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Panasonic Achieved Accumulated 100,000 Units of ENE-FARM

Reported by K. Onda

1. Governmental Measures

(1) Maritime Bureau of MLIT

The Maritime Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has announced that it would test a fuel cell (FC) ship in a radius of 4 nautical miles around Innoshima of Onomichi City for salt damage and the effects of the unsteadiness and impact from March 21st. A system of a 5 kW polymer electrolyte fuel cell (PEFC) module by Yanmer and a lithium-ion battery (LIB) system of 60 kW/h by Uzushio Electric on a 17 t, 16.5 m ship which is made of fiber-reinforced plastic (FRP). The safety guideline of FC ships using hydrogen as fuel is planned to be developed by FY2017 expecting to lead to environmental preparation for commercialization of these ships to be used for the Tokyo Olympics and Paralympics. The National Institute of Maritime, Port and Aviation Technology leads the ship experiment. (The Denki Shimbun, March 17, 2017)

(2) METI

The Ministry of Economy, Trade and Industry (METI) will build a hydrogen technology center to test hydrogen related new technologies and to develop human resource in Yamanashi Prefecture to start the operation next year. The New Energy and Industrial Technology Development Organization (NEDO) contracted this project to the Association of Hydrogen Supply and Utilization Technology (HySUT) to construct and operate the technology center. Yamanashi Prefecture set a concept to concentrate related industry to form a FC Valley in its area, and rents its land out as a part of the concept. The technology center will have a commercial level hydrogen refueling station, and will be used for technological and human resource development. The ministry will accelerate technology to advance for improving safety and reducing cost by using this center which simulates actual operation environment. (Nikkan Jidosha Shimbun, March 21, 2017)

(3) MLIT

MLIT has started inviting businesses for the "Community Green Transport Project" to promote next generation vehicles for public transport and micro mobility for the first time in this fiscal year. The promotions of (1) community green transport and (2) purchase of environmentally-friendly vehicle were individually set up to the previous fiscal year, but the ministry combined these promotions this year. The invitation this time is for (1) community green transport, and the subsidy offers one third of the purchase price, with an upper limit, of FC buses and taxis, plug-in hybrid and electric buses for transport operation and their quick chargers. Applications must contain business plans. From September, the ministry will invite businesses for subsidy for the purchase of electric and plug-in hybrid taxis, electric buses, compressed natural gas (CNG) buses and trucks. Applications for this invitation do not require business plans. The rate of subsidy is between one quarter to one fifth, but may be revised later. (Nikkan Jidosha Shimbun, April 5, 2017)

(4) Hydrogen Society Promotion Committee of Liberal Democratic Party of Japan

On April 5th, the Hydrogen Society Promotion Committee of the Resources and Energy Strategy Investigation Committees of the Liberal Democratic Party of Japan held a hearing on measures to expand the hydrogen energy use from HySUT. HySUT reported that the 1,723 FCVs were on the road and hydrogen refueling stations were prepared at 92 locations as of the end of February. They also pointed out an issue that each hydrogen refueling station needs at least 1,000 FCVs for it to be a sustainable business. (The Denki Shimbun, April 6, 2017)

(5) METI

METI has made a preliminary plan of a long-term strategy of required global warming reduction measures for 2050. The plan estimates a reduction in greenhouse gas emissions by 9.7 Gt, over 15% of the global emissions, by FY2050 by promoting technological cooperation and investments in developing countries. The ministry will promote the export of highly efficient photovoltaic generators and FCVs through official development assistance (ODA). The Ministry of the

Environment (MOE) has also published its own strategic plan, and the Japanese government will compile a long-term strategy to submit to the UN using these two plans. (The Nikkei, April 7, 2017)

(6) Japanese Government

On April 11th, the Japanese government held a committee meeting of the Cabinet members related to renewable energy and hydrogen to show action plans of ministries to expand renewable energy use. This committee was launched by renaming the Cabinet committee for renewable energy, and this was the first meeting. The meeting made sure future directions including the price of stationary storage batteries to last for 10 years to be decreased to ¥60,000 for each kilowatt per hour by the end of FY2020. Each ministry will make a basic plan for hydrogen energy promotions by FY2017. The government already has a target at accumulated 320 locations of hydrogen refueling stations to be prepared by FY2025. (The Nikkan Kogyo Shimbun, April 12, 2017)

