Chapter 5
The Socioeconomic System Driven by the Environmental Industry
—New Growth through Green Innovation—

Touched off by the global economic crisis triggered by the subprime loan problem in the United States, countries around the world have been taking active initiatives to make intensive investment in environment and energy sectors, thereby striving to ensure an economic recovery and create employment and also solve global warming and other environmental problems. In Japan, as a result of a number of policy steps, such as the eco-point system for home electrical appliances and tax reductions and subsidies for ecologically-friendly cars, personal consumption appears to be showing some signs of recovery, providing underlying support for domestic demand of home electronics, automobile and some other industries.

These developments are not just transient trends. For example, the "Declaration on Green Growth" adopted at the June 2009 Ministerial Council of the Organization for Economic Cooperation and Development (OECD) invited the OECD to "develop, as a horizontal project, a Green Growth Strategy in order to achieve economic recovery and environmentally and socially sustainable economic growth," an indication that a paradigm shift revolving around the environment is accelerating on a global scale.

In this chapter, we focus on the environmental industry that is expected to serve as the driving power of economic growth and examine policies that should be implemented in order to promote green innovation and create and foster the environmental industry. We also show trends in research on sustainability indicators and discuss a path to a socioeconomic system that creates a virtuous cycle of the environment and the economy.

Section 1 The Current State of the Environmental Industry

Japan has set the mid-term goal of reducing greenhouse gas emissions by 25% by 2020 from the 1990 level and also the long-term goal of reducing them by 80% by 2050 toward realizing a low-carbon society, premised on the establishment of a fair and effective international framework in which all major economies participate and an agreement on ambitious emissions reduction targets by all the major economies. Internationally, efforts for the prevention of global warming, the building of a sound material-cycle society and the conservation of biodiversity are commonly shared challenges, requiring all the countries to shoulder a fair share of responsibilities. In order to deal with and solve these challenges, the market size of the environmental industry is growing substantially, accompanied by the creation of employment on a large scale, not only in Japan but also around the world, with the long-term and continuous expansion of the environmental industry anticipated.

In this section, we give a broad overview of the current state and outlook of the global environmental industry and then look at the present state and strength of Japan's environmental industry.

1 The Environmental Industry Expanding in Japan and in the World

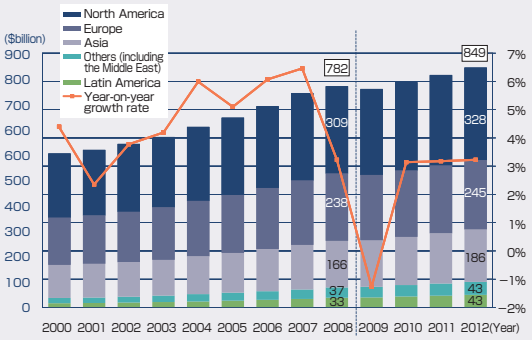
(1) The current state and outlook of the environmental industry in the world

By way of estimating the global market for the environmental industry, for example, the "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon Society" (compiled by the U.N. Environment Program (UNEP), the International Labour Organization (ILO) and other institutions in 2008, hereinafter referred to as the "Green Jobs report") expects the environmental industry's global market size to double from an estimated $1.37 trillion in 2006 to $2.74 trillion by 2020.

According to the estimate by a U.S. private company, the global market of the environmental industry has grown at an annual rate of a little over 4% between 2000 and 2008, though the coverage of the environmental industry and classifications are different from those of the Green Jobs report. While the market is estimated to have posted negative growth in 2009 following the global economic crisis, it is expected to resume and continue to grow by a little over 3% in 2010 and onward. By region, the Asian market is estimated to expand by the largest margin between 2008 and 2012, growing by about $20 billion during this period (Figure 5-1-1).

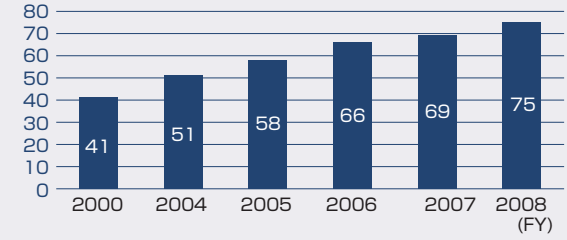
Expectations are also rising about the creation of employment in the environmental industry. The Green Jobs report estimates that green jobs in the renewable energy sector around the world, at about 2.33 million in total in 2006, will likely grow by 2030 to 2.10 million in wind power generation, to 6.30 million in photovoltaic power generation and 12.00 million in biomass power generation, for a total of at least 20.00 million.

