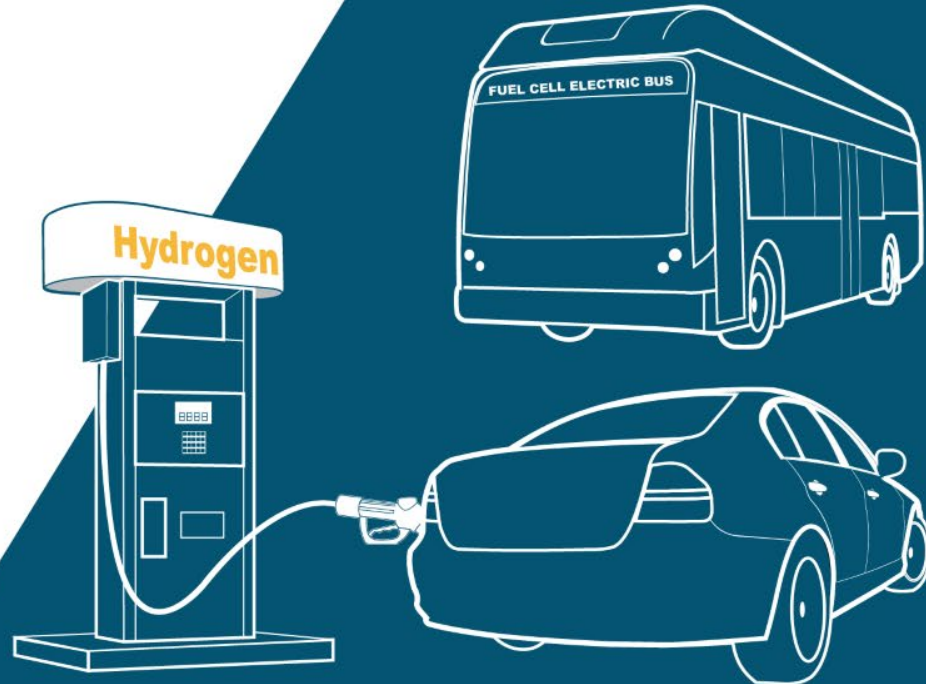


Retail Hydrogen Fueling Station Network Update

Keith Malone & Ben Xiong

Fall 2018





CaFCP Members



By the Numbers

	Numbers as of October 1, 2018	Total
*FCEVs—Fuel cell cars sold and leased in US		5,344
FCEBs—Fuel cell buses in operation in California		25
Retail hydrogen stations open in California		35
Fuel cell buses in development in California		27
Fuel cell shuttles in development in California		4
**Retail hydrogen stations in development in California		29



A Vision for 2030 in California

Governor's
goal of
5,000,000
zero-emission
vehicles by
2030.

100 

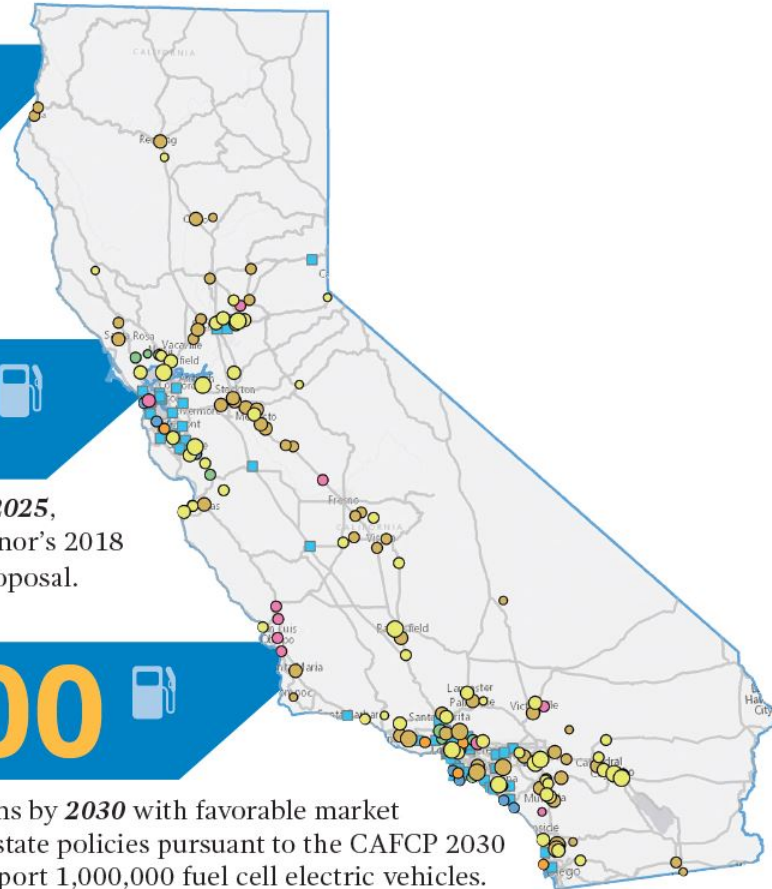
hydrogen stations by **2020**.
Funded by Assembly Bill 8
(2013).