(7) MOE, METI & MLIT

MOE, METI and MLIT have published "2016-2017 Guidebook of Next Generation Cars" to promote next generation cars. The guidebook has been published since 1996, and shows governmental schemes such as subsidies for the purchase and preferential tax treatment as well as a list of next generation cars including FCVs and EVs. It also introduces the Strategic Energy Plan which was approved at a Cabinet meeting in April 2014 and 2016 Japan Revival Plan which was approved at a Cabinet meeting in June 2016. 2016 Japan Revival Plan shows targets of 1 million EVs and plug-in hybrid vehicles (PHVs) and about 40,000 FCVs by 2020 and 800,000 FCVs by 2030 to be registered. The guidebook also contains a list of support schemes of the Japanese government, public financial institutions, local governmental bodies for hydrogen refueling facilities and chargers. (Nikkan Jidosha Shimbun, April 13, 2017)

2. Local Governmental Measures

(1) Fukui Prefecture Conference of Energy Research and Development Centralization

Fukui Prefecture had to make extensive changes in its centralization plan since the Japanese government decided to decommission Monju, a nuclear power plant. Accordingly, it has published a new plan to form an extensive hydrogen society focused on Turuga City in its business plan for FY2017 to launch a committee to investigate the installation of hydrogen refueling stations as FCV promotion. (The Denki Shimbun, March 16, 2017)

(2) Tokyo

On March 30th, Tokyo published an estimation of CO_2 emissions of the housing which is under construction as the athlete village of the 2020 Olympics and to be turned into residential housing afterwards. The resulting housing shows the emissions to be reduced by half. Hydrogen will be supplied to FCs at five locations from a hydrogen refueling station to be prepared in Harumi through pipelines. The FCs will provide electricity and heat to the buildings. A waste disposal plant in Harumi will send waste heat to commercial facilities and sheltered housing for the elderly. The plan estimates CO_2 emissions for FY2024, when the re-development to finish, to decrease by 47% that of 2013. (The Nikkei, March 31, 2017)

3. FC Element Technology Development & Business Plans

(1) Hitachi Zosen

Hitachi Zosen will soon carry out an experiment of solid oxide fuel cells (SOFCs) at Sakuya Konohana Kan, a botanical garden, in Flower Expo Memorial Park Tsurumi Ryokuchi for an introduction to the market in FY2017 in cooperation with the Osaka Research Institute of Industrial Science and Technology (ORIST). The firm joined "H2Osaka Vision Promotional Committee" of Osaka City and Prefecture, and will test the SOFCs of rated 20kW level and 50% generation efficiency or more industrial/business use after in-house test in FY2016. The FCs will use 13A natural gas as fuel, and operate for 4,000 hours or longer under an actual load environment to evaluate safety and reliability as a NEDO grant project. (The Chemical Daily, March 31, 2017)

(2) Toyo Ink

Toyo Ink SC Holdings has developed an electrode material at a low price for microbial fuel cells (MFCs) which processes waste water and generates electricity at the same time using microbes. Without using expensive materials such as platinum, the cathode catalytic layer is formed by coating metal mesh or carbon fiber with ink like material of carbon catalyst developed using technology for organic pigments. The material was tested in small-scale equipment, and the test product generated electricity at 70% of the output of platinum catalysts. It produced 1 to 2 W per 1 m^2 of electrode area steadily for three months. The firm will carry out performance valuation and cost estimation to move on to a demonstrational test. (The Chemical Daily, April 3, 2017)

(3) NGK Spark Plug

On April 3rd, NGK Spark Plug announced that it started an experiment of its cylindrical SOFC hybrid system combining with micro gas turbine supported by NEDO. This pressurized

hybrid system by Mitsubishi Hitachi Power Systems (MHPS) is a 250 kW level of rated output, and uses natural gas as a fuel. Power and steam will be used in the Komaki Plant of NGK Spark Plug. The firm signed a partnership for commercialization of cylindrical cell stacks with MHPS, and is developing flat SOFC using core technologies of forming, printing and sintering ceramics. (The Chemical Daily, April 4, 2017)

