

## Industrial FC for Backup Power Source and Fire Prevention

Arranged by T. Homma

### 1. Governmental Measures:

#### (1) Japanese Government

On July 30th, the government compiled "Strategy for the Rebirth of Japan" to 2030. Green energy, life science and health, agriculture, forestry and fisheries are chosen as the three key areas out of 11 policy areas, and the budget will be well distributed without ministerial borders. The strategy will be approved on 31st at a cabinet meeting. The two key measures related to the automobile industry are "Seizing the global market of next-generation vehicle" and "Creating storage battery market worldwide and increasing Japanese firms' competitiveness" which are based on the "Next-Generation Vehicle Plan 2010" and "Storage Battery Strategy" of the Ministry of Economy, Trade and Industry (METI). For fuel cell vehicles (FCVs), 100 hydrogen filling facilities will be installed thorough out Japan, mainly in four urban areas, Tokyo, Nagoya, Osaka and Fukuoka, by 2015 as prior investment. Also, a certifying scheme will be established for micro-mobility by the end of the fiscal year 2012. The highest penetration target of next-generation vehicles for 2020 is 50% of new car sales. Planning to install two million normal chargers and five thousand quick chargers for electric vehicles (EVs) and plug-in hybrid vehicles (PHVs), the government will promote EVs and PHVs as mobile batteries to reduce electricity demand peaks and use as emergency power sources. However, local newspapers show misgivings about the strategy because the actual plans are not clearly shown and the strategy potentially ends up as a dole-out policy. (The Kyoto Shimbun, July 30, 2012; Nikkan Jidosha Shimbun, Osaka Nichinichi Shimbun, Kanagawa Shimbun, Nagasaki Shimbun, The Ibaraki Shimbun, Gifu Shimbun, Fukui Shimbun, The Shinano Mainichi Shimbun, Nihonkai Shimbun, The Chemical Daily, Fukushima-Minpo, The Niigata Nippo, July 31, 2012; The Fukushima Minyu Shimbun, August 2, 2012; Miyazaki Nichinichi Shimbun, August 4, 2012;

Minami-Nippon Shimbun, August 9, 2012; Nikkan Jidosha Shimbun, August 20, 2012)

#### (2) METI

On July 30th, the Ministry of Economy, Trade and Industry (METI) revealed a draft of the new Basic Energy Plan for Japan at the Fundamental Issues Subcommittee meeting of Advisory Committee on Energy and Natural Resources. Renewable energies such as photovoltaic and geothermal generators will be developed and utilized as fast as possible. Also, the draft clearly shows METI's commitment to have a wider range of countries supplying fossil fuels such oil and liquefied natural gas (LNG) as well as diversifying energy source to avoid nuclear power. In addition, development of energy-saving houses, FCV and smart grid will be assisted and promoted to create an energy and fuel efficient society. (The Sankei Shimbun, Fuji Sankei Business i, July 31, 2012)

METI revealed five key measures for the fiscal year 2013. To achieve the governmental strategy for the rebirth of Japan, METI will focus on allocation for supporting the measures at the budget request for the fiscal year 2013 as well as deregulation. The capacity of the grid will be increased to operate the grid widely by the energy and environmental re-design policy. Technology development for offshore wind power, storage battery and geothermal generation will be promoted as well as their installation assistance by helping to secure backup power source and large storage batteries. Additionally, energy saving promotion including electricity will be strongly encouraged by controlling demand with price mechanisms as well as the utilization of electricity and heat. For re-constructing electricity systems, natural gas pipeline will be prepared to create hydrogen energy society by boosting cogeneration systems and FCVs. (The Denki Shimbun, August 10, 2012)

METI plans to assist the expenses for energy

providers to install commercial hydrogen filling stations to promote FCVs. ¥5 billion will be requested for the budget for the fiscal year 2013. This three-year support project is planned to start from the fiscal year 2013, and two dozen subsidies are expected for the fiscal year 2013, and more than 30 cases are expected for the later years. The construction cost of a hydrogen filling station is ¥500 to ¥600 million with the expensive part of the filling station being accumulator taking ¥100 million out of the total expense. For this reason, two thirds of an accumulator cost will be subsidized, and half the cost will be supported for the rest of the equipment. (The Denki Shimbun, August 24, 2012; The Mainichi Newspapers, Nikkan Jidosha Shimbun, August 25, 2012)

