Global Business Dialogue on e-Society

Digital Life Issue Group

Smart Society

"How has the weather been there?"

Before beginning international discussions via television conferences or other types of meetings, it has recently become natural to start with a conversation about the weather. It is a kind of a ritual to confirm we can relax knowing that unusual weather is not restricted to our own country.

According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), announced in 2007, the global surface temperature increased an average of about 0.6 degrees Celsius during the twentieth century. In particular, the twelve years of 1995 to 2006 were the warmest years recorded. Together with the rise in the global surface temperature, moreover, the average sea water level rose by 3.1mm annually since 1993. The report also points out that due to industrialization, the emission of greenhouse gases (GHG) around the world increased by 70 percent between 1970 and 2004. It further points out that new and more powerful evidence shows that most of the global warming observed over the past fifty years is attributable to human activities.

There is concern that associated with global warming there will be a widespread and serious impact on the human and biological environments. In an age such as this, it is imperative that we act for creating a sustainable social environment.

In the context of various discussions concerning the causes of global warming, all member nations at the U.N. Framework Convention on Climate Change (UNFCCC; COP 15) held in Copenhagen, Denmark in December 2009, agreed to the long-term goal of holding the increase in global temperature below two degrees Celsius. All member nations are moving quickly to respond to the agreement, and will provide the UNFCCC secretariat their voluntary goals for reducing greenhouse gasses (GHG).

Figure 1. Voluntary Goals of Selected Nations for Reducing GHG by 2020

Country	Goals	Baseline year
Australia	-5~15% or -25%	2000
Brazil	-36.1~38.9%	BAU comparison
Canada	-17%	2005
China	Based on GDP, -40~45%	2005
EU	-20% or -30%	1990
India	Based on GDP, -20~25%	2005
Indonesia	-26%	BAU comparison
Israel	-20%	BAU comparison
Japan	-25%	1990
Korea	-30%	BAU comparison
New Zealand	-10~20%	1990
Norway	-30~40%	1990
Russia	-15~25%	1990
Singapore	-16%	BAU comparison
South Africa	-34%	BAU comparison
USA	-17%	2005

Note: The BAU comparison is for nations that have introduced no particular measures

As nations move toward reducing GHG emissions, they are paying increased attention to the role of IT.

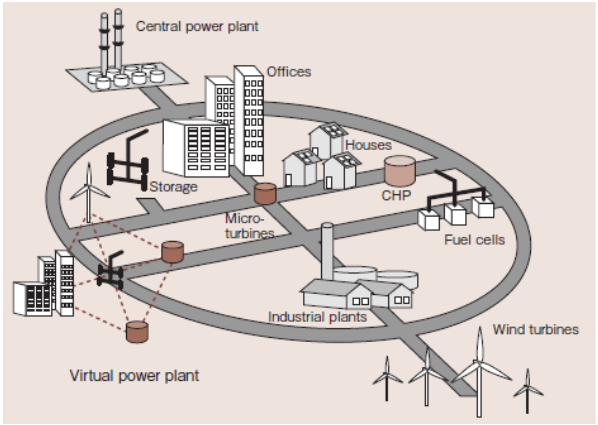
According to Professor Emeritus Yoshio Tsukio of the University of Tokyo (Dr. in engineering), “From an environmental viewpoint, one feature of conventional technology is that in comparison to the increase in convenience and comfort it provides, there is also an increase in natural resources and energy it consumes . Humans walk at a speed of no more than four kph, for example, but they use almost no natural resources or energy in doing so. If they use an automobile that uses gasoline, a fossil fuel, as its motive power, however, they can move faster, at, say, 80 kph, making transportation more convenient. Automobiles, however, consume resources and energy dozens of times the weight of the driver. In comparison, IT can increase convenience and comfort with no comparable increase in the consumption of resources or energy.”

One role IT can play is the “green” initiative that recently has come to the forefront. This refers to promoting green IT, on the one hand, by developing equipment

and systems that consume less energy. It refers to advancing a green society, on the other hand, by having IT used wisely and linking information, thus promoting changes in the structure, mechanisms, and activities of society, and contributing to the suppression of GHG emissions. These two concepts—"Green of IT" and "Green by IT"—truly are keywords frequently used when discussing initiatives for resolving environmental issues centered on IT.