Figure5-1-1 Global Environmental Market by Region



Note 1: Figures for 2009 are estimates.
2: Figures for 2010 onward are projections.
Source: Prepared by Ministry of the Environment based on data provided by Environmental Business International Inc. (EBI)

Figure5-1-2 Trends of the Market Size of Japan's Environmental Industry



Source: Ministry of the Environment

(2) The current state and outlook of Japan's environmental industry

The Ministry of the Environment has been conducting surveys on the market size and employment size of Japan's environmental industry, based on the environmental classification of the OECD. According to these surveys, the market size and employment size of Japan's environmental industry have been continuously expanding since FY 2000 (Figure 5-1-2). For FY 2008, the market size and employment size of the environmental industry, including construction reform related to buildings other than private housing and water supply as well as businesses where demand is induced by consumer behaviors conscious of environmental conservation such as low-emission, fuel-efficient vehicles and energy-saving consumer electronics, are estimated at ¥7.5 trillion and at 1.76 million people.

According to the results of "Survey on Environmentally-friendly Corporate Behaviors" (hereinafter referred to as "Survey on Corporate Behaviors") carried out by the Ministry of the Environment in FY 2009 on exchange-listed companies and unlisted companies with a workforce of 500 or more, over 40% of the surveyed companies have already engaged in environmental businesses, and when companies planning to make entries are included, over 60% of the polled companies are found to have positive attitudes toward the environmental industry. Thus, companies are placing high expectations on the environmental industry as the growth sector. In the "New Growth Strategy (Basic Policies) - Toward a Radiant Japan" (adopted by Cabinet decision in December 2009, hereinafter referred to as "New Growth Strategy (Basic Policies)"), the government said it "will aim by 2020 to create over ¥50 trillion in new environment-related markets and 1.4 million new environment sector jobs" by comprehensively mobilizing all measures available.

Column Job Creation Effect of Renewable Energy Introduction

As shown by various countries' moves to introduce the "Green New Deal policy" centering on the active introduction of renewable energy in response to the latest global economic crisis, the introduction of renewable energy not only reduces carbon dioxide emissions but also brings a significant increase in new employment.

"Green Jobs and the Clean Energy Economy" (co-authored by Mr. Ditlev Engel, Chief Executive Officer of Vestas Wind Systems A/S of Denmark, and Mr. Daniel M. Kammen, Professor and Co-Director of the Berkeley Institute of the Environment) points out that the introduction of renewable energy creates more direct employments (per unit of electric power production) in the relevant industries than the use of fossil fuel energy. This presumably stems from the fact that there is a very broad base for many forms of renewable energy because they are small-scale and distributed forms of energy and that many labor-intensive industries are involved in renewable energy fields. Take photovoltaic power generation, for example. In each stage of equipment manufacturing, installation and maintenance and management, etc., a variety of business entities are involved, ranging from solar cell manufacturers and peripheral equipment makers as well as housing makers, building materials producers, general contractors and building contractors, thus directly creating the largest number of jobs in related industries.

Since forests, water and other natural resources that generate renewable energy exist more abundantly in rural areas than in big cities, the introduction of renewable energy not only create many jobs but also generate employment in area other than big cities, and thus can be expected to contribute to the correction of regional disparities in employment.

