



Auto Companies On Fuel Cells

By Brian Walsh and Peter Moores

The auto companies' exact production time table for fuel cell vehicles (FCVs) is not known because too many factors of technological feasibility and economic logistics are uncertain at this early date. Nevertheless, projections made by car companies themselves and energy and automotive experts concur that around 2010, and perhaps earlier, car manufacturers will have mass production capabilities for fuel cell vehicles, signifying the time they would be economically available to the average consumer.

Every major automaker has been researching and developing some type of fuel cell vehicle. DaimlerChrysler, General Motors, Ford, Toyota, Honda, and Nissan predict that full commercialization for the general public will begin around 2010, starting with fleet vehicle demonstration programs in 2002 to 2004 followed by fleet commercialization. Some foresee major production or significant market penetration even earlier than 2010. Moreover, the car manufacturers' projections coincide with independent market projections and governmental plans for a dramatically rising demand curve while the cost curve continues to fall.

It is generally accepted that fuel cell vehicle production will follow a timeline as follows:

Starting in 2002-4:

- First production FCVs tested on public roads in US, Europe and Japan in demonstration fleets.

Around 2006-2007

- Second generation fuel cell systems incorporated into FCVs and the expansion of FCV fleets in the US, Europe and Japan.

Starting in 2010

- Marketing of commercially viable FCVs at affordable prices - this will be the first step toward ultimately replacing the conventional internal combustion engine models.

This is the accepted model because fleets represent the best way to gain real world experience with FCVs while continuing refinement. Fleets also circumvent fueling infrastructure problems since most fleets use a centrally located fueling station and maintenance facility.

This central station or limited hydrogen-fueling network can supply pure hydrogen for the fleet vehicles, making fleet FCVs Zero Emission Vehicles (ZEVs). By 2010 when the general public might be able to purchase a FCV, fuel providers will have to be found to supply hydrogen; clean hydrocarbon fuel, methanol, or some other fuel may also be used. Most OEMs have experimented with many different fueling options, but only hydrogen makes the vehicle a pure ZEV. Significant hydrogen infrastructure investment will be required regardless of the choice of vehicle fuel.



Historically, General Motors (GM) has been on the forward edge of production estimates. As early as December 1998, GM was forecasting “up to 10% of its Opel cars will be powered by fuel cells by 2010.”¹ Today, Opel manufactures roughly 2 million vehicles worldwide,² implying roughly 200,000 fuel cell vehicles. This forecast is “old” by industry standards, and more recent GM forecasts have placed thousands of GM fuel cell vehicles on the road by 2010.³

For instance, on August 29, 2002, Bloomberg News reported that, “General Motors has said it expects to sell thousands of fuel-cell autos annually by 2010.”⁴ Earlier that month, Larry Burns, GM’s vice-president for R&D, told reporters that “GM’s goal is to be the world’s first company to produce one million fuel cell vehicles a year,” and that GM is looking to sell hundreds of thousands of fuel cell vehicles between 2010 and 2020.⁵ Most recently, U.S. Secretary of Energy Spencer Abraham said the government believes fuel cell vehicles and a hydrogen-refueling infrastructure would be ready no sooner than 2015 to 2020 – supporting President Bush’s new Freedom Fuel initiative proposal. GM’s Larry Burns, however, says infrastructure will not delay GM’s goal to produce an economical mass produced fuel cell vehicle by 2010. In fact favorable comments from GM abound:

9/2001 – In a question-and-answer interview, HyWire/Autonomy Program Director Chris Borrioni-Bird stated: “We [GM] are on a path to provide hundreds of thousands of fuel cell vehicles and stationary module applications by the end of the decade.”⁶

8/12/02 – “In an interview with Bloomberg, Paul Lancaster, Ballard Power Systems Inc.’s vice president of finance, said of GM’s plans, ‘That’s been a bit of a surprise to me. GM had been one of the most pessimistic of all of the major automakers about

¹ Jeffrey Ball, “Road Test: Auto Makers Are Racing To Market ‘Green’ Cars Powered by Fuel Cells,” The Wall Street Journal Monday, March 15, 1999

² Opel is a subsidiary of GM. See Opel’s site at <http://www.opel.com/corporate/1/12.html>.

