Achievements of Environmental Preservation Activities

Global Warming Prevention

Structures consume a large amount of energy throughout their life-cycle, from the manufacturing of materials through construction, operation, and demolition. Calculations show that greenhouse gas emissions associated with the construction industry account for 40% of Japan’s total emission volume. Kajima is promoting global warming prevention measures at each stage of construction, placing special emphasis on increasing the energy efficiency of structures. Kajima also seeks to reduce dependence on fossil fuels through the utilization of wind power and biomass energy.

Kajima’s Energy-Efficient Design Reduces CO₂ Emissions throughout a Building’s Service Life

Kajima’s Architectural Design Division is actively involved in eco-friendly suggestions, most often in the area of energy conservation. For 74 major buildings it designed during fiscal 2003, Kajima proposed energy-conserving standards that exceeded by more than 20% on average the “evaluation criteria for building owners,” an energy-saving indicator established by the central government. These proposals will make possible an annual reduction of 15,673 tons in CO₂ emitted from buildings in use. This represents a reduction of as much as 548,000 tons over 35 years, the average service life of a building.

Kajima Reduced CO₂ Emissions per Unit Sales by 15% from the Fiscal 1990 Level

Kajima is pursuing its goal of reducing CO₂ emissions per unit sales at the construction stage by 12% (from the fiscal 1990 level) by fiscal 2010. In fiscal 2003, CO₂ emissions per unit sales and total emissions decreased 15% and 50%, respectively, as compared with fiscal 1990. CO₂ emission sources at the construction stage were light oil (70% of emissions), electricity (20%), and kerosene (10%). Major contributors to the reduction in CO₂ emissions per unit sales were enforcement of vehicle anti-idling regulations, implementation of proper maintenance procedures, promotion of green procurement, curtailment of the amount of surplus soil transported, and changes in the means of transport.

Total CO₂ emissions and the amount of construction work (sales)
Achievements of Environmental Preservation Activities
Global Warming Prevention

▶ Transporting Surplus Soil by Ship Reduced CO₂ Emissions: Izumi Yume Town Kure Project (Hiroshima Prefecture)

The challenge Kajima faced at this project site was to find an efficient way to carry away 47,570 cubic meters of excavated soil. Taking advantage of the fact that the site adjoins a port, the site used sand dredgers instead of trucks to transport excavated soil to a landfill some 20 kilometers away. This approach not only offered on-site benefits such as reduced transportation costs and shorter construction period, but also cut CO₂ emissions by 211 tons.

▶ Japan’s First Concrete Windmill Tower — Umiterasu Nadachi Wind Power Station (Niigata Prefecture)

Kajima designed and supervised construction of Japan’s first concrete windmill tower in Nadachimachi, Niigata Prefecture, which went into commercial operation in November 2003. Measuring 45 meters in diameter and 50 meters in height, the windmill houses one 600-kW generator, and has estimated annual power generation capacity of 1.3 million kWh (equivalent to the annual electricity consumption of about 290 households).

Concrete windmill towers can be built to a height over 100 meters, and have excellent durability, rigidity and resistance to salt damage. They are thus well suited to large-scale wind power generation. Kajima developed design and construction techniques for concrete windmills towers, and utilized them in this project.

▶ Organic Waste Serves as an Energy Source: METAKLES

METAKLES is a non-combustion organic gasification system developed by Kajima. Using thermophilic methane-fermenting microbes, the system efficiently decomposes organic waste and releases biogas, which is used as a fuel. Kajima continues to promote this system as a technology for efficient reduction and recycling/reuse of organic waste.
Achievements of Environmental Preservation Activities

Recycling and Effective Use of Resources

Kajima has developed and established a recycling network of manufacturers and the waste-disposal industry and is promoting the recycling of construction waste. Utilization of this network makes it possible to convert construction waste into a wide variety of products.

Reduction and recycling of construction waste

Construction waste generated during fiscal 2003 amounted to about 2.46 million tons, a marginal decrease from the preceding year. Although the recycling rate improved, the final disposal rate deteriorated slightly. The higher final disposal rate is attributable to a decrease in the amount of construction sludge dehydrated (reduction) within worksites.

By principal material category, the recycling rates for concrete fragments and asphalt/concrete fragments remained nearly 100%, while the recycling rates for construction-generated wood chips, sludge, and mixed waste improved.

