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

State-Funded Hydrogen and Fuel Cell Activities

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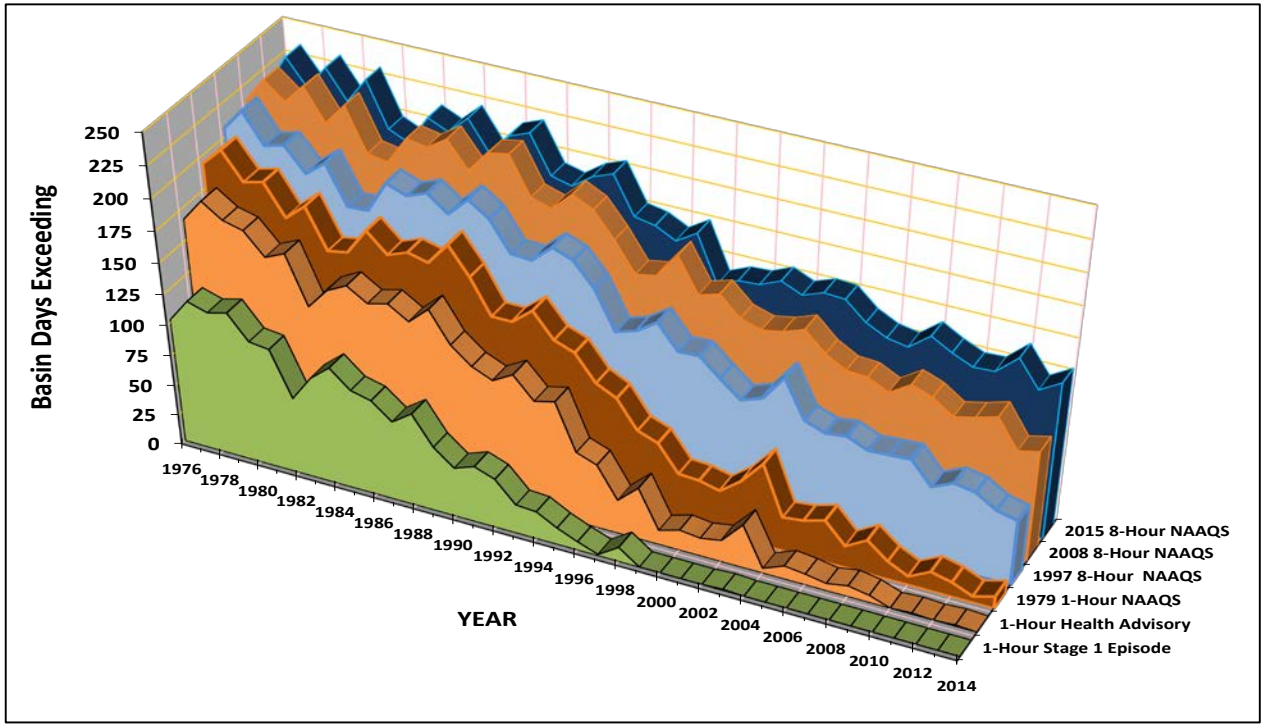
South Coast Air Quality Management District

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

Air Quality Trends (ozone)

