Studies in Ecological Community Development

Japan Environment Corporation

Contents

Studies in Ecological Community Development

I. Description of the Study

1. Background and Purpose of the Study

As observed in Japan's Basic Environment Plan, it is now a national challenge to replace our current mass-production, mass-consumption, mass-disposal social system with a socioeconomic system that is based on cycling, that alleviates environmental burdens as much as possible, and that ensures symbiosis with nature. Businesses, municipalities, and other parties have conducted a variety of initiatives (such as recycling and effective energy use) meant to mitigate environmental burdens, and society has been presented with innovative concepts such as United Nations University's "Zero Emissions Research Initiative."

Ideas like these must be given concrete expression on each site of local development such as the preparation of industrial parks and their peripheral construction, and the building of facilities in places like natural parks. Under the Japan Environment Corporation's (JEC) Construction and Transfer Programs for factory complexes, industrial parks do not just control the pollution from medium-sized, small, and very small enterprises in mixed residential and industrial areas; instead, taking into account the environmental and other changes caused by industrial parks, they are to be built with consideration for waste prevention and reduction, recycling, effective use of alternative energy, and the like.

This study was carried out for the purpose of investigating the possibilities of developing attractive new Construction and Transfer Programs that apply flexible thinking not shackled by the framework of conventional projects.

2. Study Description

(1) Catalog the basic problems involved in Construction and Transfer Programs (mainly industrial parks).
A. Changes in social circumstances affecting industrial parks
B. Exploring ecological community development

(2) Creating environmentally friendly industrial parks
A. Industrial siting and eco-industrial parks
B. Advantages accruing to local citizens, local authorities, and businesses
C. Concept of ecological infrastructure in eco-industrial parks
D. Ecological infrastructure in eco-industrial parks
E. Technology model for creating eco-industrial parks

(3) Model plan for eco-industrial parks

(4) Effectiveness of eco-industrial parks in alleviating environmental burdens

(5) Challenges of devising ecological community development

(6) Overview of primary support measures for eco-community development

3. Study Method

Establish a Group for Studies in Ecological Community Development in the Japan Industrial Location Center (JILC) to study the basic issues and problems.

Additionally, a working group composed of the Center, the Environment Agency, local governments, JEC, and other entities will seek and compile opinions and other information from specialists in various fields in order to collect basic resources and catalog the problems in specialized areas, as well as to gather information for case studies and the like.

II. Cataloging the Basic Problems Regarding Construction and Transfer Programs (Mainly for Industrial Parks)

1. Changes in the Social Climate Affecting Industrial Parks

Japan's socioeconomic situation is defined by its role as a central production base in the growing Asian economic bloc. But as the yen rapidly appreciates and the Asian economic bloc swiftly expands, Japan's manufacturing industries are transferring their manufacturing bases from Japan to other Asian countries, leading to concerns about the exodus of domestic industry.

In the area of industrial siting as well, companies have not relocated to Asia merely in search of cheap labor, for they have also taken an active part in the scale and speed of market expansion, and have located their operations primarily on that basis. As a result, domestic industrial location has been conceived as one part of siting their bases globally.

Seen from such a viewpoint, Japan's industrial bases are losing their advantage, thereby seriously affecting industrial and economic activities, as through high costs caused by regulations, various practices, and other factors; the loss of business opportunities; and aborting the births of new industries. Society also faces many problems such as the declining functionality of infrastructure due to the lopsided concentration of everything in Tokyo, which hampers Japan's balanced development; the need to address the declining birth rate and the senior boom; and the creation of jobs to accommodate the many people with higher educations. With the greater complexity due to diversification in personal values, greater individuality, and increasing sophistication, there are concerns about Japan's declining presence and attractiveness as an industrial and economic focal point in the 21st century world economy.

With respect to the circumstances affecting industrial location, we are faced with the need to reassess siting from an international viewpoint that is integrated into an Asia-wide international industrial linkage, instead of the usual factory decentralization and labor measures. It will be necessary to make improvements to the industrial structure while anticipating which industrial functions will remain in Japan and which will relocate abroad.

Here our cardinal consideration for developing new industrial parks is how we must respond to the socioeconomic circumstances affecting basic industrial siting, to changes in the globalizing industrial structure, and to environmental problems as we go about developing attractive industrial parks.

Let us catalog the problems involved.

(1) Changes in socioeconomic conditions

In the early 21st century Japan will begin the first full-blown population decrease and senior boom in its known history, ~~and~~; we anticipate a falling economic growth rate due to the decreased working population and diminished reserve investment capacity.

Accordingly, it will be important to base industrial park development on thinking that assumes population decline and more elderly people, and to work toward the formation of communities by increasing interpersonal exchanges, and strengthening interregional collaboration and the building of exchanges.

A. Change in population composition: fewer babies, more elderly

Later marriage for women due to their increasingly high academic levels, increasing employment, and other factors, as well as the heavier economic burden of childraising, have brought about a lower birth rate. Additionally, advances in medical care technologies are behind the quickly rising number of elderly citizens. It is therefore likely that Japan's working population will continue to decrease.

It is anticipated that in 2025, Japan's population of working-age citizens will have fallen by over 10 million from the present number.

B. Higher academic levels, young prefer their localities

With the huge number of people going on to higher education and raising their academic levels, values have changed and young people now have a stronger predilection to shy away from direct work in production and instead become desk workers.

Further, owing to the improved living and employment conditions in outlying districts of the country, and the effects of the- lower birth rate and other factors, a higher proportion of young high school graduates elect to stay where they grew up.

C. Citizens' values show more sophistication and diversity

As the society and economy mature, the citizens' needs are shifting from material and economic affluence to spiritual gratification and fulfillment in everyday life. Further, people's values have greater diversity and individuality, giving rise to more sophisticated and individualized needs.

And as society grays and more women join the workforce, the citizens' social requirements are changed, as in the great need to provide employment conditions for these groups.

D. Rising consciousness about the environment

Environmental problems are a matter for society as a whole to consider as we enter the 21st century, and discussion on a global level is essential.

(2) Changing circumstances in major cities and outlying districts

The basic factor necessary for success ~~factor~~ in proceeding with industrial park development is that businesses establish a presence in attractive outlying districts, but here we must evaluate and comprehend what changes in circumstances are presently occurring there.

A. Changes in outlying districts

a) Population concentrates in outlying hub cities

Although population in outlying districts overall has grown slightly, it is decreasing mainly in areas away from these districts' hub cities, while population concentrates in these cities and their environs. This creates an over/underpopulation imbalance in these regions.

These hub cities offer high-quality urban functions including diversity in consumption, livelihood, culture, amusement, employment, and scholarship, and in recent years businesses consider the existence of such urban environments important when siting their facilities.

b) Population decline in rural and other areas

There is a continuing decline in the relative importance of agriculture, forestry, and fishing in rural districts and other areas with disadvantageous industrial or social conditions, and there are concerns that the trend toward liberalization of agricultural imports will have grave impacts on regional economies, hiring, and the like.

Furthermore, because such regions have lower sewerage connection rates than do urban areas, and have insufficient opportunities to enjoy diverse and high-quality education and culture, they are behind in providing the living environments that many citizens want. Additionally, rural districts do not necessarily offer satisfactory levels for employment opportunities, in terms of both quality and quantity, which are essential in getting citizens to settle there; because these areas have no nearby cities of any significance, citizens find it hard to benefit from such urban functions.

For these reasons there are many areas whose young people leave for urban areas and cause a social decline, which then becomes a natural decrease.

c) Overseas transfer of mass-production plants

Although the formation of an Asia-wide international industrial linkage is proceeding, at the same time companies are trying to break out of the prolonged recession by switching from management practices that see overriding importance in market share and focus on numerical growth, to management that considers earnings important. We see a trend in which they are reassessing the roles of mass-production plants located in the outlying districts, moving ahead with restructuring that includes the rebuilding of group and subcontracting structures, and consolidating their mass-production plants and relocating them abroad.

As part of this, businesses are relocating their research facilities and their development and trial production plants from around the major cities, where they have mainly been located, to Japan's outlying districts owing to improvements in the transportation and communication infrastructures of those districts, and for the purpose of securing good settings for research and development -- including fulfilling living environments -- that make creative activities possible.

However, owing to the recent quick appreciation of the yen and the improvement of surrounding countries' production functions, including their technological prowess, companies also show an inclination toward overseas relocation of even their development and trial production functions, which require advanced technologies.

B. Changes in major urban areas

a) Harm caused by concentration into major urban areas

As seen in the manifestation of big cities' external diseconomies and their declining population influxes, the tendency toward urban centralization is slowing. Recently the degradation of urban living environments due to factors such as skyrocketing land prices and delays in building infrastructure, as well as factors including a shift to values that emphasize personal life and livelihood, have combined with the prolonged business downturn to slow the trend toward concentration into major urban areas.

b) Changes in urban environmental problems

While factories have steadily been dispersed in the outlying districts, in major urban areas the problems of factory deterioration and mixed residential and industrial zones remain unsolved; especially because of problems such as the underused or unused land in cities' coastal zones, such problems induce the worsening of urban environments, including their scenic views. Solving these problems and doing the groundwork to accommodate the factory transfers and other concomitant changes are seen as the role of Japan's outlying districts.

(3) Changes in the industrial structure

A. Advances in non-manufacturing and services

Changes in consumer needs due to rising living standards and other factors, society's greater use of information, and other changes are shifting economic and industrial activities toward non-manufacturing activities including services. Growing especially fast are finance, insurance, services, transportation/communication, and other industries. Even the secondary industries have fewer workers on manufacturing lines and more in staff positions. Increased emphasis is placed on non-manufacturing areas like planning, development, information, and other services, resulting in extensive qualitative changes in the industrial structure.

Also in progress is a reorganization of the distribution industry owing to increased imports of consumer goods purchased with the rapidly appreciating yen.

B. Growth of cutting-edge industries and others

Due to the rapidly appreciating yen, industries that have grown as exporting industries, such as electrical equipment, automobiles, and general machinery, further accelerate the relocation of their manufacturing to other countries, while on the other hand it is anticipated that industries that depend on domestic demand, mainly food, lumber, furniture, and the like, will be siting their operations within Japan. Additionally, advances in technological innovation by cutting-edge industries such as electronics, biotechnology, and new materials, whose achievements happen thanks to exponential improvements in technological development capacity, are creating many new industries. Faster jumps in the technical level of the industrial structure will likely occur because of this highly evolved technological capacity, thereby necessitating preparations to accommodate these industries.

C. Shift of domestic manufacturing industries toward high added value

As the preparation of production bases in Asia and other areas proceeds, mass-production factories in Japan find themselves in a situation obliging active relocation to these areas, leading to concerns about the flight of domestic industry. But the higher level of citizens' needs is spurring higher added value in products with higher quality, more sophisticated functions, and the like; owing to the increase in international specialization, it is anticipated that domestic manufacturing industries' specialization in high-added-value products, development manufacturing under research and development, and development of manufacturing technologies for advanced production systems will become the main elements of domestic manufacturing.

(4) Industries remaining in Japan, and new growth fields

As the mass-production function for mature products relocates abroad, Japan's domestic manufacturing industries in general concentrate primarily on making products with high intellectual content (high-added-value products); importance is accorded to the functions of research and development, and of planning and product development. As fields that will support industry henceforth, industrial materials that promise expanded worldwide demand (semiconductors, machinery parts, industrial machinery, etc.) will probably continue growing thanks to Japan's technological advantage. On the other hand, basic materials industries such as textiles, chemicals, and steel will grow little owing to reasons such as diminished international advantage due to labor costs and other factors, and the maturation of the domestic market.

Information, communications, and software industries can expect growth in new areas including multimedia services in communications due to higher demand for software and advances in technological innovation.

In particular, the Industrial Structure Council has announced the following areas as a broad spectrum of new and growing industries:

A. Housing-related (securing roomy living spaces)
B. Medical care and welfare (building of high-quality, high-efficiency medical care and welfare systems)
C. Life- and culture-related areas (bringing about high-quality and fulfilling living for leisure and self-realization)
D. Areas related to enhancing urban environments (achieving high-quality, urban livability by means of urban development, new transportation systems, etc.)
E. Environment-related areas (endeavors that take new directions for building an eco-friendly society)
F. Alternative energy and energy conservation (full-blown implementation of alternative energy systems)
G. Information- and communications-related areas (building an advanced information society)
H. Distribution-related areas (more efficient distribution and expanded imports)

I. Workforce-related areas (building a new labor market and system)
J. Internationalization-related areas (assuming one's role in international society)
K. Areas related to business support (support for industry's shift to non-manufacturing and services)
L. Areas related to new manufacturing technologies (creative technologies and system structuring for new industries)
M. Marine-related areas (creating spaces for marine use, preservation and creation of marine and coastal areas)
N. Biotechnology-related areas (preparation of intellectual infrastructure, encouragement of original research and development)
O. Aviation-related and space (private sector)-related areas (quick construction of airport infrastructure, support for space (private sector) activities)

Japan will have to provide infrastructure and build a workforce supply system as the necessary conditions for integrating these industries, and the way in which each region moves ahead with preparing the foundation for integrating these industries will be one condition that determines the new advances achieved in that region (according to the Industrial Structure Council report).

2. Ecological Community Development (Zero-Emission Industrial Parks)

[Fundamental Considerations for Concept Realization]

- At this time when environmental initiatives must proceed globally, it is necessary to build a sustainable socioeconomic system with a low environmental burden around the ideas of material cycling, harmonious coexistence, participation, and international initiatives, which are long-range objectives under the Basic Environment Plan.
- Realizing a sustainable socioeconomic system in the 21st century will require achieving efficient use of resources and energy, environmental efficiency, and economic efficiency on a high level by reconciling the environment and the economy.
- In working toward this goal, plan and implement policy encouragement and support on the national level, and specific measures on the local level.
- It will be necessary to structure a new social system not fettered by conventional regional economic frameworks, lifestyles, and the like.

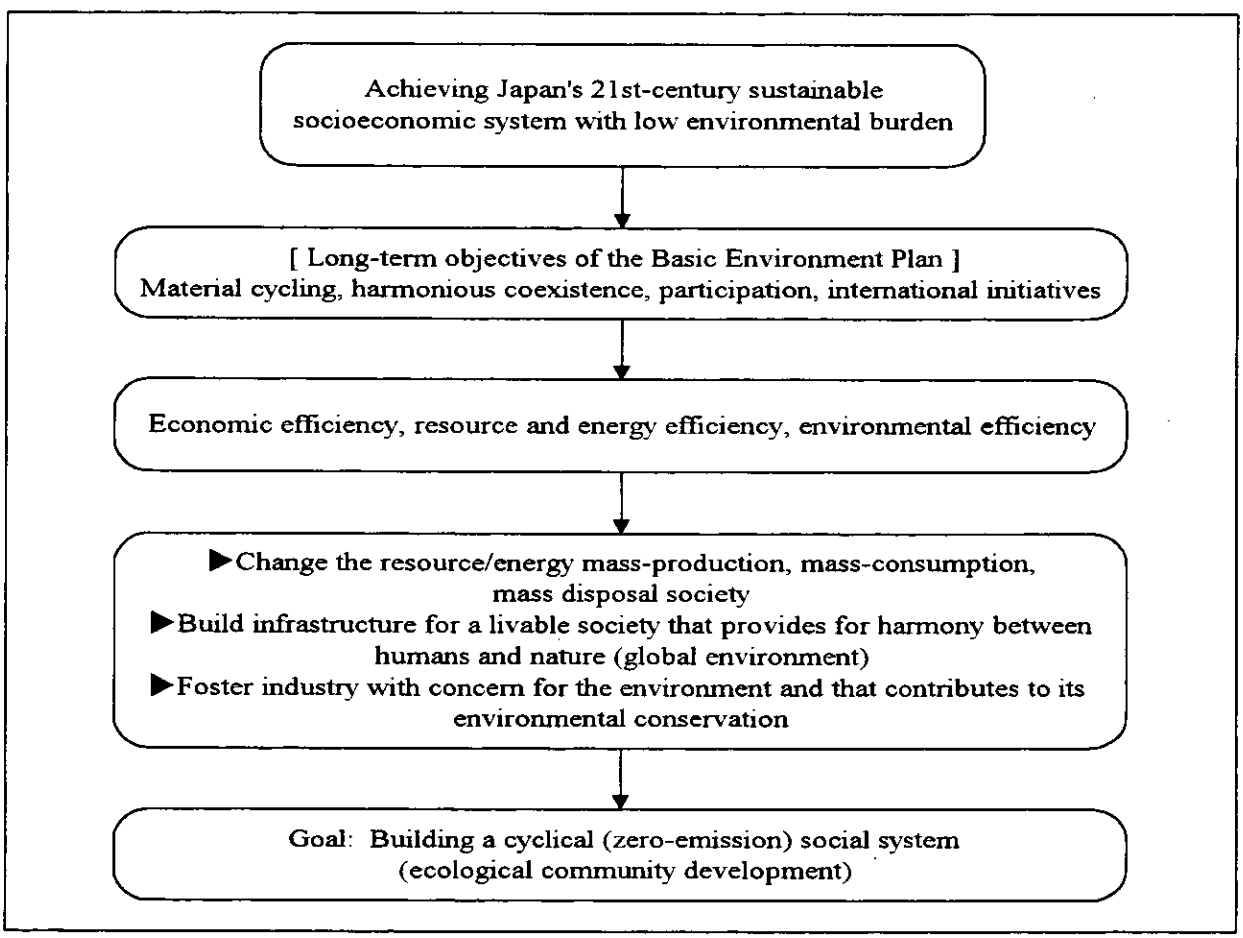


Fig. 1 Flow of Ecological Community Development

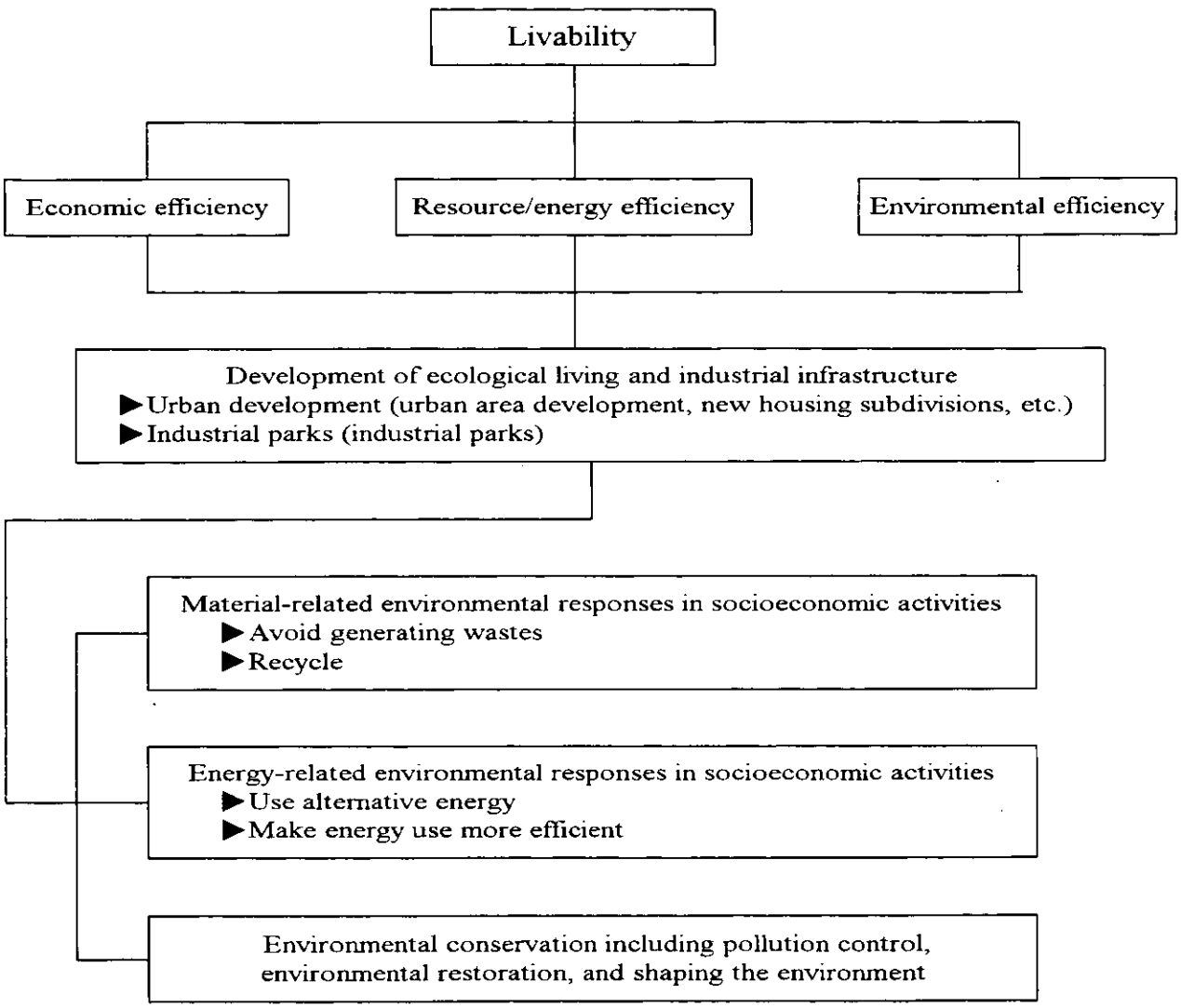


Fig. 2 Consideration of Approuch to Concept Realization

[Contents of Approaches to Concept Realization]

Development of ecological living and industrial infrastructure

(1) Urban development (urbanized area development, new subdivisions, etc.)

Set up ecological resource and energy supply and processing systems, and infrastructure for conserving the water environment (the aqueous component of the environment)

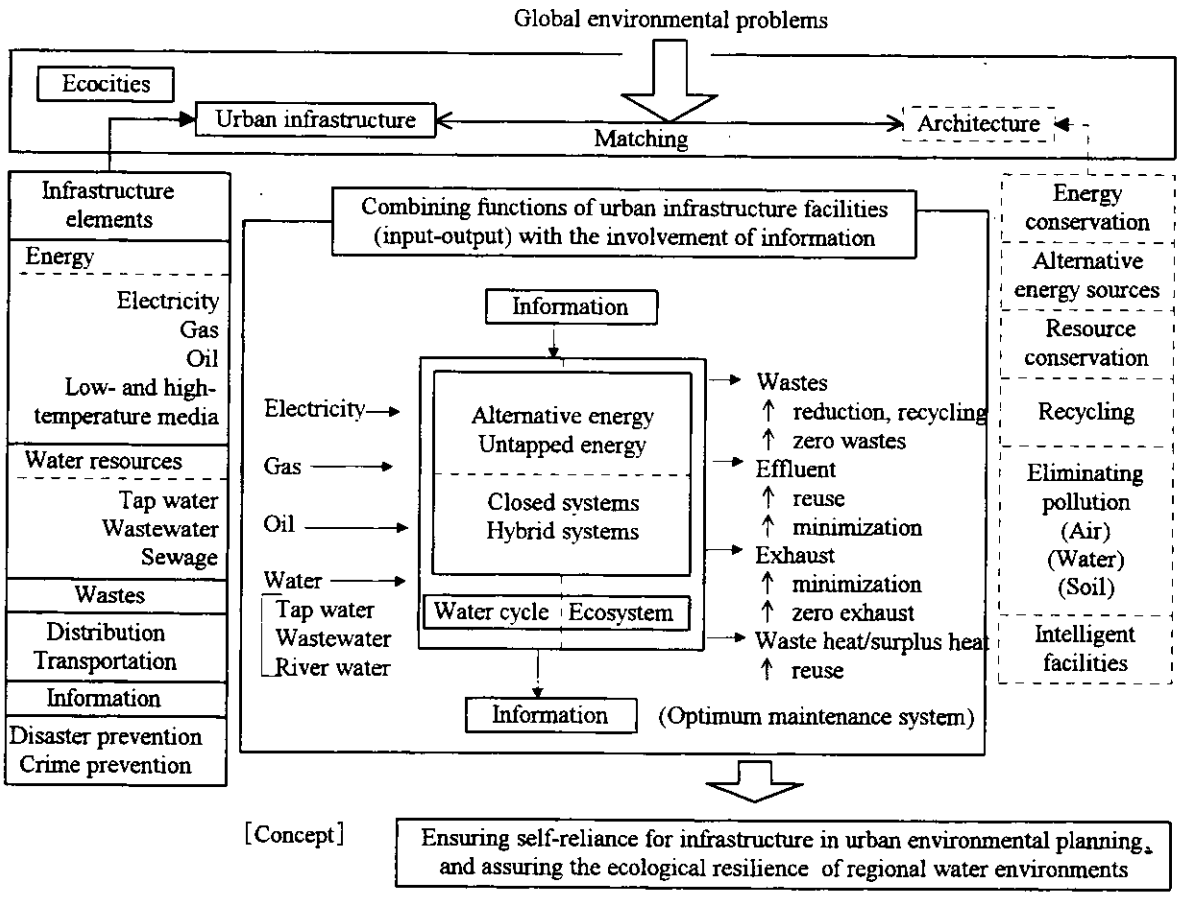
A. Items related to overall planning for urban development

- Planting trees in cities
- Urban energy cycle
- Urban transportation

- Urban water cycle
- Urban development with consideration for regional characteristics

B. Items related to urban facilities
- Refuse burning power
- Combined heat and power
- Using untapped energy, such as that in sewage
- District heating and cooling
- Cogeneration, etc.

C. Individual Technologies
- Good insulation and air tightness in buildings
- Use of renewable energy sources such as solar thermal and photovoltaics
- Composting and recycling of garbage
- Use of electric vehicles and other low-emission vehicles



Prepared by Mr. Kenji Ishikawa, Takenaka Komuten Co., Ltd.

Fig. 3 Urban Development Infrastructure Concept

(2) Building industrial parks (entrepreneurial parks, etc.)

Industrial parks especially form the nucleus in environmentally conscious urban development. As the creation of industrial parks is set forth as the main theme of this research, the problems should be cataloged.

Considering industrial parks from an environmental perspective, factories have beautified their surroundings and built employee facilities under the "new factory" policy, which emphasizes beautiful views and attractive surroundings. But we still see no initiatives from industrial parks with an integrated consideration for environmental factors. It is thus necessary to build infrastructure meant for the symbiosis of industrial parks with the environment.

A. Items related to overall industrial park planning
- Planting trees and other vegetation
- Building public parks
- Industrial park roads
- Industrial park water cycle (industrial water, effluent)
- Internal energy cycle heat supply system
- Internal waste disposal plans (generating electricity, recycling)
- Other ecological infrastructure planning

B. Items related to facilities inside park
- Refuse burning power
- Surplus heat supply
- Use of untapped energy sources such as solar and wind
- District heating and cooling
- Cogeneration, etc.

C. Individual technologies
- Coal gasification power generation
- Solar systems
- Use of wind and other renewable energy sources
- Recycling wastes (technologies for liquefaction, etc.)

Details shall be presented later.

III. Creation of Environmentally Compatible Industrial Parks

1. Industrial Siting and eco-industrial parks

Companies in all parts of the country need environmentally friendly industrial parks, and require development for that purpose.

