

Republic of Uganda

FY2017 Ex-post Evaluation of Japanese Grand Aid Project

“The Project for Rural Electrification Phase 3”

External Evaluator: Ryutaro Koga, Global Group 21 Japan, Inc.

## **0. Summary**

The Project for Rural Electrification Phase 3 (hereinafter referred to as “this project”) was implemented with the objective of improving the infrastructure of the power grid by procuring and installing long-distance power distribution equipment and materials in the eastern five districts of Uganda where industrial revitalization could be expected, thereby contributing to the improvement of rural electrification. This project is part of Ugandan rural electrification strategy plan and is consistent with the country's development plan. Considering the rural electrification rate still as low as 10% in Uganda, the necessity of electrification is high, and it is consistent with Japan's aid policy. Therefore, the relevance of this project is high. The project cost ended up within the planned budget due to a decrease in construction quantities, and even though the project period on the Ugandan side was delayed by five months, the construction period on the Japanese side fell within about 80% of the planned schedule (four months shortened), so this project's efficiency is considered high. Connections to unelectrified public facilities has advanced at a rate faster than planned, and the number of connections to customers, who are mainly households, commerce and industry, is expected to reach about 80% of the target by the target year (2018). In addition, considering that there are instances of multiple households connected to one electricity meter, the overall household connection number is even larger than grasped. The positive impacts on living convenience for residents and the positive impacts on regional economic revitalization are widely observed, so the effectiveness and impacts of this project are high. As the target areas of electrification are located in regions with low profit margins, a part of the maintenance expenses is planned to be covered by government subsidies. The operation, maintenance and management of this project are free from problems in terms of organizational, technological, financial aspects etc. Therefore, the sustainability of this project is high.

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

## 1. Project Description



Project Location



Namayingo District Office electrified by this project and a transformer

### 1.1 Background

The power consumption per capita of the Republic of Uganda, 69.5 kWh (2009), was only about one eighth of the average of Africa as a whole, the rural electrification rate was as low as 7% as of 2012, the spread of electricity to the whole nation has been delayed. For this reason, *the National Development Plan (NDP)* took up the promotion of rural electrification as one of the issues to be addressed, and in 2009 the Rural Electrification Agency (REA) formulated the *Rural Electrification Master plan (IREMP)* that identified regions that needed urgent electrification while also looking for donor support, thus promoting projects in various places. This project is based on this IREMP and covers unelectrified areas of high priority in the eastern five districts, including district capitals and the areas facing major national highways with the prospect of industrial revitalization. Through the electrification of not only general households but facilities such as health centers, education facilities and commercial centers which have high needs for electrification, it was expected that the improvement of social services, revitalization of regional economy, job creation and wage increases were to be realized. Pertaining to support of rural electrification projects through grant aids from Japan, this project follows *The Project for Rural Electrification (1998 to 1999)* and *The Project for Rural Electrification Phase 2 (2007 to 2008)*.

### 1.2 Project Outline

As part of the rural electrification plan promoted by REA, this project was conducted in five eastern districts of Uganda (Mayuge, Iganga, Bugiri, Namayingo, Busia; with electrification target population of approximately 76,000 people in 9,600 households), by procuring and

installing 33 kV MV<sup>1</sup> power distribution equipment and materials (transformers, disconnectors, distribution lines, insulators, power utility poles, ammeters/ voltmeters, etc.). This project aimed at improving the long-distance power grid infrastructure in the target area and contributing to the improvement of the electrification rate and civilian life. The procurement and installation of the 415/240V LV<sup>2</sup> line and the lead-in line construction work to each customer is handled by Uganda.

E/N Grant Limit/ Actual Grant Amount	1,204 million yen/ 1,204 million yen
Exchange of Notes Date/ Grant Agreement Date	July 2013/ July 2013
Executing Agency	Rural Electrification Agency (REA)
Project Completion	December 2014 (Japan side construction work)
Main Contractor	NISHIZAWA LIMITED.
Main Consultant	Yachiyo Engineering Co., Ltd.
Cooperation Preparatory survey	The Preparatory Survey on the Project for Rural Electrification Phase 3 in the Republic of Uganda (2011- 2012)
Related Projects	“The Project for Rural Electrification” (Grant aid Project, 1998) “The Project for Rural Electrification Phase 2” (Grant aid Project, 2007-2008)

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Ryutaro KOGA (Global Group 21 Japan, Inc.)

### 2.2 Duration of the Evaluation Study

This ex-post evaluation study was conducted with the following schedule;

Duration of the Study: August 2017- December 2018

Duration of the Field Study: November 24, 2017 - December 27, 2017/ April 9-18, 2018

---

<sup>1</sup> Medium Voltage

<sup>2</sup> Low Voltage

### 3. Results of the Evaluation (Overall Rating: A<sup>3</sup>)

#### 3.1 Relevance (Rating: ③<sup>4</sup>)

##### 3.1.1 Consistency with the Development Plan of Uganda

Uganda government's *Rural Electrification Strategic Plan: RESP (2006)* at the time of planning aimed to raise the rural electrification rate to 10% by 2012. However, the actual result for 2012 remained at 7%<sup>5</sup>, not reaching 10% until 2014. Based on this situation, the *National Development Plan II (2015/16- 2019/20)* aims to accelerate rural electrification as a policy objective of the energy sector. This includes increasing power generation and distribution capability through the power grid in not only the city but also the rural areas, effectively promoting overall economic growth. With the aim of increasing the electrification rate of 20%<sup>6</sup> in 2014 to 30% by 2020 nationwide, the Ugandan government is, while closely monitoring the electrification rates by region, working on specifically raising the electrification rate in rural areas which is lagging progress. Also, in the *Second Rural Electrification Strategy Plan (2013 - 2022): RESP II (2013)*, the rural electrification target of 2022 is set at 26%, by 2030 all lighting by kerosene is to be replaced with electrical lighting, and by 2040, global access (electrification of all households) is aimed. Taking the above into consideration, this project is deemed consistent with Uganda's development policy at the time of planning and ex-post evaluation.

##### 3.1.2 Consistency with the Development Needs of Uganda

As stated in “1.1 Background of Project”, at the time of planning (2012), the rural electrification rate was only 7%. After that, the rate increased to 10% (only 5% is on-grid distribution) at the time of the 2014 Census<sup>7</sup>, and although it is thought that it has continued to grow, the target rate of 26% in 2022, and 100% in 2040 is still far from being achieved. Therefore, from the viewpoint of the improvement of civilian life in rural areas by the electrification of general households/ social services, such as administrative facilities, health care facilities, educational facilities, and from the viewpoint of promoting regional industry by stable power

---

<sup>3</sup> A: “Highly satisfactory”, B: “Satisfactory”, C: “Partially satisfactory”, D: “Unsatisfactory”

<sup>4</sup> ③: “High” ②: “Fair”, ①: “Low”

<sup>5</sup> Source: Second National Development Plan II p.24

<sup>6</sup> Source: 2014 Census (National Population and Housing Census 2014 Main Report) p.31

<sup>7</sup> The main report of the 2014 Census was published in March 2016. There is no reliable data after this Census, and at the time of the ex-post evaluation REA is also using the electrification rate of this Census.

supply to business persons in trading centers<sup>8</sup> etc., the development needs relating to the promotion of rural electrification continues to be high<sup>9</sup>.

