Retail Hydrogen Fueling Station Network Update

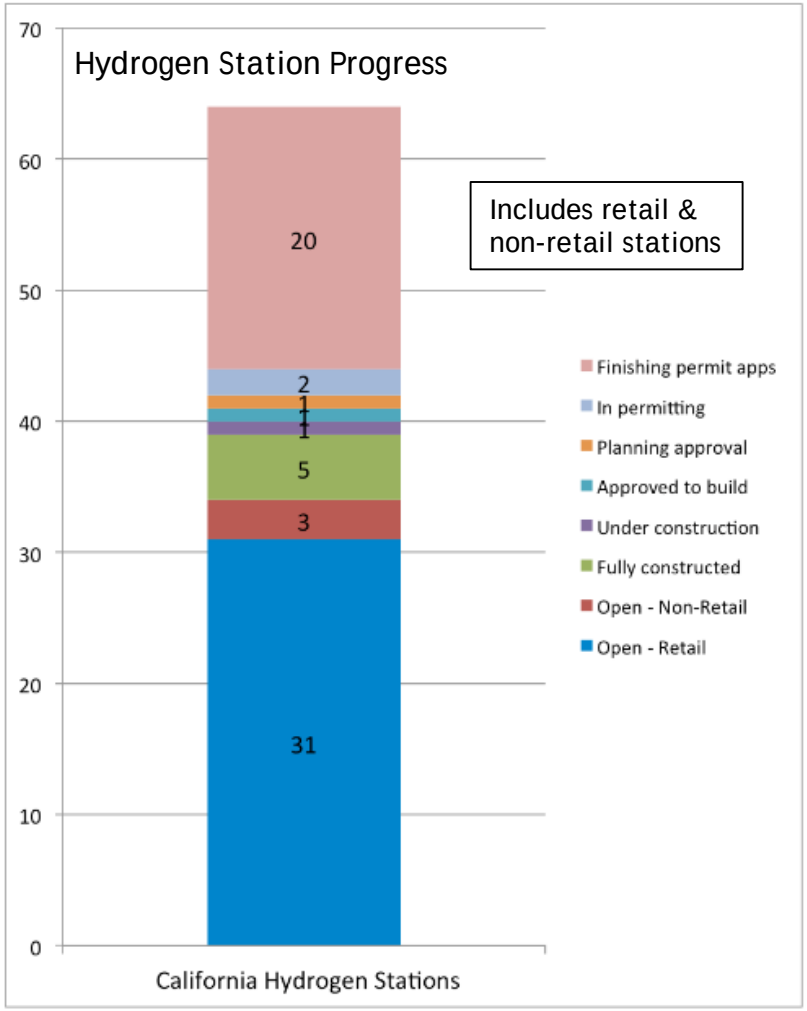
Joe Gagliano & Ben Xiong

February 15, 2018

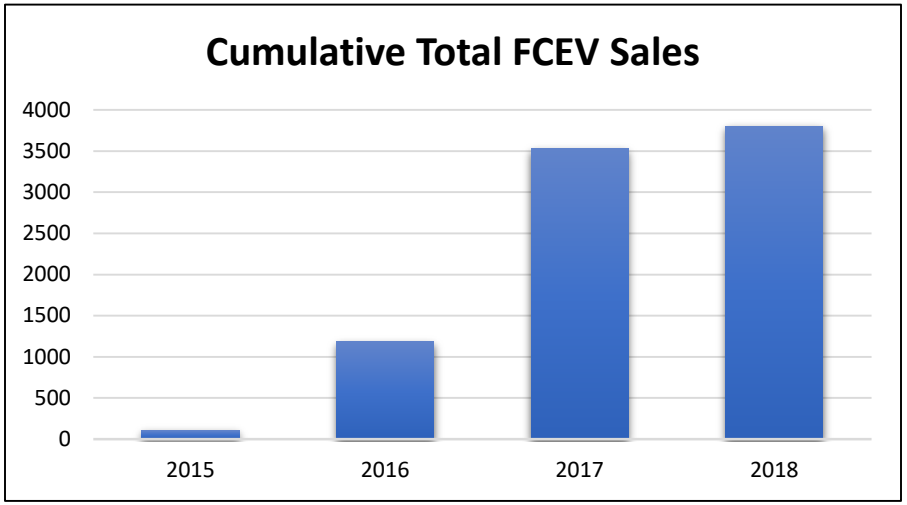
California FUEL CELL PARTNERSHIP

DRIVING FOR THE FUTURE

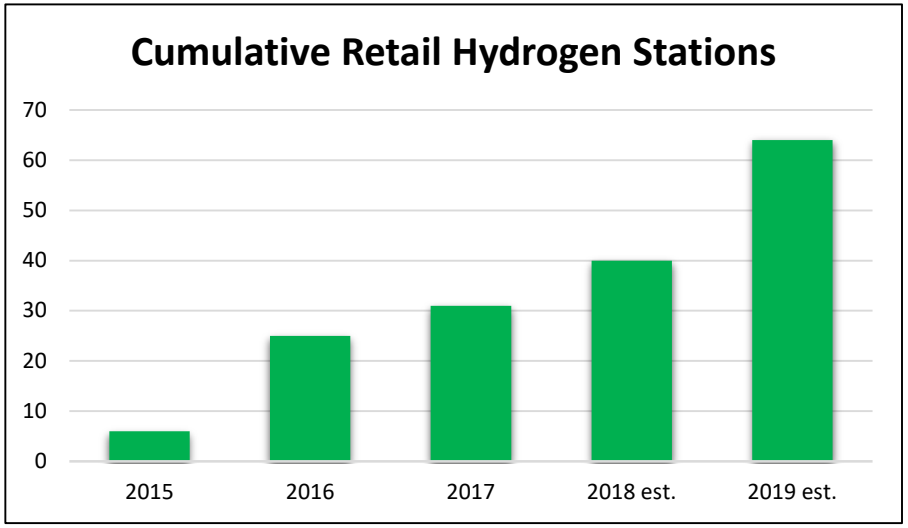
California H2 Station Network & FCEV Totals



