

## **FCVs Displayed in Japanese & US Motor Shows**

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### 1. Governmental Measures

#### (1) MOE

On October 28<sup>th</sup>, the Minister of the Environment Nobuteru Ishihara showed the ministry's intention to realize energy independent and distributed society in remote islands by using hydrogen as well as offshore floating wind turbine generation to be commercialized as early as possible. Goto City, Nagasaki Prefecture, has installed the first 2MW class floating wind turbine in Japan. In FY 2014, a project will start to convert the electricity into hydrogen for storage, and hydrogen will be used by fuel cells (FCs). The community with independent and distributed energy will be tested as "Goto Model" from next year. As well as the experiment, the Ministry of the Environment (MOE) aims to reduce CO<sub>2</sub> emission by replacing diesel generators in remote islands with renewable energy in the future. (The Denki Shimbun & The Nagasaki Shimbun, October 29, 2013)

#### (2) METI

On October 31<sup>st</sup>, the Minister of Economy, Trade and Industry Toshimitsu Motegi announced that a system reform subcommittee would be established on November 12<sup>th</sup> to discuss administration improvements for the gas industry. The subcommittee will examine in depth on full liberalization of consumer gas service, open access to the gas network, and borderless energy providing service which allows an electricity or gas provider to supply both gas and electricity. Mr. Motegi demonstrated his recognition of changes needed the administration of the gas industry to realize new usage of gas such as gas cogeneration systems and hydrogen supply for fuel cell vehicles (FCVs) which are to be commercialized within two years. (The Denki Shimbun, November 1, 2013)

The Ministry of Economy, Trade and Industry (METI) will compile technological standards for pipelines for hydrogen supply as early as FY 2015. Materials for pipeline will be selected, and the

behavior of hydrogen in the pipeline will be analyzed. Also, simulation will be carried out to find out the diffusion of hydrogen leaked in a building. These details will be taken into the technological standards and circular notices under the Gas Business Act. As the number of hydrogen refueling facilities for FCVs increases, the demand of hydrogen gas supply through pipelines to distribute from these facilities to stationary FCs at home and office buildings is expected to go up. To meet the demand, the ministry will prepare the legal standards to secure safety and to be ready for efficient supply systems of hydrogen gas. This hopefully contributes profitability improvements of hydrogen refueling businesses. (Nikkan Jidosha Shimbun, November 7, 2013)

From FY 2014, METI will create a new framework with collaboration of automobile related academia and business including automakers, universities and ventures in Japan. Japanese universities have issues such as old research facilities and many mismatching research subjects with respect to industries' demand. On the other hand, automakers need to develop a variety of powertrains including FCV fast. (The Nikkan Kogyo Shimbun, November 13, 2013)

As a measure for hydrogen filling stations, the ministry will relax the requirements for compressed natural gas (CNG) filling stations to allow hydrogen refueling facilities to be installed easily on their premises in order to supply natural gas driven cars and FCVs. At the moment, a compressed hydrogen facility has to be separated 6 m or more from a CNG facility on the same site. METI will shorten the distance from 6 to 3 m with a reinforced concrete barrier. At CNG filling stations, natural gas from the grid is compressed to refuel CNG vehicles, and these filling stations can extract hydrogen from natural gas and compress hydrogen on site with a hydrogen facility. Being a considerable advantage for businesses, this negates the need to store a large volume of

hydrogen, and can reduce initial investments. (The Nikkei, November 14, 2013; The Nikkan Kogyo Shimbun, November 21, 2013)

METI plans to revise the regulations of the automobile inspection for FCVs in FY 2013. As well as an automobile inspection, FCVs are required to be tested for their fuel tanks to store highly pressurized hydrogen. The tank inspection period will be extended one month which makes the period 26 months. (The Nikkan Kogyo Shimbun, November 15, 2013)

#### (3) Cabinet Office

The Cabinet Office will begin a revision of the development plan for advanced energy technologies. An expert council will be established to pick subjects of various energy technological developments. The subjects include highly efficient thermal generation, generation and combustion technologies which include highly efficient thermal generation and FC, renewable energy which incorporates floating wind turbine, storage battery and energy management. Prioritized technological developments will be chosen by next July, and be taken in the “Advanced Energy Technological Developments” of the Council for Science and Technology Policy which are to be revised in FY 2014. (The Denki Shimbun, November 14, 2013)