### (3) NEDO

New Energy and Industrial Technology Development Organization (NEDO) has invited business operators and universities for a grant "Research for Hydrogen Storage by Renewable Energy and Discharge-charge System", and applications will be received until September 3rd. The project will evaluate the market possibility of "a system combining a discharge-charge method with electrochemical cells using FC technologies and hydrogen production by electrolyzing water, and its storage". The system is considered to be a good large scale electricity storage and discharge-charge method. (Nikkan Kensetsu Sangyo Shimbun, Architectures, Constructions & Engineerings News (Daily), August 20, 2012; Nikkan Kensetsu Sangyo Shimbun, August 21, 2012)

## 2. Local Governmental Measures:

### (1) Gifu Prefecture

Gifu prefecture has announced that NTT Facilities was chosen as the operator for the strengthening disaster control demonstrational experiment with next-generation energy at a roadside station. NTT Facilities will install an energy providing system combining next-generation energies of a photovoltaic generator, FC and storage battery at Hoshinosato Fujihashi, the roadside station, which is a disaster management place in Ibigawacho. With the subsidy from Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the facility will serve the area as an emergency shelter with enhanced functions. (The Nikkan Kensetsu Kogyo Shimbun, July 31, 2012)

### (2) Sendai City

Three firms of NTT Facilities, Kokusai Kogyo and NTT East will construct Energy Management Systems (EMS) in Miyaginoku where Sendai city plans an eco-model town as a reconstruction project after the Great East Japan Earthquake. The EMS will be built for city housing for disaster victims, 4 apartment houses with 176 units, and 16 houses to be sold. The 16 houses will have photovoltaic generation system, FC, smart meter and electric vehicle (EV) charger with bi-directional inverter, which are controlled by a home energy management system (HEMS). The city housing and the private houses will cooperate through standardized communication interfaces to create a whole energy management. (The Nikkan Kogyo Shimbun, Nikkan Kensetsu Sangyo Shimbun, August 8, 2012)

## 3. Business Plan of PAFC:

Fuji Electric has developed a 100 kW level phosphoric acid fuel cell (PAFC) system which can be a supplemental power source for emergencies, targeting medical institutions such as hospitals. The system produces electricity with natural gas to reduce electricity consumption from the grid in normal use, and uses LPG to generate power when the natural gas supply is stopped by a disaster such as an earthquake. It only takes approximately 30 seconds to switch the fuel from municipal gas to LPG in emergencies. Because medical institutions are required to have an emergency battery, the PAFC is expected to be a supplemental power source for an emergency battery. The price for the PAFC is approximately ¥65 million, and approximately ¥15 million is needed as an installation cost including bringing a gas line in and land preparation on top of the product. The Ministry of the Environment (MOE) started a subsidy scheme to support half the cost for private hospitals to invest in energy saving facilities, which gives a good impression of active equipment spending of hospitals. Also, the exhaust gas from the chemical reaction in the FC is low in oxygen. Air normally has approximately 21% oxygen; however, the oxygen level of the exhaust gas is 14% or less which prevents combustion. This combination of generation and fire prevention has been in demand especially in Europe. The product has CE status

which is the safety standard and is required for sales in Europe. Aiming to expand its FC sales globally, Fuji Electric will invest in facilities for larger scale production in the Chiba plant. (The Nikkei, August 10, 2012)

#### 4. Development of SOFC Related Technology:

Japan Fine Ceramics Center (JFCC) studied optimizing interfacial structures of anode and electrolyte to increase efficiency of solid oxide fuel cells (SOFCs) with Kansai Electric Power (KEPCO). Being used as an electrolyte, lanthanum strontium gallate magnesite (LSGM) exhibits high conductivity of oxide ions at medium temperatures. On the other hand, it tends to react with an electrode material, and LSGM electrolytes usually have layers on both sides to prevent the reaction. However, JFCC has not concentrated on preventing the reaction on the interface. Instead, the reactive layer was researched to find out a layer material that does not reduce generation efficiency during and after the reaction. An interface insertion layer with 18 to 30 % strontium ferrite, an iron perovskite oxide, turned out the highest power density after evaluating the effect of the interface insertion layer and factors of single cell power generation characteristics. Also, the interface resistance between anode and electrolyte is reduced to a fifth to an eighth of the conventional cells by an interface insertion layer. (The Chemical Daily, August 3, 2012)

#### 5. Business Plans of Ene Farm & Smart Grid:

##### (1) Saibugas

On July 30th, Saibugas announced the accumulate sales figure of Ene Farm reached 1,000 units on the 27th. (The Denki Shimbun, The Nishinippon Shimbun, July 31, 2012)

##### (2) Dainichi

Having a manufacturing contract for the new Ene Farm available from last October for JX Nippon Oil & Energy, Dainichi, Niigata city, expects to achieve 4,000 units of production which is four time of the last year's term and ¥4 billion in production value by the term of March, 2013. (The Niigata Nippo, August 1; Dempa Shimbun August 2)

