

## **SoftBank Launches Industrial FC Business**

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### 1. Governmental Measures

#### (1) NEDO

New Energy and Industrial Technology Development Organization (NEDO) has chosen Fukuoka City for the 20<sup>th</sup> Steering Committee Meeting of International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE). The meeting will be held on two days from 13<sup>th</sup> to 14<sup>th</sup> of November. Having plenty of related research facilities to show, Fukuoka City has hosted international conventions in the hydrogen and fuel cell (FC) field. Also, Fukuoka Strategy Conference for Hydrogen Energy has received an Excellence Award in Leadership from IPHE. With these facts, NEDO determined the city is suitable for the occasion. IPHE was established in 2003 to build an international cooperative framework to promote technology development, standardization, and exchanging policy information. The organization consists of 17 members including Japan, USA, the European Commission (EC) and China. (The Chemical Daily, July 12, 2013)

#### (2) METI

On July 24<sup>th</sup>, the minister Toshimitsu Motegi of the Ministry of Economy, Trade and Industry (METI) had a meeting with the States Secretary of Energy Ernest Moniz of the United States Department of Energy (DOE) at Washington. They released a joint statement which the both countries agreed to cooperate to solve major bilateral energy issues. In the meeting, these nations confirmed the importance of cooperation for research and development including joint studies on hydrogen production and FCs carried out by National Institute of Advanced Industrial Science and Technology (AIST) and National laboratories of DOE. (The Denki Shimbun, The Chemical Daily, July 26, 2013)

To promote fuel cell vehicles (FCVs), METI will ease the requirements for steel for hydrogen filling equipment, and lead to a maximum 30% reduction of the current cost which is ¥600 million for one facility.

Also, liquidized hydrogen filling stations will be able to be installed in urban areas. The government aims FCVs to be commercialized in 2015 as a growth strategy, and plans to prepare 100 hydrogen filling stations nationwide by 2015. However, the current figure of these filling stations stays at less than 20 due to high installation cost. To reduce the costs, METI intends to bring in cheaper steel, which is used overseas, to be used for storage tanks for hydrogen refueling facilities for cost reduction. Stainless steel is certified in the current standards, and cheaper chromium molybdenum steel is planned to be usable for the tanks. The ministry will prepare the new standards to maintain safety to prevent explosion by FY 2014. Technical standards will be prepared for liquid hydrogen filling stations, which require smaller space than other hydrogen facilities, for urban areas within FY 2013. Currently only one liquid hydrogen refueling point operates in Tokyo, because the standard is not yet set. Additionally, the inspection scheme for hydrogen tanks will be eased to support FCV manufacturers' development. At the moment, a FCV is allowed to test run after its hydrogen tank is inspected. The deregulation lets FCVs to have test runs without inspection of the tanks, and the manufacturers can simultaneously develop tanks and vehicles. (The Nikkei, July 29, 2013; The Mainichi Newspapers, The Nikkei Business Daily, Osaka Nichinichi Shimbun, The Chunichi Shimbun, The Sanyo Shimbun, The Nishinippon Shimbun, Minami-Nippon Shimbun, The Hokkaido Shimbun, The Hokkoku Shimbun, Nihonkai Shimbun, The Yamanashi Nichinichi Shimbun, The Shinano Mainichi Shimbun, The Toyama Shimbun, Saga Shimbun, Jomo Shinbun, The Kahoku Shimpō, Akita Sakigake Shimpō, Iwate Nippo, To-o Nippo, July 30, 2013)

#### (3) MOE

The Ministry of the Environment (MOE) selected 14

projects including “large FC transit bus development by Hino Motors and Toyota Motor” in four fields as the “Technology Development and Experiment Projects for Reducing CO<sub>2</sub> Emission” for FY 2013. This governmental scheme is to promote technological developments and experiments which strengthen measures against global warming in the future. The ministry started the scheme from FY 2013 with a budget of ¥3.9 billion for grants to help businesses, which have projects potentially leading to large CO<sub>2</sub> reduction. (The Chemical Daily, July 30, 2013)

