

# California

FUEL CELL  
PARTNERSHIP

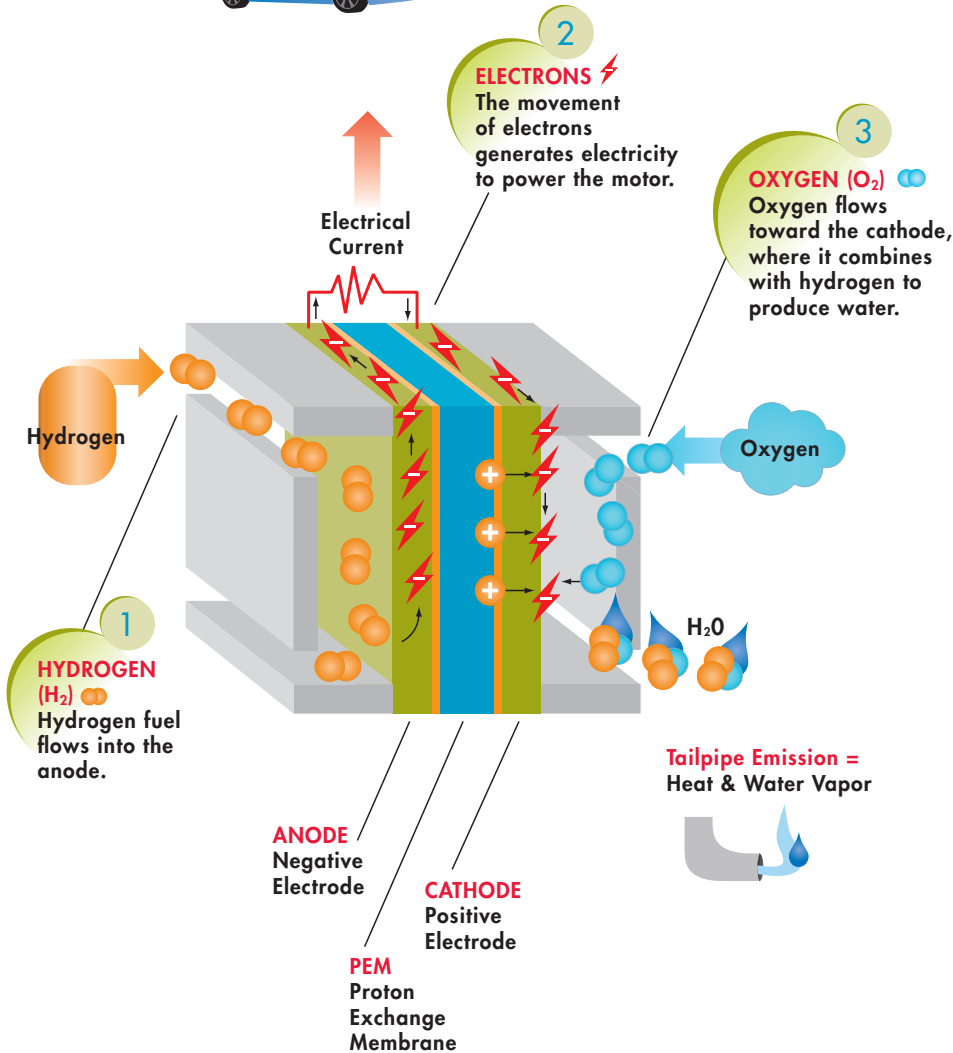


*DRIVING FOR THE FUTURE*

## HOW IT WORKS

[www.cafcp.org](http://www.cafcp.org)

## FUEL CELL ENERGY POWERS THE CAR!



Fuel cells also provide power to forklifts, airport tugs and even NASA's space shuttles. Large fuel cells can create electricity for houses and buildings. Stationary fuel cells can provide reliable, high-quality emergency power or back-up power.

