

More International Cooperation with Expectation of FCV

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1. Governmental Measures

(1) METI

The Ministry of Economy, Trade and Industry will back up a development for large hydrogen gas cylinder to transport hydrogen fuel for fuel cell vehicles (FCVs). The construction of a test facility accommodating a 500L cylinder is included in the supplementary budget bill for FY 2012. The industry will be supported to reduce the costs of development, and plans tests aimed at commercializing a large hydrogen cylinder made using carbon fiber; a global first. ¥2.9 billion is estimated and distributed for the “Test Facility Preparation for Large Hydrogen Cylinder as FCVs Refueling Infrastructure” in the supplementary budget. Also, METI started to work on technical standards for 70 MPa hydrogen cylinders on FCVs. (Nikkan Jidosha Shimbun, January 23, 2013; The Denki Shimbun, January 30, 2013)

METI intends to create an independent system to collect problem information concerning pressurized hydrogen cylinders (hydrogen fuel tanks) for FCVs. Currently, The High Pressure Gas Safety Institute of Japan carries out legal inspection at shipping as well as automobile inspection, a MOT equivalent. However, there is no method to keep detailed information on how and why facilities fail on these inspections. The current inspection scheme most likely prevents a cylinder prone to leaking to be used continuously, although the information is not kept for other inspections; e.g. signs of breakdown caused by a minor trouble or age degradation leading to gas leakage are hard to be detected, because accident and malfunctioning information of automobiles in use is not held with respect to these faults. To promote FCVs successfully, the ministry will discuss a system to collect malfunctioning information centrally, to warn manufacturers and get them to improve their design and production processes. An investigative commission will be launched and start discussion in FY 2013.

(Nikkan Jidosha Shimbun, February 8, 2013)

(2) MEXT

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) has compiled a plan to support studies on organic hydride and ammonia as a research project of next generation energy carriers, starting from FY 2013. To cover the disadvantages of hydrogen, the project will promote research on efficient production and usage of these substances as energy carriers of hydrogen, which itself is harder to transported and store. Containing hydrogen, both organic hydride and ammonia are easily liquefied at a room temperature and can release hydrogen as necessary. The maximum period of the project is 10 years. The ministry allocated ¥7.3 billion for research including a next generation storage battery project in an initial budget bill for FY 2013. An outline of the project is to be compiled by the end of March. (The Nikkan Kogyo Shimbun, January 30, 2013)

(3) MOE

On February 14th, the Ministry of the Environment (MOE) revealed an enforcement policy of “Technology Development and Empirical Research to Induce CO2 Emission Reduction Measures”. The project will include technology to reduce CO2 emission related to energy. The following research related to the automobile industry is subjects to the project; development and empirical research of highly efficient hydrogen refueling facilities and large lorries and buses with new technology including FCV, technology developments to extend cruising distance and shorten charging time for small electric vehicles, and chargers and technology development and empirical research to reduce CO2 from travel by promoting public transport and sharing mobility. Technology development and empirical research for biomass fuel is also included in the project. The public tender for the policy will start in February. The policy aims to support industries’ technology developments and

empirical researches, which are unlikely to be introduced to society without assistance, by contracts and subsidies. (Nikkan Jidosha Shimbun, February 15, 2013)

2. Local Governmental Measures

(1) Tochigi Prefecture

Tochigi prefecture decided to allocate ¥69 million in the initial budget bill for FY 2013 as a construction cost for more generation facilities to utilize biogas from three sewage treatment centers following Kennou Joka Center, another sewage treatment work in the prefecture. These three sewage treatment works are looking into an efficient generation scale and methods to start operation from FY 2015. A biogas project started earlier than the three facilities, Kennou Joka Center investigated fuel cell (FC) and gas engine as a generation method and chose a FC which is highly efficient and produces little vibration and noise. The facility can produce electricity equivalent to 700 households' consumption each year. (Shimotsuke Shimbun, January 28, 2013)

(2) Saitama City

Saitama city will start preparing hydrogen filling stations for FCVs and multi-energy stations with quick chargers as an environment and energy measure for FY 2013. This is one of the important measures in "Next Generation Vehicle and Smart Energy Special Zone Project" which is certified as a special zone package by the state. Installing a hydrogen filling station in FY 2013, four stations will be prepared by FY 2016. Also, quick chargers will be installed at 96 petrol filling stations in the city by FY 2016. In an initial budget bill for FY2013, ¥200 million is allocated for the project cost. (The Nikkan Kogyo Shimbun, February 4, 2013)

