Questions & Answers: Plug-in Hybrid Electric Vehicles (PHEVs) and Fuel Cell Electric Vehicles (FCEVs)

Q1: How many of these vehicles made by car companies are on the road?
A: FCEV's: 318 PHEVs[1]: 0

Q2: How many vehicles made by car companies have been placed on the road with their performance monitored by a US national laboratory?
A: FCEVs: 140 PHEVs: 0

Q3: How many miles have vehicles traveled under this real life evaluation program?
A: FCEVs: 1.92 million miles PHEVs: 0

Q4: According to MIT, how much more would they cost[2] in mass production compared to regular gasoline cars? (FCEV with 350 miles range and PHEV with 30 miles all-electric range)
A: FCEVs: $5,040 PHEVs: $6,020

Q5: According to the Argonne National Laboratory, how much would these vehicles reduce greenhouse gases initially?
A: FCEVs: 46% reduction PHEVs: 46% reduction

Q6: According to the Argonne National Laboratory, how much would these vehicles reduce oil consumption compared to regular cars?
A: FCEVs: 100% reduction PHEVs: 60% reduction

Q7: According to the National Academy of Sciences (for FCEVs) and the Idaho National Laboratory (for PHEVs), how much would the hydrogen fueling infrastructure (for FCEVs) and electrical charging outlets (for PHEVs) cost per vehicle?
A: FCEVs: $955/vehicle PHEVs: $878 to $2,150/vehicle

[1] Some after-market companies have retrofitted commercial hybrids, adding batteries in the trunk to provide some plug-in capacity, but no major car company with mass production capability has yet produced a PHEV.
[2] These are costs to the consumer, multiplying the estimated car company incremental costs in mass production by 1.4.

Sources

Q1: (cars on the road): 318 FCEVs: Hydrogen and Fuel Cell Letter Bulletin, May 8, 2009
[hfcletter@e.mailzeen.com]

Bulletin: May 8, 2009

Gov'ts Synchronize for 2015 Commercial FC Vehicle Launch, GM Paper Says

DETROIT, May 8 - Governments are globally synchronizing policies to start commercialization of fuel cell vehicles by 2015, according to an internal General Motors paper compiled in April and made available to The Hydrogen & Fuel Cell Letter.

It is one of several Key Takeaway statements in the 84-page document, "Global Fuel Cell and Hydrogen Infrastructure Competitive Analysis." According to a senior automotive industry source who did not want to be identified, it's not just something carmakers want but "it's a done deal."

The paper also says other countries and foreign carmakers are outpacing the United States in these areas: "Germany, Japan and OEMs based in these countries continue to execute their fuel cell and hydrogen plans for 2015," says another such statement, and "Competitors have more vehicular/engineering/manufacturing cycles of learning." Also, the "US NAS (National Academy of Science) addressed 'valley of death', low volume/immature technology, proposing price buy-down for customers" (H&FCL Feb. 07, Aug. 08).

The paper was prepared to "document the Automotive Fuel Cell and Hydrogen Infrastructure programs in both the US and foreign countries; Determine reasons for foreign nations focus on Hydrogen for Future;" and "Develop a clear understanding of the gap between the US and the rest of the world relative to these initiatives." It was compiled primarily from publicly available resources.

The paper summarizes earlier announcements by Daimler and Toyota to start building small fleets this year and in 2015, respectively (H&FCL Feb., March 09). It also says the current global fleet of fuel cell vehicles stands at **318**, with GM contributing more than one third (115). Hyundai has announced plans for another 100 cars and Honda plans to have 200 leases over the next three years.

Germany's main goal, the paper says, is to "develop and implement a strategy for a long term, nationwide market introduction of hydrogen as a fuel for transport" via its Transport Energy Strategy launched 11 years ago and, so far, scheduled to run through 2016. In Asia, "'Japan Inc.' is alive and well in advanced technologies," and "They intend to win."