#### (4) Shikoku Bureau of Economy, Trade & Industry

Shikoku Bureau of Economy, Trade & Industry certified a research and development plan of Morita Giken, Anan City, based on the Act for the “Sophistication of Basic Manufacturing Technology of Small and Medium Enterprises”. The firm will develop a “double belt press to serially produce FCs for automobiles” as the research and development project. Firms with certified projects are eligible for lower interest loans by public sector financial institutions. (The Tokushima Shimbun, July 31, 2013)

#### (5) Council for Science and Technology Policy

On July 31<sup>st</sup>, the Council for Science and Technology Policy chose five fields including an economical energy system with lower environment impact for the policy to intensively distribute the science technology budget for FY 2014. In the energy field, the schedule for highly efficient generation technology development lists targets such as commercialization of 1700°C level gas turbines, advanced ultra-supercritical generation and carbon dioxide capture and storage technology after 2020 as well as cost reduction of FCs. (The Denki Shimbun, August 2, 2013)

## 2. Local Governmental Measures

### (1) Tokyo

The Bureau of Industrial and Labor Affairs of Tokyo Metropolitan Government will support technology development of smaller businesses in three industrial fields, health, environment and risk management which are expected to expand their markets globally. The environment field includes technology and product developments on independent/distributed and renewable energy, and efficient utilization of energy as examples. The example products are generation technologies based on renewable energy such as solar,

wind and hydroelectric power, cogeneration and FC as well as home energy management system (HEMS) and building and energy management system (BEMS). (Architectures, Constructions & Engineerings News (Daily), July 9, 2013)

### (2) Saitama City

Saitama City will start a subsidy scheme to prepare energy creation and refueling points “Hyper Energy Stations” in July. A Hyper Energy Station is equipped with a quick charger for electric vehicles (EVs), storage batteries, hydrogen filling facilities for FCVs and energy creation facilities such as a solar panels and independent generators to help in the rapid restoration of transportation network during disasters. The city invites oil suppliers, and expects 10 projects to be subsidized. The maximum subsidy is around ¥7 million, and a third of the preparation cost will be supported. The projects must have installation of both chargers for EVs and energy creation facilities. (The Nikkan Kogyo Shimbun, July 10, 2013)

### (3) Shimane Prefecture

Shimane Prefecture will join a project of small emergency FC generators using hydrogen that Rohm, Kyoto City, and Aquafairy, Kyoto City, are trying to commercialize. As an emergency power source, the group aims for commercialization in 2015. The prefecture will cooperate on an experimental prototype. This fall, 20 prototypes of 200 Wh rated power will be developed to be tested. They will have with the dimensions of 24 cm width, 34 cm depth and 24 cm high and total weight of 6 to 7 kg. (The San-in Chuo Shimpo, July 11, 2013)

## 3. Technology Development of FC Related Element

### (1) Maezawa Kasei & Ryukoku University

Maezawa Kasei and Ryukoku University are developing microbial fuel cells together, and created a small scale demonstration product which can be scaled up to microbial fuel cells. The firm is developing “Asitis energy” (provisional name) in collaboration with Ryukoku University. Anaerobic microorganisms in activated sludge decompose and remove organic matters in sewerage in a short period. Electrons can be drawn to create current from organic matter in the process when the microorganisms eat organic matter for their multiplication. Because energy from microorganisms’ growth is partially collected as

electricity, this system can reduce unnecessary sludge. The group made a small demonstration product to prove that the generation efficiency can be improved by adjusting the pH of the air cathode liquid membrane over time. (The Chemical Daily, August 1, 2013)