(4) University of Tokyo & Toyota

A research team of the Institute for Solid State Physics of the University of Tokyo, Toyota Motor and Toyota Central R&D Labs discovered using the high resolution X-ray absorption spectroscopy at SPring-8, that when platinum nano particles, a FC catalyst, captured water and oxygen together on its surface, the oxidation was promoted in an actual operation environment at 1 atm. They also discovered that oxidation was promoted less with 3 nm diameter particles of platinum cobalt alloy which contained a smaller amount of platinum. (The Nikkan Kogyo Shimbun, April 6, 2017)

(5) Kyushu University

The International Institute for Carbon-Neutral Energy Research (I^2CNER) of Kyushu University announced that a platinum-free highly active FC catalyst has been developed. They formed nano-particles of $Ni_xCo_{3-x}O_4$ on high purity multi-walled carbon nanotubes (CNTs) coated by benzimidazole. The catalyst has an excellent oxidation reaction and oxygen evolution as well as high durability. (The Chemical Daily, April 7, 2017)

(6) Toray

Toray has already been supplying samples to manufacturers of redox flow batteries (RFB) in Japan, Europe and the US in order to enter the market of this type of batteries as its FC electrode material business. They are building a new facility to produce carbon paper for electrode material in their Ehime Plant in order to start production in 2018, and will expand the application to RFBs to increase the operating rate and cost advantage. RFBs charge and discharge electricity using redox of ions of materials such as vanadium, and are expected to expand their use for output adjustment of wind and solar power. The manufacturer will produce carbon paper, and it plans to make the product more demanded as a material for forklifts and storage batteries such as RFBs as well as FCVs. They will supply felt and cloth forms of the material which are standard materials for RFBs as well as paper type for carbon electrodes. (The Chemical Daily, April 14, 2017)

4. Hydrogen Infrastructure Element Technology Development & Business Plans

(1)

The Institute of Scientific and Industrial Research of Osaka University has developed photocatalyst which can absorb from ultraviolet to near-infrared lights. They synthesized cylindrical gold particles and aggregation titanium crystals which are arranged in a regular periodic pattern, and the photocatalyst has an 800 to 900 time higher catalytic reaction rate than standard titanium oxide. This technology is expected to improve the energy conversion rate of artificial photosynthesis which produces hydrogen from water. (The Nikkan Kogyo Shimbun, March 17, 2017)

(2) Gifu University

On March 21st, Gifu University announced that it had developed equipment to separate hydrogen from ammonia by atmospheric pressure plasma and to filter it through a membrane to produce hydrogen of 99.999% purity in cooperation with Sawafuji Electric. The plasma reactor consists of an external cylinder which is wound by a ground electrode and an internal cylinder which is wound by an electrode for plasma production with a hydrogen membrane, and applies current at a certain waveform voltage to ammonia. A high-voltage power supply allows efficient production of plasma, which contributes to a reduction in equipment size and cost. This enables FCV to drive using ammonia as fuel. For example, a liquid ammonia tank of 70 ℓ and 50 ℓ tank for a plasma hydrogen production unit can replace a 120 ℓ high pressure hydrogen tank of FCV. (The Chemical Daily, March 22, 2017)

(3) Toyota Tsusho, Toyota Motor Kyushu & Q-tecno

Toyota Tsusho, Toyota Motor Kyushu and Q-tecno have been working on the development of a CO_2 free hydrogen supply chain and industrial model in the Kyushu area with Fukuoka Prefecture. A part of the main system was completed, and has started operating fully. This time, they completed a photovoltaic generator, water electrolysis hydrogen production equipment, hydrogen storage tank, hydrogen supply pipes and a hydrogen refueling facility for FC forklifts. This project was subsidized by METI as the “Promotion Project of Total Using System of Locally Produced Renewable Energy for FY2016”, and has worked on the installation on the premises of the Miyata Plant of Toyota Motor Kyushu. The firms plan to install lighting for an exhibition facility, stationary FCs to supply heat to a bathing facility and a system to precisely deal with energy demands for different use and time. (Japan Metal Daily, March 22, 2017)