200 

hydrogen stations by **2025**,
pursuant to the Governor's 2018
ZEV infrastructure Proposal.

1000 

hydrogen stations by **2030** with favorable market
conditions and state policies pursuant to the CAFCP 2030
vision. Will support 1,000,000 fuel cell electric vehicles.



California Fuel Cell Revolution - <https://cafcf.org/sites/default/files/CAFCR.pdf>

100-200-1000 handout - https://cafcf.org/sites/default/files/hydrogen-stations_100-200-1000.pdf

CA Governor's Executive Order B-48-18 - <https://www.gov.ca.gov/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles/>



Hyundai NEXO

N E X O

H:\Pictures\FE\NEXO_FC_logo.png

- World's first dedicated hydrogen-powered SUV
- Longest driving range of any zero-emissions vehicle (380 miles)
- Hyundai's technological flagship with cutting-edge convenience technologies
- Class-leading advanced driver assist system
- 10 year / 100,000 mile powertrain warranty, lifetime Battery Warranty
- Available in two trims- Blue and Limited; start of sales before year end





Hyundai NEXO

	NEXO
Fuel Cell Stack	95kW (127hp)
Battery	40kW (54hp)
Max. Power	161hp / 5,000rpm
Max. Torque	291 lb. - ft. / 1,000rpm
Motor System	120kW (161hp)
H ₂ Container	13.96lb. (@10,000psi)
Fuel Economy (mpge)	61 (Blue) (65/58) 57 (Limited) (59/54)
Driving Range	380miles (Blue) 354miles (Limited)
Max. Speed	110mph