The U.S. Energy Department has funded many programs for auto fuel cells, but "there is still much work to be done to match the German/Asian Partnerships." The United States needs to do a better job to "link industries together as well as the public-private sector to insure National Competitiveness and match countries like Japan and Germany." The problems in creating a US hydrogen fueling infrastructure include "regional, fragmented, inconsistent" efforts; "multiple, convoluted funding sources," and "fuel providers have been inconsistent in their support (H&FCL April 09).

Q2: (Cars tested by National Lab): 140 FCEVs

NREL National Renewable Energy Laboratory

A national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy

Innovation for Our Energy Future

Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project

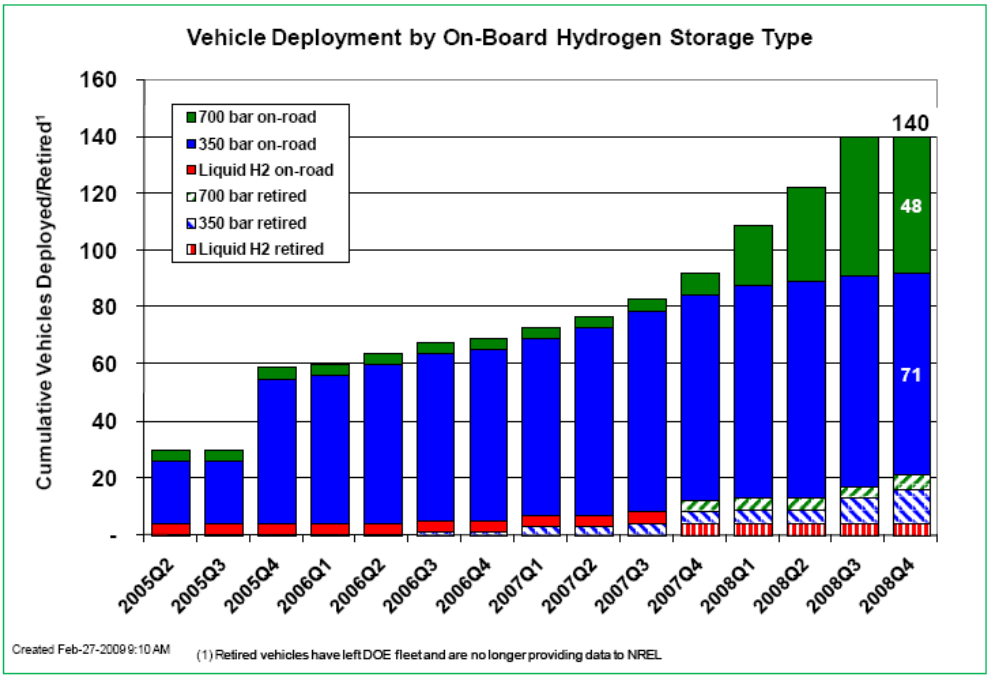
Spring 2009

Composite Data Products
Final Version March 13, 2009

Keith Wipke, Sam Sprik, Jennifer Kurtz, and Todd Ramsden

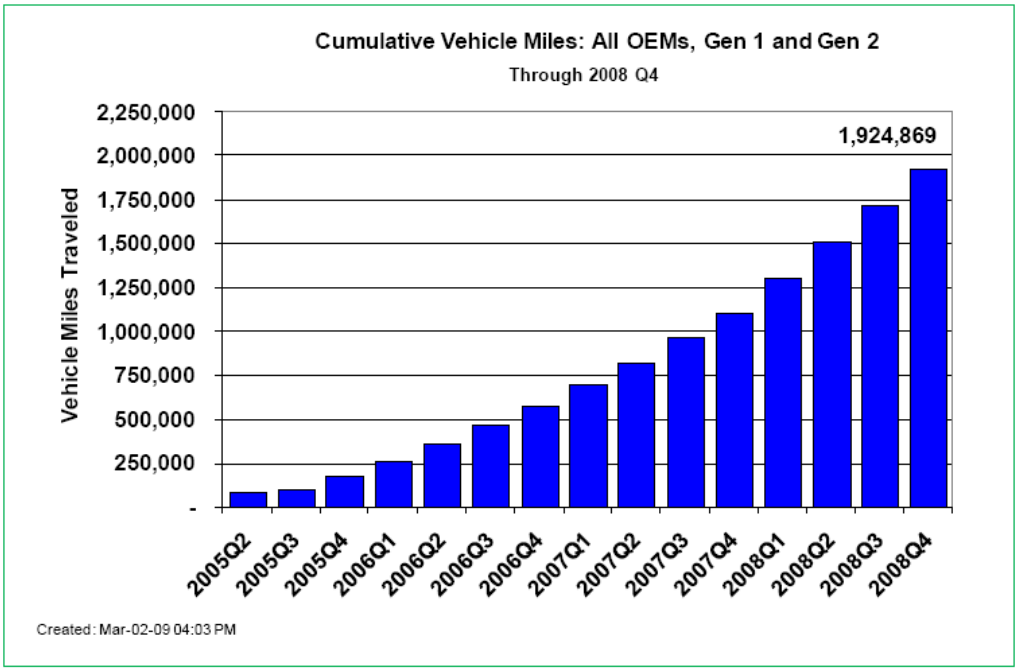
Technical Report
NREL/TP-560-45451
March 2009

CDP#25: Vehicle H2 Storage Technologies



Q3: (Miles traveled): FCEVs: 1.92 million miles (Ibid, NREL, Slide #24):