(4) Tohoku-Electric Power

On March 23rd, Tohoku-Electric Power announced that a hydrogen production system installed in its research and development center started an operation to control output fluctuations as a measure for expanding renewable energy use. In this system, water is electrolyzed using power from a photovoltaic generator to produce hydrogen to be stored. Hydrogen is used at FCs to generate electricity as needed. The firm will test the system as a measure for output fluctuation of renewable energy for two years until the end of the March 2019. The photovoltaic generator is installed on the roof of the research and development center, the outside facilities are packed in a container. The storage battery absorbs a short-period fluctuation of solar power, and a hydrogen production system takes in a long-term fluctuation. The firm is testing a large-scale storage battery as a measure to control power fluctuations from renewable energy production for the grid. (The Denki Shimbun, March 24, 2017)

(5) East Japan Railway Company

East Japan Railway Company will open Musashi-Mizonokuchi Station of Nambu line as an eco-station which uses environmentally-friendly technology such as renewable energy on April 17th. The station has a system using solar power and hydrogen to supply power every day and during emergencies in order to reduce CO_2 emissions. Power will be used for lighting of light emitting diodes (LEDs) in the station. In H_2One, an independent hydrogen energy supply system, water is electrolyzed to produce hydrogen using solar power. Hydrogen is stored, and is used at FCs of 3.5 kW to generate electricity during disasters. This system allows saving CO_2 emissions by 20% of that of FY2008. (The Nikkan Kogyo Shimbun, March 28, 2017)

(6) Tomoe Shokai

Tomoe Shokai sells a house-brand pre-cooler which is originally developed for low cost, small installation area and high mechanical strength to fortify the sales for hydrogen refueling stations. The product uses austenitic stainless steel, and has a seamless finish for its heat exchange unit. Heat exchange uses a shell and coil method. This achieves high mechanical strength and smaller size. (The Chemical Daily, April 4, 2017)

(7) German-based Heraeus

German-based Heraeus will explore the global market related to renewable energy. As well as parts for photovoltaic and wind power generators, they try to sell AnkaloN®, a catalyst coated membrane, to improve performance and stability of FCs. This product uses an iridium oxide catalyst, and the manufacturer achieved a polymer electrolytic membrane to produce hydrogen efficiently at a lower price. (The Chemical Daily, April 10, 2017)

(8) Hitachi Zosen

On April 10th, Hitachi Zosen announced that Hydro Spring, hydrogen production equipment, was delivered to the Miyata Plant of Toyota Motor Kyushu. This product uses polymer electrolytic cells, and produces hydrogen at 24Nm^3/h. Toyota Motor Kyushu, Fukuoka Prefecture, Q-tecno, and Toyota Tsusho carry out the operation of the production equipment which produces hydrogen to be stored using photovoltaic generation system in the plant in order to operate FC forklifts, two vehicles to be purchased in FY2017, and stationary FCs to be installed in FY2018. This project was selected for a subsidy of METI. The hydrogen purity is 99.99%, and the dew-point temperature is -50 to 60 ºC. (The Denki Shimbun, April 11, 2017)

(9) Tohoku-Electric Power

On April 13th, Tohoku-Electric Power held a completion ceremony of its hydrogen production system which started the operation in March in its research and development center. This system converts fluctuating power production of renewable energy into hydrogen to store, and the FCs generate electricity as needed. They will test the system until March 2019. This is the first in the electricity industry. The hydrogen production and storage system to accommodate the power output fluctuation of a photovoltaic generator, and the storage battery adjusts smaller output fluctuations, and the firm will investigate optimal control methods combining hydrogen and storage battery. (The Denki Shimbun, April 14, 2017)

