An Ene-Farm Was Born for Under ¥2 million

Arranged by T. Homma

1. Governmental Measures

(1) Hydrogen Production by Renewable Energy: METI

The Ministry of Economy, Trade and Industry (METI) will support the development of technology for hydrogen production with using renewable energy in FY 2013. Toyota Motor, Nissan Motor and Honda plan to sell commercial hydrogen fuel cell vehicles (FCVs) in 2015, and 100 hydrogen filling stations are expected be prepared throughout Japan. Renewable energy is used from a hydrogen production stage, which leads to a reduction of the environmental impact over a total FCV life cycle. The technology development is aimed to be commercialized in five to ten years. METI will back up the technology development to produce hydrogen by the electrolysis of water at a lower cost with renewable energy including wind and solar power. The cost of a hydrogen production device using electrolysis is aimed to be reduced to around ¥250,000, which is a third of the current price. The ministry will subsidize development expenses of businesses and universities. Also, hydrogen is expected to be a storage method of wind and solar energy whose output largely fluctuates upon the weather, as well as for FCVs. Hydrogen is produced by surplus electricity which cannot go into the grid, and fuel cells (FCs) are supplied with the hydrogen to provide electricity when demand is high. For the storage system, METI will also finance the development of an energy transport method from Hokkaido and the Tohoku area where large amount of renewable energy is expected to be produced, with Ministry of Education, Culture, Sports, Science and the Technology (MEXT). Energy conversion from hydrogen to ammonia for easier transportation will be investigated. (The Nikkan Kogyo Shimbun, December 19, 2012)

(2) Supplementary Budget for FY 2012

On December 10th, the Japanese government revealed a supplementary budget bill for FY 2012 as an economic policy, and ¥1,202.9 billion in total would go to METI. In detail, ¥200 billion is allocated for subsidy to promote energy saving and competitive strength for businesses as well as ¥100.5 billion for charger infrastructure of next generation vehicles such as electric vehicles (EVs). For research and development, ¥2.5 billion is allocated for verification of high-temperature superconductive direct electric current transmission, and ¥1 billion for research into contactless power transmission technology for photovoltaic generator. To stimulate the economy with research and development investment, ¥2.9 million is set with priority for the subsidy of a testing facility preparation for FCV hydrogen infrastructure. (The Denki Shimbun, January 11, 2013)

2. Local Governmental Measures

(1) Tochigi Prefecture

Tochigi prefecture will install three 3kW phosphoric acid fuel cells (PAFCs) at Kenou Joka center, a sewage treatment facility, to sell electricity by using biogas. To start the electricity sales from the end of FY 2014, the prefecture plans to receive a certificate for the facility for the net metering of the renewable energy feed-in tariff from the government within FY2012 , and then to have a contract with Tokyo Electric Power Company (TEPCO). Kenou Joka center expects an economic benefit for reducing the sewage treatment expense. The sewage treatment produces approximately 1,300,000 m3 of biogas such as methane each year. Currently 25% of the biogas is used to heat the digester chamber, and 75% is burned to dispose. In contrast, all the gas can be used up by installing FCs. The electricity will be sold to the utility firm and the waste heat will be utilized to heat the digester chamber. If contracting with TEPCO within the FY 2012, the tariff will be ¥40.95 per kWh and last 20 years. The construction will be ¥400.2 million. The annual production plan is 2,520,677 kWh which gives ¥103.222 million profit. ¥60.4057 million is

expected as a profit after taking construction and maintenance costs into account. (The Denki Shimbun, December 28, 2012)

(2) Hokkaido

In January, 2013, Tomamae town of the Rumoi area and Wakkanai city will start an operation experiment to produce hydrogen with renewable energy such as wind and solar power and convert it into an organic hydride to store. This joint project is with firms including Air Water (Osaka), Tatsumi Ryouki (Tokyo) and an environment venture Hrein Energy (Sapporo). The energy is planned to be used to heat the neighboring area for a while and to power FCVs in the future. Electrolytically-generated hydrogen is converted into an organic hydride, which is made liquid at a room temperature and under normal pressure, by a chemical reaction with a liquid such as toluene and a catalyst to enable to be stored in a tank. To be used as fuel, the hydride is reversed into hydrogen by a gasifier. The hydride is less than 1/500 of hydrogen gas in volume and can be handled in the same way as gasoline, and is more suitable to be stored and transported than hydrogen gas. The key which led to the experiment technology is from Hrein Energy. The firm developed a practical device to turn hydrogen into an organic hydride which is movable on a vehicle. (The Hokkaido Shimbun, January 3, 2013)