Taking the above into consideration, this project is highly consistent with the development needs at the time of planning and ex-post evaluation.

### 3.1.3 Consistency with Japan's ODA Policy

This project is consistent with the *Power Supply Enhancement Program* included in the *Environmental Improvement to Realize Economic Growth* that is a priority area of Japan's *Uganda Country Assistance Policy*. Also, it is consistent with *Infrastructure Supports for Acceleration of Growth* which is a priority focus of the TICAD<sup>10</sup> IV Yokohama Action Plan. As a rural electrification cooperation from the Japanese government, this project is following two grant aid projects, *The Project for Rural Electrification (1998 - 1999)* and *The Project for Rural Electrification Phase 2 (FY 2007-2008)* and is highly consistent with the Japanese ODA policy.

From the above, implementation of this project is fully consistent with Ugandan rural electrification policy, development needs and Japan's aid policy. Therefore, its relevance is high.

## 3.2 Efficiency (Rating: ③)

### 3.2.1 Project Outputs

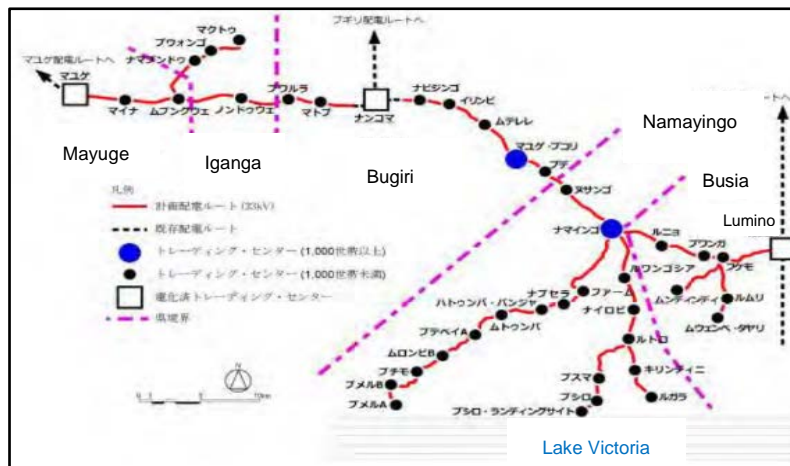
In this project, it was planned to develop a power distribution network based on around 130km, 33kv Medium Voltage lines between Mayuge and Lumino located on the north of Lake Victoria (Fig. 1).

---

<sup>8</sup> There are about 40 places in this project area where commercial facilities along the highway have accumulated. It is not an administrative area.

<sup>9</sup> In 2012, the Bujagali hydroelectric power plant (250 MW) was completed and other small hydropower stations were also constructed. As a result, the serious supply shortage has been resolved. Although the power demand rate increase in recent years has gone as high as 10 to 12% per year, other new power source developments such as the Karma hydroelectric power plant (600 MW scheduled to be completed in December 2018) is being implemented, and there is no fear of power shortage in the short-medium term.

<sup>10</sup> Tokyo International Conference on African Development: An international conference with the theme of development in Africa, since 1993, led by the Japanese government, and jointly held with the United Nations, the United Nations Development Program (UNDP), the African Union Commission (AUC) and the World Bank.



Source: Cooperation Preparation Report

Figure 1 Distribution Route and Trading Centers

Table 1 Outputs of this project - Plan and Actual

Plan (at Cooperation Preparatory survey)	Actual (at Ex-post evaluation)
(1) Civil works, Procurement of Equipment	
【Installation】 Procurement and Installation of Distribution Equipment	
MV Distribution network (33kV lines, about 134.4km in total)	about 127.8km in total
・ Mayuge – Nankoma (about 21.5km)	ditto
・ Mpungwe – Makutu (about 10.2km )	ditto
・ Nankoma – Lumino (about 37.5km )	ditto
・ Namayingo – Bumeru A and Bumeru B (about 29.9km)	ditto
・ Namayingo – Busiro port and Lugala (about 24.8km)	ditto
・ Hukemo – Mundindi and Mwenbe-Tayari (about 10.5km)	・Hukemo – Mundindi primary school (about 3.9km)
【 Equipment 】 Distribution lines, Distribution materials, Distribution transformers, Electricity meters	
(a) 33/0.415-0.240kV Distribution transformers (50 in total)	47 in total
(b) Electricity meters for trading 4 sets	ditto
(c) Automatic reclosing devices 4 sets	ditto
(d) Load switches 14 sets	ditto
(e) Parts, Maintenance tools etc.	ditto
(2) Content of consulting service / soft components	
Detailed design, Implementation management	ditto

Output from Ugandan side

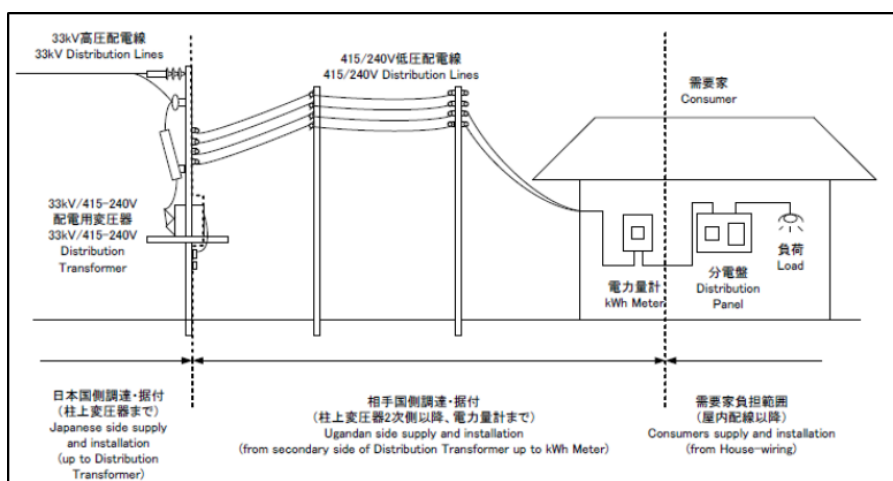
<b>Plan (at Cooperation Preparatory survey)</b>	<b>Actual (at Ex-post evaluation)</b>
(1) 33kV distribution line route survey and tree cutting	(1) completed
(2) LV distribution line procurement and installation (1.5km x 50)	(2) 109.8km were installed
(3) Customer electricity meters and Lead-in line procurement and installation (4800 connections)	(3) procurement of Customer electricity meters completed, installation of lead-in lines progressed 45% (2,163 connections: as of June 2017) Total investment amount: 10 billion UGX (about 2.8million USD)

This project was mostly implemented as planned (see Table 1), however, the amount of some of the equipment was reduced, as the estimated cost at the time of the detailed design exceeded the budget amount due to exchange rate fluctuation. Specifically, the 33 kV MV distribution line laying (between Hukemo - Mundindi and Muwenbe-Tayari) was decreased by 6.6 km (about 4.9% of the originally planned total), and three less transformers (6% of the originally planned) installed.

