

## Experimental Power Supply from FCV to Home

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### 1. Governmental Measures

#### (1) Council for Science and Technology Policy

The Council for Science and Technology Policy of the Japanese government will specify nine research fields including methane hydrate and algae as next generation energy policy priority areas. These research fields will be included in the science and technology innovation policies which will be compiled in May to be counted in the budget from FY 2013. The aim is to diversify power sources and bring the energy industry up as an export industry. The energy sources include floating offshore wind power, highly efficient thermal generation, bio fuel production using microalgae and marine resources such as methane hydrate. The government will concentrate on the technological developments such as high volume algae cultivation using exhaust heat from a thermal generator to extract oil. Also, a cost reduction will be sought on a new technology which converts electricity into hydrogen for easier storage and transportation. Additionally, the infrastructure preparations such as hydrogen refueling stations for fuel cell vehicles (FCVs) will be accelerated. A technology is also included to produce liquefied fuel from shale gas at lower cost. The prioritized issues include optimization of energy distribution using information technology and development on energy saving materials and parts as well as carbon fiber which allows for reducing the weight of cars. (The Nikkei, March 28, 2013)

#### (2) METI • JPO

The Japan Patent Office (JPO) of the Ministry of Economy, Trade and Industry (METI) will establish a package patent examination scheme from FY 2013. Specialist teams will exam patent application of products or projects which use multiple technologies such as fuel cell vehicles (FCVs) and mobile devices. Previously the scheme was planned to operate from April, 2014. However JPO finished the preparation earlier, and will start the scheme one year before the plan. Prime Minister Shinzo Abe will bring out new

strategies for growth in June to support Japanese businesses to be more successful. With the new scheme, the industries are expected strengthen their intellectual properties which are keys for their businesses, research and development. (The Nikkan Kogyo Shimbun, March 29, 2013)

#### (3) METI

METI will ease the regulations for hydrogen refueling stations for FCVs. The standards for installation of precoolers to refrigerate hydrogen will be deregulated, and technical standards will be set up for combined material accumulators using resin. With these deregulations the aim is to improve the profitability of hydrogen refueling stations, which will allow them to install facilities easier and to obtain cheaper accumulators. (Nikkan Jidosha Shimbun, April 9, 2013)

#### (4) Administrative Reform Council

On April 8<sup>th</sup>, a working group of the Administrative Reform Council of Japanese government submitted suggestions including deregulation which allows refueling facilities of natural gas to be installed at existing petrol refueling stations for promoting next generation vehicles. With current regulations, a natural gas dispenser cannot be installed at these petrol refueling stations. The change was determined essential for boosting FCVs. Natural gas can power natural gas trucks, and also be a hydrogen source for FCVs by conversion. (The Sankei Shimbun, April 9, 2013)

#### (5) MLIT

This summer, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) will invite businesses and local governments who work on development planning, housing and transportation with comprehensively creating, storing and saving energy. From applications, three to five project proposals will be chosen as leading development model plans to be supported. The expected projects are, for example, a town planning utilizing an untouched energy source,

a tourism project with EVs or a housing development with advanced environment technology such as fuel cells (FCs), storage batteries and home energy management systems (HEMS). The ministry will assist selected proposals of local government and businesses to build up their concepts to suit the size of the towns and feature. (The Nikkan Kensetsu Kogyo Shimbun, April 12, 2013)

#### (6) MOFA

The Ministry of Foreign Affairs (MOFA) will carry on promotion of Japanese next generation vehicles using official development assistance in FY 2013. As the first project, next generation vehicles will be provided for free with ¥3.5 billion allocated in the supplemental budget for FY 2012. With the growing global attention for eco cars, the ministry will try to sell Japanese technologies such as electric vehicles (EVs) and FCVs to expand in the market. A type of vehicle will be selected to suit the wishes and energy circumstance of each receiving state. The project will also supply essential facilities and replacement parts. For example, an EV will be sent with a charger. (Nikkan Jidosha Shimbun, April 12, 2013)