³ See also Rocky Mountain Institute’s report from June 2000 that, “GM aims to make “hundreds of thousands of fuel-cell vehicles annually before the end of the decade.”” available at <http://www.rmi.org/sitepages/pid388.php>.

⁴ See Bloomberg’s report at http://www.auto.com/industry/iwird29_20020829.htm.

⁵ See MSNBC’s account available at <http://stacks.msnbc.com/news/793959.asp?cp1=1>

⁶ Chris Borrioni-Bird Q&A “The Hydrogen & Fuel Cell Letter” Sept. 2002 Vol. XVII/No.9

this technology. In terms of the timeline [for fuel-cell vehicles], they've always been talking about 30 years out, 50 years out. General Motors is now saying the market for fuel cell vehicles could be something like 80 million units in the decade between 2010 and 2020. That's an outstandingly large number', Lancaster continued."⁷

7/30/02 – GM's Larry Burns said, "it's possible that hundreds of thousands of hydrogen fuel cell-power vehicles could be on the road by 2010."⁸

7/30/02 – Dan O'Connell, a GM official, said, "GM is predicting that hundreds of thousands of vehicles powered by hydrogen fuel cells will be on the road by 2010."⁹

7/30/02 - During the dedication of a new fuel cell research facility, GM's Burns, said, "GM expected to have a 'significant' number of fuel cell vehicles on the road by 2010."¹⁰

7/29/02 - "A significant number of fuel cell vehicles will be on the road by 2010, the head of General Motors Corp's fuel cell program said Monday at the dedication of a new research facility... 'Given our current technological momentum and business realities, we expect to see compelling and affordable fuel cell vehicles on the road by the end of the decade,' said Larry Burns . . ."¹¹

2/19//2002 – In Melbourne, Australia: "Approximately 50 members of Media, Government and Industry met to hear GM's new Autonomy strategy to produce hundreds of thousands of fuel cell vehicles in 2010 and to make the ICE engine obsolete by 2020."¹²

9/14/01 - "*GM Expect to Mass Produce FCVs by 2010*: General Motors expects to mass-produce fuel cell vehicles (FCVs) by the end of the decade. The FCV will use gasoline as primary fuel, which will be transformed into hydrogen through a reformer.

⁷ "Fuel Cell Vehicles: Automakers Step Up Competition," Eye For Fuel Cells, August 12, 2002 available at <http://www.eyeforfuelcells.com/ReportDisplay.asp?ReportID=1541>

⁸ It should be noted that Ed Garsten writing for the Associated Press wrote many of these quotes, but he did not consistently portray what Larry Burns said. Ed Garsten, "GM Says Stationary Fuel Cell Power Generators Key to Producing Vehicles," Associated Press, July 30, 2002 available at <http://www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/NewsDisplayArticle/0,1471,1597,00.html>

⁹ Dan O'Connell heads up GM's systems at its fuel cell development center in Honeoye Falls, N.Y. "GM Envisions Mass Adoption of Hydrogen Fuel Cell Cars" available at <http://www.eprairie.com/news/viewnews.asp?newsletterID=4020>

¹⁰ Ed Garsten, "German Organization Certifies 10,000 psi hydrogen tank," Associated Press, July 30, 2002 available at http://www.dallasnews.com/sharedcontent/autos/topstories/j073002_cc_autos_gmquantum.40d9830b.html

¹¹ Ed Garsten, "GM Opens New Fuel Cell Research Center," Associated Press, July 29, 2002 available at <http://www.detnews.com/2002/autosinsider/0207/29/autos-548745.htm>

¹² See <http://www.ozfuelcells.com/>

Other car manufacturers have said they expect to have a FCV commercially available by 2005."¹³

Granted not every comment or projection has been as optimistic as those above.