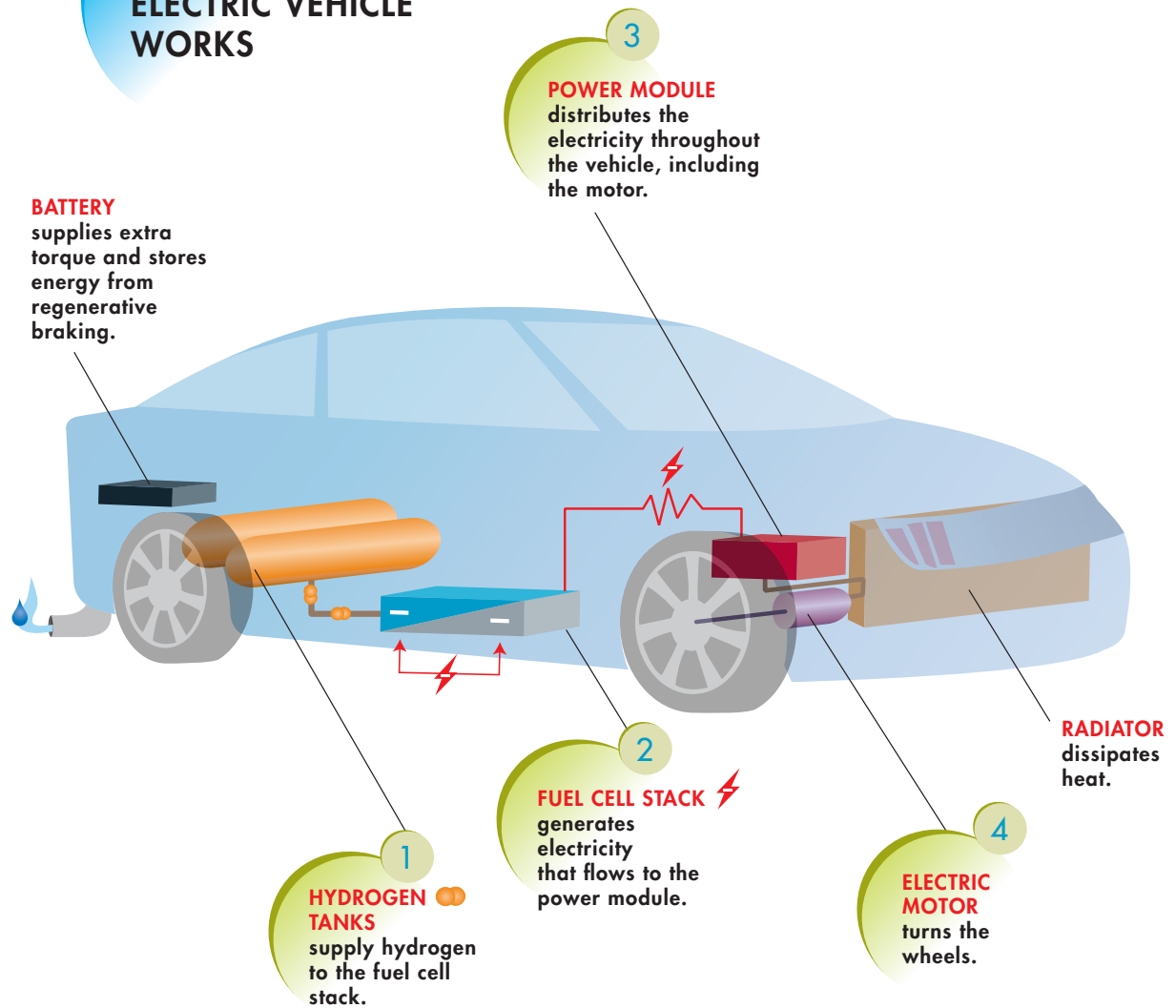
Automakers and bus builders use proton exchange membrane, or PEM, fuel cells to power the vehicles. A PEM fuel cell combines hydrogen fuel with oxygen from the air to generate electricity. In its simplest form, a PEM fuel cell is two electrodes—the anode and the cathode—separated by a catalyst-coated membrane. Fuel cells produce electricity as long as fuel is supplied.

A fuel cell stack is made up of many PEM fuel cells that are stacked together, like slices in a loaf of bread. The stack generates electricity that powers the vehicle.

