

JBIC Today

Japan Bank for International Cooperation



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Special Feature

Capturing diverse infrastructure needs of the world

Ongoing Project

Jordan sheds new light on the Middle East

Our Global Challenges

Forth Inc. (Kouka City, Shiga Prefecture)

Correcting distortion of just 0.1 mm with a hammer
Sophisticated craftsmanship supports Japanese quality in Thailand

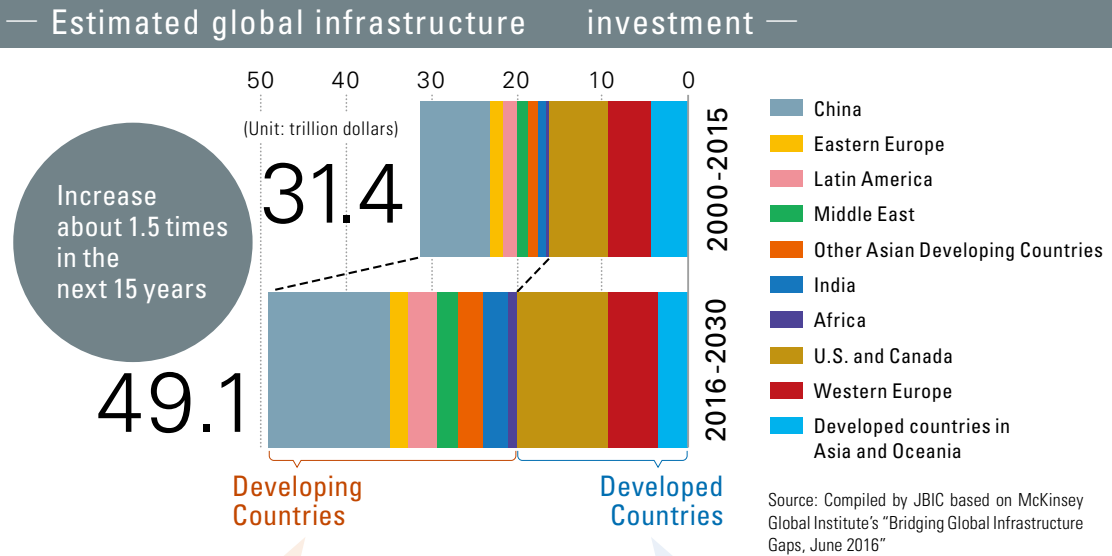


Special Feature

Capturing diverse infrastructure needs of the world



Delhi, India



Washington State, U.S.

Developing Countries

Demand for various infrastructure

Infrastructure demand in developing countries is considered to vary with the stage of economic development. In countries whose GDP per capita is less than 2,000 dollars, it is necessary to establish basic social infrastructure required for people's daily lives and business activities, such as electricity, roads and ports. However, as GDP per capita grows in developing countries, they see increasing demand for high-quality infrastructure such as energy-saving infrastructure to reduce environmental burdens, and facilities and equipment aimed at improving the quality of life (see Figure 1). According to the World Economic Outlook issued by the IMF, developing countries are expected to grow at an annual rate of about 5% in the future. The high-quality infrastructure needs of those developing countries are likely to increase in line with their economic growth.

Figure 1: Changes in infrastructure needs due to increase in GDP per capita

Needs for establishment of basic infrastructure	Needs for infrastructure for industrialization	Needs for high quality and efficient infrastructure	Needs for infrastructure to improve the quality of life
GDP per capita: Below USD 2,000	GDP per capita: USD 2,000 to 5,000	GDP per capita: USD 5,000 to 15,000	GDP per capita: Above USD 15,000
Overall objective - To secure the supply of basic infrastructure required for people's daily lives Power sector - Supply of electricity required for people's daily lives - Construction of large-scale power stations and core electric power cables Transportation sector - Construction of basic road networks connecting major cities - Construction of major ports Others - Establishment of urban water supply system	Overall objective - To increase the volume of infrastructure for industrialization Power sector - Response to increasing demand for power supply due to industrialization, Securing of stable power supply - Expansion of power supply capacity and transmission network Transportation sector - Expansion of road networks - Construction of inter-city railways Others - Response to water pollution arising from urbanization - Establishment of a sewage system	Overall objective - To increase infrastructure quality, such as improvement of efficiency and convenience or use of environment-friendly technology Power sector - Introduction of energy-saving and low-carbon technologies Transportation sector - Improvement of urban road networks - Construction of expressways and high-speed railways - Introduction of energy-saving and low-carbon technologies Others - Waste disposal	Overall objective - To increase the quality of lives Power sector - Establishment of "Smart City" - Improvement and upgrading of existing facilities Transportation sector - Establishment of advanced transportation system - Construction of international hub airports - Improvement and upgrading of existing facilities Others - Infrastructure for a comfortable urban life

Source: Compiled by JBIC based on "Table 1: Economic Development and Necessary Infrastructure" on page 85 of "MIZUHO Research & Analysis No. 12" published by Mizuho Financial Group, Inc.