## 2. Local Governmental Measures

### (1) Sapporo City

On March 18<sup>th</sup>, Sapporo City revealed a report which shows a future energy vision to eliminate nuclear power by switching energy source. The formation of a new energy policy will start in the next fiscal year with details based on the report giving it shape. According to the report, the city is sorted into three categories; urban, station and residential areas. Cogeneration systems using natural gas in energy centers will supply surrounding buildings with heat and electricity in the urban area. Also, new energy centers will be constructed around subway stations. Roof-top solar panels, Ene-Farm and storage batteries will be installed at more houses in the residential area. (The Hokkaido Shimbun, March 19, 2013)

### (2) Fukuoka Prefecture

Promoting the hydrogen energy industry, Fukuoka Prefecture announced that a new large testing facility would be constructed to examine the performance of large hydrogen storage tanks in Itoshima City of the prefecture. The facility can store 500L of hydrogen. The prefecture and organizations including JX

Nippon Oil & Energy runs the Hydrogen Energy Test and Research Center (HyTReC). HyTReC plans the construction to start in June and to be completed next March. Development of storage tank for hydrogen refueling stations will be accelerated for coming commercial FCV sales in 2015 with public and private cooperation. (The Nikkei Business Daily, March 21, 2013)

### (3) Gifu Prefecture

Gifu Prefecture installed next generation energy system combining photovoltaic generator, FC and storage battery to prepare for isolation at disasters in a road side station “Hoshinofurusato Fujihashi”. The road side station is designated as a disaster control facility by the prefecture. On March 16<sup>th</sup>, the ceremony was held there, and the system is now fully in operation. Its advantages are the capability of FC operation without power or water supply. A reserve tank of water circulates water at pressure in the FC during water interruptions, which allows the FC to operate. The system consists of a 5 kW photovoltaic generator, 0.7 kW FC, a 32 kWh capacity storage battery and a grid control device. The facilities help moderate power consumption peak every day. The cost, ¥38.85 million, is evenly shared by the state and prefecture. (The Denki Shimbun, March 28, 2013)

### (4) Northern Kyushu

On March 29<sup>th</sup>, “Northern Kyushu Automobile Industry Promotion Strategy Research Committee”, which consists of automakers, and automobile component manufacturers and academic experts, handed in its compiled report to the governor of the Kyushu Prefecture Hiroshi Ogawa in the prefectural office. The report proposes to set a goal to be a hub of the auto-industry in the Asian region as a growth strategy for the industry concentrating in the northern Kyushu. To compete with others in the region such as South Korea and China, it is suggested that higher quality products at lower cost are also requested to the component manufacturers as well as an active global operation. The area aims to be the production hub for next generation vehicles such as FCVs and EVs, and to attract manufacturers specializing in high function components there as well as increasing car production figures and the creation of more advanced technologies. Additionally, the prefecture intends to create a new industry and to

move on to the intelligent transport systems (ITS) earlier than other regions. (The Nishinippon Shimbun, March 30, 2013)

#### (5) Hirosaki City

On March 30<sup>th</sup>, Hirosaki City finished a “Development Concept with Consumption of Locally Produced Energy” which is a plan to store, distribute and consume hydrogen produced by natural energy. The concept consists of three-year experiments for “hydrogen production from sewage sludge” and “FC bus operation in the snowy and cold area for a longer period” from 2015 to 2017. The hydrogen production project will be carried out with the cooperation of the Institute of Multidisciplinary Research for Advanced Materials of the Tohoku University. Calcium hydroxide is added to sludge and heated by 600°C to extract high purity hydrogen. Calcium carbonate which comes out from the reaction is also recycled. According to the city, approximately 50 tons of sludge is produced every day from the sewage treatment works for Hirosaki City and the other neighboring areas, which costs a couple of ¥100 million each year. (The To-o Nippo, March 31, 2013; The Denki Shimbun, April 8, 2013)