#### (4) METI & MILT

METI and the Ministry of Land, Infrastructure, Transport and Tourism (MILT) will start developing a scheme of type certification for FC motorbikes. The type certification is required for production and sales of FC motorbikes running on electricity produced by hydrogen. Also, the two ministries are considering unifying safety standards for FCVs. (The Nikkan Kogyo Shimbun, November 20, 2013)

## 2. Local Governmental Measures

### (1) Gifu Prefecture

October 30<sup>th</sup>, Gifu Prefecture announced application information for open proposals to choose a contractor of a project to design a basic plan of next generation energy promotion to fortify disaster control function. The prefecture plans to install next generation energy systems which consists of FC, storage battery and renewable energy such as photovoltaic generator at “Roadside Stations”, highway rest areas which function as shelters and disaster control centers. The

contractor will select facilities for installation, and then make a basic plan to strengthen disaster controlling function of the system and project schedule. Also, they investigate the possibility to expand the project to other areas. (The Nikkan Kensetsu Kogyo Shimbun, October 31, 2013; Architectures, Constructions & Engineerings News (Daily), November 1, 2013)

### (2) Kuwana City, Mie Prefecture

Kuwana City of Mie Prefecture and its land development corporation will choose a house provider from proposals applied through public tender for the “Model Town of Urban Smart House” which is an advanced development at the Hidamarinooka area. The requirements for the project are 50 or more houses to be built on the land, and all of them must have generation and power storage facilities, highly efficient water heaters, and energy management systems. For generation and power storage, at least two of photovoltaic generation system, FC cogeneration and storage battery have to be installed. A highly efficient water heater must be selected from CO<sub>2</sub> refrigerant heat pump water heater, condensing boiler or FC cogeneration system. For energy management, a home energy management system or an energy saving navigator is required. (Architectures, Constructions & Engineerings News (Daily), November 11, 2013; The Nikkan Kensetsu Kogyo Shimbun, November 12, 2013)

## 3. Ene-Farm Business Plans

### (1) Ishikawa Prefectural Wooden Housing Association

On October 26<sup>th</sup>, “Smart Park Higashikagazawa House Exhibit Encore Fair” of the Ishikawa Prefectural Wooden Housing Association started at a residential area for sale in Kanazawa City. Five members of the association sell energy creating houses which are equipped with solar panels or Ene-Farms. This residential area is the first smart town certified in Kanazawa City, and has 19 housing lots. In the lots, two housing lots have show houses, and seven housing lots are for sale to build customized houses. (The Toyama Shimbun & The Hokkoku Shimbun, October 27, 2013)

### (2) Market Result

Fuji-Keizai revealed its market research of “Trends of Energy Creating House and Electricity Only

House”. The report says 424,000 units provided in FY 2012 were energy creating houses which outnumber electricity only house figure of 400,000 units. The housing department of the Japan Prefabricated Construction Suppliers & Manufacturers Association reports its results for FY 2012 based on “Eco Action 2020”. The report shows net CO<sub>2</sub> emission was reduced by 14.2% compared to FY 2010. (The Nikkan Kensetsu Kogyo Shimbun & Jutaku Shimpo, October 29, 2013)

#### (3) Tokyo Gas

October 30<sup>th</sup>, Tokyo Gas announced that consumer gas price would be reduced by an average of 2.09% from December 10<sup>th</sup>. The consumer basic plans will be cut down by an average of 1.59%. The selective plans including direct debit payment discount will be brought down by an average of 3.13%. The Home FC plan, a type of selective plan will be lowered by an average of 2.49%. (The Mainichi Newspapers, The Denki Shimbun, Kanagawa Shimbun & Chiba Nippo, October 31, 2013)