N E X O
Fuel Cell





Retail Stations - Highlights

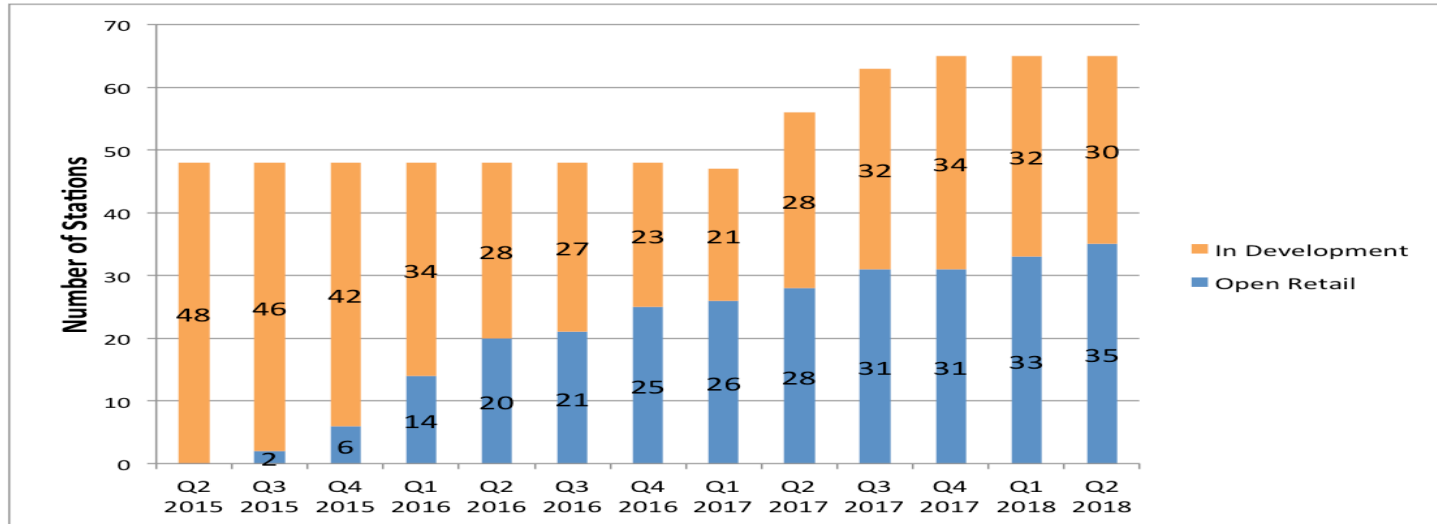
Slated to open in 2018

- Burbank (upgrade)
- LAX
- Palo Alto
- Emeryville (upgrade)

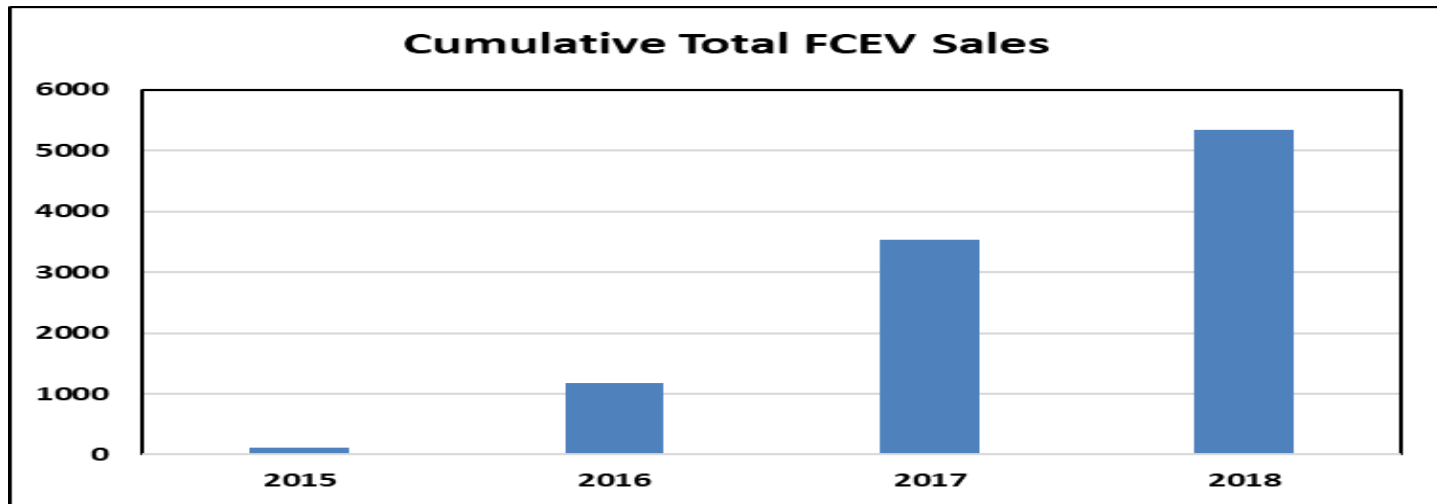
Under construction (early 2019)

