Japanese ODA Loan

Ex-Ante Evaluation

1. Name of the Project

Country: Republic of Costa Rica

Project: Las Pailas II Geothermal Project (Guanacaste Geothermal Development Sector Loan)

Loan Agreement: August 18, 2014

Loan Amount: 16,810 million yen

Borrower: Instituto Costarricense de Electricidad (ICE)

2. Background and Necessity of the Project

(1) Current State and Problems of the Power Sector in Costa Rica

In recent years, Costa Rica has maintained a steady economic growth, with an average GDP growth rate of 3.9% (between 2007 and 2013). Meanwhile, the power demand has also increased at an annual average rate of approximately 2.2% between 2007 and 2013. With rapid economic growth driven by the rise of foreign direct investments and exports boosted by the Dominican Republic-Central American Free-Trade Agreement (DR-CAFTA) with the United States, the power demand expanded by 3.8% in 2012. Although the installed capacity is 2,731MW as of 2013, the power demand is expected to continue growing at an annual average rate of approximately 5.3% between 2014 and 2020. Therefore, there is a need to develop new power plants and raise power generation capacity in order to meet the ever-increasing power demand.

As of 2013, in Costa Rica, electricity is generated from hydro (63%), thermal (22%), geothermal (8%), wind (5%), and other power sources (2%). Although hydropower (renewable energy) accounts for the largest share of power generation, there is a problem with it. In Costa Rica, where the difference in precipitation between the rainy and dry seasons is very pronounced, a capacity of hydropower falls during the dry season due to sparse rainfall. This decline is compensated for by thermal power using high-cost imported fossil fuels, resulting in an increase in greenhouse gas (GHG) emissions as well as in power generation costs in the country. In contrast, geothermal power, which is the second largest renewable energy source after hydropower, can ensure a stable supply of electricity throughout the year. It is also expected to contribute to a reduction in GHG emissions. Thus, geothermal power is becoming increasingly important as a means to increase power generation capacity during the dry season in Costa Rica. Though the geothermal power potential of the country is estimated at approximately 865MW, the current installed geothermal capacity has only reached 217MW. Therefore, expectations for future geothermal development are very high.

(2) Development Policies for the Power Sector in Costa Rica and the Priority of the Project

According to the National Development Plan 2011-2014, the Government of Costa Rica identifies the promotion of industrial development (the enhancement of competitive edge) as one of the four priority issues and aims to expand power generation capacity in order to support social and economic development. As for environmental conservation (also identified as a priority issue), the National Development Plan prioritizes the importance of developing renewable energy sources (especially, hydro and geothermal power) to mitigate the impact of economic activities on climate change. Moreover, Costa Rica is the first developing country to pledge “Carbon Neutrality”. Aiming to balance the carbon emission and absorption by 2021, the Government of Costa Rica has promoted hydro and geothermal development. This Project is identified as a priority project for geothermal development under the Power Generation Expansion Plan (Plan de Expansión de la Generación Eléctrica), which was formulated in line with the National Development Plan.

(3) Japan and JICA’s Policy and Operations in the Power Sector in Costa Rica

Recognizing that Central American and the Caribbean region is one of the most vulnerable areas to the effects of climate change, JICA launched the scheme of Co-financing for Renewable Energy and Energy Efficiency in Central America and the Caribbean (CORE scheme), jointly with the Inter-American Development Bank (IDB), in March 2012. Moreover, JICA has a policy to enhance its financial support for this sector in Central America and the Caribbean.

This Project forms part of the program for measures against climate change under the priority area “Environmental Conservation” in the Country Assistance Policy for the Republic of Costa Rica. JICA provided ODA loans for the power sector in Costa Rica through the Miravalles Geothermal Power Project (approved in JFY1985 and completed in March 1994 with a capacity of 55MW), which was the first geothermal development project in the nation, and the Pirris Hydroelectric Power Development Project (approved in JFY2001 and completed in September 2011 with a capacity of 128MW).

