

## Section 3 Environmental Technologies and Environmental Industries That Change the Socioeconomic System

As seen in the previous section, the environmental industry and circulation industry can be expected to make contributions from both aspects of environmental conservation and economic growth, and over the long term, they are believed to be capable of changing the socioeconomic system. As discussed in Chapter 2, for example, if the smart grid is realized, the use of renewable energy is expected to increase, electricity is likely to be charged into large stationary storage batteries for adjusting the power supply and demand

balance, and new services may be offered by adding security systems and the function of operating home electric appliances to the smart grid.

In this section, we introduce environmental technologies and services with the potential to alter the socioeconomic society like the smart grid, and give a broad overview of the current situation and future prospects of efforts to financially support the environmental industry and greening of economic activities.

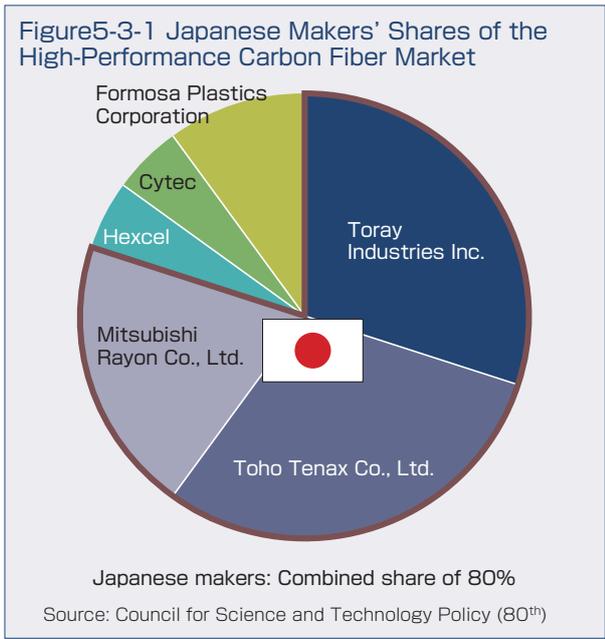
### 1 Japan's Excellent Environmental Technologies

Raw materials and manufactured products produced with Japan's excellent technologies are bringing forward energy-saving effects through weight saving, and are greatly contributing to the mitigation of environmental loads. One of such technologies is carbon fiber. Japan commands an overwhelming share of around 80% in the world's market for high-performance carbon fiber (Figure 5-3-1). After Japanese companies continued research and development investment over long periods

of time and also received support from the national government for their research and development projects, they maintain a technological edge over Western companies.

Carbon fibers are fit for use as structural materials for airplanes and automobiles due to their characteristics of being light, strong and rustproof, and also help enhance the energy-saving performance. For a new medium-size aircraft now in production, for example,

