Chapter 3

The Pathway to the Environmental Century

As stated in Chapter 1and 2, human activities that burden the environment are still expanding, including the advancement of the development of global warming, increases in resource consumption and deterioration of biodiversity.

We are now at the crossroads of whether the choices we make at the beginning of the 21st century will be seen as the right decision by human beings 100 years from now. Under such severe recognition, Japan is trying to take a leading role in international society in resolving environmental issues including global warming.

Section 1 International Negotiations with a View to the Future, 100 Years from Now and Japan's Role in the Negotiations

Let us look at the discussion points in international negotiations that will decide the future of the earth and human beings and the role that Japan should play in international negotiations.

1 The Results of the G8 Hokkaido Toyako Summit

The G8 Environment Ministers meeting, that was held in Kobe in May 2008, where G8 Ministers and other officials gathered, gave beneficial input towards the G8 Hokkaido Toyako Summit, held in July same year, in three areas—"Climate change", "Biodiversity" and "The 3Rs."

At the summit that was held in Hokkaido Toyako in July 2008, the G8 leaders came to an agreement on climate change issues including that all Parties to the United Nations Framework Convention on Climate Change will seek to share and adopt the long-term goal of at least halving global greenhouse gas emissions by 2050. The G8 leaders also acknowledged establishing ambitious mid-term goals for each country, while reflecting comparable efforts among all developed economies, in order to achieve absolute emissions reductions.

At the G8 Environment Ministers Meeting held in Syracuse, Italy in April 2009, the "Carta di Siracusa on Biodiversity" —the declaration on biodiversity was adopted, and discussions on the development and deployment of low carbon technologies, climate policy measures, biodiversity, and children's health and the environment proposed by Japan were held in the context of the current financial and economic crisis.

2 The Framework for the Next Greenhouse Gas Emissions Reduction Agreement after the First Commitment Period of the Kyoto Protocol

The Kyoto Protocol sets a framework, insisting the advanced economies take the lead in reducing greenhouse gas emissions as an international approach during the first commitment period (from 2008 to 2012). The total carbon dioxide emissions resulting from energy sources among countries bearing reduction obligations was only approximately 30% of the total global emissions as of 2006. Therefore, in the framework after the first commitment period, all parties are strongly expected to participate under the "principle of common but differentiated responsibilities and respective capabilities."

(1) International negotiations for the framework for the next greenhouse gas emissions reduction agreement after the first commitment period of the Kyoto Protocol

At the 13th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP13) held in Bali, Indonesia in December 2007, the Bali Action Plan was adopted and agreed to reach an agreement by COP15 in 2009, in which all parties to the Convention should agree to the GHG emissions reduction framework starting from 2013, after the first commitment period of the Kyoto Protocol.

The Ad Hoc Working Group on Long-term

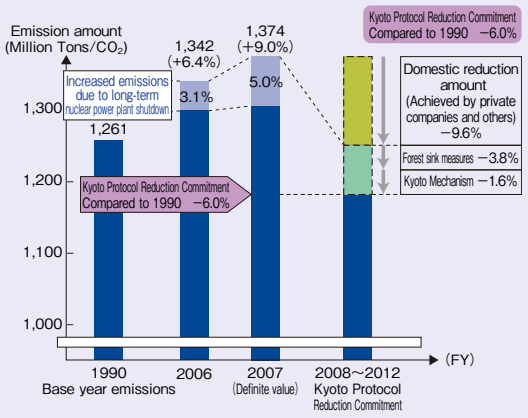
Cooperative Action (AWGLCA), set up under the United Nations Framework Convention on Climate Change (UNFCCC) will hold a conference in Bonn, Germany in next June, based on the Chair's negotiation text towards an agreement at COP15, to be held in December 2009.

(2) Japan's approaches based on the Kyoto Protocol Target Achievement Plan

A The Kyoto Protocol Target Achievement Plan

The Kyoto Protocol entered into force in 2005, under the United Nations Framework Convention on Climate Change, and Japan made a legally binding commitment to reduce GHG emissions by 6% compared to the base year during the first commitment period (2008-2012). In order to achieve the 6% reduction target, the Japanese government established the Kyoto Protocol Target Achievement Plan (Cabinet Decision of April 28, 2005, totally revised March 28, 2008) based on the revision of the Law Concerning the Promotion of the Measures to Cope with Global Warming (Act No. 61 of 2005, hereinafter referred to as "Act on Promotion of Global Warming Countermeasures"). Japan's definite figures on GHG emissions in 2007 were 1,374 million tons (CO_2 equivalent), 9% increase from the total emissions in the base year (1,261 million tons) (Table3-1-1). Therefore, in order to achieve the 6% reduction target, Japan has to reduce the emissions by as much as 15.0% (including a 3.8% reduction through forest sink measures and 1.6% through the Kyoto Mechanism) (Figure3-1-1).

Figure3-1-1 Progress of the Kyoto Protocol Target Achievement Plan



Source: Ministry of the Environment

B Action Plan for Achieving a Low-carbon Society

At the G8 Hokkaido Toyako Summit, the G8 parties reached a common understanding that all parties to the convention to seek to share and adopt the goal of at least halving global greenhouse gas emissions by 2050. Japan has also set the long-term goal of a 60% to 80% reduction from the present situation by 2050, and the Action Plan for Achieving a Low-carbon Society was approved by the Cabinet on July 29, 2008.

The plan agreed to announce national emissions targets as the mid-term goal at a specific time in 2009, and to promote Japan's "Cool Earth Partnership," which will fund around 10 billion dollars over 5 years in international support. As a domestic measure, Japan will promote the development of innovative technologies and the dissemination of existing advanced technologies. Japan will also expand the use of renewable energies including geothermal energy as well as the trial implementation of an integrated domestic market for emissions trading, setting out a framework to move the entire society to a low-carbon society, such as greening of the tax system and to support local and national approaches including the creation of low-carbon cities (Figure3-1-2).

C Domestic Emissions Trading System

Table3-1-1 The Status of GHG Emissions and the Indicator for GHG Emissions in FY2010

(Unit: million tons CO_2)

	Base FY (ratio to the overall)		FY2007 Achievements (increase and decrease from the base year)		The indicator for GHG emissions in FY2010 (note 2)	Difference of FY2007 results and FY2010 indicator for GHG emissions	
						GHG emissions needed to be reduced	Ratio to the FY2007 achievements (%)
CO_2 emissions resulting from energy sources	1,059	(84%)	1,219	+15.1%	1,076~1,089	144~131	11.8~10.7
Industrial sector	482	(38%)	471	-2.3%	424~428	47~43	10.0~9.2
Commercial and other sectors	164	(13%)	236	+43.8%	208~210	28~26	12.0~11.1
Residential sector	127	(10%)	180	+41.2%	138~141	42~39	23.1~21.5
Transport sector	217	(17%)	249	+14.6%	240~243	9~6	3.8~2.4
Energy conversion sector	67.9	(5%)	83.0	+22.2%	66.3	17	20.1
CO_2 emissions resulting from non-energy sources	85.1	(7%)	84.5	-0.6%	84.5	-0.004	-0.01 *
Methane	33.4	(3%)	22.6	-32.3%	22.6	0.003	0.01 *
Nitrous oxide	32.6	(3%)	23.8	-27.1%	24.7	-0.948	-4.0
Three CFC alternatives	51.2	(4%)	24.1	-53.0%	31.0	-6.9	-28.7
Total	1,261	(100%)	1,374	+9.0%	1,239~1,252	135~122	9.9~8.9

Note 1: The sum of each column's total in the above figure may not match, due to round-up errors.
2: The emissions indicators are set for both cases; the maximal and minimal envisioned effect of the measures. Naturally the aim is for the maximal, however, the minimal is still set to achieve the Kyoto Protocol Target Plan.
3: * is calculated as CO_2 equivalent.
Source: Ministry of the Environment

Figure3-1-2 The Outline of Action Plan for Achieving a Low-carbon Society (Cabinet Decision of July 29, 2008)

Japan's goals

(Long-term goal)
Reduce 60-80% of its current level of GHG emissions by 2050
(Mid-term goal)
Announce Japan's total volume target in 2009

Contents of actions (abstract)

(International support)
Promoting "Cool Earth Partnership", which will fund around 10 billion dollars over 5 years
Establishment of the Climate Investment Funds within the World Bank, and start operation at an early stage in proactively engaging

Dissemination of the development of innovative technologies and existing advanced technologies

◆CCS (Carbon Capture and Storage) technology
Commencement verification tests on a large scale →implementation by 2020. (cost reduce to one quarter)
◆Clean combustion technology of coal
Increase the generation efficiency of Integrated Gasification Combined Cycle (IGCC) power generation to 48% by around 2015
◆Innovative solar power generation
Increase the efficiency of electric power to 40%, from 2030, reduce the Power generation cost to 7yen/kw
◆Fuel cells
Reduce the price to 400,000yen/kw in 2020s, improve durability to 9 hours
◆Super Efficient Heat pump
(Air conditioning and hot water supply for residential)
Cost and efficiency →2030 :3/4, 1.5 times, 2050, half, 2 times
◆Zero-emissions energy sources
(solar power and nuclear power in main)
Increase the proportion to over 50 percent by around 2020
◆Solar power generation
Regain the best position in the world, set targets of 10-fold by 2020, 40-fold by 2030
◆Next generation vehicles
Increase the sales volume of new vehicles by 50% in 2020, with a range of 500km by 2030
◆Energy efficient lighting and Energy efficient lamps
Replace incandescent light bulbs with bulb-shaped fluorescent lamps in principle by around 2012
◆Energy-efficient housing and buildings and 200-year housing
Conduct energy-efficiency on all housing and buildings (for newly constructed) and widespread 200-year housing
◆Promotion of nuclear power
Aim to improve the utilization capacity to the level of major nuclear-using countries, securing safety as first priority
◆Implementing Japan's own initiatives
Cut 8% compared to 2001in GHG emissions by 2010-2012

Framework to move the whole country toward reduced carbon

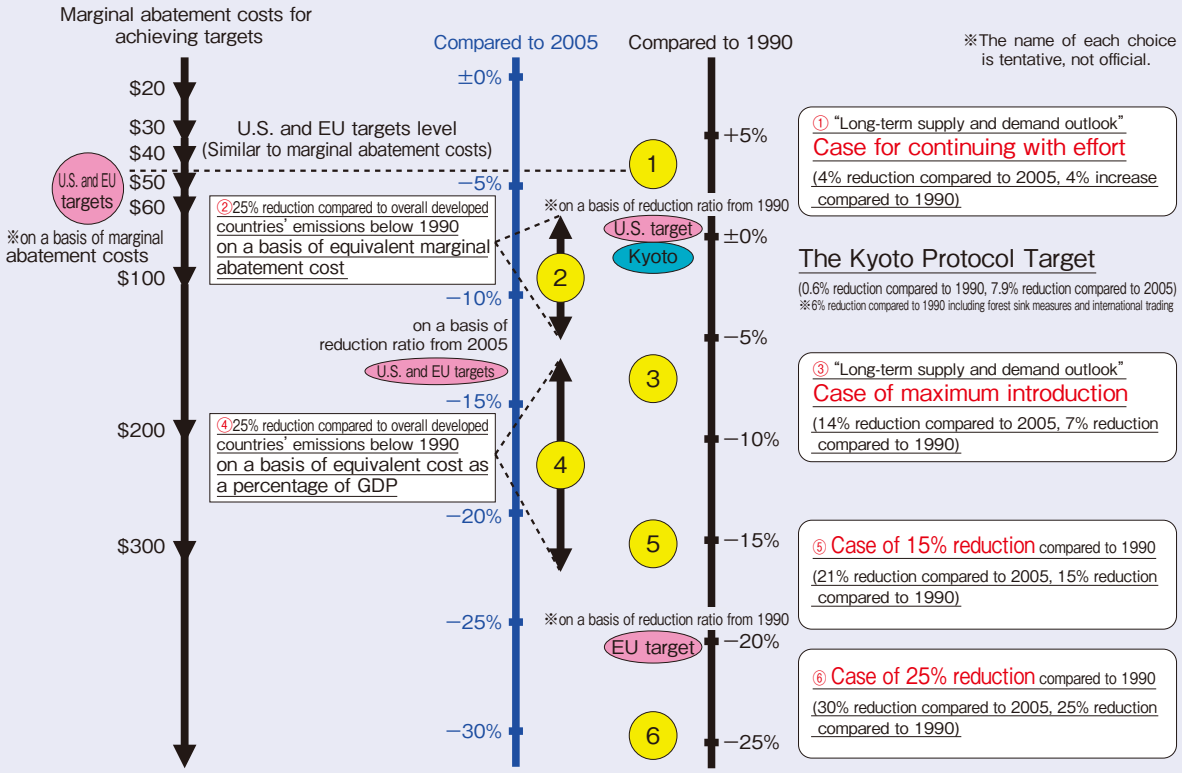
◆Emission trading
Experimental implementation of an integrated domestic market from fall of 2008
◆Making the tax system greener (Low-carbonized)
The government will carry out a cross-sectional review, including approaches on environmental taxes on a fundamental reform of the tax system from a perspective of promoting reduced carbon.
As an example, tax incentives to curb greenhouse gas emissions from cars, household appliances, housing and building will be examined.
◆Visualization of emissions
Visualize emissions of many goods, foodstuffs, services etc
◆Guide flow of capital into environmental businesses
Promotion of community funds etc. and guide the Principles of Responsible Investment (PRI) in the financial institutions

Support for regional and citizens' initiatives

◆Cut GHG emissions in the fields of agriculture, forestry and fisheries
Create Biomass Town to 300 by FY2010
◆Creating low-carbon cities and regions
Select 10 or so cities as environmental models during FY2008
◆Environmental education
Increase the number of ESD centers (UNESCO schools) to 500
◆National energy-saving campaign
Promotion of Team Minus 6%, Eco Action Point, Green IT, consideration of a daylight-saving time

Photos: courtesy of Mitsubishi Motors (Photo is a trial car), Sharp Corporation, Panasonic Corporation, Tokyo Gas Co

Figure3-1-3 6 Options for Mid-Term Targets



The Domestic Emissions Trading System is a system that first sets total emissions quotas, and then allocates emissions quotas to individual entities, as well as trading of emissions quotas with other entities and acknowledging the utilization of the Kyoto Mechanism Credit. "The trial implementation of an integrated domestic market for emissions trading" has started based on the decision by the Global Warming Prevention Headquarters in October 2008. Total emissions of the businesses that requested inclusion participation covers nearly 70% of Japan's industrial sector's emissions, as of March 2009.

D Greening of the tax system

The government will carry out a cross-sectional review, including approaches on environmental taxes on a fundamental reform of the tax system from a perspective of promoting Low-carbon Society, regarding the greening of the tax system. Expansion and extension of greening of automobile-related taxes, including limited time exemption of motor vehicle weight tax and automobile acquisition tax, and tax system to promote energy-saving houses, such as creation of tax exemption system related to building of energy-saving houses were incorporated in the 171st Ordinary Diet Session.

(3) Japan's mid-term goal progress on GHG reduction

Annex I countries under the Kyoto Protocol are encouraged to provide information on their mid-term goal progress to the United Nations. In order to discuss Japan's mid-term goals scientifically and logically, the Mid-term Target Committee was set up under the Council on Global Warming Issue held at the Prime Minister's Office in October 2008. The Committee has met seven times and presented six options in April 2009 (Figure3-1-3).

(4) Technological outlook on long-term goal for GHG reduction

GHG reduction can not be achieved without technological progress, and various long-term goals on GHG reduction are based on the assumption of technological development. With the technological outlook on GHG reduction potential in mind, we need to emerge from a society where about 65% of the energy supply is covered by oil and coal.

The Stern Review expects the maximum overall costs for stabilizing the concentration of the GHG at 550ppm (CO_2 equivalent) by 2050, at around 1% of annual GDP.

The Working Group III to the IPCC Fourth Assessment Report has covered GHG reduction policies and has indicated key technologies expected to be utilized to 2030 and from 2030.

"A Dozen Actions Towards Low-Carbon Societies" (LCSs) released in May 2008 by the "2050 Japan Low-Carbon Society" scenario team, centralized by the National Institute for Environmental Studies, indicated the possibility of reducing Japan's CO_2 emissions by 70% by 2050, compared to 1990.

(5) Japan's international negotiations towards COP15

Regarding the international framework for reducing GHG emissions after the first commitment period of the Kyoto Protocol, Japan will aim to reach an agreement at the 15th meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP15) and lead international negotiations on the basis of the following points.

- Establish an equitable and effective framework under the principle of common but differentiated responsibilities in which all major economies, including the United States, China and India will participate in addition to countries with a reduction obligation.
- Adopt the long-term goal under the United Nations Framework Convention on Climate Change by at least halving global GHG emissions by 2050, while referring to IPCC's scientific knowledge.
- Aim to peak out global emissions in the next 10 to 20 years, and to this end share the ways to reduce global emissions by 2050, including the creation of a low-carbon society and promotion of innovative technological development.

3 Japan's Efforts towards the 10th Meeting of the Conference of the Parties to the Convention on Biological Diversity (COP10)

As global environment that maintains biodiversity is necessary for human existence. Changing socio-economic rules and structures are necessary in order to maintain biodiversity in socio-economies.

(1) Background of the formation of the Basic Act on Biodiversity

The Basic Act on Biodiversity (Act No.58 of 2008) was enacted in May 2008 in order to realize a society in harmony with its natural environment. The act happened to coincide with a time when the 9th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP9) that held in Bonn announced Nagoya city, Aichi prefecture to host the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP10) in October 2009 and has reached an opportunity to dramatically improve awareness and approaches on biodiversity in Japan.

(2) The reason why biodiversity is necessary

Most of the blessings we enjoy in our daily lives unconsciously, including rice and vegetables served on our tables, are brought by biodiversity. The current burden on biodiversity caused by human activities is impossible to ignore.

As seen in the trend of the Millennium Ecosystem

Table3-1-2 Result of the Trial Calculation of the Economic Value on Three Functions that Japan's Coral Reefs Possess

Ecosystem services of coral reefs	Economic value (100 million yen/ year)
Providing tourism and recreation	2,399
Providing commercial marine products	107
Protection from wave and erosion hazards	75～839

Source: Ministry of the Environment

Assessment (MA) and an interim report on the Economics of Ecosystems and Biodiversity (TEEB), recent attempts are to assess how we benefit from biodiversity and how they impact us, in case biodiversity degrades, from a global view and to link with policies.

The Ministry of the Environment made a trial calculation of the current economic value of the partial ecosystem services that coral reefs of Japan have in FY2008. According to the calculation (Table3-1-2), annual economic value of the coral reefs services were expected to be 239.9 billion yen on tourism and recreation, 10.7 billion yen on commercial marine products and 7.5 billion to 83.9 billion yen on protection from wave and erosion hazard. Although coral reefs are said to be important for conservation as a keystone species to ecosystem, recognizing that their existence will bring invaluable benefits to us are also necessary.

(3) Japan's approaches towards the meeting of the 10th Conference of the Parties to the Convention on Biological Diversity (COP10)

Convention on Biological Diversity has three purposes: the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

Many agenda items will be discussed at COP10, such as the revision of the Strategic Plan for the Convention on Biological Diversity, including new targets for post 2010, and to finalize the international framework on Access and Benefit-Sharing (ABS), which are key agenda items. Regarding the ABS, Japan will take the reality use of international genetic resources into account, in order not to cause obstacles of the substantial use, and in order to bring the framework that will take the conservation of the biodiversity and its sustainable use into consideration. Japan will contribute to the discussion through participation in the meetings.

Regarding the revision of the Strategic Plan for the Convention on Biological Diversity, it is important that the 2010 Biodiversity Target "to achieve by 2010 a significant reduction of the current rate of biodiversity loss" will be a more measurable target – recognizable by people from all walks of life as their own target – and to link the target to the promotion of approaches. In order to achieve the target, introducing indicators such as economic assessment of ecosystem services and interrelationship between nature and human beings, which were not incorporated in the Global Biodiversity Outlook 2 (GBO2) are necessary. Japan will participate in the second phase of the TEEB study being hosted, and from this point of view will propose indicators including the sustainable management of natural resources and understandable and measurable new targets.

Japan will also establish a coral reef reserve network centralized in East Asia, in order to promote the designation of marine protected areas, which has been an international challenge towards COP10.

