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NEDO's ZEB Demonstration in US

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1. Governmental Measures

(1) Japanese Government

On October 5th, Prime Minister Shinzo Abe gave a talk at an international conference on science and technology in Kyoto City, and expressed the government's commitment to promote fuel cell vehicles (FCVs) which run on hydrogen and are considered the ultimate eco car. (The Yomiuri Shimbun, The Sankei Shimbun & The Nikkan Kogyo Shimbun, October 6, 2014)

(2) METI

Japan and the European Union (EU) will start discussions on revising international standards of hydrogen tanks for FCVs. Japan will suggest safety regulations on metal materials at a working group meeting for Japan-EU industrial policy in Brussels, Belgium this month. A German automaker is likely to use a metal tank currently under development for its FCVs, and the Japanese government is trying to harmonize the domestic standards with the others for the sales of the vehicle. Japan and the EU send their vice-ministerial-level officials to an annual meeting for industrial policy. (The Nikkan Kogyo Shimbun, October 10, 2014)

The Ministry of Economy, Trade and Industry (METI) will start an experimental project on supply chain to efficiently transport hydrogen which is produced at a cheaper price abroad to Japan. The project plans to develop a hydrogen conversion technology and liquid hydrogen carrier ship in cooperation with the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). There is unused energy such as gas which comes out during drilling oil, and lignite which contains a larger amount of water. A supply price of hydrogen made from these energy sources is estimated to be half that of hydrogen derived from natural gas. METI aims to establish a stable supply system of cheaper hydrogen for full-scale development of the FCV market and commercial operation of hydrogen power generation. (Nikkan Jidosha Shimbun, October 17, 2014)

(3) MOE

The Ministry of the Environment (MOE) will promote the structure a hydrogen society using renewable energy. CO_2 is not emitted during the use of hydrogen as energy, and hydrogen is expected to contribute to combating global warming and improving energy security. Because hydrogen production, storage and transport require energy, the ministry aims to create a model of low-carbon hydrogen society by experimenting to establish technologies to reduce CO_2 emissions using wind and solar power. A model of hydrogen supply chain producing less carbon will be developed over five years in collaboration with several local governments. MOE will assist by giving contracts and financial support to businesses and project related operations, and has allocated ¥3 billion in the budget request for FY 2015. (The Nikkei Business Daily, October 21, 2014)

(4) NEDO

On October 22nd, the New Energy and Industrial Technology Development Organization (NEDO) announced that an experimental project of zero-energy building (ZEB) would start in cooperation with the State University of New York in the US. Having been selected as the contractor, Shimizu Corporation will construct a building installed with fuel cells (FCs), solar panels and highly energy saving equipment. The facilities will start operating in FY 2015 to achieve net-zero energy where the energy production offsets the consumption. With ¥1.1 billion budget, the building is designed with 6 stories with offices for researchers. The solar panels will be the main power source in a day, and the building will be supplied by Fuji Electric's 100 kW FCs and a power grid in evening. Also, an energy management system

will be used to adjust the lighting and temperature of the building to suit the number of people in the room. The US government plans to make all new building to be ZEB, and NEDO aims to create business opportunity for Japanese companies there with this project. (The Nikkan Kogyo Shimbun & The Denki Shimbun, October 23, 2014; The Chemical Daily, October 24, 2014; Japan Metal Daily; October 27, 2014)

2. FC Element Technology Developments & Business Plans

(1) Tokyo Institute of Technology

A team of Prof. Takeo Yamaguchi at Tokyo Institute of Technology has reduced the amount of platinum of catalyst to one third. Iron is mixed in a platinum catalyst to change the distance between platinum atoms in order to triple the catalytic effect, and the durability is also improved by the effect. The catalyst has already estimated over a 10 year use, and is planned to be commercialized within five years. (The Nikkei, September 30, 2014)

(2) Toyota, Nissan Panasonic

A team consisting of Toyota, Nissan and Panasonic has changed the shape of carbon particles laid on an electrode surface of a FC to a column, for oxygen to efficiently reach the catalyst. By researching a mechanism to remove water from the reaction, the aim is for an improvement in generation efficiency of each electrode. The team targets at least a 10% reduction in FC production costs by cutting down the number of electrodes, currently around a couple of hundred. (The Nikkei, September 30, 2014)

