

Country Name	The Project for Capacity Building for Efficient Power System Development in Rwanda
Republic of Rwanda	

I. Project Outline

Background	<p>In Rwanda, in 2008, the critically low electrification rate of 5% was hindering not only improvement of living standards of the people but also the economic growth of the country recovering from the damages by the genocide in 1994. The government of Rwanda has been setting out improvement of electrification as one of the long-term national goals in the “Rwanda Vision 2020”. On the other hand, the electricity supply, which mainly covered the metropolitan area including Kigali, was unstable because of deterioration and degradation of the distribution systems. Therefore, development of the training system for improvement of technical capacity, especially for operation and maintenance of the power system, was an urgent issue. Under those situation, the government of Rwanda requested a technical cooperation project to establish a training system and capacity development for technical staffs of Energy, Water and Sanitation Authority (EWSA) for better operation and maintenance (O&M) of power facilities.</p>		
Objectives of the Project	<p>Through development of the training policy and trainings for the core-trainers and the core-engineers to deliver technical trainings as well as establishment of GIS database for the distribution system in Kigali, the project aimed at improvement of the training system of EWSA, thereby contributing to improvement of operation and maintenance activities for power facilities of EWSA.</p> <ol style="list-style-type: none"> Overall Goal: Operation and maintenance (O&M) activities for power facilities of EWSA are improved. Project Purpose: Training system for operation and maintenance of power facilities is improved. 		
Activities of the Project	<ol style="list-style-type: none"> Project Site: Rwanda (Pilot sites: Nyarugenge and Nyamirambo in Kigali city) Main Activities: 1) Developing and authorizing the Training Policy of EWSA, 2) Developing database for distribution system in Kigali using GIS, 3) Delivery of on-site practical trainings of power facilities for the core-trainers and the core-engineers, 4) Evaluating training effects for the core-trainers and the core-engineers. Inputs (to carry out above activities) 		
	<p>Japanese Side</p> <ol style="list-style-type: none"> Experts: 9 persons Trainees Received: 2 persons Equipment: GIS software, GPS, PC, Printer, Software for Transmission system analysis, training equipment for distribution system Local Cost: Cost of vehicles and project activities including inks and paper 	<p>Rwandan Side</p> <ol style="list-style-type: none"> Staff Allocated: 42 persons Land and Facilities: Project office space and the training center Local Cost: Cost of GIS surveyor, administrative costs for the distribution technician trainings, cost for preparation for the Gasata diesel power plant for the core-engineer training 	
Project Period	March, 2011 – March, 2014	Project Cost	(ex-ante) 350 million yen, (actual) 420 million yen
Implementing Agency	<p>Ministry of Infrastructure (MININFRA) Rwanda Energy Group (REG) (EWSA was reorganized to REG in July 2014)</p>		
Cooperation Agency in Japan	Nippon Koei Co., LTD.		

II. Result of the Evaluation

1 Relevance
<p><Consistency with the Development Policy of Rwanda at the Time of Ex-Ante Evaluation and Project Completion></p> <p>The project was consistent with the Rwanda’s development policies of “the Rwanda Vision 2020”, - “the Economic Development and Poverty Reduction Strategy (EDPRS) 2008-2012” and “the Second Economic Development and Poverty Reduction Strategy 2013-2018”, prioritizing capacity building of individuals and organizations in the electricity sector for provision of electricity to 270,000 households by 2012 as well as achievement of the electrification rate of 100% across the country through off-grid and on-grid solutions by 2018.</p> <p><Consistency with the Development Needs of Rwanda at the Time of Ex-Ante Evaluation and Project Completion ></p> <p>The project was consistent with the Rwanda’s development needs of capacity building of engineers and technicians operating and maintaining power facilities under EWSA as well as establishment of internal training system for the capacity building in EWSA. The needs did not change from the time of ex-ante evaluation to the time of project completion.</p> <p><Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation></p> <p>The project was consistent with the Japan’s ODA policy for Rwanda based on the annual policy dialogue on economic cooperation between Rwanda and Japan in 2010 prioritized support for the three areas including economic infrastructure and industrial development, especially road traffic and energy.</p> <p><Evaluation Result></p> <p>In light of the above, the relevance of the project is high.</p>
2 Effectiveness/Impact
<p><Status of Achievement for the Project Purpose at the time of Project Completion></p> <p>The Project Purpose was achieved by the project completion. The internal trainings on the O&M of distribution system by the core-trainers who were trained by the project (Indicator 1) were implemented five times at the Training Center by October 2013. OJTs on</p>

the O&M of the transmission system (Indicator 2) were conducted through the on-site trainings of basics of construction and supervision for the engineers at actual construction sites by the core-engineers trained by the project. In terms of OJTs on the O&M of hydropower generation plants (Indicator 3), the OJTs by the core-engineers trained by the project started as planned. The core-engineers of diesel power generation plants trained by the project conducted trainings for newly assigned plant managers and engineers (Indicator 4). For training evaluation (Indicator 5), 3 monitoring reports for the trainings of hydropower plants were prepared by the core-engineers and 1 review report for the 4th technician training on distribution system at the Training Center was prepared. However, any training evaluation report for OJTs on transmission system and diesel power generation plants was not prepared.