##### (3) Tokyu

On August 1st, Tokyu announced that an apartment

house "Stylio Musashi-koyama" with Ene Farm installed in each unit would be rented out from September 1st as an environmentally conscious town house. The apartment house is the 14th Stylio series to let. Every unit has an Ene Farm of Tokyo Gas to produce hot water and generate electricity to reduce the amount of electricity purchased. (The Nikkan Kogyo Shimbun, August 2, 2012; Jutaku Shimpō, August, 21, 2012; The Nikkei, August 23, 2012)

##### (4) Hokuriku Gas

On August 1st, Hokuriku Gas, Niigata city, started to sell Ene Farm which can generate electricity at the maximum 350 W during power cuts. The Ene Farm outputs electricity as long as gas is supplied and has been operating before the power cut. (The Niigata Nippo, August 2, 2012)

##### (5) Sekisui House, Osaka Gas & Tokyo Gas

On August 2nd, Osaka Gas and Sekisui House announced that electricity purchase from the grid had been reduced by 88% at an energy saving house "Smart Energy House" built in Ojicho, Nara prefecture with three power sources of a photovoltaic generator, FC and storage battery as an experiment with people living in. The data were collected for a year from July, 2011 to the end of June, 2012 with the two-story house for experiment. The storage battery was charged from the FC at night, while electricity is not used much, and the stored electricity was discharged from the storage battery when electricity is needed specifically morning and evening. As a result, electricity purchase from KEPCO went down substantially to 584 kWh/ per year from 4830 kWh/ per year without the three power sources. (The Mainichi Newspapers, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, The Kyoto Shimbun, August 3, 2012; The Denki Shimbun, August 6, 2012) The Yamanashi branch of Sekisui House has developed a demonstrational smart community town "Smart Common Life Kofu Fujimi" on the 3100 m2 land where a large gasholder of the Kofu branch of Tokyo Gas was previously situated. All the houses have photovoltaic generators and Ene Farm of Tokyo Gas, and the data of generation, consumption and electricity sold to the utility firm will be collected to be analyzed by the University of Yamanashi. (The Yamanashi Nichinichi Shimbun, August 16, 2012)

##### (6) Nihonkai Gas

Nihonkai Gas, Toyama city, has been promoting air conditioning systems with gas and domestic power-generating equipment. Consumers have changed their mind after the Great East Japan Earthquake, the number of Ene Farm orders rose markedly to 24 units for 2011 and 50 units for the first half of 2012. (Kitanippon Shimbun, The Toyama Shimbun, August 3, 2012)

#### (7) Asahi Kasei Reform

On August 9th, Asahi Kasei Reform announced a renovation package to convert a house into a house with a secondary suite. "Hebel Haus Remake Compact 2 Generation-type" is available to renovate a house to accommodate a family with a grandparent or grandparents. The package price is ¥19.7 million for gross floor area approximately 130 m<sup>2</sup> including a 3.5 kW level photovoltaic generator and Ene Farm. (The Nikkei Business Daily, August 10, 2012, Fuji Sankei Business i, August 16, 2012)

#### (8) Hokkaido Gas

Hokkaido Gas has been successfully selling domestic gas generation systems. The system is combination of gas water heater "Eco Jouzu" and "Coremo" which generates electricity by gas engine. Eco Jouzu uses exhaust heat from Coremo to provide heating. Also, the sales of Ene Farm was 20 units for the fiscal year 2011 and 30 units at the end of July for this year. (The Hokkaido Shimbun, August 22, 2012)

#### (9) Osaka Gas

On August 22nd, Hiroshi Ozaki, the president of Osaka Gas revealed that the sales unit of Ene Farm had exceeded 10,000 at a press conference. Proceeding at double the speed of the fiscal year 2011, Ene Farm has already sold approximately 4,000 units, more than half the target, out of 6,000 which is this year's target. (The Yomiuri Shimbun, The Mainichi Newspapers, The Sankei Shimbun, The Denki Shimbun, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, The Kobe Shimbun, The Kyoto Shimbun, August 23, 2012)

#### (10) The Japan Research Institute (JRI)

A study group formed by house-related firms compiled ideas to reduce electricity purchase by sharing between around 100 houses with power sources such as photovoltaic generators and FCs connected with cables by August 22nd. This is an example of next-generation smart grid.

"Excess electricity will be bought by electricity firm, and green energy can be used for electricity shortage without relying on nuclear power and fossil fuel." says Hideaki Matsui, a chief researcher of the Japan Research Institute (JRI), who developed the concept.

