



## Priority issue 1: Global warming prevention — Aiming for a low-carbon society

Kajima is striving to slow the progress of global warming by taking initiatives in each of its business processes and pursuing carbon reduction in construction projects. The aim is to use energy more efficiently and help create a society with minimal CO<sub>2</sub> emissions.

### Achievements in fiscal 2012

In fiscal 2012, the first year of the medium-term environmental plan, Kajima's target was a 35% reduction in CO<sub>2</sub> emissions over the life cycle of buildings compared to the level indicated in Japan's Act on the Rational Use of Energy (Energy Conservation Law). Various initiatives led to a reduction of 39%.

The fiscal 2012 target for reducing CO<sub>2</sub> emissions during construction was 17% compared to fiscal 1990. With a reduction of only 14%, the target has not yet been achieved. This was primarily due to an increase in the CO<sub>2</sub> emissions coefficient per kilowatt hour of electricity. Calculated using the coefficient for the previous year, the reduction in construction emissions would have been 18.4%, meeting the target.

### Projects to help realize a low-carbon society

The construction industry contributes to the creation of a low-carbon society through the diverse projects it undertakes. These include projects for making buildings last longer or for raising efficiency energy use in buildings through maintenance and renovation. They also include reducing exhaust gas from vehicles by easing traffic congestion through the redevelopment of transportation networks, including construction of elevated crossings and roadways. In Japan today, energy is an urgent issue, and Kajima does its part by using its technologies and expertise to promote renewable energy.

With the aim of realizing zero-energy buildings (ZEBs) by 2020, Kajima is conducting demonstration projects using our various technologies and facilities. We are also looking into building smart communities that promote the comprehensive use of energy and town-wide power management.



KI Building was transformed into a zero energy building

### Realizing ZEBs

Kajima is also investigating the conversion of existing office buildings into zero-energy buildings (ZEBs) that save energy and emit less CO<sub>2</sub>. In 2011, the Kajima KI Building was partially renovated as a demonstration project. The result was a 50% reduction in energy consumption compared to before the renovation.

Kajima has developed its own system for reporting energy usage in real time as well as an application for an ordinary tablet PC that optimizes the office environment. We have also been conducting joint research and development with leading companies in various fields such as air conditioning and lighting. This includes a smart power control system that ensures stable power supply by storing and discharging power from solar panels in a lithium-ion battery. In fiscal 2012, Kajima received a Good Design Award in recognition of the importance of the contribution of its renovations to the promotion of zero emissions buildings.

A new research building for the Kajima Technical Research Institute was completed in 2011. In fiscal 2012, it increased its operating energy efficiency and achieved a



Main research building of the Kajima Technical Research Institute incorporates various zero-energy technologies



62% reduction in annual CO<sub>2</sub> emissions. This reduction rate is among the best in Japan, and resulted in recognition at the 51<sup>st</sup> awards ceremony of the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan.

## Working to build a low-carbon society in each process

Kajima carries out initiatives to reduce CO<sub>2</sub> emissions in each process and stage—from the planning and design stage when the building life cycle is considered, to the construction stage, which includes new construction, renovation and demolition, to the operation stage after building completion.

### ■ Reducing environmental impact by streamlining construction

Before any construction project is started, a careful construction plan is made. Each day, work is carried out according to the plan. In the construction planning stage, substantial construction streamlining can be achieved by finding ways to improve operation efficiency.

The Fujifilm Nagoya Building was built in central Nagoya, Aichi Prefecture. Through the use of prefabricated sections, Kajima reduced the number of material hoists and saved labor. For example, the beams and deck materials for each floor were prefabricated in sections that included fittings for installation of equipment in the subsequent stage.

As a result of this measure, about 202 kilograms of CO<sub>2</sub> emissions were avoided for each floor, totaling 2.2 tons for the entire building. Moreover, since a lot of work was carried out at ground level, the hazard of work in high places was reduced, and higher quality was achieved by carrying out consistent work for each section, all at once. We will continue to promote this sort of construction streamlining in order to continually improve quality, health and safety, as well as environmental performance, according to specific worksite needs.



Lifting pre-assembled construction units that include beams, deck, and equipment



Hamada national highway constructed using CO<sub>2</sub>-SUICOM concrete

### ■ Online tool to reduce CO<sub>2</sub> emissions at construction sites

Devising ways to reduce the consumption of diesel and other fossil fuels and to eliminate inefficient construction methods



Home page of the "Genba de Eco" intranet site

and material waste leads to CO<sub>2</sub> emissions reduction and onsite cost savings.

Kajima has created an intranet site called "Genba de Eco" covering ecological measures taken at actual work sites. The site facilitates CO<sub>2</sub> emissions reduction at construction sites. By accessing this CO<sub>2</sub> emissions reduction tool, worksite personnel can easily calculate the standard emissions based on the construction scale, and the reduction amount for each emissions reduction option. The site allows personnel to easily select the appropriate option according to the scale-based emissions reduction target. It also allows users to investigate initiative options from the materials page summarizing the effects and adoption results. We will be rolling out this tool to construction sites across Japan and utilizing it even more actively.