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>Volume generated (tons)</th>
<th>Recycling rate (%)</th>
<th>Reduction rate (%)</th>
<th>Final disposal rate (%)</th>
<th>Final disposal volume (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>2,052,685</td>
<td>79 (66)</td>
<td>-</td>
<td>21</td>
<td>431,063</td>
</tr>
<tr>
<td>2000</td>
<td>2,062,081</td>
<td>81 (65)</td>
<td>-</td>
<td>19</td>
<td>391,795</td>
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<tr>
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<td>2,056,981</td>
<td>82 (68)</td>
<td>-</td>
<td>18</td>
<td>371,254</td>
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<tr>
<td>2002</td>
<td>2,526,678</td>
<td>71 (69)</td>
<td>15</td>
<td>14</td>
<td>344,747</td>
</tr>
<tr>
<td>2003</td>
<td>2,461,677</td>
<td>75 (90)</td>
<td>9</td>
<td>16</td>
<td>382,068</td>
</tr>
</tbody>
</table>

*Recycling rates until fiscal 2001 include reduction rates.
*Figures in parentheses represent the recycling rate for waste excluding sludge.

► Kajima Participates in a Helmet Recycling System.

Kajima became the first company in the construction industry to adopt the helmet recycling system established by the Japan Safety Helmet Industry Association. The Company sends helmets that need to be discarded for safety reasons to a recycling center, where they are stripped of chin straps and other materials. The helmets are then crushed at a fiber-reinforced plastic (FRP) crushing facility, and the crushed FRP is used as fuel for a cement kiln.

Collected helmets

► A Reduction in Mixed Waste Discharge Has Been Achieved through Full Participation in the 3R Drive: New Building Project Site for the Marunouchi 1-1 Project (Provisional Name) (Tokyo)

The construction crew working at this high-rise office building project site in Tokyo has participated in a reduce, reuse, and recycle (3R) drive, cutting mixed waste discharge to less than one-third of the target set by the Tokyo Branch. The crew and partner companies collaborated in this endeavor, instructing workers newly assigned to the site in the 3R drive. Specific 3R activities included unitization, reduction or elimination of packaging, identification of items to be separated, preparation of a separation yard, and display of actual waste samples to ensure correct waste separation. Waste was sorted into 17 categories in the collection yard.

Separation yard
Achievements of Environmental Preservation Activities
Hazardous Materials Management

Kajima manages hazardous materials in various phases of the construction process. In particular, the Company has achieved many successes in the area of soil contamination, establishing voluntary rules more rigorous than those stipulated by law, and engaging in active soil decontamination efforts in cooperation with landowners. Kajima is also working actively to prevent indoor air contamination, typified by “sick-house syndrome.”

Contaminated Soil Rehabilitation Efforts

Kajima was recognized as a designated survey institution by the Minister of the Environment under the Soil Contamination Countermeasures Law, which went into effect in February 2003 (designation number: 2003-1-311). To carry out more effective soil rehabilitation, Kajima chooses the most suitable proprietary remediation technology for each type of contaminant.

Kajima’s Soil Decontamination Technology

Air Sparging Method with Horizontal Wells

This technique enables quick remediation of contamination by volatile organic compounds (VOCs), which pose a high risk of dispersion. Because the method involves the use of horizontal wells drilled with universal boring, it eliminates the need to demolish the structure above the contaminated spot, and enables decontamination of a larger area at a time than the vertical well method, thus yielding a significant reduction in cost. When this method is used for biosparging, a technique for injecting air and nutrient salts, the biological activity of underground microorganisms is increased, and biodegrading of contaminants accelerated, resulting in a further increase in remediation efficiency.

EnviroJet Method

The EnviroJet method is a technique that enables in situ remediation of VOC-contaminated soil, as well as efficient replacement of soil contaminated by heavy metals, agricultural chemicals, and other substances deep underground. The method offers three types of cleanup operations: the Jet Replace Method, which uses jet flows of water to replace contaminated soil with harmless materials; the Jet Blend Method, which mixes in cleaning materials; and the Jet Rinse Method, which washes contaminated soil. These measures draw on Kajima’s high-pressure jet flow technology to decontaminate soil.