Amidst those general developments, "smart grids" are now being attended to closely. In such grids, interactive electric power and information networks are put into order and real-time adjustments are made to the supply and demand for energy. IT should be widely introduced in power grids that cover everything from electricity consumption in terminal locations at homes and offices all the way to power plants. IT will control electric power and realize a more efficient balance than previously in the supply of and demand for electricity. By minimizing the loss ratio when transmitting electric power, the emission of wasteful CO_2 can be held down, the operating ratio of large-scale power plants—previously, it was difficult to raise the operating ratio of facilities constructed to meet peak demand—can be improved, and dispersed power generation, such as electricity generated using solar power or wind turbines, connected to the power grid can realize a stable supply and smooth flow of power by utilizing information linked by IT. The visualization and control of energy information is the role expected for IT.

Figure 2. Illustration of Smart Grid



Source: Vision and Strategy for Europe's Electricity Networks of Future

The roles and applications of IT in the area of resolving environmental issues are quite extensive. Examples are the collection of basic data (cooperation, visualization, supervision), the processing of data and internal action (processing, control, management, analysis, protection), and providing information to the outside (reports, disclosure).

During this fiscal year, we will introduce our company's initiatives related to changes in digital life from the viewpoint of resolving environmental issues. We will also discuss the degree to which we can contribute to the environment in terms of our corporate responsibility, and what must we do in order to realize results with a greater impact.

●Changes in Business

GBDe was established in 1999 as an association of private companies from around the world meeting to discuss issues related to international electronics business transactions conducted as e-commerce and to make policy recommendations to governments and related industries. One of the founding members was DaimlerChrysler, the global automaker. At the time, one incentive for Daimler to participate in the association was to increase the efficiency of the global e-commerce it was already conducting in the procurement of parts and materials by discussing issues such as taxes and import tariff procedures that arise during international business transactions with a group of companies from diverse countries.

That Daimler wanted to participate in establishing an organization such as GBDe was because from the late 1990s companies were already realizing greater logistical efficiency and productivity by procuring parts and materials via e-commerce after accessing information from companies around the world through networks. At the time, there was almost no discussion about greater efficiency in logistics contributing to reduction of the environmental impact. Today, however, it has been proven that greater efficiency in logistics results in a reduction in CO_2, and many companies are introducing related initiatives for their environmental benefits.

Videoconferencing is an example of positive results being achieved as IT evolves and contributes physically to the environment.

Cisco Systems, Inc., has realized proven results with its in-house videoconference system.

●Videoconferences/Results achieved by Cisco

From 2006, when Cisco began using its Cisco TelePresence System, until March 15, 2009, the company introduced 404 units in its offices in 146 cities around the world. The system's positive results have been proven through statistical data concerning use of the system collected from the earliest stages of introduction, and through receipt of user feedback.

According to data announced in mid-2008, in less than two years after introducing the system, more than 100,000 TelePresence meeting were held, and the resultant savings from averting business trips by employees is estimated to have been as much as $90 million. Viewed in terms of reduced CO_2 emissions, that much less travel computes to an equivalent of 20 million cubic meters of emissions by 8,700 automobiles.

Chart 3. Main Results and Percentage of Use Data as of Mid-2008 for In-House Use of TelePresence System

Statistical data	Main results
Fewer business trips through almost 17,500 meetings	The average number of participants in one meeting was four persons. At an estimated cost of $1,100.00 per person per business trip, that computes to travel expense savings of $90 million. In terms of CO_2 emissions, that much less travel is equivalent to a reduction of 20 million cubic meters of emissions (equivalent to emissions from 8,700 automobiles). *The volume of reduced emissions was computed by considering an average flying distance of 2,000 miles (about 3,200km) for one business trip.
Over 105,000 meetings held ▪13,000 meetings with customers	An increased frequency of meetings with customers pushed up the number of confirmed sales contracts by 2%, and shortened the sales cycle time by 2%. The time it took Cisco to realize revenue from sales was also shortened.

Over 4,800 multi-point meetings ▪ Most common simultaneous connections were with 3-4 locations ▪ Some meetings simultaneously connected more than 10 locations	Improved employee productivity (equivalent to $40 million)

Chart 4. Aims of Cisco TelePresence Meetings

Aims of Meetings	Percentage of total meetings
In-house meetings	38%
Meetings with customers	31%
Meetings to avert travel	30%
Other	1%

There was a good balance in aim between in-house meetings and those with customers. The percentage was almost the same. Concerning meetings held to avert business trips, the statistics do not go so far as to clarify whether the meetings were in-house or held with customers.

Exactly because many of the actual meetings were virtual it became possible for Cisco's managers and engineers to increase the number of meetings with customers. A decrease in business trips by employees that formerly were the primary means of conducting daily business, more efficient internal communications, improved productivity, and an improved sales cycle all resulted in a higher rate of return for the company.

