

Country Name	The Project for Introduction of Clean Energy by Solar Electricity Generation System
Gabonese Republic	

I. Project Outline

Background	Approximately 45% of electricity in Gabon was generated by hydropower; however, during the dry season when the water level dropped, there was a shortage of electricity, and diesel power generation was used to meet the increasing demand for electricity. Therefore, increasing energy self-sufficiency and diversifying energy sources without relying on fossil fuels had become an issue. Against that backdrop, support for the introduction of renewable energies, including photovoltaic power generation, was expected as a technology that can provide a stable electricity supply while reducing greenhouse gas emissions.					
Objectives of the Project	To increase power generation capacity, diversify power sources, and raise awareness of people of Gabon for utilization of renewable energy by procuring photovoltaic (PV) system and related equipment as well as providing technical assistance for capacity building of technical personnel, and thereby contributing to demonstration of Japan's initiatives for promoting collaborative efforts by both developed and developing countries against climate change.					
Contents of the Project	<ol style="list-style-type: none"> 1. Project Site: Libreville (Ministry of Foreign Affairs, International Cooperation and French Speaking Countries; MFAIC and Omar Bongo University; UOB) 2. Japanese side <ol style="list-style-type: none"> (1) 130 kWp PV generation system (installed at UOB) and 70 kWp PV generation system (installed at MFAIC) (PV modules, Junction box, Power conditioner cubicle, Meteorological observation device, PV connection panel, Materials for wiring and earth, Electrical facility cubicle, Supporting structures for PV modules, Foundation of supporting structures for the PV system and electrical facility cubicle, Fences, gates, and grave surfacing, Cable connection for Electrical facility cubicle/interconnection point/display equipment) and Spare parts and tool kits for maintenances of equipment (2) 100 kWp battery control systems (2 sets) (installed at UOB) (The output was added by using the residual amount of the E/N limit amount) (3) Technical assistance (soft component): Training on basic knowledge, technical characteristics, preventive inspection, operation and maintenance including emergency response 3. Gabonese side: To secure the land, to clear and level the area for PV module installation, to install fence and gate to PV system installation space, and others 					
Project Period	E/N Date	March 18, 2010	Completion Date (Plan)	February 2012	Completi on Date	<ul style="list-style-type: none"> - Original component: June 7, 2013 (Completion of soft component) - Additional procurement: August 13, 2019 (Handover of the equipment)
	G/A Date	March 18, 2010				
Project Cost	E/N Grant Limit / G/A Grant Limit : 670 million yen					Actual Grant Amount: 661 million yen
Executing Agency	Ministère de l'Énergie et des Ressources Hydraulique (Ministry of Energy and Water Resources; MEWR), at the time of project completion					
Contracted Agencies	Main Contractor(s): Marubeni Corporation, NBK CORPORATION Main Consultant(s): NEWJEC Inc., Japan Techno Co., Ltd. Agent: Japan International Cooperation System					

II. Result of the Evaluation

1 Relevance
<p><Consistency with the Development Policy of Gabon at the Time of Ex-Ante ></p> <p>The project was consistent with the development policy of Gabon. The Government of Gabon announced a new environmental initiative, "Gabon Vert (Green Gabon)" in November 2009 where the protection of tropical rain forests and the use of renewable energy including solar energy were pronounced.</p> <p><Consistency with the Development Needs of Gabon at the Time of Ex-Ante ></p> <p>The project was consistent with the development needs of Gabon for the renewable energy. Increasing energy self-sufficiency and diversifying energy sources without relying on fossil fuels was an issue at the time of ex-ante evaluation.</p> <p><Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation></p> <p>The project was also consistent with the Japan's ODA policy to Gabon. At the time of ex-ante evaluation, the Government of Japan considered cooperation in the environmental field¹. Also, the Government of Japan introduced a scheme of "Program Grant Aid for Environment and Climate Change" in 2008 aiming at support for developing countries to take adaptation and mitigation measures against the adverse effects of the climate change.</p> <p><Appropriateness of Project Design/Approach></p> <p>The project design lacked adequacy, and some background information is as follows:</p> <ol style="list-style-type: none"> 1. This solar system development project, funded by a fiscal 2009 supplemental budget, had a provisioning condition for installing grid-connected solar equipment and no batteries. This implies that the system would not be expected to operate during a power outage. 2. The report from the cooperative preparatory study stated that there was a perception that the inability of the solar system to work during a

¹ Source: ODA country databook 2011

power outage could be problematic as power outages frequently happen in Gabon.

3. Under such conditions, the cooperative preparatory study proposed a design with a stand-alone operational function to realize a solar power system that would work during power outages. However, due to its low reliability as a power source, the function was not adopted.

