

THE LATEST NEWS NUMBER 212, 2013 FCDIC

Ene-Farm for Apartment Available from Next Spring

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1. Governmental Measures

(1) MOE

The Ministry of the Environment (MOE) will increase support for experiments and technologies to advance the prevention of global warming. Costs of FC buses and generation systems using water and sewage will be subsidized as promotions for the transportation, building and renewable energy fields. The ministry will encourage the reduction of greenhouse gas emissions by backing up new technologies, and also strengthen a new taxation scheme for countering global warming. The majority of the promotions are infrastructure such as transportation and public facilities. MOE will help projects to improve the reliability and durability of battery systems to mount fuel cells (FCs) in large busses as well as the body structure of busses as the transportation support. As soon as these technologies are developed, they will investigate higher standards for the fuel efficiency of busses to promote FC mounted busses. This measure has been started since FY 2013 and will support more projects later. (The Nikkei Business Daily, October 1, 2013)

(2) Japanese Government

On October 15th, at the cabinet meeting the Japanese government approved the “Bill for the Industrial Competitiveness Enhancement Act” to increase capital investments for restructuring of businesses intensively in five years including the establishment of a “System of Special Arrangements for Corporate Field Tests” which gives exceptional provisions of certain regulations for individual enterprises. The enforcement will start within three months of the official announcement. In the system, businesses request regulations to be eased, and the deregulation will be specifically provided while safety is secured. For example, a manufacturer can make tanks of fuel cell vehicles (FCVs) with new steel which is not currently approved for the usage as a material in this system to help commercialization of the vehicles. (The

Nishinippon Shimbun, & The Shizuoka Shimbun, October 15, 2013; The Nikkei, Architectures, Constructions & Engineerings News (Daily), The Japan Agricultural News, Kanagawa Shimbun, The Chunichi Shimbun, Minami-Nippon Shimbun, Shimotsuke Shimbun, Jomo Shinbun, The Yamaguchi Shimbun, Kumamoto Nichinichi Shimbun, Fuji Sankei Business i, The Kahoku Shimpo, The Fukushima Minyu Shimbun & Iwate Nippo, October 16, 2013)

(3) MLIT

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) will take stronger measures against global warming for sewage treatment. The measures focus on three areas; reduction in nitrous oxide (N₂O) emission at sludge incineration, energy saving during sewage treatment and utilization of biomass in sludge. Related technology tests and experimental activities for saving and creating energy are expected to encourage local governments to introduce these processes. The energy saving measures support mainly inverter controlling technologies and, micro bubble diffusers which supply oxygen more efficiently. The ministry plans to use organic matter in sewage sludge which is collected at the treatment works and estimated annual output of 4 TWh as a generation potential. However, the usage rate of biomass generation stays 13%. Extraction of hydrogen from sewage sludge gas is included in the themes for FY 2014 of “Breakthrough by Dynamic Approach in Sewage High Technology Project (B-DASH Project)”. MLIT aims to establish technologies for FCs to be used in sewage treatments, and to supply FCVs with hydrogen later. (The Chemical Daily, October 23, 2013)

On October 25th, Mr. Morishige, the Senior Deputy Director General of the Maritime Bureau, revealed an intention to approach the Australian government, a shipper, in this year about safety standards for marine transport of liquid hydrogen of which a working group

of the standard investigative commission is researching for the marine transport of dangerous goods. Following this, Kawasaki Heavy Industries has started a project to develop liquid hydrogen tankers aimed to finish in 2017. Although the International Convention for the Safety of Life at Sea (SOLAS) currently does not contain standards for liquid hydrogen transportation, liquid hydrogen can be transported provisionally if the shipper, the consignor and the flag state set safety standards for it until a convention is prepared. The bureau plans to make the safety agreement between Australia an international treaty, which allows Japan to import hydrogen from other countries since hydrogen producers are dotted all over the world. (The Japan Maritime Dairy, October 28, 2013)

2. Local Governmental Measures

(1) Yokohama City

On September 30th, Yokohama City announced that subsidy application of home energy management system (HEMS) installation would be received during the second half of FY 2013 from October 1st. Fixed amount of ¥10,000 will be given to households only installing HEMS to provide electricity usage data. Households which will also participate in a program to help saving electricity at high demand periods will receive fixed amount of ¥50,000. The city will provide dwellings which will install photovoltaic generator, FC, storage battery or electric vehicle (EV) charger/power feeder with ¥50,000 for each facility as well as a fixed ¥50,000 for HEMS. (The Nikkan Kogyo Shimbun, October 1, 2013; Architectures, Constructions & Engineerings News (Daily), October 8, 2013)

