

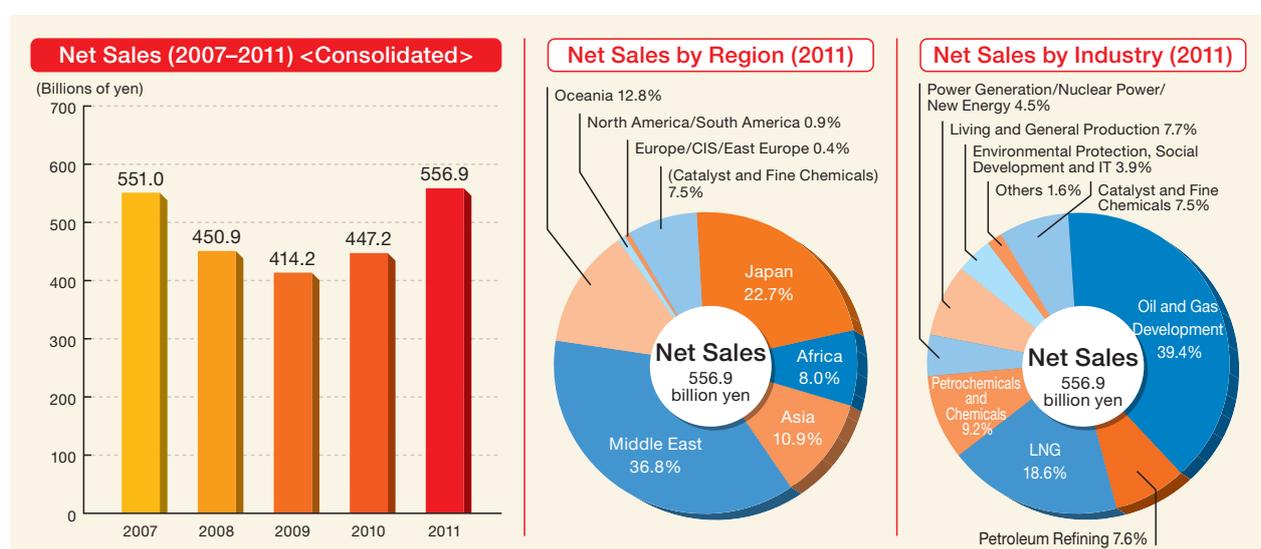


# Environmental & Social Report 2012



## ● About JGC

<b>Name:</b>	JGC Corporation	
<b>Location:</b>	Yokohama World Operations Center	2-3-1 Minato Mirai, Nishi-ku, Yokohama-shi, Kanagawa
	Tokyo Corporate Office	2-2-1 Otemachi, Chiyoda-ku, Tokyo
	MM Park Building Office	3-6-3 Minato Mirai, Nishi-ku, Yokohama-shi, Kanagawa
	Kamiooka Office	1-13-1 Saido, Konan-ku, Yokohama-shi, Kanagawa
	Research and Development Center	2205 Narita-cho, Oaraimachi, Higashi-ibaraki-gun, Ibaraki
	Domestic Office	Osaka
	Overseas Offices	Beijing, Jakarta, Hanoi, Perth, Almaty, Abu Dhabi, Paris and others
	Overseas Affiliates	Philippines, Vietnam, Saudi Arabia, Italy, U.S. and others
<b>Employees (approx.):</b>	9,000 persons (as of March 2012)	
	JGC: 2,100 persons	
	Domestic affiliates: 2,900 persons	
	Overseas affiliates: 4,000 persons	



## ● The JGC Group

As an engineering contractor, the JGC Group's core business is providing planning, design engineering, equipment procurement, construction (EPC), and commissioning services for various industrial plants and facilities. The JGC Group is also involved in enterprise investment businesses, management services, the manufacture and sale of catalysts and fine chemicals, and others.

The scope of this report mainly includes the JGC Group companies listed below.

### Total Engineering Business (EPC Business)

JGC  
JGC Plant Solutions  
JGC PLANTECH  
JGC Philippines  
JGC Gulf International  
and others

### Catalyst and Fine Chemicals Business

JGC Catalysts & Chemicals  
Nikki-Universal  
Japan Fine Ceramics

### Other Businesses (IT and Consulting Businesses)

JGC Information Systems  
Japan NUS  
JGC Energy Development  
and others

## ● Editorial Policy

The purpose of this report is to present to our stakeholders the CSR efforts of the JGC Group, with a focus on environmental conservation. This year's feature article covers our "Initiative to be No. 1 in Health, Safety, and the Environment." We report on the state of our HSE efforts in the EPC business, where the requirements imposed on us by our clients grow more important every year.

The report also details our activities as they relate to four pillars of our business: "Project—Health, Safety, and Environment Concerns in Project Activities"; "Management—Environmental Consideration Based on Environmental Management"; "Technology—the JGC Group's Environmental Technology"; and "Social—Social Dimensions of Sustainability."

### Scope of Reporting

The content of this report includes information concerning the activities of JGC Corporation ("JGC") and Group companies (listed at the bottom of the left page).

"Environmental Consideration Based on Environmental Management" (P23–29) covers the JGC's construction sites in Japan.

Note: Activities other than those specifically attributed to the JGC head office or individual Group companies refer to those of the JGC Group as a whole.

### Reporting Period

This report is compiled principally on the basis of data for fiscal 2011 (from April 1, 2011 to March 31, 2012).

Important matters (those regarded as highly significant) concerning activities outside the reporting period (up to July, 2012) are also the scope of this report.

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# Contributing to Realization of a Sustainable Society through the Power of Engineering and Project Management

## The Widening Applications of Engineering

Ever since the British Empire, engineering, together with agriculture, industry, and commerce, has formed the foundation of our social infrastructure, and played an essential role in the building of nations. In the years through to the present time, the JGC Group has applied its engineering knowledge to the design and building of energy production plants and industrial facilities worldwide, contributing to the industrialization of numerous countries.

In the engineering and construction of energy-related facilities such as oil and natural gas plants, efficiency of energy generation, economy of resource consumption, and awareness of environmental and social issues, are absolute requirements. The JGC Group has adopted “Energy,” “Economy,” and “Environment and Society” as keywords to describe these requirements, and uses “Engineering” as the means by which to optimize them. The JGC Group defines our corporate philosophy as follows: “To achieve enduring growth as a globally active company with a core business of engineering-based services, while contributing to world economic and social prosperity, as well as to the conservation of the earth’s environment.”

Today, the JGC Group makes full use of its engineering experience not only to provide various systems that support social and industrial development but also to offer energy and environmental solutions. For example, we apply our cutting-edge engineering technology to the construction of production facilities for liquefied natural gas (LNG) as a cleaner form of energy; to the efficient development of untapped resources; and to the development and use of renewable energy, including biomass, solar photovoltaic, and solar thermal energy. We also apply engineering innovations to water purification, soil decontamination, air pollution prevention, energy efficiency development and waste detoxification.

Furthermore, flexible engineering solutions are increasingly required in the energy-related field: for example, to address the electricity shortages that followed the Great East Japan Earthquake of last year. In addition, emerging countries are achieving remarkable economic

growth, which creates a pressing need for highly energy-efficient, environmentally-conscious sustainable urban development. In summary, there is very considerable demand for novel engineering technology and project management across a wide variety of fields.

## JGC is Active in a Broad Range of Fields

Under our new five-year management plan “New Horizon 2015” which took effect in fiscal 2011, JGC aims to further expand the market for our engineering services. While retaining plant engineering, procurement, and construction (EPC) as our core business, JGC intends to become a “Program Management Contractor and Investment Partner,” a business entity active both in enterprise investment and in planning and management services.

In fiscal 2011, in the EPC business arena, JGC was awarded a contract for construction of an onshore LNG plant within the scope of the Ichthys LNG Project, a mega-LNG project currently under development in Australia by INPEX Corporation. Approximately 70% of the LNG produced from this plant will to be exported to Japan, making this Project a significant element of Japan’s national energy policy.

In the field of enterprise investment, the solar photovoltaic power generation project developed by JGC in Spain has entered into commercial operation. This project contributes to a stable supply of energy in the area as well as to the reduction of greenhouse gases. Through it, JGC serves both the needs of society and conservation of the earth’s environment. In addition, construction of a Demonstration Plant for production of JGC Coal Fuel (JCF®), a petroleum alternative fuel made by artificially upgrading low-rank coal, was completed in Indonesia. Completion of the Demonstration Plant marked a major step towards the promotion of JCF® as a commercial fuel. In addition to enabling previously unused low-rank coal to be utilized effectively, this project will also support economic development and energy security in Indonesia, a country currently undergoing rapid economic growth.

EPC continues to be JGC’s core business, and we therefore take Health, Safety, and Environment (HSE)

requirements for EPC projects very seriously. In recent years, HSE standards have grown consistently higher and requirements more stringent. In this report, we detail JGC's proactive initiatives toward becoming the world's No. 1 contractor in HSE. Our philosophy for safety is that it cannot be coerced. Instead, a culture for safety can be fostered in an organization by transforming the attitudes of individuals, stressing that safety is a personal choice that has an impact on everyone else.

### **Working Toward the Realization of a Sustainable Society**

The JGC Group defined its CSR Basic Policy and set forth four Priorities of Social Contribution Activities in April 2011. The Group believes it essential to take environmental and social considerations into account when designing and constructing energy and industrial facilities. The facilities and services we deliver must be optimized to ensure safety and peace of mind for everyone. This means not only the client but also the employees, the beneficiaries of the facilities, and the local community. Our social contribution activities are organized around four priorities: Environment, Education, Science and Technology, and Local Contribution. This report covers part of these initiatives, including activities in Yokohama, where JGC's headquarters is located, as well as at overseas construction sites and subsidiary companies in Japan and overseas.

In these modern era, our global society faces numerous problems related to energy, the environment, and society. By maximizing the engineering and project management capabilities we have fostered over many years, the JGC Group will continue to strive to identify solutions for the world's problems, and in doing so realize a sustainable society.

**Keisuke Takeuchi**  
Chairman and Representative Director  
JGC Corporation



# JGC Group's CSR Policy

JGC Group's CSR Policy and Guideline have been created based on the concept of "contributing to the prosperity of the economy and society while protecting the global environment." The related activities are divided into six fields and implemented cross-functionally.

## JGC CSR (Corporate Social Responsibility) Policy

JGC is committed to fulfilling its role as a member of society (Corporate Citizenship). We recognize that the foundation of our business activities is strengthened by contributing to the prosperity of the world economy and society; to the healthy preservation of the global environment; and to the sustainable development of society and the global environment.

To meet this commitment, JGC hereby establishes the following principles, which shall be applied, throughout its operations.

1. We shall conduct our business with a full understanding of the importance of quality, safety, and the environment.
2. We shall provide our social contributions using the characteristics of the JGC Group.
3. We shall comply with legal requirements inside and outside the country, and conduct our business in a fair and sincere manner following a proper governance system.
4. We shall disclose necessary information to our stakeholders in a timely and appropriate manner.
5. We shall endeavor to maintain and further improve fair human resource management to develop people's ability and vitality based on mutual trust and responsibility.
6. We shall promote the awareness of CSR and further develop our CSR activities reflecting the voices of stakeholders.

## CSR Guideline

The JGC Group's CSR Guideline is "to contribute to the prosperity of the economy and society while protecting the global environment." Through our business and CSR activities, using this CSR Guideline, the JGC Group aims to contribute to sustainable development of society as a whole. "Sustainable development" includes ensuring the longevity of our business prospects by helping to ensure the longevity of the larger society that supports them, by aiming for development that enables continuous growth.

The JGC Group holds a strong awareness of its role as a member of society, and aims to fulfill this role based on the six points listed below.

1. "Quality, Safety, and the Environment" are the fundamental watchwords which will guide the JGC Group's continued efforts to work toward the sustainable development of society. As we exert our maximum efforts to realize these concepts, we shall maintain our awareness that providing safe, high quality, and environmentally friendly products and services contributes to gaining our customers' satisfaction.

2. The JGC Group's diverse global business activities range from the provision of comprehensive engineering services to dealing with catalysts and fine chemicals and we shall put the unique technologies and experiences we have gained through our involvement in such business fields to full use in our social contribution activities. Details of JGC's policy regarding our social contributions are described in the "JGC Social Contributions Policy." The four target areas of our social contributions can be summarized as, the Environment, Education, Science and Technology, and the Community.

3. The JGC Group is profoundly conscious that the maintenance of compliance and an efficient internal governance system are essential for the sustained well-being of an organization. Hence, we shall continue to maintain these elements as we respond to the requirements from society and the trends of the times. All management and employees shall follow legal and social rules based on high ethical standards.

4. The JGC Group is a listed company, and we take it as our duty to disclose information to the market in a timely and appropriate manner. We shall proactively provide important information in terms of the business environment and social situation, information that may have an impact on stakeholders, helpful information to deepen the understanding of the JGC Group as well as fulfilling our duty of information disclosure required by laws and regulations such as the Companies Act and the Financial Instruments and Exchange Law.

5. The JGC Group's CSR Policy describes "fair human resource management to develop people's ability and vitality." We shall be fully guided by the principle that the growth and development of the company occurs reciprocally with the growth and development of its employees. Based on this sense of mutual trust and responsibility, each employee shall contribute to the company as a professional, and the company shall provide opportunities for the empowerment of employees and for them to show their ability and vitality.