Cataloging the facilities, siting, and other conditions that companies look for in an industrial park when locating yields the categories below. A Japan Industrial Location Center (JILC) questionnaire survey of 1,000 factories located in industrial parks throughout Japan analyzed current problems and what direction industrial parks will take in the future. Results indicated that when locating, companies seek the conditions indicated below. Additionally, a survey of 838 municipalities by the Center for Inducement of Industry to Rural Areas indicated that localities have the preferences shown below.

Here we see the necessity for eco-industrial parks by juxtaposing the conditions sought by companies and by localities.

(1) Conditions sought by companies

A. Infrastructure conditions

- Inexpensive land
- Convenient access to high-speed transportation systems
- Good roads in immediate vicinity
- A ready supply of labor (including engineers)
- Sites have water, and electricity and other energy
- Presence of effluent facilities for treating wastewater, etc.

B. Required facilities (in or near industrial parks)

- Industrial waste disposal facilities
- Organizations for research and development advancement
- Distribution facilities
- Employee facilities (medical care facilities, commercial facilities, restaurants/coffee shops, banks/ATMs, etc.)

C. Institutional conditions

- Support and cooperation of municipalities' administrative bodies, etc.
- Good relations with local citizens

(2) Industrial parks sought by localities

A. How industrial parks are built

- Parks that make the most of natural topography
- Parks with consideration for the environment
- Parks created specifically for companies locating there
- "New factory" parks

B. Industry types wanted

- Hi-tech companies
- Companies that use local resources (locally based industries)
- Attracting mainly research institutions, etc.
- Attracting mainly distribution-related industries

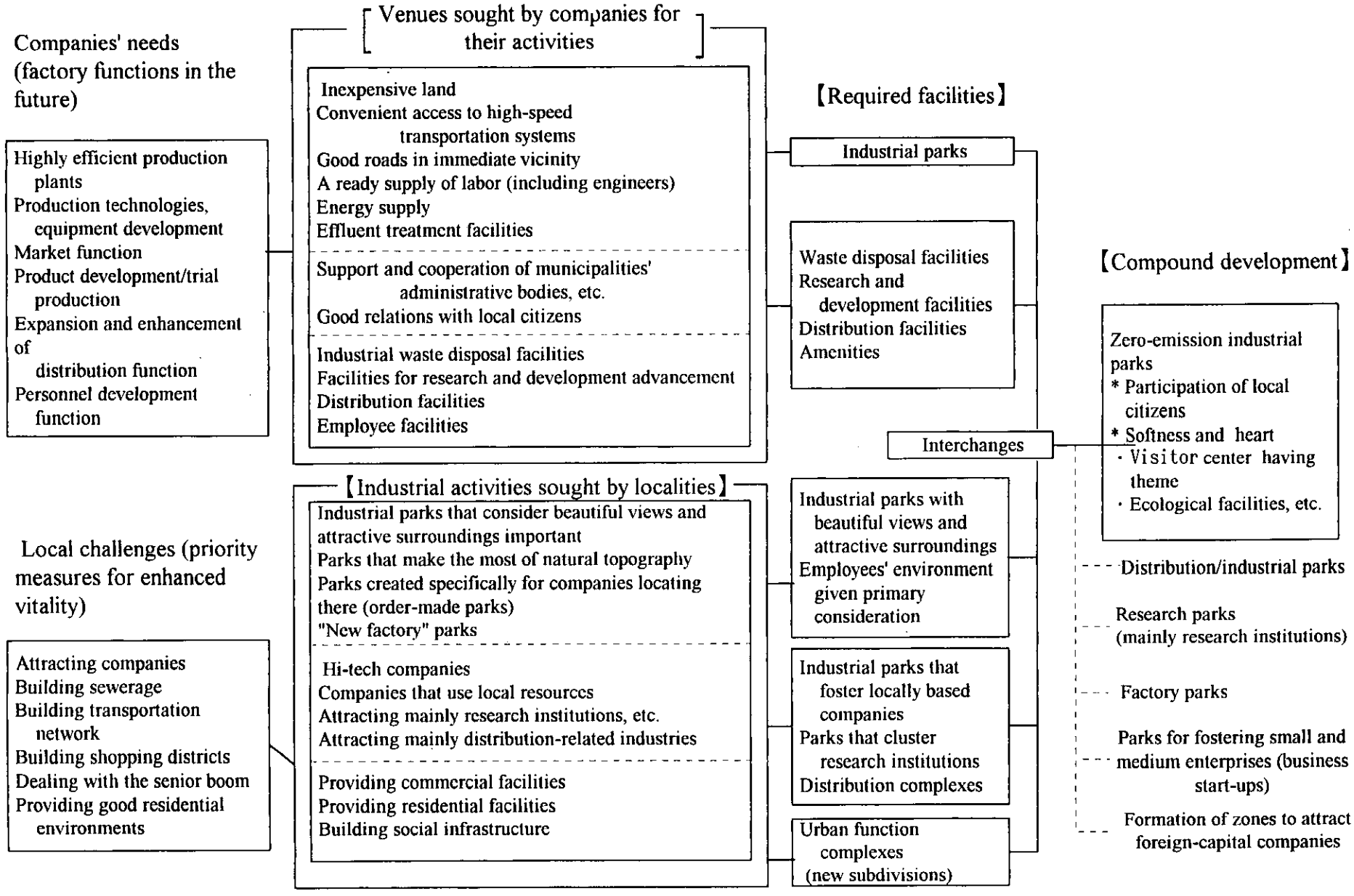


Fig. 4 Future Orientation of Industrial Parks in View of Companies' Needs and Local Challenges

(3) The eco-industrial park Concept

A. Encourage businesses' environmental initiatives by creating excellent eco-industrial parks, thereby shouldering part of the social responsibility for alleviating environmental burdens.
B. Turn eco-compatible industrial parks into environmental theme parks, and within the parks site factories offering observation tours, research institutions, and demonstration laboratories that function as "showrooms" for environment- and energy-related industries, thereby greatly improving these businesses' images.
C. Building eco-industrial parks will serve as experiments and demonstrations in the attempt to create environmentally conscious business complexes that are appropriate to the 21st century as a place for companies' production activities.

2. Roles of the Public Sector

(1) In consideration of the national glut of industrial land, the key to attracting businesses is for government administrators to present locally siting businesses with concrete policy measures. It is also vital that local authorities be aware of and respond to the needs of siting businesses that are tackling environmental problems.
(2) Currently, when the environment and development must be reconciled, it is necessary to harmonize the development of industrial parks with each locale's community development vision, thus making it essential to have administrative guidance and support through administrative participation.
(3) Local citizen participation is essential to industrial park development. Regional community consensus is important to eco-community development, which makes it necessary to release information in order to obtain local citizen cooperation from the planning stage.
(4) The Environment Agency, Ministry of Construction, Ministry of International Trade and Industry, and other national government bodies have instituted support measures for eco-compatible community development. Making effective use of them will assist economically and be a shortcut to getting into business.

3. Expectations Directed at Businesses

(1) Advantage to Involving Small and Medium Enterprises

It is necessary to distinguish between small and medium enterprises (SMEs) and large companies. While big businesses can cope individually with environmental problems, SMEs have little advantage of scale and are forced to shoulder onerous economic burdens. Consequently, they can only belatedly deal with problems that do not translate directly into profits. Thus in connection with establishing energy and material cycles as well, complexing is one effective means for SMEs to assure the streamlining of these cycles, and to mutually cooperate in environmental facilities. Another advantage of complexing is that it allows inter-company networking and the exchange of information and knowledge on environmental technologies.

(2) Cost Reduction by Recycling

In view of economic costs, many companies have currently stepped back to observe trends in environmental efforts. However, by building inter-company networks, setting up systems to achieve mutual complementary use of wastes, and reducing costs for virgin materials and other items through the effective use of recycled materials, businesses can realize production cost reductions.

Needed to make this system work, however, are quite long-term effort and continuation of the system.

(3) Pleasant Working Environments

Building factories that uphold regional ecosystems and show consideration for the beautiful views, attractive surroundings, and the natural environment will allow employees to work in pleasant surroundings and provide them with peace of mind.

4. Advantages of Local Citizen Participation

(1) There have been few instances involving local citizen participation at the development stage. Active local citizen participation at the development stage will encourage a shared perception toward the environment and the formation of networks.

(2) Local citizen participation will ensure consideration for the environment.

5. The Ecological Infrastructure Concept in Eco-Industrial Parks

In the production activities of companies in an eco-industrial park, the materials discarded by one company are used as materials or unused energy by other companies. Using this and other means, such parks must be zero-emission industrial parks that use recycling and energy extraction technologies in closed systems, which make the maximum effective use of resources.

A vital consideration in the planning for eco-industrial parks are the formation of material environments that support energy-saving, cyclical lifestyles, and the structuring of in-park cycling systems that support those material environments. Specifically, a crucial condition for setting up new eco-industrial parks is building environmentally friendly infrastructure for supplying and processing resources and energy, and for conserving the water environment.

Pages *39-42* present the general idea for eco-industrial parks. Information networks are integrated into a park's infrastructural elements, mainly for energy, water resources, and wastes, while further hybridizing park infrastructure and making it into a closed system ensures self-reliance. Another aim is to link park development with the greening of cities and contribute also to community development achieved without straining available means.

6. Ecological Infrastructure in Eco-Industrial Parks

Ecological infrastructure must combine energy conservation and cycling in keeping with the level required by a park's characteristics.

Building ecological infrastructure means, of course, eliminating environmental burdens at the source by, for example, conserving resources and energy; but also cycling by using waste heat, reusing effluent, resource recovery, and other means; renewable, untapped energy sources (solar, wind, etc.); and infrastructure functions assuming the conservation of "urban" ecosystems.

Cyclical use of resources and energy necessitates the installation of plant such as that for recovering and reusing waste heat, and the building of networks that link users with supply/processing sources, as well as requiring the provision of ecological infrastructure that clearly delineates the "urban" concept.

It is necessary to consolidate networks that include systems that combine recycled water, trash collection and transport, and cogeneration and other untapped energy sources, as well as utility services for

electricity, gas, tapwater, and sewerage, which are usually installed separately; such consolidation builds cyclical systems to flexibly share resources and energy.

Organically linking these technologies will make it possible to lay the groundwork that will, to a significant degree, satisfy the lifestyle conditions of earth-friendly industrial parks.

(1) Basics of Environmental Infrastructure

A. Items related to overall planning for urban development

- Planting trees in industrial parks
- In-park water cycle
- In-park transportation
- In-park community
- Park development with consideration for regional characteristics

B. Items related to industrial park facilities

- Refuse burning power
- Cogeneration (combined heat and power)
- Using untapped energy, such as solar and wind
- Dispersed generation

C. Individual Technologies

- Good insulation and air tightness in buildings
- Use of renewable energy sources such as photovoltaic power
- Refuse burning power
- Composting garbage
- Recycling
- Use of electric vehicles and other low-emission vehicles

(2) Energy-Conserving and Resource-Cycling Regional Systems

A stable energy supply is needed to maintain a region's level of activity, but from the perspective of resource exhaustion and avoiding damage to the global environment, reducing energy consumption and promoting resource cycling are needed in residential and urban activity cycles. Broadly, one can set forth a fundamental goal for the purpose of providing the functions of energy- and resource-conserving systems from the level of building city infrastructure, to the local level, and then to the industrial park.

A. Maximizing the efficiency of resource and energy use
B. Minimizing the life cycle and energy consumption of facilities
C. Minimizing the environmental burdens of heat, exhaust gases, wastes, etc.
D. Harmonization with water, plant life, etc.

It will be necessary to combine the following items as a means of attaining these goals.

A. Maximize resource and energy cycles.
B. Make effective use of local untapped energy sources.
C. Work toward higher efficiency in the conversion, storage, and transport of energy.
D. Hybridize multiple elements.
E. Combine multiple infrastructural systems.

(3) In-Park Water Cycling Systems

It is important to effectively use water within industrial parks in order to protect the local area's living things and natural environment.

Presently in conjunction with the growth of population and the advance of urbanization in urban areas, water flows are no longer able to maintain their natural cycles, and because of that many problems have been noted with regard to water use in the cities.

A requirement for water cycles inside eco-industrial parks is to establish suitable water cycles that do not sacrifice the convenience of production activities, thereby mitigating environmental burdens on the surrounding area, and at the same time establishing waterside spaces that will benefit the park interior as well as the local community.

Mitigating environmental burdens will require efforts to hold park water supplies to the bare minimum and reduce emissions, while at the same time improving water quality, thereby cycling water and reusing it in public parks and other places, as well as in certain residential applications.

Following are some examples of infrastructural systems meant to effectively use water resources and to create waterside ecosystems.

A. In-Park Water Cycling Systems

By combining systems for using recycled water and rainwater so as to provide for effective and rational use of water resources, create "urban areas" that conserve water and also have flourishing waterside spaces. Following are the main constituent elements of such systems.

a. System configuration

• Reuse of effluent, cycling within individual buildings, cycling within urban subdivisions, cycling within regions

b. Rainwater use

• Cycling within individual buildings, cycling within urban subdivisions

c. Use of surplus sludge

d. Uses for recycled water

• Flush toilets, water sprinkling, landscaping, waterside facilities, emergency use

B. Amenity Water Cycling Systems

By building waterside spaces with large amounts of good-quality water, create people-friendly environments with water, and provide for environmental improvements through ecosystem conservation and recovery, as well as by buffering urban climate.

C. Systems for Using Rainwater, River Water, and Other Water Sources

The intent is to actively promote the percolation of rainwater into the ground, thereby recharging groundwater and springwater, resulting in the creation of waterside space. Additionally, these systems make effective use of untapped energy in river water and sewage as the heat sources for heat pumps. System configuration follows.

System Configuration

a. Water permeable pavement

b. Rainwater infiltration inlets

c. Rainwater infiltration tanks

d. Use of untapped energy sources

7. Cautions to be Observed in Promoting the Development of Eco-Industrial Parks

The development of eco-industrial parks comes about when local citizens, local authorities, and businesses work as one within a linkage of the natural, social, and economic environments (see figure on

Fig. 5). But in actually moving forward with that, there are a number of problems and cautions to be noted. The main items are discussed below.

(1) Economic Costs

Because developing eco-industrial parks is meant to reduce environmental burdens, the overall system will change depending on how one conceives the economic costs of specific approaches. At the present stage such industrial parks often lack short-term economic viability when they make use of various systems, as in recycling parks or parks that use untapped energy sources.

The Recycling Service Cooperative in Kagoshima Prefecture has begun a project that reuses construction and demolition waste. Apparently public institutions are to take the initiative in using products made with recycled materials, and there are examples in which this is useful in reducing economic costs. As government and the private sector are increasingly working together in this way, it is necessary to explore the extent to which overall economic costs would be reduced by such active involvement, and this is a major factor in the success of environmental solutions.

We must also keep in mind the possibility that the course of world trends and global problems will induce major changes in social and economic contexts.

(2) Environmental Goals and the Diversification of Ways to Achieve Them

There are many ways to mitigate environmental burdens. Action to cope with wastes, for example, might involve extracting energy from them; if we use recycling, there is cascading; and if CO_2 emissions are to be cut, there are electric vehicles. Methods thus differ technically and economically depending on the goal of environmental measures. In this regard, it is ~~considered~~ important to clearly establish compound goals and proceed with eco-industrial park development while limning -- from the developing planning stage -- an overall picture of future systems for mitigating environmental burdens.

(3) Environmental Measures of Large Companies and SMEs

While large companies can carry out environmental measures by themselves using both funding (personnel) and technology, there is no economic advantage for SMEs to act individually, either in terms of funds, or in terms of equipment efficiency and mutual complementarity. Thus in order to realize advantage in both quality and quantity (mutual complementarity by industry types), it is important to group companies into complexes, building inter-company networks and exchanging technological information, intellectual information, and the like with one another.

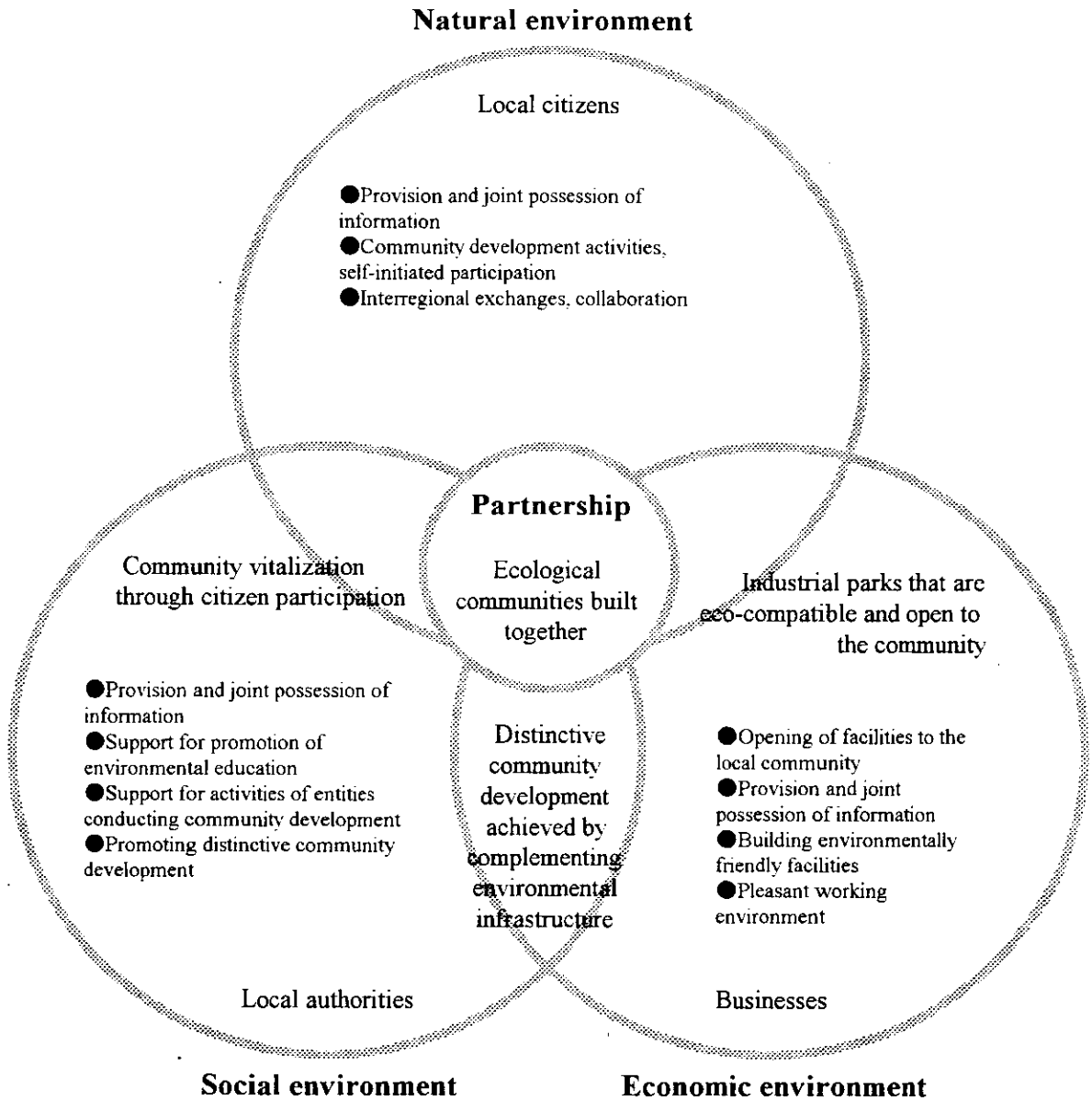


Fig.5 Approach to Ecological Community Development

(4) Environmental Measures Require Autonomous Initiatives

Environmental efforts do not work well when forced on people. Especially because industrial parks are collections of different companies, it is necessary to form cooperative business communities and to devise mechanisms by which all park members can benefit in their own ways as they work out the ideas behind self-initiated action plans, and within an economic eco-dynamism.

8. A Technological Model for Creating Eco-Industrial Parks

Since the Industrial Revolution the technologies related to production and production efficiency have improved, while the detrimental legacy for Japan's economy, which experienced decades of rapid growth, was neglecting to build systems to dispose of and recycle the huge volumes of wastes. The recent social situation requires that we build these systems with dispatch, and efforts have begun in various quarters. At the same time, technologies to manage wastes are thriving, and with this area becoming an increasingly large business, companies are increasing their research investments.

Technologically, efforts center on extracting energy from processes. Present environmental technologies include effective use of wastes, solar systems, and wind power, and companies are working hard on development.

Technology development is currently making progress, but economically many technologies still have low evaluations in terms of cost. Here we shall introduce a few examples of technologies already implemented or under development that have possibilities as systems for eco-industrial parks if we also assume the presence of eco-dynamism (i.e., a huge groundswell in social and economic circumstances).

(1) Solar Systems (Photovoltaic Systems)

These systems convert infinite solar energy into pollution-free electricity. Photovoltaics can be installed practically anyplace that receives sunlight, and power availability remains stable if connected to the grid.

Photovoltaics can be used in tapwater and sewage facilities, farmland irrigation equipment, water purification systems, disaster prevention stations, and the like.

Panels installed on the rooftops of large buildings can generate about 10 kW.

Photovoltaics are useful in reducing CO_2 emissions.

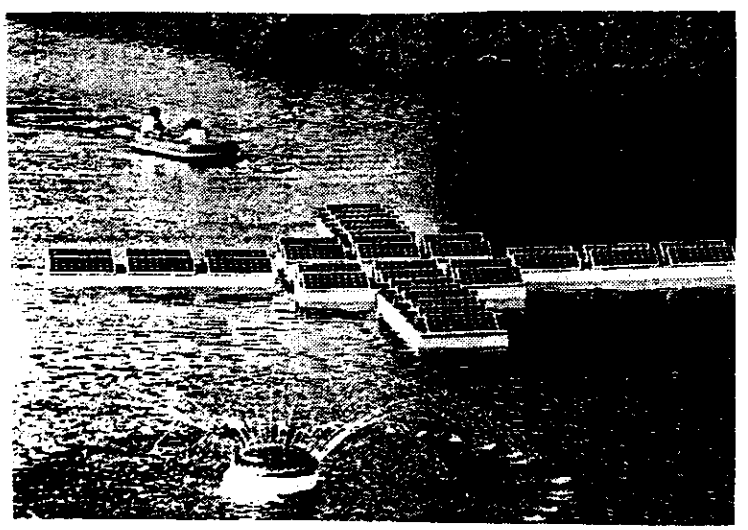


Photo. 1

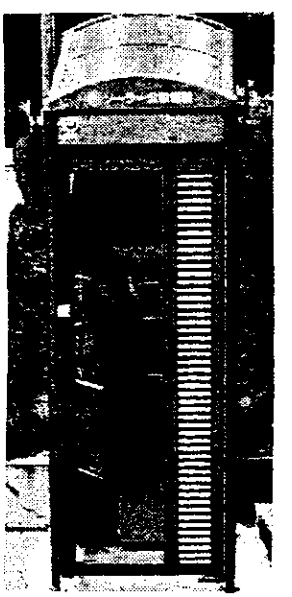


Photo. 2 Photovoltaic cells installed on a telephone booth roof.

(2) Wind Power Systems

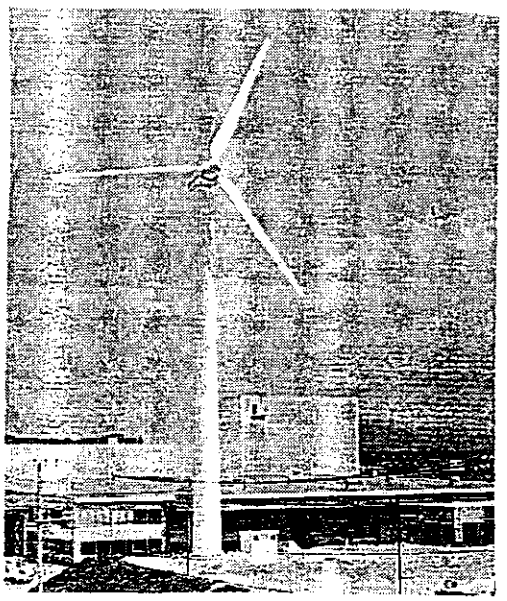
These systems use the wind, one kind of eco-friendly renewable energy, but because they do not always provide a stable energy supply, other systems are needed to make up for this shortcoming.

Japan's largest wind farm, "Tappi Wind Park," has been built at Tappi Cape in Aomori Prefecture. Its five 275-kW turbines (total output, 1,375 kW) have been undergoing demonstration tests since March 1992.

Another five turbines (total output, 1,375 kW) were added in 1995, and plans call for continuing research aimed at practicalization, including system improvements and cost reductions.

Five turbines are in operation also in Tachikawa Town, Yamagata Prefecture, and 26 more are to be added. According to calculations, this number of turbines can supply all the electricity consumed in this municipality, which aims to consume no fossil fuels for electricity.

Photo. 3



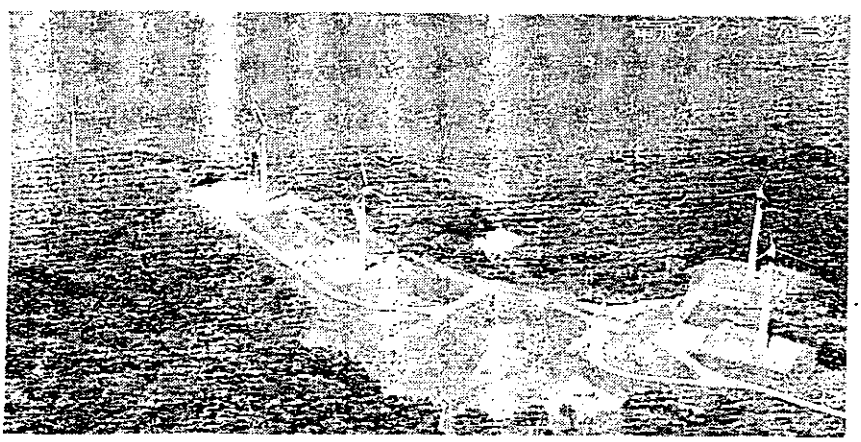


Photo. 4 Tappi Wind Park

(3) District Heating and Cooling Systems

District heating and cooling systems are capable of efficient operation because of centralized control of equipment and operation at a single heat plant. They are highly effective in both conserving energy and reducing environmental burdens. It is hoped that environmental burdens will be alleviated by having these systems make effective use of untapped energy sources such as energy in sewage, seawater, and river water, as well as the energy emitted and discarded into the environment by factories, waste disposal plants, and other facilities.