(2) Tokyo

The Tokyo Metropolis government will ask the state to create a scheme to reduce the land costs of hydrogen filling stations and for deregulation enabling gasoline filling stations install hydrogen refueling facilities as well as location requirements. The Japanese government plans to prepare 100 hydrogen refueling points nationwide by 2015, and has assessed that the regulations for installation and safety need to be eased. Under current regulations, a hydrogen filling facility can only supply up to 20 FCVs on full capacity in a commercial area, because the Building Standards Act limits the amount to 700 Nm³.

Therefore, more hydrogen filling facilities are required for FCVs to be used widely. However, Tokyo has limited land and higher value for the same size. Thus governmental deregulation is required. Tokyo will request to loosen the regulations to the related organizations such as the Ministry of Economy, Trade and Industry (METI), MILT and the Fire and Disaster Management Agency. (The Nikkan Kogyo Shimbun, October 14, 2013; The Nikkan Kensetsu Kogyo Shimbun, October 25, 2013)

(3) Kanagawa Prefecture

On October 11th, Kanagawa Prefecture revealed the outline of the “Kanagawa Smart Energy Plan” to reduce considerably the annual electricity consumption in the prefecture by 2030. The plan promotes gas cogeneration systems, FCs, hydrogen and storage batteries, and encourages increasing the number of stable distributed generations as well as renewable energy such as solar power. Also HEMS and building energy management system (BEMS) will be supported for more use. With these actions, the prefecture aims for 10% (that of FY 2010) reduction by FY 2020 and 15% by FY 2030. (The Nikkan Kensetsu Kogyo Shimbun, October 15, 2013)

(4) Chiba City

Chiba City will establish a subsidy scheme for domestic FC installations for the house owners in the city. The maximum subsidy will be from ¥10,000 to ¥200,000 for an application. The city allocated a total of ¥17.30 million including related expenses in the supplemental budget to promote energy saving systems and renewable energy. Applications will be received until the budget fills or February 14th, 2014. (The Nikkei Business Daily, October 16, 2013)

3. Technology Developments of FC Elements

(1) Kyushu & Osaka Universities & Konica Minolta

On October 1st, the team led by Prof. Hideaki Kasai at Osaka University announced that a technology had been developed to reduce size of solid oxide fuel cells (SOFC) in collaboration with Kyushu University and Konica Minolta. In this study, the oxygen ion conduction inside an electrolyte of SOFC was found to be a phenomenon involving via quantum tunneling. Also, the device structure which allows the FC to operate at low temperature of 300 °C was developed. The study team applied “Hyper-Naniwa”, which is a

first principle calculation for quantum motion of electrons in atomic nucleus and both surface and inside of solid, to SOFC. Then they analyzed by computer the electrolyte which was developed by the group of Prof. Tatsumi Ishihara and contains metal such as samarium and cerium. The results show that oxygen ion conductivity increases by compressing the electrolyte in specific direction by 4%, and the FC operates at 300 °C, a lower operation temperature than conventional SOFCs. The group of Prof. Ishihara already started to create a new electrolyte using the analysis results. Generating electricity efficiently, SOFCs are expected to be power sources at home and for vehicles. However, the FCs require complicated heating systems due to a higher operation temperature, and are disadvantageously larger and more expensive. If the facility is reduced in size, it will expand its usage and it can be domestic product. (The Nikkan Kogyo Shimbun & The Nikkei Business Daily, October 2, 2013)

(2) FCO Power

FCO Power, which is a venture firm specializing in research and development of SOFC stacks in Nagoya City, improved energy density of SOFC stacks to 3 kW/L. By using a printing technology, the single cells, which consist of anodes, cathodes, electrolytes and ceramic separators, are laminated repeatedly, and then are sintered to make a stack. Because the production technology eliminates the need of cell support, such as metal, the thickness of a single cell becomes 0.3 mm, a tenth that of a conventional cell. This largely contributes the improvement of energy density. Aiming to commercialize the product by 2018, the firm plans to continue the research to increase the stack's capacity and establish a commercial production technology as well as seeking partners in the related industry. (The Nikkan Kogyo Shimbun, October 8, 2013)