Source: Governor's Office of Business and Economic Development

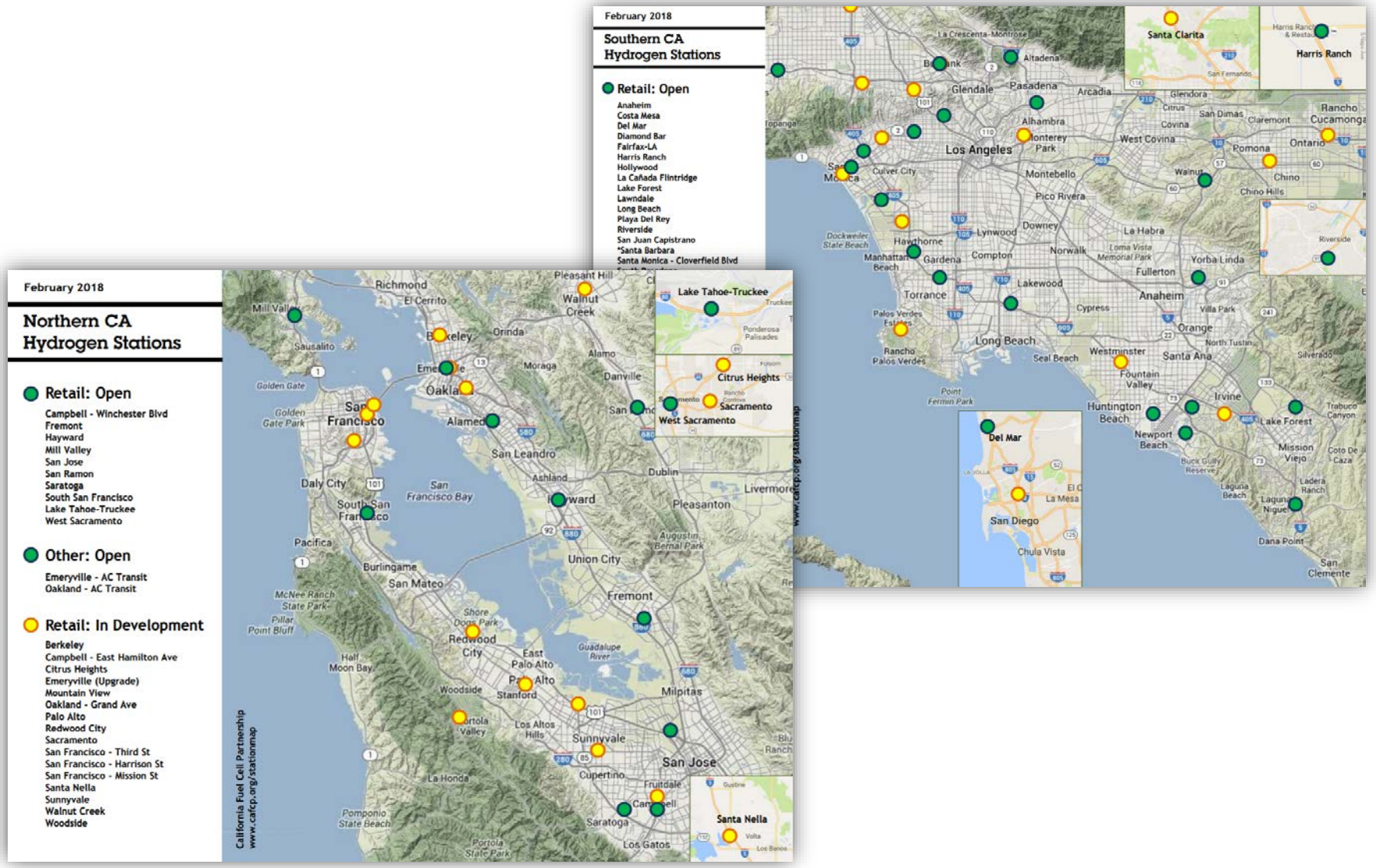


Source: HybridCars.com, Carsalesbase.com, OEMs



Source: Governor's Office of Business and Economic Development

H2 Station Network



https://cafcp.org/sites/default/files/H2-Stations-CA-map-Open-Funded-2018.pdf

Retail Station Opening Projections - 2018

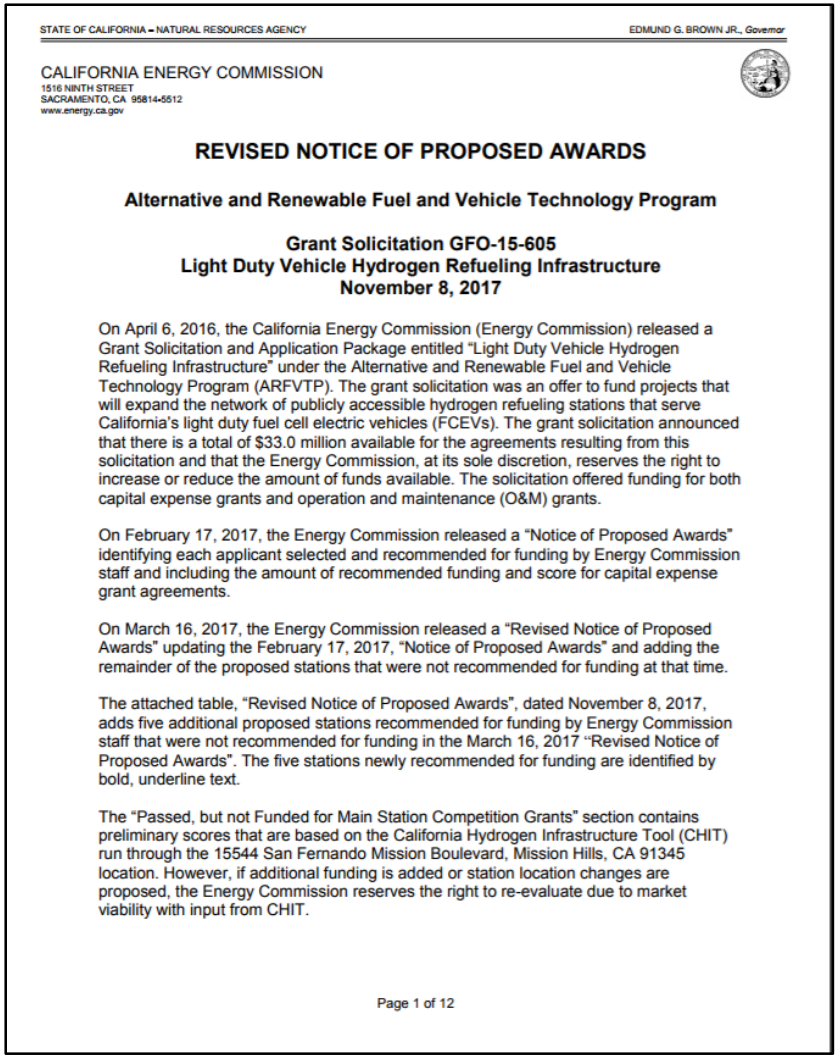
- Ontario
- Woodside
- Mountain View
- LAX
- Thousand Oaks
- Palo Alto
- Emeryville (upgrade)
- Burbank (upgrade)


South Pasadena


Torrance

CEC GFO-15-605 Revised NOPA – Nov. 2017

- Revised NOPA announced additional GFO-15-605 hydrogen station awards:
  - Beverly Hills
  - Studio City
  - Redwood City
  - Mission Hills
- Approved at Jan. 17, 2018 CEC Business Meeting
- Projected open: late 2019-early 2020



STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY — EDMUND G. BROWN JR., Governor

CALIFORNIA ENERGY COMMISSION
1516 NINTH STREET
SACRAMENTO, CA 95814-5512
www.energy.ca.gov

REVISED NOTICE OF PROPOSED AWARDS

Alternative and Renewable Fuel and Vehicle Technology Program

Grant Solicitation GFO-15-605
Light Duty Vehicle Hydrogen Refueling Infrastructure
November 8, 2017

On April 6, 2016, the California Energy Commission (Energy Commission) released a Grant Solicitation and Application Package entitled "Light Duty Vehicle Hydrogen Refueling Infrastructure" under the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP). The grant solicitation was an offer to fund projects that will expand the network of publicly accessible hydrogen refueling stations that serve California's light duty fuel cell electric vehicles (FCEVs). The grant solicitation announced that there is a total of $33.0 million available for the agreements resulting from this solicitation and that the Energy Commission, at its sole discretion, reserves the right to increase or reduce the amount of funds available. The solicitation offered funding for both capital expense grants and operation and maintenance (O&M) grants.

On February 17, 2017, the Energy Commission released a "Notice of Proposed Awards" identifying each applicant selected and recommended for funding by Energy Commission staff and including the amount of recommended funding and score for capital expense grant agreements.

On March 16, 2017, the Energy Commission released a "Revised Notice of Proposed Awards" updating the February 17, 2017, "Notice of Proposed Awards" and adding the remainder of the proposed stations that were not recommended for funding at that time.