- Sacramento
- Citrus Heights

California H2 Station Network & FCEV Totals



Source: Governor's Office of Business and Economic Development



Source: HybridCars.com, Carsalesbase.com, OEMs

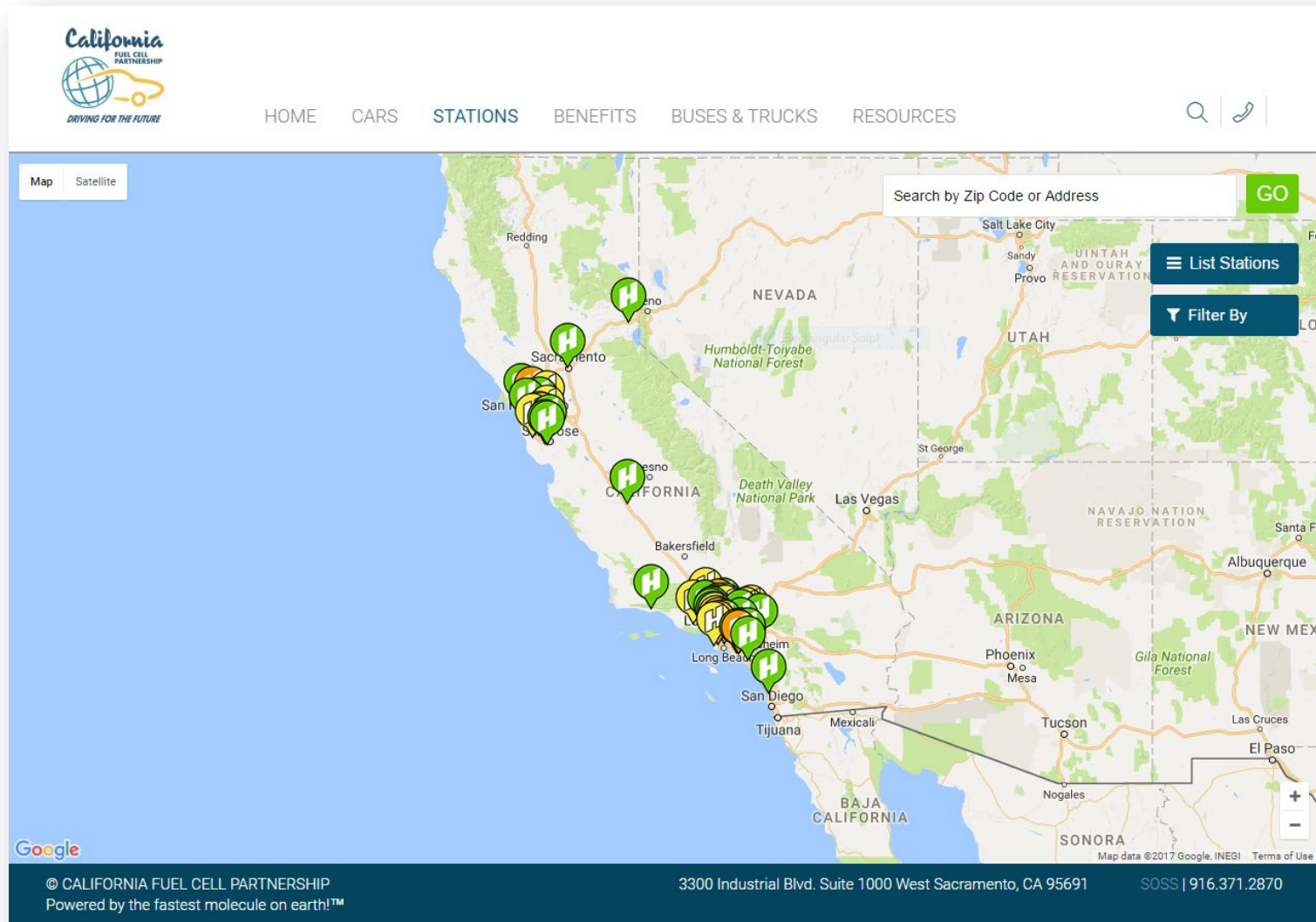


LCFS Infrastructure Amendment

- LCFS currently enables generation of credits from **H2 fuel sales**.
- Amendment adds the ability for hydrogen station developers and operators to generate credits for installed station capacity effective January 2019
- Incentivizes the investment and construction of larger, cleaner stations
- Proposal increases renewable hydrogen content to 40%



