A brand new highly efficient catalyst for reversible conversion of formic acid to hydrogen

Arranged by T. Homma

1. Governmental Measures:

The Fire and Disaster Management Agency has made a report of the review conference on the safety measures for filling stations with compressed hydrogen dispensers. Due to the favorable prospect for the fuel cell vehicles (FCV) with high pressure 70 MPa hydrogen cylinders, instead of the conventional cylinders which are pressurized to 35 MPa, the committee reviewed the required safety measures for the facilities; however, the technology standards are established for hydrogen dispensers at filling stations. Based on the suggestion from the Committee on Technical Standards for 70 MPa Hydrogen Dispensers in Filling Stations, the Nuclear and Industrial Safety Agency will consequently revise the technical standards such as the minimum safety distance from a fire handling facility to a compressed hydrogen filled facility which is to be changed to 8 m. These standards allow filling stations to install highly compressed hydrogen filling facilities, the report says. Self-service filling stations which meet the standards will also be allowed to supply hydrogen. (Architectures, Constructions & Engineerings News (Daily), March 27, 2012)

2. Local Governmental Measure:

(1) Miyagi Prefecture

Miyagi Prefecture announced the opening of a promotion office for renewable energy, with the governor as its chief, in the fiscal year 2012. The office will support the creation of mega solar power plants and smart city projects that the local governments of the disaster-affected areas are planning for the areas vulnerable to Tsunamis. Also, solar panels for houses will be promoted, and the office will invite and support clean energy firms such as fuel cell (FC) manufactures to form industrial clusters in the prefecture. (The Yomiuri Shimbun, March 14, 2012)

(2) Kyoto City

Kyoto City has certified the Aquafairy's hydrogen-powered portable FC charger which extracts its fuel from water, as one of the City's promotional purchasing schemes of smaller business products. (The Kyoto Shimbun, March 15, 2012)

Kyoto City has planned demonstration networks of smart houses which share on-site generated electricity between neighboring houses for the fiscal year 2012. Three to 10 neighboring houses with photovoltaic generators, storage batteries or/and FCs will be connected to share the electricity. The aim is to save buying electricity by sharing the on-site generated electricity. (The Kyoto Shimbun, March 18, 2012, The Yomiuri Shimbun, April 3, 2012)

(3) Aichi Prefecture

The planning committee completed the Aichi Automotive Industry Innovation Plan which will help the core industry of Aichi by promoting electric vehicles (EV) and plug-in hybrid vehicles (PHV) on March 19th, and they reported it to the governor Oomura. Infrastructural support will be given to the next generation vehicles with a target of 600 charger units, triple the fiscal year 2010, and 20 units of new hydrogen filling stations for FCVs by the fiscal year 2015. Aichi prefecture will also cooperate for research and development and human resource development with the universities in Aichi prefecture, and attract 10 automobile related firms to the prefecture. (The Chunichi Shimbun, March 20, 2012)

(4) Hyogo Prefecture

The smart town project, which is prepared by the business board of Hyogo for the Minamiashiya area has been in progress in the coastal area of Ashiya city. The area is planned to form a town filled with approximately 180 houses which are required to have a facility such as a photovoltaic generator, and the town aims to supply all the electricity needed within it. The Hyogo prefecture sold the residential area in the southern part of the artificial island to the major home

builders, Sekisui House (Osaka city) and PanaHome (Toyonaka city). Sekisui House has started to sell 72 housing lots in Suzukazecho, Ashiyashi since last March, and approximately 20 lots have already been inhabited. PanaHome will also start selling 109 housing lots there. The houses are required to have domestic photovoltaic generators or FCs. These houses save 8000 kW of electricity usage and 60 to 70 % of carbon dioxide (CO_2) emissions each year than houses without these facilities. (Kobe Shimbun, March 22, 2012)

3. Technology Development of FC Elements

(1) Toshiba

Toshiba has developed a catalyst electrode which saves half the amount of platinum of conventional products. Platinum costs around 300,000 yen for a conventional FCV. Carbon, an electrode material, is mixed into platinum solution with conventional technology. Toshiba have developed a method to spray platinum impalpable particles on carbon sheets to create ultrathin platinum layers with hollows to allow air through, which increases the reaction efficiency. Having only half the amount of platinum of conventional products, the trial cells show the same generating ability as conventional products. Additionally, it has passed a test, which switches it on and off 10,000 times, four times more rigorous than conventional products. (The Nikkei, March 30, 2012)

