Internal Ex-Post Evaluation for Technical Cooperation Project

conducted by Ghana Office: December, 2015

Country Name	The Project on Human Resource Development for Disseminating PV systems
Republic of Ghana	

I. Project Outline

Background	JICA conducted the Master Plan Study on Rural Electrification using Renewable Energy Resource in the Northern Part of the Republic of Ghana during 2005-2006 period. The master plan proposed an action plan to establish the institutional framework for the sustainable rural electrification using renewable energy resource by pointing out the institutional and structural challenges in Ghana. In addition, the master plan suggested that business models, which secured the sustainable maintenance of Photovoltaic (PV) systems should be introduced and disseminated.				
Objectives of the Project	Through (i) Training of PV Agents (PVAs), (ii) Training of Community Agents (CAs) and implementation of Community Solar System (CSS)[1] pilot projects, (iii) PV education at educational institutes, (iv) Technical transfer of PV equipment testing and (v) Awareness raising activities, the project aimed at establishing (1) the bases for the human resource development for PV rural electrification and (2) a CSS pilot model[2], and thereby contributing to sustainable use of PV system. The project objectives set forth are as follows: 1. Overall Goal: PV system are in sustainable use 2. Project Purpose: The bases for human resource development for PV rural electrification are prepared.				
Activities of the project	1. Project site: (1) 24 CSS pilot sites (in 8 regions), (2) Kwame Nkrumah University of Science and Technology (KNUST), Tamale Polytechnic, Koforidua Polytechnic for PV basic human resource development, and CSS pilot site operation 2. Main activities: (1) The project carries out training of CA and implements pilot projects, (2) The project implements training of trainers (TOT) and training for basic human resource at education institutes, (3) The project transfers PV equipment testing techniques and (4) The project carries out awareness raising activities 3. Inputs (to carry out above activities) Japanese Side 1. Experts: 6 persons 2. Study tour in Bangladesh: 6 persons 3. Equipment: vehicles, demo systems, PC related equipment, PV testing equipment, PV panels and others. Ghanian Side 1. Staff allocated: 18 persons 2. Local cost: project office, training venues and others				
Ex-Ante Evaluation	2008	Project Period	February 2008-December 2011 (Extension Period: January 2011-December 2011)	Project Cost	253 million yen
Implementing Agency	Ministry of Energy (MOEn) (Currently Ministry of Power: MOPower), Ministry of Education, Science and Sports				
Cooperation Agency in Japan	-				

II. Result of the Evaluation

1 Relevance

Consistency with Ghana's development policy at the time of ex-ante evaluation and project completion

This project was highly consistent with Ghana's development policy as rural electrification aiming at universal access to electricity is promoted in policy documents including National electrification scheme (1989) and Ghana Shared Growth and Development Agenda (GSGDA) 2010-2013, GSGDAII 2014-2017.

Consistency with Ghana's development needs at the time of ex-ante evaluation and project completion

The project was also highly relevant with Ghana's development needs of rural electrification as the rural areas which are not electrified were vast at the time of both ex-ante evaluation and project completion. At the time of project completion, electrification rate in Ghana was 72% which implies that the mostly rural areas are yet to be electrified.

Consistency with Japan's ODA policy at the time of ex-ante evaluation

The project was also consistent with Japan's ODA policy at the time of ex-ante evaluation as one of the priority areas under Country Assistance Program for Ghana (2006) is revitalization of rural areas. .

Evaluation result

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

2 Effectiveness/Impact

[1] Concept of CSS business model: to install a battery charging station (BCS) in a community, assign (a) CA(s) for daily BCS operation, and utilize the generated income from BCS to cover the maintenance cost of whole PV system(s). CSS is operated by a CA who operates the system, a concessioner who is a qualified entity for whom concession shall be given by an owner to operate and manage the community solar business, a PVA who provides technical support, and an owner (District Assembly: DA). In some sites, educational institutes including the three target institutes are owners instead of DAs. The pilot sites were assigned to the target educational institute as their practice sites.

[2] Japanese and Ghanaian sides had different views of the project purpose: The Japanese side recognized that the project purpose was to develop human resources for the promotion of rural electrification using the PV system and establish the necessary institutional and organizational mechanisms for that purpose. On the other hand, Ghanaian side understood that the purpose was to establish sustainable pilot model of the PV system. Therefore, this ex-post evaluation judges to what extent the project purpose is achieved from both perspectives (Japanese side and Ghanaian side). To incorporate Ghanaian side's perspective, an additional indicator "CSS model operational at project sites" is set at the time of ex-post evaluation.