<Continuation Status of Project Effects at the time of Ex-post Evaluation>

The project effects have been partially continued since the project completion. The internal technical training system established by the project, including the internal technical trainings on the O&M of the distribution system at the Training Center and OJTs at the transmission system and the power generation plants, have not continued because of the restructuring of EWSA¹. Since the core-trainers and the core-engineers have got promoted or have been transferred to other positions, they have not been engaged in the internal technical trainings for other engineers and technicians. In addition, the Training Center, which was established in 1988 in order to train necessary technicians and engineers for O&M of power facilities, became a property of the Water and Sanitation Corporation which was separated from EWSA as a part of the restructuring. In terms of monitoring and evaluation activities to assess the training effects, any training evaluation report has not been made after ending the project due to no person in charge of it under the organizational restructuring of REG.

The GIS distribution system database, which was established by the project for efficient and effective O&M of the distribution system with underground cables, has been continuously utilized by REG, and its coverage has expanded to the low voltage distribution lines in the whole country over Kigali city where was the site covered by the project. This is because the GIS staffs trained by the project have still taken responsibilities for operating, maintaining and updating the GIS database.

<Status of Achievement for Overall Goal at the time of Ex-post Evaluation>

The Overall Goal has been partially achieved at the time of ex-post evaluation. While internal technical trainings or OJTs by core-trainers for engineers or technicians of hydropower and diesel power generation plants (Indicator 1) have stopped since the project completion, the internal technical trainings on distribution and transmission systems have limitedly been sustained for newly recruited engineers and technicians by using the training manuals, textbooks and materials developed by the project.

Regarding improvement of the O&M of the power facilities (Indicator 2), the overall restoration time of power facilities reduced from 9,341 minutes in 2016 to 7,744 minutes in 2017. The project might have partly contributed to the improvement of power system by the improved technical capacity to identify troubles and to take necessary actions for trouble shooting. The number of accidents in the distribution system and the hydropower generation plants have been limited: 3 times a year in the entire distribution system in 2016 and as of July 2017, respectively, and 2 times in only 2015 but no accident in other years at the hydropower generation plants. The patrol and inspection of the transmission system, which is the main maintenance activity for the transmission system, has been continuously implemented by the engineers of the Transmission Department of the Energy Utility Corporation Limited (EUCL) twice a year for the period from 2014 to 2017. At the diesel power generation plants, the lubrication system has been maintained by the REG engineers while the complex system has been maintained by the manufacturer. Since the project completion, no accident has occurred in the diesel power plants.

<Other Impacts at the time of Ex-post Evaluation>

No other positive and negative impact was observed at the time of ex-post evaluation.

<Evaluation Result>

In light of the above, the Project Purpose was achieved but the project effects have been partially continued and the Overall Goal has been partially achieved. Therefore, the effectiveness/impact of the project is fair.

Achievement of Project Purpose and Overall Goal

Aim	Indicators	Results
(Project Purpose) Training system for operation and maintenance of power facilities is improved.	(Indicator 1) By the end of the project, the internal trainings by core-trainers for operation and maintenance of distribution system at the Training Center are implemented at least three times.	Status of the Achievement: Achieved (Project Completion) • Five times by October 2013 (Ex-post Evaluation) • To be verified as level of achievement of the Overall Goal (Indicator 1).
	(Indicator 2) By the end of the project, OJTs by the core-engineers for operation and maintenance of transmission system are started.	Status of the Achievement: Partially Achieved (Project Completion) • Trainings on necessary skills for operation of transmission for the core-engineers were conducted by the Japanese experts but OJTs by the core-engineers for other engineers did not start. • On-site trainings for the core-engineers and other engineers at the construction sites were conducted in order to learn basics of maintenance of transmission system but OJTs by the core-engineers for other engineers did not start. (Ex-post Evaluation) • To be verified as level of achievement of the Overall Goal (Indicator 1).

¹ The power sector of EWSA was transformed to REG and its subsidiaries of the Energy Utility Corporation Limited (EUCL) and the Energy Development Corporation Limited (EDCL).