In addition, Japan will propose and send out a global model of sustainable management of natural resources in the secondary natural environment, formed by the mutual interrelationship between human activities and the nature, centralized in the primary industry under the name of Japan's Satoyama as the "SATOYAMA Initiative" at COP10. Domestically, Japan will formulate voluntary guidelines, within businesses can act with biodiversity in mind, and to propose action lists to urge each nation to take biodiversity into account. Japan will support business activities to be active on considering biodiversity and to ensure higher public participation through these proposals.

4 3R that Secures Material Support for the Development of Human Beings

In accordance with population growth and economic development, including developing countries, concerns over increase in global demand for resources, depletion of natural resources and waste issues are expected to be more serious in the long-term. In such a situation, Japan has already taken the lead of the "3R Initiative," and international organizations such as OECD and UNEP have activated approaches towards reducing environmental impact related to the improvement of resource productivity and resource recycling.

(1) 3R Initiative

Japan focused on 3R at the G8 Environment Ministers Meeting in 2008 and the G8 Ministers agreed on the "Kobe 3R Action Plan." With this Action Plan, recognition was shared that 3Rs activities will contribute to uncoupling of resource consumption and environmental pollution (decoupling) in accordance with improvement of resource productivity and economic activities. On that basis, "Prioritize 3Rs and Improve Resource Productivity and Set Targets" and "Collaborate for 3Rs Capacity Development in Developing Countries" were listed as specific actions each G8 nation will approach. The Action Plan states that Japan will progress approaches based on the Action Plan and will follow up policies based on the Action Plan towards the G8 Environment Ministers Meeting in 2011.

Japan will launch the "Regional 3R Forum in Asia" in 2009 as an embodiment of the "Kobe 3R Action Plan." Japan considers creating and developing healthy specific 3R approaches in each Asian country and to activate regional cooperation in order to realize the "Sound Material-Cycle Society" through this forum.

(2) International approaches on analysis of material flow and improvement of resource productivity

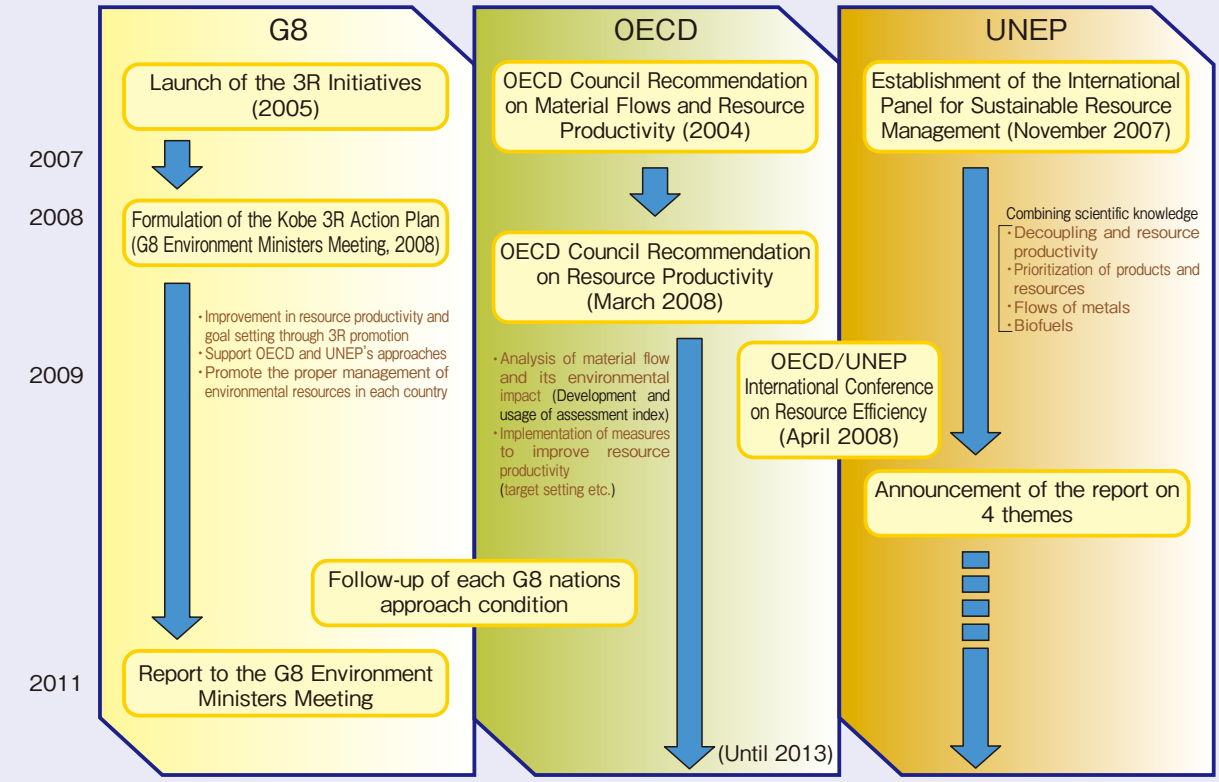
The OECD has adopted the "OECD Council Recommendation on Resource Productivity" in March 2008. This decision was based on the gathering

momentum of international approaches on the improvement of resource productivity, including the G8 agreement on setting targets "taking into account resource productivity." OECD member countries are expected to strengthen analysis capability for material flow and environmental impact accompanied by the flow, while considering the planned target usage including the use of the information on setting targets, based on the recommendation. Japan has already incorporated such contents in the Fundamental Plan for Establishing a Sound Material-Cycle Society (Cabinet Decision of March 2008) and is promoting specific approaches.

(3) International approaches on reducing environmental impact accompanied by resource usage

One of the challenges that has become clear through 3R Initiative and approaches by the OECD is that accumulation and assessment on scientific knowledge are the keys for realizing entire life cycle "Sustainable Resource Management," including the extraction of natural resources, transportation, consumption and disposal. UNEP set up the "International Panel for Sustainable Resource Management" in November 2007 and is approaching to gather information on resource usage and environmental impact and sustainability. Japan is making great contributions to the international approaches on sustainable resource management (Figure3-1-4) through funding and hosting the "Asia Regional Seminar for Sustainable Resource Management."

Figure3-1-4 Global Trends Related to Resource Productivity and Sustainable Resource Management



Source: Ministry of the Environment

Section 2 Environmental Measures, Global and Domestic Economies

A global movement is spreading to seek environmental measures as a key to overcome the recession, under the global recession since the latter half of 2008, instead of prioritizing economic recovery. This is so called policy "Green New Deals." In this section we will grasp the recent trends of the international organizations and each country towards environmental measures, and consider the close relationship between Japan and other countries through cooperation on transnational material flows and environmental measures.

1 Global Economies Driven by Environmental Measures

(1) Effects on the economy and employment by environmental measures

UNEP, International Labour Organization (ILO) and other international organizations cooperated and drafted a report in September 2008, called "Green Jobs: Towards decent work in a sustainable, low-carbon world" (hereinafter referred to as "Green Jobs"), which conducted analysis on the environment and the economy. The report defines "Green Jobs" as activities that contribute to preserving or restoring environmental quality. The pace of green job creation is likely to accelerate in the years ahead amidst the global transition to a low-carbon and sustainable economy. As an example the report concludes that the global employment in the renewable energy in 2006 was 300,000 workers in wind power, 170,000 in solar photovoltaics (PV) and 1,174,000 in biomass (Table3-2-1).

In addition, UNEP reported in its "Global New Deal" in February 2009 that each high-income OECD country should invest at least 1% of GDP over the next two years on various actions to reduce carbon dependence. The report also compiled 10 items which the international society should approach. UNEP launched the "Green Economy Initiative" with global economists, beside this, and will make recommendations to each country based on various researches over the next two tears or so. Japan is also required to advance the consideration on greening of the economy, including economic assessment on environmental value and the relationship between environmental measures and employment.

Table3-2-1 Global Estimated Employment in the Renewable Energy Sector

Renewable energy source	World	Selected Countries	
Wind	300,000	Germany United States Spain China Denmark India	82,100 36,800 35,000 22,200 21,000 10,000
Solar PV	170,000	China Germany Spain United States	55,000 35,000 26,449 15,700
Solar thermal	624,000 -plus	China Germany Spain United States	600,000 13,300 9,142 1,900
Biomass	1,174,000	Brazil United States China Germany Spain	500,000 312,200 266,600 95,400 10,349
Hydropower	39,000 -plus	Europe United States	20,000 19,000
Geothermal	25,000	United States Germany	21,000 4,200
Renewables, combined	2,332,000 -plus		

*Countries for which information is available.
Source: UNEP, "Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World (2008)"

(2) Integrated promotion of each nation's environmental and economic measures

In the United States, President Barack Obama has taken office and has taken a proactive stance on environmental measures. The policy related to the clean economy, incorporated in the Budget Message of the President, announced in February 2009 indicates the intention of investing 150 billion dollars in the clean energy field over the next decade and to increase the ratio of renewable energy derived electricity to 25% by 2025. The United States will also introduce nationwide cap-and-trade system by 14% compared to 2005 by 2020 and 83% compared to 2005 by 2050. These policies are embodied in the American Recovery and Reinvestment Act enacted on February 17, 2009. The act indicates policies to implement economic measures by also implementing environmental measures, aiming to create 3.5 million jobs over the next two years. South Korea has also unveiled its economic policy package for the future in January 2009, and will create 960 thousand jobs over four years by implementing public investment of about 50 trillion won (about 3.54 trillion yen, as of January 2009). Many countries, including these countries, are approaching to advance environmental and economic measures at the same time.

2 Japanese Economy Driven by Environmental Measures

(1) "Innovation for Green Economy and Society"

Environment Minister Tetsuo Saito compiled "Innovation for Green Economy and Society" (Table3-2-2) on April 20, 2009 on aspects of coping with environmental issues we will face and overcoming the economic crisis by implementing drastic environmental measures.

(2) "The Low-Carbon Emission Revolution by the Future Development Strategy"

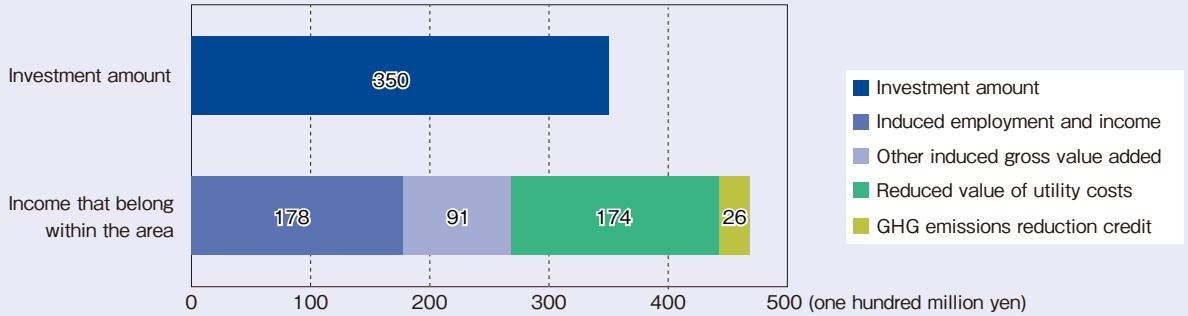
The "Future Development Strategy" was compiled under the instruction of Prime Minister Taro Aso and was approved at the Council on Economy and Fiscal Policy. In addition to "A Healthy Long-Lived Society in which People Feel Secure and Strong" and "Promoting the Attractiveness of Japan," "Leading the World in the Low-Carbon Emission Revolution" was indicated as a future pillar for which Japan should aim in 2020. These plans include leading the world in solar

Table3-2-2 Contents of "The Innovation for Green Economy and Society" Policy

Policy measures	Contents
Innovation toward green social capital	・Eco-reform across the nation starting with public facilities such as schools (eco-reform in schools, public and local government's facilities) ・Eco-reform in cities and transportation (①Develop eco and human friendly compact cities ②Develop eco-friendly transportation infrastructure ③Create water infrastructure that is eco-friendly and secures human health) ・Clean up our land (①Disposal of illegally dumped waste ②Disposal of marine litter ③Measures against PCB and Asbestos) ・Beautiful nature and waterside (①Securing beautiful nature ②Securing beautiful waterside and water environment) ・Measures to adopt climate change caused by global warming
Innovation toward green local communities	・Support for local government centralized environmental conservation approaches (①Development of eco-friendly regions ② Development of eco-friendly transportation system ③Prevention of pollution including atmospheric and water environment) ・Support for local communities approaches (①Development of active local regions by conservation and utilization of the natural environment ②Development of active local regions by eco-specialist training and various entities) ・Development of healthy forests, farms and fishing villages (①Maintenance and preservation of forests by also utilizing urban power ②Environmentally-friendly agriculture, forestry and fisheries) ・Development of a sound material-cycle society in towns and regions (①Revitalizing sound material-cycle community ② Promotion of reduce and reuse ③Cyclical utilization of biomass resources ④Promotion of circulatory use of water ⑤ Circulatory use of nitrogen and phosphorus
Innovation toward green consumption	・Promotion of purchasing energy-saving household electric appliances simultaneously (①Explosive popularization of energy-saving home appliances ②Promotion of Green purchasing and contracting) ・Dissemination of the next generation energy-saving houses and buildings (①Dissemination and expansion of houses and buildings with high environmental performance ②Eco-friendly renovation and life prolongation of existing houses and buildings) ・Approaches toward dissemination of the next generation vehicles (①Promotion of the next generation vehicles ②Installation of necessary facilities for supplying biofuels and quick charging equipment ③Promotion of the introduction of bio fuels ④ Introduction of next generation vehicles initiated by the State and other entities)
Innovation toward green investment	・Systems to integrate environmental conscious into economic activities (①Emission trading system ②Greening of the tax system ③Dissemination of carbon offset) ・Finance fostering green investment (①Expansion of loans for promoting environmental capital investment ②Promotion of loans on eco-friendly companies and the environmental industry) ・Promotion of environment-friendly operations ・Promotion of information greening ・Promotion of sound material-cycle business (①Sophistication of recycling systems and technologies ②Improvement of liability and transparency of sound material-cycle society businesses ③Promotion of low-carbonized waste disposal) ・Greening the energy industry (①Approaches to become a major renewable energy power ②Approaches to utilize local resources ③Safe and secure nuclear power generation)
Innovation toward green technology	・Basic research for improving and developing both the environment and the economy (①Promotion of the research on environmental economics and policy studies ②Mid and long-term target achievement policy research roadmap for developing low-carbon society) ・Long-term technological development targeting at 2050 ・Technological development considering practical use and dissemination in 10 to 20 years ・Dissemination and utilization of environmental technologies (①Dissemination of cutting-edge environmental technologies and utilization of existing technologies ②Environmental technology development and support in regions) ・Adaptation measures to climate change caused by global warming (①Implementation of global warming forecast at regional level ②Research and development on adaptation measures) ・Promotion of environmental monitoring, environmental management and information collection and provision (①Environmental monitoring and promotion of environment management ②Collection, analysis and provision of information toward the 10th Conference of the Parties to the Convention on Biological Diversity)
Contribution for Green Asia	・Strategic and systematic deployment of environmental cooperation through locations ・Development of environmental model cities in Asia ・Promotion of Co-benefit Approach ・Support for formulating sound water cycle ・Developing a sound material-cycle society at Asian level ・Develop society in harmony with nature in Asia ・Measures against trans-boundary pollution

Source: Ministry of the Environment

Figure3-2-1 Effects of Global Warming Measures on the Regional Economy



Note 1: The trial calculation is based on Kochi Prefecture's input-output table, regarding economic ripple effects if about 35 billion yen were invested.
2: A trial calculation was made on the induced effect of the value-added—not the effect of the induced product, in order to grasp the effect of the income improvement within the region. Although ripple effects outside the region are substantially considered, due to product delivery in actuality, trial calculation has not been made this time.
3: Reduced value of utility costs on global warming measures is the value subtracting the margin earned by gas stations and decrease of sales from global warming measures, including electric power which has originally been procured within the region.
Note 4: GHG emissions reduction credit is under the assumption that 5% were sold without the border (20,000 yen/ ton - CO_2 equivalent).
Source: Ministry of the Environment, a conference report on "Global warming measures and regional economic cycle" (March, 2009)

power and energy saving, the first nation to popularize eco-friendly cars, low-carbon transport and urban revolution and for Japan to become a major power in renewable resources and their use.

(3) Local Economies Revitalized by Environmental Measures

A Economic and employment effects that environmental measures bring on local economies

The Ministry of the Environment calculated the ripple effect on local economies if measures such as dissemination of solar power generation and promotion of public transportation usage were implemented, under the assumption that the GHG emissions will reduce by about 30% by 2020, with Kochi prefecture as an example. The trial calculation showed that the economic effects were much higher than the investment amount (Figure3-2-1).

Chiyoda Ward in Tokyo makes to support rural large-scale wind turbine projects invested by citizens to combine low-carbon urban centers with local activation in the Environmental Model City Action Plans. Such approaches have been implemented by the Chiyoda Ward since the Tokyo metropolitan government introduced an Emissions Trading System on large-scale establishments, and permitted the utilization of green energy as an implementation measure for reducing obligation. Measures to prevent global warming will advance in this way, with cities and local areas collaborating, and is thought to encourage wealth transfer from cities to local areas.

B Estimates of the ripple effect on the economy by measures on energy demand sectors

CO_2 emissions in commercial and other sectors and the residential sector have been growing significantly in recent years, and energy saving measures from the energy demand side is strongly demanded to achieve the reduction target of the first commitment period. As a specific example of such measures, if we look at the case of introducing high efficiency air conditioning units, which is an energy saving household electrical appliance; equipment of 2008 can reduce 260kg of CO_2 annually from those of 1997, also saving electricity expense of 19,080 yen (Figure3-2-2). If we simply average the emissions of the residential sector of 180 million tons (FY2007) per household, the emission volume would be 3.4t annually, and the 260kg is equivalent to 7.6% of this volume.

Photovoltaic power generation is expected to have the same kind of effect. Japan's accumulated volume of photovoltaic power generation installation was 1,919MW as of 2007. Germany possesses 3,862MW, and Japan has been left behind since Germany overtook Japan in 2005 (Figure3-2-3). The Action Plan for Achieving a Low-carbon Society also aims to increase photovoltaic power generation by 10 times by 2020 and 40 times by 2030 as a dissemination of existing advanced technologies. In order to achieve these targets, Japan has to produce approximately 12,100MW of photovoltaic power generation in about 10 years. If approximately 12,100MW of solar battery panels were to be installed, an annual power generation volume of 12.1 billion kWh would be obtained, calculated from the average availability factor. This volume is equivalent to the annual electric power consumption of approximately 3.4 million households and would reduce by about 4% of the total CO_2 emissions in the residential sector of 180 million tons (FY2007). (※ Electricity emissions intensity was calculated at 0.453kg-CO_2/kWh).

The future development strategy, based on Prime Minister Aso's speech in April 2009 entitled "Japan's Future Development Strategy and Growth Initiative towards Doubling the Size of Asia's Economy," aimed to expand the photovoltaic power generation scale by about 20 times from the current level by around 2020. Japan will introduce photovoltaic power generation in the public sector in order to realize this target, while introducing a new system for electric power companies to purchase photovoltaic power.

C Expectation on local governments tackling global environmental issues

The Act on Promotion of Global Warming Countermeasures states that accessible local governments (mandatory for about 100 local governments positioned as a specially designated city or higher) should formulate Local Governmental Action Plans in order to curb GHG emissions in their areas. Each local government will promote its own GHG emissions reduction based on the plans.

Let's look at an example, where these measures are producing positive effects on job creation and the local economy. Shibecha Town in Hokkaido produced a concept called "Regional Zero Emission" in which the citizens and the town office officials established a new industry in the local area, using waste as resources, while obtaining knowledge of the local universities. They have advanced development and production of wood composites made of thinned wood and waste plastic, and established and operated a limited company since 2002. The company is still continuing operation in resource recycling in the local area and is maintaining the employment of 15 people in the town whose population is 8,500.