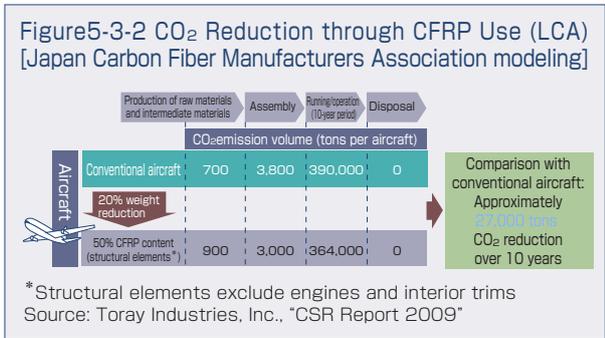




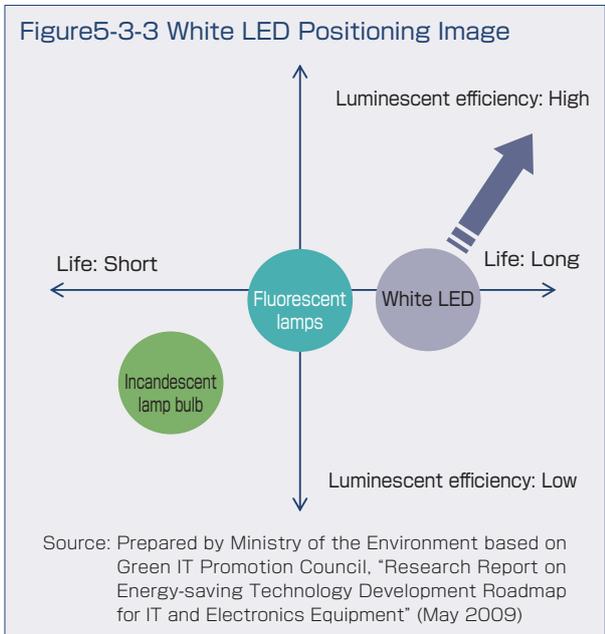
**Table5-3-1 Comparison When 60W Incandescent Lamp Bulb Is Replaced by LED Bulb**

	60W incandescent lamp bulb	LED bulb	Comparison
Photo (Note 1)			
Power consumption	54W	6.4W	Reduced to about one-eighth (CO <sub>2</sub> emissions also reduced to about one-eighth)
Life	1,000 hours	40,000 hours	40 times
Price (Note 2)	¥ 100	¥2,880	About 29 times
Electricity bills for 40,000 hours of use (Note 1)	¥47,520	¥5,632	Reduction of ¥41,888
Annual cost (Note 3)	¥2,576	¥426	Possible to recover the price difference in about 1.3 years

Note 1: The product photo and reference unit power rate are from materials provided by Toshiba Lighting and Technology Corporation.  
 Note 2: The LED bulb price was surveyed by Ministry of the Environment  
 Note 3: Annual power charges and purchase cost in case of use for 2,000 hours a year. Calculated by dividing the price by the life (hours) and adding what is obtained to the power charge per hour  
 Source: Ministry of the Environment



“disposal,” an annual reduction of 2,700 tons per aircraft in carbon dioxide emissions can be expected compared with the conventional model (Figure 5-3-2). If 15,000 passenger jets with the capacity of 100 seats or more now in operation in the world were to be replaced by aircraft using carbon fibers, the annual carbon dioxide emissions reduction of about 40.5 million tons can be expected. Given the per-capita global average carbon dioxide emissions of about 4 tons a year, the assumed reduction is equivalent to emissions by approximately 10 million people. Amid rising demand for environment-friendly products, carbon fibers are increasingly used in frames of aircraft and bodies of vehicles, and thus are likely to contribute to reductions of carbon dioxide emissions in the transportation sector. It is also expected that carbon fibers, due to their lightweight properties and high rigidity, will be widely utilized in larger windmill blades for wind power generation, high-pressure hydrogen tanks for fuel cell-powered vehicles and fuel cells.



Other than carbon fibers, there also are technologies for which Japan has large market shares in the world and which are expected to reduce environmental loads substantially. White light-emitting diodes (LEDs), developed in Japan in 1996, are small, light, energy-saving and long-life light sources, which are rapidly becoming widely used as point sources of light for lighting to replace incandescent lamp bulbs (Figure 5-3-3). Already, white LEDs are in commercial use for small liquid crystal panel backlight, traffic lights and large-screen displays for television sets, etc. Particularly in recent years, they are spreading to business offices and private homes as downlights to replace incandescent lamp bulbs.

carbon fiber reinforced plastic (CFRP) is used for 50% of main structural elements such as the body, main wings and vertical and horizontal tails, making it about 20% lighter than the comparable conventional aircraft. Looking at carbon dioxide emissions during the air frame's 10-year life cycle of “production of raw materials and intermediate materials,” “assembly,” “running/operation” and

LED bulbs consume only about one-eighth of electricity consumed by incandescent lamp bulbs. Comparison of utilization costs between LED bulbs and incandescent lamp bulbs indicate that the advantage of using LED bulbs instead of incandescent lamp bulbs will materialize in about 1.3 years in use (Table 5-3-1).