	(Indicator 3) By the end of the project, OJTs by the core-engineers for operation and maintenance of hydropower generation plants are started.	Status of the Achievement: Achieved (Project Completion) • OJTs by the trained core-engineers started. (Ex-post Evaluation) • To be verified as level of achievement of the Overall Goal (Indicator 1).																												
	(Indicator 4) By the end of the project, OJTs by the core-engineers for operation and maintenance of diesel power generation plants are started.	Status of the Achievement: Achieved (Project Completion) • Trainings for newly assigned plant managers and engineers were conducted by the core engineers as OJTs. (Ex-post Evaluation) • To be verified as level of achievement of the Overall Goal (Indicator 1).																												
	(Indicator 5) By the end of the project, at least one training evaluation report for each of the above internal trainings and OJTs is prepared.	Status of the Achievement: Partially achieved (Not continued) (Project Completion) • 3 monitoring reports were prepared for the training sessions by the core-engineers of the hydropower plants. • A review report for the 4th technician training (distribution system) at the Training Center was prepared. (Ex-post Evaluation) • Any report has not been prepared after the project completion.																												
(Overall Goal) Operation and Maintenance (O&M) activities for power facilities of EWSA are improved.	(Indicator 1) The technical training for engineers and technicians are continued. i) Refreshing and upgrading training for the trained core-trainers and core-engineers ii) Core-trainers/Core-engineers training for newly assigned engineers iii) Distribution: distribution technician training by the core-trainers iv) Transmission: on-site trainings by the core-engineers, including patrol and inspection of the transmission system and supervision of construction works, v) Hydropower plants: theoretical trainings and OJTs by the core-engineers, vi) Diesel power plants: theoretical trainings and OJTs by the core-engineers	(Ex-post Evaluation) Partially Achieved • Technical trainings have been delivered for only the newly assigned engineers and technicians under the new structure of EUCL/EDCL but the internal technical training system established by the project has been discontinued. • Any training for engineers of hydropower and diesel power generation plants has stopped. [No. of internal trainings by core-trainers for technicians or engineers] <table border="1"> <thead> <tr> <th colspan="2">Type of Trainings</th> <th>2014</th> <th>2015</th> <th>2016</th> <th>2017 (Plan)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Distribution System</td> <td>No. of trainings</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> </tr> <tr> <td>No. of participants</td> <td>5</td> <td>5</td> <td>5</td> <td>5</td> </tr> <tr> <td rowspan="2">Transmission System</td> <td>No. of trainings</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> </tr> <tr> <td>No. of participants</td> <td>4</td> <td>4</td> <td>5</td> <td>6</td> </tr> </tbody> </table>	Type of Trainings		2014	2015	2016	2017 (Plan)	Distribution System	No. of trainings	4	4	4	4	No. of participants	5	5	5	5	Transmission System	No. of trainings	4	4	4	4	No. of participants	4	4	5	6
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	(Indicator 2) Improvement of O&M activities are recorded and periodically reviewed at each power facility as follows: i) Reduction of restoration time for each power facility ii) Decrease in the number of accidents for distribution system and hydropower plants iii) Implementation of patrol and inspection for transmission system iv) Identification of cause of troubles for diesel power generation plants.	(Ex-post Evaluation) Partially Achieved • The overall restoration time of power facilities per year: 9,341 minutes in 2016 and 7,741 minutes in 2017. • The number of accidents in the power facilities have been limited. [No. of accidents in each system or plant] <table border="1"> <thead> <tr> <th></th> <th>2014</th> <th>2015</th> <th>2016</th> <th>2017 As of July</th> </tr> </thead> <tbody> <tr> <td>Distribution System</td> <td>N.A.</td> <td>N.A.</td> <td>3</td> <td>3</td> </tr> <tr> <td>Transmission Line</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Hydropower Generation Plants</td> <td>0</td> <td>2</td> <td>0</td> <td>0</td> </tr> </tbody> </table> • The patrol and inspection for transmission has been conducted 2 times per a year. • Identification of cause of troubles for diesel power generation plants has been sustained.		2014	2015	2016	2017 As of July	Distribution System	N.A.	N.A.	3	3	Transmission Line	0	0	0	0	Hydropower Generation Plants	0	2	0	0								
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Source : Terminal Evaluation Report (EN), Questionnaire and Interviews with REG/EUCL/EDCL

3 Efficiency

Although the project period was as planned (ratio against the plan: 100%), the project cost exceeded the plan (ratio against the plan: 120%) due to an additional input of a Japanese expert specifying human resources development in order to promote the activities to set up internal training system in EWSA.

Therefore, the efficiency of the project is fair.

4 Sustainability

<Policy Aspect>

There has been no policy change in Rwanda since the project completion. While the Vision 2020 targets the extension of power supply, EDPRS II (2013-2018) aims at the extension of domestic interconnectivity of the country through improvement of infrastructure, including power networks.

