

Hydrogen vehicles making impressive progress toward commercialization

17 July 2008

A transition to hydrogen vehicles could greatly reduce U.S. oil dependence and carbon dioxide emissions, says a new congressionally mandated report from the National Research Council, but making hydrogen vehicles competitive in the automotive market will not be easy. While the development of fuel cell and hydrogen production technology over the past several years has been impressive, challenges remain. Vehicle costs are high, and the U.S. currently lacks the infrastructure to produce and widely distribute hydrogen to consumers. These obstacles could be overcome, however, with continued support for research and development and firm commitments from the automotive industry and the federal government, concluded the committee that wrote the report.

Light-duty vehicles, such as cars, SUVs, and pickup trucks, are responsible for 44 percent of the oil used in the United States and over 20 percent of the carbon dioxide emitted. Concerns over climate change, oil imports, and recent spikes in gasoline prices have spurred interest in the development of alternative fuels. In 2003, President Bush announced a \$1.2 billion initiative to encourage development of hydrogen production technology and fuel cell vehicles, which are powered through a chemical reaction between hydrogen and oxygen and emit only water and heat as exhaust.

The committee estimated the maximum number of hydrogen vehicles that could be on the road in the coming decades, assuming that practical technical goals are met, that consumers want hydrogen cars, and that government policies are in place to help drive the transition from oil to hydrogen fuel. The findings therefore represent potential best-case scenarios rather than predictions.

According to the committee, it will take many years before hydrogen vehicles will significantly penetrate the light-duty fleet, even though technological developments have been

progressing rapidly. Production of hydrogen vehicles could increase significantly by 2015. At this stage, their cost -- although dropping rapidly -- would still need to be heavily subsidized for consumers. The maximum practicable number of hydrogen vehicles that could be on the road by 2020 is 2 million, says the report. By 2023, the total cost of fuel cell vehicles, including the cost of hydrogen fuel over a vehicle's lifetime, could become competitive with conventional vehicles. At that point, the number of hydrogen vehicles on the road could grow rapidly, to nearly 60 million in 2035 and 200 million by 2050.

The committee also calculated the investments, both public and private, that would be needed to make a complete transition from oil to hydrogen fuel. These costs include research and development, vehicle deployment, and establishing infrastructure. According to the committee, government support via strong policy initiatives as well as funding would be needed until at least 2023. The cost to the government would be about \$55 billion between 2008 and 2023; private industry would be expected to invest \$145 billion over that same time period. To put these numbers into perspective, the government subsidy for ethanol fuel could grow to \$15 billion per year by 2020.

The shift toward hydrogen fuel would not have a large impact on oil usage or greenhouse gas emissions until hydrogen vehicles make up a significant portion of the market. If hydrogen vehicles eventually took over the market, there would be great decreases in both, although the overall effect on greenhouse gas emissions would depend upon how the hydrogen fuel was produced. The committee compared these reductions with those that might be achieved by either improving the fuel efficiency of conventional vehicles or by converting to biofuels. Because they can be implemented more rapidly, both of these options could produce reductions in oil use and emissions faster than hydrogen, but after about 2040,

hydrogen would become more effective.

The greatest possible reductions would occur if biofuels, fuel-efficient conventional vehicles, and hydrogen vehicles are all pursued simultaneously, rather than seen as competitors. This "portfolio approach," if accompanied by government policies driving a transition toward reduced oil use and low-carbon fuels, could reduce greenhouse gas emissions from cars and trucks to less than 20 percent of current levels and could nearly eliminate oil demand for these vehicles by 2050, the committee said.

Source: The National Academies

APA citation: Hydrogen vehicles making impressive progress toward commercialization (2008, July 17) retrieved 22 February 2020 from <https://phys.org/news/2008-07-hydrogen-vehicles-commercialization.html>

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