(3) Tokyo

On January 6th, the governor assessed an energy reform and disaster control of the budget bill of Tokyo for FY 2013. A subsidy scheme will be set to promote energy creation facilities including storage batteries and FCs for the home. For five years from FY 2013 to 2017, Tokyo will add up to half the amount of state subsidy for approximately 8,500 storage batteries and approximately 19,000 FCs. The state subsidizes third of a storage battery purchase up to ¥1 million per facility. Also, ¥50 million is allocated to develop a "Solar Power Estimation Database" to promote photovoltaic generators. (The Yomiuri Shimbun, The Asahi Shimbun, The Mainichi Newspapers, The Sankei Shimbun, January 7, 2013; The Yomiuri Shimbun, The Mainichi Newspapers, The Sankei Shimbun, The Nikkei, January 19, 2013)

(4) Tottori City

A smart house was completed for "Wakabadai Area Smart Grid Town Demonstration Project", and had an unveiling ceremony on January 12th. Tottori city started the project in August, 2012. The idea of the project is to save excess energy into a shared storage battery from photovoltaic generators installed at a plant factory, which is newly built at Wakabadai North industrial estate to grow vegetables, a day-care facility and three private buildings. The stored energy will be used for outdoor lighting and an EV charger and provided to buildings during power cuts. According to Tottori Gas, electricity and gas usage of an average household of four will be reduced by 37% and the system will provide 90% of the electricity for the household. (Nihonkai Shimbun, January 13, 2013)

3. FC Related Element Technology Development

(1) Nagoya University

A study group with Prof. Masaru Hori of Plasma of the Nanotechnology Research Center at Nagoya University developed a technology to create at fast rate "Carbon Nano Graphene" which is a net structure of a hexagonally-arranged carbon atom sheet substance at a normal temperature. The product is made at 0.6-1.7 mg/min with liquid alcohol and plasma discharge, which is 10 to 100 times faster than chemical vapor deposition (CVD) using high temperature alcohol vapor. Carbon Nano Graphene is potentially more demanded as an electrode material for FCs and photovoltaic generators. The technology allows negating the need for energy to bring alcohol to high temperature and highly pressurize argon gas, which leads to commercial production of Carbon Nano Graphene at a lower cost. The study group aims to commercialize the mass production technology with a battery material manufacturer. (The Nikkan Kogyo Shimbun, December 18, 2012)

(2) Waseda University

A study team with Prof. Masakazu Washio and a visiting researcher Akihiro Oshima of Waseda Research Institute for Science and Engineering successfully improved battery characteristic by graduating the concentration of a certain atom group of an electrolyte membrane for a polymer electrolyte fuel cell (PEFC). Low energy 60 kV electron beam is applied to a thin fluororesin film to form a sulfonate group which is an atom group consisting of sulfur, oxygen and hydrogen. The film has more

concentration of the sulfonate group as it gets thicker. A film made into an electrolyte membrane of a FC to compare the performance, and the FC exhibited dozens of percentage higher output than a FC with a uniformly concentrated sulfonate group electrolyte membrane. The gradational concentration reduces hydrogen and oxygen gas crossing over by half. (The Nikkan Kogyo Shimbun, January 14)

(3) The University of Electro-Communications

The University of Electro-Communications (UEC), Tokyo, and New Energy and Industrial Technology Development Organization (NEDO) installed an facility to observe a catalytic reaction of an electrode, exclusively when a FC generates electricity, at a large synchrotron radiation facility SPring-8. This 82m-length facility allows monitoring of the change of an electrode with short wavelength light radiation, which will contribute to improve durability and reduce costs of FCs. An observation can be detailed in a 100 nm scale by the shortest period every 1/10000 of a second, which is 10 times better performance than the current best facility. The construction cost is ¥1.1 billion.