CaFCP Station Map & SOSS



The screenshot shows the CaFCP Station Map & SOSS website. At the top left is the logo for the California Fuel Cell Partnership, featuring a globe and a fuel cell icon, with the text "California FUEL CELL PARTNERSHIP" and "DRIVING FOR THE FUTURE". To the right of the logo is a navigation menu with links for HOME, CARS, STATIONS, BENEFITS, BUSES & TRUCKS, and RESOURCES. A search bar is located in the top right corner, with a magnifying glass icon and a "GO" button. Below the navigation menu is a map of California and surrounding regions, including Nevada, Utah, Arizona, and Baja California. The map is overlaid with numerous green circular icons, each containing a white "H", representing hydrogen stations. These icons are clustered in the San Francisco Bay Area, the Sacramento Valley, and the Los Angeles area. On the right side of the map, there are two dark blue buttons: "List Stations" and "Filter By". At the bottom of the map, there is a Google logo and copyright information: "© CALIFORNIA FUEL CELL PARTNERSHIP Powered by the fastest molecule on earth!™". To the right of the copyright information is the address "3300 Industrial Blvd. Suite 1000 West Sacramento, CA 95691" and the phone number "SOSS | 916.371.2870".

<http://cafcp.org/stationmap>

<http://m.cafcp.org>



Trucks and Heavy Duty FCEVs in California

California Air Resources Board preliminary awards \$41 million for Port of LA project

- 10 zero-emissions heavy-duty hydrogen fuel-cell-electric trucks
- 2 heavy-duty hydrogen stations
- 4 zero-emissions cargo handling equipment

Partnership of

- Toyota
- Kenworth
- Shell
- Port of LA

Toyota and Shell already working on Port of Long Beach project, earlier funded

Announcements:

<https://corporatenews.pressroom.toyota.com/releases/pola+preliminarily+awarded+41m+calif+air+resources+board+launch+zero+emissions+hydrogen+fuel+project.htm>

https://corporatenews.pressroom.toyota.com/releases/shell+and+toyota+move+forward+with+hydrogen+facility+freight+port+long+beach.htm?view_id=43438





Hydrogen Production On A Renewable Pathway

Like electricity

- California 33% renewable H2 requirement
- Hydrogen Council commitment to 100% decarbonized H2 fuel by 2030
- CA Energy Commission funded two more renewable H2 projects to Shell and H2B2 USA.
- Total of three CEC-funded renewable H2 projects in Inland Empire, Central Valley and Bay Area.



Energy Commission grant announcement - https://www.energy.ca.gov/contracts/GFO-17-602_NOPA_revised.pdf

Advanced Power and Energy Program Receives CEC Grant for California Renewable Hydrogen Deployment Roadmap

12

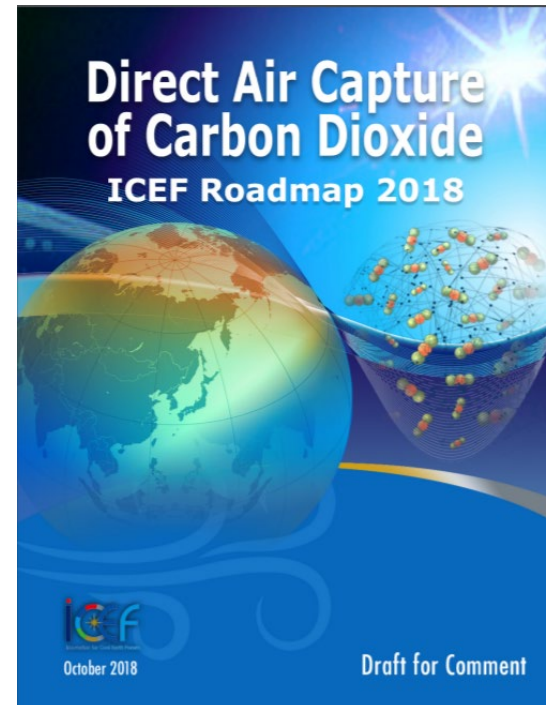
http://www.apec.uci.edu/NewsAndEvents/APEP_Receives_CEC_Grant_For_California_Renewable_Hydrogen_Deployment_Roadmap_090518.a



