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'Smart Grid/Community' Special

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Japan aims to spread idea of efficient living to the world

The Minato Mirai 21 area (top left) is one of the sites where the Yokohama Smart City Project is being conducted. Top right: A 1 megawatt photovoltaic site using cadmium telluride panels operates at a demonstration site in Los Alamos, New Mexico. Above: A community energy management system is used in an office building in Kitakyushu. YOKOHAMA CITY, NEDO, KITAKYUSHU CITY

Minoru Matsutani
STAFF WRITER

The term "smart grid" began being talked about frequently after U.S. President Barack Obama mentioned it in his so-called Green New Deal policy in 2009.

A definition of smart grid would be a grid to share energy-saving measures. But the term is generally used to describe a community of houses, buildings and other social infrastructures to reduce the energy consumption of the entire community.

Japan's New Energy and Industrial Technology Development Organization, or NEDO, develops smart grid technology, among other technologies related to new energy. NEDO cooperates with local governments and companies around the world in creating smart communities.

"In the past three or four years, NEDO has been expanding overseas projects," said Satoshi Morozumi, director of the Smart Community Department of NEDO's Energy and Environment Center.

In overseas projects, NEDO, which is not a manufacturer but a research and development organization operating mainly through the budget of the Ministry of Economy, Trade and Industry, receives orders on comprehensive smart community projects and places orders to Toshiba Corp., Kyocera Corp., Sharp Corp. and other domestic and foreign companies.

In explaining the merit for local governments to place orders with NEDO instead of directly with companies, Morozumi said the NEDO's role is convenient for both sides — smart grid infrastructure makers and foreign municipalities — because NEDO is a governmental organization and having negotiations between governments concluded first would make the rest of the process smooth for both sides. Not to mention that NEDO can also offer knowhow and technology it has developed independently.

NEDO calls its overseas projects "verification," meaning it develops technology in Japan and verifies if the technology is commercially viable overseas.

"Japanese companies such as Toshiba do smart community business basically only in Japan. NEDO conducts demonstration projects and would like to support Japanese companies to help expand their customer bases," Morozumi said.

"Because they don't do business overseas very much, engineers in those companies do not know much about energy-related regulations overseas," he said, explaining how NEDO can help domestic companies.

Among overseas projects, two in the southwestern U.S. state of New Mexico, in Los Alamos County and Albuquerque, have been launched while others are still in the preparation or negotiation stage.

The Los Alamos smart grid project began operations in August.

In Los Alamos, with a population of 20,000, NEDO offers help to optimize the amount of stored electricity in battery charged from existing electricity sources by controlling battery systems and monitoring electricity demand of households and businesses.

For example, NEDO helped set up a computer system to reduce the charging of batteries during peak electricity demand, such as in the early afternoon in summer when people turn on air conditioners or in the evening when people are home and turn on appliances.

Instead, at the time electricity demand is low, such as overnight, the computer system allows battery-recharging equipment to increase the charging capability.

Also, households have so-called smart meters installed in their houses so that they know how much electricity they consume and how much they owe. NEDO helped set a pricing system in which electricity prices go up when demand is high.

Another feature noteworthy in the Los Alamos project is that NEDO introduced technology currently not used in Japan.

Cadmium telluride is the material used for solar panels in Los Alamos, but the substance is not generally used in Japan due to its toxicity. Cadmium used to be contained in paint and coating materials for auto parts and dry cell batteries, and is the cause of itai-itai disease, which victimized people in Toyama Prefecture from the 1910s to the 1970s. The painful, degenerative bone disease, occurred in those who ate vegetables or drank water contaminated by cadmium.

"Cadmium telluride is actually the most cost-effective material for making solar panels," Morozumi said. "It is allowed for use in (New Mexico), so we decided to use it. If the (Los Alamos) project proves successful, restrictions may be eased in Japan."

Los Alamos county also uses high-speed PLC (power line communication) transfer interception equipment, which is not used in Japan because its effect has not been officially recognized in Japan. The equipment, proposed by NEDO, switches the electricity source from electric power cables to the emergency battery system in case of a blackout.

Without the equipment, Los Alamos' emergency battery system would supply electricity to a whole community via power cables and consequently have to shut down due to excessive demand, Morozumi said.

In Japan and some other places, similar equipment is not necessarily required, depending on the setting and the kind of equipment pre-installed by utilities.

The high speed PLC transfer interception equipment also collects data from the smart meters of each household. Such data will be useful in developing a way to optimize management of electricity use and supply.

The project in Albuquerque, the largest city in New Mexico with a population of 480,000, kicked off in May.

In Albuquerque's project, NEDO helped build an urban smart city with ecological buildings. The project includes the installation of a solar power generator, a cogeneration system, fuel cells and a building and energy management system in the Mesa Del Sol Aperture Center, the model building for the project.

NEDO will verify whether the building is self-operable in case of blackouts and able to optimize electricity use in case of unstable power supply from the solar power system.

NEDO is also collaborating with Sandia National Laboratory, Albuquerque, and Los Alamos National Laboratory to establish standard methods on information security in smart communities and a way to test and operate a power conditioner, or equipment to convert electricity from solar panels and batteries into a usable form of electricity, by itself, according to NEDO.

NEDO has some other overseas projects in pipeline.

On Maui island, Hawaii, NEDO is planning to help maximize the ratio of renewable energy. The project will be in practice in about a year, Morozumi said. Maui is Hawaii's second largest island and has a population of about 100,000.

The project includes the installation of a computer system, dubbed the electric vehicle management system, that optimizes a way to charge electric vehicles by using oversupplied electricity at a time of low demand.

Hawaii's electricity prices are the highest in the U.S. because of high reliance on thermal power, Morozumi said. Wind power is the largest renewable energy power there, but it is unstable, he added. When wind speed is as high as 25 meters per second, power plants stop windmills to prevent them from being broken, he said.

In Lyon, France, NEDO's project will begin in a year or a year and a half, Morozumi said. Lyon is in southeastern France and the area has a population of more than 1 million.

In line with the European Union's effort to raise the ratio of renewable energy to 20 percent, France requires buildings erected in 2020 or later to generate more electricity than they consume, an initiative called positive energy building (PEB).

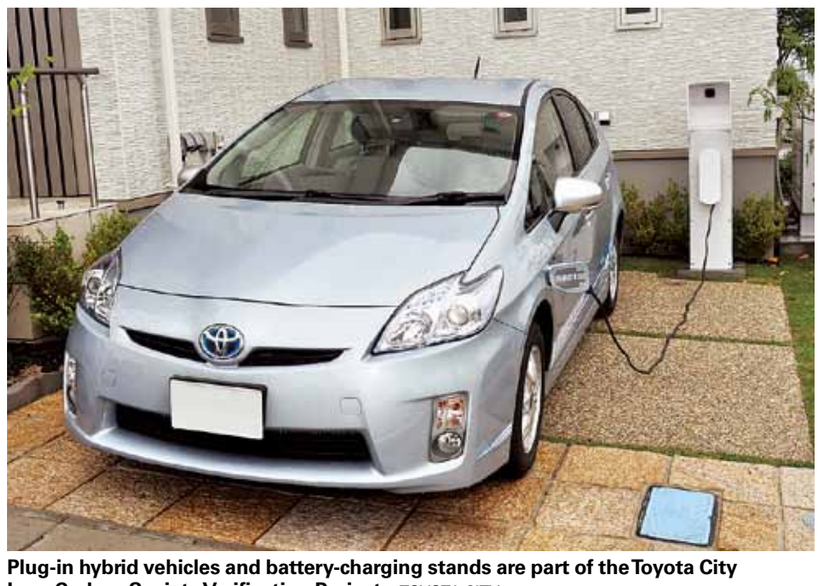
NEDO will help construct the so-called P-plot building, which is a PEB. The building will have many energy-saving features, such as solar panels and a system to visualize how much, when and where electricity is consumed. Also, NEDO will help introduce a system to share electric vehicles in order to reduce carbon dioxide emissions and mitigate traffic congestion.

In Malaga, Spain, NEDO will help install a system to manage the use of electric vehicles and infrastructures for charging station of EVs. The Malaga project will start by March.

In Spain, 40 percent of energy consumption comes from transportation, and the source of the energy is mostly thermal. In order to meet the EU's ecological goal of raising ratio of renewable energy to 20 percent by 2020, Spain aims to increase the number of EVs to 250,000 by 2014.

In this special supplement, The Japan Times has asked experts in the field to talk about the smart grid concept in more detail and how it applies to communities in Japan and around the world. Such "smart communities" may be a way forward for the future of energy use and sustainability.

Residents, workers and students of Kashiwanoha Campus City, who are involved in the smart city trial projects, participate in the community's picnic event in April 2009. URBAN DESIGN CENTER KASHIWANOHA



Plug-in hybrid vehicles and battery-charging stands are part of the Toyota City Low-Carbon Society Verification Project. TOYOTA CITY

第３種郵便物認可

'smart grid/community' special

What is a smart grid and why is it important not only in Japan?

Shigeyuki Koide
SPECIAL TO THE JAPAN TIMES

Power grids connect the electric power plants with houses, offices and other social infrastructures.

The term "smart grid" would refer to such a system that can help conserve energy.

A smart grid, however, is not just a physical network, but also a way a community is structured to improve the efficiency of the supply and consumption of electricity.