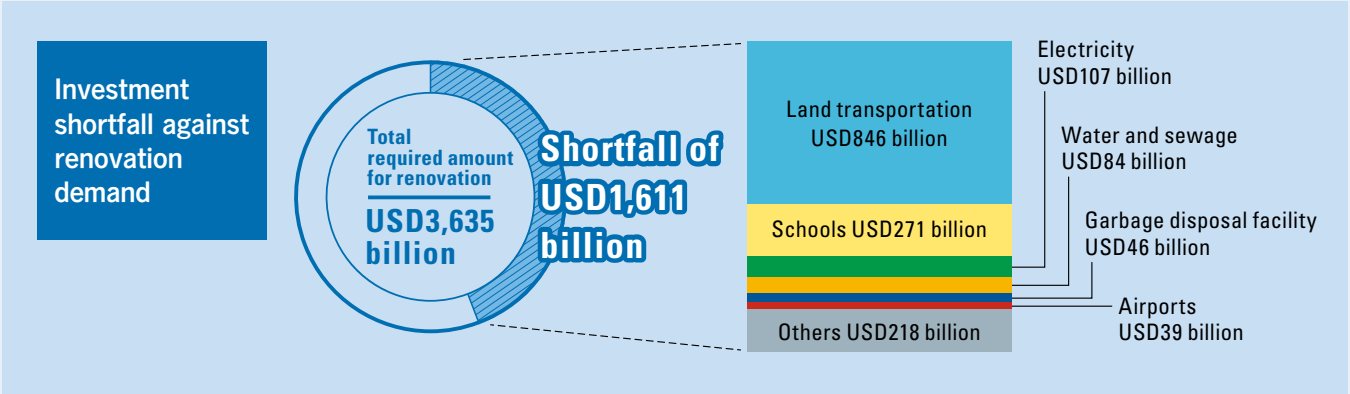
Developed Countries

Facing a serious problem with aging infrastructure

There is very large for renovation of aging infrastructure in developed countries such as the U.S. and U.K. In the U.S., infrastructure established during the Eisenhower administration, which started in 1953, is degrading rapidly. According to a report from the United States Department of Transportation, 25% of bridges across the country are inadequate or obsolete and 12% of tunnels are more than 100 years old. An investment of about USD3.6 trillion is required to repair and reconstruct major infrastructure across the U.S. between 2013 and 2020. At the same time, it is estimated that there is an investment shortfall of

about USD1.6 trillion (see Figure 2) for infrastructure improvements. The situation is the same in the U.K. The railway infrastructure constructed in the late 19th century that has supported the U.K.'s industrial development for about 200 years, now needs to be improved for enhancing transportation capacity by introducing a high-speed railway system. Furthermore, about half of the water supply networks in London are more than 100 years old and the city is facing the problem of an increasing number of water leakage cases due to the obsolete water supply infrastructure.

Figure 2: Investment demand for infrastructure renovation in the U.S. (2013–2020)



Investment shortfall = Amount required for investment – Estimated investment amount
The estimated investment amount is calculated based on the assumption that the current investment trend will continue. The proportion of public and private-sector investment varies according to type of infrastructure.
Source: Compiled by JBIC based on "Report Card for America's Infrastructure" published by the American Society of Civil Engineers in March 2013.

Current instances of infrastructure needs

Developing Countries

Developed Countries

Demand for medical infrastructure required for a comfortable urban life

Demand for infrastructure renovation

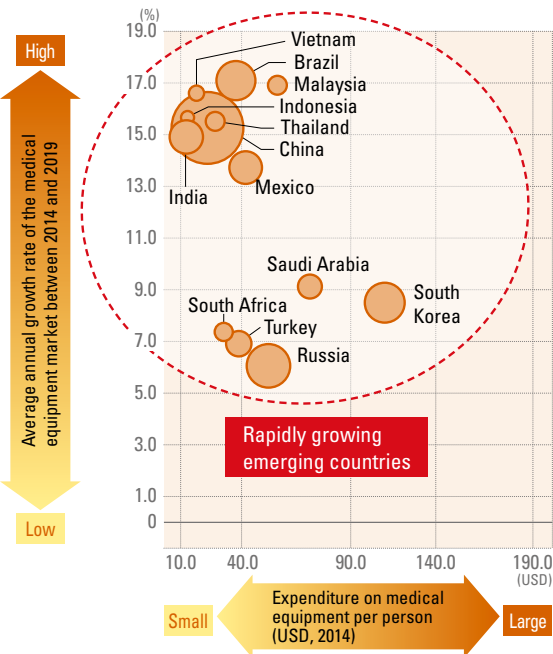
In developing countries that already have a certain level of social infrastructure and face remarkable increases in population and average life expectancy, there is a growing demand for infrastructure which is indispensable for a comfortable urban life, for example, demand for medical facilities. In the medical sector of developing countries in the Middle East and Asia, there is a movement in recent years to expand their healthcare systems, including launching a medical reform program and introducing a universal healthcare system.

The Japanese medical sector could provide attractive solutions to those developing countries in demand for medical infrastructure as Japan has efficient and advanced medical technologies and services. In fact, the Japanese government expressed its intention in the "Growth Strategy" and "Healthcare and Medical Strategy" to encourage Japanese companies to find business opportunities in overseas medical markets and roll out their technologies and services to the world. Japanese companies have already made the move to expand their business overseas, such as export of medical equipment, acquisitions of foreign companies and participation in hospital projects overseas. Since FY2014, JBIC has financed 26 projects to support Japanese companies in expanding their business in relation to healthcare to overseas countries.

On pages 6 and 7 of this brochure, we introduce an example of a hospital project in Turkey that a Japanese company participated in.

Medical equipment market in developing countries

Growing demand for medical equipment



Note: The size of the circle of each country in the above figure shows the size of the market.
Source: Compiled by JBIC based on "Latest Trend in Global Medical Device Market" published by Japan External Trade Organization (JETRO)



Delhi, India: Buildings under construction



Istanbul, Turkey: A rapidly urbanizing city



Project involving JBIC's financing

Hospital business in India

The U.S. has the greatest demand for investment in infrastructure among developed countries, more than three quarters of which is for infrastructure renovation. The Trump administration has reiterated the need to invest in infrastructure since it took office. In the 2019 Budget Message, the administration announced its plan to spend USD200 billion in federal funding for infrastructure investment, while mobilizing private-sector funds for the remaining portion of investment.

According to the 2017 JETRO Survey on Business Conditions of Japanese Companies in the U.S., Japanese companies that have already entered the buoyant U.S. market are planning to further expand their business. The survey also shows that their focus is now drawn to the direction of U.S. policy to promote infrastructure investment. On pages 8 and 9 of this brochure, we present the capability of our "state by state" approach aimed at meeting the infrastructure needs of the U.S. and an example of a Japanese company that has recently participated in an infrastructure project in the country.

