

## **H<sub>2</sub> from Renewable Energy to Produce Methane Gas**

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### 1. Governmental Measures

#### (1) MOE

The Ministry of the Environment (MOE) has started an experiment of a small fuel cell (FC) ship with reduced carbon emissions off the coast of Goto City, Nagasaki Prefecture. The ship using FCs was developed by the Toda Corporation, and the project is carried out by MOE. The project uses hydrogen produced by excess power from a floating wind turbines, and will run for two years as a part of the “Technological Development Project for Reduction in CO<sub>2</sub> Emissions. The ministry will collect data such as design of the FC ship and weight balance as well as studying safety guidelines for the actual operation of this type of ship. The FC ship uses Yamaha Motor’s boat as its base, with FCs and a motor installed. The participants are the Toda Corporation, Nagasaki Institute of Applied Science and Nippon Kaiji Kyokai, and Flat Field worked on sourcing the FCs. This 10 t class ship is 12.5 m long and 3.15 m wide, and the ceremony of its completion will be held on August 5<sup>th</sup>. (The Denki Shimbun, August 4, 2015)

#### (2) METI

On August 4<sup>th</sup>, the Ministry of Economy, Trade and Industry revealed its direction for energy saving measures for 2030. For the automobile field, they intend to use Big Data and energy saving by automatic driving technology as well as improvements in fuel efficiency and transportation measures which are already in progress. METI will start preparing actual measures. For the transport field, their target is a reduction in energy consumption of 16.07 GL oil equivalent from the FY 2012 consumption by 2030. They use an estimate of next generation car use: 29% hybrid vehicle (HV), 16% electric vehicle (EV) and plug-in hybrid vehicle (PHV) combined, 1% fuel cell vehicle (FCV) and 4% clean

diesel car. These cars in use are alone expected to reduce use by 9.389 GL. These are in a report by the “Energy Saving Working Group” of the Energy Saving and New Energy Subcommittee of the Advisory Committee on Natural Resources and Energy. (Nikkan Jidosha Shimbun, August 5, 2015)

On August 26<sup>th</sup>, METI decided to continue the subsidy scheme for the purchase of EVs and clean diesel cars in the next financial year. The scheme will slightly change to subsidize more for EVs with a longer driving range. The longer the driving range the larger the amount of subsidy. Initially the ministry was going to narrow down the subjects of the subsidy to FCVs by ending the support for EVs at the end of this financial year. However, they made a decision that the subsidy for EVs was still needed to achieve the governmental aim to bring the rate of next generation cars in use to 50% by 2020. Next generation cars will be promoted more with the tax reduction in eco cars. The ministry will allocate ¥15 billion for the subsidy in the budget estimate for the next financial year. The targets of the subsidy are EV, PHV, clean diesel car and FCV. METI will decide on requirements such as price and performance for the subsidy for each vehicle. (Nikkan Jidosha Shimbun, August 27, 2015)

On August 28<sup>th</sup>, METI compiled its budget estimate for FY 2016. As an energy measure special account, ¥975.7 billion is allocated, and it is a 22.5% (¥179.2 billion) increase in that of the initial budget for FY 2015. While full support still goes to recovery from the accident of Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Company (TEPCO), the ministry will be working on the power source constitution to be achieved by FY 2030, and energy system reformation. Promotion for energy saving in

industries, homes/offices and transport takes ¥242.9 billion, double that of the previous year, in the estimate. As an energy source measure, renewable energy and energy saving will be promoted more. In order to realize a hydrogen society, the ministry allocated ¥23.2 billion to promote the use of home FCs (Ene-Farm) and FCVs and preparation of hydrogen refueling stations. (The Denki Shimbun, August 31, 2015)