6. The JGC Group shall promote CSR awareness throughout its organization, from management to employees. We shall carefully listen to the voices of stakeholders and continue making optimal efforts to respond to social needs and trends in the business environment.

# Relationships Between the JGC Group's Businesses, Society, and the Environment

The JGC Group provides plant engineering services to private-sector corporations and government organizations around the world. JGC also engages in activities closely tied to society and the environment in a number of other fields, focusing on enterprise investment and service businesses.

## Business Sector

### EPC Servies

EPC: Engineering, Procurement, Construction

The JGC Group contributes to local economic and industrial development by building energy-related plants in Japan and other regions of the world, including Asia, Oceania, the Middle East, Africa, and South America. The JGC Group also creates general production facilities and facilities that respond to the needs of society in Japan and abroad: pharmaceutical plants, laboratories, and diverse industrial plants that meet increasingly complex and sophisticated standards, medical and welfare facilities to support an aging population, and environmental conservation facilities employing energy-saving technologies.

#### ▼ Energy and Chemicals

- Oil and Gas Development
- Petroleum Refining
- Liquefied Natural Gas (LNG)
- Petrochemicals and Chemicals
- Power Generation, Nuclear Power, New Energy



#### ▼ Pharmaceuticals, Environment and Infrastructure

- Pharmaceuticals and Research Facilities
- Medical, Welfare, Social Facilities
- Industrial Plants for Non-Ferrous Metals, etc.
- Environment and Infrastructure



### Enterprise Investment and Service Business

Taking full advantage of technology and knowledge accumulated through its EPC business, as well as trust relationships developed with clients throughout the world, the JGC Group is also expanding its investments in businesses such as desalination and power generation. JGC also delivers "planning and management services" designed from the standpoint of an operator, in fields such as business design, planning, and promotion, as well as resource development planning and infrastructure development planning.

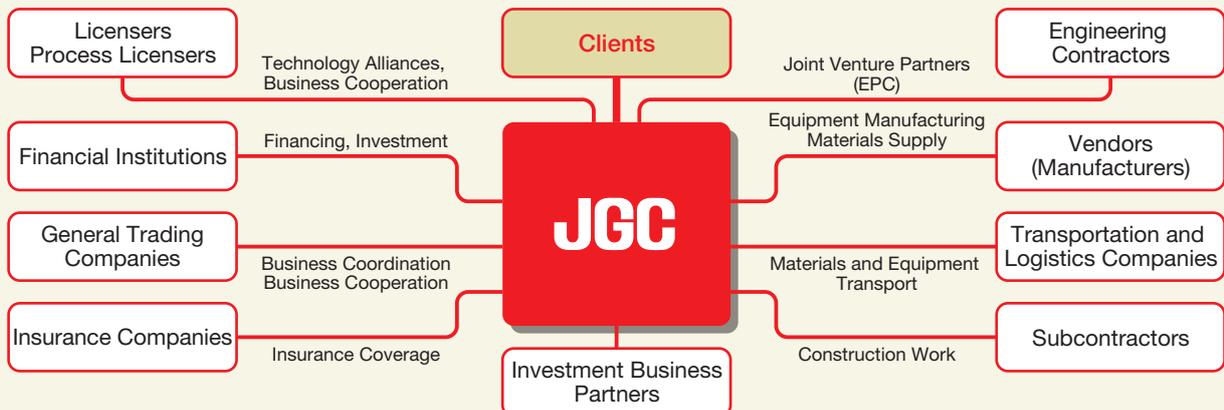
#### ▼ Enterprise Investment and Business Operation

- Power Generation and New Energy
- Resource Development
- Environment and Water
- Urban Infrastructure and New Industrial Development

#### ▼ Service Business

- Planning and Management
- Manufacturing and IT

## Companies Involved with JGC



## Engineering technology contributes significantly to mitigating environmental impacts

Active on a global scale, the JGC Group considers the mitigation of environmental impacts as an important duty and works assiduously to implement environmental conservation measures.

Population growth and global issues related to expanding economies

Resource Depletion

Climate Change

Effects on the Air, Water and Soil

### Role of the JGC Group

Optimizing customer facilities through proven engineering expertise and active introduction of the latest technology, while mitigating negative impacts on ecosystems and human health

#### The JGC Group's Input Measures

Measures to reduce resource consumption, energy use and emission of pollutants

Promoting use of new energy

Energy conservation at industrial plants

Promotion of enhanced fossil fuels (low-sulfur oil, etc.)

#### The JGC Group's Output Measures

Environmental impact reduction and detoxification measures

Promotion of natural gas use and underground CO<sub>2</sub> sequestration (see P32, 33)

CDM business (see P31)

Environmental pollutant removal and detoxification (catalyst use, enzyme use) (see P35)

### Human Prosperity in a Healthy Environment



# Corporate Governance

The basic policy of JGC's corporate governance is to continuously increase corporate value through efforts to enhance management efficiency and transparency. Maintaining the trust of society and all our stakeholders, JGC will develop our business in line with societal needs, expectations, and norms.

## Corporate Governance Framework Outline

JGC has introduced an executive officer system, which clarifies the division of management decision-making and oversight functions from executive functions. This has further enhanced management efficiency and strengthened the JGC's executive accountability system. The current implementation of the system is described below.

### <Board of Directors>

- Headed by the Chairman of the Board of Directors, it consists of 15 directors and five corporate auditors (three of which are outside corporate auditors) and meets in principle twice a month.

### <Board of Auditors>

- The Board of Auditors consists of five corporate auditors, of which three are outside corporate auditors. It meets in principle once a month.

### <Director and Executive Officer Committee>

- The Director and Executive Officer Committee meets once a month in principle for the purposes of sharing information regarding the status of management policies, and reporting/confirming the status of operations.
- Headed by the Chairman of the Board of Directors, it consists of directors, executive officers and corporate auditors.

### <Management Strategy Committee>

- The Management Strategy Committee meets in principle once a week for the purposes of deliberating on important matters for the management strategy of JGC and the JGC Group.
- The Chairman Emeritus of the JGC Group heads this committee, which consists of directors, corporate auditors, and other members.

### <Operations Steering Committee>

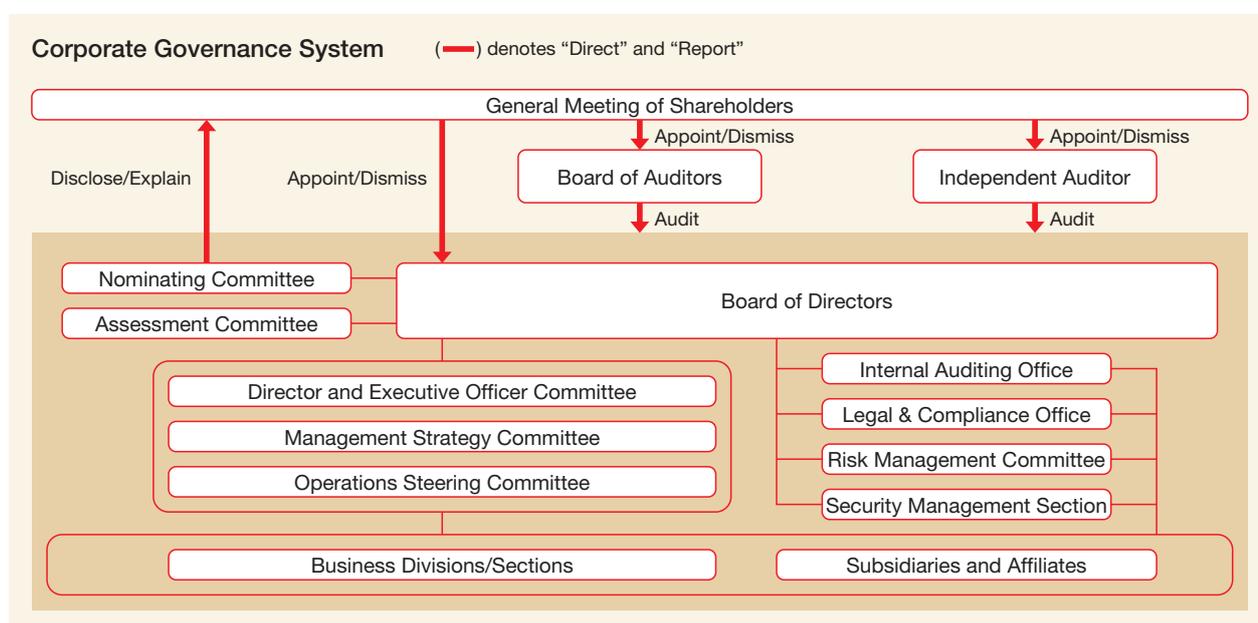
- The Operations Steering Committee meets in principle twice a month for the purpose of deliberating on matters related to the execution of business operations of JGC and the JGC Group.
- It is headed by the President and consists of corporate auditors and other members designated by the President.

### <Nominating Committee and Assessment Committee>

- These committees meet in principle once a year for the purpose of strengthening fairness and transparency regarding the appointment and compensation of executive personnel.

### <Independent Auditor>

- The certified public accountants (CPAs) who have audited JGC's accounts are Kazutoshi Isogai and Yoshihisa Uchida of KPMG AZSA LLC. Four other CPAs and nine other individuals assist with these audits.



## Status of the Internal Control System and Risk Management System

For its internal control, JGC has established an Internal Auditing Office that verifies, evaluates, and enhances the efficiency of the internal control systems of JGC and the JGC Group. The Internal Auditing Office also conducts individual audits when appropriate. In addition, JGC's management and executive accountability system has been clarified, with Job Authority Regulations set forth to define the duties and authorities of each position. Group Management Regulations instituted for Group companies are also applied.

JGC has established a Risk Management Committee as part of a comprehensive risk management system designed to systematically identify risks affecting all Group companies. The system is focused on corporate risk, and it manages risks related to management, disasters, accidents, and society, among others. The Risk Management Committee meets on an as-needed basis.

A Security Management Section has been established as part of crisis management. It gathers and manages information related to crisis management, provides training, and handles emergency situations as they arise.

## Compliance

In order to conduct sustainable business development as a member of the international community, JGC believes that it is essential for each and every employee to conduct business in conformity with corporate ethical standards, as well as to observe local laws and regulations not only in Japan but also overseas. To this end, JGC has formulated a Corporate Philosophy for the entire JGC Group, a document on Principles of Business Conduct, and a Code of Conduct manual. JGC also educates and trains employees on various laws and regulations, as part of its efforts to raise employees' compliance awareness. JGC recognizes that the bar is being raised in terms of the compliance level expected of global corporations. To respond to the demands of the international community, we have expanded our compliance division and strengthened our internal compliance system. In addition,

recognizing the importance of establishing a compliance system that encompasses Group companies inside and outside Japan, JGC maintains close coordination with the persons responsible for compliance in each company, and improves regulations and shares information to enable the development and operation of an efficient system for the entire Group.

## Disclosing Company Information

JGC discloses information in accordance with the statutory disclosure system, based on the Japanese Financial Instruments and Exchange Law. In addition, in accordance with the timely disclosure system at Japanese financial instruments exchanges, JGC promptly discloses important company information through its Public Relations & Investor Relations Department. JGC also proactively discloses corporate information falling outside the scope of such regulations and system through news organizations and other media, in cases where it determines that disclosure is desirable.

# Risk Management

## Business Continuity Plan (BCP)

JGC does not have production facilities such as manufacturing plants, and it conducts its business with employees, a sophisticated ICT infrastructure, and offices. Consequently, JGC's Business Continuity Plan (BCP) consists of three pillars: (1) Early confirmation of employee safety, (2) securing of ICT infrastructure, and (3) securing of office safety.

### (1) Early confirmation of employee safety

In 2004, in advance of many other companies, JGC introduced a Safety Confirmation System for its employees. At present, the scope of the system has been extended to include not only regular employees, but also temporary staff and contract employees who work at JGC. In addition, for a quick confirmation of employee safety, an emergency liaison network has been established as a backup in each department.

### (2) Securing of ICT infrastructure

JGC was the first company in the Japanese engineering industry to obtain ISO certification (ISO 27001) in 2006 for its information security management systems. Server operation and management, user authentication management, Internet operation and management including e-mail, management of communications infrastructure such as LAN/WAN, and other components of our IT infrastructure are tested through emergency drills every year, and they benefit from feedback to constantly evolve while supporting our business.

### (3) Securing of office safety

In 1997, JGC transferred its office to its current location, a new building located in the Minato Mirai district of Yokohama. Designed to meet earthquake-resistant specifications exceeding the new earthquake resistance standards under the revised Building Standards Act, the building suffered almost no damage from the tremors of the Great East Japan Earthquake. Stockpiles of food and supplies are also kept on hand at all times, to provide additional support and security for workers at the Yokohama office in the event of an emergency.

## Security Management Section

JGC employees and executives make approximately 3,500 overseas business trips per year, and approximately 300 JGC personnel are stationed overseas at any one time, in about 20 different countries. Therefore, JGC has established a Security Management Section available on a 24-7 basis to cope immediately with any risks employees stationed overseas might face, including political turmoil, war, terrorism, kidnapping, accident, and sickness.

