

New FCV Model at the Tokyo Motor Show

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1. National Policies

(1) The Government

On 5th December, the government announced that they had reviewed the eco-car tax reduction and planned to extend it next year onwards. In order to expand the strength in environmental issues and safety which are the highly competitive fields of Japanese automobile manufacturers, vehicle models subject to tax assistance is going to be reviewed. The fuel efficiency (performance) standard of corresponding vehicle types will be changed from the current Year 2010 standard to a much more stringent Year 2015 standard. The average fuel efficiency(performance) for 1L of automobile will be increased from 13.0km to 16.8km. For automobile which is subject to eco-car tax reduction, it will be under a system that purchasing tax, vehicle inspection tax and automobile acquisition tax will be exempted. Also, weight tax and acquisition tax during the purchase of EV, FCV, PHV will be 100% exempted. It will be expired at the end of April 2012. (The Nikkei, 6th December 2011)

(2) Ministry of Economy, Trade and Industry (METI)

As the second public subscription of the innovation centers location support project (development projects such as demonstration of equipment evaluation of the industry) conducted by the Ministry of Economy, Trade and Industry 2 proposals from Chubu Bureau of Economy, Trade and Industry has been selected. The selected proposals are "the development of on evaluation and facilities of mass production of FC by new technology" proposed by NGK Spark Plug and "demonstration and evaluation of high-precision manufacturing method for producing magnetometric sensors with ultra-high sensitivity" jointly proposed by Fujidenolo and Nagoya University. 25 applications were selected among the 113 applications over Japan. This support project is intended to subsidize part of the costs necessary to develop equipment for demonstration and evaluation of innovative

technology developed so far in order to lead to the mass production of new products using new technology. (Nikkan Kensetsu Kogyo Shimbun, 14th December, 2011 and Nikkan Kensetsu Sangyo Shimbun, 15th December)

(3) NEDO

From January 2012 up till 2015, NEDO will launch a project to demonstrate the smart community in the redevelopment district in Lyon, France.

P-plot Building in Lyon Confluence redevelopment area will be developed as an architecture model "Positive Energy Building" which is energy efficient and using renewable energy. Also, BEMS, HEMS, PV systems, FC, cogeneration system are incorporated. The model building is designed and constructed by the French company Bouygues and, Kengo Kuma & Associates. In the demonstration project, in addition to development of the positive energy buildings, car-sharing of 30 EV which is operated by photovoltaic power generation system as a primary energy source for the enterprises in Confluence area, introduction of energy box to support the energy management on 100~200 families, 7000 residents and 7000 employees, and the launch of Community Management System (CMS). The total budget of the whole project is estimated to be 50 million euro (around 5 billion yen). Starting from France, it is expected that buildings constructed in EU from 2020 onwards will be all "positive energy" and the empirical results will spread across Europe. (Architectures, Constructions and Engineerings News(Daily), 26th November 2011)

(4) Ministry of Economy, Trade and Industry & Ministry of Education, Culture, Sports, Science and Technology (MEXT)

On 16th December, it is revealed that Ministry of Economy, Trade and Industry is planning to embark on a long-term support in research and development of the industrial technology for the establishment of a new driving force in the Japanese economy.

Development in advanced technology is treated as a national project, it is considered to give out a subsidy of 200 billion yen in 10 years. The government will determine the priority area and prepare a funding mechanism starting from early-stage research in order to develop technology with international standards. Ministry of Economy, Trade and Industry is going to co-ordinate with the MEXT to unify some of the budget allocation and the supporting scale will be further increased when MEXT is also involved. Main focus area is on the technology to achieve the most energy-saving society in the world. In particular, it is considering EV batteries which can support a distance comparable to gasoline vehicles and also the development of automobiles and domestic motors without rare earth elements. In 2011, budget related to Science and Technology is estimated to be 3648 billion yen. 67% of the budget, which is approximately 240 billion, is allocated for academic research for MEXT and the rest of it is allocated to various industries in the Ministry of Economy, Trade and Industry. (Chugoku, Shizuoka Shimbun, 17th December 2011)