(4) Technology that contributes to developing a low-carbon society

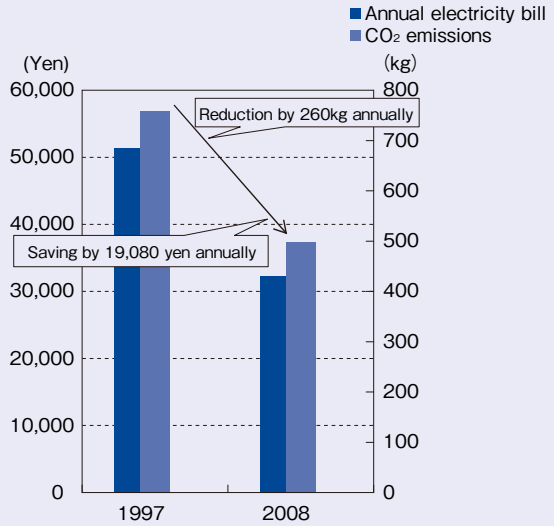
Substantial reduction of GHG emissions can not be achieved only by dissemination of existing technologies or the extension of those technologies; innovative technological development is necessary. The Action Plan for Achieving a Low-carbon Society incorporated the development of innovative technologies, as indicated in the "Environmental Energy Technology Innovation Plan." Furthermore, the Council for Science and Technology Policy stated the necessity of advancing innovation policies with long-term perspectives on the global financial crisis and global warming issues, while compiling the "Important Issues for Science and Technology Policy in 2009" in February 2009. The policy states that about 30 billion dollars will be

injected over the next 5 years to implement the Technology Road Map and other measures indicated in the "Environmental Energy Technology Innovation Plan." As part of the investment, development will be carried out with securing the necessary budget, focusing on energy innovation technologies including innovative solar power generation, hybrid and electric vehicles, innovative iron making process, advanced nuclear power generation technology, fuel cell technology and super high efficiency heat pump. The plan also incorporates sophisticated use of coal, eventually aimed at zero emissions coal-fired generation by combining carbon capture and storage (CCS). Global demands on these technologies are all expected to be huge in the future, and are expected to be Japan's international strategic products and technologies, if successful in the development of these technologies.

(5) Technologies that contribute the improving resource productivity

Cyclical use of resources, where economic development and environmental conservation can coexist, is in the global limelight as economic development by utilizing abundant natural resources has now become problematic. The process of global economic growth on a base without excessive dependency on resources can be regarded as an opportunity for disseminating Japan's advanced technologies and systems for improving resource productivity. Technologies and systems such as the Table3-2-3 (Typical 3R technologies in Japan) can contribute to global sustainable development by being utilized for the development of the sound material-cycle society in developing countries including Asia.

Figure3-2-2 Energy Efficiency Upgrading of Air Conditioning



Note 1: Data for 1997 is the average value of the top 11 air conditioning models with COP (Coefficient of Performance)
2: Data for 2008 is the average value of the top 15 air conditioning and heating models with COP (Coefficient of Performance)
Source: Compiled by the Ministry of the Environment from The Energy Conservation Center, Japan, Energy Saving Performance Catalogue (1997& Winter 2008)

(6) Maintenance conditions for private investment promotion in the environment field

In order to disseminate such environmental technologies, it is important to maintain conditions where institutional and private investors can proactively get involved in loans and investments in the environmental field, and to facilitate fund-raising for Socially Responsible Investment (SRI) and community funds.

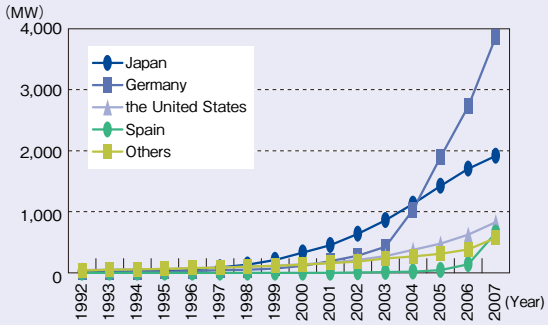
SRI is defined as an investment considering social business approaches, including environmental approaches, compliance (legal compliance) and taking care of staff, besides economic aspects such as financial indicators.

SRI in western countries started from the concept of emphasizing moral values, derived from philosophies such as religious and ethical views, and western institutional investors—including pension funds have been proactively investing compared to those of Japan. On the other hand, SRI in Japan started in 1999, as an eco-fund was set up as a mutual fund product—due to emerging concern on environmental issues. New stance overall investment in Japan is lower than those of other countries since majority of them is targeted at individual investors. According to the European SRI Study 2008, the total assets in SRI managed funds in Japan, the United States and the European nations as of the end of September 2007 was about 840 billion, 292.82 trillion and 407.8 trillion yen respectively.

In order to expand loans and investments in the environment in Japan, such as SRI, strategies that contribute to institutional investor's investment decisions through examination of the dissemination of proper and adequate information on SRI in western countries, establishment of an information disclosure system that matches the actual condition and structures to secure accuracy are necessary.

Approaches to community funds are growing, due to the emerging concern of the citizens on the environmental conservation. These approaches include investments in businesses—installing wind power and photovoltaic generation through funds raised by citizens—and loans and investments in profitable social businesses (Community Businesses), such as the operation of recycled goods shops. The Japanese government also needs to examine structures to promote these approaches.

Figure3-2-3 Changes in Cumulative Installed PV Capacity



Source: Compiled by the Ministry of the Environment from the data of IEA, TRENDS IN PHOTOVOLTAIC APPLICATIONS Survey report of selected IEA counties between 1992 and 2007 (2008)

Column

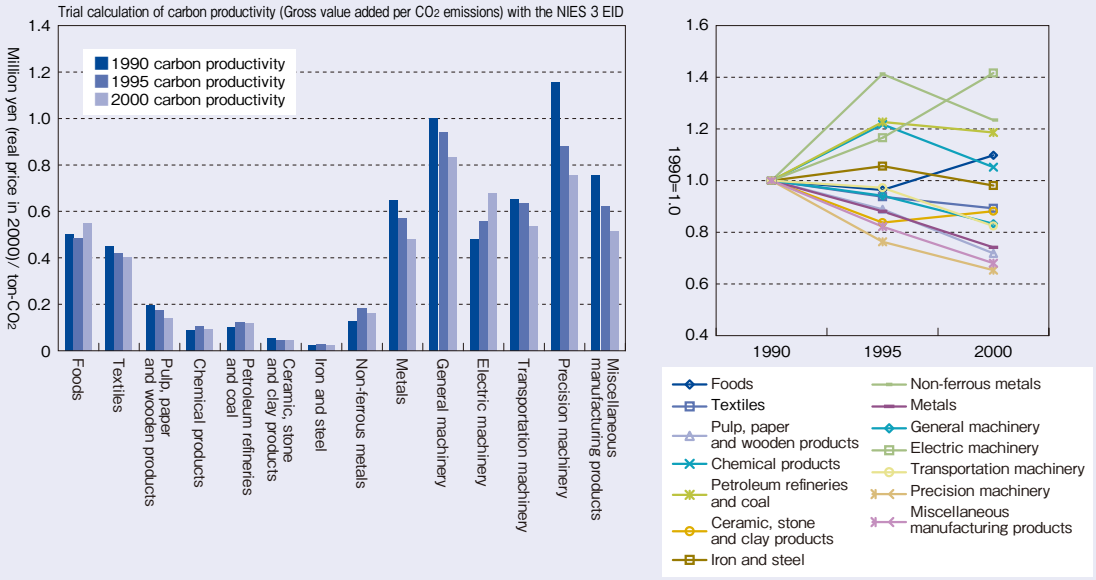
Improvement of Carbon Productivity

Upon building a Low-carbon Society, reviewing the current state of the socio-economy from the assumption of mass production, mass consumption and mass disposal, and decoupling that reduces energy consumption which maintaining the same value added must be achieved.

The McKinsey Global Institute's analysis report "The carbon productivity change: Curbing climate change and sustaining economic growth," announced in June 2008, states in its report that to meet the reduction scenario that has been discussed so far, global carbon productivity must increase from approximately 740 dollars GDP per ton of CO_2 equivalent today to 7,300 dollars GDP per ton of CO_2 equivalent by 2050—about a tenfold increase. Regarding its economic impact, the report states that the impact will depend on how new low-carbon infrastructures will be financed, but GDP is expected to increase in many countries. On that basis, the report mentions five challenges to promote reform towards low-carbon as follows; 1) utilize opportunities to enhance energy efficiency in a cost effective way; 2) decarbonize energy sources —especially in the fields of electricity, petroleum and gas; 3) accelerate the development and dissemination of new low-carbon technologies; 4) change the behavior of businesses and consumers; 5) conserve and expand the world's carbon sink, especially its forests.

Now, let's move on to carbon productivity in Japan's manufacturing industries. A big gap can be seen among industries' CO_2 emissions per gross value added (million yen - real price based on 2000), based on the National Institute for Environmental Studies "Embodied Energy and Emission Intensity Data for Japan Using Input-Output Tables (3EID)" that calculated the environmental burden of the basic unit targeting CO_2. Improvement degrees on each industry's improvement showed a big gap, comparing three years at the time of 1990—counting as 1.0, 1995 and 2000. Although the sectors of foods, chemical products, petroleum refineries and coal, non-ferrous metals and electric machinery are increasing carbon productivity, other sectors are rather deteriorating, and are expected to make special efforts to improve carbon productivity.

Changes in Carbon Productivity of Manufacturing Industries in Japan



Note: The productivity of the overall manufacturing industry was 0.18 million yen/ton-CO_2

Source: Compiled by the Ministry of the Environment, from the data of the National Institute for Environmental Studies (NIES)

Table3-2-3 Typical 3R Technologies in Japan

	Short-term measures（※2）	Mid and long-term measures（※2）
Reduce resource loading – upstream	○Resource-saving manufacturing process ・Technologies to reduce consumption of each rare metals in manufacturing processes (W, In, Nd, Dy etc.) ○Alternative materials, etc.（※1） ・IT key components, utilization of new materials (lightening, high functional materials, biomass plastics, etc.) ○Comprehensive design for life cycle ・Lightening, downsized design and life extension design ・Evaluation methods to clarify environmental burden of products to consumers (carbon footprint, etc.) ○Social capital stock management ・Ultra long life houses for generation use ・Advanced inspection and diagnosis technology	○Optimization of energy saving and resource saving in several manufacturing processes ・Chemical manufacturing process technology of material and energy regeneration (co-production technology) ○Alternative materials, etc.（※1） ・Alternative material manufacturing technology without using rare metals ・Self-healing plastics ○Comprehensive design for life cycle ・Optimization design technology for comprehensive 3R life cycle ・Evaluation methods to enhance resource recycling efficiency in regions ○Social capital stock management ・Remaining life management and maintenance technology of buildings, etc. ・Conversion and renovation methods for buildings
Increase cyclical use of waste materials (reduce final disposal , etc.) – downstream	○Cyclical use design technology ・Degradable design technology ○3R of construction materials ・New cement manufacturing technology (mainly cement manufacturing technology using waste as raw materials) ○3R of metal resources ・Recycling of rare metals from used compact appliances ・Recycling technology of flat panel displays ・Recovering technology of rare earth elements (low cost recycling technology) ・Recovering technology of iron and zinc from by-products (slag, dust, etc.) produced during steel manufacturing process ○Conversion and usage of unused biomass ・High efficiency ethanol fermentation technology and high efficiency methane fermentation technology (elemental technology) ・Low cost energy manufacturing technology from wood biomass, crop resources and unused biomass (practical technology) ・Hydrogen fermentation technology	○3R of construction materials ・Advanced recycling of demolition wastes ○New material recycling technology ・Separation, recovering system and upgrading recycling technology of nano-materials collaborating with cyclical use design technology ○Conversion and usage of unused biomass ・Technology to extract functional ingredients from non-edible parts of agricultural crops ・Household energy conversion technology (convert to methane, hydrogen, etc.)

※1 : Since alternative materials themselves are also resources, their usage volume needs to be reduced.
※2 : The assumption is made that development periods of practical technology for short-term measures are set around 2010-2015, and around 2015–2030 for mid and long-term technology. However, basic research for some mid and long-term measures will start before 2015.
Source: Compiled by the Ministry of the Environment

Column

Internalization of environmental liability into business accounting

In order to extend environmental conscious business activities while realizing sound economic development in the future, promoting the improvement of accounting standards related to the environment are important in business accounting.

A new accounting system related to this issue will start from FY2010 and will be applied to all listed companies. Listed companies will be obliged to post fixed assets, such as land and buildings they possess into their accounts upon the removal of their tangible fixed assets in the future, according to the "Accounting Standards for Asset Retirement Obligations"(ASBJ Statement No.18) announced on March 31, 2008 by the Accounting Standards Board of Japan, and its implementation. Asset Retirement Obligation (ARO) includes costs of removal and disposal of pollution that generated from past business activities before fixed assets were removed. That means companies will account the ARO, including environmental costs for the future (the so called "Environmental Liability"), in their financial reports in advance, in order to understand the total cost in the future and to allocate these as a depreciation expense in each quarter.

Therefore, the system functions to urge environmental conscious business activities, such as preventing environmental pollution beforehand, when companies set their major management policies. The introduction of the system is expected to promote preventive measures against pollution and early appropriate management, and will lead to curb unnecessary works in each company by recognizing the environmental burden as costs.

This ARO is closely related to concrete legal systems in the environmental sector, including measures such as handling and disposal of asbestos materials—stipulated in the prevention of health impairment due to asbestos, based on the provision of the Industrial Safety and Health Act (Act No.57 of 1972) and the Enforcement Order of the Industrial Safety and Health Act (Cabinet Order No.318 of 1972), the proper disposal of polychlorinated biphenyl (PCB) stipulated in the Law concerning Special Measures for Promotion of Proper Treatment of PCB Wastes (Law No.65 of 2001, hereinafter referred to as "PCB Special Measures Law") and the examination of the specific facilities at the abolished time—stipulated in the Soil Contamination Countermeasures Law. As removal or containment of Japan's environmental pollution on fixed assets is considered to be in the range of several tens of trillion yen in total, changes of the accounting system that will order companies to register partial costs of removing such pollution in the balance sheets will greatly impact the economy and business activities.

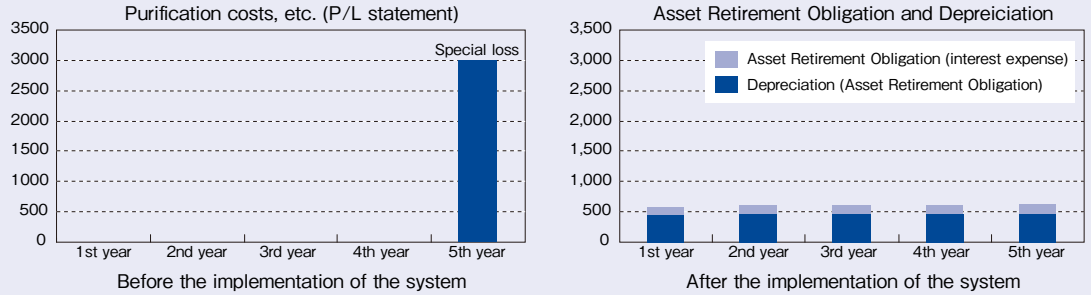
One of the points to be noted for promoting companies environmental measures, under this systemic revision, is that not all of the costs on environmental measures will be posted as ARO. From such awareness of the issues, the EU for example is advancing consideration toward describing environmental liabilities in detail. Some advanced companies in Japan as well, are in the trend of recognizing overall environmental liabilities

Image of a Balance Sheet Incorporating ARO

Assets	Liabilities
Current assets	Current liabilities
	Notes and accounts payable trade
	Short-term loans payable
Fixed assets	Allowance for doubtful accounts
Tangible assets	Asset Retirement Obligation (ARO)
Buildings and structures	Others current liabilities
Machinery and tools	
Land	Long-term liabilities
Accumulated depreciation	Corporate bonds
	Reserve for retirement benefits
	Reserve for special repairs
	Asset Retirement Obligation (ARO)
	Others long-term liabilities
	Shareholders equity
	Total shareholders equity
Total Assets	Total liabilities and shareholders equity

Source: Compiled by the Ministry of the Environment from the Accounting Standards for Asset Retirement Obligations and its Implementation

Comparison of Profits and Losses Calculation around the Implementation of the System



Source: Compiled by the Ministry of the Environment from the Accounting Standards for Asset Retirement Obligations and its Implementation

in the future and to disclose, beyond the scope of which ARO—that requires them to register.

Amidst such approach is expanding, advancement of business activities in environmental conservation approach and realization of integrated improvement of the environment and economy, at each business activity level, are expected in the future.

Advanced Cases that Grasp and Announce the Entire Environmental Liabilities, including ARO

Category	Costs for the future (before discount)
Asset Retirement Obligation (interest expense)	0.49 Billion Yen
Environmental liabilities (excluding ARO) by laws and contracts	1.24 Billion Yen
Environmental liabilities through voluntary approaches on environmental measures	1.22 Billion Yen

Source: Ricoh's Sustainability Report (Environment), 2008

3 Relationships between the Global Economy and the Japanese Economy on Environmental Measures

Today environmental issues are not something to be dealt within the country, but need to be related with the entire international society and many partner countries beyond the borders. Recognizing the environmental burden of the suppliers of resources and raw materials and approaches bringing global society into view, such as promoting economic activities while considering the burden, are important on environmental measures.

(1) Challenges which accompany the securing of biofuels

The global bio-fuel production has increased from 3.1 million kℓ in 2001 to 6.4 million kℓ in 2007, more than a double increase (Figure3-2-4). Although Japan had produced about 30kℓ of bioethanol from by-products and construction waste materials in the process of making sugar from sugarcane, and about 10 thousand kℓ of biodiesel fuel, a raw material of waste food oil, the production volume is still small compared to other countries (Table3-2-4).

The Kyoto Protocol Target Achievement Plan requires the introduction of 500 thousand kℓ of biofuels, in crude oil equivalent by 2010, and further acceleration of its introduction is required towards its achievement. However, there is concern over environmental issues for development and usage of biofuels that environmental issues, such as the food competition problem and deforestation could be caused, and sustainable use and promotion of development are important. Amidst such a situation, examinations on sustainability standards for biofuels are currently progressing in the international frameworks, such as the EU, the United States and the Global Bioenergy Partnership (GBEP), with the participation of individual countries including Japan. For example, the "Sustainability Standards for Biofuel Products" in the "Directive of the European Parliament and of the Council on the Promotion of the Use of Energy from Renewable Resources," that was adopted by the European Union Parliament in December 2008 states that only biofuels that met the GHG emissions reduction rates and the sustainability standards, including the production areas of raw materials can be targeted as the calculating items for introduction.

Japan needs to promote procurement of sustainable biofuels referring to these approaches, as well as developing the next generation of biofuel production technologies.

(2) Environmental measures targeting the entire flow of manufacturing products (supply chain) beyond the sea

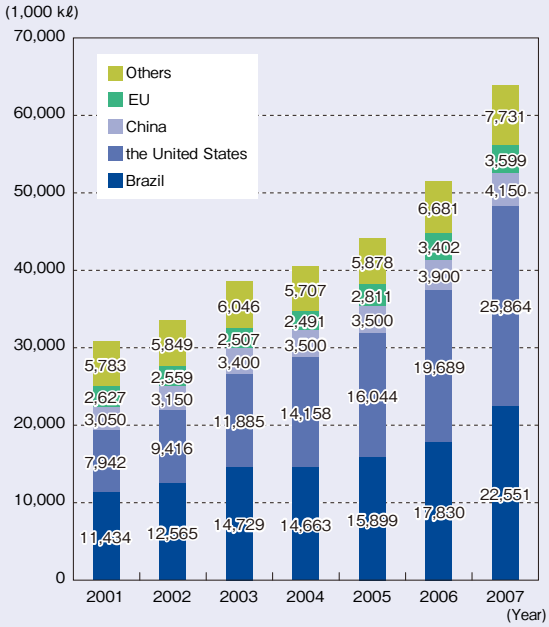
An integrated chemical maker has been making efforts to analyze environmental burdens generated at each stage—resource procurement of each product, manufacturing, transportation, products in use and waste and recycling—and to recognize the environmental burdens at each stage. According to this analysis, CO_2 emission volume turned out to be higher during procurement and processing of resources, including aluminum refining of PS plates for printing machines and structural steel for photocopiers than during the products use (Figure3-2-5). For example, if used PS plates are injected during the manufacturing process for effective use of the resources, CO_2 emissions emitted during the process of refining and manufacturing could be reduced by 74% compared to the process of refining aluminum from raw materials (Figure3-2-6). Therefore, the company is making efforts to reduce the environmental burden in the entire life-cycle of the products from overseas to Japan in the most suitable and rational way.

(3) Procurement mechanisms that will lead to sustainable use

Although forests are important in mitigating climate

change, the area of the world's forests has been decreasing, and carbon stored in forests has been released into the atmosphere with the decrease. Illegal logging has been pointed out as a major obstructive factor for forest conservation. Illegal logging includes various types, such as logging without property or logging rights, logging without observing the permitted volume or species and logging in problematic ways from the viewpoint of the traditional rights of indigenous peoples and others or for the safety of logging labor. Illegal logging is causing huge negative impacts on the world's forests, due to forest depletion and destruction in wood producing countries and disruption of import countries sustainable forest management due to distribution of low price illegally logged timber on the international market. Survey results show that about 50% of logging in Indonesia, from where Japan imports large volumes of timber, and about 20% of that in Russia comes from illegal logging.