Status of achievement for Project Purpose at the time of project completion

The project purpose of "The bases for human resource development for PV rural electrification are prepared." was somewhat achieved at the time of the project completion in a sense of the indicators set forth. The indicators which measure the achievement, "the number of conducted training" (indicator 1), "developed materials" (indicator 2), "the number of trained PV Agent and Community Agent" (indicator 4), "lectures and developed materials in educational institutes" (indicator 5) were achieved, though "the number of tested PV system components" (indicator 3) was not achieved. Except indicator 1 and indicator 3, no target values were set, however, the indicators are judged as achieved for the following reasons. Indicator 2 is judged as achieved because various materials were developed, utilized and appreciated by stakeholders. Indicator 4 is judged as achieved because the number of trained PVAs and CAs was more than sufficient to support the CSS pilot sites according to the MOPower and the target three education institutes. As to indicator 5, the weekend courses were carried out at three target institutes and materials were developed as mentioned in the indicator 2, and therefore, indicator 5 is judged as achieved. Although the indicator 1 was achieved, training in LED practice and Lantern testing not enough, according to the target educational institutes.

CSS model was operational at 22 sites, excluding 2 sites which ceased operation after having connected to the national grid. Memorandum of Understanding (MOU) which clarifies the interests among stakeholders at CSS sites was expected to be signed by them, however, data on how many MOUs was signed was not available.

Although the project achieved the project-purpose in a sense of the indicators set forth, it is difficult to judge the degree of achievement of the project purpose, as the set indicators are duplication of the indicators for outputs and some major activities discontinued or were narrowed-down[3]. It is also difficult to set alternative indicators because stakeholders had different views on indicators and were unable to reach consensus at the time of terminal evaluation.

Continuation status of project effects at the time of Ex-post evaluation

After the project completion, MOPower has continued CA training in their projects with other development partners such as Spanish Embassy and World Bank (Ghana Energy Development and Access Project: GEDAP) utilizing training materials developed by this project. At the target two educational institutes out of three, there have not been lectures on human resource development at weekend and official curriculum; however, at Koforidua Polytechnic technical/practical training has been conducted. At Tamale Polytechnic where nothing seems to have happened due to change in management, there are plans to re-commence training. Regarding the PV equipment testing and its training at the target educational institutes for which the testing equipment was provided by the project, PV testing continues as part of training.

The number of CSS pilot sites where PV system is operational has decreased after the project completion. Most of the sites which stopped its operation ceased operation due to electrification by grid extension, and in a few instance, theft of the system components was the cause of discontinuation. While three educational institutes, where trainers who receive TOT training under this project belong, have sufficient capacity to continue CSS operation (such as drawing up and implementing operation plans and monitoring plans as well as preparing annual reports), DAs are logistically constrained and therefore, are unable to conduct frequent monitoring. On the part of MOPower, they have continued monitoring the CSS sites once a year. In the meantime, CSS model has been applied to other areas of the country by projects supported by Spain Embassy and World Bank (GEDAP) which utilize the materials developed by the project.

Status of achievement for Overall Goal at the time of Ex-post evaluation

It is difficult to judge the achievement of Overall Goal as data is not available. However, as mentioned above, PV systems have been newly introduced under the project supported by Spain and GEDAP, which apply the CSS model under the project and utilized materials developed by the project. According to MOPower, all of approximately 300 PV systems installed in 2009 are still in operation with replacement of batteries and bulbs in November 2014 and March 2015. The project's training materials were used for training during replacement exercise. Therefore, the Overall Goal is judged as partially achieved.

Other Impacts at the time of Ex-post evaluation

At the CSS pilot sites under the project, positive impacts were observed. Employment opportunities for CAs and others were created. Clinics and schools were benefitted from the PV system as clinics can attend to patients with the lights from the PV system, and schools can organize night classes.

No land acquisition occurred under this project, and no negative impacts on natural environment were observed.

Evaluation result

The project somewhat achieved the effect indicators at the time of project completion, and effects of the project have partially continued. Overall Goal is partially achieved although the data is incomplete. Therefore, effectiveness/ impact of the project is fair.