The Security Management Section has two operating patterns: Crisis Management Operation and Preventive Operation, as follows.

### (1) Crisis Management Operation

A range of measures are implemented based on the risk level in a given area, according to the Basic Rules for Risk Management.

\* Examples: business trip cancellation, temporary evacuation, etc.

### (2) Preventive Operation

- 1) Collection and communication of risk information:  
issuance of situation-specific reminders and warnings  
\* Methods: company intranet and e-mail messages to individual employees
- 2) Personnel stationed overseas and persons on business trips: coverage through the Business Trip Management System
- 3) Safety education for personnel bound for risky areas
- 4) Creation of manuals, guidelines and security standards



Countries and regions visited by JGC executives and employees on business trips up to fiscal 2011

# To be the Top in HSE

Initiative to be No.1 in Health, Safety, and the Environment



## Pearl GTL Project (Qatar)



Here in Qatar, the largest gas producer in the Middle East, JGC was responsible for the construction of the GTL production unit at the Pearl GTL Project, for Qatar Shell GTL Limited. The GTL production unit is one of the plant's core facilities. Early in the morning, while the construction site was still in darkness, JGC project management staff were already performing walk-arounds and verifying work locations for the day. When local workers arrived, JGC project management staff greeted them with "Good morning, let's complete another day of safe work today," and sometimes with handshakes. After all workers had gathered, specific precautions regarding the day's work and explanations on ensuring safety were given, and then lively exchanges of opinion began between JGC project management staff, subcontractor supervisors, and workers.

Such activities implemented in the Pearl GTL Project were part of the measures introduced by JGC to raise awareness about Health, Safety, and the Environment (HSE) on site.

EPC makes up the core of JGC's business, but recently, HSE requirements imposed by clients on EPC contractors have become increasingly sophisticated, with participation strongly demanded not only at site level, but also at management level. In this context, JGC is striving for strict health and safety management in line with its Health and Safety Basic Policy, aiming to become the "No.1 HSE contractor in the world." We are also working to extend these efforts to our subcontractors, as well.

## Incident- and Injury-Free Record Achieved for 72.9 Million Hours

Every day, more than 10,000 workers of various nationalities and languages are active on a construction site at a given time. Because risk is inherent in many operations, such as work in high places and installation of large machinery, one of the primary objectives of project execution is to ensure safety in construction work.

At peak times, the Pearl GTL Project was slated to mobilize over 50,000 workers from more than 60 countries to the construction site, making safety an issue more important than ever. As the project leader, JGC had implemented the Incident- and Injury-Free (IIF) concept to take the lead in raising safety awareness among workers and promoting safety activities in construction work. Using two slogans, "Everyone Goes Home Safe" and "Caring for Each Other," IIF activities help build a safety culture based on the principle that safety cannot be coerced, but must arise from a transformation of individual attitudes, when everyone makes safety a personal choice.

On the construction site of the Pearl GTL Project, all project participants worked together to improve and raise safety awareness. Among other efforts, JGC project

management staff took the initiative by communicating with local workers to familiarize them with all aspects of safety, and a mechanism was built to promote communication between workers. As a result of these efforts, the Pearl GTL Project achieved the longest IIF record ever set by JGC, with 72.9 million hours. Clients also strongly commended JGC for its attitude toward safety in construction work and the results achieved.

## JGC's HSE Activities Expand Worldwide

A number of global companies dedicated to improving occupational health and safety in resource development and construction sites heard about JGC's efforts for the Pearl GTL Project. Many management executives from these companies came to visit the site and gave JGC accolades for its initiatives.

Drawing on the experience of the Pearl GTL Project, JGC introduced IIF activities in other projects, including the Integrated Gas Development (IGD) Project in Abu Dhabi and the Donggi-Senoro LNG Project in Indonesia. The improvement of the IIF record was a tangible result

### Efforts in the Integrated Gas Development (IGD) Project (U. A. E.)



1 To increase safety awareness, all workers shout together "Go Home Safely" during the morning meeting. 2 JGC project management staff walk through the site for proactive communication with workers. 3 . 4 Workers who maintained a high awareness of safety were actively recognized.

of the active contribution to safety made by JGC project management staff, and efforts to deepen communication between JGC project management staff, area supervisors of subcontractors, and local workers. JGC is now working on disseminating best practices to other overseas and domestic sites, and trying to use them to improve the quality of construction work and accelerate construction progress.

### Aiming to become a No. 1 HSE Contractor

Every year, JGC holds an HSE Conference hosted by the President. About 120 persons participate in this conference, including project managers, the President, and other corporate officers. The purpose of the conference is to share information on measures for strengthening health and safety and prevent accidents (see P21). In addition, HSE moments, five-minute lectures given on HSE matters by officers, are given at the opening of every meeting of the Operations Steering Committee, which is attended by top management, officers, and executives. The purpose of the HSE moments is to increase HSE awareness among

JGC management, to encourage management to take the lead in addressing HSE matters (see P20).

In addition to overseas construction sites, JGC is also actively expanding safety measures to prevent traffic accidents at overseas offices and bases (see P21). JGC is aiming to spread our safety culture and educational activities throughout the whole JGC Group, including the subcontractors we work with. Everyone stationed at overseas locations, from top management to regular employees, is working to help achieve our objective of becoming a No. 1 HSE contractor, and fulfilling our responsibility to society.



1 Names are displayed in a visible location so that local workers can call each other by their names and build community. 2 We have developed the “Shake Hands Campaign” to increase mutual consideration among all persons involved with site work. 3 With mutual contact, community-building also takes place during the morning meeting. 4 JGC project management staff actively talk to workers to raise their awareness of the importance of safety.

# Project

## Health, Safety, and Environment Concerns in Project Activities

The JGC Group executes services around the world in business sectors ranging from resource development, oil, natural gas, and petrochemicals, to chemicals, pharmaceuticals, water treatment, new energy, and the environment. In all of its projects, the Group constantly strives to fully consider Health, Safety, and Environment (HSE) concerns. Consideration for HSE is indispensable not only for plant EPC (engineering, procurement, and construction services), but also for marketing and all stages of project execution, from feasibility studies to maintenance, plant decommissioning and projects other than EPC services such as investment and service businesses. The JGC Group strives to help create a sustainable society by combining its engineering and project management capabilities with advanced consideration for HSE.

### **JGC aims to be the No. 1 contractor in HSE.**

**We aim to faithfully fulfil our social responsibility by considering HSE in every aspect of our business.**

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#### ○ **Aiming to Be a No. 1 HSE Contractor**

In recent years, the interest of operators and society in HSE as it relates to the design, construction, and operation of large-scale facilities such as energy plants has risen. Requirements on contractors have become more stringent. JGC aims to maintain the trust of its clients and fulfil corporate social responsibility by becoming a No. 1 HSE contractor.

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#### ○ **Combining Economic Efficiency with HSE at a Higher Dimension**

In large-scale plants, factors such as operating stability and ease of maintenance significantly affect economic efficiency during operation. JGC constantly strives to provide plants that combine economic efficiency with consideration for HSE. With the understanding and cooperation of our clients, who are also operators, we provide plants that meet our own high HSE standards as well as legal requirements and the needs of the client.

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#### ○ **Balance of Long-Term and Short-Term Perspectives**

Energy and infrastructure facilities in operation around the world, even those which make full use of the latest technology, all have an impact on the environment over the long term. Parties responsible for the concepts, detail specifications, and construction of these facilities must make a prior assessment not only of short-term economic feasibility, but also long-term environmental impacts. By making sure all parties involved understand the essence of HSE and overall optimization, plants can be built that will meet with the approval of clients and society. JGC is keenly aware of the need for both short-term and long-term perspectives and aims to be a company that achieves a good balance between the two.

# Health, Safety, and Environment Consideration at Every Stage of EPC (1)

In this section, we report on specific examples of the JGC Group's consideration for the environment at every stage of plant construction and other EPC services.

## The Workflow of the JGC Group's EPC Services



EPC: Engineering, Procurement, Construction

### In Marketing

Achieving balance between generating a stable energy supply and protecting the natural environment is a critical issue facing the human race. In recent years, there is a global trend moving away from using coal and oil as the primary source of energy and toward expanding the use of natural gas, which has a lower environmental impact.

To respond to the global need for an environmentally friendly energy supply, the JGC Group is actively marketing our experience with gasoline and light gasoline desulfurization facilities, heavy oil upgrading, liquefied natural gas (LNG) plants, and Integrated Gasification Combined Cycle (IGCC) facilities. In addition, we are offering our services to emerging countries in particular, to help them respond to their expanding needs for energy and social infrastructure in the face of their rapid economic growth. We have also been extensively marketing solar photovoltaic and solar thermal power generation projects, mainly in the Middle East and North Africa, and water business projects (sea water desalination, water treatment and wastewater treatment projects), in response to the increased global demand for water.



LNG plant (Indonesia)

### In Feasibility Studies

We consider many matters at the feasibility study stage, including market analysis, potentially useful technology, systems capabilities, facilities configuration, construction and operation cost analysis and financial arrangement. When configuring facilities, we take environmental consideration into account, along with regional characteristics and safety. We also consider secondary environmental impacts, such as whether waste disposal facilities are available in the region, or whether any transportation-related problems exist.

### In Basic Planning (FEED)

Basic engineering specifications of plant construction are decided at the Front-End Engineering Design (FEED) stage. At this stage, the JGC Group draws up specifications reflecting comprehensive consideration of plant construction costs, safety, operation costs, environmental impact, and other factors. In these specifications, the JGC Group makes use of its own technology for energy conservation and effective energy use.

During FEED, we measure the overall thermal balance of the plant and propose energy conservation and efficiency improvement measures, including "pinch technology" for optimization of heat recovery and use, aero-derivative gas turbines for power generation facilities, and combined cycle power generation. We also work to actively mitigate damaging environmental impact by reducing CO<sub>2</sub> emissions, and considering measures such as waste heat recovery maximization and flare gas emissions reduction.

# Health, Safety, and Environment Consideration at Every Stage of EPC (2)

## The Workflow of the JGC Group's EPC Services



EPC: Engineering, Procurement, Construction

### In Basic Engineering and Detailed Engineering

This is an essential stage of the engineering process, during which the basic design concept is optimized based on consideration of the life cycle of the plant. At this stage, we analyze realistic, practical measures for minimizing impacts on health, safety, and the environment that could arise during construction and operation. These measures are then reflected in the basic and detailed engineering (equipment specification) decided at this stage.

For example, plants must be designed so that gas and liquid emissions will meet legal standards, but we also consider means to further minimize minor emissions. Every possible source of emissions is identified and the volume of discharge estimated. This includes not only stacks, vents etc., but also possible leaks from valves, flanges, or gases discharged during maintenance operations. We also review the basic engineering from the standpoint of either avoiding or reducing emissions, for example by making the operation of the plant more efficient or reusing its exhaust heat and wastewater. In addition, we determine optimal engineering specifications for every source of emissions by selecting low-emission valves and other such equipment.

#### Consideration at Engineering Stages

##### An Example of Emissions Minimization

To secure cooling water for a new plant in the Middle East, JGC was conducting a comparative analysis to determine whether to adopt cooling towers using seawater or open circulation cooling towers using fresh water. Given the necessity to introduce seawater desalination equipment to produce pure water for the plant, JGC decided first to use this equipment for both cooling water and producing pure water. Then, taking into consideration the cost and environmental load, JGC adopted open circulation cooling towers using fresh water as coolant for minimum water intake and wastewater volume. With these choices, we were able to deliver a highly efficient system to the client.

### In Equipment and Materials Procurement

The JGC Group also encourages the materials and equipment vendors with whom we do business to adopt a proactive stance on ensuring safety and environmental conservation, including the protection of biodiversity.

Though transactions with vendors previously required a large volume of paper documentation, we have now switched to digital documents with our in-house JGC e-Procurement Solution System (J-PLUS). This system is environmentally friendly and has improved work efficiency by reducing the use of paper forms. After purchase order finalization, interaction with vendors at the detailed engineering stage has been computerized using J-PLUS P for the same purpose, resulting in a virtually paper-free work environment.

For JGC, reinforcing the initiatives taken by vendors to improve safety practices is not only essential for human safety, but also for quality control and on-time delivery of equipment and materials. Consequently, JGC encourages vendors on a regular basis to implement Safety Moments\* and reinforce traffic safety initiatives.

\*Safety Moments refer to the practice of offering safety-related topics at the opening of business meetings before bringing up the main subject. The objective is to raise safety awareness among participants by giving them an opportunity to think about and discuss such topics.

## In Construction Planning

Meticulous concern for sustainability at plant construction sites is essential.

In many countries, construction of new plants requires submission of an environmental impact assessment (EIA) report for the purpose of understanding what impacts the construction has on the environment of the construction site and minimizing those impacts as much as possible. The EIA report describes in detail impacts that construction work will have on the air, water, soil, flora, fauna, and marine life, and it also details measures that can be taken to counter them.

JGC applies environmental management systems to construction work to ensure that we demonstrate environmental consideration in compliance with EIA reports, emphasizing the following points.

- (1) We practice strict legal compliance and environmental risk management by identifying environmental laws and regulations and environmental considerations that have bearing on construction work.
- (2) We endeavor to increase client satisfaction and reinforce communication with stakeholders.
- (3) We manage environmental risks and endeavor to minimize the possibility of incidents which may have a negative impact on the environment by anticipating, preparing for, and speedily responding to emergencies.