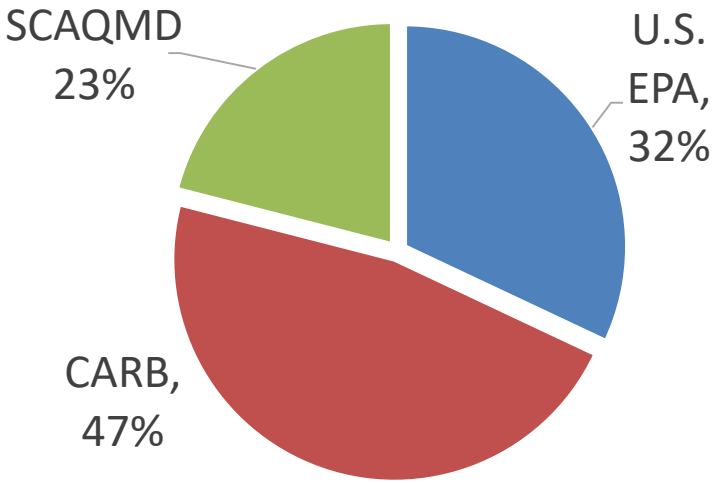


Number of Days Exceeding Current and Former Ozone NAAQS

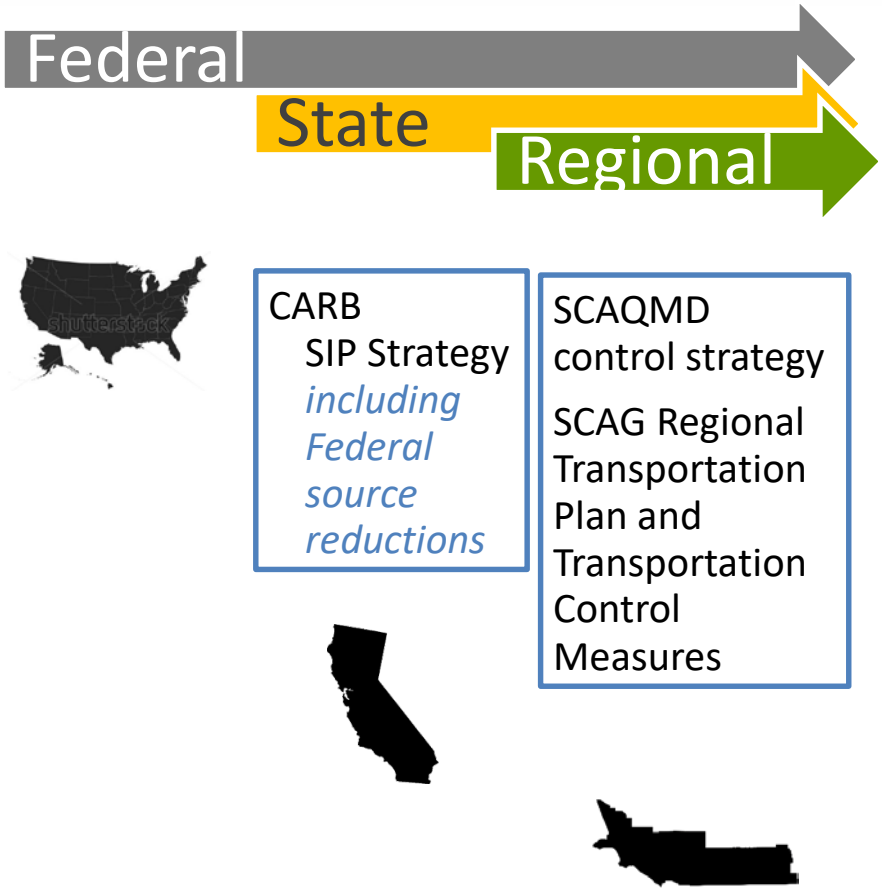
Air quality has dramatically improved; however, region still suffers from some of the worst air pollution in the nation