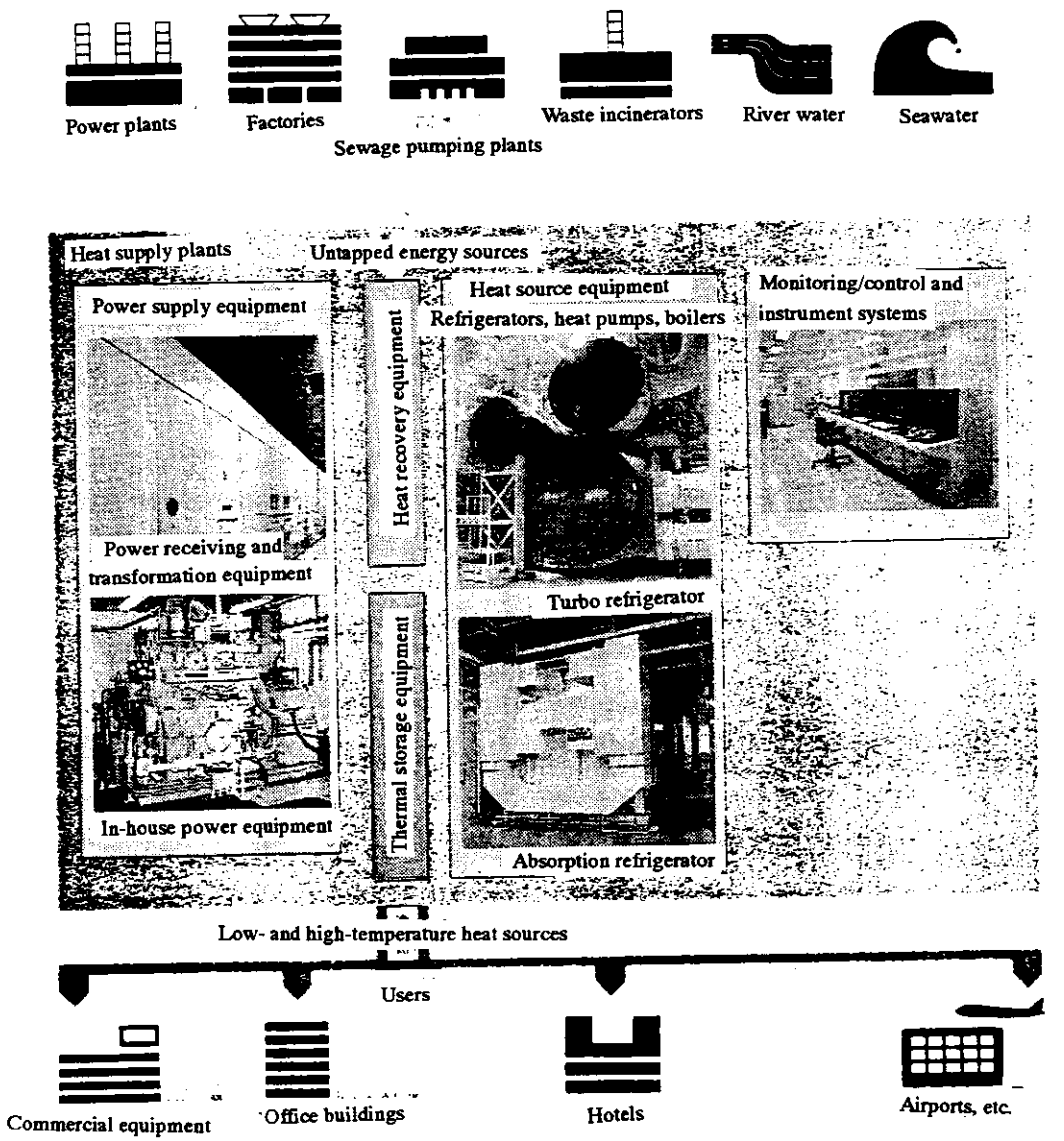


Fig. 6 District Heating and Cooling Systems

(4) Factory Waste Heat Utilization Systems

Instead of wasting the heat energy generated by the boilers and other equipment used in manufacturing and processing, and in processes including cement, glass, and other ceramics industries, as well as waste incinerators, it is put to effective use as such heat sources for district heating and cooling.

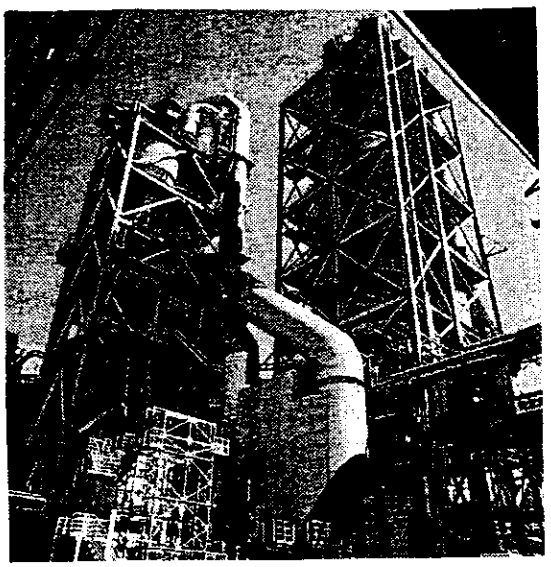


Photo. 5

(5) Cogeneration Systems

Increasing numbers of factories, large buildings, and other facilities are planning and installing cogeneration systems in order to save energy and help the environment. These systems not only generate electricity, but also recover steam and hot water from the waste heat emitted by engines. The steam and hot water are used in processes, and in space heating and cooling in combination with refrigerators, thereby bringing about highly efficient energy use.

These systems will be used in industrial parks to provide resident companies with district heating and cooling services, and will be the centerpiece in encouraging businesses and will play a central role in encouraging businesses to locate [in these parks], and in endeavoring to achieve zero emissions.

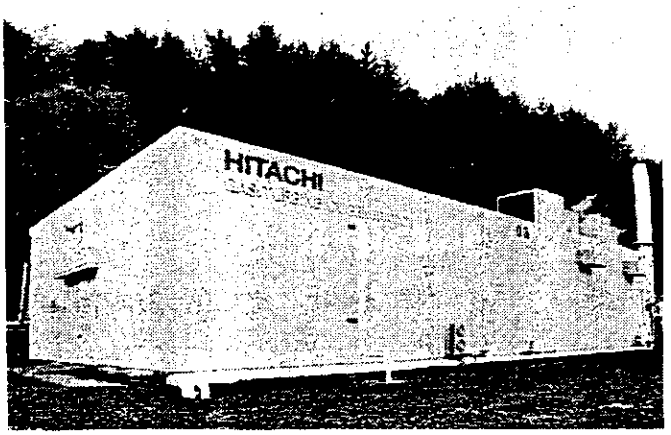


Photo. 6

(6) Gasification and Melting Systems

These systems batch process a variety of wastes and seek to recycle resources to the furthest extent possible. Usually the great diversity of wastes in society, such as municipal wastes, industrial wastes, human wastes, and sewage, are disposed of separately by incineration and other methods, but it is difficult to make a fundamental shift in the waste management system to solve the problems of incineration flue gases and landfills. However, gasification and melting systems make this shift possible because their high-temperature incineration prevents secondary pollution from heavy metals, dioxins, and the like. This technology also allows integrated recycling by combinations using thermal, material, and chemical recycling. A major feature is the integration of functions for dioxin treatment and ash melting, which simplifies equipment and is suited to ash disposal.

Electricity is generated by incinerating wastes from industrial parks and their surrounding areas.

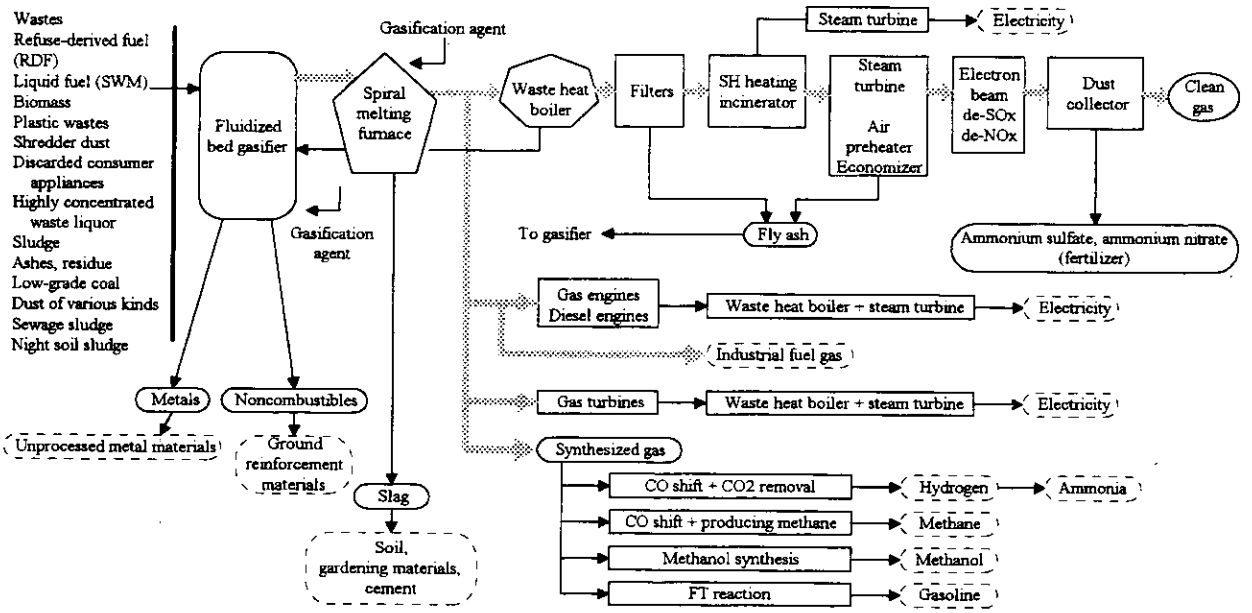


Fig 7 Gasification and Melting System

[Reference]

An Experimental Venue for the Zero-Emission Industrial Park

Translating eco-community development into reality requires not only the development of zero-emission technologies like those described above, but also a venue in which to incorporate those technologies into modern society and demonstrate their effectiveness. Additionally, it is important that problems that arise are put to use as elements of technology development, thereby serving to trigger the development of new zero-emission technologies.

In order to promote community development that gives concrete form to the zero emission idea, Ebara Corporation plans to use state-of-the-art environmental engineering technologies to establish an "eco-industrial park" on its own company land and make it a venue for zero emission experiments.

"Eco-Industrial Park"

Based on the idea of community development that eliminates wastes mainly by means of cycling water, air, and energy, as well as resources and wastes, this plan, while small in scale, calls for using a six- to 10-hectare site on company land (including company housing, single employees' dormitory, and training center) in Fujisawa City as a model area where a water purification plant, sewage treatment plant (methane fermentation), composting facility, photovoltaic generating equipment, fuel cell facility, and other social infrastructure will be joined in a center, around which will be built factories, housing, commercial facilities, a farm, and other facilities. The plan, which calls for completion in 2000, is therefore an attempt to achieve an efficient cycle that includes, for example, using thermal effluent from factories in homes and the farm, extracting resources and energy from the wastes generated by park facilities and distributing them to factories and homes, and supplying the farm with the fertilizer that is produced as a secondary product.

While at this stage only the initial concept has been developed, it is hoped that efforts will continue toward the realization of a cyclical and ecological society model district that we can tell the world about.

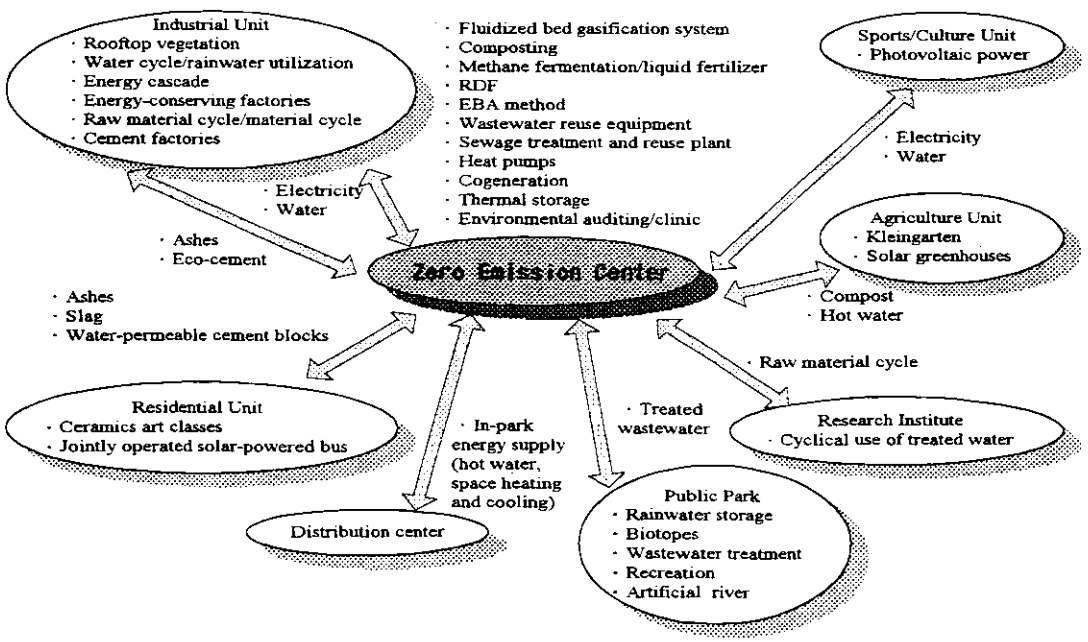


Fig 8 Eco-Industrial Park

IV. Eco-Industrial Park Model Plan

1. Cogeneration-Based Business Park Types

(1) Solar System Type

The idea behind this system is to install solar panels on factory buildings and other rooftops in a park to generate electricity that is used to power small equipment in each company, public facilities in the park, and the like.

Further, because sunlight can also be used as heat energy, it can be put to work in company space heating systems.

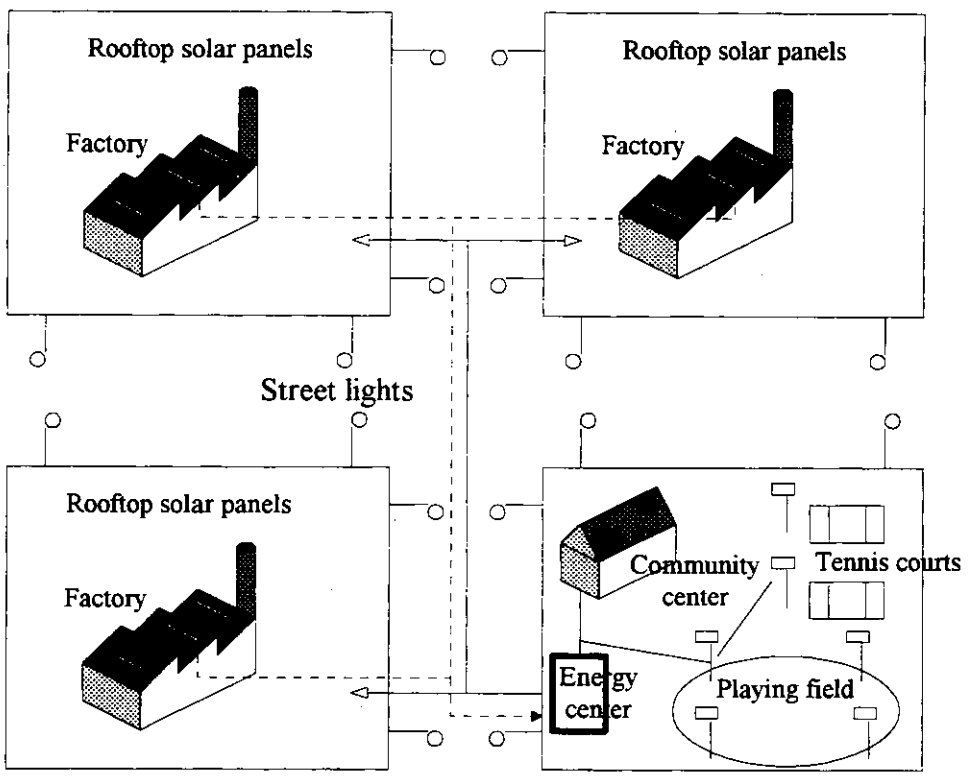


Fig. 9 Solar system type

A. Energy Use

Generate electricity by installing solar panels on factory rooftops, and route it through the energy center to the following facilities.

- Lighting for companies' office buildings and factories
- Electric power and baths in the park's community center
- Lighting such as street lights, playing field, and tennis court illumination
- Companies' space heating systems

B. Implementation Problems

As solar systems basically depend on sunlight, their costs vary greatly depending of weather, insolation, and other factors. Furthermore, winter snow accumulation and the like in certain areas make the systems unusable, necessitating the installation of alternative systems.

C. Environmental Benefits

Using pollution-free solar energy contributes to CO_2 reductions.

(2) Waste Utilization Type

The idea behind this system is to generate electricity by incinerating combustible wastes from park factories and refuse-derived fuel (RDF) made of municipal solid wastes from the immediate surrounding area, and supply the power to small-scale equipment in park companies, public facilities in the park, and the like.

Waste heat from generation can supply the energy for companies' space heating systems and for greenhouse heating in the area.

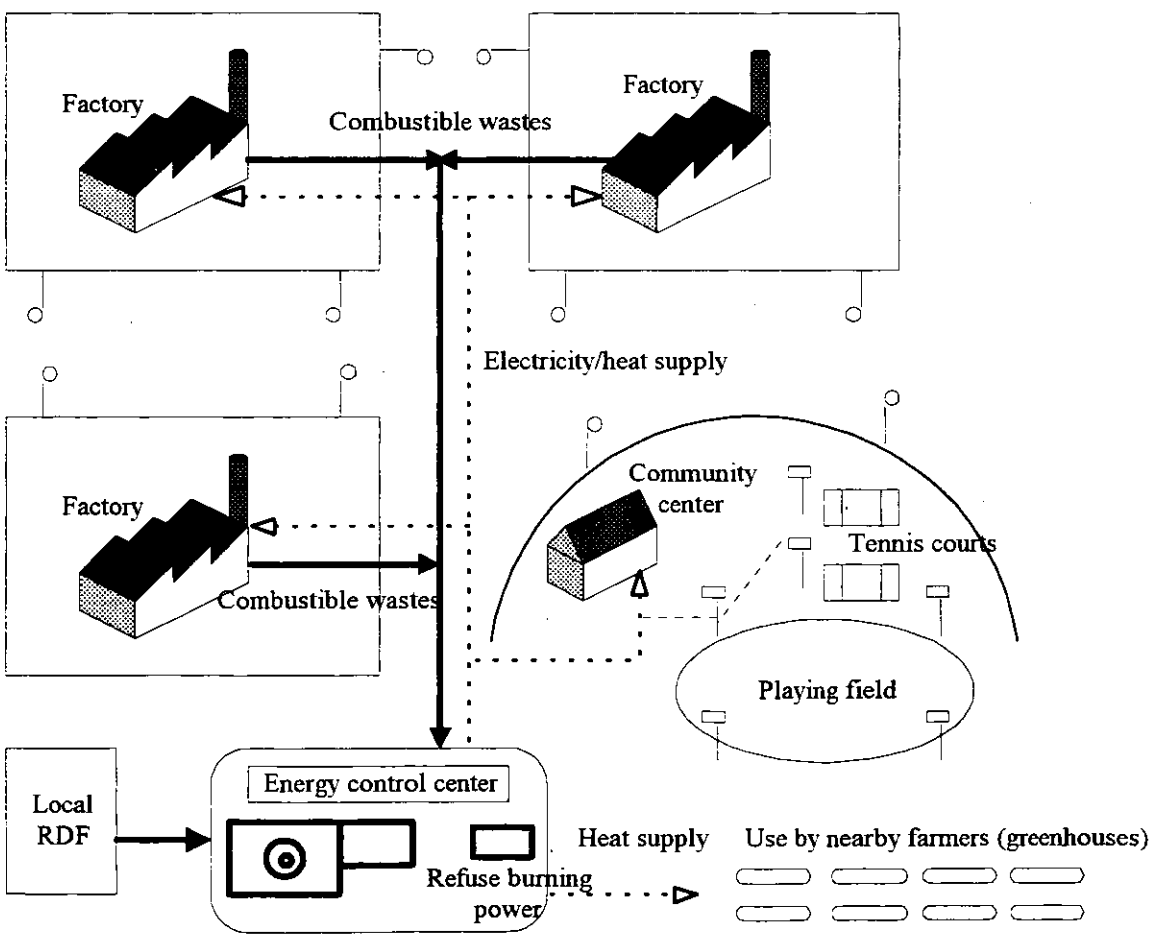


Fig. 10 Waste utilization type

A. Energy Use

The energy center accepts the combustible industrial wastes generated by factories, plus RDF made from local municipal solid wastes, and burns them to produce electricity, which is used by the following facilities.

- Lighting in companies' office buildings and factories
- Electric power and baths in the park's community center
- Lighting such as street lights, playing field, and tennis court illumination
- Companies' space heating systems
- Melting snow on parking lots and rooftops
- Supplying heat for local agriculture (greenhouses, etc.)

B. Implementation Problems

Waste-to-energy systems have great difficulty in securing stable supplies of fuel from industrial park factories, and require scale enlargement if economy is considered important, but wastes from the park alone are insufficient to attain the needed scale, in which case systems cannot operate economically. Accordingly, they are set up as energy supply/demand systems that serve their industrial parks and immediate regions, and in consideration of a stable supply/demand balance they use mainly RDF, which is supplemented with combustible industrial wastes.

But as RDF is still not in broad general use, it is important to establish systems that secure stable RDF supplies, while alternative systems will be necessary in localities which as yet are not set up to produce RDF.

C. Environmental Benefits

Not producing industrial wastes means making a social contribution to solving environmental problems. Taking on RDF services for a locality makes a significant contribution to the community, while also helping extend the lifetimes of industrial waste landfill sites.

Because industrial parks have waste-to-energy facilities, parks must gain a consensus from local citizens even though facilities may be small.

2. Recycling-Type Business Parks

Cluster mainly businesses that discard plastics, have a company use the waste plastic generated by those businesses to make recycled oil by thermal decomposition and liquefaction, and supply the product as a resource to park businesses. Wastes are recovered and recycled by other companies.

In view of the great possibility that company secrets will be lost through recycling, it must be carried out under a relationship of trust among park members.

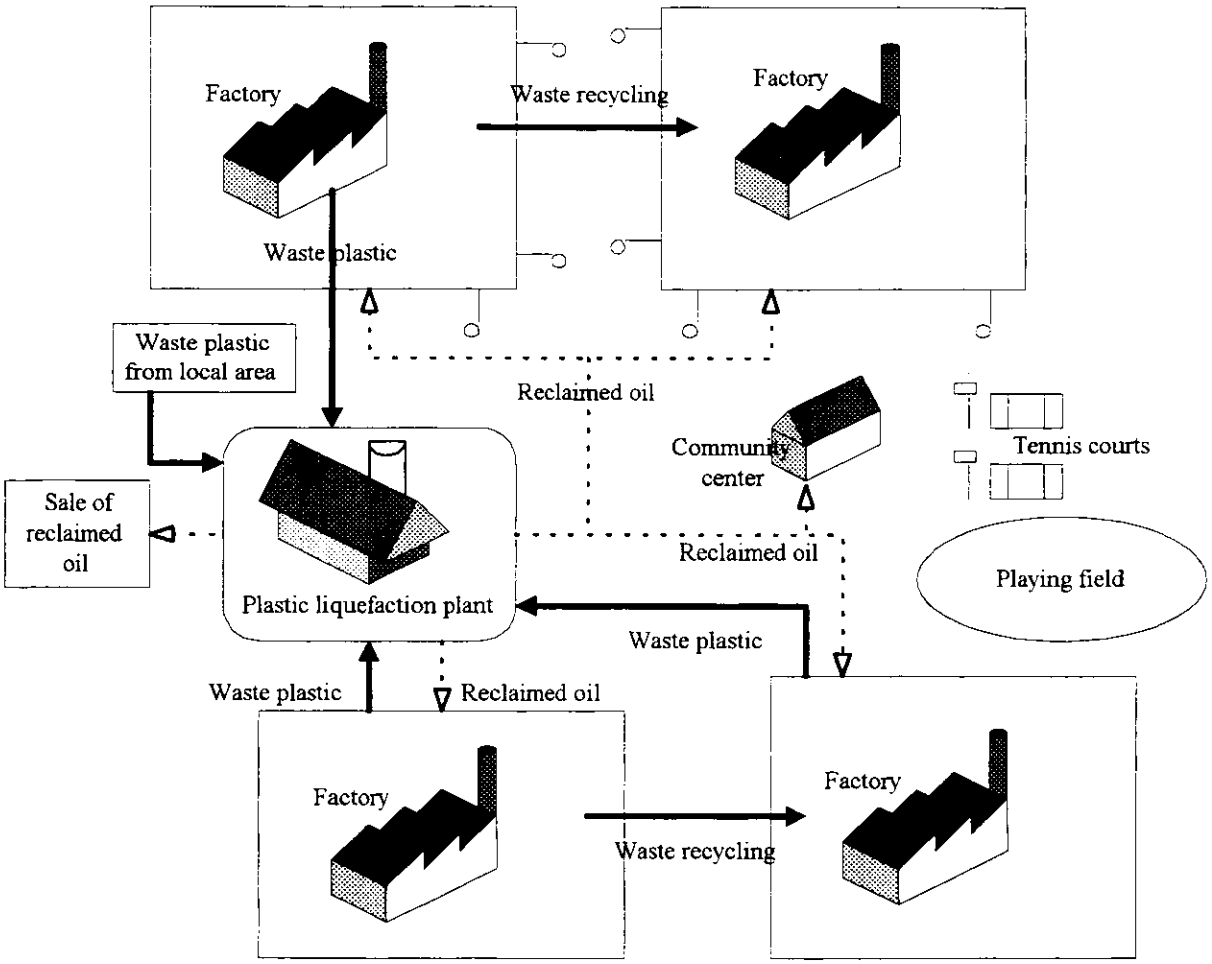


Fig. 11 Recycling - type business parks

A. Resource Use

Reclaim the waste plastic generated by factories, thermally decompose and liquefy it, and supply it to park members as a fuel resource. Reclaimed oil is also used as a fuel resource in the local area.

Additionally, contribute to the effective use of resources by reusing and recycling the wastes that factories generate.

B. Implementation Problems

Recycling of waste plastic will be further accelerated by the Law Concerning the Promotion of the Separation, Collection and Recycling of Containers and Packaging. In particular, reclaiming bulky waste plastics helps lengthen the lifetimes of landfill sites, but a problem is the volume and means of transporting waste plastic collected by the decomposition and liquefaction plants. The amount of waste plastic generated by park businesses is insufficient to allow a liquefaction plant to operate efficiently, which necessitates collecting plastic from a wide area, producing and refining oil, and selling it to a wide area.

Problems are as follows.

- Because raw materials are wastes their processing costs money, but quality is not consistent.
- Collecting large amounts of materials makes collectors and haulers travel longer distances, thus increasing costs.
- In view of the raw material situation, there are limits to economies of scale.
- There is still not a big market for oil recovered from plastic.

C. Environmental Benefits

As waste plastic recycling is the biggest issue affecting the critical shortage of final disposal landfill sites, plastic incineration, thermal decomposition/liquefaction, and other means help save landfill space and make a social contribution to solving environmental problems. However, incinerating plastic decreases an incinerator's capabilities because of the high heat produced. Thermal decomposition and liquefaction can decrease the volume of waste plastic without further burdening incinerators, and the process also helps cope with the increasing amount and caloric value of wastes.

Further, fuel (and thus energy) is conserved by lessening the amount of waste plastic that is simply burned because CO_2 emissions are reduced and primary energy is recovered.

3. Waste Heat Utilization Business Parks

These parks use the heat emitted by waste incineration, river water, seawater, treated sewage, and other sources in building heat supply systems mainly for themselves, and also for surrounding areas.