METI will request ¥14.5 billion on technological development of next generation thermal power production for the FY 2016 budget. Previously they allocated budget for each project such as highly efficient coal power generation or gas turbines; however, technological development can be more efficient with shared information and they decided to unify related projects. This project is new, but contains continued projects. The new cost, including some continuing projects, is ¥3.7 billion more than that of related projects all together for FY 2015. The budget includes development of an integrated coal gasification fuel cell combined cycle (IGFC) and a highly efficient gas turbine. To meet the power constitution target for 2030, the ministry determined that technological development was required to reduce carbon emissions of thermal power generation. The budget of related projects is unified, and the New Energy and Industrial Technology Development Organization (NEDO) will manage projects in order to share information. The road map on technological development of next generation thermal power generation plans to commercialize IGFC with 55% generation efficiency by 2025 and 57% efficiency of 1700 °C level gas turbine by 2020. (The Denki Shimbun, August 31, 2015)

### (3) MLIT

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has started taking applications for “Clean Community Transport Project with EVs”. This project will provide taxi and bus operators who want to buy EVs or FCVs for their operations with one third to maximum half the costs. The basic subsidy requirement is purchase of one FCV or three EVs or more. Applications will be taken until August 23<sup>rd</sup>, and the ministry will choose applications after evaluation by external experts. (Nikkan Jidosha Shimbun, August 7, 2015)

## 2. Local Governmental Measures

Kobe City will start an experiment of a one-way car sharing service in the center. This project expects the usage to be shopping and sightseeing, and will prepare a number of EVs including Mitsubishi Motor’s “i-MiEV”, a smaller than 660 cc four-seater. The city will investigate the possibility of EVs to supplement public transport. The experiment will start on August 22<sup>nd</sup>, and last until the end of March. To meet the diversified needs, the experiment will use 10 of the “New Mobility Concept”, Nissan’s micro tandem mobility and five micro single-seater “Coms” by Toyota Auto Body as well as 10 of i-MiEV. The tariff is ¥350 per 15 minutes for i-MiEV, and the rest is set ¥50 to 100 cheaper than that. (The Nikkei, August 19, 2015)

## 3. FC Element Technology Research, Development & Business Plans

### (1) Arcadia

Arcadia, a manufacturer of chemical products in Sendai, has developed a cell using aluminum as the fuel. Previously aluminum was difficult to be used for long-term power generation. However, the manufacturer succeeded to produce electricity stably for several days by using a special solvent. Commercialization of this type of product is unusual, and the firm plans to commercialize this aluminum FC as an emergency preparation product from a disaster area of the Great East Japan Earthquake. Electricity is generated by a chemical reaction of aluminum, and the solvent was specially developed. The solvent is an electrolysis solution, and contains a certain concentration of metal ions. When this solvent is mixed with aluminum and air, the chemical reaction starts in a few seconds to generate power. The Industrial Technology Institute of Miyagi Prefecture tested the product, and the cell stably generated power for at least for 90 hours. The manufacturer estimates over one week of generation can be achieved by changing the thickness and shape of the aluminum. (The Nikkei Business Daily, August 7, 2015)

### (2) NEDO

Technological development is progressing to process waste water using “power generating bacteria” which

are types of bacteria to produce electricity while digesting waste. This kind of system is called a “microbial fuel cell (MFC)”, and has the advantage of power generation. This gives a surprising benefit of significant energy saving and reduction in waste, and the commercialization of this technology has been eagerly awaited. The development is organized by NEDO with Prof. Kazuhito Hashimoto at the University of Tokyo as the project leader, and its participants are Sekisui Chemical, Panasonic, Tokyo University of Pharmacy and Life Sciences and Osaka University. This project aims to build a system to treat waste water from a chemical plant such as a resin factory. This kind of waste water contains a large amount of organic matter such as ethanol, and power generating bacteria will be used to process the waste water. (The Nikkei Business Daily, August 25, 2015)