CDP#24: Cumulative Vehicle Miles Traveled



Q4: (Incremental cost over ICEV): FCEV = $5,040 = 1.4 x $3,600 manufacturer's incremental cost; PHEV = $6,020 = 1.4 x $4,300 manufacturer's incremental cost over a conventional gasoline car. See Figure 53 of M.A. Kromer and J.B. Heywood, "Electric Powertrains: Opportunities and Challenges in the U.S. Light Duty Vehicles Fleet," Sloan Automotive Laboratory, Massachusetts Institute of Technology, Publication No. LFEE 2007-03 RP, May 2007.

Q5: (GHG reductions): FCEV: -46% (370 g/mile to 200 g/mile for 30 miles AER; PHEV-30: -46% (same data point at 30 miles AER)
[*For 10 miles AER, FCEV = -44% (370 g/mile to 240 g/mile) and PHEV-10 = -35% (370 to 208 g/mile)]*
Argonne National Laboratory Report: Figure 17

ANL/ESD/09-2

Well-to-Wheels Energy Use and Greenhouse Gas Emissions Analysis of Plug-in Hybrid Electric Vehicles

By
A. Elgowainy, A. Burnham, M. Wang, J. Molburg, and A. Rousseau
Center for Transportation Research
Energy Systems Division, Argonne National Laboratory

February 2009

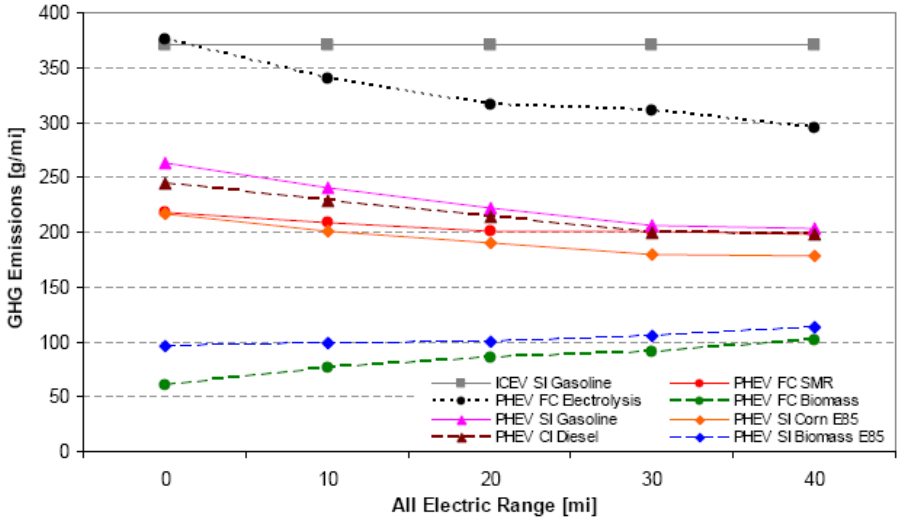


FIGURE 17 WTW GHG Emissions for Combined CD and CS Operations as a Function of AER Using the California Marginal Generation Mix