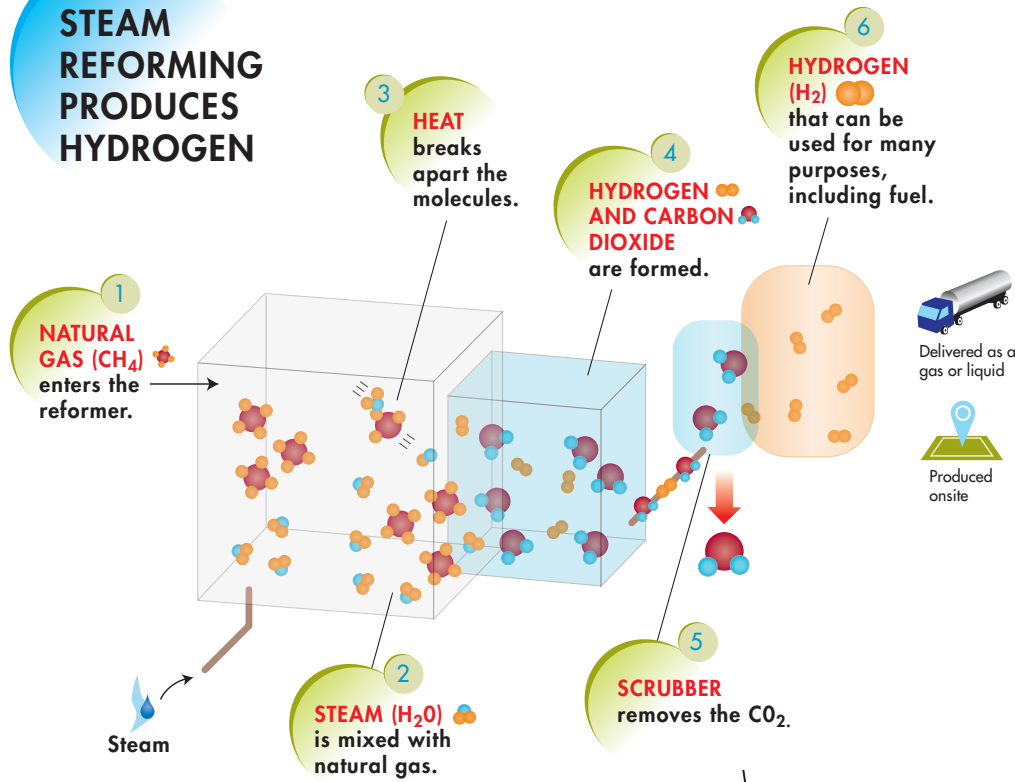
The electricity from the fuel cell stack flows into a power module, which distributes the electricity to the electric motor that turns the wheels of the car. The power module also distributes electricity to the air conditioning, sound system and other on-board devices.

A high-voltage battery, similar to those in gasoline hybrids, provides extra torque when accelerating or climbing a hill, and helps improve fuel economy. Regenerative braking charges the battery.