Job Creation by Energy Type

Energy	Job-Year per GWh
Photovoltaic power generation	0.91
Solar heat	0.27
Geothermal heat	0.25
Biomass	0.22
Wind power	0.17
Nuclear power	0.15
Coal	0.11
Natural gas	0.11

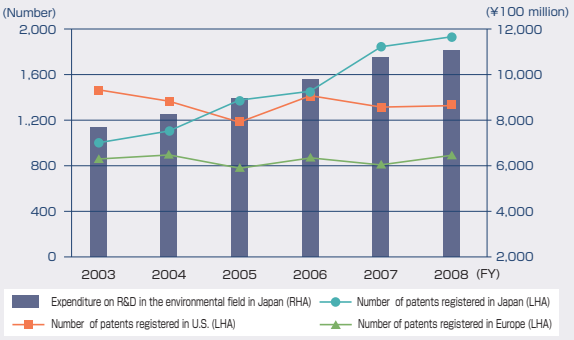
Note: 1 Job-Year means that one person is hired as an employee for a period of one year.
Source: Prepared by Ministry of the Environment based on "Green Jobs and the Clean Energy Economy" (co-authored by Ditlev Engel and Daniel M. Kammen)

2 Strengths of Japan's Environmental Industry

(1) Development of environmental technologies at the highest global standards

Looking at the strength of Japan's environmental technologies by the number of patents, while the number of patents in the environmental sector in the United States and Europe has largely stayed flat in recent years, the number of patents in the environmental sector registered in Japan has been on the steady increase, coming to approximately 2,000 cases in 2008 (Figure 5-1-3). Country-by-country shares in the application for patents on environmental technologies also show that Japan ranks high in such areas as atmospheric pollution and water quality management, solid waste management and renewable energy (Figure 5-1-4). Further, according to surveys by Japan's Patent Office on Japanese companies' patent applications in countries around the world, in the number of patent applications for solar cells, by nationality of applicants, filed in the five countries (area) of Japan, the United States, Europe, China and Korea, Japan had the largest share in Japan, the United States and China.

Figure5-1-3 Trends of the Number of Patents in the Environmental Field (Japan, U.S. and Europe) and Expenditure on R&D in the Environmental Field in Japan by Year



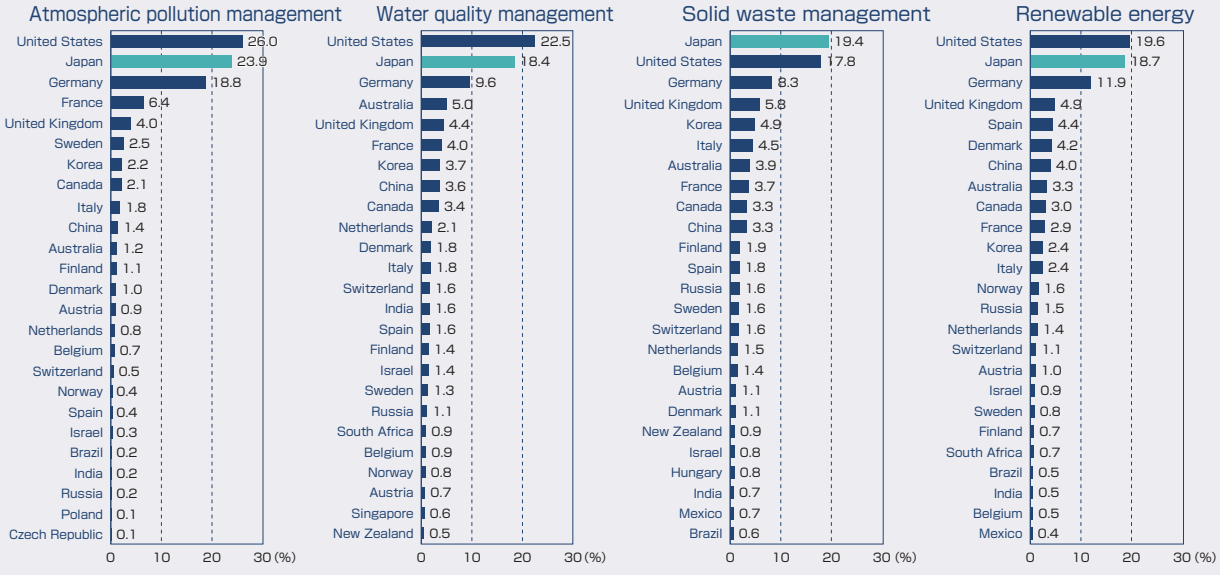
Source: Prepared by Ministry of the Environment based on "Survey of Research" of Ministry of Internal Affairs and Communications and "Development Patent Applications in Eight Key Fields" of Japan Patent Office.

