Why the hydrogen fuel cell vehicle rollout may now succeed

August 15 2014

Joan Ogden, director of the Next Sustainable Transportation Pathways (NextSTEPS) program at the UC Davis Institute of Transportation Studies, stands beside a hydrogen fuel cell vehicle, a Honda FCX Clarity. (Credit: UC Davis Institute of Transportation Studies/photo)

A convergence of factors is propelling a market rollout of the hydrogen fuel cell vehicle, according to a new study from the Institute of Transportation Studies at the University of California, Davis. A key to hydrogen's potential success is a new smart solution that clusters hydrogen fuel infrastructure in urban or regional networks, limiting initial costs and enabling an early market for the technology before committing to a full national deployment, suggests the study.

The researchers behind the study, "The Hydrogen Transition," probe the variety of factors combining to increase the likelihood of successful hydrogen-powered car commercialization. These include new thinking by government and industry on strategies for developing fuel station infrastructure, falling costs for fuel cell vehicle and hydrogen station components, a new array of sporty hydrogen cars about to come to market from major car makers, ample low cost natural gas for making hydrogen, and the strengthening U.S. interest in climate change solutions.

"We seem to be tantalizingly close to the beginning of a hydrogen transition," said lead author Joan Ogden, professor of environmental science and policy and director of the Sustainable Transportation Energy Pathways (NextSTEPS). "The next three to four years will be critical for determining whether hydrogen vehicles are just a few years behind electric vehicles, rather than decades."

Having sufficient hydrogen fueling locations has been a major challenge. It's a "chicken or egg" dilemma where automakers are reluctant to market cars without infrastructure, and station providers are reluctant to build stations without cars. Recently, however, regional public-private partnerships are emerging to develop smart, comprehensive build-out strategies in different locations around the globe. These new infrastructure paradigms enable more efficient fueling networks, saving millions of dollars compared to earlier designs, and hold the promise of providing hydrogen conveniently and affordably.

ITS-Davis researchers calculated that a targeted regional investment of $100-$200 million in support of 100 stations for about 50,000 FCVs would be enough to make hydrogen cost-competitive with gasoline on a cost-per-mile basis. This level of investment is poised to happen in at least three places: California, Germany and Japan.

In California, the state recently awarded $46 million to build 28 hydrogen fuel stations. Hyundai is leasing its Tucson FCVs to select consumers, while several other car makers—Honda, Toyota, BMW, Nissan and Daimler—expect to have production vehicles on the road in the next few years. Toyota, whose fuel cell vehicles are set to hit the market next year, is also investing in hydrogen fueling infrastructure in the state.

"In many respects, hydrogen fuel cell cars offer consumer value similar or superior to today's gasoline cars," Ogden said. "The technology readily enables large vehicle size, a driving range of 300-400 miles, and a fast refueling time of three to five minutes. Hydrogen fuel cell vehicles could help us achieve a low carbon future—without compromising consumer expectations. Along with plug-in electric and efficient internal combustion engine vehicles, hydrogen is an important part of a portfolio approach to sustainable transportation."

Additional highlights from the study include:

- Early and durable public policies are key to help launch hydrogen infrastructure and provide consumer incentives for purchasing hydrogen fuel cell vehicles. These may be similar to incentives for plug-in electrics, such as vehicle purchase subsidies, tax exemptions, free parking, and High Occupancy Vehicle lane access.
- Global public funding of $1 billion a year on hydrogen supports research and development, deployment of power, and transportation applications. Automakers have spent more than $9 billion on fuel cell development. According to the U.S. Department of Energy, its public investments have spurred 6 to 9 times more in private investment.
- The near-term prospects for plentiful, low-cost hydrogen are good. The boom in low-cost natural gas makes possible low-cost

hydrogen, especially in the United States. Methods for cost-effectively producing low-carbon hydrogen from renewable sources hold promise for greater greenhouse gas emission reductions. Hydrogen FCV emissions are already less than half that of conventional gasoline vehicles, due to the greater efficiency of the fuel cell.

- The long-term environmental, economic and societal benefits of hydrogen FCVs are significant. Fuel cost savings for customers and the reduced costs of air pollution, oil dependence and climate change outweigh transition costs by 10 to 1.
- For California, having hydrogen as part of the fuel mix could be integral to the state reaching its twin goals of 1.5 million zero-emission vehicles on the road by 2025 and an 80 percent reduction below 1990 levels of greenhouse gas emissions by 2050. Hydrogen FCVs are increasingly seen as a critical technology for reaching long-term climate goals, with the potential for capturing a major fraction of the world's "light duty" passenger car fleet by 2050.

However, the hydrogen transition is anything but certain.

"Hydrogen faces a range of challenges, from economic to societal, before it can be implemented as a large scale transportation fuel," Ogden said. "The question isn't whether fuel cell vehicles are technically ready: They are. But how do you build confidence in hydrogen's future for investors, fuel suppliers, automakers, and, of course, for consumers?"

More information: Read the report.

Provided by UC Davis