Figure3-2-4 World Bioethanol Productions



Source: Compiled by the Ministry of the Environment from the data of F.O.Licht's World Ethanol and Biofuels Report, Vol.7, No.4 October 23, 2008 p.75.

Japan has been providing technical cooperation and funding by utilizing ODA on the world's forest depletion and destruction and illegal logging issues. Within Japan, the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Act No.100 of 2000) stipulates that lumber and wood products with "legality" certificates should be purchased from 2006 as a measure against illegal logging, also stipulating that "sustainability" to be considered. The three following methods are used in accordance with the Forestry Agency's guideline to verify "legality."

1. Method by utilizing forest certification systems
2. Verification method by companies under the authorization of industry groups
3. Verification method by original approaches of each company

Forest certification systems, mentioned in the above methods, are also used for the sustainable use of forests. These are private sector-oriented system that offer options to consumers with purchasing timber, through the process of certification of each forest by third party organizations for appropriate forest management and segment managing and labeling of the lumber produced by the forest. Organizations that conduct forest certification systems include the Programme for the Endorsement of Forest Certification Schemes (PEFC), the Forest Stewardship Council (FSC) and the Sustainable Green Ecosystem Council (SGEC). Although forest certification systems are not yet well recognized in Japan, the area of the certified forests is increasing worldwide, and approaches towards forest certification in wood producing countries are progressing steadily (Figure3-2-7). For example, timber production in Malaysia is mainly concentrated in two areas, the Malay Peninsula and northern Borneo. About 97% of the forests of the Malay Peninsula - exported mainly to Europe (permanent forests posted in the management plan as forests) have been certified, while only 0.9% of the forests in northern Borneo - exported mainly to Japan—have been certified on the other hand. Japan, as one of the world's leading timber importer, is required to contribute to the producing countries biodiversity conservation and sustainable use of wood by utilizing legality certificated timber selectively and proactively.

(4) Cooperation towards advancing environmental measures in developing countries to overcome environmental pollution , while advancing measures against global warming at the same time (Co-benefit approaches)

Environmental issues, such as air pollution and water

Table3-2-4 World Biofuels Production in 2007

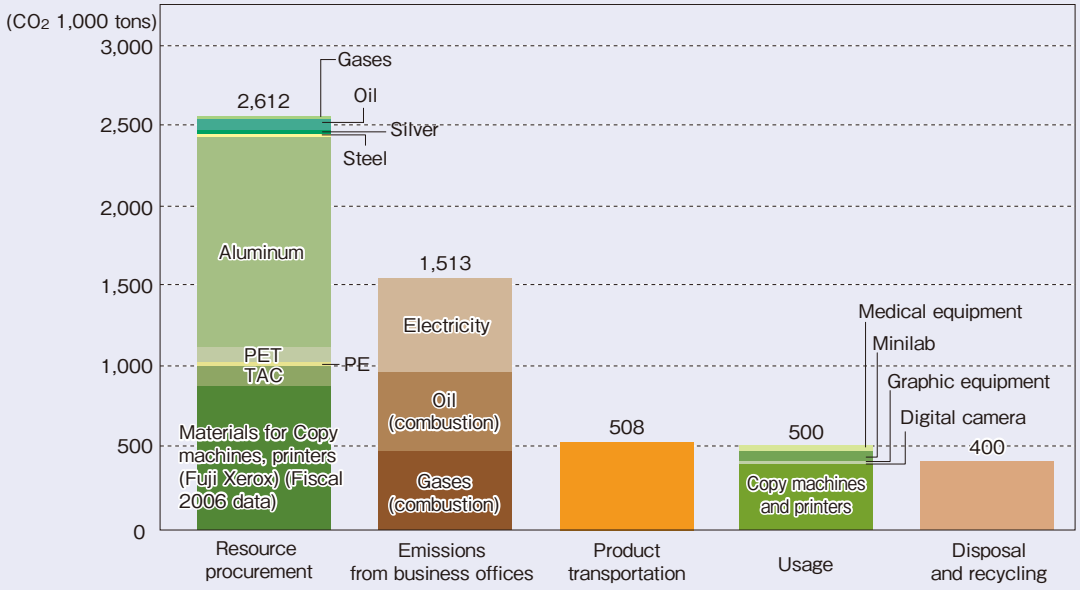
(Unit: 10,000 kℓ)

	the United States	Brazil	France	Germany	Japan
Bioethanol	2,601	2,255	115	70	0.003

	the United States	Brazil	EU		Japan
Biodiesel	170	40	649		1

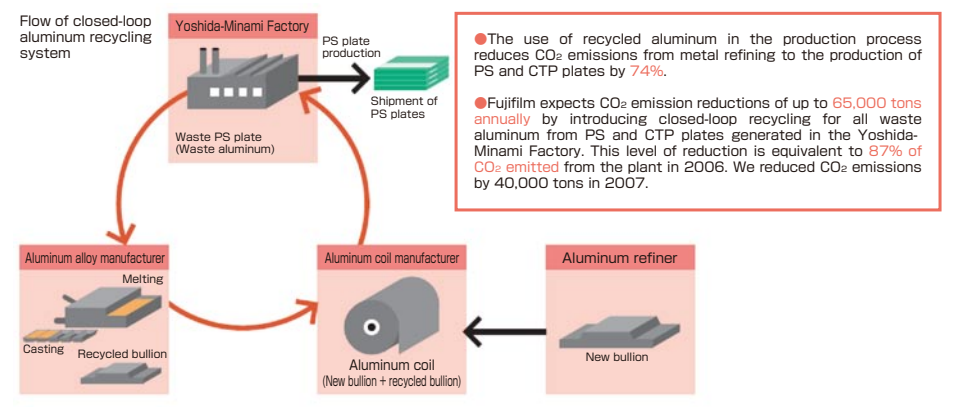
Source: Compiled by the Ministry of the Environment from the data of F.O.Licht's World Ethanol and Biofuels Report, Vol.7, No.4 October 23, 2008 p.75.

Figure3-2-5 Overall CO_2 Emissions of an Integrated Chemical Maker



Note: To calculate the equivalent amount of CO_2 emissions, the basic unit of CO_2 emissions was based on an inter-industry relations table
Source: Fujifilm Holdings Corporation

Figure3-2-6 Flow of Closed-Loop Aluminum Recycling System



Source: Fujifilm Holdings Corporation

pollution, have been serious and urgent challenges for emerging countries, while they have achieved rapid economic growth. Environmental pollution measures can lead to the reduction of the GHG emissions, depending on one's ingenuity and will be useful for environmental pollution measures that developing countries require and climate mitigation measures that the world needs to approach. Japan has been advocating the adoption of a "Co-benefit approach" (Figure3-2-8) as a way to solve two issues at the same time - fixing the environmental issue and to promote measures against global warming - towards the international society as well as developing countries. Two co-benefit CDM projects were adopted in FY2008, and those projects started in Malaysia and Thailand.

(5) Deployment of Japan's experiences and technologies towards establishment of a sound material-cycle society

Waste scattering and chaotic dumping have been taking place in developing countries in Asia, due to rapid urbanization and concentration of population. In some cases, recycling is conducted in an improper way, environmentally and medically, by people called waste pickers (collectors) who make a living from collecting valuables from disposal sites and households (Photo3-2-1). In the urban areas of East Asian countries, where remarkable economic growth is under way, the waste collection and treatment system has been improved while the generation of waste itself is increasing. The treatment and recycling of waste arises from business activities is also insufficient in technology and information, and are conducted in an

improper way in many cases. Suppressing waste generation and strengthening resource recycling and proper disposal have become more important.

Amidst such a situation, Japan has been advancing its cooperation on waste management through the Japan International Cooperation Agency (JICA) since November 2006 with a plan for three years in Hanoi City, where the volume of waste collected is increasing along with its rapidly increasing urbanization in recent years. Some model areas introduced sorted collection and recycling (composting), since raw garbage accounts for about half of municipal solid waste. As a result of outreach activities and environmental education on 3Rs in the model areas, the volume of raw garbage brought in to waste disposal sites was reduced by 59% on wet weight basis.

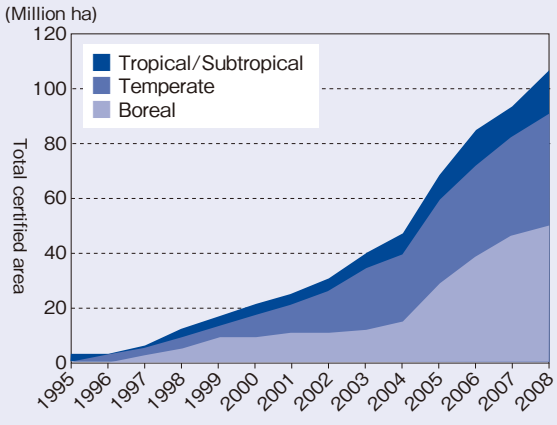
Japan's challenges while deploying projects on waste treatment and recycling in developing countries include institutional issues, such as shortages of human resources and supplies - necessary for maintaining management of funds and facilities - to introduce advanced technologies, lack of awareness of the significance and benefits on proper waste disposal and the establishment of a sound material-cycle society and lack of effective regulations. Other institutional issues are lack of information on waste flow and inadequate protection of intellectual property.

In order to effectively deploy Japan's experiences and technologies, it is important to have people understand the significance and benefits of proper waste disposal and the establishment of a sound material-cycle society, and to provide incentives to change the actions of waste generators.

(6) Development of Policy towards Training of Environmental Personnel

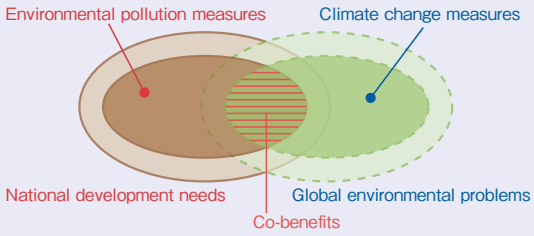
Personnel who can cope with the environmental issues that arise from rapid economic growth and industrialization of Asia, and are capable of building a sustainable society with a long-term view are strongly required. The decade of 2005-2014 has been designated as the "United Nations Decade of Education for Sustainable Development (DESD)," based on Japan's proposal, and human resource development for building sustainable society is being promoted all over the world. The Ministry of the Environment had reviewed necessary measures for the development of environmental leaders "those who look at the importance and urgency of environmental problems in light of their own experience and moral values, are committed to leveraging their area of expertise to realize sustainable development in their professional and private lives and to make actions in Asia including Japan," and formulated the "Vision for Environmental Leadership Initiatives for Asian Sustainability in Higher Education (ELIAS)" in March 2008. Japan has been implementing the "Project to Develop Higher Education Environmental Leadership Training Programs"— working with Japanese universities, companies, government and non-profit organizations, as well as institutions of higher education - since FY2008, entitled the "Environmental Leadership Vision for Asian Sustainability," in order to achieve this.

Figure3-2-7 FSC Certified Forest Area Growth



Source: Forest Stewardship Council

Figure3-2-8 Concept of Co-Benefit Approaches



Co-benefit-type measures means approaches that can achieve the development needs and the environmental pollution measures of the developing countries, while implementing climate mitigation measures at the same time. Especially the promotions of the environmental pollution measures, which are highly needed by the developing countries, are highly likely to contribute the climate change measures.

Possible target areas of co-benefits

target areas of co-benefits	Remedial activities	Environmental conservation benefits	Climate mitigation benefits
Air pollution	Improvement of combustion	Air pollutant reduction (SOx, NOx and soot and dust)	GHG emissions reduction
	Fuel conversion		
	Transportation measures		
Water pollution	Prevention of GHG emissions from sludge, etc.	Water quality improvement	
Wastes	Proper waste reclamation	Proper waste disposal	
	Utilization of biomass wastes	Waste reduction	

Source: Ministry of the Environment

Photo3-2-1 Waste Pickers Living on Disposal Sites

Source: Japan Industrial Waste Technology Center

Section 3 The New Germ Showing the First Signs of Growing at the Sight of 100 Years from Now

Three types of societies have to be realized at the same to make a sustainable society; a low-carbon society by drastically reducing GHG emissions, a sound material-cycle society - where 3Rs and proper waste treatment have been advanced - and a society in harmony with nature that can enjoy and pass the blessing of nature on to future.

In this section, first we will focus on technical aspects of environmental measures that will demonstrate multiple conservation efforts, and will consider how environmental technologies for the future should be. Secondly we will focus on the aspect of the great effect, demonstrated by combining the power of individuals and the whole of society, and will consider our future direction from environmental measures that are conducted by mutual cooperation.

1 Technological Synergetic Effects of Environmental Measures

(1)Wastes and CO_2 emissions reduced by methanization

Japan's waste biomass (animal manure, sewage sludge, black liquor, waste paper, food wastes, construction waste woods and waste from sawmills) in 2008 is expected to be about 300 million tons. Among the waste biomass, the amount of food wastes generated is about 19 million tons annually, and about 14 million tons of this is incinerated or disposed in landfills. The amount of food disposed of before expiration date is considered to have reached 5 to 9 million tons.

It is desirable to recycle food wastes as resources for recycling, since they are generated in spite of the efforts being made to reduce them. Specific ways of recycling them include eco-feeding and composting or using them as energy resources. The three main methods of using them as energy resources are fermentation, gasification and direct combustion. In this white paper, we will introduce methane fermentation, which is suitable for treating food wastes such as raw garbage containing high percentage of moisture.

Methane fermentation (methane gasification) is a method of producing methane, etc. by methane fermentation of organic materials, such as raw garbage, by the action of micro organisms including methanogen and collecting the generated biogas (Figure3-3-1).

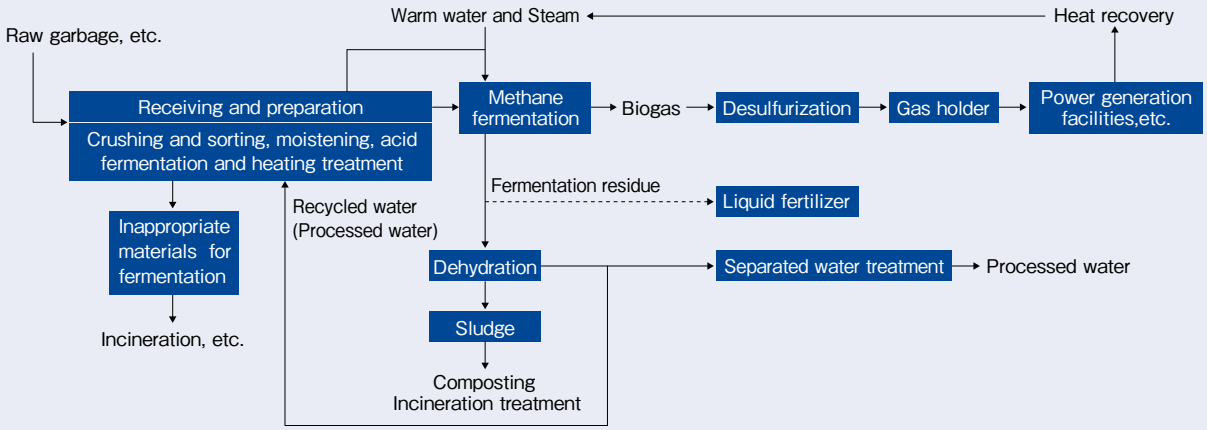
The government is promoting the maintenance of methane gasification facilities by backing "financial support for establishing a Sound Material-cycle Society," targeted at municipalities, and by drafting the "methane gasification (methane from raw garbage) facilities maintenance manual (January 2008)."

(2)Approaches for a society in harmony and the reduction of CO_2 emissions

Japan is endowed with an abundance of unused biomass (non-edible portions of farming crops and forestry waste) estimated to be about 22 million tons as of 2008. Utilization of such biomass contribute to measures against global warming, since utilization of biomass does not emit additional CO_2 into the atmosphere.

Omotetanzawa outdoor activity center in Hadano City, Kanagawa Prefecture, is performing maintenance of the surrounding Satoyama - the border zone or area between mountain foothills and arable flat land - in collaboration with volunteers, and is using the logged wood, which is produced during maintenance activities, as the fuel for wood biomass boilers for heating and to supply hot water to the surrounding facilities. Around 1,000 m^3 of wood chips are used annually from these activities, and the reduction effect is expected to be about 20,000 liters of kerosene (Photo3-3-1).

Figure3-3-1 Management Flow of a Methane Fermentation Facility



Source : Japan Waste Management Association's publication the Guidelines for Program Design on WasteTreatment Facilities, 2006 revised edition published in June, 2006 (partially arranged)

Column

Methane Fermentation Treatment Facilities

A company that gasifies methane from food waste is collecting biogas by operating methane fermentation of about 110 tons of food waste accepted daily from food manufacturing and processing industries, restaurants, department stores, convenience stores and so on. The methane gas extracted from biogas is used in fuel cells and gas engines and generate about 24,000kWh electricity (equivalent to electricity for about 2,400 households) per day. About 60% of the electricity generated is sold to external users. The effect of CO_2 reduction due to this power generation is about 14 tons per day.

When conducting methane fermentation, reducing the amount of foreign substances, such as plastics which are not suitable for methane fermentation, as much as possible is desirable. The company that gasifies methane crushes food wastes with three receivers and crushing and sorting machines, and sorts inappropriate materials from raw garbage, so the separation process while emitting food waste at restaurants and others only requires simple tasks.

Example of Leftover Foods Being Processed

Source : Bioenergy Co., Ltd.

The grassland of Aso in Kumamoto Prefecture is a vast grassland landscape of about 22,000 hectares, which are being enjoyed by about 18 million or more tourists annually. Changes in agricultural management, including the utilization of chemical fertilizer, and the decline and aging of the farming population have caused deterioration of the landscape and biodiversity in the grasslands.

Therefore, a number of collaborative entities have been taking initiatives to maintain grasslands, including the implementation of the open burning by volunteers, since 1999. In recent years, initiatives such as providing electricity and heat to existing heated pools and their ancillary facilities by collection and gasification of unused and dead autumn wild-grasses (Photo3-3-2) have also been started.

Photo3-3-1
Wood Biomass Boiler at Hadano City's Omotetanzawa Outdoor Activity Center

Source : Hadano city

(3) Realization of a sound material-cycle society and a society in harmony with nature by the effective use of lumber, etc.

A Realization of a sound material-cycle society and a society in harmony with nature

(A) Use of thinned wood

Recently, degradation of forest function has been of concern in Japan since forest maintenance practices such as wood thinning are increasingly not being carried out. Effective use of domestic lumber, including thinned wood, enables to circulate the forest cycle of "planting – growing – harvesting," and to reduce the use of depletable resources, including metals and fossil fuels, while also contributing to the establishment of a sound material-cycle society, a low carbon society and a society in harmony with nature.

"Cartocan" - a paper made beverage container - is

Photo3-3-2 Mowing at Aso Grassland

Source : Kyushu Biomass Forum

being developed, in order to effectively utilize thinned wood and mill ends produced from domestic forests. In order to inform the public of the importance "to nurture Japan's forests," the "Morikami Council (Council for Popularization of Paper Beverage Carton to Nurture Forest)"—centralized by beverage makers and affiliated companies—is popularizing Cartocan. Over 30% of the raw materials used in Cartocans are domestic lumber, including thinned wood, and are recyclable directly into paper products such as toilet paper because metal films are not attached to the inner surface. The volume of Cartocans produced in FY2007 was about 170 million packages, equivalent of about 0.3% of the drink containers of 500mℓ or less (according to the Morikami Council).

Laminated lumber makes it possible to use materials, such as young thinned wood which used to have limited purposes, for a wide range of usages, including construction materials, wall materials, and furniture (Photo3-3-3).

