

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

State-Funded Hydrogen and Fuel Cell Activities June 14, 2018

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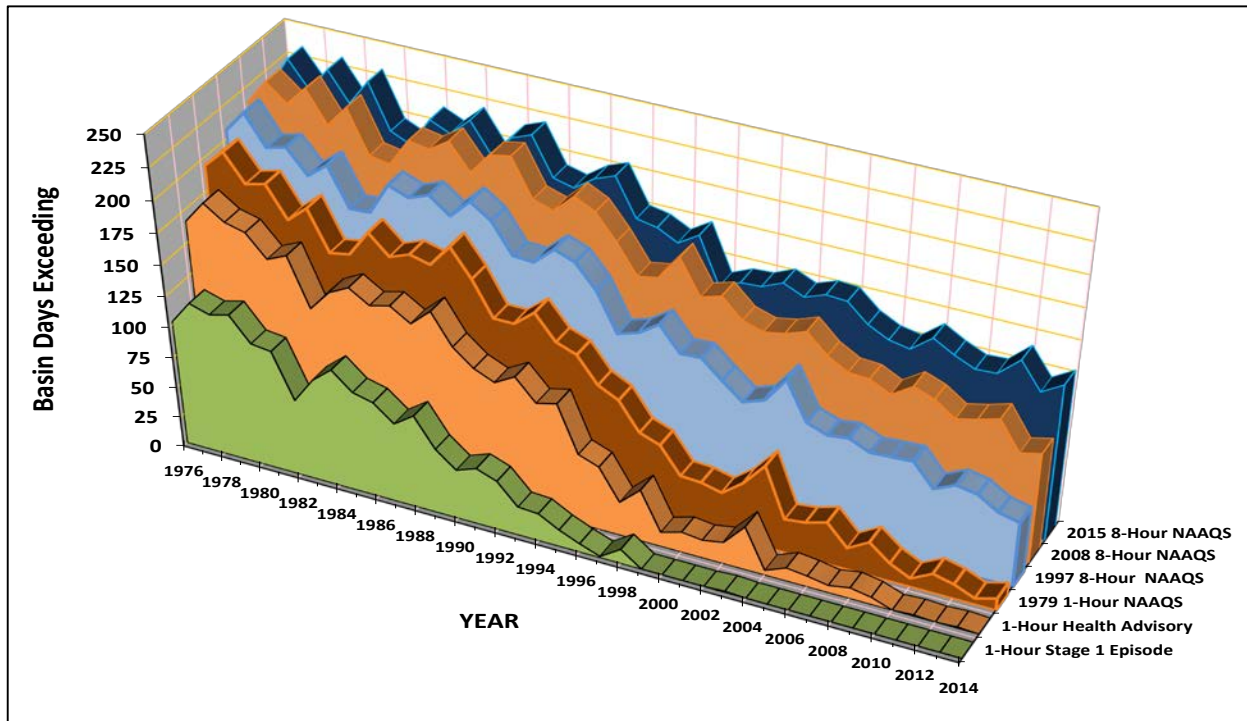
What is the South Coast AQMD?



- **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



Air Quality Trends (ozone)



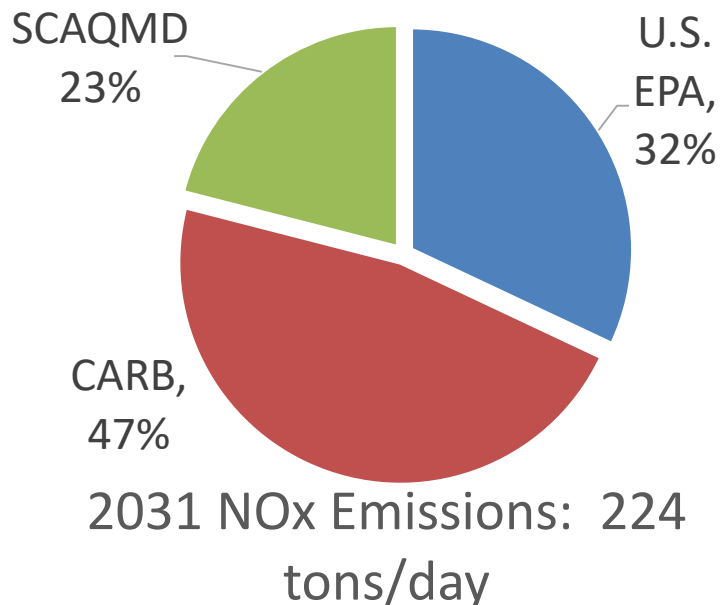
Number of Days Exceeding Current and Former Ozone NAAQS