(2) Increase of R&D investment and fostering of researchers supporting green innovation

Japan's environmental technologies are supported by unflagging efforts for innovation at companies and universities, etc. The foundations for these efforts are highly capable researchers and substantial investment in research and development (R&D) activities, and the reinforcement of these foundations can induce innovation and lead to the development of new environmental technologies and further to the strengthening of international competitiveness.

Total research expenditures in Japan had been on the steady increase until FY 2008, when they dipped 0.8% year on year to about ¥18.8 trillion for the first drop, albeit only slightly, in nine years in the aftermath of the latest economic crisis. However, research expenditures in the environmental filed rose 2.6% year on year to about ¥1.1 trillion, growing roughly three times in the past decade (Figure 5-1-5). Research expenditures by companies, etc. accounted for about 80% of this amount, showing that they are underpinning Japan's R&D activities in the environmental sector. The number of researchers, including those in the environmental field, has also been on the continuous increase, standing at approximately 840,000 as of March 31, 2009, a rise of 1.4% over the year-before level.

Figure5-1-4 Share of Environmental Technology Patents Registered by Country



Note: Country-by-country share in patents registered in the 2004-2006 period
Source: Prepared by Ministry of the Environment based on OECD Science, Technology and Industry Scoreboard 2009

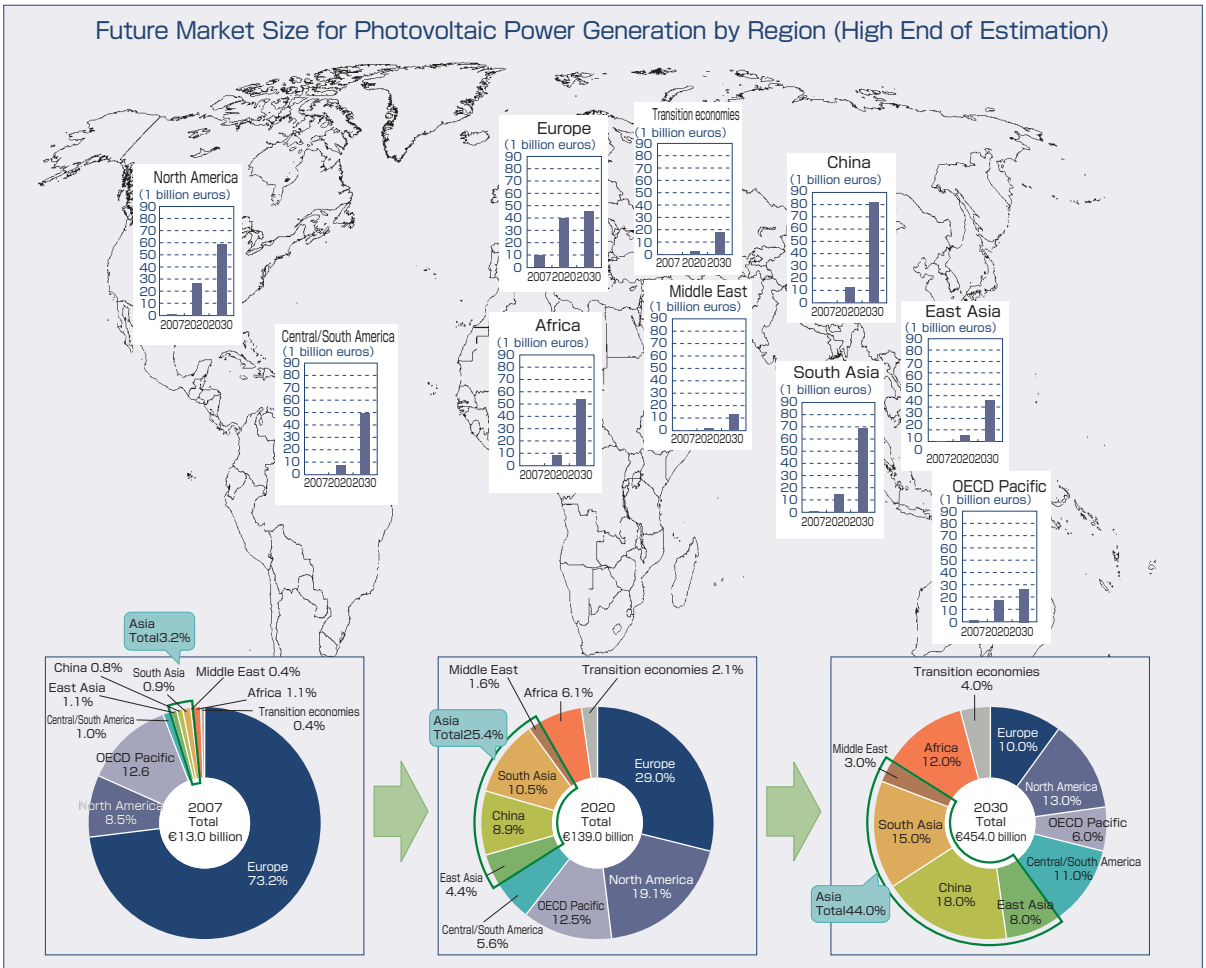
Column Potential for the Japanese Environmental Industry's Expansion in the Fast-Growing Environmental Market in Asia