As shown in Figure 2, the construction responsibility for the Japanese side was the 33 kV distribution lines, the LV distribution lines (415/240 V) from the pole transformers to facilities of customers were borne by the Ugandan government. The wiring within the customer's house was planned to be borne by the customers. However, according to the field survey and hearings from beneficiaries including residents, it was found that additional laying of utility poles is necessary for connecting buildings that are 30m or more away from the LV distribution poles built by UEDCL (Uganda Electricity Distribution Corporation Limited, in charge of power distribution and management under the umbrella of REA). This burden falls currently on the customer. In other words, the connection costs borne by the customer are (1) connection fee, (2) indoor wiring fee, (3) utility pole laying cost (if necessary), and this total amount is expensive. This is a factor<sup>11</sup> impeding the rapid increase in the number of connections.

---

<sup>11</sup> Costs of a customer for connection are as follows: (1) a flat rate connection fee (136,000 UGX since April 2017: about 39 USD) to UEDCL, (2) an indoor wiring fee (depending on the size of the house and the number of rooms, About 300,000 to 600,000 UGX: 85 USD to 170 USD), and for some customers, (3) one or more utility pole installation costs (about 150 USD / pole). From the above, there were many households which could not be connected due to high connection fees. There are many households that cannot be connected because utility poles are not nearby, but there are also many households that cannot be connected even with a nearby pole because they cannot pay the indoor wiring fee and connection fee. Furthermore, for connection, it is necessary to be a permanent building, which omits structures with traditional walls and grass-roofed houses where the risk of electric leakage is high, such as during rain. In the Namayingo District, the percentage of houses with permanent walls is 20%, which is the smallest in the target five districts, and to further improve the electrification rate in Namayingo District, improvement of the house structures is needed.



Source: Cooperation preparatory survey

Figure 2 Construction burden classification (conceptual diagram) between the Japanese side and Ugandan side

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The project cost was planned to be 1.204 billion yen, and the actual was the same 1.204 billion yen (100%) as planned. As described in the section on output, responding to the foreign exchange fluctuations, the construction quantity was adjusted to keep it within the planned budget by reducing the distribution line distance by about 5%, and the number of distribution transformers by 6%. The subject area where the reduction occurred was a relatively less influential area located at the end of the route, which was decided to be implemented by the Uganda side.

#### 3.2.2.2 Project Period

The project period was scheduled to take 22 months, and ended up being 18 months from July 2013 (G/A) to December 2014 (issue date of completion certificate), 4 months ahead of schedule (82% of the planned length). According to a project management consultant, the reason it proceeded ahead of schedule was due to the following. The installation contractor, subcontractor and the field contractor who received the order by tendering were the same as those of the preceding *Rural Electrification Phase 2* and since they were accustomed to the construction, efficient construction was possible. Also, because of the demand of the local contractor, construction work was frequently carried out on Saturdays. It should be noted that it was agreed upon in advance by both countries that construction of the 415/240V LV lines, which is required for consumer connection, would be constructed by Ugandan side almost in parallel with



construction of the 33 kV MV lines. It was completed in November 2015, the following year after completion of this project<sup>12</sup>.

From the above, although there was a slight reduction of construction quantity, the project cost was basically as planned, and the project period was considerably shortened from the planned period. Therefore, efficiency of the project is high.

### 3.3 Effectiveness and Impacts<sup>13</sup> (Rating: ③)

#### 3.3.1 Effectiveness

##### 3.3.1.1 Quantitative effects (Operation and Effect Indicators)

The purpose of this project was to provide electrification to customers in households, commerce and industry, public facilities etc. in the target area. As an indicator to measure this achievement, the number of connections to various customers are analyzed (Table 2).

As for the “consumer connection” (Indicator 1), the actual number is 2,163 as of June 2017 compared to the target number of 4,800, and the achievement level is only 45.1% (see Table 2). However, it should be noted that at the time of the ex-post evaluation about 1 year was remaining until the target deadline (end of 2018). In addition, considering that the procurement of consumer watt-hour meters, LV lines etc. has already been fully completed, the executing agency believes that it can sufficiently achieve Indicator 1. There was a record 1,600 connections in 2016 when promotion measures to discount the connection fees were implemented, and the executing agency considers that it can achieve the new-connection target for 2018 (as many as 2016) by implementing connection promotion measures again. In the case of this, the cumulative number of connections will be 3,600 to 3,700, which would be 80% of the target number, 4,800.

---

<sup>12</sup> For the preceding project, Rural Electrification Project Phase 2 (FY 2007 - 2008), it was considered that a reason for its delay in consumer connection was due to the LV line work not starting until the completion of the MV line. Therefore, in this project, a countermeasure for this was attempted responding to JICA's request. At the same time, it is recognized that electrification in this project was promoted because UEDCL was selected as a distribution operator in charge of operation and maintenance. Because it is highly interested in global access (electrification of all households), but private operators are not aggressive in increasing the number of connections in low profitability areas. Most Ugandan distribution services are entrusted to private operators, however, UEDCL is supposed to play a role as an underwriter when the power distribution service contract with private operators is terminated in some circumstances.

<sup>13</sup> Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 2 Connection Number of Customers (Plan and Actual) \*1

	Reference value	Plan	Actual		
	2013	2018	2015	2016	2017*2
	【Survey/ Plan】	3years after completion	Project completion year*3	One year later	2 years later
Indicator 1 : Consumer connection *4	0	4,800	200 (200)	1,800 (1,600)	2163 (363)
Indicator 2: Connection to public facilities not electrified*5	① Namayingo District Office: Not connected	Connected	—	2016/4/5	—
	② Namayingo Police Station: Not connected	Connected	—	2016/4/15	—
	③ Buinja Health Center (IV): Not connected	Connected	—	2016/10/5	—
	④ Other Health facilities :	7	0	9 ( 9)	19 (10)
	⑤ Educational facilities (school etc.): (Primary school)	About 50	0	25 (25)	32 ( 7)
	(Secondary school)		0	18 (18)	22 ( 4)
Indicator3: Local Industry	Industrial consumers	Not set		17 (17)	23 ( 6)

Source: Executing Agency, Japan International Cooperation Agency (JICA)

\* 1: Numbers in ( ) shows the increased number of connections each year

\* 2: Indicator 1 is as of the end of June 2017, other indicators are as of the end of November 2017

\* 3: Construction of the 33 kV MV line was completed in December 2014 (project completion year), and the construction work of the 415/240V LV line burdened by Ugandan side, was completed 11 months later (November 2015).