(4) Other Donors’ Activities

The IDB is supporting renewable energy development through the Power Sector Development Program (with a loan amount of 250 million dollars from 2008 to 2011) and the Power Sector Development Program Phase 2 (with a loan amount of 250 million dollars from 2012 to 2016). Meanwhile, the Central American Bank for Economic Integration (CABEI) supported the Las Pailas I Geothermal Project (completed in April 2011 with a capacity of 41MW).

(5) Necessity of the Project

Aiming to expand power generation from renewable energy sources in order to meet the power demand ever increasing with economic growth, this Project is in line

with the policies of Costa Rica, which seeks to balance economic growth and environmental conservation, as well as the assistance policies of Japan and JICA. Therefore, it is highly necessary and relevant for JICA to implement this Project.

3. Project Description

(1) Project Objective

The object of this Sector Loan is to increase electricity supply via renewable energy and to respond to climate change impacts by constructing geothermal power plants in Guanacaste Province, thereby contributing to the sustainable economic development of Costa Rcia. As one of the sub-projects to be implemented under the Sector Project Loan framework, the object of this Project aims to construct a geothermal power plant in the Las Pailas field in Guanacaste Province.

(2) Project Site/Target Area

Las Pailas , Guanacaste Province

(3) Project Components

1) Construction of a geothermal power plant (with a capacity of 55MW)

2) Consulting services (review of detailed designs, etc.)

(4) Estimated Project Cost

24,267 million yen (Loan Amount: 16,810 million yen)

(5) Project Implementation Schedule/Cooperation Period

August 2014 – November 2020 (76 months in total). The project completion is defined as the commencement of the operation of the power plant.

(6) Project Implementation Structure

1) Borrower: Instituto Costarricense de Electricidad (hereinafter referred to as “ICE”)

2) Guarantor: The Government of the Republic of Costa Rica

3) Executing Agency: ICE

4) Operation and Maintenance System: ICE

(7) Environmental and Social Considerations/Poverty Reduction/Social Development

1) Environmental and Social Considerations

(i) Category: A

(ii) Reason for Categorization: This Project falls into the geothermal power sector under the JICA Guidelines for Environmental and Social Considerations (published in April 2010).

(iii) Environmental Permit: The Environmental Impact Assessment (EIA) report for this Project was approved in September 2012 by the National Environmental Technical Secretariat (Sectretaria Técnica Nacional Ambiental; SETENA), an external organ of the Ministry of Environment and Energy (Ministerio de Ambiente y Energía; MINAE).

(iv) Anti-Pollution Measures: During the construction and operational phases, ICE, the

project executing agency, will take anti-pollution measures, such as imposing speed restrictions on construction vehicles, diversifying transportation routes, introducing low-noise equipment, limiting construction to daytime hours, ensuring the separate collection and proper treatment of excavated soil, oil, and other waste materials. Therefore, this Project is expected to have no significant impact on the air or water quality.

(v) Natural Environment: The project site is adjoining a national park. In order to minimize the impact on animals and plants, ICE will take measures, such as imposing restrictions on land reformation and deforestation, promoting tree planting, preventing traffic accidents on and around the access roads (installing speed bumps, etc.), installing radio equipment on transmission lines to prevent bird strikes, and providing environmental education to construction workers. ICE will also conduct ecosystem protection activities in collaboration with experts and residents. The ecosystem of the project site has been studied by ICE and will be continuously monitored by experts specialized in ecology and forest sciences. The monitoring will be carried out in collaboration with the National System of Conservation Areas (Sistema Nacional de Áreas de Conservación; SINAC) under the management of the MINAE as necessary since special permission is required to investigate national parks. In discussions with local residents, no objection has been raised against this Project.

(vi) Social Environment: This Project will require land acquisition of 211 hectares, but it will not involve involuntary resettlement of residents. The process of the land acquisition shall be made in accordance with the laws and regulations of Costa Rica and the JICA Guidelines for Environmental and Social Considerations. The ownership of the land will be transferred to ICE before the project commencement date. Moreover, in order to minimize the impact on landscape, the project power plant will be located in a lowland area, and trees will be planted around the area.

