Internal Ex-Post Evaluation for Grant Aid Project

conducted by South Africa Office:July ,2018

Country Name	**The Project for Introduction of Clean Energy by Solar Electricity Generation System**
The Kingdom of Lesotho	

I. Project Outline

Background	The power supply of Lesotho heavily depended on the main power generation plant of the Muela Hydropower Generation Plant. However, the maximum peak load reached to 123 MW (2010) which exceeded the generation capacity of the Muela Power Generation Plant with 72 MW and the shortfall of the power demand had been covered by the power purchase from the Southern African Power Pool. The total power consumption of 613 GWh in 2008/2009 was supplied by the Muela Power Generation Plant (489 GWh) and the Southern African Power Pool (South Africa and Mozambique) (124 GWh). On the other hand, other neighboring countries had also been facing power shortage and the power supply in the region became tight. Under those situations, Lesotho needed to increase domestic power sources in order to secure stable power supply in the country.			
Objectives of the Project	To enhance power generation capacity, diversify energy sources and increase awareness among the people of Lesotho on the utilization of renewable energy by procurement and installation of grid-connected Photovoltaic (PV) system as well as capacity building of engineers in the Moshoeshoe I International Airport (MIA), thereby contributing to demonstrating the initiatives of Japan to promote efforts by developed and developing countries towards climate change.			
Contents of the Project	1. Project Site: Moshoeshoe I International Airport, Maseru 2. Japanese side: (1) Provision of grant necessary for procurement and installation of PV system (280kW) Equipment of PV System: PV Module, Power Conditioner, Mounting structure for PV Array, Data Logging Device, Monitoring system, Display panel, Junction box, Connection box, Low voltage distribution board, Control House, Spare parts, etc. (2) Technical Assistance (soft component of Grant Aid) Training on basic knowledge about interconnecting PV system and its operation and maintenance (O&M) including daily /periodic maintenance check-ups, data logging system/data analysis and management 3. Lesotho side: Site for installation of PV system, provision of soil disposal site and moulded case circuit breakers for low voltage systems, temporary offices for contractor and consultant, utilities for the construction site, and necessary costs including personnel for implementation of the project except the ones the Japanese side's defrayment			
Project Period	E/N Date	March 16, 2011	Completion Date	October 31, 2013
	G/A Date	April 11, 2011		
Project Cost	E/N Grant Limit / G/A Grant Limit: 297 million yen, Actual Grant Amount: 277 million yen			
Executing Agency	Department of Energy (DOE) of Ministry of Energy, Meteorology and Water Affairs Moshoeshoe I international Airport			
Contracted Agencies	Main Contractor and Agent: Sojitz Corporation Main Consultant: Nippon Koei Co., Ltd.			

II. Result of the Evaluation

<Special Perspectives Considered in the Ex-Post Evaluation> >

[Target year to measure the effects]

- According to the ex-ante evaluation sheet, the target year to measure the expected quantitative effects was set one year after the project completion, and it was expected to be 2013. However, as the project was eventually completed in October 2013, the target was changed to 2014. Therefore, this ex-post evaluation verified the achievement level of project objectives based on the data for the period from 2014 to 2016.

[Appropriateness of quantitative indicator to verify project effects]

- In the ex-ante evalaution sheet, one of the quantitative indicators to verify the project effects is reduction of CO2 emission by solar power generation using the PV system installed by the project. However, since the main power source of Lesotho is hydropower generation without CO2 emission and no thermal power plant supplies electic power through the power system in the country, the reduction of CO2 emission may be expected indirectly at thermal power plants supplying in the South African Power Pool. In addition, the power generation volume by the PV system istalled by the project (350,000 kWh) is negligble level against the total power consumption in Lesotho (613 GWh, 1GW=1,000,000kW). Therefore, the estimated theoretical values of annual reduction of CO2 emission by the project were calculated as an impact of the project.

1 Relevance

<Consistency with the Development Policy of Lesotho at the Time of Ex-Ante and Ex-Post Evaluation>

The project has been consistent with the "Lesotho Energy Policy" (2003) prioritizing rural electrification at the time of ex-ante evaluation and kept consistent with the policies at the time of ex-post evaluation. In "the National Strategic Development Plan (NSDP)" (2012/13-2016/17), promotion of wind, solar and biomass energy to complement hydropower energy was one of the eleven priority items to adapt to climate change. In addition, the "Lesotho Energy Policy" (2015-2025) aims at the improvement of access to renewable energy sources and technologies in order to improve the energy security by reducing reliance on fossil fuels and imported electricity.

