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Part 1

Social Responsibilities

Measures for a Stable Supply of Electricity

The J-POWER Group produces electricity at hydroelectric, coal-fired thermal 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.

Toward Nuclear Power Stations that are Safe and Trusted Locally

Japan depends on imports for almost all its energy resources. In order to stabilize the supply of energy into the future, it will be essential to go forward with use of the nuclear fuel cycle. A distinctive strength of nuclear power generation is that it does not emit CO₂ in the course of generating electricity. Assuring safety is the top priority in building the Ohma Nuclear Power Station, a full MOX-ABWR, and construction is proceeding steadily to make this a power plant that the people of local communities have trust in.

Significance of the Full MOX-ABWR

Most of the uranium that exists in nature is uranium-238, which is not readily fissionable. There is very little of the fissionable uranium-235 to be found. However, even the not readily fissionable uranium-238, when it absorbs some of the neutrons inside a nuclear reactor, will convert into fissile plutonium-239. When this plutonium-239 is reprocessed, removed, and used again in a nuclear power station, the utilization of uranium resources can be made more efficient.

The use of uranium and plutonium mixed oxide (MOX) fuel in nuclear power stations (light water reactors) for the purpose of using plutonium as nuclear reactor fuel is called “pluthermal” in Japan.

Ohma Nuclear Power Station is a full MOX-ABWR that is aimed at loading MOX fuel in all the reactor cores. This follows Japan’s conceptual approach to the peaceful use of plutonium by not possessing surplus plutonium. Based on the policy of building broader foundations for the flexibility of the pluthermal program, this method plays an important role by contributing to the conservation and effective use of valuable uranium resources.

Plan and Background of the Ohma Nuclear Power Station

The J-POWER Group has been carrying out surveys and studies concerning nuclear power development since 1954, and since 1976 it has been pursuing plans to build the Ohma Nuclear Power Station in Ohma-machi, Shimokita-gun, Aomori Prefecture. The Ministry of Economy, Trade and Industry (METI) granted permission to build this nuclear reactor in April 2008. Construction began in May of that year and is currently proceeding with the aim of starting commercial operation in November 2014.

Overview of the Ohma Nuclear Power Station

<table>
<thead>
<tr>
<th>Location</th>
<th>Ohma-machi, Shimokita-gun, Aomori Prefecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction begins</td>
<td>May 2008</td>
</tr>
<tr>
<td>Commercial operation begins</td>
<td>November 2014 (scheduled)</td>
</tr>
<tr>
<td>Output</td>
<td>1,383 MW</td>
</tr>
<tr>
<td>Reactor</td>
<td>Advanced Boiling Water Reactor (ABWR)</td>
</tr>
<tr>
<td>Fuel Type</td>
<td>Enriched uranium and uranium-plutonium mixed oxide</td>
</tr>
<tr>
<td>Fuel assembly</td>
<td>472 elements</td>
</tr>
</tbody>
</table>

Five barriers encasing radioactive materials

- 1st barrier: Fuel pallet
- 2nd barrier: Fuel cladding tube
- 3rd barrier: Reactor pressure vessel
- 4th barrier: Reactor containment vessel
- 5th barrier: Reactor building

The nuclear reactor containment vessel being assembled

References
Status of Construction Work

The site underwent a government bedrock inspection, which is one of the basic foundation tests that checks the strength of the rock foundation, over October 28-29, 2009. This confirmed that the bedrock was entirely safe enough as the foundation for a facility housing a nuclear reactor.

The construction gained momentum after the bedrock inspection, and work on the foundation of the nuclear reactor building began in the spring of 2010. The nuclear reactor building, which houses the nuclear reactor containment vessel, the nuclear reactor pressure vessel, and other key equipment, is a crucial structure in terms of seismic safety, as well, and the steel-reinforced concrete foundation was therefore laid 5.5 m thick.

The mechanical and electrical work of assembling and installing large pieces of equipment is also being performed in order. The use of five barriers is a key element in containing radioactive materials, and the nuclear reactor containment vessel is one of those barriers. On-site assembly of the interior steel plate lining of this vessel is moving forward, and installation will begin in the summer of 2010.