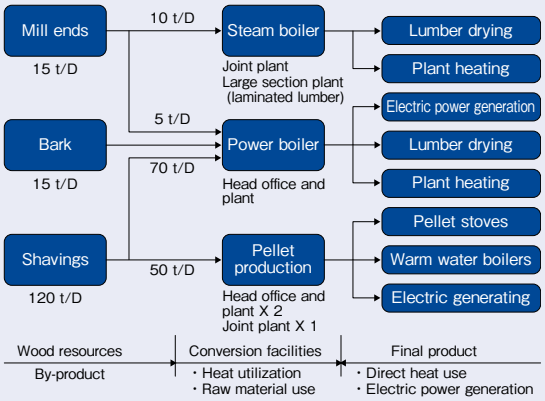
A laminated lumber manufacturer for construction is constructing various forms of buildings with laminated lumber made from domestic lumber. The manufacturer not only produces laminated lumber, but also produces wood pellets and generates woody biomass, using waste wood generated in the laminated lumber manufacturing process. This is an approach to contribute to the protection of nature, the reduction in consumption of fossil fuels and to reduce wastes (Figure3-3-2).

Regarding thinned wood used in copy paper, Japan has set criteria for environmentally friendly goods and is advancing approaches to prioritize procuring them, in accordance with the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on promoting Green Purchasing). In the past, only 100% post-consumer recycled paper pulp was purchasable; however after the revision of the criteria, copy paper partly made of thinned wood, etc., has been purchasable since FY2009, if it utilizes 70% or more recycled paper pulp. Some paper makers have succeeded in developing copy paper using thinned wood, and are supplying the market.

(B) Umi-no-Mori (Sea Forest)

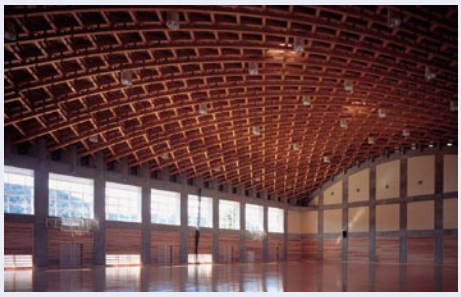
The Tokyo Metropolitan Government is projecting the "Umi-no-Mori" project to rebirth Tokyo Bay's final disposal sites into 88 hectares of green forests (reclamation area of waste and construction waste soil) through the collaborative activities of citizens, businesses and NPOs to plant trees. Forest creation will be conducted under the project with the collaboration of the private sector and public administration through seedlings, cultivated from acorns by elementary school children in Tokyo and volunteers, and planting seedlings

Figure3-3-2 General Outline of the Utilization of Woody Biomass by Laminated Lumber Manufactures for Construction



Source : Meiken Lamwood Corporation Ltd.

Photo3-3-3
Example of Application of Laminated Lumber



Source : Meiken Lamwood Corporation Ltd.

Figure3-3-3
Umi-no-Mori (Sea Forest) Project

Photo3-3-4 Participants Planting Trees

Source : Tokyo Metropolitan Government

purchased with funds raised by citizens and businesses. Soils used for planting trees are compost and construction waste soil, produced from pruned branches and leaves from city parks and street trees, and forest creation with environmentally sound resource cycle is being promoted. The area is about to revive as a place that contributes to harmony with nature and recycling (Photo3-3-4).

2 Environmental Measures that Mobilize Individuals and Social Powers

(1)Individual and local initiatives aiming at a low-carbon society

For the realization of a low-carbon society, it is necessary to understand about the energy consumption of our own daily life and to convert energy-intensive life into energy-saving life. Changing consumers demand types and quantities will be a great power to urge suppliers initiatives.

A Combining the team's overall power

The "Team Minus 6%," a national campaign for global warming prevention, is accepting citizens"my challenge declaration"as the "I declare CO_2 reduction of 1 kg 1 day 1 person" campaign. In this approach, each individual will choose items which "they want to put into practice" from the list on the global warming prevention menu that can be conducted in daily lives , aiming at reducing 1kg of CO_2 per day per person. According to the participants questionnaire conducted by the office of this campaign, the average number of eco activities being practiced per person was 17 items, and the average reduction amount of CO_2 was 1,023g per day. Since the number of participants is about 1.005 million as of the end of April 2009, the annual reduction amount of CO_2 that the participants achieved is estimated to be about 37,500 tons, if the actual results were the same as the survey.

While practices such as to "Set air conditioners to 28℃ in summer, 2℃ higher from 26℃" (76.0%) and to "Thoroughly sort waste, and recycle plastic waste," (71.8%), tend to be well practiced (Figure3-3-4), eco activities that arise from replacement or new purchases including, to "Replace incandescent light bulbs with compact fluorescent lamp" (43.2%) and to "Replace old type of air conditioners with energy saving ones" (16.0%) tend to be less well-practiced.

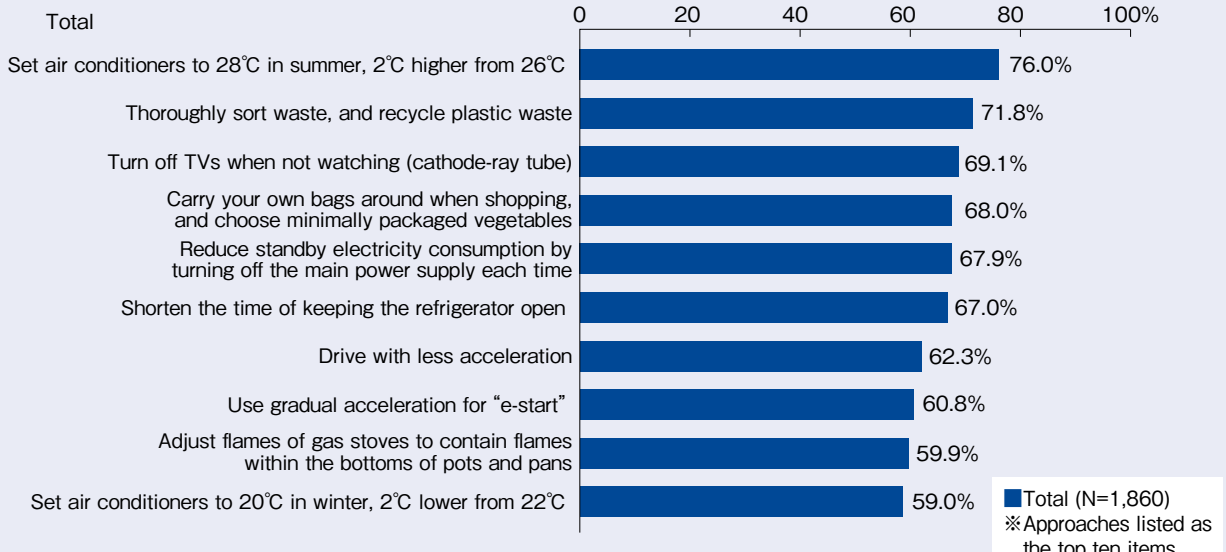
B Approaches activating Environmental Labeling, such as certified products

(A) Biodiversity –oriented certified products, etc.

In Japan's agriculture, forestry and fisheries, each local region began promoting activation of the certified system on forestry and agricultural products which were produced in biodiversity-oriented sustainable forestry and agricultural managements. The "Sustainable Green Ecosystem Council (SGEC)," which operates the forest certification system that meets Japan's actual conditions - a high proportion of forest plantations with a majority of forests owned by small-scale owners - was established in 2003. Certified forests in Japan by these certificate systems are increasing in area since an establishment of the Forest Stewardship Council (FSC) in 2000, reaching 107 certificates and about 1.2 million hectares as of the end of March 2009. This is equivalent to about 10% of the area of Japan's forest plantation.

The Marine Stewardship Council (MSC) which was established in 1997 sets certain rules on fish catches, species, fishing periods and fishing methods and internationally certifies to use sustainable fishing methods which do not deplete fish stocks. As of the end of March 2009, the MSC has certified 41 fisheries, reaching about 5 million tons of certified fishery products, equivalent to about 7% of the world's catch of edible fishery products. In Japan, the Kyoto Danish Seine Fishery Federation obtained MSC fishery certification in 2008 for the first time in Asia, by trawl fishing on Chionoecetes opilio and Hippoglossoides dubius,

Figure3-3-4
The I Declare CO_2 Reduction of 1 kg 1 Day 1 Person "A Schedule Practiced by Many Participants"



Source : "The I declare CO_2 reduction of 1 kg 1 day 1 person movement" office

using trawl nets. As for the domestic fishery certification system, "Marine Eco-Label Japan," established by the Japan Fisheries Association in 2007, received certification on Chionoecetes japonicus Rathbun in 2008 (Table3-3-1).

(B) Environmental considerations in promoting green purchasing

According to the "results of the FY2007 questionnaire concerning green purchasing in local government" implemented targeting 1,874 local governments nation-wide, 87.1% of them responded that they are "taking a systematic approach" to green purchasing in some way, if the consideration includes the level of the persons in charge. This resulted in almost all local governments approaching green purchasing in some way.

"Systems which certify eco-friendly products and display marks" was chosen as the most necessary system for enrichment of information on selecting products, followed by "Standardized and uniformed methods for product information comparison and expression," ranking second (Figure3-3-5). Environmental labeling is considered to play an important role in selecting products from this result.

C Supply and demand nodes for CO_2 reduction

Recently, carbon offset is drawing attention as a positive voluntary approach toward achieving a low-carbon society. Carbon offsets reduce CO_2 by cooperation between entities. The members of society, including citizens, enterprises, NPOs/NGOs, local governments and the government will first recognize the amount of their own greenhouse gas emissions, and make efforts to proactively reduce them. Then, entities will purchase a portion of emissions, which are difficult to reduce or remove from other places where GHG reduction has seen fulfilled offsetting all or part of emissions in this way.

Carbon offsets products and services and approaches have been extended into various situations. The carbon offset approach for the G8 Environment Ministers meeting held in Kobe, has offset about 512 tons of CO_2 emissions by purchasing Green Power Certificates and CDM credits for wind power generation projects in South Korea and India. New year's cards (carbon offset new year's cards) which the purchasers pay 5 yen of the sales price (55 yen) as a donation, earmarked for purchasing CDN credits and others, also sold

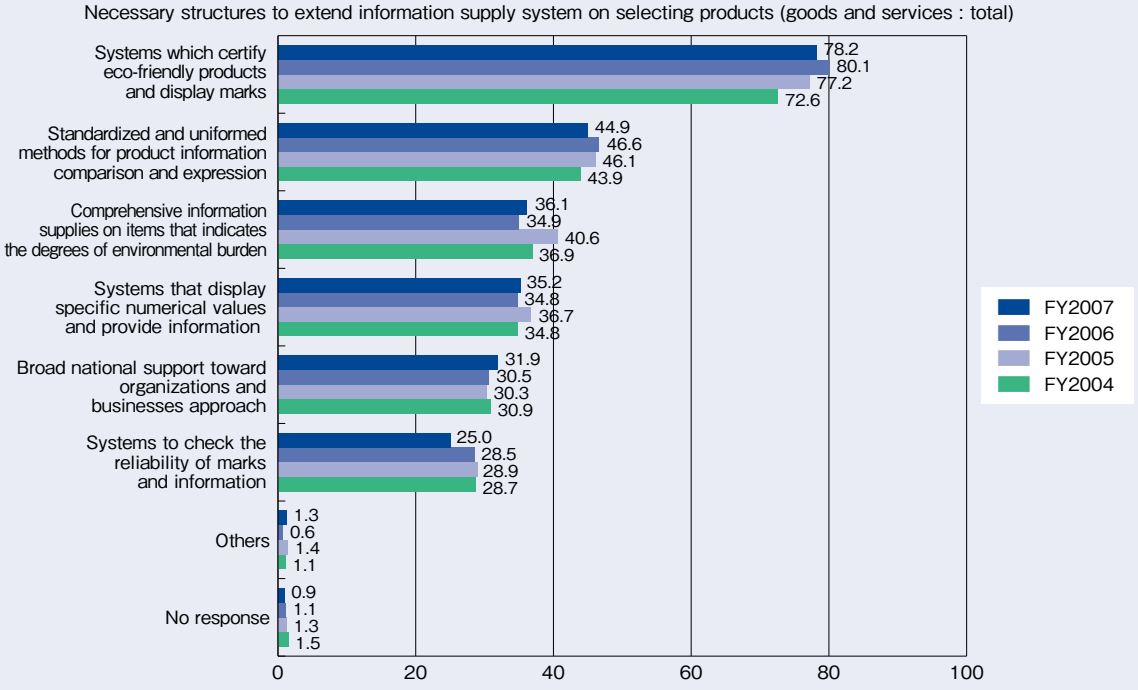
Table3-3-1 Japan's Fishery Certification Status

As of the end of March 2009

No.	Fish species	Certification holder	Certification system	Certified date
1	Chionoecetes opilio	Kyoto Danish Seine Fishery Federation	Marine Stewardship Council (MSC)	September 19, 2008
2	Hippoglossoides dubius	Kyoto Danish Seine Fishery Federation	Marine Stewardship Council (MSC)	September 19, 2008
3	Chionoecetes japonicus Rathbun	Sea of Japan Crab Pot Fishery Association	Marine Eco-Label Japan	December 10, 2008

Source : Compiled by the Ministry of the Environment based on the data of the offices of the Marine Stewardship Council and Marine Eco-Label Japan

Figure3-3-5 Necessary Structures for Selecting Products to Promote Green Purchasing of Goods and Services



Source : Compiled by the Ministry of the Environment from the "results of the FY2007 questionnaire concerning green purchasing in local government"

about 15 million units in 2008.

Besides such approaches, approaches combining credit and other purchasing with GHG reduction in various products and services have been started.

A regional bank will purchase emission quotas equal to certain percentage of the deposit amount (0.1%) over 5 years, if they receive time deposits from customers, and have transferred this to the Japanese government without charge. The deposit was 6.23 billion yen, exceeding the initial offering amount of 6 billion yen and 2,000 tons of emission quotas were transferred to the government without charge as for the first fiscal year. Furthermore, this bank is promoting its environmentally friendly loans, such as to provide financing the deposits to businesses which conduct GHG reductions. Besides this, various products and services are being created, including the followings: a home delivery service where the product purchasers bear the partial burden of CDM credits when using a certain mail order business; a member card of a certain convenience store with a system in which the convenience store transfers the amount of emission quotas to the government by trading the CDM credits created by wind power generation projects with their points.

(2) Highly effective environmental load reduction approaches in cooperation with regional development

Some environmental measures can be approached by individual entities, while for other measures, it is essential to change them by community and regional development with medium and long term perspectives. Each entity's effort on environmental conservation will bear great fruits, by structuring the community itself for less environmental load. Community development for less environmental load is also expected to revitalize regions.

A Compact city created in cooperation with each entity

Aomori City formulated the basic concept for its compact city forms, under the banner of the Aomori Urban Master Plan in 1999, triggered by the forced volume expansion of its administrative expenditures, including snow removal expenses, due to the expansion of its urban area. The city is promoting urban development and curbing suburban development and set down a transportation system classified by area, from the basis that enables to transport by foot and public

Column

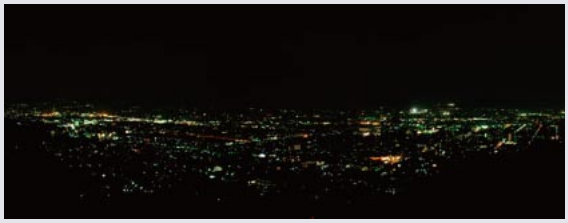
More Stars Should Be Visible

The Ministry of the Environment is calling for the "CO_2 Reduction/Lights-Down Campaign"every year to turn off the lights at illuminated facilities and others. The ministry called for a nationwide blackout on illuminated facilities and others on the first and last days of the campaign (June 21 and July 7) in 2008. Especially July 7 was chosen as the "Cool Earth Day" in the Action Plan for Achieving a Low-carbon Society, since it was the opening date of the 2008 Toyako Summit in Hokkaido, and various nationwide events, including the "TANABATA LIGHTDOWN" were addressed. Light downs will lead to prevention of light pollution, in addition to global warming prevention and energy saving. Although the direct effects of global warming prevention and energy saving can not be seen easily, the starry skies may shine brighter than usual on the nights where unnecessary lights are eliminated. Even if the campaign itself ended after a short time, these approaches are expected to encourage further actions, such as refraining from electricity use in one's daily life.

The "Light-down Kofu-valley 2008" was held in Kofu basin, Yamanashi Prefecture in October 2008. The event has been held for ten years to "restore the beautiful starry sky by eliminating street lights," and the night view of Kofu basin turned pretty dark in the hour between 8pm and 9pm.

The lights-down can contribute to global warming prevention and other issues, and will lead each individual to consider global issues, while looking at the night sky. Region-wide approval and actions are essential for conducting lights-down, and the darkness of the night sky where stars can be seen is the expression of the region's will. There should not be unnecessary illumination in our surroundings. The year 2009 is the International Year of Astronomy, and with such nationwide efforts at the same time, Japan's night sky will be more beautiful. CO_2 emission reduction is also expected from such approaches.

Night view of Kofu basin before the Light-down



Night view of Kofu basin during the Light-down

transportation in the central area (Table3-3-2).

Comparing the environmental effects of Aomori City's compact city forms with the effects of other nationwide core cities, Aomori City, which has reduced carbon dioxide emissions from passenger vehicles by 25% between 1999 and 2005, has realized a more effective reduction rate than other core cities (Table3-3-3). During this period, although the number of journeys (movements) per person has increased, the mileage per trip has greatly decreased (Table3-3-4), suggesting that the formation of the compact city has shown positive results. Furthermore, for the purpose of decreasing the number of trips per person, enhancement of public transportation, which can replace the vehicles-oriented transportation, is important.

Thus, expanding movements based on community's interests with a wide range of concerned parties is expected to promote the development of local communities. There, people can enjoy active community with less environmental burden.

Table3-3-3 Changes in CO_2 Emissions from Vehicles from 1999 to 2005 in Core Cities

	Emissions in 2005	Emission in 1999	Changes in CO_2 emissions
H City	0.35	0.61	−43.4%
T City	0.44	0.68	−35.0%
F City	0.56	0.79	−29.3%
M City	0.84	1.15	−27.3%
Aomori City	0.77	1.03	−25.0%
N City	0.47	0.62	−24.2%
K City	0.86	1.09	−21.0%
Omitted			
Y City	1.30	1.24	4.6%
G City	0.80	0.76	5.2%
S City	0.96	0.89	7.8%
I City	1.33	1.22	8.7%
A City	0.92	0.79	16.1%
B City	0.92	0.79	17.0%
O City	1.17	0.86	36.0%

Note : Comparison of core cities. Local governments except for the top seven and bottom seven have been omitted.
Source : Compiled by the Ministry of the Environment from the data of the National Institute for Environmental Studies

B Environmental load reduction with community block reconstruction

(A) CO_2 emission reduction and amenity improvement by improving the heat environment of residential areas

Let's see the effect of the environmental improvement per community block unit, which is a smaller section of a whole city. Specifically, we will examine the methods and effects of improving the heat environment in dense residential areas, in order to balance the GHG reduction and the improvement of city amenities and life quality.

The overall city blocks prevent heat from accumulating, in this simulation. Green coverage rate is improved with greenery areas and greening of the rooftops, a creek was regenerated and its water is used and improvement of building's insulation performance and structures for shielding sunlight were adopted. In addition, life quality has improved by increasing living space - privates and commodities combined—by 20% compared to the existing city blocks. The distinctive characteristics of the new city blocks are the balance of the drastic CO_2 reduction, due to the heat environment improvement and the introduction of advanced facilities and equipments, and the richness of the living space.

The simulation was also conducted under the conditions of a sunny summer day's electricity consumption will reach a peak on the new city block which indicates overall image and improvement points. Due to the measures taken against the heat environment outdoors and response to the next generation energy saving standards for housing, the electricity on air conditioning for each housing unit has been reduced, and the CO_2 reduction has been reduced by about 85%, combining the effect of the state-of-the-art equipment, may be introduced in 2010. Simulation made using the equipment—which could be disseminated around 2030—showed reduction of 100%, adding the effect of highly efficient solar power generation, and even 20% surplus power would be generated (Figure3-3-13). The value of HIP (Heat Island Potential), an index of sensible heat in the atmosphere,

Table3-3-2 Aomori City's Compact City Forms Being Aware of the Differences in Transportation System

Inner-city	Zone for enjoying highly convenient urban lives Establishment of a transportation system to support movements on foot and public transportation
Mid-city	Zone for keeping the balance between compact cities and urban vitality by residential functions with latitude and its vicinity functions Establishment of a transportation system to support movements by public transportation in principle
Outer-city	Zone for backing up the formation of compact cities by maintaining the abundant natural environment Establishment of a transportation system to balance the traffic of public transportation and private vehicles

Source : Compiled by the Aomori Urban Master Plan

Table3-3-4 Status of Vehicle Flow in Aomori City in 2005 and 1999

Population (thousand people)		Number of vehicles per population (units/ thousand people)	Distance per trip (km/Trip)	Annual number of trips per person	Annual number of trips per unit	Annual mileage per person (10km)	Annual mileage per unit (10km)	Total annual number of trips (million trip)	Annual total mileage (million km)	Total emissions from vehicles (per person)	Total emissions from vehicle (thousand ton)	Total number of vehicles (thousand unit)
2005	312	450	9.0	324	719	291	646	101	905	0.77	241	140
1999	319	379	12.2	268	708	328	866	85	1,046	1.05	335	121
	−7	71	−3.3	56	11	−37	−220	16	−141	−0.28	−94	19
	−2%	19%	−27%	21%	2%	−11%	−25%	19%	−13%	−26%	−28%	16%

Source : Compiled by the Ministry of the Environment from the data of the National Institute for Environmental Studies

decreased from 30℃ to 15℃ during daytime and its emissions after sunset was almost zero, reaching around 0℃ (Figure3-3-12). That means, the city block has very little accumulation of heat at night that could cause the heat island phenomenon. Not only introducing highly efficient equipment, but also examining the structure of the city is important for energy saving measures from the long-term perspective.