(3) Kyushu University

A research group of Associate Prof. Miho Yamauchi at the International Institute for Carbon-Neutral Energy Research (I²CNER) of Kyushu University developed a nanoparticle catalyst of an iron group alloy including iron, cobalt and nickel. By using a precursor of which elements are bound at an atomic level, the alloy ratio of tri-metal and bi-metal was successfully controlled precisely. Also, particle

diameter was made approximately 20 nm which was considered impossible. The product was confirmed beneficial as an electrode for FCs. The group plans to develop applications by advertising the advantage of lower material costs, and to seek research partners. (The Chemical Daily, October 17, 2013)

4. Business Plans of Ene-Farm

(1) Sinanen

Sinanen has started a test of smart houses. Their subsidiary Shinagawa Hainen built two test houses of two stories with Ene-Farms, Photovoltaic generation systems and lithium-ion battery (LIBs) in Nonoichi City, Ishikawa Prefecture. With the experience of the residents of the houses, Sinanen will investigate the effect. Also the latest facilities such as underfloor heating systems and bathroom heaters are installed in the houses as well as HEMS. Families with different life styles will live in the houses. Sinanen will research zero energy houses with the data obtained from the experiment. (The Nikkan Kogyo Shimbun, October 2, 2013)

(2) Asahi Kasei Homes

Last July, Asahi Kasei Homes provided a visualization system so users can see their energy consumption, and prepared "V2H System", which can interchange energy between an electric vehicle (EV) and a home. Also HEMS will be available to manage household energy management later, which would be added to complete the product range as well as photovoltaic generation system, FC and LIB for smart houses for an effective sales activity. The firm is characteristically specialized in houses for two generations of a family, and also makes special effort in smart houses. Last April, a system was developed to share electricity and heat from Ene-Farm and photovoltaic generators between two generations in the cooperation with Osaka Gas and Tokyo Gas, which makes a house with net zero energy and CO₂ emission. In the system, a single unit of Ene-Farm generates power and heat for two households efficiently. Hot water from Ene-Farm directly goes to the first household, and the second household is supplied via "EcoJozu", a condensing boiler. This system can meet hot water demand of two households easily. (Jutaku Shimpo, October 8, 2013)

(3) Osaka Gas

On October 8th, Osaka Gas announced that its accumulated Ene-Farm sales had reached 20,000 units in about 52 months. They started the sales July, 2009. (The Yomiuri Shimbun, The Asahi Shimbun, The Nikkei, The Sankei Shimbun, The Denki Shimbun & The Kyoto Shimbun, October 9, 2013; The Nikkan Kogyo Shimbun, October 10, 2013)

(4) Sanyo Homes

On October 16th, Sanyo Homes held an opening ceremony of a smart town “Suma e Town Urban Tsurumiryokuchi” of which housing lots are for sale in Osaka City. The smart town is located where municipal houses of Osaka City stood, and the firm bought the land and prepared 28 housing lots there. Each house is installed with a photovoltaic generator and a FC to make an environmentally conscious town. (The Nikkei Business Daily, October 17, 2013)

(5) Tokyo Gas

On October 21st, Tokyo Gas announced that natural gas Ene-Farm for apartment units would be available from April 1st. The product was developed in collaboration with Panasonic, and according to the both firms is the world's first FC for apartment units. The basic specifications are similar to new Ene-Farm for houses, and earthquake performance was improved for usage at a higher level. The FC is expected to be installed with other facilities such as a water heater in a pipe space by the entrance doors. Tokyo Gas aims for 500 units of orders for FY 2014. As a start, the product will be provided as a standard feature to all units of condominiums (total 456 units) sold by Tokyu Land Corporation and Sohgo Real Estate. (The Yomiuri Shimbun, The Asahi Shimbun, The Mainichi Newspapers, The Nikkei, The Sankei Shimbun, The Denki Shimbun, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, The Tokyo Shimbun, Kanagawa Shimbun, The Nishinippon Shimbun, The Kitanippon Shimbun, Nara Newspaper, The Toyama Shimbun, The Ibaraki Shimbun, Jomo Shinbun, The Shikoku Shimbun, The Hokkoku Shimbun, The Yamanashi Nichinichi Shimbun, The Shinano Mainichi Shimbun, Miyazaki Nichinichi Shimbun, Fuji Sankei Business i, The Chemical Daily, Chiba Nippo, The Niigata Nippo, Iwate Nippo & Kahoku Shimpō, October 22, 2013)