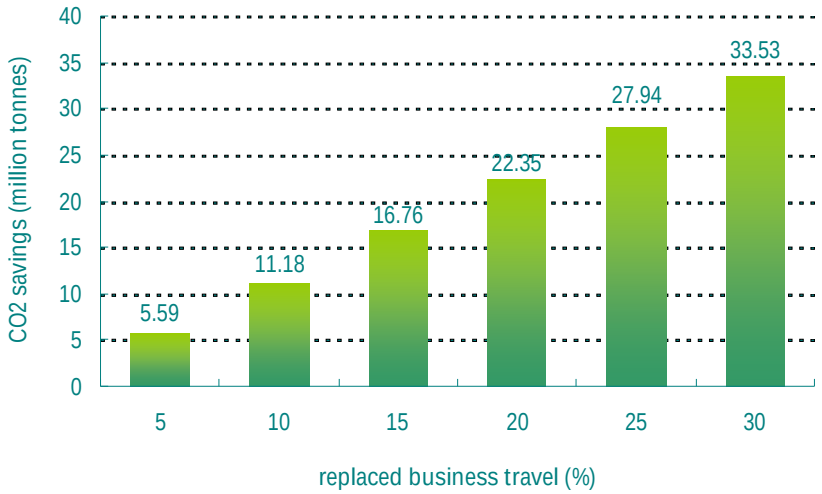
According to Cisco, the decrease in time used for business trip transportation, improved communication with customers, and increased efficiency in internal communication resulted in improved productivity worth the equivalent of over $40 million.

Concerning initiatives apart from those that end inside a single company, there are benefits realized in reducing CO_2 emissions by using ICT for global teleconferencing. In November 2004, for example, the world's largest conservation NGO, the World Wildlife Fund (WWF), and the European Telecommunications Network Operators' Association (ETNO) embarked on a joint initiative called "Saving the Climate @ the Speed of Light." As a link in their activities for requesting policies at the EU government level, they announced in October 2006 a report they prepared titled "First roadmap for reduced CO_2 emissions in the EU and beyond."

http://www.etno.be/Portals/34/ETNO%20Documents/Sustainability/Climate%20Change%20Road%20Map.pdf)

As an example of CO_2 reductions realized from applying ICT within the EU, the report said a 20% reduction of business travel in the 25 countries in the EU through videoconferencing could save 22.35 million tons of CO_2 annually.

Chart 5. CO_2 savings by replacing business travel in Europe



In addition to videoconferencing, the same report quoted also introduced the example of teleworkers(telecommuters). It says if a telework system were introduced to 10% of the workers in the EU-25 countries, it would result in approximately 22 million tons of CO_2 reduction.

As seen in the great changes in the international logistics business driven by the appearance and spread of the Internet and the e-commerce transactions utilizing the Internet, teleconferencing systems and telework will also play major roles in changing business in the future. Even if business trips decrease due to teleconferencing, however, that does not mean airplanes will not fly, although some observers point out there will be more empty seats on airplanes and a related drop in their efficiency. Public transportation, meanwhile, must continue to respond to peak passenger volumes, and it is a fact that the irregular travel patterns of teleworkers may not lead to a decrease in power and gasoline consumption.

There is no doubt that the use of ICT will increase business efficiency. In order to conduct teleconferencing and telework, however, there will be a need to work regularly without using paper, and changes must be introduced in workstyles. Concerning a resultant positive effect on the environment, meanwhile, it is safe to say the current individual initiatives are producing only separate, "orphan" results. In order to realize true results it will be necessary for overall society to change the ways offices are operated and business is conducted and place a priority on the environmental viewpoint.

◯Changes in Car Life

Automobiles depended up to now almost 100% on oil for their fuel. And automobiles are said to account for almost 20% of the total volume of CO_2 emissions in Japan. As global warming turned more critical and initiatives for reducing emissions of CO_2—the substance causing global warming—grew more critical, calls emerged for reducing engine emissions and switching to automobiles with a superior environmental performance. As well, in a situation where the depletion of fossil fuels is imminent and oil prices are skyrocketing, the world is being driven by necessity to quickly establish a society independent of fossil fuels.

Among the various options developed, next-generation electric vehicles (EV) using lithium ion batteries emit zero emissions while running. Even if the CO_2 emitted during the generation of electricity at power plants is considered, the total volume of CO_2 is only about 25% that of gasoline-powered automobiles and less than 50% that of hybrid vehicles (HVs). EVs thus provide the best environmental performance among automobiles currently available, and it has become necessary to promote the all-out spread of their use for preventing global warming, reducing the dependence on oil, and improving the urban environment.