(B) Community development aiming to reduce greenhouse gas emissions

Looking at the approaches aimed at reducing GHG emissions, developed in actual communities, it is especially important not only to urge each relevant approach, but also to pursue collaboration and cooperation of those involved led by local governments, in community development where the region as a whole makes efforts. Achievement of environmental targets, which the region share, will progress as projected with this, and regional vitalization can be expected at the same time.

a Consideration of community development in regions

—Community development of Iidabashi Station West Exit area, which incorporates target of reducing CO_2 emission intensity—

Chiyoda ward in Tokyo established the "Chiyoda ward global warming mitigation ordinance" in December 2007, and set a mid-term goal to reduce CO_2 emissions within the ward by 25% by 2020 compared to 1990. The ward is to accomplish this goal by intensively focusing on energy savings measures in existing small and medium buildings, area measures on city blocks and areas and to promote the introduction of renewable energy, in addition to measures by electric power companies to reduce CO_2 emissions intensity. Especially, strategies to stock green energy—utilizing know-how of large corporations, such as energy saving methods and information on their cost-benefits to small and medium buildings—should be deployed, in order to advance energy savings in existing buildings. The ward was selected as an eco-friendly model city by the Regional Revitalization Bureau Cabinet Secretariat in January 2009.

In March 2009, the ward formulated and announced the eco-model city action plan to achieve the target of reducing GHG emissions as an eco-friendly model city, by 25% by 2020, and 50% by 2050, compared to 1990.

In 2008, the Law Concerning the Promotion of the Measures to Cope with Global Warming was revised. The revised law stipulated that prefectures, designated cities, core cities and special cities should establish items related to the measures to curb GHG emissions as needed in the Action plans of local governments, depending on the area's natural and social conditions. Regarding the measures related to curb GHG emissions of city plans and others, the governments were made to take GHG emission curb in collaboration with the Action plans of local governments into account, while balancing with the achievement of goals of such measures. Other municipalities are also expected to reduce GHG emissions in collaboration with the Action plans of local governments and others.

Iidabashi Station West Exit area of Chiyoda ward is located in front of Iidabashi station and is one of the most important transportation hubs in the urban center where five railroads converge, and is an area where new businesses and residential functions are accumulating. The ward is aiming to develop the infrastructures of this area in order to improve its attractiveness, and has agreed upon the "Iidabashi Station West Exit Area Development Project" based on the City Planning Act (Act No.100 of 1968) in June 2008.

In the project, the energy savings and CO_2 reduction in buildings, and total reduction of environmental load in collaboration with buildings in the region should be progressed as the approach driving the measures against global warming of the entire ward. The plan is also aiming to promote environmental measures in collaboration with surrounding areas.

In addition, when the building functions are renewed during the redevelopment of Iidabashi Station West Exit area in the future, under protection ordinance against global warming, eco-model city action plans and Iidabashi Station West Exit Area Development Project, the Chiyoda ward will streamline energy use, while promoting approaches towards improving the environment, such as appropriate use of resources systematically. Especially, the project stipulates that the average CO_2 intensity within the area to be less than 60% of those related to the operational division in the ward in principle.

As for energy-saving measures, the ward will implement heat load reduction by using super insulating glass and using energy-saving lighting, as well as implementing greening and water retention pavements in the area. The reduction of CO_2 intensity in the above business division are to be realized, and in 2012, although expecting the increase of total square meters of building floor area, due to the mitigation of floor-area ratio, the ward is aiming to contain the increase of the total CO_2 emissions from buildings in the area to within 5% of current levels.

Furthermore, Chiyoda ward is seeking to keep collaborate with businesses, aiming to reduce the total amount of CO_2 emissions from buildings in the area by about 25% in 2020, compared to the 1990 level. Other intended measures are as follows: the use of heat waste in surrounding areas which was produced within the area; the use of electricity in the area which was generated with solar power generation devices, intensively installed in surrounding areas; the introduction of an area energy management system, which will collect the energy consumption data of the buildings within the area and surroundings by computer systems, and then specialists will give energy-saving advice, based on the collected data.

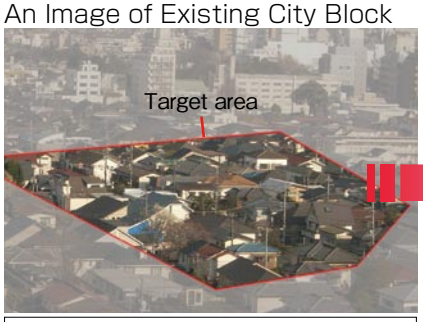
b Redevelopment of old factory sites, in cooperation with private developers and city hall

—Redevelopment of Settsu city's Minamisenrioka area, aiming to reduce CO_2 emissions and the heat island load at night—

In Settsu city, Osaka prefecture, a trilateral agreement called "The memorandum of Minamisenrioka community building, a model area against global warming" was concluded between a private railroad company, which will establish the new station, a private business, which proposed community development on introducing private revitalization, and city hall. In order to realize countermeasures against global warming, the parties concerned are advancing community development through cooperation. The area aims to reduce the amount of CO_2 emissions by 25% by around spring of 2013, at the time of the opening of the community, compared to the current estimated CO_2 volume on the assumption that average residential and business facilities in the Osaka area will be as simulated (Figure3-3-15). As for the countermeasures against heat island, the city is aiming to reduce heat load by 12W/m² at night.

As for the approaches towards achieving the target, the following are planned: private businesses to replace

Figure3-3-6 An Image of Existing City Block



Existing city block: An existent congested residential area in Tokyo Two-story wooden house(Partly RC)
Building-to-land ratio: 60%,
Plot ratio: 150%
Site area: Approximately 8,000㎡

Figure3-3-7 Overall Image of the New City Block and Improved Points

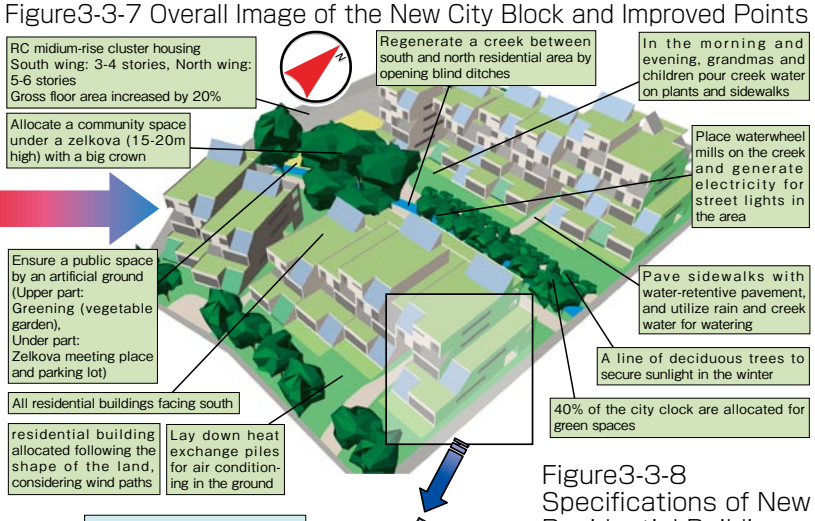


Table3-3-5 Building Performance Scheduled for Introduction (equipment items)

(equipment items)

Building performance	Present	Year of 2010	Year of 2030
Insulation and air proof performance	Before the Energy Efficiency Standards (year of 1980), partly the Energy Efficiency Standards	The next-generation energy efficiency standards (year of 2001)	same as on the left
Utilization of heat storage	N/A	Direct heat gain	same as on the left
Specification of apertural area	Normal aluminium sash	Wooden sash + Low-E Glass	same as on the left

Table3-3-6 Family Structure of All Houses

Family structure	Percentage
Type A: Family of four (Husband, non-working wife, 2 children)	20 percent
Type B: Family of four (Husband, working wife, 2 children)	30 percent
Type C: Family of two (Husband, working wife)	20 percent
Type D: Family of two (Elderly couple)	30 percent
Total: Approximately 60 houses, 180 people	

Figure3-3-8 Specifications of New Residential Buildings

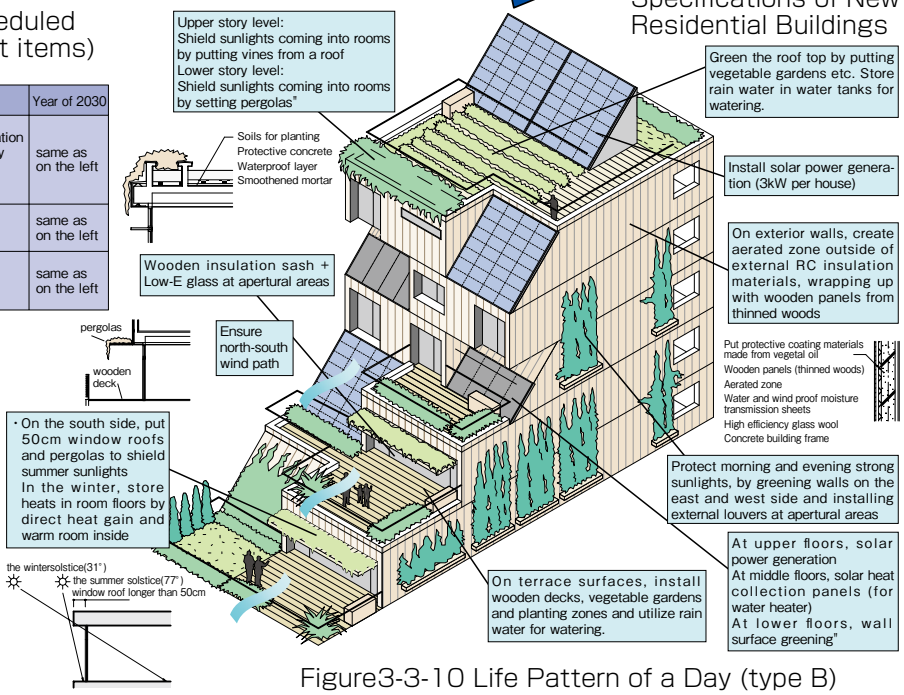
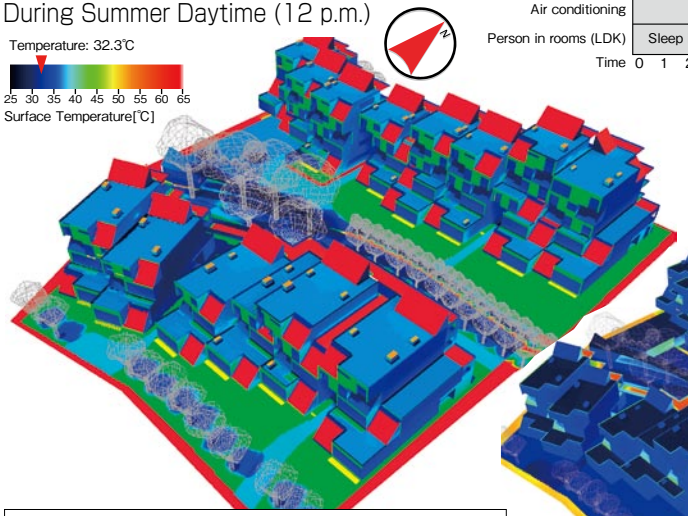
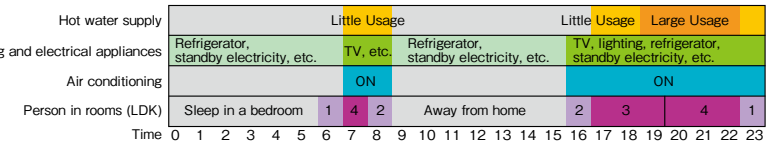


Figure3-3-9 Surface Temperature Distribution During Summer Daytime (12 p.m.)



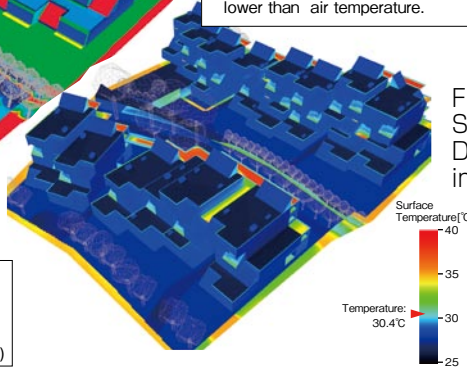
・Assumption:
Tokyo, summer sunny day
External temperature 32.3℃
・Wind direction:
south wind in the daytimemoderate wind in the night (sultry night)

Figure3-3-10 Life Pattern of a Day (type B)



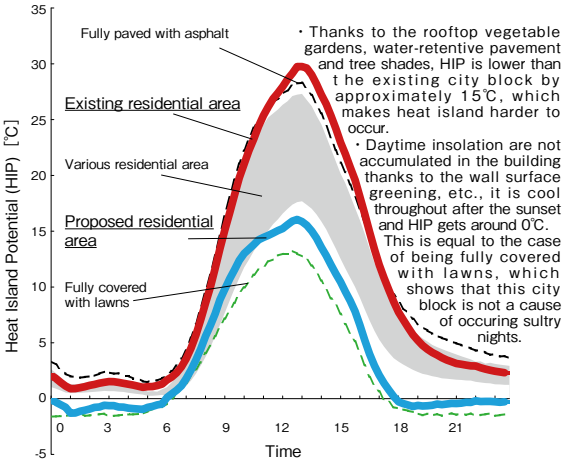
・Buildings do not get high surface temperature by the effects of rooftop vegetable gardens, wall surface greening, etc., except for panels for solar power generation in the daytime.
・Surface temperature of the rooftop vegetable gardens watered in the morning and water-retentive pavement are kept at a low temperature, 38℃, even at noon.
・At the surfaces of the tree-shaded water-retentive pavement and grasses, surface temperatures are kept lower, which is equal to or lower than air temperature.

Figure3-3-11 Surface Temperature Distribution after Sunset in the Summer (8 p.m.)



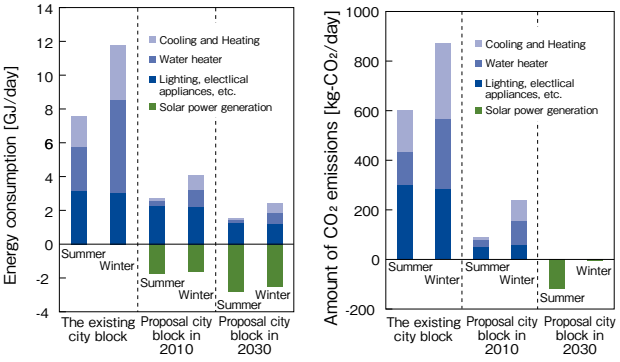
・Thanks to the greened build-ing walls on the east and west side, solar radiation heats in the daytime are not accumulated and surface temperatures get lower than air temperatures from the night to the morning.

Figure3-3-12
Daily Variation of Heat Island Potential
(a summer sunny day)



Heat Island Potential (HIP) [℃]
A measure to evaluate levels of possibilities for heat island to occur, which is used as an index for environmental effects to surrounding areas a site or a city block as objects for development brings.
The measure shows sensible heat load to the atmosphere and is calculated from the computation of surface temperatures.

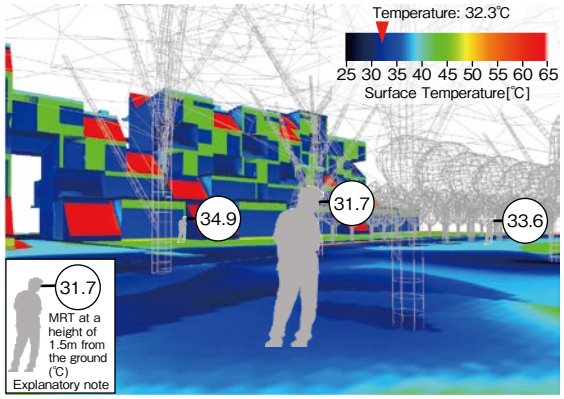
Figure3-3-13
Energy Consumption and Amount of CO_2 Emissions in Summer and Winter



Computation results in the cases of a sunny day in summer and winter.
Energy consumption is based on the second standard.
Amount of CO_2 emissions are based on the energy consumption of buildings in operation stage.

・In the proposal city block, energy consumption for cooling and heating is considerably reduced by adoptation of the next-generation energy efficiency standards to buildings, shielding summer sunlight and direct heat gain in winter, etc.
・Energy consumption of hot-water supply is also largely cut down, thanks to introduction of solar water heaters and high-efficiency heat pump water heaters.
・The proposal city block (year of 2010) can generate about 60% of energy consumption of a sunny day in summer from solar power generation panels installed on each houses.
・The proposal city block (year of 2030) is expected to reduce further energy consumption, thanks to energy saving in lighting, electrical appliances, etc. by the Top Runner method and high-efficiecy heating and cooling and hot-water systems.
In addition, solar power generation enables to make amount of CO_2 emissions less than 0 at the stage of operation. electricity generated surpassing energy consumption.

Figure3-3-14
Situations of Thermal Comforts in Living Areas (MRT)



Mean Radiant Temperature (MRT) [℃]
This is an index to evaluate effects by heat radiation, which is one of major parameters to decide thermal comforts in outdoor living areas.

・Because, under large tree crowns, sunlights are shielded and surface temperatures are kept lower than air temperatures by water-retentive pavement, MRT gets 31.7℃, lower than air temperature (32.3℃), creating living areas where breezes gives coolness.
・MRT are less than 35℃ even on the tree-lined roads and the grass surface without tree shade and places with high MRT are not observed unlike above the paved road in the existing city block.

Simulations were conducted by Tokyo Institute of Technology Hoyano/Asawa laboratory

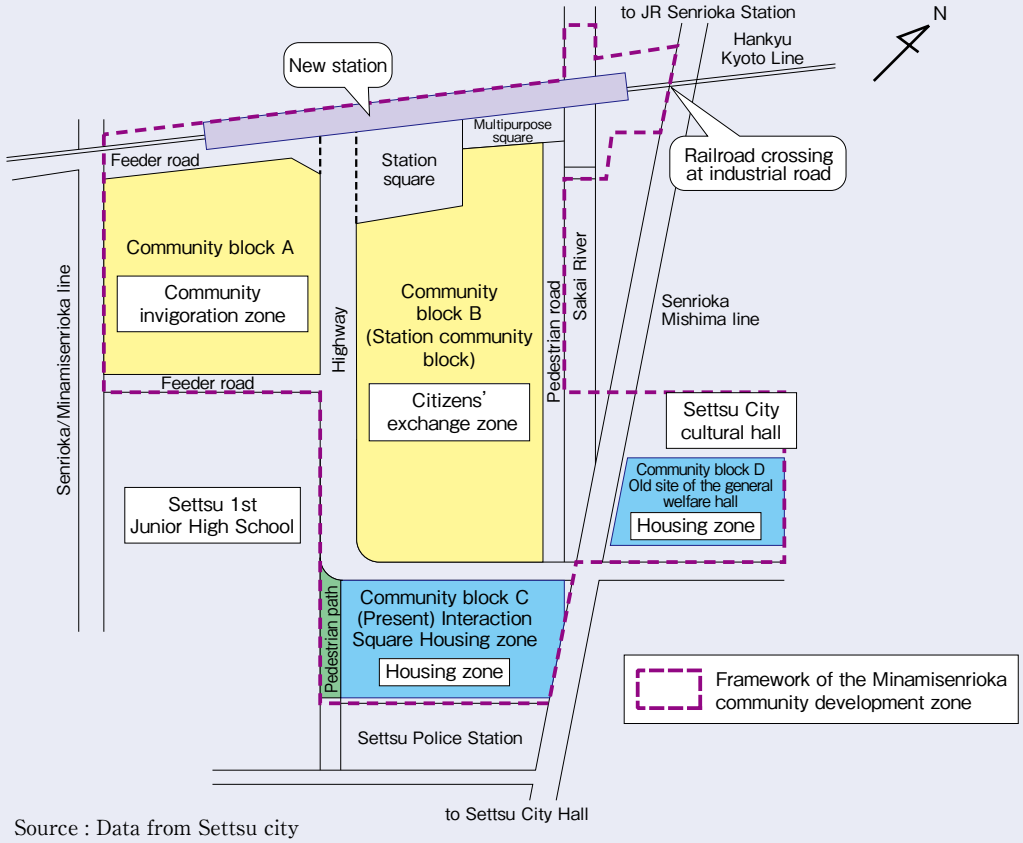
incandescent lighting with fluorescent lighting at residential and business facilities; residents to replace their electrical appliances to most energy efficient, to promote the utilization of public transportation by reducing the number of parking lots; the city hall to plant tree etc. along roads and sidewalks, to implement permeable asphalt pavement, to use rain water; to install energy saving lights, to install solar power generation panels for illuminating streetlights and other lights, and to secure the greening rate of at least 25% by planting plants in the building lots. Currently, the examination of setting these target values and assessment methods of the effect of countermeasures are under way.