5. ENE-FARM Business Plans

(1) Toho Gas

Toho Gas will start purchasing excess power generated by ENE-FARM Type S in June. In this scheme, ENE-FARM operates 24 hours at rated 700 W, and the gas supplier purchases unused electricity from the household. The gas supplier uses the purchased power for its electricity sales. They will start taking applications for the scheme in May, the purchase rate is about ¥11/kW. The scheme gives an advantage of about annual ¥5,000 compared to the FC system without using the scheme. This is the second in the major gas supplier to offer this kind of scheme following Osaka Gas. However, Toho Gas does not purchase electricity from households which have a photovoltaic generators as well as ENE-FARM. ENE-FARM Type S can be installed to boilers in established houses from April. (The Denki Shimbun, March 17, 2017)

(2) Panasonic

On March 23rd, Panasonic announced that accumulated 100,000 unit production of ENE- FARM, which has been produced since July 2008, was achieved in eight years and eight months. Their target for 2019 is to achieve 200,000 units. After a three year large-scale experiment from 2005, they started sales of the world's first domestic FC system in Japan May 2009, and introduced a system for apartment units in 2014. Their sales in Europe have started. Compared to the initial system, the new system released in April has advanced to over double the durability and half the weight of the FC unit. (The Denki Shimbun, March 24, 2017)

(3) Saibu Gas

On March 27th, Saibu Gas announced that five new condominiums, a total of 275 units, in Fukuoka and Kitakyushu Cities decided to use ENE-FARM Type S compatible with the internet of things (IoT) by Aishin Seiki. Residents of these condominiums can control under floor heating and filling of the bath from outside by Saibu Gas' remote watching service. (The Denki Shimbun, March 27, 2017)

(4) Daikyo

Daikyo has started its first sales of condominiums of which all the 50 units are installed with ENE-FARM in Adachi-ku, Tokyo. The FCs allows annual ¥40,000 saving of utility bills compered to condominium units with conventional heating equipment. (Jutaku Shimpo, March 28, 2017)

(5) Shizuoka Gas

Shizuoka Gas will start purchasing excess electricity production from its customers who purchase ENE-FARM Type S released on April 1st and use the gas supplier as an electricity provider. They say their purchase rate for March was ¥14.83/kWh, and this allows about annual ¥5,000 saving of electricity bills. Shizuoka Gas and Power, a group member of the gas supplier, will use purchased excess power as its consumer electricity sales. (The Denki Shimbun, April 3, 2017)

6. FCV

(1) Japan Engineering College

On March 9th, Japan Engineering College gave a lecture at Hyogo prefectural Ono technical High School about the basics of cars. They offered the passenger experience of EVs and test drive of FC cart. (Nikkan Jidosha Shimbun, March 16, 2017)

(2) BMW

On March 21st, German-based BMW announced that they would start small-scale production of FCVs under development in cooperation with Toyota, and could supply from 2025 at the annual press conference. This FCV is a large model, and suitable for long distance driving. The manufacturer thinks issues are reduction in FC cost, improvement of energy density and infrastructure preparation to be worked on further. They anticipate the sales price of FCV to be on a level with conventional EVs by 2025. (The Nikkei, March 22, 2017)

(3) Suzuki

On March 21st, Suzuki announced that they would start a test drive of 18 FC motorbikes under development on public roads in an area including Shizuoka Prefecture to develop knowhow and schedule for commercial sales. Their FC motorbike, Burgman Fuel Cell, received type approval from MLIT last August. Hydrogen refueling stations in prefectures will fill these motor bikes. The FC motorbike uses Burgman 200, 200 cc engine scooter, as its base, and stores a small light-weight FC unit and tank in its frame. The appearance is kept in the same style as the existing model, and the product drives about 120 km at 60km/h. FCs have been produced at the joint venture with Intelligent Energy, a UK-based venture. Suzuki assembled the motorbike at its production center in Aichi Prefecture, and plans to use the technology for four-wheelers in the future. Japan developed safety standards of FC motorbikes in 2016 before the rest of the world. The commercialization of this product is expected to shore up the motorbike industry which is shrinking (The Nikkei Business Daily, March 22, 2017)

(4) Hyundai Motor

On March 30th, Hyundai Motor revealed a plan to introduce a new FC sport utility vehicle (SUV) of which driving range is 580 km in February 2018. (The Nikkei, March 31, 2017)