EVs are equipped with many embedded softwares. In addition, in order for companies and individuals to use EVs comfortably, it is essential to build an infrastructure of charging stations throughout Japan. As well, based on the understanding that motorists will charge the lithium ion and other storage batteries mounted in EVs in the night, the linking of automobiles to power grids and information networks will become an important task when considering how to build the most socially acceptable charging system.

In the future, moreover, as a measure for using excess electricity after solar power and other new generating systems are introduced on a large scale, the batteries in automobiles will be viewed as "mobile batteries" such as in the Vehicle to Grid (V2G)

thinking that positions storage batteries as sources of electric power. As automobiles and power grids are integrated in such ways, automobiles can be viewed as infrastructure elements when building smart city systems. When that happens, various IT services will come to be utilized.

Apart from moves related to automobiles in Car Life, another initiative coming to the forefront and headed toward realization is the Intelligent Transportation System (ITS) that utilizes IT to the fullest, such as in easing traffic congestion. Automobiles have long been considered only as a mode of transport, but if they utilize IT they will take on a bilateral nature, and their role in cities and transportation will change.

The following sections introduce two initiatives currently at the verification test level.

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▪ Charging Infrastructure Project in Oregon State (NEC, others)

On August 6, 2010, NEC announced it will begin a joint project with the electric utility Portland General Electric (PGE) in Oregon State in the United States. The project includes a deployment test for quick-charge EV charging stations.

Takasago Machinery Works, a subsidiary of NEC, will install quick-charge stations at the PGE Headquarters in Portland. These stations will comply with the CHAdeMO Association specifications that Japanese companies are aiming to have accepted as the global industry standard. The highest voltage and current available under these specifications is 500 volts and 125 amperes DC. The maximum output is 50kW. Charging a storage battery to 80% of its capacity will take 20-30 minutes.

The deployment test is a link in the EV Project, a large-scale project in the U.S. for installing a charging infrastructure jointly promoted by eTec of the U.S., Nissan Motors, and others. The EV Project was begun in October 2009, and in three years has delivered as many as 1,000 EVs to sixteen cities in Oregon, Washington, California, and three other states, and installed over 2,000 units of 220V charging stations and about 50 quick-charge stations. Surveys and research are being conducted to determine how EVs are used in different topographic and weather conditions, confirm effectiveness of the charging infrastructure, and trial various revenue models in using the charging infrastructure. The U.S. Department of Energy (DOE) provided a grant of $99.8 million for the EV Project in August 2009. Since PGE installed the first EV charging station in July 2008, twenty 220V stations have been installed throughout Oregon. EV drivers use the stations gratis to charge their vehicles.

Figure 6. Charging EVs in Oregon

Source: State of Oregon webpage

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▪ Verification project by NTT Data (Japan) (Effectiveness verification of infrastructure)
In order to promote EV usage, it is necessary to have a common charging infrastructure to allow owners to relax when driving their EVs. In that backdrop, NTT Data initiated a project to verify the effectiveness of charging infrastructure facilities equipped with a user authentication system and an inter-company payment system to determine how multiple corporations and local government entities can mutually use the charging facilities they own separately.

In order to promote EV use in the future, moreover, NTT Data collected information on the actual use pattern of EVs. In this project, NTT Data worked closely with diverse organizations, including electric utility companies, automakers, primary oil distributors, logistics companies, trading companies, local government entities, and extra-governmental organizations. It then analyzed the EV users information, including pattern used, time used, and power consumed.

One result of this project was that an environment was created allowing the different organizations to mutually use each other's charging facilities. EV users applauded the results, saying they could now relax when they use their vehicles. They also said that one urgent task is to put the charging infrastructure environment into order for spreading the use of EVs further in the future.

The following two issues were clarified concerning the installation of charging facilities.

1. The cost burden is heavy for installing and maintaining charging facilities.
2. If a charging infrastructure is prepared impulsively, it will lose some of its convenience to EV users. Such an infrastructure would be quite inconvenient because it also means that drivers would not be able to use facilities other

than their registered ones.

It will be necessary to create a situation where drivers have ID cards verifying that they have permission to charge their EVs anywhere. That would resolve the second issue. For that purpose, the companies creating the charging infrastructure should integrate their facilities and aim to make them part of the social platform.

○Smart Grid—Daily life will change according to changes in delivery of power

As mentioned, smart grids are currently attracting much attention. In addition to making power networks more efficient and its supply more stable by distributing both centralized power transmission from a large-size power plant and dispersed power, a smart grid can also coordinate the use of power at home through EV-mounted batteries. It can store power at night or even store solar power for distribution when needed, Power grids hold the potential for substantially changing our daily lives, and various initiatives have begun in the home and in the city.