5/3/02 – Lawrence Burns: “I’m frequently asked when we expect to see large numbers of fuel-cell vehicles. The timetable is hard to predict; I’d rather spend my time creating the future instead of trying to predict it. Current state of technical feasibility and business realities lead us to conclude that there will be affordable, profitable fuel-cell vehicles on the road by the end of the decade. High penetration of fuel-cell vehicles will take longer because of the issues relating to an adequate hydrogen infrastructure and the installed base needed to support high volumes of vehicles.”¹⁴

5/2/02 - “Every major automaker is working on some sort of fuel-cell vehicle and plans to begin making some available for fleet sales within a year. Mass-produced, affordable fuel-cell vehicles are not expected to be available until at least 2010.”¹⁵

2/11/03 - "My view on the infrastructure is pretty simplistic," Larry Burns says. "It's an appliance. You can create the hydrogen today in your garage if you want, with electrolyzers and natural gas reformers. If infrastructure means how do you create hydrogen and put it in a car, I don't think that will be a showstopper."¹⁶

Despite GM's minor ambivalence and the standard claim that mass production of fuel cell vehicles is not economically feasible until 2010, GM has made strong and clear claims that it believes it will be producing, at minimum, a significant number of fuel cell vehicles by 2010. GM has also repeatedly expressed its desire to be the first to sell 1,000,000 fuel cell vehicles profitably.



To help with GM's technological transition, it has expressed a commitment to the production of stationary fuel cell power generators. The idea is to follow the fuel cell cost curve and enter different markets as systems become competitive for those markets. Stationary fuel cells are cost competitive around \$1,000/kW while transportation fuel cell developers are aiming at \$50/kW. GM plans to begin selling

¹³ From Reuters News Service, September 14, 2001 available at http://www.yournextcar.org/NewsBriefs_0901.html

¹⁴ Larry Burns: to the MIT Sustainable Mobility Symposium May 3, 2002 available at http://www.gm.com/company/gmability/sustainability/news_issues/speeches/autonomy_050602.html

¹⁵ Ed Garsten, “GM Unveils 1st Gas-Fed Fuel Cell,” Associated Press, May 2, 2002 available at <http://www.siliconvalley.com/mid/siliconvalley/news/3178811.htm>. Garsten's reporting appears to have assumed that no mass commercialization until 2010 until Burn's comments later in the year.

¹⁶ Richard Truett, “GM Sticks to 2010 target for Fuel Cell Vehicles.” Automotive News, Feb. 11, 2003 available at: <http://www.autonews.com/news.cms?newsId=4538>

75 kW hydrogen fueled stationary fuel cell systems in 2005, using this market to help drive costs down to produce cost competitive transportation fuel cells by 2010:



12/4/02 – “If either [stationary or vehicle fuel cells] is ever to make it into mass production, General Motors will have to cut the cost of their fuel-cell engines by a factor of 10 from the \$37,000 they would cost now.”¹⁷

7/30/02 - Tim Vail, GM's director of distributive generation solutions: , “GM will produce prototype units by late 2003 or early 2004 and have fuel cell-powered electric generators commercially available by 2005.”¹⁸

12/4/02 – “By 2005, ‘we believe that we will be at sub-\$1,000 a kilowatt of installed power, which will be competitive with diesel generators,’ Vail said in a telephone interview. The company's fuel-cell generators cost about \$5,000 a kilowatt now. Vail said that if the agreements to sell the first several generators, to be built in the company's Honeoye Falls, New York, research center, ‘work out on the marketing side, then we will make a significant investment in a factory to produce 10,000 of them a year for 2005.’ That decision will be made in 2004, Vail said.”¹⁹

Although GM has conceded the race to make the first fuel cell vehicle sales agreement, it has shown a substantial commitment to fuel cells and has taken a well calculated slow and steady approach, focusing on new technological approaches and new technologies. The HyWire represents a proof of concept – to package the entire fuel cell vehicle into a skateboard platform with little concern for an impressive range: “just enough for a full day’s worth of media ride and drives”. Theoretically, however, it could have the same range and mile per gallon (mpg) gas equivalent as GM’s HydroGen3 since both vehicles use identical power trains.



