Guidance to Hydrogen Permitting

Background

A fuel cell electric vehicle (FCEV) is a zero-emission vehicle (ZEV) that is powered by hydrogen.

FCEVs are propelled by electricity converted from hydrogen and oxygen on board the vehicle in a fuel cell stack, emitting only water vapor[1]. FCEVs for on-road transportation mainly consist of passenger (light-duty) cars and transit buses, with some heavy-duty trucks.[2] Other vehicle weight classes with varying fuel storage volumes are expected, such as delivery trucks/vans and large work/utility trucks. Regardless of the vehicle, they all need a place to be fueled.

FCEVs are fueled similarly to conventional internal combustion vehicles. The passenger vehicle customers access hydrogen fuel at a public retail station to fill within five minutes and reach 300 or more miles per fill. Hydrogen fuel dispensed in California stations has a 60 to 90 percent renewable content.[3] Unlike petroleum fueling infrastructure that contributes to pollutants at the pump and through the tailpipe, hydrogen emits no pollutants through an FCEV.[4]

When FCEVs fill up in California, they are growing the renewable fuel market in the state, supporting California jobs, and decarbonizing California's heavily polluting transportation sector. Having access to hydrogen fueling stations encourages the purchase of FCEVs and creates an immediate impact on the air quality of the community where FCEVs drive.

1 https://www.energy.gov/sites/default/files/2022-01/hydrogen-fuel-cells-101-jan2022.pdf
2 https://h2fcp.org/by_the_numbers
3 2022 Annual Hydrogen Evaluation Report (AB 8 Report)
4 https://escholarship.org/content/qt2j7143v5/qt2j7143v5.pdf?t=oj7712


Hydrogen Fueling Stations

Permitting hydrogen fueling stations is an essential aspect of growing the ZEV market in the state. We encourage referencing this permitting guidance to assist your community in building its hydrogen fueling network that will support California's growing FCEV users.

Governor Brown issued an executive order in 2018 for the buildout of 200 hydrogen fueling stations by 2025. (B-48-18).[5] While the state is working toward meeting this goal, California will need at least 1,000 retail hydrogen fueling stations[6] to support the number of passenger FCEVs needed to reach California's ZEV goals of 100 percent zero-emission new retail car sales by 2035. (N-79-20).[7] California continues to further its emissions reduction goals through zero-emissions goals for all forms of transportation; heavy-duty trucks, transit, and rail included. Visit both the California Air Resources Board (CARB)[8] and California Energy Commission (CEC)[9] for more information.

Retail hydrogen fueling stations are located across the state,[10] with a majority of fueling locations in the Bay Area and the Greater Los Angeles Area. Hydrogen fueling stations are typically located within an existing conventional gas station providing one to four fueling (hose/nozzle) positions. Hydrogen fueling stations have been partially funded by the state and partially funded by private companies. Project developers and the authorities having jurisdiction (AHJ's) make up the first line to deploy stations state-wide and, eventually, throughout the U.S. SB 1291 (2022)[11] was passed to help facilitate the deployment of fueling infrastructure in California. It expanded on legislation to facilitate battery electric vehicle charging infrastructure in Planning and Zoning Law to include hydrogen fueling stations. The overarching goal for both ZEV infrastructure types is to develop the network and meet the growing demand for vehicle drivers.

This document is meant to assist AHJs in understanding the hydrogen fueling station and give guidance on available resources.

H_2

5 https://www.library.ca.gov/wp-content/uploads/GovernmentPublications/executive-order-proclamation/39-B-48-18.pdf
6 https://h2fcp.org/sites/default/files/CAFCR.pdf
7 https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf
8 https://ww2.arb.ca.gov/our-work/programs/zero-emission-vehicle-program
9 https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program
10 https://h2fcp.org/stations
11 https://atrn.assembly.ca.gov/sites/atrn.assembly.ca.gov/files/SB%201291%20%28Archuleta%29.pdf

Components of a Retail Hydrogen Fueling Station

Retail fueling stations store hydrogen either as a compressed gas (GH_2) or as a cryogenic liquid (LH_2). Regardless of the storage method, it is only pressurized, gaseous hydrogen that is dispensed through the nozzle into the vehicles.

The main components of a station, which are in an enclosure and not publicly accessible, may consist of:

- On site, above ground storage, in either gaseous pressure vessels or a vacuum-jacketed, low pressure cryogenic storage tank
- Compressor(s)
- A vaporizer or pump (for LH_2)
- High pressure "buffer" storage
- Controls

There may also be a heat exchanger or pre-cooler underground near the dispenser island. This is also not for public access.