- District heating and cooling for park members
- Park recreation facilities (bathing facilities, swimming pools)
- Melting the snow in parks, etc.

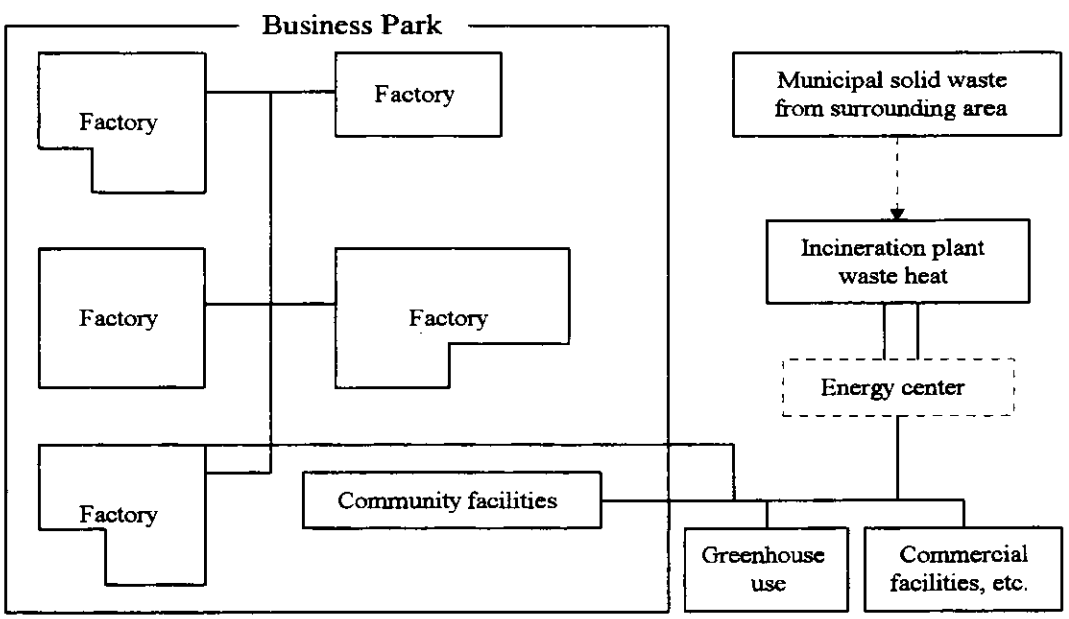


Fig. 12 Waste treate utilization business parks

A. Resource Use

Through heat exchange, use heat emitted by nearby factory electric furnaces, cement plants, waste incinerators, and power plants for park space heating and cooling, and heating water.

B. Implementation Problems

Basically, this system is not viable without nearby factories, incineration plants, or power plants. For an industrial park to use this waste heat, either heat-emitting facilities must be built in a section of the park, or the park must be developed next to such facilities.

4. Industrial Parks that Harmonize with the Natural Environment

When developing industrial parks, apartment complexes, and the like, it is necessary to adopt the viewpoint of things that have been living in that place, and proceed with development that allows symbiosis based on the concept of "humans can't work in a place where other things cannot live."

- Leave existing natural forests as untouched as possible, incorporate plenty of green space, and provide for coexistence with other living things.
- Leave buffer zones between roads and the lots of park companies, thereby having continuity of green space.
- In order to create pleasant spaces, set up symbolic items such as monuments, and have green space and community greens (public parks).

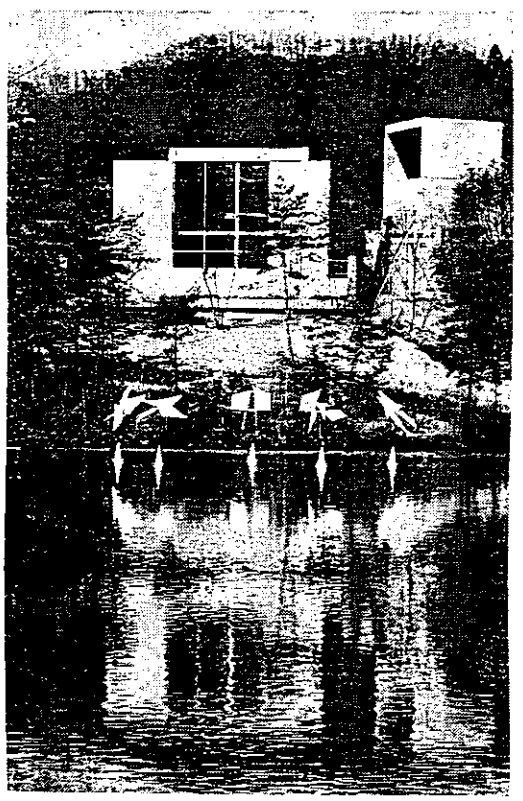


Photo. 7

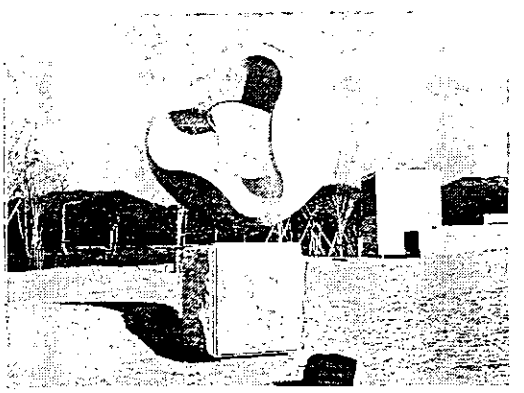


Photo. 8

V. Effectiveness of Eco-Industrial Parks (Zero-Emission Industrial Parks) in Mitigating Environmental Burdens

1. Industrial Parks that Generate Electricity from Wastes and Use Untapped Energy Sources

Industrial parks install generating and waste heat utilization facilities to make use of their own waste resources, and employ solar and wind power systems. They also use the electricity and waste heat generated by incinerating refuse-derived fuel made with the municipal and industrial wastes from local municipalities, new housing subdivisions, businesses, and other sources, as part of the electric power for park companies, district heating and cooling, swimming pools, greenhouses, employee facilities, health spas, melting snow, and energy for agriculture and other applications.

For the purpose of creating zero-emission industrial parks, let us try simulating the assessments for energy conservation and CO_2 reductions realized by waste power generation.

We shall assume the development of a 20-ha industrial park in an outlying regional city of 200,000 and that the park generates a total of 2,500 KW/h comprising 2,400 KW/h from waste generation (a gasifier), 30 KW/h from solar systems, and 70 KW/h from wind power, with the gasifier fueled by regional municipal solid wastes (RDF) and combustible wastes from the park and surrounding area. Assessments are based on the extent to which this system reduces the amount of equivalent primary energy that would be needed for the same power generated with fossil fuels.

A simple comparison based on the foregoing conditions yields the following results, but the reader should note that this is just one attempt, and represents nothing definite.

Table 1 Necessary power: 2,500 KW/h

Fuel type	Fossil fuel (liquid)	Wastes (RDF) and combustibles from the park	Solar, wind
Amount	15 kl/day	75 t/day (40 t/day RDF and 30 t/day combustibles from park)	—
CO_2 emissions	56.1 t/day	100.7 t/day*	—

- CO_2 reduction: 56.1 t/day
- Fuel savings: 15 kl/day

[Description of Reduction]

Supplying 2,500 KW/h of power emits 56.1 t/day of CO_2 if fossil fuel is used, and combined with the 100.7 t/day CO_2 from waste incineration, the total comes to 156.8 t/day of CO_2 emissions. But generating electricity with the wastes results in a CO_2 emission cut of 56.1 t/day and a fossil fuel savings of 15 kl/day.

2. Effectiveness of Mitigating the Environmental Burden of Food Industry Wastes

Here we shall discuss a paper entitled "Analysis of Food Industry Wastes and the Challenge of Achieving a Cyclical Society" by Ms. Reiko Sodeno at Kyoto University (under the guidance of Professor Naito) about the effectiveness of mitigating the environmental burden of food industry wastes. This paper details research that applies an LCA-like assessment to the effectiveness of decreasing the environmental burden by instituting a food industry wastes cycling system that combines the food industry, livestock industry, and agriculture for the purpose of cycling organic wastes.

Calculations are performed for the effectiveness of reducing environmental burdens in the food manufacturing industry by a method for disposing of soy sauce lees, and in examples of food cycling systems.

(1) Mitigating the Environmental Burden by Means of Disposal Methods

Interviews were conducted with people in the soy sauce industry, and burden intensity was sought for each way of soy sauce lees disposal. The following three methods were chosen, and Fig. 13 shows the processes covered by calculations.

(A) Fertilizer production
(B) Incineration plus heat recovery
(C) Incineration

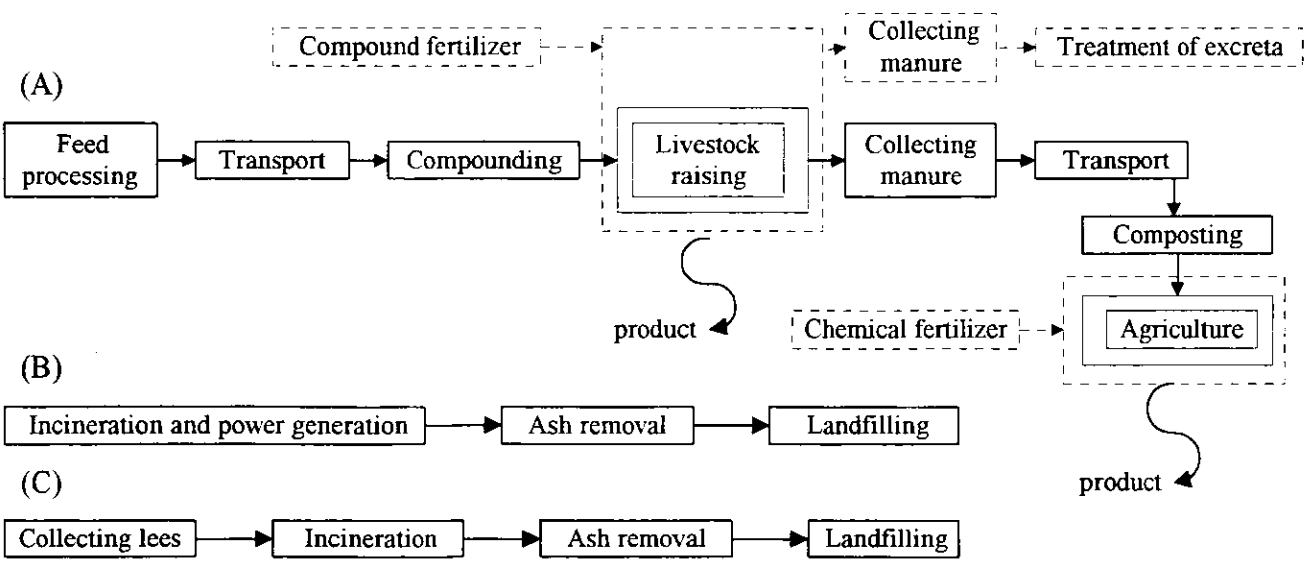


Fig. 13 Processes Covered by Calculations According to Method of Soy Sauce Lees Disposal

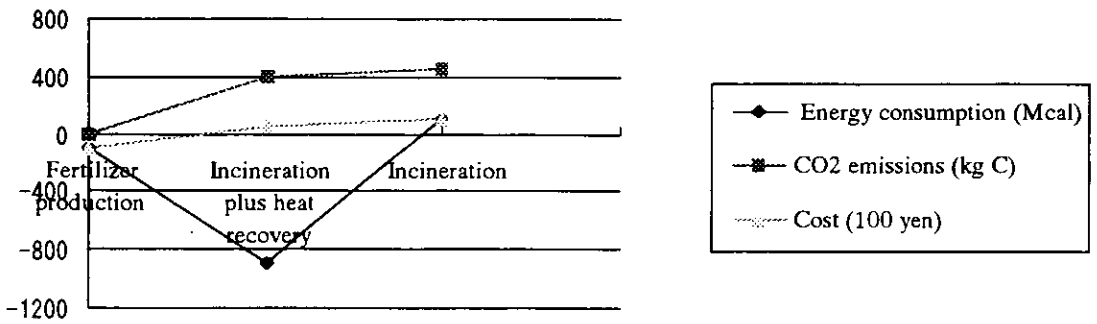
Burden intensity was determined by using the LCA "aggregation" procedure to seek the burden magnitude caused per ton of lees at the construction and operation stages in each process, and the following three items were used as assessment indicators for environmental burden.

A. Energy consumed (kcal)
B. Carbon dioxide emissions (kg C)

C. Cost (yen)

Analysis results appear in Fig. 14 as the burden produced by each of the disposal methods.

On the whole the largest burden was caused by incineration, by incineration plus heat recovery if one focuses on CO_2 emissions, and by fertilizer production if one focuses on energy consumption. Changing the assessment perspective makes it difficult, but overall the method that causes hardly any



environmental burden is fertilizer production.

Fig. 14 Burden According to Disposal Method

The burden-reducing effectiveness of making fertilizer of Japan's soy sauce lees is as follows.

[Assessment Assumptions]
- 100,000 tons of soy sauce lees
- 2,300 factories in soy sauce industry (five major companies account for half of all production)

If all the factories producing more than 1,000 tons of lees per year (accounting for 79.5% of all lees produced) make all their lees into fertilizer, the social effect would be as follows.

[Assessment Results (the burden-reducing effectiveness)]

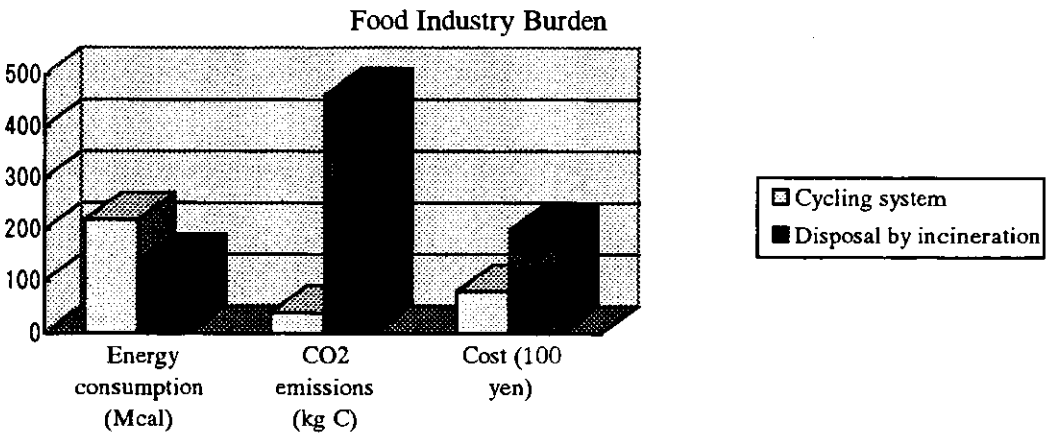
A. Energy consumption: 5,439 Gcal
B. CO_2 emissions: 19,727 t C
C. Cost: 1.38 billion yen

(2) Mitigating the Environmental Burden by Food Cycling Systems

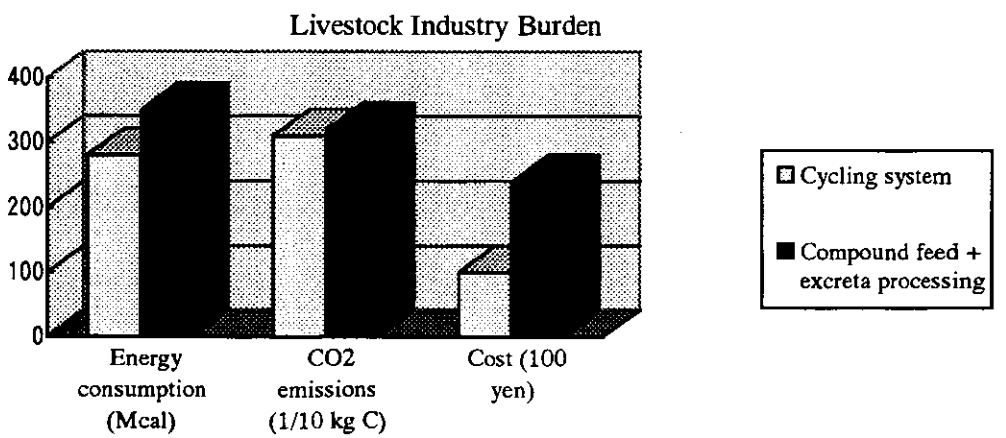
[Assessment Assumptions]

The smoothly functioning cycling system of Y Corporation "uses food by-products from food manufacturers as raw material, and the cities get milk and meat. Livestock excreta are composted and returned to the soil, and the cities get the resulting agricultural products." Food cycling systems are assessed with this agriculture-based community as the model.

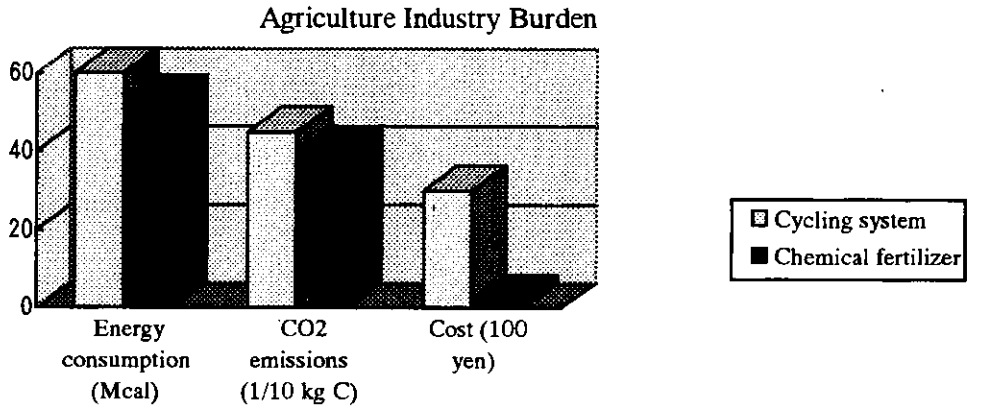
Fig. 15 shows the burdens generated internally by three industries. Note, however, that because each industry is assessed separately, the same processes are calculated more than once. Y Corporation, which is a complex of different industries, achieves the efficiency of integrated management because sharing functions among different industries eliminates the burden that would accrue by repetition.



	Scope covered
Incineration	Food industry → lees collection → incineration → ash removal → landfilling
Cycling	Food industry → feed processing → transport → compounding



	Scope covered
Compound feed Excreta disposal	Compound feed → livestock industry → excreta collection → excreta disposal
Cycling	Feed processing → transport → compounding → livestock industry → collecting manure → transport → composting



	Scope covered
Chemical fertilizer	Chemical fertilizer manufacture → agriculture
Cycling	Manure collection → composting → transport → agriculture

Fig. 15 Burdens Generated Internally by Three Industries

[Assessment Results]

Calculations indicate that the annual burden reduction by using Y Corporation's cycling system is as follows.

A. Energy consumption: 2,813 Gcal
B. CO_2 emissions: 155.9 t C
C. Cost: 410 million yen

However, this benefits society as a whole, not just Y Corporation. These savings are equivalent to the annual electric power consumption of 894 households, and the carbon dioxide emissions of 92 people (based on an prediction of the environmental assimilation capacity in 2030).

The foregoing discussion provides useful data that serve as a yardstick for the effectiveness of mitigating environmental burdens, and help create explicit systems for building a cyclical society model.

3. Alleviating the Burden on Local Authorities

The following passage comes from *Steering Business Toward Sustainability*, edited by Fritjof Capra and Gunter Pauli.

"From the building of industrial sewerage to the construction of high pressure water systems, high-voltage power transmission lines, and roads, industrial parks require large prior investments from local and central governments. It is a fact that without such investments there is no hope of attracting industry. But let us consider the following possibility. Industry cuts water consumption to one-tenth. The reuse of all wastewater eliminates the need to build industrial sewerage. Energy efficiency improves five-fold. Because companies adopt dispersed manufacturing processes instead of centralized ones, there is no need to supply high-voltage power. That would totally change the expenditures for industrial park infrastructure, and the budgets needed for investment reserves. My calculations show it would be possible to cut 80% of the infrastructure costs generally needed for industrial parks."

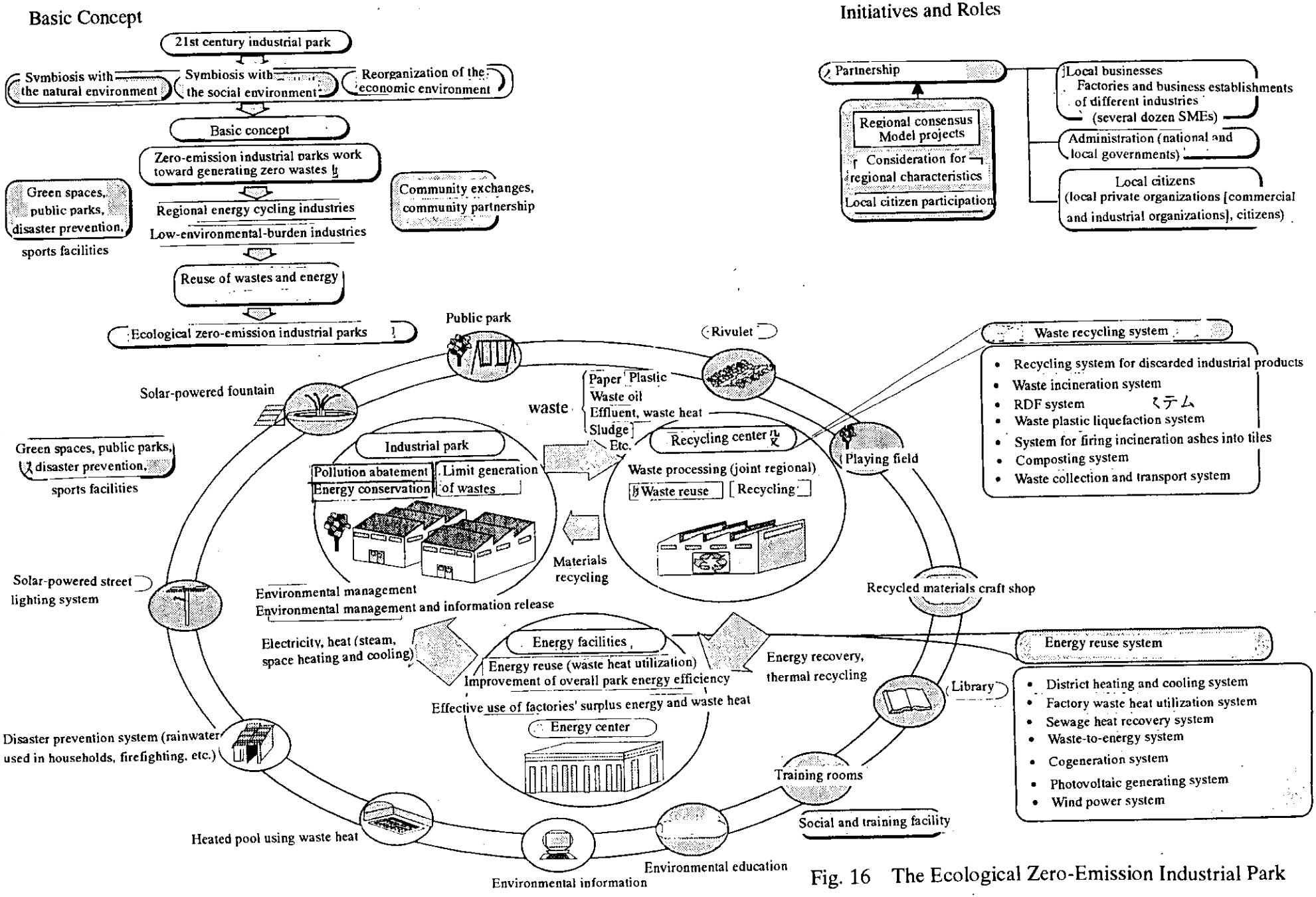


Fig. 16 The Ecological Zero-Emission Industrial Park

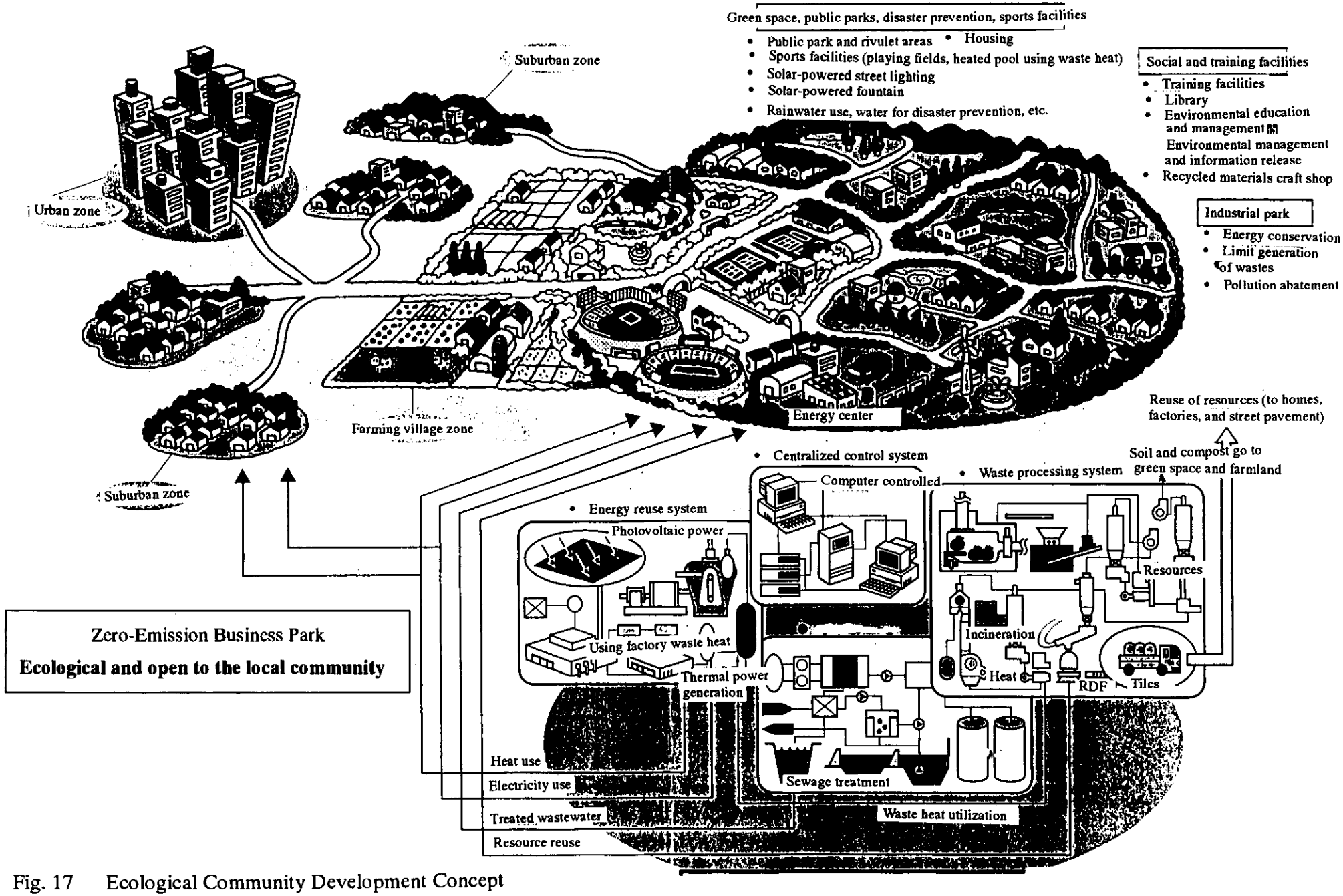


Fig. 17 Ecological Community Development Concept

VI. The Challenge of Ecological Community Development (Zero-Emission Industrial Parks)

Promoting the zero emissions concept both technologically and in social systems requires, first of all, improvements by businesses so their products are manufactured by "zero-emission production systems." Cataloging the challenges involved produces the following list.

