Ishikawa Coal Thermal Power Station (Okinawa Prefecture)

Social Responsibilities

Social Responsibilities

Part 1

Measures for a Stable Supply of Electricity

J-POWER Group produces electricity at hydroelectric, coal-fired and wind power stations throughout Japan and transmits it through its power transmission and substation facilities, supporting people in their daily lives. Backed by a highly trustworthy technical capability, it will continue to supply electric power in a stable and efficient manner, bringing peace of mind to people's daily lives.

TOPICS Maintenance and Operation of Power Facilities

J-POWER Group has hydroelectric power facilities at 59 locations and thermal power facilities at eight locations (including one geothermal) throughout Japan. We also own and operate transmission facilities that include a total of some 2,400 km of lines and eight substations. The following will introduce the kind of efforts we make in maintenance and operations at J-POWER Group to carry out the mission of stable operation of these power facilities.

Hydroelectric Power Facilities

Sakuma Power Station

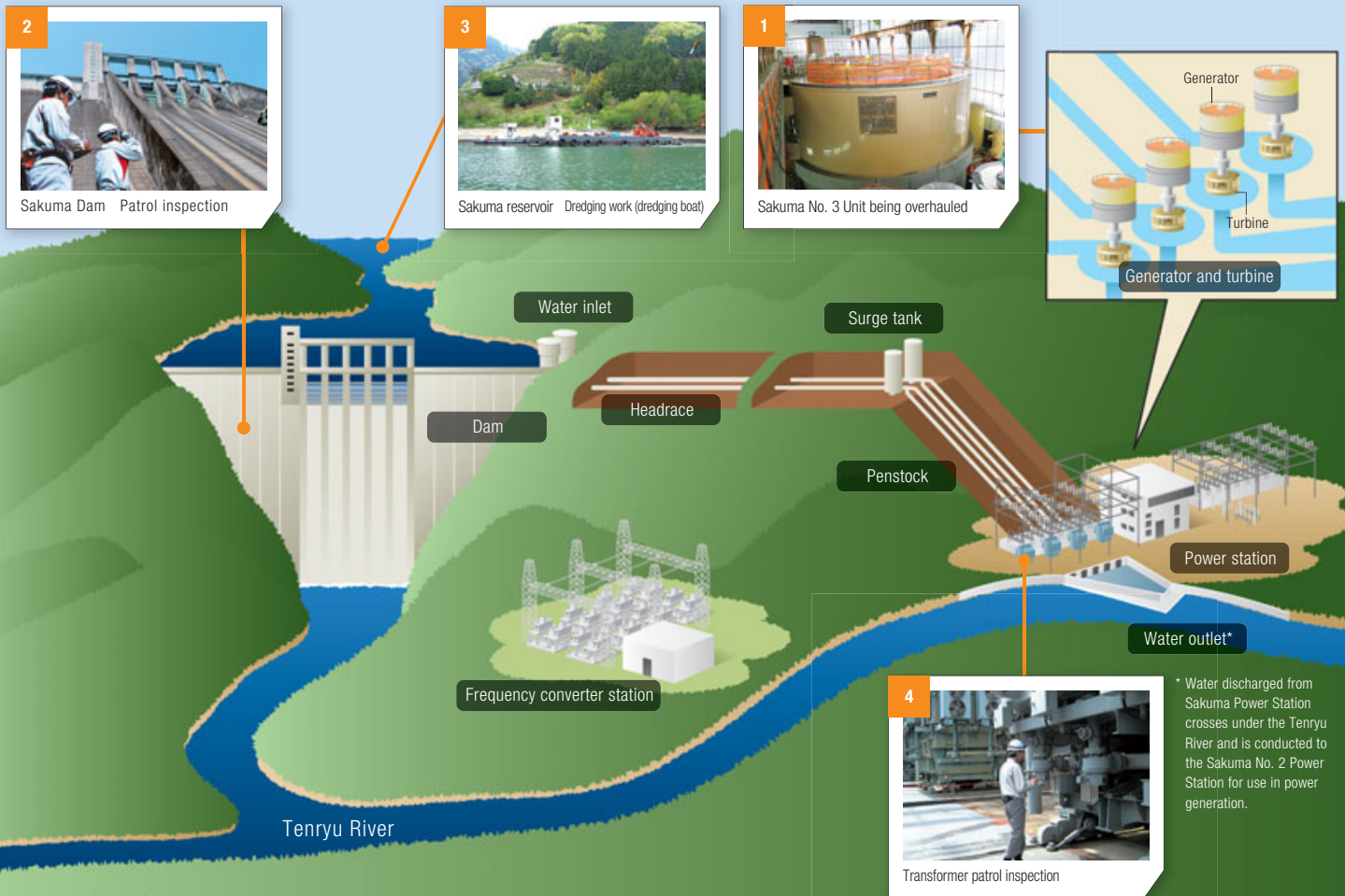
Sakuma Power Station, a premier J-POWER facility, is a large-scale hydroelectric power station that has been in commercial operation since 1956.

It once provided the electric power to support Japan's postwar industrial reconstruction, and now, even 55 years after coming on line, this facility's average annual power output amounts to approximately 1,400 GWh. This makes it the hydroelectric power station with the highest annual power output in Japan.

Sakuma Power Station was the first in Japan to introduce large construction machinery from the United States, and it was built in the short period of three years. Over the subsequent 55 years, it has contributed to the stable supply of electric power in Japan. Going forward, we intend to contribute to society with hydroelectric power stations providing precious, purely domestic and renewable energy.

Overview of Facilities

Location	Tenryu-ku, Hamamatsu-shi, Shizuoka Prefecture
Maximum Capacity	350 MW
Number of power generators	4 units
Maximum water usage	306 m^3/s
Effective head	133.49 m
Started operation	April 1956



* Water discharged from Sakuma Power Station crosses under the Tenryu River and is conducted to the Sakuma No. 2 Power Station for use in power generation.

1 Maintenance and Operation of Power Stations and Electrical Equipment

The Sakuma Power Administration Office, which controls the Sakuma Power Station, maintains and operates the frequency converter station and nine power stations on the Tenryu River water system. A major characteristic of the Sakuma Power Administration Office's jurisdiction is that it serves as an interconnection point between the system on 60 Hz power and the system on 50 Hz power. There are two power stations capable of switching between generation of either 50 Hz or 60 Hz electricity, as well as the frequency converter station that enables interchange between systems with different frequencies.

In order to operate stably over the long term, generators are given an overhaul every 10 or so years in which they are completely dismantled and inspected. Sakuma Power Station has four generators, and Unit No. 3 went through an overhaul from December 2010 to June 2011. This work generally takes a half-year, and other, related equipment that has deteriorated is renewed at the same time. The work is carried out with an emphasis on safety first, and a thorough preliminary survey is made first to ensure that there is no impact on adjoining units that are in commercial operation as well as to ensure that the work can be completed within the limited shutdown time. The equipment is definitely locked down and the work area marked off when work is being done, and the people involved in the work hold daily meetings during the work period to enable the work to proceed safely and surely.