2017 Infrastructure Evaluation in the U.S.

Various infrastructure with grade "D: Poor"

AVIATION	D	WASTE WATER	D+
ROADS	D	INLAND WATERWAYS	D
DRINKING WATER	D	BRIDGES	C+
PORTS	C+	TRANSIT	D-
RAIL	B	ENERGY	D+
DAMS	D	America's Cumulative Infrastructure Grade	D+

A : Exceptional B : Good C : Mediocre D : Poor F : Failing

Source: Compiled by JBIC based on data from the American Society of Civil Engineers



U.S.: Town with aging streets



U.S.: Rapidly aging electric power cables



Project involving JBIC's financing

Intercity Express Programme in the U.K.

Hospital Business in Turkey

— Introducing safe, reliable and efficient medical infrastructure technology from Japan —

Construction of Ikitelli Hospital in Istanbul in Turkey is scheduled to be completed in 2020. To meet growing healthcare needs in the country, Japanese trading firm Sojitz Corporation ("Sojitz") has launched a project in the form of a public-private partnership^(Note 1) to build a hospital. The aim of this PPP project is to design, construct and manage a hospital facility, and provide related medical services. JBIC will provide project finance^(Note 2) for this joint project undertaken by Sojitz and Ronesans Holding A.S. ("Ronesans Holding"), a leading Turkish construction company. The loan is co-financed by private-sector financial institutions, bringing the total financing amount to JPY163 billion. This report highlights the background of the launch of this project in Turkey, which is the first hospital PPP project in which a Japanese company has participated, and Sojitz's challenges and enthusiasm for entering the medical infrastructure business which is a new area for the company.

Paving the way for Japanese companies to enter medical infrastructure business in a developing country

—Why were you interested in starting the medical infrastructure business in a developing country, such as hospital facility operation?

Koinuma Amid expected increases in the world's population and average life expectancy, we recognized that Japan's technology and knowledge of developing high-quality medical infrastructure is indispensable for improving the quality of people's lives. People in developing countries are becoming increasingly health-conscious as their economies grow. Against this backdrop, we came to believe that Japan's highly-efficient medical care system will help to provide solutions to the issues faced by the healthcare sector in developing countries because Japan has advanced medical technology and services. The Japanese government announced its "Healthcare and Medical Strategy" in July 2014, with the aim of promoting the roll-out of Japanese healthcare services in the world. In response to this announcement, we thought that Sojitz, as a trading firm, could become the first successful example of exporting Japanese medical technology and services, which would help to pave the way for other Japanese companies to expand into the medical infrastructure business.

— Why did Sojitz establish Medical Infrastructure Office in April 2017?

Koinuma To focus on the Ikitelli Hospital PPP Project, we decided that we need to enhance

and deepen our new efforts to develop medical infrastructure. To this end, we established Medical Infrastructure Office, which integrates multiple divisions working in the field of healthcare and infrastructure development.

— Why did you choose Turkey as an investment destination for your first medical infrastructure business?

Koinuma We have two major reasons. The first reason is that Turkey has improved its own health insurance system, including launching a medical reform program in 2002, introducing a universal healthcare system in 2008 and enacting the new hospital PPP law in 2013. The current Erdogan administration is also striving to enhance the Turkish health care system in addition to upgrading transportation infrastructure and improving education. Against this backdrop, medical needs in Turkey are expected to continue growing. The second reason is that we were already seeking an opportunity to work with Ronesans Holding on forming a joint venture in the concession business^(Note 3) which is positioned as the core business of Ronesans Holding. We have already established a close business relationship with Ronesans Holding, which is why they are our partner company for this project. As JBIC promptly considered our request for financing this project, we decided to participate in the project which is expected to help establish our core business in the medical field and increase healthcare services in Turkey, in addition to further strengthening our relationship with Ronesans Holding.

— Please explain how the roles of Sojitz, Ronesans Holding and the Turkish government are split in this project.

Koinuma The Turkish government is responsible for providing overall medical services, ranging from hiring doctors and nurses to offering medical treatments to patients. We and Ronesans Holding will work together to design and construct the hospital, raise funds as well as maintain hospital facilities. We are in charge of providing non-medical services in the hospital by utilizing our knowledge of operating Japanese hospital facilities, includ-

ing that of hospital building management, maintenance of medical equipment, cleaning, car park management, information system management, hospital meal services, diagnostic imaging systems and support services for rehabilitation.

Providing solutions to issues in the medical sector in Turkey; Aiming for further medical infrastructure development

— What are the issues in the medical sector in Turkey?

Koinuma Medical issues facing Turkey include constraints in the provision of both medical facilities and services. Although the introduction of a universal health insurance system allowed all Turkish people to receive medical treatment, many national hospital buildings and facilities are aging because they were built in the 1930s and 1940s. Under such circumstances, medical infrastructure supply in Turkey lags behind demand. Moreover, healthcare professionals in Turkey currently work under an inefficient system that requires them to perform hospital administrative duties in addition to their medical work. This makes it hard to improve the quality of medical services in the country.

— What are the innovative points of this project?

Koinuma The host country can attract investment and financing from abroad as well as gain knowledge on medical infrastructure development, through the use of private-sector techniques that cover every task of a hospital project from building construction to facility management. This can also help construct a new hospital in an efficient way. We also believe that using private-sector companies for the provision of non-medical services enables medical professionals to focus more on their medical work, which will lead to improved medical services in Turkey. This project meets the medical needs of Turkey through the introduction of efficient Japanese methods of hospital facility management. This project will also help the country to provide state-of-the-art medical treatment while providing solutions to the issues and challenges that the medical sector is facing.

— Please explain "efficient Japanese methods of hospital facility management."

Koinuma The strength of the Japanese methods of hospital facility management can be characterized by "total optimization" of hospital facility management. This management technique refers to increasing the overall efficiency of a hospital, for example by centralizing the management of drugs and medical supplies inside the hospital, rather than managing them at each medical department. This type of hospital is not common outside Japan. We plan to employ local people for the hospital facility management company. This will not only create new employment opportunities for the local community, but also contribute to the development of the medical sector in Turkey through the transfer of techniques and knowledge on Japanese hospital facility management to local staff members during personnel training programs.