### ■ Utilizing CO<sub>2</sub>-SUICOM® concrete

Kajima is also actively working to reduce CO<sub>2</sub> emissions in the area of construction materials. CO<sub>2</sub>-SUICOM®, an environmentally friendly concrete with zero CO<sub>2</sub> emissions, was developed through joint research by Kajima, Chugoku Electric Power Company, Inc. and Denki Kagaku Kogyo K.K. The concrete absorbs CO<sub>2</sub> while hardening, offsetting power plant emissions. The level of CO<sub>2</sub> absorption is higher than the CO<sub>2</sub> emissions during the production of cement, a raw material for concrete. Consequently, it helps to reduce CO<sub>2</sub> in the atmosphere. Coal ash, a byproduct of thermal power plant operation, can also be used as an ingredient in the cement, thereby contributing to resource recycling.



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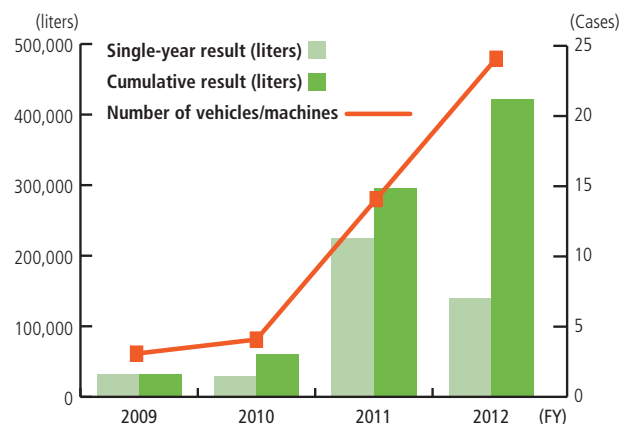
The concrete is used as an outdoor building material in civil engineering projects for concrete blocks and fence foundations. It has also been used in large-scale residential redevelopment projects. The technology has received a great deal of recognition including the Japan Society of Civil Engineers Environmental Award, the Electric Power Civil Engineering Association Takahashi Award, and the Chairman's Award of the 3R Suishin Kyogikai (a 3R promotion association).

**■ Bio-diesel fuel reduces CO<sub>2</sub> emissions by 1,000 tons**

Since fiscal 2009, Kajima has been using bio-diesel fuel (BDF) to operate heavy equipment and vehicles at construction sites. Made from vegetable oil, BDF is a carbon-neutral fuel that does not increase CO<sub>2</sub> in the atmosphere, and is helping to greatly reduce CO<sub>2</sub> emissions. In fiscal 2012, BDF was

used by six branch offices at 15 construction sites. Kajima's total usage to date is about 420,000 liters, accounting for a reduction in CO<sub>2</sub> emissions of over 1,000 tons.

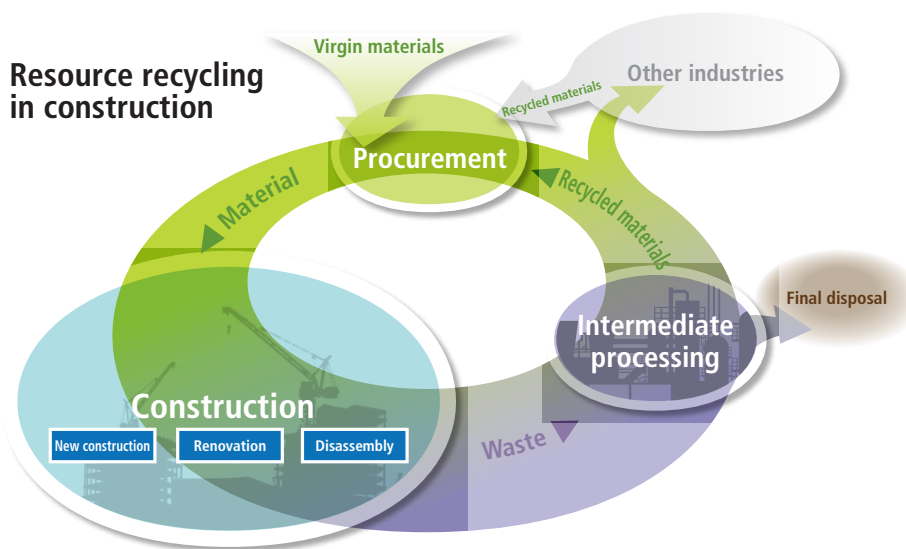
**Bio-diesel utilization results**



**Priority issue 2: Resource recycling and effective use — Aiming for a recycling society**

At construction sites, Kajima is striving to reduce the amount of materials and energy used, while also curbing the amount of waste generated and minimizing final disposal amounts. We are also worked to help foster a resource-recycling society. In order to realize this kind of society, the challenge is to reduce CO<sub>2</sub> emissions, while promoting a low-carbon society that exists in harmony with nature.

**Resource recycling in construction**



**Achievements in fiscal 2012**

Various initiatives taken brought the company-wide final disposal rate for fiscal 2012 down to 2.8%, surpassing our target of 3%. In the area of green procurement, the usage rate of recycled materials by weight for the five targeted

principal materials (asphalt, crushed stone, cement, concrete, and steel) was 50%. This remained roughly unchanged from fiscal 2011.



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Providing Innovative Solutions for a Better Environment