Air quality has dramatically improved; however, region still suffers from some of the worst air pollution in the nation



Legal Authority and Responsibility

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



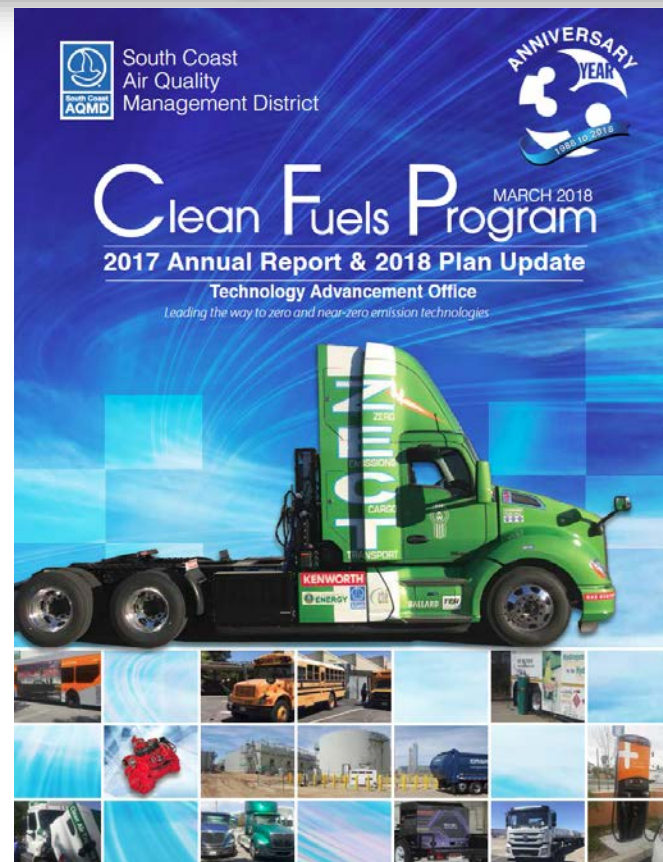
CARB
SIP Strategy
*including
Federal
source
reductions*