— What competitive advantages have you built in this medical infrastructure project? What business do you think you could start in future based on your competitive advantages?

Koinuma In this project, we have made a great achievement in the operation and management of large-scale hospital facilities. The collaborative framework we built with partner companies in our business network, as well as support from JBIC and NEXI, will continue to be sources of our competitiveness in the future. At present, there are business opportunities for Japanese companies in medical infrastructure development. I believe that Japanese companies can also see business opportunities in areas such as

logistics for medical equipment and supplies, and other related services as they can utilize their strengths for such businesses. Recognizing those areas as future business opportunities, we will continue to structure projects in an accelerated manner.

Note 1: Public Private Partnership is a contractual scheme under which the public and private sectors cooperate to develop infrastructure projects or provide public services by mobilizing private-sector funds and knowledge.

Note 2: Project finance is a financing scheme in which repayments for a loan are made solely from the cash flows generated by the project.

Note 3: A concession business is a business in which a private-sector company established as a special-purpose company is contracted to operate facilities owned by a public agency for a certain period of time.

Voices of JBIC's staff members

Providing financial support for Japanese companies planning to expand into overseas medical and healthcare markets

There were three key factors for the successful development of the project finance scheme for this project. The first factor is that Turkey's PPP system for hospital projects looks stable in the eyes of the lender. The second factor is that the project is jointly undertaken by Sojitz, a large Japanese trading firm, and Ronesans Holding, an experienced Turkish constructor. The third factor is that, through Sojitz, the project is expected help expand the Japanese medical business in Turkey, including the introduction of Japanese techniques and knowledge of hospital facility operation and management into the country.

After holding numerous dialogue with Turkish government high officials, we confirmed their commitment to maintaining a PPP system for hospital projects in Turkey as well as the significance of this project. We also had discussions with international organizations such as International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD), which had financed a number of hospital PPP projects. We considered the information gained through those discussions when examining the financing for this project. Based on these efforts, we took the lead in developing a bankable financial scheme for this project. As a result, project risks were shared among the parties involved in the project, including the Turkish government, in an appropriate manner, which finally enabled us to make a loan to this project.

Amid the increasing population in emerging countries and growing expectations for advanced medical services, the global demand for medical and healthcare products and services is becoming stronger and more diverse. Under such circumstances, Japanese companies are expected to find huge business opportunities not only in the hospital business, but also in the area of medical equipment and pharmaceutical products. As a Japanese policy-based financial institution, JBIC, in collaboration with private-sector financial institutions, will continue to provide financial support for Japanese companies which plan to expand into overseas medical and healthcare markets, by drawing on its various financial instruments for structuring projects and by expanding its risk-taking ability.



Taro Kato

Director
Division 1
Corporate Finance Department
Industry Finance Group



Aoi Suzuki

Division 1
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Entering the infrastructure business in developed countries

— Leveraging the growing demand for infrastructure renovation in the U.S. —

The Trump administration in the U.S. aims to mobilize a total of USD1.5 trillion of public and private investments in infrastructure projects over the next 10 years. In the 2019 Budget Message released in February 2018, the federal government announced plans to use USD 200 billion in federal funding for infrastructure investment. The purpose of the investment plan is to make large-scale renovations to the country's infrastructure which has been left untouched for more than half a century. The Trump administration strives to attract investment from the private sector and local governments into the massive infrastructure plan, while using the federal budget. How can Japanese companies benefit from the growing demand for infrastructure improvements in the U.S.?

Business Example 1 Washington State needs improved “connectivity”

JBIC's Action

Conclusion of a memorandum of cooperation with Washington State Government

JBIC signed in August 2017 a Memorandum of Cooperation (MOC) with the Washington State Government to support infrastructure business in Washington State. The aim of the MOC is to establish a business cooperation relationship between JBIC and the Washington State Government to promote business expansion in the state through investments by Japanese companies.

— What is the current situation of infrastructure in the U.S.?

Suzuki When I worked in JBIC's New York representative office several years ago, I often noticed aging roads and bridges while driving along the streets. Utility poles were sometimes brought down by heavy snow, knocking out the power. It was quite obvious that there was an urgent need to renovate infrastructure. No large-scale infrastructure improvements have been made throughout the U.S. since the Eisenhower administration took office in 1953. An investment of USD1.5 trillion in infrastructure projects in the next 10 years seems ambitious but it is essential.

— JBIC applies a “state by state” approach, by which JBIC tries to develop collaborative relationships with state governments, to help Japanese companies find opportunities to join infrastructure projects in the U.S. Please elaborate on this approach.

Suzuki Although the federal government has announced its massive

infrastructure investment plan, local governments in each state actually attract investments because they have strong authority over infrastructure improvements in the state. Therefore, it's extremely important to establish connections not only with the federal government but also with state governments when structuring projects in each state.

Washington State has a faster growing economy and population compared to other states in the U.S. In response, a number of infrastructure projects are being planned in the state. Located along the Pacific Coast, the state is also geographically important for logistics between inland areas of the U.S. and Asian countries. Due to this, various industries have been attracted into the state and many Japanese companies have also started doing business in the state. Capitalizing on its geographical convenience, Washington State strives to become a gateway to Asia, while improving the traffic networks of the state and increasing the “connectivity” between Asian countries and other states in the U.S.

Against this backdrop, JBIC signed an MOC with the Washington State Government to support Japanese companies which plan to expand their business to Washington State. The scope of this MOC includes exchange of information about the competitive advantages of Japanese companies and the infrastructure needs of Washington State.

Becoming a “solution provider” in each state in the U.S. by meeting the needs of local communities

— Specifically, what renovation needs do you foresee?

Suzuki There are several infrastructure plans in Washington State, including railway improvements in the center and suburbs of Seattle and a high-speed railway line connecting Vancouver, Seattle and Portland. I believe that Japanese companies will have opportunities to negotiate on supplying trains and signaling equipment for those projects, as they have a great competitive advantage in these areas.