●Smart Meter

Smart meters are devices that play a central role in smart grids. They are fitted with a communications function and their use has begun to spread in countries around the world, centered on the U.S. and Europe. One function of digitalized meters used in homes is to collect consumption data related to household equipment using electricity. That allows power suppliers to control, via the smart meters, the amount of electricity needed depending on consumption, and makes possible a range of prices based on the time of day that power is consumed. In Europe, the EU Commission has a goal of 100% use of smart meters by fiscal 2022, and the governments of the member countries are promoting their introduction. The Berkeley Research Group in the U.S., forecasts the global use of 250 million smart meters by 2015.

Smart metering requires a system for receiving data from meters and a system for managing the meters. In the future, equipment and machinery used in a home, including home electrical appliances and lights, will be connected by wireless and wired connections, and communication with them will result in a sophisticated demand/response system that requires an advanced metering infrastructure (AMI).

Many private-sector companies are paying attention to the outlook for integrating large volumes of power consumption data.

In 2009, Google began providing a service called Google PowerMeter in the U.S. and Europe. Google PowerMeter is a free energy monitoring tool that enables energy users to view their home's energy consumption from anywhere online using energy information provided by smart meters. Users can check every ten minutes to see how much power is being used in their homes. Since the amount of power being used is available in real time, it thus becomes possible to adjust the use of appliances or to switch to new energy-conscious appliances.

The webpage for Google PowerMeter contains comments from users. Samples are "26% decrease in energy bills or $1,080 saved per year," "40% decrease in energy bills or $240.00 saved per year," and "20% decrease in energy bills or £133 pounds saved per year." http://www.google.com/powermeter/about/user-stories.html

One question concerning the installation of smart meters is who will pay the installation expenses. As well, much discussion is now ongoing around the world about who will own the power consumption data collected from smart meters. Knowing the amount of power a household consumes makes certain assumptions about that household's lifestyle, and based on those assumptions it becomes highly possible for companies to create new business opportunities. Since having that data involves the issue of personal privacy, meanwhile, it is necessary to be especially careful about the range of data disclosed and the method of disclosure.

●Smart House

In order to reduce greenhouse gas (GHG) emissions and realize a low-carbon society, it is necessary to introduce energy conservation and renewable energy in the home and the office. For promoting the spread of effective energy conservation measures in the home, equipment must be installed that allows smart demand management, such as home-use storage batteries and household appliances capable of providing information to a network. In addition, a system must be built that interconnects the house and ICT so that controlled information from inside the house can be shared with the local area and society. A house with such mechanism is called a "smart house."

Governments and others are currently introducing various initiatives and conducting tests toward realizing smart houses.

For example, based on the premise that there is a limit to what can be done to increase the energy conservation performance of home electric appliances, the Japanese

Ministry of Economy, Trade and Industry (METI) conducted a test for having a smart house provide maximum control of the supply and demand information for energy in a home. (Report on Smart House Verification Project, 2009, METI) While aiming to realize overall energy management of a home by making possible external control of the energy equipment, such as solar or other types of batteries, household appliances and equipment—depending on the diverse lifestyles of users—and reduce CO_2 emissions by half, the possibility emerges of creating new services using information received from interconnected equipment.

As a link in that general move, and in order to study a hypothetical service utilizing smart house functions, NRI conducted a questionnaire survey among residents of Japan. (Report titled "An Analysis of the Possibility of Creating Services Related to Utilizing Smart House Functions in Apartment Complexes")

The following are some results of analyzing the responses to the survey:

- Despite being previously unable to view the household's energy usage, about half of the respondents showed interest in being able to do so.
- Concerning a service that would show the amount of electricity a household used, 25% of the respondents said there is a possibility the amount to be paid would be tolerable.
- There is a strong need for certain ancillary services, with respondents saying they looked forward to direct benefits such as "being provided energy conservation loyalty points" and "being provided advice about the best ways to utilize energy."

●Smart City (Smart Community)

The global warming countermeasures introduced to date have been focused on specific measures such as the substantial introduction of new forms of energy as well as energy conservation in the manufacture and use of automobiles, machinery, and equipment. As we head toward building a low-carbon society on a global scale, however, it will become necessary to construct so-called smart communities utilizing IT-related technology, such as by organically linking machinery and equipment. For emerging economies, in particular, one serious task is to resolve energy-related issues, global warming, and other global issues while supporting population increases and economic

development. These economies are paying attention to building modernized infrastructures that utilize energy efficiently and increase convenience.