Yoshiyuki Nakamura
Deputy Director, Sakuma Power Administration Office
Chubu Regional Headquarters
Hydropower and Transmission System Department, J-POWER

2 Appropriate Maintenance of Civil Engineering Structures for Dams and Other Facilities

We conduct maintenance of the civil engineering structures at hydroelectric power facilities so as not to allow any interference with the operation of generators. Our work includes inspection, measurement, repair, and other maintenance of dams, reservoirs, waterways, and other structures, renewal of deteriorated facilities, measures to deal with sediment and driftwood, monitoring water quality, and other duties covering a wide range of operations. We also operate the dam gates appropriately when flooding occurs due to typhoon or other heavy rains, and perform tasks that include safe downstream discharge of water that enters the dam.

Our maintenance duties include keeping track of the condition of facilities by inspection, measurement, and other such actions, finding deformations and abnormalities and investigating the necessity for repair, determining countermeasures, and taking other such actions to maintain the functionality of facilities. When we inspect and measure facilities, we take care not to overlook deformations or abnormalities, and when we do detect deformations, we make every effort to identify the risk correctly and deal with it promptly. For the future, I intend to continue pursuing maintenance in a further appropriate and rational manner.

Yukio Ibe
Civil Engineering Group, Sakuma Office
Chubu regional company, JPHYTEC Co., Ltd.

3 Dam Reservoir Sedimentation Control Measures

Each year large quantities of earth flow into dam reservoirs from upstream, and a portion of the earth builds up as sediment in the reservoir. This makes it necessary to institute sedimentation control measures to reduce the accumulation of earth. We are presently implementing three sedimentation control measures for the Sakuma Dam reservoir.

The first measure is transporting within the reservoir using a dredging boat and a sediment transporter to move sediment in the upstream and middle parts of the reservoir to downstream parts. The second measure is removal from the reservoir. This work is done by sand and gravel extraction contractors, and the removed sediment is used effectively for concrete and asphalt aggregate and other such purposes. The third measure is sediment flushing. This involves lowering the water level in the dam during the dry season so that the center and upstream portions of the dam reservoir form natural river channels. By this measure, sediment in the center and upstream portions of the dam reservoir is led to the place which exist below active storage capacity.

All of these methods involve work within the large field of the dam reservoir, and we put the greatest care into supervising and coordinating with the people involved to make certain there are no oversights. In addition to sediment, there is also driftwood and trash that flows into the dam, and we also dispose of that material with consideration for the environment and attention to possible reuse.

Kenichiro Takatsuka
Sakuma Power Administration Office,
Chubu Regional Headquarters
Hydropower and Transmission System Department, J-POWER

Comments from Younger Employees

4 Everyday Inspection and Maintenance of Electric Power Facilities

Sakuma is interesting as the location of power generators that output at frequencies of both 50 Hz and 60 Hz as well as of a frequency converter station, and there are water turbine generators of a variety of types. My work is to deal with these electric power facilities, conducting everyday inspections, repairing and renewing equipment and facilities, and so on.

This service area has power stations like the Sakuma Power Station, which has seen a half-century go by since starting operation, and we engage in renewing and repairing its aging equipment in order to maintain its functionality. Doing this work requires that the equipment be shut down. As the presence of the frequency converter station indicates, however, Sakuma is an important location because it serves to interconnect power grids with different frequencies, and this means that facilities cannot be shut down for very long. In order to do our work safely, quickly, and with high quality, we put great care into preparations, such as studying technical information materials in the archives, seeking the advice of senior colleagues, and investigating construction methods. Then when we do the work, and the equipment returns to good working order without incident, I feel a great sense of accomplishment. I intend to go on doing my very best to help provide a stable supply of electric power, putting safety first.

Kentaro Tsuchida
Sakuma Office, Electric Power Group,
Chubu regional company (now the Control Group,
Generation and Transformation Department,
Generation and Transformation Division)
JPHYTEC Co., Ltd.

Thermal Power Facilities

Takasago Thermal Power Station

The Takasago Thermal Power Station is a coal-fired power station built to secure the demand for domestic coal, with the No. 1 Unit starting commercial operation in July 1968 and the No. 2 Unit in January 1969. As of FY 2011, this station has seen 43 years of service. The past decade has also been a period of transition to thermal power that burns overseas coal because of the shrinking of domestic coal mining, but this power station has been striving to provide a stable supply of electric power for over 40 years since it started operating. For the future, we will continue the effort to meet your expectations while taking care to harmonize with the local community and with the environment.

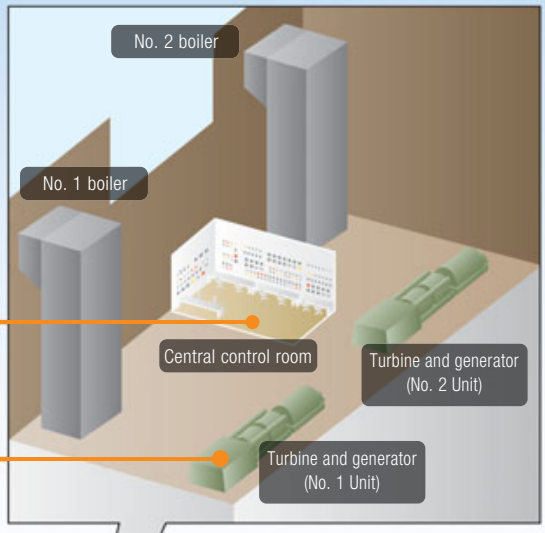
Overview of Facilities

Location	Takasago-shi, Hyogo Prefecture
Output	500 MW (250 MW × 2 units)
Fuel	Coal
Start of Operation	July 1968 No. 1 Unit starts commercial operation January 1969 No. 2 Unit starts commercial operation