Thus far, Japanese companies are believed to have uncontested large shares in the global white LED market. In recent years, however, Taiwanese companies are

increasing their shares and Korea is in hot pursuit just behind. Amid intensifying international competition, white LEDs are said to be still under development in terms of raising luminescent efficiency and lowering costs. In order for Japanese companies to maintain the current levels of market shares and expand them further, the government's efforts to support the penetration of white LEDs are necessary along with the promotion of technological development by the private sector.

Other technologies for which Japan has large global market shares and which are expected to be used in environment-friendly products include inverse osmosis membranes use for water purification, lithium ion secondary battery separators for electric vehicles and

IGBT (insulated gate bipolar transistor) power semiconductors used in automobile inverters, etc. The environmental industry is developing and products for which Japan has a technological edge is widely spreading not only at home but also in the entire world, setting the stage for the global display of the power of "monozukuri (manufacturing)" prowess, Japan's particular strength. On the other hand, as seen in the market for white LED bulbs, international competition is expected to intensify in tandem with the development of the environmental industry in technological fields where Japan now has strengths, the government's appropriate support is necessary, including the promotion of such technologies at home.

## Column Japanese Mosquito Nets and Efforts to Cope with Malaria in Africa

Products to help improve the living environment for humans include those using traditional Japanese mosquito nets.

In Africa suffering from malaria, efforts are under way to spread mosquito nets with insect repellent kneaded into, and mosquito nets developed by a Japanese company are being widely distributed. Using these highly durable mosquito nets that do not lose insect repellent effects for over five years even after repeated washing, people can defend themselves from malaria-transmitting mosquitoes economically and effectively. Since production of mosquito nets started in 2003, several thousand jobs were created at the production site. Part of sales of these mosquito nets is used to construct schools for improving primary education, thus also contributing Africa's self-sustaining development.

A Look at a Mosquito Net Production Factory in Africa



Photo: Sumitomo Chemical Co., Ltd.

## 2 From "Selling Goods" to "Offering Functions"

In order to reduce environmental loads and build a sustainable society, it is necessary to shift away from the past socioeconomic system of mass production, mass consumption and mass disposal. As one way of achieving that shift, businesses that provide only the functions of goods without regard for the consumption pattern of selling goods are drawing attention.

Such businesses that have already taken root in Japan include "lease and rental of products" where service providers manage products for their life cycles to reduce environmental loads and "repair and reform of products" where environmental loads are reduced by lengthening the life of products. Some recent approaches are aimed at reducing the quantity of manufactured products used in society as a whole by promoting the sharing and joint use of goods, thus reducing the consumption of resources and environmental loads. They include "car sharing" and other businesses. The market is also expanding for "ESCO (Energy Service Company) business," which

promotes energy saving for the entire building or entire facility by offering a package of services, including energy-saving diagnosis, design/construction, operation and maintenance and fund procurement, thereby realizing reductions of greenhouse gas emissions.

These businesses for providing the functions of goods can contribute to building a sound material-cycle society. In the "lease and rental of products," for example, the maintenance and management is carried out appropriately until products are disposed of to promote their effective utilization and recycling is carried out without fail as used products are collected with certainty. Further, by entrenching the new concept of values that business operators and consumers alike make use of the functions and services of goods instead of owning them when they choose and utilize products, their production and consumption behaviors can be expected to be changed into sustainable ones.

## Column

## Car-Sharing of Electric Vehicles

## ~Blending of Environmental Technology and Systems~

In 2009, Japanese automakers began mass production and marketing of electric vehicles and plug-in hybrid vehicles on a full scale. On the other hand, electric vehicles, etc. are still expensive now, making it difficult for individuals to purchase them easily. Because of this, there are an increasing number of cases in recent years where electric cars are provided as vehicles for car-sharing that costs less than owning vehicles and is often used for shopping and pickup, as one of ways to spread electric vehicles, etc.