The study group suggests an efficient consumption system which interchanges electricity produced by households and moderates the demand that varies on time and households. The system will have a relay point with a storage battery to minimize exchanging amount of electricity between the grid and houses, and the study group aims to establish a scheme to offer a lower transmission fee which is paid to a utility supplier for using the grid to sell excess power. The energy integration area is named "Smart Residential Square". (The Chugoku Shimbun, Kanagawa Shimbun, The Shizuoka Shimbun, The Niigata Nippo, August 23, 2012)

### 6. Cutting Edge Technologies of FCV & EV:

#### (1) Mitsubishi Motors

Mitsubishi Motors has stopped supplying PSA Peugeot Citroën (PSA) with an EV i-MiEV. Although the Mitsubishi's contract as an original equipment manufacturer for PSA has not finished, the supply may not be resumed due to slow sales of PSA. (The Nikkei, August 6, 2012)

#### (2) HySUT

On August 5th, the Research Association of Hydrogen Supply/Utilization Technology (HySUT) had a closed FCV test drive for the press with FCVs, from three firms, Honda's FCX Clarity, Toyota Motor's FCHV-adv and Nissan Motor's X-TRAIL FCV. (The Nikkei Business Daily, August 7, 2012; Nikkan Jidosha Shimbun, August 8, 2012)

#### (3) Seven-Eleven Japan

Seven-Eleven Japan plans to prepare micro EVs for its 200 shops between August and September to fully move into delivery service. (The Nikkei, August 10, 2012)

#### (4) Subsidies for Micro Cars

The Japanese government will subsidize private firms and local governments for purchasing micro cars from the fiscal year 2013. Approximately 100 projects will be chosen in tourism and home care over three years, and half the purchase price of a micro car which is between ¥0.5 to 1 million will be supported.

The majority of micro cars are EVs which are smaller than Kei car, 660 cc class, but larger than a 50 cc motorized bicycle. These micro EVs take one to two people, and elder people and tourists are expected as targets of the projects. The government plans subsidies for more than 3,000 units over three years. Applications are expected from local governments, hotels, private developers and supermarkets who want to utilize the vehicles as a transportation device for people raising children and elder people and distributors who aim for more efficient logistics in areas. Ministry of Land, Infrastructure, Transport and Tourism (MLIT) will establish a scheme to certify a micro car which meets a certain safety standards to drive on public roads in this autumn. Micro car is planned to be a class of transportation by the fiscal year 2015 with amendment to the Road Trucking Vehicle Act, and Toyota Auto Body will sell a single-seater "COMS" for approximately ¥660,000. Also, Nissan and Suzuki plan a commercial micro EVs. (The Nikkei, August 15, 2012)

#### (5) Tokyo University of Science

Tokyo University of Science will start a test drive of a FCV which drives on a powder compound of "sodium borohydride". Sodium borohydride ( $\text{NaBH}_4$ ) mixed with water changes into hydrogen and sodium metaborate ( $\text{NaBO}_2$ ) at a high temperature, which allows extracting hydrogen from the compound as needed. These compounds are stable and safe, and  $\text{NaBO}_2$  mixed with water does not react unless it is heated. The biggest advantage is that  $\text{NaBH}_4$  does not require a special hydrogen supply infrastructure such as a hydrogen filling station, and the energy density can be six to nine times higher than a high-pressure tank. If this method is commercialized, a fuel may be sold in a cartridge at convenience stores. Also, reacted compound powder can be turned into  $\text{NaBH}_4$ . Having achieved generating 1.5 kW with a FC unit, the study group plans to have a test drive on a car with the fuel system in this year and seeks cooperation with an automaker for earlier commercialization as well as reducing the size of the unit. (The Denki Shimbun, August 16, 2012)

## 7. Technology Development & Business Plans for Hydrogen Filling Facility:

### (1) Osaka FCV Promotion Council

An industry-academic-government organization "Osaka FCV Promotion Council" to support FCVs will establish a working group "FCV Hydrogen Infrastructure Investigative Meeting" in late August. The working group will study where and how many hydrogen filling facilities to be installed and measures to increase the number of FCV in Kansai area. After around three meetings, study report will be compiled as early as the end of December or the end of March, 2013 at the latest. The group will discuss the number of hydrogen filling stations and places, for the report with an analysis of the traffic mobility pattern from a statistical traffic survey and a questionnaire survey to individuals and businesses. The report will be shared with "Kansai FCV Infrastructure Development Promotion Liaison Conference" (the secretariat at Kansai Bureau of Economy, Trade and Industry, METI-Kansai) which has larger local governments than Osaka FCV Promotion Council. (The Nikkan Kogyo Shimbun, August 7, 2012)