■ The Status of MOX Fuel Procurement

Procurement of MOX fuel to use in the Ohma Nuclear Power Station is proceeding steadily in parallel with construction of the power plant. A contract for processing MOX fuel was concluded in April 2009, and a contract to take possession of the necessary plutonium was concluded with an electric utility in November.

■ Quality Assurance Activities

Quality assurance is indispensable to the construction of a safe power plant that can earn the trust of surrounding communities and give them peace of mind. We have established a quality assurance organization headed by the President, and implement quality assurance measures based on the Quality Policy for Nuclear Safety.

Quality Policy for Nuclear Safety

Basic Policy
With sincerity and pride underlying all our corporate activities, and with safety as our first priority, each of us shall be involved in quality assurance activities by making ourselves fully aware of our duties and roles, as well as their importance. In this way we will build the Ohma Nuclear Power Station as a facility worthy of the local community’s trust and peace of mind.

Conduct Rules
1. We will perform high-quality design and construction work, giving top priority to assuring safety.
2. We will observe the requirements in laws and regulations, as well as the company’s own rules.
3. We will strive for smooth communication with the surrounding communities, the national government, and other related institutions.
4. We will work continuously to improve the effectiveness of quality assurance activities.

Coexistence with Local Communities

We at the Ohma Nuclear Power Construction Office are engaged in a variety of activities directed at residents of the surrounding communities, seeking to gain their understanding of the nuclear power station and trust.

The public information magazine we publish for the residents of local communities has entered its 20th year of covering topics of local interest while providing information on construction status and plans.

We provide educational assistance in cooperation with schools by holding field trips to geological formations and supplemental instruction in science classes. Programs for participation in local festivals and other events of various kinds are also being carried on continuously.

[http://www.power.co.jp/bs/field/gensiryoku/index.html](http://www.power.co.jp/bs/field/gensiryoku/index.html) (Japanese only)

COLUMN

Ohma Main Transmission Line
The electric power generated by the Ohma Nuclear Power Station being built in Ohma-machi, Shimokita-gun, in Aomori Prefecture will be transmitted via the Ohma Main Transmission Line. This 500-kV line extends a distance of 61.2 km over 129 pylons from this power station to the No. 1 Pylon of the Mutsu Main Transmission Line of the Tohoku Electric Power Co., Inc., located on the grounds of the Higashidori Nuclear Power Station in Higashidori Village. Construction of the Ohma Main Transmission Line was completed at the end of January 2010. We have been paying very careful attention to the surrounding environment when building transmission lines (see p. 59, “Northern Japanese Macaque”). We will carry out maintenance of power transmission facilities accurately in the future so as to provide a stable supply of electricity under the harsh climatic conditions of the Shimokita Peninsula.

Published monthly, the public information magazine is distributed to every household.

One of the field trips to geological formations being conducted for local elementary and junior high school students

http://www.power.co.jp/bs/field/gensiryoku/index.html (Japanese only)

The Ohma Main Transmission Line (Aomori Prefecture) after construction was completed

*1 Nuclear reactor containment vessel
A structure that contains the nuclear reactor and its cooling system and other such equipment and is important for the safety of the nuclear reactor. Even in the unlikely event of an abnormality such as damage to the nuclear reactor cooling system, this prevents the discharge of radioactive materials to the outside.

*2 Nuclear reactor pressure vessel
A strong vessel made of thick steel to contain the core portion of a nuclear reactor. Inside it are the reactor core with the fuel assembly, the control rods and other core internals, the primary coolant (light water), and so on. During operation, the vessel is under high temperature and high pressure.
Helping Ensure the Stable Supply of Electricity

The power generating facilities of the 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.

Fulfilling Our Commitment to Stable Supply

Drawing on Different Power Sources to Help Ensure Stable Power Supply

- Combining sources of power to match changing demand

Daily electricity demand varies substantially from daytime to night, and during the course of a year, demand in summer and winter differs greatly from spring and fall. During a single day, factories, offices, and so on use a large amount of electricity in daytime, while the amount used diminishes at night because there is not very much industrial activity. During a year, there is a great difference in power consumption between the summer and winter, when air conditioning and heating see heavy use, and the spring and autumn, when that use is lighter.

There are also differences among nuclear, thermal, hydropower, and other power generating facilities in their economy of use and their operating characteristics. Therefore, J-POWER and other electric power suppliers provide stable power by combining electricity from different sources to create an optimal balance that is matched to demand as it fluctuates day by day and minute by minute.

