

**Rural Electrification Agency (REA)  
Ministry of Energy and Minerals Development (MEMD)  
The Republic of Uganda**

**PREPARATORY SURVEY REPORT  
ON  
THE PROJECT FOR  
RURAL ELECTRIFICATION PHASE III  
IN THE REPUBLIC OF UGANDA**

**MARCH 2012**

**JAPAN INTERNATIONAL COOPERATION AGENCY  
(JICA)**

**YACHIYO ENGINEERING CO., LTD.**

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## **PREFACE**

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the project for Rural Electrification Phase III in the Republic of Uganda, and organized a survey team headed by Mr. Masatsugu KOMIYA of Yachiyo Engineering Co., Ltd. between February 2011 and March 2012.

The survey team held a series of discussions with the officials concerned of the Government of Uganda, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Uganda for their close cooperation extended to the survey team.

March 2012

Kyoko KUWAJIMA  
Director General,  
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# SUMMARY

## ① Overview of the Country

The Republic of Uganda (hereinafter referred to as “Uganda”) is located right on the equator along with Lake Victoria, covering an area of approx. 241,000km<sup>2</sup>, most of which is between 800m and 1,300m above sea level. With a total population of approx. 32.7 million (2009 by the statistical data of the World Bank), it is primarily an agricultural nation producing such farming products as coffee, cotton and tobacco, agriculture thus accounting for approx. 25% of the GDP. However, production and exportation is controlled by climate and market trends, so it remains unstable. Moreover, since beneficiaries from economic growth are concentrated mainly in urban areas, infrastructure development and expansion in rural regions has become a major issue for development in Uganda.

## ② Background of the Project

The Government of Uganda formulated a comprehensive national development plan in 1997 called the Poverty Eradication Action Plan (PEAP). The plan advocates “income generation for the rural poor.” Then in 2009, Uganda followed up PEAP III by formulating the National Development Plan (NDP) as a development plan for the nation as a whole. The NDP plans for rural development by extending 33kV distribution lines as a strategy for rural electrification.

Disparities between rural and urban living standards have become an important issue in promoting agricultural policy and preventing an exodus to urban centers. In the Strategic Plan formulated in 2006, the Government of Uganda set a target of increasing rural electrification rates from 2005 levels of 4% to 10% in 2012 for an annual increase of 1%.

To achieve this target, the Government of Uganda formulated the Indicative Rural Electrification Master Plan (IREMP) in 2009 in cooperation with the World Bank. IREMP introduces the Benefit Points System being used in South Africa and Namibia to simplify calculation of benefits for rural electrification projects. This system quantifies the benefit of electrifying each region according to number and scale of residences, public facilities, agricultural and commercial facilities to quantitatively determine the order of precedence for projects.

Uganda established the Rural Electrification Agency (REA) in 2003 under the direction of the Ministry of Energy and Mineral Development (MEMD) to manage rural electrification projects. With its financial difficulties, however, Uganda has been struggling to finance electrification projects in regions with low profitability, especially for those projects involving loans.

Given the above, the Government of Uganda selected six regions based on IREMP and requested grant aid from Japan for a plan to extend 33kV distribution lines.

In selecting the six regions, they looked at which regions needed electrification within 3-5 years, which were long enough to receive donor support, regional equality in support and other factors.

### **③ Outline of the Study Findings and Project Contents**

In response to the request, JICA dispatched the Study Team to Uganda from April 2 to 28, 2011 (first field survey) and from June 11 to July 22, 2011 (second field survey) in order to reconfirm the contents of the request and discuss the contents for implementation with related agencies on the Ugandan side (responsible government agency: Ministry of Energy and Mineral Development (MEMD), and implementing agency: Rural Electrification Agency (REA)), survey the Project sites and gather related materials and data.

Consulting with Uganda in the first field studies, we selected the plan for regional extension of 33kv distribution lines covering the Eastern Region districts of Mayuge, Iganga, Bugiri, Namayingo, and Busia as having the highest priority of the six requested regions. On the second field survey, we agreed on this region for the collaboration project. At this point, we explored the site conditions to confirm the validity as a Japanese grant aid project and draw up a schematic design.

On returning to Japan, the Study Team examined the necessity, social and economic impacts and validity of the Project based on the field survey materials and compiled the findings into the draft preparatory study report. Furthermore, JICA dispatched the Study Team to Uganda for the third field survey from October 3 to 14, 2011 in order to explain and discuss the draft preparatory study report and reach a basic agreement with the Ugandan counterparts.

To improve the living standard and local economy by securing access to electricity, the Project plan compiled based on the survey findings targets procurement and installation of approximately 135 km of 33 kV distribution line traversing through parts of five districts; Mayuge, Iganga, Bugiri, Namayingo and Busia.

## Outline of the Basic Design

| <b>Summary of the Project</b>       |  |
|-------------------------------------|--|
| <b>Procurement and Installation</b> | <p>Procurement and installation of the following equipment and materials for 33 kV distribution line</p> <p>(1) 33 kV Distribution Line (Total Length: Approx. 134.4 km)</p> <ul style="list-style-type: none"> <li>➤ Trunk line from Mayuge Trading Center (T/C) to Nankoma T/C through Mpungwe T/C      Approx. 21.5 km</li> <li>➤ Branch line from Mpungwe T/C to Makutu T/C      Approx. 10.2 km</li> <li>➤ Trunk line from Nankoma T/C to Lumino T/C through Namayingo T/C and Hukemo T/C      Approx. 37.5 km</li> <li>➤ Branch line from Namayingo T/C to Bumeru A T/C and Bumeru B T/C      Approx. 29.9 km</li> <li>➤ Branch line from Namayingo T/C to Busiro Landing Site and Lugala      Approx. 24.8 km</li> <li>➤ Branch Line from Fukemo T/C to Munjinji T/C and Muwembe-Tayori T/C      Approx. 10.5 km</li> </ul> <p>(2) 33 / 0.415-0.240 kV Distribution transformer (Total Number: 50 units)</p> <ul style="list-style-type: none"> <li>➤ 200 kVA × 4 units, 100 kVA × 7 units, 50 kVA × 11 units, 25 kVA × 28 units</li> </ul> <p>(3) Metering Unit      4 units</p> <p>(4) Auto Re-closer      4 units</p> <p>(5) Load-break Switch      14 units</p> |
| <b>Procurement</b>                  | <p>Spare parts and maintenance tools for 33 kV distribution line</p> <p>(1) Emergency Spare Part      1 set</p> <p>(2) Replacement Spare Parts      1 set</p> <p>(3) Maintenance Tools      1 set</p>  |

### ④ Project Implementation schedule and Cost Estimation

In the event where the Project is implemented based on the Japan's Grant Aid scheme, the total cost of the Project will be (*confidential*). The total cost to be borne by the Ugandan side will primarily be approximately 200 million yen. The main components of the portion to be borne by the Ugandan side is procurement and installation of the equipment for low voltage network (approximately 195 million yen). The implementation schedule for the Project including the detailed design will be approximately 23 months.

### ⑤ Project Evaluation

#### (1) Relevance

The relevance of the Project to the spirit of Japan's grant aid scheme is judged to be strong as it not only contributes to the realisation of the development programme and energy policy of Uganda but also benefits the people of Uganda, including the poor.

#### (2) Efficiency

Main points of effects expected by implementation of the Project are shown as follows. The detail quantitative effects and qualitative effects are shown after them.

- Approx. 4,800 customer connections (approx. 38,400 beneficiaries) to the grid are expected until the target year (2018) of the project after commissioning of the project. Though 9,500 households (76,000 populations) exist in the Project site, half of them are expected to connect to the grid until the target year in consideration of progress rate of customer connections in the previous project site.
- The Project provides distribution lines supplying power to Mayuge, Iganga, Bugiri, Namaingo and Busia Districts in the Eastern Region. The distribution lines includes power supply to the district capital; i.e., Namaingo District Headquarter, which electrification is highly prioritized in the National Development Plan.
- Buyinja Health Center IV, which works as the referral hospital around the area, is located in the Project site. Lack of power at the hospital makes it impossible to install sufficient diagnostic equipment despite having the doctors to operate them. Electrification around the area improves the situations.
- 93 primary schools (Approx. 54,000 students), 13 secondary schools (6,700 students) and a technical school holding total 8 courses (mechanical, electrical, plumbing, architectural, painting, carpentry, dress designing and barber) are located in the Project site. Power supply to these facilities will allow stable use of lighting, computers, practice and testing equipment and more, and stimulate education at facilities in the project site. Stable lighting in dorms also allows students to study at night, improving learning efficiency.
- The Namayingo Police Station is also located in the project site. The station manages 18 local precinct stations, and helps maintain peace throughout the district (there are about 70 crimes/month). Improve the peacekeeping communication system by ensuring power for the radio used in the Namayingo police system communications grid. Control night crime by installing street lights and electric lighting in residential areas is expected by the Project.

1) Quantitative Effects (Size of Population Directly Benefitting: Approx. 38,400)

| Indicator                            | Reference Value (2011)  | Target Value (2018:Five years after commissioning)  |
|--------------------------------------|---|---|
| Improvement of Rural Electrification | <Improvement of Access to the Grid in Rural Area><br>➤ Number of general customers connected to the grid : No Connection  | ➤ Number of general customers connected to the grid : 4,800Connection (Approx. 38,400 People)<br>※ It is estimated that 50% of Approx. 9,500 households (Approx. 76,000 people) will be connected to the grid.  |
|                                      | <Contribution to Achievement of IREMP><br>➤ To increase 250,000 connected customers to the grid within 5 years in Uganda<br>➤ To Extend 7,300 km of 33 kV distribution lines within 5 years in Uganda | ➤ 4,800 Customer will be connected to the grid within 5 years in the project site and it will contributed to Approx. 2 % of the target of IREMP<br>➤ Approx. 135 km of 33 kV distribution line will be extended in the project site and it will contributed to Approx. 2 % of the target of IREMP |
|                                      | <Power Supply from the Grid to Public Facilities>   | ➤ Namayingo District Office : Connected   |

| Indicator | Reference Value (2011)  | Target Value (2018:Five years after commissioning)  |
|-----------|---|---|
|           | <ul style="list-style-type: none"> <li>➤ Namayingo District Office : Not Connected</li> <li>➤ Namayingo Police Station : Not Connected</li> <li>➤ Medical Facilities<br/>Buyinja Health Center IV : Not Connected<br/>Health Centers : No Connection</li> </ul> | <ul style="list-style-type: none"> <li>➤ Namayingo Police Station : Connected</li> <li>➤ Medical Facilities<br/>Buyinja Health Center IV : Connected<br/>Health Centers : Seven Facilities <ul style="list-style-type: none"> <li>※ It is estimated that 50% of total 14 facilities will be connected to the grid.</li> </ul> </li> <li>➤ Educational Facilities : Approx. 50 schools <ul style="list-style-type: none"> <li>※ It is estimated that 50% of total 100 facilities will be connected to the grid.</li> </ul> </li> </ul> |
|           | <ul style="list-style-type: none"> <li>➤ Educational Facilities : No Connection</li> </ul>  |   |

## 2) Qualitative Effects

| Current Situation and Problems   | Improvement Measures Under the Project   | Project Effects and Degree of Improvement   |
|--|--|---|
| <p>&lt; Medical Facilities &gt;</p> <p>The Buyinja Health Center IV in the project area currently gets its power from diesel generators and photovoltaic installations. It still struggles with power instability and lacking generation capacities, however, due to malfunctioning equipment and other issues. These power issues make it impossible to install sufficient diagnostic equipment despite having the doctors to operate them.</p> <p>Lighting is another issue. The hospital was using kerosene lamps at night due to deficient electric lighting. The lamps started a fire which burned down the main building (November 20, 2000).</p> <p>Health Center III, which serves several towns, uses gas refrigerators for medicine and vaccine storage, as well as sterilization equipment fueled by gas burners, coal and kerosene. Gas-powered equipment needs its gas canisters to be refilled regularly (1-3 times/month for refrigerators); however, it can be hard to gauge how much gas is left, and gas will run out, frequently leaving the equipment unusable. Unlike electric equipment, output for gas equipment changes with atmospheric temperature, making it hard to store medicines and vaccines. Lack of electricity also prevents doctors from using the electrical medical equipment needed for primary</p> | <p>Equipment and Materials for Procurement and Installation of Approx. 134.4 km of 33 kV distribution line lying on Mayuge, Iganga, Bugiri, Nmayingo and Busia Districts</p> <ul style="list-style-type: none"> <li>(1) 33 kV Distribution Lines<br/>(Length : Approx. 134.4 km)</li> <li>(2) 33 / 0.415-0.240 kV Distribution Transformers<br/>(Number of Units : 50 Units)</li> <li>(3) Metering Unit : 4 Units</li> <li>(4) Auto Re-closer : 4 Units</li> <li>(5) Load-break Switch : 14 Units</li> </ul> | <p>This project will allow power supply, in turn letting facilities install radiographic X-ray equipment and other basic diagnostic equipment doctors need for medical exams and stabilize health practices. In addition to local residents, this will also improve medical conditions for emergency patients and outpatients from other regions.</p> <p>Power supply will ensure medicines and vaccines are stably refrigerated, and that items are sterilized. It will ensure basic medical care in the hospital and vaccination community visits are stable. With many infants and expectant mothers among the patients, this activity will contribute to their health. Doctors will also be able to safely treat patients at night.</p> <p>&lt; Buyinja Health Center IV &gt;</p> <ul style="list-style-type: none"> <li>• Number of Patient :<br/>450 patients/day</li> <li>• Population of Coverage Area :<br/>Approx. 222,000 people_</li> </ul> <p>&lt; Other Health Centers III &gt;</p> <ul style="list-style-type: none"> <li>• Number of Patient :<br/>562 patients/day</li> <li>• Population of Coverage Area :<br/>Approx. 240,000 people_</li> </ul> |

| Current Situation and Problems   | Improvement Measures Under the Project | Project Effects and Degree of Improvement  |
|--|--|--|
| <p>health care.</p> <p>&lt; Educational Facilities &gt;</p> <p>There are technical schools, tertiary schools and other schools in the project region. These schools train the work force which will shoulder the industry and economy into the next generation. Power supply deficiencies make it so these facilities cannot use electronics, which lowers the efficiency of student learning.</p> <p>Nalwire Technical Institute is currently powered by solar power, which poses a few issues. First, the high costs of photovoltaic installations mean the schools do not have sufficient capacity to use educational equipment, lighting or computers. Additionally, no power can be generated on rainy days.</p> <p>Lastly, lack of nighttime lighting in the dormitories adjoining schools are an obstacle to student life and studies, as well as teacher classroom preparations.</p> | <p>Same as above</p>                   | <p>Power supply will allow stable use of lighting, computers, practice and testing equipment and more, and stimulate education at facilities in the project region.</p> <p>Stable lighting in dorms also allows students to study at night, improving learning efficiency.</p> <p>&lt; Nalwire Technical Institute &gt;</p> <ul style="list-style-type: none"> <li>• Educational Courses :<br/>Total 8 courses<br/>Mechanical / Electrical / Plumbing / Architectural / Painting / Carpentry / Dress Designing / Barber</li> <li>• Number of Students :<br/>Approx. 200 students</li> </ul> <p>&lt; Secondary School &gt;</p> <ul style="list-style-type: none"> <li>• Number of Schools :<br/>13 schools</li> <li>• Number of Students :<br/>Approx. 6,700 students</li> </ul> <p>&lt; Primary School &gt;</p> <ul style="list-style-type: none"> <li>• Number of Schools :<br/>93 schools</li> <li>• Number of Students :<br/>Approx. 54,000 students</li> </ul> |
| <p>&lt; Namayingo District Office &gt;</p> <p>The Namayingo District Headquarters, staff of 138, provides services from its Production, Social Infrastructure, Health, Resources, Education, Planning, Finance, and General Affairs Departments (11 departments total). They use office equipment to manage extensive amounts of data for residents and businesses, but are currently using a smaller, inefficient diesel generator for each building to provide power. Power outages due to high fuel costs, running out of fuel and equipment failure are a major obstacle to their operations.</p>  | <p>Same as above</p>                   | <p>This project is expected to make the following improvements:</p> <ul style="list-style-type: none"> <li>• Improve work efficiency by ensuring power for office equipment to manage district government work and resident data.</li> <li>• Eliminate the need for the current inefficient small diesel generators and greatly decrease fuel expenses.</li> <li>• Electrifying these public facilities to improve their operation would help improve the lives of all 222,000 district residents.</li> </ul>  |
| <p>&lt; Namayingo Police Station &gt;</p> <p>The Namayingo Police Station is also</p>  | <p>Same as above</p>                   | <p>This project is expected to make the following improvements:</p>  |



| Current Situation and Problems   | Improvement Measures Under the Project | Project Effects and Degree of Improvement  |
|--|--|--|
| <p>in the project area. The station manages 18 local precinct stations, and helps maintain peace throughout the district (there are about 70 crimes/month). They currently use radio equipment running on photovoltaic power to secure their communication network, but rainy day power outages are a major obstacle to peacekeeping activity. Not having street lights also severely limits both police crime fighting activity and the suppression of crime.</p> |  | <ul style="list-style-type: none"> <li>• Improve the peacekeeping communication system by ensuring power for the radio used in the Namayingo police system communications grid.</li> <li>• Control night crime by installing street lights and electric lighting in residential areas.</li> <li>• Electrifying these public facilities to improve their operation would help improve the lives of all 222,000 district residents.</li> </ul> |
| <p>&lt; Local Industries &gt;</p> <p>Small-scale flour milling, wood processing, steel works and other local industries in the project region operate at low production efficiency with no power.</p>  | <p>Same as above</p>                   | <p>Secure power supply for the industrial area in the project region to improve operation of processing equipment, quality and other production factors to stimulate local industry.</p>   |