Legal Authority and Responsibility

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

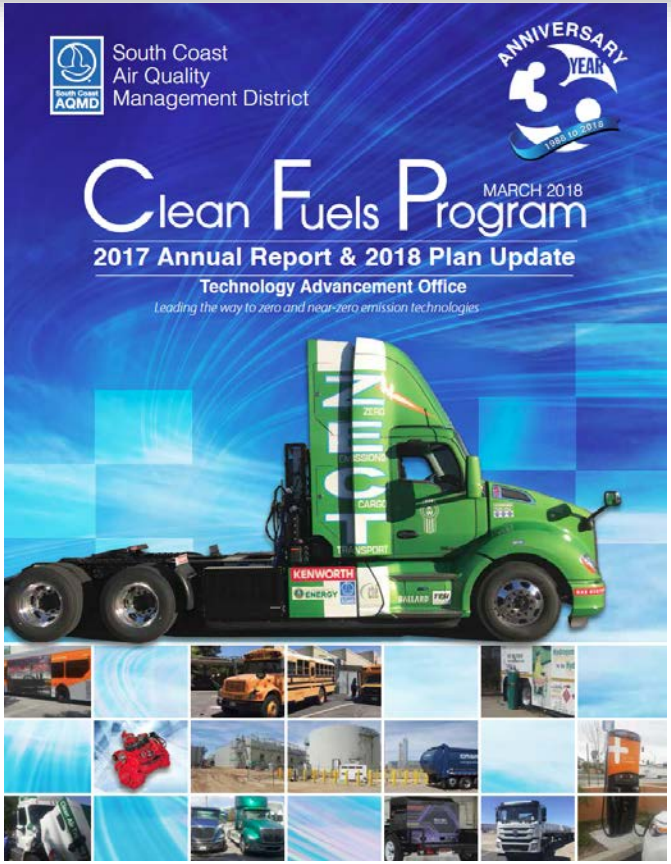


2031 NOx Emissions: 224 tons/day



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

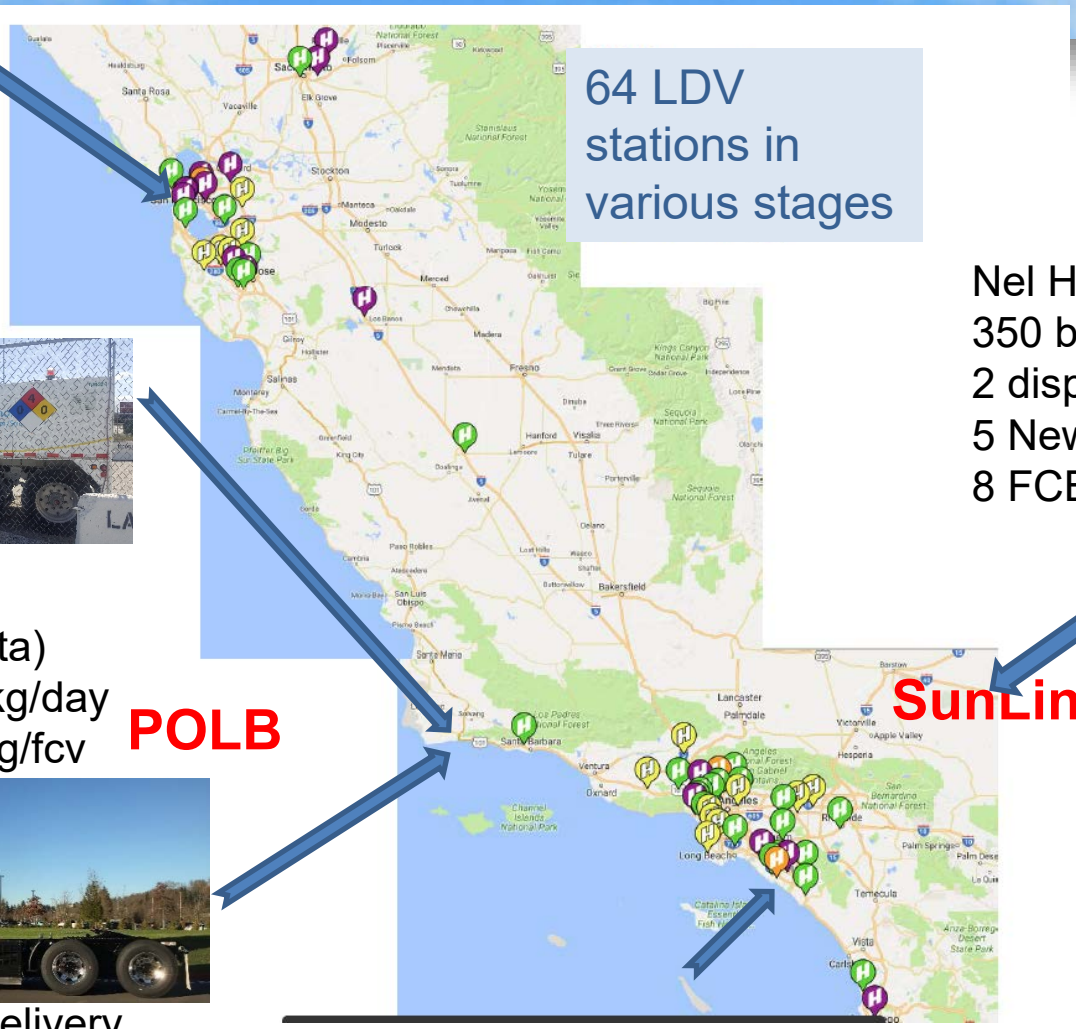
1989		Ballard Fuel Cell Bus Support
1991		First Commercial Stationary Fuel Cell at SCAQMD
1996 – 2000s		Hydrogen Infrastructure and Transit Bus Support
2004		"Five Cities" Stations and 30 H2 Prius Program; AQMD Electrolysis station
2007		National Fuel Cell Bus Program Support
2008 -		CARB and CEC H2 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