\* 4: The target value is about 50% of the target area households totaling about 9600, that includes both single and three-phase connections.

\* 5: The target value is about 50% of the facilities in the connectable range

In Table 2, the annual connection number of consumers from 2016 to 2017 decreased. According to the executing agency, there were two reasons for this as follows.

Ferdsult Corporation, one of the private power distribution operators that had posted a deficit in 2014 - 2016, did not renew their contract after expiration in December 2016. REA decided to entrust the distribution services previously covered by Ferdsult to UEDCL, which was the sole underwriter. As a result, the equipment and materials procured for this project but not connected by 2016 (for about 2,600 connections out of 4,800) were rapidly deployed by UEDCL into the areas with strong connection needs outside the targeted area.

In March 2017, a promotional connection fee<sup>14</sup> of 20,000 UGX (Uganda Shilling) terminated and the connection fee went up to 136,600 UGX. Many consumers responded in interviews that it was expensive. According to REA, they are planning to re-introduce the discount system<sup>15</sup> again after June 2018, and furthermore, if required, the agency will consider applying the use of a subsidy, *Output Based Aid*, which is used for low-income households in areas where connection is delayed.

The numbers in Table 2 are those of customers contracting with UEDCL. From the Ugandan JICA office, however, information was obtained that there were quite a few general customers not included in those. To check this, we conducted a related investigation during the field survey and confirmed that there was a considerable number of cases where one electricity meter was shared by multiple customers/ households. Factoring this, the likelihood of achieving the target number of connections (households) further increases. In principle, one electricity meter is installed for each customer or household, but there are many cases in trading centers<sup>16</sup> developing along the highways that about 2 - 6 tenants have moved in a collective shop building, and that individual houses are built behind these buildings. In these cases, often one watt-hour meter is installed in a building and its owner collectively pays to UEDCL, while each tenant pays his/ her burden to the owner. Because of this, many of the tenants are not registered as customers.

Table 3 shows the survey results<sup>17</sup> of the electricity meters and number of customers that was conducted at 15 trading centers during site visits. The number of customers per electricity meter is 2.2, the actual number of customers (837) is more than twice the number of customers contracted with UEDCL (382), and regarding only the 15 trading centers surveyed, the number of actual customers was 455 more than the number of electricity meters<sup>18</sup>.

---

<sup>14</sup> The connection fee collected by UEDCL consists of the distribution line laying cost from the nearest distribution pole, the wiring inspection fee in connected houses, the initial electricity charge, and in cases where the pole is not nearby, the expenses for laying additional electric poles are also required separately.

<sup>15</sup> As for a connection support, from 2012 the connection assistance system, *Output Based Aid: OBA*, is being budgeted and used. This system is applied to customers/ households not connected for 18 months after a LV line was laid nearby. This project has not used this subsidy since not much time has passed since the completion of the project. The executing agency, REA, is planning to decide whether to utilize OBA after considering the future connection progress.

<sup>16</sup> Trading center refers to the areas where commercial facilities along the highway gather, and there are about 40 places in this project area. It is not an administrative unit.

<sup>17</sup> For each survey, we selected a collective building store along the highway (2 to 6 tenants in a one-story building) at each trading center from every other three places starting from the nearest transformer etc., and checked a prepaid electricity meter, the number of lead-in lines and the number of stores in business. After that we conducted an interview with the tenants. During the interviews, if there were landlords, we prioritized the interview with them. The following point needs attention; Different from consumers in agriculture and fishery occupying many of the surroundings, these tenants are in the business of sales-merchandising (restaurants, miscellaneous goods etc.), service industry (printing, mobile phone charging, cash exchanging, etc.), processing industry (welding, wood processing, etc.).

<sup>18</sup> The extent to which the number of residents of these TCs accounts for the total number of residents in the target area is unknown because there are no statistics as the TC is not an administrative area, and the executing agency

Table 3 Comparison of Number of Connection (electricity meters) in Trading Centers and Actual Consumer

Name of TC Description	Mayuge TC	Mpungwe	Nama vundu	Makutu	Nondwe	Nankoma TC	Nabigingo	Muterere	Mayuge-Bukholi	Namayingo	Bumeru B	Bumeru A	Busiro Landing Site	Lugala	Hukemo	Total
	Number of buildings	30	26	30	20	30	30	30	38	56	20	10	15	38	20	27
Number of meters	31	27	31	21	34	34	30	40	59	21	10	15	39	21	28	382
Number of customers	69	61	69	33	116	116	64	80	89	55	23	28	63	40	54	837
Customers per meter	2.2	2.259	2.226	1.571	3.412	3.412	2.133	2	1.508	2.619	2.3	1.867	1.615	1.905	1.929	2.2
TC magnitude	□	●	●	●	●	□	●	●	◎	◎	●	●	●	●	●	

Note: □ Electrified before the project ● Less than 1000 households ◎ More than 1000 households

Responding to our question to customers in the field survey “why electrification is not necessarily going smoothly, although there is an enormous potential number of customers wishing prompt access to power?”, many pointed out that, in addition to the connection fee, the indoor wiring cost is high. For connection, it is necessary to complete the indoor wiring work in advance and to get the inspection and approval by UEDCL. Therefore, there were some households that quit pursuing after obtaining an indoor wiring cost estimate, because it was expensive, including some schools and health facilities that applied for connection budget but could not get permission. Indoor wiring costs depend on the number of rooms and size of the house. It takes 100,000 to 200,000 UGX per room. Resulting in a total of 600,000 to 800,000 UGX per house as many houses have 3-4 rooms, which is far more expensive than the connection fee itself. To further increase the electrification rate, it is therefore recognized that financial support systems such as loans for indoor wiring cost coverage, as well as assistance for connection fee is needed.

As shown in Table 2, “electricity supply to unelectrified public facilities” (Indicator 2), has already achieved targets earlier than planned for government institutions and healthcare facilities, and connections to education facilities is going smoothly (as of the end of November 2017, 32 facilities out of 50 facilities connected: 64%). “Connection to local industry etc.” (Indicator 3) is the number of three-phase electricity<sup>19</sup> users (part of Indicator 1) required for induction motors

---

has no data. According to a local consultant who carried out the above survey, it is estimated that at present only two years have passed from electrification, and the trading center and its surrounding residents are the majority of consumer connections.

<sup>19</sup> 240V single phase Alternating Current is used for connection to general households, and many of the shops also use single phase for store operations. The work for three-phase AC connections for industrial use is different from single-phase AC connections and application to UEDCL is separately necessary.

etc., and includes facilities in the woodworking industry, milling industry, gas stations, etc. Businesses within the electrified areas are utilizing the electricity, showing signs of growth.

From the above, the number of consumer connections (Indicator 1) is expected to reach about 80% of the target by 2018. In TCs which occupy many of the number of connections so far, multiple households are using electricity for each connection. As a result, it is considered that the number of electricity customers being reached is more than the number of contracts with UEDCL. In addition, power usage (Indicator 2 and 3) by public facilities and local industries is progressing. Therefore, the effectiveness of this project is judged to be high.