4

Monitoring underway in the central control room

Indoor facility layout diagram



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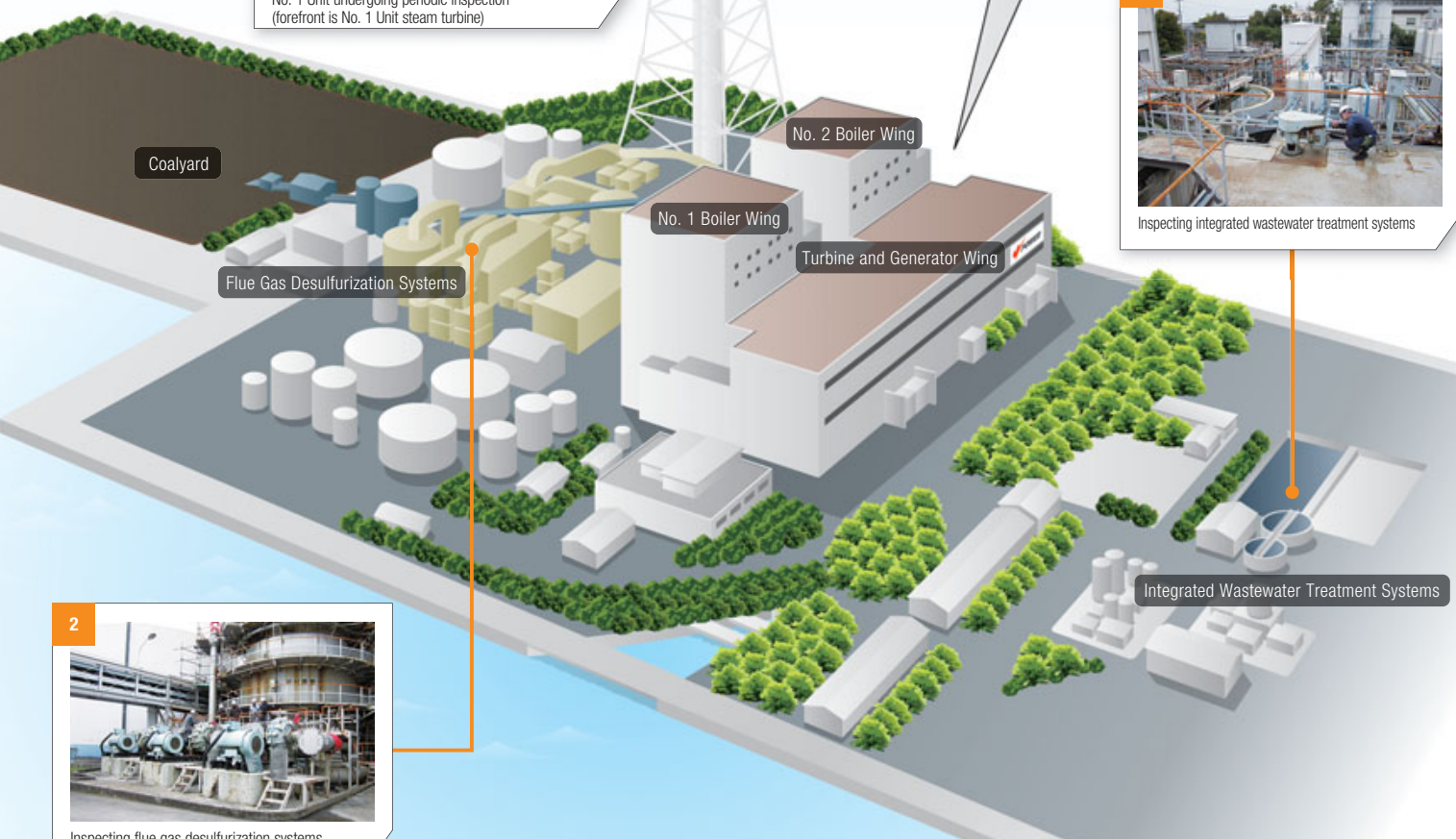
No. 1 Unit undergoing periodic inspection (forefront is No. 1 Unit steam turbine)



3

Inspecting integrated wastewater treatment systems

2

Inspecting flue gas desulfurization systems

1 Appropriate Maintenance of Thermal Power Facilities

It is absolutely essential to take a medium to long-term perspective and create maintenance plans in order to carry on stable operation of thermal power facilities and assure their reliability.

Ever since the Takasago Thermal Power Station started operation, it has sustained its thermal efficiency*1 and this is something we take great pride in. The greatest reason for this is that we do not fail to perform appropriate maintenance, including preventive maintenance and planned repairs. Conducting proper maintenance of electric power facilities (maintaining their thermal efficiency) reduces the amount of coal that has to be consumed to generate the same amount of electric power. This cuts down on carbon dioxide (CO_2) emissions, which means this relates very closely to the environmental aspect of the matter.

Drawing up appropriate maintenance plans requires investigation of various matters, including technological aspects and cost aspects. We will continue to deal with these matters using the technology J-POWER possesses for maintaining and operating advanced coal-fired power stations.

Hideyuki Inoue
Plant Engineering Group, Takasago Thermal Power Station
Thermal Power Department, J-POWER

2 Inspection and Maintenance of Flue Gas Desulfurization Systems

Takasago Thermal Power Station has seen 43 years go by since its No. 1 Unit entered operation. I think the fact that this old power station is in service and in full operation is proof that the people involved have been working together to carry out appropriate facility maintenance and operation management.

Flue gas desulfurization systems are devices that remove sulfur oxides (SOx)*2 from (desulfurize) exhaust gases from the boilers. They are essential systems for environmental protection at coal-fired power stations. Flue gas desulfurization systems have tanks called absorption towers that are equipped with numerous pumps. Inside the absorption towers, the exhaust gases and liquids are brought into contact to perform desulfurization. When the performance of the pumps is degraded, the system becomes unable to remove sulfur oxides, so we have always paid attention to any unusual sounds or other symptoms from the pumps. We carry on our day-to-day inspection and maintenance work with the constant aim of early detection and early repair of abnormalities in every pump.

Although the Takasago Thermal Power Station is old, I intend to put all my strength into maintaining it while constantly considering what I can do and what is needed for it to continue stable operation into the future.

Toshio Soga
Maintenance Group, Takasago Company
JPec Co., Ltd.

3 Operation Management of Integrated Wastewater Treatment Systems

The integrated wastewater treatment systems at Takasago Thermal Power Station deals with the wastewater produced by electric power facilities and flue gas desulfurization systems as well as rainwater recovered on our grounds and other such water. We put this water through appropriate treatment by chemical treatment, filtering, and precipitation according to the water quality. Controls on discharge of wastewater outside our grounds are based on the Water Pollution Control Law, the Law Concerning Special Measures for Conservation of the Environment of the Seto Inland Sea, and agreements with prefectural and municipal governments. We consider compliance with these to be our greatest mission as we engage in operation management of integrated wastewater treatment systems.

Takasago Thermal Power Station has changed from exclusive use of domestic coal to use of overseas coal, and this has also caused changes in the properties of the wastewater. Advanced wastewater treatment technology and operation management are necessary in order to keep track of wastewater properties, which change with the operating conditions of the electric power facilities, and to obtain full performance from wastewater treatment facilities.

I intend to continue my efforts to have all our employees here understand this historic power station and also understand and observe legal statutes and regulations so that we can keep the power station in stable operation.

Miyuki Inoue
Operating Group, Takasago Company
JPec Co., Ltd.

4 Comments from Younger Employees Stable Operation of Electric Power Facilities

I am presently engaged in operations work at the power station. My work is to discover abnormalities in the equipment promptly by monitoring the operation of electric power facilities and conducting patrols, then to deal with the abnormalities so that the station can provide a steady supply of electric power.

My work also involves using the simulator facilities at the power station and at the Wakamatsu Thermal Power Training Center (see p. 28) in Kitakyushu City to improve our operations technology so as to enable rapid, accurate judgment and action in response when accidents occur.