4. When the team from the study shared with the MFAIC and the UOB the system's specification that would not work during power outages, their response was not favorable.

From these facts, it was highly challenging to include an appropriate power outage countermeasure function in the design. At the same time, it is also true that decision-makers were aware of the risk of problems that could adversely affect the project's progress if they proceeded with the project without the power outage countermeasure function.

In fact, in the middle of the project, the counterparts became aware of the problem of the specification of the solar system not working in the event of power failure. The project was put on hold for an extended period due to lengthy discussions, which was a significant factor in the extension of the project period.

<Evaluation Result>

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

2 Effectiveness/Impact

<Effectiveness>

The project partially achieved the objectives. The power is not currently generated from the PV system installed under the project.

As for the UOB site, the power from the PV system has not been available as the inverters cannot be activated due to the air conditioning system failure caused by the theft of the part of the system since 2020. In addition, the computer used for monitoring the daily production of the solar power has not been functioning properly due to technical problem since around the end of 2018. Hence, an engineer fails to measure the energy production and to find if the target is achieved or not. In order to cope with this situation, a possibility of the follow-up cooperation is under discussion between the Ministry of Energy, the JICA headquarters and the JICA Gabon office.

At the time of ex-post evaluation, no PV system is installed at MFAIC as it was displaced to UOB and a vocational training center called Centre des Métiers Jean Violas (CDM) which is run by the Electricity and Water Corporation of Gabon (Société d'Electricité et d'Eaux du Gabon: SEEG) in the end of November 2019. The decision to move the solar system was triggered by the complete renovation of MFAIC. Seventy PV panels and two inverters were moved to UOB, which are in use at the time of ex-post evaluation. The rest of the system from MFAIC was transferred to CDM, which has not been installed yet. The Ministry of Energy has been in charge of the installation at CDM, and the work has not been completed. JICA has been discussing a solution to this issue with the Ministry. Until the system was displaced in 2019, the system was utilized at MFAIC site and the target was deemed to be achieved since the amount of energy consumed from the SEEG network had decreased, according to a technician who was in charge of the site at MFAIC, However, he has not maintained the records of the power production data, and therefore, it cannot be justified.

As qualitative effects, it was expected that the capacity on Operation and Maintenance (O&M) has been enhanced as a result of implementation of a soft-component, and awareness on the use of renewal energy is raised. At UOB, one engineer is well trained and competent. However, he has been faced with difficulties such as financial and human resources support to ensure the entire maintenance of the system. As for the awareness raising, although there were no activities to increase public awareness on the PV system, the location of the project sites is highly visible enough to be recognized by the public people. As for the UOB site, people used to enquire about the project during construction period. After the end of the site construction, 3 students from the CDM campus (SEEG student campus), used to approach the engineer at UOB to collect information for their thesis. Another group of 8 students who were preparing their exams approached him (around 2016-2017) to have detailed information about the objectives and operating of the system.

<Impact>

Although it was expected that Japan's initiative for promoting measures climate change both by developed and developing countries is publicized, it was unable to confirm any cases such as the project being as a model case at symposiums and other occasions.

No past or current damage on the natural environment has been observed. However, as Gabon is not equipped to dispose of the batteries, the Ministry of Energy is afraid of the damages of the used batteries that could cause harmful impacts on the environment. At the time of the ex-post evaluation, a feasibility study is underway for constructing a waste disposal and collection center with battery disposal facilities with the support of the European Investment Bank. The construction is expected to be completed around 2024-2025.

No land acquisition and resettlement occurred under this project.

<Evaluation Result>

Therefore, the effectiveness/impact of the project is low.

Quantitative Effects

	Baseline (2009) Baseline Year	Target (2015) 3 year after Completion	Actual (2014) 1 year after Completion	Actual (2015) 2 years after Completion	Actual (2016) 3 years after Completion	Actual (2020 or 2021) At the time of ex-post evaluation
Indicator 1: Power generation volume at transmission end (MWh/year)	0	250	n.a.	n.a.	n.a.	n.a.
(Breakdown)						
UOB	0	160	n.a.*1	n.a.	n.a.	n.a.
MFAIC	0	90	n.a.*2	n.a.	n.a.	0
Indicator 2: Estimated reduction of CO2 emission (ton/year)	0	129	n.a.	n.a.	n.a.	n.a.

*1 Power generation during the period from Jan 1 2013 to Sep 19 2013 was 65.9 MWh during the period from Jan 1 2013 to Sep 19 2013 from a piece of document stored in JICA Gabon office.

*2 Power generation during the period from Feb 1 2013 to Jan 31 2014 was 66.6 MWh from a piece of document stored in JICA Gabon office..