"A direct observation of platinum catalyst in an electrode at a nano level will help us to understand its behavior and can lead to improve durability of FCs and to reduce use of valuable platinum." says Yasuhiro Iwasawa director of Innovation Research Centre for Fuel Cells of UEC. (The Asahi Shimbun, January 17, 2013)

4. Business Plan for FC Part Technology

Teijin plans to expand the target field for a polyethylene-naphthalate (PEN) film Teonex which is a highly functional polyethylene film produced by Teijin DuPont. The film has good heat and hydrolysis resistance and gas barrier properties. The sales of the film have been strong, and the shipping is expected to be 4,000 tons for FY 2012. The firm will intensely promote the product for PEFC parts. With a high chemical resistance and durability, the film is planned to be sold for a process film of PEFC, catalyst layer printing film and a gasket material. The firm expects the sales for FC materials to be expanded to ¥3 billion in 10 years. (The Chemical Daily, December 28, 2012)

Teijin will try to expand the usage of its woven carbon fiber by strengthening sales as a base material of FC gas diffusion layer (GDL). Since a fabric less than 200 μm, which is thinner than conventional products, is ready to be mass produced, the firm aims to construct a supply system which fits to customers' desires. Teijin targets the FCV market which is expected to grow fully from 2015 as a usage of the product. The product is flat woven polyacrylonitrile (PAN) carbon fibers and Toho Tenax will carry out the production. Constituting a key part of a FC, GDL base material supplies hydrogen and oxygen, collects power and discharge water produced in electrolyte membranes. (The Chemical Daily, January 15, 2013)

5. Business Plan for Ene-Farm

(1) Daiwa House

Daiwa House will start a large complex development combining housing and medical and care facilities at land which was formerly a Musashino classification yard in front of JR Musashino line "Yoshikawa-Minami Station". Houses and apartment houses are planned to provide approximately 1,200 units in total. The firm will develop an environmentally friendly town with houses to buy and housing to let and apartment units for sale. The houses for sale will have external walls with breathable insulation which is durable, energy saving and the firm's original wall system. Also, Daiwa House aims the housing to be net zero energy houses which produce more energy than they consume by installing photovoltaic generation systems, domestic lithium-ion batteries (LIBs), home energy management system (HEMS) and cogeneration (Ene-Farm) actively. (Architectures, Constructions & Engineerings News (Daily), Nikkan Kensetsu Sangyo Shimbun, December 18, 2012; The Denki Shimbun, December 20, 2012; Jutaku Shimpo, December 25, 2012)

(2) Osaka Gas

On December 18th, Osaka Gas held an opening ceremony in Osaka city for "Kansai Double Power Generation Promotion Plan" which is a campaign starting from January, 2013 to encourage customers to have domestic double power generation system with natural gas and solar power. Takao Osawa who appears in their advertisement was designated as a promotion leader. The president Hiroshi Ozaki revealed that Ene-Farm sales were expected to reach

the target of 6,000 units for FY 2012 by the end of December. The target for FY 2013 is expanded to 10,000 units. The firm will start a sales target of 14,000 units combined with a domestic cogeneration system "Ecowill" from January, 2013 ahead of schedule. (The Yomiuri Shimbun, The Mainichi Newspapers, The Sankei Shimbun, The Denki Shimbun, The Nikkan Kogyo Shimbun, Osaka Nichnichi Shimbun, The Kobe Shimbun, The Kyoto Shimbun, December 19, 2012)

(3) Takashimaya Kyoto

Since being environmental friendly is becoming both popular and fashionable, Takashimaya Kyoto store sells the latest eco house with combined energy saving facilities such as photovoltaic generator and Ene-Farm for ¥25.25 million. At "¥4 to 5 million cheaper than regular price" they appeal to customers. (The Asahi Shimbun, December 19, 2012; The Yomiuri Shimbun, December 25, 2012)

(4) Toho Gas

On December 25th, Toho Gas announced that solid oxide fuel cell (SOFC) "Ene-Farm type S" by Aisin Seiki would be available from January 21st, 2013. Aisin Seiki realized a generation efficiency of a 46.5% lower heating value (LHV) on the product. Also, the product fits in a smaller space by rearranging the layout to improve maintainability. Approximately 70% of electricity costs can be reduced, which is the equivalent of a utility cost of approximately ¥67,000 in a year for a household of four family members with floor panel heating and a bathroom heating and clothes dryer. The suggested retail price is ¥2.94 million after tax excluding installation cost. (The Denki Shimbun, The Chunichi Shimbun, December 26, 2012; The Nikkei Business Daily, January 4, 2013; The Nikkan Kogyo Shimbun, January 7, 2013)

