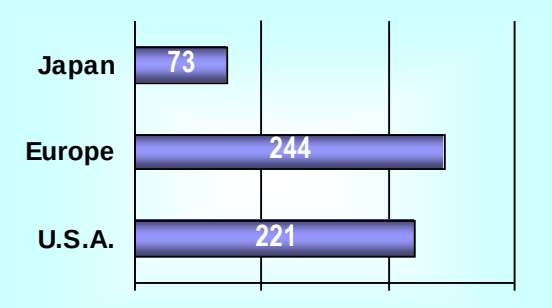
Background and History

Japan is the world's second largest automobile nation, with 73 million vehicles on its roads. The automobile industry has been supporting Japan's economy, while it is to blame for current environmental and energy problems including air pollution, global warming, noise, congestion, and oil dependence. For sustainable development of the automobile industry, clean and energy efficient vehicles are indispensable in Japan and in the world.

World's automobile statistics 2001



- 4-wheel vehicles on road
- Europe includes Germany holding 47 million units, Italy of 36 million, France of 34 million, U.K. of 31 million, etc.

Source: JAMA

In Japan, the development of electric vehicles started early in this century. After the Second World War, owing to the serious shortage of gasoline and surplus electricity caused by the termination of war industry, the number of electric vehicles increased rapidly. In 1949, there were 3, 300 electric vehicles on Japan's roads and annual production was 1,614 units. The electric vehicles, however, were soon driven out by vehicles using internal combustion engines with higher performance and lower costs. The electric vehicle came in the limelight again in the 1960s when pollution caused by gasoline and diesel vehicles became serious social concerns, and in the 1970s because of the oil crises. From 1971, the government launched electric vehicle promotion with a 5-year large-scale project for electric vehicle research and development with a total budget of 5.7 billion yen, and produced prototype vehicles with a 455 km range per charge. The development and introduction of electric vehicles slowed considerably in the 1980s, however, when the immediate environment and energy problems were considered to be overcome with the improvement of conventional vehicles. In the 1990s, the development of electric vehicles has reached its next stage, motivated by growing concerns over global warming, deterioration of the urban environment, and the 1992 California mandate for zero emission vehicles. High performance electric vehicles, so-called second generation EVs, first appeared on the market in 1997. The vehicles were initially powered by nickel-metal hydride

or lithium-ion batteries, claiming a range of about 200 km per charge. Toyota RAV4 EV was the first commercial electric vehicle to be powered by nickel-metal hydride batteries, and Nissan Motor's Prairie Joy EV was the world's first production electric vehicle powered by lithium-ion batteries. The Honda EV Plus, unveiled in April 1997, was an electric vehicle of totally original design. From 1997 until 1999, based on a Memorandum of Agreement with the California Air Resources Board, about 1000 Japanese electric vehicles were sold or leased in California.

In conjunction with the concept of new transportation that is environmentally friendly and benefits urban traffic, advanced compact electric vehicles such as Honda CityPal, Toyota e-com and Nissan Hypermini have been developed and demonstrated in sharing and rental EV projects since 1998. The projects were expected to create a new niche market for electric vehicles. Currently, however, the production of these second generation EVs is, limited or at a standstill, which may be caused by their high cost, declined motivations including the revision and postponement of the California ZEV regulations, growing expectations to hybrid electric vehicles and fuel cell vehicles, etc. However, new types of one-seater neighborhood electric vehicles have been released commercially at relatively low prices, and are now being used in the delivery business and for shorter daily trips.

HYBRID ELECTRIC VEHICLES ENTER THE STAGE

In 1997, Toyota Motor Corp. launched its originally designed production hybrid passenger car Prius, which changed the stream of electric vehicle's history. The vehicle is powered by both gasoline engine and electric motor independently or jointly, doubling the fuel efficiency to 28km per liter compared with a conventional Corolla. The vehicle claims lower emissions, half of carbon dioxide and one tenth of nitrogen oxides compared to a gasoline car. Honda Motor Co. also launched a gasoline-electric hybrid passenger car Insight in November 1999. The Insight features the Integrated Motor Assist parallel hybrid system and a lightweight aluminum body, achieving a fuel efficiency of 35 km per liter at 10.15 mode and low emissions meeting California's Ultra-Low Emission Vehicle standard. The development and commercialization of hybrid electric vehicles have made remarkable progress as a practical option for replacing internal combustion engine vehicles. Hybrid passenger cars are driving the clean energy vehicle market, achieving a substantial success in sales due to the features of high fuel efficiency, low emissions and affordable price.

FUEL CELL VEHICLES GROWING UP

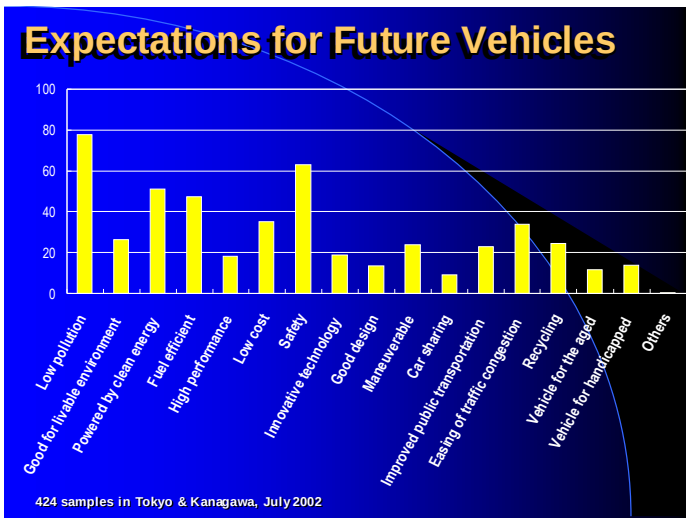
In the 21st century, fuel cell vehicles are attracting a great deal of attention all over the world. Fuel cell vehicles run on electricity generated on-board by chemical reaction combining hydrogen with oxygen from air, and produce zero or near-zero