As Japan’s largest wholesale power supplier*1, J-POWER owned and operated domestic power generating facilities with a capacity of approximately 17 GW, as of March 31, 2010. These facilities were mainly hydropower, which is purely domestic energy, and coal-fired thermal, which is economically efficient. The company is thus responsible for approximately 7 percent of Japan’s electric power supply. The electric power we generate is delivered to consumers via general electric utilities*2 throughout the country.

Unifying Electric Power in Japan

- Electric power distribution on a nationwide scale

J-POWER owns and operates approximately 2,400 kilometers 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) (see p. 4).

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.
Facilities Maintenance and Technology Transmission

The J-POWER Group possesses various facilities in fields such as power generation, power transmission, transformation of electrical energy, telecommunications, civil engineering, and construction. We engage in high-quality facilities maintenance in order to prevent accidents or other incidents before they occur in these facilities and to minimize their environmental load. These maintenance activities maintain the functionality of the facilities, help stabilize the power grid, and contribute to the stable supply of electric power throughout Japan.

Efforts are being made to pass down facilities maintenance skills that have been accumulated through work in these various fields through on-the-job training and training programs conducted at training centers and other locations, with the goal of developing personnel and raising technical skill levels.

Ensuring Stable Facility Operations

In addition to 24-hour monitoring of power generation facilities, the J-POWER Group works to detect equipment abnormalities as early as possible through daily patrols and strives to maintain reliability and prevent accidents and other incidents via such measures as regular overhaul inspections of facilities.

For example, undersea DC cable connecting Hokkaido and Honshu and large-capacity cable linking Honshu and Shikoku, which crosses a bridge connecting the two islands (Seto-Ohashi Bridge), must be managed while taking into account two extreme locations, the bottom of the ocean and the top of a bridge. Recently, J-POWER has worked to make its DC facilities connecting Hokkaido and Honshu more functionally advanced and reliable by upgrading control equipment and other components.

Also, because transmission and substation facilities are located in various environments, from mountainous regions to urban cities, and subjected to harsh natural conditions such as wind, snow, lightning, and sea salt contamination, surroundings must be taken into account when addressing aging facilities and changes in local environments.

Response to Emergency

In addition, J-POWER strives to promptly and accurately respond to emergency situations and has conducted the following measures to prepare for the event of a natural disaster or accident.
1) Establishment of information contact routes with regions where its power generation and substation facilities and transmission lines are located
2) Operation of a mutual assistance structure with all related units
3) Stockpiling of supplies for post-accident recovery
4) Training for dealing with accidents

Improving and Passing Down Technical Skills

The J-POWER Group works to improve and pass down technical skills accumulated in various fields, including facilities maintenance.

In order to maintain stable operations at hydropower and thermal power facilities, the Hydropower Division’s Kawagoe Training Center in Saitama Prefecture and the Thermal Power Division’s Thermal Power Training Center in Kitakyushu City conduct technical training aimed at maintaining and further developing the practical capabilities of operators and onsite maintenance staff through the use of simulators and other training tools. In the IT & Telecommunications Division, the information technology training facility in Saitama Prefecture is equipped with microwave telecommunications systems and other devices used on actual communications networks. The facility conducts practical technical training to sharpen response capabilities, including training for maintenance workers on how to respond to malfunctions. In the Civil Engineering Division, the Chigasaki Research Institute in Kanagawa Prefecture runs practical training on dam operations using dam simulators located onsite as well as Civil Engineering Technology Training, a comprehensive training program for J-POWER Group employees involved in the field.

*1 On-the-Job Training
Educating and training employees through actual work at the workplace.
Stable Procurement of Coal

Coal Mining Projects in Australia

J-POWER Group is working toward long-term stable procurement of coal to use in coal-fired thermal power stations, and owns stakes in four coal mining projects in Australia for that purpose. The Blair Athol Coal Mine, the key project among those four, will be closing down after 25 years or more since it began exporting coal, while the new Clermont Coal Mine and Narrabri Coal Mine will begin producing in 2010. We are engaging steadily in project management of the development and operational stages of these existing coal mining projects in order to realize stable coal procurement and assure our revenues.