(6) Tokyu Land Corporation

On October 22nd, Tokyu Land Corporation

announced that a condominium would be sold with Ene-Farm installed in each unit as a standard feature. The sales will start in May, 2014, and the construction will be completed in July, 2015. The firm chose Tokyo Gas's FC systems for apartment units for the condominium to reduce utility bills by about ¥40,000 each year. (The Nikkei Business Daily, October 23, 2013)

(7) Sohgo Real Estate

Sohgo Real Estate will build “Renai Sky Premier Shinagawa-Nakanobu (provisional name), the first condominium with Ene-Farm for apartment units by Tokyo Gas. The construction will be carried out by the Haseko Corporation aiming for completion by late February, 2015, and Sohgo plans to start move-in of residents from late March, 2015. Each unit has FC and water heater units and a backup heat source in its pipe space where gas and water pipes are stored by its entrance door. (Nikkan Kensetsu Sangyo Shimbun & Architectures, Constructions & Engineerings News (Daily), October 24, 2013)

5. Cutting Edge Technologies of FCVs and EVs

(1) CEATEC

On October 1st, the largest IT and electronics exhibition and conference in Japan “CEATEC Japan” will open in Makuhari Messe. This time, auto giants attract more attention. Nissan Motor will reveal its self-driving car which is developed from “Leaf”. The car demonstrated its autonomous driving in a course prepared in the exhibition. Toyota Motor disclosed its single-seater EV “i-ROAD” for the first time in Japan with the latest technologies of manned driving including smart mobility system of urban areas with the micro EVs. The system allows sharing the micro cars using IT, and manages positions of these cars. Users receive availability of roads and the EVs, and the system provides users with the shortest route combined with public transport. (The Nikkei, October 1, 2013)

(2) GM

On September 30th, General Motors (GM) announced that its cooperation for FCV development with the US Army would be expanded. The automaker will develop materials and designs for FCVs as well as performance assessments in collaboration with The United States Army Tank Automotive Research,

Development and Engineering Center (TARDEC). (The Nikkei, October 1, 2013)

GM's FCV achieved 100,000 miles (approximately 160,000 km) in an experiment. In 2007 "Project Driveway" started with 119 FCVs to demonstrate, and one of "Chevrolet Equinoxes" achieved the mileage in the project. They estimated a saving of approximately 19,911 L worth gasoline. The project accumulates nearly 3,000,000 miles (approximately 4,800,000 km), which is estimated at 597,693 L of gasoline saved by the 119 vehicles. (The Chemical Daily, October 28, 2013)

(3) Hino Motors

Hino Motors revealed that PHV bus was developed. The bus can drive 15 km only on electricity, and 300 km by diesel engine combined with electricity on 100 L of diesel. Additionally electricity can be output from the bus. For commercialization, the automaker will drive on actual roads in the Tohoku area and supply electricity in an experiment. (The Nikkei, October 2, 2013)

(4) TDK

TDK will enter the market for automotive LIB. A battery unit will be developed by binding multiple cells to supply automakers. The Chinese auto giant "Beijing Automobile Group" has already employed the unit for its EV. (The Nikkei, October 2, 2013)

(5) Tohoku University

A team led by Prof. Fumihiko Hasegawa at the New Industry Creation Hatchery Center (NICHe) of Tohoku University originally developed a prototype of one- or two-seater EV. They will test the prototype by driving in the Aobayama area where the School of Engineering of Tohoku University is located near Sendai City. In the experiment, the EV aims to travel to a destination without a driver using global positioning system and robot technologies. The team will also investigate the feasibility of the automatic function that the EV returns to a start point from a dropped off point on its own. Additionally, a contactless charging facility will be studied for a technology to recharge while running. To contribute the industry in Tohoku, the team will invite smaller business in Miyagi Prefecture to build EVs locally at a several thousand level of small production which will be used in the area. (The Nikkei, October 3, 2013)

(6) SGHD

SG Holdings which is a parent company of Sagawa Express will start to deliver environmentally friendly facilities such as an EV charger for a smart house. A delivery network was prepared nationwide by making partnerships with logistics companies which have advantage of large and heavy goods. (The Nikkei Business Daily, October 3, 2013)