The attached table, "Revised Notice of Proposed Awards", dated November 8, 2017, adds five additional proposed stations recommended for funding by Energy Commission staff that were not recommended for funding in the March 16, 2017 "Revised Notice of Proposed Awards". The five stations newly recommended for funding are identified by bold, underline text.

The "Passed, but not Funded for Main Station Competition Grants" section contains preliminary scores that are based on the California Hydrogen Infrastructure Tool (CHIT) run through the 15544 San Fernando Mission Boulevard, Mission Hills, CA 91345 location. However, if additional funding is added or station location changes are proposed, the Energy Commission reserves the right to re-evaluate due to market viability with input from CHIT.

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http://www.energy.ca.gov/contracts/GFO-15-605_NOPA_Rev_11-17.pdf

2017 OEM Priority Location Recommendations

Arvin/Lebec (I-5/Wheeler Ridge Rd.)	Palm Springs/Rancho Mirage
*Barstow/Victorville (I-15)	Rancho Santa Margarita (SR 241)
Baldwin Park/W. Covina (I-10/I-605)	Redondo Beach
Beverly Hills	Redwood City (US 101)
Brea (SR 57)	Sacramento/Downtown (I-5/Bus80)
Calabasas (US 101)	Sacramento/Folsom (US 50)
Cerritos (US 91/I-605)	San Diego /La Jolla–University Town Center
Corona (I-15/US 91)	San Diego/Airport (I-5)
Cupertino	San Diego/Carlsbad-Oceanside (I-5)
Davis (SR 113/I-80)	San Diego/Rancho Bernardo (I-15)
Downey/Norwalk (I-5/I-605)	San Jose/Alamitos (SR 85/SR 87)
Dublin/Pleasanton (I-580/I-680)	San Luis Obispo (US 101)
Garden Grove/Orange (SR 22/I-5)	San Mateo/Foster City
Granada Hills (I-405/SR 118)	San Rafael/Corte Madera (US 101)
Irvine North	Santa Cruz (PCH/SR 17)
Laguna Niguel/Aliso Viejo	Santa Rosa (US 101)
Los Angeles (near Downtown)	Simi Valley (SR 118)
Malibu (PCH)	Temecula (I-15)
Manhattan Beach	Toluca Lake/Burbank (SR 134)
Monterey	Vallejo (I-80/SR 29)
Napa (SR 29/Trancas St.)	Ventura (US 101)
Newport Beach	Walnut Creek (I-680/SR 24)
Pacific Palisades	

www.cafcp.org/sites/default/files/2017-Priority-Station-Location-Letter.pdf

ZEV Executive Order – January 2018

- **5 million ZEVs** on CA roads **by 2030**
- **200 hydrogen fueling stations** by 2025
- Updating 2015 Hydrogen Station Permitting Guidebook
- Updating ZEV Action Plan
- Recommending ways to expand ZEV infrastructure through the Low Carbon Fuel Standard (LCFS) Program

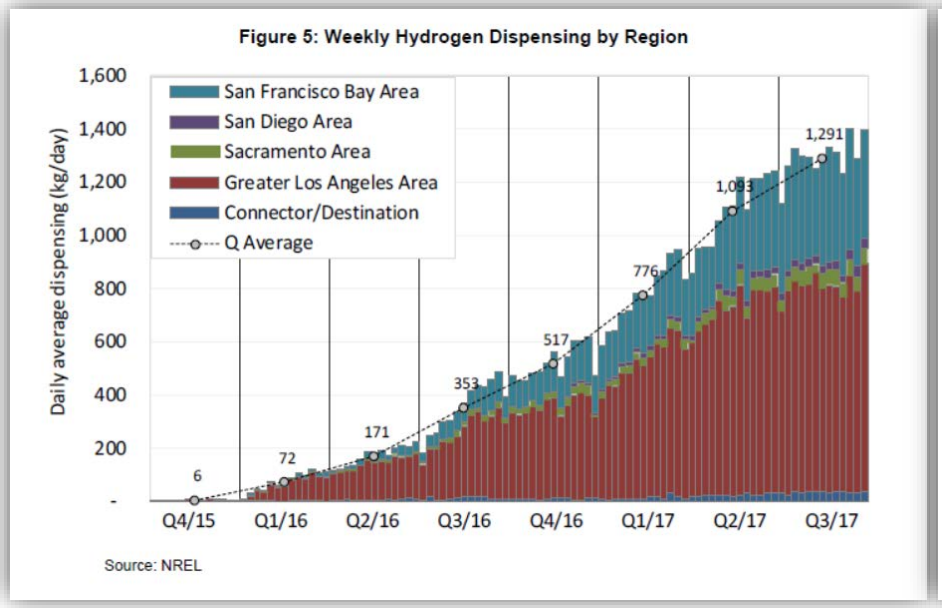
- **ZEV Infrastructure Program** – $900M, 8-year initiative
- $235M in 1st year, $95/year for next 7 years
- ZEV=H2 stations & EV charging stations
- Funding: ARFVTP & one-time funds from expiring New Solar Homes Partnership Program
- **Clean Vehicle Rebate Program** - $200M annually thru 2025 for purchase/lease of light-duty ZEVs and plug-in hybrids
- Funding source: Cap & Trade funds

