FCHEA
Fuel Cell & Hydrogen Energy Association

Debunking Fuel Cell Electric Vehicle and Hydrogen Energy Myths

With fuel cell electric vehicles (FCVs) on the roads in California, Japan and Germany, and automaker commitments to increase production and sales in the next few years, many misconceptions and myths are being perpetuated by critics and those unfamiliar with the technology.

Fuel cells generate electricity using an electrochemical reaction, not combustion, to unleash a fuel's stored chemical energy. They are clean, quiet, efficient, and scalable, making fuel cells an excellent option in nearly every power application, including transportation.

The Fuel Cell and Hydrogen Energy Association (FCHEA) has prepared this fact sheet to clear up some of the most common myths about FCVs and hydrogen. For further information, please visit us online at www.fchea.org, or contact us directly by email at info@fchea.org.

MYTH: Hydrogen is an unsafe fuel.

FACT: Hydrogen systems in FCVs are made to be as safe, if not safer, than gasoline systems in conventional vehicles.

Hydrogen has been safely produced, stored, transported, and used in the U.S. industrial sector for more than half a century. Millions of metric tons of hydrogen are produced annually for use in the fertilizer, agriculture, food, chemical, and petrochemical industries, and more.

As with every fuel, safe handling practices are required. However, unlike fossil fuels, hydrogen is non-toxic and does not pose a threat to human or environmental health if released.

Photo 3 - Time: 1 min, 0 sec - Hydrogen flow is subsiding, view of gasoline vehicle begins to enlarge
Hydrogen vehicle on left, gasoline vehicle on right (Source: Fuel Leak Simulation, Dr. Michael Swain, University of Miami)

Hydrogen tanks and the vehicle systems are designed with multiple safety enhancements to prevent leaks in both routine use and extreme circumstances. In the very unlikely scenario that an issue should occur, hydrogen systems are designed to safely release and ventilate the hydrogen fuel. Should a leak and subsequent ignition happen, the low radiant heat of a hydrogen fire and will reduce any potential damage, especially when compared to a gasoline fire (see above picture).[1]

MYTH: FCVs are dangerous.

FACT: FCVs have a demonstrated safety record and are just as safe as today's gasoline vehicles.

FCVs meet the strictest national safety and quality standards through the Federal Motor Vehicle Safety Standards (FMVSS).

[1] Fuel Leak Simulation. Dr. Michael Swain. University of Miami. http://evworld.com/library/Swainh2vgasVideo.pdf

FCVs have a proven safety record, with over 10 million miles logged by the automakers.[2,3,4] The Department of Energy has validated hundreds of thousands of FCV trips and tens of thousands of hydrogen fuelings.[5] In addition, there are more than 850,000 hydrogen fuel cell car, truck, van, bus, and forklift fuelings per year.[6]

High-pressure hydrogen is safe to have on-board a vehicle as FCV manufacturers have developed and tested carbon-fiber hydrogen tanks. These tanks withstand any credible environmental and man-made damage, including crash and ballistic testing. Toyota has demonstrated that only a .50 caliber armor piercing bullet was able to penetrate its hydrogen tanks, and even then the hydrogen simply dispersed into the atmosphere.[7]

MYTH: FCVs are inefficient.

FACT: FCVs are about twice as efficient as today's ICE vehicles.

Today's conventional ICE vehicles are only able to convert about 17-21% of gasoline or natural gas energy to motive energy.[8] Due to the high efficiency of fuel cell systems, FCVs using hydrogen generated from natural gas are able to convert 36% - 44% of that natural gas energy into motive energy to propel the car.[9]

This means that using hydrogen generated from natural gas will allow a FCV to travel twice the distance of an ICE vehicle burning that same amount of natural gas. This two-to-one efficiency advantage results from the fact that fuel cells use an electrochemical reaction to generate power, rather than combustion.

MYTH: FCVs are dirty.

FACT: FCVs generate zero tailpipe emissions. On a well-to-wheels basis, FCVs still generate far fewer emissions than gasoline ICE vehicles.

FCVs are zero-emission vehicles (ZEVs). The only emission produced from an FCV is water.

FCVs greatly reduce carbon emissions when compared to traditional vehicles, even when accounting for the full hydrogen fuel lifecycle.

For example, a Hyundai Tucson FCV fueled using California's hydrogen mix would attain the equivalent of 63 miles per gallon, a 60% reduction in carbon emissions relative to a conventional gasoline ICE Tucson.[10]

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[2] Ford, Daimler, Nissan to research hydrogen cars. Associated Press. January 29, 2013. https://www.globalautomakers.org/media/industry-news/2013/01/ford-daimler-nissan-to-research-hydrogen-cars-0

[3] GM fuel cell fleet tops 3 million miles. Green Car Congress. May 7, 2014. http://www.greencarcongress.com/2014/05/20140507-gm.html

[4] Hydrogen-Fueled Toyota FCV Priced at $69,000 in Japan on Sale in California by Summer 2015. Car and Driver. July 1, 2014. http://blog.caranddriver.com/hydrogen-fueled-toyota-fcv-priced-at-69000-in-japan-on-sale-in-california-by-summer-2015/

[5] Accomplishments and Progress. Department of Energy Fuel Cell Technologies. http://energy.gov/eere/fuelcells/accomplishments-and-progress