(7) MHI

Mitsubishi Heavy Industries (MHI) started to sell a system to optimize EV operation. A device is mounted on an EV to measure location information, average speed and battery level, and the data are analyzed and processed for better understanding to suit clients in different industries. For carsharing service providers and car rental agents, the firm suggests a method to locate vehicles in multiple positions more efficiently using an EV driving record. They have participated in an experiment of a smart community including EV management system in Spain to develop technologies. The expertise will be used for the growth of the new business. (The Nikkei, October 6, 2013)

(8) Osaka & Kyoto Universities

Osaka University and Kyoto University developed technologies of "multivalent-ion battery" which can store more than double the amount of a LIB. A multivalent-ion battery uses an oxide for its cathode and a metal such as magnesium and aluminum for its anode. Ions transport multiple electrons, which can make the battery capacity larger. Unlike LIB, the battery does not have risks of overheating and causing fire. Study group of Prof. Susumu Kuwabata at Osaka University created an aluminum battery which can charge and discharge 100 times. The study group of Prof. Yoshiharu Uchimoto at Kyoto University advanced the structure of the cathode for magnesium ions to move in and out easily, which slows down degradation. A 5 cm battery was made as a prototype. The results show the battery kept its performance after a couple of dozen charge and discharge session. The group aims to commercialize the technology for EVs in 2020s. (The Nikkei, October 8, 2013)

(9) Sumitomo Seika Chemicals

Sumitomo Seika Chemicals developed a material for LIB which can operate without reducing the perform at a high temperature of 60°C in collaboration with the National Institute of Advanced Industrial Science and Technology (AIST). The material was made of

acrylic resin to cover the metal plate of cathode. By using the material, a LIB accumulated 5,000 times of a charging and discharging session at 60°C without reduction in performance. This development can cut down size by eliminating the need of a large chiller system. The firm plans to ship out samples to EV related firms soon. (The Nikkei, October 8, 2013)

(10) Mitsubishi Motors

On October 8th, Mitsubishi Motors announced that three new cars would be displayed including plug-in hybrid vehicle (PHV) which can be charged through a home plug at the “Tokyo Motor Show 2013”. (The Nikkei, October 9, 2013)

The “Tokyo Motor Show 2013” will be open to the public from November 23rd, and eco cars with better driving performance will be displayed there. Mitsubishi Motors plans to exhibit a PHV version of the “Pajero”, a SUV, there. (The Nikkei, October 24, 2013)

(11) Nissan

On October 8th, Nissan Motor announced that about 700 quick chargers for EVs would be installed at its dealers nationwide by the end of March. (The Nikkei, October 9, 2013)

On October 11th, Nissan Motor and Yokohama City will start a carsharing service with two-seater micro EVs. They will charge users ¥20 each minute, and users can drive on public roads except controlled-access highways such as Expressways and By-passes in Yokohama City. The expected usages are short distance travel and transport tools for the elderly. 30 EVs have been prepared as a start, and there are plans to increase to 100 vehicles later. (The Nikkei, October 11, 2013)

(12) Toyota

Toyota Motor has unveiled its prototype of a FCV sedan for the first time to the press. The prototype was made more practical by cutting down the size of core components. The automaker already revealed a prototype of FC SUV, and this smaller sedan prototype uses more advanced technologies to reduce the costs and improve the performance by downsizing core components. The FC system is stored beneath the front seats, not in the engine compartment, and the number of hydrogen tanks is decreased from four to two. The prototype sedan is expected to show the same traveling performance level as a 2.5 L engine car

at high speed. On October 7th, it drove with the air conditioner on without any recharge from the headquarters of the automaker in Toyota City, Aichi Prefecture, to Harumi wharf, Tokyo, which is 322 km. Toyota aims to release a sedan type FCV in Japan, US and Europe by 2015, and targets at ¥3 to ¥5 million for the price range in 2020s. (The Nikkei, Nikkan Jidosha Shimbun, The Chunichi Shimbun, The Shikoku Shimbun, Gifu Shimbun, Saga Shimbun & Kahoku Shimpō, October 11, 2013; The Asahi Shimbun, The Kobe Shimbun, Nara Newspaper & Fuji Sankei Business i, October 12, 2013; The Nikkan Kogyo Shimbun, October 14, 2013)