(3) Schott

On September 30th, German-based Schott announced that its range of sealing glass for solid oxide fuel cells (SOFCs) would be expanded. Sr and Ba free glass was newly added to their range. The product can use metal alloy containing chromium, and it is optimized to seal SOFCs operating at low to medium temperatures. NEC Schott Components, a group member of the firm, will distribute the product in Japan. (The Chemical Daily, October 1, 2014; Nikkan Jidosha Shimbun, October 8, 2014)

(4) NINS

A team of Assistant Prof. Yasumasa Takagi and Prof Toshihiko Yokoyama at the Institute for Molecular Science of the National Institutes of Natural Sciences (NINS) has succeeded in observing electrodes during operation in a FC on a real-time basis. Photoelectron spectroscopy which allows observation under high pressure gas was developed to monitor a state change of electrons in platinum particles using X-rays at "SPring-8", a large synchrotron radiation facility. The results can be useful for the development of new materials for electrodes, battery and catalyst. Although FCVs are under development, they still have many disadvantages including the amount of expensive platinum catalyst used in FCs. The mechanism of the platinum catalyst reaction is still unknown, and an observation of the catalyst state during a reaction was previously difficult. (The Nikkan Kogyo Shimbun, October 17, 2014)

(5) Teijin

Teijin has developed a cheaper catalyst for FCVs which are to be introduced into the market by automakers. The development was a NEDO project in cooperation with Tokyo Institute of Technology. The product uses cheaper iron and nitrogen instead of expensive platinum. The firm used iron compound such as iron chloride and polyacrylonitrile (PAN), a polymer resin containing nitrogen, as materials of the catalyst. The iron compound and PAN were dissolved in a solvent. The solvent was thermally processed in gas containing ammonia, which made particles of a couple of hundred nm diameter. A test FC was made with these particles as its catalyst to test, and a 1 A current and approximately 0.4 V was generated. Currently the catalyst performs at approximately 70% of conventional products, the manufacturer plans to improve this to achieve higher performance than that of platinum. The target of the catalyst price is a tenth or less that of a conventional product. Samples may be provided on request. (The Nikkei, October 21, 2014)

(6) The University of Electro- Communications

A group of Prof Yasuhiro Iwasawa at the University of Electro- Communications has developed a technology to observe the deterioration process of a platinum catalyst for polymer electrolyte fuel cells (PEFCs) in detail. A platinum catalyst was monitored in an actual operating environment by using strong X-rays from SPring-8, a large synchrotron radiation facility, and the team observed platinum dissolving on the surface of the catalyst. Platinum catalyst

deteriorates over the period of generation with holes and cracks, and decreases in performance. Due to this nature, expensive platinum is used more than it is theoretically needed. Once durability improves, the operation time of a FC can be extended as well as reduction in platinum use. For a FC to operate, its catalyst needs to be moist with vapor. The team monitored the catalyst in the same vapor concentration as that of an actual FC operation, and discovered that platinum 3 μm below a surface ionized and easily dissolved. They will analyze other trial catalysts of businesses from the next fiscal year. (The Nikkei Business Daily & The Chemical Daily, October 23, 2014; The Denki Shimbun, October 27, 2014)

3. Ene-Farm Business Plans

(1) Ene-Farm Partners

On September 29th, Ene-Farm Partners, an industrial organization to promote Ene-Farm, announced that Ene-Farm sales had reached 100,000 units from May 2009 to September 2014. Ene-Farm for apartment units has been available since this April, and the sales units are expected to go over 120,000 by the end of this year. The governmental basic energy plan targets at 1,400,000 units by 2020 and 5,300,000 units by 2030. (The Mainichi Newspapers, The Nikkei, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, & The Chemical Daily, September 30, 2014)

(2) Toshiba

Toshiba Fuel Cell Power Systems has announced that the accumulated shipping unit of Ene-Farm, available from 2009, had reached 50,000. They shipped 38,000 units of Ene-Farm by FY 2013, and have achieved shipping 12,000 units for this fiscal year. This figure of an accumulated 50,000 units awards the firm with the top share in the market. (Dempa Shimbun, September 30, 2014)

