MASTER TECHNIQUES from Japan to the World 1

Japan's Leading-Edge Research Promotes Geothermal Power Development in El Salvador

In El Salvador in Central America, where volcanoes are distributed across the country, geothermal power generation is an important energy source that accounts for approximately 27% of the domestic power supply and demand. Currently, El Salvador promotes the further development and use of geothermal power generation, a renewable energy source, in order to reduce thermal power generation, which accounts for approximately 25% of total power generated. However, due to the difficulty in proceeding with geothermal power development on its own, the Government of El Salvador requested Japan to provide technical cooperation through JICA. Based on the request, Japan has implemented the "Project for Thermoluminescence Techniques in Geothermal Exploration and Integrated Evaluation System of Geothermal Reservoir" in El Salvador since 2018 under the Science and Technology Research Partnership for Sustainable Development (SATREPS) program.*1

Thermoluminescence Techniques*2 are Japan's unique techniques that Dr. TSUCHIYA Noriyoshi, Professor of the Graduate School of Environmental Studies, Tohoku University, and principal investigator of this project, has advanced the research and development on for over 20 years. These techniques can be applied to narrow down promising areas for geothermal development inexpensively and efficiently. The project is working on the technical transfer by inviting faculty members from the University of El Salvador and engineers from geothermal power company to Japan to learn relevant leading-edge technologies that are under research in Japan, or by holding workshops in El Salvador with lecturers from Japan. "It is crucial to have people understand the importance of principles as well as the know-how of the technology. The speed of development in El Salvador is much faster than in Japan, so it is interesting to see how our research and new technologies are being rapidly put to practical use," said Dr. Tsuchiya. Through this project, geothermal power development has already commenced at four sites, while geothermal exploration is ongoing at another four sites.

A field survey to collect rock samples for exploration using thermoluminescence near the Ahuachapán Geothermal Power Plant (Photo: JICA)

The project has also achieved significant results in terms of human resources development and research and development. Researchers at the University of El Salvador developed a world-first geothermal technology after deepening their knowledge and conducting multiple experiments in Japan, and their paper was published in a prestigious international journal. It is expected that learning from Japan will foster researchers in El Salvador and promote geothermal research in their country.

Dr. Tsuchiya also hopes that young researchers, who will lead the future of Japan, will "understand firsthand" the significance of international cooperation and the importance of international exchange. Therefore, he takes Japanese students with him to project sites and focuses on human resources development through fieldwork. Seeing the students throw themselves into the local community without hesitation, he said, "As we proceed with geothermal research while overcoming cultural barriers, I feel we are advancing international exchange at the grass-roots level. I renewed my conviction that it is important for researchers in both countries to continue exchanging and inspiring each other even after the completion of the project."

This project contributes to expanding the use of renewable energy in El Salvador through the development of geothermal power generation, as well as to fostering researchers in both countries.

Thermoluminescence measurement equipment provided to the University of El Salvador. This equipment, originally developed by Tohoku University, enables exploration for prospective geothermal sites. In addition, an X-ray Fluorescence (XRF) analyzer and an Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) have also been provided. (Third from the left (back row): Dr. Tsuchiya) (Photo: JICA)

*1 See the glossary on page 41.

*2 A resource exploration method for revealing wide-area geothermal activities as well as local heat sources and hydrothermal activities.

MASTER TECHNIQUES from Japan to the World 2

Sharing Lessons from the Great East Japan Earthquake and Japan's Technologies

—Joint Research with Mexico to Create Readiness against Megathrust Earthquakes—

Mexico, like Japan, is a country prone to natural disasters. The country is located where earthquakes tend to be triggered by friction instabilities between plates, and is said to be one of the areas with the highest risk of ocean trench megathrust earthquakes and subsequent tsunamis in the world.