Before starting construction work, we consider the above matters and unflinchingly perform the following preliminary work:

- (1) Identifying environmental impacts of the construction work
- (2) Setting environmental objectives and targets for the construction work
- (3) Preparing a Construction Environmental Management Plan for the construction work
- (4) Providing new workers with environmental education and training

We incorporate the Zero Emissions Initiative 2015, a JGC Group independent environmental conservation initiative, into this preliminary work, and thoroughly confirm environmental conservation measures before starting construction.

## In Construction

Construction work by JGC is preceded by thorough environmental consideration at the planning stage.

Matters laid out in the Construction Environmental Management Plan include project environmental policy, the organizations and persons responsible for environment-related work, environmental protection measures, environmental performance monitoring and measurement, regular testing of emergency prevention and relief procedures, monthly reporting, etc. Following the start of construction, a review of environmental aspects of the project (the relationship between construction work and the environment) is conducted to confirm whether the construction work differs from the plan. If any differences are found, the plan is revised to ensure that there are no omissions in environmental consideration in the environmental management framework.

### Environmental Conservation Initiatives in the Operations of JGC Energy Development

JGC Energy Development (USA) Inc. ("JEDI") has been operating an oil and gas field (Little Lake Field) in the State of Louisiana since 2007. In addition to the production of oil and gas, JEDI also conducts drilling operations.

In its operations, JEDI adheres to the regulations of the Federal Government, Louisiana's Department of Natural Resources (DNR), and Department of Environmental Quality (DEQ). It also implements environmental conservation initiatives that include environmental measures based on its own internal regulations.

Because the Little Lake Field is located in a lake region of Southern Louisiana, where many fishermen live, the greatest care must be taken to prevent oil leaks into lakes. The field has been producing oil since the 1950s, before JEDI's acquisition of a working interest, and consequently, production facilities have been aging. However, since it became an operator in 2007, JEDI has renewed the existing facilities as it was drilling new wells, and by taking appropriate measures when necessary, it is doing its utmost to prevent oil leaks from occurring.

Should any oil pollution occur, arranged response measures are always available. They include steps to stop the source of pollution, reports to concerned parties, deployment of a boom (containment) to prevent the pollution from expanding, and mobilization of a pollution control operator. So far, no major problem or defect has been pointed out during the annual on-site inspections carried out by the U.S. Coast Guard.

After the occurrence of oil pollution caused by Hurricane Katrina in 2008, the U.S. Coast Guard also commended JEDI for the preciseness of its swift response, which prevented the pollution from expanding.

# Health, Safety, and Environment Consideration at Every Stage of EPC (3)

## The Workflow of the JGC Group's EPC Services



EPC: Engineering, Procurement, Construction

### In Maintenance

Rigorous HSE risk assessments by specialists are conducted in the engineering phase for various industrial plants, and risk mitigation measures determined to be necessary are borne out in the engineering and construction work. However, over years of plant operation, facilities age and operating conditions or feedstock composition may change. In some cases, chemical substances not assessed as risks at the time of construction become recognized as health risks. In recent years, the necessity of the regular and timely reassessment of HSE risks that may potentially increase over the course of long-term plant operation has long been advocated and plant operators recognize the need for this as well.

Utilizing its ability to act as a third party with the latest technology, knowledge, and ability to supply needed resources to plant operators, the JGC Group actively supports plant operators in conducting HSE risk assessments at operating plants, recognizing the importance of thorough maintenance operations. Accidents at energy industry facilities obviously carry an inherent risk of becoming worst-case scenarios. The JGC Group offers maintenance services with full consideration of these needs and risks.

### Considerations for Maintenance

#### HSE Risk Assessment in Existing Plants

When plants have to undergo successive upgrades because of their age, environmental and health standards initially set as requirements when the plants were built become often difficult to maintain. Aiming at improving the environmental performance and safety of aging plants, JGC offers HSE risk assessments and support services. We conduct surveys during plant operation and identify problems through HSE-specific examinations. Taking advantage of the experience we have gained from numerous plant construction and maintenance service contracts, we offer realistic propositions that bring significant improvements.

### In Facilities Decommissioning

JGC also strives to minimize environmental impacts in dismantling work.

For example, in the course of several hospital construction projects and pharmaceutical laboratory renewal projects, we use construction drawings and sample analysis to confirm the presence or absence of harmful materials that include asbestos dust, PCBs, chlorofluorocarbons, mercury, lead, and other substances before dismantling facilities or existing buildings. We seek to minimize environmental impact by preventing asbestos contamination, as well as recovering and decomposing chlorofluorocarbons etc.

We measure asbestos particle concentration in the air before, during, and after construction and confirm that asbestos had not been dispersed outside the work area. In addition, we work on preventing occupational accidents and diseases by giving every consideration to the health and safety of workers. Measures taken include risk assessments, special health checks, wearing of personal protective equipment such as fully protective masks, and

use of adequate dust control in working environments.

When dismantling structures, we also strive to minimize the impact on nearby residents by using low-vibration and low-noise construction machinery, and constantly monitoring operations through vibration meters and noise meters.

In an effort to reduce the processing volume of industrial waste generated during decommissioning, we dismantle each type of waste separately and promote waste recycling and reuse. In this way, we have achieved a recycling rate of 100% for concrete and asphalt. We use industrial waste control manifests to ensure appropriate treatment for industrial waste at every stage up to final disposal.

#### Consideration during Engineering and Construction of Pharmaceutical Plants

##### Engineering System for Environmentally-Conscious Facilities

During the engineering and construction phases for large pharmaceutical plants, laboratories, or hospitals, one major issue is to control their huge energy consumption and mitigate the environmental impact of the facility while securing its necessary functions. When designing and constructing buildings, air conditioning and electrical facilities, JGC uses optimization technology and assessment systems for low-carbon air conditioning and electrical systems, providing owners (operating companies) with facilities that can be operated in an environmentally-conscious manner.

#### Introducing “HSE Moments”

Since September 2010, JGC has introduced “HSE Moments,” five-minute lectures given by a participant officer at the opening of meetings of the Operations Steering Committee, which are attended by officers and executives. The purpose is for management to take the lead in addressing HSE matters, in consideration of JGC’s aim to be a No. 1 HSE contractor.

Various topics were covered in fiscal 2011, including “Safety Risks and Measures during the Final Phase of Construction Work,” “Environmental Impact of Shale Gas Development,” and “Legal Status of Bicycles and Penalties in Case of Accident.” A wide range of topics, such as issues closely related to work and subjects that arouse intellectual curiosity, are chosen to heighten HSE awareness at JGC.



HSE Moments

#### Management and Control of Hazardous Chemical Substances

In overseas construction sites, we use the management system Control of Substances Hazardous to Health (COSHH) as part of our HSE efforts. COSHH is a framework of safety practices that include obtaining in advance the Material Safety Data Sheets (MSDS) of materials to be used, creating registers of harmful substances, and working to prevent the potential hazards posed by these substances. An MSDS contains safety guidelines for a given chemical substance, including information on hazards, storage methods, handling methods, which personal protective equipment should be worn when handling the substance, warnings regarding routine or non-routine use, recommended first aid measures in case of direct contact, emergency measures in case of soil contamination after accidental spillage, disposal of waste products after use, and so on. Before any operation, JGC conducts a special training session based on MSDS data for supervising staff and all workers involved, to ensure a comprehensive safety management system.



Handling of chemical substances



Hazardous substance storage area

# Occupational Health and Safety

In accordance with our Health and Safety Policy, JGC conducts health and safety management covering the JGC Group companies and business partners. Above all, we focus on the prevention of occupational accidents at construction sites.

## HSE Organization

The HSE Committee deliberates on important safety matters for the entire Group. It also reports to the Operations Steering Committee, which is chaired by the President. Matters decided by the HSE Committee are promptly acted upon by the various company divisions.

An audit group appointed by the chairman of the HSE Committee conducts health and safety audits at principal construction sites in Japan and overseas, and reports the audit results to the Operations Steering Committee.

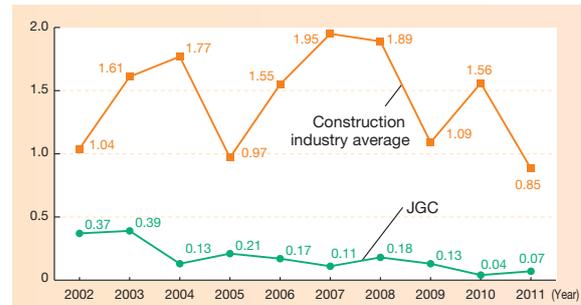


HSE Organization

## Safety Performance

As a result of continuous implementation of group-wide health and safety improvement measures, our incident rate\* (ILO method) has remained at around 0.2 for the past ten years, a lower level than the average incident rate of 1.5 for the construction industry as a whole. In addition, specific annual Total Recordable Injury Rate (TRIR) targets have been set for domestic and overseas projects, with monthly status of achievement circulated within the company to raise the awareness of safety. The TRIR is a workplace safety indicator that includes the number of cases of accidents without first aid cases. For fiscal 2011, JGC's TRIR for domestic projects was 0.60 against a target of 0.60 or below, and 0.10 for overseas projects against a target of 0.18 or below.

\* The incident rate expresses the occupational accident frequency as the toll of occupational accidents per million hours worked.



Comparison between the Incident Rate at JGC and in the Japanese Construction Industry (ILO Method)

## HSE Conference Hosted by the President

Every year in July, JGC holds an HSE conference hosted by the President. Approximately 120 corporate officers, project division heads, project department heads, project managers, and construction managers participate in the conference. Following the President's opening speech and the Zero-Accident Award Ceremony, presentations are given on a variety of safety themes, and are followed by group discussions. Through the conference, JGC seeks to enhance the health and safety awareness of officers and employees and demonstrate the leadership of the top management in HSE matters.

### Consideration for Worker Safety

#### Measures for Traffic Accident Prevention

JGC is strengthening its measures to prevent traffic accidents at overseas sites and bases. In fiscal 2010, we introduced a thorough set of guidelines for management of vehicle operation, including the Seven Golden Rules for accident prevention, a traffic safety management system, and the In-Vehicle Monitoring System (IVMS). We also revised the guidelines for the prevention of traffic accidents overseas. In addition, to continuously monitor the status of traffic safety measure implementation at overseas sites and bases, JGC's management conducts traffic safety audits and mandates the submission of Monthly Traffic Safety Reports and semiannual reports.

# Environmental Consideration in Investment Projects and Research & Development

In this section, we report on the environmental conservation measures we take regarding our investment projects, and regarding the research and development that supports our engineering business.

## Enterprise Investment Business

The JGC Group, in addition to being involved in the EPC business, is also involved in numerous investment projects as a strategic equity partner. Investments include infrastructure projects (desalination and power generation), renewable energy projects (solar thermal and solar photovoltaic power generation), resource development projects (for oil, gas, and other resources), CDM projects, new energy development projects, as well as environmental catalyst and fine chemicals manufacturing projects.

As a general rule, in the enterprise investment business, we keep the following objectives in mind:

- Development of social infrastructure
- Environmental improvement on a local or global scale
- Improvement in energy use efficiency
- CO<sub>2</sub> reduction and utilization of natural energy

In investment projects, from the feasibility study stage onward, we abide by the environmental regulations of the country or region, as well as the environmental standards set down by the World Bank Group. In our current desalination and power generation projects, we are performing detailed environmental impact assessments, and are working in compliance with the aforementioned environmental standards and regulations.

The JGC Group makes investments with the belief that environmentally considerate projects increase corporate value for the JGC Group and for our business partners.



Concentrating Solar Power project (Spain)

## Research and Development

JGC conducts research and development, principally testing, at our Research and Development Center in Oarai, Ibaraki Prefecture.

At the Research and Development Center, we treat wastewater generated as a by-product of the tests we conduct by filtering, adsorption, and neutralization, in strict compliance with voluntary management criteria as well as relevant laws, ordinances and regulations. We dispose of treated water in accordance with environmental standards. In controlled areas where we use radioactive isotopes, we strive to reduce the amount of test waste liquid and hand washing wastewater generated. We treat these liquids and wastewater by ion exchange, filtering, adsorption, and concentration, and recycle them within the controlled area. Under no circumstances do we discharge this water outside the controlled area.

Furthermore, we release exhaust from the controlled area after filtering it through a high-performance HEPA filter, with continuous monitoring to confirm that it complies with emission control standards.

We aim to reduce the amount of industrial waste generated within the Research and Development Center, and we separate and dispose of waste in compliance with industrial waste disposal standards.

In addition, to support safety management and help prevent accidents, the Research and Development Center's Safety Committee conducts monthly patrols to identify hazards and provide guidance for improvement of safety protocols. Moreover, written plans must be submitted to the Committee before the beginning of new research operations. The Committee then deliberates on the contents of the operations from the standpoint of safety, to provide sufficient accident prevention measures.



Research and Development Center (Oarai, Ibaraki Prefecture)

# Management

## Environmental Consideration Based on Environmental Management

The JGC Group develops its business while aiming to create sustainable local communities and protect the global environment. The specific environmental factors we take into consideration in the process of the business development are detailed in the previous section, “Project—Health, Safety, and Environment Concerns in Project Activities.” JGC also strives to improve the way we address environmental issues through the continuous improvement of our Environmental Management Systems (EMS).