On October 2nd, Toshiba opened "Toshiba Smart Home" which is a showroom for visitors to have experience of the home solutions as well as for a demonstration at its Fuchu Complex, the core development and production facility of its social infrastructure business. The showroom displays products and services focusing on energy, occupant comfort, and healthcare. In the energy area, solutions to minimize utility bills including a best combination of energy facilities and optimum energy management are offered for the coming deregulation of electricity. The showroom is equipped with smart meter, 20 kW photovoltaic generator, 6.6 kW storage battery, Ene-Farm, home energy management system (HEMS) and total air-conditioning system. The firm expects 600 groups of visitors each year. (The Denki Shimbun, The Nikkei Business Daily & Dempa Shimbun, October 3, 2014)

Toshiba Group plans to deploy its domestic FC business oversea. They have estimated energy efficient domestic FC would be popularized in Germany, the US and South Korea. The product specifications are being researched to suit the lifestyle of each country. In March, Toshiba Fuel Cell Power Systems, a subsidiary, signed a partnership with German-based Baxi Innotech, a European major heating equipment manufacturer and member of the BDR Thermea Group, for the development and sales, and the joint product development has started for the European market. (The Denki Shimbun, October 17, 2014)

(3) Saibu Gas

Saibu Gas and Mitsubishi Jisho Residence, Tokyo, announced that a condominium would be built for sale in Fukuoka City to have all the units for apartments equipped with Ene-Farm. According to Saibu Gas, this is the first new condominium for sale with Ene-Farm in the Kyushu area. The FC system is produced by Panasonic. (The Nikkei Business Daily & The Denki Shimbun, October 3, 2014; Jutaku Shimpo, October 7, 2014)

(4) Toho Gas

On October 1st, Toho Gas will release Ene-Farm for apartment units. They use an FC system for houses produced by Panasonic, and the system was made more air-tight to be installed by entrances in a pipe space where gas and water pipes are stored. (The Nikkan Kogyo Shimbun, October 1, 2014)

(5) Osaka Gas

Osaka Gas released a new model of Ene-Farm in April, and it has since sold well. The suggested retail price of the product is 25% cheaper than the existing model. The product is designed at a good size to be installed. These improvements have helped to expand the range of users. Despite disadvantages of increase of a consumption tax percentage and decrease of

subsidy, the utility firm has sold 6,850 units of the new Ene-Farm from April to the end of August, which is 36% more than the existing model for the same term of the previous year. (The Nikkei Business Daily, October 2, 2014)

(6) JX

On October 10th, JX Nippon Oil & Energy announced that its own development and production of Ene-Farm would end at the end of next March. They will keep providing maintenance for the existing product users, and buy FC systems from Toshiba to offer products for consumers. Having developed the product, JX started the sales of SOFC type Ene-Farm, a FC with higher generation efficiency, in 2011. However, a quality problem of the product came out March 2013, and the firm stopped the sales until March 2014. Although they resumed the product sales in April, the sales have kept low with accumulate sales of approximately 4,000 unit until September. Due to the weak sales, this operation was under examination for restructuring. On the other hand, a PEFC type product purchased from Toshiba has sold approximately 8,000 units from April 2013 to September 2014. (The Nikkei & The Nikkei Business Daily, October 11, 2014; The Nikkan Kogyo Shimbun, October 13, 2014; The Denki Shimbun & The Chemical Daily, October 15, 2014)

(7) Dainichi

On October 10th, Dainichi Co. announced that the contract to produce Ene-Farm for JX Nippon Oil & Energy will end at the end of March 2015. (The Niigata Nippo, October 11, 2014)

4. Cutting Edge Technology of FCVs & EVs

(1) The University of Tokyo

A group of Prof. Nobuhiro Yoshikawa at the University of Tokyo has found a possibility to reduce the production costs of hydrogen tanks for FCVs by 10% in cooperation with Nissan. A highly precise simulation technology is used to save unnecessary carbon-fiber- reinforced plastic (CFRP) to be wound to the tanks. The conditions will be sought to retain strength while reducing an amount of CFRP by calculations of 85 million points of a tank. (The Nikkei, September 30, 2014)

