



Hydrogen 101 for Fleets

What is hydrogen?

Hydrogen is a carbon-free fuel that can replace traditional fossil fuels like gasoline and diesel in cars, trucks, buses, and even ships. Hydrogen fuel is available from a pump, similar to gasoline and diesel. Hydrogen is a gas at room temperature, so it is delivered at high pressure (up to 700 bar) from the fueling pump to specially designed tanks inside the vehicle.

Hydrogen is the most abundant element in the universe, but here on Earth, it is usually bonded with other components. A feedstock such as water, renewable natural gas, methane, or solid waste is processed to isolate the hydrogen molecules to get the pure hydrogen needed for vehicle fueling.

How does hydrogen move my vehicle?

Unlike gasoline or diesel, which are combusted via engines, a hydrogen fuel cell uses the chemical energy of hydrogen to produce electricity. It is a clean form of energy, with electricity, heat, and water being the only products and by-products. This is why hydrogen fuel cell vehicles are classified as Fuel Cell Electric Vehicles (FCEV) and meet all California Air Resources Board (CARB) Zero Emission Vehicle (ZEV) compliance requirements.

FCEVs show advantages over Battery Electric Vehicles (BEVs) for fleets that transport heavy loads over long distances or require continuous long-distance transit without the flexibility to recharge at EV charging stations. BEVs are often better suited for transporting lighter loads with more frequent stops.

Did You Know?

Ten million metric tons of hydrogen are safely produced and consumed in the United States every year.¹

There are now more than 50,000 hydrogen fuel cell forklifts in use across the United States.²

What vehicle type is better for my fleet: battery electric or hydrogen fuel cell?

As a fleet owner/operator, there are several considerations that factor into which technology is the right fit for your fleet. Here are some key considerations:

- Driving patterns and routes
- Fully loaded vehicle weight
- Vehicle duty cycle
- Fueling/charging costs
- Fueling/charging availability
- Fueling/charging infrastructure requirements
- Vehicle purchase price and availability
- Funding opportunities
- Timing

¹ *Hydrogen and Fuel Cells Program Record. 2016. United States Department of Energy. hydrogen.energy.gov/docs/HydrogenProgramLibraries/pdfs/16015_current_us_h2_production.pdf?Status=Master*

² *Hydrogen and Fuel Cells Program Record. 2018. United States Department of Energy. hydrogen.energy.gov/docs/HydrogenProgramLibraries/pdfs/18002_industry_deployed_fc_powered_lift_trucks.pdf?Status=Master*

Hydrogen Fuel Cell Electric Vehicle (FCEV) procurement

A limited selection of medium-duty (MD) and heavy-duty (HD) FCEVs are currently available for purchase. Companies like Kenworth, Peterbilt, Mercedes-Benz, Cummins, Toyota, Hyundai, Nikola, Hyzon, Tevva, Hino and Quantron are preparing to manufacture FCEV class 5-8 vehicles. Local, state, and federal incentives are available to help offset the cost of purchasing or leasing an FCEV. These incentives can significantly reduce the purchase price, and in some cases, fleet owners and operators may bear little to no cost.

When considering an FCEV for your fleet, it's crucial to confirm its range and functionality align with your needs, just like with BEVs. While BEVs require a charging plan, FCEVs need a well-thought-out fueling strategy. Also, like BEVs, maintaining an FCEV is straightforward, involving routine tasks like tire rotations, cabin filter changes, and brake replacements. Additionally, hydrogen storage tanks and fuel cell stacks should be inspected annually.



Public funding opportunities: Qualifying fleets can take advantage of government funding to offset procurement and adoption costs. Use the Funding Finder to explore applicable funding opportunities for vehicle procurement, infrastructure installations, and regular operation of eligible clean vehicles, including FCEVs. For more information, visit [fundingfindertool.org](https://www.fundingfindertool.org).



Hydrogen fueling

Develop your strategy

Discuss hydrogen fueling options with your FCEV dealer upfront to determine your fueling needs and strategy. A strategic hydrogen procurement plan can help establish efficient operations and avoid costly mistakes. Currently, hydrogen FCEVs lack a single industry fueling standard, and different vehicles may have varying fueling needs depending on the manufacturer.