Voltage and frequency — two major properties of electricity — are maintained under a rigorously controlled system. If either of the two become out of order, precision machinery in factories will fail to operate or electric transmissions will be blocked, causing blackouts. To prevent this from happening and to distribute electricity more efficiently, the whole transmission network from power generating stations and substations that transform voltage levels to final consumers should be connected employing information and communications technology. This is the basic concept of a smart grid.

Think about blood and the human circulatory system, which is supported by our heart and cardiovascular system. To keep the bloodstream flowing to the peripheries of our body, blood pressure and pulse are controlled on a steady basis. Feedback from each organ on blood requirements are processed by the brain and nervous system, which can be described as the computing and communications network within the human body.

Also, we see a similar structure to this in the distribution of goods from manufacturers, wholesalers and retailers to consumers, where production adjustment, stock clearance and feedback on retail sales should be properly performed. Today, there are moves to control the life-cycle assessment — from raw materials procurement, production, consumption to disposal — through computer software, which is among the many areas where "smartification" is being applied.

The term smart grid moved into the limelight with the so-called Green New Deal policy of U.S. President Barack Obama. The U.S. government started promoting the reconstruction of electricity grids in the country to employ smart grid technology.

The U.S. power infrastructure spans a large expanse of land. Without upgrades, some grids have become older, sometimes leading to frequent blackouts. So the degree of confidence in the electricity supply network was not high. Particularly in sparsely populated regions, stabilization of the electricity supply is required. Through the American Recovery and Reinvestment Act of 2009, a smart grid-related investment subsidy program was launched, which encourages the installation of smart meters that manage and show the electricity consumption.

Before the U.S. started its push toward the implementation of smart grids, Europe, had begun efforts on grid optimization technology in the 1990s with the deregulation of electricity.

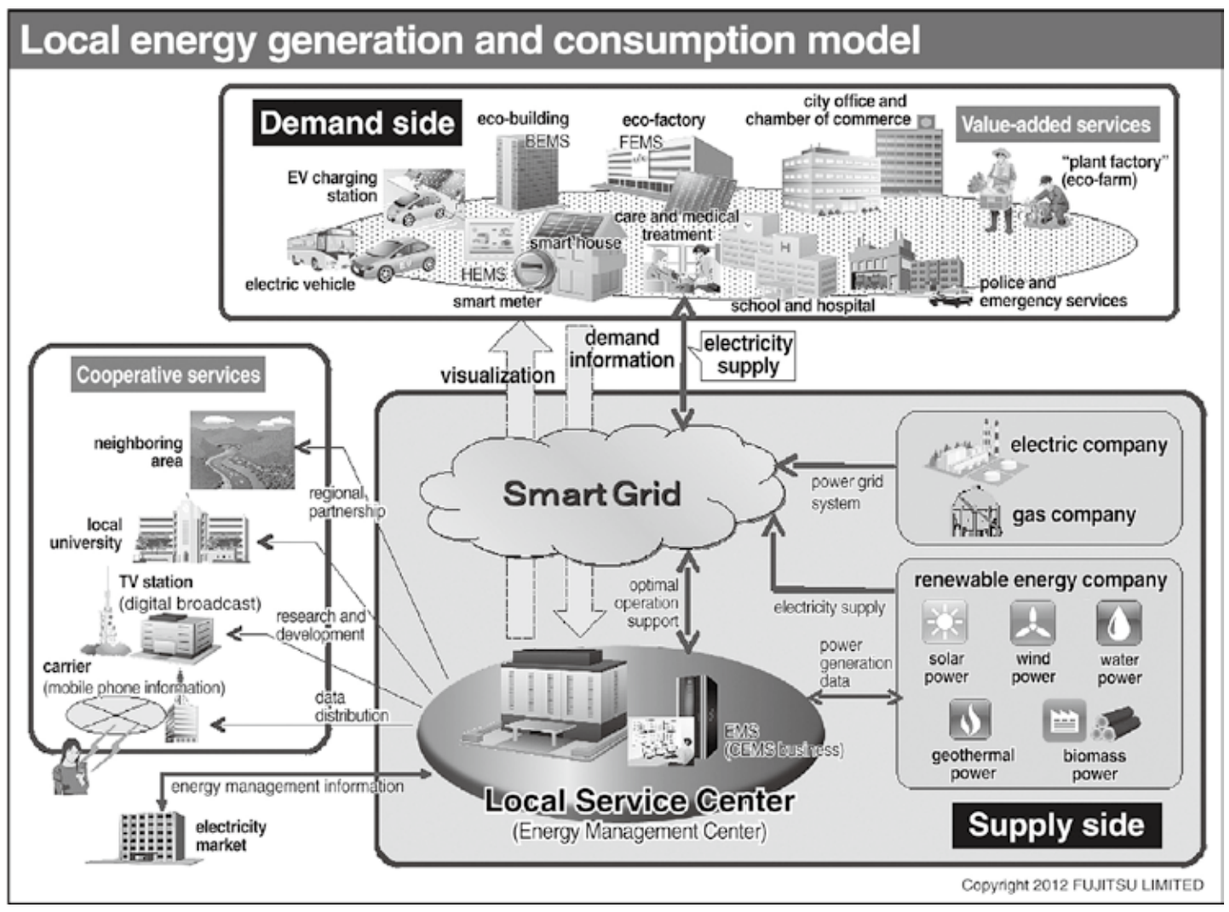
For example, in Denmark, the development of nuclear energy was rejected in a 1984 referendum after the oil shock. Riso, the nation's nuclear research institution was then reorganized as Riso DTU National Laboratory for Sustainable Energy, which embarked on expanding wind power generation and developing power line communication systems. However, wind power generation depends on weather conditions, causing changes in voltage and frequency to the power distribution grid.

In order to overcome these challenges, Denmark started wind farms nationwide, connected them to wind power plants and national grids, and trial projects to control voltage and frequency with computers started.

In 1999, I interviewed the spokesman of the Danish Energy Ministry, who said: "Even though wind turbines in some regions of the country may not be moving on certain days, there is never a day when all the wind turbines throughout Denmark stop generating electricity. Based on this meteorological data, we have developed this network."

With the expansion of electricity liberalization, the electricity grid of Denmark is connected across borders to a huge power network covering the Nordic countries of Norway, Sweden and Finland. While Denmark depends on 20 percent of its electricity from wind power, the nation maintains an environment insusceptible to wind variations by being part of the regional network, in which the rate of wind power is as low as 3 percent.

In contrast, Spain shares only 4 percent of its maximum electricity demand with a foreign power network. Spain is actively promoting the introduction of wind power generation to increase the ratio of renewable energy in the country. In 2011, wind power generation accounted for 21 percent of all electricity generated in Spain. To prevent wind power from causing disturbances to the power distribution network, the Control Center for Renewable Energies (CECRE) was established in 2006. The center is connected to 21 wind power generation control centers and developed the Maximum Admissible Wind Power Generation System (GEMAS), a program that controls the amount of optimal wind power generation by analyzing climate conditions taking into account electricity supply and demand. With such a program, the country is transforming its power network into a smart grid.



An example of a conceptual model envisioning a future society employing smart grid technology.

"Wind power generation, which is not able to ensure a stable supply on a steady basis due to weather conditions, can be regarded as a negative demand of electricity," said Takashi Ishihara, a professor of civil engineering at the University of Tokyo. "The above-mentioned system for controlling wind power generation can also be called a smart grid system. This program is indispensable for Japan to expand wind power generation. Japanese electric companies should introduce it to the country as soon as possible."

For Japan, the evolution of smart grids in the country could be said to have begun after the oil shock in the 1970s. Japan then started the development of renewable energy just as Denmark did. The ministry known today as the Ministry of Economy, Trade and Industry (METI) and the New Energy and Industrial Technology Development Organization (NEDO) launched the New Sunshine Project and started exploring the possibility of making a major shift to alternative energies such as wind power, solar power, geothermal power and energy from biomass. This was the beginning of such a development project in Japan.

Meanwhile, there has been strict quality control over the electricity grid in Japan under the Enforcement Orders of the Electricity Business Act, which sets down that the allowable power fluctuation range for voltage is between 95 volts and 107 volts and that the frequency variation should be controlled between plus or minus 0.2 hertz and 0.1 hertz. Simply connecting an unstable renewable energy source to the existing electricity supply network would not be allowed under such controls.

Since 2000, trial projects in Japan aimed at connecting a decentralized power supply, such as wind power or photovoltaic generation, to the existing electricity grid and further to each home went into high gear, but the systems are not yet ready for practical use.

On the other hand, trial operations of smart meters, which encourage consumers to realize and adjust their electricity consumption at home, are forging ahead in various locations. In this field, the Japan-U.S. Collaborative Smart Grid Project started this year, which is receiving attention as showcasing the world's first progressive approach.

The project features experiments to control the electric current in the power network and to keep the fluctuation range of voltage and frequency as narrow as possible by installing large-scale stationary batteries and energy-managing smart meters on the demand side, including each household, while connecting the network to large-scale photovoltaic generation, which changes its output depending on weather conditions. NEDO and electrical and electronic equipment manufacturers from the Japanese side and the New Mexico state government and the Los Alamos National Laboratory overseen by the U.S. Department of Energy are collaborating on the project.

Satoshi Morozumi, director of the Smart Community Department of NEDO's Energy and Environment Center, emphasizes the importance of taking the lead in standardization.

"With the spread of smart grids around the world in the future, global standardization of technology including the communication protocol is indispensable. In order for Japanese technology to be of greatest assistance to the world, it is necessary for us to contribute to establishing the de facto global standard through international demonstration projects such as in the U.S.," Morozumi said.

