Auto Motives: An American Love Story

Simply Hydrogen

Elegant technology, but questions remain

by Justin Gerdes

"This is so weird." A few seconds pass. "This is beautiful, peaceful, and quiet. I'm glad I volunteered to drive it." Just that quickly, Louie Rios, with 20 years' experience driving diesel buses for AC Transit, becomes a fuel cell bus convert. After a five-minute crash course on the state-of-the-art bus by ISE Corp. field project engineer Jayson Cannon, Rios pulls away from the Berkeley Marina.

We're aboard a 30-foot, zero-emissions, hydrogen-fueled, fuel cell hybrid bus manufactured by ISE Corp. and Thor Industries, powered by UTC Fuel Cells. The bus exists due to a push by federal and state funding and California air quality regulations. According to emissions reduction requirements approved by the California Air Resources Board (CARB) in February 2000, 15 percent of new buses purchased in California must be zero-emissions vehicles by 2015. Transit agencies across the state began to explore ways to meet the target.

Perhaps the most ambitious demonstration project so far is led by AC Transit. Funded by $17 million in state and federal grants, AC Transit will operate three fuel cell hybrid buses, beginning in September 2005. The hydrogen-fueled buses are being constructed through a unique collaboration: the chassis and bodies come from the Belgian company Van Hool, the fuel cells from UTC, and the hybrid propulsion system from ISE. To fuel the buses, AC Transit is partnering with ChevronTexaco to construct a hydrogen refueling station in Oakland. It is, boasts AC Transit spokesman Jaimie Levin, "one of the most robust and elite demonstration projects in the world."

"Who will invest in the manufacture of fuel cell vehicles if there is no widespread hydrogen supply? At the same time, who will invest in facilities to produce hydrogen if there are not enough fuel cell vehicles to create sufficient income for hydrogen producers?" This conundrum comes from Michael Ramage, chair of a National Academy of Engineering/National Research Council joint study of obstacles hindering a hydrogen fuel cell economy. In a February 2004 report, Ramage's committee concluded that even under a best-case scenario, the switch to hydrogen will take decades.

Yet the promise of the hydrogen fuel cell is so tantalizing that research by companies and advocacy by environmentalists continues undeterred; indeed, the quest to fulfill hydrogen's climate-change-mitigating potential has been called the "Holy Grail of the 21st century." Mass commercialization of fuel cells, however, is confounded by a paradox: that such an exquisitely simple system—hydrogen, released from fossil fuels or freed from water through electrolysis, combined with oxygen in a fuel cell, releases

Sustainable Transportation Education Project (BAYSTEP)

Community Water Rights Project

Plastics Task Force

International Plastics Task Force (IPTF)

City of Berkeley Motor Oil Recycling Program

electrons that drive an electric motor, which emits only water vapor—is at the same time fraught with seemingly insurmountable challenges.

Chief among these is cost. The Department of Energy (DOE) estimates that hydrogen refined from natural gas costs the equivalent of $4 per gallon, while hydrogen supplied through electrolysis or renewable energy such as wind and solar power costs three times as much. And that's just for the hydrogen fuel. Costs for an entire hydrogen infrastructure have been pegged as high as $500 billion by the Argonne National Laboratory.

Assuming that costs can be contained, hydrogen fuel cell critics wonder where the hydrogen will come from. Obtaining hydrogen provokes a clash between "black" (generated from fossil fuels) and "green" (generated from renewable energy). Jeremy Rifkin, author of The Hydrogen Economy, calls the black vs. green hydrogen debate "the seminal environmental question of the coming century." The problem is that extracting hydrogen from fossil fuels releases carbon dioxide. Green hydrogen proponents say that any system that does not rely on renewables is folly. As Dave Becker, director of the Sierra Club's Global Warming and Energy Program puts it, "Getting hydrogen from dirty or unsafe sources makes no sense. It's like trying to lose weight by jogging to McDonald's."

Ask people at random what they know about hydrogen and invariably you get one reply: the Hindenburg. The mental image of that exploding German Zeppelin and the perception that hydrogen is inordinately dangerous persists, so much so that critics maintain that hydrogen's high flammability deems it unacceptably risky to use in vehicles. Complicating matters is the fact that hydrogen must be stored in tanks at extremely high pressure, up to 10,000 pounds per square inch. In a Motor Trend report examining the pros and cons of hydrogen and fuel cells, the magazine's editors present the lingering hydrogen fear this way: "Would you balk at strapping a child seat a few inches away from a tank that holds space shuttle fuel pressurized to 10,000 pounds per square inch?"

Yet the technology's most prominent proponent, Amory Lovins of the Rocky Mountain Institute, believes that go-slow proponents simply have it all wrong. In June 2003, Lovins published a peer-reviewed paper, Twenty Hydrogen Myths, contending that the "Oft-described technical obstacles to a hydrogen economy—storage, safety, and the cost of hydrogen and its distribution structure—have already been sufficiently resolved to support a rapid deployment starting now." And while he concedes that "a poorly designed hydrogen transition"—one reliant on black hydrogen—"could cause environmental problems," he adds that "a well- designed one can resolve most of the environmental problems of the current fossil-fuel system."

We're a half-hour into the second run of the morning. Every passenger who boards the bus has a question—or ten. These curious riders approach 27-year-old Jayson Cannon, the fuel cell bus's jack-of-all-trades. Cannon's been touring with the bus across California—Chula Vista, San Diego, Palm Springs, LA—for months. In Berkeley, the bus has found a home. Cannon tells me that the bus is welcomed with applause at bus stops and chased down by bikers who want to know when the buses arrive for good. "It's been really overwhelming," he says. "I expected a response, but it's been better than I would have thought."

I hear the same sentiment from AC Transit's Jaimie Levin, who reads me a card from an appreciative customer: "I've never been so proud to ride AC Transit as when I took the zero-emission fuel cell bus. Keep up the good work." If the public is apprehensive about the impending arrival of hydrogen fuel cells, they aren't showing it. "It's never, 'Why are you doing this?'" says Levin. "It's 'Why aren't you doing more of it?'"

Levin says that transit agencies like his will hasten the adoption of fuel cells. In ten to 15 years, he predicts, up to 15 percent of AC Transit's new buses will be powered by fuel cells and, meanwhile, gasoline- and hydrogen-fueled hybrid buses will help replace the present fleet of 700 diesel buses. Many experts, including Levin, agree

that the advantages inherent to fleets—buying power, convenient centralized fueling, trained staff—afford them the opportunity to mainstream fuel cells. This also explains why the DOE estimates that affordable, reliable fuel cell cars won't appear in showrooms until 2020.

Even so, Levin is optimistic: "I hope we're looking at a snowball rolling down a steep mountainside. Very quickly we're moving away from the technology of the past." ¥t

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