#### (6) Tochigi Prefecture

On April 1<sup>st</sup>, the land preparation department of Tochigi Prefecture announced that its biogas generation of the Kenou Joka center, sewage works, on Kinugawa river had been approved for the “feed-in tariff for renewable energy” by METI on March 29<sup>th</sup>. The sewage work will install three FCs to generate electricity using biogas produced by the process. Each FC is rated 105 kW output, and the system is expected to produce approximately 2,500,000 kWh each year from approximately 1,300,000 m<sup>3</sup> of gas. The planned electricity production is equivalent of 700-household annual consumption. The construction cost is approximately ¥400 million. (Shimotsuke Shimbun, April 2, 2013)

### 3. Technological Developments of FC Related Element

#### (1) Tokyo Institute of Technology, Toyohashi University of Technology

A study group of Tokyo Institute of Technology and Toyohashi University of Technology unraveled the structure of nanoscale ceria-zirconia catalyst. The result shows that the symmetric property (tetragonal

system) of the nanocrystal holds at high temperature. This means the structure does not change at the high temperature at which the catalyst works when converting auto exhaust. This fact gives high confidence to manufactures. Previously the relationship between structure and reactivity was tested with bulk samples which have a couple of 100  $\mu$  m particle diameter. The group made clear the relationship with nanoscale quantities. Crystalline structure of an approximately 10 nm diameter ceria-zirconia sample was formerly examined with X-ray diffraction, which did not give clear analysis of the structure. This time, neutron diffraction was used to accurately determine the amount of displacement of oxygen, and the structure was proved to keep its tetragonal system to 1176 K which is the operating temperature of the catalyst. The basic data were obtained indicating thermal and phase stability, structural difference from bulk samples and oxide ion diffusion, which is expected to help catalyst development for auto exhausts and FCs. (The Chemical Daily, April 3, 2013)

#### (2) Kyoto University & JST

On April 4<sup>th</sup>, the study group of Prof. Hiroshi Kitagawa of Department of Chemistry and the graduate Division of Chemistry at Kyoto University announced with the Japan Science and Technology Agency (JST) that a new ruthenium (Ru) metal catalyst had been successfully developed. This result possibly improves conventional Ru catalytic performance, which would lead to extend life spans of products such as polymer electrolyte fuel cells (PEFCs). Previously, conventional Ru catalysts were known to only have a hexagonal close-packed (hcp) structure. The study group succeeded in creating a face-centered cubic (fcc) structured Ru catalyst, by chemical reduction, to precisely control the atomic arrangement. The fcc structured Ru nanoparticles proved their stability over a wide temperature range in the CO oxidation analysis, which shows a potential to be a long lasting and highly reactive catalyst. Additionally, the developed method may be able to give other metals different structures, which are not known, to make new nano alloys. This advancement possibly brings out new materials and substances with better properties at lower cost than conventional materials. (The Nikkan Kogyo Shimbun, The Nikkei

Business Daily, Japan Metal Daily, The Chemical Daily, April 5, 2013; The Denki Shimbun, April 9, 2013)

#### (3) Sumitomo Osaka Cement

Sumitomo Osaka Cement developed nanoparticles of yttria-stabilized zirconia (YSZ) with oxygen ion conductivity as an electrolyte material for solid oxide fuel cells (SOFCs). With a diameter of approximately 3 nm, the particles are highly dispersive. A closely packed material can be produced at a lower temperature by filling gaps between larger YSZ particles with YSZ nanoparticles. The nanoparticle added material was confirmed to reduce sintering temperature by 200 °C compared to a material without the nanoparticles. Also, another compound can be doped. Early commercialization of the product is aimed as a sintering additive. The firm has expertise of nanoparticle synthetic technology including shape, composition and diameter controls which are obtained from comminution technology of the cement production process. (The Chemical Daily, April 15, 2013)