The smart community is an important element in creating sustainable social systems for realizing a low-carbon society. With the goals of maintaining and enhancing comfort, safety, and ease of mind, minimizing the impact on the environment—such as reducing CO_2 emissions—and holding down total social costs, these systems will enable consumer participation in the social infrastructure.

In order to process and control the huge amount of data moving back and forth in a particular region, and to build and operate the core platform, it is necessary to utilize information and communications technology for collecting, linking, and utilizing the huge amount of diverse information. Also necessary are control technology for rapid control of information, security technology for protecting personal information and certifying equipment, and detailed expertise closely related to various equipment, facilities, and systems linked together.

Centered on governments, electric utilities, and IT-related corporations, countries around the world have begun introducing various initiatives. Introduced in the following are a Hitachi Ltd. initiative in Tianjin Eco-city, China, and a Cisco Systems, Inc., initiative in Incheon, Korea.

Cisco Initiative in Incheon, Korea

On March 29, 2010, Cisco and Incheon Metropolitan City announced they will collaborate closely in building Incheon Free Economic Zone (IFEZ) into a high-tech, globally competitive and environmentally sustainable smart connected city, and supporting continued innovation in Korea.

Incheon City is already moving forward with putting into order inside the IFEZ comfortable residential, trade, and scientific areas that will lead the twenty-first century. In the future, as a smart connected city, the IFEZ will become a leading regional center for innovation, healthcare, education, and society. Besides the official smart city business, Cisco will also support private ICT models.

The headquarter location for this global initiative will be in Songdo, where Cisco will establish the Cisco Global Center for Smart+Connected Communities. Through this center, Cisco will not only develop and provide new service delivery models, but will also develop and build new solutions especially focused around public services and green-based technology for Cisco's Smart+Connected Communities initiatives worldwide. As well, Cisco will also use the services it defines to help the development of new network-enabled cities in other countries. The Global Center will

feature a training facility and briefing center for showcasing these advanced solutions. Establishment of the Cisco Global Center for Smart+Connected Communities was based on MOUs signed in February and April 2009 between Cisco and Incheon. At the time of the April signing, Cisco outlined a multi-year US$2 billion commitment to developing Cisco's operations in Korea.

Cisco has two strategic goals in this collaboration: 1. to have IT support the infrastructure needed for urban living, and 2. to improve energy efficiency and the convenience for citizens. If both these goals can be achieved, it will result in supporting the global environment, and increasing economic benefits.

Tianjin Eco-city

Tianjin Eco-city is a large-scale eco-city development project being promoted under a collaborative agreement between the governments of China and Singapore. Located about 40km from the Tianjin city center, construction of the Tianjin Eco-city began in September 2008 on an old saltpan site about 30 square kilometers wide. When the city is fully developed in 10~15 years, plans call for it to have about 350,000 residents and 110,000 homes. Investments are estimated to be around one trillion yen.

Two basic concepts behind the project are environmental friendliness and resource conservation. High environmental targets have been set, including having 20 percent or more of the energy used coming from reusable sources within the city. In order to achieve those targets, searches were made around the world for the most outstanding environmental technology, and corporations everywhere are watching the project closely. As the first government-level, large-scale eco-city development project in China, expectations are high that Tianjin Eco-city will serve as a model for the sustainable development of other cities in China.