— What does Washington State expect from Japanese companies?

Suzuki They expect Japanese companies to provide advanced technologies and high product quality. Although Japanese products cost more than those of other countries at the time of installation, they are less prone to failure and offer lower repair costs. That is, the lifecycle cost of Japanese products is low. Developing countries might focus most on the initial price, but developed countries emphasize a balance between price and quality as an important element of evaluation. Business achievements in developed countries lead to further business in developing countries.

— What is needed to meet those expectations?

Suzuki It is necessary to know local needs precisely and offer the right solutions. We need to explore local needs by involving JBIC's local staff members. It is also important to explain quantitatively why Japanese technology is prominent in terms of lifecycle cost, in addition to the high level of technology. We have to become a “solution provider” for the problems and challenges that the state government is facing.

Business Example 2 Meeting environmental infrastructure needs of California State with Japanese technology for improving quality of life (“QOL”)

Project involving JBIC's finance

Waste treatment and power generation project by a U.S. subsidiary of Hitachi Zosen Corporation

In this project, Kompogas SLO LLC (Kompogas SLO), a U.S. subsidiary of the Hitachi Zosen Cooperation Group, is to construct a waste treatment and power generation plant with a waste treatment capacity of 30,000 ton/year and a power output capacity of 730 kW. Kompogas SLO will conduct waste treatment and biogas power generation and sell compost^(Note) for 20 years. JBIC signed a loan agreement with Kompogas SLO amounting up to USD6.1 million (JBIC portion). The loan is co-financed by a private financial institution, bringing the total co-financing amount to USD12.4 million.

Note: Compost is fertilizer made by fermenting organic matter, such as food waste.

— Where do you think Japanese companies can find other business opportunities in the U.S.?

Suzuki Let me describe a project in which a Japanese company responded to the environmental needs of the State of California. Even after President Trump declared that the U.S. was withdrawing from the Paris Agreement, California has remained committed to achieving the targets set by the Paris Agreement, and is considered as an environmentally advanced state. Recognizing California's need for environmental technology, Kompogas SLO, the U.S. subsidiary of Hitachi Zosen, participated in the project to construct a biogas power generation plant that generates power by collecting and fermenting food waste. This technology integrates the fermentation technology of a Swiss company that Hitachi Zosen acquired with the advanced thermal power combustion technology of Hitachi Zosen. It generates power by fermenting household food waste and burning the generated gas. This is a suc-



The same plant as the waste treatment and power generation plant of the California project

cessful example in which a Japanese company found a business opportunity by recognizing that their business met the objective of the environmental policy of the state.

— What is the key point in taking an approach to meet the environmental technology needs of states?

Suzuki It is important to understand the environmental policy precisely, which varies by state. Japanese companies have not yet accumulated a strong track record of providing environmental technology. However, if Japanese companies understand the environmental technology needs of state governments and take different approaches for different states when negotiating with them, I strongly believe that they will consider the advanced Japanese technologies to be in line with their environmental policies. It could successfully join the project by bringing in the technology of the Swiss company that it had acquired. M&A is another important way of meeting the infrastructure needs of developed countries.

— What advice can you give to Japanese companies planning to enter the infrastructure business in developed countries including the U.S.?

Suzuki In general, Japanese companies have a competitive advantage in providing technologies that help to improve quality of life. As shown by the above two business examples, when Japanese companies try to enter the infrastructure business in developed countries, it is extremely important to make business proposals to national governments or state governments of developed countries in a way that demonstrates that Japanese companies' technologies can provide solutions to the problems and challenges that those governments are facing.



Hiroyuki Suzuki

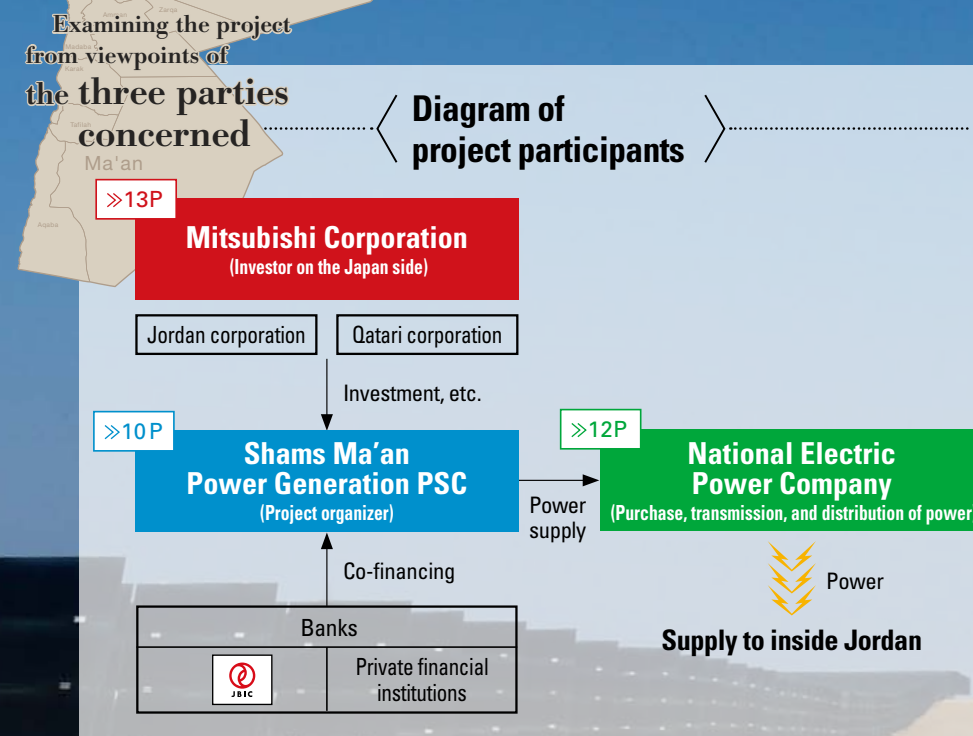
Director
Division 1 and Division 4
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JBIC will continue to support Japanese companies in structuring projects that satisfy various infrastructure needs of developed countries by capitalizing on Japanese technologies that help to improve quality of life, such as projects which are expected to increase the connectivity between developed countries and other countries in the world.