The Great East Japan Earthquake and the accident at the Fukushima No. 1 nuclear power plant in March 2011 had a big impact on Japan's energy strategy. It accelerated the development of energy sources other than nuclear-generated electricity, as well as the making of normal power grids into smart grids.

Among the government's trial sites in the push for efficient use of energy, Kashiwanoha Campus City in Kashiwa, Chiba Prefecture, is going ahead with a smart city project installing smart meters in each household. One resident of the area says that he has become accustomed to seeing the display on the smart meter, which makes him think about how he is using energy.

Many of Japan's nuclear power plants are located in remote areas that are suffering from a declining population and employment issues. Furthermore, most of the energy that is generated there is consumed in the big cities. The people of the areas that supply the electricity have continued to implore that people who live in big cities should give more than a passing thought to what areas are the sources of their electricity. Where and with what kind of efforts is the energy being generated? The spread of smart grid technology is likely to have a civilizing influence on consumers who had been previously been unaware.

Shigeyuki Koide, a former science editor at the Yomiuri Shimbun and a former visiting researcher at Imperial College London, is a freelance science journalist.

A view into life in a smart city, as seen at Kashiwanoha Campus City

Chiho Iuchi
STAFF WRITER

With the increasing attention to the "smart city" concept, which takes advantages of information technology-controlled power grids and renewable energy, businesses and governments are launching various field operation test projects at home and abroad. While the technological aspects, business models and export potential have been much talked about, the idea of a smart city is still unrealistic for most people. What is it truly like to be a resident living in such a community that employs cutting-edge systems and technologies?

One of the nation's largest smart-city complexes, Kashiwanoha Campus City in Kashiwa, Chiba Prefecture, a project built by real estate company Mitsui Fudosan in cooperation with the University of Tokyo and Chiba University, will serve as a pioneering example.

"We did not know about the smart city-related projects when we decided to live in this community," said Kyohei Ueda, 31, who has resided in an apartment in Kashiwanoha for a year and half. "We just decided based on commuting distance and transportation convenience."

"And the space. It's roomy here," added his wife, Chiyuri, 31, who gave birth to their first child three months ago.

Opened in 2007, Kashiwanoha Campus City is already home to around 4,000 residents in some 1,300 households, unlike other projects in Japan that are still in the trial stage.

Prior to moving in, the Uedas received an explanation about the home energy management system, or HEMS, which graphically represents carbon dioxide emissions of each household.

"But I just thought to myself, 'Uh-huh, is that so?' at that time," Kyohei Ueda said.

However, once they started living with HEMS, it turned out to be very useful.

"The system tells us how much electricity we use from hour to hour, whereas we used to learn only the total amount upon receiving the monthly electricity bills," Ueda said.

Kyohei Ueda, a resident of Kashiwanoha Campus City in Kashiwa, Chiba Prefecture, checks the smart meter of the home energy management system at his home. SHIGEYUKI KOIDE, CHIHO IUCHI

Ueda showed the wall monitor that is integrated with the intercom. The monitor keeps track of carbon dioxide emissions based on the amount of electricity, gas and hot water consumed.

"It's all easy to use. Just touch the panel and it displays our energy consumption as a carbon dioxide emission equivalent," Ueda said. "It also has a ranking function that tells our achievement in reducing energy consumption among the 400 participating residents. We rank in the middle," Ueda said with a laugh.

The system is connected to the Internet as well and the residents are given more detailed information on their computers.

According to Ueda, the electricity bill usually cost over ¥10,000 when they lived in Tokyo. This went down to around ¥7,000 after moving to Kashiwanoha. In the aftermath of the March 2011 disasters, power shortages occurred and rolling blackouts were introduced in some areas.

"So we were particularly careful about our way of using electricity last summer," Ueda said.

"This summer, we used the air conditioner more than last year, because we now have a baby," Chiyuri Ueda said. "But we keep our electricity expense within ¥9,000 per month.

"For example, if we use the dryer for laundry, the electricity cost jumps. So I avoid using it when the weather forecast says it's going to be sunny the next day. I have become more conscious of the weather."

Besides the energy management system within each household, there are various projects, such as a bicycle-sharing system, electric vehicle-sharing system, flower planting and urban agricultural programs with the University of Tokyo, as well as lectures on sustainable designs at Chiba University, organized and supported by the public and private sector.

"I feel that a new town is now developing with us," Kyohei Ueda said.

An elementary school student and a senior citizen learn agriculture with a university student using tablet computers during a Kashiwanoha community activity organized by the University of Tokyo's Research Center for Advanced Science and Technology, which is involved in various demonstration experiments. URBAN DESIGN CENTER KASHIWANOHA

'smart grid / community' special

Electric vehicles promote sustainability

Japanese innovation in field can spread globally, but smart grid technology needed to charge batteries

Masaru Yarime
SPECIAL TO THE JAPAN TIMES

Sustainability concerns long-term constraints on various types of resources, including energy as one of the most critical issues at the global level.

The automotive industry, accounting for a considerable amount of energy consumption in the world, is particularly facing a significant challenge to embrace sustainability in its activities. This challenge has placed the automotive industry into a period of transformation, characterized by increased variation, experimentation and uncertainty. The electrification of automobiles, such as in vehicles powered by hybrid engines, fuel cells or batteries, has been under way as one of the approaches to address sustainability from a long-term perspective.

As electric vehicles are significantly different from conventional vehicles with internal combustion engines, the automotive industry is currently under strong pressure to innovate. As innovation involves technological, policy and institutional aspects in integrated ways, it is of critical importance to take a systemic approach to encouraging the development and diffusion of electric vehicles.

In the past, technological change in the global automotive industry has been considerably influenced by environmental regulations introduced in the United States, the largest automotive market in the world. The Clean Air Act, which was considered as one of the most stringent environmental regulations in the world, was enacted in the U.S. at the beginning of the 1970s. Under this legislation, the auto industry was required to reduce the amount of emissions of carbon monoxide, hydrocarbons and nitrogen oxides by 90 percent. Honda, for example, focused on using its expertise in engines for technological development and became the first automaker to succeed in complying with the stringent Californian target of reducing emissions through the development of a new type of engine, CVCC. Other auto companies, such as Toyota and Nissan, on the other hand, later developed a new type of catalyst, called the three-way catalyst. Nevertheless, the two technological approaches to coping with the strong requirement of reducing automotive emissions remained within the paradigm of conventional internal combustion engines, constrained by the existing knowledge base.

In 1990, the Low-Emission Vehicle regulation introduced by the California Air Resources Board required that seven large automobile producers, namely, General Motors, Ford and Chrysler of the U.S., and Toyota, Nissan, Honda and Mazda of Japan, sell zero-emission vehicles (ZEVs) as a percentage of their total sales, which was to increase from 2 percent after 1998 to 5 percent after 2001 and 10 percent after 2003. The ZEV regulation introduced in the U.S. initially encouraged Japanese automakers to develop electric vehicles, particularly battery-powered cars, as they were considered to be the only option available in the industry. As the battery technologies at that time were not sufficient for commercialization, however, it was necessary to explore other technological options that could meet the stringent target of the ZEV regulation.

Since the middle of the 1990s, Japanese companies have been very active in applying for patents on hybrid cars. Toyota was particularly active in developing alternative vehicle technologies and experimented in various types of technologies on electric vehicles. Having worked on electric cars and nickel-metal hydride battery technologies, the company accumulated knowledge and used it in revitalizing the development of hybrid vehicles in-house. As the company released its first hybrid car, the Prius, on the market in 1997, hybrid cars began to take off, and Honda started to develop technologies on hybrid vehicles. Then other major automotive producers, including Nissan, Fuji Heavy Industries, and Mitsubishi Motors followed in applying for many patents on hybrid cars. Large suppliers to automakers, such as Aisin AW and Denso, key suppliers to Toyota, are also included in major applications. Since the early 2000s, Toyota, Nissan, Honda and Mitsubishi Motors, as well as large Japanese electric and electronic manufacturers producing batteries, which include Hitachi, Sanyo Electric and Panasonic, have started to make numerous applications for patents on electric cars.

The extent to which leading automakers are moving toward commercializing electric vehicles has been exerting a considerable impact on the automotive sector, shifting the technological trajectory and transforming the structural environment for the whole industry. Electric vehicles, which include multiple options of hybrid and fuel cell as well as battery-powered vehicles, are quite distinct from conventional gasoline vehicles. The former technology critically depends on the performance of batteries, motors, inverters and control systems, which have been traditionally beyond the expertise of automakers. Therefore, it is becoming increasingly important to incorporate different types of knowledge that are not necessarily created in-house for successful development of electric vehicles. Inter-company relationships constitute one critical channel to produce and share new knowledge, either through a limited number of close relations like those between the Japanese automakers and battery producers, or a multitude of more open relations as in the case of U.S. counterparts. The strong Japanese position in battery technologies has facilitated the first step for a potential paradigmatic shift toward electric vehicles.

Recharging large amounts of electric vehicles clustered in specific areas would require additional power supply and charging stations, which leads to substantial costs incurring. Hence, a large diffusion of electric vehicles will require a major innovation to the electricity grid so that its control and management can be done more efficiently.