2. Measures of local authority

(1) Saitama Prefecture

In Saitama Prefecture, the construction work for installation of a hydrogen station will be started from 26th November in the main building of prefectural office in Urawa Ward of Saitama City. Upon completion, Honda's FCX Clarity will be used as official cars of the prefecture and driving test on practical application will be performed until Year 2013. It aims at demonstrating the next generation car with a power capacity of 10kW or above can be also used as a vehicle to supply electrical power to households. (Saitama Shimbun, 25th November 2011 & Nikkan Kensetsu Sangyo Shimbun, 30th November 2011)

(2) Gifu Prefecture

Gifu prefecture had decided to introduce six models of system which makes up of cogeneration and storage battery such as solar cells and FCs. Intended to assist a portion of the cost of infrastructure deployment, chosen participators will have to complete the development in the current year and need to submit the data of energy supply situation to local authority for 5 years from 2012. (Nikkan Kensetsu Kogyo

Shimbun, 6th December 2011)

3. Development on FC Component Technology

On 29th November, Teijin and Tokyo Institute of Technology and Teijin had announced that they had developed a new Carbon Nano Fiber(CNF) with the elliptical cross-section of aligned single-layered graphite crystal. The characteristic is that its length is 10 times longer than the conventional CNF fiber length with a lower electrical resistance which is reduced by 30-40%. It can be produced from an existing melt spinning method which is expected to reduce the production cost. The company is planned to proceed to expand the market on electrode materials and FC gas diffusion layer such as rechargeable batteries and capacitors in the future. (Nikkan Kogyo Shimbun & the Chemical Daily, 30th November 2011)

4. Development and business implementation of domestic FC

(1) Venture corporation in the UK

A venture corporation based in Scotland of the UK will launch a domestic FC in the UK and Ireland in 2014. The company is merged with Intelligent Energy which had been involved in the development of FC, SSE which is a major energy company and government agencies in Scotland, domestic machines of 1kW and commercial machines of 10kW will be put into the market sequentially. In the UK, cost on electricity and gas have been rising, small domestic cogeneration system is gaining its popularity. (The Denki Shimbun, 24th November 1999)

(2) Nisshinbo Chemical Inc.

Nisshinbo Chemical Inc. is going to expand its business in environmental energy areas such as FC separator, high performance plastic materials and carriers for water treatment. The operation of the new plant for FC separator in Chiba had been started last year (The new plant for FC separator in Chiba had been started to operate last year)and had arranged a system that can meet the growing demand in the future. At the moment, it aims at expanding the adoption of stationary applications. From 2015, as FCV is expected to spread across the country, the performance improvement of the separator to equip with FCV is being done and cost reduction is promoted. (The Chemical Daily, 16th December 2011)

5. SOFC technology development and business development

(1) Wärtsilä

Wärtsilä(Helsinki) in Finland will begin the test for the implementation of SOFC of output 50kW in early 2012. Stack accepted the offer from Topsøe Fuel Cell of Denmark and Bertha Power Systems of Canada. These products will be unitized and commercialize under Wärtsilä's brand. The period is to be determined. From 2008, the company had been already doing demonstrations on 20kW FC using bio-gas (methane) generated from the landfill of waste and 20kW FC using methanol for vessels. The result is started to show that it can reduce the emissions of NOX and SOX and reduce the noise. For vessels, the test is carried out on the ferry. The company has been developing a diesel engine for the marine industry but it had started to develop FC which has attracted public's attention as an efficient clean energy in the future and has a growing need. Also, in order to commercialize the SOFC for industrial use, it had started the development several years ago in collaboration with Hitachi Zosen. (Nikkan Kogyo Shimbun,15th December 2011 & the Chemical Daily,16th December)

(2) Agency of Natural Resources and Energy, NEDO, Mitsubishi Heavy Industries

Agency of Natural Resources and Energy will undertake the development of a triple-combined power generation system combining with 500kW SOFC, gas turbine and steam turbine in the NEDO project from next year. Mitsubishi Heavy Industries is developing a 250kW intermediate capacity system for industrial use and it is under reliability demonstration by next year. And it will be used practically in the industry from 2013. Based on technology developed in 250kW type, MHI had installed the 500kW SOFC into the upstream of the combined system with the existing gas turbine and steam turbine to form a triple combined system. Power generation efficiency is expected to improve from 45% of existing combined system to 65% and CO2 emission is estimated to be 30%. As a five-year project, a budget of 1.5 billion yen in next fiscal year is being requested. Also, as a potential system export project, it aims at realizing a large scale thermal power plant of 1200kW in the future and apply the

technology to the integrated coal gasification fuel cell combined cycle (IGFC). (The Chemical Daily, 16th December, 2011)