In the “project to promote the introduction of next-generation vehicles, etc.” implemented between January 2009 and July 2009, the Ministry of the Environment lent out and operated electric vehicles to a total of 102 divisions of 37 local governments, etc. for the demonstrative use of electric vehicles as official cars. The Kanagawa prefectural government, which is positive about the spread of electric vehicles, has been undertaking the “EV sharing model project” since September 2009 in a tie-up with two car rental companies. Under the project, the prefectural government rents electric vehicles from the two firms for use on business purposes on weekdays, and general users rent and use them on weekends. These forward-thinking efforts are spreading to many other municipalities, including Minoo City of Osaka Prefecture and Arakawa Ward of Tokyo. Private-sector businesses are also launching various initiatives using electric vehicles. For example, a condominium management company is offering a system under which condominium residents can jointly use electric vehicles.

Turning eyes to other countries, Paris, where the bicycle rental system, “velib,” launched in 2007, has taken firm root as a means of transportation, is planning to start its automobile version, “autolib,” in

September 2011. Specifically, Paris will set up arrival and departure stations with battery charge facilities at 1,400 locations, including 700 locations within the Paris city in a large-scale project of operating as many as 4,000 electric vehicles. To make the system easy to use for many citizens, electric vehicles can be returned to stations different from those where they are rented, and rental fees will be set at around 4-5 euros (about ¥490-610).

If car-sharing schemes using electric vehicles spread, it can be expected to produce significant effects in easing traffic jams and reducing exhaust gas and carbon dioxide emissions. Further, while lithium ion batteries are still expensive with the absence of volume efficiency yet, if their prices decline due to the marketing and wider penetration of electric vehicles going forward, municipalities and companies that introduce car-sharing schemes using electric vehicles are likely to increase further and the new concept of values in favor of utilizing the function of vehicles instead of owning them can be expected to take root.

Kanagawa Prefecture “EV sharing model business”



Photo: Kanagawa Prefecture

### 3 Contributions of Environmental NPOs to Building a Sustainable Society

With the declining birthrate and the aging of the population, concentration of population in urban areas and changing lifestyles, etc., various issues including nursing care and welfare of the elderly and disabled, town development and revitalization, are coming to the fore. These issues have so far been addressed by the public sector, citizen volunteers and charitable nonprofit organizations (NPOs). In recent years, however, more and more attention are focusing on NPOs trying to solve such issues while balancing revenues received from business operations and services they provide. Environmental conservation NPOs are no exception in terms of this trend. In order to realize a low-carbon and

sustainable society, it is necessary to revitalize the community through the utilization and conservation of untapped energy resources and natural resources. To that end, environmental social enterprises (including NPOs) are expected to play a greater role to bring about social change in the community.

Various efforts are required to promote activities by such environmental social enterprises. For example, supports are needed so that NPOs can acquire knowhow on management, accounting and fund raising and build cooperative relations with relevant actors in the community, including small and medium-sized businesses, municipalities and financial institutions.

Column

Community-Based Joint Citizen Ohisama Power Station

~NPO Minamishinshu Ohisama-Shinpo~

Nonprofit organization (NPO) Minamishinshu Ohisama-Shinpo launched the “joint citizen power station ‘ohisama (meaning the shining sun) power station’ project” in 2004 to raise funds from donations to install photovoltaic power generation facilities at kindergartens and nurseries in the community under the idea of “building a sound material-cycle society through local production and local consumption of energy.”