### (3) Horiba

Horiba will develop a system to analyze molecular compositions of FCs and photovoltaic generators, and it plans to commercialize the system by FY 2016. With cooperation of Prof. Kazuyuki Hirao at the Kyoto University, an original molecular analysis technology will be used. The firm plans to sell the product to manufacturers of FCs, organic solar cells and materials for these products as well as research institutes. Analysis of materials can contribute to the improvement and reduction in costs of FCs and photovoltaic generators. The product allows observation of the characteristic spectrum of scattering light when monochromatic light is applied to a cell material to investigate the size of molecules, chemical composition and material composition. Because analysis cannot be performed with weak scattering light, the material surface is scanned by a cantilever, the microscopic needle of an atomic force microscope (AFM), to amplify the light. This light amplifying phenomenon is called tip-enhanced Raman spectroscopy (TERS). This optical analyzer “AFM Raman” will be jointly developed to investigate the chemical composition at 10 nm, a molecule level, in a TERS state. Prof. Hirao will make a new cantilever, and Horiba will develop a new application for the optimum operation of the equipment. Cantilevers use metals such as gold and silver at their tip, and the shape of the new cantilever will be specially designed in order to analyze any materials

by creating stable TERS. The professor has studied precise control technology of metal nano-particles. Existing Horiba’s analyzers can only examine certain carbon materials such as carbon nano-tubes for lithium-ion batteries (LIB). With Kyoto University’s technology, the manufacturer will build an analyzer to examine materials for solid hydrogen FCs which produce hydrogen for power generation and thin film solar cells. The group aims to develop the new cantilever by the end of this year, and to commercialize the product by 2016. The new analyzer is expected to sell for around ¥50 million. (The Nikkei Business Daily, August 31, 2015)

## 4. Hydrogen Infrastructure Technology Development & Business Plans

### (1) Sanno

Sanno, a firm in Yokohama City which treats precious metal surfaces, will hasten commercialization of metal hydrogen membrane. A metal membrane of palladium layered porous nickel support is under development. The manufacturer plans to cut down the thickness of the membrane from 10 to 8  $\mu\text{m}$  to reduce palladium use. A testing hydrogen production system will be developed by 2016 to evaluate the performance. The firm aims the product to be used for hydrogen refueling stations for FCVs. (The Chemical Daily, August 5, 2015)

### (2) Showa Denko

Showa Denko has signed agreement with Kawasaki City for realizing a hydrogen society with low-carbon emissions. Based on the agreement, the firm will carry out technology evaluation of energy from pure hydrogen FCs using hydrogen produced from used plastic to users at the Kawasaki coastal area through a pipeline. The local government will coordinate the participants, and give support to obtain permits as well as advice on the project. Showa Denko will produce and supply hydrogen made from used plastic as well as necessary technological evaluation for supply chain development. This project was selected for the “Community Collaboration Project for Technological Evaluation of Hydrogen with Low-carbon Emission” of MOE. Planning and designing will start in this financial year, and the experiment and evaluation will be carried out from FY 2016 to 2019. (Japan Metal Daily, August 6, 2015)

### (3) KHI

On August 5<sup>th</sup>, Kawasaki Heavy Industries (KHI) held an explanatory meeting on its hydrogen business plan. Their research results revealed that a production level of 3 million FCVs was required to reduce the current cost of hydrogen by half. “Power generation is an effective method to expand hydrogen use.” Mr. Nishimura, the vice director of Hydrogen Chain Development Center, emphasized. The manufacturer has a plant to liquefy hydrogen at a super-low temperatures and technologies for shipping vessels and storage tanks. Because they have a plant technology to extract hydrogen from lignite containing 50 to 60% water, research was carried out in the southeast of Australia to plan a hydrogen business. A large amount of lignite is buried on the Earth, and lignite breaks spontaneously into flame when it is dried. Due to this, the price of lignite is cheap, which allows ¥30/m<sup>3</sup> at a daily production level plant of 770 tons. 770 tons of hydrogen each day can supply 3 million FCVs or 1 GW level hydrogen power plant. “The FCV market will take time to grow, and hydrogen demand will not catch up with the supply for a while. If hydrogen power generation is commercialized prior to FCV growth, hydrogen power generation can create a large amount of demand.” he strongly insisted. (The Nikkei Business Daily, August 6, 2015)