6.The expanding of "ENE-FARM" business

(1)Sekisui House

Sekisui House will be the first house builder to exhibit in the "42nd Tokyo Motor Show 2011". The company has put the "Green First Hybrid" equipped with 3 cells (solar cell, fuel cell, secondary battery) on the market in August this year, In the motor show, it is going to propose a high-tech smart house without using energy and EV can still be charged during power failure. Besides, it will also exhibit like unique damping system "Jikasu" which can suppress the deformation of building by turning the seismic motion energy into heat and then it was absorbed. (Nikkan Kogyo Shimbun, Fuji Sankei Business Eye 22nd November 2011 & Sankei, Nikkan Kensetsu Kogyo Shimbun, Fuji Sankei Business Eye, 2nd December & Tokyo,Chunichi Shimbun 3rd December & Nikkan Kensetsu Shimbun, 7th December)

Sekisui House is also going to start the construction of the single family house equipping with the Green First Hybrid in this month and it is the first example in the land for sale in lots at "Common City Akaishidai" under development in Tomiya-machi, Miyagi Prefecture and the build-and-sell houses are soon going to be released.

(2) Osaka Gas

Regarding to the SOFC type of ENE FARM which is being developed by Osaka Gas, President Ozaki will commercialize it by mid-2012. And it aims at selling 10,000 units per year in 5 years after it is put on the market. And he stated that purchaser will bear 2.4 million yen with the subsidy from the government which adopts the same standard with the present product. It hopes to decrease to 5 to 6 million yen few years later. (Sankei Shimbun 2nd February,2011 & Osaka Nichinichi Shimbun 15th December)

President Ozaki revealed the policy with the target of selling thirty thousand to fifty thousand of ENE FARM (2.76 – 3.25million yen) per year in 2020. As "After the Tohoku Earthquake, people will concern more about non-utility generator (or standby generator) which acts as a countermeasure of power failure or energy saving." ,it is expected that it should

be able to achieve 3000 units this year. Moreover, he said “It cannot get popular if Osaka Gas cannot sell one-third to half of the year sale of water heaters as the ENE FARM. In the next year, the commercialized SOFC would be smaller in size and we would like to apply it into condominium 3 years later as well.” (Mainichi Shimbun, 14th December,2011)

On 16th December, Osaka Gas has revealed that regarding the cogeneration system “ENE FARM” and “ECOWILL”, the improved model which can be used even during power failure will be put into the market next year. Osaka Gas is going to combine the ENE FARM, ECOWILL with storage battery in order to allow continual operation and generation even during power failure. (Asahi Shimbun, 17th December,2011)

(3) Tokyo Gas

Tokyo Gas is going to sell the ENE FARM for condominium in 2013. The mid-term vision of the company is to reach the target number of ENE FARM in operation to thirty thousand flats by 2020. In order to increase the numbers, it was judged that it is necessary to adopt into condominium and to develop a smaller and lighter one. Not only PEFC but also SOFC is being released into the market for ENE FARM. President Okamoto said, “The development of PEFC is preceding that of SOFC. Though it is of high difficulty but it is not impossible to achieve it”, which stated the policy to respond to the need with PEFC. (Nikkan Kogyo Shimbun, 7th December 2011)

7. The frontier of FCV & EV

(1) Toyota Industries Corporation

Toyota Industries Corporation announced on 25th November that the verification experiment of FC Fork Lift would be commenced on December 2012. Toyota Motor and Toyoda Gosei will join the “North Kyushu Smart Community Creative Business” promoted by the Ministry of Economy, Trade and Industry and the North Kyushu city. 2 units of Fork Lift with the FC system developed for Fork Lift by Toyota together will be undergone verification on the effect of environmental loading deduction, workability and the economic efficiency in North Kyushu factory of Toyoda Gosei. (Nikkan Jidosha, the Chunichi Shimbun, the Nishinippon Shimbun, 26th November 2011 & Nikkan Kogyo Shimbun, 28th November, Nikkei Sangyo Shimbun 29th November)

