

Bringing Protection and Creation to Every Project Stage

Kajima is tackling environmental issues, taking into account the entire life cycle of buildings and structures. While buildings consume a lot of energy during occupancy, i.e., when people conduct activities there after construction is completed, civil engineering structures consume more energy during the construction itself. We contribute to achievement of a sustainable society by taking effective measures in each process in consideration of the entire life cycle.



Construction Planning and Design Stage

As construction planning and design is an important stage which may have impact on the environment over the entire project, we take approaches in terms of both hardware and software, and cumulatively make biodiversity-friendly proposals. We also procure resources in full consideration of environmental impact, such as depletion of resources after extraction, energy consumption through production and transportation of materials, waste emissions, impact on ecological systems, and contamination of air, water, and soil.

1	Global warming prevention	<ul style="list-style-type: none"> ● Energy-saving building designs ● Designs for long-lasting buildings and structures ● Usage of renewable energy
2	Resource recycling and effective use	<ul style="list-style-type: none"> ● Examination of items for green procurement ● Designs that minimize waste over a structure's life cycle
3	Hazardous substance management	<ul style="list-style-type: none"> ● Surveys to check for soil contamination ● Countermeasures against sick house syndrome
4	Conservation of biodiversity	<ul style="list-style-type: none"> ● Proposals that aim to conserve biodiversity in urban areas ● Employment of methods for restoring the natural environment

Kajima Biodiversity Guidelines

Kajima established its Action Plan for Ecosystem Conservation in August 2005, and revised it in July 2009 under the new name of the Kajima Biodiversity Guidelines. The Company is carrying out various initiatives based on these guidelines.

Basic Philosophy

As a company with "a vision for all eras," Kajima is pursuing its mission of maintaining a rich environment for future generations and building high-quality social infrastructure for society.

The deterioration of biodiversity, which affects the environment around the world, along with global warming are monumental issues of our time—and companies have a major role in finding solutions.

Kajima will take initiatives for the conservation and sustainable use of biodiversity through its related activities in its construction business, with the overall objective of contributing to

realizing a society in which people and nature can harmoniously coexist.

Guidelines

Participation of All Employees

Kajima shall promote company-wide efforts for the conservation and sustainable use of biodiversity by raising awareness of the value of nature among its employees and disseminating information on biodiversity.

Development of the Construction Industry

Kajima shall aim for the conservation and sustainable use of biodiversity by offering proposals that make use of information and technology related to biodiversity and promoting environmental considerations at construction sites.

Improvement of the Supply Chain

Kajima shall aim to reduce the impact on biodiversity by improving the supply chain for construction materials and office supplies.

Pursuit of Research and Development

Kajima shall accumulate information and technical expertise related to the conservation and sustainable use of biodiversity, and pursue research and technology development in this area.

Consideration of Social Demands

Kajima shall not only comply to laws and regulations related to biodiversity, but also respect related policies and social demands, and apply its expertise in this field to its construction business.

Promotion of Communications

Kajima shall share its achievements and research results related to the conservation and sustainable use of biodiversity and promote cooperation and dialogue with stakeholders, including clients, local communities, public administrations, research institutes, private enterprises, and NGOs.

Aiming to improve added value in the project planning stage

In a construction project, the project owner and Kajima share concepts during the project planning stage. Kajima puts forth proposals and support for both the technical and non-technical aspects to raise the value added to each project. In particular, Kajima offers a combination of value-maximizing technologies suited to customers' needs, built on a foundation of pioneering initiatives in areas including biodiversity.

Moreover, as a part of the risk management that Kajima undertakes together with project owners, our head office, branch offices, and all concerned parties act as one to conduct proper treatment and management of hazardous materials, including surveys of buried objects or soil contamination.

Environmentally conscious design with an eye on the life cycle

At the design stage, we look beyond the structure and form of the building to consider also the materials and construction methods to be used. By doing so, we raise quality.

In order to minimize energy consumption during occupancy, the Building Construction Division of Kajima approaches architecture and equipment from the design stage, incorporating improved performance of insulation and solar radiation, shading of windows and outer walls, the use of natural ventilation and lighting, and the adoption of efficient air conditioning and lighting equipment.