### (4) Hitach Zosen

Hitach Zosen aims to develop a system to convert hydrogen and CO<sub>2</sub> into methane gas and commercialize the product in two to three years. Their on-site hydrogen production facility generates hydrogen by electrolysis using renewable energy such as wind turbines. Hydrogen is reacted with CO<sub>2</sub> to make methane gas which is the main component of natural gas. The firm plans to supply liquefied natural gas (LNG) power plants with the gas as the fuel to use excess renewable energy more and to reduce CO<sub>2</sub> emissions. Currently, some projects are in progress to build a system to produce hydrogen using renewable energy and to transport it to consumption areas. At the same time, FCVs and hydrogen power generation facilities are under development. However, infrastructure preparation requires a significant amount of costs and time. The manufacturer promotes the system to produce methane made of

hydrogen and CO<sub>2</sub>, and to use methane directly as an energy carrier. A premium is placed on the established infrastructure and cheaper costs. Since January, 2012, the firm has been researching on the synthesis of methane from hydrogen and CO<sub>2</sub> in cooperation with PTT Exploration and Production, an oil and gas exploration and production company in Thailand. Since April, 2014, the project has used a highly efficient catalyst by Daiki Ataka Engineering, which was merged into Hitachi Zosen, to make use of CO<sub>2</sub> coming out during drilling methane gas fields. This catalyst achieved the worlds’ highest hydrogen conversion rate of 99.3 %. This catalyst contains no rare earth metals, which is cost efficient. Previously, the most efficient catalyst for the conversion process to methane reached about 90% of conversion rate. “Hydrogen can be produced using excess renewable energy, but currently hydrogen users are too few. We can offer the energy in a fossil fuel form, and this approach allows more renewable energy to be used.” Mr. Naokazu Kumagai, an Executive Officer of Hitachi Zosen insists. (The Denki Shimbun, August 13, 2015)

### (5) Toyota Technological Institute

Toyota Technological Institute has launched the “Advanced Catalyst Development Research Center”, a research organization for catalysts, to establish safe and efficient technology for production and use of hydrogen. The research center aims to advance a wide range of basic technologies for hydrogen usage including catalytic reactions without limiting them to FCs. This project was selected for “Project to Form Strategic Research Base for Private Universities” for FY 2015 of the Ministry of Education, Culture, Sports, Science and Technology (MEXT). Prof. Yukihiro Motoyama who specializes in organic hydride is appointed as the head of the research center. The other members are three professors and one associate professor in materials and electric engineering studies with their group members. The study subjects are photocatalysts to directly produce hydrogen from water, highly efficient solar battery devices, efficient catalysts to achieve hydrogen storage and separation using hydride and analysis of reactions. The project will be carried out with a system flow of hydrogen production, storage and separation at its base. In FY 2015, the center will install analyzing instruments

such as digital nuclear magnetic resonance to examine organometallic compositions with an investment of ¥100 million. In FY 2016, thin film production equipment for electrode solar cells will be installed. (The Nikkan Kogyo Shimbun, August 18, 2015)

## 5. Ene-Farm Business Plans

### (1) Daiwa House

Daiwa House Industry has held an opening ceremony of “Smart Eco Town Hidamarinooka”, ready-made houses in housing lots for sale, developed in Kuwana City, Mie Prefecture. The proposal of this development was selected as the “Hidamarinooka Advanced Urban Smart Housing Supply Project” of Kuwana City. The land was sold from the city to the developer in March, 2014. The development started this April, and is the first large-scale smart town for the prefecture. All 66 houses have 6.2 kW capacity home LIBs, original home energy management systems (HEMS), photovoltaic generator, light emitting diodes (LED) for lighting and either highly efficient water heaters or Ene-Farm. The feature of this eco town is that the profit of 100 kW level “solar power plant in town”, and will be used for maintenance of the houses and town management, which is the first project using this kind of scheme. Additionally, “Sma Eco Station” will be built in a town corner to offer a two-seater micro mobility smaller than 660cc car to residents for a certain period as an experiment. (Jutaku Shimpo, August 4, 2015)

