Project Ex-ante Evaluation

South America Division, Latin America and the Caribbean Department, JICA

1. Basic Information

Country: Republic of Ecuador

Project: Project for Supporting the Advancement of Energy Matrix Transition

Loan Agreement Signing Date: January 28, 2020

2. Background and Necessity of the Project

(1) Current State/Issues of the Electricity Sector in Ecuador

In spite of being a crude oil producing country, the Republic of Ecuador (hereinafter referred to as "Ecuador") does not have sufficient oil refining facilities domestically and is dependent on imports for fossil fuels. For this reason, Ecuador has raised the conversion of its energy matrix (switching from thermal power to renewable energy) in its national development plan, aiming for macroeconomic stability through the reduction of fuel imports and the improvement of fiscal balance through the reduction of fuel subsidies.

The Ecuadorian government, in its "National Development Plan 2013-2017", listed the conversion of its energy matrix through the implementation of renewable energy businesses as a basic policy of the electricity sector. Currently, the Ecuadorian government is constructing hydroelectric power generation facilities to utilize its abundant hydropower resources as the pillar of its energy matrix conversion, and while in 2007 hydropower made up 49.6% (2,057MW) of total installed power capacity to 45.6% (1,610MW) of thermal power, in 2016 the proportion of hydropower increased, making up 66.2% (4,446MW) and 30.87% (2,148MW), respectively. Furthermore, five new hydroelectric power plants are scheduled to begin operation over the next years, and 90% of electricity demand in Ecuador is expected to be covered by renewable energy by 2019. In addition, work is underway to develop stable geothermal resources which are less susceptible to seasonal fluctuations.

On the other hand, electricity demand in Ecuador shows a high rate of growth (5.45%), and the expansion and enhancement of the transmission and distribution network is indispensable to delivering stable renewable energy as new construction continues. Also, there are remote primary industries and households in the country that are not yet connected to the transmission and distribution network, and these primary industries and households utilize inefficient fuels such as small-scale private diesel power generators and firewood. In particular, in the shrimp farming industry, which is

the third largest export from Ecuador after crude oil and bananas, 87% is not electrified nor receives industrial power services, relying on inefficient diesel power generation.

In converting the energy matrix, not only is it essential to enhance renewable energy in the power generation sector, but also to improve the stability and reliability of power transmission and distribution departments and to promote the use of renewable energy in the consumer sector. Thus the Ecuadorian government in its "National Development Plan 2013-2017" raised policies to enhance and expand the power transmission and distribution network for the stable and efficient delivery of renewable energy power sources currently under development to the consumer sector, as well as to promote new connections to the transmission and distribution network of non-electrified industries and households. The "Project for Supporting the Advancement of Energy Matrix Transition" (hereinafter referred to as "this project") aims to promote initiatives to expand access to renewable energy (hydropower), provide stable power supply and promote energy efficiency, through the expansion and enhancement of the power transmission and distribution network and the implementation of energy saving promotion programs. This is positioned as a high priority project by the Ecuadorian government in line with its "National Development Plan," to promote the conversion of Ecuador's energy structure and contribute to sustainable economic development.

(2) Cooperation Policy of Japan and JICA in relation to the Power Sector, and the Positioning of this Project

The Country Assistance Policy for the Republic of Ecuador (April 2012) positions the "development of energy aimed at sustainable development" under the priority area of the "reducing inequalities", with the purpose of supporting the development and promoting the use of renewable energy. Previously, 7 projects with a cumulative total of 63,756 million yen in ODA loans has been approved for Ecuador, of which more than half, or 4 projects, provided a total of 35,088 million yen for support in the energy sector.

This project contributes to SDGs 7 (Ensure access to affordable, reliable, sustainable and modern energy).

(3) Response of other Aid Agencies

The Inter-American Development Bank (IDB) has approved a total of $1.288 billion of loans for 9 projects (consisting of 8 project loans and 1 policy loan) in the

power sector since 2011. A new loan of $150 million was also approved as co-financing for this project in October 2017.

3. Project Description

(1) Project Objective

This project aims to promote initiatives to expand access to renewable energy (hydropower) and stable power supply, and for energy saving, for the promotion of the conversion of the energy structure of Ecuador and sustainable economic development, through the implementation of the expansion and enhancement of the power transmission and distribution network and an energy saving program.