Be aware of your vehicle's rated fueling pressure (usually 350 or 700 bar) and whether it requires liquid hydrogen refueling. Consider these hydrogen-fueling strategies:

PUBLIC FUELING: Fueling at public stations can allow you to operate and manage the fueling of their FCEV fleet, similarly to how you operate your current diesel fleets.

- Relying on public fueling allows fleet managers to avoid significant engineering work, capital costs, and land use requirements associated with constructing, managing and operating their own fueling systems.
- Within the SDG&E® service territory, one dedicated public hydrogen FCEV fueling station serves only light-duty vehicles. While there are currently no public MD/HD hydrogen refueling stations in our region, many are expected to be built in the coming years, especially along major travel corridors and at the Otay Mesa border crossing.
- In 2023, California dedicated \$106 million to support MD/HD FCEV infrastructure through 2030. Additionally, California has been named a US Department of Energy **Hydrogen Hub** and will receive up to \$1.2 billion in federal funding in addition to the significant private investment anticipated for the development of hydrogen infrastructure in the state over the next five to ten years.
- Risks associated with a public fueling strategy include uncertainty around fuel prices and fuel availability. As the industry matures, those risks will likely decrease.



PRIVATE, ON-SITE FUELING: If you operate a large FCEV fleet (20+ MD/HD vehicles or more), on-site fueling can allow you to manage your own hydrogen fueling infrastructure and have better control over fuel availability and price.

- Several California public transit agencies that operate FCEV buses purchase hydrogen fuel from a third party, have it delivered on-site, and dispense it in their own depots.
- Dispensing options can be designed to be permanent or more temporary, and even mobile. A short-term on-site option may help facilitate your fleet's early adoption of hydrogen vehicles while the regional fueling infrastructure is developed.
- Depot managers will have to understand their fueling needs upfront to properly manage delivery frequency and volume, determine on-site hydrogen storage requirements, and build the right kind of fueling infrastructure.
- Risks associated with a private, on-site fueling strategy include high upfront capital costs, station maintenance costs, reliability of fuel delivery and reduced flexibility should your fleet needs change over time.

Hydrogen fueling (continued)

TRANSPORTATION AS A SERVICE (TAAS): TAAS or Transportation as a Service, also referred to as MAAS or Mobility as a Service, can be a cost-effective way for fleet owners and operators to reduce initial or upfront costs.

- TAAS best serves owners and operators in the short term by providing scalable solutions. It also allows you to determine if hydrogen is appropriate and feasible in the long run without significant upfront costs.
- This option may be helpful for companies that cannot afford large capital equipment outlays.

ON-SITE PRODUCTION AND FUELING: On-site production and fueling is an option for sophisticated, well-capitalized operators with a large fleet and plentiful space who want the ultimate fuel price and supply predictability.



Projected Hydrogen Fuel Prices

Vehicle Fuel Type, 2030	\$/mile 2030 ^{Projected}	\$/mile 2035 ^{Projected}
Diesel (today)	\$0.86	\$0.86
Hydrogen, CEC, IEPR Baseline Scenario	\$1.03	\$0.75
Hydrogen, NREL Dispensed Price, 2030*	\$0.67	\$0.67

* Projections included in this table are from the California Energy Commission and the National Renewable Energy Laboratory, respectively. Future hydrogen prices are subject to many variables. SDG&E cannot make any promises about the price to guarantee pricing projections of hydrogen in 2030 or beyond.

Funding

Common funding pathways for FCEV fleet owners and operators

The California Energy Commission (CEC) invests up to \$100 million annually through the Alternative and Renewable Fuel and Vehicle Technology Program (Clean Transportation Program). The program supports the transition of fuel cell electric vehicles by expanding California's network of hydrogen refueling stations throughout the state.