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>



Fuel Cell & Hydrogen Highlights

1989



Ballard Fuel Cell Bus Support

1991



First Commercial Stationary Fuel Cell at SCAQMD

1996 – 2000s



Hydrogen Infrastructure and Transit Bus Support

2004



“Five Cities” Stations and 30 H2 Prius Program; AQMD Electrolysis station



2007



National Fuel Cell Bus Program Support

2008 -



CARB and CEC H2 Station Support; 2015 AQMD Delivered H2 station

2013 -



400 kW Stationary Fuel Cell at SCAQMD



California H2 Refueling Stations

Snapshot



A.C. Transit

APCI Trailer
350 bar, 300 kg
10 Fuelings/Day



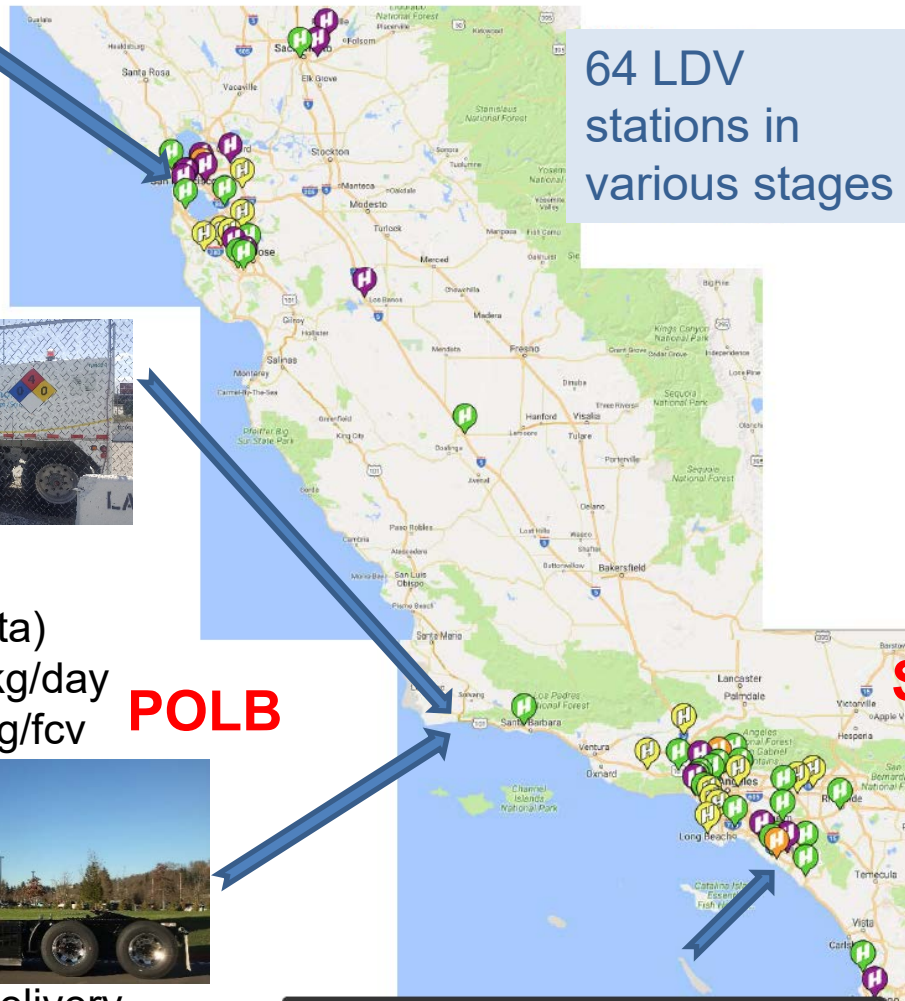
POLA

CEC NOPA 17-603
Equilon (w/FCE, Toyota)
700 & 350 bar, 1000 kg/day
2 dispensers, 30-50 kg/fcv



Trillium w/ APCI LH2 delivery
350 bar, 1600 kg/day
360 kg peak fueling
10 New Flyer, 30 kg/bus, 6-10 min fill

OCTA



64 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



SunLine Transit*

* - SMR production for 10+ years





Delivered Hydrogen Station



1. Hydrogen is generated by central natural gas reformation facility.



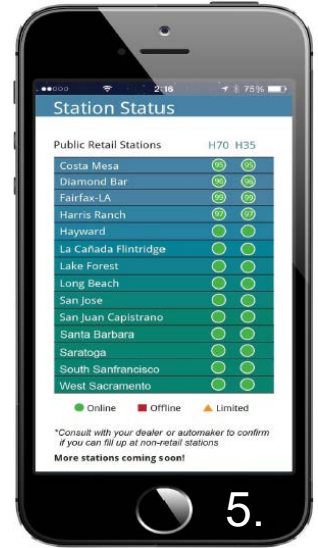
2. Hydrogen (33% renewable) is delivered to SCAQMD.