The operation of electric power facilities requires not only specialized technical abilities but also acquisition of official qualifications and a variety of skills, such as management ability and ability to communicate well. I will continue to study so that I can make the maximum use of my capabilities and be able to contribute to providing a stable supply of electric power.

Daisuke Naoi
Operating Group, Takasago Thermal Power Station
Thermal Power Department, J-POWER

References

*1 Thermal efficiency
The ratio of the electric power generated (converted to thermal units) to the heat energy input to an electric power facility.

*2 Sulfur oxides (SOx)
The general term for compounds of sulfur and oxygen is abbreviated as SOx. These include sulfur dioxide (SO_2), sulfur trioxide (SO_3), and sulfuric acid mist (H_2SO_4). SOx are generated when coal and heavy oil containing sulfur are fired as fuel in factories and thermal power stations, and they are released into the atmosphere in exhaust gases. They are a source of atmospheric pollution, for instance as a substance responsible for acid rain.

Transmission and Transformer Facilities

J-POWER owns and operates approximately 2,400 km of transmission lines that link the islands of Honshu, Hokkaido, Shikoku, and Kyushu, as well as three extra high-voltage substations, four AC-DC converter stations, and one frequency converter station. J-POWER thus plays a major role in the overall operation of Japan's electric power grid.

Upholding the Main Power Artery Connecting Honshu and Shikoku: The Honshi Interconnecting Line

The Honshi Interconnecting Line, one of the power transmission lines under the control of the West Transmission Line Maintenance Center, is an inter-regional interconnecting line that links the Shikoku region and the Chugoku region. It is a facility that contributes to power interchange between these two regions, and more broadly in western Japan. One distinguishing feature of the Honshi Interconnecting Line is that it has 500 kV oil-filled (OF) cable*1 strung even across the Seto-Ohashi Bridge. Its maintenance must cover the cable itself, cable storage facilities, disaster prevention and facility monitoring systems, ventilators and other secondary equipment and facilities, and a wide variety of civil engineering, and architectural structures and other facilities. Center personnel are united in recognizing the importance of this power transmission line and in making the effort to conduct regular patrols and inspections and make appropriate repairs, doing all that is necessary to deal with the problems that arise with the passage of time.

Patrolling the Honshi Interconnecting Line

Mitsumasa Asano
Sub-Leader
West Transmission Line Maintenance Center,
West Regional Headquarters
Hydropower and Transmission System Department, J-POWER

On-Site Technical Capabilities in Support of a Stable Power Supply (Nishi-Tokyo Substation)

The Nishi-Tokyo substation is a large-scale primary substation with 20 transmission line circuits and four main transformers, with a facility capacity of 1,350 MVA. These facilities are maintained jointly by J-POWER Nishi-Tokyo Power Administration Office and the Nishi-Tokyo Office of JPHYTEC Co., Ltd. It has been 55 years since the substation began operating, and the question of how to take appropriate measures with deteriorated facilities has become an issue. In addition to concerns about obtaining repair parts and the dwindling number of manufacturer technicians, the fact of being a center that is important to grid operation makes it difficult to shut down facilities to work on them. Therefore it is important to proceed systematically and efficiently with facility renewal and repairs. We are also working to maintain and improve our on-site technical capabilities in maintenance and operation with the primary aim of supporting the stable supply of power.

Inspecting a transformer

Katsuhiko Kawai
Director, Nishi Tokyo Power Administration Office, East Regional Headquarters
Hydropower and Transmission System Department, J-POWER
(Presently Director, Nagoya Power Administration Office, Chubu Regional Headquarters,
Hydropower and Transmission System Department)

Information Technology and Telecommunications Facility

J-POWER telecommunications for electric power systems are used for a wide variety of purposes, including protection, monitoring, control, and operational administration of power facilities. They perform vital functions as the nervous system of the electric power business. We conduct steady, regular maintenance, operation, and monitoring of these electric power telecommunications facilities, thus contributing to the stable supply of electric power.

Steel telecommunications tower at the Head Office

Maintaining Reliability and Supporting Adoption of Advanced Information Technology

Network Monitoring Center

J-POWER's business sites, power generation and distribution facilities, and other such establishments are distributed throughout Japan. What connects them is a communication network that must be designed and built with a high degree of reliability so that communications will not be interrupted even by an earthquake or other such disaster. The way our network has been given redundancy through the use of microwave radio, fiber-optic cable, and so on is one example of this.

Information and communications services are growing more diverse, and the technology is also developing rapidly. This means that we will maintain the solid structure we have used to date while studying the renewal of facilities in the medium to long-term and entertaining possibilities for the introduction of new technology.

Our mission is to uphold the functionality of this information and communications network with its nationwide structure, and to constantly maintain it in good operating condition, in order to contribute to the operation of power stations and the electric power grid.

Youichi Taira
Control Center, IT and Telecommunications Office
Corporate Planning and Administration Department, J-POWER

The stable operation of power facilities is essential to stable profitability in the domestic wholesale electricity business, which is the profit center for J-POWER Group. It is also extremely important to the fulfillment of our responsibility to provide a stable supply of electric power.

For this reason, as well, we are committed to enhancing the diagnostic capabilities of the facilities owned by J-POWER Group and making every effort toward preventive maintenance. In this way, we will focus our energies on assuring the stable operation of our various facilities over the long term.

References

*1 OF cable
Abbreviation for oil-filled cable. This cable has its interior filled with insulating oil to improve its insulating properties.

Helping Ensure the Stable Supply of Electricity

The power generating facilities of J-POWER Group constitute a stable supply capacity, while the company's transmission, substation, and communications equipment bear a portion of the load for the nationwide system of power companies. The company also contributes to the stable supply of electricity as a system of wide area interconnection that connects different regions.

Unifying Electric Power in Japan

Electric Power Distribution on a Nationwide Scale

J-POWER owns and operates approximately 2,400 km of transmission lines and eight substations and converter stations that link Japan's disparate regional power companies together. In this way it plays a major role in the overall operation of Japan's electricity grid. It also operates essential facilities that support power transmission over a wide area in Japan, including extra-high-voltage transmission lines that connect Japan's main island of Honshu with the other main islands of Hokkaido, Shikoku, and Kyushu, and the Sakuma Frequency Converter Station, the first facility in Japan that has made possible the transmission of electricity between the differing frequencies of Eastern Japan (50 Hz) and Western Japan (60 Hz).

Sakuma Frequency Converter Station (Shizuoka Prefecture)

Additionally, the Central Load Dispatching Center issues appropriate operating instructions (load dispatching) on a 24-hour basis to power stations and other facilities in order to help keep the electricity grid stable while maintaining stable, efficient operations at domestic power facilities owned by J-POWER.