(2) Softbank

In October, Softbank Mobile will start operation of rental micro EVs for tourists in Asuka Village, Nara Prefecture. The micro EVs will be equipped with dedicated application software installed tablet computer for tourists. Using a communications feature, the tablets give information to users when the EVs arrive at tourist spots. The firm promotes its new business combining EVs and communications. The service is called "MICHIMO", and will be operated in cooperation with Community Promotion Public Corporation of Asuka Village and the village. Taking up to two people, the EVs are produced by Nissan Motor. Nine vehicles will be prepared by mid-October, and then increased to about 20 by next spring. The service is booked through a dedicated website and payments will be made online using credit cards. Users will pick up EVs at the office by Kintetsu Asuka Station. The rental charge is ¥8,000 (excluding tax) for a day including electricity. These vehicles are supplied with US-based Apple's uPad mini which comes with a special application to navigate tourists and provide tourist information. The audio guide will give information on tourist spots, such as Takamatsuzuka and Kitora Tombs, when the EVs reach attractions using iBeacon, an indoor proximity system, and be provided from next spring. (The Nikkei, October 1, 2014)

(3) Toyota

Toyota Motor has announced its exhibition for CEATEC JAPAN 2014 starting from October 7th at Makuhari Messe. Their exhibition will be focused on FCV and next generation telematics service "T-Connect" with related products such as high pressure hydrogen dispensers for FCVs and the urban transport system "Hamo". (Nikkan Jidosha Shimbun, October 2, 2014; The Chunichi Shimbun, October 3, 2014; The Nikkan Kogyo Shimbun, October 7, 2014)

Toyota Motor will release its FCV running on hydrogen in December. Although the plan was rollout by the end of FY 2014, the automaker finished the preparation for production and decided on an earlier introduction into the market, before the rest of the world. Approximately 700 vehicles are planned each year so far. However, orders for 1,000 vehicles have already sent to the automaker. They are considering an increase in production while taking the state of hydrogen refueling infrastructure preparation into account. The FCV is a four-seater sedan, and drives

approximately 650 km on a full tank. It takes about three minutes to refuel the vehicles. The vehicle was named "Mirai", and the production will start at Motomachi Plant, Toyota City, in December. The majority of purchasers are public organizations so far. However, the automaker also plans to sell 20 vehicles each month also to consumers. The price of the vehicle is expected to be around ¥7 million, and the real price including governmental subsidy is aimed at ¥5 million. The main sales areas are four big cities Tokyo, Nagoya, Osaka and Fukuoka where hydrogen filling stations are being prepared. Toyota plans to introduce the vehicle into the European and US markets in the summer of 2015. The number of hydrogen filling station is currently about 30 locations nationwide. The Japanese government targets 100 locations by FY 2015. (The Nikkei, October 16, 2014; The Asahi Shimbun, October 17, 2014; Dempa Shimbun, October 22, 2014)

On October 23rd, Toyota revealed that it had sold some stock holdings of Tesla Motors. The capital and business partnership will be kept as a minority shareholder. However, collaboration for EV development between the two seems not to be going further. Tesla has announced that its lithium-ion battery (LIB) supply for EVs to Toyota would be terminated at the end of this year. (The Nikkei, October 24, 2014)

(4) Honda

Honda Motor has announced the outline of its exhibition for CEATEC JAPAN 2014. The exhibition will cover cars and life in a hydrogen society. The automaker will display a full-scale mockup of a smart hydrogen filling station to explain the system to produce hydrogen, technological explanations of FCVs and a portable inverter box which allows FCV to supply electricity to other facility. (Nikkan Jidosha Shimbun, October 4, 2014; The Denki Shimbun & Nikkan Jidosha Shimbun, October 8, 2014)