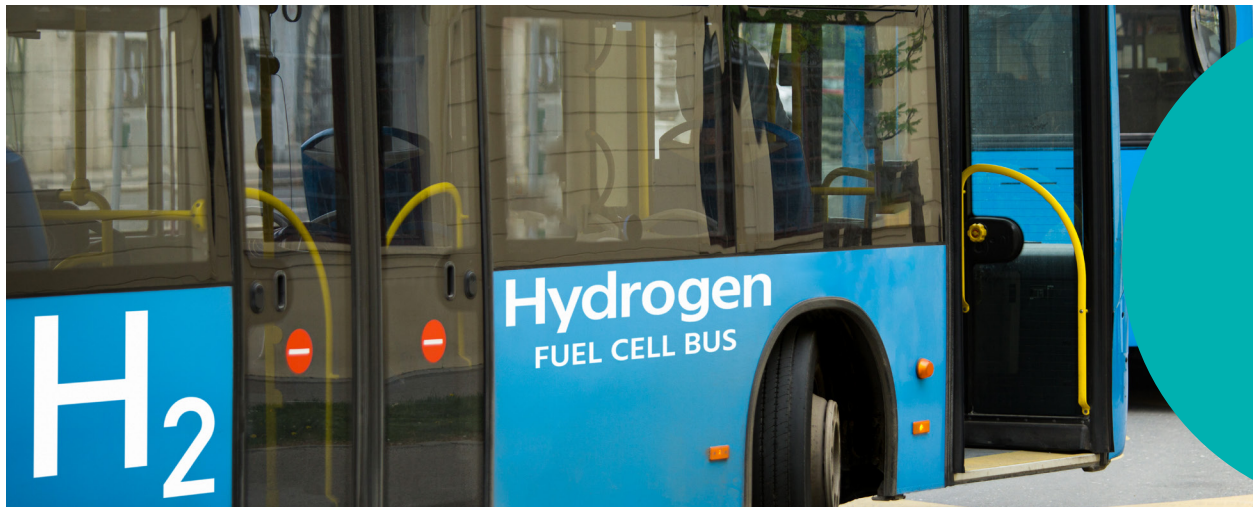
ENERGIIZE: (Energy Infrastructure Incentives for Zero-Emission) Commercial Vehicles Project is the nation's first commercial vehicle fleet infrastructure incentive project.

Funded by the CEC's Clean Transportation Program, FCEV fleet owners and operators can receive up to \$4 million in funding for infrastructure. Applications are accepted on a quarterly basis. Visit [energiize.org](https://www.energiize.org) for program details.

CEC: Provides hydrogen and infrastructure funding throughout the year, both from State and Federal programs. For more information, [click here](#).

LCFS CREDITS: FCEV fleet owners and operators receive a credit for every ton offset by driving electric or switching from traditional fuels to hydrogen. Credits are subject to market fluctuations.

For a list of funding opportunities within SDG&E service territories, please [click here](#).



Additional resources: California Governor's Office of Business and Economic Development (GO-BIZ) has published the Hydrogen Station Permitting Guidebook, which provides a detailed outline of the hydrogen station development process.

**PUBLIC HYDROGEN
REFUELING STATIONS**

*Hydrogen Fuel
Cell Partnership*



California's hydrogen landscape

Transportation is the most significant contributor to greenhouse gas emissions in California, and pollution impacts where we live, work and play. To meet California's health-based air quality standards and greenhouse gas emission reduction goals, MD/HD vehicles must transition away from petroleum to zero-emission (ZEV) technologies. California has developed ambitious goals focused on transitioning to one hundred percent zero-emission transportation by 2045, where applicable, referred to as **Governor's Executive Order N-79-20**.

CARB also developed the Advanced Clean Fleet Regulation (ACF), which complements the executive order by requiring a phased-in transition from ICE to ZEV technologies, specifically for MD/HD vehicles. In addition to saving \$25.6 billion in statewide health benefits from carbon emissions, the transition to ZEVs is estimated to save fleet owners and operators up to \$48 billion. Additional information on ZEV regulations **can be accessed here**.

How is SDG&E® supporting hydrogen adoption in our region?

SDG&E is exploring how clean hydrogen can support energy reliability, affordability, equity and clean transportation to help California achieve net zero GHG emissions by 2045. As part of our sustainability strategy, we are exploring and investing in hydrogen for electric generation, fleet vehicle fueling and decarbonizing the natural gas system. SDG&E currently owns and operates a private hydrogen fueling station to support our own light-duty hydrogen fuel cell fleet vehicles. For more information, visit sdge.com/Hydrogen.



Power Your Drive *for* Fleets
customer interest list
sdge.com/MDHD-Interest-Form



For more
information, visit
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