Toyota revealed its micro EV “TOYOTA i-ROAD” to the press in Tokyo. (Saga Shimbun, The Shikoku Shimbun & Gifu Shimbun, October 11, 2013; The Kobe Shimbun & Nara Newspaper, October 12, 2013)

(13) EV Japan

Electric Vehicle Japan, which operates an automobile service in Osaka Prefecture, has prepared a research and development facility for automotive LIB. Subsidy for “Industry Creation for New Energy” which strengthens battery businesses in Osaka Prefecture went to the firm, and the facility was capitalized by about ¥10 million. The facility is ready for production soon. The firm also developed a system to control the voltage of LIB, and converted a battery for EVs to enable to power an evacuation lift during disasters. (The Nikkei, October 18, 2013)

(14) Wider Usage of EVs in Remote Islands

EVs have been expanding their usage in remote islands. Yakushima of Kagoshima Prefecture subsidizes its residents and businesses for purchases of EVs and chargers, and the scheme supported 120 vehicles. The prefecture office in Yakushima bought seven vehicles as official vehicles, and Yakushima Town office obtained one vehicle. Five two-seater EVs by Nissan are leased to Osakikamijima Town office, Hiroshima Prefecture, for three years, and the office will have a contract with a local car rental operator to hire them out to tourists in November. Kamijima Town, Ehime Prefecture, obtained three vehicles of “Coms”, a single-seater EV, in August. (The Nikkei, October 21, 2013)

(15) EV Sharing Businesses in Lyon

Two carsharing businesses with EVs started in Lyon, France, in October. Having prepared 50 charging

points, Bolloré Group, a French conglomerate, started “BlueLy” using 130 EVs to offer the service. They will increase the numbers of EVs to 250 and chargers to 100 next year. Another project started in Lyon with the cooperation of Japanese and French firms. Toshiba and New Energy and Industrial Technology Development Organization (NEDO) join the project from Japan. The French participant is a member of Veolia Environnement. Having prepared 6 charging points, the project uses 30 EVs of Mitsubishi Motors and Peugeot Citroën Group (PSA). (The Nikkei, October 21, 2013)

(16) Mitsubishi Electric

Mitsubishi Electric will sell a charger for EVs which works with photovoltaic generator with the cooperation of Mitsubishi Motors and Nissan. As well as a charger for EV, the “PV-EV bidirectional power conditioner” supplies electric appliances at home using the vehicle, and stores electricity from photovoltaic generator to EV battery for usage during disasters. The charger of Mitsubishi Electric will be available in 2014. (The Nikkei, October 24, 2013)

(17) Federal and States’ Policies & State of Businesses in US

Federal and state governments of the US will support EV sales which have hit the wall. The US government shows intention to prepare charging infrastructure more enthusiastically, which was desired by the automobile industry. The Department of Energy announced to increase the number of charging stands to 10 times in five years. On October 24th, the governors of eight states of east and west coasts including California, New York and Massachusetts signed a memorandum of understanding on the promotion of zero-emission vehicles (ZEV) such as EV and FCV. More EVs will be used as official vehicles in these states, and the amount of state subsidy for purchase will be increased for each application. These movements to encourage FCV and EV purchase are more likely to spread to other states. For the industry, GM released its first small EV in June. Daniel Akerson, the CEO, announced GM’s plan to develop an EV version of the luxury class “Cadillac” to move into the market fully. Leading in the field, Nissan prepared a local productions system manufacturing from batteries in its plants in Tennessee to tackle the issue to bring the

costs down. (The Nikkei, October 28, 2013)

6. Business Plans of Hydrogen Filling Station

(1) European Businesses

Expecting FCVs’ growth, European firms have committed to hydrogen related businesses. Germany-based Daimler and Royal Dutch Shell based in UK and Netherlands announced that 400 hydrogen filling stations would be prepared in Germany by 2023. European firms are well forward with preparation of pipelines and hydrogen dispensers, and aim to take a lead in the related markets. Daimler and Royal Dutch Shell will capitalize approximately €350 million (about ¥46 billion) for the hydrogen filling stations with the cooperation of four firms, a France-based Air Liquide and Germany-based Linde in the industrial gas field and France-based Total and Austria-based OMV in the energy field. Currently 15 hydrogen filling stations are in operation in Germany. The group of six plans to install one facility for every 90 km on autobahns and 10 at least in large cities by 2023. Norway has already prepared 580 km length of pipeline to transport hydrogen which is converted from its own source of natural gas. Other countries can easily prepare hydrogen infrastructure since gas pipelines go all over in Europe. (The Nikkei Business Daily, October 2, 2013; The Chemical Daily, October 4, 2013; The Nikkei, October 6, 2013; Fuji Sankei Business i, October 28, 2013)