### 3.3.1.2 Qualitative Effects (Other effects)

As for the qualitative effects of this project, it was expected after electrification that the quality of social services such as the Namayingo district government, the police station, the health facilities, the educational facilities, etc. would improve, stimulating the local economy. This is explained further in detail in the following “impacts” section.

## 3.3.2 Impacts

### 3.3.2.1 Intended Impacts

This project aimed to contribute to improving the rural electrification rate by constructing the power grid in the target area. In connection with the improvement of the rural electrification rate, impacts such as improvements to the living convenience of residents and the regional economy were assumed<sup>20</sup>. Here, we analyze these impacts by dividing into (1) the contribution of this project to improving the electrification ratio, and (2) the impact on the living convenience of residents and regional economy improvements.

#### (1) Contributions to improving the electrification rate by this project

Against the extension target of distribution lines to the rural areas outlined in *the Rural Area Electrification Master Plan (2013-2022)* created by the Ugandan government (7,300 km 33 kV

---

<sup>20</sup> As a qualitative effect of this project, improvement of services at public facilities after electrification, and improvement of production efficiency of regional industries was expected. In this evaluation, in order to grasp the impact of the project, we conducted individual and group interviews with the staff of government agencies, health care facilities, educational facilities, commerce and industry men, individual households etc. in about 40 trading centers in the target area electrified in this project. Those are, as for individual interviews, six local government departments including the Namayingo District government office (regional development officers), Namayingo Police station, eight health care facilities of level II to IV including Buinja Health Center IV (physicians, nurses, facility chiefs), eight primary and secondary level educational institutions (principals and veteran teachers), eight business owners in commerce and industry, three visits to electrified private residences, one visit to unelectrified personal home, for a total of 51 individuals. As for group interviews, 69 residents of seven groups consisting of approximately five men and women in each group.

MV line in a 5-year period from 2013-2018), this project is equivalent to about 1.8% (128 km), which is the contribution stemming from the improvement of the power grid infrastructure as planned. The increase target in the number of units connected from the Master Plan is 250,000 over the same period, and an increase of 2,163 by this project is equivalent to about 0.9%. If it advances as planned to 4,800 connections by 2018, the contribution rate will be about 1.9%.

Table 4 shows the changes in the electrification rate after this project in the target districts. Since the latest electrification rate statistics by districts that were available at the time of the field survey are those of the 2014 Census, using the Census data (household connection number 2014) and the number of connections realized by this project (2015-2017), a Corrected household electrification ratio 2017 was obtained taking into consideration the situation of one-meter multiple households connection in the trading centers described previously. Although the increase in the number of connections by this project was not large (2,163 at the time of evaluation), and the impact on improving the electrification rate was limited, a significant improvement (3.4%), was seen in the Namayingo district which was electrified for the first time by this project. Based on this, it is judged that the contribution by this project was high<sup>21</sup>. In some districts the change after this project is negative. This occurred because the electrification increase rate did not reach the population increase rate (roughly 3% per year). These districts did, however, increase the number of connections and that is recognized as a contribution none the less.

Table 4 Change of Electrification Rates in the target districts of this project

	Mayuge	Iganga	Bugiri	Namayingo	Busia
No. of Households connected 2014	9,092	17,450	6,213	2,095	7,941
Electrification rate 2014 *1	9.5%	17.0%	8.3%	4.9%	12.3%
No. of connections by this project 2015-2017 (Total in five districts; 2163)	443	171	386	835	328
No. of Households connected 2017	9,535	17,621	6,599	2,930	8,269
Electrification rate 2017 *2	9.1%	15.8%	8.1%	6.2%	11.7%
Corrected electrification rate 2017 *3	9.6%	15.9%	8.7%	8.3%	12.2%
<b>Change after the project</b>	<b>0.1%</b>	<b>-1.1%</b>	<b>0.4%</b>	<b>3.4%</b>	<b>-0.1%</b>

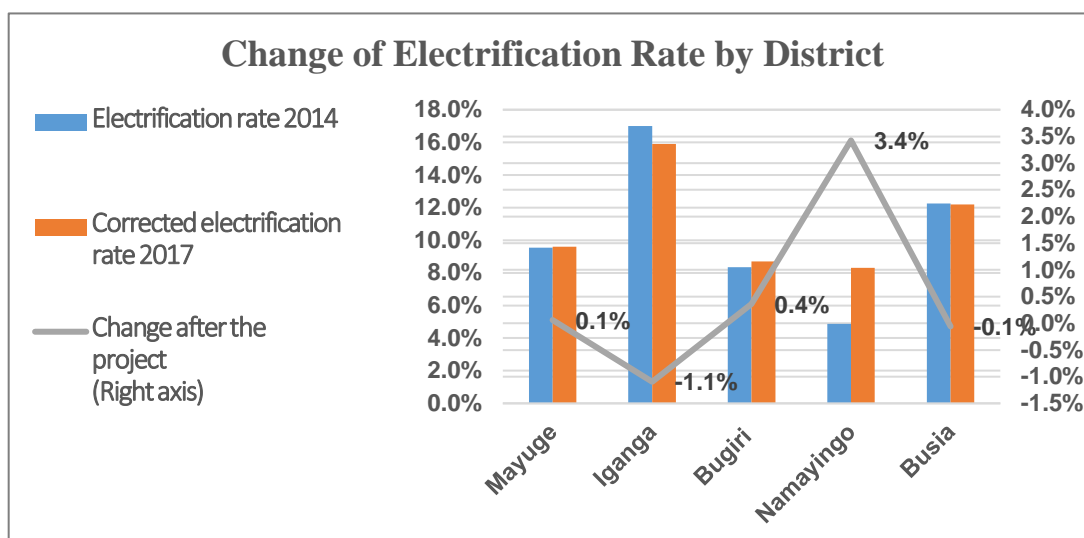
Source: Created by Evaluator from the 2014 Census data and data of connections from this project

\*1: Rate of households using electricity for lighting in Census 2014

\*2: Calculated using number of households (2017) developed using an average growth rate of 2002-2014

\*3: Calculated assuming 2.2 end-users are connected to an electricity meter

<sup>21</sup> The reason why electrification rate in Namayingo District in 2014 is not zero is because the definition of electrification is made as “households using electric lighting”, the users of solar power systems are counted as electrified before electrification by grid power.



(2) Improvement in life convenience of residents and impact on regional economic improvement

The following impact was confirmed by a field survey targeting customers.

