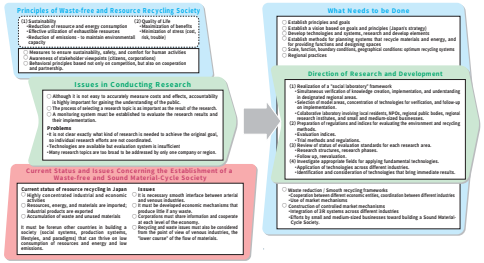
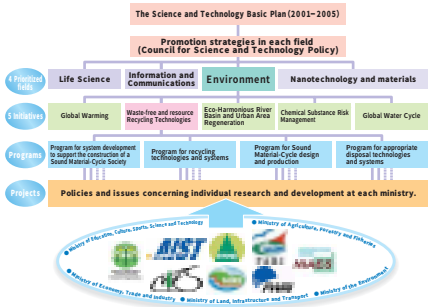
Concept Sheet for the Waste-free and Resource Recycling Technologies Research Initiative



Initiative Projects for the Promotion of a Sound Material-Cycle Society

The goals of the Waste-free and Resource Recycling Technologies Research Initiative are to develop material cycles and environmental technologies and systems based on low consumption, reduced waste and a minimal environmental burden. To this end, the initiative aims to establish programs to develop (i) systems supporting the construction of a Sound Material-Cycle Society, (ii) recycling technologies and systems (iii) Sound Material-Cycle design and production, and (iv) appropriate disposal technologies and systems. Under the initiative, the individual projects implemented by various government ministries will be integrated into each program, thus promoting alliances between industry, academic institutions, and the ministries.

Position of the Waste-free and Resource Recycling Technologies Research Initiative



International Cooperation

According to the action plan adopted in September 2002 at the Johannesburg Summit (World Summit on Sustainable Development), each country must promote sustainable production and consumption practices if sustainable development is to be achieved on a global scale. Each country is therefore encouraged to establish a 10-year framework plan for accelerating the implementation of such practices.

At the G8 summit held on Sea Island, Georgia, in the U.S. in June 2004, the G8 Action Plan: Science and Technology for Sustainable Development: 3R Action Plan and Progress on Implementation (3R Initiative) was adopted. The action plan aimed, from a global perspective, to achieve the construction of a sound material-cycle society through the promotion of waste reduction, reuse, and recycling. The plan will officially start at the Ministerial Conference to be held in Japan in the spring of 2005.

Even before the enactment of the 3R initiative, Japan proposed at the April 2003 G8 Environment Ministers Conference the implementation of a joint international research project to consider the establishment of common methods for material flow accounts and resource productivity. Based on this proposal, the International Expert Meeting on Material Flow Accounts (MFA) and Resource Productivity was held in Tokyo in November of the same year. Following the meeting, in April 2004, the OECD (Organization of Economic Co-operation and Development) adopted the Recommendation of the Council on Material Flows and Resource Productivity, which aims to promote the development of methods for material flow analysis and their use among OECD member nations.

Director for Environment
Bureau of the Council for Science and Technology Policy
Cabinet Office, Government of Japan
3-1-1 Kasumigaseki,Chiyoda-ku,Tokyo 100-8970,Japan
Phone:+81-3-3581-9265,FAX:+81-3-3581-9969
http://www8.cao.go.jp/cstp/project/envpt/english/

Waste-Free and Resource Recycling Technologies Research Initiative

Director for Environment
Bureau of the Council for Science and Technology Policy
Cabinet Office, Government of Japan

The Need to Establish a Sound Material-Cycle Society

In today's society, human activities are accompanied by the circulation of materials. This circulation has significant impacts in many areas. Until the 1980's, Japan focused on rapid economic growth, but in the early 1990's, both society and corporations became concerned about the impact of their activities on the global environment and began efforts to reduce that impact, with the goal of creating a Sound Material-Cycle Society in which resources are used efficiently, waste is prevented, and used materials are recycled.