At the same time, stable grid operations are supported by remote monitoring and operations that utilize the latest in information technology. We possess a communications network that includes highly reliable microwave radio circuits, fiber-optic cable, and other such components that we employ to conduct high-precision operation.

Central Load Dispatching Center

Middle & West Regional Control Center Enters Operation

The Middle & West Regional Control Center (in Kasugai City, Aichi Prefecture) started operating on April 1, 2010. This facility integrates the West Regional Control Center (in Saijo City, Ehime Prefecture) and the Central Regional Control Center (in Kasugai City, Aichi Prefecture) that were previously in operation under the new name of Middle & West Regional Control Center. This control center has completely changed over from the former centralized system that used large computers to a new distributed system that uses general-purpose computers.

Control center operators from both regions were assigned to the factory testing, installation work, and local testing involved in this renovation so that they could learn the new system's functions in advance. This process was then augmented by preparations such as training for local operators carried out in advance, with the result that operation commenced according to schedule on April 1, 2010.

The Middle & West Regional Control Center was assigned control over hydroelectric power stations (31 locations, combined output of 3.5937 GW), the Sakuma Frequency Converter Station, and the Nagoya Substation. This means that the center conducts management across an extremely wide range of facilities at once, ranging from the Sakuma Power Station and other power stations in the Tenryu River water system in Shizuoka Prefecture, in the east, to Sendaigawa No. 1 and No. 2 Power Stations in Kagoshima Prefecture, in the far west.

In commencing operation of the Middle & West Regional Control Center, J-POWER completed its renewal of nationwide regional control center facilities that it had been gradually carrying out by seeking to further heighten its facilities' functionality and increase the efficiency of its operation management system. This inaugurated a system in which operations of nationwide hydroelectric power generator and transformer facilities are to be conducted from three places, the North Regional Control Center (in Hakodate City, Hokkaido), the East Regional Control Center (in Kawagoe City, Saitama Prefecture), and the Middle & West Regional Control Center (in Kasugai city, Aichi Prefecture).

Opening of the Middle & West Regional Control Center (Aichi Prefecture)

Contributing to Wide Area Operation of the Hokkaido-Honshu Electric Power Grid

The only interconnecting facility to link the islands of Hokkaido and Honshu, the Hokkaido-Honshu Electric Power Interconnection Facility (the Kitahon HVDC link) is Japan's first extra- high-voltage DC transmission facility. It is made up of three large parts: (1) an AC-DC converter station that converts AC to DC and DC to AC; (2) overhead transmission lines approximately 124 km in length on the Hokkaido and Honshu sides together; and (3) a long-distance submarine cable approximately 43 km in length that crosses the Tsugaru Straits. It has been 30 years or more since this facility commenced operation in 1979. Its capacity, initially 150 MW, was increased to 300 MW in 1980, then 600 MW in 1993. It is contributing to wide area operation of the Hokkaido and Honshu electric power grids.

One purpose of the Kitahon HVDC Link is to enable power interchange with other regions when disaster occurs or when electric power demand increases suddenly. The facility also controls load flow*1 and regulates frequency during periods of normality, performing a key role in stabilizing frequencies on the electric power grid.

Kitahon HVDC Link Kamikita Converter Station (Aomori Prefecture)

References

*1 Load flow
The general term for the flow of electric power (electricity) on the electric power grid, which is the integrated system from the generation of electric power, through distribution, up to demand. It is normal for load flow to flow from the power source toward the demand location, but load flows are not necessarily fixed in size or other properties, depending on the configuration of the electric power grid, and they sometimes fluctuate with the season or time of day.

Stable Procurement of Coal

Coal Mining Projects in Australia

J-POWER Group seeks stable procurement over the long term of coal for use in coal-fired power stations, and we therefore own stakes in coal mining projects in the states of Queensland and New South Wales in Australia. Of these, the Blair Athol Coal Mine has until now been the key mine, and it will be closing down after 25 years or more since it began exporting. Meanwhile, we began taking coal from new coal mines, the Clermont Coal Mine and the Narrabri Coal Mine, in 2010.

The Clermont Coal Mine held a grand mine opening on October 15, 2010, with participation not only by the people concerned from J-POWER and its three partners (Rio Tinto, Mitsubishi Corporation, and Japan Coal Development Co., Ltd.), but also the Governor of Queensland, the Japanese Ambassador, concerned parties from local communities, and people from the Japanese power utilities. We are engaging steadily in development and operational management of these existing coal mining projects in order to realize stable coal procurement and assure our revenues.

Our aim is to continue diversifying our sources for coal procurement and securing revenues at the upstream end of the coal business. To that end, we will also study new coal mine investment projects that are relatively cost competitive, paying careful attention to the coal supply-and-demand balance and competitor activity, and we will continue taking steps to participate in new coal mining projects.

Clermont Coal Mine (Australia)

Narrabri Coal Mine (Australia)

Stable Transportation of Coal

Stable Transportation of Coal

J-POWER Group uses many different types of coal, and transporting them to the various power stations requires 200 or more voyages per year. Measures we take for stable transportation include the long-term engagement of specialized vessels to carry purchased coal and the conclusion of contracts of affreightment with the shipping companies.

Voice **We are striving to realize stable imports of coal.**

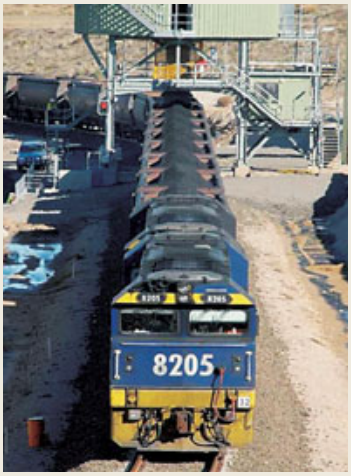
Measures for Coal Mine Investments with a View to Stable Procurement of Coal

Hiroyuki Mochida
Business Development Group
Energy Business Department
J-POWER

J-POWER imports coal as the fuel for our coal-fired power stations largely from Australia and Indonesia. In Australia, we own rights in coal mining projects and manage our investments through our local Group company, J-POWER Australia Pty., Ltd. (JPA).

J-POWER itself is in the position of a purchaser of coal for use in power generation. However, JPA is in the position of a seller that produces and markets coal. As such, it coordinates with J-POWER while engaging in sound project management through participation in regular meetings (four times per year) with each coal mining project as well as in unscheduled technical meetings.

The operation and profitability of coal mines are affected by a variety of different factors in addition to natural disasters such as heavy rains and flooding, including crowded conditions at the shipping port, coal market prices, and foreign exchange movements. Therefore we engage in steady, day-to-day execution of duties as required from a variety of perspectives in order to implement measures for stable coal procurement by means of our coal mining investments.