Stable Transportation of Coal

The J-POWER Group uses many different types of coal, and transporting them to the various power plants 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

Toward the Stable Procurement of Coal

Kouta Yasue
Fuel Group
Energy Business Department

The coal that J-POWER uses as fuel in coal-fired thermal power stations is imported primarily from Australia, Indonesia, and other countries on 200 or more ships per year. When scheduling these shipments, we monitor the schedules of ships that are already at sea and project the amounts and times of coming coal shipments, coordinate shipment times with the coal suppliers, and then request the assignment of vessels by international maritime shipping companies.

When shipments are arranged, there is normally a lead time of one to two months from the start of the process to actual delivery of the coal at the power plant. Even when an extra margin of time is allowed, the actual arrival of coal at the power plant is sometimes significantly delayed by weather at the loading port or production circumstances at the coal mine. Therefore, the stable transportation of coal to every power plant does not simply require coordination with the people in our company who handle coal procurement, transportation, scheduling, and the power plants. Coordination with the people concerned in shipping companies, trading companies, call centers, agencies, and other parties outside the company is also essential. The pursuit of these duties on a day-to-day basis from a variety of perspectives, as required, is what makes it possible to realize the stable transportation of coal 365 days a year (see p. 34).
Contributing to Stable Supply over the Long Term
— Topics for FY 2009 —

Recognition as Future Technology Heritage (Numappara Power Station)

The pump turbine at Numappara Power Station (Tochigi Prefecture) was recognized for its value to the history of technology as “the world’s first high-head high-volume pump turbine to exceed 500 m in pumping capability (528 m).” In October 2009, it was designated “essential historical materials for science and technology” (popularly referred to as a “Future Technology Heritage” and so referred to below) by the National Museum of Nature and Science.

Tagokura Power Station celebrated its 50th anniversary of operation in May 2009. This facility was developed as part of the Okutadami-Tagokura-Miboro (O.T.M.) Project, which was one of the next greatest hydropower development projects after the construction of the Sakuma Power Station. Tagokura is a flagship hydroelectric power plant for J-POWER.

The facilities have reached a stage of growing deterioration due to their 50-some years of operation. A comprehensive overhaul of the Tagokura Power Station is therefore underway. (See p. 48.)

We will continue to take action to exist in harmony with local communities, aiming for another 50 years of sustained stability in the supply of power.

Pump turbine registered as a Future Technology Heritage

This power station was built to help satisfy the rapidly growing peak demand for electricity in the Tokyo metropolitan area. Construction was begun in December 1969, and commercial operation started in June 1973. With a total output of 675 MW, it is a high-capacity pure pumped storage power station*1.

The Miyama Dam upstream on the Naka River forms the lower reservoir, while the Numappara Regulating Pond was constructed up on a prominence on the east side of it as the upper reservoir. The vertical distance between the two is 500 m or more. At the time, the single-stage pump turbine with the highest head drop in the world was capable of pumping water to a height of approximately 400 m. It was even said that 450 m was the technical limit, so that pumped hydropower using the highly economical single-stage pump turbine with a greater head drop than that was considered impossible to achieve.

However, a detailed study based on our engineering capability and experience in the construction of hydroelectric power plants accumulated since the company’s founding led to the conclusion that it was possible to achieve. We therefore began joint research with a manufacturer that had abundant experience building pumping machinery. Numerous technical issues were overcome, such as the design of a pump turbine that could realize unprecedented performance and the development of steel for penstock pipe capable of withstanding high pressure. These efforts yielded the first high-head high-volume pump turbine in the world capable of pumping water higher than 500 m.

The engineering success achieved at the Numappara Power Station greatly enhanced the economic efficiency of pumped hydropower, and it also expanded the range of sites capable of development. This power station therefore played an epochal role in the history of pumped hydropower development in Japan.

50 Years Since Commencing Operation (Tagokura Power Station)

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*1 Pure pumped storage power generation

Pumped storage is a method of power generation in which water stored in a lower reservoir is pumped up to an upper reservoir at night, on weekends, or during other time periods when the demand for electricity is low. The stored water in the upper reservoir is then guided and dropped back down to generate power during time periods when the demand for electricity is greater. Pure pumped storage power generation is a particular type in which the upper reservoir receives virtually no inflow from rivers, so that pumping water up from the lower to the upper reservoir is essential in order to generate power.