(2) Project Site

Ecuador

(3) Project Components

1) Power grid development: 5 sub-projects (Power grid expansion and enhancement: about 60 km of transmission line development and new/expanded substations in 5 locations)
2) Distribution network development
   i) Improvement, expansion, and enhancement of distribution network: 83 sub-projects
   ii) Household electrification: Not covered by JICA loan
   iii) Electrification of primary industries: 49 sub-projects
3) Consulting Services
   i) Support for the promotion of energy saving
   ii) Strengthening organizational capacity
   iii) Strengthening, auditing, and evaluating project implementation systems

*All of the above are subject to cooperative financing except for two sub-projects under 1) and 2) (ii).

(4) Estimated Project Cost (Loan Amount)

Estimated Project Cost: $309 million (of which $70 million is covered by the ODA loan)

(5) Schedule

Scheduled for January 2020 to March 2025 (total of 63 months). According to IDB

definitions, the project shall be completed at the completion of all loan disbursement (March 2025), including for consulting services.

(6) Project Implementation Structure

1) Borrower: The Republic of Ecuador
2) Guarantor: None
3) Executing Agency: Ministry of Energy and Non-Renewable Natural Resources (Ministerio de Energía y Recursos Naturales No Renovables (MERNNR))
4) Operating/Maintenance Agency: Transelectric Power Transmission Corporation will carry out the power grid maintenance components and the distribution network maintenance components will be carried out by public distribution corporations in each region.

(7) Cooperation and Sharing of Roles with Other Donors

1) Japanese ODA Activities

The details of support already implemented in the country's electricity sector in recent years (both paid account technical assistance) are as follows. This project complements these other projects, contributing to the stability and expansion of the country's electricity supply

i) Geothermal power generation development advisor (March 2016 – March 2018)
ii) Chachimbiro geothermal power plant construction project preparatory survey (February 2016 – March 2019)

2) Activities of Other Agencies

IDB provided a first term loan in August 2016 ("Investment Plan to Support the Transition of the Energy Matrix in Ecuador") to expand and enhance the power transmission and distribution network and to implement an energy saving promotion program as part of support for power configuration and conversion, and this project is underway and due to be completed in 2020. IDB signed a second term loan for the same project in July 2019. This will co-finance the same project.

(8) Environmental and Social Consideration / Cross-Cutting Issues / Category of Gender

1) Environmental and Social Considerations

i) Category Classification: B

Reason for Categorization: Undesirable environmental impacts under this

project are judged to be insignificant from the perspective of the sector characteristics, project characteristics and regional characteristics under the JICA Environmental and Social Consideration Guidelines (promulgated in April 2010),.

ii) Environmental Permit: With respect to environmental approvals for this project, the executing agency shall obtain all necessary environmental approvals prior to the start of construction, based on the requirements for each sub-project for the scale of facilities to be constructed and in accordance with local Ecuadorian law. Of these, for some transmission projects Transelectric is preparing an environmental impact assessment (hereinafter referred to as "EIA") report for the implementation of individual sub-projects, and these are expected to be approved prior to the start of the project. In addition, regarding the power distribution project, some approvals have already been acquired by the executing agency, but because of the small scale no EIA report has been required for most of these under local Ecuadorian law, and environmental approvals are expected to be obtained by the executing agency prior to the start of the project.

iii) Anti-Pollution Measures: During construction there is expected to be impacts from air pollution (dust and exhaust gas), noise/vibration and waste etc., but the impacts are expected to be minimal due to proper maintenance and speed limits of construction vehicles, the safe storage of waste, and proper processing in accordance with local laws. There is expected to be noise/vibration from the operation of substations etc. after operation begins, but this is expected to meet the standards specified by local laws.

iv) Natural Environment: Regarding the power distribution project to be implemented in the Galapagos National Park, while parts of this area correspond to a "Protected Area" under local Ecuadorian law, these correspond to buffer zones in these areas (zones in which use is recognized to some extent), and do not correspond to native reserves intended for the protection of rare flora and fauna. Regarding the impact on the ecosystem, there is a possibility of wild birds colliding with or being shocked by distribution lines etc., but the impact is expected to be minimized by attaching insulation to the distribution lines and promptly replacing deteriorated portions.