(5) Tokyo Gas

On December 31st, Tokyo Gas revealed that Ene-Farm for apartments would be available from late 2013. This would be the first product for an apartment unit. Under development by Tokyo Gas, the new product fits in a small piping space for gas and water and will be installed for new apartment units at construction. The cost of the FC and installation will be at the same level on an existing model, which is nearly ¥2 million or less with subsidy. (Fuji Sankei Business i, January 1, 2013)

(6) Sumitomo Forestry

Sumitomo Forestry renewed its housing package "Kodachi" which provides a wide range of plan and room layouts to accommodate customers' demands. A total of 388 plans are available adding 88 plans with desired themes such as a house for two generations. The price is from ¥54,000 per 3.3 m2. The firm aims at 1,000 houses for a year. Being environmentally conscious, all the plans have photovoltaic generators as a standard feature, and Ene-Farm and HEMS are optional. (The Nikkan Kogyo Shimbun, The Nikkei Business Daily, January 7, 2013; The Nikkan Kensetsu Kogyo Shimbun, January 8, 2013)

(7) Hiroshima Gas

Hiroshima Gas plans to expand Ene-Farm sales. The sales for FY 2012 are expected to be 250 units (contract base), and 370 units are aimed for FY 2013. Their products will be displayed at a show house site in a large new town "Kasugano" area in Asaminamiku Hiroshima city. House manufacturers will build seven smart houses there and four of them are planned to be installed with the FC. (The Nikkei Business Daily, January 8, 2013; The Chugoku Shimbun, January 16, 2013)

(8) Panasonic and Tokyo Gas

On January 17, Panasonic and Tokyo Gas announced "New Ene-Farm" would be available from April 1st. The new product is approximately ¥76,000 cheaper than an existing product by reducing number of components by 20% and amount of platinum catalyst by 50%. They are less than ¥2 million; suggested retail price is ¥1.995 million excluding installation. Also, the product operates at a lower temperature around 300 ℃ and is confirmed to run 60,000 hours. Panasonic plans to produce over 15,000 units for FY 2013, and Tokyo Gas aims to sell 12,000 units. Additionally, Toho Gas and Saibugas announced that they would also sell the product from April 1st. (The Yomiuri Shimbun, The Mainichi Newspapers, The Nikkei, The Sankei Shimbun, The Denki Shimbun, The Nikkan Kogyo Shimbun, The Nikkei Business Daily, Dempa Shimbun, The Chunichi Shimbun, The Nishinippon Shimbun, The Chugoku Shimbun, Fuji Sankei Business i, The Chemical Daily, January 18, 2013)

6. Developments of Business Use FCs and the

Business Plans

(1) Osaka Gas

Osaka Gas will introduce a cogeneration system with FC for shops and office buildings by FY 2015. Cogeneration product range for business user will be expanded with several kW output SOFC as well as existing small gas engine cogeneration systems. Osaka Gas developed a domestic SOFC system with Aisin Seiki and Kyocera and introduced in April, 2012. However, the firm considers oversea procurement as an option. (The Nikkan Kogyo Shimbun, December 24, 2012)

(2) Miura

Miura, a major boiler manufacturer, developed a prototype of a SOFC generator running on natural gas, for business use. The product generates electricity and produce hot water by combining the firm's boiler technology and collecting and using heat from waste gas from generation. The output is 4.2 kW, and the hot water supply capacity is 1.3 L/min. With 48% generation efficiency, the FC reaches 90% total energy conversion efficiency. The FC is 55 cm wide, 110 cm depth and 165 cm height and installed outside buildings. The generation module, the core component, is provided from Sumitomo Precision Products, and Miura designed the system to heat water from collected heat. The product will have an operation test with Tokyo Gas and Osaka gas for two years from FY 2013, and Miura plans to sell it to restaurants and care facilities for under ¥4 million from FY 2015. (The Nikkei Business Daily, January 1, 2013)

7. Cutting Edge Technologies of FCV and EV

(1) METI

Ministry of Economy, Trade and Industry (METI) will subsidize EV charger installation over ¥50 billion in total. Chargers will be installed at rest areas of expressways and commerce facilities to increase to approximately 5,000 units nearly four times the current facility number. Currently EVs have difficulty to drive long distance, but they can go farther with more chargers installed on the way, which allows increasing popularity by infrastructure preparation to lead the world in the EV market. METI will allocate ¥100.5 billion for charger preparation in the supplementary budget for FY 2012. A certain proportion, e.g. 50% of a charger, will be supported for installing a quick charger which fills an EV battery for about 30 minutes. Although another subsidy scheme already supports EVs and chargers, the scheme focuses on vehicle purchase. The new scheme will exclusively target chargers. Around 4,000 chargers are expected to be installed ahead of schedule, with more than 5,000 units by 2020. (The Nikkei, January 6, 2013; Nikkan Jidosha Shimbun, The Chemical Daily, January 8, 2013; The Denki Shimbun, January 18, 2013)