# CONTENTS

Preface

Summary

Contents

Location Map / Rendering of 33kV Distribution Line of the Project

List of Figures&tables / Abbreviations

## Chapter 1 Background of the Project

|         |  |      |
|---------|--|------|
| 1-1     | Background of the Japanese Assistance .....  | 1-1  |
| 1-2     | Natural Conditions .....   | 1-5  |
| 1-3     | Environmental and Social Considerations.....   | 1-6  |
| 1-3-1   | Environmental Impact Evaluation .....  | 1-6  |
| 1-3-1-1 | Project Components .....   | 1-6  |
| 1-3-1-2 | Outlines of the Project Sites .....  | 1-6  |
| 1-3-1-3 | Institution and Organization of Environmental<br>and Social Considerations in Uganda ..... | 1-9  |
| 1-3-1-4 | Comparison of the Alternatives.....  | 1-14 |
| 1-3-1-5 | Site Survey .....  | 1-15 |
| 1-3-1-6 | Evaluation of Anticipated Environmental and Social Impacts.....                            | 1-26 |
| 1-3-1-7 | Mitigation Measures .....  | 1-32 |
| 1-3-1-8 | Environmental Management and Monitoring Plan .....   | 1-34 |
| 1-3-1-9 | Stakeholder's Meetings.....  | 1-35 |
| 1-3-2   | Land Acquisition and Resettlement.....   | 1-36 |
| 1-3-3   | Others .....   | 1-37 |
| 1-3-3-1 | Draft Monitoring Forms.....  | 1-37 |
| 1-3-3-2 | Environmental Check List.....  | 1-39 |

## Chapter 2 Contents of the Project

|         |   |     |
|---------|---|-----|
| 2-1     | Basic Concept of the Project .....  | 2-1 |
| 2-1-1   | Objectives of the Project .....   | 2-1 |
| 2-1-2   | Outline of the Project .....  | 2-1 |
| 2-2     | Outline Design of the Japanese Assistance .....                             | 2-2 |
| 2-2-1   | Design Policy .....   | 2-2 |
| 2-2-1-1 | Basic Policies .....  | 2-2 |
| 2-2-1-2 | Natural Conditions .....  | 2-3 |
| 2-2-1-3 | Socioeconomic Conditions .....  | 2-3 |
| 2-2-1-4 | Local Construction Industry.....  | 2-3 |
| 2-2-1-5 | Use of Local Construction Companies and Local Materials.....                | 2-4 |
| 2-2-1-6 | Operation and Maintenance Capability of the Project Implementing Body ..... | 2-6 |
| 2-2-1-7 | Scope and Grades of Facilities and Equipment.....                           | 2-6 |
| 2-2-1-8 | Construction and Procurement Methods and Schedule.....                      | 2-7 |

|                                  |   |      |
|----------------------------------|---|------|
| 2-2-2                            | Basic Plan (Equipment Plan).....                | 2-9  |
| 2-2-2-1                          | Preconditions for Planning.....                 | 2-9  |
| 2-2-2-2                          | Design Conditions.....                          | 2-14 |
| 2-2-2-3                          | Outline of the Basic Plan.....                  | 2-16 |
| 2-2-3                            | Outline Design Drawing.....                     | 2-24 |
| 2-2-4                            | Implementation Plan.....                        | 2-25 |
| 2-2-4-1                          | Implementation Policy.....                      | 2-25 |
| 2-2-4-2                          | Implementation Conditions.....                  | 2-26 |
| 2-2-4-3                          | Scope of Works.....                             | 2-28 |
| 2-2-4-4                          | Consultant Supervision.....                     | 2-31 |
| 2-2-4-5                          | Quality Control Plan.....                       | 2-33 |
| 2-2-4-6                          | Procurement Plan.....                           | 2-33 |
| 2-2-4-7                          | Operational Guidance Plan.....                  | 2-35 |
| 2-2-4-8                          | Soft Component (Technical Assistance) Plan..... | 2-35 |
| 2-2-4-9                          | Implementation Schedule.....                    | 2-35 |
| 2-3                              | Obligations of the Recipient Country.....       | 2-36 |
| 2-4                              | Project Operation Plan.....                     | 2-36 |
| 2-4-1                            | Basic Policy.....                               | 2-36 |
| 2-4-2                            | Regular Check Items.....                        | 2-37 |
| 2-4-3                            | Spare Parts Procurement Plan.....               | 2-38 |
| 2-5                              | Project Cost Estimation.....                    | 2-40 |
| 2-5-1                            | Initial Cost Estimation.....                    | 2-40 |
| 2-5-2                            | Operation and Maintenance Cost.....             | 2-41 |
| <br>Chapter 3 Project Evaluation |   |      |
| 3-1                              | Preconditions.....                              | 3-1  |
| 3-2                              | Necessary Inputs by the Recipient Country.....  | 3-1  |
| 3-3                              | Important Assumptions.....                      | 3-2  |
| 3-4                              | Project Evaluation.....                         | 3-3  |
| 3-4-1                            | Relevance.....                                  | 3-3  |
| 3-4-2                            | Effectiveness.....                              | 3-7  |

[ Appendices ]

A-1 Member List of the Study Team

A-2 Study Schedule

A-3 List of Parties Concerned in Recipient Country

A-4 Socio-economic Data

A-5 Minutes of Discussions (MD)

A-6 Drawings

A-7 Field Report





**Rendering of 33kV Distribution Line of the Project**

## LIST OF FIGURES & TABLES

### Chapter 1

|                |   |      |
|----------------|---|------|
| Figure 1-3-1.1 | Proposed Project Site .....   | 1-7  |
| Figure 1-3-1.2 | Proposed Project Routes with Trading Centers.....                           | 1-8  |
| Figure 1-3-1.3 | Procedure to Obtain Environmental Certificate in Uganda .....               | 1-12 |
| Figure 1-3-1.4 | Schematic Land Use on the Project Route in Mayuge and Iganga Districts..... | 1-19 |
| Figure 1-3-1.5 | Schematic Land Use on the Project Route in Bugiri District.....             | 1-19 |
| Figure 1-3-1.6 | Schematic Land Use on the Project Route in Busia District.....              | 1-20 |
| Figure 1-3-1.7 | Schematic Land Use on the Project Route in Namayingo District-1 .....       | 1-20 |
| Figure 1-3-1.8 | Schematic Land Use on the Project Route in Namayingo District-2 .....       | 1-21 |
| Table 1-1.1    | Periodization in the first field survey .....                               | 1-2  |
| Table 1-1.2    | Periodization in the second field survey .....                              | 1-2  |
| Table 1-1.3    | Areas where Site Survey was carried out.....                                | 1-2  |
| Table 1-1.4    | Comparison of the Alternative Project Sites .....                           | 1-4  |
| Table 1-3-1.1  | Environmental and Social Aspects in the Project Site .....                  | 1-8  |
| Table 1-3-1.2  | Legal Framework for Environmental and Social Considerations in Uganda....   | 1-9  |
| Table 1-3-1.3  | ESMF Screening Category.....  | 1-14 |
| Table 1-3-1.4  | Major Beneficiaries of the Project .....                                    | 1-16 |
| Table 1-3-1.5  | Land Use Aspects on the Project Route .....                                 | 1-21 |
| Table 1-3-1.6  | Environmental and Social Impact Evaluation.....                             | 1-28 |
| Table 1-3-1.7  | Environmental Impact Mitigation Measures.....                               | 1-33 |
| Table 1-3-1.8  | Environmental Management and Monitoring Plan .....                          | 1-35 |
| Table 1-3-3.1  | Draft Monitoring Forms.....   | 1-38 |
| Table 1-3-3.2  | Environmental Checklist: Power Transmission and Distribution Lines .....    | 1-39 |

### Chapter 2

|                |   |      |
|----------------|---|------|
| Figure 2-2-1.1 | Typical Arrangement around Wetland/Stream .....   | 2-8  |
| Figure 2-2-1.2 | Typical drawings of Connection method .....   | 2-9  |
| Figure 2-2-4.1 | Work Demarcations between the Japanese and Uganda Side .....  | 2-28 |
| Figure 2-2-4.2 | Project Implementation Regime.....  | 2-32 |
| Figure 2-2-4.3 | Project Implementation Schedule of the Project.....   | 2-36 |
| Figure 2-4-1.1 | Basic Concept of the Maintenance of the Transforming,<br>Transmission and Distribution Facilities ..... | 2-37 |
| Table 2-1-2.1  | Summary of the Project.....   | 2-2  |
| Table 2-2-1.1  | Procurement of Equipment and Materials.....   | 2-5  |
| Table 2-2-1.2  | Connection Method between New 33kV Distribution Lines<br>and Existing Distribution Lines .....          | 2-8  |
| Table 2-2-2.1  | Progress of customer connection in the previous project site .....                                      | 2-10 |

|                |  |      |
|----------------|--|------|
| Table 2-2-2.2  | Outline of the survey results of the customer connection growth<br>in the previous project sites ..... | 2-11 |
| Table 2-2-2.3  | Increase rate of customer connection .....   | 2-12 |
| Table 2-2-2.4  | Demand Forecast for the Project.....   | 2-13 |
| Table 2-2-2.5  | Climatic Conditions for the Equipment and Facilities Design.....                                       | 2-14 |
| Table 2-2-2.6  | Summary of Electrical System.....  | 2-15 |
| Table 2-2-2.7  | Basic Plan of Components .....   | 2-17 |
| Table 2-2-2.8  | Quantity of Conductors for 33 kV Distribution Lines .....  | 2-18 |
| Table 2-2-2.9  | Quantity and Capacity of Distribution Transformers .....   | 2-20 |
| Table 2-2-2.10 | Specifications of Major Equipment and Materials.....   | 2-21 |
| Table 2-2-3.1  | List of Outline Design Drawings .....  | 2-24 |
| Table 2-2-4.1  | Work Demarcations for Both Countries.....  | 2-28 |
| Table 2-2-4.2  | Engineers to be Dispatched by the Contractor .....   | 2-33 |
| Table 2-4-3.1  | Spare Parts and Maintenance Tools Procured by the Project.....   | 2-39 |
| Table 2-5-2.1  | Cost for Operation and Maintenance of 33kV Distribution Line<br>in the Project Site.....               | 2-41 |
| Table 2-5-2.2  | Income from Electricity Charge in the Project Site .....   | 2-41 |

### **Chapter 3**

|               |  |      |
|---------------|--|------|
| Table 3-4-1.1 | Prioritized Subjects related to Power Sector .....             | 3-4  |
| Table 3-4-1.2 | Target of IREMP for Improvement of Rural Electrification ..... | 3-5  |
| Table 3-4-2.1 | Emission Factor by Type of Fuel .....                          | 3-11 |

## Abbreviations

|       |   |
|-------|---|
| AAAC  | All Aluminum Alloy Conductor                                |
| BS    | British Standard  |
| CAIIP | Community Agricultural Infrastructure Improvement Programs  |
| CAE   | Certificate of Approval of EIA                              |
| CAO   | Chief Administrative Officer                                |
| CFR   | Central Forest Reserve                                      |
| DWRM  | Directorate of Water Resources Management                   |
| E/N   | Exchange of Notes   |
| EIA   | Environmental Impact Assessment                             |
| EIS   | Environmental Impact Statement                              |
| ERA   | Electricity Regulatory Authority                            |
| ERT   | Energy for Rural Transformation                             |
| ESMF  | Environment and Social Management Framework                 |
| EU    | European Union  |
| EMP   | Environmental Management Plan                               |
| G/A   | Grant Agreement   |
| GDP   | Gross Domestic Product                                      |
| IDA   | International Development Association                       |
| IEC   | International Electrotechnical Commission                   |
| IEE   | Initial Environmental Examination                           |
| IPP   | Independent Power Producer                                  |
| IREMP | Indicative Rural Electrification Master Plan                |
| ISO   | International Standardization Organization                  |
| JCS   | Japan Cable Maker's Association Standard                    |
| JEAC  | Japan Electric Association Code                             |
| JEC   | Japanese Electrotechnical Commission                        |
| JEM   | The Standard of Japan Electrical Manufacturer's Association |
| JICA  | Japan International Cooperation Agency                      |
| JIS   | Japanese Industrial Standards                               |
| JST   | JICA Study Team   |
| KfW   | Kreditanstalt für Wiederaufbau                              |
| M/D   | Minutes of Discussion                                       |
| MDGs  | Millennium Development Goals                                |
| MEMD  | Ministry of Energy and Mineral Development                  |
| NDP   | National Development Plan                                   |
| NEA   | The National Environment Act                                |
| NEMA  | National Environmental Management Agency                    |
| NEPS  | National Rural Electrification Planning Study               |



|       |  |
|-------|--|
| NFA   | National Forestry Authority                          |
| O&M   | Operation and Maintenance                            |
| OJT   | On the Job Training                                  |
| PB    | Project Brief  |
| PCE   | Policy Committee on the Environment                  |
| PEAP  | Poverty Eradication Action Plan                      |
| PVC   | Polyvinyl Chloride                                   |
| REA   | Rural Electrification Agency                         |
| REB   | Rural Electrification Board                          |
| REF   | Rural Electrification Fund                           |
| RESP  | Rural Electrification Strategy and Plan              |
| SIDA  | Swedish International Development Cooperation Agency |
| TC    | Trading center                                       |
| UEB   | Uganda Electricity Board                             |
| UEDCL | Uganda Electricity Distribution Co., Ltd.            |
| UEGCL | Uganda Electricity Generation Company Ltd.           |
| UETCL | Uganda Electricity Transmission Company Ltd.         |
| UGX   | Ugandan schilling                                    |
| UNRA  | Uganda National Roads Authority                      |
| USAID | United States Agency for International Development   |
| VRA   | Volta River Authority                                |

# **Chapter 1 Background of the Project**

## **1-1 Background of the Japanese Assistance**

The Government of Uganda formulated a comprehensive national development plan in 1997 called the Poverty Eradication Action Plan (PEAP). The plan advocates “income generation for the rural poor.” Then in 2009, Uganda followed up PEAP III by formulating the National Development Plan (NDP) as a development plan for the nation as a whole. The NDP plans for rural development by extending 33kV distribution lines as a strategy for rural electrification.

Disparities between rural and urban living standards have become an important issue in promoting agricultural policy and preventing an exodus to urban centers. In the Strategic Plan formulated in 2006, the Government of Uganda set a target of increasing rural electrification rates from 2005 levels of 4% to 10% in 2012 for an annual increase of 1%.