The main function of the smart grid is to optimize the electricity grid by efficient use of information for measuring and controlling end-points, which will enable the optimization of energy production, transmission, storage and use. When equipped with smart equipment that allows the uploading as well as downloading of electricity from batteries, they can be used to store energy and serve as a reserve of power during the time electric vehicles are dormant. Used batteries can also provide their remaining power capacity for other uses, such as backup stations, which implies extending their economic value beyond their life in powering electric vehicles. Under vehicle-to-grid operations, batteries connected for recharging can also provide backup power for a number of purposes, including contingent load in the event of failure of a generating unit connected to the grid, frequency regulation for fine-tuning the necessary instantaneous balance between supply and demand on the grid, reactive power for providing local phase-angle corrections important in AC networks, and load-following reserves, which is particularly important to back up and absorb variations in power provided by renewable energy sources such as wind and solar.

In the aftermath of the Fukushima disaster, the Japanese electricity sector has faced a serious challenge of imminent supply shortage. The electrification of mobility offers off-peak demand, which will be coupled with uncertainties on the extent of benefits and complexities of involving vehicle batteries in grid storage. As electric vehicles have started to be connected to electricity networks through the smart grid, this systemic innovation also requires active involvement of other relevant actors, such as utility providers, electric and electronic manufacturers, housing construction firms, and construction companies. Many of them have not been engaged in close collaboration with the automotive sector before and would have different interests and incentives, which may not necessarily be compatible with each other.

A key challenge for the large-scale deployment of electric vehicles will be how to implement effective integration of various types of knowledge and expertise possessed by these diverse stakeholders. The emergence of social experiments for establishing robust business models in many parts of Japan will provide valuable lessons and implications for corporate strategy, public policy and institutional design in moving toward sustainability across the globe.

Masaru Yarime is an associate professor of the Graduate Program in Sustainability Science of the Graduate School of Frontier Sciences, University of Tokyo, Kashiwa Campus in Chiba Prefecture.

Visitors look at new cars on display at the 42nd Tokyo Motor Show held at Tokyo Big Sight on Dec. 3, 2011. KYODO

A Nissan Leaf's battery is charged at a station in Central Point, Oregon, in March. AP

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TOYOTA

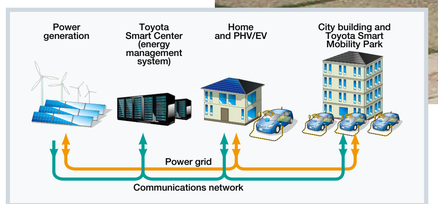
Power Gets Smart

The future of our planet depends on using energy wisely and intelligently.

To combat global warming we must reduce carbon dioxide production. There are two ways to do this. First, we need to shift increasingly to renewable energy, which produces little or no net carbon dioxide. Second, we need to use all types of energy more efficiently.

As a car manufacturer, Toyota is in a position to contribute to this effort in several ways. We have a responsibility to make environment-friendly vehicles and have led the way with the Prius and other gasoline-electric hybrid cars, followed by our new Prius PHV plug-in-hybrid vehicle and eQ electric vehicle. We are also continuously improving the fuel economy and emissions of our conventional powertrain vehicles. However, we plan to go beyond the vehicle level and apply on a considerably broader scale the energy-management expertise we have gained from making hybrid cars.

Specifically, we are working toward a future society of "smart mobility", with "smart houses" and "smart communities" all linked together in a smart energy-management system. This comprehensive solution goes beyond the functions of a smart grid in the usual sense. It does more than simply prevent blackouts and flatten peaks and troughs in the supply of electrical power. It also spurs a widespread switch to alternative energy and encourages energy-saving, green lifestyles. We have already started putting this plan into action in our home town of Toyota City, Aichi Prefecture, Japan.



Plug-in hybrids and electric vehicles will play key roles in building a smart grid that helps all of society save energy

Toyota City Low-Carbon Verification Project

To demonstrate the feasibility of this smart grid, we launched the Toyota City Low-Carbon Verification Project in August 2010. Participating in the project are 32 municipalities, companies and organizations, including Toyota City and Toyota Motor Corporation. Planning for the pilot project began after Toyota City was selected by the Japanese Ministry of Economy, Trade and Industry (METI) as a Next-Generation Energy and Social System Demonstration Area in April 2010.

The project's mission is to improve resident satisfaction and promote a low-carbon society, while preserving the environment and reducing infrastructure development costs. Besides optimizing both household and personal-vehicle energy use, project goals include constructing a low-carbon public transportation system under control of a Traffic Data Management System (TDMS).

To predict and manage energy consumption and provide auxiliary support functions, the project uses a specially developed energy data management system (EDMS) and home energy management system (HEMS). At the heart of this system is the Toyota Smart Center, which allows people to see on TV screens and mobile handsets their household power consumption and energy storage as well as PHV or EV charging status.

Living the Energy-Efficient Life

The project's stated target is to reduce CO_2 emissions from each home by 70% or more, compared to 2005 levels. Current results show a CO_2 reduction of 69.3%, thanks to all-inclusive energy optimization at the household and community level.

In each "smart house", a HEMS links energy-generating devices (solar cells, fuel cells, etc.) and energy storage devices (storage batteries, heat-pump water heaters, etc.) with next-generation vehicles (PHVs and EVs) and intelligent household appliances. The smart houses in this project are built to precise energy-saving standards by Toyota Housing Corporation and equipped with LED lighting and advanced household appliances selected for their environment-friendly performance. Each house also comes with a Prius PHV supplied at no additional charge. So far, 67 smart houses have been sold to families in Toyota City participating in the project.

At the community level, the EDMS links homes, businesses, schools and other entities via the Toyota Smart Center to coordinate and balance electric power supply and demand while promoting local production of energy for local consumption. For example, if the system predicts a shortage of locally generated solar power, it can advise residents to limit energy consumption. Desirable behavior is rewarded through an eco-point incentive system.

In addition to managing PHV and EV charging from household electricity via an H2V (home-to-vehicle) system, the project will test V2H (vehicle-to-home) supply of electric power from motor vehicle batteries. PHV and EV batteries have a large capacity that can store excess power from the home and from the community. Specifically, low-carbon electricity (green electricity) from regional or home solar or wind generators (or low-cost, late-night electricity) is stored in vehicle batteries and then used to supply power to the household during peak consumption times. In this way, vehicle batteries can contribute to efficient energy usage and, when necessary, support regional energy autonomy by acting as mobile power sources during emergencies or other times when an autonomous energy supply is needed.

Toyota Smart Mobility Park is a next-generation vehicle charging station powered by renewable energy. Linked to the Toyota Smart Center energy management system, it will function as a hub to manage electricity used for transportation and to support future car-sharing systems.

Smarter mobility extends to safety and fuel efficiency with ITS (intelligent transportation systems) technology that links vehicles and infrastructure. ITS can help prevent accidents, improve traffic flow and promote eco-conscious driving. Toyota is participating in ITS projects in collaboration with government agencies and academia.

Collaborating Around the World

To take full advantage of the potential of PHVs and EVs and increase use of renewable energy and maximize efficiency in electric power distribution, we need to switch to a smart grid. Toyota is collaborating with technology partners and authorities to develop and test smart grids in North America, Europe, China and Japan.

http://www.toyota-global.com/innovation/

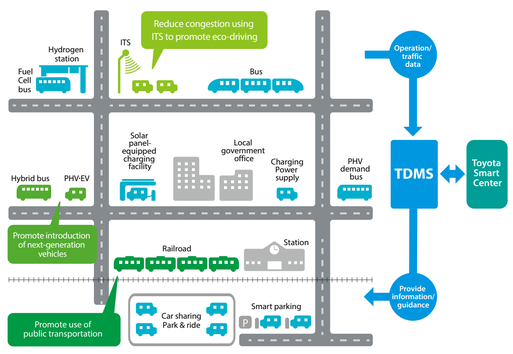
PHVs and EVs: A Challenge and an Opportunity

Although hybrid vehicles generate and store their own electricity as they run, electric vehicles need to be plugged into an electric outlet or charging station to recharge their batteries. The wide-scale adoption of PHVs and EVs will greatly increase consumption of electricity by households and businesses. If people choose to charge their cars at the same time, it could exceed grid capacity. Electric vehicle charging could also trip circuit breakers in the home if other high-amperage appliances such as air conditioners or water heaters are also in use. The good news is that PHVs and EVs can serve double duty as storage batteries, supplying electricity to homes when extra capacity is needed. An advanced smart grid achieves both goals — flexible handling of increased power demand and the application of PHVs and EVs to supplement the power supply.

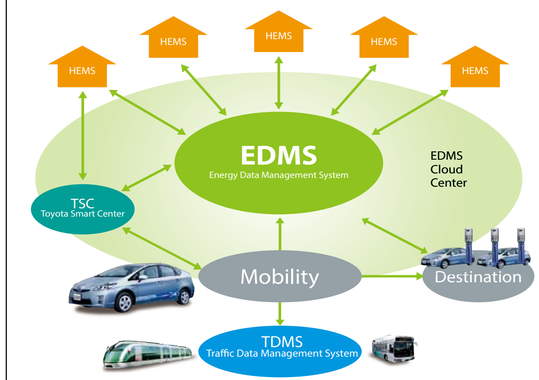
New joint smart grid project slated for Indiana, USA

In early 2013 Toyota will participate in a smart-grid pilot project in Indiana, the United States, in cooperation with Duke Energy and Energy Systems Network (ESN). The one-year project will seek to equalize day-and-night power-grid load and establish an optimized vehicle-charging scheme. Toyota will provide Prius PHVs for regular use by selected consumer households in the project. These households will also be equipped with a charging station and a home gateway communication system to allow monitoring and optimization of charging. The project will evaluate the performance of the communication system between vehicles and the grid, and examine the effectiveness of the charging-management system.