#### (4) Haseko

Haseko Corporation will design and construct a new condominium with 100 units in Tokyo for Sohgo Real Estate. The condominium will be the first work for Haseko equipped with the Ene-Farm for apartment unit by Tokyo Gas. Hot water tanks and FCs and backup power units will be individually installed, for easy maintenance, in each utility meter box at the open hallway. Being approximately 1.3 m<sup>2</sup>, the meter box is classified as a home generation facility space and excluded from the calculation of floor area ratio. (The Nikkan Kensetsu Kogyo Shimbun, November 1, 2013)

#### (5) Lixil

On October 31<sup>st</sup>, JX Nippon Oil & Energy announced that a business partnership was agreed with Lixil Group. They aim to mutually expand their sales channels of JX's home FCs and solar panels and Lixil's housing facilities and building material. Lixil will also sell JX's home FCs through its sales channel. (The Nikkei, The Nikkei Business Daily, The Nikkan Kogyo Shimbun & Nikkan Kensetsu Sangyo Shimbun, November 1, 2013)

#### (6) Toho Gas

Toho gas has been increasing its sales of “Double Generation” combining Ene-Farm and photovoltaic

generators. The number of contracts for double generation for FY 2013 is about 1,350, which is approximately a 60% raise on that of the last fiscal year. (The Nikkei Business Daily, November 12, 2013)

(7) Hiroshima Gas  
Hiroshima Gas decided to sell Ene-Farm which generates power by natural gas for apartment units. The new Ene-Farm is designed to be installed in a pipe shaft space by an entrance door, and aims to be available from FY 2014. (The Chugoku Shimbun, November 23, 2013)

### 4. Cutting Edge Technologies of FCV & EV

#### (1) Kondo Electric & Toyo System

Kondo Electric which produces electric parts in Asakawa Town, Fukushima Prefecture, and Toyo System which manufactures analysis facilities for batteries in Iwaki City, Fukushima Prefecture, together have developed an electric vehicle (EV) running on gas canisters for tabletop (or camping) stoves. The EV has already passed motor vehicle inspection. The two firms aim to sell the vehicle to local governments and businesses in 2014. Gas from conventional canister fuels a battery to generate electricity to drive the motor of the two-seater EV. These manufacturers bought a used small car which is less than 660 cc, and removed its engine and fuel tank to install a motor, gas generator and lead storage battery. With only a driver, the EV drives approximately 20 km at a fixed speed of 40km/h on a gas canister, and goes further by replacing canister. Also, the battery can be charged through a household wall socket, and it takes five hours to fully charge the battery. The EV drives about 10 km in the same conditions on the full battery. (The Nikkei, October 30, 2013)

#### (2) Nissan

On November 1<sup>st</sup>, Nissan Motor announced that a partnership agreement had been signed with Atsugi City, Kanagawa Prefecture in order to form an ecological city. They will help each other in the preparation of an EV charging infrastructure. The cooperation will be in five fields including utilizing advanced technology to provide service using communication facilities for cars and installation of user friendly chargers which use information on position, travel distance, and battery level of cars.

(The Nikkei, November 2, 2013)

### (3) Nissan-Renault Alliance & Mitsubishi Motors

On November 5<sup>th</sup>, the Nissan-Renault alliance announced that cooperation with Mitsubishi Motors would be extended. Nissan and Mitsubishi have only worked together for small class car which is less than 660 cc in Japan. This time, the automakers decided to extend the joint development of a key small car to a small EV, and will use Renault's plant in South Korea. For EV, Nissan and Mitsubishi already established a joint venture "NMKV" in 2011 in order to develop and produce small class vehicles. By using Mitsubishi's small car as a base, the firms will cooperate to develop a new EV. (The Nikkei, The Sankei Shimbun, The Nikkei Business Daily & The Tokushima Shimbun, November 6, 2013)

### (4) Tokyo Motor Show

On November 5<sup>th</sup>, Toyota Motor announced the exhibition contents of the "43<sup>rd</sup> Tokyo Motor Show 2013" which is to be open to the public from the 23<sup>rd</sup>. A total of eight vehicles will be displayed as reference including FCV and a concept car with a system which makes its driver feel more attached to the car. The automaker used carbon fiber for the hydrogen tank of the concept car of FCV which is to be available from 2015, and newly developed small and lightweight core components to produce electricity from hydrogen. These units are arranged in a dedicated sedan body which accommodates four adults. It takes approximately three minutes to refill with hydrogen, and the FCV drives 500 km on a full tank. The body has a design to evoke water ripples around the filler cap. On October 30<sup>th</sup>, Daihatsu Motor revealed its display contents for Tokyo Motor Show, and its "FC Deko Deck" will make the world debut. The vehicle has an originally developed FC using liquid fuel. The FC stack contains no precious metal, which reduce the costs.