Loading coal cars at Narrabri (Australia)

Contributing to Stable Supply over the Long Term

Maintaining Stable Supply by Thoroughgoing Attention to Fundamentals

The Matsushima Thermal Power Station started operation in 1981 as the first large-scale thermal power station (two 500 MW units) in Japan fueled exclusively by overseas coal. Since then it has played an important role as a wide area power source supplying electricity to the western Japan region, and it has furnished operating expertise and advanced technology to the power stations that have come after it. Today, even 30 years after it commenced operation, we still make thoroughgoing efforts on the fundamentals, including operation management, checking and analysis of operational data, everyday patrols, and regular ongoing measures for safety and hygiene, and the station continues in stable operation.

Matsushima Thermal Power Station (Nagasaki Prefecture)

Mission as a Wide Area Power Source

In June 2010, the Matsuura Thermal Power Station's No. 1 Unit reached its 20th year since beginning commercial operation. Following the start of operation of the No. 1 Unit (1 GW) in June 1990, it was joined by the No. 2 Unit (1 GW), which began operating in July 1997. The two have a combined output of 2 GW of electric power that is supplied to the Kyushu, Chugoku, and Shikoku areas, carrying out its mission as a wide area power source that supports the provision of a stable supply of electric power to the western Japan region. In the future, too, we will strive to promote appropriate maintenance and operation, to reduce CO_2 by the co-combustion of biomass fuel, and to take other such measures with the aim of contributing to the stable supply of electric power and functioning as a power station in harmony with local communities and the environment.

* Regarding the co-combustion of biomass fuel, please see page 57.

Matsuura Thermal Power Station (Nagasaki Prefecture)

Toward Long-Term Stable Supply

The Tachibanawan Thermal Power Station started operation in July 2000 as a high-efficiency coal-fired power station using ultra-supercritical (USC) technology. Since then, it has been serving as a wide area power source that satisfies strict environmental standards while supplying electric power to the western Japan region.

Now, in its tenth year since commencing operation, some of the facilities and equipment are coming up to their time for renewal. The employees will work together with all their strength to perform maintenance on the power station and keep it in stable operation so that it can continue providing electric power with efficiency and stability for the coming 20 or 30 years.

Tachibanawan Thermal Power Station (Tokushima Prefecture)

COLUMN

Thermal Power Training Center Reaches 10,000 Students

The Thermal Power Training Center was established in 1988 in the Wakamatsu Operations and General Management Office (Kitakyushu City) as an organization to conduct technical training of J-POWER Group employees.

The center provides simulator training (start-up, shut-down, and accident response training, evaluation testing) for thermal power station operators and specialized subject training (theory of valves, pumps, and other equipment, disassembly and assembly skills) for maintenance personnel. Its purpose is to maintain and improve practical competence.

The number of trainees reached the noteworthy total of 10,000 in May 2010. These consisted mainly of J-POWER Group employees together with employees of independent power producers (IPP) and trainees from other countries.

Going forward, we will continue to provide training with the aim of developing technical staff with the advanced practical capability for thinking about what to do and putting it into practice themselves.

Specialized subject training

Specialized subject training

Accident response training

Plant operation simulator training

Developing Technologies for Stable Power Supply

In order to support the stable supply of electricity, J-POWER Group engages in technology development related to the stable operation and maintenance of electric power facilities, the reduction of the environmental load, and the effective utilization of limited resources.

Ensuring Safe, Secure Power Facility Operations

J-POWER has set up the Chigasaki Research Institute and the Wakamatsu Research Institute under the Technology Development Center. These facilities work in coordination with the relevant Head Office departments, the thermal power stations, the regional headquarters, branches, and other units concerned to promote the development of technology that supports the stable supply of electricity. The Chigasaki Research Institute was founded in 1960 as a civil engineering testing center to support large-scale hydropower development. Its organization was subsequently expanded to keep up with J-POWER business developments, and the institute presently has Civil Engineering Laboratory, Thermal Plant Engineering Laboratory, Material Science Laboratory, Power System Engineering Laboratory, as well as Administration group. This institute engages in various kinds of technology development in addition to the kinds described below, including development of various technologies involved in the construction, operation, and maintenance of hydropower, thermal power, wind power, and transmission facilities.

Its other activities include hosting civil engineering workshops, dispatch of instructors to universities, committees, and other such organizations, study tours for members of the public, outreach science classes, and other activities that make advantageous use of institute facilities and personnel resources. In 2010, we held various celebrations of the Chigasaki Research Institute's 50th year of operation, including an anniversary ceremony, planting of Shokawa Sakura (see p. 50), issuance of a commemorative publication, a community concert, and exchanges with local enterprises. We are committed to continuing steadfastly with the Chigasaki Research Institute's work of J-POWER technology development aimed toward the frontiers of energy and the environment.

Technology Development Center Chigasaki Research Institute (Kanagawa Prefecture)

At the 50th anniversary ceremony

Community concert (50th anniversary event)

Anniversary tree-planting underway

Increasing the Reliability of Grid Facilities

Power Grid Analysis

With the object of maintaining stable operation of electric power facilities as well as the voltage, frequency, and other aspects of power quality, the Chigasaki Research Institute runs Power System Engineering Laboratory where power grid analysis simulators are used to verify and analyze the operation of control systems for electric power sources, direct current substations, and other such facilities. These analyses aid in improving the operational reliability of facility control systems and enable a more precise response in case of lightning strikes and other such events, as well.

Power grid analysis simulator

Working to Protect the Dam Reservoir and River Environment

Efficient Technology for Aspirating and Flushing Dam Reservoir Sediment

Sand and gravel from mountains and other upstream areas are washed down during floods into dam reservoirs, where they accumulate. This sand and gravel, which is referred to as sediment, can be a factor causing flooding in the vicinity of the dam reservoir or upstream from it, diminishment of dam reservoir capacity, and riverbed degradation when the downstream supply of sand and gravel from the dam is reduced.

There are locations in J-POWER dam reservoirs where large amounts of sediment have accumulated. We are going to be required, for the future, to drastically limit the impact on the natural environment of downstream rivers and other such areas while continuing to supply dam reservoir sediment downstream.

At present, we are confirming the functionality and making improvements to the sand aspirating and disposal method as a technology for efficiently aspirating and removing this dam reservoir sediment. This technology uses the difference in water level between the dam reservoir and the discharge location and other such factors to draw out sediment through conduit-like equipment placed inside the reservoir and discharge it downstream from the dam.

Experimenting with sucking in sediment by the sand aspirating and disposal method

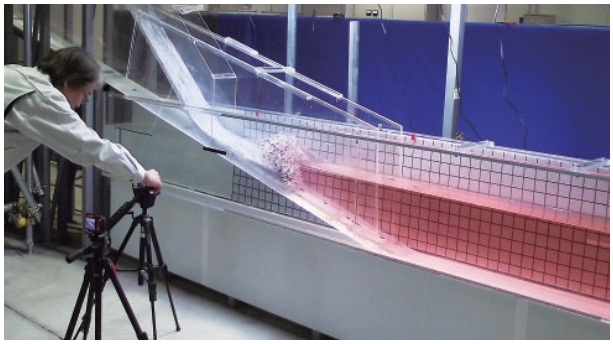
Protecting Power Stations from Natural Disasters

Clarification of the Mechanism that Generates Waves of Various Kinds

Waves include more than just waves at sea caused by winds and tsunami caused by earthquakes. There are also waves generated by natural disasters on land, such as when large-scale slope failures, avalanches, pyroclastic flows, or other such phenomena enter a body of water.