Achievement of project purpose and overall goal

Aim	Indicators	Results
(Project Purpose) The bases for human resource development for PV rural electrification are prepared.	1) The number of conducted training (more than 20 times)	Status of achievement at Project Completion: Achieved (Project Completion) 28 Courses were conducted in total. (CA training:17, Trainer training:3, PV testing: 4, LED practice training:1, AGSI joint training:2, Lantern test training: 1) (Ex-post Evaluation) CA training is carried out on project basis.
	2) Developed materials	Status of achievement at Project Completion: Achieved (Project Completion) Technical Service Guideline, Technical Guideline for PV Rural Electrification, PV Testing Manual, CA Manual, Community Solar System Manual, Practice Board, Brochure "Solar Energy is good for you!", 3 kinds of Posters, Stickers for PV Lantern, Video

[3] Although, the project originally tried to establish a cascade training system (the Project implements TOT, trainers train PVAs and PVAs train CAs), an output for establishment of an institutional training system for PVAs was discontinued. The project decided to entrust this component to Association of Ghana Solar Industry (AGSI) which had already well-established PVA training. Also, the scope of "development of an institutional testing system for PV equipment" was narrowed down, as the original plan required a huge investment both for the project and the Ghanaian side to establish the proper testing system.

<table>
<tr><td></td><td></td><td>(Ex-post Evaluation) The developed materials have not been revised, but they have been reprinted and used by the educational institutes and other rural electrification projects.</td></tr>
<tr><td></td><td>3) The number of tested PV system components (more than 10 models of panels, 5 models of controllers, 5 models of batteries and 4 models of inverters)</td><td><u>Status of achievement at Project Completion: Not achieved</u>
(Project Completion) Panel:3, Controllers: 2, Batteries: 1, Inverter: nil, PV Lantern: 4
(Ex-post Evaluation) Some components have been tested as part of training of PV equipment at KNUST and Koforidua Polytechnic.</td></tr>
<tr><td></td><td>4) The number of trained PV Agent and Community Agent</td><td><u>Status of achievement at Project Completion: Achieved</u>
(Project completion) PVA: 36 persons, CA: 59 persons</td></tr>
<tr><td></td><td>5) Lectures and developed materials in educational institutes</td><td><u>Status of achievement at Project Completion: Achieved</u>
(Project completion)
- Weekend courses were carried out at three target educational institutes.
- 30 people participated in at KNUST, approximately 25 people participated in Koforidua Polytechnic. No data was available at Tamale Polytechnic
(Ex-post Evaluation)
- Lectures on human resource development have discontinued at KNUST and Tamale Polytechnic.
- There has been continuous human resource development both at weekend and official curriculum at Koforidua Polytechnic.</td></tr>
<tr><td></td><td>ADDITIONAL INDICATOR*: the number of CSS model operational at project sites</td><td><u>Status of achievement at Project Completion: Achieved</u>
(Project completion)
CSS model was operational at 22 sites. Two sites ceased operation as they were connected to the national grid.
(Ex-post Evaluation)
No. of CSS pilot sites which continues operation under the project
<table>
<tr><td></td><td>2012</td><td>2013</td><td>2014</td></tr>
<tr><td>No. of sites which continue CSS</td><td>17</td><td>16</td><td>8</td></tr>
</table>
No. of sites which applied the CSS model
<table>
<tr><td></td><td>2012</td><td>2013</td><td>2014</td></tr>
<tr><td>No of CSS sites under the project supported by Spain Embassy</td><td>1,286</td><td>-</td><td>-</td></tr>
<tr><td>No. of CSS sites under GEDAP</td><td>-</td><td>348</td><td>300</td></tr>
</table></td></tr>
<tr><td>(Overall goal)
PV system are in sustainable use</td><td>1) The number of PV system in use, the years of operation</td><td><u>Status of achievement: Partially achieved</u>
(Ex-post Evaluation) Data not available, however, in addition to the CSS pilot sites under the Project, PV systems were implemented under the projects supported by Spain and GEDAP as mentioned above.</td></tr>
<tr><td></td><td>2) The number of PV systems in use at public facilities more than five years after installation</td><td><u>Status of achievement: Data not available</u>
(Ex-post Evaluation) Data not available</td></tr>
</table>

Source：Terminal evaluation report, Questionnaire and interviews with counterparts

*The indicator was added at the time of ex-post evaluation to incorporate the perspective of Ghanaian side on project purpose.

3 Efficiency

The project cost exceeded the plan (ratio against the plan: 139%) and the project period was longer than the plan (ratio against the plan: 134%) because the project period was extended as it would take time to complete the component of CSS pilot project implementation which was added and approved at Joint Coordination Committee (JCC) meeting in September 2009. Therefore, efficiency of the project is fair.