By contrast, aiming to reduce energy consumption during the life cycle of civil engineering structures such as dams and bridges during the construction stage, we focus on three perspectives: 1) reducing the thickness of components and amounts of materials used; 2) changing the selection of materials and how they are used; and 3) adopting building methods that shorten the construction period. Kajima takes care to use alternate materials that consume less energy per unit and reduce the amount of materials used in order to ensure that its structures can be used efficiently over a long service life.

■ Efforts for realizing ZEB

Kajima participates in zero-energy building (ZEB) research and development, which aims to reduce the annual primary net energy consumption of a building in use to zero by 2020, and has established a roadmap for incorporating technologies that reflect the ZEB concept in 80% of its projects, including the design and construction stages, by 2025.





To be more specific, we are making efforts for the achievement of ZEB in four phases. It is essential to incorporate eco design from the construction planning and design stage to integrate building and facility assessment for energy saving with features that enable an "eco work style" developed by considering how building users will live and work in the buildings. In addition, ZEB is expected to be achieved with energy management and use of renewable energy after starting use of the building.



AKASAKA K-TOWER, a model of the future of large-sized tenanted buildings, aims to reduce CO₂ emissions by 40%



Construction Stage

The construction stage includes processes that consume great amounts of materials and generate considerable waste. Terrain modification, turbid water, noise, construction waste, contaminated soil, and CO₂ emissions from heavy machinery and vehicles can all be considered as having a direct impact on the global and local environment.

1	Global warming prevention	<ul style="list-style-type: none"> ● Streamlined construction operations ● Utilization of highly efficient machinery ● Activities to save energy ● Usage of natural energy
2	Resource recycling and effective use	<ul style="list-style-type: none"> ● Green procurement ● Zero emission measures ● Restrictions on generation of waste volume ● Reduction of the final disposal rate
3	Hazardous substance management	<ul style="list-style-type: none"> ● Surveys to check for soil contamination ● Countermeasures against sick house syndrome
4	Conservation of biodiversity	<ul style="list-style-type: none"> ● Biodiversity-friendly procurement ● Reducing the burden on local ecosystems

Contributing to the environment through linkage with the design stage

In projects of which Kajima is responsible for design and construction, we take into account the entire construction plan and methods of construction from the design stage. Accordingly, further precise review and approaches taking advantage of the merits of our integrated design and construction expertise have become possible. In addition to meeting land developer's or client's needs for structural aseismic capacity and useful life, we consider adoption of more productive construction methods and materials and components. Pursing streamlined construction and improvement in productivity, which are regarded as primary issues for the construction industry, leads to achieving a low-carbon emissions society and a reduction of energy consumption.

Approaches through materials and equipment

At construction sites, various materials and equipment are used. In relation to materials, we are taking advanced approaches in consideration of environmental burdens at the point of carrying materials in, decreasing the burdens by reducing amounts of usage and using recycled materials.

We also use high-performance equipment according to conditions at the site and the nature of the construction to realize more speedy and streamlined construction.

As revealed by Kajima's performance over three years from fiscal 2006, 50% of CO₂ emitted during construction is attributable to the use of construction site heavy machinery and 23% to vehicles, for a total of 73% stemming from the use of diesel fuel. Cranes and excavators account for half of diesel fuel consumption. Furthermore, various efforts for promoting hybrid heavy machinery and cleaner fuel have been made in cooperation with manufacturers and subcontractors.

■ Use of bio diesel fuel

Kajima has employed some heavy machines using bio-diesel fuel (BDF) since 2009. We have established a system in which Toshi Kankyo Engineering Co., Ltd., a member of the Kajima Group, collects vegetable oil from large-scale office and tenanted buildings in the Tokyo metropolitan area, and supplies BDF made from the recyclable oil within the Group. In the metropolitan area, where only further refined BDF is permitted for use, we have met this criterion since fiscal 2011. Crawler cranes using BDF which meet the said criterion have operated at a construction site of Shinonome Joint Government Building (tentative name), a PFI project ordered by the government. In fiscal 2011, heavy machines using BDF were used at 9 construction sites nationwide, including a civil engineering work site in Aichi Prefecture. We will make environmental contributions with group-wide cooperation and comprehensive ability.