The "Project for Hazard Assessment of Large Earthquakes and Tsunamis in the Mexican Pacific Coast for Disaster Mitigation" (SATREPS)*1 began in 2016 when Associate Professor ITO Yoshihiro of the Disaster Prevention Research Institute, Kyoto University, proposed cooperating with the National Autonomous University of Mexico (UNAM), with the idea of helping Mexico based on lessons learned from the Great East Japan Earthquake in 2011. Dr. Cruz Atienza, the principal investigator on the Mexican side who has contributed to the development of seismology in Mexico, recalled the situation at that time and said, "Mexico was hit by a magnitude 8.0 earthquake in 1985 and suffered a large amount of damage in and around the capital city. One of the factors was our weakness in assessing risk and preparing countermeasures. Faced with a lack of expertise on undersea earthquakes and tsunamis as well as financial resources, I welcomed this cooperation proposal as the head of the Department of Seismology in UNAM."

In the State of Guerrero, located on the southern Pacific coast and the subject of this joint research, indications have been identified that megathrust earthquakes and earthquake-triggered tsunamis may occur in the near future. Therefore, it was necessary to carry out more precise observations and to establish highly reliable earthquake/tsunami models based on the observed data. It was also imperative to raise awareness of threats posed by tsunamis among Mexican people with no experience of major tsunami-based damage. To resolve these issues, stakeholders of both countries worked together to promote research and the implementation of research results into society. Dr. Cruz Atienza said, "This project has delivered three major results for Mexico."

First, this project has established seismic and geodetic networks operating onshore and on the ocean floor. Based on the lessons from the 1985 major earthquake and Japan's cooperation, Mexico installed seismometers, pressure recorders, and other devices on the ground and on the seafloor for the first time. Japan also shared a variety of know-how such as operation and maintenance of these devices and analysis methods of data obtained from them. Mexican researchers successfully developed new theories and methodologies in geodetic observation, and established powerful data analysis methods.

The research team preparing to install seismometers and pressure recorders (Dr. Cruz Atienza, the main researcher on the Mexican side (third from the left), and Associate Professor Ito of the Disaster Prevention Research Institute, Kyoto University, serving as a representative from Japan (center)) (Photo: Kyoto University)

An event held on the Second World Tsunami Day in the city of Zihuatanejo de Azueta, a targeted city of this project, to commemorate disaster prevention education and bury a time capsule. Capsule to be opened 50 years later in 2067. (Photo: Kyoto University)

Second, the project developed and verified hazard maps by simulating earthquakes and earthquake-triggered tsunamis. The tsunami inundation simulation, which was developed based on Japan's insights, illustrated how far inland a tsunami can reach and how people should evacuate. The Mexican side conducted seismic hazard simulations to quantify the risk in coastal areas. These efforts help inform people of the threat posed by earthquakes and tsunamis and the appropriate actions to take.

Third, the project has also worked with Mexico's National Center for Disaster Prevention, which was established by Japanese grant aid after the 1985 major earthquake, to develop disaster education programs based on scientific evidence and Mexico's needs, as well as to introduce these programs to many schools. In developing these education programs, Japan's expertise in disasters from a psychological aspect was also of great help.

Dr. Cruz Atienza appreciates these significant achievements and says, "We are thankful for the collaboration with great Japanese researchers and funding from Japan. We are now engaged in the next proposal to leverage collaboration results in wider areas." It is expected that both countries will further enhance collaboration in this area in the future.

*1 See the glossary on page 41.

MASTER TECHNIQUES from Japan to the World 3

Contributing to Agriculture Promotion with Japan's Technical Guidance on Organic Fertilizers

—Disseminating and Establishing Agricultural Techniques through the Soil and Crop Analysis Center of Kyrgyz National Agrarian University—

The Kyrgyz Republic became an independent country in 1991 following the collapse of the Soviet Union. Agriculture is one of the main industries in the country, but after independence, the destruction of collective farming and the degradation of administrative functions led to the discontinuance of technical assistance and the distribution of agricultural resources such as chemical fertilizer to farmers. While the country had to depend on expensive and unstable imported chemical fertilizers because they were not manufactured domestically, farmers had a hard time purchasing a sufficient amount. As a result, declines in technical expertise and soil fertility lowered crop yield and quality, and consequently, the income of farmers who constitute around 60% of the population.