Along the same lines, GM’s latest prototype, an advanced version of the HydroGen3 released in December, 2002, is the first fuel cell vehicle to incorporate a 10,000 pounds per square inch (psi) hydrogen storage tank, at least double that of any previous fuel cell vehicle. Additionally, GM’s liquid hydrogen fueled HydroGen3 prototype will be its first fuel cell vehicle used by a private company, FedEx Corp. in

¹⁷ Alan Katz, “GM sees fuel cells used in factories before cars,” Bloomberg News, Dec. 4, 2002 available at: http://www.auto.com/industry/iwirg4_20021204.htm

¹⁸ Dan O’Connell heads up GM’s systems at its fuel cell development center in Honeoye Falls, N.Y. “GM Envisions Mass Adoption of Hydrogen Fuel Cell Cars” available at <http://www.eprairie.com/news/viewnews.asp?newsletterID=4020>

¹⁹ Alan Katz, “GM sees fuel cells used in factories before cars,” Bloomberg News, Dec. 4, 2002 available at: http://www.auto.com/industry/iwirg4_20021204.htm

Tokyo, Japan. FedEx will use it between June 2003 and June 2004. It represents GM's first entry in Japan's Hydrogen and Fuel Cell Demonstration Project as well as the first liquid hydrogen fueled vehicle allowed on Japanese public roads. FedEx will have free use of the vehicle; a GM technician will ride along collecting data.



Initially, Ford plans on small consumer market penetration beginning with around 40 Ford fuel cell Focus vehicles for fleets in 2004.²⁰ Ford intends to will ramp up to producing 50,000 fuel cell vehicles per year by 2010. Its plan is expressed in the following:

8/23/02 - "Ford, DaimlerChrysler, Honda, and Toyota are among the big names working feverishly to commercialize zero-emission hydrogen fuel cell vehicles. Low-level production is set for 2004, while mass availability is projected between 2008-2010, industry sources say."²¹

8/1/02 - "Ford Motor Co. plans low-volume, 'limited-application development production' of fuel cell vehicles in 2004, with an incremental increase in 2005, and a 'step up in volume' in 2006 and 2007, says Richard Parry-Jones, Ford's chief of global product development. 'That may provide the springboard for what I call a viable entry, although not very high volume, in 2010,' he says."²²

4/8/02 - "According to Fleet News Europe, the German fleet vehicle market is set to play a major part in Ford's plans for the commercialization of fuel cell vehicles. By 2010 Ford believes it will be making at least 50,000 fuel cell vehicles per year, many times the number the company will produce in 2004, when it is expected to make the first sales. In 2004 Ford is expected to produce a few dozen fuel cell cars at most. These vehicles - revealed Dr. Franz-Martin Duel, manager of alternative power trains marketing at Ford Europe - will first be operated in small fleets in Germany and California. He indicated that it



²⁰Stefan Geiger, "Ford Presents Production Ready Fuel Cell Vehicle," FuelCellToday, Oct. 3, 2002 available at

<http://www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/NewsDisplayArticle/0,1471,1878,00.html>

²¹"Hydrogen Economy to Fuel the 21st Century," Deutsche Presse-Agentur, August 23, 2002 available at

<http://www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/NewsDisplayArticle/0,1471,1731,00.html>

²² Drew Winter with Peter Robinson, Eric Mayne and Herb Shuldiner, "Behind the Fuel Cell Hype," Ward's Auto World, August 1, 2002 available at http://waw.wardsauto.com/ar/auto_behind_fuel_cell_2/

would not be until 2010 that a fuel cell vehicle was launched in commercial volumes.”²³

10/30/00 – “Kopf said the production Focus FCVs will likely be sold mostly for use in business fleets that can install equipment for handling hydrogen. He said reducing the cost of fuel cell power was the biggest technical challenge, one that Ford won't likely solve before 2010.”²⁴

Ford apparently expects to have “mass availability” starting around 2010 and perhaps full-scale production then. At minimum, according to the April 2002 report, Ford will be making “at least 50,000” fuel cell vehicles per year in the worldwide market.