On November 7<sup>th</sup>, the Japan Automobile Manufacturers Association unveiled the exhibition contents of the motor show. Honda Motor, Toshiba and Sekisui House will together propose a system whereby a house can be supplied with electricity from a FCV and electric appliances can be remotely operated by cell phone. US-based Tesla Motors will display its EV for the first time. Mitsubishi Motors will show its plug-in hybrid vehicle (PHV) which can

be charged from a socket. Germany-based Volkswagen will display its EV version of small car Golf.

Having announced its exhibition contents on November 8<sup>th</sup>, Nissan will reveal a concept car of the next generation EV with a triangular body. Being named "BladeGlider", this sports car has its driver's seat in the middle front and passenger seats are at the back, accommodating a total of three people. The body has an aeromechanic delta-wing design to minimize air resistance, and "in-wheel motors" are used to drive both rear wheels directly and separately. The automaker plans to bring out the car as a signature EV and is considering commercializing it in future. (The Nikkan Kogyo Shimbun, Nikkan Jidosha Shimbun & Fuji Sankei Business i, October 31, 2013; The Yomiuri Shimbun, The Sankei Shimbun, The Tokyo Shimbun, The Chunichi Shimbun, The Hokkaido Shimbun & The Shinano Mainichi Shimbun, November 5, 2013; The Asahi Shimbun, The Mainichi Newspapers, The Nikkei, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, The Denki Shimbun, Nikkan Jidosha Shimbun, The Chunichi Shimbun, The Chugoku Shimbun, Kanagawa Shimbun, The Kyoto Shimbun, Osaka Nichinichi Shimbun, The Nishinippon Shimbun, The Kitaniippon Shimbun, The Yamaguchi Shimbun, The Sanyo Shimbun, Gifu Shimbun, The Ehime Shimbun, The Shikoku Shimbun, The Tokushima Shimbun, Miyazaki Nichinichi Shimbun, Kumamoto Nichinichi Shimbun, The Ibaraki Shimbun, The Nagasaki Shimbun, Saga Shimbun, Nihonkai Shimbun, Yamagata Shimbun, Fukui Shimbun, Fuji Sankei Business i, Chiba Nippo, The Niigata Nippo, Iwate Nippo, Fukushima-Minpo, Okinawa Times, The Ryukyu Shimpo, Kahoku Shimpo & Akita Sakigake Shimpo, November 6, 2013; The Yomiuri Shimbun, The Mainichi Newspapers, The Nikkei, The Nikkei Business Daily, Nikkan Jidosha Shimbun, The Nishinippon Shimbun, The Nikkan Kensetsu Kogyo Shimbun, The Tokyo Shimbun, etc.; November 8 to 24, 2013)

### (5) Tesla Motors

On November 5<sup>th</sup>, an US-based EV manufacturer Tesla Motors published the results for July to September, and the sales were \$431.34 million (approximately ¥42.4 billion) which is about nine

times that of the same term in last year. Their new sedan “Model S” sold better, which contributed to the overall sales increase. Since its production took off, the automaker agreed to increase its LIB order to over triple to Panasonic. The gross result for July to September ended in a \$38.49 million loss, the last term was a \$110.8 million loss. However, the net income without special factors was \$15.93 million in black. On the same day, the founder Elon Musk revealed a plan for a large plant to be built in cooperation with a storage battery manufacturer. (The Nikkei, November 6, 2013)

On November 19<sup>th</sup>, the National Highway Traffic Safety Administration of the United States Department of Transportation started an investigation of Tesla Motors, an EV manufacturer whose cars currently caused a series of fire accidents. Three fire accidents were found in Tesla’s new sedan “Model S” within 45 days. (The Nikkei, November 20, 2013)