(2) Nippon Kodoshi

Nippon Kodoshi, Kochi prefecture, has developed a new material for electrolyte membranes. This product offers a tenth the cost of conventional product and better resistance to heat and oxidation. 200 million yens worth of small pilot production facility will be installed by April, and distribution of trial products will start by May. Newly developed inorganic/organic hybrid membranes are materials combining inorganic oxide and organic polymer at the molecular level. The new membrane shows the same performance level of conventional fluoride electrolyte membranes with hydrogen ion conductivity required for an electrolyte membrane and heat resistance over 200℃. Also, good acid resistance which is the advantage of inorganic oxide negates the needs for special and expensive materials. Moreover, the new membrane does not require a large amount of organic solvent, which allows cost saving. (The Nikkei Business Daily, April 5, 2012)

4. Development and Commercializing Phosphoric Acid Fuel Cells (PAFC):

Tokyo Gas announced the introduction of the smart energy network (SEN) for the redevelopment of Minato-ku (ward), Tokyo on April 2nd. They will start the project with 90,000 m^2 in the eastern area after signing an agreement with Minato-ku. After the facilities' completion, the produced energy will gradually be distributed from April, 2014. The overall construction is estimated at least one billion yen. The facilities are planned to supply 20 % of the whole electricity demand with 740 kW by gas engine combined heat and power and 100 kW by PAFC. These generators operate during power cuts as long as gas is supplied. The air conditioning will be provided by heat pumps taking heat from water, which is more stable in temperature all year around, in underground tunnels as well as 160 kW solar thermal collectors to be installed on the roofs of the pedestrian walkways. A large number of photovoltaic generators are to be installed, and the energy production will be adjusted with the combined heat and power system. Tokyo Gas aims to reduce CO_2 emission by 45 % by installing the central energy control system. (The Nikkei Business Daily, The Nikkan Kogyo Shimbun, April 3, 2012, Nikkan Kensetsu Sangyo Shimbun, April 5, 2012)

5. Development and Commercializing of Solid Oxide Fuel Cell (SOFC):

(1) Osaka Gas, Kyocera etc.

Having completed the joint development of "SOFC Ene Farm (combined heat and power generator) type S", Osaka Gas, Aisin Seiki, Kyocera, Chofu Seisakusho and Toyota Motor announced on March 13 that the product would be in the market from April 27th. The generating efficiency reaches 46.5 %, and this improvement allows a saving of 76,000 yens worth total energy usage each year for a common household. The price is 2,751,000 yen after tax. Osaka Gas designed the SOFC cogeneration system, and operates its installation and maintenance. The generating unit is designed and manufactured by Aisin Seiki and Toyota Motor, and its cell stacks are

developed and produced by Kyocera. With operating temperatures increased to 700 - 750℃, the heat energy helps to reform coal gas to hydrogen, which gives high efficiency. The system's overall energy efficiency reaches 90 %. (The Yomiuri Shimbun, The Asahi Shimbun, The Mainichi Newspapers, The Nikkei, The Sankei Shimbun, The Denki Shimbun, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, The Kobe Shimbun, The Kyoto Shimbun, The Shizuoka Shimbun, The Chugoku Shimbun, The Hokkaido Shimbun, The Yamaguchi Shimbun, Fuji Sankei Business I, The Niigata Nippo, March 14, 2012, Dempa Shimbun Daily, The Chemical Daily, March 15, 2012, Nikkan Jidosha Shimbun, March 17, 2012)

(2) NGK Spark Plug

On April 1st, NGK Spark Plug set up the New Business Advancement Group that has taken over the function of the Engineering R&D Group and the Development Management Department and its Product Planning Center, which accelerates commercializing next generation technologies such as SOFC under the direct administration of the president.

