen Station Upgrade: MSRC for up to $1M (PON 2018-02) CEC $400k (ARFVTP) SCAQMD $400k (Clean Fuels)

- Goal – Co-fund at least one hydrogen station per county
- Up to $2M remains available

http://www.cleantransportationfunding.org
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
Zero-Emission Cargo Transport II

Progress

- First deployment began from Q2 2018 with two fuel cell range extended trucks
- Portable hydrogen fuel onsite is in operation
- Debugging and design improvement are in progress by lessons-learned from the first demo trucks

2018/2019 Objectives

- Complete all vehicle builds
- Data analysis and design improvement from demonstration

Impact

- Pushing Zero Emission Technology and Industry Envelope by Demonstrating First Fleet of FCEV’s in Drayage Service in California
Zero-Emission Cargo Transport II

Deployment of Fuel Cell Technology for Heavy-duty Sector

- Six of seven vehicle designs and integration are complete including CNG hybrid truck
- Design improvement and system optimization
- Analyze data collected and secure reliability

Challenge

- Costs will remain a challenge for the near and mid term
- Penetration into mid or long range application