There are cases of such waves caused by natural disasters on land that have occurred in Japan, and there is a possibility that they may occur, for instance, due to a slope failure close to a lake or dam reservoir.

J-POWER has used simulations and the latest analytical models to ascertain the mechanisms that generate various kinds of wave, and we are engaged in development of technology that will contribute to coastal power station structure and dam safety evaluations.



Experiment being conducted on water surface elevation due to an avalanche

Supporting Large-Scale Thermal Power Stations

Accurate Determination of the Lifespan of High-Temperature Equipment

The equipment and piping at power stations includes large items that cannot be easily replaced. At thermal power stations, the soundness of heat-resistant steel that is exposed to an environment of high temperatures and high pressures is critical to stable operation. Accurate lifespan assessment is therefore required.

Lifespan assessments of heatresistant steel have been conducted from long ago. However, the mechanisms of deterioration can change as the development of materials progresses, so the goal is to establish accurate assessment technologies that are permanently geared to the type of steel involved. Our coal-fired power stations that have adopted ultra-supercritical (USC) technology, in particular, have achieved power generating efficiency at the top world level with the support of high chrome ferrite heat-resistant steel[*1]. The Material Science Laboratory at the Chigasaki Research Institute is carrying on creep testing and other such work using a large single-axis creep tester to establish lifespan assessment technology for this type of steel with CO_2 reduction in mind, as well.

Large single-axis creep tester (maximum load of 200 kN) used to collect lifespan assessment data

Aiming for Diversification of Fuels

Evaluating Fuel Suitability for Thermal Power Stations

J-POWER's thermal power stations use coal as their main fuel. Supplies of high-grade bituminous coal and sub-bituminous coal that have relatively high heating value and low moisture content have been growing tight in recent years, and expectations for the use of lignite and other low-grade coal are rising. Attention is also turning to expanded use of biomass in order to contribute to reduction of CO_2 emissions. Since these kinds of low-grade fuel yield low heating value per weight, it is necessary to transport them to the power stations efficiently. There are some fuels that undergo spontaneous combustion more readily, and these must be safely transportable and storable. It is also necessary to maintain good combustibility and environmental properties in the boiler, and to avoid ash deposition, corrosion, and other such problems. These are the purposes we have in mind in seeking to establish technology for assessing fuel suitability.

Electrically heated drop tube furnace (DTF) used to measure fuel combustion properties

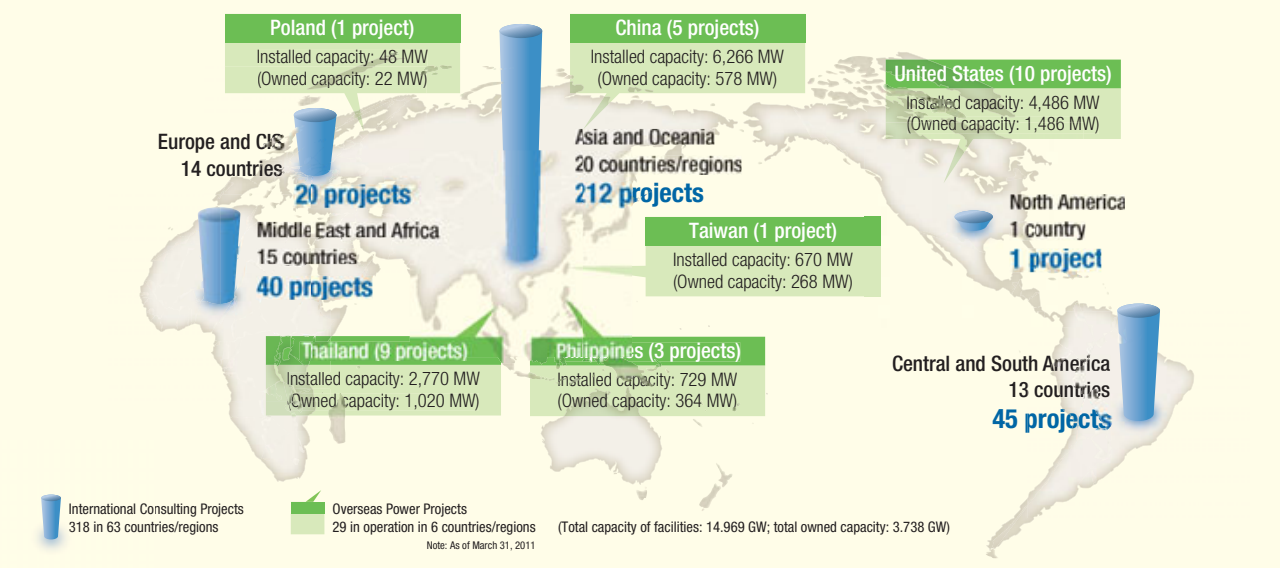
References

*1 High chrome ferrite heat-resistant steel
Steel with the chrome content increased to make it capable of withstanding the high temperatures and high pressures found in ultra-supercritical (USC) and other such technology.

Overseas Operations

J-POWER Group's corporate philosophy calls on us "to play our part for the sustainable development of Japan and the rest of the world." Taking this as our basic approach, and leveraging the accomplishments and know-how we have acquired through some 50 years of overseas operations, we are engaging in international consulting projects, which involve technical cooperation to develop power sources and protect the environment, and in overseas power generation projects, which involve our participation in businesses in which we invest capital and technology. As of the end of March 2011, we had 29 overseas power generation projects in six countries/regions operating electric power facilities with a capacity of approximately 3.74 GW (owned capacity), making this the second pillar of J-POWER Group management.

International Consulting Projects and Overseas Power Generation Projects



International Consulting Projects around the World

J-POWER Technology Earns Trust Overseas

J-POWER Group's overseas operations began with our entry into the field of international technology cooperation, which was prompted by revisions to Japan's Electric Power Development Promotion Law in 1960. All along, we have used the technology and trust developed in Japan to support sustainable development. Starting with the Tacna Hydropower Project in Peru in 1962, our track record in international consulting projects stands at 318 total projects in 63 countries/regions as of the end of March 2011.

For many years and in countries around the world, our international consulting projects have drawn on our technologies and experience in hydropower and thermal power to assess environmental impacts, transfer technology for removing sulfur and nitrogen during coal-fired power generation, and plan, design and supervise the construction of hydropower stations.

Recent projects we have undertaken in new markets and fields include the Java-Sumatra interconnection transmission line project in Indonesia and the Preparing Hydropower Development for Energy Crisis Project in Nepal. In addition, we implemented a project supporting the formulation of a Master Plan for Hydropower Development in Uganda, Africa on a contract for the Japan International Cooperation Agency (JICA) in FY 2010.