Subsequently, in the same year, “Ohisama-Shinpo Energy,” a private limited company (later a joint stock company), was established as a private-sector company to undertake the project in Iida City, Nagano Prefecture, adopted as “A Community Model Project of a Virtuous Circle for Environment and Economy” of the Ministry of the Environment. The project, as a participatory project of citizens, is designed to solicit capital contributions from citizens (under an anonymous association contract) and use these funds to set up ohisama power stations and invest in energy-saving projects at companies in the city. Revenues from the sale of electricity generated at the power stations and from energy-saving services are returned to capital investors and also distributed as profit. A combined amount of over ¥700 million was raised in investment ohisama power stations have been built at 162 locations in Nagano Prefecture for a combined capacity of 1,280 kW. The company is also engaged in energy-saving businesses and heat supply businesses utilizing forest resources (woody biomass) abundant in

Ohisama Power Station (Kanae Mitsuba Nursery in Iida City)



Photo: NPO Minamishinshu Ohisama-Shinpo

the Minamishinshu area, and these businesses are estimated to be reducing carbon dioxide emissions by about 1,800 tons annually.

The area is rich in energy resources, including the direct utilization of solar energy for power generation and heat supply, abundant forest resources and small-scale hydraulic power generation using perennial water resources and precipitous geological formation. Activities of an NPO to utilize natural energy as a business in collaboration with a municipal government and citizens in the community can be expected to help revitalize the local community and also lead to the building of a sound material-cycle society.

4 Financial Flows Heading to the Environmental Industry

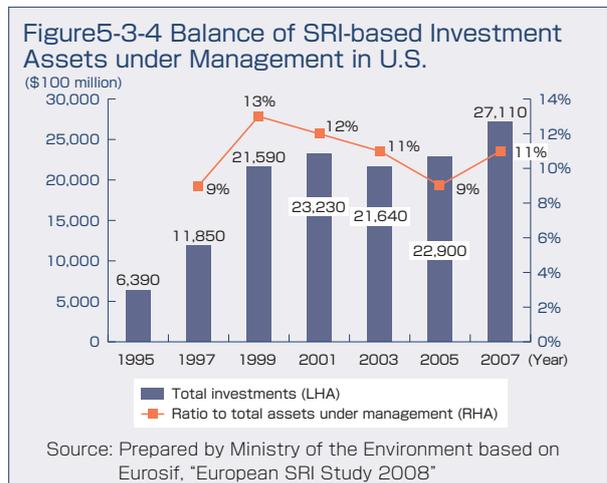
Investment to be made in consideration of efforts on the environment in addition to investment criteria such as corporate profitability and growth potential is called socially responsible investment (SRI). The balance of SRI-based investment is on the increase globally.

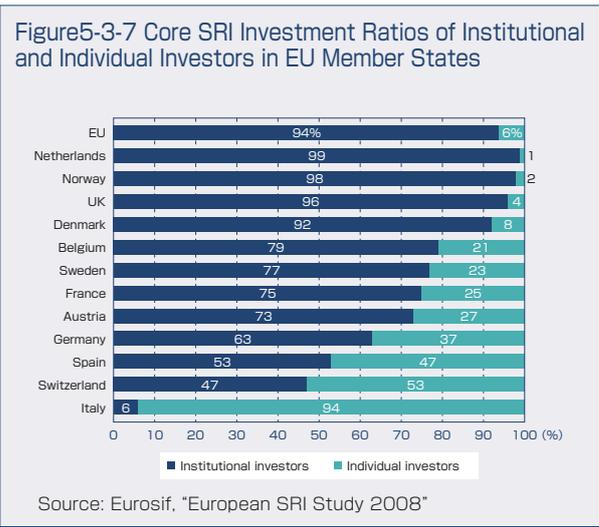
For example, the balance of SRI-based investment in the United States has been increasing in recent years. While these assets declined between 2001 and 2003, they kept growing from 2003 onward and reached \$2.7 trillion in 2007, a little over four times the 1995 level (Figure 5-3-4).

A similar trend can be observed in Europe as well. The market size for SRI kept growing since 2002, and expanded to 2.7 trillion euros in 2007, about eight times the 2002 level (Figure 5-3-5).