3. Hydrogen is compressed and chilled (-40F) to provide hydrogen at 70 MPa (H70)



4. Dispenser provides both H35 and H70 with self-fueling instructions
Vehicles fuel with all major credit cards



5. Station data posted at www.m.ca fcp.org
35 retail stations open in CA plus 29 under construction



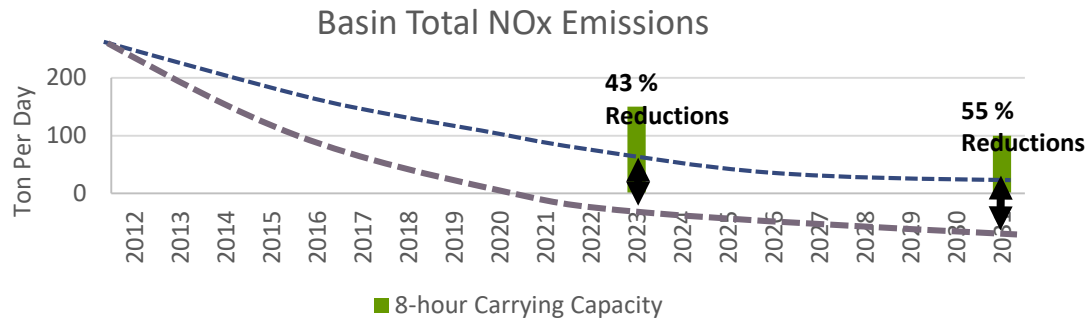
Federal/State Actions

- USEPA/CARB – Proposed Heavy Duty Engine Standards
- CARB – Mobile Source Strategy
- Sustainable Freight Action Plan
 - Improve freight system efficiency 25% by 2030
 - Deploy over 100,000 NZ and ZEVs - maximize near-zero technology by 2020



South Coast Plans & Policies

- 2016 AQMP – NAAQS
 - 2008 8-hr Ozone – 75 ppb



Facility Based Mobile Source Measures

- MOB-01 – Commercial Marine Ports
- MOB-03 – Warehouse Distribution Centers
- MOB-04 – Commercial Airports
- EGM01 – New/Redevelopment Projects



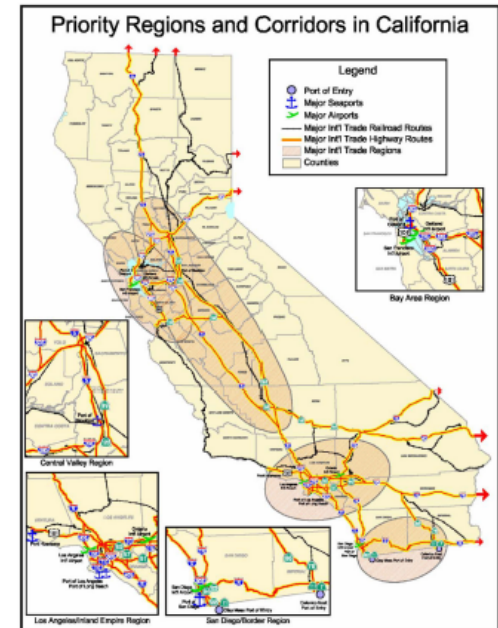
Potential Funding

- CEC ARFVTP
- Port and Terminal Operators
- MSRC
- CARB
 - HVIP – up to \$315K/zero emission truck + \$50K towards infra.
 - Low Carbon Transportation (LCT) – up to \$363M statewide
 - AQIP – up to \$25M statewide
 - VW Settlement Mitigation Trust – up to \$800M statewide
- State & Federal Solicitations, Other/Future
 - Carl Moyer – \$30M to SCAQMD in 2017, up to \$200k/HHD ZE CARB certified truck or bus, 50% for new H2 fueling
 - DOE - FOAs



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



Challenges



- Cost
- Supply Chain
- CEQA/Permits
- Need higher capacity stations, with refined fueling protocols to become – “Recommended Practice.”



California Hydrogen Infrastructure Research Consortium

- U.S. DOE H2@Scale program
- Joint agreement led by NREL to continue hydrogen infrastructure research efforts, focused on California near-term priorities with CA Go-Biz, CEC, & SCAQMD and in coordination with CARB
- Project Management Plan with schedule, budget, roles, milestones, tasks and reporting