### (2) Shizuoka Gas

On August 10<sup>th</sup>, Shizuoka Gas and Mishima City announced that an experiment to purchase excess power from Ene-Farm would start in FY 2015. This project will use three new houses with Ene-Farm built by Misawa Homes in Mishima City for sale. Excess power from Ene-Farm will be bought by Shizuoka Gas & Power which is a group member of Shizuoka Gas, and is appointed as Power Producer and Supplier in Fuji City of Shizuoka Prefecture to supply the customers with purchased electricity. Shizuoka Gas will examine issues for consumer sales of electricity through the experiment. Mishima City will help them in public relations. (The Denki Shimbun, August 12, 2015)

### (3) Tokyu Land Corporation

Tokyu Fudosan Next Generation Engineering Center is working on a credit scheme for reduction in CO<sub>2</sub> emissions as a leading project in saving CO<sub>2</sub> emissions. After an examination, this scheme has been registered as a Programme of Activities by the J-Credit Scheme to reduce emissions. This project is to reduce CO<sub>2</sub> emissions by installing FCs at the apartment building “Branz City Shinagawa Katsushima”. This program using home FC systems for apartment units is the first one by a business registered by J-Credit Scheme in Japan. The apartment building with a total of 335 units will have all its units installed with home FC systems for apartment units. This is to be the world’s first apartment building with home FC systems for apartment units. Energy produced by the systems will reduce by approximately 1 tons of CO<sub>2</sub> emissions from the average household each year and a maximum 335 tons of reduction as a whole. The engineering center will work on the credit scheme of CO<sub>2</sub> reduction as the office of “Energy Saving/Creating Club” which consists of the residents of the apartments. As an actual measure, the amount reduced CO<sub>2</sub> emission of households will be used to offset with emissions in CO<sub>2</sub> emission of electricity use for common space. (Jutaku Shimpo, August 18, 2015)

### (4) Tokyo Gas

On August 18<sup>th</sup>, Tokyo Gas announced that its accumulated sales of Ene-Farm had exceeded 50,000 units. The FC system was introduced into the market in 2009, and Tokyo Gas is the first seller which has sold 50,000 units. In April, the firm released a new product which sells for ¥1.6 million, about 15% cheaper than its existing product, and the new product is going strong. Also their FC system for apartment unit has sold well since FY 2014. (The Nikkei Business Daily & Fuji Sankei Business i, August 19, 2015; The Chemical Daily, August 21, 2015)

## 6. Cutting Edge Technologies of FCV & EV

### (1) Tesla

On August 5<sup>th</sup>, US-based EV manufacturer Tesla Motors revealed its sales result of the term from April to June to be \$0.95497 billion, approximately ¥119 billion, and a 24% increase of that of the same period for the previous year. Their sedan “Model S”

contributed to the sales rise. The final result ended at a \$0.18422 billion loss due to high research and development costs, and the amount of loss is triple that of the same period for the previous year, \$0.0619 billion. (The Nikkei, August 6, 2015)