Challenge 1: Allocation of roles to citizens and local authorities
- Local authorities make information publicly available and incorporate the opinions of local citizens.
- Local communities are formed through active citizen participation.

Challenge 2: Conversion of companies' production processes
- Qualification under ISO 14000, which is an indicator of environmental burden mitigation
- Giving thought to materials used to manufacture products, reviewing energy and other utilities used
- Examination of product manufacturing processes, packaging and packing materials, changes in methods, and means used to carry items in and out of the company
- Ascertaining amounts of energy and CO_2 by using life cycle assessments (LCAs)
- Carrying out integrated reductions in environmental burdens and costs

Challenge 3: Creation of used product market and inverse factories
- Recovery and reuse of discarded products based on their life cycles

Challenge 4: Transforming wastes generated by one industry into the raw materials of another
- Establishing cascade systems

Successfully answering each of these challenges will involve problems in social systems, economic viability, and technology development, and are therefore easier said than done. There is a keen awareness this will require insights truly leading to a revolution, or perhaps we should say a paradigm shift.

Achieving zero emissions encompasses a plethora of problems: Internationally, there are the problems of ISO 14000 involving the West and the economic competition and cooperation with Southeast Asian countries; domestically Japan must deregulate in some cases while toughening regulations in others, reform institutions, and take other steps.

Currently the concept moves ahead on its own, while we have yet to develop concrete technologies to be fixed in the fabric of society, and build a social system to support those technologies.

Zero emissions is an ideal, and an expression of a decision based on the strong will to eliminate wastes. The concept must face the 21st century with the trinity comprising facilities, institutions, and "heartware" (feeling, or new ethical norms for the 21st century). People have united themselves in the effort to discharge their social duty with respect to livelihood infrastructure, livelihood support systems, and the like, which are a part of the worldwide effort to achieve "sustainable development," which we hear so much about.

Government and citizens in all countries must cooperate in overcoming various problems and building a better society.

VII. An Overview of the Primary Support Measures Implemented for Ecological Community Development

This table describes the main programs, implemented by government agencies during FY1996, related to eco-community development, and gives the budgets for the main related programs by the Environment Agency and the Ministry of International Trade and Industry (MITI) during FY1997.

1. Descriptions of Programs Conducted by Ministries in FY1996

Field	Implementing agency	Program name, etc.	Eligible entities	Description of Assistance	
				Assistance type	Subsidy ratio, interest rate, etc.
Use of alternative energy (photovoltaic generation, etc.)	MITI	Residential photovoltaic (PV) system monitor program	Individuals	Subsidy	Pays half of cost for installing photovoltaic systems in private residences
		Field testing program for photovoltaic generation in public facilities, etc.	Private-sector businesses, local governments, etc. (program partners of New Energy and Industrial Technology Development Organization (NEDO))	Subsidy	Pays two-thirds of costs for test installations in museums, schools, community centers, and other public facilities.
		Demonstration tests on technologies for residential PV generation load leveling (technology development)	Single-family dwelling builders, etc. (NEDO program partners)	Subsidy	Pays two-thirds of costs for demonstration testing needed when installation of residential PV systems comes into full swing
		Program to develop technologies for PV system practicalization	Private sector, etc.	Subsidy	Subsidizes costs for developing new manufacturing technologies to substantially reduce PV cell costs, and to develop systems for using PV generation.

		Program to subsidize costs of installing solar systems and other equipment in certain public facilities, etc.	Educational/cultural, health/medical care, social welfare, sports/recreational, and other facilities	Subsidy	Pays half of costs for installation in eligible facilities.
Integrated energy conservation	MITI	Program to encourage formation of eco-friendly energy communities	Local governments, private sector, etc. (NEDO program partners or co-researchers)	Subsidy	Pays 15% of model project costs for large-scale cogeneration district heat supply facilities, cascading industrial parks, facilities using energy from wastes, and facilities supplying surrounding area with surplus energy from generating plants, factories, and other facilities (upper limit of 600 million yen/year/project).
				Subsidy	Subsidy for feasibility studies (30 million yen per project)
		Model program for advanced high-energy-efficiency buildings	Local governments, private sector, etc.	Subsidy	Pays one-third of costs for building materials, equipment, goods, labor, etc. for efficient energy use.
General urban development	Ministry of Construction	Model program to facilitate improvements to urban infrastructure (Eco-City Construction Promotion Program)	Municipalities, public-private joint ventures, etc.	Subsidy	Pays one-third of costs for formulating priority construction plans, a component of the urban environment planning conducted by local governments. Pays one-third of costs for designing district heating and cooling systems that use untapped energy sources; expenses for improvements to open undeveloped land and artificial ground in conjunction with planting trees; and designing of systems for water utilization facilities.

				Priority implementation of projects under Construction Ministry's authority	Priority implementation of public works under the ministry's authority, such as sewerage and urban greening based on urban environment planning
		Integrated eco-cities construction program	Private sector	Low-interest financing from development banks, etc.	Financing construction costs for urban greening facilities, water-permeable pavement, and facilities for water storage and percolation (special interest rate 4%, financing ratio about 40%, 25 years repayment) Financing for facilities at which the Urban Environment Management Center, citizens, businesses, and others exchange ideas on the urban environment (special interest rate 4%, financing ratio about 40%, 25 years repayment)
		New technology development	Private sector	Low-interest financing from development banks, etc.	Financing for the reuse of incinerator ashes and other substances as construction materials, and for developing new technologies for greening of rooftops, walls, etc. (special interest rate 5%, financing ratio about 50%, 25 years repayment)
		Program for building eco-city facilities	Public-private joint ventures (some private businesses)	NTT-C interest-free financing	Financing for building setbacks; storage and percolation facilities; core facilities with rooftop greenery, etc.; and facilities for citizen use (15 years repayment, financing ratio 25-50%)
		Model project for ecological residential districts	Local governments, Housing and Urban Development Corporation, Local Housing Provision Public Corporation, private sector, etc.	Subsidy	Pays one-third of costs for studies, design, and planning; costs for water-permeable pavement, rooftop greenery, and other infrastructural improvements; costs for public relations, etc.
		Loan addition program for eco-housing	Individuals	Financing addition	Additional financing of 1.5 million yen per home from the Housing Loan Corporation

Field	Implementing agency	Program name, etc.	Eligible entities	Description of Assistance	
				Assistance type	Subsidy ratio, interest rate, etc.
District heating and cooling	MITI	District heating and cooling facility construction program (pursuant to the Heat Service Law)	Local governments, public corporations, government project corporations, public utilities, private sector, etc.	Development bank low-interest financing	Financing for cogeneration district heat supply, facilities to use surplus heat from generating plants, etc. (special interest rate 3-5%, 20-25 years repayment, financing ratio 30-50%)
		Projects for district heat supply systems that use untapped energy sources	Heat supply businesses, etc.	Subsidies	Pays 15% of expenses for projects which, for example, are district heat supply systems using untapped energy sources and have over 5 Gcal/h capacities (600 million yen ceiling/year/project)
Waste management	Ministry of Health and Welfare	Government subsidy program covering costs of building waste management facilities	Local governments, etc.	Subsidies	Pays one-fourth of either costs of waste management or other facilities to be subsidized, or the amount obtained by subtracting contributions and other income from total business expenses, whichever is lower.
Refuse	MITI	Subsidies for development costs of refuse burning power	Local governments, private sector, etc.	Subsidies	5% or 10% subsidy for costs of constructing refuse burning power facilities for stable power sales
		Financing for refuse burning power facilities and waste plastic heat recovery facilities	Local governments, private sector, etc.	Development bank low-interest financing	Financing for equipment for power generation and heat recovery using wastes (waste plastic, metal scraps, etc.) as fuel (special interest rate 5%, financing ratio 40%)
	Ministry of Home Affairs	Refuse burning power projects (electric power utilities)	Local governments	Local bond measures	Local bond measures for commercial power projects, 100% appropriation

		Super refuse burning power projects (electric utilities)	Local governments	Local bond measures	Local bond measures for commercial power projects, 100% appropriation
		Refuse-derived fuel generation projects (electric utilities)	Local governments	Local bond measures	Bonds from General Account (10%, with remaining 90% covered by electric industry bonds) and taxes allocated to local governments (50% entry rate) to cover power generation construction costs

2. FY1997 Related Project Budgets

(1) Environment Agency (Subsidies, etc.)

* Strategic Initiatives on Global Environmental Issues
  Enhancement and strengthening of policy measures and the like for conserving biodiversity and the marine environment
  • Subsidize costs of projects for eco-community development 220 million yen
  (Creating habitat and feeding spaces, improving ponds, lakes, and other habitats, etc.)
  Local gocernments; subsidy ratio 1/3

* Encouragement of environmental conservation activities with localities and citizens in the lead
  Encouraging eco-friendly community development (implementing cutting-edge model projects)
  • Comprehensive promotion of eco-compatible community development in rural areas, etc. 2.05 billion yen
  • Facilitating intensive introduction of low-emission vehicles 510 million yen

* Promoting coexistence with nature
  Preparation and creation of venues to commune and become familiar with nature
  • Project costs for natural parks, etc. 12.81 billion yen
  (Green Diamond Plan project, Nature Interaction School construction project, etc.)

* Strengthening the foundation for nature conservation initiatives such as promoting environmental impact assessment programs
  Encouraging new EIA programs 340 million yen
  Promoting the structuring of environment-conserving social systems 290 million yen
  Promoting research and the development and deployment of technologies that contribute to innovative changes that make economic structures conservation-oriented 8.8 billion yen

* Subsidies for establishing natural parks, etc. 6.8 billion yen
  Prefectures; subsidy rates 1/2, 1/3
  (Includes projects for vitalizing developed areas in national and quasi-national parks
  Japan Environment Corporation; subsidy rate 1/2 250 million yen)

(2) Ministry of International Trade and Industry (subsidies, etc.)

* "Eco-Town Program" for promoting the zero emissions concept
  - Costs for eco-compatible regional development projects (institutional component) 240 million yen
  - Facility construction costs for eco-compatible regional development (infrastructural component) 280 million yen
  - Studies on encouraging the development of regional eco-businesses 50 million yen
  - Other Special Account budgets

* Alternative energy-related budget proposals
  - Promotion of PV generating systems 20.2 billion yen
  - Establishing a program to assist businesses installing alternative energy systems 1.12 billion yen
  - Introduction, promotion, etc. of alternative energy in local areas 4.78 billion yen
  - Popularization and encouragement of alternative-fuel motor vehicles 3.13 billion yen
  - Promotion of solid waste power systems 8.28 billion yen

* Energy conservation-related budget proposals
  - Energy conservation publicity, diagnoses, etc. 2.82 billion yen
  - Installation, promotion, etc. of alternative energy equipment 1.12 billion yen
  - Development of energy conservation technologies 9.72 billion yen
  - Introduction, promotion, etc. of energy conservation in local areas 2.85 billion yen
  - International cooperation (international energy conservation measures) 5.47 billion yen

VIII. Examples of eco-industrial parks

Many local governments are working on industrial parks that could be called eco-industrial parks. Some companies are using their own land to begin implementing the eco-industrial park concept, and there are factories that incorporate two perspectives: One from the employee working environment, and the other from the overall local community. Meanwhile, the Japan Environment Corporation has carried out many environmentally friendly Construction and Transfer Programs. A few representative examples are presented below.

1. New Industrial Zone Development Project (Okayama City)

— Community development using surplus heat —

(1) Overview

The New Industrial Zone is an industrial park to be built mainly around groups of high-tech industries; plans call for it to be not only groups of high-added-value businesses, but also to provide a venue for interaction with agricultural producers and consumers, a waste management facility, and public facilities for local citizens such as sports and recreation facilities, and public parks. Currently under construction, plans call for completion in 1997 (total area, about 71 ha).

Zone plans call for the surplus heat from a waste incineration plant (East Clean Center), which will manage the park's wastes, to be used by a nearby heated pool, thereby using energy effectively and improving the venue for interaction between the local community and park businesses.

(2) Characteristics

The project is to be integrated by combining groups of high-added-value businesses, a farmers' market, and the East Clean Center, and the new industrial zone created by adding the pool heated with surplus heat, a multipurpose plaza, a sewage treatment center, and other facilities.

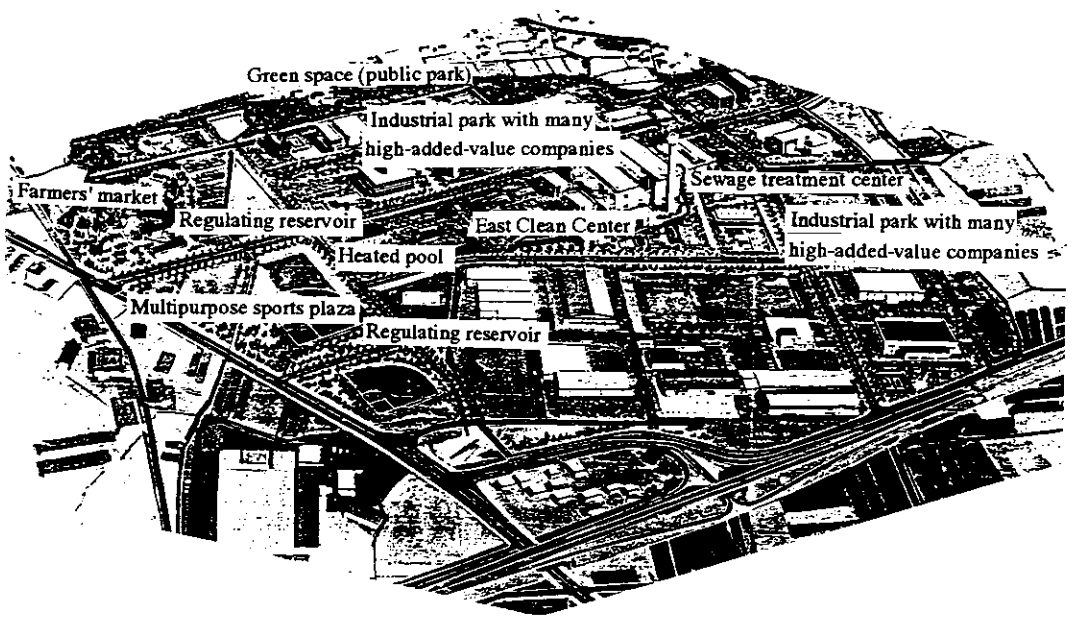


Fig. 18 Concept of completed zone

2. Oguni Town District Heat Supply System (Yamagata Prefecture, Oguni Town)

— Community development using surplus heat —

(1) Overview

Oguni Town in Yamagata Prefecture is an underpopulated municipality bordering on Yamagata, Fukushima, and Niigata prefectures. One of the heaviest snowfall areas in Japan, it is closed in by snow from December to March, and its only transportation routes are national highways and the JR Yonezaka train line.

Since before World War II Oguni has been home to the Oguni Plant of Japan Metals and Chemicals Co., Ltd. Located in the town's central area, the plant is a vital local employer. Since 1986 the waste heat from the plant's electric furnace (furnace top waste heat) has been used for purposes including heating water, space heating, and melting snow in the local area.

(2) Characteristics

The furnace top waste heat is stored via heat exchange as 70°C hot water in thermal storage tanks with 20- and 50-ton capacities. Users exchange this heat in two steps, store it as high-temperature (50°C) and low-temperature (30°C) hot water, and use it for floor heating.

That water's heat is further exchanged and used to melt snow.

The main implementing entity is Japan Metals and Chemicals, and the system provides hot water and floor heating in municipal offices and a special nursing home for the elderly, and melts snow on bridge sidewalks.

3. The Kurashiki (Kuroishi) Industrial Park Considers Nature Protection Important (Kurashiki City)

Environmentally Sensitive Industrial Park Development

(1) Overview

The Kurashiki (Kuroishi) Industrial Park was built in a mountainous area not far from Kurashiki City's urban area in a bid to separate residential and industrial areas, and it was completed in February 1997. For nature conservation and so as not to spoil the view, Kurashiki planted many trees for this park. To secure effective land use area (40%), Kurashiki kept the topography and lot limitations in mind when preparing the park's lots, and used advanced banking design and execution techniques to build a very large slope 70 meters high and consisting of 13 steps.

(2) Characteristics

In accordance with environmental impact assessment results, the park chose tree species providing greenery year around, and planted trees to hide the concrete walls of embankment slopes and regulating reservoirs. Side drains were made friendly to small animals by installing slopes allowing them to crawl out if they fall in, and the park also includes springwater-fed wetlands and biotopes meant for the protection and fostering of the *kasumi sanshouo* (a salamander, *Nynobius nebulosus nebulosus*), insects, and other things living in the area.

Additionally, pipes have been buried underground to improve rainwater drainage efficiency and in consideration of the beautiful view and attractive surroundings (encouraging greenery).

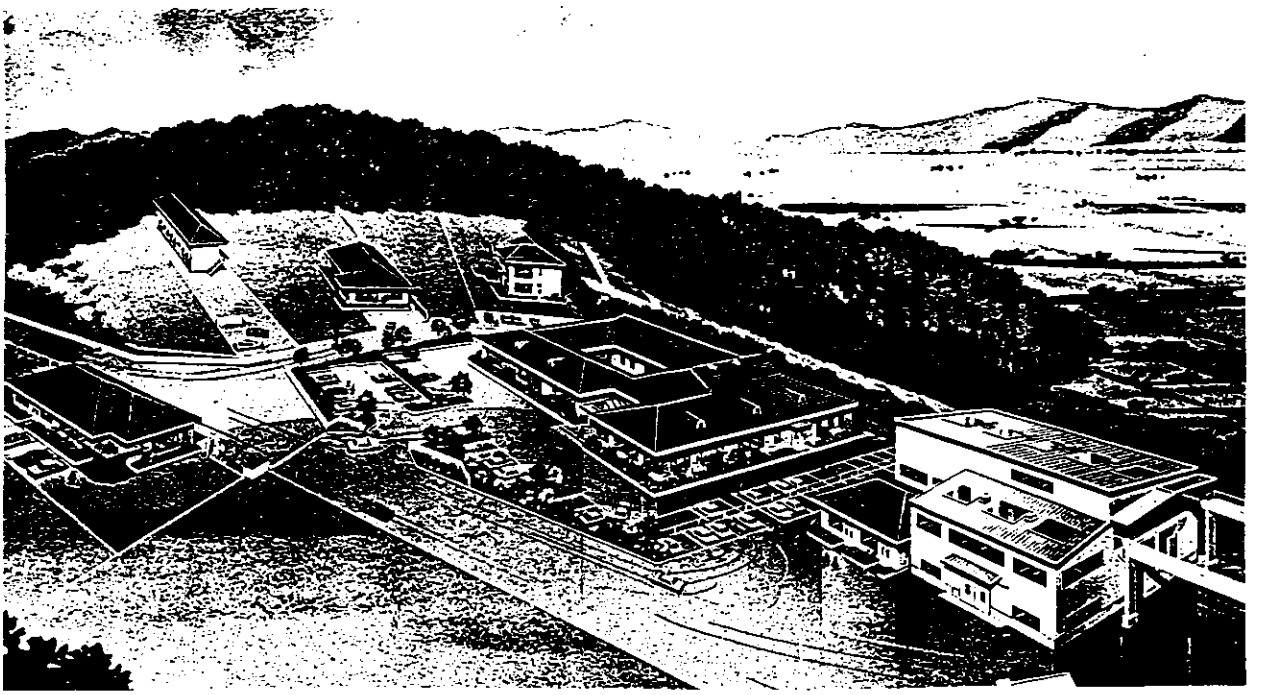


Fig. 19 Artist's conception of completed park

4. Industrial Park in a Natural Setting: Kuboizumi Industrial Park (Saga City)

— Environmentally Sensitive Business Park Development —

(1) Overview

Kuboizumi Industrial Park was conceived and developed as an "industrial park in a natural setting" by Saga City to harmonize with a rural area.

Located in the northeast section of Saga City, the capital of Saga Prefecture, the park was developed so it could coexist with area flora and fauna, and its abundant greenery is appropriate for such a production base. Another name for the park is "Wakuwaku [Thrilling Expectation] Village," for it has many facilities that in various senses delight park visitors (total area is about 53 ha, of which 38 ha is factory lots, and already several companies have located there).

(2) Characteristics

In consideration of what an industrial park in this area should be from the perspective of its native flora and fauna, the park includes a regulating reservoir, streams, a public park, and other facilities that people generally like.

The regulating reservoir in particular is called "Zawazawa Ike Hiroba" [Lively Pond Plaza] and is an area consisting of a broad field and an artificial pond where people and animals gather. The stream, called "Sarasara-gawa" [Babbling Brook], is to be a place where firefly nymphs can live. Consideration for the environment has been exercised in other places throughout the industrial park, as in "Kakinoki Hiroba" [Persimmon Tree Plaza] and "Yorimichi" [Stopping Off Place], which are linked to the preexisting forest by trails that employees use for taking walks.

5. Garden Factory Park (Kumamoto City)

— Community Development with "Software" and "Heartware" —

(1) Overview

Kumamoto Garden Factory Park is a new kind of industrial park that actively courts consumer attendance, and offers direct sales, tours, production learning experiences, meals at a park restaurant, and marketing. Its development concept consists of: (1) Consumer interchange by means of lifestyle proposals and by receiving and providing information on consumer needs; (2) gathering motivated companies that take the lead in their communities; (3) a high-quality working environment with consideration for enhancing citizen welfare and making a social contribution; (4) working hand in hand with local agriculture, livestock farming, and marine industries; and (5) the creation of a pleasant place by building eco-compatible infrastructure (Total area of 27.8 ha; scheduled for completion during 1997).

(2) Characteristics

The park is divided into the zones called the Health Zone (a health town of Western-style buildings), which makes products for health and has an invigorating image; the Sweet Zone (make-believe town), which makes products having a feminine image; and the Craft Volume Zone (a handicraft town of Japanese-style buildings), which makes products replete with a traditional feel, the art of the craftsman, and a family image. Provisions for interaction between consumers and companies include a tour course, production experience opportunities, and an exhibit facility.

For harmonization with the surrounding environment the park created new areas of greenery including a shrine grove, which is to be a local forest. This park provides for harmonious interchanges between the environment and consumers.

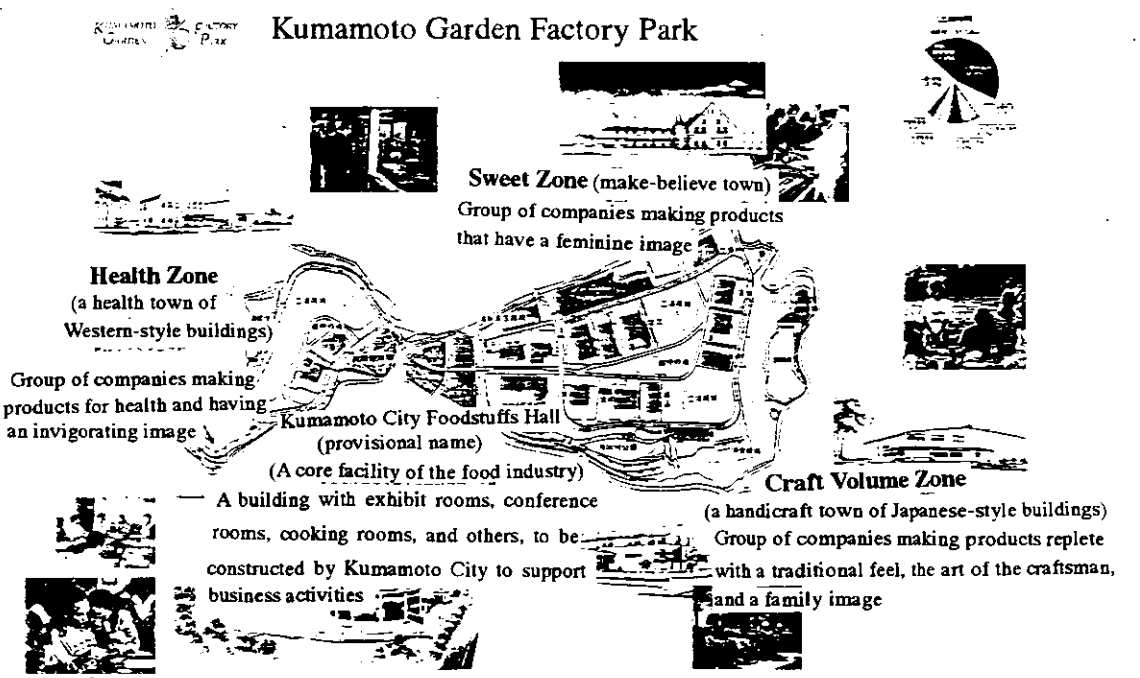


Fig. 20 Zone layout "Kumamoto Garden Factory Park"

6. Yokohama Metal Park

— Community Development with Software and Heartware —

(1) Overview

Yokohama Metal Park, located within Yokohama City's Kanazawa Industrial Park, is an urban-style industrial park with an excellent environment affording relaxation and fulfillment. The park has plenty of shared green space among its Western-style buildings, and could thus be termed an environmentally-sensitive industrial park. Nearby is an employee welfare and benefit facility called the Yokohama City Kanazawa Industry Promotion Center, plus other facilities that support business activities, such as the Fukuura Factory Effluent Treatment Plant, which assures effluent water quality. In the vicinity there are Yokohama's only marine leisure centers, *Umi no Koen* and Hakkeijima, as well as a residential complex with a planned population of 30,000, making this an urban-style industrial park working for symbiosis with the citizens.

(2) Characteristics

This urban-style industrial park, with an excellent environment affording relaxation and fulfillment, has Western-style buildings, shared green space, and a joint parking lot, which lend vitality to community development.

To provide for interaction with local citizens, the park has a concert hall that it opens to the citizens, and uses for concerts and other events, and it also conducts factory tours, thereby enhancing contact with citizens.