Ongoing Project

Jordan sheds new light on the Middle East

Endless rows of solar panels exposed to direct sunlight can be seen in an area of Ma'an Governorate of Hashemite Kingdom of Jordan (hereafter Jordan), which is located about 220 km south of the capital city of Amman. In this province, the Shams Ma'an photovoltaic power generation project was carried out with the participation of a Japanese company. The goal of this project is to generate and sell electricity converted from sunlight, and contribute to the local area through active corporate social responsibility (CSR) activities. Since its start in September 2016, the project has been operating successfully. This report takes a close look at the project and the views of the people involved.



Summary of the project

This is the largest photovoltaic generation project in the Middle East,^(Note) in which the Jordanian company Shams Ma'an Power Generation PSC (hereafter "Shams Ma'an") sponsored by Mitsubishi Corporation constructed a photovoltaic power plant with a generation capacity of 52.5 MWac in Ma'an Governorate to sell electricity to National Electric Power Company (hereafter "NEPCO") for a 20-year period to 2036. In support of this project, JBIC signed a financing agreement for up to 77 million USD for Shams Ma'an in January 2015, its first project financing for photovoltaic generation business in the Middle East.

Note: As of January 2015 when the financing agreement was signed.

Shams Ma'an photovoltaic power station in Ma'an Governorate of Jordan

Implementing a power generation project

Viewpoint of Shams Ma'an

Establishing a milestone for photovoltaic projects in the Middle East



Samer Al-Ma'any

CEO
Shams Ma'an Power Generation PSC

Located in Ma'an Governorate, Jordan, Shams Ma'an is the company engaged in the construction and operation of this project. Mitsubishi Corporation participated in this project as a sponsor from Japan. The success of Jordan's first large-scale photovoltaic generation project is expected to be a milestone of photovoltaic generation projects in the Middle East.

Question

Can you tell us about the history of this project from its start to completion and about the development of business rooted in the local community from the standpoint of a project operator?

— Tell us about the history of this project up to its completion.

This project was initiated according to the plan drawn up by His Majesty King Abdullah II Ibn Al Hussein in 2011. The project site Ma'an Governorate is inconveniently located because it is 220 km from the capital Amman, and faced a high unemployment rate because small-scale industry was not developed. In Jordan's pursuit of a renewable energy strategy, Ma'an Governorate is considered to be an ideal place for using solar power for the generation of electricity because of its flat land and abundant solar radiation needed for high generation efficiency. King Abdullah's goal was to promote photovoltaic generation business using facilities inside the province without relying on procuring fuel from distant areas. In the construction phase, the project faced several problems, including the treatment of waste flowed from other photovoltaic power plants located in the surrounding areas and measures against floods in the rainy season. While struggling with these problems, people involved in the project worked very hard to complete the construction of the photovoltaic power plant. As a result of their

hard work without a holiday for 45 days before the completion, the opening ceremony was successfully held on October 10, 2016.

—What are the operating conditions of the photovoltaic power plant?

The current availability factor operating ratio^(Note 1) of the installed solar panels is 99.6%, which exceeds the target of 98%. At the same time, the power output performance ratio^(Note 2) is 79.3%, exceeding the target of 78.2%. As fugitive dust that accumulates on the solar panels greatly affects power generation efficiency, the solar panels need to be cleaned in an effective way. In this respect, our employees, including 50 local residents, do excellent work in cleaning and monitoring of the solar panels, as well as device management. The photovoltaic power generation business has spread to other countries such as Saudi Arabia and Dubai. We hope that the experience gained by the employees of Shams Ma'an will be of benefit for them when they work on renewable energy projects in other countries in future.

Note 1: The availability factor refers to the proportion of time when a photovoltaic facility is in operation.

Note 2: It shows how much electricity was generated as compared with the nominal maximum output of a photovoltaic cell.

Active corporate social responsibility (CSR) activities

—What influence has this project had on the surrounding area?

We are conducting various activities as the first company implementing CSR efforts in Ma'an Governorate. We built a park in the province and a roofed bus stop for children waiting for their school bus. In addition, we installed small solar panels for in-house power generation in schools. We offer technical training on the operation of photovoltaic

generation plant to local residents with a view to developing human resources who can play an active role in renewable energy projects in other provinces and countries. By conducting these project-related activities in surrounding areas, our aim is to realize a project that benefits not only the buyers of electricity but also the project stakeholders including local residents.



Panels, which change the angle in accordance with the sunshine angle, are always kept clean.



Medals awarded in the Karate tournament organized by Shams Ma'an

Purchasing, transmitting, and distributing power inside the country

NEPCO's viewpoint

Growing expectations for future public-private partnership (PPP) projects accelerated by the success of this project



H.E. Eng. A. Daradkah
Managing Director
NEPCO

It will buy electricity generated in the Shams Ma'an Photovoltaic Power Plant for 20 years and supply it to users in Jordan. This project marks an important first step in Jordan's departure from dependence on imported energy and a successful energy strategy toward 2020.

Question

What does Jordan expect from this project and how does the kingdom evaluate the participation of a Japanese company?

— Tell us about the background to Jordan's renewable energy efforts.

Jordan is not an oil-producing country and depends on imports for 95% of its energy needs. Gas shipments from Egypt have been unstable since the Arab Spring in 2011, and generation cost has soared because Jordan was forced to import expensive diesel oil and heavy oil. Under such situation, the government announced an energy strategy to reduce its dependence on imported energy and increase the ratio of renewable energy to the total power generation inside the kingdom. The government plans to boost the ratio of renewable energy generation capacity to 2,440MW by 2020, which stands at 25% of the total power generating capacity in the kingdom, of which 1,600MW will be generated from solar power and 840MW from wind power except the net metering and wheeling in distribution side.

— How do you position the photovoltaic generation project by Shams Ma'an in the process of achieving the goal?