Source : Questionnaires and interviews with Ministry of Energy, UOB

3 Efficiency

Although the project cost was within the plan (the ratio against the plan: 99%), the project period significantly exceeded the plan (the ratio against the plan: 194%-original scope only). One of the most critical reasons was that Ministry of Energy and MFAIC had some serious complaints on a lack of power outage countermeasure function in the installed PV system. It took long time to discuss and settle this issue. In October 2015, an agreement was reached on an additional procurement to install power failure countermeasures equipment including storage batteries on solar power units at the Ministry of Foreign Affairs and the UOB, and the project was resumed. In this way, the project was at a standstill for a long period. Outputs were produced as planned. _

Therefore, the efficiency of the project is fair.

4 Sustainability

< Institutional/Organizational Aspect>

At UOB, Equipment and Assets Department has been responsible for Operation and Maintenance. However, at the time-of ex-post evaluation, one engineer works voluntarily to ensure operation and maintenance of the system (No staff has been officially assigned). Also, not having an assistant is problematic for him as the site maintenance requires physical work such as replacement of broken modules. As for CDM, though the Department of Equipment will look after the operation and maintenance, the actual team has not yet been constituted.

<Technical Aspect>

The technical staff trained by the project has been continuously engaged in O&M of the PV system installed by the project at UOB. As for the system for upgrading skills, in case new engineers are assigned, they will receive training from the existing engineer or from the technicians of the Ministry of Energy.

<Financial Aspect>

Due to government budget restriction, the financial line could not be secured for the UOB. The engineer has faced a problem that he has had no financial budget to purchase the necessary equipment to clean and to maintain the sites. As for CDM, as the system has not been operational, there has been no budget allocated.

At the time of ex-post evaluation, JICA Gabon office has been looking for a possibility to conduct a follow-up cooperation, however, it could be difficult to realize without a guarantee of the budget by the Ministry of Energy on O&M after the project.

The problem is that there is no budget for security in the project site and no security guards assigned.

<Current Status of Operation and Maintenance>

Most of the equipment items had been functioning well. However, the air conditioning system in the control room has been broken because a part of the system was stolen during the lockdown associated with Covid-19 in 2020. As a result, the facility cannot activate the inverters, and is not able to produce the electricity from the solar power system. In addition, the software installed on the PC in the room has malfunctioned, making it impossible to check the amount of electricity produced. As for the PV modules, 525 out of 572 modules installed at UOB (including modules moved from the MFAIC) have been functioning.

Regarding the practice of inspection and maintenance at UOB, the engineer checks the conditions of storage batteries and the current flow every day. In the event of a power outage, the electricity stored in the batteries will be automatically provided to each building in the university. Currently, the facility does not have access to solar power generation, so it receives electricity from its power supplier to be held in storage batteries.

If overall photovoltaic system functions well, the engineer will verify and record the amount of electricity produced by the photovoltaic system in addition to the current routine work.

At UOB, the spare parts have been properly maintained and utilized, nevertheless, it is important to mention that an entire cargo container has been stolen just after the end of the project in 2018. It was placed on the side of the road in the university at the time of the theft because there was no space to put in the project site. Important tools which were inside this container have not been replaced since then. Though the PV system has not been installed at CDM, they have kept spare parts such as modules and inverters properly.

<Evaluation Result>

Major problems have been observed in terms of the institutional/organizational and financial aspects. Therefore, sustainability of the project effects is low.

5 Summary of the Evaluation

The project partially achieved the objectives. The power has not been generated from the PV systems installed under the project since 2020, and therefore, the project did not achieve the targets. The computer used for monitoring daily production has not been functioning properly, which is another reason why no data is obtained. PV modules at MFAIC have been relocated to UOB and CDM, but not installed. As for the efficiency, the project period significantly exceeded the plan. As for the sustainability, major problems have been observed in terms of the institutional/organizational, technical aspect and financial aspects.

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

III. Recommendations & Lessons Learned

Recommendations to Executing Agency:

- It is recommended that Ministry of Energy and UOB increase security to prevent theft in the project site as it has occurred two times in 2018 and 2020 and some of project property has been lost.
- It is suggested that Ministry of Energy and UOB repair the air conditioning units installed to the control room so that the photovoltaic system can operate properly.

Lessons Learned for JICA:

- Careful confirmation should be made during the project preparation phase that the project meets the counterpart's needs. In the case of this project, it was necessary to fully recognize the high importance of the outage countermeasure function for the counterparts.
- When the counterpart and the beneficiaries are from different entities, it would be recommended to clearly define the responsibilities after the project of each partner. In this case, it would have been preferable to define who will bear the costs of maintenance and repairs. Though the Ministry of Energy was the counterpart, the maintenance of the photovoltaic system is still the charge of a volunteer worker



Bulletin board that displays the amount of electricity produced at UOB



Solar panels installed at UOB