## HOW A FUEL CELL ELECTRIC VEHICLE WORKS



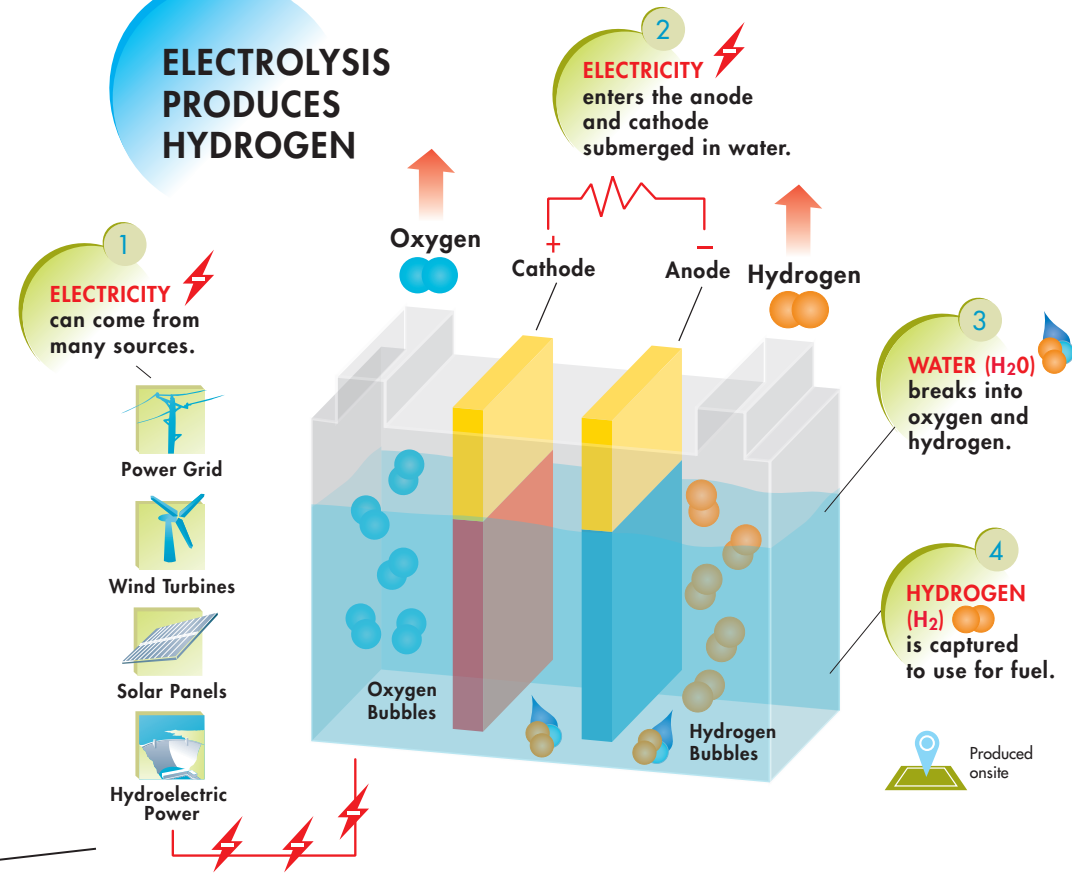
## STEAM REFORMING PRODUCES HYDROGEN



“Reforming” combines natural gas or biogas with superheated steam. The heat and a catalyst cause the molecules to collide and break apart. Oxygen and carbon combine to form CO<sub>2</sub> and the released hydrogen molecule is captured for many uses, including gasoline refining and processing consumer goods and food.

Hydrogen made at a central production plant is delivered to a station as a liquid or a compressed gas. A few stations make hydrogen onsite.