3. Developments of FC Parts and Element Technologies

(1) NEC

NEC developed a mass production method for a new carbon nanomaterial which will significantly improve performance of parts for FCs and storage batteries. The material consists of carbon atoms forming a cone shape of 2 to 5 nm diameter and 40 to 50 nm long. The firm named the product "Carbon Nano Horn" due to the shape similar to a cow horn. Although, the

material was developed 15 years ago, a mass production method in high purity form was hard to establish. NEC made haste to achieve the mass production technology since it recognized the high potential of the material in the FC and medical field, and proved the product's safety. The material has a larger surface than carbon nanotube and fullerene for the same weight, and extracts electrons 20% to 30 more than activated coal in a FC. (The Nikkei, January 29, 2013)

(2) Mitsubishi Rayon

Mitsubishi Rayon will enhance its range of gas diffusion layer (GDL) base material. In addition to 205 and 170 µm thick products, 110 to 120 µm thick roll of carbon fiber paper is planned to be added to the product line within two years. The thinner product is in demand for reducing FC size. As well as domestic FCs, the firm will sell the carbon fiber paper intensely as a material of FCVs which are to be introduced to the market from 2015 and also extend the target to oversea FCs which are expected to expand as backup power sources. A thinner carbon fiber paper is under development, because FCs on FCVs are specifically required to be smaller. Polyacrylonitrile (PAN) carbon paper base material "Pyrofil GDL" has a good flat, smooth surface and porous structure to control liquid well. Coming in rolled form, the paper can be efficiently integrated into production assemblies and is easy to handle. (The Chemical Daily, January 29, 2013)

(3) Hitachi Zosen

Hitachi Zosen established a mass production technology for producing carbon nanotubes (CNTs) distributed vertically, like brush bristles, on a sheet of metal base. A chemical vapor deposition device is planned for this spring allowing roll to roll commercial fabrication which gives stable and serial production of the CNT material. The device is capable of outputting over 100 sheets worth of A4 paper in a day, and the distribution of sample sheets is planned to start in summer. Targeting FCs and lithium-ion batteries (LIBs), the firm will investigate the product's applications and evaluate the performance in FY 2013, and aims to commercialize by FY 2015. (The Nikkan Kogyo Shimbun, January 29, 2013; The Nikkei Business Daily, February 7, 2013)

(4) Kyushu University

A study group of Prof. Seiji Ogo developed a catalyst for FCs without using precious metals such as platinum. The catalyst is a nickel-iron compound mimicking hydrogenase which is a biological enzyme in microorganisms found in natural environments such as hot springs. The modeled enzyme lives in groundwater which has more hydrogen but less oxygen, and is disadvantageously affected by oxygen. On the other hand, the catalyst has a unique structure with phosphate compound to remedy the downside. Also, the product is easily controlled and extracts electrons as well as operating stably at room temperature and under normal pressure, which gives better safety. The catalyst is applicable to an anode to draw electrons out. The study group is also creating a material for a cathode without using precious metal. Production costs can be a thousandth of conventional catalyst with precious metal. Working with the University of Illinois, the study group aims to commercialize the product. (The Mainichi Newspapers, The Nikkei, The Nikkan Kogyo Shimbun, The Nishinippon Shimbun, February 8, 2013; The Chemical Daily, February 13, 2013)

(5) Japan Vilene

Japan Vilene will accelerate the expansion of the application of its conductive porous sheet. The product is nonwoven fiber sheet made of carbon conductive particles and fluororesin, where the fluororesin can be replaced on demand. As well as flexibility, the pore diameter and porosity of the sheet can be adjusted. Also, the material penetrates fluids such as gas and liquid better. Appealing drainage and gas permeation properties, the firm targets the GDL of FCs, which is expected to expand, as an application of the conductive porous sheet. With the current technology to create 5 to 200 μm thick sheets, thinner sheet samples are distributed to selected customers as smaller FCs are needed. Their laboratory will improve the mechanical strength and conductivity and optimize pore diameter to be able to accommodate each customer's demands. (The Chemical Daily, February 14, 2013)

4. Technology Development for SOFC

On January 28th, the National Institute of Advanced Industrial Science and Technology (AIST) revealed that a new portable FC system had been developed.