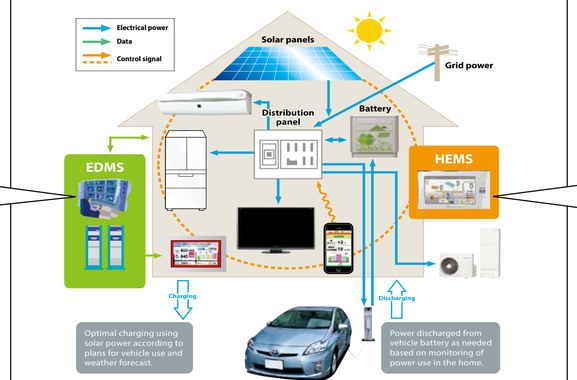
Traffic Data Management System (TDMS)



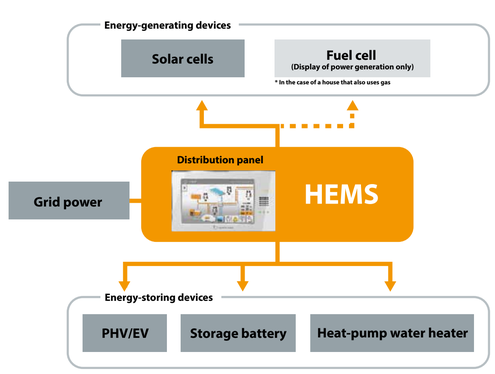
Energy Data Management System (EDMS)



Vehicle to Home (V2H)



Home Energy Management System (HEMS)



第３種郵便物認可

Yokohama City

(Publicity)

Yokohama shares growth experience with the world

Y-PORT project provides local governments from across the globe with knowhow, consultations regarding infrastructure, development

Minoru Matsutani
STAFF WRITER

Despite the name, the Yokohama City government's Y-PORT project is not about a port, though it might be easily assumed since Yokohama is one of Japan's largest ports and well-known for having prospered as an international trade center since the 19th century.

Y-PORT, which stands for Yokohama Partnership of Resources and Technologies, is one of Yokohama's midterm projects that Mayor Fumiko Hayashi has made a priority. It is about providing local governments in the world with Yokohama's knowhow to install the social infrastructure necessary to handle a rapidly growing population.

"Yokohama is one of very few cities in the world that have experienced a rapid increase in population, subsequent rapid deterioration of the urban environment and success in handling such situations. We the city government, companies and residents have together made efforts to create a win-win situation for everybody," said Norihiko Nomura, director general of the Office of Co-Governance and Creation of the Yokohama Policy Bureau.

"It's a very rare and valuable experience globally for a local government to have," he said.

The pace of population growth in Yokohama is much faster than in Tokyo and Osaka, and thus, installation of social infrastructure that is necessary to accommodate a growing population such as sewage systems and garbage processing systems must also be much faster, Nomura said.

And Yokohama's former pace of growth is "very similar to the current pace of large cities in Southeast Asia," he said, explaining why Yokohama has much to share with such Asian cities.

Yokohama City's population doubled from 1.37 million in 1960 to 2.77 million in 1980. The growth rate has decreased since then, but the population has steadily increased to the current 3.69 million, second most in Japan after Tokyo.

However, the percentage of households and businesses with accessible sewage services was about 2 percent in 1960 and 20 percent in 1980, according to Yokohama City. It is now near 100 percent.

People with no access to sewage systems were dumping dirty water into the sea and rivers, which made the city suffer from serious pollution, Nomura said. Yokohama had to deal with the situation and did so quickly, he added.

The city also had problems with air pollution and traffic jams, which have been solved by expanding infrastructure networks including efficient public transportation systems throughout the city, he said.

Large Asian cities realize that Yokohama has such experiences that they can refer to in dealing with their own problems. Officials from local governments around the world, mainly Asia, visit Nomura's office for consultations, he said.

In Y-PORT, Yokohama City collaborates with engineering companies, infrastructure makers and other companies involved in urban development, which have headquarters and branches in the city, to help Asian cities tackling problems caused by a sudden increase in population.

Among the companies that have signed on to collaborate in Y-PORT are global engineering companies such as JGC Corp. and JFE Engineering Corp., which makes water purifying facilities, recycling plants and other social infrastructures, and Chiyoda Corp., a company providing services related to clean energy.

These companies will seek business opportunities in Asian countries while Yokohama City can support such tax-paying entities. The city receives no direct monetary benefit through this project.

Nomura said Yokohama City will be a good liaison for companies to obtain legitimate inquiries from Asian cities because it can give them proper advice as an operator of infrastructures, while companies tend to give advice only from a manufacturer's viewpoint.

There have been no concrete examples of Y-PORT programs yet, but Cebu City in the Philippines and Yokohama City are close to initiating some concrete deals.

In a prelude to the Y-PORT project, Yokohama and the Japan International Cooperation Agency in October last year announced JICA's collaboration with Y-PORT. JICA will initiate urban development plan formulations in various Asian cities while the City of Yokohama will provide technical advice to cities based on a variety of experiences that Yokohama has accumulated so far.

In March, Yokohama and Cebu signed a memorandum of understanding on comprehensive collaborations, in which Yokohama provides advice on ecological urban development, with the support of JICA.

In late July and early August, both city officials and employees of related companies went to Cebu to exchange information.

"Soon, we may be able to announce something concrete," Nomura said.

Cebu is the fifth most populated city in the Philippines, with 718,821 residents in 147,600 households. The average temperature ranges from 23 to 33 degrees Celsius and annual precipitation is about 2,000 millimeters. Damage from typhoons is relatively less than in other places in the Philippines.

Five Yokohama City officials, 32 employees of 20 companies and a faculty member of Yokohama City University, who went as an observer, visited Cebu. The companies represented included JFE Engineering, Nissan Motor Co. and NTT DoCoMo Inc.

They inspected river pollution and garbage collection areas, and exchanged opinions with local businesspeople and municipal officials.

Cebu's needs are to make rivers clean, set up sewage systems and establish garbage processing systems, Nomura said.

Another city that Yokohama is close to beginning to support through the Y-PORT project is Bangkok.

The capital of Thailand and Yokohama have previously had various connections in urban development.

Since 2009, Bangkok officials have come to JICA's Yokohama center to learn about Yokohama's efforts in reducing carbon dioxide emissions. They learned how to operate energy-efficient buildings and social infrastructures, Nomura said.

"Especially, they are interested in reducing the number of cars by strengthening their train and other public transportation systems. They are also interested in increasing greenery in the city," he said. "Those are Yokohama's strong points."

The urban development that Yokohama wants to highlight in environmental technology can be found in the Minato Mirai 21 area, which hosts Landmark Tower, Japan's tallest building. Other facilities in the development include the Yokohama Red Brick Warehouse, a structure over 100 years old renovated to serve as a shopping and dining complex, the sail-shape hotel the InterContinental Yokohama Grand in the Pacifico Yokohama convention complex, department stores and amusement parks.

The Yokohama Smart City Project is involved in taking care of Minato Mirai 21's ecological environment. The YSCP has been selected by the Ministry of Economy, Trade and Industry as one of its Next-Generation Energy and Social Systems Demonstration Areas.

In Minato Mirai 21, structures equipped with many ecological features are connected to an energy and information grid, meaning they share energy sources and information with wired and wireless connections. Many buildings have solar power generation systems, efficient sunlight-gathering mechanisms, heat-insulating surfaces, high-reflectance coatings, rooftop and wall greenery, and other measures that help save electricity.

Those structures also have systems to gather rainwater to mix with wastewater for recycling. Tiles on walkways are made of material that collects and retains rainwater, which keeps surface temperatures low.

The Minato Mirai 21 and surrounding waterfront areas also have several small-size wind turbine power generators as well as the large "Hama Wing" wind power generator. The area uses many LED lights, which are initially expensive but save on future electricity costs, and has charging stations for electric vehicles.

In another ecological effort, Yokohama City boasts its residents' high standard in reducing the amount of garbage by 42 percent, exceeding the original target of 30 percent, from 2004. This was achieved simply through frequent notifications to residents on the proper methods to separate waste into cans, plastics, paper materials and others.

The increase in recyclable items has led to an increase in recycling companies enjoying economies of scale. The flourishing of such companies means better services, making it even easier for residents to recycle.

"Waste categorization is very important because the recycling business would not go well without it," Nomura said.