<Institutional Aspect>

[Internal Training System]

The restructuring process of the former EWSA has been still on going. Although the new organizational plan includes the internal technical training system, the organizational structure to conduct the internal technical trainings and OJTs at the power facilities has not

been confirmed yet at the time of ex-post evaluation. Therefore, no core-trainers for the internal technical training and no core-engineers for OJTs at the power facilities has been assigned. While the Human Resources Department of REG is in charge of training evaluation, the new organizational structure does not have a training evaluation system based on the ones proposed by the project. REG deploys 14 staffs for the human resource management and trainings for the staffs of the two subsidiaries of EUCL and EDCL.

The training center, which had been a part of assets owned by EWSA, was handed over to the Water and Sanitation Corporation (WASAC), which was the entity in charge of water supply and sanitation separated from the former EWSA. REG has a plan to construct a new training center in in Gahanga area, Kicukiro District, in Kigali City.

[O&M activities for the Power facilities]

Under the new structure of the power sector, REG is responsible for management of the power sector business as a holding company. As mentioned above, REG owns EDCL and EUCL. While EDCL is in charge of planning and development of power supply facilities, EUCL is responsible for operation and maintenance (O&M) of the power supply system. EUCL has the Department of Distribution for the distribution system, the Department of Transmission for the transmission system and the Department of Generation for the hydropower generation plants and diesel power generation plants.

Each of EUCL and EDCL have deployed the sufficient numbers of engineers and/or technicians for the O&M activities: EUCL has 95 staffs for the distribution system and 130 staffs for the transmission system and 124 staffs for the hydropower plants and 38 staffs for the diesel power plants.

[GIS distribution system database]

The Planning Department of EUCL has been in charge of the distribution system database based on GIS which had been established by the project. The GIS team trained by the project transferred to EUCL and three staffs were newly recruited in 2015. It has 6 staffs for operating, maintaining and updating the database so that they are sufficient to carry out their tasks.

<Technical Aspect>

[Internal Technical Training and OJTs]

The core-trainers and the core-engineers trained by the project have sustained the knowledge and skills to deliver the internal technical trainings and OJTs. However, there is no chance for them to transfer their skills and knowledge to other engineers and technicians since the internal technical training system has not been functioning in the new organization. On the other hand, the training manuals, textbooks and materials for the internal technical trainings or OJTs at the power facilities have still been utilized by REG even after the project.

[O&M of the power facilities]

Since the O&M of the power facilities have been improved by the reduced restoration time, the limited number of accidents at the power facilities, and the improved maintenance activities by the engineers, the engineers and/or technicians have sustained the necessary skills and knowledge about the O&M of each power facility.

[GIS distribution system database]

The staffs trained by the project have sustained their knowledge and skills to utilize and to update the distribution system database based on GIS and still been involved in the database without any influence brought by the organizational restructuring so that they have expanded its coverage from Kigali city to the whole country after ending the project. The training manuals of GIS elaborated by the project have been still useful. These manuals have been utilized for OJTs of the newly recruited staffs.

<Financial Aspect>

As the organizational restructuring in REG has been on going, there is no any available data for REG and its subsidiaries.

<Evaluation Result>

In light of the above, some problems have been observed in terms of the institutional and financial aspects of the implementing agency. Therefore, the sustainability of the effectiveness through the project is fair.

5 Summary of the Evaluation

The project achieved the Project Purpose and partially achieved the Overall Goal. While the O&M activities of the power facilities have been improved, the internal technical trainings and OJTs at the power facilities, which had been established by the project, have not been sustained due to the ongoing restructuring process of REG (EDCL/EUCL). As for sustainability, the improved O&M activities introduced by the project have been practiced at each power facilities. Though some internal trainings continued to be implemented, the proper technical training system designed by the project has not been established yet under the new organization of REG and no budget data is available for REG. As for efficiency, the project cost exceeded the plan due to the fact that an expert of Human Resource Development was additionally added as input in order to promote activities to setup an internal training system of EWSA.

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

III. Recommendations & Lessons Learned

Recommendations for Implementing Agency:

[For EDCL and EUCL]

- It is necessary to ensure the organizational structure or setting to conduct the internal technical trainings or OJTs at the power facilities introduced by the project for the proper O&M activities at the distribution, transmission and generation facilities in the new EUCL and EDCL structures in the ongoing restructuring process for the coming 2018-2019 fiscal year.

Lessons Learned for JICA:

After the project, the core-engineers and core-trainers were promoted or assigned to other positions and the internal trainings and OJTs have been suspended under the new organization of REG. Therefore, it is important to mitigate impacts by the organizational structure change and to increase commitment and ownership of the implementing agency in order to consider and sustain the project achievements even after the organizational restructuring. In addition, JICA overseas offices need to discuss closely, monitor and follow-up with the implementing agencies and related ministries on how to ensure the “sustainability” of the project effects especially when a sudden institutional change has occurred after the project completion.



Ongoing utilization of GIS Distribution System Database equipped by the project



EUCL Engineers conduct regular patrol and inspections of the entire transmission system