The system has a generation module containing 36 solid oxide fuel cell (SOFC) micro tubes inside. These FCs are heated by waste heat from a burner and generate from liquefied petroleum gas (LPG). Weighing about 5 kg, the prototype is approximately 23 cm long, 25 cm wide and 13 cm high. The output is 50 W and 5 V to 36 depending on the cell connections. The system powered a 5 V light emitting diode (LED) within two minutes of startup. A commercially-supplied LPG cartridge could power the battery for 24 hours continuously. Making it power electric devices outdoor or at disasters, the study group aims to commercialize the battery in two to three years. (The Nikkei, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, The Chemical Daily, January 29, 2013)

5. Business Plans for Ene-Farm

(1) Toho Gas

For FY 2013, Toho Gas set the Ene-Farm sales target at 1,500 units which are 15.4% more than the FY 2012. Their range was expanded to four with Aisin Seiki's product added on January 21st. Available from April, Panasonic's FC is priced at ¥2.1 million, ¥0.88 million cheaper than conventional models, which gives the firm a competitive advantage. (The Nikkan Kogyo Shimbun, January 22, 2013)

(2) Global L-Seed, Shiraishikensetsu, Tobishima

Global L-Seed, Shiraishikensetsu and Tobishima will build apartment houses which will provide approximately 15,000 m² floor area in an about 8,000 m² land bought from Mitaka city, Tokyo for "L-Seed Mitaka Shinkawa Project". The construction is planned to finish at the end of September, 2014. As the city demanded at the public tender, at least one of photovoltaic generator, FC and energy storage system will be installed in the project. (The Nikkan Kensetsu Kogyo Shimbun, January 23, 2013; Nikkan Kensetsu Sangyo Shimbun, January 29, 2013)

(3) Komeri

Komeri, Niigata city, has been seeking more business opportunities selling next generation environmentally friendly houses to consumers, by displaying a show house. Photovoltaic generators, Ene-Farm and LIB are advised individually or a combined system to save energy in everyday life as well as securing power during disasters. Also, the show house has a quick

charger to offer free EV refueling. (Japan Metal Daily, January 29, 2013)

(4) Nihonkai Gas

On February 14th, Nihonkai Gas, Toyama city, revealed that its Ene-Farm accumulated sales (installation base) broke the 100 unit target and reached 106 on the day. The last year's sales achieved nearly three times that of the year before, and combined with photovoltaic generators "Double Generation" increased to approximately 60%. Targeting at 100 for 2013, the firm has been promoting more. Available from April, 2010, Ene-Farm sold 10 units in the year. The sales rose to 23 units for 2011, 63 in 2012, and 10 units have been already sold since the beginning of this year. Three out of the 10 units for 2010 were "Double Generation". The Double Generation sales increased to 13 out of Ene-Farm sales for 2011 and 38 for 2012. According to Nihonkai Gas, the majority of Ene-Farms have been installed at the time of building new houses, and consumers have gradually considering independent energy sources to avoid having a single power source since the Great East Japan Earthquake changed consumer minds. Currently, the Feed-in Tariff is set ¥42/ kWh for solely installed photovoltaic generation and 34/kWh for combined generation which is lower. Having a cash back point campaign to fill the gap, the firm plans to expand the sales with the promotion. (Kitanippon Shimbun, The Toyama Shimbun, February 15, 2013)

6. Business Use FC and Business Plan for FC Application Technology

(1) Sakura Internet

On January 22nd, a data center operator Sakura Internet, Osaka city, announced that a FC was installed as an emergency generator in an experiment facility power supply system with high voltage direct current (HVDC). The experiment facility provides power to the data center which is jointly operated with NTT Data Intellilink, Tokyo. (The Denki Shimbun, January, 23, 2013)

(2) Tanita

On February 1st, Tanita, Tokyo, will introduce a new breath alcohol testing instrument "Alblo (FC-1000)" and try to sell it to transport service providers. Using a FC as its sensor to improve accuracy, the product

recognizes only alcohol and detects more precisely than conventional semiconductor gas sensors. (The Nikkei Business Daily, January 30, 2013)