### 4. Ene-Farm Business Plans

#### (1) COLLABO

On March 18<sup>th</sup>, the Japan Gas Energy Promotion Council (COLLABO) announced a joint statement with the industry organizations for natural gas and liquefied petroleum gas to promote gas to be the core energy, as well as building stronger relationship between them. The statement includes an Ene-Farm promotion for FY 2013 with longer term targets which are to accumulate 1.4 million units by 2020 and 5.3 million units by 2030. (The Denki Shimbun, The Nikkan Kogyo Shimbun, March 19, 2013)

#### (2) JX Nippon Oil & Energy

On March 27<sup>th</sup>, JX Nippon Oil & Energy announced that cooperation for a domestic energy saving business with LIXIL Group, who produces and sells housing equipment and building materials, was under consideration. JX has provided “Energy Saving Consultant” service for homes since last April, and will start to suggest LIXIL products such as glass for insulated windows and doors. A LIXIL group’s building firm is considering selling Ene-Farm and storage batteries of JX. (The Nikkei, The Nikkan Kogyo Shimbun, The Nikkei Business Daily, March

28, 2013)

#### (3) Misawa Homes

Misawa Homes Kinki, Osaka City, which is a subsidiary housing supplier for Misawa Homes will sell 17 housing lots conditioned to build smart houses as “Hills Garden Katsurazaka Goryonosato” in the Katsurazaka area which is close to the Katsura campus of Kyoto University in Nishikyo-ku, Kyoto City, from April 1<sup>st</sup>. The smart houses will have double generation systems combining Ene-Farm and photovoltaic generators and HEMS “enecoco” of Misawa Homes as standard features. (The Kyoto Shimbun, March 30, 2013)

#### (4) Saibugas

On March 29<sup>th</sup>, Saibugas revealed its capital investment plan for FY 2013 that was ¥35.6 billion, a decrease by 11.4% that of FY 2012, on a consolidated basis. The gas sales are planned at 925,000,000 m<sup>3</sup> which would be a 1% increase that of FY 2012 and the highest ever. The Ene-Farm target is 1,270 units, a 49% raise that of FY 2012. (The Nishinippon Shimbun, March 30, 2013)

#### (5) Mitsui Fudosan & Kyocera

Mitsui Fudosan Residential will use “photovoltaic generator, storage batteries and HEMS (SAMURA series)” of Kyocera for its smart house project “Fine Court Otsuka”. Constructing 21 houses in Tokyo, the project offers creation, storage and saving of energy with photovoltaic generators and storage battery systems, HEMS, domestic FCs, EV power stations and light emitting diodes (LEDs) for lighting. (Dempa Shimbun, April 3, 2013)

#### (6) Hiroshima Gas

On April 3<sup>rd</sup>, Hiroshima Gas revealed business plan for FY 2013 and a medium-term management plan. Sales targets are set for domestic gas equipment; 3,200 units for water heater and heating system, 4,000 units for heaters, and 370 units for Ene-Farm. The capital investment is set at ¥11.1 billion. A double generation system combining photovoltaic generator and Ene-Farm will be promoted. Also, the construction of a large scale solar power plant is planned in Kure City with an output of 733 kW. The plant is expected to be in operation from this August and to produce approximately 850,000 kWh each year. (The Denki Shimbun, April 4, 2013)

#### (7) Sekisui House

On April 8<sup>th</sup>, Sekisui House announced that new standards for houses “Green First Zero” would be used to realize net zero energy consumption. The number of construction projects following the standards is aimed at 40% of their new houses, which is approximately 6,000 houses, by January 2014 and 60% which is approximately 9,000 houses by January 2015. To achieve net zero energy consumption, insulated glazing and window sash are used to increase thermal efficiency by 30% more than conventional houses, and photovoltaic generators and FCs produce electricity. Optionally storage batteries can be installed. (The Yomiuri Shimbun, The Mainichi Newspapers, The Sankei Shimbun, The Nikkei, The Nikkan Kogyo Shimbun, The Nikkan Kensetsu Kogyo Shimbun, April 9, 2013)