64 LDV stations in various stages

POLA

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

POLB

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

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

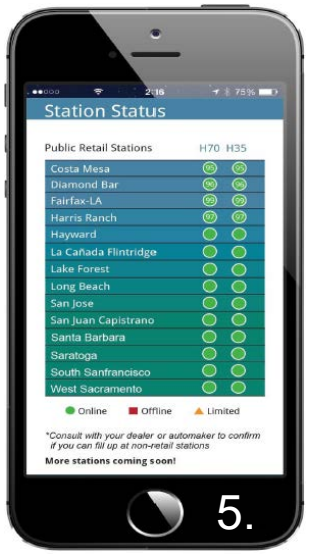
SunLine Transit*

* - 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



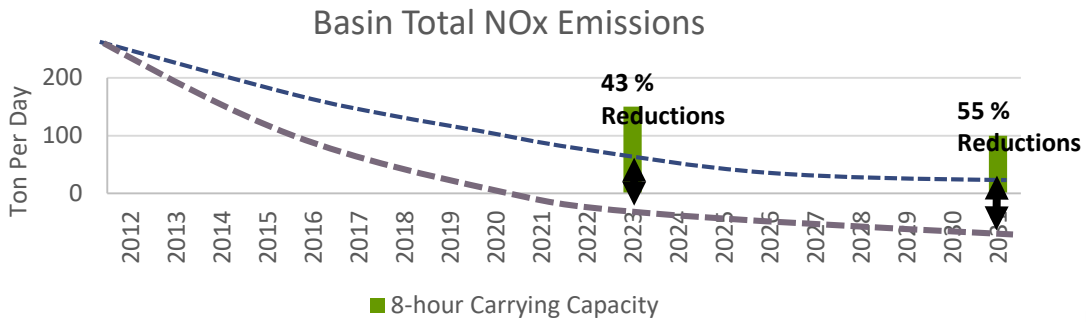
5. Station data posted at www.m.cafcp.org
   35 retail stations open in CA plus 29 under construction

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

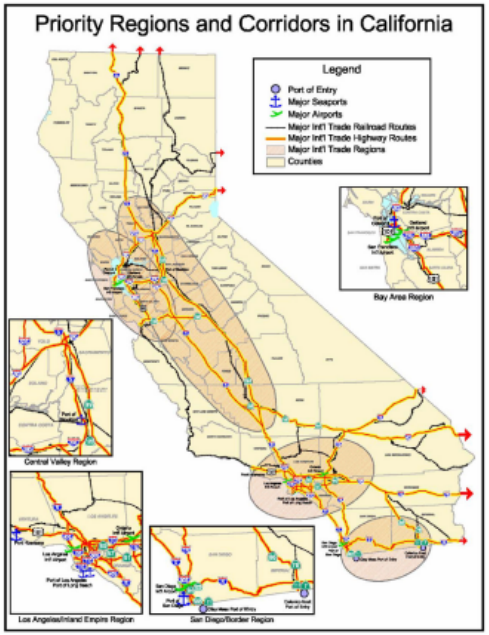
- MOB-01 – Commercial Marine Ports
- MOB-03 – Warehouse Distribution Centers
- MOB-04 – Commercial Airports
- EGM01 – New/Redevelopment Projects

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