Voice

The Mission of Providing a Stable Supply of Electricity

Ikuo Nakamaru
Director, Tagokura Power Administration Office
East Regional Headquarters
Hydropower & Transmission System Department

Celebrating the 50th anniversary of commencement of operations at Tagokura Power Station has renewed my commitment to making this power plant continue contributing a stable supply of electricity for another 50 years, and then 100 years.

As the power plant ages, what supports its operation is steady maintenance work. We are focusing our undivided attention on our daily work with this understanding ever in mind.

Many of J-POWER’s hydroelectric power plants are, like the Tagokura Power Station, now approaching their 50th year since starting operation. We consider it the mission of the J-POWER Group to make maximum use of hydropower generation, which is purely domestic energy and which also contributes to curbing global warming.

Everybody in the J-POWER Group joins in the work of improving our hydropower maintenance techniques and steadily engaging in the work of renovation, which no doubt will be increasing in the future. In this way, we will all support the work of providing a stable supply of electricity.
Developing Technologies for Stable Power Supply

In order to support the stable supply of electricity, the 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 the Chigasaki Research Institute and the Wakamatsu Research Institute set up under the Technology Development Center. These facilities promote the development of technology to support the stable supply of electricity, working in coordination with the actual sites concerned and with the relevant departments. 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. The Chigasaki Research Institute will celebrate its 50th year of operation in 2010, and we intend to hold steadfastly to our work of J-POWER technology development intended to achieve the continuing harmony of energy and the environment.

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.
Maintaining Power Generating Facilities

- Technology for Assessing the Health of Concrete Structures

J-POWER’s older power generating facilities have passed the age of 50 years or more, and some of the facilities have undergone damage. The questions of when and how much it would be optimal, from a long-term perspective, to spend on maintenance in order to keep providing a stable supply of electricity, must be answered. The Civil Engineering Laboratory at Chigasaki Research Institute has worked on techniques for predicting the deterioration of concrete structures by combining prediction methods proposed at academic conferences with survey data on J-POWER facilities. The result was the proposal of a deterioration prediction technique unique to J-POWER, and it is being used at J-POWER’s hydropower generating facilities.

Toward the Effective Use of Water Resources

- Technology for Increased Efficiency of Mountain Stream Intake Structures

The J-POWER dams used for hydropower generation include large-scale dams such as the Sakuma Dam that are well known. However, these do not tell the whole story. Our predecessors built small intake structures along mountain streams and channels, and made effective use of the limited water resources. These facilities sometimes become clogged with fallen leaves and branches so that they are unable to take in the designated amount of water. When that happens, somebody goes to that place and clears out the fallen leaves. Almost all the facilities are located deep in the mountains, so that maintenance is difficult. The Civil Engineering Laboratory of the Chigasaki Research Institute built models and conducted experiments with imitation fallen leaves drifting on the current. They have developed techniques for making simple modifications to the facilities so that fallen leaves and branches do not clog the intake and the designated water intake can be achieved without the need for human labor to clear debris away.

Supporting Large-Scale Thermal Power Plants

- Accurate Determination of the Lifespan of High-Temperature Equipment

The equipment and piping at power plants includes large items that cannot be easily replaced. At thermal power plants, the soundness of heat-resistant steel that is exposed to an environment of high temperatures and high pressures is critical to stable operation. Lifespan assessments of heat-resistant 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. The top world level of power generating efficiency achieved by J-POWER’s coal-fired thermal power stations, in particular, is supported by high chrome ferrite heat-resistant steel. The Thermal Plant Engineering Laboratory at the Chigasaki Research Institute is working to establish assessment technology for this type of steel with CO2 reduction in mind, as well.

Aiming for Diversification of Fuels

- Evaluating Fuel Suitability for Thermal Power Plants

The main fuel for J-POWER’s thermal power plants is coal. Recent years have brought increasing demand for the high-grade bituminous coal and sub-bituminous coal that have relatively high heating value and low moisture content. Consequently, expectations have turned toward the use of lignite and other low-grade coal. Attention is also turning to expanded use of biomass in order to contribute to reduction of CO2 emissions.

    Since these kinds of low-grade fuel yield low heating value per weight, it is necessary to transport them to the power plants efficiently. There are some fuels that undergo spontaneous combustion more readily, and these must be safely transportable and storabe. 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.