(vii) Other/Monitoring: During the construction and operational phases, ICE will monitor the air quality, noise, water quality, waste management, and any impacts on animals and plants. Though the land adjoining the project site is owned by a non-governmental organization (NGO) engaged in environmental protection, no objection has been raised against this Project.

2) Promotion of Poverty Reduction

Guanacaste Province includes the area which has the highest poverty rate in Costa Rica[1]. This Project is expected to create employment opportunities for the poor since it is designed to hire a certain number of local workers for construction.

[1] The northern part of Guanacaste Province is estimated to have the highest poverty rate (over 45%) in Costa Rica. (Source: National Institute of Statistics and Census of Costa Rica (Instituto Nacional de Estadística y Censos; INEC), 2011)

3) Promotion of Social Development (e.g. Gender Perspective, Measures to Prevent Infectious Diseases Including AIDS, Participatory Development, Consideration for Handicapped, etc.)

None in particular.

(8) Collaboration with Other Donors

This Sector Project Loan, including this Project, is to be provided as co-financing with the IDB based on the CORE scheme.

(9) Other Important Issues

Aiming to develop renewable energy sources, this Project is estimated to reduce GHG emissions by 14,308 tons per year.

4. Targeted Outcomes

(1) Quantitative Effects

1) Operation and effect indicators

Indicators (draft)		Baseline (Actual value in 2014)	Target (2020) [two years after project completion]
Maximum power generation capacity (MW)		-	52
Plant load factor (%)		-	80
Availability factor (%)		-	85
Auxiliary power ratio (%)		-	8 or less
Outage hours by cause (hours/year)	- Human error	-	0
	- Mechanical failure	-	0
Gross thermal efficiency (GWh/year)		-	364

2) Internal Rate of Return (IRR)

Based on the conditions below, the Economic Internal Rate of Return (EIRR) of this project was calculated as 24.07% and the Financial Internal Rate of Return (FIRR) will be 8.05%.

[EIRR]

Cost: Project cost (excluding tax) and operation and maintenance expenses

Benefit: Reduction in the purchase of fossil fuels, reduction in CO_2 emissions compared to thermal power plants

Project Life: 30 years after the commencement of operation

[FIRR]

Cost: Project costs and operation and maintenance expenses

Benefit: Revenue from electric power sales

Project Life: 30 years after the commencement of operation

(2) Qualitative Effects

- Activation of the local economy
- Improvement of the quality of life of local residents

5. External Factors and Risk Control

Natural disasters (e.g., earthquakes, hurricanes, and volcanic eruptions) in the construction site

6. Lessons Learned from Past Projects

According to the ex-post evaluations of geothermal development projects in other countries, such as the Northern Negros Geothermal Project and the Tiwi Geothermal Power Plant Complex Rehabilitation Project in the Philippines, some of the geothermal power plants could not generate sufficient electricity due to the lack of steam. This taught a lesson that it is important to assess geothermal reservoir potential in the preparatory stage and to properly manage the reservoir in the operational stage of the power plant.

As it is to develop a new geothermal power plant, this Project shall also ensure a sufficient supply of steam in order to generate expected effects. In the preparatory phase, ICE conducted a reservoir simulation based on the data on the steam produced from the test well drilled at its own expense. The results of the simulation indicated that the project power plant can maintain a power generation capacity of approximately 55MW for the next 30 years. Moreover, in order to support the assessment of the geothermal reservoir, JICA will provide technical assistance to refine the conceptual model as well as set the scope of the consulting services for this Project to include the development of a numerical model. As for the proper management in the operational stage, ICE was confirmed to have sufficient experience and technical capability at the time of appraisal.

7. Plan for Future Evaluation

(1) As described in (1) Quantitative Effects, 1) Operation and effect indicators in 4. Targeted Outcomes

(2) Timing: Two years after the completion of the project.