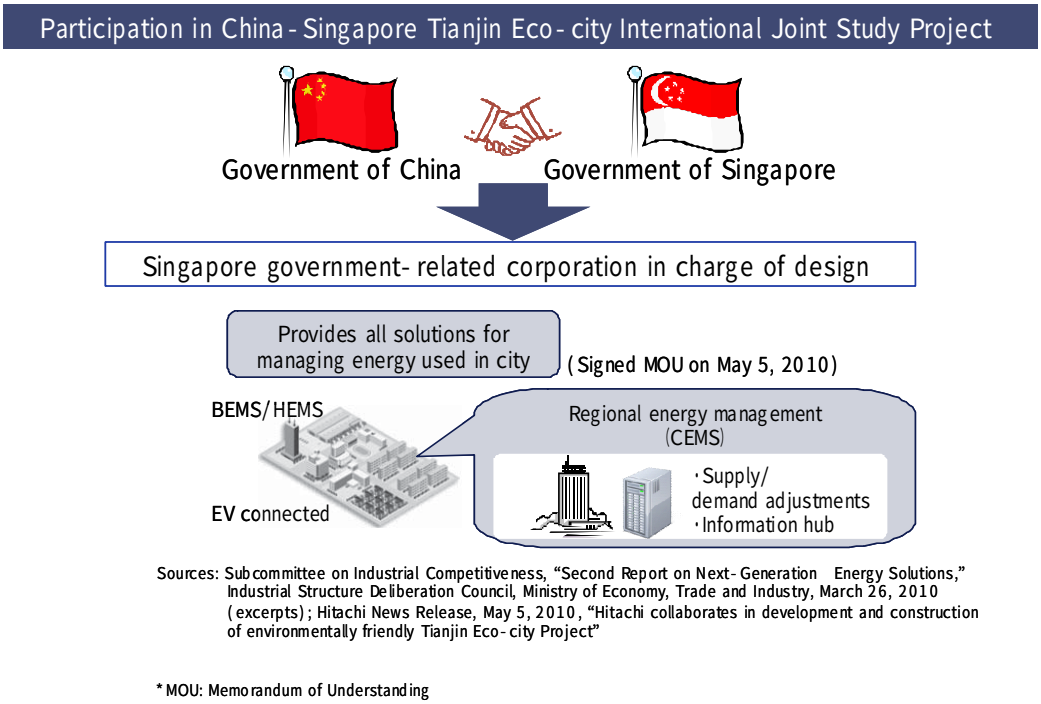
Hitachi Initiative in Tianjin Eco-city

As a result of a collaborative agreement in May 2010 between Hitachi Ltd. and the China-Singapore Tianjin Eco-city Investment Development Authority, Hitachi will provide environmental technology and solutions to be used in the Tianjin Eco-city project. The Hitachi Group has contributed toward mutual exchanges and cooperation between Japan and China, including collaborations with Yunnan Province in 2007 and Ningbo City in 2008 to promote model projects related to energy conservation and environmental protection for realizing a greener economy. As well, the Group used next-generation technology based on a smart grid in undertaking smart city projects aimed at realizing highly efficient, lower environmental impact, next-generation cities,

and is bolstering its related business after positioning such projects as growth engines for expanding its social innovation business.

Concerning its role in the Tianjin Eco-city project, Hitachi will cooperate with the China-Singapore Tianjin Eco-city Investment Authority by using a smart grid for the eco-city and proposing the solutions and advanced technology needed for considering the environment, such as smart houses and a system for recharging electric-powered cars. The members of a joint task force will study and select the solutions and technology for possible application in the Tianjin Eco-city project.

Figure 7. China-Singapore Tianjin Eco-City



Sources: Subcommittee on Industrial Competitiveness, "Second Report on Next-Generation Energy Solutions," Industrial Structure Deliberation Council, Ministry of Economy, Trade and Industry, March 26, 2010 (excerpts); Hitachi News Release, May 5, 2010, "Hitachi collaborates in development and construction of environmentally friendly Tianjin Eco-city Project"

* MOU: Memorandum of Understanding

Two basic concepts behind this large-scale Eco-city development project are environmental friendliness and resource conservation; the Hitachi Group will propose the leading-edge technology needed for a green city.
(*Hitachi Hyouron* (Hitachi Review), August 2010).

The EMS of the electric power company, the supervision and control system of the regional DER, the HEMS, FEMS, BEMS, and EV recharging system on the users' side and the systems of service provider's are all interconnected through a Centralized Energy Management System. This integrated system aims at realizing the

local consumption of energy produced locally and making it possible to provide various services to consumers as well.

A smart community is an effective system even in areas apart from electric energy, such as for holding down investments in the social infrastructure and reducing CO_2 emissions. The system can also be applied in social infrastructure areas such as city water systems and transportation. Centered on cities and communities, this system will become the core of smart cities—the next-generation cities—and will expand to become the social infrastructure that supports cities.

【Conclusion】

As seen in the foregoing, diverse initiatives, beginning with smart grids, are being implemented more actively in countries around the world for resolving environmental issues. Realizing their goals, however, is not easy. According to estimates published by the Battelle Group in the U.S., investments needed to realize smart grids will be $1.5 trillion for the twenty years from 2010 to 2030. One major problem Battelle points out is who will assume the burden of such enormous investments. The *World Energy Outlook 2009*, meanwhile, says that investments of $10.5 trillion will be needed to realize the IEA 450 ppm scenario.

* 450 ppm scenario: In order to hold the global temperature increase within 2 degrees Celsius, the developed countries must reduce their overall GHG emissions in 2020 to 17% less than in 2007, and in 2030 to 41% less than in 2007. As well, the 2020 figure must be the GHG emissions peak for the whole world.