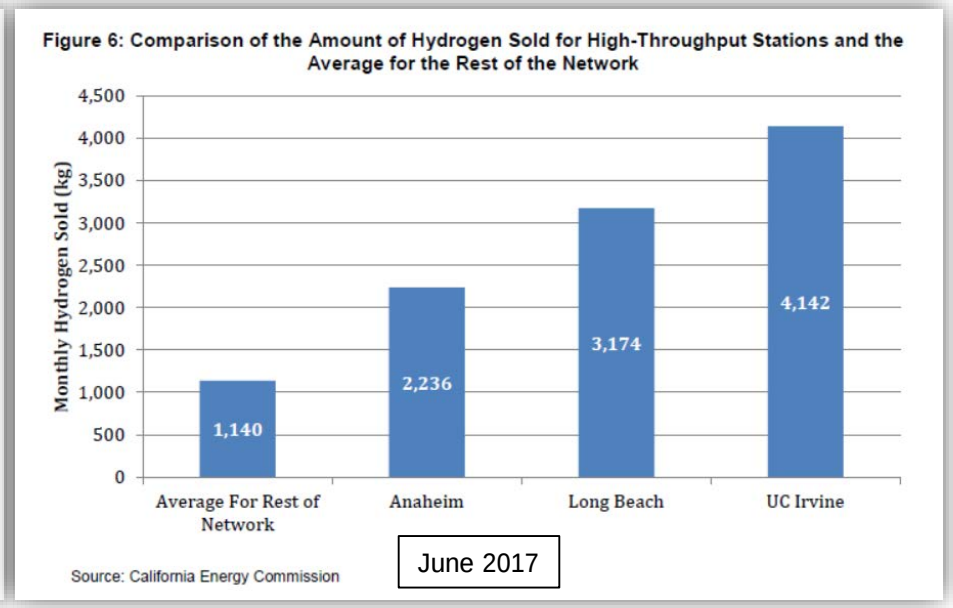
https://www.gov.ca.gov/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/

H2 Market Activation

- To achieve H2 station goals (200 HRS by 2025 and CaFCP Vision 2030 goals of 500+) will require more than CEC GFO grant funding process
- Industry stakeholders developing additional policy mechanisms to propel the commercial FCEV market and H2 station network
- Examples:
  - LCFS Program modification
  - Investment tax credits
  - Fuel rebate program
  - Targeted grant program

Joint AB 8 Report 2017 – Station Usage





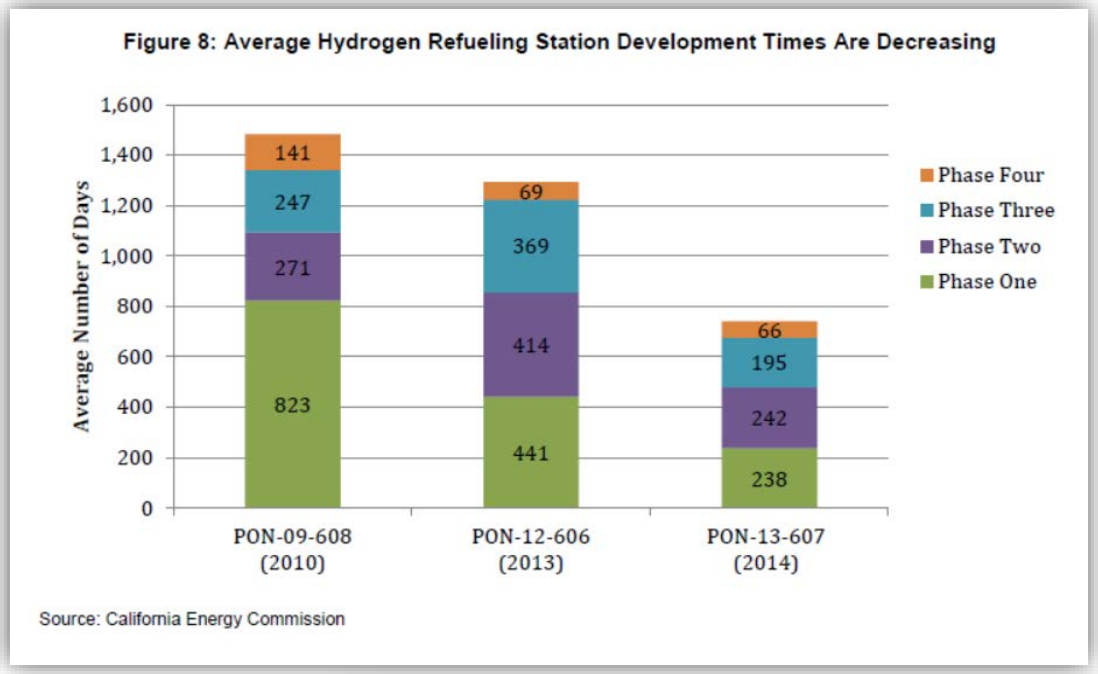
Station Usage – Figure 5

- Shows average dispensed hydrogen in kg/day in each quarter.
- In Q3 of 2017, nearly **1,300 kilograms of hydrogen were dispensed a day on average**.
- Using the average fueling quantity of 3.1 kg/fill observed in the same quarter, this amount of dispensing equates to filling nearly 420 FCEVs a day.
- On July 19, 2017, FirstElement Fuel's network alone sold more than 1,000 kilograms of hydrogen in one day, or enough to fill about 320 FCEVs.