#### (2) Hokkaido University

A study team of Prof. Jian Ping GONG at the Hokkaido University developed a very strong hydrogel which heals itself once it is cut and put together. This hydrogel is over 100 times stronger than conventional self-healing gel, and is potentially used for electrolyte and separators for FCs, material to mitigate seismic motion and biomaterial. A common material monomer is used for the hydrogel, which allows mass production at a low cost. Same amount of positively- and negatively-charged monomers were mixed at double the concentration of normal use, and exposure to ultraviolet light at room temperature for 11 hours to make the highly tough and self-healing hydrogel. Various ionic monomers can also be used, and softness of the gel can be adjusted by altering the concentration of monomers. Cut pieces of the gel stick together in three to ten hours. The team aims to commercialize the gel in collaboration with a business. (The Nikkan Kogyo Shimbun, The Chemical Daily, August 5, 2013)

#### 4. Business Plan of Professional-use FC

Softbank will start an industrial use FC business this fall. Large stationary FCs will be sold to offices, hospitals and public facilities. The product is a solid oxide fuel cell (SOFC) which uses natural gas and outputs 200 kW. The firm established Bloom Energy Japan in Tokyo, and will use and sell the FC at its own office in Fukuoka City. Bloom Energy Japan is capitalized at ¥2 billion equally by a US-based FC venture Bloom Energy and Softbank. The SOFC from Bloom Energy produces electricity with an average 52% high generation efficiency, and supplies Google and Coca-Cola with energy in the states. Softbank will charge more per unit of energy to spread the facility cost to eliminate the initial investment of its customers expecting a long contract of about 20 years. The fee will be collected monthly or yearly and includes electricity, maintenance, gas and facility costs of the FC. Because the FC generates more efficiently

than a thermal power plant as well as the long term contract, their plan is potentially cheaper than buying electricity from a utility firm for the same period. (The Nikkei, July 18, 2013; The Asahi Shimbun, The Denki Shimbun, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, The Nikkan Kensetsu Kogyo Shimbun, July 19, 2013; The Nishinippon Shimbun, August 3, 2013)

#### 5. Ene-Farm Business Plans

##### (1) Taisei

Taisei Housing Corporation renewed and reopened its showroom “Taisei Housing” on the 19<sup>th</sup> floor of the Shinjuku Park Tower with “Smart Palcon Corner” and “Apartment Corner” newly added. The Smart Palcon Corner explains how a smart house optimizes energy consumption using information technology, and displays facilities used for the house such as Ene-Farm and lithium ion battery (LIB). (The Mainichi Newspapers, July 25, 2013)

##### (2) Daiwa House

Yamanashi Branch of Daiwa House will prepare land for a total of 30 housing lots where NHK Kofu broadcasting station was located in Iida, Kofu City. They recommend their energy saving house with breathable external insulation wall, LIB and Ene-Farm. The lots are between 170 to 230 m<sup>2</sup> and building cost is expected to be between ¥45,000 to ¥76,000 per a square meter. (The Yamanashi Nichinichi Shimbun, July 25, 2013)

##### (3) Japan Gas Association

On July 25<sup>th</sup>, the Japan Gas Association revealed the accumulated installed capacity of natural gas cogeneration for FY 2012 was 4,819 MW, a 6.3% or 284 MW increase on that of the previous year. Ene-Farm has been also strong, and its accumulated installed capacity ended at 145 MW, an 18.2% raise on that of the previous year. Total Ene-Farm installation finished at 149,902 units a 19.9% increases on that of the previous year. (The Nikkei, The Denki Shimbun, The Nikkei Business Daily, Fuji Sankei Business i, July 26, 2013)

##### (4) Mitsui Fudosan Residential

On July 24, Mitsui Fudosan Residential revealed to the press its ready build houses for sale “Fine Court Otsuka” which is advertised as the first smart house project in Japan. Their smart house is equipped with

Ene-Farm, home storage battery and HEMS as standard specification, and can annually save up to 55% energy consumption on that of an average household. The Ene-Farm provides 60% of the electricity requirement, and cheaper energy is stored in the storage battery (7.2 kWh) at night to be used in a day, which allows the house to require very little electricity during daytime from Tokyo Electric Power Company (TEPCO). Photovoltaic generators and EV power station are optional for all the smart houses. Because these houses can be run by energy from Ene-Farm and the storage battery most of the time, most of the electricity from the photovoltaic generators can be sold to TEPCO. The house sales will start from next weekend. (The Denki Shimbun, July 26, 2013)