emissions. They promise increased energy efficiency and performance comparable to the internal combustion engine vehicles. Fuel cells will also make for diversification of energy sources for they can use hydrogen produced from alternative fuels and renewable energy. A variety of innovative technologies of fuel cell is also expected to reinforce the industrial competitive power and foster new industries. Japan's first fuel cell powered experimental vehicle was developed by Mazda Motor Corp. in 1992, and the full-scale development race started in 1996 when Toyota Motor Corp. demonstrated a RAV4-based fuel cell test vehicle on the public road for the first time in Japan. In 1993, the government started a research project for the development of fuel cells of various types including phosphoric acid fuel cell, molten carbonate fuel cell, and polymer electrolyte fuel cell targeting in 2003 for viable performance. From 1993 to 2002, the national research and development project was conducted in terms of the technologies for production, distribution and refueling of hydrogen for FCVs. Japan's first road test of fuel cell vehicles was launched in Yokohama in February 2001, funded by the Ministry of Economy, Trade and Industry. Mazda and DaimlerChrysler have joined in the project with Premacy FC-EV and Necar 5, and a methanol fueling facility was established. In December 2002, Toyota and Honda led the world in limited sales of fuel cell vehicles, marking the first step for full-scale dissemination to society. Further, in 2002, Japan's first extensive demonstration project for fuel cell vehicles and hydrogen refueling stations was launched.

On December 2, 2002, Toyota FCHV and HONDA FCX were delivered to the Cabinet, and Prime Minister Junichiro Koizumi gave a test run.

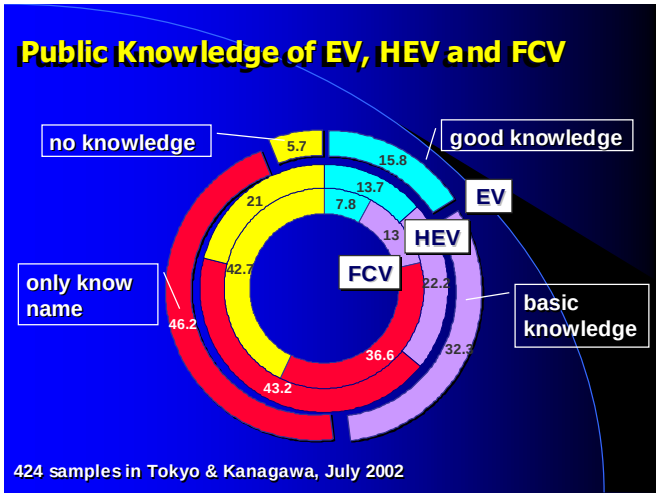
PROPELLED BY PUBLIC EXPECTATIONS

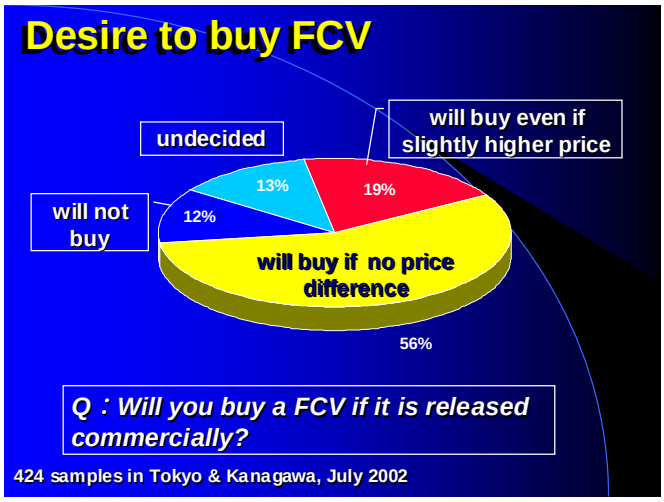
According to a questionnaire survey conducted on 400 people in Tokyo and Kanagawa in 2002, the feature of a future vehicle that was given the highest priority was low pollution, selected by 80% of respondents. "Safety", "powered by clean energy", and "fuel efficiency" were also keywords for future vehicles. Clearly, battery, hybrid and fuel cell electric vehicles should be made available to meet the expectations of the public regarding the propulsion systems for the next generation of vehicles.



However, the general public do not have a good knowledge of electric and hybrid vehicles, and in particular, knowledge of fuel cell vehicles is lacking. The electric vehicle is known relatively well, and 48% of respondents said that they had a good or basic knowledge of these vehicles. For hybrid vehicles, the percentage of respondents with some knowledge is 36%, which is still low in spite of increasing sales. Those with some understanding of fuel cell vehicle seems to be increasing gradually. In 2002, 21% of respondents said that they had a good or basic knowledge of fuel cell vehicles.

It is interesting to note, however, that after providing basic information on fuel cell vehicles, 56% responded that they wanted to buy a fuel cell vehicle if it could be commercialized at the same price as a gasoline vehicle. Further, 19% of respondents said that they would buy it even if it was more expensive than a conventional vehicle.





Source: JHFC questionnaire survey, July 2002