## ELECTROLYSIS PRODUCES HYDROGEN

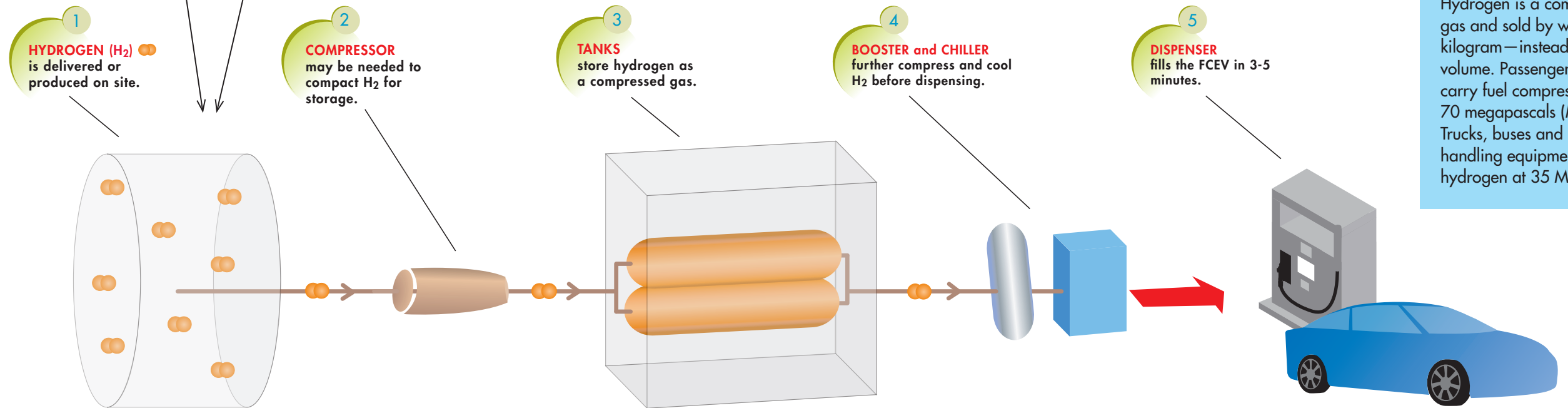


Electrolysis passes a current through water, splitting water molecules into hydrogen and oxygen. The electrolyzer contains a thin membrane coated with a catalyst to speed the reaction. Oxygen is released and gaseous hydrogen is stored for fuel. Currently, all electrolysis is done onsite at the station using renewable electricity.

Researchers are also looking at hydrogen produced from electrolysis as energy storage—a way to save excess solar and wind power and later put it back into the grid.