To achieve this target, the Government of Uganda formulated the Indicative Rural Electrification Master Plan (IREMP) in 2009 in cooperation with the World Bank. IREMP introduces the Benefit Points System being used in South Africa and Namibia to simplify calculation of benefits for rural electrification projects. This system quantifies the benefit of electrifying each region according to number and scale of residences, public facilities, agricultural and commercial facilities to quantitatively determine the order of precedence for projects.

Uganda established the Rural Electrification Agency (REA) in 2003 under the direction of the Ministry of Energy and Mineral Development (MEMD) to manage rural electrification projects. With its financial difficulties, however, Uganda has been struggling to finance electrification projects in regions with low profitability, especially for those projects involving loans.

Given the above, the Government of Uganda selected six regions based on IREMP and requested grant aid from Japan for a plan to extend 33kV distribution lines.

In selecting the six regions, they looked at which regions needed electrification within 3-5 years, which were long enough to receive donor support, regional equality in support and other factors.

The Ugandan side and JICA Study Team confirmed in the first field survey that the priority of the six project sites above mentioned was shown as Table 1-1.1. Their prioritization was in accordance with the priority shown in IREMP, which prioritizes project sites in consideration of economic development of the project sites and improvement of living standard of the residents.

Based on the discussion and agreement between Both Parties, the site survey was carried out on these three sites which were rated as Priority Ranking 1st and Priority Ranking 2nd. Both parties also agreed that these sites shall be selected as candidates of the Project for further consideration.

**Table 1-1.1 Periodization in the first field survey**

| Areas  | Components  | Rate         |
|--------|---|--------------|
| Area-1 | Rural Electrification in Kayunga District                                     | Priority 3rd |
| Area-2 | Rural Electrification in Masaka and Rakai District                            | Priority 2nd |
| Area-3 | Rural Electrification in Mubende District                                     | Priority 3rd |
| Area-4 | Rural Electrification in Mayuge, Iganga, Bugiri, Namayingo and Busia District | Priority 1st |
| Area-5 | Rural Electrification in Bushenyi and Rukungiri District                      | Priority 2nd |
| Area-6 | Rural Electrification in Hooma and Masindi District                           | Priority 3rd |

All of three project sites are local metropolitan areas, such as Jinja, Masaka and Mbarara. However, it had been confirmed through the site survey that some part of the requested component in Mbarara area (Area-5) has been already constructed by the Ugandan side. The rest of the requested lines were separated to four parts and the length of each part is less than 10 km (total length: approx.. 30 km). Therefore, the scale of the components in Area-5 is considered to be too small for the Japan's grant aid project, and the scale merit is not expected. Based on the results of the site survey, the both parties agreed that Area-5 shall be prioritized in the 3rd.

**Table 1-1.2 Periodization in the second field survey**

| Areas  | Components  | Rate         |
|--------|---|--------------|
| Area-4 | Rural Electrification in Mayuge, Iganga, Bugiri, Namayingo and Busia District | Priority 1st |
| Area-2 | Rural Electrification in Masaka and Rakai District                            | Priority 2nd |
| Area-5 | Rural Electrification in Bushenyi and Rukungiri District                      | Priority 3rd |

Source: JICA Study Team

In the site survey carried out in the first field survey, benefit and effectiveness of the Project were also confirmed. The results were shown in Table 1-1.3. Benefit and effectiveness of Area-4 are remarkable.

**Table 1-1.3 Areas where Site Survey was carried out**

| Components   | Length [km] | Number         |             |           |          |         |     |    |   | Household | priority |
|--|-------------|----------------|-------------|-----------|----------|---------|-----|----|---|-----------|----------|
|  |             | Trading Center | Educational |           |          | Medical |     |    |   |           |          |
|  |             |                | Primary     | Secondary | Tertiary | IV      | III | II | I |           |          |
| Rural Electrification in Mayuge, Iganga, Bugiri, Namayingo and Busia District (Area-4) | 135         | 37             | 101         | 17        | 2        | 2       | 5   | 8  | 0 | 9,000     | 1st      |
| Rural Electrification in Masaka and Rakai District (Area-2)                            | 65          | 13             | 25          | 5         | 3        | 0       | 2   | 1  | 2 | 2,000     | 2nd      |
| Rural Electrification in Bushenyi and Rukungiri District (Area-5)                      | 30          | 10             | 20          | 4         | 2        | 0       | 2   | 2  | 0 | 1,000     | 3rd      |
| Total  | 225         | 60             | 146         | 26        | 7        | 2       | 9   | 11 | 2 | 12,000    |          |

Source: JICA Study Team

The Ugandan side and the Team agreed that the proposed distribution line traversing through parts of five districts; Mayuge, Iganga, Bugiri, Namayingo and Busia as the most prioritized site. Main reasons for the prioritization are (1) electrification of beneficiaries in terms of the number of consumers which include trading centers, households, schools and health centers, (2) the importance of electrification of new district headquarters in Namayingo, and (3) project impacts including synergy with the Interconnection of Electric Grids of Nile Basin Initiative Countries Interconnection Project.

JST concluded three alternative project sites, Area-4, Area-2 and Area-5, with Ugandan counterpart. JST compared three alternative project sites above mentioned and the zero option (the case without the Project) with four evaluation items, benefits to expected consumers and public facilities, urgency (scale of TC and social service facilities), social environment, natural environment, explained in Table 1-1.4.

The Project can contribute to generate the following benefits for the project sites. On the result of comparison, Area-4 is given priority over the other alternatives. Area-4 has the most households, TCs and public facilities, while the CFRs and permanent wetlands are the least. The most loss of crops and trees are expected, however it is not significant impact because those locations are partial and limited for installing poles and distribution lines even the Project Route is the longest. Surely, those losses will be compensated by REA. In the Zero Option, the following project benefits will not be expected although there are no negative impacts on social and natural environments.

#### Expected benefits by the Project

Improvement of Socioeconomic Activities for Households, Industries:

- Living environment
- Communication with TV, radio and mobile phone
- Increase of micro enterprises (stores and workshops)
- Increase of entertainments
- Social safety with lighting in homes and streets

Improvements of Social services for Health Centers, Schools, Local Government Offices:

- Urgent medical service in night
- Storage condition to keep medicine and vaccine cold
- Infants and children's health with immunization expanded by stable stored vaccine
- Medical services with electric medical equipment
- Academic progress with lengthened night learning time
- Education/living conditions and safety in school
- Efficiency of local government public services

**Table 1-1.4 Comparison of the Alternative Project Sites**

| No. | Item   | Area 4   | Area 2   | Area 5   | Zero Option   |
|-----|--|--|--|--|---|
| ①   | Length   | 135km  | 65km   | 30km   | —   |
| ②   | District   | 5  | 2  | 2  | —   |
| ③   | Benefits to expected consumers and public facilities | A  | B  | C  | D   |
|     |  | The Most beneficiaries TCs:38<br>Households : about 9,400<br>Schools : 108<br>Health centers : 15  | Less beneficiaries TCs: 13<br>Households : about 2,000<br>Schools : 33<br>Health centers : 5   | The least beneficiaries TCs: 10<br>Households : about 1,000<br>Schools : 26<br>Health centers : 4  | No benefits to the expected consumers and public facilities   |
| ④   | Urgency  | A  | B  | C  | D   |
|     |  | There are large-scale TCs in the area. Namayingo TC, the largest TC, is not electrified in spite of a district capital. The area has more schools and health centers which cannot provide stable services without power. | Medium-scale TCs and less public facilities are located.   | Small-scale TCs and the least public facilities are located.   | No impacts on urgency (social services will not be improved.)   |
| ⑤   | Social environment                                   | C  | B  | A  | A   |
|     |  | The most impact on loss of crops and planted trees along the longest route.<br>Major land uses are cultivated lands, residential lands and plantations   | Less impact on loss of crops and planted trees along medium length of the route.<br>Major land uses are cultivated lands (pinery), residential lands, ranch and plantations.                 | The least impact on loss of crops and planted trees along the shortest route.<br>Major land uses are cultivated lands, residential lands, ranch and plantations. | No impacts on social environment.   |
| ⑥   | Natural environment                                  | A  | C  | B  | A   |
|     |  | The least impacts on nature are expected.<br>- Gentle hilly site, Lake shore site<br>- Irimbi CFR (plantation): Approx. 1km on the route<br>- Mostly seasonal wetlands which are cultivated by local people              | More impacts on nature are expected.<br>- Gentle hilly site, Lake shore site<br>- 3 CFRs (Eco system): approx. 3km on the route<br>- Large-scale permanent wetland: approx. 2km on the route | More impacts on nature are expected.<br>- Mountainous site<br>- No CFRs<br>- Many permanent wetlands   | No impacts on natural environment.  |
| ⑦   | Evaluation   | A  | B  | C  | D   |
|     |  | There are the most expected consumers, public facilities and the least impacts on nature. Large impacts on Namayingo district capital will be expected.  | There are less expected consumers, public facilities and some impacts on nature.   | There are the least expected consumers, public facilities and some impacts on nature.  | Poor situations on living environment, socio-economic activities and social services will not change or can decrease. |

Source: JICA Study Team

## **1-2 Natural Conditions**

### **(1) Climatic Zone**

Positioned between 4° N '12 and 1° S '29, Uganda sees little temperature change throughout the year. Despite being just below the equator, the elevation makes the climate cool. At an elevation of 1,200 m, the project region covering the Eastern Region districts of Mayuge, Iganga, Bugiri, Namayingo and Busia is pleasant throughout the year with little difference in temperature.

### **(2) Ambient Temperature**

The project site has average monthly high temperatures of 30-35° C and average monthly low temperatures of 10-15° C. Temperatures drop off significantly after sunset.

### **(3) Humidity**

Maximum relative humidity for the project site is high at 75-85%, but is not unpleasant, staying at 40-60% during the day (monthly averages at noon).

### **(4) Rainfall**

Uganda has two rainy seasons. The main rainy season is from March to May, and the smaller rainy season is from September to November. Annual rainfall for the project site is 900-1,400 mm.

### **(5) Soil**

Ugandan soil is made up of gneiss and schist metamorphosed from granite in the Cambrian. Western Uganda has phyllite and shale containing copper, tin, tungsten ore and beryllium. Eastern Uganda has Cretaceous magnetite and phosphate rock, along with limestone. The Tororo Region has phosphate rock and limestone. Soil on the project site is made of laterite, which is unique to tropical regions. Laterite is soil formed from weathered rock, colored a reddish brown from iron content. Limestone is used as material in the cement industry, and phosphate rock is used by the superphosphate industry.

### **(6) Lightning**

Given the high elevation of the project site, along with its proximity to Victoria Lake and high relative humidity, there is an extremely high amount of lightning. Lightning strikes between 160-230 days annually.

## **1-3 Environmental and Social Considerations**

### **1-3-1 Environmental Impact Evaluation**

#### **1-3-1-1 Project Components**

The Project components are summarized as follows.

**(1) 33 kV Distribution Line (Total Length: Approx. 134.4 km)**

- Trunk line from Mayuge Trading Center (T/C) to Nankoma T/C through Mpungwe T/C, Approx. 21.5 km
- Branch line from Mpungwe T/C to Makutu T/C, Approx. 10.2 km
- Trunk line from Nankoma T/C to Lumino T/C through Namayingo T/C and Hukemo T/C, Approx. 37.5 km
- Branch line from Namayingo T/C to Bumeru A T/C and Bumeru B T/C, Approx. 29.9 km
- Branch line from Namayingo T/C to Busiro Landing Site and Lugala, Approx. 24.8 km
- Branch Line from Hukemo T/C to Mundindi T/C and Muwembe-Tayari T/C, Approx. 10.5 km

**(2) 33 / 0.415-0.240 kV Distribution transformer (Total Number: 50 units)**

- 200 kVA × 4 units, 100 kVA × 7 units, 50 kVA × 11 units, 25 kVA × 28 units

#### **1-3-1-2 Outlines of the Project Sites**

The results of 1st and 2nd field surveys show that most lands along the Project Routes are cultivated already and many trade centers (TCs) are located on. The Project Site has totally gently undulating hills in topography and the requested route passes a Central Forest Reserve (CFR) named Irimbi CFR which is used for industrial and commercial plantation on rocky hill in the short length at approximately 1km. It is partially planted by licensed individuals along the existing road. The land is mostly cultivated by local people.

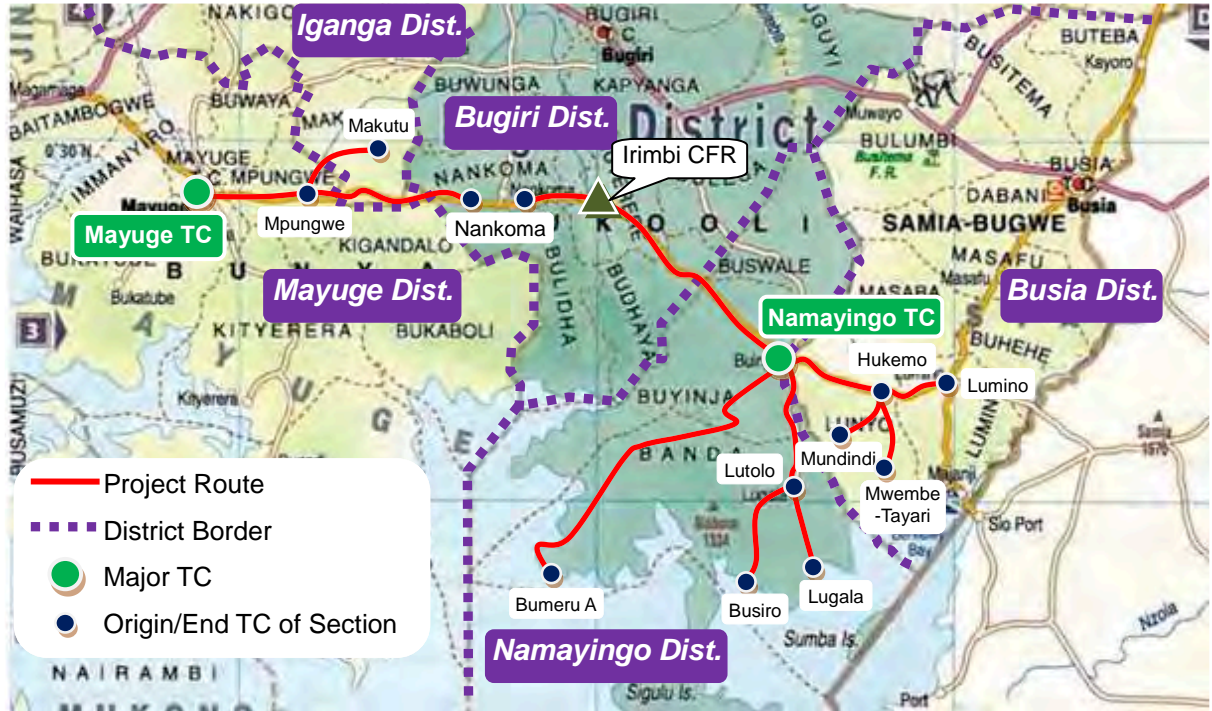
In the inland of Project Site, there are seasonal wetlands that the local people have been cultivating and few permanent wetlands. Permanent wetlands are also highly modified already. Those lands are used for the cultivation of maize, rice and vegetables. Small water pools can be seen around culverts with mostly reed vegetation. Respective District Environment Officers say that the local wetlands have common aspects in the country. Besides, there are no permanent wetlands close to Lake Victoria.

The Project Route will be designed along the existing road passing five districts, Mayuge, Iganga, Bugiri, Namayingo and Busia and branch routes to TCs around and at shore of Lake Victoria. The buildings along the Project Routes are mostly built set-back about 10m – 12m from the road center.

In the inland, main livelihoods of potential consumers are farming (cassava, maize, ground nut, beans, rice, millet, sugarcane), trading and they also have livestock (cattle, goat, chicken). All activities are in small scale. On the lake shore, the main livelihood is dominated by fishing of tilapia and Nile perch although they have farming. Based on the interviews to the local peoples, approximate average monthly incomes are 50,000 - 300,000 UGX/household by farming, 150,000 - 350,000 UGX/household by fishing and 100,000 - 600,000 UGX/household by trading.