7. Smart Power System Development

A study group of Prof. Takashi Hikihara at Kyoto University developed an "electricity router" to allocate power to devices, and it was successfully tested. The "electricity router" transmits electricity in small units like the packet switching of mobile communications. In the experiment, a device "mixer" received all the electricity from two power sources and added distribution information tags to it, and electricity was transmitted in units through the mixer switching at 1 kHz. An electric fan and LED lighting were effectively operated according to the destination signals. Electricity from photovoltaic generators and FCs is direct current which is normally converted for use into alternate current. However, approximately 10% of electricity is lost by a single conversion. The new technology allows reducing unnecessary conversions, which can save energy at offices and home. (The Nikkei, January 22, 2013)

8. Trends and Cutting Edge technologies of FCVs and EVs

(1) Toyota & BMW

On January 24th, Toyota Motor revealed that a FCV joint development agreement with BMW AG was signed. Aiming to introduce FCVs into the market in 2015, Toyota intends to reduce development time and expense by cooperating with BMW. Provided technologies of core components for a FCV including FC from Toyota, BMW plans to develop its own FCVs to be sold from 2020. Having creating its own FC stack and high pressure hydrogen cylinder, the Japanese automaker succeeded in reducing the size of a stack and system by cutting down on the number of cylinders. On the other hand, the German firm has its strength in the light weight material for the hydrogen cylinder. The automakers are trying to outdistance their competitors by taking advantage of these technologies. Toyota's FCV is planned to be rolled out in 2015, and the Japanese firm plans to develop a totally new basic FC system with BMW in 2020. Toyota might try to target approximately ¥5 million as the price of the vehicle. Additionally, Toyota and

BMW agreed to develop a lithium-air battery together. The battery is a next step of LIB and has higher energy density and efficiency. (The Yomiuri Shimbun, The Asahi Shimbun, The Mainichi Newspapers, The Sankei Shimbun, The Nikkei, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, Nikkan Jidosha Shimbun, The Tokyo Shimbun, The Chunichi Shimbun, The Kyoto Shimbun, The Kobe Shimbun, The Chugoku Shimbun, The Nishinippon Shimbun, The Shizuoka Shimbun, The Hokkaido Shimbun, The Shinano Mainichi Shimbun, Fuji Sankei Business i, The Niigata Nippo, The Kahoku Shimpo, January 25, 2013; Nikkan Jidosha Shimbun, January 26, 2013)

(2) Tokyo University of Science

A study group of associate Prof. Nobukazu Hoshi of the Department of Electrical Engineering of the Faculty of Science and Technology at Tokyo University of Science successfully carried out a test drive with a fuel cell electric vehicle (FCEV) running on sodium borohydride (NaBH₄) powder. Having higher hydrogen volume density, NaBH₄ beneficially does not require a hydrogen refueling infrastructure. In the experiment, power from NaBH₄ was loaded on the vehicle to generate hydrogen by hydrolysis with a water added catalyst. (The Chemical Daily, January 25, 2013; The Nikkan Kogyo Shimbun, January 28, 2013; The Nikkei Business Daily, January 30, 2013)

(3) EVs and ITS at Goto Islands

An experiment on a futuristic tourism system using EVs and intelligent transport systems (ITS) started in Goto Islands, Nagasaki prefecture. Using EVs to hire as a tool, the system displays various tourist information on car navigation systems using ITS at “TTS Spots” which are sightseeing spots dotted all over the remote islands. The local government aims to stimulate the economy while protecting the rich nature. Consisting of about 150 large and small islands, this series of islands is located approximately 100 km off west the coast of the Nagasaki prefecture main land. In three islands, 99 EVs and hybrid vehicles (HVs) have been prepared to be hired for tourism. The price is about ¥5,000 for six hours. According to the prefecture, EVs were hired 8,834 times during April to December, 2012, which is a 5 % increase from the same term in 2011. (The Nikkei, January 28, 2013)