The Osaka FCV Promotion Council was established in September, 2003 with hydrogen and FC-related businesses academy and governmental bodies in Kansai area, specifically Osaka. The members are Osaka prefecture and Osaka city, Kinki District Transport Bureau, METI-Kansai, Osaka Sangyo University, Daihatsu Motor, energy firms such as Osaka Gas, KEPCO, Iwatani and others. Development of hydrogen filling station and FCV test drives have been carried out in the Osaka area as a state project "Japan Hydrogen & Fuel Cell Demonstration Project". The number of members was increased from 11 to 20 bodies this time to strengthen the council. Three automakers Toyota Motor, Honda Motor and Nissan Motor joined as well as smaller local firms such as Samtech, Fujikin and Kaji Technology. (Nikkan Jidosha Shimbun, August 7, 2012)

### (2) HySUT

HySUT aims to decrease the cost construction of hydrogen filling station without land cost by 75%, to ¥200 million by combining facilities into a unit to reduce construction time and communalizing major equipment such as hydrogen vessels. Average total cost of 12 HySUT's hydrogen filling stations in Japan is ¥600 to 800 million which requires investment of up to eight times that of a similar sized-petroleum

filling station. HySUT will put more effort to build expertise as well as verifying technology. As this year's project for FCV promotion, commercial hydrogen filling stations will be constructed in three places; Nagoya city, Ebina city (Kanagawa prefecture) and Toyota city (Aichi prefecture) to investigate to minimize cost and construction time. (Nikkan Jidosha Shimbun, August 8, 2012; Architectures, Constructions & Engineerings News (Daily), August 21, 2012)

### (3) JX Nippon Oil & Energy

JX Nippon Oil & Energy has converted its hydrogen filling station in Suginami, Tokyo to accommodate a hydrogen trailer. The hydrogen filling station started operating with an area to place a trailer storing 1435 Nm<sup>3</sup> hydrogen after preparing safety measures such as a trailer locking device, gas detector and sprinkler facility. This change will largely increase the transport efficiency which leads reduction in operation cost of the hydrogen filling station. (The Nikkan Kogyo Shimbun, August 13, 2012)

## 8. Development and Business Plans of Hydrogen Production & Refining Technologies:

### (1) University of Miyazaki and others

University of Miyazaki, Miyazaki prefecture and an optics manufacture in Tokyo completed building their "Beam Down Solar Thermal Concentrator" in the university by August 6th. The device reflects sunlight to be collected with mirrors, and a research will start in summer, 2013 to use the device for new energy such as hydrogen. University of Miyazaki signed a joint research agreement with Niigata University for a study on hydrogen production, and Niigata University will provide production equipment. The group will also investigate the application of heat collected from the device to a solar furnace to produce silica, a silicon material. (Miyazaki Nichinichi Shimbun, August 7, 2012)

### (2) Iwatani

Iwatani has been increasing liquidized hydrogen sales in its near monopoly. The third plant will operate to produce liquidized hydrogen in Yamaguchi prefecture from spring 2013. Operating three 3000 L/h liquidizing lines in Osaka and Chiba prefectures, the firm will expand its production line to four. The demand has been rising 10% every year and will

exceed the production ability by 2015. However, the situation of hydrogen gas is getting difficult. (The Nikkan Kogyo Shimbun, August 10, 2012)

## 9. Development and Business Plan of FC Related Technology:

On August 21st, OMRON announced a newly developed high capacity DC power relay "G9EN" which is half the volume and the weight of a conventional product. A hermetic sealed type with 400 VDC/60 A will be available from October 1st. Keeping the same performance of an existing product, the product was made smaller and more lightweight by improving the sealing architecture and the position of permanent magnets. The dimensions are 28 mm × 40 mm × 50 mm, and weight is approximately 140 g. For wider applications, switching relays of 150 A and 300 A for pre-charger and higher capacity products will be available from the fiscal year 2013. OMRON aims to sell the products largely for environmentally friendly cars with high voltage batteries such as EV and hybrid vehicles (HVs). An annual sales target of 500,000 units could be achieved by the fiscal year 2013, if the product is applied in FCs and photovoltaic generators earlier. The price is planned to be similar to conventional products. (The Nikkan Kogyo Shimbun, August 22, 2012; Nikkan Jidosha Shimbun, August 23, 2012)

— This edition is made up as of August 27, 2012—

## **2013 Fuel Cell Symposium**

### *20<sup>th</sup> Anniversary*

Date: **28-29, May, 2013**

Site: **Tower Hall Funabori**

Edogawa\_ku, Tokyo, Japan