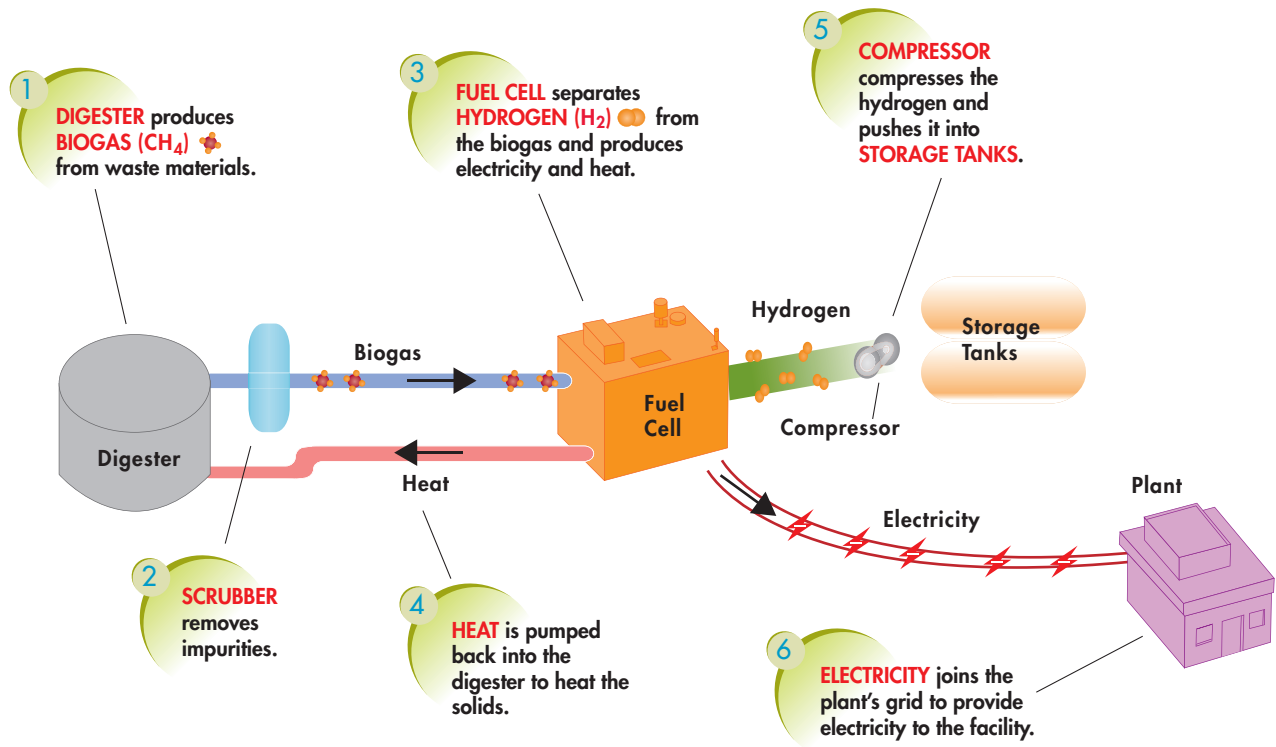
## HYDROGEN STATIONS REFUEL FCEVs

Most hydrogen stations in the U.S. are added to existing gas stations and function like a typical gas station. Hydrogen storage and dispensing equipment is above ground, and hydrogen is dispensed as a compressed gas. Some stations make the hydrogen onsite, others have hydrogen delivered as a liquid, and others receive hydrogen as a compressed gas. The manner of delivery dictates the equipment at the station.



Hydrogen is a compressed gas and sold by weight—a kilogram—instead of volume. Passenger vehicles carry fuel compressed to 70 megapascals (MPa). Trucks, buses and material handling equipment use hydrogen at 35 MPa.

## HYDROGEN, HEAT AND POWER



Waste materials—sewage, crop waste, cow manure—enter a digester in which microbes convert the waste into methane (CH<sub>4</sub>), a biogas similar to natural gas. A scrubber removes impurities in the biogas, including carbon and sulfur. Clean biogas enters a stationary fuel cell that separates the CH<sub>4</sub> into hydrogen and CO<sub>2</sub>. Excess heat generated in the reaction goes back into the digester and excess energy feeds into the plant's electrical system. Hydrogen is compressed and stored for dispensing on site.

The California Fuel Cell Partnership is a collaboration of industry, government, NGOs and transit agencies that work together to promote the commercialization of electric vehicles and hydrogen fuel.

Today, CaFCP members operate FCEVs and hydrogen stations in California, and in other regions of the U.S. and countries around the world.

## FAST FACTS

- FCEVs are available now in California, Japan, and Europe, and coming soon to other areas.
- FCEVs have driving range and refill time similar to a gasoline vehicle, and the power and performance of an electric car.
- FCEVs are zero-emission vehicles and eligible for state and federal incentives, including rebates, tax credits and HOV stickers.
- Hydrogen stations are open and under construction in California, the Northeast U.S., Japan, Germany, South Korea, the UK, Scandinavia, and elsewhere.
- Hydrogen can be made from many sources, including renewables, providing every region with energy security.

For more information, please visit the California Fuel Cell Partnership's website at [www.cafcp.org](http://www.cafcp.org).

## HYDROGEN STATION MAP

The California Fuel Cell Partnership's interactive station map provides up-to-date information about hydrogen stations open, in construction and planned throughout the state. Visit [www.cafcp.org/stationmap](http://www.cafcp.org/stationmap).

The screenshot shows the California Fuel Cell Partnership's Hydrogen Station Map website. The page has a navigation menu with links for HOME, CARS, STATIONS, BENEFITS, BUSES & TRUCKS, and RESOURCES. A search bar is present with a 'GO' button. The main content area displays a map of California with numerous hydrogen station icons. On the right side, there is a list of stations, each with a 'RETAIL - OPEN' status, a name, and a 'Details' link. The stations listed are:

- San Juan Capistrano: Open - Retail, 26572 Junipero Serra Road, San Juan Capistrano, CA 92675
- Santa Barbara: Open - Retail, 150 South La Cumbre Road, Santa Barbara, CA 93105
- Lake Tahoe-Truckee: Open - Retail, 12105 Donner Pass Road, Truckee, CA 96161
- San Jose: Open - Retail, 2101 North First Street, San Jose, CA 95131

At the bottom of the page, there is a footer with the following information: © CALIFORNIA FUEL CELL PARTNERSHIP, Powered by the fastest molecule on earth!™, 3300 Industrial Blvd. Suite 1000 West Sacramento, CA 95691, and SOSS | 916.371.2870.



***DRIVING FOR THE FUTURE***

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The members of the California Fuel Cell Partnership believe fuel cell vehicles powered by hydrogen have the potential to change the future of transportation.

For a complete list of members, please visit us at

**[www.cafcp.org](http://www.cafcp.org)**