A special sticker posted on heavy machinery using BDF

■ Fuel-efficient operation training

Among heavy machines, the cranes and hydraulic shovels account for half of fuel consumption. Therefore, in order to promote lean and efficient machine operation, Kajima has held fuel-efficient operation training at each site. So far, 19 training sessions have been held at 11 sites with 415 participants. For the Group companies, two training sessions were provided using Kajima's educational materials with 105 participants.

Initiatives at construction sites

Kajima creates an environmental management plan for each site prior to the start of construction, and works to prevent environmental incidents through checks by branch offices. Our construction site environmental management guidebook, which offers concrete measures for dealing with issues, is regularly revised and distributed to employees at sites. In addition to information on regulatory revisions and best practices, inappropriate cases, if any, are also promptly disclosed in an effort to prevent reoccurrence. Risk scenarios are placed on our intranet. Like this, we have enhanced those initiatives. At each work site, zero emissions activities are conducted, and efforts are made to reduce the final disposal rate.

■ Using and promoting manufacturer recycling programs

As a part of measures for facilitating zero emissions of construction wastes, we have used and promoted manufacturer recycling programs (a wide-area recognition system). In this system, manufacturers recognized by the Minister of Environment collect wastes (scraps, etc.) stemming from construction materials produced by the manufacturers, and recycle or dispose them in an appropriate manner. For example, gypsum plasterboards are separated into paper and gypsum powder at the manufacturer's plant. They are recycled respectively to make corrugated board, etc., and raw materials for more gypsum plasterboards.

Kajima has used the manufacturer recycling programs for gypsum plasterboards, ALC, glass wool, vinyl chloride floor sheets, etc., which can be recycled as raw materials for the same products. Through the programs, better quality recycling is possible.

■ Ensuring appropriate waste disposal

At construction sites, in order to ensure appropriate waste disposal, especially for sludge, mixed waste, and asbestos, etc., which are often illegally dumped, Kajima selects waste disposal contractors from among certified contractors after managers of branch administrative divisions review contractors' facilities. In relation to the above-mentioned three wastes, a disposal entrustment contract is concluded under the name not of a project manager but a head of a branch office, and the administrative divisions examine whether the designated contractor system is surely operated. In order to bear appropriate costs as a waste-generating business, Kajima as a rule pays the costs directly to waste haulers and disposal firms.

In fiscal 2011, there was an inappropriate case where some sand that was produced for transport to a construction site for re-use turned out to contain past buried waste such as rubble. In addition to thorough implementation of the above-mentioned management policy, we intend to further strive to conduct appropriate waste disposal, ensuring risk management during construction.



Examining a worksite

■ Management of asbestos removal work

Kajima formulated the company-wide standards concerning measurement of asbestos concentration and management of dust collectors in compliance with relevant laws and regulations, taking into account the past results of construction. Following these results, we relied on our unique construction management capabilities. However, a case occurred at a store repair worksite in Nagoya City, in which a lot of asbestos fiber was detected around a vent in a workroom although the legal criterion of asbestos concentration was met at the boundaries of the site. In response, we intend to make efforts for further appropriate asbestos removal work by enhancing the management method of dust collectors.

■ Ongoing Onsite Solar Project

The Onsite Solar Project, which was launched in fiscal 2009, has been conducted at 25 worksites in total as of April 2012. In this project, photovoltaic (PV) panels are installed on the roofs of construction site offices to generate a portion of the power used by the office. The amount of power generated is visible on our website.

Holding meetings of personnel responsible for environmental affairs

With the aim of improving the skills of personnel in charge of environmental management belonging to the administrative division of each branch, meetings of personnel responsible for environmental affairs are held on a regular basis. In these meetings, revisions of environmental laws and regulations are publicized, policies to respond to the revisions are considered, and newly formulated internal rules are reviewed. Decisions on horizontal development of preventive measures against recurrence of environmental accidents are also made, and visitors to sites where advanced activities are conducted and waste disposal facilities, etc. operate are planned.