The economic growth of Asian countries in recent years has been truly remarkable. After coping with the latest economic crisis appropriately, they have now emerged as the driver of the global economy with robust recovery. The fast growth of middle-income groups in Asia and the fact that Asian countries are growing with constraints and problems, such as environmental problems that Japan had faced and overcome in the course of its economic development, indicate that significant business opportunities exist for Japan's environmental industry going forward.

Take photovoltaic power generation, for example. The European Photovoltaic Industry Association (EPIA) estimates that the global market for photovoltaic power generation will grow rapidly from about 13.0 billion euros (about ¥1.6 trillion) in 2007 to about 94.0 billion to 139.0 billion (about ¥11 trillion to 17 trillion) in 2020 and to about 204.0 billion to 454.0 billion (about ¥25 trillion to 55 trillion) in 2030. In particular, the Asian market is expected to see an exponential expansion. Using the higher end of the EPIA estimates, the Asian share of the global market is seen to increase from only 3.2% in 2007 to 25.4% in 2020 and further to 44.0% by 2030.

Japan, armed with environment technologies with the highest global standards and close relations with Asian countries, is in an advantageous position to capture a considerable portion of massive demand from Asia, and the environmental industry has the potential to lead Japan's economic growth going forward. The market for the environmental industry is already under fierce competition. It is therefore necessary for Japan to secure its solid competitive edge through technological innovation and strive to map out overseas business strategies, jointly in public and private sector, in accordance with Asia's regional characteristics and needs.

Future Market Size for Photovoltaic Power Generation by Region (High End of Estimation)

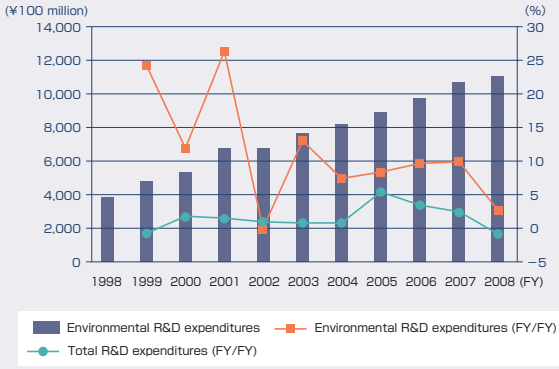


Source: Prepared by Ministry of the Environment based on Solar Generation V - 2008 (EPIA)

(3) Growth potential as a member of the Asian region

The Asian region, which has close geographical and economic ties to Japan, accounts for over half of the world's population and is seeing rapid economic growth, while it is confronted with serious environmental problems, including greenhouse gas emissions, air pollution, water contamination, inappropriate disposal of wastes and deforestation. If Asian countries under such conditions are to achieve sustainable development, Japan's experiences and wisdom to have overcome pollution problems while sustaining economic growth should be shared by Asian countries and it is also necessary for Japan to serve as a bridge for growth in Asia. It is deemed feasible to apply the strengths of Japan's environmental technologies in a proactive manner in this endeavor.