The new station (Settsu city station), the entrance of the community, is promoting approaches towards the nation's first "carbon neutral station"—to eliminate CO_2 emissions caused by the station. The amount of CO_2 emissions emitted at the new station is estimated to be about 65 tons per year. About 35 tons of this (54% of the emissions) will be by introducing solar power generation and adopting energy saving equipment, such as LED lights. About 30 tons (46% of the emissions), where direct reduction is difficult, will be offset by purchasing emission reduction credits, etc., planning to reduce CO_2 emissions from the new station to zero.

C Environmental education and practice with collaboration of administrations, civil groups, etc.

In order to advance approaches to regional environmental conservation, combining community and regional developments, participation and cooperation of people from various parties is indispensable. Each regional administration, citizens, civil groups that are practicing approaches related to developments, educational institutions, such as schools, and

Figure3-3-15 Outline of the Land Use Zone for Minamisenrioka Community Development Project (plan)



Source : Data from Settsu city

businesses should proactively cooperate with each other as partners, that mean "Collaboration" is important. In order to do so, capacity building of duty bearers of sustainable regional development by such collaboration has also become a big challenge.

(a) Environmental community development of Higashimatsuyama city, Saitama prefecture

Higashimatsuyama city, Saitama prefecture, is famous for advancing community development by concluding an "agreement" which includes contents of mutual cooperation with equal rights of the administration and civil groups. The city has concluded an agreement not only for the purpose of coming to an agreement, but also to focus each essential entity to unite with other entities to proactively play its role.

For example, the market expansion of recycled products, made in workplaces for the physically challenged, has been quite difficult to achieve only through relationship with the welfare participants, but as they participated in an environmental event, their soap made from waste oil, which had not been sold at all, flew off the shelves. Subsequently, the organization for people with disabilities has participated in the agreement after they participated in the waste food oil collection in the model area.

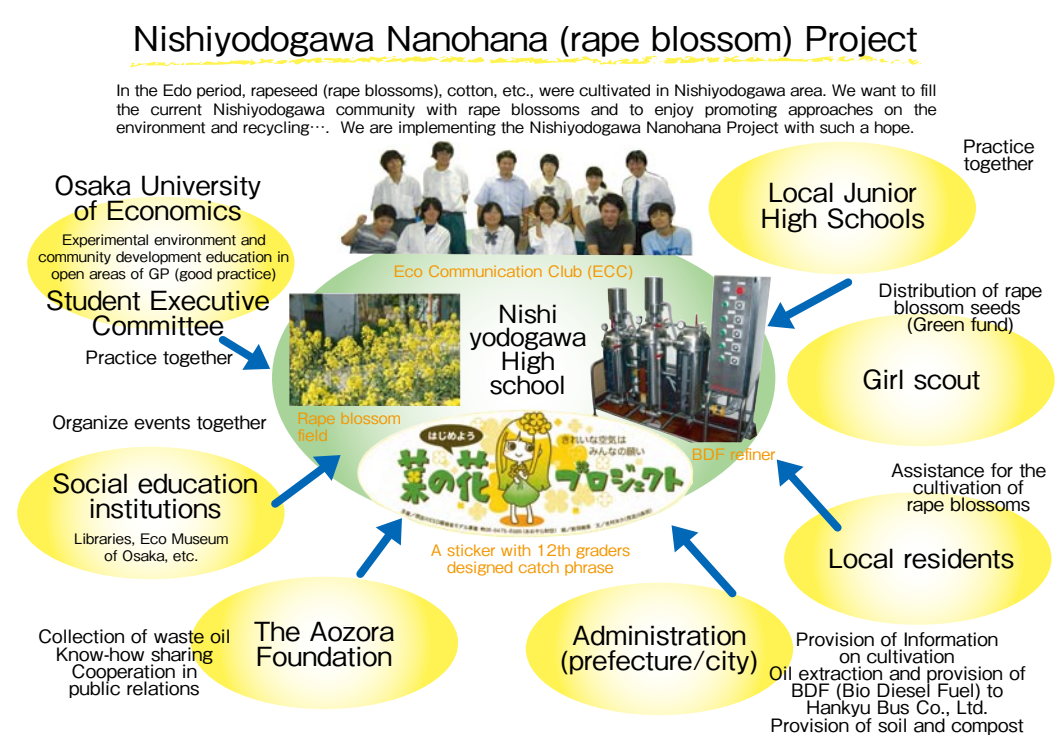
Thus, the agreement was studied as a reciprocal rule based on collaboration through actual activities, and the agreement was concluded by confirming the result of the study. It's worth noting that the rule that should have only a weak binding force, on the basis of equal rights under the agreement, will demonstrate high strength in each area, regarding specific segregation of duties.

(b) Approaches towards a sustainable community development in Osaka prefecture's "Nishiyodogawa ESD Commission"

Under the "United Nations Decade of Education for Sustainable Development," initiated by Japan's proposal, countries across the world are progressing their approaches. The Ministry of the Environment implemented the creation of practical ESD models in local communities for a period of three years starting in FY2006, and through public advertisements, the Ministry selected areas as models to engage in the implementation of ESD aimed at creating sustainable communities.

A model area, the "Nishiyodogawa ESD Commission," in Osaka prefecture, is working on a project aiming to realize a sustainable community development. Nishiyodogawa high school in Osaka, an ESD Commission member, has made an approach to the "Nanohana Project" (a sound material-cycle project in which students cultivate rape blossoms, cook foods using the oil extracted from the plants, utilize the waste oil from the cooking for driving cars and to let rape blossoms absorb the CO_2 emitted by cars) (Figure3-3-16) in the compulsory subject classes of "The Environment." After school, the high school students voluntarily conduct club activities, and have extended the scope of their activities by collaborating with other commission members. Members of the collaboration include the Center for the Redevelopment of Pollution-damaged Areas in Japan (The Aozora Foundation), a foundation which aims to redevelop pollution-damaged areas and plays a central role, local universities and junior high schools, the local administration, social education facilities, community associations and Girl Scouts. In this way, synergetic effects have been created that community

Figure3-3-16 Nanohana Project



Source : Center for the Redevelopment of Pollution-damaged Areas in Japan (The Aozora Foundation)

development will progress, as well as advancing living environment education, under the cooperation of the region and educational institutions with the key word of "sustainable regional development with ESD."

The Ministry of the Environment has combined "39 key ideas for ESD, learning from the Japanese 14 model areas' experience" which introduces the detailed approaches of these model areas, and key ideas for advancing ESD in model projects.

D Energy supply in collaboration with agricultural groups

The Act on the Promotion of New Energy Usage (Act No.37 of 1997) was revised in 2007 and the micro-hydroelectric power generation with the maximum output power of 1,000kW was newly included as a new energy. Accordingly, local governments and others are showing a trend towards introducing the new energy. Major distinctive feature of the micro-hydroelectric power generation is that environmental impacts, such as environmental modification during construction is low, installation can be completed in a short period of time, and suitable for localized use low volume power demand.

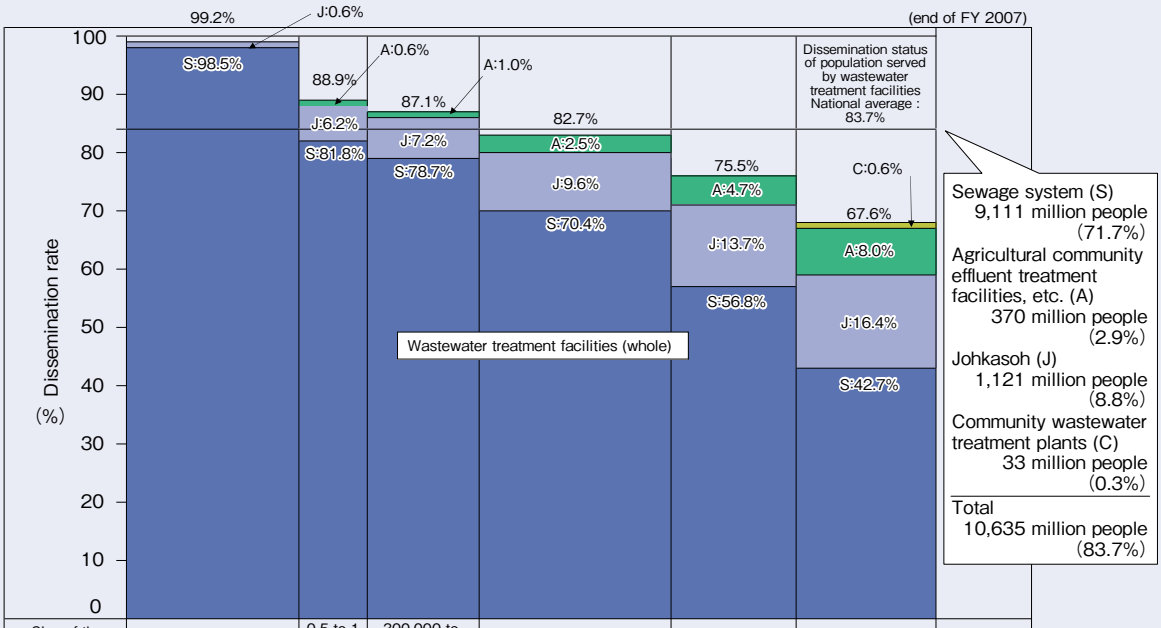
Omachi city, Nagano prefecture started businesses to maintain micro-hydroelectric power generation facilities in 2007, subsidized by the New Energy Foundation and NEDO (New Energy and Industrial Technology Development Organization). This business is to effectively use the unused head in the Machikawa irrigation canal, and the run-of-river type power plant will release all of the used water in the Machikawa. The Machikawa has an abundant volume of water, enabling water sampling stability at maximum of 1.1m^3/s and the utilization of the steep terrain (available head of 16.0m, and penstock extension of 83.7m) makes it possible to generate maximum output of 140kW of electricity. The generated electricity will be self-consumed at the nearby night soil treatment facilities, which is also expected to be a place for learning about environment and energy, since 550 tons of CO_2 emissions will be saved annually. The Omachi city based "Workshop for Sustainable Community" has also established experimental facilities of micro-hydroelectric power generation facilities in two locations of the city and is maintaining the micro-hydroelectric power generation facilities with a contract with local fishery cooperatives.

These Omachi city approaches have drawn attention nationwide, and many people from many areas are visiting the city for eco-touring and inspection training, leading to invigoration of the area.

E Conservation and creation of sound water environment by developing municipal wastewater treatment facilities, taking regional characteristics into consideration

For the purpose of conserving a sound water environment in rivers and lakes, as well as improving public health and living environment, it is important to develop municipal wastewater treatment facilities, which are essential for a healthy environment, and to appropriately treat the wastewater emitted from households and plants. The dissemination status of population served by wastewater treatment facilities as of the end of FY2007 (Figure3-3-17) has reached about 84% at the national average, with the sewage system covering about 70% and johkasoh-on-site systems for domestic effluent - and rural community sewerage systems covering about 10% of the total population's burden. However, suburban areas of provincial cities and small or middle sized municipalities, etc.,

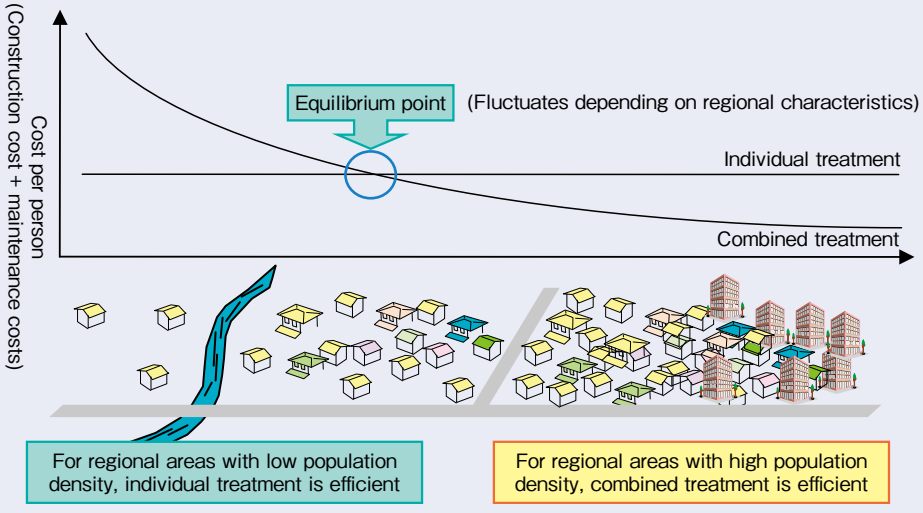
Figure3-3-17 Dissemination Status of Population Served by Wastewater Treatment Facilities by Regional Scale (end of FY2007)



Size of the population	1 million people or more	0.5 to 1 million people	300,000 to 500,000 people	100,000 to 300,000 people	50,000 to 100,000 people	Less than 50,000 people	Total
Total population (10,000 people)	2,751	1,036	1,743	3,052	1,941	2,185	12,707
Population served by wastewater treatment facilities (10,000 people)	2,730	920	1,518	2,524	1,465	1,478	10,635
Number of municipalities	12	15	45	189	279	1,254	1,794

Note 1 : The total number of municipalities, 1,794, is comprised of cities 784, towns 815, and villages 195 (Tokyo metropolitan wards are included in cities) (as of March 31, 2008)
2 : The values of total population and population served by wastewater treatment facilities were rounded to the nearest ten thousand people.
3 : The total value and breakdown may not match, since the values less than 0.5% of the dissemination status of each wastewater treatment facility by regional scale are not listed.

Figure3-3-18 The Concept of Zoning Combined Treatment and Individual Treatment



Source : Ministry of the Environment

with a total of population of 20 million people are unserved by such facilities, and urgent development of municipal wastewater treatment facilities is desirable.

In enclosed water areas such as rivers and lakes which are essential for water quality conservation, focusing promotion of dissemination of wastewater treatment facilities, as well as the introduction of advanced treatment are necessary, in order to remove nitrogen and phosphorus, which are the cause of red tide and blue tide, due to eutrophication.

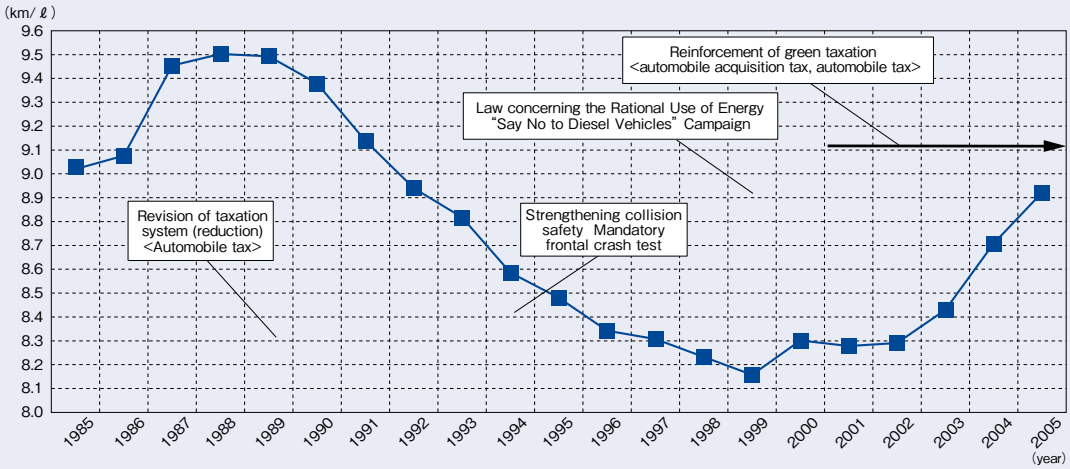
Regarding the development of municipal wastewater treatment facilities, johkasoh—an per household treatment—is economic in sparse population distribution areas. Combined treatment, such as sewage system and rural community sewerage systems, becomes economic as the population

Column

Reduce CO_2 Emissions from Automobiles—Conversion towards Fuel-Efficient Vehicles and Public Transportation

The transport sector accounts for about 20% of CO_2 emissions resulting from energy use, with vehicles accounting for about 90% of these emissions, of which about 60% are private vehicles (hereinafter referred to as automobiles). That means automobiles emit about half of the CO_2 emissions of the transport sector. Looking back several years, upsizing of automobiles and increase in the number of units has continued to grow in the 1990s, and in increased CO_2 emissions of the entire transport sector, due to decreased per kilometer fuel consumption. In the 2000s, CO_2 emissions have peaked, since the number of fuel-efficient vehicles and per kilometer fuel consumption have increased.

Relationships between CO_2 Emissions Resulting from Private Vehicles and Passenger Transportation Volume

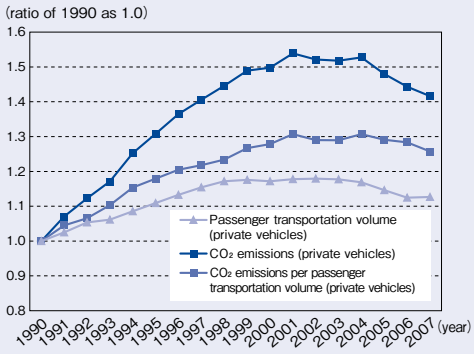


Source : Compiled by the Ministry of the Environment from the data of the Ministry of Transport's "Handbook on Transportation-Related Energy Consumption" and the Ministry of Land, Infrastructure, Transport and Tourism's "The Survey on Transport Energy"

Various factors, as listed in the above chart, are the likely cause of this. For example, the automobile tax reduction (1989) has become a factor to increase the number of mid-size cars (the so called three numbers plates) The strengthening of green taxation (implemented at a full-scale from 2001) has also become a factor to progress the dissemination of fuel-efficient vehicles and the taxation system is considered to be related as this factor.

CO_2 emissions resulting from automobile use have shown an increasing trend until about a decade ago, but since the passenger transportation volume leveled off in the 2000s, the emissions have shown a decreasing trend. In order to keep reducing emissions, improvement of transportation efficiency and promotion of modal shift (conversion of transportation means) are necessary, in addition to improvement of per kilometer fuel consumption, low carbonization of fuels and the reduction of automobile mileage. Promotion of decoupling—to increase convenience and productivity, while reducing CO_2 emissions—are also required to curb passenger transportation volume itself by utilizing intensive land use and IT.

Relationships between CO_2 Emissions Resulting from Private Vehicles and Passenger Transportation Volume



Source : Compiled by the Ministry of the Environment from the Energy Data and Modelling Center (EDMC), the Institute of Energy Economics, Japan's Transportation Sector's Volume of Transportation by Mode from the "GHGs Inventory"

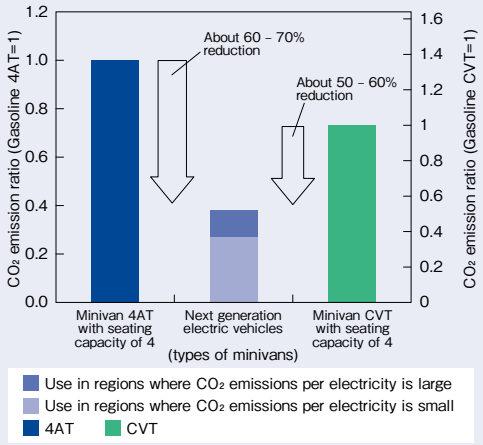
Conversion towards fuel-efficient vehicles and public transportation is a way to reduce CO_2 emissions from automobiles.