#### (6) Japanese Auto Giants

Four automakers, Toyota Motor, Nissan Motor, Honda and Mitsubishi Motors, announced that businesses would be eligible for a maximum ¥1.9 million in subsidies from them for EV charger installation as an EV and PHV promotion. The promotion aims to build a better charging network by reducing the investment of charging operators. Around spring of 2014, the automakers plan to establish a charging service provider which is to operate the service and to collect fees from customers. (The Nikkei, November 13, 2013)

Japanese auto giants accelerate their development of next generation storage batteries with a larger capacity. Toyota Motor succeeded in developing a metal-air cell battery, with a better performance than previous storage batteries. Metal-air cell takes oxygen from air to supply electricity. Because oxygen is plentiful in air, the capacity of the battery can be larger. In 2010, Toyota successfully charged and discharged power from the battery for the first time. With the collaboration of Oita University, the firm developed a technology to improve charging and discharging performance to a couple of thousand cycles which is the level for EV usage. Also a technology was developed with Tohoku University to triple the current from a battery in order to get close

to the acceleration performance of gasoline cars. With these technologies, EV is expected to be able to drive 400 to 800 km in future. (The Nikkei, November 16, 2013)

Nissan has been developing a lithium-sulfur battery which is expected to extend EV driving range to 600 km. This new storage battery uses sulfur for electrodes, and has a larger capacity. In collaboration with Kansai University, the automaker worked on materials for the electrolyte which store electricity. Having achieved 50 cycles of charge and discharge, the battery is estimated to be commercializable by around 2020. These next generation batteries still have problems to be solved in order to be used for EVs. Because the battery materials degrade over charge and discharge cycles, a new technology is required for stable electricity supply. Also, further safety research needs to be carried out to prevent fires. (The Nikkei, November 16, 2013)

#### (7) Honda

On November 12<sup>th</sup>, Honda displayed its new prototype of FCV “Honda FCV Concept” as well as a drawing at 2013 LA Auto Show starting from 19<sup>th</sup> in Los Angeles, US. The commercialized FCV will be rolled out in US and Japan in 2015. The automaker plans to introduce the vehicle into the European market later. The vehicle is a succession model of “FCX Clarity” which is leased from 2008. The size of the FC stack is reduced to two thirds of Honda’s existing FC. The vehicle has enough space to accommodate five adults comfortably, and drives over 480 km on a full tank of hydrogen. (The Nikkei, The Sankei Shimbun, The Denki Shimbun, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, Nikkan Jidosha Shimbun, The Kyoto Shimbun, The Chunichi Shimbun, Gifu Shimbun, Fukui Shimbun, The Nishinippon Shimbun, The Chugoku Shimbun, The Kitanippon Shimbun, The Shikoku Shimbun, The Saitama Shimbun, The Yamanashi Nichinichi Shimbun, Miyazaki Nichinichi Shimbun, Kumamoto Nichinichi Shimbun, The Yamaguchi Shimbun, The Kochi Shimbun, The Toyama Shimbun, The Nagasaki Shimbun, Saga Shimbun, The Hokkoku Shimbun, The Sanyo Shimbun, Yamagata Shimbun, Fuji Sankei Business i, Chiba Nippo, The Niigata Nippo, Iwate Nippo, The To-o Nippo, The Ryukyu Shimpo, The Kahoku Shimpo, Akita Sakigake Shimpo,

November 13, 20,21& 22, 2013)

Honda revealed its micro EV “MC-β(beta)”. The EV is designed to support people’s lives in town, and will be tested at three places in Japan to find out how its usage and user matches. (The Nikkan Kogyo Shimbun, November 22, 2013)

(8) BMW Japan

On November 13<sup>th</sup>, the subsidiary of Germany-based BMW for Japan announced that an EV and PHV version of its “BMW” series would roll out in Japan. A small EV “i3” will be available from April, 2014, and a sports PHV “i8” will be introduced into the market in summer of 2014. These vehicles are the first EV and PHV for the firm. With 8% consumption tax, the “i3” will sell for ¥4.99 million, and “i8” will sell for ¥19.17 million. A quick charger can fully charge the “i3” in 30 minutes. The vehicle drives approximately 160 km with standard specification, and there is an option to extend the range up to 300 km. (The Nikkei, November 13 & 14, 2013)