Yokohama Mayor Fumiko Hayashi (left) shakes hands with Cebu Mayor Michael Rama of the Philippines at the Yokohama City Government building in Naka Ward on March 28 during the ceremony to sign the memorandum of understanding on technical cooperation for sustainable urban development. Right: Officials from Yokohama City and Japanese companies based or with branches in the city take part in a business matching session that Cebu City, the local chamber of commerce and other business groups jointly organized in the Philippine city on Aug. 1. YOKOHAMA CITY

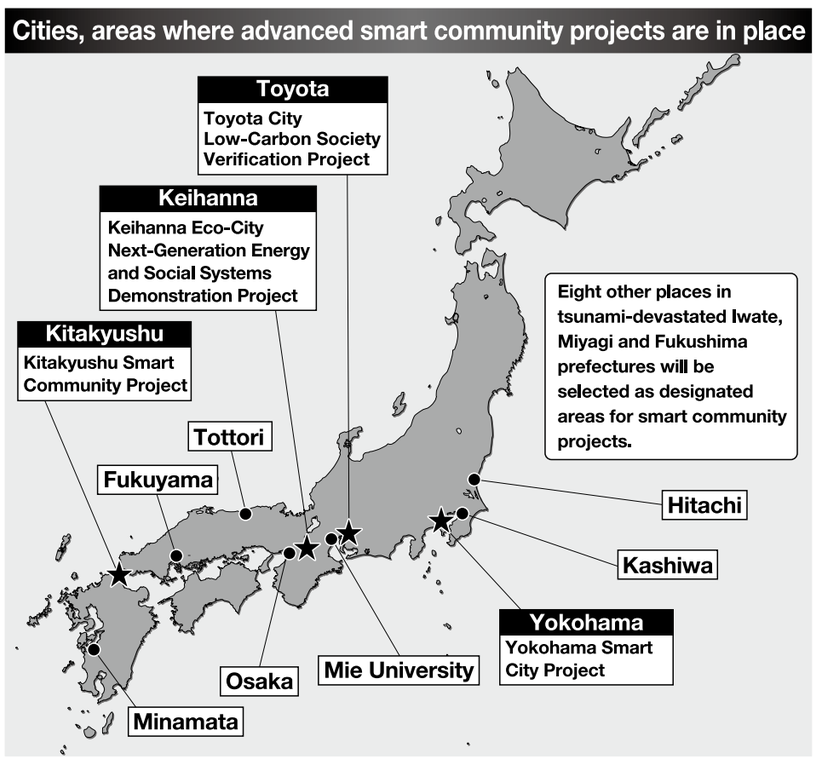
Norihiko Nomura, director general of the Office of Co-Governance and Creation of the Yokohama Policy Bureau, shows off the Minato Mirai 21 area, the main venue of the Yokohama Smart City Project, in Yokohama on Sept. 26. The YSCP has been selected by the Ministry of Economy, Trade and Industry as one of its Next-Generation Energy and Social Systems Demonstration Areas. YOSHIAKI MIURA

'smart grid / community' special

Japan hopes to spread 'smart city' idea through demonstration areas

An aerial view shows the Keihanna area, which straddles Kyoto, Osaka and Nara prefectures. Right: A woman plugs an electric cord to connect her house and electric vehicle in Toyota City. KEIHANNA ECO-CITY NEXT-GENERATION ENERGY AND SOCIAL SYSTEMS DEMONSTRATION PROJECT COUNCIL, TOYOTA CITY

Minoru Matsutani
STAFF WRITER



JAPANTIMES GRAPHIC

Promoting the concept of a smart community, the idea of which is to efficiently use energy within a locale, is something Japan has thought of for quite some time as the country has always relied heavily on imports of resources such as oil for its energy needs.

It was not until U.S. President Barack Obama mentioned the idea of smart community in his Green New Deal policy in fall 2009 that the Ministry of Economy, Trade and Industry (METI) set up a section to promote the concept in Japan.

METI prefers the term "smart community" to "smart grid," which has also often been used when referring to the smart community concept.

"Smart community sounds like the demand side takes the initiative to create an energy-efficient community, while smart grid sounds like the supply side creates energy-efficient infrastructures," said Yuta Sakaki of the Smart Community Policy Office, Energy Conservation and Renewable Energy Department of the Agency for Natural Resources and Energy, a part of METI. "Our focus is the former."

After thorough discussions with experts in various fields, the ministry concluded it had to create model cases to show to the public and thus decided to subsidize four areas from April 2011, Sakaki said.

Nineteen areas applied for the state subsidy and METI selected four areas that were already advanced in smart community building: Yokohama City, Toyota City, Kitakyushu City and the Keihanna area straddling Kyoto, Osaka and Nara prefectures.

The ministry gave the four areas ¥14.92 billion in fiscal 2011 and earmarked a budget of ¥10.6 billion for the current fiscal year.

METI gave labels to the four areas. Yokohama City is a large-area urban type, Toyota City is a stand-alone house type, the Keihanna area is a condominium type and Kitakyushu is a special supply area type, or an area where there is no local-dominant power company that supplies electricity. In the case of Kitakyushu, the Nippon Steel and Sumitomo Metal Corp.'s Yahata steelmaking factory supplies power.

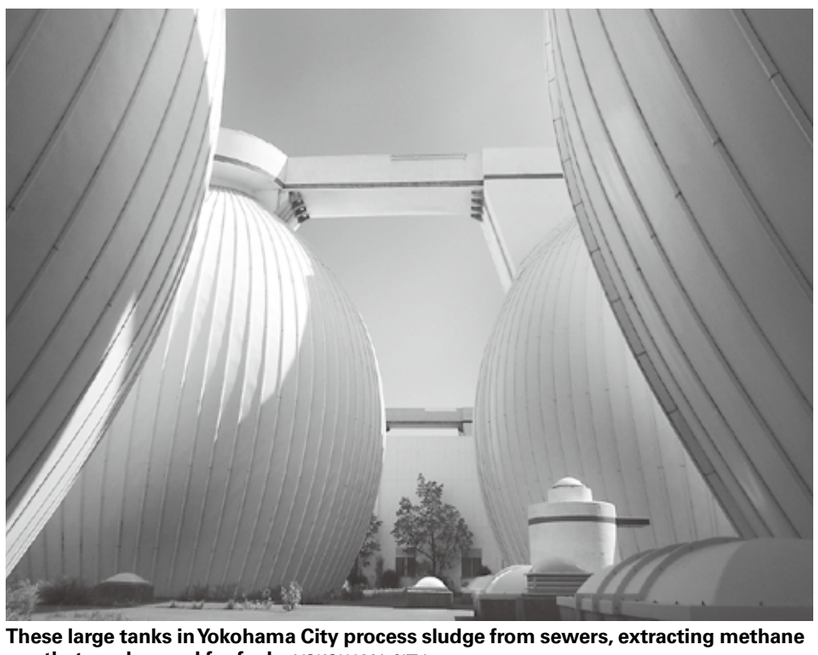
In Yokohama, the Minato Mirai 21 area is the model site, with 4,000 households living there. The waterfront area hosts Landmark Tower, Japan's tallest building. Other facilities in the development include a renovated early 20th century warehouse that serves as a shopping and dining center, a convention center and exhibition hall complex that contains a hotel, department stores and amusement parks.

Yokohama's target is to create 27 megawatts of electricity from solar power generation, install a home energy management system, or HEMS, for 4,000 households and provide 2,000 electric vehicles.

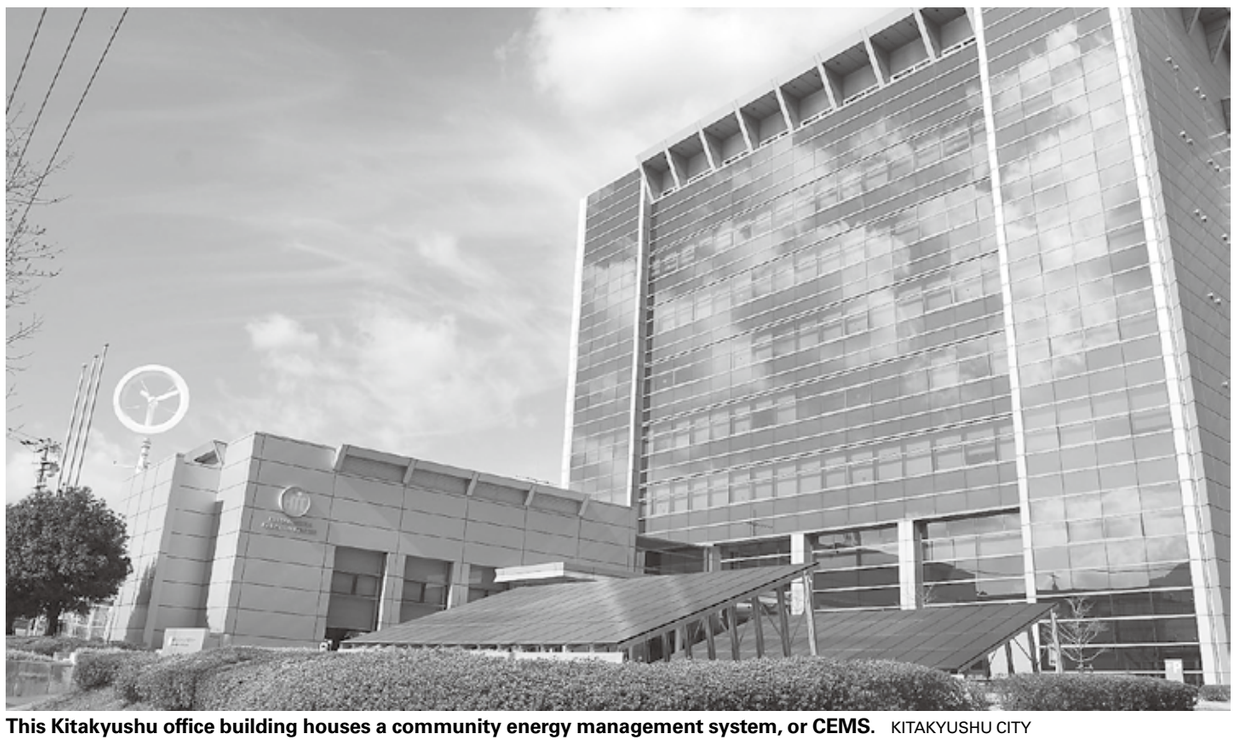
HEMS refers to a system that uses the weather forecast to optimize the operation of power sources. For example, HEMS turns off the so-called Ene Farm, or power generating equipment using gas and kerosene, if the forecast says it will be sunny, and turns it on if cloudy or rainy weather is forecast.