Biomass research co., ltd. (Bird) plays a role in improving this situation. Bird started as a venture company which was supported by Obihiro University of Agriculture and Veterinary Medicine in Hokkaido, Japan, and works on biogas plant projects leveraging the university's research outcomes. Since 2013, Bird has been working on a JICA Partnership Program to promote organic farming by providing technical assistance for producing organic fertilizers in the Kyrgyz Republic. In February 2022, "Human Resources Development Project for Soil and Crop Analysis Technology at Kyrgyz National Agrarian University" started for a planned period of three and half years, aiming to establish and disseminate organic farming techniques in the Kyrgyz Republic.

Dr. NISHIZAKI Kunio, an executive officer of Bird, who has been working on various projects in the Kyrgyz Republic for a long time, explains that "We started this project to leverage Japan's techniques so that we could develop organic fertilizers using livestock waste readily available to farmers and promote their usage. This approach was welcomed by farmers since other fertilizers were expensive and unaffordable, while these fertilizers can be produced from discarded livestock waste. Using these organic fertilizers in infertile land doubled harvests. As harvests visibly grew, farmers almost started fighting to get the organic fertilizer. This experience made me recognize that using organic fertilizers would help promote agriculture in the country. The Kyrgyz Republic and Hokkaido have many similarities such as climate and industries, so I feel familiarity with the country. I continue to cooperate with people in Kyrgyz, with a hope to help struggling farmers as well as to promote the country's agriculture."

Dr. Nishizaki providing a lecture to leaders in organic farming at the Soil and Crop Analysis Center in Kyrgyz National Agrarian University

Providing technical assistance to local farmers on making organic fertilizers

Many seminars on organic fertilizers were held through such cooperation. Many farmers have started organic farming, since organic fertilizers are environment-friendly and cost-effective and help improve the quality and quantity of crops as well as the income of farmers. In recognition of his contribution to the development of organic farming in the Kyrgyz Republic, Dr. Nishizaki received the title of professor emeritus from Kyrgyz National Agrarian University in 2016.

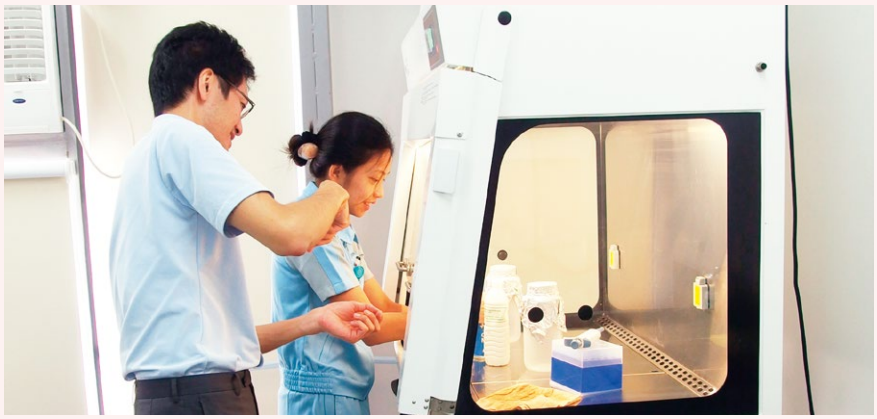
In 2019, the Kyrgyz Republic enacted a law about organic agricultural production and established a policy of promoting organic farming across the country. "Techniques that accurately analyze soil conditions and enable good harvest with a minimum amount of fertilizer should be established in the Kyrgyz Republic in order to further develop organic farming in the country. We currently help the country establish soil and crop analysis techniques that are crucial for this purpose, organize manuals and documents that are important tools for sharing these techniques, and develop leaders who disseminate them to farmers," says Dr. Nishizaki. As crops from organic farming have added value, the project plans to support selling them in new markets including through exports. Organic farming garners a lot of expectations as a technique that helps the growth of the Kyrgyz economy.