#### (2) Seven & i Holdings

Seven & i Holdings and NEC together will install about 3,400 EV chargers at 45 stores of Ito Yokado and Sogo/Seibu by the end of FY 2015. This charger installation will continue after FY 2015, the number of their charger is expected to be the largest in Japan in FY 2016. A large number of 100 to 200 chargers will be installed at one store to attract environmentally conscious customers. Seven & i Holdings expects EV growth, and decided to invest in the chargers in advance. The amount of investment is ¥5 billion including governmental subsidy. All together the number of their EV chargers will go over that of Nissan Motor's chargers which are approximately 2,100 normal chargers and 1,600 quick chargers installed at the car dealers. Large stores of Seven & i will be installed with 100 to 200 chargers, and Yokohama Sogo will have 225 chargers in one place. As an example of a large number of chargers, Mitsui Fudosan has 125 units in Tokyo Midtown. However, the majority of charging spots have one to two chargers at a facility such as car dealer and convenience stores. Seven & i Holdings plans to charge users at ¥120 per hour for normal chargers and ¥450 per half an hour for quick charger. (The Nikkei, August 6, 2015)

#### (3) Hyundai Motor

Hyundai Motor Company has announced that its FCV "ix35 FCEV (Tucson FCEV)" had driven 2,383 km on German public roads in 24 hours. This FCV drove around from urban areas to Autobahns under various conditions to prove its good performance for various scenes in daily life. "Our FCV exhibited good performance in this durability test drive. This result strongly shows that our technology can contribute to the environment as well as the achievement of practical long distance driving." said Thomas Schmid, the COO of Hyundai Motor Europe (Nikkan Jidosha Shimbun, August 11, 2015)

#### (4) BYD

Chinese major automaker BYD has started operating a new plant for EV buses in Tianjin. This

project will cost approximately 2 billion CNY (¥3.9 billion) in total, and this time 1 billion CNY was spent on the first phase. The automaker aims to produce 10,000 vehicles at the plant each year in the future. (The Nikkei, August 13, 2015)

In the evening of August 26<sup>th</sup>, BYD announced that its net profit ended 0.467 billion CNY (approximately ¥8.8 billion) for the term from January to June, 2015 which is a 29 % rise of that of the same period for the previous year. The sales ended 30.435 billion CNY, a 21% increase. Their marquee PHV "Qin" has been strong as well as their new product "Tang". With eco cars' contribution, the automobile section extended sales share from 48 to 56 % in BYD. The profit margin was also improved. At the same time, the firm revealed that the net profit was expected to increase from 4.9 to 5.3 times for the term from January to September of that of the same term for the previous year. This means that the sales would go up from 0.38891 billion CNY to between 1.9 and 2.08 billion CNY. (The Nikkei, August 28, 2015)

#### (5) Mahindra & Mahindra

Mahindra & Mahindra, the largest manufacture in India, will challenge the global automakers with its products using advanced technologies. A development center has been built for cars, their core product, in the US to overreach global auto giants in the EV development using high tech. Their core business Mahindra & Mahindra opened a research and development center in a suburb of Detroit, the symbol of the American automobile industry in Michigan, in 2014. They developed the first commercial four-wheeled EV as an Indian firm in 2013, and their electric three-wheeler was introduced in the US market in 2014. They plan to release their EV in Europe in 2016. The firm is in third place in the Indian passenger car market as a Indian automaker, and the leader in the global agricultural tractor market. EVs are their sign to compete against global auto giants in the technological development. (The Nikkei, August 13, 2015)

#### (6) Mitsui Fudosan

Mitsui Fudosan Realty operates car parks "Mitsui Repark", and will install a total of 200 chargers for EVs and PHVs. The installation will start in September to increase the number of chargers. They expect EVs to grow, and aim to add more value to

their car parks. In September, 20 chargers will be installed in Chiba Prefecture, and six chargers will be installed in Roppongi, Tokyo, in November. They will bring the number to 200 units as they examine the demand trend. This project uses normal chargers, and plans to charge ¥150 per hour. Easy access to charging facilities is essential to expand EV use. These days, retailers have started preparing chargers, expecting EV market growth, and so have car park operators such as Park24. (The Nikkei, August 13, 2015)