High-Throughput Stations – Figure 6

- Anaheim and Long Beach experience high usage to the point that they require up to two truck deliveries of 100 kg of hydrogen per day.
- Comparison of the amount of hydrogen that was sold during June 2017 for each of the high-throughput stations and the rest of the network.

Joint AB 8 Report 2017 – Station Timelines

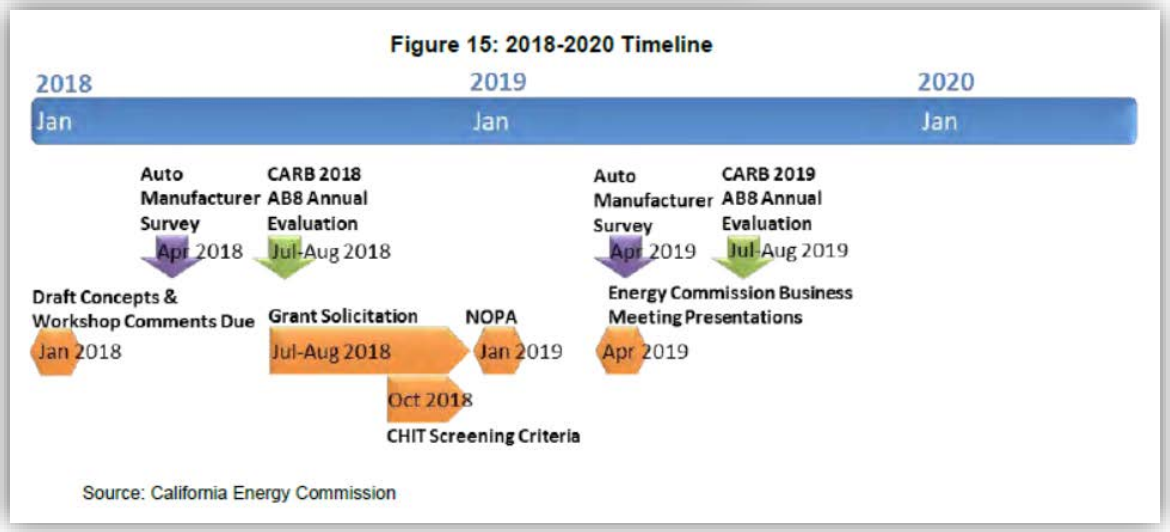


Phase One: Start of Energy Commission grant-funded project to initial permit application filing

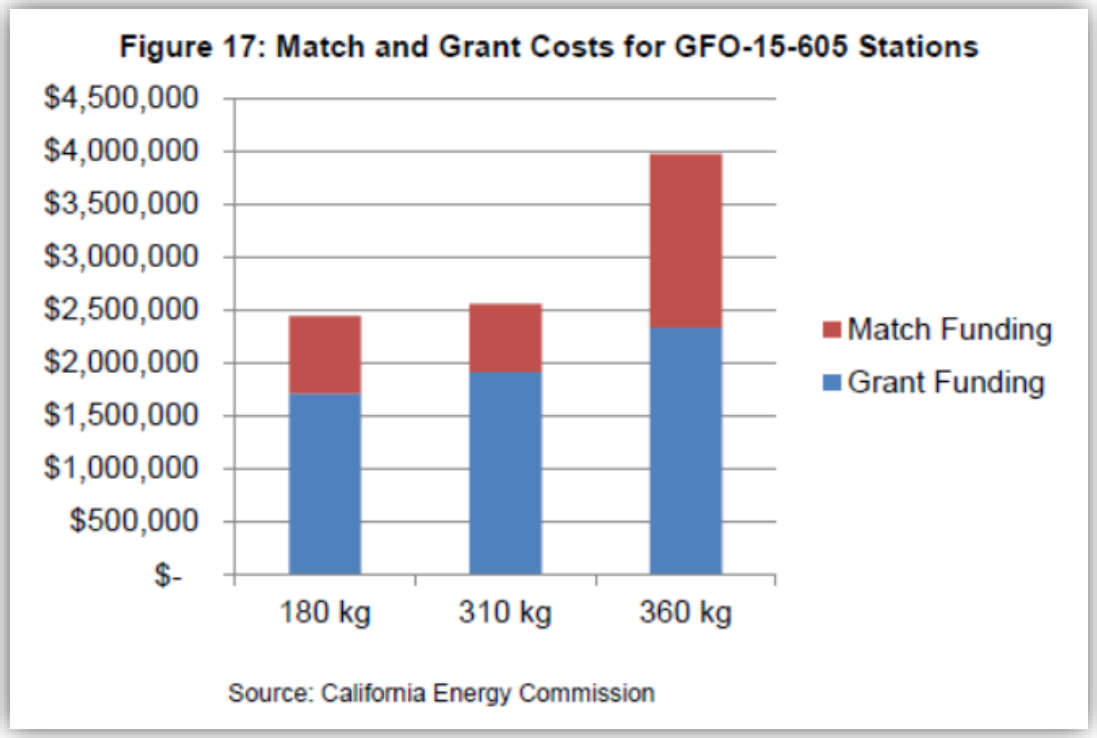
Phase Two: Initial permit application filing to receipt of approval to build