This is the first renewable energy project by an independent

power company in the Middle East, and the first large-scale photovoltaic generation project under a PPP scheme in Jordan. We believe that the excellent relationship we established with Shams Ma'an, the sponsor companies, and the government of the host country helped to share risks effectively among project participants, which has also led the project to success. The success of this project greatly increased trust in the government of Jordan and the PPP scheme NEPCO built, making a good impression on investors who are considering investing in business in Jordan. There are high expectations for structuring PPP projects in Jordan. At the same time, we believe that Jordan has taken a big step toward achieving its target for the amount of total power generation by renewable energy by 2020.

Jordan's continued expectations for quality of Japanese companies

— Please tell us your evaluation and expectations for Japanese companies.

The Jordanian power sector highly evaluates the participation of Japanese companies as business operators in several successful projects including this project and the world's largest diesel engine thermal power generation project. The strengths of Japanese companies are characterized by high-quality products and highly reliable management teams, which have gained great trust from both the Jordanian government and our company. In this project, the top management of Mitsubishi Corporation paid a private courtesy visit to King Abdullah to develop a favorable relationship with the kingdom, leading the way to launching this project.

— What are Jordan's future efforts for increasing renewable energy use and attracting foreign investment?

Jordan is promoting the "Green Corridor" project to increase the power transmission capacity between the southern part of the kingdom where renewable energy business aggregates and the northern and middle part of the kingdom that consumes a majority of the electricity generated in the southern part. In conjunction with this project, Jordan plans to increase renewable energy projects and expects Japanese companies to participate in these projects. Jordan can be a gateway to neighboring countries including Syria, Iraq, and Lebanon, as well as Gulf countries in terms of technological and personnel exchanges. If those neighboring countries make progress in national stability and reconstruction efforts, we assume that the success in Jordan will become a role model and a supply source of technology and human resources. NEPCO strives to attract further foreign investment by improving its international creditworthiness through an effort to restore fiscal soundness.



Head office of NEPCO in Amman of Jordan

Investing in the power project

Viewpoint of Mitsubishi Corporation

Focusing on Jordan to establish a foothold for renewable energy business in the Middle East



Yuji Okafuji
General Manager
International IPP Department
New Energy & Power Generation Division
Mitsubishi Corporation

Mitsubishi Corporation is the project sponsor on the Japanese side. As the company aims to increase the ratio of renewable energy to the total power-generating capacity it owns worldwide, it positions this project as providing a foothold to increase its competitive advantages in the Middle East. Investing in this project to take a stake as a sponsor, the company has been involved in the operation and financial management of the project.

Question

What were the reasons for selecting Jordan and the knowledge you acquired through this project? How do you plan to put the experience from this project to use for future projects?

— What is the position of renewable energy in the power business and the significance of the photovoltaic generation project in Jordan?

Positioning renewable energy business as one of our growth pillars, we strives to increase the ratio of renewable energy to the total power generation capacity we own worldwide to more than 20% by 2030. We focused on Jordan in the Middle East, because the kingdom historically pursues an omnidirectional foreign policy and maintains a neutral foreign policy with countries in the Middle East. With a hereditary ruling system, the Hashemite family is greatly respected by Middle Eastern countries, maintaining its influence and status within the region. We have conducted fertilizer businesses for more than 30 years and also participated in power generation businesses, which provided us with opportunities to gain a lot of experience

Ongoing Project

Jordan sheds new light on the Middle East

and knowledge of working in the kingdom. As we view this project as giving us a foothold to develop renewable energy business in the Middle East, we decided to participate in the project.

— We heard that the photovoltaic power plant that started operation in September 2016 is operating successfully because the operating ratio of the installed solar panels exceeds the target amount.

Photovoltaic generation is largely affected by solar radiation. The current amount of solar radiation is larger than originally planned, which has greatly contributed to the current excellent operating conditions. Another factor behind such favorable operating conditions is that those installed solar panels are cleaned and monitored in an effective manner by the local staff members who are working with our dispatched employees. We expect this project to help improve the livelihood of local residents in various ways including employment creation and establishment of a better community.

Transfer of our knowledge from this project to future projects

— What benefits did this project bring to your businesses?

We plan to increase the ratio of renewable energy worldwide. There are large-scale off-shore wind generation projects in Europe and the regions surrounding the North Sea. We have recently participated in several projects. Large-scale photovoltaic generation projects were launched in the Middle East, Africa, and the Sun Belt of the United States. We accumulated valuable knowledge on such questions as: Is investment in renewable energy being promoted based on a properly organized national system? For example, does the project ask users to bear the burden widely and shallowly without too much dependence on the country in terms of system planning? On what point do we need to focus when deciding whether to participate in the project, in light of the legal system of the host country? In addition, we had an opportunity to work with the local partners in Qatar with whom we established a relationship through this project when we participated in the thermal-power generation and desalination project in Qatar. I feel we largely benefited from this project in terms of expanding human networks.

— What is the overall evaluation of this project?

This is Jordan's first project to utilize a PPP scheme for a domestic large-scale photovoltaic generation project in Jordan. We heard that this successful PPP project is highly evaluated not only by the government of Jordan but also by the investors who plan to invest in business in Jordan in the future. We believe that earning trust and a high evaluation from the host country based on the strengths of Japanese companies, such as high quality technology and management team, will help to increase the presence of Japanese companies in the Middle East and in the renewable energy sector, which will also lead to further business development and expansion.



Holding a PF/PPP Workshop in Jordan

We held a PF/PPP Workshop in Jordan in October 2017, where we explained the importance of utilizing a PPP scheme and the theory of cash flow in project financing. We also explained to Jordanian government officials the importance of the roles played by the project host country and JBIC's intention to contribute to the growth of the kingdom. JBIC works hard to establish good relations with project host countries around the world by organizing such seminars.