#### (5) Osaka Gas

On July 30<sup>th</sup>, Osaka Gas announced the accumulated sales figure of domestic natural gas cogeneration had reached 99,000 units by the end of June and was expected to reach 100,000 units in August. The firm has sold Ecowill since 2003, and Ene-Farm was added to its product range in 2009. The accumulated sales of natural gas Ene-Farm and Ecowill of the major natural gas suppliers are; approximately 34,000 units for Tokyo gas, approximately 17,600 units for Toho Gas, and approximately 7,400 units for Saibugas. (The Kyoto Shimbun, The Kobe Shimbun, Nara Newspaper, July 31, 2013)

## 6. FCV & EV Cutting Edge Technologies

### (1) Softbank & Nissan

Softbank developed an EV charger system which allows users to pay by amount. The system will be tested from July 20<sup>th</sup> in Teshima, Kagawa Prefecture. When the charger is connected to an EV, the system will send vehicle and user information and charged amount to a dedicated server via internet. The user will be billed the amount of electricity charged afterwards. The firm expects filling stations and car dealers as the target customers for the product, and will consider the commercialization with experiment results. (The Nikkei, July 10, 2013)

Microcars are available, as an experiment, for tourists to hire in Teshima, an island on Seto Inland Sea, Kagawa Prefecture. The experiment started on

July 20<sup>th</sup> and will last until next March. Six EVs of “New Mobility Concept” taking one to two people by Nissan Motor are offered for ¥8,400 a day. Two charging points are located on the island. As an experiment Softbank Mobile provides its system to confirm energy changing information under development. As well as environmental performance, Microcars have been gaining attention as a next generation vehicle easily driven by elderly people. The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) simplified the certification scheme to drive public roads in January to promote the vehicle. (The Nikkei, July 20, 2013)

### (2) Nissan & Renault

Nissan Motor and France-based Renault target 1.5 million vehicles of accumulated EV sales by FY 2016, although they are considering extending the period. A development of new type energy “shale gas” has reduced gasoline price, and the charging infrastructure has not been prepared as expected, which has caused slow sales. However, the firms are keeping the target figures and the active sales activities for EVs. Nissan has sold approximately 70,000 vehicles of EV “Leaf”, and Renault introduced four EVs into the market. Nissan plans to introduce three more EVs by FY 2016 into the market. Production lines have been prepared in Japan, the US and Europe to produce locally, and the production costs have been reduced to lower consumer prices for sales growth. (The Nikkei, July 13, 2013)

On July 23<sup>rd</sup>, Nissan Motor and Renault announced EV accumulated sales reached 100,000 vehicles combining both firms’. Nissan has sold 71,000 vehicles of Leaf, and Renault has sold 30,000 vehicles of four types of EVs. (The Nikkei, July 24, 2013)

### (3) Tokyo Metropolitan University

LIB performance has been improving with technological development. Prof. Kiyoshi Kanamura of the Tokyo Metropolitan University and Dainippon Screen Mfg established a method to create electrodes with microscopic asperities on surface by using ink-jet technology. Electrode material is sprayed on a metal plate to make large numbers of 70  $\mu$  m wide and 150  $\mu$  m high asperities. With the new technology, a trial battery was made double the thickness. The capacity was doubled. The power output hardly changed, although output dropped to a quarter in previous

studies. Microscopic grooves potentially reduce electric resistance. The durability and production cost are expected to be the same as conventional products. The university and firm aim for the method to be commercialized for EVs. (The Nikkei, July 16, 2013)