6. Demonstration Experiment and Commercialization of Energy Saving Houses and Ene Farm:

(1) Osaka Gas

Osaka Gas aims to reduce the peak electricity demand by 300 MW in the fiscal year 2012 by promoting more natural gas and decentralized generating plants, stated in the fiscal year 2012 management plan revealed on March 13th. The target for business use cogeneration systems is 100 MW, 1.4 times of last year, and the target for home FC and cogeneration systems is increased to 10 MW, 1.2 times of last year. Osaka Gas will accelerate sales of gas air conditioning system and aims to increase the target for photovoltaic generators to 20 MW. The sales target for Ene Farm is 6,000 units and for Eco Will (gas cogeneration system) is 4,000 units. (The Yomiuri Shimbun, The Nikkan Kogyo Shimbun, March 14, 2012, The Denki Shimbun, March 15, 2012)

(2) JX Nippon Oil & Energy

JX Nippon Oil & Energy will start a demonstration experiment of Smart House (environmentally friendly house) which is an apartment house with the next generation energy saving equipment from May. These kinds of experiments are generally operated with detached houses, and hardly tested with an apartment house where people with different life styles live. The apartment house will be prepared with four units of SOFC Ene Farm, 20 kW output photovoltaic cells, EcoCute which is an electric heat pump water heating unit using extracted heat from air and a 30 kWh capacity storage battery. JX Nippon Oil & Energy will invite its 16 employee families to live in the company owned apartment house in Yokohama city. The estimated cost of the system is approximately 130 million yen. The aim is to reduce the amount of electricity bought by keeping the SOFC, a highly efficient generator, in operation for 24 hours to distribute electricity to the apartments. Combined with EcoCute the apartment house will provide hot water for baths without external energy. (The Nikkei, March 14, 2012)

(3) Tokyo Gas

Having finished its Smart Apartment House in Yokohama, Tokyo Gas announced on 14th that they would start a demonstration experiment on the apartment house from April. The newly built apartment house, having 24 units, is equipped with 10 units of Ene Farm, a gas and solar thermal water heating system SOLAMO, a photovoltaic generator outputting approximately 25 kW and a 40 kW storage battery for the company's employees with families in Isogo. With these common facilities controlled by Home Energy Management System (HEMS), the heat and electricity will be shared between the households. Tokyo Gas will examine the effect of the management system which provides information to encourage energy saving actions of the residents. The consumption of primary energy is expected to be reduced by approximately 40 % compared to an average household. Personal digital assistant iPad2 with special software installed will be provided to show the consumption of electricity, gas and water including comparison with the previous day and the production and consumption of electricity and hot water with the hot water production. An incentive program is also prepared to give points to the residents that use energy efficiently. Additionally, providing EV to share, Tokyo Gas will examine the quick charging system which lowers the power

contract required. (The Denki Shimbun, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, The Nikkan Kensetsu Kogyo Shimbun, The Kanagawa, Fuji Sankei Business i, March 15, 2012, The Asahi Shimbun, March 20, 2012)

(4) Japan LP Gas Association

On 22nd, Japan LP Gas Association announced that the penetration figure for home FC with LPG was increased from 1.1 to 1.5 million units in its revised long term prospect to 2030. Another 1.8 GW worth target is added with a favorable prospect of gas heat pumps (GHP) for office buildings. Due to a drastic change of the energy situation by Tohoku earthquake in 2011, Japan LP Gas Association revised the prospect two years after the first edition. (The Nikkan Kogyo Shimbun, March 23, 2012, The Nikkei Business Daily, March 26, 2012)

(5) Seibu Gas

On March 30th, Seibu Gas revealed the capital expenditure program for the fiscal year 2012. The business gas usage is expected to increase by gaining new customers and a rise in the factory operation rate, and the sales target for gas is 900,001,700 m3, a 3 % increase from last year's target; however the home usage is expected to stay at the same level. The sales target for coal gas Ene Farm is doubled to 850 units from the last year. (The Nishinippon Shimbun, March 31, 2012)

(6) Toho Gas

On March 30th, Toho Gas revealed its business plan for the fiscal year 2012. The gas sale is expected to increase in three consecutive years with a target of 3,900,002,200 m^3, a 1 % rise from the estimate for the last fiscal year sales. For Ene Farm, the target is set 1,300 units, a 10 % rise from the last year. Toho Gas will create a new sales section dedicated to promote Ene Farm combined with other equipment such as photovoltaic generators with 20 members of staff. (The Chunichi Shimbun, March 31, 2012)

(7) PanaHome

On April 5th, PanaHome announced the introduction to the market of a highly environmental conscious house Casart Famio from April 6th. The combination of a photovoltaic generator, a heat pump water heating EcoCute using a natural heating medium and Ene Farm allows the house to be energy bill free. The house comes with insulation under the floor and in the wall covering to the foundation and an automatic ventilation system sensing the temperature difference between outside and inside, and also the thermal gradient under the floor contributes to the ventilation. A model plan (total floor space 127.86 m2) is 25.77 million yen. (The Nikkan Kogyo Shimbun, April 6, 2012)