Hydrogen (continued)



- Carbon emissions reductions can be "achieved through combinations of new and existing technologies and practices, including electrification, hydrogen..."
http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

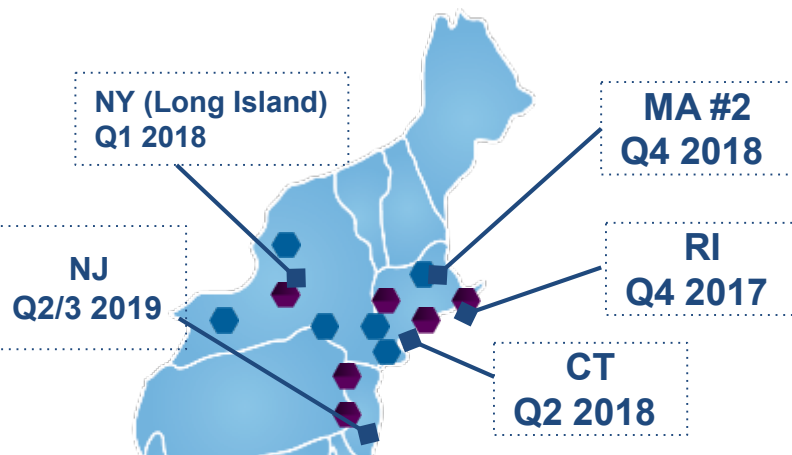


- Some of these (e.g., electrochemical weathering) also have the benefit of generating hydrogen..." https://www.icef-forum.org/pdf2018/roadmap/ICEF2018_Roadmap_Draft_for_Comment_20181012.pdf



Northeast Retail H2 Stations

- 4 stations built and awaiting vehicles
- Broke ground on 2nd station in Massachusetts



New York

Bronx, NY
Hempstead, NY
Site Location TBA



New Jersey

Lodi, NJ
Whippany, NJ



Rhode Island

Providence, RI



Connecticut

Hartford, CT



Massachusetts

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

Network of 12 stations in collaboration with:



TOYOTA

Dedicated hydrogen supply chain provided by:





Pacific Northwest Retail H2 Stations

- 1st retail station in Vancouver, British Columbia
 - 5 more expected
- HTEC is developing a total of 6 British Columbia H2 fueling stations in partnership with others, including Shell
- HTEC also in partnership with Harnois Groupe pétrolier in Quebec



HTEC's British Columbia Retail H2 Stations



Station #	Location	Opening
Station #1 -Shell	8686 Granville Street, Van	June 2018
Station #2 –Shell	4505 Canada Way, Bby	April 2019
Station #3 –TBA	Victoria	Q2/3 2019
Station #4 –TBA	North Vancouver	Q2/3 2019
Station #5 – Shell	Vancouver	Q4 2019
Station #6 – TBA	Vancouver	Q2 2020

Hawai'i Retail H2 Stations

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Transportation

Servco opens Hawaii's first publicly accessible hydrogen station





In Closing

- More than 5,000 light-duty FCEVs on CA roadways
- Network of 35 light-duty retail hydrogen stations open
 - 3 stations for heavy-duty funded
- CA Governor's goal of 200 stations by 2025
- All CA stations use minimum 33% renewable H2
- In Northeast, 4 retail hydrogen stations, ready and waiting
- In Northwest, 1 station in Vancouver, BC, 5 to come
- In Hawai'i, 1 station on outskirts of Honolulu
- CaFCP Vision 2030 document to accelerate market expansion to 1,000+ retail stations, and guide efforts for buses, trucks and renewable H2
 - Members beginning work on potential policy mechanisms to accelerate commercial FCEV market & decrease costs



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