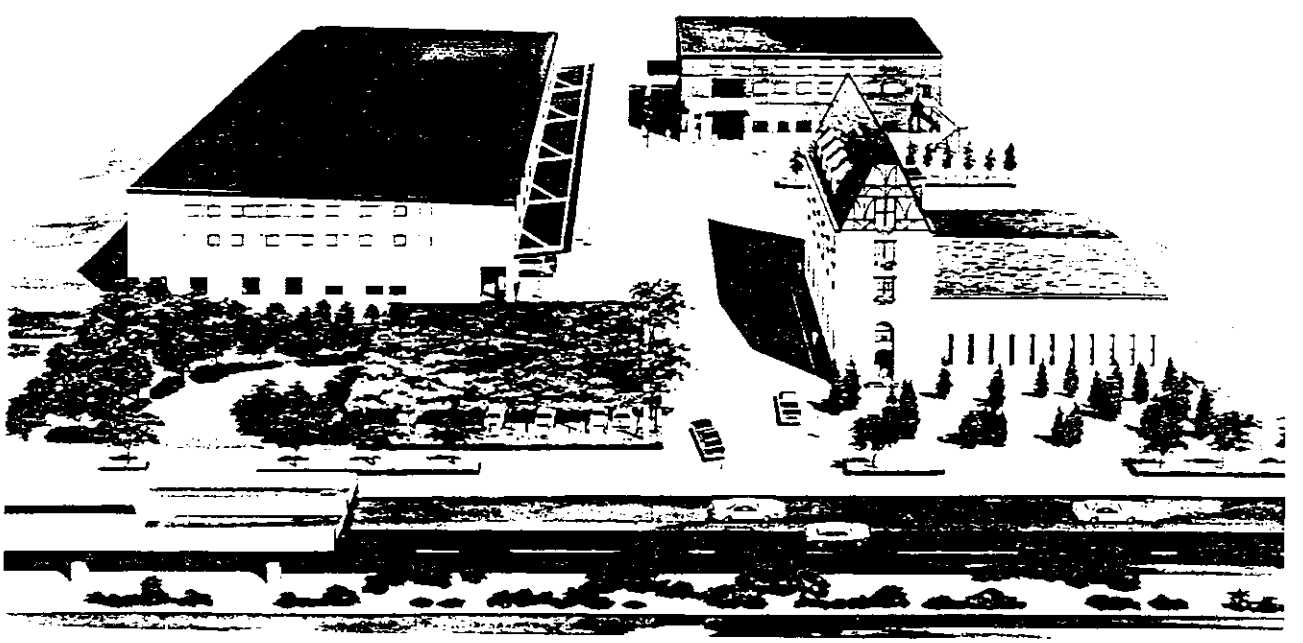


Fig. 21 Completed figure

7. Expanding the Scope of Eco-Dyanamism Throughout the Area: Kokubo Industrial Park (Yamanashi Prefecture, Showa Town)

— Zero-Emission Community Development —

(1) Overview

Created nearly 20 years ago in an area about 15 minutes from JR Kofu Station, Kokubo Industrial Park has an area of about 96 ha. The 23 factories currently located here include those making components for consumer appliances/electronics and office equipment, and printing companies, and they are organized into the Kokubo Industrial Park Industrial Association.

Through discussions in the "Executive Club," whose members are factory managers and the like, Association members developed a mutual understanding about the importance of companies taking spontaneous initiatives on environmental problems, and in April 1994 they decided to make their industrial park environmentally friendly. For reasons including the lack of even a single final disposal site in the prefecture, eight people in charge of wastes at major factories established the Industrial Waste Management Research Group, and after more than 30 meetings they embarked on the first step in November 1995: Initiating the Paper Waste Cooperative Recycling Operation, which formed a partnership with a local cutting-edge waste management company and established one collection point in each factory. Three times a week, a collection vehicle named the Recycling Promotion Truck by the company makes free pickups at the collection points. This operation allows factories to save the costs of incineration and commissioning disposal, which they had previously paid, and the management company realized more profitability through the increase in scale. Paper collected is made by local Yamanashi recyclers into bathroom tissue and other products with the KOKUBO logo, which is then purchased and used by industrial park companies (about 230 tons of paper are recycled annually). Since 1997 Kokubo has been working on their second step, which is the production of refuse-derived fuel (RDF) from waste plastic, wood waste, and unrecyclable paper (total of about 4,300 cubic meters). This operation likewise collaborates with local waste management companies. Plans call for selling the RDF to cement factories as fuel, and using the ashes in eco-cement. For the third step, the plan is to begin an operation during 1997 that will compose the food waste from park companies' employee cafeterias and other facilities (serving a total of about 5,000 people). Kokubo intends to provide this compost to local farmers, and then purchase organic vegetables from them, which would recycle the food waste back to cafeteria tables.

(2) Characteristics

Kokubo Industrial Park initiatives are characterized by: (1) participants achieved ready mutual understanding and smooth decision-making thanks to the activities of the Executive Club and Research Group; (2) they began with an idea that promised advantages for each company, and proceeded one step at a time under the principle of spontaneous participation, without anyone being forced; (3) the park actively expands the scope of environmental efforts (partnerships with local cutting-edge waste management companies, formation of a group of in-prefecture recyclers to make recycled bathroom tissue, attempt at symbiosis with local agriculture through recycling food waste); (4) nearly 10 park factories are working on qualifying under ISO 14001; and (5) park companies are influential members of the Business Liaison Council on the Environment (comprising 500 places of business in Yamanashi Prefecture), they prepared a "Guide to Energy and Resource Conservation," they hold meetings at which they present good examples of energy and resource conservation efforts at factories and places of business, they distribute a "Collection of Good Case Studies," and make other efforts. These varied activities inside and outside the park influence each other and create a major spillover effect, by which the park also serves as a source of eco-dynamism for environmentally oriented community development.

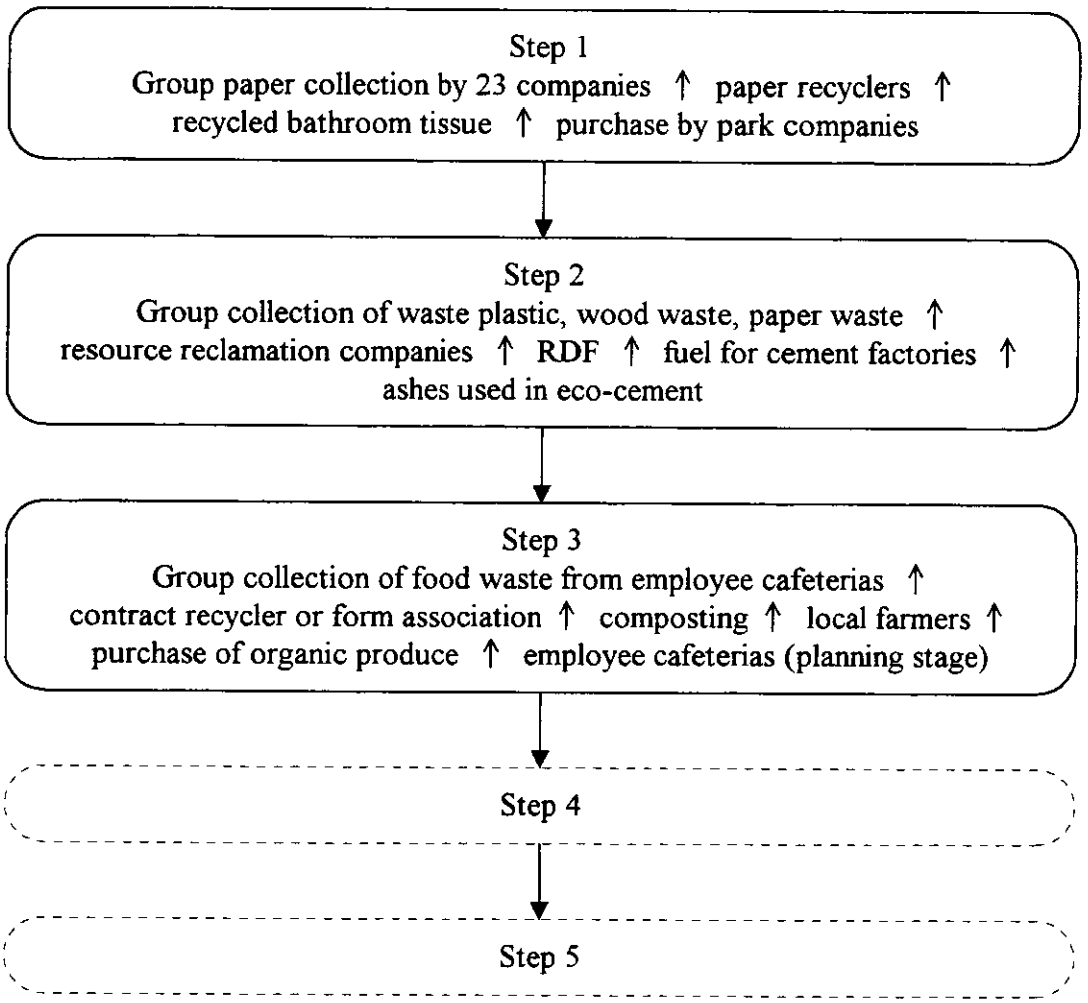


Fig. 22 Kokubo Industrial Park's Steps to Zero Emissions

8. A Factory Building that Combines Living Quarters and Industry (Tokyo, Itabashi Ward)

— Community Development with Software and Heartware —

(1) Overview

A factory building combining living quarters and industry is by nature a compound operation, but it is not just housing and factories on the same lot. Rather, it is conceived as a facility that is open to the locality and which produces a new fusion of the local community and industries.

The idea behind this factory building is to alleviate pollution such as noise and vibration while keeping small and medium-sized manufacturers inside the ward to vitalize the local economy. Furthermore, the building of leased factories and housing together provides for the coexistence of residential facilities and industry.

(2) Characteristics

Factory buildings combining living quarters and industry provide far better conditions than private-sector leased factories in working environments, rental rates, and the like. Lessees are especially happy with the substantial industry-support facilities in factory buildings such as business negotiation areas, showers, craft shops for ward citizens, and work stations.

This facility also provides for contact with local citizens by offering, for example, craft classes for ward residents in making "magic silver spoons" (an introduction to plating).

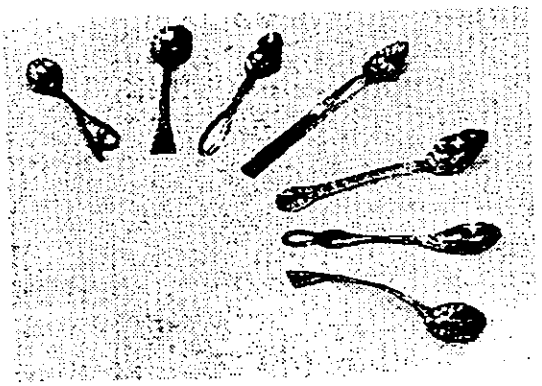


Photo. 9

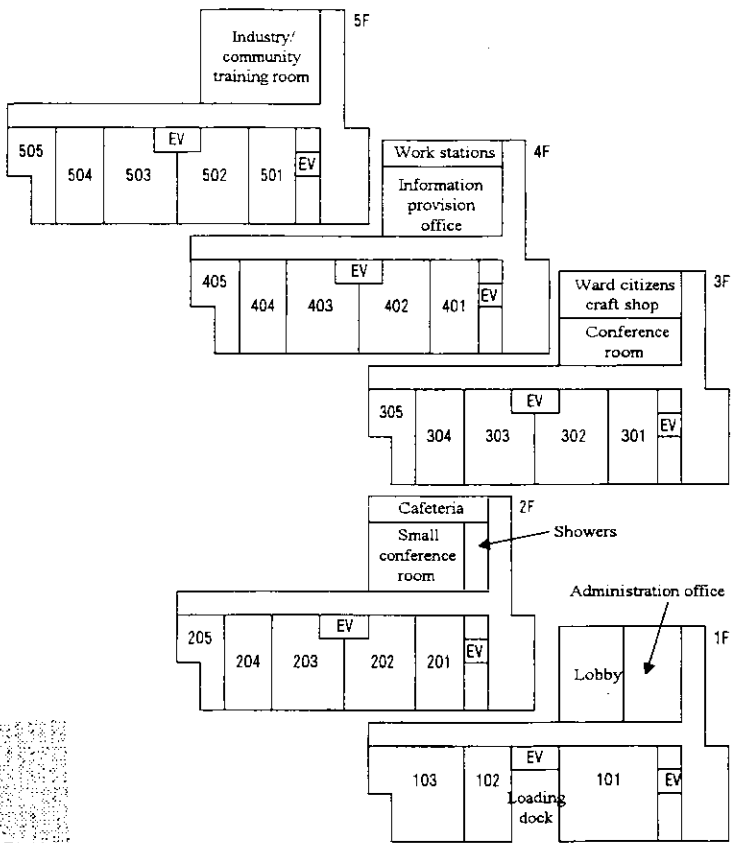


Fig. 23 Building floor plan

9. Eco-Industrial Park Concept (Ebara Corporation)

— Zero-Emission Community Development —

(1) Overview

In cooperation with Fujisawa City and Keio University, Ebara Corporation is using 6 to 10 ha of its own land in Fujisawa City, Kanagawa Prefecture to initiate a model city development concept whose intention is to cut wastes to zero.

Construction began in 1998 on the model city, which comprises large multi-family dwellings, a training center, a shopping center, factories, and a farm. Scheduled for 2000, this project is to incorporate and use the waste management and effluent treatment technologies that have been developed by Ebara.

(2) Characteristics

In addition to the gasification and melting system, which is considered to be the next-generation technology for disposing of wastes, this project will incorporate systems including solid waste power generation, and eco-cement. Power generated will be used for lighting and other applications, while sludge will be composted and used on the farm, and sewage will be treated and the water reused.

To encourage the effective use of energy, the project will employ photovoltaic power and cogeneration systems in housing, greenhouses, and factories.

In consideration of symbiosis with nature, the model city will include greenery on housing rooftops and a biotope public park.

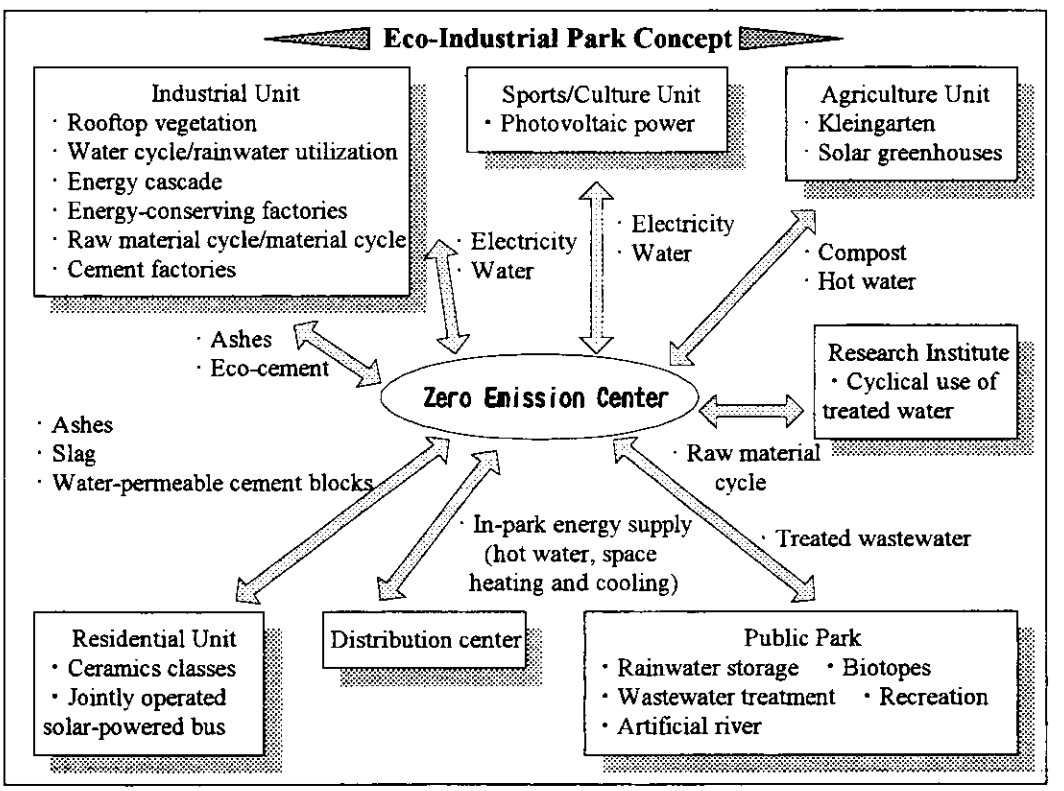


Fig. 24 Eco-Industrial Park Diagram

10. Yakushima Zero Emission Concept (island of Yakushima)

— Zero-Emission Community Development —

(1) Overview

Yakushima's zero emission concept attempts to build alternative energy systems, waste recycling systems, and systems to use local resources. Fashioning a lifestyle and culture unique to the island and putting them into full practice will make it possible to create new eco-compatible industries as well as jobs, by which means the island's strict nature protection policy will succeed.

For this purpose Yakushima is considering: (1) achieving a clean energy environment by switching from fossil fuels to renewable and untapped energy sources (development of alternative energy systems); (2) facilitating the elimination of wastes (appropriate disposal and reuse); and (3) a system to make thorough use of local resources.

(2) Characteristics

A. Development of alternative energy systems

Switching to electric vehicles (about 3,800 units), beginning power generation by solid wastes and other fuels, installation of photovoltaic cell panels (on island homes), etc.

B. Facilitating the elimination of wastes (appropriate disposal and reuse)

Promoting the composting of kitchen scraps, making RDF of combustible wastes, composting of primary industry wastes, etc.

C. A system to make thorough use of local resources

Upgrading the wood industry, development of local health food, tourism, advancement of the educational field (putting ecotourism into practice), etc.

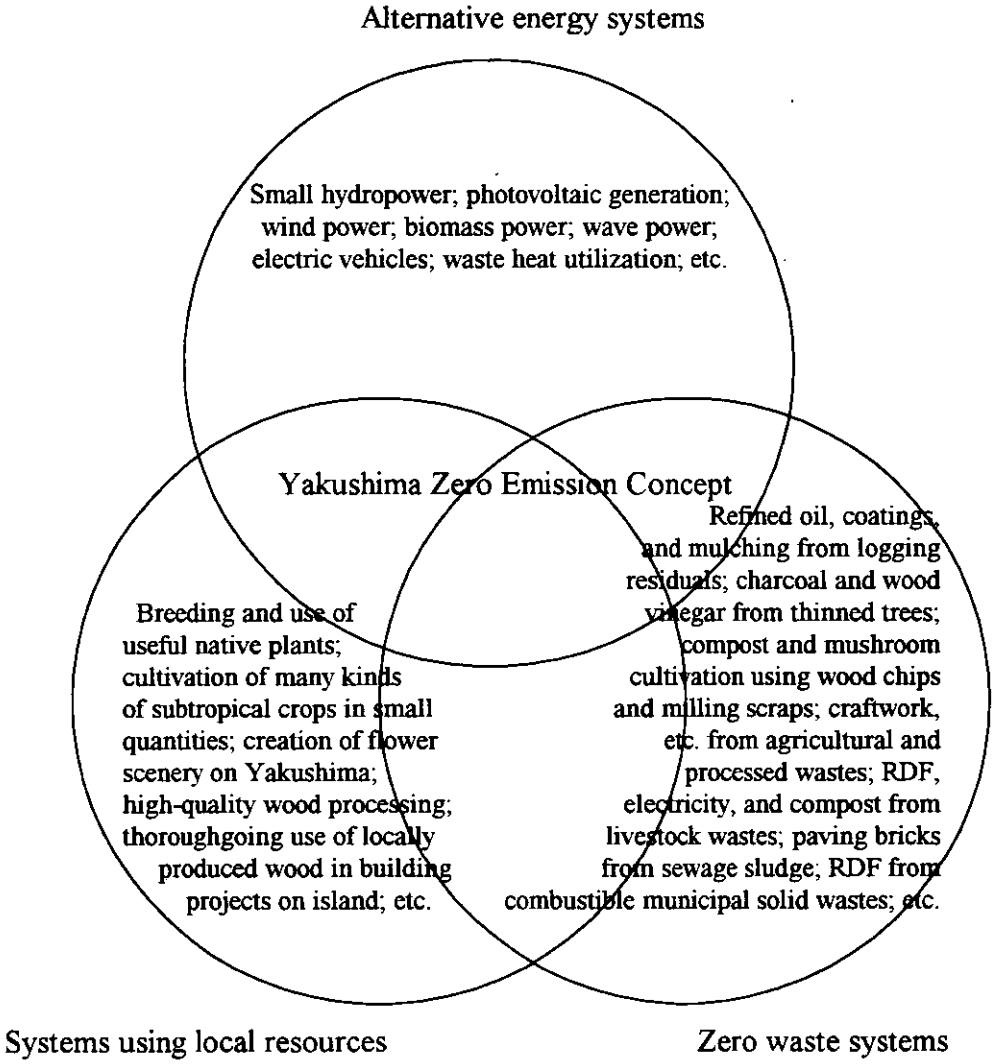


Fig. 25 Zero emission cyclical system

11. Recycling Businesses Cooperative (Kagoshima City)

— Helping the Environment by Recycling —

(1) Overview

During 1997 the Kagoshima Prefecture Recycling Businesses Cooperative (113 member companies) will begin operating a plant to recycle 100% of construction and demolition wastes, an effort being promoted in Kagoshima City.

This operation has been planned for 10-odd years by local construction companies in line with the concept, "Take care of limited resources -- be earth-friendly, protect the environment, and contribute to society."

The ground-breaking ceremony came only after having surmounted many obstacles to achieving this project, which entailed efforts including founding a cooperative with the cooperation of other companies in the construction business, obtaining various kinds of permits, and gaining a local consensus.

(2) Characteristics

This operation recycles the construction by-products from civil engineering and building construction sites (concrete, surplus soil, wood wastes), makes them into mechanically stabilized aggregate and earth to be reused as road base material, and sells them to cooperative members. Wood wastes are carbonized into fuel and wood-based carbon materials to be used for soil improvement and as activated carbon, while some wood chips are used for in-house power production.

In-house generating equipment has a 1,200 KW/h capacity, and power is used for running machinery and equipment, to supply factories, and other uses.

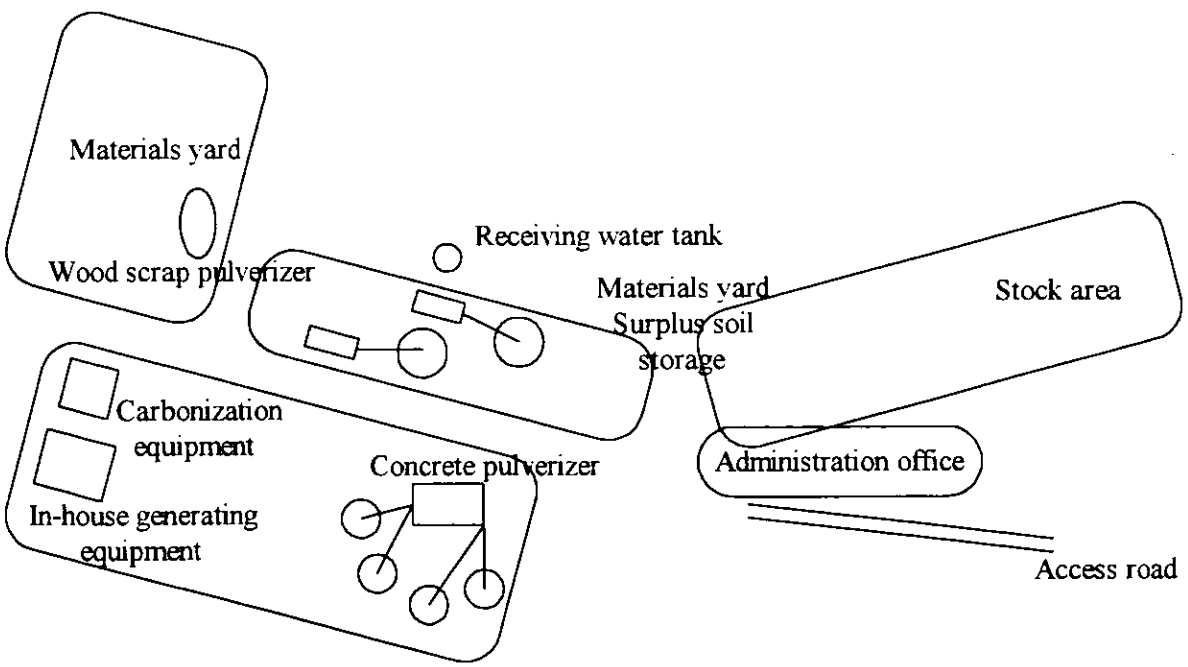


Fig. 26 Plant layout plan

12. Japan Groundwork

— An NGO Initiative —

(1) Current state of the Groundwork initiative

Meaning "(fostering and rooted in) the land," Groundwork is a new kind of activity that began in the UK for improving local environments. Local citizens, businesses, and local authorities cooperate in providing each other with people, materials, money, and information, establish nonprofit organizations with specialized staffs, and undertake the following types of work in the inner city, urban fringes, and rural areas. Examples are regenerating blighted environments, putting up community facilities, preserving the historical heritage and promoting tourism, interaction with cities through projects to restore rural scenery, and environmental education. In 1995 the Japan Groundwork Association was founded in Japan. Their activities are the focus of attention in Mishima City, Shizuoka Prefecture (making public parks out of unused corporate land with spring water from Mt. Fuji, making fallow rice paddies into firefly breeding ponds, etc.), Yonago City, Tottori Prefecture ("Make Nakaumi Lake Safe to Swim in Again" campaign, which includes the collection of used cooking oil), and in other places.

(2) Renewal of Pollution-Devastated Areas (Osaka City, Nishiyodogawa Ward)

As the Nishiyodogawa Pollution Lawsuit was being fought in court over air pollution in the Nishiyodogawa area of Osaka, the pollution-victimized plaintiffs proposed community development in which local citizens take the lead in effecting the recovery of their local environment, which had been damaged and destroyed by pollution, and bring back the lifestyle and culture that had been a concomitant of the natural environment. This became the "Nishiyodogawa Redevelopment Plan." In March 1995 the corporate defendants and citizen plaintiffs reached a settlement whose terms included provisions to use part of the settlement payment for the environmental health of plaintiffs and others, improvement of their living environment, rejuvenation of the Nishiyodogawa area, and other purposes.

In the autumn of 1996 the implementation of these settlement terms led to establishment of the Center for the Redevelopment of Pollution-damaged Areas in Japan (commonly known as the Aozora [Blue Sky] Foundation), which learned from the activities of the UK's Groundwork and started initiatives to improve and rejuvenate the local environment through a partnership among local authorities, businesses, and citizens. *Aozora* is also making preparations for arrangements to promote support and cooperation for environmental renewal projects in polluted-devastated areas in Japan and other countries.

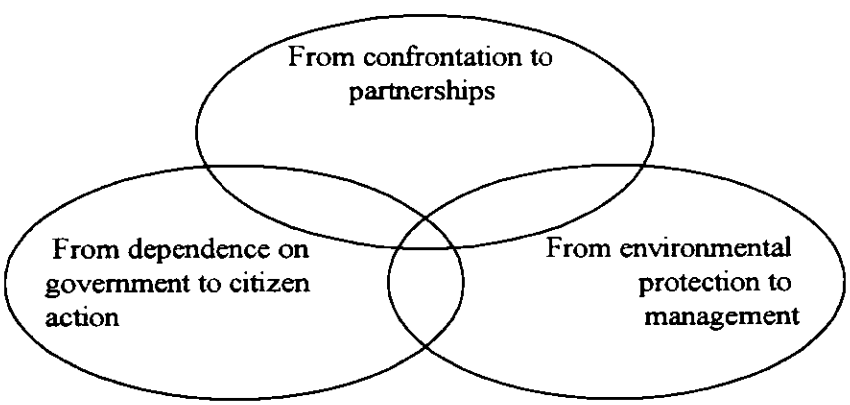


Fig. 27 Groundwork's three keywords

13. Factories for Interaction with the Public

Factories are losing their "3 D's" (dark, dirty, and dangerous) image, and there is a heightened perception that businesses should make contributions to society. Against the backdrop of these factors, this new kind of factory provides for interaction between businesses and the ordinary public by creating production spaces that have consideration for beautiful views and attractive surroundings, improving the convenience of employee working environments, and sharing that convenience with the local community.