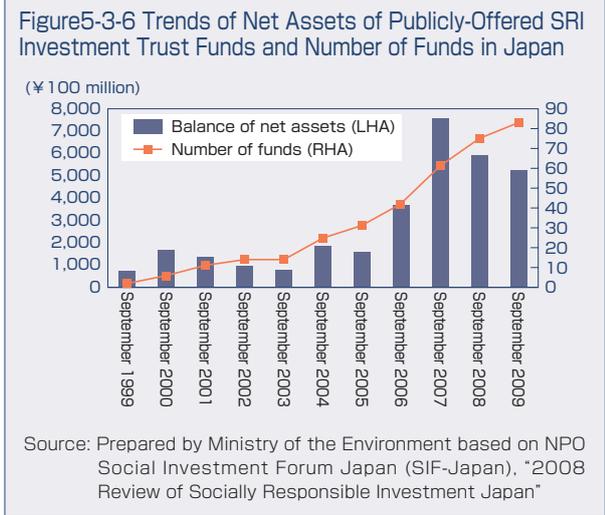
The number of funds making SRI investment is increasing, standing at 83 as of September 2009. The balance of net SRI investment assets in 2009 declined sharply from the previous year due to the global slowdown of economic activities, but the balance of such

assets is basically on the increase since 2003 (Figure 5-3-6). On the other hand, the size of SRI investment in Japan is a far cry from compared with Europe and the





investment in environment-friendly areas and areas conducive to social contributions instead of just pursuing higher investment returns. Publicly offered funds require the participation of many investors and thus are structured on the needs of investors. Therefore, the steady increase year after year in the number of publicly offered eco-funds in Japan can be seen as an expansion of green investment, which reflects the rising environmental consciousness among individuals and the rising needs of "green investors" who want to aggressively invest in environment-friendly companies.



Aside from SRI, another movement related to the environment and financing are efforts in international financing based on the "Equator Principles," the leading voluntary standard set by financial institutions for managing social and environmental risk in project financing. The Equator Principles are the principles for financial institutions that provide a framework for determining, when they are making new project financings globally with total project capital costs of US\$10 million or more, whether projects to be financed are paying due heed to potential impacts on local communities and the natural environment. The Equator Principles were first adopted by 10 U.S. and European financial institutions in June 2003.

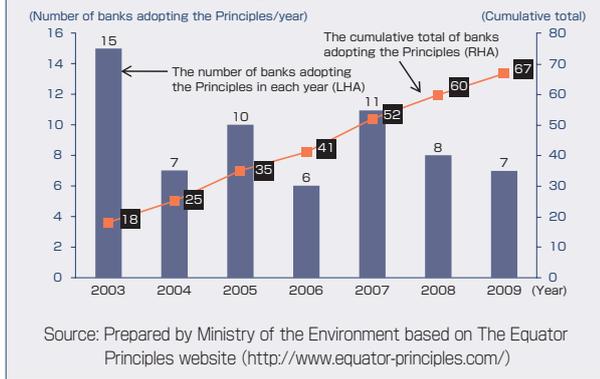
United States. As of 2007, SRI investment in Europe and the United States was in the range of several ¥100 trillion, while SRI investment in Japan stood at just several ¥100 billion. It is believed that this is because that while SRI investment is made mainly by institutional investors with large pools of funds under management in Europe and the United States, SRI investment in Japan is done mainly by investment trust funds with relatively small amounts of funds under management for individual investors. Particularly in Europe, 94% of core SRI investment is dominated by institutional investors (Figure 5-3-7).