DAIMLERCHRYSLER

DaimlerChrysler is markedly different from General Motors or Ford in its projections. In

recent years, DaimlerChrysler has not publicly made any strong estimates for production of fuel cell vehicles before 2010. Instead, it has mostly accepted the maxim that “these vehicles are not likely to be commercially available in quantity until at least 2010.”²⁵

DaimlerChrysler officials in the late 1990's made some remarks that it was planning on building from 50,000 to 100,000 fuel cell vehicles between 2005 and 2010.²⁶ One



Wall Street Journal Article has a DaimlerChrysler representative claim that its partnership with

Ford and Ballard could produce “enough fuel-cell systems for 40,000 vehicles by 2004 and 100,000 vehicles by 2006”, but this does not establish the economic viability of the plan nor has the forecast begun to manifest itself.²⁷



Despite DaimlerChrysler's not publicizing projections, its FCV demonstration endeavors are on a larger scale regarding numbers and scope than other OEM's.

²³ Fleet Market Beckons for Ford Fuel Cell Vehicles, Fuel Cell Today, April 8, 2002 available at <http://www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/NewsDisplayArticle/0,1471,1137,00.html> (emphasis added).

²⁴ Justin Hyde, “Ford Says Focus to be Base for Production Fuel Cell Vehicle,” Associated Press, October 30, 2000 available at <http://www.detnews.com/2000/autos/0011/01-141592.htm> (Bruce Kopf was the director of engineering for ThInk, Ford's alternative fuel division)

²⁵ “Fuel Cell Car Coasts Across U.S.,” Wired Magazine, June 5, 2002, available at <http://www.wired.com/news/technology/0,1282,52877,00.html>

²⁶ See Report from the French Atomic Energy Commission available at <http://www.cea.fr/gb/publications/Clefs44/an-clefs44/clefs4442a.html> (“In the 2005-2010 period, DaimlerChrysler plans to build between 50 000 and 100 000 fuel cell vehicles.”)

²⁷ Jeffrey Ball, “Road Test: Auto Makers Are Racing To Market 'Green' Cars Powered by Fuel Cells,” The Wall Street Journal Monday, March 15, 1999

DaimlerChrysler is demonstrating a fuel cell Sprinter van at Hermes delivery service in Germany - the world's first fuel cell vehicle in regular service on public roads.

DaimlerChrysler is also producing the world's first fuel cell vehicle fleet, comprising 33 Citaro fuel cell buses, which will be operated in 11 cities worldwide starting in 2003. Most recently, DaimlerChrysler announced it will

place 60 passenger fuel cell vehicles (F-Cell) in 2003 around the world, starting with eight on Japan's roads early in 2003.²⁸



The Japanese OEMs are in perhaps the most advanced stages of fuel cell vehicle development. Honda's FCX was the first fuel cell vehicle to receive certification by the U.S. Environmental Protection Agency and California Air Resources Board as a zero emission vehicle. Honda has also met applicable U.S.

safety standards.²⁹ In the next two to three years, Honda expects to lease 30 cars in California.³⁰ These new plans appear to retrench from older estimates that it would "start building in the region of 300 fuel cell vehicles a year in 2003, for sale in Japan and the USA."³¹ Honda prefers to comment on the current status of its technology rather than predicting any future trends.