MASTER TECHNIQUES from Japan to the World 4

Contribution to Countermeasures against the Growing Cases of Chronic Kidney Disease in the Philippines

—Provision of Low Protein Rice Production Technology by a Japanese Company—

In the Philippines, the National Objectives for Health were formulated, and health and medical standards have been improved through the implementation of various measures such as the National Health Insurance Program for spreading healthcare services. However, the types of diseases that undermine public health have changed. Lifestyle-related diseases account for half of the top ten leading causes of mortality in the Philippines, and the number of people with diabetes and chronic kidney disease (CKD) caused by obesity has increased. Against this backdrop, there is a growing demand to improve diets as well as to introduce and popularize dietary therapy to counter such diseases.



An employee of Biotech Japan Corporation (left) providing instructions to local staff on how to conduct quality inspections on low protein rice (Photo: Biotech Japan Corporation)

Biotech Japan Corporation (BTJ), headquartered in Niigata Prefecture, has long been engaged in the research, development, and marketing of low protein rice. With the Japanese market coming into a plateau due to population decline, however, the company was exploring the possibility of expanding into foreign markets. BTJ focused on the Philippines, where it is possible to communicate in English and people consume more rice than in Japan. In 2014, BTJ visited the country to conduct a market survey on dietary therapy for diabetes and CKD patients, and came to the conclusion that the introduction of low protein rice could help the people in the Philippines improve their dietary lives. Amid the difficulties it faced in finding a local business partner that could serve as a foothold for its overseas expansion, BTJ achieved a breakthrough by utilizing JICA's Support for Japanese Small and Medium Enterprises (SMEs) Overseas Business Development scheme (currently implemented as SDGs Business Supporting Surveys). Development of BTJ's business was accelerated immediately after the adoption of the "Verification Survey with the Private Sector for Disseminating Japanese Technologies for Low Protein Rice for Dietary Therapy of Chronic Kidney Disease in the Philippines" by JICA. With regard to the benefits of utilizing JICA's support scheme, Mr. EGAWA Jo, BTJ's Chief Executive Officer, says, "Even the companies that had previously turned us away would meet with us immediately when we explained that it was a JICA project. I was surprised at the complete difference in their openness to taking appointments. It made me keenly aware of the wonderful trust that JICA has built up over the years."

This project, implemented in cooperation with the Philippine Rice Research Institute (PhilRice), involved the production of low protein rice by using long-grain rice grown in the Philippines. However, there were many challenges in transferring Japan's technology because of the different properties of this rice compared to short-grain rice, which is the mainstream variety in Japan. Long-grain rice has a propensity to crack when it undergoes processes to reduce protein content, which made BTJ struggle with selecting suitable varieties of long-grain rice. According to Mr. Egawa, "The hard water in the Philippines makes processing more difficult in comparison with the soft water used in Japan, and the people also have different preferences in rice flavors and textures from the Japanese people. Therefore, we produced numerous prototypes to create the exact product that suits the preferences of Filipinos."

As a result of these efforts, low protein rice production technology for Philippine rice was established. Efforts are now ongoing, in cooperation with the Food and Nutrition Research Institute (FNRI), to disseminate dietary therapy by explaining the effects of low protein rice to local doctors and nutritionists, among other measures. In this way, ODA provides support for the overseas expansion of SMEs as well as contributes to resolving issues in developing countries. Local doctors have expressed their appreciation with feedback such as, "We are truly happy to finally be able to realize the production of low protein rice in the Philippines."

Promoting low protein rice with an exhibition on it. It attracted attention from medical practitioners as a food that enables easy nutritional management. (Photo: Biotech Japan Corporation)