(5) German-based VW

Volkswagen (VW) will release EV "e-up!" this year, and the price including subsidy is expected to be less than ¥3 million. The firm has already taken orders in Germany. Being the first commercial EV for the automaker, e-up! will sell for €26,900 (approximately ¥3.7 million). The price without subsidy in Japan is expected to be lower than in Germany, and the automaker is going to promote the vehicle in Japan at the lower price to popularize it. The EV will presumably be subject to the governmental subsidy scheme, and the price including the subsidy is most likely to be less than ¥3 million. On the other hand, Nissan Motor's EV "Leaf" including the subsidy sells from ¥2.2672 million. German-based BMW released "i-3" in April, and the price with the subsidy is ¥4.46 million. (The Nikkei, October 2, 2014)

On October 14th, Volkswagen Group Japan, the subsidiary in Japan of German-based VW, announced that the electric versions of its two popular models would be available from 2015. VW considers that the EV market would fully take off soon with charging infrastructure and battery performance improvements, and has decided to introduce these EVs into the Japanese market. Small four-seater EV "e-up!" drives up to 185 km on a single charge, and will sell for ¥3.669 million. The subsidiary will take orders from February, 2015, and the earliest delivery is expected to be in March. The price including subsidy is expected to be less than ¥3 million. Also "e-Golf", an EV version of their core product "Golf", will be released in mid-2015. The EV market has had a long gap of new vehicle introduction by a major automaker since the rollout of EVs by Mitsubishi Motors and Nissan Motor. The accumulated EV sales have stayed at approximately 60,000 vehicles. Despite the slow sales of EVs, VW sees brighter prospects, and decided to go into the Japanese EV market. Progress of their research and development has given them confidence. "VW's engineers plan to double the current battery performance, revealed Mr. Shigeru Shoji, the president of Volkswagen Group Japan. Another factor is the development of charger infrastructure preparation. The number of quick chargers which can charge a battery to 80% in about 30 minutes was approximately 800 units in January 2012. The figure went up to about 2,000 units this September, and is planned to be increased to about 6,000 units, triple, by the end of 2015. (The Asahi Shimbun, The Nikkei & The Denki Shimbun, October 15, 2014; Nikkan Jidosha Shimbun, October 18, 2014)

(6) Nissan

On October 1st, Nissan Motor announced that a flat-rate charging service would start for EV users. The service allows users to charge their EVs as much

as they want at over 4,000 EV quick chargers nationwide for a flat fee of ¥3,000 monthly. The automaker aims for EV growth by preparing an easier charging environment for travelling long distance. (The Nikkei, October 2, 2014)

On October 1st, Mr. Carlos Ghosn, the CEO, revealed that the firm's intention to purchase EV batteries, a core component, from a manufacturer as long as the battery performs better than existing one. The automaker currently uses LIB which was developed in cooperation with NEC for its EV. He also added that they planned to keep developing their own battery system at this moment to show an intention to continue the current operational structure. (The Nikkei, October 2, 2014)

On September 10th, Dongfeng Nissan Passenger Vehicle Company, a joint venture of Nissan Motor and Dongfeng Motor Corporation, released its first EV "Venucia e30". The EV uses Nissan's EV "Leaf" as its base and is developed for the Chinese market. The driving range is 175 km, and the price starts from 267,800 CNY (¥4.55 million). (The Yomiuri Shimbun, October 20, 2014)

(7) The Paris Motor Show

On October 2nd, the Paris Motor Show started. European automakers are displaying their rechargeable plug-in hybrid vehicles (PHVs). Renault revealed its concept PHV of which the fuel efficiency reaches 100 km per 1 L and 60 km solely on its motor. German-based VW unveiled a PHV version of its medium size car "Passat" which drives 50 km solely on its motor. Mr. Martin Winterkorn, the chairman of VW, stressed that VW spent € 10 billion (approximately ¥1,380 billion) for research and development including environmental investment each year. They are expanding their range of PHVs which are considered to be the "winner of eco cars for a while". (The Nikkei, October 3, 2014)