Now, Japan endeavors to establish a Sound Material-Cycle Society in which the consumption of natural resources is reduced and the burden on the environment is minimized, toward the sustainable development. This can be achieved by promoting the 3Rs (Reduce, Reuse, Recycle), as well as by ensuring the appropriate disposal of waste materials, making use of natural systems of material circulation, and so on. Technologies related to the 3Rs lower the cost of reducing the burden on the environment, increase production efficiency, and encourage the appropriate consumption of energy. Therefore, using the 3Rs to develop new environmental technologies will not only help establish a Sound Material-Cycle Society in Japan, but also increase the competitiveness of Japanese industries as a whole and individual company in the global economy.

The Importance of Science and Technology in Establishing a Sound Material-Cycle Society

In order to establish a Sound Material-Cycle Society, it is important to systematically interlink individual technologies. Therefore, resource circulation systems must be accommodated with regional industrial structures and lifestyles so as to establish a sound resource circulation loop according to scale. Because many products are produced in foreign countries, domestic efforts alone are insufficient. Japan and other countries must coordinate their efforts. Problems such as inappropriate processing and illegal disposal of waste occur frequently and are growing worse. Thus "a negative legacy" of contaminated soils and illegal waste dumps has been accumulated and accidents resulting from the failure to implement safety procedures also continue to occur. Appropriate processing technology must be developed to ensure greater safety and security, waste disposal sites must be regenerated and their use extended, and illegal-dumping sites must be environmentally restored and their safety ensured. These issues all require immediate action.

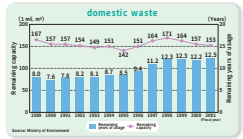
Policy Responses for Establishing a Sound Material-Cycle Society

Under these circumstances, the cabinet passed in March 2003 a resolution called the Fundamental Plan for Establishing a Sound Material-Cycle Society. The plan aims to achieve by 2010 such goals as an improvement of resource productivity by 40%, a reduction in the amount of waste generated per person per day by 20% and a doubling of the size of the related business market and the number of people employed in businesses that contribute to establishing a Sound Material-Cycle Society. Although the final goals of the plan have been clearly specified, a diverse range of practices is needed to achieve those goals. These practices have yet to be brought together in a coherent scenario. To realize the plan's goals, the government must develop a comprehensive scenario with a clear statement of principles and vision.

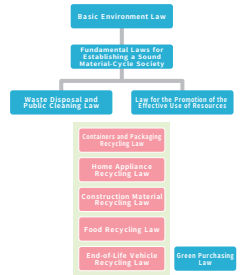
Launch of the Council for Science and Technology Policy and Establishment of the Initiative

The Council for Science and Technology Policy was launched in January 2001. Under the Basic Plan for Science and Technology (passed by a cabinet resolution in March 2001), the Council has developed strategies to promote science and technology in core areas. With regard to core issues related to the environment, the Council recommended that the promotion efforts be in the form of an initiative based on a scenario that specifies government-wide policy goals and the paths to achieve them. In this scenario, the individual research projects being carried out by each ministry are to be steadily accumulated and reconstructed. As a result of these proposals, the Waste-free and Resource Recycling Technologies Research Initiative has been implemented since fiscal 2002.

Remaining capacity and years of usage for final disposal sites



Japanese System of Laws Related to the Promotion of a Sound Material-Cycle Society



Program for system development to support the construction of a Sound Material-Cycle Society

Evaluating societies by analyzing material and energy flows

Material Flow Analysis (MFA), which is sometimes referred as Material Balance Analysis, is a comprehensive and quantitative methodology for examining the input-output balance of materials through a particular system, in which inflows such as energy and material resources are transformed into outflows such as products, by-products, and wastes. MFA focuses either on entire flows of various materials or on a particular flow of a specific material or substance.
One area of active research is national economy-wide MFA. In one example, 5 countries (initially 4 countries)--Japan, the United States, and a few countries from the European Union jointly launched international comparison research and several European states are in the process of implementing MFA in order to evaluate their society's impact on the environment. MFA has been very useful in answering critical social questions about "hidden material flows", which are generated by mining processes that create huge volumes of by-products such as sand and rock.