Financial institutions adopting the Equator Principles classify projects they are financing into the three categories of A (projects with potential significant adverse social or environmental impacts), B (projects with potential limited adverse social or environmental impacts) and C (projects with minimal or no social or environmental impacts) in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC). When a project is classified as Category A and Category B, a financial institution should carry out a detailed environment review using the industry-wide "check list," and a borrower also should make social and environment assessment, including the consideration of an environmentally and socially feasible, desirable alternative. At the same time, an independent social or environmental expert not directly associated with the borrower will review the financial institution's environment assessment. Financial institutions that have adopted the Equator Principles are required to disclose

While there are differences in the size of investment and rates of increase among countries and regions, in the world as a whole, SRI investment made in consideration of environmental and other considerations, can be said to be on the increase in recent years.

It is believed that behind this trend is the "diversification of investment needs" seeking active

Figure 5-3-8 Trends of the Number of Financial Institutions Adopting the Equator Principles



the implementation process of the Principles and actual results at least once a year.

Since the adoption in 2003, the number of financial institutions subscribing to the Equator Principles has increased steadily, and stands at 67 as of 2009, including three Japanese financial institutions (Figure 5-3-8).

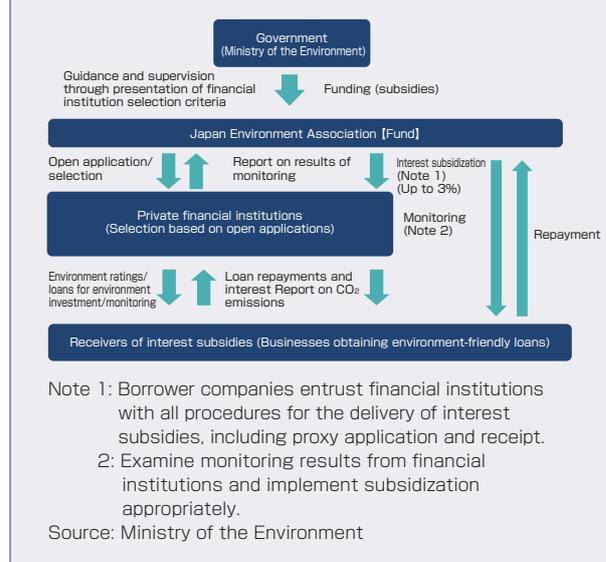
Because of the adoption and development of the Equator Principles, over 80% of international project financings are being provided by financial institutions that have adopted the Principles. The Equator Principles have brought about significant changes in project financing deals as de facto rules when private financial institutions make investment decisions.

Efforts to encourage environment-friendly investment are also being made by public institutions. In Norway, for example, a new environment investment program is under consideration to direct part of state funds to environment investment. Under the program, about ¥280 billion (2 trillion kroner) is to be invested over five years in projects, such as the supply of environment-friendly energy and improvement of energy efficiency, that can be expected to reduce environmental loads.

The UNEP is reviewing the current form of fiduciary responsibility focusing only on the pursuit of short-term monetary returns. The “Fiduciary Responsibility” released in July 2009 by the UNEP considered the legal and practical aspects of integrating environmental, social and governance issues into institutional investment. As a result of this consideration, the UNEP report, in its summary conclusion, states that “all asset manager and asset owner signatories will be required to embed ESG (environmental, social and governance) issues in their legal contracts” and that “advisors to institutional investors have a duty to proactively raise ESG issues within the advice that they provide.”

Japanese government is also supporting financial institutions in order to promote capital investment in the environment. For example, the Ministry of the Environment created the “interest subsidy scheme for special support for the Kyoto Protocol target achievement” in FY 2009. Under the loan system, businesses that pledge reductions of carbon dioxide

Figure 5-3-9 No-Interest Loan System for Special Support for the Kyoto Protocol Target Achievement



emissions by 6% over three years can receive interest subsidies of up to 3% (but no more than no interest) for capital investment in measures to cope with global warming through financial institutions that offer lending on preferential terms by environmental ratings (Figure 5-3-9). Under the second supplementary budget for FY 2009, another new lending scheme, “interest subsidy scheme to support the acceleration of global warming countermeasures,” was created. These loan systems can be expected to encourage capital investment in the environment put off for reasons of interest burdens. As for actual disbursements of loans, under the “no-interest loan system for special support for the Kyoto Protocol target achievement,” which began with a budget of ¥4.5 billion, as of February 2010, environment-friendly loans totaling a little over ¥80 billion were extended. Going forward, loans under this scheme are expected to exceed ¥110 billion.