(2) Daimler

Daimler announced in 28th November to put FCV into Japan market in 2015. Around 200 units are being used for test in Germany. (Asahi Shimbun, 29th November 2011)

(3) Mercedes Benz

Mercedes Benz Japan has disclosed the product FCV “F125!” in the Tokyo Motor Show. Regarding the power source, FC is used with the next generation secondary battery high voltage lithium sulfur battery of the next generation to mobilize 4 wheels by motor. The hydrogen of fuel will be stored in the hydrogen storage alloy which is integrated with the body of the car. Intending “changing the definition of luxury car”, FCV possess the continual power out is 170kW (max. 300kW) and 7.5g of hydrogen can be stored in the underneath hydrogen storage alloy. The travelling distance can reach 1000km, and 50km for using battery only. It can reach 100km/h in 4.9 seconds. With FC of output 130kW and 0.8kg of hydrogen, the car can travel for 100km. When the output of lithium sulfur battery is 70kW (max. 100kW), “the energy density can be double to that of the lithium ion battery,” said be the Vice-President. It is expected to put into the market from 2015 to 2020.

(Yomiuri, Asahi, the Nikkei ,the Nikkei Business Daily, Nikkan Kogyo Shimbun, Fuji Sankei Business Eye, the Chemical Daiily 29nd November 2011 & Nikkan Jidosha,30th November) Nikkan Kensetsu Kogyo Shimbun, Fuji Sankei Business Eye, 2nd December & Tokyo,Chunichi Shimbun 3rd December & Nikkan Kensetsu Shimbun, 7th December)

(4) Toyota

On 29th November, Toyota started to receive the order of Prius PHV which is rechargeable using household electricity. When the car is fully charged, the fuel efficiency for one liter of gasoline is 61km which is almost double of that of Prius PHV. Even it is out of battery, it is possible to travel with gasoline safely in order to oppose EV. The PHV to be released on 30th January next year can allow a travelling distance of maximum 26.4km in only one full charging process without gasoline. Besides, it had undergone the development of the charging infrastructure prior the commercialization of PHV. Through Toyota Home under the same group, they will start household electricity charging service. Installation of electricity

charging facilities is under process in around 5000 retail stores over the country. It is planned to set up 1500 to 2000 retail stores during January next year when the product is put into the market and the facility is free of charge to purchasers. On the other hand, Panasonic had announced on 29th November that it will provide high capacity LiB of basic parts for Toyota's Prius PHV.

Toyota Motor and Daihatsu had invented the concept model targeting at the practicability of FCV. Toyota has tried to manufacture the large-scale FCV of Land Cruiser type, as its size is not easy to become widespread; Toyota has tried to manufacture the 4-people sedan-type "FCV-R". Sedan of FCV is made possible by changing the rolling method of carbon fiber to decrease the thickness and size of the tank, also the number of built-in tank is decreased from 4 to 2. Though the carrying capacity of hydrogen decreased from 6kg, the travelling distance can still be kept at 700km due to the improvement of fuel efficiency. Besides, space is saved by changing the location of FC from the front to the driver's seat underneath. It is planned to put into the market in 2015. (The Chemical Daily, 5th December 2011)

(5) Daihatsu

Daihatsu specializes in light automobile to show a difference with Toyota. As there is not enough space to equip hydrogen tank in the light automobile, anion-type FC using hydrazine hydrates is equipped. Hydrazine hydrates is in liquid form under normal temperature and pressure and of low inflammable. A trial manufacture "FC ShoCase" stored in a 30L tank under floor allows travelling distance of 500 – 600km by 35kW power output. Anion-type is not hydrogen ion but moving among OH⁻ electrodes. As there is no need to resist from strong acidity in the electrodes, cheap transition metal like nickel and iron rather than expensive platinum catalyst can be used. As a result, the cost of electrodes can be decreased to 1/1000. The problem is the sustainability of the electrolytic film and it can sustain for 1000 hours and it is 1/5 of the target to the present carbon hydrogen film. National Institute of Advanced Industrial Science and Technology and Tokuyama are developing anion adopted electrolytic film. It is expected to commercialize in 2015. (The Chemical Daily, 5th December 2011)