(8) Panasonic

On October 3rd, Panasonic announced that a subsidiary had been set up to produce LIB for EVs in the US. To manufacture batteries, the subsidiary will prepare a production facility in the plant which will be built in Nevada by Tesla Motors. Panasonic and Tesla agreed on the construction of the battery plant for EVs at the end of July. Being capitalized at $5 million on its own, the new firm "Panasonic Energy Corporation of North America" launched on October 1st. The initial investment is estimated to be between ¥20,000 to 30,000 million, and further investment will depend on sales of Tesla's EVs. The total investment is expected to be ¥150,000 to 200,000 million. (The Nikkei, October 4, 2014)

(9) Mitsubishi

On October 9th, Mitsubishi Motors announced that the prices of its three EVs had been reduced by approximately 10%. These new prices allow consumers to purchase the EVs for around ¥1.5 to 2 million including subsidy. These EVs also improved their safety systems. The reduction is up to ¥250,000 to 270,000. The price of "i-MiEV", a passenger vehicle, including subsidy is now between ¥1,771,520 to ¥2,128,240. The "MINICAB MiEV VAN" for business purposes sells for from ¥1,596,120 to ¥1,896,520 including subsidy, and Mini truck type sells for ¥1,475,640 including subsidy. The automaker added the function that when the car strongly decelerates by releasing the accelerator this causes a regenerative brake, and the tail light is automatically lit without pressing the brake pedal to warn cars behind to avoid collision. (The Nikkei, October 10, 2014)

(10) Tesla

On October 9th, Tesla Motors announced that an upper class EV sedan of all-wheel drive had been developed. The delivery of the new EV is planned to start by the end of this year. The firm developed a driving assistance function such as an image reader to recognize speed limits of roads and automatic lane change, which is a step towards to achieve an automatic driving car. The vehicle aims to attract consumers who want better driving performance for cold regions. (The Nikkei, October 11, 2014)

(11) China

In China, the production of new energy cars is expanding. According to the Ministry of Industry and Information Technology, the production for September was 10,113 vehicles, over 10 times that of the same month in the previous year. The breakdown is 5,755 EVs and 4,358 PHVs. The accumulated production from January to September ended approximately 40,300 vehicles, four time that of the same terms in the previous year. In early July, the Chinese government decided a preferential taxation scheme for new energy cars at an executive meeting of the

State Council. EVs, PHVs and FCVs are exempt from the automobile acquisition tax until the end of 2017. (The Chemical Daily, October 16, 2014; The Yomiuri Shimbun, October 20, 2014)

(12) Autobacs Seven

Autobacs Seven will increase the number of its shops with chargers for EVs to 300, triple that of the current figure, over the medium term. Improving EV users' convenience, they aim for product sales during charging. The current numbers are six quick chargers which charge a battery 80% in 30 minutes, and 87 normal chargers taking eight hours for a full charge. (The Nikkei, October 17, 2014)

(13) GLM

On October 17th, GLM, a venture of Kyoto University, unveiled the first commercial electric sports vehicle "Tommykaira ZZ". Mr. Yasuhiro Koma, the CEO of GLM, visited Mr. Yoshio Tateishi, the chairman of Kyoto Chamber of Commerce and Industry. Mr. Tateishi showed his expectation that "Kyoto can be a good example of a center of the EV industry". Having started the sales in August, GLM produces Tommykaira ZZ using components of manufacturers in Kyoto such as OMRON, Nichicon and GS Yuasa Group. The EV sells for ¥8 million. GLM has received orders for 99 vehicles in Japan, and commercial production will start early 2015 in Maizuru City. (The Nikkei, October 18, 2014)

(14) Sumitomo Metal Mining

Sumitomo Metal Mining will intensively invest in a LIB material for EVs. On October 20th, they announced that approximately ¥20 billion would be used to expand their production capacity of a cathode material for batteries to 2.2 times by the end of 2015. The firm will accommodate increasing demand from Tesla Motors which is the main user of batteries with the cathode material for EVs. Approximately ¥15 billion will be invested in facilities including Isoura Plant, Ehime Prefecture, to enlarge the production scale of lithium nickelate, a cathode material for LIB. The main user of the material is Panasonic who supplies Tesla with batteries for EVs. The plant already increased its production capacity from 300 to 850 t per month this June. Tesla's sedan EV "Model S" was released in 2012, and has boosted the demand. This encouraged Sumitomo to extend the capacity to 1,850 t per month by the end of 2015. Also their Harima Smelter plans to raise its production of nickel sulfate, a material of lithium nickelate, with ¥5 billion to 45,000 t, 2.3 times that of the current annual capacity, by October 2016. (The Nikkei, October 21, 2014)