The important characteristics of these meetings include having personnel in charge of environmental affairs air various issues, exchange opinions, and make presentations, and through such sharing and exchange, determine the direction the Company should take in its environmental management. These meetings have been held 21 times in total since 2004, and they will continue.



Signboard used at the site office for the construction of the new Mie Prefectural Museum (Chubu Branch)



JV construction site office of Kitanomine Tunnel using photovoltaic (PV) panels and wind-power generation (Hokkaido Branch)

Using eco-friendly heavy machinery— Okutainai Dam Construction Site Office, Hokuriku Branch

As several precious kinds of animals and plants inhabit the vicinity of the construction site of Okutainai Dam, we are taking various measures to minimize the impact of the construction. While using many heavy machines in the construction, we selected low-noise and low-emission machines and avoided using colors which valuable birds of prey would be wary of, such as red, yellow, and orange. We also adopted colors for temporary equipment that fit in with natural environment as much as possible. In the construction, the cornerstone was laid in the fall of 2011, and concrete has been placed in the main body of the dam, looking toward full-scale operation in 2019.



Blue hydraulic shovels, etc., are used (upper right) Taking into account the colors of plants at construction sites (below)

Expanding e-learning environmental management educational programs

Deciding to prevent environmental accidents similar to the past ones from reoccurring, we have enhanced environmental management education for all employees. In fiscal 2011, among e-learning programs on the Kajima Group Code of Conduct, which employees take every year, a section related to environment management was expanded.

The program consists of interpretation of basic knowledge concerning environmental laws and regulations, which employees of construction companies must know, and Kajima's policies, as well as Q&A exercises to check the knowledge level of the employees. We strive to provide further practical education through Q&A by querying employees about the right measures to take under various possible conditions at a worksite.





Occupancy and Usage Stage

Among a variety of structures, buildings in particular are stages for people's lives and activities. After the completion of construction, energy consumption continues for long years during the Occupancy and Usage Stage. In addition, during periods of renovation, the construction stage and use stage are repeated. Moreover, dismantling at the end of a building's life cycle marks a period in which much waste is generated, and noise and vibration impact the surrounding area. As buildings and structures have long lifetimes, their environmental impact must also be considered over the whole life cycle.

1	Global warming prevention	<ul style="list-style-type: none"> ● Appropriate inspections based on monitoring and consulting ● Adoption of Building Energy Management Systems (BEMS)
2	Resource recycling and effective use	<ul style="list-style-type: none"> ● Increasing longevity of buildings and structures <ul style="list-style-type: none"> - Reinforcements for earthquake resistance - Strengthening of dam regrading functions
3	Hazardous substance management*	<ul style="list-style-type: none"> ● Proper handling and disposal of asbestos ● Proper handling of devices containing PCB and fluorescent tubes during disposal <p>* during renovation work or demolition</p>
4	Conservation of biodiversity	<ul style="list-style-type: none"> ● Monitoring of surrounding ecosystems ● Environmental education with applied projects

Support in non-technical fields

Interest in energy conservation at the usage stage is rising rapidly; part of this is the need to comply with the revised Law Concerning the Rational Use of Energy and the Tokyo Metropolitan Ordinance on Environmental Preservation, and to take measures for energy conservation, a pressing issue in fiscal 2011. Kajima has conducted support activities such as monitoring and verification, operational guidance, and proposals for reform and renewal of facilities, by using Building Energy Management System (BEMS), aimed at optimal conditions for the use of equipment, and EneMASTER which supports energy-saving planning in maintenance while making building energy usage visible.

■ Starting development and operation of the Kajima Smart Power Management System

In fiscal 2011, Kajima implemented various measures for electricity conservation in the head office and each branch office, and achieved a result exceeding the target for demand restraint. In addition to expertise on energy-saving technologies which have been cultivated by Kajima, the Kajima Smart Power Management System was developed, which can surely save electricity without impairing amenity. Based on verification of measures taken for electricity conservation in the summer of fiscal

2011 and questionnaires on amenity given to employees in offices, a control logic was built which automatically conducts optimal control at the level set in advance. As a result, peak power was rationally and surely suppressed. By accumulating verification data in operation, we plan to establish a precise system.