Correcting distortion of just 0.1 mm with a hammer Sophisticated craftsmanship supports Japanese quality in Thailand

Forth Inc. (hereafter “Forth”) is an SME that specializes in sheet-metal processing of auto parts. Staffed by seven workers, its head office and factory are located in Kouka city in Shiga Prefecture. Its sophisticated technology is highly appreciated by major auto parts manufacturers, and its competitive advantage is rare “craftsmen engineers” who process sheet metal manually to perfection. Their extremely high skill enables them to correct distortion of 0.1 mm just by using a hammer, and this skill by far exceeds the accuracy of the latest machine tools. This skill is highly evaluated, and enabled the company to expand its business to Thailand in 2015. Its sophisticated technology is the crucial final step that automakers need to build delicate prototypes, and Forth is accumulating results steadily.

Even the latest processing machines can achieve only 90% accuracy; manual work delivers the last 10%

“We named our company “Forth” because it was established by four people and because it sounds like going ‘forth’ or moving ahead in English.”

While manufacturing is rapidly mechanizing, Forth has been going “forward and ahead” since it was established in 2003 as a team of unique specialists in sheet-metal processing using manual labor to build prototypes. When building a prototype, sheet-metal processing is an important process for correcting minute distortions in the prototype before starting mass production, and craftsmanship is needed to correct small differences between the design on the drawing and the actual prototype, with just a hammer. In addition to sheet-metal processing to build prototypes, Forth has installed a three-dimensional laser processing machine,

so it can now machine dies, which is an upstream process in sheet-metal processing. The company now receives orders not only from parts manufacturers affiliated with leading Japanese automakers but also from companies that supply auto parts to foreign automakers.

“Even the very latest processing machine cannot build a part that perfectly matches the drawing. It may achieve a precision of about 90%, but the remaining 10% must be done by hand. The human hand is needed to correct distortions of just 0.1 mm width or 0.5 degree angular misalignment. Although mechanization is making rapid progress in parts processing, lately we have been receiving orders that other companies had to abandon, leading to an increase in orders. We are like lifeguards in sheet metal processing.”

For example, the auto industry is now in-



The factory at the headquarters where three-dimensional laser processing machines are also installed

creasingly using strengthened high-tensile steel plate for the skeletal structure to reduce the weight of auto bodies to increase fuel efficiency and improve safety in collisions. This is because high-tensile steel plate offers high strength even though it is just half as thick as traditional steel sheet.

According to President Hirao's view of the future of the auto industry, “Processing a high-tensile steel sheet requires an even higher level of processing technology. Because it is so

strong, it is not easy to process by machinery. But with a hammer, an engineer can achieve such a high level without leaving a scratch on the surface, because the hammer hits the sheet surface perpendicularly. Automobiles keep advancing, as evidenced by autonomous cars and electric vehicles, and automakers design the body shape for differentiation. The more unique the shape becomes, the more delicate processing is required. Consequently, the demand for handwork will increase.”

Expanding to Thailand, committed to maintaining Japanese quality and technology

Around 2012 President Hirao started to think about expanding overseas. He always thought there was demand for handwork in other countries, but he could not proceed for financial reasons and because of the conditions offered by other countries. In 2014 the idea surfaced again. An executive of an auto body components manufacturer became president of a subsidiary in Thailand, and he strongly asked President Hirao to set up in Thailand and help him, because his company in Thailand could not make components as precisely as those available in Japan. In response, President Hirao flew to Thailand and worked on just correcting distortion for two months. This convinced him of strong local demand for precision components and so he decided to establish a joint venture, THAI FORTH CO., LTD. (TFC), in 2015.

TFC has a total staff of five. Forth dispatched an experienced handwork engineer from Japan, who taught local staff how to use a three-dimensional laser processing machine. At the same time, he has been teaching them handwork technology as needed. “The Thai subsidiary has established a system to let a Japanese engineer always check the final products to make sure that they have the precision and quality of Japanese products. Until we started doing business in Thai-

land we didn't realize that it is very hard for Japanese parts manufacturers to maintain high quality in the country. In our business in Thailand, we are determined to maintain Japanese quality and technological competence. Local staff watch our experienced engineer correct delicate distortions to perfection with a hammer as if watching a magician. They are very interested in handwork, and we will continue to teach them.”

Leading the way through sophisticated technology

According to President Hirao, “Seven or eight years have passed since the abolition of the tax break on new car purchases under the former Yingluck regime, and so people are expected to trade up for a new car soon. The auto industry in Thailand expects this peak to occur after 2020, and so automakers are likely to introduce new models in time for this replacement period. We will be busy from mid 2019.”

TFC plans to strengthen its production system and has decided to introduce a three-dimensional laser processing machine and a nitrogen gas separation device to blow off cutting chips. The company used financing from JBIC to purchase the devices. “Our local bank, Shiga Bank, introduced JBIC's financing system to us. We are very grateful to JBIC for agreeing to provide long-term financing denominated in Thai baht free from exchange rate risks for us, and we were also very impressed that JBIC has a representative office in Bangkok.”

President Hirao intends to make his company even greater with its technological competence: “I am looking forward to seeing what we can achieve when we increase our technological competence beyond the level of our competitors. I wish to make my company indispensable to all companies concerned so that they will need us to stay in business.”

In the rapidly-changing Thai auto market, TFC supports Japanese quality with hammers and state-of-the-art processing machines.



Takashi Hirao
President
Forth Inc.



Company Profile

Name	Forth Inc.
Incorporated	2003
Capital	3.3 million yen
President	Takashi Hirao
Employees	7
Business lines	Sheet-metal processing and adjustment processing for manufacturing auto part prototypes, various kinds of welding processing, three-dimensional laser processing, various kinds of machine processing

Relationship with JBIC

In March 2017 JBIC signed a loan agreement with TFC, the Thai subsidiary of Forth, as co-financing with Shiga Bank, Ltd. for the amount of 11.9 million Thai baht (JBIC portion) and in January 2018 signed another loan agreement for 7 million Thai baht (JBIC portion). Each of these two loan agreements is to finance the necessary long-term funds denominated in Thai baht for the sheet-metal processing business for auto parts to be conducted by TFC in Chonburi Province of Thailand.