#### (7) GS Yuasa

GS Yuasa Corporation, GS Yuasa, will produce the next generation LIB for automobiles which is under development in cooperation of German-based Bosch and Mitsubishi Corporation from 2017. As its advantage, this LIB is to make the current EV driving range double, and a joint venture established by these three firms is developing the product. By preparing for the commercial production quickly, the three firms aim to get a large-scale order from global major automakers. In early 2014, Lithium Energy and Power, the joint venture of GS Yuasa, Bosch and Mitsubishi Corporation, was launched in Germany, and it is developing next generation batteries. A fully charged standard LIB allows an EV to drive only 200 km which is short for automobiles. Using technologies of GS Yuasa and Bosch, their next generation LIB will double the driving range while reducing the size. They are discussing construction of a new plant dedicated to produce the battery, and will decide on the location and the amount of investment. The production is aimed to start in FY 2017. (The Nikkei, August 18, 2015)

#### (8) Nissan

Nissan Motor has developed a technology to increase the capacity of the LIB for EV “LEAF”. This technology can extend the driving range to 300 km on a single charge. The size of the battery will stay the same, which allows the manufacturer to use the current production line. Also, the cost is expected to stay at the similar level, and the LIB will add value without increasing the price. Improved LEAF is planned to be released by the end of this year. Nissan is working on research and development to pursue a 400 km driving range. “Battery technology is improving rapidly, and it is possible to bring the

driving range of an EV to the level of conventional engine cars as a long-term target”, says their executive. Japan is leading in the technological development of eco cars such as hybrid vehicles (HVs) and EVs, but the sales are limited in the global market. Since LEAF was introduced into the market in 2010, over 180,000 vehicles have been sold globally by the end of June, 2015. The automaker targets 1,500,000 EVs, and the sales figure is way behind. However, the regulations on fuel efficiency will be tightened in Europe and the US, and the eco car market is expected to expand. (The Nikkei, August 23, 2015)

#### (9) Honda

Honda will bring the driving range of its FCV to over 700 km which is to outperform Toyota’s FCV “MIRAI” of 650 km driving range by the end of the March, 2016. (The Nikkei, August 23, 2015)

#### (10) Nara Toyota & Toyopet

In September, Nara Toyota and Nara Toyopet will start the sales of FCV “MIRAI”. They aim to show their presence as car dealers based in Nara Prefecture which has rich nature and plenty of tourist spots by stimulating the new car sales in the prefecture. They will install hydrogen equipment at their headquarters and a maintenance center to get ready for after sale inspection and maintenance. However, preparation of hydrogen refueling stations is the key for FCV sales. Osaka Gas opened “Kita-Osaka Hydrogen Station”, Ibaraki City, this April, which gives users access to fuel within an hour’s drive from Nara Prefecture. Next spring, “Kamitoba Hydrogen Station” (provisional name) in Minami-ku, Kyoto City, will finish its construction, and the hydrogen supply chain has been progressing around Nara Prefecture. (Nikkan Jidosha Shimbun, August 24, 2015)

#### (11) Kuraray

On August 25<sup>th</sup>, Kuraray announced that its highly functional polyamide (PA) resin “Genestar” was used in Toyota’s FCV “MIRAI”. With this new usage, Kuraray aims to sell more products to the automobile industry. Genestar is used in “stack manifold”, piping of the FC stack, of Toyota Boshoku. This resin has excellent mechanical and electric characteristics under high temperature and humidity, which contributes to reduction in weight and thickness. (The Chemical Daily, August 26, 2015)

## (12) BMW

The Japanese arm of German-based BMW will open the world first showroom to promote EVs in Toranomon, Tokyo. The showroom will offer test drives of EV “i-3” and car sharing service as well as sales of BMW goods. Also, their PHV “i-8” will be displayed to sell more EVs and PHVs which are increasing demand. This showroom will be open for a limited period of one year. The building of the showroom will be installed with solar panels to charge i-3 and to power the showroom. The staff will be dedicated to explaining the products in detail, but will not try to sell vehicles. (The Nikkei, September 2, 2015)