Micro Bubble Entraining Method

This method is a cleanup technique suited for remediation of soil contaminated by high concentrations of oil. Contaminated soil is immersed in an alkaline-based solution, and micro air bubbles are used to efficiently and economically remove and recover oil by floatation.
Achievements of Environmental Preservation Activities / Hazardous Substances Management

Measures to Prevent Dioxin Exposure during Waste Incinerator Demolition
Kajima boasts a long track record in the safe and proper demolition of waste incinerators. We have instituted a system that provides full support at all stages of construction: preliminary study, planning, the removal of contaminants, demolition, waste disposal/treatment/recycling, and follow-up study.

Measures to Prevent Indoor Air Contamination
In 2000, Kajima became the first company in the industry to establish and adopt the “standard specifications for healthy housing.” We implemented countermeasures against “sick-house syndrome” in compliance with the amended Building Standard Law with the aim of providing healthy living space, while meeting regulatory requirements for toluene and xylene concentrations in the air in schools, public buildings, and other buildings.
Kajima utilizes the Air Quality Testing Laboratory, an ultra-clean room at its Technical Research Institute, to research and develop materials, construction methods and measuring techniques, and to actively promote in situ applications. One example is the reduction of VOC concentrations in manufacturing facilities such as semiconductor plants, and the reduction of the concentration of acidic and alkaline substances in facilities for storage and exhibition of art objects and handicrafts.

Achievements of Environmental Preservation Activities / Ecosystem Conservation
Kajima has carried out R&D work and utilized the results in order to harmonize construction activities with ecosystems. For instance, the Company established the Hayama Marine Science Laboratory in 1980 and the Kemigawa Revegetation Experiment Station in 1993. Kajima draws on a powerful combination of basic knowledge and analytical, design and construction techniques it has gained over many years to develop construction methods and materials that contribute to the maintenance, restoration and creation of the ecosystem.

An Eco-Friendly Housing Development That Typifies Kajima’s Real Estate Development
— CI Town Rifu Hayama Gardens Port (Miyagi Prefecture)

Situated in a suburb of the city of Sendai, Miyagi Prefecture, CI Town Rifu Hayama Gardens Port is a housing estate Kajima developed jointly with the Itochu Group. The estate takes full advantage of the geographical characteristics of a site surrounded by a magnificent natural forest, featuring tree-lined streets, green spaces and parks resplendent with trees and flowers. Kajima offers a variety of environmental education programs to encourage residents to participate in community-building efforts and engage in nature conservation.
Buried beneath the street separating the town and the adjacent remaining forest are Hume pipes that create four “ecoroads” for use by small animals. The ecoroads directly connect the town and the surrounding natural environment, facilitating movement by insects, amphibians, and mammals. To promote biodiversity, the upstream section of the regulating reservoir of a biotope is gently sloped to facilitate animal traffic.
Plants and animals found on the estate site prior to the start of construction were transplanted or relocated for conservation, and their growth is being monitored.

“Ecoroads” for small animals (above)
Birdhouses set up in the remaining forest
Achievements of Environmental Preservation Activities / Ecosystem Conservation

► Kajima Created a Biotope for the Protection of Newts at Its Project Site in England

Kajima Europe UK Holding Ltd., Kajima’s subsidiary in England, has been engaged in the construction of school buildings in the central England town of Northampton under the school private finance initiative (PFI) since March 2003. When a pond on the school premises was found to be home to the great crested newt—designated as a protected wildlife species—we erected a protective fence on the construction site and created a biotope to improve the habitat of this threatened species. Periodic counting of the newt population shows the construction works have had no ill effect on the newts.

► Kajima Developed Technology for Accelerating Regeneration of Eelgrass Beds, the “Ocean’s Cradle”

Eelgrass, a marine plant that grows in clumps in shallow waters of one to three meters, attracts many sea creatures. It serves as a feeding and spawning ground for fish, and provides young fish with a refuge from predators. For this reason, eelgrass beds have been called the “ocean’s cradle.” Kajima and Kitasato University have jointly developed a technology for regenerating eelgrass beds, which have been shrinking in recent years because of land reclamation and marine pollution.

Green Procurement

Promotion System and Achievements

The construction industry consumes vast quantities of resources, and as such must play a major role in finding uses for recycled materials. In 2001, Kajima established the Kajima Green Procurement Guidelines to promote its green purchasing efforts. We have also made progress in using recycled or secondhand materials in key construction materials.

Kajima also promotes green procurement in office-related areas. Eco-products now account for 69% of all office supplies purchased, and 32% of company-owned cars are low-emission vehicles.