(15) TDK

TDK has developed a contactless power supply system for EVs and PHVs. This system charges an EV or a PHV parked in the spot without cables. In addition, charger coils can be buried in a road to provide a power supply to EVs and PHVs during driving. The manufacturer aims for the product to be used in a commercial vehicle by 2018. In April, the firm signed a partnership with US venture WiTricity to gain technical know-how for wireless power supply systems for EVs. The system was developed using WiTricity's technology as a base and the magnetic coil technology of TDK, one of advantages of the firm. The system contains transmitting and receiving coils for a contactless power supply. The system works with over a 10 cm distance between the coils. The firm will provide samples to automakers from the first half of 2015. A test has started to supply EVs with electricity during driving. Six units of transmitting coils are placed every 5 m in a test track of 30 m, and a test car has driven 120 km at 5 km/h. (The Nikkei, October 21, 2014)

(16) Daimler

On October 21st, German-based Daimler announced that its capital alliance with Tesla Motors had been dissolved. The current operations such as the use of Tesla's LIB will be kept. However, Daimler plans to manufacturer its own batteries, and to distance itself from Tesla. Daimler acquired all the share of a joint venture of LIB this year to structure an integrated production system from cells, a core component, to battery system. (The Nikkei, October 22, 2014)

(17) French-based Symbio FCell

Symbio FCell, a French FC system producer, has revealed a large-scale project of hybrid cars using both batteries and its hydrogen FCs in an actual working environment. In this project, 50 vehicles of Renault Kangoo Z.E. will be deployed in Rhône-Alpes, France, and two hydrogen filling stations will be constructed in Lyon and Grenoble in the region. The project is the first large-scale demonstration test of hydrogen FCVs in a real environment. Kangoo Z.E. uses Symbio

FCell's hydrogen FC range extender to stretch EV's driving range. (The Nikkan Kogyo Shimbun, October 22, 2014)s

5. Hydrogen Filling Station Technology Developments & Business Plans

(1) Samtech

Samtech, an automobile parts manufacturer in Osaka Prefecture, will start commercial production a of high pressure container for hydrogen filling stations. The production scale is up to 50 units per month, and the shipping will start in November. The tank has the advantage over other products in its durability, and the firm aims for a large share in the hydrogen filling station market. At the end of September, METI gave the manufacturer certification for the production based on the High Pressure Gas Safety Act. Using an aluminum container of which the exterior is wound by carbon fiber as reinforcement, the tank is suitable for mobile hydrogen filling stations because it is lighter and less likely to burst than a solely metal tank. A hydrogen filling station uses three to 10 tanks. The firm aims to sell to 70% of 40 planned hydrogen filling stations for FY 2014. (The Nikkei, October 6, 2014)

(2) German-based Daimler

German-based Daimler and Linde, a major industrial gas producer, announced that hydrogen filling stations would be prepared at 20 locations in Germany by the end of 2015 in cooperation with four oil companies. Both firms will invest approximately € 10 million (approximately ¥1,400 million) each. The petroleum companies are French-based Total, Austrian-based OMV, Swiss-based Avia and German-based Hoyer. In 2012, Daimler and Linde started a project to prepare hydrogen filling stations at over 50 locations by 2015 led by the German transport authority in cooperation with three oil companies including Total, and the new project is a part of this plan. (The Nikkan Kogyo Shimbun & The Nikkei Business Daily, October 10, 2014)

(3) Tatsuno

Tatsuno, a major manufacturer of fuel measuring equipment in Tokyo, will target an over 60% share in the fuel measuring equipment market for FCV refueling in Japan from FY 2015. Small and competitively priced hydrogen dispensers will be offered to oil distributors. Current hydrogen dispenser is around ¥40 million, which is very far from gasoline dispenser of around ¥2 million. Tatsuno plans to reduce the production costs to ¥10 to 20 million in future while promoting the product. Their first hydrogen dispenser t was commercialized in early 2000s, and the current model was developed to dispense at 70 MPa in 2012. The firm designs specifications of a fuel dispenser for each order at the moment, and the dimensions and price are also determined for each order. In cooperation with material suppliers of fuel dispenser, further cost cuts are being sought to beat competitors. (Nikkan Jidosha Shimbun, October 11, 2014)