Phase Three: Approval to build to becoming operational

Phase Four: Operational to open retail



Joint AB 8 Report 2017 – Station Costs

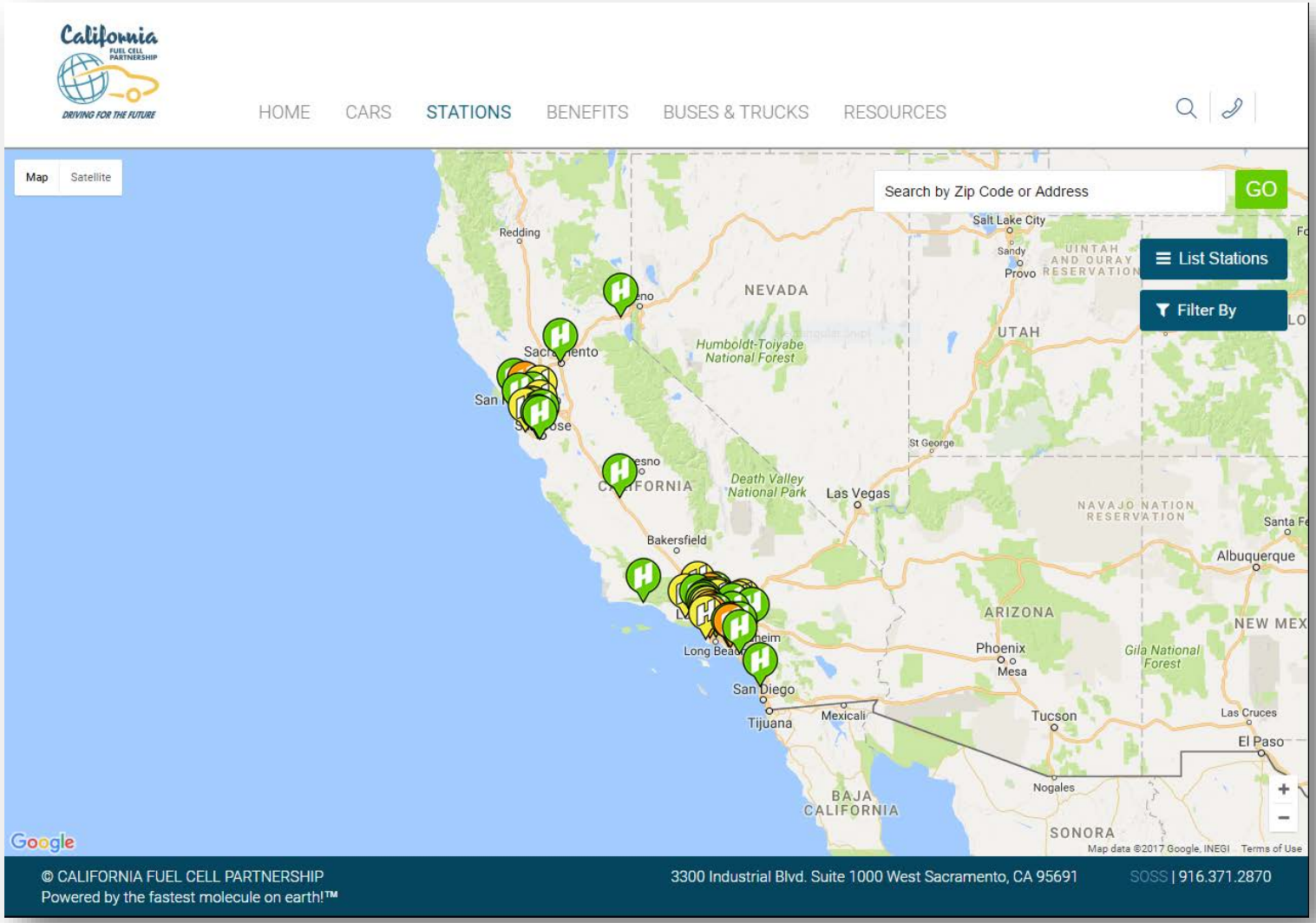


Capital Costs of Hydrogen Refueling Stations

- According to the budgets for the 21 awarded stations under GFO-15-605, the equipment, design, engineering, construction, project management, and overhead costs ("**all-in costs**" include match funding) for hydrogen refueling stations with delivered gas are **nearly $2.5 million for 310 kg/day stations** (for main stations), **nearly $4.0 million for 360 kg/day stations** (for main stations), and **nearly $2.4 million for a 180/day station** (a connector station).
- The **360 kg/day stations** funded under GFO-15-605 **provide two independent, redundant compressors, storage systems, and dispenser systems.** This design allows FCEV drivers to refuel even if one dispenser goes off-line, meaning the station provides redundancy and backup to itself.