### To realize our Environmental Policy, we promote the reduction of environmental impacts throughout all business activities.

In addition to quality and cost, clients in recent years have been placing more emphasis on construction safety and environmental considerations for facilities in operation or currently under construction. This trend is not limited to JGC’s clients alone, but is developing worldwide. JGC has long emphasized HSE in plant construction. We have established a HSE Committee chaired by a Director and deployed a company-wide HSE policy while balancing client requirements with social and economic needs as an engineering company. Under the leadership of the HSE Committee, several relevant departments are in charge of overseeing concrete operations through mutual cooperation.

<b>Quality Assurance, Safety &amp; Environment Office</b>	<b>HSE Systems Department, Engineering Division</b>	<b>Construction Department, International Project Division</b>	<b>Construction Management Department, Industrial &amp; Domestic Project Division</b>
Management of and guidance on general HSE matters	In charge of HSE in engineering for each project, from basic planning to part of construction planning	In charge of HSE regarding overseas construction projects	In charge of HSE regarding domestic construction projects

In addition, HSE Committee members from each Division continuously conduct routine HSE activities in offices. In this way, the JGC Group’s management recognizes that raising the awareness of HSE management within the company is essential, and takes the lead in implementing it. To document its environmental management systems, JGC has also established an Environmental Manual in 2003 in accordance with ISO 14001.

# The JGC Group's Environmental Management

In the context of growing interest in regulations, environmental issues, and sustainable development, JGC has set forth the following policy regarding its environmental performance.

## Environmental Policy

JGC, as a professional engineering contractor, is committed to achieving environmental excellence in both its corporate operations and the services it renders its clients. To meet this commitment, JGC has hereby established the following principles, which shall be applied throughout its operations.

- We shall endeavor to preserve the natural environment through the prevention of pollution and the conservation of energy and natural resources.
- We shall provide our clients with technical solutions that conserve energy and natural resources, and reduce pollution and other adverse environmental impacts.
- We shall fully comply with both environmental laws and regulations, and the environmental requirements of our clients.
- We shall reduce the production of waste through measures that emphasize reuse and recycling.
- We shall apply the following specific principles to the execution of our EPC projects:
  - Engineering Phase:  
We shall reduce the adverse environmental impacts of completed plants by minimizing the energy and resource consumption of each plant, and minimizing emissions and waste production.
  - Procurement Phase:  
We shall give preference to vendors that adopt environmentally-friendly manufacturing practices.
  - Construction Phase:  
During construction, we shall endeavor to minimize emissions, adverse impacts on the surrounding environment, energy and resource consumption, and waste production. Furthermore, we shall ensure that our subcontractors adopt work practices consistent with this principle.

To ensure the thorough, consistent and effective implementation of this policy throughout our operations, JGC shall establish, maintain and continually improve a corporate Environmental Management System in conformance with ISO 14001.

**Koichi Kawana**  
President of JGC Corporation  
1st July 2011

### Engineering is in Essence an Activity that Contributes to Environmental Conservation

JGC's engineering business, which involves providing engineering, procurement, and construction (EPC) services for oil and natural gas production plants, is intrinsically related to environmental conservation. Since the 1960's, JGC has been grappling with environmental issues in its capacity as an engineering company. We remain keenly aware that our business activities in and of themselves must contribute to environmental conservation, and we declare that awareness in the JGC corporate philosophy. We have tested various

innovations aimed at improving environmental efficiency over the course of the EPC process, and won accolades from clients for our efforts.

In enterprise investment, a new sector outside of the EPC business, JGC is expanding further the scope of our activities contributing to environmental conservation. We also continuously work to reduce environmental impacts, including CO<sub>2</sub> emissions, at our construction sites and at our head office.

# Environmental Objectives, Targets, and Achievement

In accordance with our Environmental Policy, JGC strives for continuous improvement of our environmental management systems by setting environmental objectives and targets, and measuring and assessing achievement as shown in the table below.

## ● Fiscal 2011 Results and Fiscal 2012 Improvement

E: Completely implemented G: Extensively implemented NG: Not yet implemented  
 ↷: Substantial modification of environmental improvement measures  
 →: Continuation of environmental improvement measures

Activity objective	Fiscal 2011 results	Assessment	Initiatives for fiscal 2012	Improvement
Implementation of the Zero Emissions Initiative 2015	<ul style="list-style-type: none"> <li>• CO<sub>2</sub> Emissions reduced to Kyoto Protocol level.</li> <li>• Soil pollution from leaks reduced to almost zero.</li> <li>• Zero industrial waste: objective achieved.</li> <li>• Environmental investment</li> </ul>	G	Continuing Zero Emissions Initiative 2015	→
Environmental targets	In departments that provide supervision/guidance, setting of environmental targets directly linked to original business, promoting of linkage with quality management systems.	G	Continuing promotion of environmental improvements directly linked to original business	→
Strengthening of internal auditing	Implemented at all overseas sites. (Currently implemented 16 times in total.) Score: 78 points (target: 77 points)	E	Planning for multiple implementation at all overseas sites (To be implemented 30 times in total.) Target: 78 points	↷
Strengthening initiatives for biodiversity	Initiatives for biodiversity directly linked to original business (expansion also at overseas sites and in Group companies.)	G	Continuing promotion of biodiversity initiatives directly linked to original business	→

## ● Zero Emissions Initiative 2015 Environmental Performance (JGC sites in Japan)

Environmental indicators		Unit	Fiscal 2008	Fiscal 2009	Fiscal 2010	Fiscal 2011
1. Final disposal rate of industrial waste	Result (Target)	%	5.3 (11)	3.7 (7)	4.1 (4)	3.3 (3)
2. Number of leaks	Result (Target)	Leaks	0 (0)	2 (0)	1 (0)	0 (0)
3. Energy-related CO <sub>2</sub> emission units	Result (Target)	kg-CO <sub>2</sub> /hour	1.05 (1)	0.94 (1)	0.75 (1)	0.46 (1)

### Notes:

- Office activities** ... Regarding office activities, environmental performance has reached a satisfactory level that indicates saturation. Consequently, environmental improvements in offices are now implemented with environmental targets as operation and maintenance items.
- Project execution** ... Divisional environmental targets for project execution are set for environmental improvements in the original business and are matched to quality targets. Consequently, targets cover a broad range of division-

specific items, they are loosely linked to the quality management systems, and they produce steady results. (see P29)

- Group companies** ... Group companies also actively engaged in activities of the "Zero Emissions Initiative 2015" and obtained significant results in environmental improvement. However, because these companies conduct very diverse forms of business, summarized environmental targets are difficult to express, and for this reason they are not mentioned in this report.

## Promotion of the Zero Emissions Initiative 2015

Since 2008, as part of its corporate social responsibility, the JGC Group has enacted environmental improvements through the Zero Emissions Initiative, which details strategies for reducing the harmful by-products of JGC's business activities to zero. In 2011, with new targets set for the mid- and long-term in consideration for the development of our environmental business, we have renewed the initiative under the new title, "Zero Emissions Initiative 2015." The Zero Emissions Initiative 2015 covers the head office, the Research and Development Center, JGC construction sites in Japan and overseas, JGC Group companies in Japan and overseas, and domestic and international sales bases.

### • JGC Group Offices

Environmental improvements were promoted in offices by adopting an environmental target of a five-year average reduction of 1% or more in energy-related CO<sub>2</sub> emissions units.

### • JGC Domestic Construction Sites

Environmental improvement targets were quantified in three areas: final disposal rate, number of leaks, and CO<sub>2</sub> emission units. Although the target (3%) for the final disposal rate was not reached (3.3%), the figure was improved from last year (4.1%), while targets for the number of leaks and CO<sub>2</sub> emission units were reached.

### • JGC Overseas Construction Sites

Compared with domestic sites, overseas sites have different conditions for each site, which make it challenging to quantify environmental improvement targets. In this difficult context, in an operating environment that tends to lack sufficient recycling mechanisms, efforts were made regarding the use of valuable resources, rigorous reuse of materials, and prevention, preparation of treatment, and handling of oil leaks. In addition, internal HSE audits are conducted at all sites.

### • Efforts in Group Companies

Because these companies conduct extremely varied forms of business, they pursued independent efforts aiming at zero by-products, based on their respective business characteristics.

## HSE 2015 and Environmental Improvement Activities

After the start of our five-year medium-term management plan "New Horizon 2015" in 2011, the JGC Group has been promoting a new initiative, "HSE 2015," with the objective of becoming a "HSE No. 1 Contractor."

In accordance with the expansion of our business fields, and emphasis on Health, Safety, and Environment (HSE) in our policies, we do not limit the environmental improvement activities of "HSE 2015" to reducing immediate by-products (wastes, leaks, greenhouse gases). Medium- and long-term targets (2020, 2050) are also set, while "Environmental Efforts through Business Activities" are promoted.

The JGC Group has now renamed its environmental improvement activity "Zero Emissions Initiative 2015." To grow toward its vision, the JGC Group will accelerate its activities: Proposing, planning and implementing projects to respond to the needs of global environment conservation, and operating businesses and investing in them when necessary.



Poster for Zero Emissions Initiative 2015

# Environmental Report on Office Activities

JGC works on mitigating the environmental impacts of its office activities in line with the vision of Minato Mirai 21, where our head office is located. Minato Mirai 21 was conceived as a district developed with consideration for a more efficient use of energy, the needs of a recycling-oriented society, urban disaster prevention, and environmental friendliness.

## Efforts based on Minato Mirai 21 Urban Management

The Queen's Tower A building, which houses JGC's Yokohama World Operations Center, is located in Queen's Square Yokohama, a complex in the Minato Mirai 21 district in the Nishi Ward of Yokohama city. This area is being developed with consideration for a more efficient use of energy, the needs of a recycling-oriented society, urban disaster prevention, and environmental friendliness. Its urban management is based on the "Basic Agreement on Town Development under Minato Mirai 21." The efforts made by JGC to mitigate the environmental impacts of our office activities are also based on this concept, and they include reducing electricity consumption, heating and cooling consumption, CO<sub>2</sub> emissions, and waste, and increasing the recycling rate.

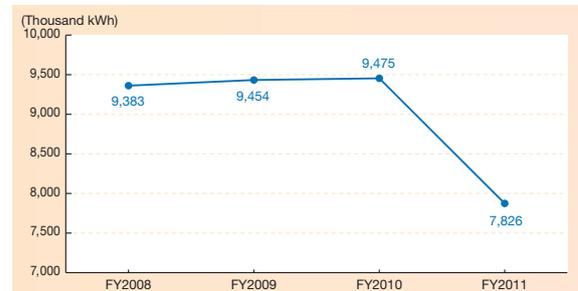


Minato Mirai 21 District

## Efforts to Reduce Electricity Consumption

In fiscal 2011, JGC significantly reduced its electricity consumption, decreasing it by 17.4% year on year, as a result of various activities implemented by the Queen's Square Yokohama Management Association to achieve a 15%-power saving goal. This goal was set by a ministerial ordinance for the restriction of the use of electricity, based on article 27 of the Electricity Business Act, to respond to power shortages caused by the Great

East Japan Earthquake. Concrete measures adopted to reduce consumption included significant cuts in the use of fluorescent lighting in office floors and elevators, reductions in the number of elevators in operation during daytime, maximized battery use on personal computers used by employees, and replacement of conventional bulbs by LED bulbs in part of the lighting fixtures.



Electricity consumption by JGC Yokohama World Operations Center (FY2008 - FY2011)

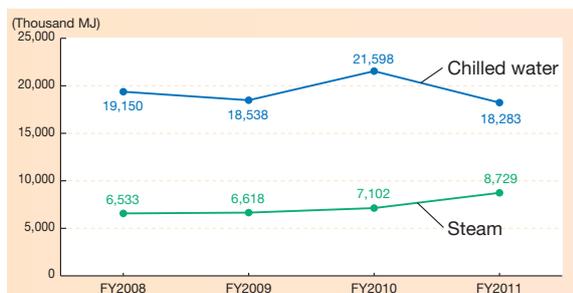


A sticker distributed to call for power-saving efforts by all employees in using personal computers

## Efforts to Reduce Heating and Cooling Consumption

For cooling and heating, the Minato Mirai 21 District adopts a District Heating and Cooling System designed for the efficient use of energy, with centralized production, provision, and management of heat, cold, and steam for necessary uses such as cooling, heating, hot water, etc. The air conditioning of the Queen's Tower A building, where JGC's Yokohama World Operations Center is located, receives all its heating and cooling through this system.

In fiscal 2011, the volume of chilled water necessary for heating and cooling regulation was reduced by 15.3% year on year, as a result of reductions in electricity consumption and heat generation, stemming from various energy saving measures implemented in offices. Because of low average temperatures during winter, the volume of steam necessary to heat the offices increased by 22.9% year on year. However, the total consumption of chilled water and steam decreased by 4.0% year on year.