Electric product ownership effect:

It is judged that each household has enjoyed the convenience according to its function of the electric appliances owned. Together with the residents' interview results, all the households use fluorescent light bulbs (average 3 or more depending on the size of the house in general households) and over 80% households use mobile phones. Regarding fluorescent lighting, some people were using solar panels before electrification, but due to limited battery capacity they could only use for a limited time. Due to the grid power connection many respondents stated that the lighting was far brighter and more stable. There are even more households that use local candles and kerosene lanterns (impacts related to kerosene lanterns are described later). In addition, about 30 to 50%<sup>22</sup> of households use TV, irons and radios, and about 10% of households use Woofer (audio equipment) and refrigerators. Electric pots, electric cookers, mixers (blenders) etc. are still very few, and their popularization is still to come. In many general households, the amount of electricity used after electrification is less than 1 kWh per day<sup>23</sup>, and although the refrigerators (150 W to 600 W) which constantly consume electricity is on the top of electric appliances to be purchased in the future, it is not widespread yet.

<sup>22</sup> Regarding the number of households who own radios (including dry battery-type ones), in the Census 2014 for the Namayingo district it is 53%. If battery-type radios are included, ownership of a radio in electric home appliances is estimated to be the third highest following light bulbs and mobile phones.

<sup>23</sup> The connection fee of UEDCL includes 15,000 UGX for initial power charge. Divided by 686 UGX / kWh which is the unit electricity charge for general households as of December 2017, it is about 22 kWh. Monthly power use of many households is less than this.

### Improvement of Security

The improvement of security after electrification by using grid power lighting, which is much brighter than solar panels, was also pointed out commonly from nearly all beneficiaries of local government officials, public facility personnel, commerce and industry persons, and general residents. Street lights have not been installed in the target area yet, but the shops in trading centers now have lights at night and at the entrances of houses, deterring suspicious activities. According to the Namayingo Police Station, the crime rate such as theft has decreased sharply after the electrification, 70% in the residential areas and 90% in the trading center area, of course this could be due to the initial shock factor and crime may increase again, but still a large improvement to the local security.

### Extension of service provision time of administrative facilities and private stores, etc.:

Servicing time to customers of administrative facilities and private stores was greatly extended by using lighting. Prior to electrification, the government office staff came home around 5 pm and the shops were closed mostly around 8 o'clock, but after electrification, overtime at the government office increased to 10 pm, and many shops operated until midnight. Also, high-level health facilities such as Buinja Health Center (Level IV) had been accepting emergency illnesses at night, but the use of electricity by the solar system was limited to lighting equipment and the waiting room was also dark, so patient acceptance during night hours was limited. Pregnant women were asked to bring lights such as lanterns or flashlights when they delivered at night. But now these problems have been eliminated, and the health center can operate 24 hours a day. As a result, the number of visiting patients has more than doubled in many electrified health centers.

Police officers at the Namayingo Police Station (overseeing 18 political stations) had an operation system of 24 hours (two 12-hour shifts) from the past, but it was difficult to mobilize outside the shifts at night because they could not be contacted. Currently, mobile phones (private ownership) are always charged, so they can be called at all times, the communication system for security maintenance activities improved, and the 24-hour system was improved. The effect of deterring crime at night is a direct result of introducing the 24-hour electric lighting of shops and surrounding residential areas.

### Improvement in the quality of social services by using electrical appliances/ equipment:

As well as the extension of operating hours to administrative facilities and private stores, the use of electrical appliances/ equipment has greatly contributed to the improvement of the quality of customer service of public facilities. In regional government agencies such as the Namayingo district government, they have become able to use printers, and it has become easier to print



documents for residents on paper, post it on the wall or distribute it, and the information provision to residents has improved overall. Data management has also improved as information entered is properly maintained in the database.

At Buinja Health Center, the largest health care facility in Namayingo district, sterilization equipment (Sterilizers) has become available at all times, and surgical procedures such as cesarean sections have been made possible. Sterilization equipment was introduced in the age of solar panels, but it was not actually used because there was a risk of electricity shortage when it was in use, and the solar power system had been limited to the use of lighting mainly. In addition, an incubator for premature babies (Incubators) was able to be used with confidence and premature infants began to be rescued. Electric refrigerators are now available even in other health care facilities, and in addition to vaccines, blood for transfusions can also be preserved. The use of centrifuges and diagnostic lights became possible, making diagnosis of malaria, tuberculosis, jaundice etc. readily easy. It became possible to collect patient samples to other hospitals and cooperate to provide experimental data. As for the gas type refrigerator used before electrification, there was a necessity of migration and storage of the vaccine in cooperation with surrounding health care facilities (called “cold chain”) when gas was exhausted, but now this is unnecessary as vaccine storage is reliable and stable.

In regard to educational institutions, the principal of the Naruwire Technical Institute stated, “the age of darkness has ended with the use of personal computers”, it is recognized as contributing greatly to the acquisition of information and its provision to the students. According to the teachers in the electrified primary and secondary schools, the learning environment in mornings and evenings improved as the classroom became bright. It is expected that using personal computers for education will be introduced in the future. In addition, students in electrified households increased their opportunities to invite friends to their homes and to have opportunities to collaborate under electric lighting, resulting in improved overall student performance. Many teachers are realizing that the students are benefitting from electrification, such as the emergence of students getting "first grade" for the first time in national unified exams (academic examinations received by selected students of schools that are conducted for public schools every year). Furthermore, since welding shops were established, iron fences have been built around schools with dormitories greatly improving security for the students, the number of applicants who enrolled, especially female, increased significantly. Since students wander less around the town at night than before, they spend more time reviewing, doing homework and watching TV.

### Increase of new business

Many regional officials, such as that of the Namayingo district government, cited revitalization of businesses as the most important impact of electrification. More specifically, many services and stores that had not existed prior to electrification increased as follows; welding processors (production of metal products involving welding such as fences, doors, window frames etc. used in brick houses), miller (grain milling such as maize, rice etc.), furniture manufacturing (use of electric tools to make beds, chairs, desks), salons (hairdressers or barbershops using hair clippers, hairdryers etc. ), bar/coffee shops (place of recreation equipped with TV, audio equipment, beer etc.), cold drink trader (selling chilled soft drinks at shops) etc. However, there were some new business founders who mentioned that 1 to two months after opening they have not yet realized any growth in business from electrification. There is a possibility that growth is lagged or shop owners misunderstood the needs for some of these new businesses, but regardless, we assume these are impact of this project on business. On the other hand, for businesses that existed before the electrification, many of the shopkeepers (gas station, welding processor, and shops) realized that, in less than three years after electrification, sales increased by about 30% to 70% and that energy costs such as kerosene declined.



*New Business Sample 1:*  
Welders and iron doors



*New Business Sample 2:*  
Meter of Milling Shop



*New Business Sample 3:*  
A retail store with many bulbs

### Increase of population

There are population increases from emigration to newly electrified areas that have the convenience of electrification. In particular, Namayingo Town Council (located in the center of Namayingo district) which was not electrified until the implementation of this project, recorded an increase of approximately 72% from 15,740 in the 2014 Census to about 27,000 at the time of the field evaluation. The government gathers the population statistics of the administrative areas nationwide every ten years by the Census. According to this, the ratio of the inhabitants living in the urban area of the Namayingo district before this project was 7%. It is considerably lower than other districts and there are many residents who moved in after electrification. People pointing

out the population increase were commonly in the electrified areas other than Namayingo as well. But there are also places where such a large population increase has yet to be realized, such as fishermen's villages Bumeru A and Bumeru B located at the end of the distribution route. Along with the population increase, some people said that not only the construction of houses increased, but also the buildings are being erected with more attractive designs than before.