This scheme is applicable only to lending from financial institutions that offer loans based on environmental ratings. Loans based on environmental ratings are offered by financial institutions on preferential terms based on the results of the screening and evaluation of environment-friendly efforts by borrowing businesses. Since the national government introduced the no-interest loan system, the number of financial institutions that extend loans on environmental ratings substantially increased from just four banks prior to the system’s introduction to 31 banks as of February 2010. Thus, it is expected that environment-friendly loans will increase going forward. The national government, through these loan systems, is building a mechanism under which environment-friendly companies are valued highly and the flow of financial assets goes into the direction of the environment.

**Column** Financial Institutions' Efforts on the Environment

We introduced the “Equator Principles” as an example of efforts by financial institutions to voluntarily integrate environmental issues in their lending operations. Aside from institutional efforts, it is also important for individuals to act by altering their consciousness about the environment.

For example, a major international financial institution encourages employees to take part in volunteer activities by treating their participation in environmental practices of a non-profit organization (NPO) as “business trips.” In volunteer activities, this financial institution supports a project, among others, to investigate a linkage between climate change and coastal ecosystems, helping the collection and analysis of data on seaweed beds for marine plants and rocky intertidal zones, which play important roles as habitats for animals and plants in coastal areas in temperate marginal zones.

Environment-friendly financial flows may be expected to accelerate going forward if financial institution employees become more conscious about

A Scene of Financial Institution Employees Participating in Volunteer Activities



Source: HSBC Holdings plc, “HSBC Community Activities”

the environment and loans to finance initiatives that contribute to environmental conservation and sustainable development become commonplace practices.

## Section 4 Global Environment and Economic and Social Activities

The environment provides the foundation for sustainable development of the economy and society. Hence, a variety of environment problems are important challenges that threaten stable economic and social activities and at times, even their continuation. The Japanese economy, meanwhile, remains under difficult circumstances, though it is recovering from the latest economic crisis. The progressing decrease in the labor force and the declining savings rate are feared to have adverse impacts on Japan’s economic growth going forward, while the Japanese economy is exposed to competition not only from longstanding rivals in the developed world but also from China, India and other emerging economies that have moved into the global market on the back of cheap and abundant labor and the large-scale introduction of foreign capital.

In order to overcome these difficulties concerning the environment and the economy, it is necessary to maintain

and reinforce the international competitiveness of the environmental industry, the strong point for Japan, by striving toward further development and spread of environmental technologies through creative innovation. With these environmental technologies and the environmental industry as the driving power, it is also necessary to sever the linkage between economic growth and increases in resources/energy consumption accompanied by environmental loads, and strive to reduce environmental loads while sustaining economic growth.

Along the line of this approach, in this section, we give an overview of policies necessary for the development of the environmental industry going forward, centering on the promotion of innovation in the environmental field (green innovation) and consider a new socioeconomic system that creates a virtuous circle for the environment and the economy.

### 1 Promotion of Green Innovation by Environment Policy

#### (1) Environment policy that creates green innovation

Internalization of social costs of environmental loads (external diseconomy) through environment policy should increase demand for environmental technologies and lead to the creation of green innovation. As demonstrated by the dramatic advance in low carbon technologies since the adoption of the Kyoto Protocol in 1997, it is important to

send clear messages to the market for business investment decisions in research and development for low-carbon technologies in the private sector (Figure 5-4-1).

When multiple policies can be considered for the identical goal, it is desirable to take flexible policy approaches to allow options to develop and introduce various new technologies. Given this point of view, for the promotion of green innovation, it is important not only to introduce direct regulations specifying the reduction