Consumption of chilled water and steam by JGC Yokohama World Operations Center (FY2008 - FY2011)

## Efforts to Reduce CO<sub>2</sub> Emissions

The JGC Yokohama World Operations Center is a Type 1 Designated Energy Management Facility under the Act on the Rational Use of Energy (Energy Saving Act), and as such, we are legally obligated to report our CO<sub>2</sub> emissions. As a result of reductions in electricity, heating, and cooling consumption, CO<sub>2</sub> emissions decreased by 13.8% year on year.

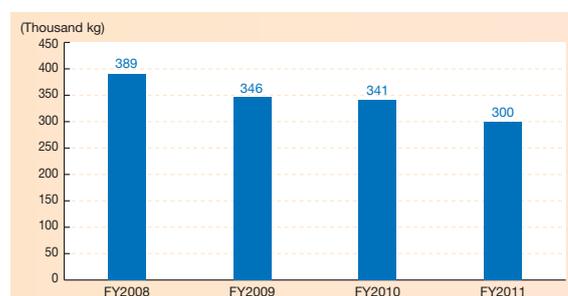


CO<sub>2</sub> emissions by JGC Yokohama World Operations Center (FY2008 - FY2011)

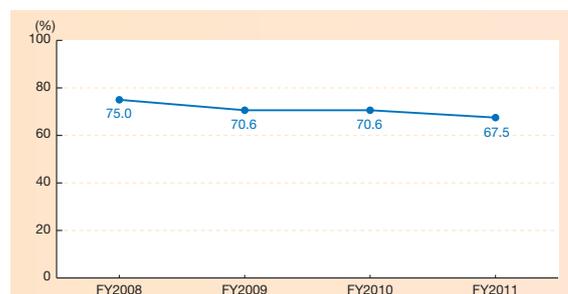
## Efforts for Resource Saving, Waste Reduction, and Recycling

In the Minato Mirai 21 District, all companies recycle used paper, bottles, and cans under a joint program to reduce waste and save resources. JGC's total volume of waste disposal by JGC decreased by 12.0% year on year. This was achieved by reducing the volume of paper consumed (volume of paper purchased) and promoting the digitization of various documents, which resulted in a 13.6% year-on-year decrease in general waste (for incineration) and a 11.3% reduction in waste for recycling. The recycling rate achieved in fiscal 2011 was 67%, a 3.1% decrease year

on year. A reduction in overall volume of waste, as well as the reduced disposal of recycled paper as a result of a reduction in volume of paper consumed (volume of paper purchased), seems to be the main cause.



Volume of waste disposal by JGC Yokohama World Operations Center (FY2008 - FY2011)



Rate of waste recycling by JGC Yokohama World Operations Center (FY2008 - FY2011)

# Continuous Improvement of Management Systems

In December 2003, JGC obtained the ISO 14001 certification from Lloyds Register Quality Assurance (LRQA). ISO 14001 is the international standard for environmental management systems. Since then, the certification has been renewed twice, and the audit required for maintaining it in fiscal 2011 was completed in September 2011, including at overseas sites.

## Environmental Improvement Activities in Line with Our Business

As environmental improvement activities at JGC's Headquarters tended to center on reducing waste, paper, and electricity consumption, our task was to shift this focus to activities that fall in line with our actual business. To accomplish this, with the participation of the heads of all divisions, we reviewed our methods for identifying opportunities for environmental conservation and our procedures for target setting. We reached a common recognition of the following points.

- While we solve environmental issues through our original business and aim for sustainable development in society, it is important to link these processes to the creation of corporate value and improvements in competitiveness.
- While concerns over environmental issues are rising worldwide, JGC is contributing directly and indirectly to solutions through its original core business. JGC recognizes sustainability as an issue it has to address in this particular business.
- Important points that JGC must consider to develop itself sustainably are as follows:
  - (1) Implementing adequate operation and maintenance to prevent environmental problems from arising in the future.
  - (2) Continuing to implement improvements to increase corporate profits, while giving consideration to environmental matters.

With this common recognition, JGC continuously makes a concrete review of the significance of environmental objectives and targets, and implements environmental

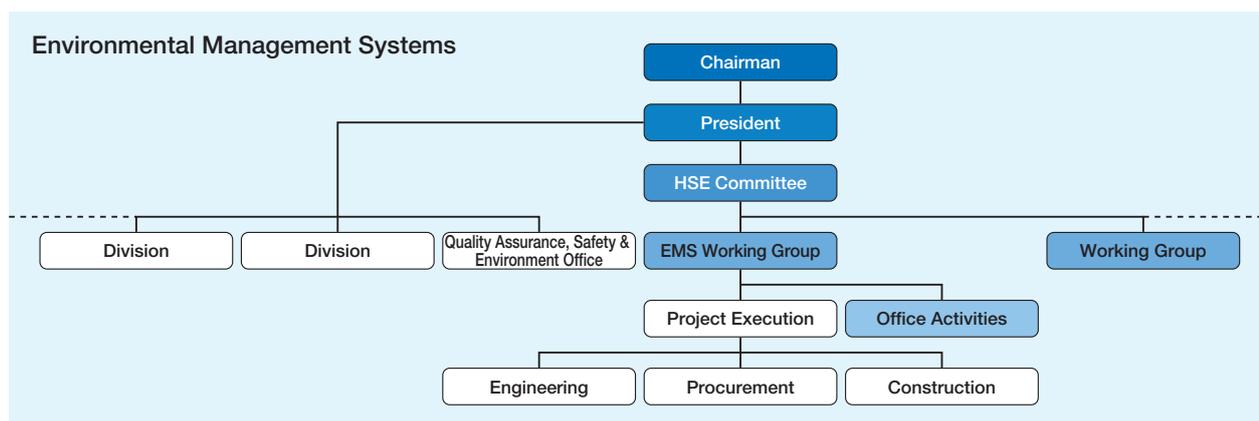
management activities from the following perspectives.

- Environmental management activities conducted with environmental objectives and targets are not separate from business, they are business.
- The operational policies of divisions and departments are determined for substantial performance improvements of the organization and its operations.
- Environmental targets and quality targets can be matched together.

In this way, JGC conducts environmental improvement activities in line with its original business, by loosely linking its environmental management systems to its quality management systems.

## Recycling of Construction Waste

JGC aims at minimizing final waste through the rigorous implementation of the "Zero Emissions Initiative 2015." In fiscal 2011, the final disposal rate of domestic construction projects was 3.3%. On every site, before contracting disposal to a provider of intermediate waste treatment services, we confirm its recycling rate with our own industrial waste surveys. In particular, because there are significant differences between contractors regarding the treatment methods and recycling rates of construction sludge, we carefully compare treatment methods and costs. Before starting construction, we also establish an adequate waste separation plan based on the characteristics of waste to be generated. In addition, through the rigorous separation of wastes in accordance with this plan, we seek to improve the recycling rate during construction.



# Technology

## The JGC Group's Environmental Technology

The JGC Group applies the knowledge we have acquired through years of experience with a wide range of engineering projects to various environmental businesses, including electric power and water projects and Clean Development Mechanism (emissions trading) projects. In this section, we report on how the JGC Group companies have put our environmental technology to use in contributing to environmental conservation efforts. These efforts include environmental clean-up projects, development of low-environmental-impact energy resources, and initiatives to realize a low-carbon society.

**Combining technology that enriches human standards of living with technology that protects the environment, JGC is working towards the realization of a sustainable society.**

In our global plant EPC business, JGC efficiently combines a wide range of elemental engineering technology while introducing proprietary processes when necessary. Although each kind of industrial plant we construct serves the purpose of improving our standard of living, plants may also have an impact on their surrounding environment in various ways. JGC has always worked to create the optimal plant both for clients and society, continuously striving to combine advanced performance with minimization of environmental impact. More sophisticated plant EPC technology can be translated to more advanced environmental conservation technology. In this way, JGC works to develop and promote diverse environmental technology that can be transformed into business solutions.

The JGC Group includes subsidiary and affiliate companies that operate in the EPC business, similar to JGC, as well as companies in the catalyst and fine chemicals business, and companies that provide process licensing, inspection, maintenance, and consulting services. In this section, we report on the new environmentally-friendly technology and mechanisms being developed by these group companies. Looking ahead to the next generation, the JGC Group strives actively to ensure that our development and introduction of new technology can contribute to realizing a sustainable society.

# Using JGC's Environmental Technology to Solve Difficult Issues

## CDM Projects in China

Clean Development Mechanism (CDM) emission-reduction projects are conducted as cooperative efforts between developing countries and developed countries. Emission reduction credits issued for CO<sub>2</sub> emission control and/or CO<sub>2</sub> absorption enhancement achieved by a given project are divided among the project participants. This system makes it possible for developed countries to apply emission reductions made in investment recipient countries toward the achievement of their own CO<sub>2</sub> emission reduction targets. JGC is participating in several CDM projects in China.

### 31.6 Million-ton greenhouse gas reduction from chlorofluorocarbon substitute gas recovery and decomposition

JGC, in partnership with Marubeni Corporation, has been executing the Juhua CDM project, the first-ever Japan-China CDM project. The objective of the gigantic project is to acquire Certified Emission Reduction (CER) credits through the recovery and decomposition of the greenhouse gas HFC23 at a chlorofluorocarbon substitute production plant in China's Zhejiang Province. The plant is owned by Zhejiang Juhua Co., Ltd. Greenhouse gas equivalent to 40 million tons of CO<sub>2</sub> will be reduced over a period of seven years. The decomposition facilities began operation at beginning of August 2006, and greenhouse gas reductions of approximately 31.6 million tons were achieved by May 2012.

### Acquisition of CER credits of 50,000 tons through residual heat power generation at cement plants

A second CDM project in which JGC is participating involves using of residual heat from cement plants to generate electricity that can in turn be used to power the plants themselves. JGC has undertaken the project in partnership with Huaibei Mining (Group) Cement Co., Ltd., and the plants are located in China's Anhui Province. JGC obtained CER credits for the equivalent of approximately 50,000 tons of CO<sub>2</sub> from the project by March 2012, and plans to obtain further credits for approximately 30,000 tons during fiscal 2012.

### Acquisition of CER credits of 420,000 tons through cement raw material substitution

China is the world's second-largest consumer of energy, and also accounts for 40% of the world's cement output. However, since many cement production facilities are outdated, China uses large quantities of limestone (calcium carbonate), which creates high levels of CO<sub>2</sub> emissions. Many Chinese cement plants also do not effectively utilize the surplus energy released during cement production.

JGC, in partnership with Elion Jidong Cement Co., Ltd. of the Inner Mongolia Autonomous Region, is currently involved in a cement plant CDM project that applies a new cement production method using a different raw material as a substitute for limestone. In conventional cement production, "clinker," the intermediate product, is produced using limestone as a raw material. In this project we use carbide residue (calcium hydroxide), a substance produced as a by-product at vinyl chloride production plants, as a substitute for limestone. In this new method, the by-product generated through clinker production is water vapor, not CO<sub>2</sub>. Therefore, the new method enables more than 80% reduction in CO<sub>2</sub> emissions from production processes, as well as effective utilization of carbide residue.

Through this project, JGC acquired CER credits for the equivalent of approximately 420,000 tons of CO<sub>2</sub> by March 2012, and plans to continue the project by 2017 to acquire the same of approximately 1,400,000 tons.



Elion Jidong Cement Co., Ltd. Cement Plant

### U.N. registration of a project for the recovery and use of coal mine methane and ventilation air methane

During coal mine operation, methane gas in the coal bed is recovered to ensure the safety of the miners. However, much of the recovered coal mine methane (CMM) is emitted into the atmosphere. In addition, the air in the mine tunnels also contains methane gas in extremely low concentrations (0.3% to 0.7%). This is known as ventilation air methane (VAM). Since methane gas has 21 times the greenhouse gas potential of CO<sub>2</sub>, the recovery and effective use of methane gas can contribute significantly to climate change mitigation efforts, and can also improve energy conservation. A VAM recovery project in Anhui Province in China, implemented by a partnership between JGC and Huaibei Mining (Group) Co. Ltd., was registered by the United Nations as a CDM project in October 2009. This project enables emissions reduction for the equivalent of approximately 45,000 tons of CO<sub>2</sub> per year. In addition, JGC obtained U.N. registration of another CDM project to recover CMM (annual reductions equivalent to 75,000 tons of CO<sub>2</sub>) in September 2010.



Coal mine VAM duct

### Medium- to Small-Scale LNG Plant Project

As the demand for energy continues to rise globally, and the development and production of shale gas continues to advance, many observers consider that natural gas will play an important role as a comparatively environmentally-friendly energy source to bridge the gap toward a renewable-energy-based, low-carbon society. The demand for liquefied natural gas (LNG) is expected to expand steadily in Japan and emerging countries such as China and India.

Recently, baseload LNG plants have tended to be large in scale because of investment efficiency considerations, leaving smaller gas fields undeveloped. JGC has contributed to the construction of more than one-third of the world's LNG plants. Making full use of the technology and knowledge we have accumulated in this field, JGC has developed a concept for an LNG facility model for medium- to small scale gas monetization (production on the scale of about one million tons LNG per year) that can ensure sufficient economic efficiency.