Specifically, some of the main efforts are greening factory grounds, enhancing employee facilities and opening them to the general public, and making factories into theme parks. Such schemes combine two perspectives: that from the employee working environment, and that from the overall local community.

(1) Plus Land (Maebashi City, Gumma Prefecture)

This is a large composite industrial facility covering the entire grounds of Araishi Industrial Park in Maebashi City. The nucleus of the facility, run by the major office equipment manufacturer Plus, is a factory that specializes in office furniture. Facilities other than the factory include satellite offices in the center, a headquarters to which some main office functions have been relocated, a convention hall, a research institution, a museum, and a heliport.

Photo. 10 Plus Land Factory Building (Maebashi City, Gumma Prefecture)

(2) Apple Dome (Sannohe Town, Aomori Prefecture)

This is the factory of the jewelry maker Platinum Interwork. There is a fine hall, and the center of the dome, which has the ambience of a gymnasium, is open to the community to be used as an arena for indoor sports. The circular building's outer ring houses the factory and offices.

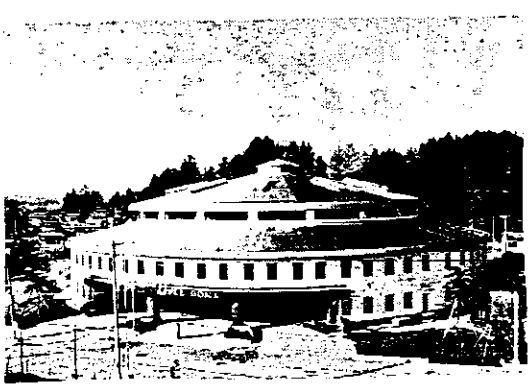


Photo. 11 Apple Dome (Sannohe Town, Aomori Prefecture)

(3) Joint Display Hall Tsubame (Tsubame City, Niigata Prefecture)

Tsubame and Sanjo area boast of being Japan's largest producer of Western-style metal tablewear, 95% (by value) of which is exported to 120 countries around the world. Over the last few years, the industry has changed its orientation from exports to developing products abroad and importing them. While conducting mass production in China and other countries, at home the industry produces deluxe Western-style tablewear for hotels and other establishments in Western countries, and enhances interaction with the ordinary public in Japan. The Joint Display Hall Tsubame was built by the Tsubame Koike Industrial Park Cooperative. The stylish brick building is open all year, and its parking lot can accommodate 14 buses and 30 passenger cars. Instead of being just a showroom, the hall endeavors to make direct sales to visitors. For groups the facility has a dining room as well as a coffee shop offering light meals, and the building has equipment allowing visitors to see pressing, which is one of the production processes for Western-style tablewear.

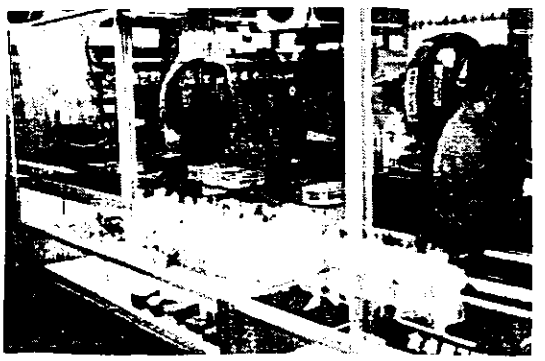


Photo. 12 Joint Display Hall Tsubame (Tsubame City, Niigata Prefecture)

(4) Castle of Sweets (Inuyama City, Aichi Prefecture)

Built as the home office plant of Takeda Confectionery and opened in March 1986, it includes plant tours (Castle of Sweets Model Tour), a bake-it-yourself room (Clumsy Cakemaker's Room), confectionery art museum, smorgasbord of sweets, restaurant, and shop (selling sweets and gifts).

Although there is a 500 yen entrance fee, Castle of Sweets has 500,000 visitors a year. Because it is located inside Inuyama Industrial Park, it is accessible only by cars and tour buses.

Present in the same industrial park are the Suntory Kisogawa Plant (which bottles whiskey, wine, and soft/fruit drinks) and the Original Aoyagi Inuyama Plant (a sweet rice jelly manufacturer), which also offer tours. Both the Inuyama Tourist Information Association and the Inuyama City Tourism Association include these three plants among the attractions they tell tourists about.

Photo. 13 Castle of Sweets (Inuyama City, Aichi Prefecture)

14. Japan Environment Corporation Initiatives

Small and medium enterprises (SMEs) and small municipalities with no experience in building pollution abatement facilities find it difficult to build such facilities by themselves. Through Construction and Transfer Programs the Japan Environment Corporation (JEC) builds facilities and the like in place of SMEs and municipalities, and then transfers the facilities. Entities receiving the facilities make long-term repayments at low interest rates. Generally when creating an industrial park, a cooperative is set up and the companies locating there become copartners.

(1) Examples of Environmental Provisions Adopted by Industrial Parks, and their Efficacy

A. Environmental Provisions Adopted by JEC when Implementing Projects

Item	Environmental Provisions Implemented	Efficacy
Symbiosis with natural environment (planning stage)	Preservation of natural green space and creation of artificial green space	◎
	Uniformity of park view	○
	Making biotopes of rainwater regulating reservoirs	◎
Symbiosis with natural environment (construction stage)	Burying electric lines	○
	Water-permeable pavement	○
	Applying treated wastewater to green space	○
Making changes related to economic environment (construction stage)	Lot preparation using surplus soil from construction	○
	Using recycled plastic wastes as building materials	◎
	Using recycled concrete and asphalt wastes	◎

B. Environmental Provisions Adopted by Cooperatives When Implementing Projects

Item	Environmental Provisions Implemented	Efficacy
Symbiosis with natural environment	Installation of shared pollution control equipment	◎
	Reuse of treated factory effluent	◎
	Construction of Aqua Center (for greater efficiency in using park water supply)	○
Measures in consideration of social environment	Establishment of Pollution Committee	◎
	Entering into pollution abatement agreements with local communities	◎
	Park companies enter into a pollution abatement agreement with each other	○
	Regular cleaning and weeding	○
	Holding local festivals on park grounds	◎
	Priority hiring of local people	◎
	Holding park tours for local citizens and schools	◎
Making changes related to economic environment	Separation, collection, and joint management of wastes	◎
	Joint power receiving and transforming facility, installation of joint incinerator	○
	In-park production of new products from park waste plastic	○

C. Environmental Provisions Implemented by Cooperative Members in Their Business Activities

Item	Environmental Provisions Implemented	Efficacy
Symbiosis with natural environment	Installation of individual pollution abatement facilities	◎
	Construction of noiseproofed buildings (no windows, etc.)	◎
	Closed-loop use of industrial water	◎
	Water-saving tap packings	○
	Circulating refrigeration equipment	○
	CFC recovery	◎
	Using gas heat pumps for space heating and cooling	○
	Stopping idling engines	◎
Symbiosis with natural environment	Environmental measures to comply with Product Liability Law	○
	Preparation of basic environmental policy and action plan	◎
	ISO 14000 study groups	◎
	Cutting power consumption by lighting and office equipment	◎
Making changes related to economic environment	Simplified product packaging	◎
	Reducing use of copy and fax paper	◎
	Waste separation and collection	◎
	Making product containers returnable	◎
	Selling product refills	◎
	Installing waste incinerators	○
	Joint research with local universities on waste plastic liquefaction	◎
	Consideration for environment thorough quality control	◎

Note
Double circles signify major expected effectiveness in view of global environmental conservation and symbiosis with local community.
Single circles signify that study will be needed from the perspective of economic efficacy owing to technical hurdles, or that they should naturally be implemented.

(2) Specific Examples

A. Factory Complexes (Example 1)

Photo. 14 Looking for Comprehensive Possibilities

General Description

Name Hachioji (Miyama) District Factory Complex

Location Hachioji City, Miyama

Park area 12.9 ha

Cost 9.461 billion yen

No. of companies 21

Facility Overview

Construction term 1988-1990

Description

• The use as an industrial park of a location whose environment had been devastated by quarrying; conservation and reconstruction of natural forest and large slope that account for over half the development's area.

• Factory lots: 40,041 square meters (31%)

• Public park, peripheral green space: 70,950 square meters (55%) (peripheral, slope, and residual green space)

Material/energy cycling	Symbiosis	Participation
All effluent, excepting rainwater, is treated for reuse, and then used for production, watering vegetation, flush toilets, and other miscellaneous uses.	A. Renaturization used to rejuvenate a former quarry whose natural environment had been devastated. B. 55% of area used is peripheral green space around companies, greened slope, preexisting vegetation.	Paintings and other items on display at cooperative hall for purpose of stimulating interaction between local citizens and companies.

B. Factory Complexes (Example 2)

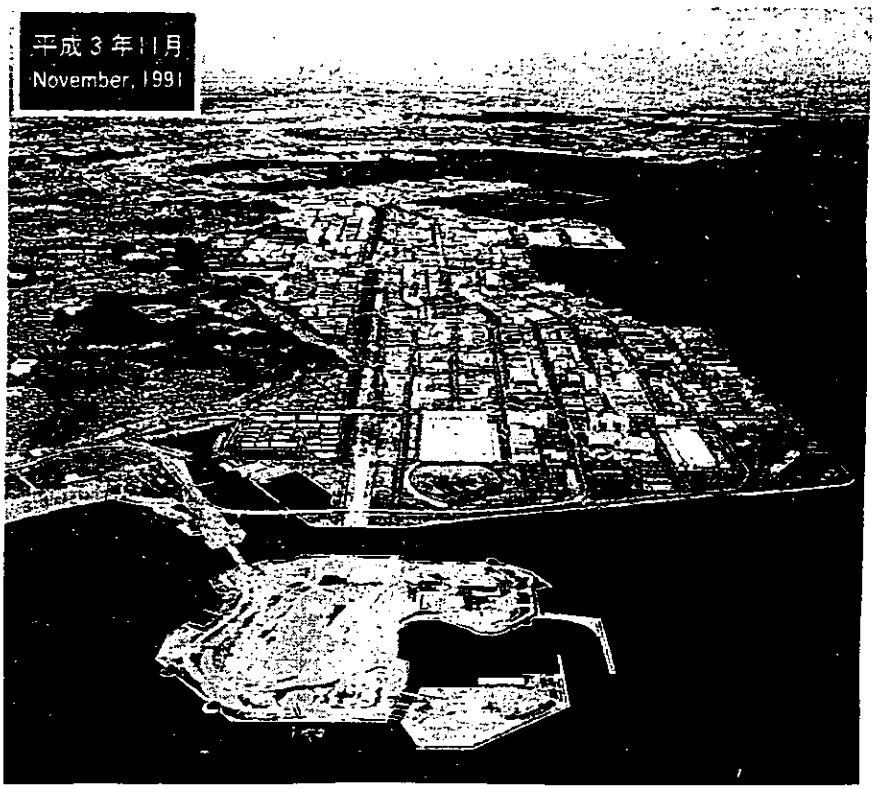


Photo. 15 Yokohama City (Kanazawa) Industrial Park

General Description
Name Yokohama City (Kanazawa) Industrial Park (view of entire park)
Location JEC project (industrial park, buffer green belt, financing project)
* Kanazawa Industrial Park is land for urban development occupying about 259 ha of 660-ha coastal reclaimed area created between 1968-1978 by Yokohama City just off Kanazawa Ward for the purpose of urban redevelopment.
* Between 1980 and 1982 a 15-ha Joint Welfare and Benefit Facility (buffer green belt) was established between the industrial park and the housing development behind it.

Material/energy cycling	Symbiosis
Industrial heat sources are electricity or gas; use of heavy oil and kerosene is prohibited.	A. Developed integrally with residential development. B. Creation of buffer green belt to separate industrial and residential zones from each other. C. Actively incorporate greenery on park grounds when building facilities.

Following is a description of a factory complex in the industrial park.

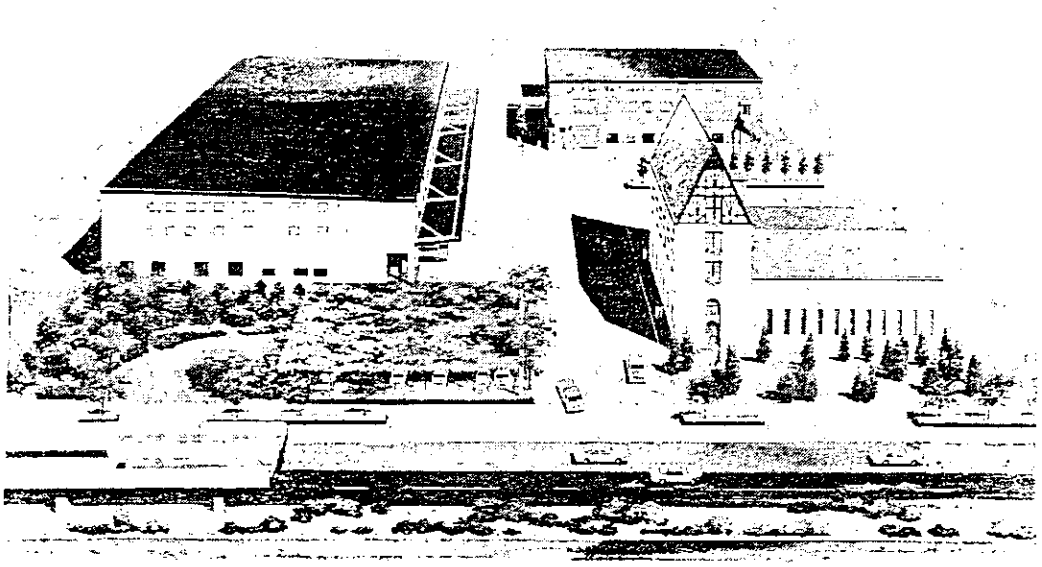


Fig.28 Yokohama City (Kanazawa) district factory complex

General Description
Name Yokohama City (Kanazawa) district factory complex
Location Yokohama City, Kanazawa Ward, Fukuura
Park area 7,607 square meters
Cost 3.41 billion yen
No. of companies 3

Facility Overview
Construction term 1990-1992
Description
- Urban-style industrial complex inside Kanazawa Industrial Park with an excellent environment for industrial operations and affording relaxation and fulfillment.
- Factory lots: 5,943 square meters (78%)
- Public park and green space: 999 square meters (13%)
- Roads, slopes, etc.: 665 square meters (9%)

Symbiosis	Participation
A. Western-style buildings that lend vitality to community development B. Makes original picture signboards in response to orders from stores.	A. Park has concert hall that it opens to the citizens, and uses for concerts and other events. B. Factory tours conducted.

C. Factory Complexes (Example 3)

Development Concept

A. Interaction with public
- Providing new lifestyle suggestions
- Trying to ascertain people's needs

B. Enthusiastic business development that leads the local community
- Becoming responsible companies with an awareness of their station and obligations

C. High-quality working environment
- Enhancing welfare and making a social contribution

D. Working hand-in-hand with local agriculture, livestock, and marine industries
- Securing fresh ingredients
- Making contracts with farmers

E. Development from the perspective of community development
- Eco-friendliness, adequate infrastructure
- Creating pleasant spaces

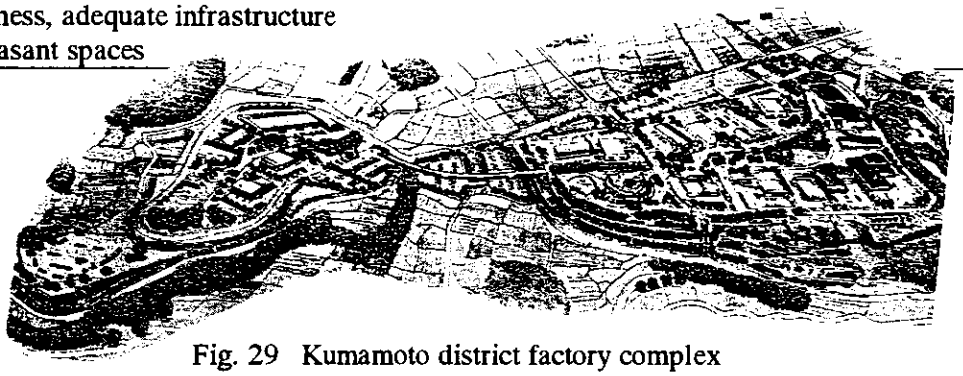


Fig. 29 Kumamoto district factory complex

General Description

Name Kumamoto district factory complex
Location Kumamoto City, Mitsugu Town and Izumi Town
Park area 25.8 ha
Cost 15 billion yen
No. of companies 18

Facility Overview

Construction term 1993-1997
Description
- Foodstuffs industrial park that has interaction with the public and a direct link to consumer needs.
- Factory lots: 85,100 square meters (33%)
- Public park and green space: 87,720 square meters (34%)
- Roads, slopes, etc.: 85,180 square meters (33%)

Material/energy cycling	Symbiosis	Participation
A. Water supplied by bountiful and clean groundwater. B. Water conservation targets set for each company.	A. Creation of Local Forest, which covers 20% of industrial park land. B. Enhancing infrastructure C. Building-to-land ratio of under 40%; floor-area ratio of under 80%; factory walls set back; etc.	Consideration for view through tours for public-company interaction; places for visitors to experience production; display gallery; restaurant; barbecue garden; direct-sales shop.

D. Joint Welfare and Benefit Facility (Example 1)

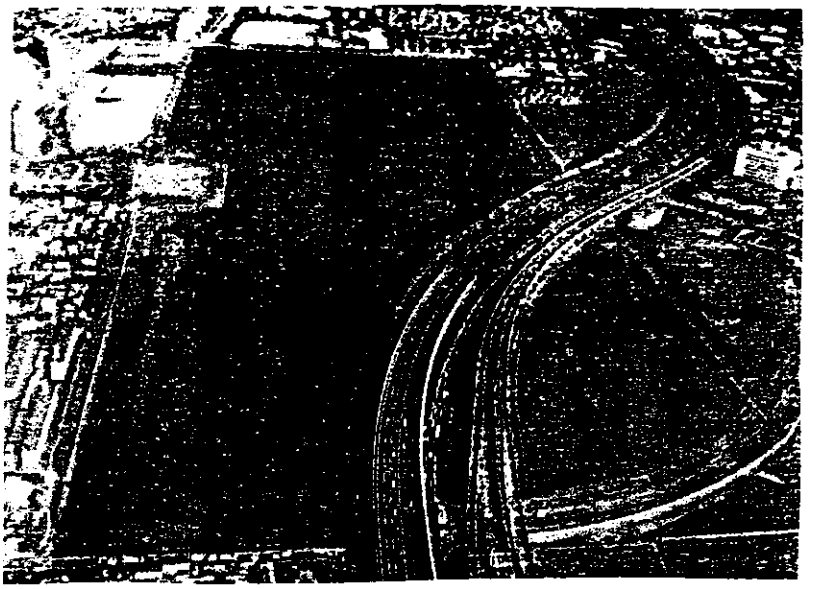


Photo. 16

General Description
Name Narashino District Joint Welfare and Benefit Facility
Location Narashino City, Yatsu and Akitsu
Park area 42 ha
Cost 14.09 billion yen

Facility Overview
Construction term 1987-1994
Description
- A facility that functions as a public park for conservation of Yatsu Tidal Flat and observations of its ecology
- Nature Observation Center
- Observation wall and observation deck
- Observation paths, island for birds to rest

Photo. 17

Symbiosis	Participation	International Cooperation
A. Green space concept is of city's "mountains, fields, urban area, sea," and planned so that the series of scenery changes leading from the mountains to the sea will be expressed with an integrated feeling. B. External design and materials of observation center have been coordinated.	A. Built an Ecology Observation Center, observation wall, and observation deck for the observation of wild birds that visit the tidal flat. B. Observation guidance for general visitors.	As the registration area of the Ramsar Convention, the information exchange is carried out internationally, and international conference is held at this facility.

E. Joint Welfare and Benefit Facility (Example 2)

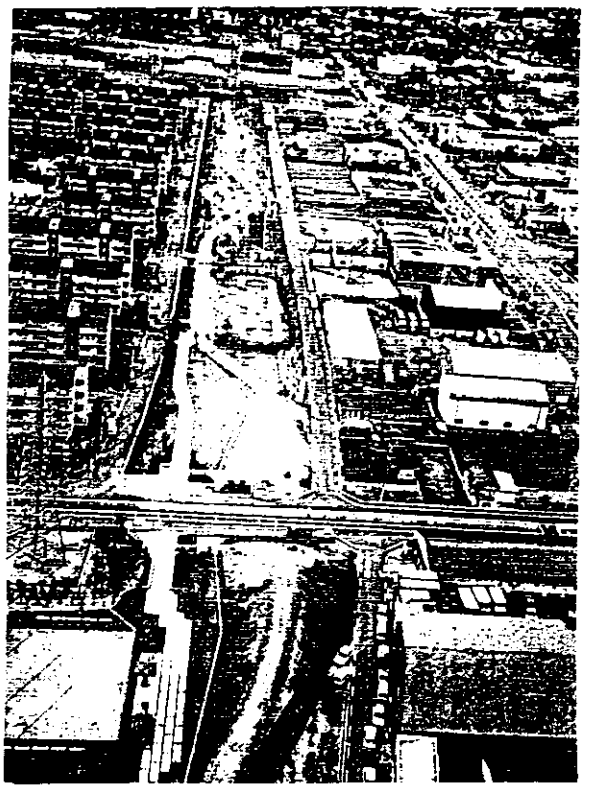


Photo. 18

General Description
Name Higashi Osaka District Joint Welfare and Benefit Facility
Location Higashi Osaka City
Park area 12.6 ha
Cost 7.587 billion yen

Facility Overview
Construction term 1987-1991
Description
- Buffer green belt and green oasis; forms large recreation area for citizens.
- Baseball diamond, tennis courts, croquet courts
- Plaza with water pools, rest area, multipurpose field
- Pergolas, gazebos, shelters, etc.

Symbiosis	Participation
Building a buffer green belt park between residential and industrial areas helps abate industrial pollution and improve the local living	A. Sports Zone (tennis courts, baseball diamond, Assembly Plaza) B. Lawn and Flower Zone (large lawn, flowers blooming all year, garden-like plaza) C. Water Zone (place for children to play in water, stream with waterside plaza and waterfall constructed of stones)

Interim Proposal of the Group for Studies in Ecological Community Development

This proposal was compiled on December 4, 1996 by the Group for Studies in Ecological Communit Development; this Group was established in the Japan Industrial Location Center for the purpose c carrying out studies on eco-community development commissioned by the Japan Environment Corporatic in order to facilitate initiatives for new community development efforts by citizens from all segments c society including people in business, community residents, and local authorities.

Collaborate in creating an eco-compatible socioeconomic system that can be passed on to future generations.

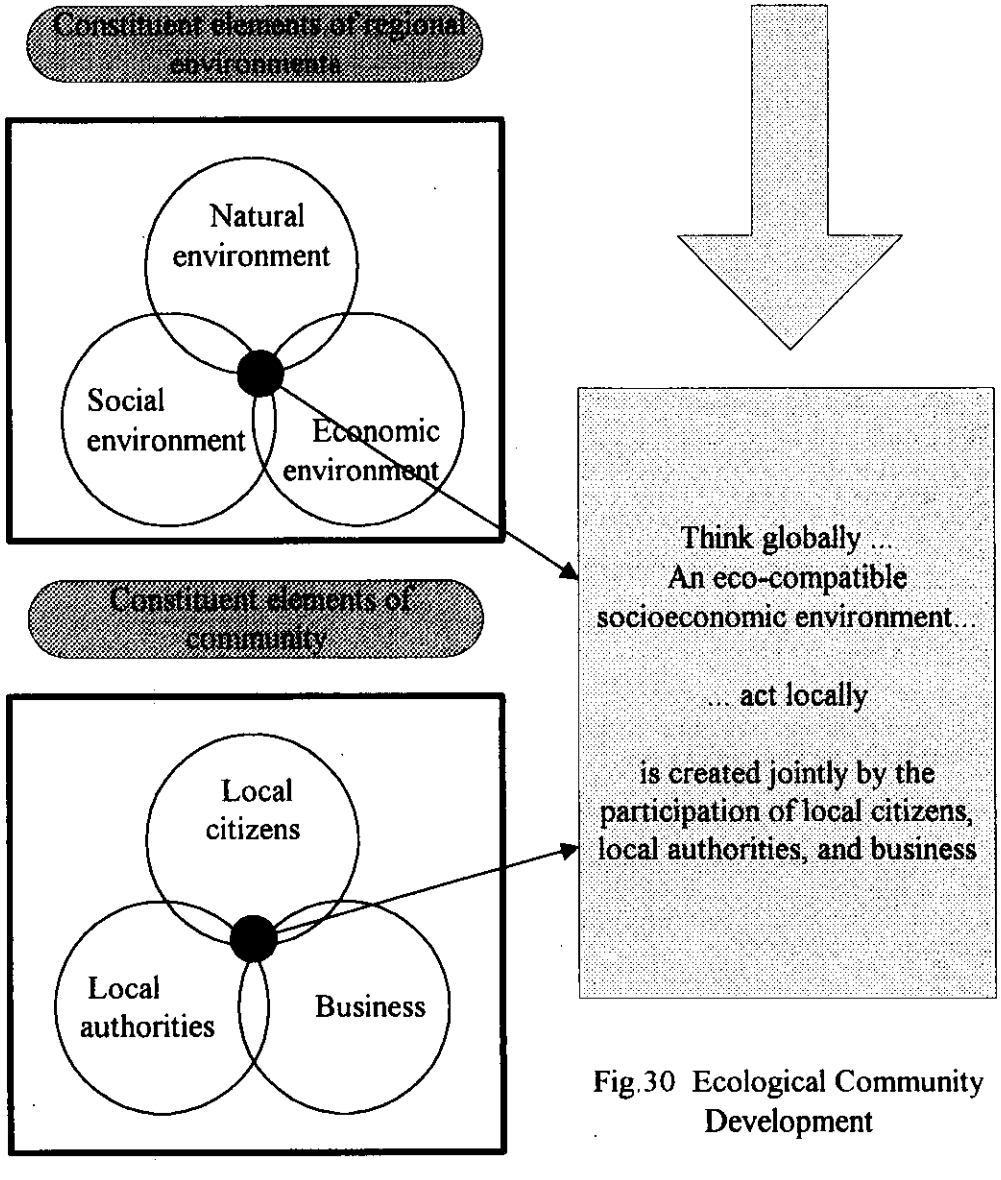


Fig.30 Ecological Community Development

Seven Proposals for Achieving Ecological Community Development

1. A practical manual for local businesses.

2. Using public assistance, actualize a model community that takes advantage of regional characteristics.

3. Support for technology development and system building.
   A. Promoting the development of environment-related technologies
      Public assistance for highly practical technologies and provision of technology information by municipalities.
   B. Innovation in processes that are cyclical and have low environmental burdens.
      Positive initiatives for research on innovating systems for production, distribution, specifications, and disposal.
   C. Eco-town plans, etc.
      Comprehensive community development leading to a green socioeconomic system.