## 5. Development and Business Plan of Business Use FC

The Japan Steel Works developed PEFC for traffic lights with Nissei, a large reduction drive manufacturer. With a 1.5 kWh generation capacity, the PEFC can operate traffic lights for seven to eight hours. Replacing hydrogen canisters allow the FCs to power traffic lights longer than a storage battery. Hydrogen is stored in a canister which uses Japan Steel Works’ hydrogen storage alloy. Having dimensions of 42 cm, 32 cm and 92 cm, the FC is attachable to the power pole of traffic lights. Tokyo Metropolitan Police Department recently bought nine units. The FC will sell for approximately ¥2 million which is 20 to 30% higher than same capacity lithium ion battery (LIB) or diesel generator. The Japan Steel Works has sold 15 kg portable FC using hydrogen storage alloy since last year. (The Nikkei Business Daily, April 2, 2013)

## 6. Cutting Edge Technology of FCV & EV

### (1) Toa Road

Toa Road, a road paving firm, developed a paving technology to charge driving EVs without charger cables. Alternating electromagnetic field transmits energy from sending coils in the ground, and the energy is converted into current in receiving coils in the vehicles. The firm developed a special elastic cement to avoid damaging sending coils by pressure and heat during the paving processes. With the new

development, the coils can be buried 4 cm below the surface. The fitting costs can be reduced to one third and they are easy to install in existing roads. Nissan cooperated by providing its EV for the experiment. The firm aims to commercialize the technology as early as possible to solve the issue of the cruising range of EVs. (The Nikkei, March 18, 2013)

### (2) Sumitomo Realty & Development

Sumitomo Realty & Development will offer an EV carsharing service for a condominium in Kanagawa-ku, Yokohama City with a cooperation of OASYS Solution. The battery of the EV will provide power for water supply during water interruption during disasters. (The Nikkei, March 22, 2013)

### (3) BYD

On March 21<sup>st</sup>, BYD, a major car and battery manufacturer of Guangdong, announced that its EV would be shipped to Hong Kong for taxis. Test operation will start with 45 vehicles from April, and a 3,000 vehicle scale operation is planned by 2015. The firm aims to familiarize its EV among consumers and promote their reliability by public transport such as taxis. (The Nikkei, March 22, 2013)

### (4) US Policy

The Obama regime announced that a foundation would be established to provide research grants of \$2 billion (approximately ¥190 billion) over 10 years to commercialize next generation vehicles powered by electricity and hydrogen. According to the office, the fee from newly approved mining concessions of oil and gas will partially go to the foundation to avoid using existing budget. The government will support the technological development of EV, FCV and bio fuel vehicles. (The Nikkei Business Daily, March 25, 2013)

### (5) Mitsubishi Motors

On April 27<sup>th</sup>, Mitsubishi Motors announced that a problem had been found in a LIB in its plug-in hybrid vehicle (PHV) “Outlander” which can be charged at home. The LIB had overheated and partially melted. The vehicle was stored and charged prior to the delivery at a dealer in Kanagawa Prefecture. On April 21<sup>st</sup>, the dealer could not start the car, there was an unusual smell, and they found a part of the battery cover melted. Mitsubishi has sold approximately 4,000 vehicles. On April 18<sup>th</sup>, a LIB for EV “i-MiEV” overheated and the battery casing ignited during charge and discharge inspection in the Mizushima

Plant, Kurashiki City of Okayama Prefecture. 68 vehicles were sold with the battery on-board in Japan, and 45 vehicles have possibly been installed as replacement. These batteries were produced by Lithium Energy Japan, Ritto City of Shiga Prefecture, whose capital is 51% from GS Yuasa. Due to a production line change, foreign matter possibly mixed, which may have led to short circuits inside the batteries. Mitsubishi has suspended the production and sales of these vehicles and called for the owners to stop charging the batteries. (The Nikkei, March 28, 2013; The Mainichi Newspapers, April 11, 2013)