4 Sustainability

Policy aspect

In the policy aspect, this project is still given importance in the current development policies including National Energy Policy (2009 - 2020), National Strategic Energy Plan (2006 – 2020), GSGDA II. (2014 – 2017) which promote rural electrification and renewable energy.

Institutional aspect

MOEn was divided into two in year 2014: MOPower and Ministry of Petroleum. The Renewable Energy Directorate is under the MOPower. The roles and responsibility remain same. MOPower's monitoring system of DAs for CSS model is established as monitoring carried out by MOPower once a year and their staff number is adequate to promote CSS. However, on the part of DAs, frequent transfer of staff responsible for monitoring and logistical constraints, the role of monitoring has not been effectively performed. Whether or not MOU is signed is not clear, and therefore, the interests, roles and responsibilities among stakeholders for CSS pilot sites are unstable. Renewable Energy Authority was expected to be established during the project implementation and foster the tasks of MOPower, especially in terms of regularly supervision of DA, however, it is still under review.

Technical aspect

MOPower has sufficient techniques to support CSS model/CA training. Feedback from their monitoring is used to take necessary actions as well as to refine new projects. In most CSS sites, CAs have sufficient skills to operate BCS and to carry out basic repairs and bookkeeping though the quality of record of transactions is not high and transparency is also low. CAs have the opportunity to consult the educational institutes when they encounter difficulties. In case of the sites under DAs, PVAs support CAs although their responses are not

quick enough.

Financial aspect

Budget is not sufficient for MOPower to promote PV systems including transfer of CSS facilities and monitoring. As for the financial aspect of BCS operation, according to the pilot sites survey at the time of ex-post evaluation BCS are generally able to collect charging fees to cover the operations cost and renewing equipment. In some cases however, revenues keep dwindling due to competition from other operators and new solar gadgets.

Evaluation result

From these findings, it is considered that the project has some problems in institutional, technical and financial aspects; therefore, sustainability of the project is fair.

5 Summary of the Evaluation

This project somewhat achieved the project purpose at the project completion as the project achieved the indicators set to measure the effect such as "the number of conducted training", "developed materials", "the number of trained PV Agent and Community Agent", "lectures and developed materials in educational institutes" were achieved, though "the number of tested PV system components" is not achieved. In addition, CSS model was established and became operational at pilot sites. After the project completion, some CSS pilot sites ceased operation as they are connected to the national grid. CA training is carried out on project basis. Although data on the achievement of overall goal is not obtained, the project contributed to maintain the existing PV systems in the whole country. As for sustainability, this project is still given importance in the current development policy. However, there are problems in terms of institutional, technical and financial aspects such as constraint in DA's activities, lack of techniques in bookkeeping at CSS pilot sites and insufficient budget of MOPower. As for efficiency, both project cost and project period exceeded the plan.

In the light of the above, this project is evaluated to be partially satisfactory.

III. Recommendations & Lessons Learned

Recommendations for Implementing agency:

1. Additional Training in LED practice and Lantern testing should be organized for the trainers of three educational institutes to consolidate understanding in these areas.
2. Currently, PV testing continues as part of training at three educational institutes and therefore, testing equipment is utilized relatively at limited scale. It may be better for three educational institutes to redistribute PV testing equipment to organizations which can more fully utilize them such as Ghana Standards Authority (the statutory institution for ensuring standardization in Ghana and one of the cooperating agencies of the project).
3. MOPower is recommended to incorporate capacity development of CA in PVA training and establish common understanding of capacity level requirement of CAs especially for Government and development partners funded projects to ensure a fully capable CA who is practically oriented.
4. MOPower is recommended to find replacement sites for PV systems where communities are connected to the national grid and to avoid duplication with the national grid.
5. MOPower is recommended to take security measures for the PV system components.
6. For MOPower, there is a need to create opportunity for CAs in the implementation of PV projects to enable them brush up their skills particularly in the aspect of book keeping and pricing especially when competition intensifies.

Lessons learned for JICA

The training materials developed by the project are used for Polytechnic level education. In addition, training boards were developed in KNUST and Tamale Polytechnic with the intention of helping students gain practical knowledge on PV components and systems. Manuals developed under the project have been reprinted and are used by educational institutes and on other rural electrification projects. The content of the manual, particularly the use of pictorial illustrations, made it easily comprehensible for learning and easy for training and disseminating the use of solar PV for off-grid application in Ghana. During project implementation, careful development of training materials and manuals is important as where the quality of those materials developed meets the needs of stakeholders, the level of utilization is high.

Solar panel installed in a school at Akyerekyerekrom

Lighting in a classroom at Loagri No.1