http://www.energy.ca.gov/2017publications/CEC-600-2017-011/CEC-600-2017-011.pdf

CAFCP Station Map & SOSS

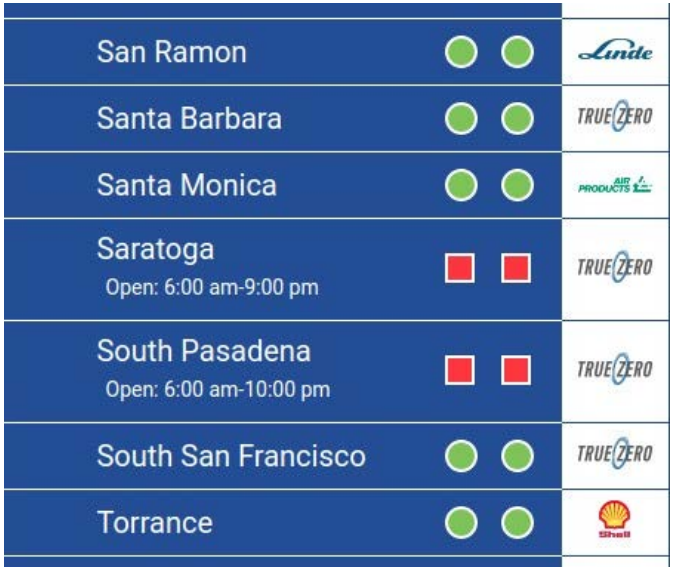


http://cafcp.org/stationmap
http://m.cafcp.org

SOSS – Routine Station Closing

As - is

Empty boxes



Hours

Combo

Hydrogen Production On A Renewable Pathway

Like electricity

- California requires 33% of hydrogen fuel to be renewable
- Hollywood & Playa del Rey stations use 100% renewable H2; Riverside electrolyzer H2 production onsite
- Renewable H2 road map is in development
- California Energy Commission considering demonstration project for renewable H2 transportation fuel
- Stakeholders educating policy makers about renewable H2 and energy storage

Northeast Retail H2 Stations

Update

- Hartford, Connecticut station completed construction / commissioning, and being Stress Tested
- Providence, Rhode Island station completed construction / commissioning, and being Stress Tested
- Mansfield, Massachusetts completed construction and presently commissioning (first fill of hydrogen week one of February)
- Hempstead, New York completed construction and presently commissioning, scheduled for end of Q1 2018 early Q2 (first fill of hydrogen January 15 2018)
- All other locations in permitting phase and planning

Building the Northeast

Network of 12 stations in collaboration with:

TOYOTA

Dedicated hydrogen supply chain provided by:

Air Liquide

New York
Bronx, NY
Hempstead, NY
Brooklyn, NY
Site Location TBA

New Jersey
Lodi, NJ
Whippany, NJ

Rhode Island
Providence, RI

Connecticut
Hartford, CT

Massachusetts
Braintree, MA
Mansfield, MA
Site Location TBA
Site Location TBA

In Closing

- Network of 31 retail hydrogen stations open in CA
- All stations use minimum 33% renewable H2
- Over 3,800 light-duty FCEVs on California roadways
- Governor's EO – 200 HRS by 2025; $900M, 8-yr initiative
- HRS station usage is increasing; HRS build timelines decreasing
- In Northeast, 4 retail hydrogen stations in commissioning
- CaFCP Members developing a Vision 2030 document to accelerate market expansion beyond 500+ retail stations
- Stakeholders working on potential policy mechanisms to accelerate commercial H2 FCEV market & decrease HRS costs

CaFCP Members

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)*
Comdata
Energy Independence Now
FASTECH
FirstElement Fuel, Inc.
General Motors
Honda
Hydrogenics
Hydrogen-XT, Inc.
HyGen
Hyundai
ITM Power
Institute of Transportation Studies, UC Davis
Kobelco
KPA
Linde North America, Inc.
Mercedes-Benz
National Fuel Cell Research Center, UC Irvine
National Renewable Energy Laboratory *(NREL)*
Nel Hydrogen
Nissan
Office of Governor Edmund G. Brown Jr.
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
University of California, Berkeley
Volkswagen

CaFCP Members

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www.cafcp.org

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By the Numbers

Numbers as of February 1, 2018	Total
*FCEVs—Fuel cell cars sold and leased	3,801
FCEBs—Fuel cell buses in operation in California	20
Retail hydrogen stations open in California	31
Fuel cell buses in development in California	33
Fuel cell shuttles in development in California	4
**Retail hydrogen stations in development in California	31