Figure5-1-5 Trends in Japan's Total Expenditure on R&D and Expenditure on R&D in the Environmental Field



Note: Of environmental R&D expenditures, those between 1998 and 2000 are figures under the category "environmental conservation" and those between 2001 and 2008 are figures under the category of "environment"
Source: Prepared by Ministry of the Environment based on "Survey of Research and Development 2009" of Ministry of Internal Affairs and Communications

Section 2 Sound Material-Cycle Society Business for Sustainable Economic and Social Activities

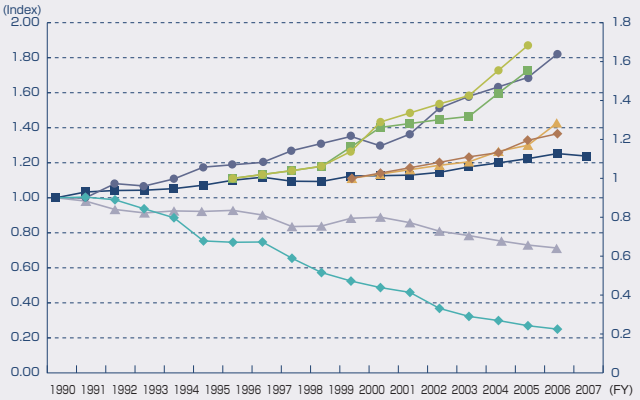
1 Expanding Sound Material-Cycle Society Businesses

The Fundamental Plan for Establishing a Sound Material-Cycle Society, adopted in March 2008 by Cabinet decision, defines a sound material-cycle society as "a society in which the amount of new resource extraction is minimized at all stages of social and economic activities, from resource extraction through production, distribution, consumption and disposal, through a range of measures such as reduction of waste generation and use of circulative resources, thereby minimizing environmental loads." Businesses contributing to the building of the sound material-cycle society are called sound material-cycle society businesses. This section looks at the expansion of sound material-cycle society businesses.

The idea of "decoupling" is drawing attention in the environmental field as well. The term decoupling means "separation." When used in the environmental field, it indicates the desirable situation where the rate of increase in environmental loads is lower than the rate of economic growth. We can say that the world in the past, particularly during the 20th century, has achieved economic growth by increased consumption of resources and intensification of environment loads through mass production, mass consumption and mass disposal. If we turn our attention to the separation of vectors of economic growth and environmental loads that have grown almost in tandem, or to materials and resources, it becomes evident that the important thing is to have lower increase in the input of natural resources than the economic growth rate to create a decoupling situation.

Figure 5-2-1 shows trends of Japan's gross domestic product (GDP), the input of natural resources, etc. (quantity of domestically produced and imported natural resources and imported products), the cyclical use rate and final disposal amount indicator, the market size for sound

Figure5-2-1 Trends of Economic Indicators and 3R Indicators (1990=1.00)



- GDP growth (1990=1.00) Source: Cabinet Office, "System of National Accounts"
- Cyclical use rate increase (1990=1.00) Source: Ministry of the Environment, "Results of the Second Progress Evaluation of the Second Fundamental Plan for Establishing a Sound Material-Cycle Society"
- Increase in the input of natural resources, etc. (1990=1.00) Source: Ministry of the Environment, "Results of the Second Progress Evaluation of the Second Fundamental Plan for Establishing a Sound Material-Cycle Society"
- Increase in final disposal amount (nonindustrial waste + industrial waste) (1990=1.00) Source: Ministry of the Environment, "Results of the Second Progress Evaluation of the Second Fundamental Plan for Establishing a Sound Material-Cycle Society"
- Increase in industrial waste disposal businesses (number of businesses) (1990=1.00) Source: Statistics Bureau, Ministry of Internal Affairs and Communications, "Establishment and Enterprise Census"
- Increase in industrial state disposal businesses (number of employees) (1990=1.00) Source: Statistics Bureau, Ministry of Internal Affairs and Communications, "Establishment and Enterprise Census"
- Growth of the market size for sound material-cycle society businesses in Japan (2000=1.00) Source: Ministry of the Environment, "Results of the Second Progress Evaluation of the Second Fundamental Plan for Establishing a Sound Material-Cycle Society"
- Increase in the employment size for sound material-cycle society businesses in Japan (2000=1.00) Source: Ministry of the Environment, "Results of the Second Progress Evaluation of the Second Fundamental Plan for Establishing a Sound Material-Cycle Society"