(8) Hiroshima Gas

Hiroshima Gas revealed the business plan for the fiscal year 2012 and medium term management plan from the fiscal year 2012 to 2014 on April 6th. The gas sales target is 518 million m^3, a 1.1 % rise from the last year sales due to the influence of the economic stagnation. The targets for home gas equipment are 2,700 units for central heating with water heating, 4,200 units for heating appliances and 220 units for Ene Farm. The sales figure for Ene Farm was 35 units in the fiscal year 2010 and 105 units in the fiscal year 2011. The sale for the fiscal year 2012 is expected to be double of the previous figure. (The Chugoku Shimbun, April 7, 2012, The Denki Shimbun, April 9, 2012)

7. Cutting Edge Technologies of Next Generation Cars (EVs, EFCs):

(1) Aichi University

Aichi University has come to an academic agreement in the automobile field with Tsinghua University, Beijing, China. They will jointly research infrastructure development for promoting next generation cars such as FCVs and the industrial policy. Aichi University aims to expand its automobile research which feeds the economy of China and Japan and to attract good students and researchers. With the agreement, the Department of Automotive Engineering of Tsinghua University and International Center for Chinese Studies of Aichi University will have regular meetings. Aichi University will provide search results such as a change in the industrial structures by growth of the next generation cars. On the other hand, Tsinghua University will organize information to create a direction of technology development and provide the information for both universities' research. (The Nikkan Kogyo Shimbun, March 16, 2012)

(2) SIM-Drive

SIM-Drive (Kawasaki city), a venture company on

EV development from Keio University, revealed its second EV prototype SIM-WIL on 28th. Using Panasonic's lithium-ion rechargeable battery (LiB), the prototype is improved by 30 % of battery capacity to 35 kWh and cruising range per charge by 30 % to 351 km in JC08 mode, and retains cabin space of a large car. SIM-Drive plans the mass production by 2014. (The Nikkei, March 29, 2012)

(2) Meidensha and Sumitomo Electronic Industries

With the Sumitomo Electronic Industries, Meidensha will make its way into the capacitor business for automobile. They jointly developed a product, a third of the conventional capacitors size, with Sumitomo Electronic Industries' Aluminum Celmet which is high conductivity porous aluminum which is also light in weight. Meidensha plans to introduce the product into the market by the fiscal year 2015, targeting for environment conscious cars such as EVs and HVs. The product allows a reduction in size and price of high-cost batteries, which is expected to lead cars towards higher performance and a lowering of prices, reduced-size and improved efficiency. (The Nikkei, March 29, 2012)

(4) Nissan

On April 5th, Nissan Motor revealed its first EV concept vehicle "LE Concept" of its luxury line Infiniti at the New York International Auto Show. The car contains a wireless (contactless) electricity charging system and is to be mass produced within two years for the US market. The CEO Ghosn aims accumulated sales of 1.5 million units for EV combined with Renault by fiscal year 2016. (The Nikkei, April 6, 2012)

(5) Japan Automobile Research Institute (JARI)

JARI has estimated the CO_2 emission of the domestic automobile industry in 2050. With the Cost and Effectiveness Assessment Model for Automobile Technologies (CEMAT), the figure was worked out taking into consideration future fuel consumption by technology, prospected vehicle unit, prospected fuel demand on automobile with the consideration for social responsibilities such as a traffic flow improvement, a result of environmentally conscious way of driving, greenhouse effect gas emission and vehicle and fuel price. The share of EV and hybrid vehicle (HV) in the passenger vehicle market is expected to reach 50%. The next generation of conventional automobile is expected to have improved fuel efficiency due to a battery and FC system enhancement. In contrast to the conventional vehicle rising in price due to technology to improve fuel efficiency, the price of next generation vehicle is anticipated to go down due to mass production. The unit sales of the next generation vehicle are expected to expand to 48 % for the passenger vehicle and to 56 % for large and medium size truck with diesel HV or natural gas. The CO_2 emission while driving is expected to be reduced by 55% as compared with the fiscal year 2005 for the passenger vehicle and by 36 % for the large and medium size truck, which would be 47 % reduction overall in the automobile industry. (The Chemical Daily, April 4, 2012)