Most trading centers have generators and solar panels for TV theaters, barber shops, lighting, charging for mobile phones and even distributing electricity for neighbour houses. Milling machines are also inevitable to process local food materials (maize, millet and cassava) for daily life. They also consume oils for kerosene lamp and tadoba as main lathing. They are willing the electricity for the existing activities done by the generators and solar panels, the lighting and to establish new businesses like food processing, cool storage, welding and carpentry.

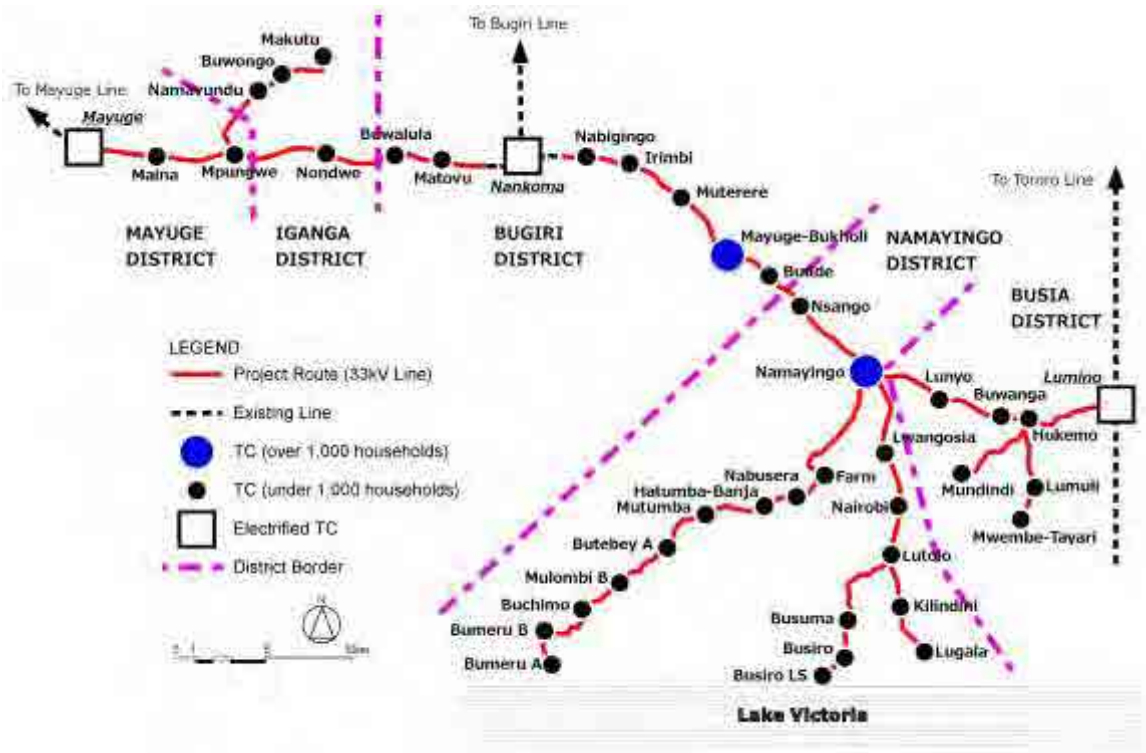
Figure 1-3-1.1 shows the proposed Project Site and Figure 1-3-1.2 explains the proposed Project Routes with trading centers. Table 1-3-1.1 summarizes the environmental and social aspects of Project Site from the site survey and interviews to local representatives (Local Council Chairmen).



Source: JICA Study Team

Figure 1-3-1.1 Proposed Project Site





Source: JICA Study Team

**Figure 1-3-1.2 Proposed Project Routes with Trading Centers**

**Table 1-3-1.1 Environmental and Social Aspects in the Project Site**

| Item           | Description  |
|----------------|--|
| District       | Mayuge, Iganga, Bugiri, Namayingo, Busia   |
| Topography     | - Gently hilly site<br>- Lake shore site   |
| Land Use       | - Settlements (trading centers)<br>- Cultivated lands, Cattle grazing land<br>- Woodlot (plantation)   |
| Socio-economy  | - Trading centers: 38<br>- Households: about 9,400<br>- Population: about 73,000<br>- School: 108<br>- Health center: 15<br>- Farming: cassava, maize, ground nut, beans, rice, millet, sugarcane<br>- Fishing: tilapia, Nile perch<br>- Livestock: cattle, goat, chicken<br>- Trading<br>- Approx. average monthly income: 50,000 - 300,000 (farming), 150,000 - 350,000 (fishing), 100,000 - 600,000 (trading) UGX/household |
| Forest Reserve | - Irimbi CFR (Bugiri District): rocky hill, partially planted, mostly cultivated, approx. 1km on the Project Route   |
| Wetland        | - There are few permanent wetlands and most wetlands are common seasonal wetlands with reed, sedge, elephant grass, thorny bushes in vegetation<br>- Local people have been cultivating the wetlands   |

Source: JICA Study Team

### 1-3-1-3 Institution and Organization of Environmental and Social Considerations in Uganda

#### (1) Legal Framework for Environmental and Social Considerations in Uganda

Table 1-3-1.2 summarizes the legal framework for environmental and social considerations in Uganda. The National Environment Act by NEMA legislated in 1995 is the fundamental law to implement environmental impact assessment (EIA). The Environmental Impact Assessment Regulations in 1997 and the Environmental Impact Assessment Regulations in 1998 were also legislated to stipulate the procedure of EIA, methods, screening criteria, scoping process, public consultations as the baseline of EIA implementation.

In the power sector, the Environmental Impact Assessment Guidelines for the Energy Sector was formulated in 2004. For the electric distribution projects, the Energy for Rural Transformation (ERT) Environment and Social Management Framework was established by REA with MEMD and REA uses the framework to apply environmental certificate to NEMA.

**Table 1-3-1.2 Legal Framework for Environmental and Social Considerations in Uganda**

| Category                          | Title   | Year of Enforcement | Competent Body |
|-----------------------------------|---|---------------------|----------------|
| Environmental Impact Assessment   | National Environment Act  | 1995                | NEMA           |
|                                   | Guidelines for Environmental Impact Assessment in Uganda                              | 1997                | NEMA           |
|                                   | Environmental Impact Assessment Regulations   | 1998                | NEMA           |
|                                   | Environmental Impact Assessment Guidelines for the Energy Sector                      | 2004                | NEMA           |
|                                   | Energy for Rural Transformation (ERT) Environment and Social Management Framework     | 2006                | REA            |
| Protected Area                    | Wildlife Act  | 1996                | UWA            |
|                                   | National Forestry Policy  | 2001                | NFA            |
|                                   | The National Forestry and Tree Planting Act   | 2003                | NFA            |
| Water Resource Management         | The Water Act   | 1997                | DWRM           |
|                                   | The National Environment (Wetlands, Riverbanks and Lakeshores Management) Regulations | 2000                | NEMA           |
| Land Acquisition and Resettlement | The Constitution of the Republic of Uganda  | 1995                | GOU            |
|                                   | Land Act  | 1998                | GOU            |
|                                   | Electricity Act   | 1999                | GOU            |
|                                   | Land Acquisition Act  | 1965                | GOU            |

Source: REA

#### (2) Organizational Structure for Environmental Impacts Assessment in Uganda

NEMA, National Environmental Management Agency, is responsible for environmental management in Uganda, which was established on National Environment Act, Cap. 153 in 1995.

NEMA coordinates, monitors and supervises all activities in the field of the environment mainly with the following activities.

- to coordinate the implementation of Government policy and the decisions of the policy committee
- to ensure the integration of environmental concerns in overall national planning through coordination with the relevant Ministries, departments and agencies of the Government
- to liaise with the private sector, intergovernmental organisations, nongovernmental agencies and governmental agencies of other States on issues relating to the environment
- to propose environmental policies and strategies to the policy committee;
- to initiate legislative proposals, standards and guidelines on the environment in accordance with National Environment Act, Cap. 153
- to review and approve environmental impact assessments and environmental impact statements submitted in accordance with National Environment Act, Cap. 153

Policy Committee on the Environment (PCE) consists of the following departments and Environmental Monitoring and Compliance Department (D/EMC) is responsible for the EIA evaluation.

- District Support Coordination and Public Education Department (D/DSCPE)
- Environmental Monitoring and Compliance Department (D/EMC)
- Policy, Planning and Information Department (D/PPI)
- Finance and Administration Department (D/F&A)

### **(3) EIA Procedure in Uganda**

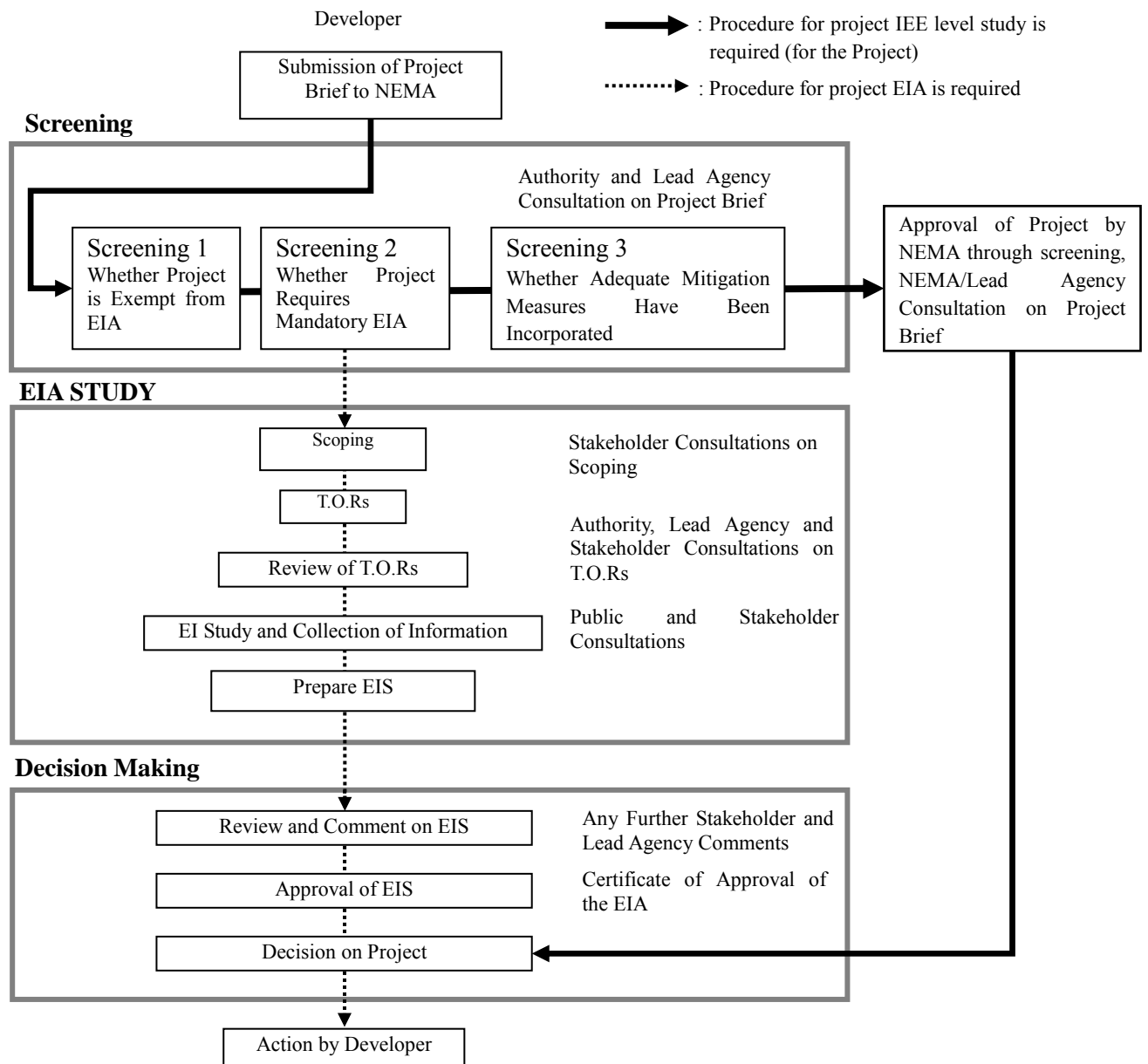
#### **1) Procedure to Obtain an Environmental Certificate**

The entire procedure of environmental assessment in Uganda is explained as follows and in Figure 1-3-1.3. A project opponent should firstly prepare a project brief to describe project activities, environmental conditions of the project site, expected environmental and social impacts and mitigation measures, and submit it to NEMA.

Expected processes for the Project are the following ① - ③ and indicated with a solid arrowed line in Figure 1-3-1.3. REA shall obtain an Environmental Certificate from NEMA to implement the Project. As the first step, REA shall submit NEMA a Project Brief which describes the outline of the project, likely impacts caused by the Project and the mitigation measures. NEMA will determine whether or not the Project is exempted from an EIA based on the Project Brief. To prepare the Project Brief, an environment expert who belongs to MEMD joined the site survey. REA finalized the Project Brief and submitted it to NEMA in the end of August 2011.

### Environmental Assessment Procedure

- ① Submission of Project Brief to NEMA and to Lead Agencies
- ② Consultation on Project Brief by NEMA and Lead Agencies (screening 1: whether project is exempt from EIA), screening 2: whether project requires mandatory EIA, screening 3: whether adequate mitigation measures have been incorporated)
- ③ Certificate of approval of EIA If EIA is not required through the screening
- ④ If EIA is required through the screening, TORs of EIA is made after scoping and Stakeholder Consultations on Scope
- ⑤ TORs are reviewed with NEMA, Lead Agencies and Stakeholders Consultations
- ⑥ Environment Impact Study (EIS), Collection of Information, and Public and Stakeholder Consultations
- ⑦ NEMA reviews and comment on EIS with lead agency and public comments
- ⑧ Approval of EIS, Certificate of Approval of the EIA
- ⑨ Action by developer with the certificate
- ⑩ Developer monitors the project with monitoring plan in EIS, NEMA and lead agencies monitor developer's activities



Source: Basic Design Study on the Project for Rural Electrification Phase II in the Republic of Uganda

**Figure 1-3-1.3 Procedure to Obtain Environmental Certificate in Uganda**

**2) Differences from JICA Guideline**

The Guidelines for Environmental Impact Assessment in Uganda was established with a support of USAID, which includes screening, scoping, public consultation processes for EIA as explained in the above section. The contents show that the guideline varies little from the JICA Guideline for Environmental and Social Considerations. However, JST dealt on the following two works.

① Stakeholder’s Meetings

The Ugandan Guideline requires public and stakeholder consultations through the process

of EIA study and evaluation. However, the JICA Guideline requires stakeholder's meetings as necessary on category B projects in earlier stage of environmental and social considerations. Therefore, JST proposed REA to hold the stakeholder's meetings in the Project site and supported them.

## ② IEE Study

When a project brief is screened by NEMA whether an EIA is exempt or not, they assess environmental mitigation measures, management and monitoring plans are adequately studied or not with project descriptions, environmental condition in project sites and evaluation of impacts. The contents of project brief can be regarded an Initial Environmental Examination (IEE) although the Ugandan Guideline does not state the IEE study is necessary for the project brief. However, the JICA Guideline requires an environmental study at IEE level on category B projects. Therefore, JST supported REA to study and prepare the project brief for the Project study.

## 3) Screening

### ① Guidelines for Environmental Impact Assessment

For screening 1, the Project to install 33 kV lines is not included in the projects of List A which are exempt from EIA.

- Cleaning and farm construction for individual subsistence small farms
- Construction or repair of individual houses
- Minor land use change in area with slopes less than 20% including housing construction
- Information collection (scientific or educational) except if it involves use of chemicals or endangered species or alien materials
- Transfer of ownership of land or related facilities so long as the general character of the area is not changed
- Environmental enforcement actions
- Emergency repairs to facilities within the character of its surroundings

For screening 2, the Project to install 33 kV lines is not included in the power sector projects of List B which requires EIA.

- Electricity generation stations
- Electrical transmission lines
- Electrical substations
- Pumped storage schemes

② Energy for Rural Transformation Environment and Social Management Framework (ESMF)

REA uses ESMF as a guideline for environmental certificate for their projects. The screening categories are summarized in Table 1-3-1.3 and the Project, the installation of 33kV distribution lines, can be categorized in Category I or II.