## 7. FC Ship Development

On August 5<sup>th</sup>, Toda Corporation held a completion ceremony of the building of a FC ship powered by hydrogen in Goto City, Nagasaki Prefecture. The highest speed is 20 knots (approximately 37 km per hour), and the ship can cruise for two hours on a single charge. The test operation will be carried out until the end of FY 2015 to pick up technical issues for commercialization. This FC ship is the first one in Japan, but there is a FC ship already built in Europe. (The Nikkei & The Nikkei Business Daily, August 6, 2015)

## 8. Hydrogen Refueling Station Development & Business Plans

### (1) Tohyama

Tohyama, a building constructor in Gifu, will prepare the first hydrogen refueling station for FCVs in Gifu Prefecture in cooperation of Nippon Engineering Consultants. To be mobile, the filling equipment will be installed on a vehicle, and will go around in Toki City and Ginan Town from next March. The investment will be approximately ¥400 million, and the prefecture will subsidize it by ¥180 million. (The Nikkei Business Daily, August 4, 2015)

### (2) Iwatani

On August 4<sup>th</sup>, Iwatani launched a new commercial refueling station “Iwatani Hydrogen Station Yamaguchi Shunan” in Shunan City, Yamaguchi Prefecture. This is the sixth hydrogen refueling stations for the firm, and the first one in the Chugoku area. Also, a filling facility for FC forklifts is installed,

and this is the first one in Japan. The firm has “Yamaguchi Liquid Hydrogen”, a liquid hydrogen production plant jointly established with Shunan City, and the firm operates the refueling stations using the advantage of the supply being nearby. The new station supplies vehicles with hydrogen transported from the production plant. The facility is installed with a liquid hydrogen tank, a hydrogen compressor by Linde, an accumulator and a dispenser on 1,200 m<sup>2</sup> of land. With 340 Nm<sup>3</sup>/h supply ability, six FCVs can be fully filled. The dispenser supplies FCVs at 70 MPa. (The Chemical Daily, August 5, 2015)

— This edition is made up as of September 2, 2015 —

## *A POSTER COLUMN*

### Creation of Environmentally Friendly Next Generation Motor Sports

Electric motors are to replace engines of motor sports. Formula E Championship started the autumn of 2014, and is an EV race without using gasoline. This is to create environmentally friendly next generation motor sports, and contributes to promoting EVs.

This event was launched by International Automobile Federation (FIA) in 2012, and the uses city-center street circuits. In other words, racing cars drive on public roads all the way through the event, which is the first for auto racing. EVs emit no harmful gases, and produce very little noise because no combustion engines are used. These facts allow the event to attract a bigger audience, and urban areas to hold an auto race.

The first season started in Beijing in September, 2014, and held 11 races touring 10 cities around the world, including Miami. The final round was held in London this June. “Amlin Aguri” led by Mr. Aguri Suzuki joined the event from Japan. The team consists of the main members from “Super Aguri F1” which was also led him. Additionally, engineers who played important roles in F1 races participate in this Formula E team.

This race was thought boring without engine sound and with a speed limit to be environmentally friendly. However, the first series was exiting and was above expectations. This set the mood for the second season which will start this autumn. As a technical side, teams are now allowed to develop their own

“drivetrain” such as motor and gearbox, and this raises expectations to attract a bigger audience. Japan is also seen as a candidate for a host nation as a working group of the Liberal Democratic Party approved a bill for related regulations, which give the real possibility for the country to hold the auto race on public roads.

The second season will start in the same place, Beijing, in October. F1 machines have become “hybrid” using a regenerative system of kinetic energy to store electricity generated from braking to power the acceleration of the vehicles. Formula E might be able to take over F1 in the future. (The Nikkei, August 15, 2015)