#### (4) Honda

On July 16<sup>th</sup>, Mr. Koich Fukuo, a managing executive officer of Honda Motor expressed the Honda's intension to use technology of GM, the partner, for the FCV to be available from 2015. This month, Honda also announced that FC systems would be developed in 2020 in collaboration with GM. (The Nikkei, July 16, 2013; The Yomiuri Shimbun, The Sankei Shimbun, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, Nikkan Jidosha Shimbun, The Tokyo Shimbun, The Chunichi Shimbun, The Tokushima Shimbun, The Yamaguchi Shimbun, The Kitanippon Shimbun, Yamagata News, Oita Godo Shimbun, Fuji Sankei Business i, The To-o Nippo Press, July 17, 2013)

#### (5) Nissan

Nissan Motor will install quick chargers to recharge "LEAF" at 100 leading dealers in the US. The firm installed 24 chargers at dealers on the west coast to investigate usage trend, and will deploy chargers to meet the demand throughout the states. In Japan, chargers are equipped at 800 dealers as of the end of March. The automaker also will use more renewable energy in its domestic bases, and supply dealers with the energy for EV chargers to satisfy environmentally consciousness customers. (The Nikkei, July 21, 2013)

#### (6) Taiyo Yuden

Taiyo Yuden developed a 1 kW power output charger, and will enter the charger market for electric motorcycles. The sales activity will start by the end of the year targeting automakers and other manufacturers worldwide. The capacity of the 1 kW type charger is 60% smaller than conventional products of other manufacturers. The firm will develop an EV charger and aim at ¥1 to ¥1.5 billion sales in FY 2015. (The Nikkei, July 21, 2013)

#### (7) Rakuten

Rakuten will enter the home EV charger market. The charger for Nissan's EV "LEAF" will be available from July 23<sup>rd</sup> on a website "Rakuten Solar" which sells photovoltaic generation systems. Ecosystem Japan, a photovoltaic generation system seller, is

funded by Rakuten, and operates the charger installation. The charger can also power a house, and will sell for ¥567,000 including installation. (The Nikkei, July 23, 2013)

#### (8) BMW

On July 22<sup>nd</sup>, Germany-based BMW announced that its first mass produced EV "i3" would be available from November in Germany. The EV will sell for € 34,950 (approximately ¥4.6 million). This small four-seater car drives 160 km on a single charge. The automaker will start the sales in Europe first, and plans to sell the car in Japan and the US from 2014. (The Nikkei, July 23, 2013)

#### (9) Toyota, Nissan, Honda, Mitsubishi

The four auto giants, Toyota Motor, Nissan Motor, Honda Motor and Mitsubishi Motors will cooperate to prepare chargers for EVs and plug-in hybrid vehicles (PHVs). On July 29<sup>th</sup>, the automakers announced the total number of chargers would be increase to 12,000 by the fall of 2014, from the current 4,700 in Japan, as a joint effort. Charger installation at public facilities will be subsidized by the four firms. Specifically the number of quick chargers in Japan aims to be 4,000 units, over double the current figure. Charging infrastructure will be improved to promote the EV and PHV. Chargers should be increasingly installed with the governmental subsidy and automakers' promotional support. (The Nikkei, July 27, 2013; The Kyoto Shimbun, The Kobe Shimbun, Kanagawa Shimbun, The Shizuoka Shimbun, The Nishinippon Shimbun, The Shikoku Shimbun, The Hokkaido Shimbun, The Kitanippon Shimbun, Minami-Nippon Shimbun, The Yamanashi Nichinichi Shimbun, The Ibaraki Shimbun, The Shinano Mainichi Shimbun, Gifu Shimbun, The Toyama Shimbun, The Saga Shimbun, Miyazaki Nichinichi Shimbun, Oita Godo Shimbun, The Hokkoku Shimbun, Yamagata News, Akita Sakigake Shimpo, Chiba Nippo, The Niigata Nippo, Iwate Nippo, The Fukushima Minyu Shimbun, July 30, 2013)

#### (10) Patent Ranking Related to FCVs

Patent Result which analyzes patents, Tokyo, revealed a comprehensive patent rank of FCV businesses. The analysis is based on patents publicized in the US by July 29<sup>th</sup>. As well as number of patent applications, the number of patents cited in other patents was evaluated. The result shows GM