These international consulting projects will help our host countries develop a stable supply of energy into the future and reduce environmental burdens by first surveying socioeconomic conditions and energy consumption and demand trends in the countries and then transferring technology from our experience and knowledge through individual projects.

Field visit by trainees from other countries
(Ishikawa Coal Thermal Power Station in Okinawa Prefecture)

Son La Hydroelectric Power Station (Vietnam)

Overseas Consulting Projects Contracted in FY 2010 (New Projects)

Country/region	Type	Project Name	Project Overview or Description of Operation
Indonesia	Power transmission	Java - Sumatra Interconnection Transmission Line Project	Transmit 500 kV power over 233 km of AC power transmission line, 630 km of DC power transmission line, and 35 km of DC submarine cable in order to transmit 3 GW to the island of Java from the 3.6 GW at three locations of thermal power stations being planned as independent power producers (IPP) in the south of the island of Sumatra.
Latin America Caribbean Region	Energy conservation	JICA Training Course for the Improvement of Energy Efficiency Policies for the Promotion of Co-financing with the IDB in Central America and the Caribbean Region	Implement training for the purpose of providing an understanding of Japan's energy conservation policy and measures, clarifying the policies and measures that will be needed in the Latin America and Caribbean (LAC) region in the future, and form the starting points for studying coordination and cooperation with the JICA and the IDB. In light of the results, study and make recommendations regarding the desired modality of coordination and cooperation, with a focus on co-financing.
Nepal	Hydropower	Preparing Hydropower Development for Energy Crisis	A plan meant to deal with this country's serious electric power shortage by constructing a hydropower station with 127 MW capacity on the Seti River near Pokhara City, west of Kathmandu.
India	Thermal	Pre-primary Study of Efficiency and Environmental Improvement of Coal-fired Power Stations, Wanakbori Unit #1, GSECL	To ascertain the facilities and operating conditions of No. 1 Unit of the Wanakbori Power Station (1.47 GW) in Gujarat State, to assess the station's energy conservation, environmental, and operation and maintenance (O&M) state, and to formulate suggestions for improvement.
Taiwan	Thermal	Feasibility Study for Existing Taiwan Coal Fired Power Plant	Renewal of No. 1 and 2 Units (each 500 MW) and No. 3 and 4 Units (each 550 MW) of Hsing-ta Coal-Fired Power Station, located approximately 30 km north-northeast of Kaohsiung.

An Active Part in Overseas Power Generation

Building a "Second Pillar" of Management

Thailand

Thailand has allowed private capitalization in the power generating sector since 1992 as it seeks to diversify its electricity business. Starting in 2000, J-POWER Group has been working with independent power producers (IPPs) in Thailand to keep up with the power demand in that country, which continues to grow from both industry and citizens. By taking part in numerous IPP and SPP projects, we are improving the electric power situation in Thailand and promoting its economic development with both funding and technology.

Particularly, the Kaeng Khoi 2 Power Station, which began commercial operation in Thailand in 2008, is helping to provide a continuous, stable supply of electric power as one of the most important electricity providers in the country. In addition to the conventional electricity business, we are also developing and promoting biomass power generation, for instance at the Roi-Et Biomass Power Station, in Northeast Thailand, which uses rice chaff as fuel. This is contributing to the effective use of untapped resources and reduction of CO_2 emissions.

We are currently developing IPPs in two locations and SPPs[*1] in seven locations.

Roi-Et Biomass Power Station (Thailand)

U.S.A.

J-POWER Group has been wholeheartedly pursuing business in the US since we set up a local affiliate in 2005. We currently have 10 power stations in the country with owned capacity of about 1.49 GW, accounting for some 40% of our power generation business outside Japan.

Although most of our overseas power generating business has been in the high-growth region of Asia, the US offers features different from the Asian market, such as the relatively advanced state of its electricity business system, the universality of its currency, and the maturity of its generating assets sales markets. Having business in the US as part of our portfolio is significant also for our business pursuits in Asia.

Also, being relatively unknown in the US at the time of our market entry there made it more of a struggle for J-POWER Group than in Asia. In the process, we had to work hard to gain access to many projects, build networks with other enterprises and bring talent on board, but these efforts have paid off well.

Recently, we finished our first construction project, the Orange Grove Power Station in California, a state with very stringent environmental protection rules. We successfully brought this power station into operation, and it has been a valuable experience for us. We will use this asset to conduct our next project in a sustained initiative to provide a stable supply of electric power in the US.

Orange Grove Power Station (U.S.A)

China

With its rapid economic development, China has brought some 60 - 100 GW of new power sources online every year since 2002, and most of this has come from coal-fired power stations. Most of the conventional thermal power stations, however, have been of small scale, so they had low power generating efficiency and were unsatisfactory in terms of environmental protection. The Chinese government has adopted a policy of building larger power stations and reducing the number of small ones in order to improve this situation by increasing the efficiency of power generation and lowering its environmental impact on the country as a whole.

J-POWER Group has done consulting projects in China for over 30 years and is also a partner in power generating projects. Using our track record and advanced power generating technology, we are currently involved in the development and operation of many power stations.

In the area of coal-fired thermal power, the Tianshi Power Station makes effective use of low-grade coal, and 10 stations are in stable operation under the Gemeng International Energy Co., Ltd. In the area of renewable energy, the Shuhe Hydropower Station in the Han River Basin has begun operation of all units.

Because some environmental problems have no borders, J-POWER Group will continue to spread its technology to contribute to sustainable development.

Tianshi Power Station (China)

Asia

In the Asia region, J-POWER Group is undertaking overseas power generating projects in the Philippines, Taiwan, and other areas in addition to Thailand and China.

The CBK Project in the Philippines is J-POWER Group's first hydropower IPP project, and it consists of three facilities: the Caliraya and Botocan ordinary hydropower stations and the Kalayaan pumped-storage hydropower station. As well as being an investor in this project, the Group is also in charge of operations and maintenance. As such, we provide the local engineering staff with guidance and endeavor to maintain stable operation. As the Philippines' only pumped-storage power station, Kalayaan in particular helps adjust supply to demand fluctuations and plays a big role in stabilizing the power system.

Chiahui Power of Taiwan is a high-efficiency gas-turbine combined-cycle power generation project we are undertaking jointly with Asia Cement Corporation of Taiwan. In this project J-POWER Group helped to build the station and gave technical support during its early operation, and since then we have continued to post staff locally. Through our active engagement for the company's sound management and stable operation, we are contributing to the stable supply of electric power in Taiwan.

CBK Power's Kalayaan Pumped-Storage Hydropower Station (Philippines)

References

*1 SPP (Small Power Producers)
A system that guarantees purchases of power from small-scale power producers; it promotes the introduction of cogeneration and other energy-efficient equipment.