12/23/2002 – "It's the most promising technology for future cars' power trains. Performance-wise, even today, they're better than conventional cars. The starting torque is very high and smoother . . . the technology is changing so much that each car is handmade," says, Hiroyuki Yoshina, Honda's president and chief executive.³²

It appears Honda is keeping true to its latest projection of 30 vehicles. The city of Los Angeles, California, has leased five Honda fuel cell FCXs, the first of which was delivered on December 2, 2002. The rest will follow in 2003 and are being leased for \$500 per month per vehicle



²⁸ "DaimlerChrysler to Test Hydrogen Fuel Cell Vehicles in Japan," Asia Pulse Pte Ltd. December 17, 2002. Available at:

<http://www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/NewsDisplayArticle/0,1471,2250,00.html>

²⁹ "Honda Fuel Cell Vehicle First to Receive Certification Honda FCX Slated for Commercial Use," July 24, 2002 available at <http://world.honda.com/news/2002/4020724.html>

³⁰ "Honda Fuel Cell Vehicle First to Receive Certification Honda FCX Slated for Commercial Use" July 24, 2002 available at <http://world.honda.com/news/2002/4020724.html>

³¹ Mark Cropper, "Fuel Cells in Japan: Transportation," September 7, 2001 available at <http://www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/IndustryInformationDisplayArticle/0,1168,192,00.html>

³² "Online Extra: Honda's CEO on Fuel Cells' Future," December 23, 2002. Business Week online, Science & Technology. Available at:

http://www.businessweek.com:/print/magazine/content/02_51/b3813085.htm?tc

for two years. On the same day, Honda delivered one FCX to the Japan's Cabinet Office for \$6,500 (800,000 yen) per month under a 12-month contract. In the same month, Honda signed a supply agreement with Ballard Power Systems for up to 32 Mark 902 fuel cell modules through 2005 and support services for Honda's fuel cell vehicle customer deliveries in the US and Japan.

Honda does not appear to have released information detailing its intended practice beyond its initial phase for transportation. Honda has, however, been extensively researching the infrastructure requirements for fuel cell vehicles, specifically the feasibility of solar-powered hydrogen production and fueling stations like the one it recently built in California, and a hydrogen home fueling system with Plug Power, Inc.



Toyota has also carried out its plan to make fuel cell vehicles available in limited numbers for lease by the end of this year (2002). "Toyota

plans limited selling of a fuel-cell hybrid passenger vehicle (FCHV) in Japan and the US from around the end of this year."³³

These plans were realized on December 2, 2002 when Toyota leased one FCHV to each of four central Japanese government agencies: Cabinet Secretariat, the Ministry of Economy, Trade and Industry, the Ministry of Land, Infrastructure and Transport and the Ministry of Environment. The agencies each have a 30-month lease contract and are paying \$9,800 (1.2 million yen) per month per vehicle.³⁴

On the same day, Toyota delivered one FCHV to the University of California, Irvine (UCI) and one to the University of California, Davis (UCD). These deliveries are Toyota's first step in a plan to establish California fuel cell "community" partnerships of government, business and higher education to tackle product, infrastructure and consumer-acceptance challenges.



The two University of California (UC) vehicles were the first of a total of six that will be leased to the two UC campuses - the additional four vehicles will arrive later in 2003 - and each vehicle will be leased for a total of 30 months for \$10,000 per

³³ See Fuel Cell Highlights at <http://fuelcellsworks.com/InsidetheindustryJuly02.html>

³⁴ "Toyota to launch hydrogen car in Japan Dec. 2," Kyodo News, Nov. 18, 2002 available at: <http://www.fuelcelltoday.com/FuelCellToday/IndustryInformation/IndustryInformationExternal/NewsDisplayArticle/0,1471,2091,00.html>.

month.³⁵ However, Toyota has been explicit that it does not expect “full-scale commercialization” until 2010 at the earliest.³⁶ In fierce competition with Honda for Japan’s burgeoning fuel cell interest and dollars, Toyota released its vehicles one year ahead of schedule and plans to lease a total of 20 vehicles in the next few months (10 in California).³⁷ Toyota has publicly delivered or committed 10 FCHVs – already half their publicized goal of 20.