7. FCV Component Development & Business Plan

(1) Toyota

Toyota Motor announced that it will make the development of electrode materials faster using artificial intelligence (AI) in cooperation with universities in the UK and US and research institutes by investing $35 million over four years. They will work together with Stanford University, the Massachusetts Institute of Technology and University of Michigan through the Toyota Research Institute (TRI) in Silicon Valley in the US. They will work on battery materials for EVs and catalyst for automobile FCs as well as developing a method to efficiently collect test data. In January 2016, Toyota Motor launched TRI to fortify organization for research including AI which is essential for automated driving technology, and the investment will be $1,000 million over five years. The cooperative research is a part of this project. (The Nikkei Business Daily,

(2) Toyota & University of Tsukuba

On April 6th, Toyota Motor and University of Tsukuba

announced that the R&D Center for Strategic Frontier in Social Planning was opened as an industry and academia cooperation in the university campus in April. The center will look for solutions for issues in communities by combining automobile technologies of Toyota such as automated driving and AI that the university studies. They use the open lab system, and plan to work for five years. The target areas for research are innovations in automobile technologies such as automated driving, robotics and FC, data analysis using advanced technology, and the development of new social service by using the technologies. (Nikkan Jidosha Shimbun, April 7, 2017)

8. Hydrogen Refueling Station Technology Development & Business Plans

(1) JXTG Nippon Oil & Energy

On March 15th, JXTG Nippon Oil & Energy announced that it opened a hydrogen refueling station of off-site production system with Suiso Terrace, and an exhibition booth, to display information on hydrogen, in the Smart City Tsunashima Sustainable Smart Town (SST) which is underdeveloped in Yokohama City by Panasonic along with others. There are hydrogen stations at about 80 locations in Japan, and JXTG Nippon Oil & Energy has half of these. (The Nikkei Business Daily, March 16, 2017)

(2) Air Liquide Japan

Air Liquide Japan has completed construction of its fourth wholly owned hydrogen refueling station in Wakamiya City, Fukuoka Prefecture. The refueling station is located on the premises of Toyota Motor Kyushu Miyata Plant close to the Miyata Smart Interchange of the Kyushu Expressway. The firm held the opening ceremony on March 13th. The operation will start on March 28th. (The Chemical Daily, March 16, 2017; Nikkan Jidosha Shimbun, March 23, 2017)

(3) Hiroshima Toyota Trading

On March 12th, Hiroshima Toyota Trading, a member of the Toyota Group, opened a mobile refueling station which operates half of its time in Kure City and the other half in Asaminami-ku of Hiroshima City every week. The standard retail price is ¥1,300/kg. This is the third hydrogen refueling station in Hiroshima Prefecture. (Nikkan Jidosha Shimbun, March 16, 2017)

(4) Iwatani

On March 22nd, Iwatani held the opening ceremony of Iwatani Hydrogen Refueling Station Miyagi Sendai. Seven-Eleven shop will open next to the refueling station, and have pure hydrogen FC systems and external power supply systems installed to supplement shops with power every day and to work as an emergency power source including recharging smart phones of evacuated residents during disasters. This completed a network for FCVs to travel from Tohoku to Kyushu solely using Iwatani's hydrogen refueling stations. (The Nikkan Kogyo Shimbun, March 23, 2017)

(5) Choshu Industry

On March 27th, Choshu Industry opened Solar Hydrogen i Power Station (SHiPS), a small-scale experimental hydrogen refueling station. In the system, the photovoltaic generator is used for water electrolysis to produce hydrogen, and hydrogen is compressed to be supplied to FCVs. Electricity will be generated using stored hydrogen during emergencies. (The Nikkan Kogyo Shimbun, March 23, 2017)

(6) Iwatani

On April 11th, Iwatani installed three more hydrogen refueling stations in the Kansai International Airport working on switching from conventional forklifts to FC forklifts. These stations are located in the international cargo areas using investment of about ¥6,500 million, and it takes about three minutes to refuel FC forklifts giving them four to five hours operation. Currently, six forklifts operate there. (Fuji Sankei Business i, April 12, 2017)

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