**Table 1-3-1.3 ESMF Screening Category**

| Uganda Category | Description   | WB Category | Requirement  |
|-----------------|---|-------------|--|
| Category III    | Large scale projects likely to have significant environmental impacts whose mitigation measures cannot readily be identified            | Category A  | Require a full EIA   |
| Category II     | Medium to large scale projects likely to have significant environmental impacts for which mitigation measures can readily be identified | Category B  | Require or not require a full EIA, Environmental Management Plan (EMP) by WB |
| Category I      | Projects likely to have no or negligible negative impacts   | Category C  | Exempt from EIA (Project Brief)  |

Source: ESMF

③ Former REA's projects

REA obtained environmental certificates by project briefs for their 33kV distribution line projects exempt from EIA. For only one project (33kV distribution line in Fortportal – Bundibugyo – Nyahuka) supported by SIDA, an EIA was required by SIDA although NEMA did not require the EIA. SIDA required REA the EIA because the project route passed an area where a hunting race indigenous would inhabit at less than hundred peoples. However, the EIAs were not required for any other 33kV distribution line projects which were supported by donors and at own budgets.

There are no national parks, protected areas, historic/cultural sites and inhabited areas of ethnic minorities in the Project site. The Project route is designed and installed within the road reserves and most lands are cultivated even in wetlands. Loss of crops and trees will be compensated by REA. No significant negative impacts are expected by the Project and the expected impacts will be mitigated. In these contexts, the Project can exempt from EIA and obtain an environmental certificate from NEMA with the project brief.

#### **1-3-1-4 Comparison of the Alternatives**

Comparison of alternatives between three project sites highly prioritized by the Ugandan and Japanese side, and the zero options are described in 1-1, Chapter 1.

### **1-3-1-5 Site Survey**

JST and REA conducted the site survey in the Project Site including five districts along the Project Route which is 133.4km long with the following methods.

- Explanation to Chief Administrative Officer (CAO) and other district officers about the Project and data collection (nature and socioeconomic conditions, plans)
- Collaborative site survey with respective district environment officers, REA's environmental specialist, REA's engineers to identify focal points of environmental and social considerations (An officer from NFA Bugiri office attended for the survey of Irimbi CFR.)
- Visits to local representatives (TC mayors, LCI chairmen, sub-county officers) for sensitization of the Project and data collection of local environmental matters
- Interviews to households, health centers, schools, Namayingo district office and Namayingo police office to identify the expected benefits by the Project
- Land use observation

#### **(1) Points of Environment and Social Considerations**

The following sections summarize the results of 1st field survey of the Project Route. The following points are derived from those results for the works of environmental survey in 2nd field survey.

- Socio-economic activities can be affected on the Project routes
- Land use and structures can be affected on the Project routes
- Nature areas can be affected on the Project routes (CFR, wetlands, rivers, vegetation especially roadside valuable trees)
- Local people's involvement

#### **(2) Focal Points for the Environmental and Social Considerations from the District Officers**

In the 1st field survey, the Team visited district environment officers and forest officers, and obtained their suggestions on the specific points for the environmental and social considerations of Area-4 as follows.

- Electricity is a step for improving livelihood leading to conserve environment
- Water flow in the wetlands should not be obstructed by poles
- Embankment for pole installation in the wetlands should be shorten from roads
- No erosion from the embankment
- Prevent preservatives of poles being into the wetlands
- Involvement of communities (local councils), district offices and sub-counties
- Sensitization for workers and local peoples (to prevent risks of extension of diseases/HIV or to respect local cultures)



- Conserve cultural and valuable trees or re-plantation

Key Findings:

- Adverse impacts on wetlands should be prevented or minimized.
- Involvement of local peoples is necessary.
- Valuable trees should be conserved.

**(3) Summary of Beneficiaries in the project Site**

Table 1-3-1.4 summarizes the numbers of TCs, households, population, schools and health centers along the Project Route through the site survey. The Project Site has considerable households and public facilities. TCs over thousand households are also located along the Project Route. Namayingo is the largest TC which is the district capital of Namayingo district divided from Bugiri district last year (2010). The TC has approximately 3,000 households, many public facilities including the district head quarter around the TC. One health center IV, the heist class in health center, is also located in the TC.

**Table 1-3-1.4 Major Beneficiaries of the Project**

| No. | Size of TC            | TC | Household | Population | School  |           |          | Health Center |     |    |   |
|-----|-----------------------|----|-----------|------------|---------|-----------|----------|---------------|-----|----|---|
|     |                       |    |           |            | Primary | Secondary | Tertiary | IV            | III | II | I |
| 1   | Over 1,000 households | 2  | 4,200     | 31,800     | 14      | 2         | 1        | 1             | 1   | 0  | 0 |
| 2   | 500 – 999 households  | 0  | 0         | 0          | 0       | 0         | 0        | 0             | 0   | 0  | 0 |
| 3   | 100 – 499 households  | 25 | 4,640     | 37,080     | 55      | 9         | 0        | 0             | 5   | 6  | 0 |
| 4   | Under 100 households  | 11 | 555       | 4,110      | 24      | 2         | 1        | 0             | 1   | 1  | 0 |
| 5   | Total                 | 38 | 9,395     | 72,990     | 93      | 13        | 2        | 1             | 7   | 7  | 0 |

Source: JICA Study Team

**(4) Fact Findings with District Environment Officers**

The Team and REA will avoid or minimize development projects' adverse impacts on the environment and local communities. Based on the policy, both of them conducted the site survey involving the District Environment Officers to identify the focal points of environmental and social impacts to reflect them on the route design.

Through the site survey, the Team, REA and the District Environment Officers found and concluded the following points should be considered most in the Project Site, which are described in the Fact Sheets attached in ANNEX A-7.

- Wetlands (permanent and seasonal)
- Forest (Irimbi CFR)
- Cultural Site (shrine)
- Clouded built up area at Namayingo branch point

### ① Wetlands

The Team, REA and respective District Environment Officers observed wetlands (seasonal and permanent), seasonal streams, flood plains, water valley tanks along the Project Route. They are highly modified for cultivation mainly with maize and rice except the water valley tanks. The other crops, sugarcane, cassava, matoke (banana), were observed in the wetlands. Cattle grazing are also typical activities in the wetlands. Small water pools around box culverts were observed at the lowest points in them with the common wetland vegetations mainly of reeds, sedges, alfalfa, phragmites, elephant grass, acacia, and thorny bushes. In the south area of the Project Site, along the Project Routes up to the lake shore, the water valley tanks are main domestic water sources as there are few bore holes.

- Wetlands: Seasonal (23 places), Permanent (5 places)
- Seasonal streams: 5 places
- Protected spring: 1 place
- Water valley tanks: 2 places
- Seasonal water pool: 1 place
- Seasonal flood plain: 1 place

### ② Forest (Irimbi CFR)

Irimbi CFR managed by NFA is located at 250 meters from Irimbi TC. Main function of the Irimbi CFR is categorized in industrial and commercial forest plantations. The area is located on rocky Irimbi hill and it protects soil from erosion for the surrounding villages. The CFR also supplies fuel woods to Bugiri, Iganga and the surrounding trading centers. There are three licensed persons in four parts of land along the road. The plantations at the south side are more than the north side along the road.

- North side aspects: Young Grevillea and Pine trees at about 1 meter tall are planted sparsely. Another type of plantation is Burtydaria trees which is also planted few. Most land is mixed with maize cultivation encroached by local peoples. Burtydaria trees about 5 years grown (about 6m tall) are planted sparsely. A cultural site (Kazimba Kungira) is located on the road.
- South side aspects: Grevillea, Pine trees and Burtydaria trees about 5 years grown (about 6m tall) are planted in one licensed area. These trees can be used for timbers. A part of land is used mixed with vegetable and maize cultivation encroached by local peoples. Few trees are planted at half part of land along the road. Most land is cultivated with maize.

### ③ Cultural Site (shrine)

Two shrines were identified along the Project Route. Baisemena is located on the north

side of the road at the border of Iganga District and Mayuge District, which is taken care by Nalugodha (a cultural leader). There are several rocks surrounded by trees. The other shrine, called Kazimba Kungira is located on the northern side of the road in Irimbi CFR. The site is surrounded by tall trees.

④ Crowded built up area at Namayingo branch point

Residential buildings are established close to the carriageway at the start of the preliminary Project Route branch to Bumeru A TC at Namayingo TC. The preliminary Project Route will affect the residential buildings along the road at about 400 meters. The space is too narrow to pass the Project Route along the road.

**(5) Other Subjects to be considered**

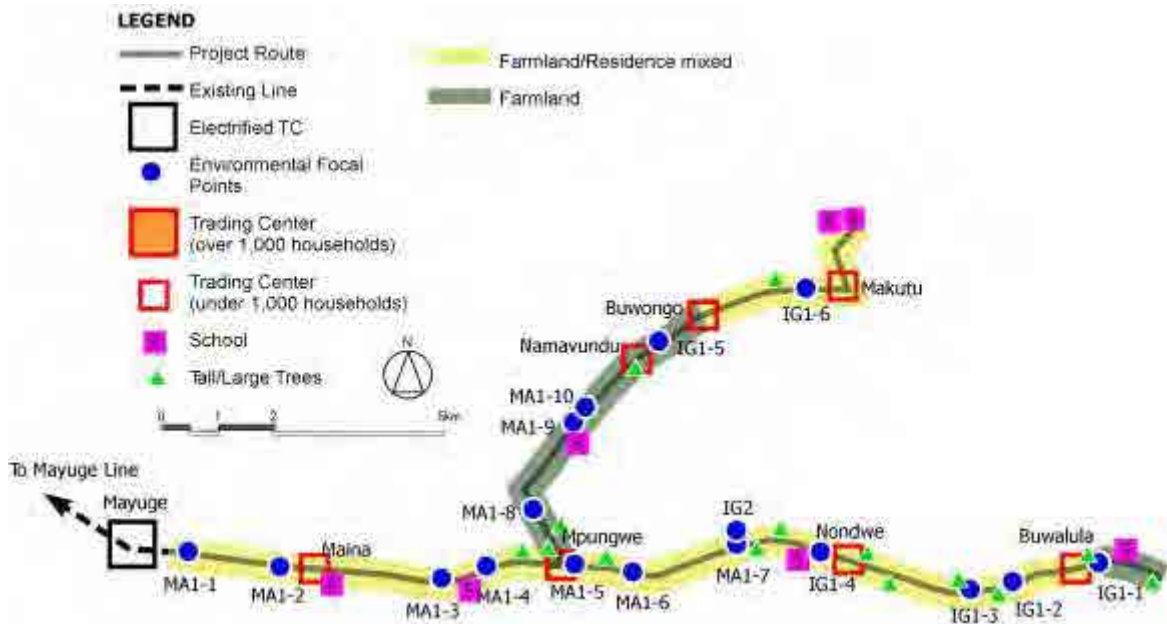
In addition to the fact findings, the Team and REA have concluded that the subjects to be considered as much as possible for the Route design as follows.

- Buildings and Structures should not be affected
- Loss of crops will be minimized
- School especially playground will be avoided
- Tall/large trees or massive trees will be avoided or those losses will be minimized

**(6) Land Use Aspects**

The total Project Route has 134.4km and the distribution line will be installed along the existing road. 38 trading centres of various sizes are located on gentle hill tops along the Project Route. The land use aspects can be summarized as the following five uses. The trading centres can be classified into i) large (residential/commercial area and ii) small (settlement) trading centres. In-between the trading centres, land uses are dominated by iii) farmland/residential mixed area and iv) farmland. Thus, most of land uses along the Project Route are these farmlands and farmland/residential mixed areas. Wetlands which have been highly modified are also located mostly at the lowest points between gentle hills especially along the main route between Mayuge TC and Lumino TC.

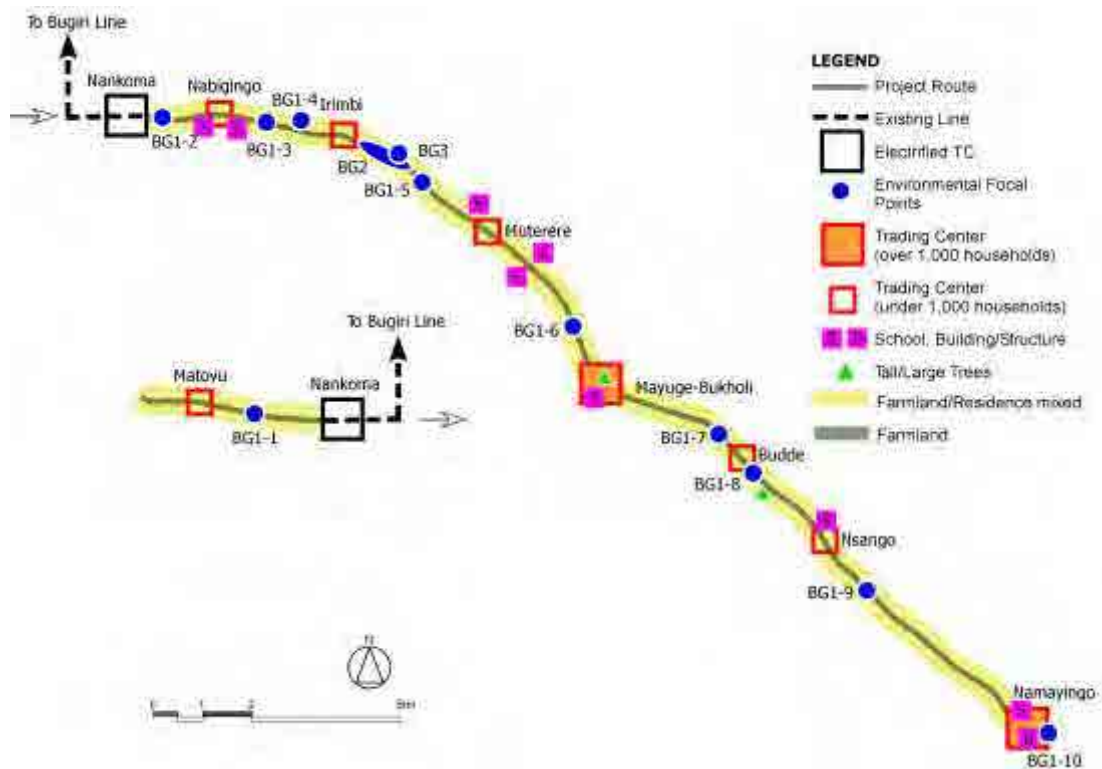
- i) Large Trading Centre: residential/commercial area
- ii) Small Trading Centre: settlement
- iii) Farmland/Residence mixed: farmland dotted with houses (including plantations)
- iv) Farmland: farmland with few houses (cultivated land, grass)
- v) Wetland: there are culverts at the lowest points between gentle hills and small water pools with natural vegetations around them but surrounding lands are highly modified to cultivated lands.



Note: Numbers like MA1-1 indicate environmental focal points shown in Table 1-3-1.5 and ANNEX A-7: Fact Finding Sheets in the Site Survey.