METI decided details for charger infrastructure preparation for EVs which are in the supplementary budget bill for FY 2012. The state will finance two thirds of a charger and its installation costs for installations fitted in local governments' plans. The amount seems be over three times the current subsidy scheme per case in value. For apartment houses and car parks, the scheme will support a half of a total cost including charger and installation. For businesses installing a charger for their own EVs and the home, half the amount of a charger cost will be provided as before. (The Nikkei, January 18, 2013)

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8. Hydrogen Filling Station Trend

(1) NEDO

Hydrogen stations are necessary for FCVs to be popular, and their construction costs have been reduced. One technology development project funded by New Energy and Industrial Technology Development Organization (NEDO) has found out a way to lower costs to ¥ 0.2 billion, which is a third of a conventional method excluding land expense. The project members are Japan Petroleum Energy Center (JPEC), Toho Gas, Tokico Technology, Hitachi Automotive Systems, Taiyo Nippon Sanso, The Yokohama Rubber and an industry-academia consortium of Saga University, and the project has a contract with NEDO. JPEC studied standard specifications for a hydrogen filling station and designed a construction plan within ¥ 0.2 million. The component devices are optimized and "packaged" in a container to reduce the expense. (Nikkan Jidosha Shimbun, January 5, 2013)

(2) Taiyo Nippon Sanso

Taiyo Nippon Sanso will start an operation test of hydrogen filling stations from FY 2013. The facility is in a 40-ft. movable container, and large and small

facilities of two types are prepared depending on capacity, pressure of the tank and the number of cars to be filled from a single container. Compact and flexible to install, the facility cost appears to be a third to a quarter of other firms' products to construct and install. The Taiyo Nippon Sanso aims at over 30 units FY 2015. (The Chemical Daily, January 11, 2013)

(3) JX Nippon Oil & Energy

JX Nippon Oil & Energy has been considering opening 40 hydrogen supply sites in Japan by 2015. The number is 40% of the target that automobile and energy industries presently aim to install. Currently, a dozen of hydrogen filling stations are under operation at test. JX Nippon Oil & Energy operates three filling stations including one in Suginamiku, Tokyo, and will manage hydrogen filling facilities installed to two petrol filling stations from February. (The Nikkei, January 15, 2013; The Nikkei Business Daily, January 16, 2013; The Chemical Daily, January 21, 2013)

9. Developments and Operation Tests of Hydrogen Filling System

(1) The National Institute for Land and Infrastructure Management

On December 17th, the National Institute for Land and Infrastructure Management (NILIM) carried out an experiment to provide domestic FCs with hydrogen by using a public utility conduit of Tsukuba city. To be used as power source, hydrogen has to be distributed by urban infrastructure to realize a low carbon society, and this experiment is a start. NILIM installed a pipe for approximately 250 m in the conduit to supply hydrogen near Chuo Koen (park) in the city. In the simulation, hydrogen was supplied to a FC in an experimental house through the pipe from a hydrogen cylinder, and electricity and heat was generated to operate lighting, a DVD player and a water heater. (The Nikkei, The Ibaraki Shimbun, December 18, 2012; The Nikkei Business Daily, December 19, 2012)

(2) New Kansai International Airport Company

On December 19th, New Kansai International Airport Company announced that "KIX Smart Island Hydrogen Grid Research" was established to construct a system to produce and provide hydrogen for FCVs with Toyota Motor and Iwatani. The project aims to develop a system which produces hydrogen by natural energy such as solar and wind power and stores hydrogen in Kansai International Airport. The energy will be used for FC shuttle buses and airport's FCVs, and is also expected to be an emergency power source. (The Sankei Shimbun, December 20, 2012)