© NASA

Life Cycle Assessment (LCA)

LCA was originally developed as a method to evaluate the overall environmental impact caused by a product's "function". In recent years, LCA has been used evaluate waste disposal technologies and resource recycling technologies. These LCAs focus either on products for disposal or recycling, or on waste disposal and recycling technology (or, more specifically, on the services that is provided by these technologies). LCAs have been conducted on a wide range of products, technologies, and systems.

© Japan for Sustainability, High Moon Gallery (http://www.japanfs.org/)

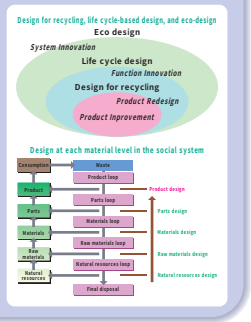
Program for Sound Material-Cycle design and production

From Design for Recycling to Life Cycle Design

In its narrowest sense, eco-design means designing man-made artifacts such as products and buildings so that they are in harmony with the environment. Various labels are given to the process, including environmentally compatible design, environmentally friendly design, and Design for Environment (DfE). In the past, eco-design focused on producing products that were easily disassembled, selecting materials that were easy to recycle, and properly labeling the materials. This can be termed "design for recycling". However, such designs focus only on recycling, which may result in mass production and large-scale recycling. The next, more advanced generation of eco-design is "life cycle design". Such design is based on the "life cycle" concept and the idea of Sustainable Services & Systems (3S). These designs aim to improve the level of service and reduce the environmental burden throughout the entire life cycle.

Concept of "Circular Manufacturing"

Another important issue is the development of technology for manufacturing and reverse manufacturing, which together drive circular manufacturing. The concept of "zero emissions", has spread widely, significantly reducing the amount of waste at the individual business level. A large part of this is attributable to management technologies such as environmental monitoring systems. A large proportion of the cost associated with reverse manufacturing is caused by the collection of used products (also referred to as "reverse logistics" or the "reverse supply chain".) Therefore increasing the efficiency of this reverse logistics is also a major issue.



Waste-free and Resource Recycling Technologies Research Initiative

The initiative aims to develop the necessary technologies and systems to achieve by 2010 quantitative targets for waste reduction (50% reduction from 1996 levels, 24% recycling rate for domestic waste, 48% recycling rate for industrial waste), and reduce the risk posed to the environment by harmful waste, as laid out in the Fundamental Law for Establishing a Sound Material-Cycle Society.

In the mid to long-term, the initiative aims to develop the necessary technology to realize the Sound Material-Cycle Society envisaged by the above law, and also to build appropriate recycling systems through coordination with overseas organizations.

Program for system development to support the construction of a Sound Material-Cycle Society

Develop technologies for systems evaluation such as Life Cycle Assessment (LCA) energy and material flow analysis, establish methods of prediction, and develop methods to encourage the technology. Also establish systems for maintaining contact with citizens, which is fundamental to realizing a Sound Material-Cycle Society.

(Aim)
Develop technologies that promote the transformation to a Sound Material-Cycle Society and methods for evaluating systems (such as LCA) based on the two principles; the hierarchy of material cycles and minimizing the environmental burden.

Program for recycling technologies and systems

Research and develop technologies and systems connected with the recycling of end-of-life vehicles construction waste, organic waste, and textile waste. Also systems related to the promotion of regional recycling through the verification of social models and other methods.

(Aim)
Develop and improve recycling technologies and systems related to individual recyclable resources. Also develop and improve "venous distribution systems", which are the foundation of the recycling system.

Program for Sound Material-Cycle design and production

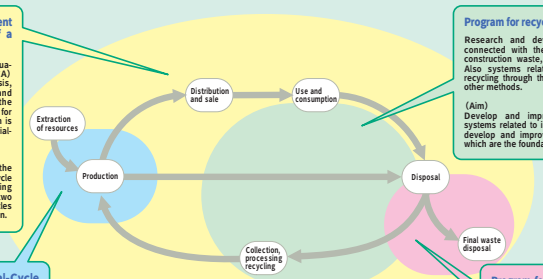
Develop design, construction, and production technologies that make it possible to "Reduce" and facilitate efforts to "Recycle" and "Reuse".