<Keywords of JGC's design concept>

- Low-cost**      Standardized design for reduced engineering cost
- Short delivery**      Ordering of preselected equipment and repeated orders of the same equipment for a reduced delivery time
- Compact**      Modularization of plant equipment for minimized construction work on site

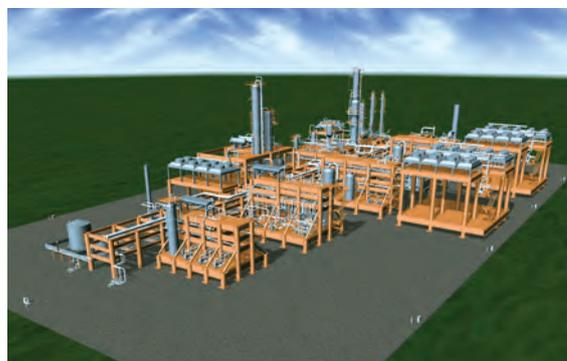


Image of completed 1.0 MTPA LNG plant

Through the application of this design concept, JGC contributes to developing projects using as-yet undeveloped small- to medium-sized gas fields into successful LNG operations. By using this generic concept the time from front-end engineering design to the plant start-up will be shortened to three and a half years, down from corresponding six to eight years for conventional LNG project development.

LNG is also gaining momentum in the U. S. and Europe as a clean fuel for the internal combustion engines of trucks and vessels, while new business models are under study, such as the LNG production of thousands to tens of thousands of tons per year from pipeline gas and its retail in LNG stations. By further developing its medium- to small-scale LNG plant concept, JGC will support the creation of this new LNG-based business chain.

# Using JGC's Environmental Technology to Solve Difficult Issues

## Development of an Efficient CO<sub>2</sub> Separation and Recovery Technology

JGC has developed the High Pressure Acid-gas Capture Technology (HiPACT) process in partnership with BASF of Germany. HiPACT is a technology for high-pressure recovery of the CO<sub>2</sub> in natural gas and synthesis gas. The technology makes it possible to greatly reduce the energy use and cost of CO<sub>2</sub> underground storage, and could help promote widespread use of Carbon Dioxide Capture and Storage (CCS).

After the completion of basic technology pilot testing at our Research and Development Center, JGC conducted demonstration testing of CO<sub>2</sub> recovery (40,000 tons per year) using actual natural gas at the carbon dioxide gas removal facility of INPEX Corporation's Koshijihara Gas Plant (Nagaoka City, Niigata Prefecture) in 2010. Now that testing has confirmed that energy reduction targets can be achieved, commercial applications are possible. Because it reduces costs and operational energy, HiPACT could contribute to the early dissemination of CCS, which is viewed throughout the world as a promising technology for achieving large-scale reductions of CO<sub>2</sub> emissions. Thus, this is one way in which JGC is contributing to the mitigation of climate change.



Koshijihara Gas Plant of INPEX Corporation

## Biomass Power Generation Project Started for Greenhouse Gas Reduction

Japan has set a target of 25% reduction in greenhouse gas emissions by 2020 compared to 1990 levels. Since the Great East Japan Earthquake, dispersed electricity generation, especially from renewable energy sources, has been attracting attention. Because Japan is a heavily forested country, the efficient use of woody biomass has been a much studied topic. However, examples of commercialization have been limited, because of the challenge of efficiently collecting woody biomass, which is thinly spread over wide areas. In this context, the Ministry of the Environment has invited proposals as part of its Regional Projects for Challenge 25 Campaign, with the objective of expanding new energy projects including those that use woody biomass. In the Shonai Region of Yamagata Prefecture, the Ministry has adopted a demonstration project using a Gasification Cogeneration System using woody biomass proposed by the JGC Group company Japan NUS Co., Ltd.

This system uses thinning residue from mountain forests, in addition to orchard pruning residue and driftwood, as a raw material that is plentiful and easy to collect efficiently. The raw residues are processed into chipped woods, and used in a demonstration plant to generate power and heating for nearby welfare facilities. The demonstration plant supplies heat and power to nearby PVC greenhouses, as well. As such, the system is expected to be highly economically viable and to generate high returns. Plant installation and commissioning were completed during the first year, in fiscal 2011, and from the second year and onwards, the plant will fully operate to demonstrate the stability of its raw material supplies and its CO<sub>2</sub> reduction effects, as well as its economic viability and profitability.

### Efforts as an Operator of the Eco-Home Diagnosis Program of the Ministry of the Environment

The JGC Group company JGC Information Systems Co., Ltd. (J-SYS) has been selected as one of the operators of the Eco-Home Diagnosis Program implemented by the Ministry of the Environment in fiscal 2011. The program is an effort to provide a visual understanding and a reduction of CO<sub>2</sub> emissions from households. Under this program, JGC Information Systems implemented various activities for 150 monitor households, including measurement of data on hourly power consumption during the monitoring period, data collection on the use of water, light and heat, and provision of advice for CO<sub>2</sub> emission reduction by an Energy Saving Consultant.

Households commented that they were able to gain a new perception of power consumption, and that the objective advice given by the Power Saving Consultant raised their awareness of CO<sub>2</sub> emission reduction. Data collected during the monitoring period, as well as reference information including power-saving efforts by households and specific methods they used, were shared on regional information websites viewable by the public. By allowing households to mutually compare their power consumption, the initiative helped them renew their perception of energy saving.

### Initiatives for the Next-Generation Energy and Social System Demonstration Project of the Ministry of Economy, Trade and Industry

Demonstration tests for the adoption of renewable energy and smart grids have been conducted recently in many countries around the world, with an eye toward the building of a sustainable society. As part of these experiments, JGC and JGC Information Systems are participating in a Next-Generation Energy and Social System Demonstration Project subsidized by the Ministry of Economy, Trade and Industry (METI) in Yokohama City.

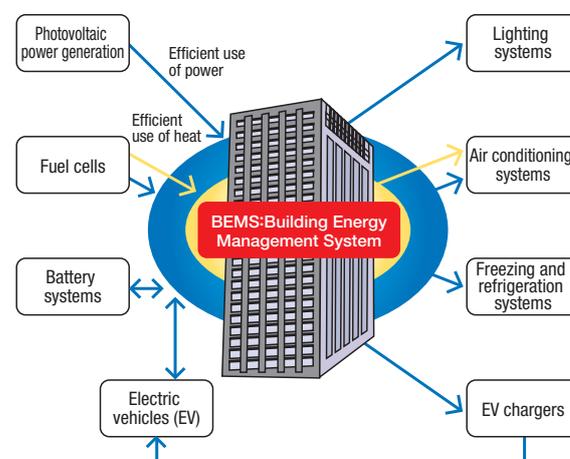
Commercial facilities, as core energy users in their communities, must lead the push toward energy efficiency. This project introduces the Building Energy Management System (BEMS) into commercial buildings.

BEMS is designed to effectively use demonstration equipment installed in buildings to maximize energy efficiency. JGC and JGC Information Systems are also undertaking demonstration project that applies BEMS to the operation and control of equipment related to daily life, combining low-carbon technologies and products such as photovoltaic power generation, storage batteries and electric vehicles.

Because the behavior of the users of facilities is also an essential element of energy use, the project includes joint research with the University of Tsukuba on the Human and Energy Symbiotic System, which is designed to entice users to adopt energy-saving behaviors voluntarily. The research applies the Human and Energy Symbiotic System to the charging behavior of the users of electric vehicles, aiming at demonstrating how the electric load can be leveled while maintaining convenience for users. The BEMS stimulates user behavior by displaying optimum charging times based on the modeling of charging behaviors and forecasts on power excess or limitation in the facilities.

While making full use of the results of the demonstration, JGC Information System is working on this project as a member of the JGC Group, to contribute to the realization of a low-carbon society.

### Overview of the Next Generation Energy and Social System Demonstration Project BEMS



# Using JGC's Environmental Technology to Solve Difficult Issues

## Introduction of a Nitrogen Oxides (NOx) Removal Catalyst in Overseas Markets

In the early 1970's, JGC Catalysts and Chemicals Ltd., a member of the JGC Group, began to develop catalysts for the flue gas DeNOx equipment used at power plants and other facilities. In 1976, it became the first company to offer a honeycomb structure DeNOx catalyst (NOx removal catalyst) to the Japanese market. Subsequently, following the strengthening of NOx regulations in various countries, JGC Catalysts and Chemicals has offered NOx removal catalyst manufacturing technology licenses to companies in the EU, the US, and South Korea. By removing more than 80% of NOx, which causes photochemical smog and acid rain, honeycomb structure DeNOx catalysts contribute to maintaining the safety of ecosystems.

Environmental regulations have been strengthened in China, and in expectation of a sharp rise in demand for DeNOx catalysts, JGC Catalyst and Chemicals has been offering technology licenses for NOx removal catalyst manufacturing to Chinese manufacturers. The company also offers technology licenses for manufacturing the raw materials of DeNOx catalysts in China. In 2010, it has also established a sales company in Beijing to distribute these materials and started its sales activity. JGC Catalyst and Chemicals is working to make NOx removal catalysts manufactured under its license to come into widespread use at power plants in China as the country's standard in the coming years, thereby broadly contributing to the curbing of China's NOx emissions.

## Efforts for Commercialization of Titanium Paste for Dye-Sensitized Solar Cells

Solar cells, which convert solar energy into electricity, are power generation devices that require no oil, coal, natural gas, or other fossil fuels. Solar cells are attracting increasing attention and have been coming into widespread use in recent years as a solution to energy problems and a means of protecting the global environment.

Although several types of photovoltaic materials are used for solar cells, dye-sensitized solar cells are being

heralded as the next generation of solar cell technology. Dye-sensitized solar cells are made using a photovoltaic material that consists of a thin nanoparticle titanium dioxide layer uptaking with a special dye on a glass or plastic plate. These solar cells possess the following special characteristics:

- They offer good reactivity to comparatively faint light energy such as artificial light
- They have high photoelectric conversion efficiency even with diffused light
- They require only low costs for manufacturing equipment because high-vacuum manufacturing processes are not necessary
- They come in a variety of colors, and are easy to fabricate.

An international accreditation organization (NREL: National Renewable Energy Laboratory) has confirmed that the light harvest efficiency of dye-sensitized solar cells, and even submodules, outpaces that of amorphous silicon-based solar cells that are currently in widespread use. Dye-sensitized solar cells are expected to come into widespread use also because of other advantages they hold over conventional solar cells. For example, they have demonstrated durability in actual use under temperatures as high as 80°C and humidity as high as 85%.

Two factors affect the performance of dye-sensitized solar cells. One is the preparation technique used to control the size of nanoparticles to the optimum value of 0.4 microns in nanoparticle titanium dioxide, the material that creates the light-encapsulating effect. The other factor is the preparation of a paste forming an evenly thin layer of titanium dioxide particles in exactly the same form as it is staged by the industrial level. The JGC Group member JGC Catalysts and Chemical has been developing paste preparation technology using optimum particle size and has already refined this technology to an industrial standard level. JGC Catalysts and Chemical is now improving the technology with an eye toward commercialization.

# Social

## Social Dimensions of Sustainability

As a professional engineering company, the JGC Group offers its employees the opportunity to improve their skills, and considers it an essential social responsibility to use these skills to give back to society at large. As a good corporate citizen, we also aim to build prosperous societies by proactively committing to technology licensing and human resources cultivation for the next generation.

**Social prosperity and the development of our business are inextricably linked.**

**Always giving consideration to our coexistence with society, the JGC Group engages in diverse activities to fulfill our social responsibility.**

**Establishing client satisfaction and earning society's trust, developing our business through coexistence with society**

The above words are taken from the "Principles of Business Conduct of the JGC Group," which was formulated to guide JGC on the path to being an enduring company achieving consistent innovation. Recognizing that our business development is inextricably linked with social prosperity, we always give consideration to our coexistence with society. In fiscal 2011, the JGC Group formulated a new CSR Basic Policy, and systematically organized the social contribution activities it has implemented so far based on this policy.

### **The Four Priorities of the Social Contribution Activities**

- 1. Environment:** To actively contribute to environmental conservation
- 2. Education:** To support the education of the next generation of qualified professionals
- 3. Science and Technology:** To support science and technology that will form the foundation of sustainable development
- 4. Community:** To contribute to the sustainable development of the areas where we do business

In this section, we cover specific examples of social contribution activities.

# Personnel Development and Communication with Employees

As an engineering company, JGC's sustained growth depends upon its people. Therefore, the JGC Group focuses on personnel development and communication with its employees.

## Personnel Systems

JGC's fundamental policy for personnel systems is "autonomous development and creation of new value." In 2001, we introduced a personnel system to enable employees to autonomously develop their professional skills, while sharing the strategic direction of the company, and offering new value and contributions to customers and society. Improving our systems when appropriate, we strive to develop the abilities of our employees.

## Personnel Development at JGC Techno College

In 2001, JGC founded the JGC Techno College as a place where motivated personnel can voluntarily participate in continuing education courses. Senior staff members with long-term technical experience act as instructors at the college and organize and run the sessions, to help pass on their skills and experiences to younger employees. In addition to offering conventional in-house technical courses, the college holds lectures inviting prominent experts in various fields from Japan and foreign countries. In 2011, JGC held ten Techno College lectures and attracted more than 700 officers and employees.