(score: 2596) as the top, followed by Toyota Motor (2<sup>nd</sup>: 2457), Honda (3<sup>rd</sup>: 2391), Panasonic (4<sup>th</sup>), South Korea-Based Samsung SDI (5<sup>th</sup>). Nissan Motor is placed as 14<sup>th</sup> with 532 points. (The Tokyo Shimbun, Osaka Nichinichi Shimbun, The Shizuoka Shimbun, The Chunichi Shimbun, The Sanyo Shimbun, The Shikoku Shimbun, The Nishinippon Shimbun, The Kitanippon Shimbun, Minami-Nippon Shimbun, The Hokkoku Shimbun, The Toyama Shimbun, The Hokkaido Shimbun, Nara Newspaper, Gifu Shimbun, Kumamoto Nichinichi Shimbun, Miyazaki Nichinichi Shimbun, Oita Godo Shimbun, The Saga Shimbun, Nihonkai Shimbun, Shimotsuke Shimbun, Iwate Nippo, Chiba Nippo, The San-in Chuo Shimpo, Okinawa Times, The Fukushima Minyu Shimbun, July 30, 2013)

#### (11) Shin-Etsu Chemical

Shin-Etsu Chemical developed a new material for LIBs which are used for EVs and smartphones. Sheet material is required to store electricity in a battery. Currently LIBs use carbon materials, but the firm replaces them with silicon by using its technology for semiconductor wafers. Although silicon is more expensive than carbon materials, it characteristically stores 10 times more energy. Samples were developed and globally distributed to battery manufacturers. With battery manufacturers' cooperation, the firm will investigate deformation and degradation whilst the material is used and the production cost for commercialization. (The Nikkei, August 1, 2013)

#### (12) Panasonic, Toshiba, Mitsui Fudosan, Chiyoda, Odakyu

Five firms Panasonic, Toshiba, Mitsui Fudosan, Chiyoda Corporation, and Odakyu Electric Railway have just joined the political-bureaucrat-business research group "Promotion Workshop to Realize a Hydrogen Society with FCVs as Core" which already has seven business members including Toyota Motor. The group studies actual measures regulations and budget allocation for FCVs and domestic FC systems. (The Nikkei, August 4, 2013)

## 7. Hydrogen Filling Station Technology Developments and Business Plans

### (1) JX Energy

JX Nippon Oil & Energy established a new dedicated team to develop a strategy for hydrogen businesses for

FCVs. The research and development department previously operated promotions. The new team has taken over the function to create a unified system covering hydrogen production, transportation and sales as soon as possible, which potentially supports the growth of FCVs coming into the market in 2015. A new team "Hydrogen Station Project Group" is set under Corporate Planning & Management Department which makes management strategies. The team will investigate in what kind of areas the firm should install hydrogen filling stations as well as moving up the schedule. (The Nikkei Business Daily, July 31, 2013)

On August 1, 2013, JX Nippon Oil & Energy developed a refining facility to produce higher purity hydrogen for FCVs. The facility has a membrane which uses palladium to separate hydrogen and a membrane which captures CO<sub>2</sub> to produce CO<sub>2</sub> reduced hydrogen from fossil fuel. The CO<sub>2</sub> capture rate is improved approximately 20% over conventional technology, and production costs can be reduced by approximately 10%. The facility will be tested from September to be commercialized after 2016. The firm installed a production facility to produce hydrogen in a petroleum refinery process in mid-2010, and plans to develop a unified system from production to sale of hydrogen. (The Nikkei, August 2, 2013)