#### (6) SIM-Drive

On March 27<sup>th</sup>, SIM-Drive revealed the third preceding development vehicle “SIM-CEL”. The development started last year, and the vehicle uses SIM-Drive’s signature in-wheel motors as well as smart grid technology. The firm offers a social system which cycles renewable energy and uses the energy selectively. For example, a wind turbine generates electricity and charges an EV, and the vehicle discharges power at its destination or on the way such as at a restaurant. The system supposes the driver is awarded with points or a product for the contribution to the environment. The participants of the project are 26 organizations including Mitsubishi Electric, Daikin Industries and Fujikura. This two-seater vehicle has 29.6 kWh storage battery Lithium Energy Japan, a joint venture of GS Yuasa, to secure a 324 km of cruising range as well as sporty acceleration performance. The energy consumption is 91.2Wh/km improved by approximately 20% compared to the EVs of major automakers. A CHAdeMO quick charger is on-board. (The Denki Shimbun, March 28, 2013; Jutaku Shimpo, April 2, 2013)

#### (7) Seoul Motor Show

On March 28<sup>th</sup>, the largest automobile exhibition in South Korea “Seoul Motor Show 2013” was open to the press prior to the grand opening. Under “With nature, for the people”, a total of 384 firms from 14 countries including Japan participated in the show. 15 models of concept cars were exhibited. Total 36 models were displayed as “eco-friendly green cars”; 21 hybrid vehicles, 14 EVs and one FCV model. (Nikkan Jidosha Shimbun, March 29, 2013)

#### (8) Hyundai Motor

South Korea-based Hyundai Motor displays its FCV

in the Seoul Motor Show. “We successfully started mass production of FCV in February ahead of Germany, the US and Japan.” said President Choong Ho Kim on March 28<sup>th</sup>. The opening ceremony of the world’s first volume production was held at its main plant on February 26<sup>th</sup>. Also, the firm announced that 1,000 FCVs were planned for governments and local governments worldwide by 2015 as well as 15 vehicles for the city of Copenhagen, Denmark. The FCV uses the sports utility vehicle Tucson ix (ix35) as the base, and an originally developed FC system and hydrogen tank are installed. The tank allows driving a maximum of 594 km on a single charge. The FC stack, driver’s seat and inverter are modularized to increase productivity. (The Nikkei Business Daily, April 1, 2013)

#### (9) Tesla Motors

On April 2<sup>nd</sup>, a US based-EV manufacturer Tesla Motors revealed a promotion plan which guarantees the owners of its new sedan Model S to buy back three years after the sale with conditions. At least 43% of purchase price is promised for the vehicles which meet the conditions such as the shape of car and mileage, and a lower price is offered for the cars which do not meet their level. If the firm does not accept a car, Elon Musk, the founder and CEO, plans to buy the car personally. This shows his strong will and confidence to promote the EV, and should attract more attention. (The Nikkei, April 3, 2013)

#### (10) Osaka Prefecture University

In April, the Research Organization for the 21st Century of the Osaka Prefecture University will reorganize its “R&D Center for the Electric Vehicles” into “R&D Center for Next Generation Electric Vehicles” (director; Shigeo Morimoto). The study area will expand to FCV’s research, development and technology assistance as well as EVs with the re-origination. The center will seek new businesses with cooperation of ventures and smaller firms in the prefecture by extending its research to FC development and infrastructure such as hydrogen refueling station as well as development of LIB for EVs and micro EVs. (Nikkan Jidosha Shimbun, April 3, 2013)