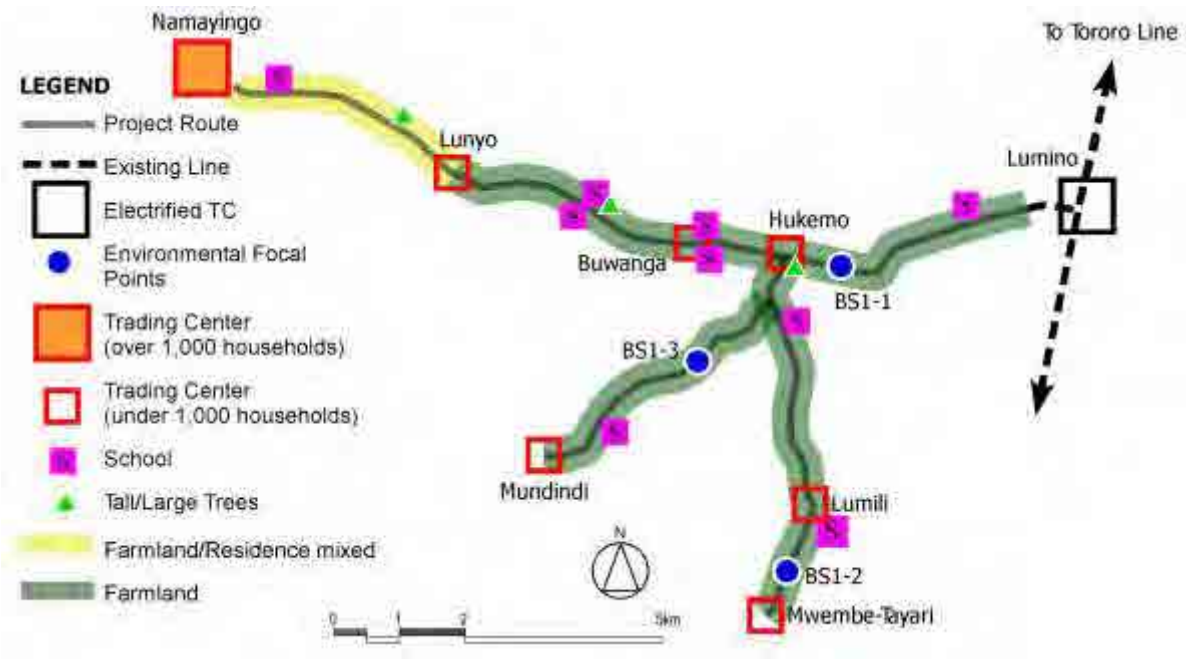
Source: JICA Study Team

**Figure 1-3-1.4 Schematic Land Use on the Project Route in Mayuge and Iganga Districts**



Source: JICA Study Team

**Figure 1-3-1.5 Schematic Land Use on the Project Route in Bugiri District**



Source: JICA Study Team

**Figure 1-3-1.6 Schematic Land Use on the Project Route in Busia District**



Source: JICA Study Team

**Figure 1-3-1.7 Schematic Land Use on the Project Route in Namayingo District-1**



Source: JICA Study Team

**Figure 1-3-1.8 Schematic Land Use on the Project Route in Namayingo District-2**

**Table 1-3-1.5 Land Use Aspects on the Project Route**

| Project Route/<br>District | No.                       | Section                  | Length<br>[km]  | Land Use Aspects and<br>Environmental Focal Points              | Mitigation Measures for<br>Environmental Focal Points       |
|----------------------------|---------------------------|--------------------------|---|---|---|
| 1) Mayuge – Nankoma        |                           |                          |   |   |   |
| Mayuge                     | 1)                        | Mayuge TC                | 0.2   | Residential/Commercial area                                     |   |
|                            | 2)                        | Mayuge TC -<br>Maina TC  | 2.0   | Farmland/Residence mixed  |   |
|                            |                           |                          |   | MA1-1: Seasonal wetland and<br>stream (Maize cultivation)       | Take 100m span of poles (50m<br>each side from the culvert) |
|                            | 3)                        | Maina TC                 | 0.4   | MA1-2: Seasonal wetland with a<br>box culvert (Paddy field)     | Take 100m span of poles (50m<br>each side from the culvert) |
|                            |                           |                          |   | Settlement  |   |
|                            | 4)                        | Maina TC -<br>Mpungwe TC | 4.0   | Farmland/Residence mixed  |   |
|                            |                           |                          |   | MA1-3: Seasonal wetland with a<br>box culvert (cultivated land) | Take 100m span of poles (50m<br>each side from the culvert) |
| 5)                         | Mpungwe TC                | 0.4                      | MA1-4: Seasonal wetland with a<br>box culvert (cultivated land)       | Take 100m span of poles (50m<br>each side from the culvert)     |   |
|                            |                           |                          | Settlement  |   |   |
|                            |                           |                          | Farmland/Residence mixed  |   |   |
| 6)                         | Mpungwe TC -<br>Nondwe TC | 5.2                      | MA1-5: Seasonal wetland with a<br>box culvert (cultivated land)       | Take 100m span of poles (50m<br>each side from the culvert)     |   |
|                            |                           |                          | MA1-6: Seasonal wetland with a<br>box culvert (Sugarcane cultivation) | Take 100m span of poles (50m<br>each side from the culvert)     |   |
|                            |                           |                          | MA1-7: Seasonal wetland with a<br>box culvert (Paddy field)           | Take 100m span of poles (50m<br>each side from the culvert)     |   |

| Project Route/<br>District                               | No.        | Section                      | Length<br>[km]              | Land Use Aspects and<br>Environmental Focal Points  | Mitigation Measures for<br>Environmental Focal Points    |
|--|------------|------------------------------|-----------------------------|---|--|
| Iganga   |            |                              |                             | IG2: Cultural site (Baisemena Shrine) at 30m north side from the road (Paddy field)   | Install the lines at the south side (opposite side)      |
|  |            |                              |                             | IG1-4: Seasonal wetland with a box culvert (Paddy field)  | Take 100m span of poles (50m each side from the culvert) |
|  | 7)         | Nondwe TC                    | 0.4                         | Settlement  |  |
|  | 8)         | Nondwe TC -<br>Buwalula TC   | 3.6                         | Farmland/Residence mixed  |  |
|  |            |                              |                             | IG1-3: Seasonal wetland with a box culvert (Paddy field/Maize cultivation)  | Take 100m span of poles (50m each side from the culvert) |
|  |            |                              |                             | Small water pools were observed around box culverts and surrounding land was highly modified.   |  |
|  |            |                              |                             | IG1-2: Permanent wetland with a box culvert   | Take 100m span of poles (50m each side from the culvert) |
|  | Bugiri     | 9)                           | Buwalula TC                 | 0.5   | Settlement   |
| 10)  |            | Buwalula TC -<br>Matovu TC   | 2.5                         | Farmland  |  |
|  |            |                              |                             | IG1-1: Seasonal wetland with a box culvert (Paddy field)  | Take 100m span of poles (50m each side from the culvert) |
| 11)  |            | Matovu TC                    | 0.4                         | Settlement  |  |
| 12)  |            | Matovu TC -<br>Nankoma TC    | 1.5                         | Farmland  |  |
|  |            |                              |                             | BG1-1: Matovu-Namkoma seasonal wetland with a box culvert (Maize cultivation)   | Take 100m span of poles (50m each side from the culvert) |
| 13)  | Nankoma TC | 0.4                          | Residential/Commercial area |   |  |
|  |            | <b>Total</b>                 | <b>21.5</b>                 |   |  |
| 2) Mpungwe – Makutu                                      |            |                              |                             |   |  |
| Mayuge   | 1)         |                              | 2.0                         | Farmland  |  |
|  |            |                              |                             | Small water pools were observed around box culverts and surrounding land was highly modified.<br>MA1-8: Permanent wetland with a fish pond 30 meters from the road (Paddy field)  | Take 100m span of poles (50m each side from the culvert) |
|  | 2)         | Mpungwe TC -<br>Namavundu TC | 2.0                         | Cultivated wetland: small water pools were observed around box culverts and surrounding land was highly modified.<br>MA1-9: Permanent wetland with a water stream (Paddy field)<br>MA1-10: Permanent wetland with a box culvert (Maize cultivation) | Take 100m span of poles (50m each side from the culvert) |
|  |            |                              |                             | Farmland  |  |
| Iganga   | 3)         | Namavundu TC                 | 0.5                         | Settlement  |  |
|  | 4)         | Namavundu TC –<br>Buwongo TC | 1.5                         | Farmland  |  |
|  |            |                              |                             | IG1-5: Seasonal wetland with a box culvert (Paddy field)  | Take 100m span of poles (50m each side from the culvert) |
|  | 5)         | Buwongo TC                   | 0.5                         | Settlement  |  |
|  | 6)         | Buwongo TC -<br>Makutu TC    | 2.5                         | Farmland/Residence mixed  |  |
| IG1-6: Seasonal wetland with a box culvert (Paddy field) |            |                              |                             | Take 100m span of poles (50m each side from the culvert)  |  |
| 7)   | Makutu TC  | 1.2                          | Settlement                  |   |  |
|  |            | <b>Total</b>                 | <b>10.2</b>                 |   |  |
| 3) Nankoma – Lumino                                      |            |                              |                             |   |  |
| Bugiri   | 1)         | Nankoma TC -<br>Nabigingo TC | 1.2                         | BG1-2: Nabigingo seasonal wetland with box culverts (Paddy field)   | Take 100m span of poles (50m each side from the culvert) |
|  |            |                              |                             | Farmland/Residence mixed  |  |
|  | 2)         | Nabigingo TC                 | 0.5                         | Residential/Commercial area   |  |

| Project Route/<br>District | No.                            | Section                           | Length<br>[km]   | Land Use Aspects and<br>Environmental Focal Points   | Mitigation Measures for<br>Environmental Focal Points   |
|----------------------------|--------------------------------|-----------------------------------|--|--|---|
|                            | 3)                             | Nabigingo TC –<br>Irimbi TC       | 2.0  | Farmland/Residence mixed   |   |
|                            |                                |                                   |  | BG1-3: Nabigingo - Ivunangabo<br>seasonal wetland with a box culvert<br>(cultivated land)                  | Take 100m span of poles (50m<br>each side from the culvert)   |
|                            |                                |                                   |  | BG1-4: Protected spring (Paddy<br>field)   | The Project pole will be<br>installed behind the spring.  |
|                            |                                |                                   |  | Farmland/Residence mixed   |   |
|                            | 4)                             | Irimbi TC                         | 0.3  | Settlement   |   |
|                            | 5)                             | Irimbi CFR                        | 1.0  | BG2: Irimbi Central Forest Reserve<br>(CFR) categorized as Industrial and<br>Commercial Forest Plantations | Take 100m span of poles,<br>The Project Route will be<br>designed passing less<br>plantations         |
|                            |                                |                                   |  | BG3: Cultural site (Kazimba<br>Kungira Shrine)   | The Project Route will be<br>designed passing the opposite<br>side of the road (the southern<br>side) |
|                            | 6)                             | Irimbi CFR –<br>Muterere TC       | 1.8  | Farmland/Residence mixed   |   |
|                            |                                |                                   |  | BG1-5: Irimbi seasonal wetland<br>with a box culvert (Matoke/Cassava<br>cultivation)                       | Take 100m span of poles (50m<br>each side from the culvert)   |
|                            |                                |                                   |  | Farmland/Residence mixed   |   |
|                            | 7)                             | Muterere TC                       | 1.5  | Residential/Commercial area  |   |
|                            | 8)                             | Muterere TC -<br>Mayuge-Bukoli TC | 2.5  | Farmland/Residence mixed   |   |
|                            |                                |                                   |  | BG1-6: Mayuge seasonal wetland<br>with a box culvert (Paddy field)   | Take 100m span of poles (50m<br>each side from the culvert)   |
|                            |                                |                                   |  | Farmland/Residence mixed   |   |
| 9)                         | Mayuge-Bukoli TC               | 1.2                               | Residential/Commercial area  |  |   |
| 10)                        | Mayuge-Bukoli TC<br>- HCIII    | 0.3                               | Settlement   |  |   |
| 11)                        | Mayuge-Bukoli TC<br>- Budde TC | 2.0                               | Farmland/Residence mixed   |  |   |
|                            |                                |                                   | BG1-7: Budde seasonal wetland<br>with a box culvert (Grass)                          | Take 100m span of poles (50m<br>each side from the culvert)  |   |
|                            |                                |                                   | Farmland/Residence mixed   |  |   |
|                            | Budde TC                       | 0.5                               | Settlement   |  |   |
| Namayingo<br>(Bugiri)      | 12)                            | Budde TC -<br>Nsango TC           | 2.0  | BG1-8: Budde-Nsango seasonal<br>wetland with a box culvert (Paddy<br>field/Maize cultivation)              | Take 100m span of poles (50m<br>each side from the culvert)   |
|                            |                                |                                   |  | Farmland/Residence mixed   |   |
|                            | 13)                            | Nsango TC                         | 1.0  | Residential/Commercial area  |   |
|                            | 14)                            | Nsango TC -<br>Namayingo TC       | 4.5  | Farmland/Residence mixed   |   |
|                            |                                |                                   |  | BG1-9: Nawaibete permanent<br>wetland and stream with box<br>culverts (Maize cultivation)                  | Take 100m span of poles (50m<br>each side from the culvert)   |
|                            |                                |                                   | Farmland/Residence mixed   |  |   |
| 15)                        | Namayingo TC                   | 1.5                               | Residential/Commercial area  |  |   |
|                            |                                |                                   | BG1-10: Namayingo town seasonal<br>wetland with a box culvert (Maize<br>cultivation) | Take 100m span of poles (50m<br>each side from the culvert)  |   |
| Busia                      | 16)                            | Namayingo TC -<br>Lunyo TC        | 3.0  | Farmland/Residence mixed   |   |
|                            | 17)                            | Lunyo TC                          | 0.6  | Settlement   |   |
|                            | 18)                            | Lunyo TC -<br>Buwango TC          | 3.8  | Farmland   |   |
|                            | 19)                            | Buwango TC                        | 0.5  | Settlement   |   |
|                            | 20)                            | Buwango TC -<br>Hukemo TC         | 1.0  | Farmland   |   |
|                            | 21)                            | Hukemo TC                         | 0.5  | Settlement   |   |
|                            | 22)                            | Hukemo TC -                       | 1.2  | Farmland   |   |



| Project Route/<br>District     | No. | Section                       | Length<br>[km] | Land Use Aspects and<br>Environmental Focal Points  | Mitigation Measures for<br>Environmental Focal Points   |
|--------------------------------|-----|-------------------------------|----------------|---|---|
|                                |     | Lumino TC                     |                | BS1-1: Nalwire seasonal wetland with a box culvert (cultivated land/grass)  | Take 100m span of poles (50m each side from the culvert)  |
|                                | 23) |                               | 3.1            | Farmland  |   |
|                                |     | <b>Total</b>                  | <b>37.5.5</b>  |   |   |
| <b>4) Namayingo – Bumeru A</b> |     |                               |                |   |   |
| Namayingo<br>(Bugiri)          | 1)  | Namayingo TC                  | 0.9            | BG5: Residential houses are built close to the carriageway  | The Project Route will be designed to pass behind the buildings.<br>It will consequently connect to the Namayingo – Lugala Project Route. |
|                                |     |                               |                | BG4-5: Manyamba seasonal stream (concrete pipes will be installed/grass)<br>Settlement/Farmland                             | Take 100m span of poles (50m each side from the culvert)  |
|                                | 2)  | Namayingo TC - Farm TC        | 5.0            | Farmland<br>BG4-4: seasonal stream with pipe culverts (grass)<br>BG4-3: Seasonal water pool (Maize cultivation)<br>Farmland | Take 100m span of poles (50m each side from the culvert)<br>Install the line opposite side  |
|                                | 3)  | Farm TC                       | 0.3            | Settlement  |   |
|                                | 4)  | FarmTC-Nabusera TC            | 1.7            | Farmland  |   |
|                                | 5)  | Nabusera TC                   | 0.4            | Settlement  |   |
|                                | 6)  | Nabusera TC - Hatumba-BanjaTC | 3.5            | Farmland  |   |
|                                | 7)  | Hatumba-Banja TC              | 0.4            | Settlement  |   |
|                                | 8)  | Hatumba-Banja TC – MutunbaTC  | 3.5            | Farmland  |   |
|                                | 9)  | Mutunba TC                    | 0.3            | Settlement  |   |
|                                | 10) | Mutunba TC - Butebey A TC     | 3.5            | Farmland  |   |
|                                | 11) | Butebey A TC                  | 0.2            | Settlement  |   |
|                                | 12) | Butebey A TC - Mulombi B TC   | 3.5            | Farmland  |   |
|                                | 13) | Mulombi B TC                  | 0.2            | Settlement  |   |
|                                | 14) | Mulombi B TC - Buchimo TC     | 2.5            | Farmland<br>BG4-2: Buchimo-Mulombi seasonal wetland with pipe culverts (Paddy field/Maize cultivation/grass)<br>Farmland    | Take 100m span of poles (50m each side from the culvert)  |
|                                | 15) | Buchimo TC                    | 0.2            | Settlement  |   |
|                                | 16) | Buchimo TC - Bumeru B TC      | 2.0            | Farmland<br>BG4-1: Buchimo-Bumeru seasonal wetland with pipe culverts (Paddy field/Maize cultivation/grass)<br>Farmland     | Take 100m span of poles (50m each side from the culvert)  |
|                                | 17) | Bumeru B TC                   | 0.1            | Settlement  |   |
|                                | 18) | Bumeru B TC - Bumeru A TC     | 1.5            | Farmland  |   |
|                                | 19) | Bumeru A TC                   | 0.2            | Settlement  |   |
|                                |     | <b>Total</b>                  | <b>29.9</b>    |   |   |
| <b>Namayingo – Lugala</b>      |     |                               |                |   |   |
| Namayingo<br>(Bugiri)          | 1)  | Namayingo TC - LwangosiaTC    | 4.2            | Farmland<br>BG4-6: Nasinu-Lwangosia seasonal stream with a box culvert (Maize cultivation/grass)                            | Take 100m span of poles (50m each side from the culvert)  |