To transition to fuel cells, Toyota has a strong commitment to hybrid gasoline/electric systems and plans use these systems to sell 300,000 gasoline/electric hybrids per year under its own name in five years. Although not ZEVs, gasoline/electric hybrid vehicles may serve as an important step towards fuel cell vehicles as many of the system components are directly transferable. Nissan has stated that it would buy gasoline/electric hybrid engine systems from Toyota starting in 2006, and GM is currently in negotiation for a similar supply deal.³⁸



Similar to GM, Toyota is also developing its own stationary fuel cell power plant. Toyota will target the Japanese residential market with a 1kW system in 2008, with the hope of driving the fuel cell costs down to meet the competitive costs needed for the automotive market.

Toyota also has a second-generation pair of fuel cell hybrid buses, FCHV-BUS1 and BUS2. Toyota claims these vehicles are three-times more efficient than conventional gasoline-powered vehicles. In-house road tests were conducted in Japan on the FCHV-BUS1 in 2001. The FCHV-BUS2 prototype, released in 2002, has received Japanese Transport Ministry’s approval for public road testing, which will continue into 2003. The Tokyo metropolitan government has chosen Toyota’s FCHV-BUS2 to run on its new waterfront route during the summer of 2003. This will be the first fuel cell bus to operate in regular service on Japanese roads.



³⁵ “Toyota Delivers First two, Market-Ready Zero-Emission-Certified Hydrogen Fuel-Cell Vehicles,” PRNewswire, Dec. 2, 2002.

³⁶ “Toyota to Release Full Cell Vehicle Earlier than Planned,” Detroit News Wire Service, July 1, 2002 available at <http://www.detnews.com/2002/autosinsider/0207/01/autos-527857.htm>.

³⁷ Toyota to Release Full Cell Vehicle Earlier than Planned,” Detroit News Wire Service, July 1, 2002 available at <http://www.detnews.com/2002/autosinsider/0207/01/autos-527857.htm>. (“Toyota, the world’s No. 1 automaker by market value, initially planned to release the FCHV-4, based on the Kluger V/Highlander sport-utility vehicle, in 2003”)

³⁸ “Toyota aims for 100% hybrid line-up by 2012,” AUTOASIA, 10/24/02



Nissan, the third of the major Japanese automakers, announced it would begin to deliver its first fuel cell vehicle in 2003 instead of 2005.³⁹ "We are advancing it by two years," Nissan Chief Executive Carlos Ghosn told a news conference.⁴⁰ Nissan's long-range predictions are unclear, but the push for Japanese companies to produce fuel cell vehicles has mostly been government driven. Following Toyota, Honda, and GM, Nissan's fuel cell X-Trail was approved by the Japanese Minister of Land, Infrastructure and Transport for public road testing, which will start immediately along with limited marketing later in 2003.

Japan has the ambitious goal of laying the groundwork by 2005 for FCV commercialization, with the aim of having 50,000 fuel cell vehicles by 2010 and five million by 2020 (one out of every 14 cars), according to Japan's Ministry of Economy, Trade, and Industry (METI).⁴¹ Japan has also pledged to work with the vehicle manufacturers: "Japan's government said . . . it will work with automakers and energy firms in three-year projects to encourage the development of fuel cell technology for vehicles and households."⁴²



Moreover, Japan's government has decided to aggressively purchase fuel cell vehicles with Japan's Prime Minister Junichiro Koizumi commenting, "[w]e decided at today's cabinet meeting that the government would start buying fuel cell vehicles, [six] next year if car companies are able to market them."⁴³ This was demonstrated with the Dec. 2 Toyota and Honda deliveries, and more Japanese government purchases may be expected in 2003. In reaction to a forecasted rise in the fuel cell market, the Japanese government is beginning to invest great sums of money into the industry.⁴⁴

It appears clear that Japan is stimulating Japanese automakers pursuant of commercialization for its fuel cell vehicles, and the warming competition among

³⁹ Alston Gee, "Nissan Accelerates Fuel Cell Plans." BBC World Business Report, July 30, 2002 available at <http://news.bbc.co.uk/1/hi/business/2161279.stm>