(6) Yamanashi Kotsu and Iwatani Corporation

With the cooperation of Iwatani, Yamanashi Kotsu will start operating bus running on hydrogen in early April. The bus takes 38 passengers and has six hydrogen canisters on its roof connected to a diesel engine. It can drive 150 km with full canisters. In the first two years of the experiment, it will run within Kofu city for the first year and Iwatani will supply its hydrogen gas in a truck. Yamanashi Kotsu will make a final decision for the full-scale operation with the experiment date. (The Nikkei Business Daily, April 4, 2012)

8. Technology Development and Commercialization on Hydrogen Filling Station:

(1) Iwatani Corporation

Iwatani has decided to employ a compressor of Linde AG (Munich, Germany) in its hydrogen filling station for commercialization. The compressor having achieved high pressure 70 MPa recently and having already been used in the US and Germany, Iwatani evaluated it would reduce the initial cost of the filling station. Also, the construction and operation cost for the filling station will be reduced combined with Iwatani's liquidized hydrogen. Hydrogen gas needs to be refrigerated to -40℃ before being put into 70 MPa cylinders, to prevent a temperature rise, a so called precool process. On the other hand, liquidized hydrogen creates very low temperature hydrogen gas, without precool process, which allows a saving of the facility cost. (The Nikkan Kogyo Shimbun, March 26, 2012)

(2) Osaka Gas

Producing hydrogen from coal gas, Osaka Gas will develop a hydrogen production facility in a larger size to be profitable for business use by 2013. Although they have already hydrogen production facilities of 30 Nm^3/h and 100 Nm^3/h in use, a facility of 250 Nm^3/h is under the development because production levels of these smaller facilities do not reach the profitable level. The larger facility will enable the filling of 70 cylinders in a day, which would just reach the profitable level. Osaka Gas expects the production cost to be 100 million yen or less. (The Nikkan Kogyo Shimbun, March 26, 2012)

(3) Honda

On March 27th, Honda announced that a hydrogen filling station had been installed in the site of the Saitama prefectural office. Honda also delivered its FCV, FCX Clarity, for the joint demonstration experiment with the prefecture. The filling station produces 1.5 kg of hydrogen in 24 hours from water with electricity generated by a photovoltaic generator. Honda developed the smaller and quieter filling station by eliminating the need for a compressor to create high pressure. The filling station fills the cylinder of the FCV with 24 hour production of hydrogen in three to four minutes, and then the fuel allows the vehicle to drive approximately 150 km. The filling station does not emit CO_2 during the production and supply of hydrogen. As contractors of Ministry of the Environment, Honda and Saitama prefecture will collect data such as the electricity production of the photovoltaic generator. Having invertors in its trunk, the FCV supplies maximum 9 kW electricity for over 7 consecutive hours with the hydrogen in the cylinder. (The Nikkei, The Denki Shimbun, The Nikkei Business Daily, The Nikkan Kogyo Shimbun, Tokyo Shimbun, The Chugoku Shimbun, The Saitama Shimbun, Fuji Sankei Business i, March 28, 2012)

9. Technology Development of Producing and Purifying Hydrogen:

(1) Tomamae Town, Hokkaido

On March 15th, the Mayor Mori of Tomamae town, Rumoishi announced an experimental plan for producing liquidized hydrogen by wind power. A liquidized hydrogen producer Hrein Energy of Sapporo city will cooperate with it. Installing the production facility in the electricity generator room in a town's wind power facility, Tomamae will examine the practicality of the liquidized hydrogen production with such methods as electrolysis of water by wind generated electricity for approximately one year. There are 42 wind power generators including three town owned generators in Tomamae; however, the town sells all the electricity to Hokkaido Electric Power as it does not have grids to distribute the electricity. Tomamae has been looking for an effective usage of the wind generated electricity for the coming end of the power selling agreement in the end of the fiscal year 2016. (The Hokkaido Shimbun, March 16, 2012)

(2) National Institute of Advanced Industrial Science and Technology (AIST)