(9) Toyota

On November 14<sup>th</sup>, Toyota Motor demonstrated a power system which supplies building with electricity from a FC bus, as emergency power source with a large capacity, at Toyota Ecoful Town in Toyota City. The system provides an average household with power for about 40 days. (The Mainichi Newspapers, The Nikkei, The Nikkan Kogyo Shimbun, The Tokyo Shimbun, The Kobe Shimbun, The Chunichi Shimbun, The Shizuoka Shimbun & Gifu Shimbun, November 15, 2013; Nara Newspaper, November 16, 2013)

(10) Yamaha Motor

On November 20<sup>th</sup>, Yamaha Motor revealed a prototype of its first four wheel vehicle at Tokyo Motor Show. Two types of the vehicle are under development; a two-seater 1000 cc gasoline engine version and an EV specification with 25 kW power output motor. The manufacturer plans to introduce the vehicle worldwide by 2020. (The Nikkei, The Kobe Shimbun, Osaka Nichinichi Shimbun, Kanagawa Shimbun, The Ehime Shimbun, The Yamaguchi Shimbun, The Sanyo Shimbun, Fukui Shimbun, The Toyama Shimbun, Gifu Shimbun, The Ibaraki Shimbun, The Nagasaki Shimbun, Saga Shimbun, The Tokushima Shimbun, The Kochi Shimbun, The Shikoku Shimbun, Yamagata Shimbun, Jomo

Shinbun, Shimotsuke Shimbun, Nihonkai Shimbun, The Hokkoku Shimbun, The Kitanippon Shimbun, Minami-Nippon Shimbun, The Shinano Mainichi Shimbun, Miyazaki Nichinichi, Kumamoto Nichinichi Shimbun, Oita Godo Shimbun, The Ryukyu Shimpo, Fukushima-Minpo & Okinawa Times, November 21, 2013)

(11) Hyundai Motor

On November 20, South Korea-based Hyundai Motor announced that its FCV would start to be leased in spring of 2014 in Los Angeles, US. The car uses the sports utility vehicle “Tucson” as its base, and the first Hyundai’s commercial FCV. Monthly lease plan is expected to be \$499. The FCV drives nearly 500 km on a full tank of hydrogen, and the refueling time is about 10 minutes. On the other hand, FCVs of Toyota and Honda require about three minutes for refilling. (The Nikkei & The Hokkoku Shimbun, November 22, 2013)

(12) MHI & Hitachi

Mitsubishi Heavy Industries (MHI) and Hitachi try to create smart community related businesses in Europe. From next spring, Málaga, Spain, will have an experiment with EVs which store excess electricity when demand is low, and charging periods will be shifted during tight power supply. They will sell a new service combined with renewable energy in Germany and Spain. 160 vehicles of Mitsubishi Motors’ “i-MiEV” and 40 vehicles of Nissan Motor’s “Leaf” will be prepared, and residents can lease these EVs. MHI will provide 9 quick chargers which supply power to EVs complying with CHAdeMO, a Japanese charging method. (The Nikkei, November 22, 2013)

(13) Auto Guangzhou

On November 21<sup>st</sup>, Auto Guangzhou started in Guangdong, China, and Nissan Motor announced that an EV version of “Venucia”, a car specifically designed for the Chinese market, would be available from 2014. The EV uses expertise accumulated with “Leaf”, and developed to suit Chinese traffic conditions. Nissan will release it ahead of the schedule which was 2015. In China, 10,000 EV and 1,500 PHV were sold in 2012. (The Nikkei, The Tokyo Shimbun The Chunichi Shimbun, November 22, 2013)

(14) Kowa

Kobot, Fukuoka Prefecture, which is a subsidiary of Kowa, Nagoya City, is testing its micro EV “Kobot θ

(theta)” in Oshima, an island belonging to Munakata City, Fukuoka Prefecture. Commercialization of the EV is under consideration. However, the firm believes the vehicle attracts consumers for convenient transportation for two people, and plans to sell it for tourist sites and remote places. (The Nikkan Kogyo Shimbun, November 22, 2013)