<Consistency with the Development Needs of Lesotho at the Time of Ex-Ante and Ex-Post Evaluation >

The project has been consistent with Lesotho's development needs of introduction of solar power generation, in particular in rural areas

in order to increase rural electrification by renewable energy source and to reduce CO2 emission by use of biomass fuel at both of the time of ex-ante evaluation and ex-post evaluation.

<Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation>

The project was consistent with Japan's ODA policy to support improvement of access to clean energy including utilization of solar power generation under the financial mechanism for "the Cool Earth Partnership" which was launched in 2008. The project was implemented under a scheme of "Program Grant Aid for Environment and Climate Change", which the Government of Japan newly introduced in 2008 in order to support developing countries with willingness to contributing to mitigation of climate change but with lack of technologies and funds to balance between their economic growth and greenhouse gas reduction." The Japan's ODA policy for Lesotho has prioritized assistance for efforts against climate change in the fiscal year of 2011.

<Evaluation Result>

In light of the above, the relevance of the project is high.

2 Effectiveness/Impact

<Effectiveness>

The project achieved its objectives at the time of ex-post evaluation. As all the solar panels installed by the project have been functioning, the PV system installed by the project has generated more than the target value of electricity (350,000 kWh) a year for the period from 2014 to 2016. The generated electricity has been used by MIA and the surplus electricity has been transmitted to the Lesotho Electricity Company Ltd (LEC). MIA has realized cost savings incurred for electricity due to own power generation from the PV system installed by the project.

The PV system installed by the project raised awareness of solar as an energy source of electricity generation to visitors to Lesotho. For example, almost all visitors at MIA have noticed the PV system installed at MIA and have made inquries about the PV system in relation to the company which built the facility and the funder of the installation. . There are at least 3 time visits per month by primary and secondary school students to see the PV system installed by the project. The electricians operating the failicty get a chance to explain how the PV system works to these students. University students and lecturers have done some analysis on the performance of the PV system and produced articles for publication.

<Impact>

Some positive impacts were observed at the time of ex-post evaluation.The project has contributed to demonstration of the initiatives of Japan to promote global collaborative efforts towards climate change in Lesotho. Through the policy dialogue between the Government of Lesotho and the Government of Japan, the discussion about renewable energy is continuing and there have been installations of small scale off-grid PV systems (1.1kW) in hospitals and schools by the Government of Lesotho since the project completion. Despite the fact that contribution of electricity generated from solar is still limited to only 0.38% of the total power generation in the country, DOE and other relevant organizations have gained confidence on utilization of PV system in Lesotho through operation of the grid-connected PV system at MIA installed by the project. As a result of the project, there is also a lot of interest from the private sector to generate electricy from renewable solar which can improve local power generation. The project has been demonstrating that electricity can be produced from solar.

In addition, it is assumed that the power generation by the PV system has contributed to the reduction of CO2 emission as an indirect impact on thermal power plants supplying power for the South Africa Power Pool from South Africa, in particular (Estimated value of reduction of CO2 emission: 161 tons in 2014, 167 tons in 2015 and 124 tons in 2016)[1].

<Evaluation Result>

In light of the above, the effect of the project has been observed mostly achieved as planned. Therefore, the effectiveness/impact of the project is high.

Quantitative Effects

Indicators	Baseline 2009 Baseline Year	Target 2014 1Years after Completion	Actual 2014 1 Year after Completion	Actual 2015 2 Years after Completion	Actual 2016 Year of Ex-post Evaluation
Indicator 1: Total power generation volume at transmission end (kWh/year)	0	350,000	489,158.4	505,753.4	376,146.1
Indicator 2: Annual savings of electricity cost by the PV system installed by the project	0	40,654 Maloti	39,412.1	48,251.7	35,886.3

Source : Ex-Ante Evaluation Sheet (JP), Preparatory Survey Report (EN), data provided by MIA

3 Efficiency

The project cost was within the plan (ratio against the plan: 97%), however, the project period exceeded the plan (ratio against the plan: 147%). The reason for the project period exceeded the plan was that local contractor took longer period by ordering wrong materials, and the construction process was ill-organized because the local contractor did not submit the construction procedure specification even Japanese side pointed over and over. At the later stage, Japanese contractor changed this local contractor to another one in order to manage the plan. Therefore, the efficiency of the project is fair.

