

Issues And Opportunities In Hydrogen Fuel Cell Development

By **Pamela Wu** (April 11, 2023, 5:48 PM EDT)

Hydrogen fuel cell vehicles will be a key component in the nationwide effort to achieve net zero emissions by 2050.

The Biden administration's U.S. National Blueprint for Transportation Decarbonization, which highlighted specific decarbonization opportunities and challenges for various modes of transportation, identified hydrogen as the option with the greatest long-term opportunity for decarbonizing long-haul heavy trucks.[1]



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However, adoption of hydrogen fuel cell technologies for long-haul heavy trucks is highly dependent on advancing hydrogen fuel cell technologies and expanding the hydrogen refueling infrastructure, as well as the availability of hydrogen supply, the cost of alternative types of transportation and regulatory drivers.

Available funding opportunities and incentives can provide value across the hydrogen fuel cell business chain. Together, they can reduce the overall cost of hydrogen fuel cell vehicles and establish a stronger business case for the continued development of fuel cell technologies and hydrogen infrastructure.

Why Hydrogen Fuel Cells?

Hydrogen fuel cells offer several advantages that can make them more suitable for long-haul heavy trucks. Fuel cell trucks have a longer range due to their onboard hydrogen storage and therefore require fewer stops on long routes.

In addition, hydrogen fuel cell trucks can be fueled much faster than the time it takes to recharge a battery, which reduces the overall time required to travel a long distance.

Hydrogen fuel cell vehicles can also allow for more cargo capacity as a result of the smaller battery that is used in a hydrogen fuel cell configuration.

However, the cost, durability and comparability of hydrogen fuel cell technologies will need to be addressed. Currently, the cost of fuel cell components and cost of hydrogen remain relatively high and require further investment, research, development and demonstration.

Existing hydrogen infrastructure, delivery options and hydrogen refueling networks will need to be

further developed and expanded to facilitate more widespread adoption of hydrogen fuel cell vehicles.

Efforts to Promote Development of Hydrogen Fuel Cell Technologies

Significant funding has been allocated to the development of hydrogen fuel cell technologies to improve the efficiency and cost of the technology.

Earlier this year, the U.S. Department of Energy made available \$47 million to fund the research, development and demonstration of hydrogen carriers with unique storage and delivery methodologies, onboard storage of liquid hydrogen, liquid hydrogen transfer and vehicular fueling technologies, and high-performing, durable membrane electrode assemblies for medium- and heavy-duty applications.

More recently, the Department of Energy announced the availability of \$750 million in funding to improve the efficiency, durability and cost of producing clean hydrogen using electrolyzers; advance new manufacturing technologies; and create innovative approaches to increase reuse and recycling of clean hydrogen and fuel cell technologies.

Additional funding opportunities are expected to be announced in the future, including funding to develop and demonstrate electrolyzer technology and for clean hydrogen storage technologies, technologies that integrate hydrogen production with compression and drying technologies, and integrated systems that combine hydrogen production with renewable power or nuclear power generation.

Efforts to Expand Hydrogen Network and Refueling Stations

Key hurdles to be addressed are the establishment of a connective clean hydrogen infrastructure, and for purposes of scaling hydrogen fuel cell vehicles, the development of a nationwide hydrogen refueling network.

As the Department of Energy noted in a recent report, there is no optimal hydrogen delivery solution that can accommodate the various production schedules, the distance and volume transported, and the requirements of the end user.

Hundreds of miles of hydrogen pipelines currently exist, but additional connective infrastructure and delivery options are needed to effectively move hydrogen from the production facility to the end user.

The development of a national connective hydrogen infrastructure is being spurred in large part by the Department of Energy's \$7 billion program to establish regional clean hydrogen hubs across the U.S.

These hubs are intended to serve as the foundation of a national clean hydrogen network of hydrogen producers, consumers and local connective infrastructure, and will help facilitate the delivery, storage and end use of hydrogen, including in hydrogen fuel cells.