## 5. Technology Developments and Business Plans of Hydrogen Filling Station

### (1) Osaka Gas

On October 28<sup>th</sup>, Osaka Gas announced that a larger scale hydrogen extractor “HYSERVE-300” had been developed with the world’s highest efficiency production for hydrogen filling stations, and it would be available from December 1<sup>st</sup>. The product uses a vacuum swing adsorption technique, a type of pressure swing adsorption, to remove impurities by absorbent material filled in a vessel during a hydrogen refining process of reacting natural gas and water vapor. This improved the production efficiency to 79% from 71% that of their existing products. The new facility measures 7.5 m wide, 3 m deep and 3.3 m high. The production volume is 300m<sup>3</sup>/h which is triple that of the current product. The installation area is made 43% smaller than products with a conventional technology as well as a 50% reduction of facility costs. The product can fully fill five to six FCVs. The price is expected to be just less than ¥200 million per unit. (The Mainichi Newspapers, The Nikkei, The Nikkan Kogyo Shimbun, The Denki Shimbun & The Kitanippon Shimbun, October 29, 2013; The Kyoto Shimbun, October 30, 2013; Osaka Nichinichi Shimbun, November 1, 2013)

### (2) Toyota Tsusho

On October 28<sup>th</sup>, Toyota Tsusho revealed that it has agreed to establish a joint venture with Air Liquide Japan, Tokyo, for their hydrogen filling stations for FCVs. The venture “Toyota Tsusho Air Liquid Hydrogen Energy Corporation” will be capitalized ¥500 million. They plan to build hydrogen filling stations in Atsuta, Nagoya City, and Fukadacho, Toyota City, by the end of 2014. (The Nikkan Kogyo Shimbun, The Chunichi Shimbun, The Chugoku Shimbun, Gifu Shimbun & Fuji Sankei Business i, October 29, 2013; The Denki Shimbun, The Chemical Daily, October 30, 2013)

### (3) Chiyoda Corporation

Chiyoda Corporation has been preparing a hydrogen supply base which is to operate in the Kawasaki coastal areas of the Keihin region from FY 2015, and the hydrogen price for heavy users such as refineries and chemical plants is expected to be about ¥30/Nm<sup>3</sup>. Organic chemical hydride (OCH) is used as the base technology of hydrogen transport and storage. A large amount of hydrogen is combined with toluene to form methylcyclohexane, and an original catalyst is used for hydrogen extraction. With conventional methods, hydrogen is highly pressurized in cylinders for transport or refrigerated to less than -253 °C for liquidization. However, the OCH method has the advantage of liquid hydrogen storage and transport at a normal temperature. (The Chemical Daily, October 31, 2013)

Chiyoda Corporation will establish a venture to sell hydrogen in FY 2014 in order to start a hydrogen supply business fully. They aim to build a hydrogen transport network with an originally developed catalyst. A wholesale distribution is planned in Japan with excess hydrogen bought from the Middle East. Looking for a partner for the business, the firm will establish a joint venture in FY 2014. (The Chemical Daily, November 11, 2013)

### (4) Kobe Steel

Kobe Steel developed a diffusion bonded compact heat exchanger (DCHE) which contributes to make hydrogen filling stations smaller, and will start full scale sales of the product. The metal plates of DCHE have microscopic channels processed on their surfaces, and are stacked together and diffusion bonded. Capable of strengthening base metal, diffusion bonding is a welding method which joins base metals such as stainless steel, nickel and titanium using diffusion of atoms on the bonding surfaces. Two different fluids go into each channel to exchange heat between the fluids. The more channels form, the larger the surface area created. This technology allows significant reduction in the size of the heat exchanger comparing to conventional products using tubes. Also the micro channel heat exchanger with the diffusion bonding technology cuts down the installation area to one thirtieth to one hundredth of that of conventional dual tube heat exchangers as well as giving better pressure performance and heat resistance. Because

hydrogen filling stations require smaller components, the new product should suit the demand. (The Chemical Daily, November 5, 2013)