#### (11) Toyota Motor

Toyota Motor aims at approximately 700 FCVs for consumers in 2015 as its sales plan. The figure is

possibly a half the share in Japan. The automaker is developing sedan FCV with 700 km cruising range on a full tank. The price is expected to be around ¥5 million which is a luxury range. The Motomachi Plant will produce the vehicle. (The Yomiuri Shimbun, April 5, 2013)

#### (12) Honda

On April 9<sup>th</sup>, Honda Motor announced that an experimental power supply from FCV to home started in Kitakyushu City. The aim is to examine its operational stability as a mobile power generator in emergencies. The experiment uses FCX Clarity leased in Japan and the US. A full tank of hydrogen provides an average household with electricity for six days which is approximately triple that of an EV. The experiment will last for two years. (The Nikkei, The Nikkei Business Daily, The Chugoku Shimbun, The Hokkaido Shimbun, April 10, 2013; The Denki Shimbun, April 12, 2013)

### 7. Hydrogen Refueling Station Business

Hydrogen Energy Test and Research Center (HyTReC), a public interest incorporated foundation, announced open tender for the “testing facility design and construction for large hydrogen tanks supporting FCVs as refueling infrastructure”. This project uses the budget allocated to METI in a supplemental budget for FY 2012 of “testing facility preparation for large hydrogen tanks as refueling infrastructure for FCV”. The facility preparation ¥2.94 billion is fully funded by the state for examinations of a large hydrogen storage tank for hydrogen refueling stations. The majority of storage tanks are currently made from steel, and the industry is moving to carbon fiber which is a cheaper and lighter material. Currently large tanks are tested abroad because there is no facility to examine the safety and durability of large tank in Japan. (Nikkan Kensetsu Sangyo Shimbun, March 26, 2013; The Nishinippon Shimbun, March 28, 2013)

### 8. Technology Developments and Business Plans of Hydrogen Refining

#### (1) University of Calgary

A study group of Assistant Prof. Curtis Berlinguette at the University of Calgary developed an inexpensive method to split water into hydrogen and oxygen using

amorphous metal as a catalyst. Being a metallic oxide consisting of iron, cobalt and nickel, the catalyst has the same or better performance of conventional metal catalysts for a thousandth the cost of these expensive catalysts. With its disordered structure, the amorphous catalyst better promotes the reaction of hydrogen and oxygen compared to pure crystalline-structured catalyst. The expected usage is storage of excess energy from wind and solar power, and the catalyst can store energy more efficient than saving it in a battery. (The Nikkan Kogyo Shimbun, April 4, 2013)

#### (2) Mitsubishi Gas Chemical & Mitsubishi Corporation

On April 9<sup>th</sup>, Mitsubishi Gas Chemical & Mitsubishi Corporation made an official statement that joint production of 1 Mt level methanol and 0.1 Mt level dimethyl ether was planned from FY 2016 in Trinidad and Tobago of the Caribbean. The final decision will be made in FY 2013, and the total investment is approximately ¥83 billion. Consumption of methanol is expected to increase as an ingredient of hydrogen for FCs and FCVs. Dimethyl ether attracts attention as alternative fuel with less impact to the environment than diesel. (The Nikkei, The Nikkei Business Daily, April 10, 2013; Nihon Securities Journal, April 11, 2013)

### 9. Business Plan in the FC Industry

PRIMIX, Osaka City, plans to expand the sales of its slurry mixer for electrode “FILMIX”. Being designed for research and development, this desk top mixer has been significantly reduced its size. The firm will strengthen the sales to battery manufacturers, and aims for annual ¥3 billion sales in the capacitor, LIB and FC fields. A cylindrical wheel with holes on the side goes in the fixed container. Materials are fed from the lower part of the mixer, and brought to the side wall of the container through the holes in the side by the apparent centrifugal force of the fast-rotating wheel. The material is spun and then pressed against the fixed container wall, which gives shear stress in the material and effective distribution. Couple of 10 nm level distribution is possible. (The Chemical Daily, April 12, 2013)

-This edition is made up as of April 15, 2013-