First, we will look at the effect of reducing CO_2 emissions of automobiles used for short journeys, such as local commuting and shopping. According to the "Research on reduction of environmental load by a review of daily use transportation," conducted by the National Institute for Environmental Studies (NIES), on-road tests on next generation electric vehicles showed that about a 60% to 70% reduction in CO_2 emissions can be expected by switching automobiles from gasoline minivans (4AT) to electric vehicles (seating capacity of 2). On the other hand about 50% to 60% reduction of CO_2 emissions can be expected by switching automobiles from gasoline minivans (CVT) to electric vehicles (seating capacity of 2).

The Action Plan for Achieving a Low-carbon Society is aiming automakers to sell one unit of next generation vehicle out of every two new vehicles by 2020, and the NIES has made a trial calculation in the case that the promotion of hybrid vehicles will spread rapidly. The trial calculation estimated that if all new automobiles sold were hybrid vehicles by 2020 with their diffusion rate reaching 40%, CO_2 emissions of the transport sector would be reduced by 3%, compared to the base year.

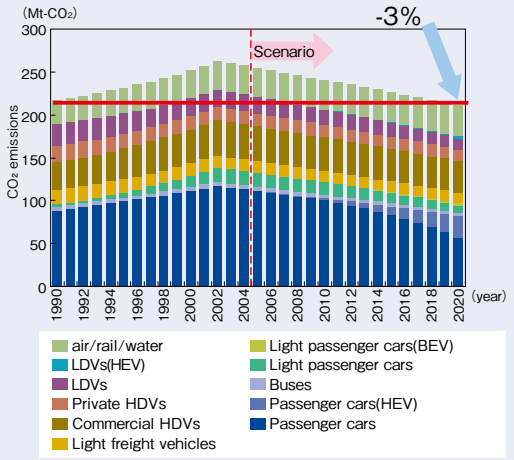
Next, we will look at a case where conversion from automobiles to public transportation is progressing. Toyama city in Toyama prefecture projected a full-scale LRT (Light Rail Transit) by launching a new route (1.1 km) converting to a street car with the relevant route (6.5 km), in order to stop the vicious circle, including the motorization in which the decreasing number of Toyama-ko line users reduces the number of trains operated which further reduces the number of users. Toyama city's dependency on vehicles is high compared to the national average, and transport share by means of transport for public transportation has remained at 4.2% with vehicles having about 72% share. The average number of users using the Toyama-ko line after its conversion to LRT on weekdays jumped to about 4,900 in 2006, from about 2,200 (2.2 folds) during the period operated by the West Japan Railway Company. The average number of users during weekends has also increased by 5.3 fold and especially the percentage use among the aged has been high. Passengers transferring from buses and automobiles have reached about 25% and 22% on weekdays and weekends respectively, and CO_2 emissions from vehicle use are considered to be reduced. Toyama city's LRT introduction has affected many fields, including the formation of a barrier-free city in the age of aging society with fewer children, and economic effects such as an increase in tourists and residential construction numbers, in addition to the development of a compact community focusing public transportation and the formation of a low-carbon society without depending on vehicle traffic.

CO_2 Reduction Effects by Switching from Minivans to Next Generation Electric Vehicles



Source: National Institute for Environmental Studies "Research on reduction of environmental load by a review of daily use transportation"

CO_2 Reduction Scenario of Transport Sector



Source: National Institute for Environmental Studies "Transportation in Low Carbon Society"

density becomes higher (Figure3-3-18). Therefore, urgent review to develop proper wastewater treatment facilities by sufficiently reflecting regional characteristics, including the importance of economic efficiency and water quality, taking changes of social conditions into account, such as the recent trend of population decline is being promoted in the "Prefectural Plan"—a comprehensive plan on wastewater treatment formulated by each prefecture. The dissemination of wastewater facilities will contribute to regional invigoration, including the promotion of settlement, industrial development and improvement of sightseeing attractiveness—due to the development of regional living and social infrastructure—in addition to water environment improvement, such as the reduction of bubbles and foul odor from smell floating on rivers and lakes, for example.

Furthermore, biomass such as biogas and sludge generated during the process of wastewater treatment is planned to be effectively used, and treated water is utilized to maintain the water volume of chatter water and rivers. In addition the usage of flush toilet water, is to be used cyclically valuable resource.

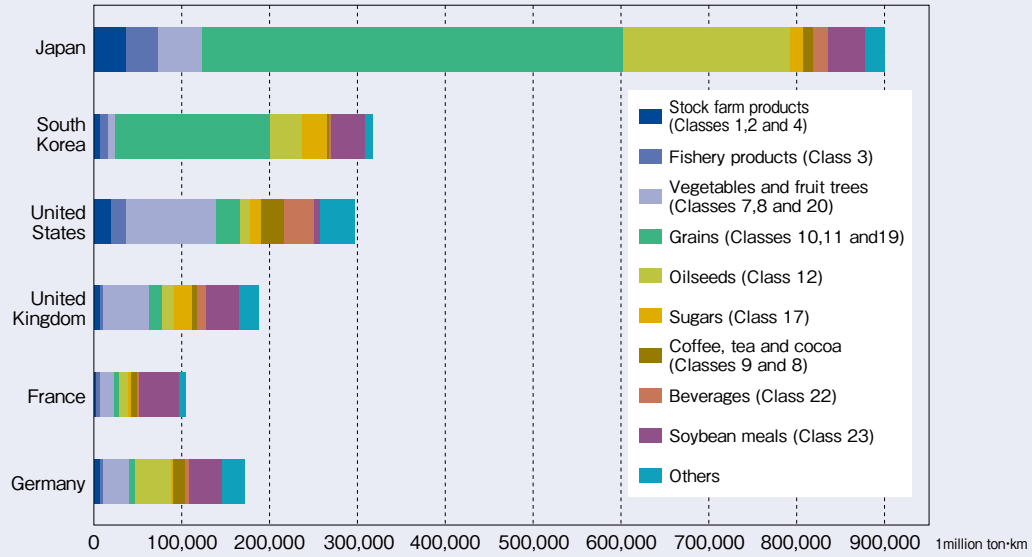
(3)Regional approaches of the local consumption of locally produced products

A The status of Japan's food mileage

Japan's self-sufficiency rate of food supply is about 40% on a calorie basis, and self-sufficient rate of timber is only about 20%. The majority of our lives being supported by imported products.

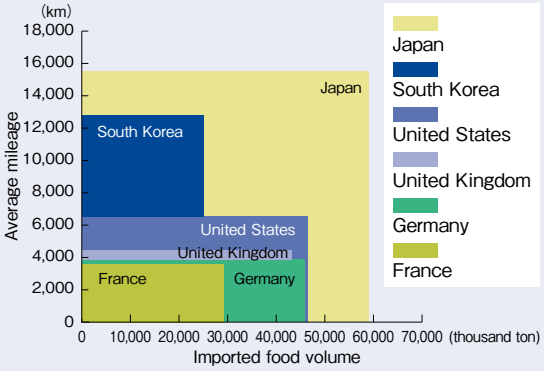
"Food mileage" is an index which represents environmental load that arises from food transportation, multiplying the transported food (ton) by the mileage (km). It shows that the longer the distance between a production site and a

Figure3-3-19 Comparison of Each Country's Food Mileages of Imported Foods



Source : Tetsuya NAKATA "Food mileage—and its Influence on the Environment" (Nippon Hyoron-sha Co., Ltd., 2007)

Figure3-3-20 Imported Food Products and Average Mileage of Each Country



Source : Tetsuya NAKATA "Food mileage — and its Influence on the Environment" (Nippon Hyoron-sha Co., Ltd., 2007)

consumption site is, the more the global burden will be with more energy required. According to a provisional estimate by the Ministry of Agriculture, Forestry and Fisheries in 2000, Japan's total food mileage is exceptional in the world (Figure3-3-19). Japan's imported food volume was at the level of 70 to 80% of those volumes in each western country excluding France, considering the total imported volume. However, considering the average mileage, each western country remains at the level of 20 to 40% of Japan's average mileage. That means that Japan's food imports are imported from quite long distances, compared to other countries, in addition to their large quantity (Figure3-3-20).

The trend of four typical item's food mileage among Japan's major fresh vegetables is shown in the Figure3-3-21. If all four items were to be replaced with domestic products, CO_2 that arises from overseas transportation would be reduced by 3,000 tons.

B Energy supply with locally produced wood biomass

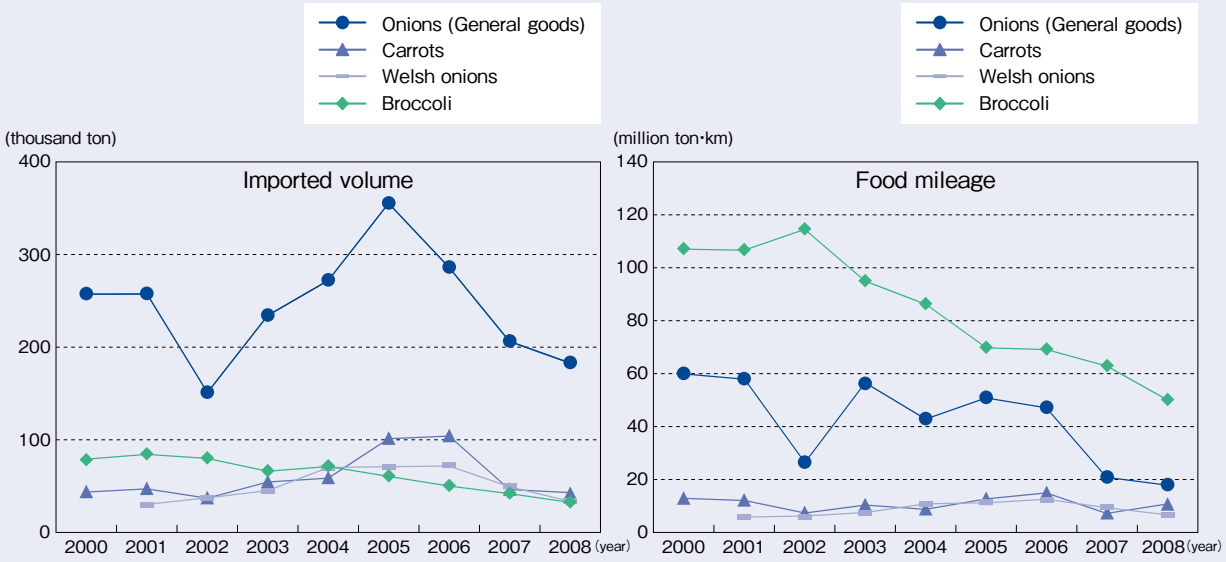
Wood biomass is expected to be increasingly used as a renewable energy. Here, we will calculate the reduction effect of greenhouse gases hypothetically, in the case that about 2.4 million tons, equivalent to about 40% of about 6 million tons of domestic unused biomass (leftover at saw mills, lumber at construction sites and forest leftovers) as of 2005, were used. If 2.4 million tons of unused biomass were used as fuel by processing it into wood pellets, the volume is equivalent to 1.14 million kℓ in kerosene. Since the amount of annual kerosene consumption is about 5.65 million kℓ (2007), in about 6.1 million households in Hokkaido and Tohoku region, if this were to be replaced by wood pellets, the volume would be equivalent to about 20% of the kerosene stoves used in households. Since the calculation is based on the allocation of Hokkaido and Tohoku region, where kerosene consumptions are heavy, if wood pellet becomes widely used in these regions, energy is considered to be able to be replaced in many households. Comparing the initial and operational costs between pellet stoves and kerosene stoves (Table3-3-7), pellet stoves contribute to reduce greenhouse gases, while measures such as reducing the cost through dissemination are considered to be necessary.

C Approaches to make the most of regional lives

(a) Regional invigoration brought about by Oriental storks

In September 2005, artificially bred storks were experimentally released in Toyooka city, Hyogo prefecture. It was the first time in 34 years to experimentally release storks after the death of the last wild stork in Japan in 1971. This was the first attempt in Japan to release a wild animal, once extinct in the wild, back in to the wild. Toyooka city had formulated the "Toyooka City Sustainable Strategy for Environment and Economy" in March 2005, before the experimental release. The strategy aimed at developing the environment along with economy, symbolizing a stork, is composed of the following five pillars: the "Promoting Local produce, Local consumption," "Promoting the Organic agriculture," "Developing the Stork tourism," "Accumulating environmental and economical companies" and "Promoting Eco-energy."

Figure3-3-21 Changes in Imported Volume and Food Mileage of 4 Major Fresh Vegetables



Source : Compiled by the Ministry of the Environment from the data of the National Institute for Environmental Studies

Table3-3-7 Cost Comparison of Pellet Stoves and Kerosene Stoves

	Purchase price	Operational costs
Pellet stoves	About 350 thousand yen	Necessary fuels: 2,832kg (1.3kg × 12h × 180 days) Fuel price: 118,944 yen (42 yen/kg) (Heating output 1.7–13.9kW、Fuel consumption : 0.6 – 2.25kg/h)
Kerosene stoves	About 130 thousand yen	Necessary fuels: 1,518ℓ (0.703ℓ × 12h × 180 days) Fuel price: 124,223 yen (1,473 yen/18ℓ) (Heating output 1.75kW-18.7kW、Fuel consumption : 0.49-1.2ℓ /h)

Note 1 : Purchase price, necessary fuels, heating output and fuel consumption for both pellet and kerosene stoves represent the average of 10 models.
2 : Fuel price of pellets represents the average price of 4 companies in the Tohoku district.
3 : Kerosene price is the average during six months from October, 2008 to March, 2009 in the Hokkaido and Tohoku Bureaus based on monthly surveys by the Oil Information Center of the Institute of Energy Economics, Japan
Source : Ministry of the Environment

One of the specific approaches is wet rice cultivation by pesticide-free or reduced amount of agricultural chemicals to nurture various animals that will feed on the storks.

The city established the "Agricultural Method that Helps the Oriental White Stork Survive" by (1) pesticide-free or reduced amount of agricultural chemicals, (2) reduction of chemical fertilizers and (3) such as to extend the period during which rice paddies are filled with water. The rice produced with these agricultural methods is sold as "Rice made from rice paddy field where storks can live." The rice is sold at a price about 30% to 60% higher than that of ordinary rice, in troublesome managing weeds and water, sales are going well with some major mass retailers in other regions selling them. The crop areas by this agricultural method has been extended from 16 hectares in FY2004 to 183 hectares in FY2008.

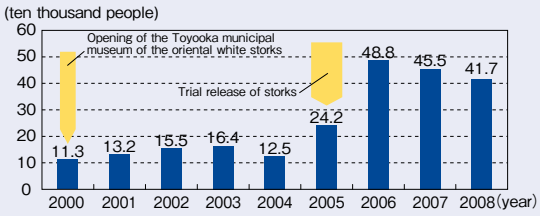
There are also effects on tourism and the number of visitors to the Toyooka municipal museum of the oriental white storks has increased from about 120 thousand in FY2004 to about 420 thousand in FY2008 (Figure3-3-22). Professor Onuma's group at Faculty of Economics, Keio University, made a trial calculation that the annual total expenditure by stork tourists on travel and souvenirs, has reached 1.2 to 3 billion yen.

(b) Approaches to make the most of harmful wildlife and alien species as resources

The damages on agriculture, forestry and fisheries and the ecosystem caused by wild birds and mammals such as deer and wild boar, which have increased locally, and fish of foreign origin, such as largemouth bass and bluegill still remains serious. In each region, wild birds and mammals and fish of foreign origin are being controlled, in order to prevent such damages. Approaches to effectively use these animals as food, pet food and feed in each region is recently progressing. According to the recent distribution area of deer and wild boars in intermediate and mountainous areas, the distribution has been extended, heavily damaging agriculture, forestry and fisheries and eco systems. The amount of damage to farm products caused by wild birds and mammals has reached 18.5 billion yen annually (FY2007), and although the development of habitat and harmful wildlife control are under way towards the reduction of damage, the number of captured birds and mammals has been increasing year by year. The number of deer and wild boars captured nationwide in FY2005 was about 190 thousand and about 220 thousand, respectively (Figure3-3-23).

In Hokkaido, around 3 billion yen in damage was reported, due to the surge in agricultural and forestry damages caused by the extension of distribution areas and the increased population of Yezo sika deer. Under these circumstances, Hokkaido positioned the effective use of the captured Yezo sika deer as a part of conservation management, and drafted a manual for hygienically processing Yezo sika deer. In

Figure3-3-22 Number of Visitors to the Toyooka Municipal Museum of the Oriental White Storks



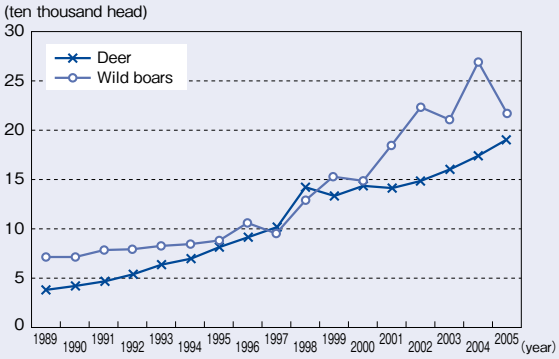
Source : Compiled by the Ministry of the Environment from the data of Toyooka city

Photo3-3-5 Oriental White Stork Pecking Food in a Rice Field

Source : Toyooka city

FY2007, about 12,000 of Yezo sika deer were slaughtered. In Misato town, Shimane prefecture, the recycling of wild boar meat has been promoted since 2000 with the town's leadership. They have established a community brand,

Figure3-3-23 Changes of the Number of Deer and Wild Boars Captured Nationwide



Source : Ministry of the Environment

"Oochiyamakujira"—meat produced from captured wild boars—and are selling foods, such as processed foods and pet foods, by establishing a processing system from capturing to meatpacking. As for the efficient use of alien species, efforts to control largemouth bass and blue gills are conducted in each region. In some regions, where the controlled amount is huge, several hundred tons of culled alien species are disposed of annually in landfills. Usage of such as fertilizers and feeds will reduce the amount of fertilizers and feeds from outside the region, leading to approaches to prevent the water area from eutrophication. In Shiga prefecture, about 440 to 570 tons of fish of foreign origins in Lake Biwa have been exterminated annually since FY2002. These are used as food for human consumption, or in a variety of other ways such as being processed into fish meal.

Conclusion Incorporate Japan's Economy into the Sound Global Environment

With the objective of forming a sustainable society, it is important for various entities to collaborate and to exercise their ingenuity in a variety of ways. Measures to be approached should not be limited to environmental measures, but also should be pursued to integrate economic and social values together.

By continuing the steadily approaches to improve the environment, the quality of our lives will be enhanced, while a complete sound climate and eco system will be maintained, leading to a lean society. In order to realize this, we should recognize again that the earth is dependent on limited systems, and should build up the human economy that permanently exists in the earth's huge material circulation, energy flow and the sound eco system.

The principles of economic activities are to properly distribute resources and products, etc., to the individuals who require them. These activities are exactly what will provide additional values for all, and will work out while co-existing with the environment. That is to say, our economic activities should be proactively maintained even under strict environmental limitations. On the other hand, although we have recognized that the earth is dependent on limited systems, we have been burdening the environment through our economic activities due to its large acceptance capacity. However, should we continue using the environment without understanding its value before it has internalized, its value will be lost. To realize economic activities, co-existing with the environment, it is essential to move on to a new type of economy in which environmental measures are incorporated.

We are committed to being the steward of the earth for the children of 100 years from now. Now is the time to combine wisdom and power, so that future generations can live on the earth in peace, and that they will say that the human beings of the early 21st century made the right choice. Japan has been nurturing a culture of not wasting resources through the ages. This can be seen from our stances, such as using various resources and our attitude to try to carry out agriculture, forestry and fisheries sustainably, without using up all of nature's blessings. We consider that human beings can continue to survive by recognizing such philosophies again, by properly reflecting the environmental values in the economy, and by making steady approaches to improve the environment.

In 2008, the world has faced an unprecedented economic crisis, and remains in a serious situation. However, this once in 100 years depression is a golden opportunity for Japan to express its presence in the world. It is time for Japan to mobilize all its wisdom and human resources for environmental measures and technologies, and to lead the global value by quickly creating a society in which the environment and economy will sustainably develop.