On August 1, JX Nippon Oil & Energy revealed its Central Technical Research Laboratory to the press. Focusing on hydrogen technology in which the firm devotes its energy, refinery and storage facilities of hydrogen for FCVs were shown as well as the latest information of polymer electrolyte fuel cell (PEFC) and SOFC. For more stable drive, FCV motor requires higher purity hydrogen, of 99.9999% instead of 99.99% which is used for ordinary petroleum refining. Additionally commercialization of a highly efficient refining facility is another large issue to be solved to expand the FCV and hydrogen energy market in future. The facility under development has realized 90% capturing rate and 83% energy efficiency. Cost reduction of the facility is next. On the other hand, the firm is developing a container of carbon-fiber-reinforced plastic, which is lightweight and very strong, to transport and store hydrogen. (The Denki Shimbun, The Nikkan Kogyo Shimbun, August

2, 2013)

## (2) Shinko EN & M

To prepare for FCV growth, Shinko Engineering & Maintenance aims to expand orders for hydrogen filling stations by riding on the strength of a total energy engineering, combining its hydrogen filling unsteady simulation technology and Kobe Steel's high pressure hydrogen compressor and pre-cooler. 10 orders for FY 2013, their target for FY 2015 is 40 orders which are a half that of currently planned hydrogen filling stations. As test facilities for hydrogen filling stations, the plant department of Shinko EN & M designed three skid mount systems for Kobe Steel's hydrogen compressor in FY 2012, and the Takasago office installed prefabricated piping giving the firm experience. Because the installation of hydrogen filling stations is expected to increase, the firm aims to increase orders by cooperating with its group companies more and offering a comprehensive system. (Japan Metal Daily, August 1, 2013)

## 8. Hydrogen Production and Refining Technology Development

The leading material firm BASF, an industrial gas supplier Linde and a steel manufacturer ThyssenKrupp of Germany will jointly research to use CO<sub>2</sub> as a raw material. They aim to establish environmentally friendly methods to produce syngas, which is an industrial chemical, and to extract hydrogen and carbon from natural gas. A method to separate hydrogen and carbon from natural gas in supercritical state will be developed as one of two researches. The firms aim to reduce by half the emission of CO<sub>2</sub> from that of current hydrogen reforming from natural gas. A lower cost syngas production method will be studied by using a hydrogen and CO<sub>2</sub> reaction. (The Nikkei Business Daily, July 10, 2013)

## 9. Measuring and Observation Technology Developments and Business Plans

### (1) Ogihara MFG

Small pumps and water treatment systems manufacturer Ogihara MFG, Shimosuwa-machi started to develop a multi-function sensor which replaces two sensors. The firm started the commercial production of a sensor to detect bubbles in water,

which causes damage in FC, in the spring of 2012, and also supplies those who buy the bubble sensors with a sensor to measure water purity. The electrode structure of the sensor to measure the purity of water was improved to also detect bubbles, as a multi-function sensor. The product uses expensive fluororesin, which repels water, in the bubble sensor part. However the manufacturer has kept the production cost down due to minimal fluororesin usage. (The Shinano Mainichi Shimbun, July 10, 2013)

### (2) FIS

FIS, Itami City, will provide a hydrogen sensor which can detect very low level of hydrogen as a safety measure for FCVs in 2013. The product is a semiconductor sensor which detects a change in resistance when gas is captured on surface of metal oxide, and will be supplied to an automaker in Japan. Since the contract, a dedicated mass production facility will be installed in the Production Technology Research Center. The firm produces 8 million semiconductor gas sensors each year to detect pollution in air for air purifiers and alcohol for alcohol detectors, and keeps high global market share. (The Nikkan Kogyo Shimbun, July 16, 2013)

## 10. FC Related R&D and Business Plans of Private Sector

### (1) Toray

Toray is accelerating development of materials for FCs. They develop their own materials for electrode substrates and electrolyte membranes of the four main parts of FC stacks, as well as production, and are the only manufacturer to do this. For substrate, a gas diffusion layer was developed using carbon paper base on which carbon fiber technology is applied. Ready for full introduction of FCVs, a large scale production facility for the gas diffusion layer was already installed as well as dedicated development facility to prepare a system to cover basic study to production. Also, hydrocarbon electrolyte membranes have been researched since 2000, and its commercialization is planned. Toray is having negotiation with auto giants for the electrolyte membrane, and the mass production method will soon be established. Additionally, carbon fiber, of which the firm has large share, for high pressure hydrogen

tanks will be improved and optimized for FCVs to be commercially produced from 2015 and hydrogen tanker trucks. The carbon fiber for stationary tanks has gone ahead, and the firm targets at approximately ¥3.5 billion sales around 2020. (The Chemical Daily, July 16, 2013)