(3) Kawasaki Heavy Industries

On December 26th, Kawasaki Heavy Industries, Kobe city, revealed that a project would start to produce and fully utilize hydrogen totally. Hydrogen has been researched as clean energy, although it has not been commercialized fully due to its flammable nature making it difficult to handle. The firm is building a research plant for production at Harima Works, and an experiment is planned to start by 2017. The considered plan is to gasify coal, which is cheaper and lower quality from Australia, to take hydrogen out. The hydrogen is liquefied to transport by a tanker, stored in a tank and sold to semiconductor and power plants as well as a fuel for FCVs. Higher safety measures are required due to hydrogen management. Also, the hydrogen production process creates CO2 waste and that will be an issue. The firm is considering burying this under soil. (The Kobe Shimbun, December 26, 2012)

10. FC Facility Construction and R&D by Universities

(1) Tokyo Institute of Technology

Tokyo Institute of Technology constructed a system "Tokyo Institute of Technology Campus Smart Grid" to fully manage energy information, including a lecture building. The campus smart grid consists of highly intense 4,570 solar panels installed on the south and west walls and the roof top, and highly efficient and distributed generation system combined with FC to supplement energy shortage. The CO2 emission is reduced by approximately 60% by the system. (Information Industry and Market News, December 17, 2012)

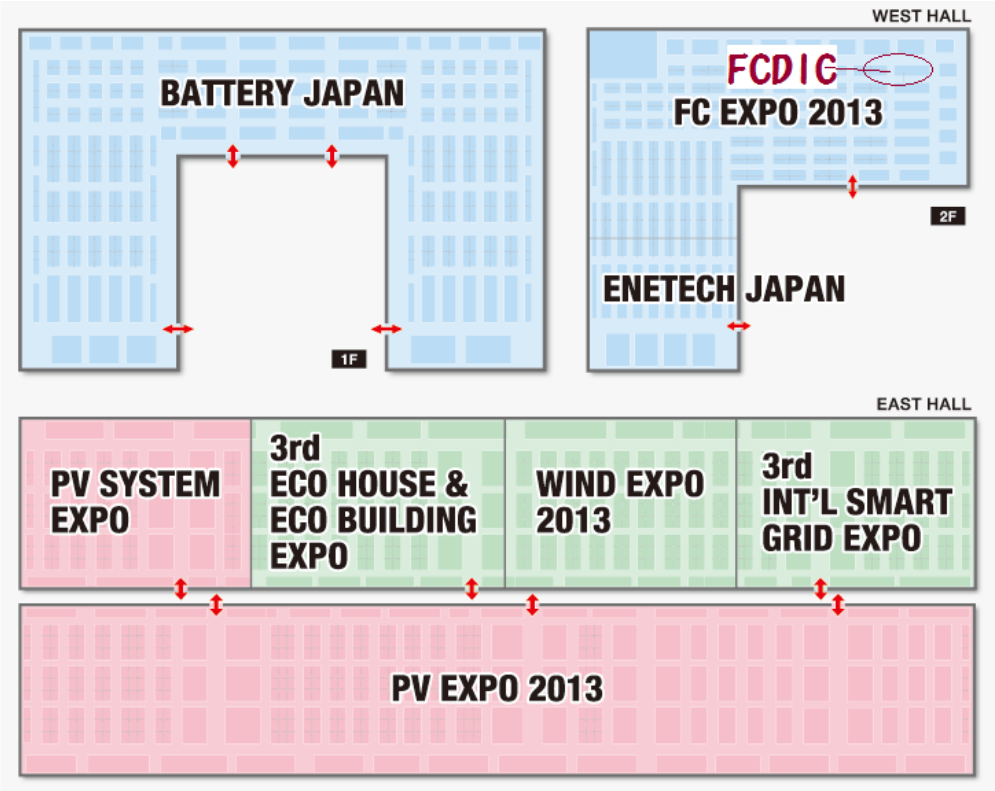
(2) Kyushu University

In January, 12 Japanese FC related firms opened laboratories to aim for a higher functional FC and to gain popularity at the "Next-Generation Fuel Cell Research Center" of Kyushu University. Expected advantages are a synergetic effect of the university's advanced facilities and fundamental research, and to build on product development capability of industrial firms.

"Without a border between university and industries, we would like to create a technology and product of international standard in the future" the university anticipates.

The participants include TOTO, Saibugas, Kyocera, Mitsubishi Heavy Industries and JX Nippon Oil & Energy. (The Nishinippon Shimbun, January 6, 2013)

-This edition is made up as of January 21, 2013 -



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