The publicly accessible components include:

- the dispenser(s) with the hose/nozzle/breakaway assemblies
- a point-of-sale system
- a concrete fueling pad

Other safety elements include emergency stops, bollards, and flame detectors, per code.

Primary Codes and Standards

Along with the CA Codes (Fire, Building, Electrical), NFPA 2, Hydrogen Technologies Code[12] is the applicable installation code for hydrogen infrastructure. While the model fire code for California, the International Fire Code which does reference NFPA 2, California's Office of the State Fire Marshal adopts NFPA 2 by reference into the CA Fire Code, which is the newest edition of the document[13].

The Governor's Office of Business and Economic Development (GO-Biz) produced a Hydrogen Station Permitting Guidebook[14] which has some references to code and standards. Separately, the Hydrogen Fuel Cell Partnership developed a Station Buyers Guide with high-level codes and standards. Each of these documents is available online[15]. Be aware, however, that neither of these documents contain exhaustive lists of all codes and standards for hydrogen but are good references to lead one to the cited standards for hydrogen infrastructure.

For details and training resources on hydrogen properties, safety, stations, vehicles, and codes, and standards, visit the Center for Hydrogen Safety[16] and the H2Tools[17] websites.

For other resources around codes and standards, and safety, visit the Compressed Gas Association[18] and the Fuel Cells and Hydrogen Energy Association[19].

12 https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=2
13 https://osfm.fire.ca.gov/media/wvnfmvzy/23-005-nfpa-2-hydrogen-edition-update.pdf
14 https://static.business.ca.gov/wp-content/uploads/2019/12/GO-Biz_Hydrogen-Station-Permitting-Guidebook_Sept-2020.pdf
15 https://h2fcp.org/system/files/cafcp_members/Hydrogen_Station_Buyers_Guide.pdf
16 https://www.aiche.org/chs
17 https://www.aiche.org/chs/hydrogen-tools
18 https://cganet.com/resources
19 https://fchea.org/

Pre-Planning Meeting

While, traditionally, the first step for a project proponent is to submit a planning review request to the AHJ, the hydrogen fueling station developer may request a 'pre-planning' meeting. The goal of this meeting is to introduce the jurisdiction to the proposed project and give some background, get input and/or feedback from the jurisdiction and answer any of the AHJ's questions or address concerns.

It is recommended that as many AHJ staff attend as possible, such as appropriate fire personnel, the local zoning officials, the City Manager, the City Chief Engineer (if applicable), the County Clerk, and the Environmental Planner, as examples. Items of discussion may include confirmation of compatibility of the design and general safety features of the planned hydrogen fueling station with adjacent land uses and the master plan (or equivalent), determine any local requirements or special circumstances, and discuss timing, documentation, etc. all in the effort for the project developer to submit a complete package for review.

Commissioning

Upon completion of construction, the project developer will commission the station only after they are permitted to have hydrogen on the site. The following are some elements of the commissioning process and items of awareness for the AHJ:

Fuel Quality, Metrology, and Point of Sale:

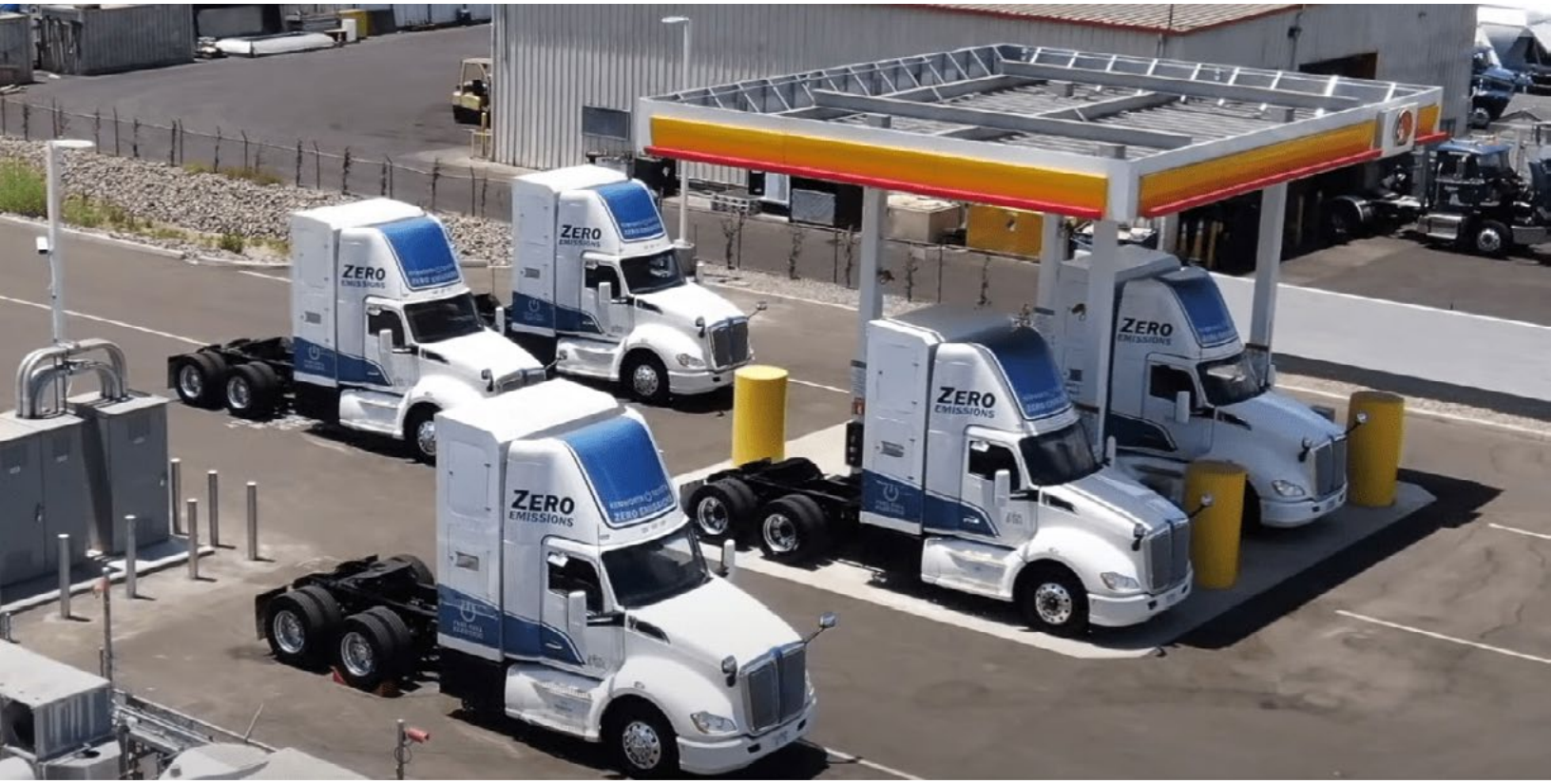
The hydrogen fuel quality will be tested for compliance with SAE J2719, Hydrogen Fuel Quality for Fuel Cell Vehicles.[20] SAE J2719 "identifies impurities that could occur with various hydrogen generation methods and within filling station systems and define limits for these impurities based on acceptable long-term fuel cell performance."[21] The hydrogen fueling station developer will provide documentation through a third-party certifying entity that demonstrates it has met these requirements.

The California Department of Food and Agriculture's Division of Measurement Standards (DMS) will conduct commercial testing and certification of the hydrogen metering and the point-of-sale systems.

Fueling Performance Verification, Retail Passenger Vehicle Stations:

Per NFPA 2, Chapter 10, look for validation, attestation, or certification to CSA/ANSI HGV 4.3, Test Methods for Hydrogen Fueling Parameter Evaluation.[22] The hydrogen fueling station developer will provide documentation through a qualified third-party or certifying entity that demonstrates it has met these requirements.

20 https://webstore.ansi.org/Standards/SAE/sae27192020
21 https://www.energy.gov/sites/default/files/2015/04/f21/fcto_2014_hcd_workshop_5_steele.pdf
22 https://www.csagroup.org/store/product/2703376/



Stations for fueling Heavy-Duty Trucks

In addition to retail public fueling stations for passenger vehicles, there are stations for fueling Heavy-Duty Fuel Cell Electric Trucks (FCETs).[23] Some are in operation with more in planning or development. These stations may be co-located at existing diesel truck stops, at Ports, or other industrial locations where drayage trucks are used, or purpose built along interstates and major freight corridors. The California Energy Commission's GFO-22-607[24] will co-fund multi-use hydrogen refueling infrastructure, where a mix of vehicle sizes may fuel at different islands/dispensers.

Soon after the fueling protocols and associated hardware specific to large volumes and high gas flows for heavy-duty vehicles are developed in SAE International and ISO, the test methods and hardware to validate their performance will be developed. For the immediate term, heavy-duty vehicles in operation are utilizing the existing light-duty passenger vehicle parameters.

23 https://h2fcp.org/stations
24 https://www.energy.ca.gov/solicitations/2022-10/gfo-22-607-light-duty-vehicle-and-multi-use-hydrogen-refueling-infrastructure