Q6: (Oil reduction): FCEV: 100% reduction; PHEV: 60% reduction, from 4,000 btu/mile for an ICEV to 1,600 btu/mile for a PHEV with 30 miles all-electric range. Ibid, Elgowainy, Argonne National Lab, Figure 16:

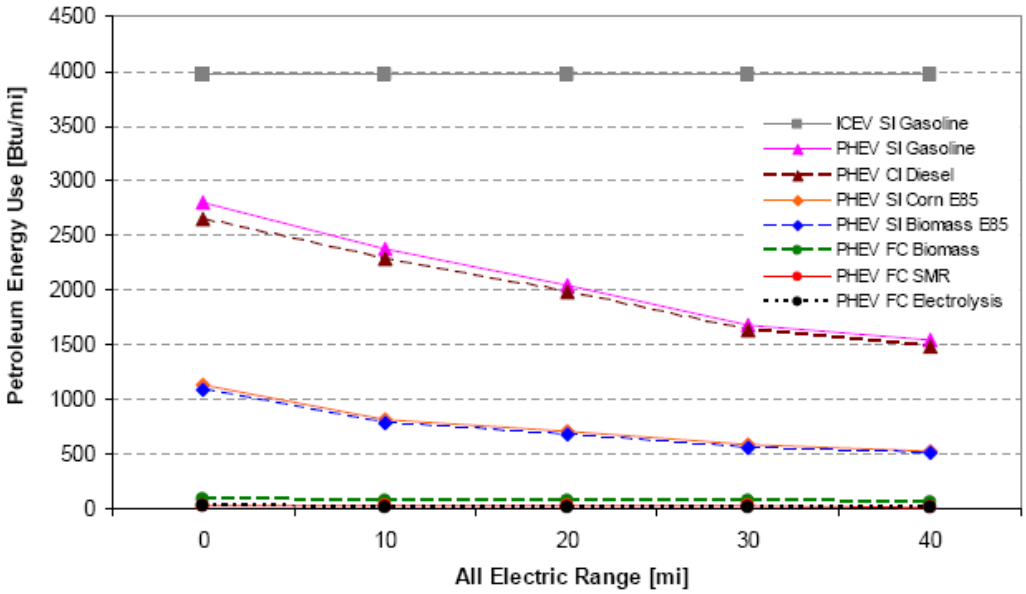


FIGURE 16 WTW Petroleum Energy Use for Combined CD and CS Operations as a Function of AER

Q7: (fueling infrastructure cost): FCEV: the NRC/NAS study estimated that a 1,500 kg/day refueling station based on steam reforming of natural gas would cost $2.2 million; this station would serve approximately 2,300 FCEVs, assuming 4.5 kg of hydrogen for 350 miles range, 70% average station capacity factor, and 13,000 miles per year average vehicle travel. The station cost per FCEV would then be $2.2 million / 2,300 = $955/vehicle.

Ref: M. P. Ramage, Chair, Committee on the Assessment of Resource Needs for Fuel Cell and Hydrogen Technologies, "Transitions to Alternative Transportation Technologies—A Focus on Hydrogen," National Research Council of the National Academies, Washington, DC, 2008 http://books.nap.edu/catalog.php?record_id=12222#toc

PHEV: Morrow et al at the Idaho National Laboratory estimated the current costs of installing a Level 1 120 Volt, 20 Amp single phase circuit ($878) for charging a PHEV and a Level II outlet at 240 Volt, 40 Amp, single phase ($2,150) for somewhat faster charging at home.

Ref: Morrow, K., D. Karner, J.Fancfort, "Plug-in hybrid electric vehicle charging infrastructure review," Final Report INL/EXT-08-15058, Idaho National Laboratory, November 2008