In Minato Mirai 21, structures have been equipped with many ecological features including solar power generation systems, efficient sunlight-gathering mechanisms, heat-insulating surfaces, high-reflectance coatings, rooftop and wall greenery, and other measures that help save electricity. The Minato Mirai 21 area also has several small-size wind turbine power generators as well as the large "Hama Wing" wind power generator.

In Toyota, Aichi Prefecture, 67 houses are the subject of its smart community project. Toyota's focus is to use fuel cells for the houses effectively. Fuel cells are key components for electric vehicles, and the city, the home of Toyota Motor Corp., has many Toyota group companies with fuel cell technology.



These large tanks in Yokohama City process sludge from sewers, extracting methane gas that can be used for fuel. YOKOHAMA CITY



This Kitakyushu office building houses a community energy management system, or CEMS. KITAKYUSHU CITY

Besides fuel cells, the houses have rechargeable batteries and solar panels. The households are supplied with electric vehicles or plug-in hybrid cars, which are cars that can be charged by simply plugging into an electric outlet.

Toyota City's target is to raise the ratio of renewable energy for power generation to 61.2 percent and lets residents use 4,000 electric vehicles.

Currently, 50 percent of the power required by the smart houses comes from their own power generation systems, and Toyota City aims to raise it to 70 percent.

Also in the area of the smart houses, ultra-small electric vehicles will be shared by residents. The city will also enable buses installed with fuel cells to supply power to schools and other facilities in case of natural disasters.

The Keihanna area project is led by Kyoto Prefecture. The project area is home to 900 households. In the area, electricity prices fluctuate daily based on prediction of electricity demand based on the previous day.

The area aims to set up a management system to control energy consumption of the entire community, which includes an electricity and gas supplying infrastructure, public transportation system and many other infrastructures.

Focus on smart community building in condominiums makes Keihanna unique. The 900 households, mainly in condominiums, have tablet devices that give information such as a graph of energy consumption, daily spending on electricity, prediction of the following day's electricity prices and other information that raises the awareness of the households on how they can save energy.

Sakaki said Keihanna is working on adding more features to the tablet devices because their costs generally exceed the savings on electricity bills.

Two examples of the possible additional features are applications that can give advice on skincare by assessing temperature and humidity, and a system to provide information remotely to security companies and relatives living far away to allow them to know when an elderly person living alone does not use electricity at all for a certain number of days. The tablet devices can also have services such as digital data storage and online shopping.

The Keihanna area also provides electric vehicles and installs devices to charge EVs and manage an EV-controlling system. There were 60 EVs in the area as of April.

To selected households, Kansai Electric Power Co., or Kepco, the dominant local utility, gives consultations to see if such advice saves on energy consumption.

In Kitakyushu City, 50 offices and factories as well as 230 households are the subject of its smart community project.

The city set up a system to make electricity prices change every two hours based on the predicted supply-demand situation. The price change can be as big as tenfold.

The area is not provided electricity by Kyushu Electric Power Co., but Nippon Steal and Sumitomo Metal's Yahata steel-making factory.

In two condominiums, storage batteries have been installed and electricity usage is controlled by HEMS. Through these actions, the condominiums have reduced electricity purchases during the day down to almost zero yen.

In some selected houses, hydrogen emitted by the factories is used in fuel cells supplying electricity and heat. Some 40 percent of electricity and 80 percent of hot water used in the houses is from the hydrogen.

The Higashida Clinic in the project area is expected to rely for about 30 percent of its heat usage on solar power in winter, which lets it save electricity costs by about 40 percent.

The project area in Kitakyushu City has already achieved a 30 percent reduction of carbon dioxide emissions from the level of ordinary communities in the city, and through this project the area aims to reduce additional the number by another 20 percent.

Apart from the four areas, METI has earmarked ¥2.78 billion in the current fiscal year to support demonstrations of next-generation energy technology in the following eight areas: Tottori City; Fukuyama City, Hiroshima Prefecture; Minamata City, Kumamoto Prefecture; Sasebo City, Nagasaki Prefecture; Hitachi City, Ibaraki Prefecture; Mie University in Mie Prefecture; Osaka City; and Kashiwa City, Chiba Prefecture.

第３種郵便物認可

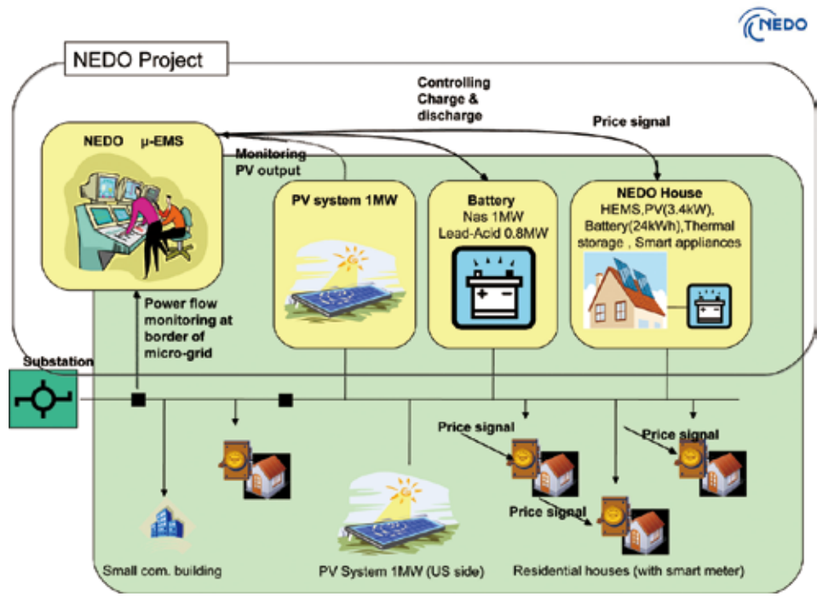
'smart grid / community' special

NEDO collaborates on global projects

Japan-U.S. effort may lead to standardization of smart grid technologies for worldwide use

Construction at a demonstration site in Los Alamos, New Mexico, for the Japan-U.S. Collaborative Smart Grid Project, which is being carried out jointly by the New Energy and Industrial Technology Development Organization (NEDO), the New Mexico state government and other participants, has been completed and full-scale operation has started. The project in New Mexico is NEDO's first overseas smart community project, and its demonstration site in Albuquerque is already in operation.

A launch ceremony is held at the demonstration site in Los Alamos, New Mexico, on Sept. 17, attended by 270 personnel from relevant organizations and companies including NEDO Chairman Kazuo Furukawa, who is holding scissors with New Mexico Gov. Susana Martinez after cutting the ribbon. A smart house (above left) and a 1 megawatt NAS battery system (left) in the Los Alamos site are in operation. A solar energy system operates on the roof of a parking lot (above right) in the photovoltaic demonstration site in Albuquerque, New Mexico. Right: A NEDO graphic of the Japan-U.S. Collaborative Smart Grid Project. NEDO



will be a key element of a community using demand response (the world's most advanced system that will operate in conjunction with photovoltaic power generation forecasting and demand response signals from power grids)

3) Demonstration of a smart building that will be a key component of a smart grid using demand response (a highly functional building equipped with a low-carbon, high-quality power supply system that can stabilize the fluctuating output of photovoltaic power generation systems and is capable of stand-alone operation in emergency situations, such as power outages)

In addition to quantitatively assessing the effectiveness of demand response, the capacity of storage batteries necessary to absorb fluctuations in photovoltaic power generation will be identified through the above activities in order to establish the most suitable smart grid for the environment. Furthermore, it is hoped that the data collected through the project will be utilized in the design of optimum systems for other areas, thereby promoting the rapid deployment of smart grids.

(2) Demonstration in Los Alamos

Following the launch of the demonstration site in Albuquerque on May 17, 11 companies* commissioned by NEDO will carry out smart grid and smart house demonstrations at the Los Alamos site.

Using a newly constructed 1 megawatt photovoltaic (PV) system, the smart grid demonstration will establish an environment that makes it possible to change the introduction rate of PV power by switching three distribution lines. By making the best use of the environment, a combined system of a local energy management system (micro EMS) and demand response for residential houses with 1.8 MW of battery storage will be established for smart house use. The system will demonstrate technologies to absorb PV output fluctuations as well as to harmonize and optimally control the power flow of the distribution lines with the existing power system.

In the smart house demonstration, a home energy management system (HEMS) will be established and demonstrated using a smart house equipped with a 3.4 kilowatt PV power generation system, a 24 kilowatt-hour lithium ion battery, power storage devices such as a heat pump water heater, and smart home appliances, including air conditioners and LED lighting. The HEMS will be used to optimally control power in conjunction with PV power generation and in-home demand forecasting as well as demand response signals from a micro EMS.

Since its establishment, NEDO has carried out activities to develop and introduce renewable energy. Developing a smart community system that can be utilized around the world will require cooperative relationships with organizations overseas, and NEDO is well positioned to play a leading role in the smart community field by promoting international demonstration projects. While cooperating in four national projects in Japan, NEDO is working toward realization of international standardization for smart grid systems through the activities of the Japan Smart Community Alliance.