(6) German BMW and GM

The BCW of Germany and GM of America works together in the FC field recently. BMW announced that it will cooperate to develop second generation lithium ion battery with Toyota together to speed up the collaboration in environmental aspect. According to the news report, BMW accepts the technological provision of FC from GM while it will bear part of research and developing fee. In the future, parts may be shared by both companies as well. Though GM refrained from giving comments, BMW admitted that it is under negotiation. (Mainichi Shimbun, 12th December 2011 & Denki Shimbun, Fuji Sankei Business i, the Kahoku Shimpo, 13th December 2011)

8. Business related to hydrogen station

Tokyo Gas and Chiba University has announced on 24th November that they had started the research of using the CO₂ separated and collected in the hydrogen supplying facility for FCV in tomato greenhouse cultivation. It is being discussed as one of the solutions to the problem raised by the disposal of CO₂ generated during the production of hydrogen from city gas. As the photosynthesis rate increases according to the density of CO₂, it is possible to increase the yearly yield of tomato per year. Tokyo Gas has opened the "Haneda Hydrogen Station" in Ota-ku, Tokyo in December 2010 and there is around 10kg/h of CO₂ generated during the hydrogen production process from city gas and it is liquefied. 160kg of it is put into gas cylinder and then sent to the plant factory in Chiba University. 2 gas cylinders per month would be supplied to the tomato cultivation facility of site area 1000m², and then it will be vaporized at the receiving facility set-up inside the plantation factory, raising the CO₂ density in air from 400ppm to 1000ppm. It is expected for an increase from the usual yearly yield of around 40kg/m² to around 50kg/m², and the harvested tomato is expected to be sweet and in good quality. (Nikkei Newspapers, Denki, Nikkan Kogyo Shimbun, Fuji Sankei Business Eye, The Chemical Daily, 25th November 2011 & Architectures, Constructions and Engineerings News, 29th November & Everyday Newspaper 30th November, Yomiuri, Nikkan Kensetsu Kogyo Shimbun, 5th December & Asahi Shimbun, 17th December)

9. Development of hydrogen generation and purification technique

The research group of Assistant Professor Zheng and Professor Saito of the Institute of Multidisciplinary Research for Advanced Materials of Tohoku University has developed the technique in the heating treatment of underwater mud to gain a high receiving rate of over 90% of highly purified hydrogen. It has merits of reducing processing cost as the preliminary processing of smashing and drying the mud is eliminated. The research group has succeeded in 2007 to smash and heat the woody biomass (cellulose) to produce the hydrogen of purity level 98% with the receiving rate of 97%. The new technique is developed based on this method. By mixing the inorganic powder which functions as a gas promoting agent with the sewage sludge mud with 80% of water content, and then heat it at around 600°C, over 90% of receiving rate of hydrogen can be gained. As the underwater mud grain is small so it is easy to combine with the inorganic powder. (The Chemical Daily, 29th November 2011 & the Nikkei Business Daily, 14th December)

10. Development of FC and related measurement and observational technique relating to hydrogen

(1) JGC Trading & Services Co. Ltd.

The mechanical trading company JGC Trading & Services Co. Ltd., Nikki Shoji (Yokohama city) of JGC Group has started the handling of infra-red ray surveillance system of anti-explosive pressurized hydrogen type. It adopts the housing with high anti-explosive characteristic so that a continual surveillance by automated equipment supervision in an explosive environment is made possible.

The infra-red ray thermo camera system “WI-XXX” sold by the company adopts the anti-explosive pressurized hydrogen infra-red ray type camera “XIR-1000A” of Orient Brain (Osaka) and the Avio infra-red technology (Tokyo) for the system grade-up. Anti-erosion aluminum alloy is used for the housing. (The Chemical Daily, 24th November 2011)

(2) Chino

Chino has developed the test device of evaluation which is corresponding to large-scale cell of SOFC. SOFC is developing a large scale cell to spread to the

public and it becomes much necessary to analyze the circulation and the power generation characteristics of fuel gas. It is now developing towards the practical level of 50 – 100mm size and increasing in size of the cell from now on. Also, in corresponding to this large scale cell evaluation test, in order to withstand the high temperature and against metal contamination, starting from screw and spring, Chino is developing a holder which is all made in ceramics (Al₂O₃) for exclusive use and integrating into the measuring machine for gas chromatography. (The Chemical Daily, 29th November 2011)

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