4 Sustainability

<Institutional Aspect>

MIA has been responsible for operation and maintenance of the PV system installed by the project. MIA deploys 5 electricians for O&M of the PV system who are in charge of maintenance of electric facilities in MIA. According to the Lesotho Electricty and Water Authority (LEWA), the Government of Lesotho is preparing regulations on PV sytems in Lesotho as planned in the project. This regulation

[1] The volume of contribution to annual CO2 reduction is estimated by multiplying CO2 reduction unit by the annual power generation volume of the PV system. The CO2 reduction unit used by the ex-ante evaluation was the CO2 emission factor for the power sector in Japan to attain the 2020 goal for the greenhouse gas as of 2009.

is expected to be approved by the end of year 2018. DOE and LEC often visit MIA (at least once a month) to collect data such as energy efficiency from the PV system in order to formulate other PV system projects.

<Technical Aspect>

The electricians of MIA have sustained their technical level for daily check of the PV system based on the necessary knowledge and skills obtained from the trainings by the project and they properly conduct daily check. In addition, they were able to fix the power conditioner when it was broken in 2016 and 2017 in accordance with the manuals prepared by the project. Althought there is no clear and documented training program for electricians to maintain the PV system, the trained electricians provide a training for the newly hired electricians.

<Financial Aspect>

According to the electricians, there is no specific budget for O&M of the PV system installed by the project since the PV system had no major issues requiring budget so far. MIA can allocate budget for small costs such as failures of air conditioning of the PV system. Some minor operational problems were solved by using spare parts provided by the project and a limited amount of budget was required to fix air conditioners for the PV system. In addition, due to the plenty of spare parts, there is no necessity to procure additional spare parts for at least 10 years.

<Current Status of Operation and Maintenance>

By the time of ex-post evaluation, all the equipment procured by the project have been fully functioning and utilized.

<Evaluation Result>

In light of the above, no problem has been observed in any aspects of the implementing agency. Therefore, the sustainability of the project effect is high.

5 Summary of the Evaluation

The project has achieved its objective to enhance power generation capacity, diversify energy sources and increase awareness among the people of Lesotho on the utilization of renewable energy. As for efficiency, the project period exceeded the plan.

Considering all of the above points, this project is evaluated to be highly satisfactory.

III. Recommendations & Lessons Learned

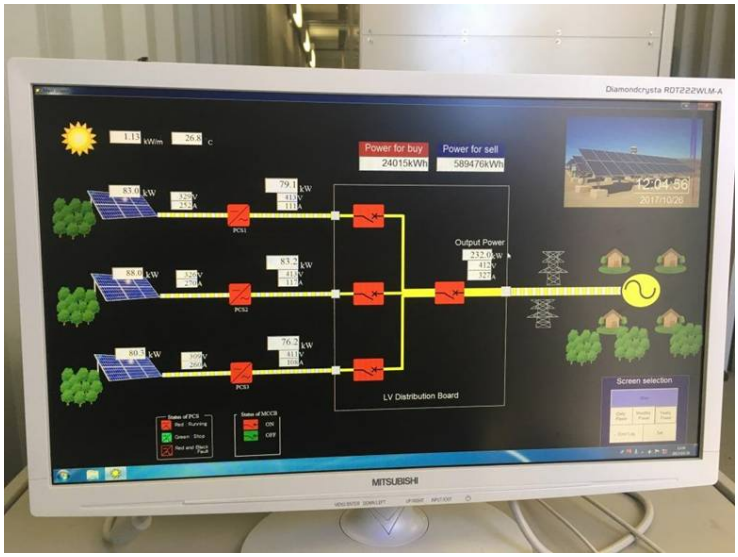
Recommendations to Implementing Agency:

- DOE is requested to continuously provide technical advice and feedback as well as further technical trainings to the electricians of MIA that will contribute to enhance the sustainability of the project. In order to establish a technical backstop system for MIA, it is preferable to sign a memorandum of understanding (MOU) between DOE and MIA which specifically spellout responsibilities and obligations of the two institutions regarding operation and maintenance of the PV system. By the effective technical backstop system, it is expected that the electricians of MIA will be able to have opportunities to deepen their technical knowledge for improvement.
- MIA should conclude a power purchase agreement with LEC as recommended by the project for sales of electricity generated by the PV system installed by the project once a legislative and/or regulatory framework are concluded. MIA will be able to earn some revenue from the sales of electricity injected into the LEC's transmission system. Since the project was considered as a pilot, LEC didn't have a plan to purchase the electricity from MIA. LEC is just receiving the energy from MIA without paying money.

Lessons Learned for JICA:

- It is important to select the proper local contractor in order to complete the project within the plan. Therefore, the advise from the implementing agency and the record of contractor in JICA office will help concluding a contract with a proper local contractor.

PV panels installed at MIA



Data logging system to showing generating electric power by the PV system