4. Promoting symbiosis between the natural environment and industry.
   Development of industrial parks with consideration for the recovery, regeneration, and preservation of the natural environment.

5. Free access to environment-related information, giving and receiving information.
   Public release of information by businesses; environmental education for businesses and consumers.

6. Forming mutual partnerships among businesses, citizens, and administration.
   Creation of venues and arrangements for forming partnerships.

7. Community development that is friendly also to the elderly and handicapped.
   Consideration for an everyday-life environment that is barrier-free, etc., and compatibility with local ideas and challenges.

Toward the Achievement of Ecological Community Development

--- A Proposal for Parties Working in Community Development ---

I. Basic Perspective of Ecological Community Development

Introduction

From the proposal for sustainable development at the 1992 Earth Summit until the present, there have been initiatives in a variety of fields on the challenges involved in integrating environment and development so that needs are not compromised, even for future generations. However, there has been mixed progress depending on the country/region and on the problem; many environmental problems from wastes to global warming have yet to be addressed.

A special session of the UN General Assembly is scheduled for next September in New York, five years after the Earth Summit, to follow up on Agenda 21 and other agreements reached at Rio. As one of the developed nations with its common but differentiated responsibilities, Japan will be expected to make even greater efforts toward building a sustainable socioeconomic system that reconciles the environment and the economy.

Additionally, the Third Conference of the Parties to the United Nations Framework Convention on Climate Change (COP-3) is scheduled for next December in Kyoto for the purpose of deciding how to abate global warming, including CO_2 emission reductions, in 2000 and beyond. As the host country, Japan shoulders heavy responsibilities, including that for cutting its serious CO_2 emissions.

In the area of wastes, the impending partial application of the Container and Packaging Waste Recycle Law next April has all quarters of society hurrying with initiatives to reduce and recycle wastes from the perspective of reconsidering the disposable socioeconomic system and building a cyclical society.

Meanwhile, the International Organization for Standardization's (ISO) environmental management standards will take effect this September, and this has triggered self-initiated, full-out initiatives by businesses. Eco-business has also grown considerably, and governments are procuring environmentally friendly products. Further, self-initiated efforts by citizens' organizations (environmental NGOs and the like) are becoming very active in Japan as well, and there are broadening possibilities for partnerships in conservation activities.

In providing for even greater environmental efficiency, how to proceed with exchanges and systematization on the local level with respect to individual initiatives that are meant to reduce the aforementioned environmental burdens will henceforth be a matter of the greatest importance.

Currently new kinds of community development are being explored from various perspectives in localities around the nation, and it is safe to say that it will be essential to reduce environmental burdens with efforts that keep points such as the following in mind:

A. Changing our thinking to "Think globally, act locally."
B. Increased regional vitality through initiatives aimed at building a cyclical society, such as the zero emissions concept, which is meant to eliminate waste and to minimize consumption of resources and energy.
C. Encouraging the participation of all parties in a locality, and the building of partnerships.
D. Highly distinctive community development that builds on the characteristics of a locality.
E. Accommodating socioeconomic structural changes such as the senior boom and the increasingly grave exodus of industry.

Already some localities are working on eco-community development with local citizen participation via the formation of, for example, master plans for environmental management and urban

planning. Overall, however, this has yet to form a major trend, and at this time it is not exactly clear what efforts businesses and citizens should make on their own, how they should go about looking for ways to become environmentally friendly, and, for those purposes, what kind of noninvasive support from national and local governments, and other parties, will be needed.

In view of such trends, this study group would like to propose a number of specific measures that smoothly expedite community development that responds to new challenges, and which act in concert with the groundswell in autonomous initiatives among involved parties in each locality.

1. A Conceptual Picture of Ecological Community Development

Sketching a picture of eco-community development using the three facets of the natural, social, and economic environments yields the following.

(1) Symbiosis with the Natural Environment

A. Conservation of the local natural environment; regeneration of farming village environments; creation of nature-like environments and their mechanisms.
B. Development, revival, and implementation of "eco-technologies" (appropriate technologies, traditional industrial technologies, advanced technologies, etc.) that are based on the sustainable wise use of local environmental resources (water, atmosphere, vegetation, topography, weather, scenery, etc.) and assessments of the potentials of environmental resources in each region.
C. Maintenance and rejuvenation of urban ecosystems, and building environmental infrastructure.
D. Promotion of environmental education for many segments of society including citizens, children, businesses, and employees.

(2) Community Vitality with Consideration for the Social Environment

A. Being heedful of the community's history, culture, and the like.
B. Forming a nucleus for self-actuated community development through dialog that includes the participation of knowledgeable persons and others from outside the locality with various segments of the community (citizens, businesses, government, NGOs).
C. Inter-regional exchanges and collaboration that are open nationally and internationally (environmental sister cities, urban-rural exchanges, etc.).
D. Setting up local-level environmental management systems with the cooperation of citizens, businesses, and government.

(3) Reorganization of the Economic Environment

A. Expedite the provision of industrial infrastructure with a low environmental burden and that suits the locality.
B. Switch to local cyclical systems for materials, goods, and energy involved in various economic activities (production, distribution, use, disposal), and create eco-communities.
C. Achieve breakthroughs for environmental technologies (institutional and structural) bringing together broad segments including industry, government, and academia, and port those technologies into model projects.
D. Encourage the release of environmental information by businesses, green business, and green purchasing.
E. Rejuvenate industrial and cultural legacies, and make effective use of them (economic development of villages with traditional crafts, theme parks with handmade products, etc.).

As the foregoing shows, conceptual pictures of eco-community development are diverse, and the natural, social, and economic facets are interrelated. What is more, we need to carefully note that the state of eco-compatibility itself as achieved within those three facets changes dynamically in response to changes in environmental factors including those that are global, the accumulation of scientific findings, technological progress in "hardware" and "software," changes in values, maturation of markets, and other factors.

Eco-community development entails becoming more sensitive to change, and facilitating desirable changes while changing ourselves, but without the various entities in a locality being shackled by preconceptions. That makes it important to incorporate mechanisms to carry out flexible and sustained initiatives that respond to dynamic changes in circumstances.

It is along these lines that our group wants to proceed by focusing on things that are possible to achieve by autonomous local initiatives.

2. Community Development Initiatives and the Roles of Involved Parties

Basic to eco-community development are autonomous initiatives by businesses planning factories, places of business, and other facilities, and by local citizens. As noted previously, eco-compatibility involves many different combinations, meaning that involved parties are given wide latitude in making choices in response to their local situations. While working hand-in-hand and building partnerships with local private organizations (commercial and industrial organizations, etc.), local businesses and citizens must themselves look for concrete ways to proceed with new undertakings based on master plans for environmental management and urban planning.

Partners may include entities such as NGOs that have close ties to the community and conduct environment-related volunteer activities. Examples of measures for the use of green space around factories are cooperation of local environmental organizations, and waste disposal that incorporates volunteer activities for collecting empty cans and the like. Closely watched from this perspective is the work of Groundwork in the UK, which creates specialized organizations (trusts) under three-way partnerships of businesses, citizens, and local authorities, and provides for the recovery and improvement of local environments in cities and farming villages. In the US, NGOs have a long history of community development activities. And in Japan it is possible that NGOs will play a vital role in eco-community development from now on if NGO activities establish a firm position in society and efforts including the training of experts are made.

Meanwhile, the role of administrative departments in the national and local governments to lend noninvasive support to the initiatives of businesses and local citizens by way of, for example, providing information, technology development, and public education, or the preparation of the right institutional conditions. When local authorities are involved, sometimes additional roles are directly serving as project coordinator, or running operations themselves.

When an allocation of roles among the involved parties is assumed in this way, the result is mutual understanding and interaction among businesses, private organizations, local citizens, local authorities, and other parties, and this leads to the accomplishment of eco-community development.

3. How to Proceed with Ecological Community Development

(1) Pursuing Community Development with "Software" and "Heartware"

Of importance to each implementing party in eco-community development are not only performing work on the actual structural elements as in lot preparation and construction, but also institutional arrangements, which will henceforth be more important than before. That is to say, working to achieve

harmony and symbiosis between facilities and their local environments necessitates providing for collaboration among local citizens, local authorities, and all the other involved parties from the planning stage. Unless procedures and methods for development are devised, implementation might not proceed smoothly. In that sense, it is urgent that institutional elements be enhanced for the purpose of achieving eco-community development.

Further, to ensure that community development proceeds smoothly, it is effective to try responses that go somewhat farther than the usual institutionally based methods. Some examples recently attracting interest are the active release of information by project implementors on waste management sites and on factories and other facilities with heavy impacts on local environments, or offering consumer tours of food processing facilities (or industrial parks) and the like, and promoting interaction with citizens by establishing craft shops inside factories. It is believed that such initiatives confer benefits on businesses too, such as developing feelings of trust toward businesses among local citizens and consumers. Providing there is progress in the exchange and public dissemination of information, it will engender major advances in eco-community development itself. If such efforts are called community development with "heart," then it will be vital for eco-community development to be "community development with software (institutional components) and heartware, in addition to being conventional community development using "hardware," or structural components.

(2) The Importance of Project Strategies Pivoting on Technology

While autonomous initiatives by project implementors and local citizens are essential to achieving eco-community development, equally essential is creation of the technologies and systems -- the "hardware" or structural components -- that support these initiatives. To smoothly convert companies' production systems and citizens' lifestyles from mass-production to cyclical, low-burden types without impairing economic affluence, it will be necessary to widely deploy and establish in society the technologies and systems to make this conversion possible (in addition to developing new technologies and systems, this includes, for example, combinations of existing technologies, and the active and creative use of local technologies). An urgent task for that purpose is to inaugurate "bellwether projects" for low-burden community development with technology as a pivot point, while providing for the mutual collaboration of the national and local governments, businesses, local citizens, and other parties.

Although Japanese society is maturing, the goods-producing industrial sector still accounts for a considerable proportion of socioeconomic activity, and that holds for environmental burdens as well. Furthermore, that sector's impact is related not only to production processes, but also directly and indirectly to resource procurement, and to product distribution, use, and disposal. Thus it occupies a crucial position in converting socioeconomic activities to cyclical systems with low environmental burdens.

For this reason, as an area for the pioneering implementation of projects, it seems appropriate for the time being to work on well-defined projects with a focus on primarily the industrial sector such as industrial parks and waste management facilities, and various kinds of factory facilities that require efforts to conserve the environment, as in abating noise and water pollution, which are project types often seen.

Further, as the main entities to whom projects are directed, more emphasis should be placed on large companies and SMEs that are able to conduct activities for conserving the environment on their own initiative. Because SMEs have more difficulty than large companies in making their environmental management plans and the like reflect the overall trends of their localities, and because of their financial, technical, and other limitations, there is especially great significance in motivating them in eco-community development. On the other hand, an advantage of SMEs is that they find it easier to carry out activities that are closely linked to the community and local citizens, and to deal flexibly with problems, thereby leading to considerable expectations for their sustaining role in community development. It will be necessary to keep the circumstances of SMEs in mind when considering project start-ups.

(3) The Need for Initiatives that Take Advantage of Local Characteristics

Accomplishing eco-community development will make it necessary to carry out initiatives based on each locality's natural, social, and economic environments, and that are tailored to suit their characteristics, situations, unique problems, and the like.

In towns and villages blessed with good natural environments, it is important to provide for the conservation, use, and other actions on their abundant natural resources while making those actions lead to community vitality. An example would be working to reduce the environmental burden of areas as a whole and to build material and energy cycling systems that are compatible with the local environment while making various creative and resourceful attempts from the perspective of increasing community vitality, such as energizing village economies by using natural resources and untapped energy sources (like solar and wind power), making a green business of recycling and using local wastes (composting food waste including that from businesses; making glass bottles, PET bottles, and other containers returnable; recycling construction and demolition wastes, etc.), improving the local image through environmental conservation, and other means.

Ebenezer Howard's *Garden Cities*, proposed and implemented in the early 20th century, attempted the "happy marriage of cities and farming villages." In our day, pursuing community development that attempts -- from the perspective of eco-compatibility -- to achieve cycles in and the symbiosis of nature and industry, as well as cycles in and the symbiosis of the primary and secondary/tertiary industries while coupling rich natural environments with fulfilling human relationships is, in a certain sense and from a new perspective arising on the threshold of the 21st century, an effort that reexamines the meaning of "garden city," and is therefore of extremely great benefit in terms of local vitality.

On the other hand, the situation for eco-community development in large cities differs entirely owing to a complex mixture of interrelated problems including: (1) As a premise for community development, how should a city as a whole cycle the water, energy, materials, and other items that make up the basic elements that support urban activities? (2) How should cities deal with urban pollution such as the air pollution, water pollution, noise, and vibration that come with the concentration of production, distribution, use, and disposal, and how should they solve looming environmental problems such as the heat island phenomenon? (3) How should cities proceed with low-burden urban redevelopment? (4) How can nature-like environments be created in the cities? And (5), how can cities bring about the participation of businesses, local citizens, NGOs, and others in community development? To deal with these problems, a variety of entities, including the national government and local authorities, have been working hard using diverse approaches. Eco-community development requires a perspective for integrating such efforts as much as possible, and making them lead to the building of a new social system.

As this shows, realizing eco-community development requires that businesses, local citizens, local authorities, and other parties pull together as they work on highly distinctive community development that builds on the characteristics of their respective domains.

4. Toward the Creation of Eco-Communities

Additionally, eco-community development requires a perspective oriented toward gradually making the community as a whole eco-compatible while continuing efforts on projects connected with individual facilities and the like. The basic framework for community development is set forth in urban planning and other plans related to the area, but it is necessary that in content they reflect the fundamental thinking of "eco-community development."

If we conceive of a community as a fundamental building block of society having functions including those for shelter, working, and playing, then a local community refers to a coherent social unit comprising urban divisions and other defined areas that include not only individual project-related facilities,

but also stores, offices, farmland, homes as venues for daily life, public facilities such as roads and parks, and other elements. It is desirable that cyclical social systems with low environmental burdens are built as wide-area systems using these communities as building blocks, whether in major cities, core cities, other cities, towns, or villages. In other words, it is necessary to decrease, to the greatest possible extent, the area-wide environmental burden of an entire community while linking these efforts not only with the initiation of industry-related projects, but also with community development efforts in all sectors.

And if, through these efforts, circumstances allow the formulation of a comprehensive plan for mitigating the environmental burden, and that plan incorporates a prescription for the material cycle, energy cycle, and green space distribution of a community, then great strides will be made in ecological community development.

Needless to say, plan development and implementation will require "software and heartware" initiatives. If businesses, local citizens, local authorities, NGOs, and other parties participate in eco-community development under their own volition and from their respective standpoints, and if community development that harmonizes the venues for production and livelihood is conducted on an individual community basis with environmental burden mitigation as the pivotal element, then it is possible that major changes will occur in the prescription for community development and in individual lifestyles related to that. Since the arrival of modern times, Japan's local communities as "livelihood venues" have been turning into hollow shells with the advance of industrialization and urbanization, but it follows from the above discussion that, through such development, the concept of eco-compatibility will serve as a place to start in providing those communities with new meaning.

II. Concrete Proposals for Achieving Ecological Community Development

The basic idea behind eco-community development is that businesses, local citizens, and other involved parties work on community development under their own volition while collaborating with one another. But one facet of this matter is that leaving development entirely up to the efforts of involved parties is not necessarily adequate if we take into account Japan's socioeconomic situation until now, especially factors including local social systems, institutions and practices, and the critical awareness of involved parties. Bringing about eco-community development requires, for example, the provision of appropriate institutional conditions that make the best use of involved parties' efforts, and adequate understanding of community undertakings. While keeping this point in mind, this study group hereby makes seven concrete proposals on the methods for trailblazing eco-development projects, and prescriptions for desirable project content.

1. Proposals on Project Methods

Proposal 1: The Need to Prepare a "Project Method Manual"

While the basic idea behind eco-community development is set forth in the government's Basic Environment Plan and the various plans of each locality, currently there are no practical manuals on project methods for local implementors, except for general ones such as the ISO 14000 series.

Yet now, primarily with large-scale development projects, there are quite large differences in substance depending on the project, but we find an increasing number that strive toward eco-compatibility and symbiosis with the locality, showing that on the whole business is trying harder.

It is hoped that from now on such efforts will be encouraged, and that actual project implementation will actively incorporate the eco-community development philosophy especially in relation to, for example, grouping by SMEs, and the effective integrated use of materials and energy with the intention of cycling them, which is accomplished by collaboration among different industry types. (SME grouping has always been swayed by the concept of "scale," but from the perspective of eco-compatibility it is necessary to reconceive the idea of grouping, including the aspects of effective energy use between the production processes of companies (i.e., energy cascades), and overall matter/energy cycles for local areas.)

It is therefore necessary to consider preparation of easy-to-understand handbooks (manuals) on project methods, including the following items:

A. The fundamental thinking that underpins eco-compatible projects, and for whom they are implemented.
B. How to concretely proceed (preparing action plans, checklists, etc. from the planning stage)
C. Lists of environmental technologies that can be used.
D. Environmental self-evaluation methods by businesses, local involved parties, etc.

Such handbooks must provide ideas and data that serve as hints for the autonomous initiatives of businesses, and they must promote highly distinctive initiatives that are grounded in the characteristics of each locality. When developing manuals it is beneficial to use the latest findings obtained from lifecycle assessments (LCAs) on products. (In order to assist manual preparation, this study group is thinking of examining the actual content of manuals in order to help the parties who use them.)

Individual companies in the various industries and business categories of a locality also find technical difficulties in fields that lack environmental quality standards, an example being objectively assessing the amounts of greenhouse gases (CO_2) and wastes generated. In view of the fact that the CO_2 and

waste problems demand urgent action and require efforts by all citizens, it is advantageous in dealing with such problems to take a hint from the "Environmental Household Account Book" used in homes for the development of, for example, a simple self-performed checklist we might call an "Environmental Balance Sheet" for businesses, which would support their autonomous efforts to reduce CO_2 and waste emissions.

Proposal 2: Model Projects

As shown above, there are many different ways to proceed with eco-community development depending on local circumstances, a project's business category, and other factors, and in some aspects individual companies will find difficulty in standardized approaches. Therefore in conjunction with the aforementioned manuals, the national government and other public-sector entities must take the initiative in promoting "model projects" concerned with eco-community development, and increase understanding of this problem among the diversity of involved parties in all parts of the country, while making the connection to matters of great urgency such as recycling wastes and reducing CO_2 emissions through energy conservation.

"Eco-compatibility" is a basically acceptable idea to many businesses, but when it actually comes to participating in a green development project, current circumstances present concerns about costs and the like that companies cannot dismiss. Assuming it is possible to achieve model projects using environmental technologies and other means, it is hoped that this would provide a convincing answer to the fundamental doubts that such companies feel.

Such model projects would demonstrate desirable forms of collaboration among businesses, local citizens, and local authorities. Realizing literal environmental "symbiosis" makes it essential for businesses to interact with local citizens and local authorities, but in Japan initiatives like these have a short history and little accumulation of social know-how. Local consensus-building is the key to project implementation especially with regard to waste management, recycling, urban redevelopment, and other concerns. In that sense as well, implementing model projects is of the greatest importance.

It is hoped that businesses, local citizens, local authorities, and the other major role-players in community development will work toward achieving self-initiated, highly distinctive community development that takes advantage of their localities' characteristics, and that model projects will be a source of ideas for them.

Further, if Japan as an environmentally advanced country marshals its insights and cutting-edge technologies and sets forth models of feasible green projects, it is possible there will be something of value for solving environmental problems in developing countries, which face grave situations. When carrying out model projects, it will be meaningful to take these points into consideration and provide support functions of a certain level (for example, facilities for interchange and training that allow sojourns by visitors from Japan and abroad, and incorporating "craft shops" and the like) from the perspective of expediting the transmission and provision of information not only domestically, but also to other countries including the developing nations.

2. Proposals on Project Content

When proceeding with actual projects on the basis of "1. Proposals on Project Methods," it is especially necessary to keep the following five items in mind with regard to a project's "hardware," or structural components (proposals 3 and 4) and "software," or institutional components (proposals 5 through 7).

-----Hardware (Structural Components)------

Proposal 3: Reinforcing Support for Technical and System Development

A. Promoting the Development of Environment-Related Technologies

Providing businesses with incentives to actively pursue projects under their own volition is essential to successful eco-community development, and to that end it is crucial to achieve cost-cutting breakthroughs by means including the development of environment-related technologies.

It is important to note that environment-related technology development in such cases is not necessarily limited to practicalizing cutting-edge technologies. For example, from the perspective of keeping urban air clean there is consideration of community development that takes advantage of air movement. It is necessary to provide for symbiosis with the local environment while taking full note also of these kinds of land use.

In addition to these considerations, it is necessary to provide for the further enhancement of public assistance for environment-related technology development, especially the development of highly practical technologies that will be directly useful in the nuts-and-bolts work of community development, as well as to help the preparation of systems by which local authorities and other parties offer environment-related technical information (using multimedia, for example).

B. The Need for Innovation to Make Processes Cyclical and Mitigate Their Environmental Burdens

Another possibility is developing technologies that substantially mitigate environmental burdens (what we shall call "cyclical, low-burden process innovation") by means of not only developing individual environmental technologies, but also accomplishing fundamental innovations in the very systems for production, distribution, use, and disposal that companies have been using. An example of the latter would be replacing a high-temperature, high-pressure chemical reaction process with an ordinary-temperature, atmospheric pressure bioreactor). Eco-community development is closely related to and inseparable from the preferred state of production, distribution, use, and disposal systems employed by businesses and other entities in those localities, and there are hopes that if "cyclical, low-burden process innovation" is achieved, it will exert a powerful force to realize eco-community development. This will require the further enhancement of research in this field, and positive initiatives by government and citizens. Such thinking also underpins the Zero Emissions Research Initiative, which works to develop and deploy production systems that eliminate wastes, and certainly the time for its implementation has come. (For example, if the food industry and others that generate large amounts of waste could build material and energy cycling systems that switch from incineration disposal to recycling and reuse, that would be highly effective in reducing both CO_2 emissions and industrial wastes.

C. Hopes for Eco-Town and Other Concepts

Additionally, using zero emissions as the key concept, the national and local governments, private sector, and others have begun new community development initiatives seeking to create environmentally friendly socioeconomic systems on various levels.

One of these, the national government's Eco-Town concept, works from the standpoint of developing local green economic systems to pursue comprehensive community development by having the institutional and structural components act in partnership, while at the same time setting up the infrastructure to foster private-sector environmental industries, and having local authorities and the private sector work in tandem to make environmental measures more efficient and achieve zero emissions. This concept is not just an attempt to help environmental technologies grow, but aims from a broad perspective

to conduct comprehensive initiatives that include private-sector parties. Such an approach, it could be said, is important for realizing eco-community development.

Through the structuring of wide-area material and energy cycles, it is possible that these initiatives would change those very local communities spoken of above, and for that reason the progress and actualization of projects are being closely watched.

Proposal 4: Promoting Symbiosis with the Natural Environment

With the decline of appropriate locations to site factories, and the citizens' higher consciousness concerning environmental conservation in recent years, there are more and more cases in which development must be reconciled with conservation. For example, in Japan the natural environment in farming villages plays a major role in environmental conservation, so it would be very meaningful from the perspective of symbiosis if it were possible for development to take these farming village environments into account.

Among recent development examples it is worth noting efforts to actively harmonize industrial infrastructure with the natural environment, such as making factory green space into "protective groves" like those around Shinto shrines; planting vegetation in river conservation areas; and using industrial park regulating reservoirs as biotopes.

Taking the initiative on the recovery, regeneration, and preservation of natural environments by means of many individual efforts in each locality is an important process for achieving symbiosis.

--------Software (Institutional Components)--------

Proposal 5: Facilitate the Provision of Information to Help Businesses Set Their Courses

One consideration in achieving symbiosis with a locality is the sharing of environment-related information, and, for that purpose, the willing release of information. In Japan too some companies have begun efforts to prepare and release environmental reports, and it is hoped that local businesses will take note of this and explore the possibilities for voluntarily releasing and providing environment-related information. At the same time, the increase in information exchanges allows expectations that businesses will also be receivers of information such as the possibilities for utilizing environmental resources unique to their localities, ideas for community development, and the like.

From the standpoint of bettering the understanding of eco-community development, it is also crucial that the kind of thinking behind international standardization in the environmental management field (the ISO 14000 series) be disseminated among Japan's SMEs. (In doing so, it is likely that, if we consult examples from the US, Canada, and other countries, developing simplified texts for the ISO 14000 series is worth considering.) It goes without saying that it is important to underpin such initiatives with steady, continuing efforts toward information dissemination and public education, including environmental education for local businesses and consumers.

--------Software and Heartware-------

Proposal 6: "Partnership Plans"

In bringing about eco-community development there are expectations for the roles of various local parties other than businesses. In view of the experiences of the US and other countries, when implementing

eco-compatible projects it is desirable to have broad-based initiatives that involve entire localities, that stem from the participation of businesses and local citizens, and that begin as early as possible, for example at the initial planning stage. Especially for the purpose of looking for avenues leading to symbiosis that conforms to local situations, and conducting that search under voluntary and mutual partnerships of businesses, local citizens, and local authorities, it is vital to have made a platform ("partnership plans") to facilitate development of the requisite arrangements and venues.

Generally, the specific setup for such platforms is a committee-like organization including knowledgeable persons and others from outside the locality in addition to local involved parties. (In Japan it is conceivable that in the future NGOs will play a certain role in this area.) It is here that one hopes local authorities and other public institutions will play roles as the providers of venues and information, as well as organizers. In cases such as redevelopment in places like major cities, in fact, the matter of how to set up these platforms, how to use them, and how to reconcile various interests, is truly the core of eco-community development.

Proposal 7: Elderly- and Handicapped-Friendly Community Development

Realizing symbiosis with a locality in the true sense of the word requires paying heed to all the difficulties faced by that locality, not just environmental problems. These days, for example, there are strong demands for community development that allows the elderly and the handicapped to live free of concerns. Barrier-free community development is a fundamental idea that requires consideration even in factories and other industrial facilities. Specifically, careful attention to everyday things like non-slip floors and eliminating differences in floor level should be a part of community development.

There are many other problems that demand urgent action when pursuing community development, such as disaster prevention in major cities, and the exodus of industry from and depopulation of outlying regions. In the promotion of green projects, it is necessary to attempt harmonization with fundamental ideas and challenges of community development other than just eco-compatibility.

Finally I should like to add that when implementing such projects, collaborative ties should be further strengthened among the involved national and local government administrative departments and related projects, and that involved parties should pull together to achieve eco-community development.

* * *

It is said that environmental problems transcend generational divisions. It is no overstatement to say that the success or failure of ecological community development is truly a touchstone determining whether our generation can leave good environmental resources to the next. Community development is a matter that is highly relevant and directly related to our everyday lives; it tests both the depth of our awareness of environmental problems and our stance in dealing positively with them.