| Project Route/<br>District | No.                          | Section                            | Length<br>[km]   | Land Use Aspects and<br>Environmental Focal Points   | Mitigation Measures for<br>Environmental Focal Points       |
|----------------------------|------------------------------|------------------------------------|--|--|---|
|                            |                              |                                    |  | Farmland   |   |
|                            | 2)                           | Lwangosia TC                       | 0.5  | Settlement   |   |
|                            | 3)                           | Lwangosia TC -<br>Nairobi TC       | 3.2  | Farmland   |   |
|                            | 4)                           | Nairobi TC                         | 0.2  | Settlement   |   |
|                            | 5)                           | Nairobi TC -<br>Lutolo TC          | 2.4  | Farmland   | Install the line opposite side                              |
|                            |                              |                                    |  | BG4-9: Buwoya water valley tank<br>(grass)   |   |
|                            |                              |                                    |  | Farmland   |   |
|                            | 6)                           | Lutolo TC                          | 0.3  | Settlement   |   |
|                            | 7)                           | Lutolo TC -<br>Kilinidini TC       | 3.2  | Farmland   |   |
|                            | 8)                           | Kilinidini TC                      | 0.2  | Settlement   |   |
| 9)                         | Kilinidini TC -<br>Lugala TC | 2.4                                | Farmland   | Take 100m span of poles<br>(50m each side from the<br>culvert), Reinforcement of<br>pole structure |   |
|                            |                              |                                    | BG4-7: Seasonal flood plane<br>(cultivated land/grass) |  |   |
|                            |                              |                                    | Farmland   |  |   |
| 10)                        | Lugala TC                    | 0.2                                | Settlement   |  |   |
|                            | <b>Total</b>                 |                                    | <b>16.8</b>  |  |   |
| 5) Lutolo – Busiro LS      |                              |                                    |  |  |   |
| Namayingo<br>(Bugiri)      | 1)                           | Lutolo TC -<br>Busuma TC           | 2.0  | BG4-8: Bukeda water valley tank<br>(Maize cultivation)   | Install the line opposite side                              |
|                            |                              |                                    |  | Farmland   |   |
|                            | 2)                           |                                    | 0.5  | Farmland/Residence mixed   |   |
|                            | 3)                           |                                    | 2.0  | Farmland   |   |
|                            | 4)                           | Busuma TC                          | 0.2  | Settlement   |   |
|                            | 5)                           | Busuma TC -<br>Busiro TC           | 2.0  | Farmland   |   |
|                            | 6)                           | Busiro TC                          | 0.2  | Settlement   |   |
|                            | 7)                           | Busiro TC - Busiro<br>LS           | 1.0  | Farmland   |   |
| 8)                         | Busiro LS                    | 0.1                                | Settlement   |  |   |
|                            | <b>Total</b>                 |                                    | <b>8.0</b>   |  |   |
| 6) Hukemo – Mwembe-Tayari  |                              |                                    |  |  |   |
| Busia                      | 1)                           | Hukemo TC                          | 0.2  | Settlement   |   |
|                            | 2)                           | Hukemo TC -<br>Lumuli TC           | 3.6  | Farmland   |   |
|                            | 3)                           | Lumuli TC                          | 0.2  | Settlement   |   |
|                            | 4)                           | Lumuli TC -<br>Mwembe-Tayari<br>TC | 1.5  | Farmland   | Take 100m span of poles (50m<br>each side from the culvert) |
|                            |                              |                                    |  | BS1-2: Hone a tributary of<br>Nasyegombe seasonal stream with a<br>box culvert (grass)             |   |
| 5)                         | Mwembe-Tayari<br>TC          | 0.2                                | Settlement   |  |   |
|                            | <b>Total</b>                 |                                    | <b>5.7.7</b>   |  |   |
| 7) A fork of 7. – Mundindi |                              |                                    |  |  |   |
| Busia                      | 1)                           | Route 6. -<br>Mundindi TC          | 4.6  | Farmland   | Take 100m span of poles (50m<br>each side from the culvert) |
|                            |                              |                                    |  | BS1-3: Nasyegombe seasonal<br>stream with a box culvert (grass)                                    |   |
|                            |                              |                                    |  | Farmland   |   |
| 2)                         | Mundindi TC                  | 0.2                                | Settlement   |  |   |
|                            | <b>Total</b>                 |                                    | <b>4.8</b>   |  |   |
| <b>Grand Total</b>         |                              |                                    | <b>134.4</b>   |  |   |

Source: JICA Study Team

## **(7) Findings from Environment Officers**

The followings are findings for the Project Route from interviews to the District Environment Officers of five districts.

- Important ecosystems: wetlands, Irimbi CFR, plantations
- Environment issues: deforestation, wetland degradation,
- Likely positive impacts: lighting, value added agricultural production, welding, produce processed materials, boost of economic activities, growth of trading centers, reduce use of fire wood (deforestation)
- Likely negative impacts: loss of crops and trees, stream flow interruption, destruction of property, people's health
- Mitigation measures: compensation, re-plantation, minimum excavation
- Specific land use: mostly cultivated land with maize, cassava, mullet, potato, settlements (shops), schools, plantation along the road
- Threatened species: nothing special, local trees (Mvule-Milicia Excelsa)

## **(8) Findings from Local Representatives**

It is also important to involve local representatives in the process of the Project. The Team and REA visited 43 local representatives including sub-county headquarters and local representatives (LCI chairmen and mayors of TCs) to explain the Project, collect information and ask questions. The results are summarized as follows.

- Specific land use, ecosystems (forests, wetlands, etc.), trees, graveyards, structures, to be considered along the Project Route: Nothing special, some grave yards but not clear
- Positive impacts: Milling (Maize, Rice, Coffee), Charging phone and battery, Sawmill, Refrigerator for cool drink, Welding (workshop), Carpentry, Salon, Industrialization (processing factory), Video theater, Health center, School, Reduce use of fire wood (deforestation)
- Negative impacts and fears: Loss of crops, mango trees, Construction workers encroach on land, Accidents (lack of knowledge), Accidents on the facilities (poles and wires), Expensive electricity charge/connection cost,
- Mitigation measures for the impacts: compensation, sensitization
- Others: Peoples are aware of road reserve (but need sensitization); Peoples can allow the Project Route pass in front of/behind buildings; Peoples are waiting power long time

### **1-3-1-6 Evaluation of Anticipated Environmental and Social Impacts**

Anticipated environmental and social impacts are summarized as shown in Table 1-3-1.6 incorporating the findings of the site survey and interviews with various stakeholders. The distribution lines will be designed and installed in the road reserves. Most buildings are built set-back from the carriageways

and the lines will be installed to avoid the buildings. Therefore, the Project will not cause resettlement. The lines are also designed at the opposite side of schools or tall/large trees to avoid affection on them.

Total 38 TCs include residential/commercial area of larger TC and settlement of smaller TC. Most lands are dominated by farmlands even in both seasonal/permanent wetlands and farmland/residence mixed lands along the Project Route. Loss of crops and trees is the most negative impacts on the cultivated lands along the Project Route, however, will be compensated by REA.

Most wetlands are highly modified and cultivated with maize, rice and cassava although there are small water pools around the culverts. The project Route passes 1km in Irimbi CFR which has industrial purpose in rocky hills. The land along the Project Route is partially planted and mostly cultivated. These focal points of environmental and social impacts found with the District Environment Officers are already mitigated and reflected on the route design as well as the other subjects mentioned in section 1-3-1-6. Poles are designed and will be installed at the maximum span (100m) centered at a culvert not to obstruct water flow. The same span will be taken in Irimbi CFR to minimize the number of poles. The distribution lines are designed and will be installed at the opposite side to avoid dense plantations.

The installation works will be done by human and few heavy machinery. Beside, several working groups will work in parallel at different sites. Consequently, it will limit the construction sites and periods and minimize the impacts (pollution) due to the installation works.

In this context, the installation of 33 kV distribution lines can minimally affect the social and natural environments. Meanwhile, the power supply to un-electrified households will possibly provide new means of livelihood and extend night-time learning for children at home. At health centers, schools, Namayingo district office and police station, their public services will be more accessible and reliable for people in a wider area.

**Table 1-3-1.6 Environmental and Social Impact Evaluation**

| No                    | Item  | Design Phase | Construction Phase | Operating Phase | Anticipated Impacts   |
|-----------------------|---|--------------|--------------------|-----------------|---|
| [ Social Environment] |   |              |                    |                 |   |
| 1                     | Involuntary Resettlement                              | D            | D                  | D               | The distribution lines will be designed and installed in the road reserves. Most buildings are built set-back from the carriageways and the lines will be installed to avoid the buildings. Therefore, the Project will not cause resettlement.   |
| 2                     | Local economy such as employment and livelihood, etc. | D            | B+/-               | A+              | <p>[Design Phase]</p> <p>The Project Route is designed and will be installed in the road reserves and to avoid buildings, schools, local shrines, tall/large trees. However, the crops and trees will be removed by necessity for the installation work. There are two sites where the road reserves are narrow and the Project routes are designed to avoid buildings.</p> <p>At Namayingo branch point of the Project Route, there is an area where the space is too narrow to pass the Project Route along the road. The other narrow space is seen along the Namayingo-Bumeru route at ‘Farm’ trading centre. The Project Route could affect the residential buildings in the areas.</p> <p>[Construction Phase]</p> <p>As the work to install the distribution lines will be conducted along existing roads, the local traffic and economic activities can be affected by the delivery of materials to the sites. However, the work will mostly be manually conducted in relatively confined areas. The short construction period means minimal impact on them.</p> <p>Most land along the Project Route is cultivated even in wetlands. The tall/large trees, plantations were also observed along the Route. These crops and trees along the Project Route will be cleared during installation of poles and wires.</p> <p>The installation work will mainly be manually conducted, and the demand for workers (especially unskilled) will provide a temporary boost for local employment. Local service sector will provide the construction workers accommodation, foods and beverages. It can facilitate business opportunities for the local service sector.</p> <p>However, external construction workers can induce fears among the local people. They may use abusive language not respecting local culture and traditions, or could harm peoples’ properties.</p> <p>[Operation Phase]</p> <p>The power supply to households can create opportunities to establish new businesses (micro enterprises) for developing new livelihoods using electricity as:</p> <ul style="list-style-type: none"> <li>• Kiosks with refrigerators</li> <li>• Welding, carpentry, and sawmills workshops</li> <li>• Video theaters, saloons</li> <li>• Ice plants for refrigerating fish</li> <li>• Improvement of living environment</li> </ul> <p>The electrification can improve the living environment like:</p> <ul style="list-style-type: none"> <li>• Reduce risks of fire and health damage from kerosene lamps.</li> <li>• Facilitate access to social information and entertainment with TV, radio, electrical devices, etc.</li> <li>• Facilitate charging batteries, mobile phones, and communication.</li> </ul> |

| No | Item   | Design Phase | Construction Phase | Operating Phase | Anticipated Impacts   |
|----|--|--------------|--------------------|-----------------|---|
|    |  |              |                    |                 | <ul style="list-style-type: none"> <li>• Improve home safety and awareness on sanitation with lighting</li> <li>• Enable night studies for children</li> </ul> <p>The most likely development from electrification is improvement of agricultural industry through establishment of grinding mills especially for maize and rice. The electric grinding mills can produce better quality flour and more quantity with lower cost, and those ones can be sold with better prices. Additionally, availability of power can promote investment in agricultural processing. Lighting in households, installation of street lights and lighting at police stations can contribute to prevent crimes like theft and violence in the darkness. Moreover, the lighting can moderate mental fears of darkness.</p>   |
| 3  | Land use and utilization of local resources  | D            | D                  | D               | <p>The Project mainly installs the distribution lines and project area is linear to use the road reserves of existing roads. The installation work will remove the crops and trees on the route but it is temporary and in the limited area. As the scale of the project sites is small, the Project is not expected to have any significant impact on the land use and utilisation of local resources.</p>   |
| 4  | Social institutions such as social infrastructure and local decision making institutions | D            | D                  | B+              | <p>[Construction Phase]</p> <p>The scale of the Project is small and the geographically affected areas are very limited. As the Project aims at improving the power supply which is a public service, no negative impacts on social institutions are anticipated.</p> <p>[Operation Phase]</p> <p>Namayingo TC has not been electrified although it is the district capital. District head quarter that 138 staffs work uses generators with high fuel cost and the power is generated unstable. Meanwhile, a new head quarter building is planed and it is expected social services will be more stable and expanded by electrification. Local people will be able to charge mobile phones and use them easier. These can facilitate to improve the social services and communication. It can lead to strengthen community networks.</p>   |
| 5  | Existing social infrastructures and services   | D            | B-                 | A+              | <p>[Construction Phase]</p> <p>Primary and secondary schools are located along the Project Route. If the poles are installed in them, the installation works and installed poles can hinder the student's activities on the playgrounds. However, the work will be mostly conducted manually and it will limit the working areas and periods to minimize the impacts.</p> <p>[Operation Phase]</p> <p>Better and more reliable public services will be provided by the health centers and schools for people in a wider area. In areas where the local peoples can hardly get access to domestic water supplied by borehole or spring, electrification could induce a water pumping system in those areas.</p> <p>In the health centers, power connections will facilitate the following:-</p> <ul style="list-style-type: none"> <li>• Enable emergency services in the night</li> <li>• Enable them to introduce electrical medical equipment</li> <li>• Improved cold storage condition for medicine and vaccines can improve medical care services including immunization</li> </ul> <p>In the schools, students and boarders can obtain academic progress by</p> <ul style="list-style-type: none"> <li>• Introducing lighting equipment, Computers, laboratory, practical equipment,</li> </ul> |

| No                     | Item  | Design Phase | Construction Phase | Operating Phase | Anticipated Impacts  |
|------------------------|---|--------------|--------------------|-----------------|--|
|                        |   |              |                    |                 | and<br><ul style="list-style-type: none"> <li>• Extending time of night learning</li> </ul> Moreover, electrification for Namayingo t head quarter and police station can improve social services and safety.  |
| 6                      | The poor, indigenous and ethnic people              | D            | D                  | B+              | There are no indigenous people or ethnic minorities in the areas affected by the Project.<br>[Operation Phase]<br>Most households live on agriculture, fishing and small stores. They can create opportunities to establish new businesses (micro enterprises) for developing new livelihoods using electricity.   |
| 7                      | Misdistribution of benefit and damage               | D            | D                  | D               | The Project will improve the local electricity supply as a public service. This item is, therefore, not expected.  |
| 8                      | Cultural heritage                                   | D            | B-                 | D               | As there is no cultural heritage in the project areas to be considered, no impacts will occur in regard to cultural heritage.<br>[Construction Phase]<br>There are two local shrines identified along the Project Route and the route could affect them. Besides, some graves could be located along the roads and they also have to be avoided.   |
| 9                      | Local conflict of interests                         | D            | D                  | D               | The Project will improve the local electricity supply as a public service. This item is, therefore, not expected.  |
| 10                     | Water Usage or Water Rights and Rights of Common    | D            | D                  | D               | Local people mainly use boreholes, springs or water valley tanks for water sources and use stream and wetland water very few. Water rights and rights of common were not identified in the Project site.   |
| 11                     | Sanitation  | D            | D                  | D               | As the scale of the expected construction work, which is mostly manual work, is small, no impacts will occur on local health and sanitation.   |
| 12                     | Hazards (Risk) Infectious diseases such as HIV/AIDS | D            | B-                 | D               | [Construction Phase]<br>As the scale of the installation work is small and local labourers will be employed, there is few tangible risk of a disaster or the occurrence of infectious diseases due to the mass inflow of labourers from other areas.<br>However, the DDTs say the districts' prevalence rates of HIV/AIDS are higher than the national average. The external workers could induce/illicit for sexual relationships with the local peoples and it would enlarge risks on both of them without sensitizations. |
| [ Natural Environment] |   |              |                    |                 |  |
| 13                     | Topography and Geographical features                | D            | D                  | D               | As the Project site is generally hilly, the construction work will not involve any major alteration of the topography or civil engineering work. No impacts are anticipated on the local topography or geology.  |
| 14                     | Soil Erosion  | D            | D                  | D               | As the Project site is generally hilly, the construction work will not involve any major alteration of the topography or civil engineering work, causing negligible impact on soil erosion.  |
| 15                     | Groundwater   | D            | D                  | D               | The foundations for the electric poles will be 2 m deep. This shallow foundation will not affect on groundwater.   |
| 16                     | Hydrological Situation                              | D            | B-                 | D               | [Construction Phase]<br>Wetlands are observed along the Project Route, which include wetlands (seasonal and permanent), seasonal streams, flood plains, water valley tanks.  |