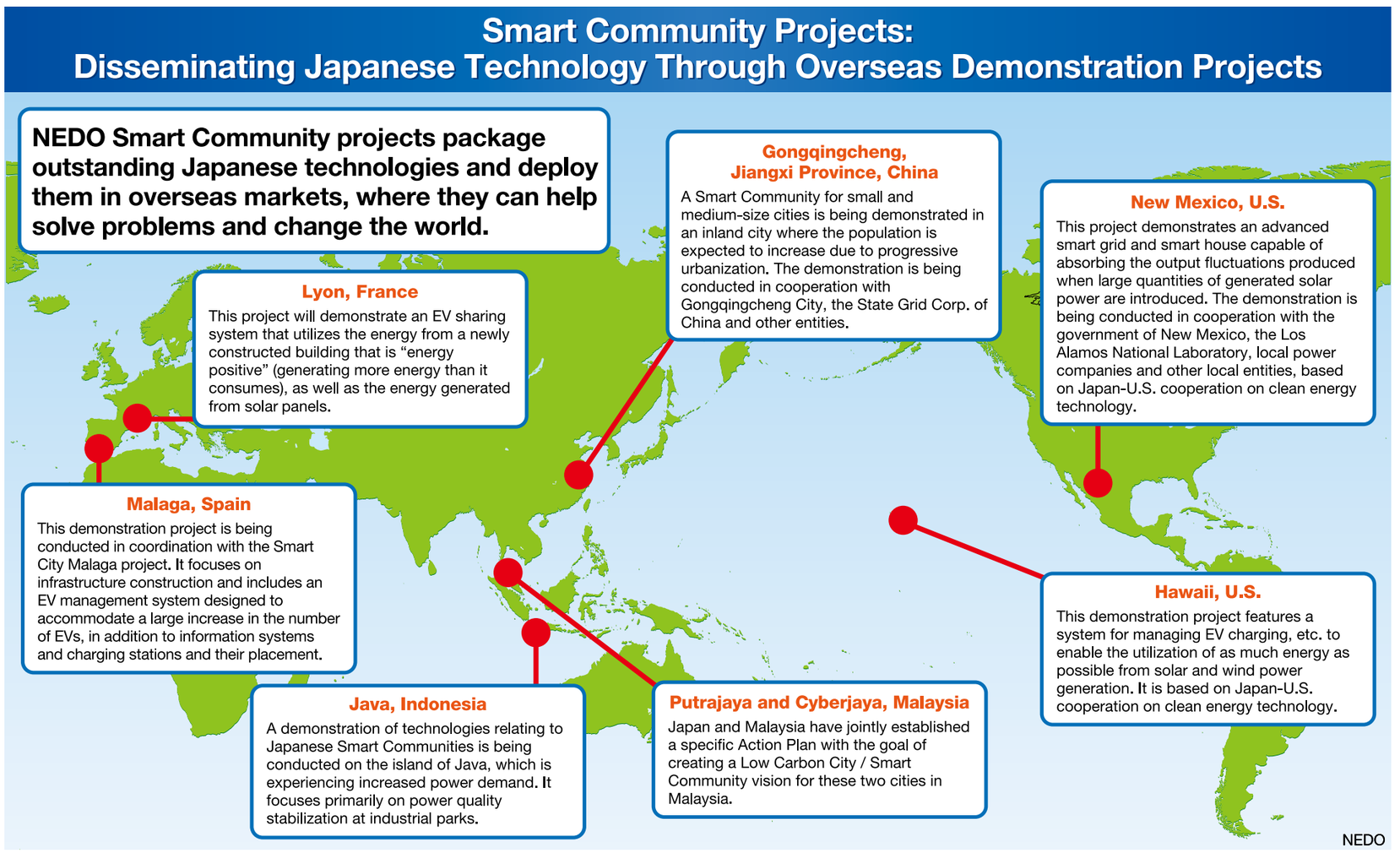
*Companies participating in the demonstrations at the Los Alamos site:

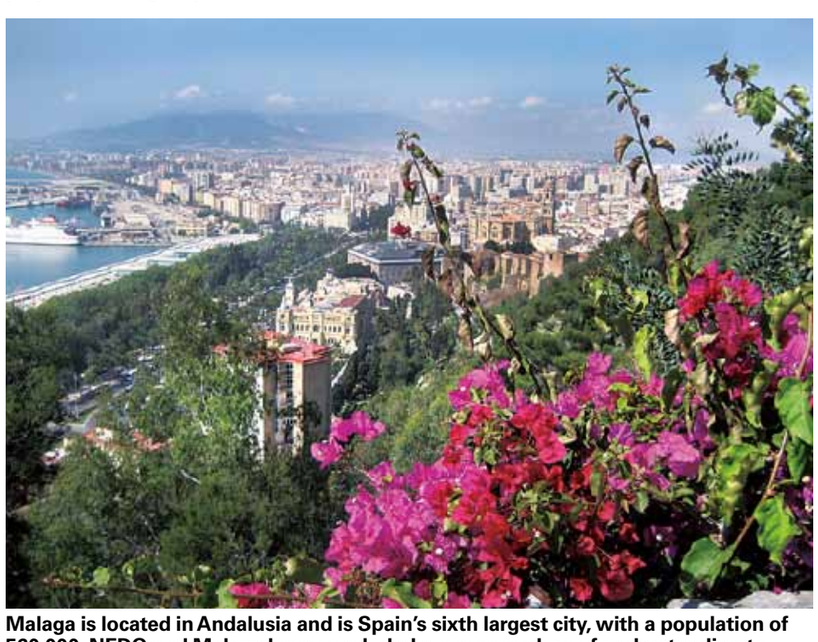
- Toshiba Corp. and Toshiba International Corp. (smart grid demonstration site coordination, micro EMS, comprehensive system)
- Kyocera Corp. (smart house demonstration site coordination, HEMS, large-scale PV)
- Itochu Techno-Solutions Corp. (PV forecasting),
- Sharp Corp. (HEMS, smart electrical appliances)
- NGK Insulators, Ltd. (NAS battery system)
- NEC Corp. (high-speed PLC, equipment to stabilize supply and demand)
- Hitachi, Ltd. (lead-acid battery system, large-scale PCS for PV)

Collective research conducted by Accenture, Itochu, NTT Facilities, Inc., Kyocera, Cyber Defense Institute, Inc., Toshiba, NEC, Hitachi.

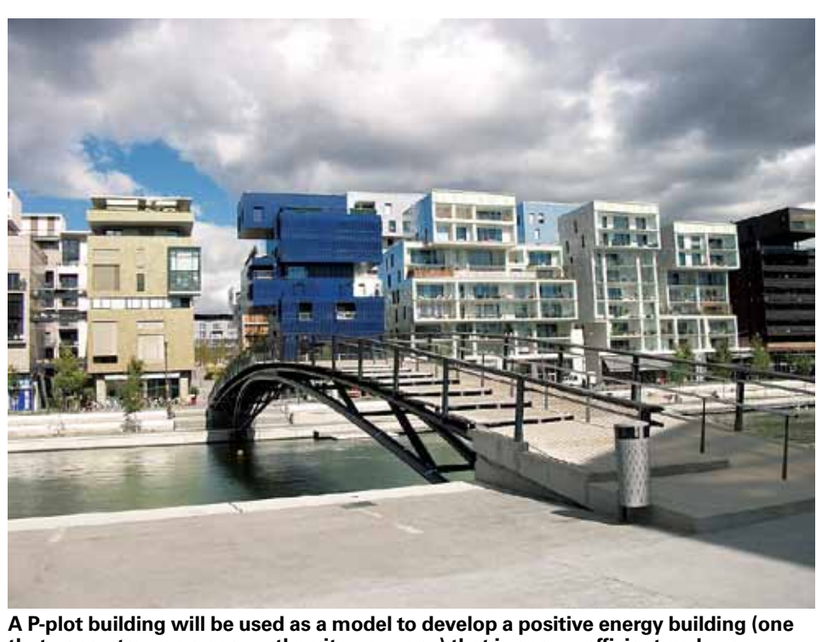
This is an edited version of an article from the official website of NEDO. For more information, visit www.nedo.go.jp.

Electric vehicle chargers, such as the Vehicle-to Grid (V2G) charger (above), and some 200 EVs are involved in a smart community system demonstration project in Malaga, Spain. NEDO





Malaga is located in Andalusia and is Spain's sixth largest city, with a population of 560,000. NEDO and Malaga have concluded a memorandum of understanding to promote a smart community system demonstration project being carried out in Malaga from fiscal year 2011 to FY2015 to introduce and demonstrate technologies for the future large-scale introduction and dissemination of electric vehicles. NEDO



A P-plot building will be used as a model to develop a positive energy building (one that generates more energy than it consumes) that is energy efficient and uses renewable energy. The building will be constructed in a 12,500-sq.-meter area located in the heart of Lyon, France, where Cours Charlemagne and Place Nautique meet, during the first phase of the Lyon Confluence urban initiative. NEDO

Remote islands such as Hawaii share common issues such as inefficient energy security, very high energy costs and environmental restrictions, so the need for renewable energy is greater than in other areas. These areas, however, need to also mitigate the adverse effects on power grids, such as from significant changes in power frequencies caused by the fluctuating output of renewable energy. NEDO