Concerning the environmental response, there are always questions about who will assume the expense burden and how it will be borne. In particular, the cost of the diverse considerations for establishing a sustainable society are positive costs for the future and a clear return cannot be measured when investing. After Japan passed the Green Purchasing Law in 2000, however, the government and independent administrative institutions took the lead as calls grew stronger to purchase products and services that reduce negative environmental impacts. Although at the time the idea of purchasing eco-friendly products and services was not widely accepted and people thought that green purchasing would mean increased purchasing costs, the huge spending by the government and other public institutions after legislation was passed, supported and helped expand the eco-friendly market. Depending on the product, there were no higher costs. As well, although initial costs might be higher, being able to

reduce running costs resulted in a cost-reduction situation. In a word, eco-friendly products became regular commodities. In this way, instead of limiting initiatives for resolving environmental issues to initial investments, it became essential—more than in the early stage—to promote comprehensive initiatives that viewed future returns.

As the interest in smart grids grows stronger, initiatives to realize "smart x," such as smart houses, smart communities, smart cities, etc., are becoming more energetic around the world. From the start, the concept "smart grid" covered a wide spectrum of fields, including renewable energy such as solar power, storage energy in which energy is stored in storage batteries or through compressed air, the conservation of energy through smart electric home appliances fitted with information devices for controlling the energy they use, and so forth. The concept also covers large complex systems that include electric vehicles and superconductor technology that minimizes energy loss when transmitting power.

A smart community, meanwhile, aims for regional optimization of large and complex energy networks that comprise many elements. In fact, a smart community contains much more than energy, covering social infrastructure such as water supply and sewage systems, and systems for processing waste, all aiming to optimize a city function. This also called a smart city.

The previously mentioned Tianjin Eco-city project, for example, is not only introducing renewable energy and energy conservation but is also putting into order green buildings that reflect earthquake resistance and universal design. Plans call for putting into place a city-supportive infrastructure that includes water supply and sewage systems, and a recycling mechanism. Plans, of course, also call for putting residential areas into order, including apartment complexes and single homes. As a project for creating a city that considers not only energy but also the overall environment, including natural resources, the whole world is watching it closely.

Referring to Tianjin Eco-city again, besides energy data related to renewable energy, stored energy, and the conservation of energy, it is also necessary to make visible and to integrate water-related and resource-related data. In these ways, the more elements included in a project, the greater the increase in information that should be made visible, and the analysis and processing of data to find the optimal solution, as well as the controls to realize the optimal solution, become active.

Even if only energy-related data is considered, such as all the household power consumption data and data related to power generated from renewable energy, it combines to total a tremendous volume. Add water-related and resource-related data

and the overall volume of data expands further. Those in charge will be asked to manage the network supporting the flow of data and to process the huge volume of data quickly. In order to control data most optimally, it will likely be necessary for such data to be pulled together in real time or at predetermined short time intervals. In these ways, in order to realize smart communities and smart cities, it will be necessary to make huge volumes of data visible, and to process and control it. In doing so, IT will play quite an important role.

Although one might think that smart communities and smart cities will be realized if huge volumes of data are processed properly, that is not the case. To begin with, in the energy industry, other large corporations besides power utilities also supply energy, such as gas companies and oil companies. Usually, energy providers that conduct activities as private companies aim for maximum expansion of their business, and the possibility is great for a company to propose the optimum energy supply system available that benefits its interests. In order to create the most suitable energy supply system for a city or region covering a large land area, however, it is necessary to aim for a solution that rises above what is best for the individual company and is the best overall solution. If the excess heat from a factory is to be used for heating a community, for example (and such is already being done), the effort does not stop at energy being restricted to one area. If CO_2 emissions are to be minimized in a region, for example, it becomes necessary for power utilities, gas companies, and oil companies to divide the control burden in agreed-upon proportions.

When moving to create smart communities and smart cities, it is essential to rise above the best solution for the individual and choose the best solution overall. In doing so, what are most important are the control mechanisms that utilize IT and putting into order a social system for realizing the optimum solution.

Utilizing IT makes it possible to realize the best total solution, one that rises above the best solution for the separate parts. That is the type of smart society we are aiming for.

Countries and companies everywhere have begun undertaking initiatives to reduce GHG and make the earth we live on a "sustainable living environment." Our goals should not end up as empty theories but rather each initiative should be put to maximum use, and we should create a better environment with our own hands. For that reason, and to realize results with a greater impact, we in GBDe, as an organization that rises above individual countries, should initiate a dialogue that aims to achieve the best overall solution.