(4) Iwatani

On October 22nd, Iwatani opened a filling station to supply FCVs with hydrogen in Kokura Kita-ku, Kitakyushu City. This is the first commercial hydrogen supply facility in Kyushu. Using an off-site system, the hydrogen filling station uses compressed hydrogen transported from its Saga Plant, Iwatani's hydrogen production center, to supply FCVs and FC buses. Hydrogen is dispensed using the pressure difference between the accumulator and a hydrogen tank on a vehicle. According to the firm, the construction costs are approximately ¥500 million. The filling station has a single hydrogen dispensing unit which fills a vehicle tank in about three minutes. Although the hydrogen price is still undecided, it is planned to be priced at the similar level when FCV retail sales start. (The Nikkan Kogyo Shimbun & The Chemical Daily; October 23, 2014)

6. Hydrogen Related Element Technology Developments & Business Plans

(1) Japan Atomic Energy Agency & Tohoku University

A group of Japan Atomic Energy Agency and Tohoku University has succeeded in observing a hydrogen atom inside an iron crystal. The crystal has two types of microscopic spaces, and hydrogen was also found in narrower spaces using the Japan Proton Accelerator Research Complex (J-PARC) in Tokai Village, Ibaraki Prefecture. The findings are considered to contributing to understanding the mechanism of how iron becomes brittle by reacting with hydrogen. Iron crystal has microscopic spaces between atoms. The spaces are categorized into two shapes; tetrahedron consisting of four triangles and octahedron structured

by eight triangles. Previously, hydrogen atoms were believed to go only into spaces of octahedrons. Spaces between iron atoms expand by a tiny amount with hydrogen atoms getting together in those spaces, and this causes whole material to become more brittle and more breakable. Hydrogen embrittlement often occurs in tanks of FCs containing high pressure hydrogen and at chemical plants using hydrogen, and sometimes results in accidents. The study group made iron to capture hydrogen atoms, and identified the position of the hydrogen atom by applying a neutron beam generated by the accelerator. Contrary to the previous theory, hydrogen was set in the smaller spaces of a tetrahedron. The observation results allow speculation on effects such as the expansion of iron caused by hydrogen intrusion, which helps in the development of steel material with less hydrogen embrittlement. The group aims to find out the mechanism of hydrogen embrittlement by observing positions of hydrogen atoms at various temperatures and pressures. (The Nikkei Business Daily, October 6, 2014)

(2) Meiwa Kogyo & Kyushu University

A group of Meiwa Kogyo, an environmental equipment manufacturer in Kanazawa City, and Kyushu University will develop a power generation system using the sludge of shrimp ponds from next April. Sludge with remains of shrimp food will be fermented to produce methane to extract hydrogen for FC power generation. The group aims for commercialization within five years. Being an "on-site" system, the generator is to provide the installation site with some power all the time to be environmentally-friendly. The group will test the system in the Mekong Delta in southern Vietnam. Shrimp farming is well-practiced in this area which has 70% of the shrimp production of the whole of Vietnam. (The Nikkei Business Daily, October 24, 2014)

(3) MHI & Chiyoda Corporation

On October 24th, Mitsubishi Heavy Industries (MHI) and Chiyoda Corporation announced that a hydrogen production plant on the sea had been jointly developed. To produce hydrogen on-site, the plant uses gas which comes out with crude oil from underwater oilfields. Both firms aim for early commercialization to provide FCVs with cheaper fuel. The plant will be in the shape of a ship. In addition, hydrogen transport costs are planned to be reduced by using conventional technology to carry hydrogen in a tanker ship. (The Nikkei, October 24, 2014; The Mainichi Newspapers, October 26, 2014; The Nikkei Business Daily, October 27, 2014)

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