v) Social Environment: About 30 ha of land (14 ha of which is covered by JICA loan) is required for the construction of the substation, and negotiations are

underway for acquisition, and if no agreement is reached another site will be selected, so there will not be any involuntary land acquisition or resident relocation. There has been no particular opposition from affected parties to the project.

vi) Other/Monitoring: The executing agency, MERNNR, Transelectric and distribution companies in each region will perform monitoring of air quality, noise/vibration, waste and ecosystems during construction and noise/vibration after the start of operation.

2) Cross-cutting Issues

i) Climate change measure related: This project contributes to the reduction of greenhouse gas (GHG) emissions, spreading the use of renewable energy and promoting energy saving. The climate change mitigation effect of this project (approximate amount of GHG emission reduction) will be the equivalent of approximately 38,800 tons/year of CO^2.

3) Category of Gender: [gender-responsive project] GI (S) (gender integrated project)

Reason for Classification: Support the formulation of a gender equality promotion strategy in the Ecuador power sector as a component of this project.

(9) Other Important Issues: N/A

4. Targeted Outcomes

(1) Quantitative Effects

1) Performance Indicators (Operation and Effect Indicators)

Indicator	Baseline (2016)	Target (2025)
Average number of power outages (times/kVA per year)	5.59	4.78
Length of power outages (hours per year)	6.41	5.62
Number of households additionally covered by this electrification program under this project (households)	0	16,680
Number of shrimp farms with electricity services available due to this project (locations)	0	400

* The target is to be achieved by 2027 in line with the target year for the IDB.

(2) Qualitative Effects

Promotion of initiatives aimed at energy saving in industry, promotion of the conversion of Ecuador's energy structure and sustainable economic development

(3) Internal Rate of Return

Based on the following assumptions, the economic internal rate of return (EIRR) for this project is 47.7%, and the financial internal rate of return (FIRR) is 13.9% (Project life: 20 years).

[EIRR]

Costs: Project costs (excluding taxes), operating and maintenance costs, etc.

Benefits: Benefit of connection (primary industries, households), reduction of primary industry fuel subsidies, increased electricity exports, reduced losses from power outages, etc.

[FIRR]

Costs: Project expenses, operation and maintenance costs, power purchase expenses

Benefits: Income from selling electricity, etc.

5. External Factors and Risk Control

(1) Prerequisites: Nothing particular.

(2) External Conditions: Nothing particular.

6. Lessons Learned from Past Projects

A lesson learned from an ODA loan project in Peru with an extensive number of small-scale components was that the capacity of the executing agency should be given more attention in projects with large number of subprojects. There was also found to be risks associated with leaving the supervision of construction of ODA loan projects to consultants alone.

Under this project, it has been confirmed that there is sufficient capacity and system in place to carry out regular site visits, regular reports and the placement of construction managers (staff of electric power companies) on site by the executing agency and the individual electric power companies who are responsible for procurement procedures and implementation supervision related to each component for the confirmation of appropriate systems to understand the operating status of each sub-project. There were no issues of unfinished or significant delays with any of the 8 IDB-funded sub-projects implemented and completed under this same system.

On the other hand, based on the above lessons, for some components that consist of

particularly small sub-projects, it was agreed by IDB and the executing agency that only IDB would finance them and that a mid-term evaluation would be performed to evaluate the progress by consultants commissioned by JICA. In addition, while this would be performed by IDB in accordance with IDB guidelines on procurement and loan execution, the JICA Ecuador Office would also supervise the project by participating in regular monitoring meetings with the executing agency and through the above progress evaluation.

7. Evaluation Results

This project is consistent with the development policies of the country and the cooperation policies of Japan and JICA, and also contributes to SDG 7, "Ensure access to affordable, reliable, sustainable and modern energy". Therefore, there is high need and relevance for supporting the implementation of this project.

8. Plan for Future Evaluation

(1) Indicators to be Used

4. As per (1) through (3).

(2) Timing

At project completion

End