(2) Iwatani

Iwatani Corporation will change the production of hydrogen filling station related facilities except high-flow compressors to Japan. Their hydrogen filling station contains a filling unit package of Linde as standard feature. The package consists of key components such as a high-flow compressor, cooling unit and heat exchanger. Iwatani aims to improve usability and reduce the required space for the facility by filling compressed hydrogen directly from the compressor to FCV. The Japanese safety standards on hydrogen filling stations are different from German standards; for example, materials and welding points are incompatible. Therefore, Linde’s original packages cannot be used in Japan, and customizing specification for the Japanese standards adds extra costs. Also, the shipping fee from Germany causes an expense rise for construction. The firm will fabricate other devices and piping of the package, apart from

Linde's high-flow compressor, in Japan to bring the cost down. The production plans to start in FY 2014 in Japan. A hydrogen filling station generally costs around ¥500 to ¥600 million to build. By switching to domestic production, the manufacturer intends to reduce the cost down to ¥200 million. (The Chemical Daily, October 10, 2013)

7. Solid-Hydrogen Source FC

Rohm has developed a solid-hydrogen source FC unit taking solid-hydrogen in a canister, and the commercial products of the unit will be shipped out from 2015. A solid-hydrogen canister goes into the portable FC unit, which is 19 by 34 by 29 cm and weighs 7 kg; by adding water the source releases hydrogen to the cells to generate power. The unit can continuously generate electricity by replacing canisters. The product was developed in collaboration with Kyoto University and Aquafairy. The manufacturer will annually deliver 200 units of "Hybrid High Power Output Type" (AC 100V and two 5 V-USB outputs), which are solid-hydrogen source FCs outputting 100 Wh and a 100 Wh LIB combined, to local governments as emergency power sources as a demonstration project in 2014. From 2015, the product will be manufactured at an annual 1,000 unit level of full volume production as a portable generator. (Dempa Shimbun, October 3, 2013)

8. FC Related Technology Developments and Business Plans

(1) Noritake

Noritake Co. will improve its business for core materials for FCs. Sealing glass was already developed, and their product range are expanding by making trial pieces of an electrode and electrolyte. The firm can advantageously manufacture these products from material within its group, and will bring them as a new business. Their existing technology can be used for SOFC, because the FC operates at a higher temperature of over 650°C and requires highly heat resistant materials. The manufacturer already moved into the FC material market by developing the sealing glass to fix FC cells and metal separators together in May. The product keeps its sticking force to put different materials such as metal and ceramic together at a high temperature

of around 800 °C, and characteristically does not contain boric acid or sodium which makes SOFC deteriorated. Following this, an electrode and electrolyte are currently under development for commercial production. A material producer of the Noritake group can supply nickel oxide and zirconium, which allows them to manufacture from material to final products. Having this advantage, the firm will appeal on the difference it and between conventional products. (The Chemical Daily, October 7, 2013)

(2) The University of Tokyo & Hiroshima University

A research group of the Tokyo University and Hiroshima University has conceived a method to make a material to store electricity at high temperature. The method is considered to be available to be used for electronic parts for FCs within three to five years, and its application is most likely to be a capacitor which stores electricity temporarily. The group synthesized barium dititanate (BaTi_2O_5) containing a high level of calcium. When BaTi_2O_5 was annealed at 1000°C for several minutes, a crystal as obtained of which the barium was partially replaced with calcium. By controlling the ratio of calcium in BaTi_2O_5 , the material can store large amount of electricity between 220 to 470 °C. (The Nikkei Business Daily, October 25, 2013)

(3) SCSK

SCSK will structure its business to be able to suggest total solutions of analysis for manufacturers. A distributor agreement was signed with Germany-based Math2Market, Rhineland-Palatinate, and SCSK will sell GeoDict which is an analysis software package of Math2Market for material developments from November 1st. With the new product for material development, the range of software for production technologies is now fortified as well as for research and development, structure for general purpose and production method. The firm targets automakers and LIB and FC manufacturers for the software sales. (The Nikkan Kogyo Shimbun, October 28, 2013)

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