

Hydrogen-Fuel Focus Shifts to Big Rigs

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Auto makers have spent decades developing hydrogen fuel cells as a green alternative for cars with little to show for it. Now, they are shifting their attention to the trucking industry.

The technology, which mixes hydrogen with oxygen to create electricity, propels a vehicle's motors and emits only water vapor. Car companies say it has particular advantages for commercial trucks that travel long distances and need to refuel quickly, and they are trying to satisfy growing interest in alternative-fuel big rigs.

Tougher regulations in Europe and other regions are driving fleet operators to think about cutting their pollution risk by replacing their diesel trucks. A new California law, for example, will require commercial-truck sellers to include at least some zero-emission models by 2024.

"It's clear that hydrogen fuel-cell trucks are needed," said Andrew Lund, Toyota's chief engineer for the technology. "They provide technical solutions that other technologies cannot meet in the long run."

Truck manufacturers have been pursuing battery-electric technology for smaller trucks and buses that can be recharged for several hours at night. But batteries are less practical for large trucks that haul trailers of cargo long distances, often overnight, hydrogen advocates say. The stacks of lithium-ion batteries needed to power those rigs can weigh 25,000 pounds, making them less efficient.

Toyota Motor Corp., General Motors Co. and other car companies began experimenting with hydrogen-fuel cells decades ago.

For a time GM envisioned fuel cells as the primary technology for moving consumers to emission-free cars. But the high cost of the vehicles themselves and the stations needed for refueling have stymied those efforts.

There are only three fuel-cell car models on sale in the U.S. from mainstream auto makers—Toyota, **Hyundai Motor Co.** and **Honda Motor Co.** Last year, sales of these three totaled around 2,000, less than the number of Ford F-150 pickup trucks sold in an average day.

Fuel cells draw hydrogen gas from tanks on board a truck and convert it to electricity, eliminating the need to store power in heavy stacks of



Hyundai is banking on the technology to break into the commercial-trucking market in North America.

batteries. With the available hydrogen fuel, trucks could stay on the road for days, as they do now with diesel fuel.

Fresh interest from the trucking industry is reinvigorating auto makers' efforts to further develop hydrogen-fuel cells. It also is attracting newcomers, such as Phoenix-based **Nikola Corp.** and **Hyllion Holdings Corp.**

Trucking company **U.S. Xpress Enterprises Inc.** has made reservations with Nikola and other companies to place orders for hydrogen-fuel trucks when production starts later this decade.

"It makes sense to get out early," Chief Executive Eric Fuller said. "We do think when this product gets rolled out there it will truly be a competitive advantage."

GM last month struck a tentative deal to supply hydrogen fuel cells to Nikola, which plans to use them in heavy-duty trucks. If the deal closes, this would be the first time GM brings in revenue from fuel-cell technology, which it has been developing since the 1960s.

The broader deal with Nikola, however, has been delayed following a short seller's allegations the startup misled investors. Nikola has called the claims false. GM and Nikola continue to discuss terms, people familiar with the matter said.

Daimler AG recently shifted its fuel-cell efforts from pass-

senger cars to its truck lines, which include the Freightliner and Western Star brands in North America. The company in April joined forces with Swedish truck maker **Volvo Group** to develop fuel cells for trucks and industrial applications.

Toyota and Hyundai also are moving more in this direction. Toyota said this month that it is developing a demonstration fuel-cell truck with subsidiary Hino Trucks, targeted at the North America trucking market.

Hyundai is banking on the technology to help it break

ability of hydrogen.

The cost to develop a network of hydrogen fueling stations and the infrastructure to transport the fuel globally is about \$30 billion, according to a January report from the Hydrogen Council, a consortium of companies advocating for investment in hydrogen-related projects. Another \$20 billion would be needed to develop renewable sources of hydrogen, the group said.

Hydrogen fuel-cell trucks, which will be sold in relatively low volumes initially, will cost more than the diesel trucks widely used today.

The performance and durability of hydrogen-powered trucks in high-mileage service also remains unknown. Diesel trucks usually stay in service for about 14 years, piling up more than one million miles under multiple owners. That longevity is important to trucking companies for the resale of the big rigs.

To establish hydrogen as a viable alternative, trucking companies and their customers likely will have to accept higher costs for moving freight, said Amy Davis, president of the new power business unit for engine maker **Cummins Inc.**

"Fuel cells are going to be really important to move forward into a zero-emissions world," she said. "At the end of the day, though, these electric technologies just cost more."

There are still major hurdles, including the availability of hydrogen stations.

into the market for commercial trucking in North America, where it currently doesn't sell any heavy-duty trucks. It has plans to deliver 50 new fuel-cell trucks this year and is targeting 12,000 hydrogen-powered heavy trucks this decade.

"The bigger and heavier the truck, the more fuel cells seem to be the better solution," said Yuval Steiman, Hyundai's director of product strategy.

There are still significant hurdles to widespread adoption, beginning with the avail-