(Aim)
Develop design, construction, and production technologies for industrial products, food resources, and construction materials that incorporate and promote the 3Rs.

Program for appropriate disposal technologies and systems

Develop technologies to reduce waste volume and advanced recycling, decomposition and treatment of hazardous waste, revitalize and environmentally restore polluted disposal sites and monitor inappropriate waste disposal.

(Aim)
Develop technologies and systems that relieve the pressure on disposal sites and eliminate inappropriate waste disposal, disposal of unwanted goods, and illegal disposal, and reduce the environmental burden caused by inappropriate treatment.



Reduce resource consumption

Reduce environmental burden

Reduce final waste disposal

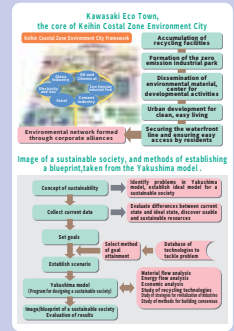
Program for recycling technologies and systems

Developing technologies and systems for recycling end-of-life products and waste

At the product level, each sector of Japanese society, industry, academia, and government is currently working to promote the recycling of post-consumer products and waste (based on separate recycling laws, including the Containers and Packaging Recycling Law, the Home Appliance Recycling Law, the Construction Material Recycling Law, the Food Recycling Law, and the End-of-Life Vehicle Recycling Law). The Biomass Nippon Strategy is another initiative designed to promote the research and development of technology relating to the use of biomass.
At the regional scale, the Ministry of Economy, Trade and Industry and the Ministry of the Environment are jointly implementing the Eco Town Project, which supports the regional creation of Sound Material-Cycle Societies. The project supports the goal of "zero emissions" as the basic framework for creating an environmentally friendly regional economic society. The "zero emissions" goal is also regarded as a core pillar of regional economic revitalization to promote environmentally friendly regional economic development. The project supports the development of technology that creates advanced and environmentally sound business.

Promotion of regional materials recycling

Current research projects aim to promote the recycling of materials in a designated region. One example is the research being carried out on Yakushima Island, Kyushu, which is a UNESCO World Heritage Site. The project aims to produce a model that provides analytical and simulated results about the environmental impacts associated with socio-economic activities in several future scenarios for sustainable development. Given the unique environmental and geographical conditions of Yakushima Island, the project also aims to provide a plan for improving the island's economy as well as a manual or blueprint that can be used to develop other sustainable regions. The results will be disseminated domestically and internationally to promote cultures that emphasize sustainability.



Program for appropriate disposal technologies and systems

Appropriate disposal of waste products, and monitoring and control of waste disposal sites

Research is currently underway into technologies for 1) reducing waste volume, improving waste reuse, and decontaminating hazardous waste, 2) monitoring and reclaiming waste disposal sites, and 3) rehabilitating polluted sites. These efforts aim to combat various waste disposal problems, including relieving the pressure on waste disposal sites, handling waste products, and preventing illegal disposal and environmental pollution through inappropriate waste processing. Furthermore, there is a strong need to monitor related substances and processes to ensure that waste is appropriately reused or disposed of safely and securely. Such monitoring encourages the reuse of waste products and prevents environmental pollution during disposal and processing. These monitoring technologies are currently being developed.

Development of technology for decomposing hazardous waste

Public anxiety is growing concerning the adverse effects on both people and the environment of residual chemicals such as dioxins in hazardous waste. This is due to the discovery of inappropriately discarded waste products and the detection of residual chemicals on regional and global scales. Examples of problems caused by inappropriate waste management include the Love Canal incident in the US and the Seveso Incident in Italy, both of which occurred in the 1970's, and the Teshima Incident that occurred in Kagawa Prefecture, Japan, in the 1980s. In addition, residual chemicals such as PCBs, Hexachlorobenzene (HCB), and DDT have been detected in many places. These incidents of pollution and detection of residual chemicals do not merely cause anxiety about their effects on individuals and the environment, but also have an extremely large impact on the industrial economy and international society. Therefore, there is a strong need to develop technologies for decomposing hazardous substances.