⁴⁰ "Nissan to Start Selling Fuel Cell Cars in 2003," Reuters, July 30, 2002 available at http://money.iwon.com/jsp/nw/nwdt_rt.jsp?section=news&news_id=reu-t301909-u1&feed=reu&date=20020730&cat=INDUSTRY

⁴¹ "Japan wants 50,000 fuel cell cars on road by 2010," November 11, 2001 available at <http://www.auto-asia.com/viewcontent.asp?pk=5897>

⁴² "Japan Government, Car & Energy Firms in Fuel Cell Projects," Reuters, July 18, 2002 available at <http://www.evworld.com/databases/shownews.cfm?pageid=news180702-06>

⁴³ "Japan Government Pledges to Buy Fuel Cell Vehicles," Reuters, April 26, 2002 available at <http://www.fuelingtech.com/corporate/articles/Article4.pdf>

⁴⁴ "Domestic Efforts To Spread Use of Fuel Cells Viewed," Tokyo The Nikkei Weekly in English, October 14, 2002

Japanese car manufacturers over bringing fuel cell vehicles to the market is evidence of this.

Moreover, government interjection is becoming more and more prevalent throughout the world. The EU recently announced plans to spend approximately US\$2.09 billion from 2003 to 2006 on renewable energy development at least partly focused on hydrogen.⁴⁵ This marks a significant increase from Europe's last three-year investment of US\$127 million.



Most other automakers are also involved in public road tests for their fuel cell prototypes. South Korea's **Hyundai Motor Co.** has a strategic partnership with UTC Fuel Cells and hopes to have a number of hydrogen-fueled fuel cell Santa Fe's at power utilities and research institutes in 2003 and 2004. Hyundai has two prototypes at the California Fuel Cell Partnership undergoing road testing. Hyundai is also leading a consortium made up of five international rivals - Ford, Toyota, DaimlerChrysler, Nissan, and PSA Peugeot-Citroen – to develop high pressure hydrogen fuel systems capable of 10,000 psi. Current prototype fuel cell vehicles use 5,000 psi hydrogen storage tanks (except for GM who has its own 10,000 psi prototype using a storage cylinder made by Quantum). These six automakers aim to complete development of its 10,000 psi system by January 2004 and commercialize it by 2005.

Mazda has made two different fuel cell prototypes to date. Its latest one, the Premacy FC-EV, was awarded Japanese road permits in 2001 and is undergoing public road testing.



Volkswagen also has two different fuel cell prototypes to date. Its latest, the HyPower, has been tested in cold temperatures and high altitudes in the Swiss Alps.

Mitsubishi displayed a fuel cell concept vehicle in 1999 and has announced plans to have a commercial fuel cell vehicle in 2005.



⁴⁵ Scott Miller, Bhushan Bahree, and Jeffrey Ball, "A Global Journal Report: Europe Launches Hydrogen Initiative," Wall Street Journal, October 16, 2002.

In summary, the automakers have mostly forecast that they will be at full-scale commercialization by or during 2010. General Motors and Ford have gone beyond those claims to assert that they will at minimum have brought a significant number of fuel cell vehicles to the market. The makers who do not have plans to release vehicles in 2003 or receive certification from CARB are the most optimistic. In contrast, Honda and Toyota have been much more guarded with their future plans, but have accelerated their timetables this year perhaps because of competition with each other for the Japanese market. Likewise, Nissan has bumped up its initial release date by two years from 2005 to 2003 in order to compete. Perhaps competition and increased government spending like that of the EU will also speed the transition for all OEMs to full-scale commercialization.

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For more fuel cell market and industry information, visit www.fuelcells.org/charts.htm to find Fuel Cells 2000's unique industry charts. These continuously updated charts summarize: **fuel cell vehicle development; fuel cell bus development; world-wide hydrogen fueling station development; world-wide fuel cell installations; micro-fuel cell product development; portable fuel cell product development; stationary fuel cell product development; and transportation fuel cell product development.**