## Educating Future Engineers (Piping School)

Expecting a shortage of technicians skilled in plant piping layout, the JGC Group company JGC Plant Solutions Co., Ltd. has opened a Piping School in April 2007 to train students for this field. Located in Morioka, Iwate Prefecture, the school hires high school graduates from the area with an interest in mathematics and design. After one year of intensive training in basic design techniques at the school, they refine their skills through on-the-job training (OJT) in the Yokohama area. Forty-eight students that graduated by 2012 are already accumulating experience through this OJT system. The Morioka-based company, Plant Engineering Morioka Co., Ltd., is taking charge of plant designing in some portions of projects in which the JGC Group is working on worldwide, and this initiative that provides young people with the stable job

has also attracted attention within the city.



Practical training using drafters

## JGC Family Day (Bring-Your-Child-To-Work Day)

On August 3, 2011 JGC held JGC Family Day, to allow children from primary school grades four through six to observe their parents' workplaces. Fourteen children of JGC employees participated in the event, the purpose of which is to develop children's social awareness and foster the concept of work and occupation. They exchanged handmade business cards with Chairman and employees, in addition to observing work and meetings in the actual company office. We hold this event every year to raise employee awareness of the importance of a healthy work-life balance.



Employees and children participating in JGC Family Day

# Corporate Social Responsibility

The JGC Group is keenly aware of its social responsibility as a corporate citizen. We seek a harmonious coexistence with society and aspire to contribute to local communities and society at large through our business activities.

## Sales of Bread Hand-Made in Facilities for the Disabled

In January 2012, JGC has started using lunchtime to support sales of bread baked by physically or developmentally challenged people at facilities for the disabled in Yokohama City. The initiative is meant to support the local community near JGC's head office, and to provide employees with the opportunity to make a social contribution in a simple way. Aimed at helping Yokohama residents with disabilities participate in society, this project became possible through cooperation between Yokohama City, which supports finding sales opportunities and channels of products made in these facilities, and JGC, which was considering contribution activities to benefit the area.

Vendors were selected through food tasting sessions and test sales organized by members of related divisions of JGC, and six facilities were eventually chosen for vending on a day-by-day rotating basis (including two facilities on alternating weeks). The bread is moderately priced and tastes good, and is very popular with JGC staff. The bread is sold in the Bento lunchbox vending space, at the sixth floor of JGC Yokohama World Operations Center. Workers from other nearby offices are also welcome to purchase lunches here, as the space is open to the public (from shortly before noon, for about one hour, on business days only).



The vending area is crowded with employees

## Participation in the Post-Tsunami Monitoring Project

JGC has begun cooperating with NGOs to offer more efficient contributions in line with its four pillars of social responsibility: Environment, Education, Science and Technology, and Community. As part of these activities, the NGO Earthwatch Japan, of which JGC is a corporate partner, has begun its Post-Tsunami Monitoring Project to take care of the natural environment and nurture biodiversity in the Tohoku area, which suffered significant damage from the Great East Japan Earthquake of March 2011.

This project is undertaken as a cooperation between a university (Tohoku University), NPOs, private companies, and citizens, to monitor ecosystems in areas damaged by the tsunami. The objective is to sustainably rehabilitate these areas, focusing on the ecosystems that will support the local agriculture, forestry and fisheries industries in years to come.

In November 2011, the first participant from JGC took part in a survey carried out in the rice paddies of Sabusawa Island, Shiogama City. The survey monitored the ecosystem of rice paddies, which serve as habitat for aquatic insects, plants, amphibians, and fish. Water and soil quality were also surveyed, restoration work was conducted, including removal of debris and construction of borders around rice paddies.



Participants working on project surveys

# Corporate Social Responsibility

## Participation in the Ecosystem Survey Project

JGC has invited its employees to participate as volunteers in survey projects on domestic ecosystems organized by the NGO Earthwatch Japan. As a result, in fiscal 2011, one employee took part in the Ecological Survey of the Nagoya Daruma Pond Frog of Rice Paddies of Takashima City, Shiga Prefecture, and another employee took part in the Ecological and Conservation Survey of Indigenous Japanese Pond Turtles.

Such surveys are conducted to help the conservation of endangered organisms by clarifying the ecological conditions under which they live. As research assistants, the volunteers joined field work activities carried out by researchers and collected valuable data. JGC intends to continue offering its cooperation to survey projects.



Survey participants

## Sponsorship of the “Fureai Concert—Fostering the Heart” in Yokohama City

Since fiscal 2011, JGC has been a sponsor of the Fureai Concert Series “Fostering the Heart” organized by the Board of Education of Yokohama City. This initiative pertains to Education and Community, two of the four major CSR priorities set forth by JGC.

The Fureai Concert Series “Fostering the Heart” has been organized since fiscal 1998 for upper grade pupils of municipal elementary schools, and elementary departments of schools for the blind, deaf, or physically or mentally handicapped. The concert is meant to cultivate

and enrich the students’ sensibilities through music appreciation. The concert series is attended by about 33,200 pupils in total (approximately 3,000 pupils per day.)

Every year, the concert series includes performances by the Kanagawa Philharmonic Orchestra, as well as organ performances. The conductor, who also acts as the master of ceremony, provides the audience with playful, easy-to-understand explanations of the pieces performed, allowing not only children, but also parents and other adult participants to develop their cultural knowledge while enjoying the music.

## Donation of Used Stamps and Foreign Coins

At JGC, permanent donation boxes have been installed to collect foreign coins that employees have left over from business trips abroad, as well as used stamps from postal items employees have received. This is intended as a social contribution activity that employees can participate in during the course of day-to-day work. These boxes have been installed in the social contribution area of the reception lobby to raise interest in such activities among employees and visitors. Many JGC employees regularly travel abroad for business, and consequently, the coin donation box often fills up within a single week. Collected coins are donated to UNICEF, and stamps of various designs from all over the world are donated to the Make-A-Wish Foundation, an international volunteer organization, to help its support activities for children who fight serious illnesses.



Donation boxes for used stamps and foreign coins in their dedicated space

### Support to NPO Activities through Donation of Used Books, CDs and DVDs (Thank You Books)

Since July 2012, JGC has been participating in a donation program called Thank You Books, which is organized by the Shinrai Zaidan foundation. This is intended as another social contribution activity that employees can participate in during the course of day-to-day work. Through this program, used books, magazines, CDs, DVDs, and game software are sent to the company Value-Books, which purchases them, with payments donated to designated organizations via the Shinrai Zaidan foundation. In this way, used books and CDs collected from JGC employees help support the Post-Tsunami Monitoring Project run by the NGO Earthwatch Japan, to help restore the Tohoku area.

### Traffic Safety Training Sessions On-Site in Indonesia

In January 2011, JGC was awarded the contract for the Donggi-Senoro LNG Project, located in Indonesia. In Indonesia, people regularly drive without a proper license, and children under the legal driving age ride motorbikes at high speeds with little regard for safety. The low awareness of traffic safety became a deep cause for concern among the local police. In 2011, the number of traffic accidents around the construction site was approximately twice that of 2010, and 60% of them involved motorbike drivers aged between 17 and 21. In addition, risks were increasing because of the extra traffic from vehicles related to the construction site.

To address the problem, JGC organized training sessions on traffic safety in cooperation with the local police. Training sessions have been held four times since January 2012, and have been attended by more than 1,000 children from local schools. During the sessions, JGC project leaders emphasized the importance of safe school commuting for everyone, based on the Incident- and Injury-Free (IIF) concept currently in operation at the construction site. The sessions also included hands-on safety training conducted by police officers.

JGC considers support of the local community to be an essential element of the plant construction project.

As such, JGC will continue offering new contributions to meet local needs.

### Forest Conservation in the Watershed Forests of Kanagawa Prefecture

In August 2008, to commemorate its 80th anniversary, JGC became a watershed forest partner in Kanagawa Prefecture's Water Source Conservation Project, and launched an ongoing environmental conservation project in the forest. Through the project, employees of the JGC Group assist with watershed forest conservation while deepening their understanding of the role of watershed forests and the importance of coexisting with nature. Activities are carried out once a month, and in fiscal 2011, approximately 100 employees participated in various events, including forest walking tours and aquatic wildlife observation tours, which gave them the opportunity to enjoy contact with nature in different seasons.

In October 2011, a large bus was hired for an event attended by about 50 persons, including the President, as well as various employees and their families. During the trip to the forest, participants received explanations on the meaning of watershed forest conservation, and once on the site, with the guidance of forest instructors, they were divided into three groups—Tree Thinning, Craftwork, and Forest Walking Tour—, learning about the importance of forest conservation while enjoying exchanges bridging nationality and age.



Many employees participated along with President Kawana

# Corporate Social Responsibility

## KAUST Industry-University Collaboration Program

In Saudi Arabia, JGC is a member company of the KAUST Industrial Collaboration Program (KICP), an industrial collaboration program at King Abdullah University of Science & Technology (KAUST), which opened in 2009. KAUST is a graduate-studies level university established by an initiative of King Abdullah to serve as a research base in advanced technology fields including resource development, energy, water and environmental studies, life sciences, catalyst and nanotechnology, and computer science. JGC offers the technology and know-how it has accumulated over years of experience in the field of plant construction, to support the creation of next-generation technology and training of personnel that will contribute to both Saudi Arabia and the international community. In May 2011, JGC members attended the first presentation of a research report at KAUST, and exchanged opinions with researchers.

## JGC Philippines' Sustainable Social Contribution Program

JGC Philippines, Inc., JGC's subsidiary in the Philippines, is involved in several social contribution programs focusing on local communities and the environment. In fiscal 2011, 33 employees joined "Run for Japan," a charity event organized to help the victims of the Great East Japan Earthquake. A "Pray for Japan" booth was installed on the site of the race, and relief money raised from participants and spectators was sent to the Japanese Red Cross Society, to assist disaster victims and restore housing and basic services.

To support educational institutions, JGC Philippines also donated educational material, including ten computers with tables, chairs, and textbooks to a public elementary school of Muntinlupa City, where JGC Philippines has an office. Located in an area with many low-income residents, the school had requested assistance from private companies to cope with a chronic budget problem that prevents it from procuring the computers and educational material necessary for the curriculum.

JGC Philippines and its employees participate in social improvement initiatives as one and as a member of the local community. The company engages in social contribution activities with the aspiration to always be a better corporate citizen.



Ceremony for the presentation of educational material to the school

## Christmas Cards from JGC Gulf to Children in Quake-Hit Miyagi

In December 2011, children of the employees of JGC Gulf International Co., Ltd. ("JGC Gulf"), the Saudi-Arabian subsidiary of JGC, sent Christmas cards to children in areas of Miyagi Prefecture that were stricken by the Great East Japan Earthquake. This project began with a call from Takuo Tanaka, professor emeritus at Chuo University, who proposed to send Christmas cards to warm the hearts of children of disaster-stricken areas and give them courage. Professor Tanaka thought that messages received from far countries would nurture the hopes of children for the future and their openness to the world.

JGC Gulf cooperated with the project through the Japanese Association of Saudi Arabia and the Embassy of Japan in Saudi Arabia. Containing warm messages from the children of JGC Gulf employees, the cards were sent to the venue of a piano recital to which local children, and volunteers who helped with restoration, were invited. After the concert, the cards were bound in booklets and donated to local libraries in Miyagi Prefecture.



Christmas cards sent by the children of JGC Gulf employees

### Nikki-Universal Organizes Internships for High School Students

Since 2005, the Hiratsuka Plant/Research Center (Hiratsuka City, Kanagawa Prefecture) of Nikki-Universal Co., Ltd., a JGC Group company, has been offering internships for students from the Hiratsuka High School of Science & Technology, accepting two students every summer vacation. The purpose of the internship program is to give high school students a taste of on-site work, to galvanize their enthusiasm for careers in science and technology. During the three-day training program, students gain hands-on experience with catalyst performance tests and analysis at the Research Center, and measurement and processing operations of environmental catalysts for office equipment at the Plant.



A student learns from an employee how to use an instrument

### JGC-S Scholarship Foundation: Support for the Next Generation

Through the JGC-S Scholarship Foundation, JGC contributes to the cultivation of scientists and the advancement of science and technology in Japan and overseas. The foundation was established in March 1968 with an endowment by JGC founder Masao Saneyoshi. Its principal undertakings include provision of educational loans to Japanese university and graduate students majoring in scientific and technical fields, grants to foreign students studying in Japan, and research funding assistance for young researchers.

As of fiscal 2011, the foundation has provided assistance to a total of 18,951 persons, through educational loans to 13,570 students and educational grants to 5,831 students (494 Japanese and 4,887 foreigners studying in Japan at their own expense). The foundation has also provided research funding assistance to a total of 2,029 young researchers. Annual disbursements have reached 362 million and 450 thousand yen. The foundation is supporting students affected by the Great East Japan Earthquake by extending to fiscal 2012 the special framework established in fiscal 2011 after the disaster, and by adding three universities to the four already designated in disaster-stricken areas.

### Social Welfare Grants by the JGC Social Welfare Foundation

The JGC Social Welfare Foundation develops and provides welfare equipment for persons with physical disabilities, as well as providing funding for support groups and volunteer organizations for senior citizens and persons with disabilities in Kanagawa Prefecture. Since its establishment in March 1994, the foundation has made 550 contributions to support groups, 356 contributions to volunteer organizations, and eight contributions to other groups. In fiscal 2011, the foundation made 37 contributions to support groups, 21 contributions to volunteer organizations, and four contributions to other groups.



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