#### (5) HySUT

The Research Association of Hydrogen Supply/Utilization Technology (HySUT) revealed its exhibition contents for the 43th Tokyo Motor Show 2013 and the 8<sup>th</sup> Osaka Motor Show. Their hydrogen filling station shaped booth shows hydrogen dispensers and FCVs as well as explanations on the safety measures and the structure of the filling station. (Nikkan Jidosha Shimbun, November 7, 2013)

HySUT will increase number of hydrogen filling station to 36, double that of the current figure, by the end of FY 2013. This is a part of METI's technology demonstration plan which aims to prepare 100 filling stations as a governmental target by FY 2015. (The Nikkan Kogyo Shimbun, November 21, 2013)

#### (6) Iwatani

Iwatani will produce its own core component of hydrogen filling station for FCVs as early as 2014. Components developed by Linde are currently imported for Iwatani's hydrogen filling station. Fabricating its own components will reduce the production cost. By 2015, Iwatani aims to reduce the total construction cost of a hydrogen filling station including storage tank and building to about ¥200 million, half of current cost. The components to be produced compress hydrogen to dispense it to FCVs, and a hydrogen compressor, chiller and heat exchanger will still be bought to assemble the product from other manufacturers. Linde will dispense technical advice for the production. Except for some materials from Germany, most parts will be produced in Japan. The firm estimates 10 filling stations will be made each year for a while. (The Nikkei, November 16, 2013)

#### (7) Chugoku Kogyo

On November 18<sup>th</sup>, the biggest gas container manufacturer Chugoku Kogyo, Kure City, announced that a hydrogen tank using carbon-fiber-reinforced plastic (CFRP) had been developed. The small tank accommodates 12 L and stands 3600 times the force of atmospheric pressure. Special resin is used inside the tank, and the tank is wounded by resin bound carbon fiber to strengthen it. This technology reduced the cost while keeping the strength of the conventional tank,

and allows for an increasing size of a tank more easily. The manufacturer plans to commercialize a 300 L (45 cm diameter, 2.8 m long and 500 kg weight) product which stands repeated use over 100,000 times. The 300 L tank is expected to sell for ¥10 million and the aim is for it to be made available from 2018. (The Chugoku Shimbun, November 19, 2012)

#### (8) Samtech

Samtech, Kashiwara City of Osaka Prefecture, will start larger scale production of storage tanks for hydrogen filling stations in FY 2013. The product uses aluminum as its base, and the base is wound with carbon fiber to strengthen it. The tank accommodates high pressure hydrogen and costs less than two thirds that of conventional products. The manufacturer targets a 60% share of the tank market for hydrogen filling stations in Japan. The development was carried out in collaboration with JX Nippon Oil & Energy and Kyushu University. (The Nikkei Business Daily, November 20, 2013)

### 6. Research and Development of FC System

MHI announced that an innovative closed-cycle FC system had been developed in cooperation with the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and succeeded to supply observation equipment with power, for ocean use, as a trial operation. The compact FC system employs a new structure in its gas circulation system to solve technical issues. This achievement shows the new marine use FC system can power seabed-installed observation instruments and marine research vessels for long operation period which currently uses a storage battery. Having passed the underwater operation, the unit is a high-efficiency multi-less (HEML) polymer electrolyte FC system. The system was installed in JAMSTEC's "Deep Tow", marine research towing unit, and was submerged to a depth of 180 m. The FC system provided two observation instruments simultaneously with electricity. The test results show these observation instruments operated with a stable power supply without any interruption. (The Japan Maritime Dairy, November 14, 2013; The Chemical Daily, November 15, 2013; The Denki Shimbun, November 18, 2013)

### 7. Business Plans of Businesses and Organization

The Advanced Scientific Technology & Management Research Institute of Kyoto (ASTEM) established “Kyoto City Growing Industry Creation Center (ACT Kyoto)” specializing in research and development in the chemical field. The joint research laboratory chose 10 research subjects. Prof. Susumu Kitagawa of Kyoto University will carry out a material study to store and separate gas (such as hydrogen and CO<sub>2</sub>) which can be an energy source. Rohm plans to develop solid hydrogen cycle FC systems. (The Nikkan Kogyo Shimbun, November 14, 2013)

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