Initiatives by our offices

In order to comply with the revised Law Concerning the Rational Use of Energy and the Tokyo Metropolitan Ordinance on Environmental Preservation, etc., Kajima enhanced its guidelines for management of facilities owned by the Company nationwide. In addition, we established an internal system to conduct energy management efficiently, for example, by using the above-mentioned "EneMASTER" at 150 facilities nationwide.

Meanwhile, cooperation of tenants who account for 70%–80% of energy consumption is essential for promoting energy conservation at office buildings for rent. In Toranomon Towers Office, Kajima's development project, individual tenants can check out trends in their own energy consumption with a visualization system, and information on circumstances is available on a dedicated website. A day-to-day management and operation system has been established chiefly by Kajima, a main operator of the facility, in cooperation with its group companies such as Kajima Tatemono Sogo Kanri Co., Ltd. With this system, we detect problems early, and take measures for them. Furthermore, semiannual meetings of the energy conservation promotion committee, in which all tenants participate, are held in order to continue our initiatives. For these efforts, Toranomon Towers Office has been recognized as "top-level place of business" as specified in the Tokyo Metropolitan Ordinance on Environmental Preservation (applied in fiscal 2010). Apart from it, another four facilities have been recognized as "quasi-top-level place of business," including Gran Tokyo South Tower.



Toranomon Towers

Renovation for ZEB

We have continued on-site verification by innovating part of the floors of Kajima KI Building in 2011, and then monitoring it. We will continue to verify power generation and storage, changing lights to LED and using various kinds of solar panels. Kajima is taking the initiative with the goal of realizing ZEB across the entire industry, while, in parallel, developing Kajima's unique technologies and conducting verification with specialists in various industries.

In actual work, renovation was implemented while tenants remained in the building so as to reduce inexpedience and risks in business activities. As a way to make it possible to renovate hardware

while reinforcing software, "Inagara® renovation" (renovation while tenants remain) is considered a powerful method to respond to social needs in the future for "adding high value to existing buildings."



Renovation work (left) Kajima KI Building (right)



Creating richer spaces through co-existence with natural life forms

Kajima conducts advanced technological research and development using various living things such as Japanese honeybees and woodpeckers as indicators. We believe that the construction project area can be made a richer space by adapting the project area to nearby ecosystems, and regarding it as a base to establish a new ecological network. Furthermore, research and conservation activities concerning plants in both land and water areas have been conducted.

■ Studying a green land management method using living things

It is important to maintain and manage reservoirs and riverside parks, which are valuable environmental resources in urban areas, in order to preserve the quality of biodiversity. Pursuing a study on eradicating weeds in green land using living things such as goats and silky fowls, Kajima established a cost-effective maintenance and management technique, which can reduce noise and CO₂ emissions compared to weeding with machinery.



As the improvement in the quality of green land has shown, it was found this technique has hidden potential to be an effective means for people and other living things to come into contact with each other. For this study, Kajima received the environment prize of the Japan Society of Civil Engineers Award in fiscal 2011.

Before weeding with a goat ▶ After weeding with a goat



Targets for Fiscal 2012

With the aim of achieving the new medium-term targets started from fiscal 2012, targets for fiscal 2012 have been set.

Four priority issues	Targets for fiscal 2012
1 Global warming prevention	<ul style="list-style-type: none"> ● Reducing CO₂ emissions of buildings in use by 35% compared to the criterion of the Act on the Rational Use of Energy ● Reducing CO₂ emissions per unit at construction sites by 17% compared to the level of fiscal 1990
2 Resource recycling and effective use	Final disposal rate at less than 3%
3 Hazardous substance management	Promote preventive measures Priorities: soil contamination, asbestos
4 Conservation of biodiversity	10 priority projects or more per year Promote activities for Communication, Education, and Public Awareness (CEPA)*

* A term which means dissemination and awareness raising as defined in Article 13 of the United Nations Convention on Biological Diversity and Article 24 of Japan's Basic Act on Biodiversity