[6] Powerhouse Hydrogen. Air Products. June 2014. http://www.airproducts.com/~/media/Files/PDF/products/article-powerhouse-hydrogen-June2014-HE.pdf

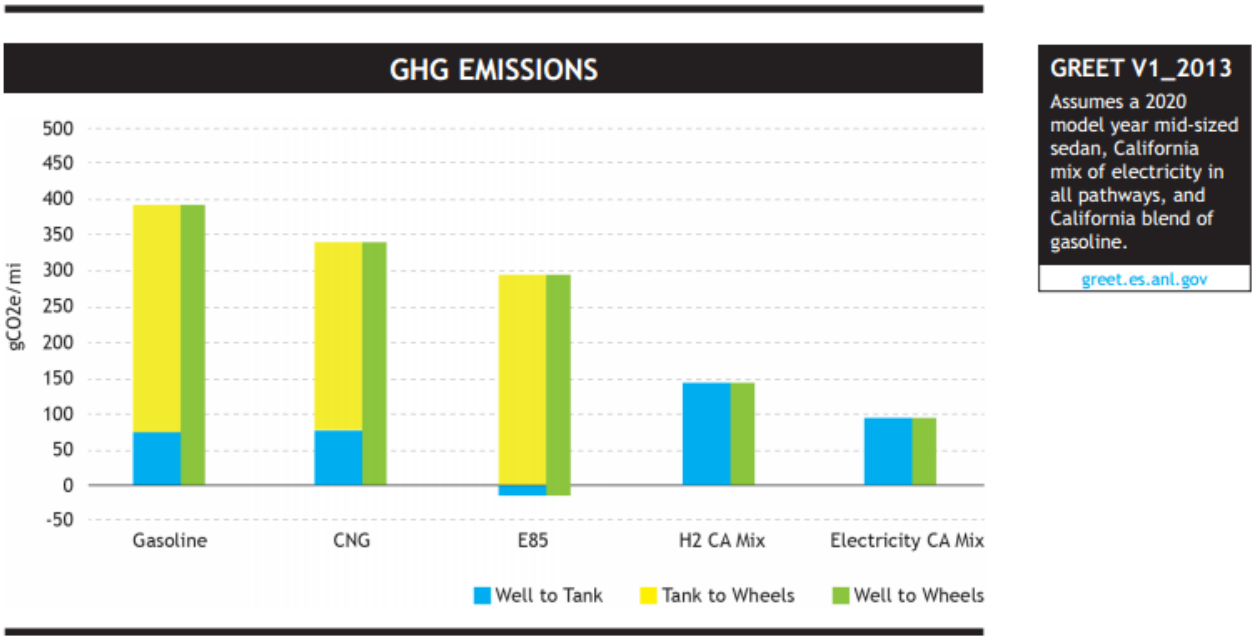
[7] 2014 Automotive News World Congress. Bob Carter Remarks. January 2014. http://corporatenews.pressroom.toyota.com/releases/2014+automotive+news+world+congress+carter.htm.

[8] U.S. Environmental Protection Agency. All-Electric Vehicles. http://www.fueleconomy.gov/feg/evtech.shtml.

[9] Air Climate Energy Water Security. California Fuel Cell Partnership. Page 7. http://cafcp.org/sites/files/W2W-2014_Final.pdf.

[10] How Clean are Hydrogen Fuel Cell Electric Vehicles. Union of Concerned Scientists. October 21, 2014. http://blog.ucsusa.org/how-clean-are-hydrogen-fuel-cell-electric-vehicles-696

As seen in the below graph, a 2020 mid-sized gasoline sedan would generate roughly 400 grams of CO_2 per mile, while a FCV would generate only 150 grams of CO_2 per mile assuming the California hydrogen feedstock mix.[11]



While battery electric vehicles (BEVs) would generate fewer greenhouse gases using the California electricity mix (approximately 100 grams of CO_2 per mile), in other parts of the country where power generation is more reliant on fossil fuels sources such as coal, FCVs will be a cleaner option when hydrogen is generated from natural gas.[12]

As FCV adoption increases across the country, efforts are underway to expand renewable hydrogen generation. In fact, the state of California already mandates that at least 33% of the hydrogen used for refueling is derived from renewable sources. When using hydrogen generated from renewables such as solar or wind, total lifecycle carbon emissions are eliminated completely.

MYTH: FCVs are difficult to refuel.

FACT: FCV refueling is very similar to a conventional gasoline internal combustion engine (ICE) vehicle.

Refueling a FCV is a simple, safe, and a self-service process that works similar to a conventional gasoline station fill-up. For both gasoline ICEs and hydrogen FCVs, consumers today use the same fueling process of connecting the dispenser to the vehicle tank, filling-up the vehicle with fuel, paying with a credit-card, and getting back on the road ready to drive another 300 miles in just 3 to 5 minutes.

[11] Air Climate Energy Water Security. California Fuel Cell Partnership. Page 6. http://cafcp.org/sites/files/W2W-2014_Final.pdf.
[12] Well-to-Wheels Greenhouse Gas Emissions and Petroleum Use for Mid-Size Light-Duty Vehicle. U.S. Department of Energy. May 10, 2013. http://www.hydrogen.energy.gov/pdfs/13005_well_to_wheels_ghg_oil_ldvs.pdf