#### Eliminate the need to visit neighboring towns for services

According to the resident interviews, electrification made it possible to use new services in the trading center where they live. They no longer need to go to neighboring towns because they can utilize services for milling maize or rice, making furniture/ door manufacturing, coping, typing, or sending electronic mail etc., in their own town. Also, they no longer need to go to the TC to charge mobile phones, as mobile phones can be constantly charged at home, so you can contact business partners anytime.

#### Reduction in fuel costs:

There was sufficient feedback from the beneficiaries (general households, commerce and industry) who have used kerosene and propane gas daily that the electricity fee after electrification is much cheaper than the sum of the costs of alternative fuel for power (candles, kerosene lanterns, gas refrigerators, mobile phone charging). However, as a fixed service charge<sup>24</sup> is taken every month regardless of electricity usage, there are more people pointing out that the electricity bill is high.

#### Reduction of health risks due to stoppage of use of kerosene lamps, etc.

Local candles/ kerosene lamps which use kerosene are harmful to the health of surrounding children and adults, such as causing respiratory troubles. Also, it has the risk of being knocked over and causing a fire, making unventilated areas black with soot. As a result, the Ugandan government has laid out a policy to eliminate the use of these by 2030. In this project area, after electrification, all households using kerosene lamps were switched to electric lighting. There were many customers who pointed out that this change has reduced health problems and the soiling of houses due to soot.

---

<sup>24</sup> 4,000 UGX (about 1.1 USD) is charged regardless of usage amount when paying electricity fees first time of each month. In the case of households using 3 USD/ month for electricity for example, the service charge of 1 USD occupies one third, so it may be felt expensive.



Local Candles which half of the population utilizes



Electric refrigerator to store chemicals etc. (Muterere Health Center)



Primary school library electrified from this project

### Other effects

Many interviewees pointed out the capability to “drink chilled beverages at any time” as a positive change in life. The improvement in the psychological sense of security by bright electric lighting was also mentioned by many of the general households, medical staff and others.

### 3.3.2.2 Other Positive and Negative Impacts

#### (1) Impact on the Natural Environment

Since the target area of this project does not fall in an affected area such as a national park, the *Environmental Impact Assessment (EIA)* was approved in February 2012 by the Environment Agency (NEMA) after submission of the *Project Brief*. Most of the project area is located along existing roads, so it is considered that negative impacts on the natural environment is small. In some wetlands close to Lake Victoria where the inspection tour was conducted, the evaluator confirmed that environmental impact mitigation measures in the seasonal streams were properly implemented as planned in the preparatory survey for seasonal wetlands for the installation of ecosystem-conscious utility poles (such as widening the distance between utility poles and selecting the exposed areas of the wetlands without constructing access roads). Also, in other distribution network areas, tree cutting more than required was avoided and there were no environmental adverse impacts.

#### (2) Resettlement / Land Acquisition

According to REA, a social monitoring was conducted, and utility poles and other required equipment for this distribution network project were built mostly on existing road sites, and land acquisition and resident resettlement were not necessary. There is no need to acquire the land under electric distribution lines in Ugandan legal system, and as for the compensation for trees and crops that need logging for 33 kV LV distribution line sites, agreements were reached between REA and the owners prior to construction. However, the budget for compensation was attached in the 2017/2018 fiscal year, so it is planned to be paid by the end of 2018. Furthermore,

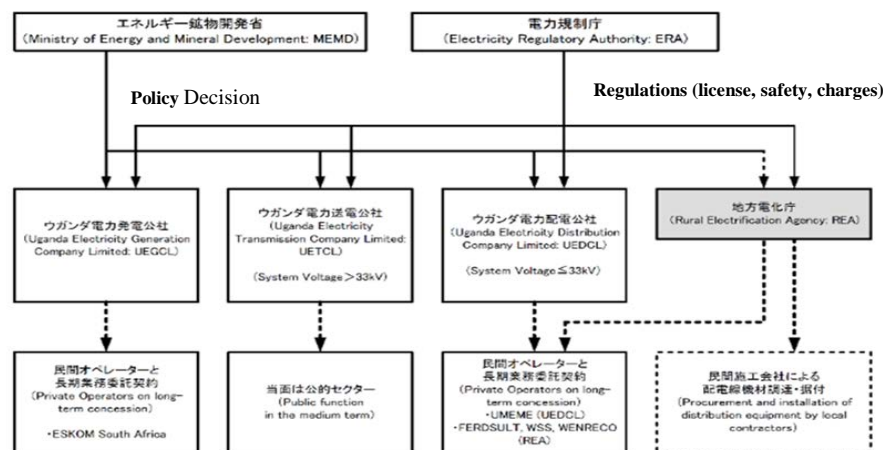
the compensation for cutting trees and crops related to laying down 415/240V LV distribution lines is also planned to be implemented during 2018. The target persons affected is calculated at 3,092 landowners of each site of MV and LV lines, and 365 million Uganda schilling that is necessary for compensation is budgeted. Early compensation should be implemented.

Based on the above, this project has largely achieved its objectives. Therefore, effectiveness and impacts of the project are high.

### 3.4 Sustainability (Rating: ②)

#### 3.4.1 Institutional/ Organizational Aspects of Operation and Maintenance

Power grid facilities developed from this project are managed under direct control by UEDCL under the umbrella of REA, which supervises the rural electrification projects and this management system has not changed since project completion. UEDCL was born after the spin-off of the electric utility company (UEB: Uganda Electricity Board) in 2001, and still manages and operates<sup>25</sup> about 7% of the power distribution facilities nationwide even at present as privatization of power distribution service has advanced (Umeme occupies over 90%<sup>26</sup> of the total number of connections in Uganda). Therefore, UEDCL has extensive experience in maintaining and managing power distribution facilities. REA is, however, currently preparing the *Service Territory Master Plan* (scheduled to be completed in 2018) targeting 13 areas nationwide, and after completing it, REA plans to entrust the management and operation of the areas including this project to private distribution operators (including regional distribution cooperatives).



Source: Provided by JICA

Figure 3 Power Field Structure of Uganda

<sup>25</sup> UEDCL has entered into a maintenance and management agreement with REA and is operating and maintaining eight service territories including the Eastern district service territory where this project is located.

<sup>26</sup> As of 2017, there are nine companies entrusted for power distribution services including Umeme Co., Ltd. and UEDCL.