In addition, the Section 45V clean hydrogen production tax credit under the Inflation Reduction Act is also available and provides tax credits based on the kilograms of clean hydrogen produced.[2]

With respect to hydrogen refueling stations, the stations that exist today are predominantly located in California. Additional stations in other areas of the U.S. are under development and in progress, and the continued expansion of the existing hydrogen refueling network will be critical to the successful

integration and deployment of hydrogen fuel cells.

The development of hydrogen refueling stations beyond the West Coast will expand the reach of hydrogen fuel cell vehicles. The Department of Energy recently awarded grants that support the development of hydrogen refueling infrastructure plans in the Midwest corridor and between Houston and Los Angeles.

In addition, mobile refueling options are currently being developed and deployed, which should further extend the range of hydrogen fuel cell vehicles.

The Inflation Reduction Act also makes available the Section 30C alternative fuel vehicle refueling property credit, which provides credits for alternative fuel vehicle refueling and charging property in low-income and rural areas.

Alternative fuels include hydrogen and other clean burning fuels. A qualified alternative fuel vehicle refueling property may be eligible for a credit of up to \$100,000, which can significantly help with the overall costs of developing a hydrogen refueling station.

State hydrogen dispensing incentive programs have been or will be made available to allow low-carbon hydrogen to earn additional incentives based on the amount of hydrogen that is dispensed into a fuel cell vehicle. For example, California has established the Low Carbon Fuel Standard, and states in the Northwest have announced similar programs.

Looking Ahead

Together, tax incentives, funding opportunities and state programs are expected to provide value across the hydrogen fuel cell business chain. If the overall cost of production of clean hydrogen can be reduced, it can in turn reduce the overall cost of ownership of a hydrogen fuel cell vehicle, so that ownership costs become more in line with owning a traditional diesel vehicle or electric vehicle.

The credits and funding can also create a stronger business case for continued development of the needed technologies and infrastructure, including hydrogen refueling stations to enable hydrogen fuel cell vehicles to achieve the long-distance travel this technology is capable of and designed to provide.

In addition, the Section 45W commercial clean vehicle credit makes available up to \$40,000 for qualified commercial clean vehicles, including fuel cell vehicles.

However, there are many open questions and issues. For example, in order for hydrogen refueling stations to operate successfully, there must be a reliable source of clean hydrogen.

Hydrogen refueling stations could look to partner with or invest in a hydrogen production facility and secure hydrogen through an offtake agreement. For hydrogen refueling stations that are not located adjacent to a hydrogen production facility, hydrogen supply could be transported by pipeline or truck and/or stored in a hydrogen storage tank.

Developers will need to consider the manner in which hydrogen can and will be delivered to hydrogen refueling stations, which may affect where such stations can be developed and the footprint they require, given that stations may require facilities such as hydrogen storage tanks and compressors.

In addition, there remain regulatory uncertainties as to which agencies will exercise jurisdiction over the infrastructure that is used to produce, transport and store hydrogen.

For example, the Federal Energy Regulatory Commission may assert jurisdiction over pipelines that transport hydrogen and hydrogen storage facilities. If it does, it is unclear under which framework, i.e., the Natural Gas Act or Interstate Commerce Act, FERC will regulate such facilities.

Separately, the Surface Transportation Board has the authority to exercise economic regulation of pipelines transporting any commodity other than water, gas and oil, and may assert or exercise jurisdiction over hydrogen pipelines, although it has not yet done so.

Addressing these regulatory uncertainties will be critical in facilitating efforts to establish a nationwide hydrogen network and the continued development of hydrogen pipelines and storage facilities.

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[1] <https://www.morganlewis.com/pubs/2023/03/the-road-to-scaling-zero-emission-vehicles>.

[2] <https://www.morganlewis.com/pubs/2022/08/inflation-reduction-act-would-significantly-expand-federal-income-tax-benefits-for-green-technology-industry>.