#### (2) Toray Engineering

Toray Engineering, Tokyo, will fortify its business for FC production process. Various production facilities will be sold for assembly and material process, such as catalyst layer formation with coating technologies and hot roll presses to join function membranes. For material processes, the facilities can be used mainly for catalyst layer as well as carbon paper process, and formation of packing. The firm plans to develop its FC related business with ¥3 billion sales. (The Nikkan Kogyo Shimbun, The Chemical Daily, July 16, 2013)

#### (3) Nakayama Amorphous

A venture amorphous metal producer Nakayama Amorphous, Osaka City, will start in the FC material business in 2014. As a start, samples of current collectors for domestic FCs will be distributed from early 2014. A current collector collects electricity produced in cells, and is required to be conductive and highly resistant to corrosion due to contact with dilute sulfuric acid. Amorphous alloy is a potentially advantageous material for the collector. The firm plans to start and commercialize a business of separators for FCVs in 2015 when the FCV market is expected to be established. (The Nikkan Kogyo Shimbun, July 16, 2013)

#### (4) Nisshinbo Chemical

Nisshinbo Chemical will strengthen its range of FC related materials and its multifunction resin material “Carbodilite”, which is expected to expand the demand, and aims at over ¥10 billion sales for 2013. For FCs, their separator business is planned to expand, and the development will be accelerated to commercialize carbon alloy catalysts to replace platinum. Having the highest share for domestic FCs, their carbon separator with their own process technology is characteristically resistant to corrosion, conductive, very strong and thin. Having no rare materials, the carbon alloy catalyst uses carbon as the main ingredient allowing industrial production. Due to stable carbon supply, FC cost can be largely reduced. (The Chemical Daily, July 18, 2013)

#### (5) Mitsubishi Gas Chemical

Mitsubishi Gas Chemical developed a portable generation system as an application development of its original direct methanol fuel cell (DMFC). The system consists of LIB and DMFC using a methanol solution as the fuel, and works as an uninterruptible power supply. With fuel being supplied, the product operates eight hours, and is quieter than a conventional gasoline generator. NO<sub>x</sub>, SO<sub>x</sub> and CO are not produced, which allows the system to be used indoors. With proportions of 335 mm, 480 mm and 300 mm, the DMFC uses an originally developed stack with a 300 W level power output. The system gained a high result from an experiment with end users, and the firm aims early commercialization. (The Chemical Daily, July 22, 2013)

#### (6) Railway Technical Research Institute

The Railway Technical Research Institute has started a research, development and new technology application for train operators to be more environmentally friendly. The government will invite energy saving plans from train operators from FY 2013, and subsidy will be allocated depending on project plans. As a part of new attempt, the drive control laboratory lead by Mr. Yamamoto of the institute is developing a hybrid train using FCs and storage batteries to be commercialized by 2020. (The Asahi Shimbun, July 24, 2013)

#### (7) Ogura Clutch

Ogura Clutch will produce and promote a small roots blower, a supercharger for machines as a next generation product. As well as a supercharger, new applications are largely sought in the environment field such as diesel particulate filters (DPFs) and FCs for the product. Also, the product is expected to be used for a hydrogen circulating pump for FCs. Due to its lightweight, Ballard Power Systems uses the product as well as Volvo’s construction machinery. Because the product application is expanding to next generation vehicles, Ogura Clutch decided to increase production. (Nikkan Jidosha Shimbun, August 1, 2013)

— This edition is made up as of August 5, 2013 —