### 3.4.2 Technical Aspects of Operation and Maintenance

The O&M team that conducts day-to-day management of the power distribution equipment developed by this project is stationed at the Namayingo branch of UEDCL. The team consists of four staff members including a territory manager with senior electric engineering qualifications, a technician with an electrical engineering degree, and two staff with electrical construction qualifications. The equipment is still new at only 2 years from installation, the initial problems had been sorted out at the time of the routine inspection 1 year after completion, thus, it is recognized that they have established a stable and sufficient routine for daily operation checks. According to responses of a questionnaire to REA/ UEDCL, sometimes trouble occurs in the automatic reclosing device installed at Lumino. A new technician, however, has already been employed for periodic inspections since January 2018, and he is planned to address pending issues including identification of the causes of troubles. From the above, there are no problems in terms of technical aspects of O&M.

Table 5 Financial Situation of UEDCL

	UGX in million	
	2016	2015
<b>Operating Income</b>		
Operating Income	22,320	21,593
(Of this, power sales revenue under REA service territories)	5,982	4,321
Other operating Income	6,786	9,374
(Of this, Subsidies for REA service territories)	1,354	—
<b>Total revenue</b>	29,106	30,966
<b>Operating Costs</b>		
Cost of sales	10,782	9,563
Staff and Administrative expenses	16,366	12,077
Other operating expenses	352	246
<b>Total expenses (without Depreciation)</b>	27,500	21,885
<b>Surplus before tax and asset amortization</b>	1,606	9,081
Depreciation	18,207	18,365
Taxation	(1)	
Total expenses	45,707	40,250
<b>Profit /Loss after Depreciation</b>	(16,601)	(9,284)

Source: UEDCL Annual Report 2016

### 3.4.3 Financial Aspects of Operation and Maintenance

Table 5 shows the financial situation of UEDCL<sup>27</sup>. The areas operated under UEDCL are regions with low profitability, and currently, only purchase costs from the UETCL and O&M costs are directly reflected in electricity charges and collected. In 2016, Approximately 23% of income from electricity sales were obtained as subsidies. For this reason, although its records profit before depreciation in the two years, it is in the red after depreciation. Investment funds will be provided as subsidies for what the Electric Power Regulatory Authority (ERA) deems necessary. In this way, the government puts priority on the global access of electricity and the necessary funds have been compensated by the government. Therefore, there is no deficiency in maintenance and maintenance expenses.

### 3.4.4 Status of Operation and Maintenance

During the ex-post evaluation, the evaluator conducted a survey of 33kV distribution lines, switches, transformers, and other equipment in this project along the distribution route. The team found some loose utility-pole support wires (guy-wire) and cracks scattered. It was confirmed, however, that these are not enough to have a considerable influence on the life span of the facility, and that the facilities are generally maintained in good conditions. The function status (judged by the number of failures by UEDCL) is good for each section, the usage situation (judged by the number of connections by UEDCL) has a difference for each section, the interval between the Nankoma-Lumino as the backbone is high, and those in the terminal sections such as Mpungwe-Makutu, Namayingo-Bumeru A/ B, Hukemo-Mundindi section are relatively low. According to UEDCL, the equipment maintained in this project are transformers, switches and power cables installed along utility-poles, and the burden of periodic inspection and maintenance is not so heavy. After the completion of this project UEDCL has already upgraded a transformer to a new one with double capacity of the original (100 kVA in Muterere TC was upgraded to 200 kVA) because the electric power demand is larger than the initial estimate, it has enough technology and experience concerning the O&M of equipment. Spare parts for future breakdowns etc. are not procured within this project, but since they are not special parts, it is considered that the company can fully deal with it.

---

<sup>27</sup> UEDCL is commissioned by REA to conduct business around power distribution and conducts the concession management of UMEME company which entrusts about 90% of electric power distribution business nationwide, and management of electric pole antiseptic / insect repellent plant.

From the above, no major problems have been observed in the institutional, technical, financial aspects and current status of the operation and maintenance system. Therefore, sustainability of the project effects is high.

## **4. Conclusion, Recommendations and Lessons Learned**

### **4.1 Conclusion**

This project was implemented with the objective of improving the infrastructure of the power grid by procuring and installing long-distance power distribution equipment and materials in the eastern five districts of Uganda where industrial revitalization could be expected, thereby contributing to the improvement of rural electrification. This project is part of Ugandan rural electrification strategy plan and is consistent with the country's development plan. Considering the rural electrification rate still as low as 10% in Uganda, the necessity of electrification is high, and it is consistent with Japan's aid policy. Therefore, the relevance of this project is high. The project cost ended up within the planned budget due to a decrease in construction quantities, and even though the project period on the Ugandan side was delayed by five months, the construction period on the Japanese side fell within about 80% of the planned schedule (four months shortened), so this project's efficiency is considered high. Connections to unelectrified public facilities has advanced at a rate faster than planned, and the number of connections to customers, who are mainly households, commerce and industry, is expected to reach about 80% of the target by the target year (2018). In addition, considering that there are instances of multiple households connected to one electricity meter, the overall household connection number is even larger than grasped. The positive impacts on living convenience for residents and the positive impacts on regional economic revitalization are widely observed, so the effectiveness and impacts of this project are high. As the target areas of electrification are located in regions with low profit margins, a part of the maintenance expenses is planned to be covered by government subsidies. The operation, maintenance and management of this project are free from problems in terms of organizational, technological, financial aspects etc. Therefore, the sustainability of this project is high.

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

### **4.2 Recommendations**

#### 4.2.1 Recommendations to the Executing Agency

- (1) Compensation for cutting trees etc. for MV distribution cables and LV distribution lines has not been completed and it is desirable for early implementation by REA.



- (2) In order to achieve the target number of connections, it is highly recommended to reduce the costs of connection which is becoming a bottleneck and burdened by households. Consideration should be given to support measures to facilitate setup costs such as indoor wiring costs and additional financing and installment payment options related to laying utility-poles in addition to subsidies relating to a fixed connection fee to be paid to UEDCL.

#### 4.2.2 Recommendations to JICA

Compensation for cutting trees etc. relating to MV and LV distribution line installments has been delayed, and the monitoring for facilitating early implementation is important.

### 4.3 Lessons Learned

Points to keep in mind when improving electrification rates is set as the overall goal / project purpose

- (1) In this project, multiple households may be electrified per connection (electricity meter), and the number of connections grasped by the executing agency was recognized to be considerably lower than the actual number of electrified households. In addition, because of the high household number growth rate (or population growth rate), it was shown that in some targeted districts the electrification rate may not increase as the number of connections increases, if it does not exceed the household growth rate. As for the improvement of the electrification rate, it is necessary to set a target after fully grasping the actual circumstances.
- (2) In this project, there was a bottleneck in promoting electrification that the cost burden put on the customer for connection (including not only the connection fee but also the indoor wiring fee and utility-pole laying fee) was high. Therefore, it is desirable to consider the possibility of reducing the burden, if necessary, after analyzing not only the burden amount of the recipient country government, but also the total amount of expenses to be borne by customers.

**END**