(4) Nissan

Through a capital alliance with Daimler AG, Nissan Motor and Renault are developing a FCV together, and announced on January 28th that the Ford Motor Company will join them. A production vehicle is planned to be introduced by 2017. The new alliance expects a large reduction of cost by sharing core components such as FC stacks and hydrogen cylinders by the cooperation. Ford can play a role as a springboard for Nissan and Renault to better sell FCVs in the USA. Because a governmental assistance is required for hydrogen filling station preparation, Nissan and Renault can benefit from the cooperation with Ford who has a strong connection with the US government. Mr. Toshiyuki Shiga, the Nissan COO said that the Japanese-French-American alliance could accelerate sharing standards and components of FCVs by the collaboration. The alliance potentially affects the other automakers such as GM, VW and Hyundai for strategies, which is worth watching. Additionally, Nissan announced that “FCV Development Promotion Office” will be launched on February 1st. (The Yomiuri Shimbun, The Asahi Shimbun, The Mainichi Newspapers, The Sankei Shimbun, The Nikkei, The Nikkei Business Daily, The Tokyo Shimbun, The Chunichi Shimbun, The Kobe Shimbun, The Chugoku Shimbun, Kanagawa Shimbun, The Shinano Mainichi Shimbun, Fuji Sankei Business i, The Niigata Nippo, The Kahoku Shimpo, January 29, 2013; Dempa Shimbun, The Nikkan Kogyo Shimbun, Nikkan Jidosha Shimbun, January 30, 2013)

(5) Overseas Trends

On January 31st, the US Department of Energy (DOE) announced a cooperation with 13 firms including Google and GM for its EV promotion. The number of chargers is targeted at 10 times that of the current number over five years. Nissan joins the project as a Japanese firm. The Obama administration announced the “1 Million EVs” plan, but the number has not increased as expected due to lack of charging spots. To solve this, more charging infrastructure will be prepared by the government-private cooperation. As part of the project, Nissan announced that chargers will be installed at over 500 places within 18 months to boost EV sales. (The Nikkei, February 1, 2013)

China announced its target of 5 million EVs and

plug-in hybrids (PHVs) by 2020, and subsidizes RMB 60,000 (approximately ¥0.9 million) per purchase. On top of that, Shanghai municipality adds RMB 40,000 to promote as well as exemption from registration fee which is now over RMB 70,000 due to a measure for traffic congestion. (The Nikkei, February 2, 2013)

(6) Toyota Industries

Having developed a polymer electrolyte fuel cell for forklifts with Toyota Motor, Toyota Industries revealed its FC forklift. The forklift operates on a three minute refueling regime. As a part of the “Kitakyushu Smart Community Project”, the product will be used at the Kitakyushu plant of Toyota Gosei until March to exam the performance and cost efficiency. Durability, cold-start ability and cost efficiency are issues for commercializing the product. Two forklifts accommodating 2.5 tons and hydrogen filling facility will be operated as the experiment. (The Asahi Shimbun, The Nikkei, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, Nikkan Jidosha Shimbun, The Chunichi Shimbun, The Chugoku Shimbun, The Nishinippon Shimbun, February 8, 2013)

(7) Eisan

Eisan Marketing, Tokyo, who operates duty free shops will enter the electrically assisted pedal cycle market in March. With exclusively developed Samsung SDI's LIB, their product has a similar cycle range to that of products of major producers including Panasonic Cycle Technology, Bridgestone Cycle and Yamaha Motor, and is set about 40% lower price. The bicycle travels 35 to 45 km on a single charge and the battery withstands 900 to 1,200 charges. The bicycle will sell for ¥59,800. (The Nikkei, February 11, 2013)

9. Hydrogen Storage Technology Development

Kobe Steel and the University of Tsukuba developed an alloy to store large amount of hydrogen efficiently. The alloy is made with iron, titanium, zirconium, manganese and chrome, and hydrogen absorption performance is improved by optimizing the ratio. The product absorbs hydrogen at under 20°C and releases it when over 80°C. Three to four times more hydrogen can be stored in the new material cylinder than when using conventional hydrogen cylinders for FCVs. Working under normal pressure, the tank allows costs to be reduced. (The Nikkei, January 26, 2013)

10. Application and Further Plan of FC Technology
Toagosei plans to develop a commercial scale electrolytic cell using gas diffusion electrodes as early as possible to reduce the costs of its electrolysis department and to increase the efficiency. To make the department more competitive, the amount of electricity consumption has to be decreased. The experiment has been carried out in the Tokushima plant. The firm has been working on the development with the New Energy and Industrial Technology Development Organization (NEDO) and Kaneka. The method is applied from FC technology and it allows electricity usage to be cut down to two thirds that of ion exchange membranes (IM). (The Chemical Daily, January 22, 2013)

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