AIST has revealed a new highly efficient catalyst which reversibly converts hydrogen gas and CO_2 to formic acid (HCOOH), jointly developed with Brookhaven National Laboratory, BNL. Hydrogen gas and CO_2 are efficiently converted to formic acid in ambient temperature water solution and under atmospheric pressure, and then formic acid is converted to provide highly compressed hydrogen. The reaction speed reaches over 10 times and the yield (amount of stored hydrogen) of formic acid is extended over 100 times in milder conditions than with conventional catalysts, and the reversing process of formic acid into hydrogen does not produce additional CO_2. Considerable energy saving is made converting both ways, and the catalyst is expected to contribute to develop a large hydrogen storage system with CO_2. Formic acid, which is liquid at normal temperatures and is composed of CO_2 and hydrogen, has a higher energy density, and has been studied and considered as an easy form of hydrogen material to transport and store. However the CO_2 conversion process requires high temperature and pressure and consumes large amount of energy, which have been issues to be solved. Also, an improved is needed on the energy efficiency of the reaction for storing and releasing hydrogen. AIST achieved production of formic acid combining CO_2 and hydrogen in water solution and under 100 □C and atmospheric pressure for the first time in the world. They also achieved a release of carbon monoxide (CO) free hydrogen in the most efficient way. The new catalyst, which is hybrid

of proton response and proton relay types, is a combined technology of the reaction mechanism analysis of artificial photosynthesis and hydrogen activation technology with proton relay model of BNL with catalyst expertise of AIST. Proton response type hydroxide carried out near iridium, the catalyst, activates hydrogen molecules by the interaction of iridium and hydroxide. Further improvement is required for commercialization on the cost of iridium, a minor metal, the time to store hydrogen on amount of hydrogen stored. (The Asahi Shimbun, The Nikkan Kogyo Shimbun, The Chemical Daily, March 19, 2012, 2012, Nikkan Jidosha Shimbun, March 21, 2012)

10. Development and Commercialization of Direct Methanol Fuel Cell

(1) Panasonic

Panasonic has started a demonstration experiment for a hybrid portable generation system consisting of DMFC and LiB. DMFC has been studied and developed as a battery for mobile devices for several years; however, it has not yet succeeded in the market. Toshiba once introduced a DMFC product in 2009 but did not produce the batteries in the following year and concluded the sales with the first 3000 unit production. Panasonic aims its generation system for portable usage introducing into the market to replace engine generators by improving the output. A DMFC outputting 100 W was developed based on the technology built from the prototype outputting 10 to 20 W. As the surface area of the electrodes was expanded to provide higher output, the fuel and air were not adequately distributed, which caused unstable generation. The problem was solved by improving the fuel and air flow and developing an air supply control system without a flow sensor. Furthermore, the DMFC reached to the high output level of maximum 1 kW by combined with LiB. A high power DMFC requires a large volume of minor metal catalysts such as platinum, which pushes price of products up. DMFC has long generating hours per fuel but cannot raise output quickly. On the other hand, LiB provides high power output in an instant for a momentary drop, which contributes to minimizing the amount of the catalyst. Taking both advantages, the generator stably outputs high power for long hours. Panasonic targets this quiet and fumeless product for night time road works which want to avoid noise, and medical facilities which aim to avoid odor or dirty air. (The Nikkan Kogyo Shimbun, March 16, 2012)

(2) Hitachi

Hitachi, Ltd has developed a high quality polymer electrolyte membrane for DMFC. Methanol, the fuel, unintentionally goes through polymer electrolyte membrane with conventional DMFCs, which decrease the generation efficiency. To solve this problem, Hitachi focused on the mutual relationship between methanol penetration and absorption rates with respect to polymer electrolyte membranes, and improved the molecular structure of the membrane, an engineering plastic, which prevents the membrane expanded when coming into contact with methanol solution. As a result, the penetration rate has been reduced to half of that of the conventional membrane, and hydrogen ion conductivity was approximately tripled, which leads an improvement of the generating efficiency. The generation efficiency of DMFC is generally 20 to 25 %; however, the efficiency is estimated to rise by approximately 5% with the new membrane. The product is targeted to be applied for portable generators and power source. (The Nikkan Kogyo Shimbun, March 26, 2012)

11. Survey on Energy Saving

Hokkaido Eco Life Suishin Kyokai (promotional association) has announced the result of the survey on energy saving which was conducted on the visitors of Kateito Chikyuni Yasashii eKadenno Hiroba (home and the earth friendly electronics plaza) held in six places in Hokkaido from last November to January, 2012. 652 people provided their answers. 8.25 % of people say that they are more conscious of saving energy after the Tohoku earthquake. For facilities they would like to install in their homes; 27.8 %, the highest number, asked for a photovoltaic generation system, 17.6 % would like an energy efficient electric heat pump or condensing boiler (EcoCute, EcoJozu), 8.0 % would like a home FC and 1.4 % suggested a gas engine generator unit for the home. (Dempa Shimbun Daily, March 13, 2012)

— This edition is made up as of April 9, 2012—