FCEVs and H$_2$ in California

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Santa Barbara County Air Pollution Control District
June 2015
Who we are

Air Liquide
Alameda-Contra Costa Transit District *(AC Transit)*
Automotive Fuel Cell Cooperation
BAE Systems
Ballard Power Systems
Bay Area Air Quality Management District
California Air Resources Board
California Department of Food and Agriculture
California Energy Commission
California State University - Los Angeles
CALSTART
The Center for Energy Efficiency and Renewable Technologies *(CEERT)*
Center for Transportation and the Environment *(CTE)*
Daimler
Energy Independence Now
FirstElement
General Motors
Office of Governor Edmund G. Brown Jr.

Honda
Hydrogenics
Hyundai
ITM Power
Institute of Transportation Studies, UC Davis
Linde North America, Inc.
National Fuel Cell Research Center, UC Irvine
National Renewable Energy Laboratory *(NREL)*
Nissan
Sandia National Laboratories
South Coast Air Quality Management District
Southern California Gas Company
SunLine Transit Agency
Toyota
U.S. Department of Energy
U.S. Environmental Protection Agency
US Hybrid
University of California, Berkeley
Volkswagen
California ZEV Action Plan

• By 2015: California major metropolitan areas “ZEV-ready” with infrastructure and streamlined permitting
• By 2020: California ZEV infrastructure can support up to 1 million vehicles
  ▪ Including widespread use of ZEVs for freight and public transit
• By 2025: Over 1.5 million ZEVs in California

Visit www.cafcp.org/toolkits/cities to download the ZEV Action Plan
California is taking the lead

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>Funding</td>
<td>For at least 100 H₂ stations through California Energy Commission, readiness grants</td>
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<tr>
<td>ZEV Action Plan</td>
<td>Agency actions to enable FCEVs and BEVs</td>
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<td>ZEV Manager</td>
<td>Governor appointee to help with planning and permitting for H₂ and charging stations</td>
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<td>State Fire Marshal</td>
<td>Including hydrogen and FCEVs in state training guidelines</td>
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<td>Weights &amp; Measures</td>
<td>Setting standards for certifying dispensers</td>
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<td>Evaluation</td>
<td>Survey of OEM deployment plans</td>
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</table>
How a fuel cell works

1. Hydrogen (H₂)
   - Hydrogen fuel flows into the anode.

2. ELECTRONS
   - The movement of electrons generates electricity to power the motor.

3. OXYGEN (O₂)
   - Oxygen flows into the cathode, where it combines with hydrogen to produce water, which is emitted from the vehicle.

- ANODE: Negative Electrode
- PEM: Proton Exchange Membrane
- CATHODE: Positive Electrode
- H₂O
FCEVs are electric vehicles
Today in California

- Honda, Hyundai and Mercedes lease cars
  - 300+ FCEVs on the road
- Toyota introducing the Mirai; Honda in 2016
  - Many automakers will come to market
- 3 transit agencies operate buses
- 8 open stations
  - 40+ stations in development
More than cars...
Fuel cell buses and trucks

- 19 fuel cell buses
- >1.5M miles in service
- >2.5M passengers carried
- Bus roadmap
- MD/HD roadmap
  - In process

AC Transit, Oakland, CA
13 buses

SunLine Transit, Coachella Valley, CA
5 buses
7 more on the way
Stations must come first

- 68 stations provide coverage to enable market launch
  - Supports customer convenient fueling in early markets
  - Enables travel throughout early market regions and state
- 100 stations to support market growth
Hydrogen stations

Emeryville: H$_2$ from solar electrolysis and liquid delivery

Fountain Valley: H$_2$ from wastewater

Newport Beach: H$_2$ reformation

Harbor City: H$_2$ gaseous delivery
Northern CA Hydrogen Stations

- **Open**
  - Emeryville - AC Transit

- **In Development**
  - Cupertino
  - Foster City
  - Mountain View
  - *West Sacramento
  - Campbell
  - Hayward
  - Mill Valley
  - Oakland
  - Palo Alto
  - Redwood City
  - *Rohnert Park
  - San Jose
  - San Ramon
  - Saratoga
  - South San Francisco
  - *Truckee
  - Woodside

*Not shown on map

January 2015

Managed by BKI

California Fuel Cell Partnership: Driving for the Future
Southern CA Hydrogen Stations

Open
Burbank
Fountain Valley - OCSD
Irvine - UC Irvine
Los Angeles - Harbor City
Newport Beach
*Thousand Palms - SunLine Transit
Torrance

In Development
Anaheim
Chino (upgrade)
Diamond Bar (upgrade)
Irvine - UC Irvine (upgrade)
Irvine - Walnut Ave.
Lawndale
Los Angeles - Cal State LA
Los Angeles - West LA 2
Los Angeles - Woodland Hills
Los Angeles - Beverly Blvd.
Mission Viejo
Redondo Beach
San Juan Capistrano
Santa Monica
*Coalinga
Costa Mesa
La Canada Flintridge
Laguna Niguel
Lake Forest
Long Beach
Los Angeles - LAX (upgrade)
Los Angeles - Lincoln Blvd.
Los Angeles - Hollywood Blvd.
Ontario
Orange
Pacific Palisades
*Riverside
*San Diego
*Santa Barbara
South Pasadena
*Not shown on map

California Fuel Cell Partnership
www.cafcp.org/stationmap
MEETING 2050 GOALS:
NEW PASSENGER VEHICLE SALES

ZEV sales reach 100% by 2040, but on-road fleet is still mixed: ZEVs are 87% of on-road fleet in 2050

Source: CA Air Resources Board
Meeting GHG Goals

![Graph showing the percentage of on-road LDV fleet over time, transitioning from Advanced Gasoline Vehicles to Hydrogen Fuel Cell Vehicles, with targets set for 2050 at 87%.

Source: CA Air Resources Board]
Next H2 station locations

• CaFCP automaker members’ suggestions
  ▪ Identifies next 19 stations
  ▪ Two categories: primary priority, secondary priority

• Locations include
  ▪ Thousand Oaks/Agoura Hills
  ▪ Ventura/Oxnard
We’re here to help

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