| No           | Item                          | Design Phase | Construction Phase | Operating Phase | Anticipated Impacts  |
|--------------|-------------------------------|--------------|--------------------|-----------------|--|
|              |                               |              |                    |                 | They are highly modified for cultivation with maize, rice, cassava, and vegetables except for the water valley tanks. Small water pools around box culverts were observed in them with vegetations mainly of reeds, sedges, alfalfa, phragmites, elephant grass, acacia, and thorny bushes. The positions of poles can affect water flows especially very close to the culverts.<br>A few trading centers are located on the shore of Lake Victoria but the Project route is designed with 200m distance from the shore.   |
| 17           | Coastal Zone                  | D            | D                  | D               | As the Project site is not near a coastal zone, this item is irrelevant.   |
| 18           | Flora, Fauna and Biodiversity | D            | B-                 | D               | The Project routes are located along the existing roads and not pass through national parks or protected areas. No special biodiversity was also heard from the local peoples and the District Environmental Officers.<br>[Construction Phase]<br>The Project Route is designed along the road passing through Irimbi CFR which is used for industrial and commercial plantation on rocky hill in the short length at approximately 1km. Mature trees are planted partially about 1/4 of 1km by three licensed individuals in four parts of land along the existing road. The land is mostly cultivated by local people. Some trees will be removed although the Route is designed to avoid felling the trees as much as possible. REA will compensate them. |
| 19           | Meteorology                   | D            | D                  | D               | The scale of the installation work is small and the work will be mostly conducted manually. Therefore, no impacts on the local climate will occur.   |
| 20           | Landscape                     | D            | B-                 | D               | [Construction Phase]<br>Installation of electricity poles will lead to loss of tall/large trees, plantations and vegetation along the Route although they will be avoided as much as possible. REA will compensate them but green landscape will be reduced from the Project site.   |
| 21           | Global Warming                | D            | D                  | D               | The scale of the installation work is small and the work will be mostly conducted manually. Therefore, hardly any impact on global warming will occur.   |
| [ Pollution] |                               |              |                    |                 |  |
| 22           | Air Pollution                 | D            | D                  | D               | As the use of heavy construction machinery is very limited with manual work accounting for the bulk of the construction work, air pollution due to the Project, if any, will be negligible.  |
| 23           | Water Pollution               | D            | D                  | D               | As no large-scale alteration of the topography or civil engineering work is planned, water pollution due to soil runoff will not occur or limited in amount and area around the poles and limited period. Moreover, the Project route is designed to avoid water flow.   |
| 24           | Soil Contamination            | D            | D                  | D               | The electric poles to be erected for the distribution lines will be pressure creosoting mechanically in a factory. A storage yard about one hectare will be prepared for poles, wires, insulators and transformers. There are very limited sources of soil contamination from the Project.   |
| 25           | Waste                         | D            | D                  | D               | As the Project is new installation of the distribution lines and does not involve the replacement of existing transformers or wooden poles. Therefore, no abandonment of chemical substances contained in existing facilities will occur. Only a minimum amount of surplus soil will be generated by humans with few   |



| No | Item                | Design Phase | Construction Phase | Operating Phase | Anticipated Impacts   |
|----|---------------------|--------------|--------------------|-----------------|---|
|    |                     |              |                    |                 | heavy machinery to excavate holes for poles and fill in it again. Therefore, no significant negative impact by waste materials is anticipated.  |
| 26 | Noise and Vibration | D            | D                  | D               | As the uses of heavy construction machinery are few with manual work, noise and vibration from the work activities are limited in amount, area and period.  |
| 27 | Ground Subsidence   | D            | D                  | D               | As no large-scale alteration of the topography or civil engineering work is planned for the installation works and no ground subsidence is anticipated to occur.  |
| 28 | Offensive Odor      | D            | D                  | D               | No offensive odour is anticipated to originate from the distribution facilities.  |
| 29 | Bottom sediment     | D            | D                  | D               | The installation works will not induce to affect on bottom sediment due to soil erosion from the works. As no large-scale alteration of the topography or civil engineering work is planned for the installation works.   |
| 30 | Accidents           | D            | B-                 | B-              | <p>[Construction Phase]</p> <p>Although a contractor will use few heavy machinery, the manual nature of the work means that there is a possibility of accidents involving workers. The works to install poles and wires also can induce the accidents on the local people. According to an interview to a local contractor, less than 10 accidents on workers could cause a year. However, a supervising consultant and a contractor take responsible to ensure safe working conditions in the contract in order to prevent accidents at work and to the local residents during construction period.</p> <p>[Operation Phase]</p> <p>Due to lack of knowledge on electricity, the consumers may have accidents like electric shock in their homes. Public consultations with the local representatives, LCI/III chairmen, and sub-county officials, also indicate the same fears. Although rare, the overhead cables may be cut and dangled due to an accident or disaster.</p> |

Source: JICA Study Team

**Legend**

- A<sup>+/-</sup> : Significant negative impacts are anticipated
- B<sup>+/-</sup> : Considerable negative impacts are anticipated
- C<sup>+/-</sup> : Minor negative impacts/possibility of negative impacts are anticipated depending on further planning
- D : No or negligible negative impacts are anticipated

**1-3-1-7 Mitigation Measures**

As the environmental items which may experience negative impacts of the Project based on the evaluation results, their mitigation measures are identified as shown in Table 1-3-1.7.

**Table 1-3-1.7 Environmental Impact Mitigation Measures**

| No.                                 | Items   | Possible Negative Impacts                             | Mitigation Measures  | Organization  |
|-------------------------------------|---|---|--|---|
| 1) Before/During Construction Phase |   |   |  |   |
| 2                                   | Local economy, such as employment and livelihood    | Obstruction of buildings and other infrastructure     | <ul style="list-style-type: none"> <li>To avoid the affections on buildings, the Project Route will be designed to connect to the other branch line of Namayingo – Lugala Project Route at Namayingo TC.</li> <li>The line will pass on a private land. Therefore, JST explained the land owner the Project with REA, a district engineer and a Namayingo town council clerk, and obtained his consent to allow the line pass the land.</li> <li>At Farm TC on the branch line to Bumeru, the Project Route will be designed pass behind the buildings because there is little space for the line installation in the road reserve. JST also explained the land owners the Project with REA, the district engineer and a LCI chairman, and obtained his consent to allow the line pass the lands.</li> </ul> | REA, Consultant, Contractor                         |
|                                     |   | Loss of crops and trees on the Project Route          | <ul style="list-style-type: none"> <li>REA will conduct community meetings, survey, explain to the local peoples, make agreements, evaluate the subjects with district compensation rates and compensate the owners.</li> </ul>  | REA   |
|                                     |   | Construction workers encroaching on the land          | <ul style="list-style-type: none"> <li>REA will introduce a contractor to local peoples in the community meetings and facilitate understandings of local customs and cultures between them.</li> <li>Contractor will sensitize the construction workers about proper manner in the sites and to learn the local traditions</li> </ul>  | REA, Contractor                                     |
| 5                                   | Existing social infrastructure and services         | Obstruction of the schools especially the playgrounds | <ul style="list-style-type: none"> <li>The Project Route will be designed and installed passing the opposite side of the road where schools are located.</li> </ul>  | REA, Consultant, Contractor                         |
| 8                                   | Cultural heritage                                   | Obstruction of cultural sites (shrines)               | <ul style="list-style-type: none"> <li>The cultural site will not be tampered with; the Project Route will be designed and installed passing the opposite side of the road.</li> </ul>   | REA, Consultant, Contractor                         |
| 12                                  | Hazards (Risk) Infectious diseases such as HIV/AIDS | Expansion of HIV/AIDS                                 | <ul style="list-style-type: none"> <li>Contractors will sensitize workers and communities with cooperation of respective health centers.</li> </ul>  | Contractor, Health Centers                          |
| 16                                  | Hydrological Situation                              | Obstruction of wetlands                               | <ul style="list-style-type: none"> <li>The Project Route will be designed and installed to avoid water pools and soft ground.</li> <li>The poles will be installed at approximately 100m span, 50m each from the culverts to avoid stream flow.</li> <li>In case the poles are installed in the wetlands, the poles' location will also be away from the culverts to avoid obstruction of the flow of water and the pole structure will be reinforced (two poles type).</li> </ul>   | REA, Consultant, Supervising Consultant, Contractor |
|                                     |   |   | <ul style="list-style-type: none"> <li>Clearance of the vegetation and excavation will be limited to the area where the electricity poles will be installed.</li> </ul>  | Supervising Consultant, Contractor                  |

| No.                | Items                         | Possible Negative Impacts                             | Mitigation Measures  | Organization                              |
|--------------------|-------------------------------|---|--|---|
| 18                 | Flora, Fauna and Biodiversity | Loss of trees in Irimbi CFR                           | <ul style="list-style-type: none"> <li>West side: The Project Route will be designed and installed to pass the north side to avoid more massive licensed plantations.</li> <li>East side: The Project Route will be designed and installed to pass the south side to avoid the local shrine and licensed plantations.</li> <li>The poles will be installed at approximately 100m span to minimize the numbers of poles in the site</li> </ul>                      | REA, Consultant                           |
|                    |                               |   | <ul style="list-style-type: none"> <li>REA will compensate NFA, the licensed persons and other farmers for the felled trees, crops and encourage replanting in other areas.</li> </ul>   | REA                                       |
| 20                 | Landscape                     | Loss of vegetation and landscape                      | <ul style="list-style-type: none"> <li>The Project Route will be designed and installed to avoid tall/large trees or massive trees along the road as much as possible. (especially Mvure)</li> </ul>   | REA, Consultant, Contractor               |
|                    |                               |   | <ul style="list-style-type: none"> <li>The trees felled by necessity will be compensated by REA as same as loss of crops and trees.</li> <li>Re-plantation program will be conducted to provide communities with seeds, tree seedlings for replanting</li> </ul>   | REA, Community, Public facilities         |
| 30                 | Accidents                     | Accidents of construction workers and local residents | <ul style="list-style-type: none"> <li>Supervising consultant and contractor take responsible to ensure safe working conditions in accordance with contractor's construction manuals which are required in the contract in order to prevent accidents at work and to the local residents during construction period.</li> <li>Personal protective wear will be provided for all the workers during construction according to the labour laws of Uganda.</li> </ul> | Supervising Consultant, Contractor        |
| 2) Operation Phase |                               |   |  |   |
| 30                 | Accidents                     | Accidents in households                               | <ul style="list-style-type: none"> <li>REA will sensitize the local peoples to educate about electricity and instruction how to use it safely.</li> </ul>  | REA, District/ Sub-county offices         |
|                    |                               | Accidents on the facilities                           | <ul style="list-style-type: none"> <li>Operator is obligated to maintain the facilities complying with their maintenance regulation.</li> <li>Community development Officers will also sensitize the local people on the importance of maintaining the facilities, need protect them from theft, vandalism or burns in the field.</li> </ul>   | Operator, Community (LCI/III, Sub-county) |

Source: JICA Study Team

### 1-3-1-8 Environmental Management and Monitoring Plan

Environmental management and monitoring plan was proposed based on the mitigation measures as shown in Table 1-3-1.8. The subjects can be mitigated with the route design and are excluded from the plan. The safety management is also excluded because it is a term of contract for supervising consultant, contractor and operators.

In REA, the wayleaves officer, the environment officer and the auditor will monitor the project activities. The environment officer of REA shall coordinate the production of internal monthly/quarterly reports for REA, and annual environmental audit report for submitting to NEMA. A supervising consultant will report JICA the monitoring results informed by REA.

**Table 1-3-1.8 Environmental Management and Monitoring Plan**

| No. | Item   | Subject  | Activity  | Location                            | Time of                             | Organization |
|-----|--|--|---|-------------------------------------|-------------------------------------|--------------|
| 2   | Local economy, such as employment and livelihood | Consent building with community  | Community meetings and consent building                                       | Communities along the Project Route | After E/N and agreement             | REA          |
|     |  | Consent building with local peoples                                    | Explanation to local peoples and consent building with consent form           | Communities along the Project Route | Before construction                 |              |
|     |  | Quantity and conditions of crops and trees to be removed               | Survey and inventory of the subjects (crops/trees) for compensation           | Communities along the Project Route | Before construction                 |              |
|     |  | Payment of compensation  | Payment and preparation of receipts   | Communities along the Project Route | After compensation value evaluation |              |
| 3   | Landscape  | Quantity and conditions of trees to be felled                          | Survey and inventory of the trees to be felled                                | Land along the Project Route        | Before construction                 | REA          |
|     |  | Re-plantation  | Species, quantities and locations of the planted trees                        | Public lands                        | After construction                  |              |
| 18  | Flora, Fauna and Biodiversity                    | Quantity and conditions of crops and trees to be removed in Irimbi CFR | Survey and inventory of the subjects (crops/trees) for compensation           | Irimbi CFR                          | Before construction                 | REA          |
|     |  | Payment of compensation  | Payment and preparation of receipts   | Irimbi CFR                          | After compensation                  |              |
| 30  | Accidents  | Sensitization for safety use of electricity                            | Public relations and promotion for safety use of electricity to local peoples | District/Sub-county Offices         | After construction                  | REA          |

Source: JICA Study Team

### 1-3-1-9 Stakeholder's Meetings

REA organized two stakeholder's meetings on 13th and 14th July, 2011 for five districts in the Project Sites. The 1st meeting was for Bugiri, Namayingo and Busia districts and the second meeting was for Mayuge and Iganga districts. Total project length is 133.4km and the participants were district and sub-county officials, local council members of LCV and LCIII as the representatives of local peoples.

The JST with REA visited TC mayors or LCI chairmen as the other stakeholders in the site survey and explained them about the Project as well as collection of local environmental information. They stated that they desired electricity and very positive opinions to the Project. For village and community levels, REA will conduct community meetings with LCI chairmen as the 1st step of compensation procedure after the Project is committed and both governments make an agreement.

The stakeholder's meetings had 70 and 80 participants through the cooperation with the districts. The meetings were able to facilitate the participant's understandings on the Projects and its environmental and social impacts. They stated very positive opinions to the Projects. Most questions were on realization of the Projects and how can poor household connect to the line. Regarding the environmental and social matters, they stated facilitation of mutual understanding between construction workers and local communities, expectation for employment as the construction workers.

Purposes:

- Disseminate the Project
- Explain Environmental and Social impacts
- Obtain opinions to the Project

Contents:

- Project Profile (Background of the Project, Objectives of the Meeting, Project Site and Route, Project Components, Rough Project Schedule, Responsible and Implementation Organizations)
- Environmental and Social Considerations (Focal Points of Environmental and Social Impacts, Anticipated Impacts, Proposed Mitigation Measures)

Participants:

- District level: CAO (Chief Administrative Officer), ACAO (Assistant Chief Administrative Officer), RDC (Resident District Commissioner), LCV chairmen/councillors, Environment Officer, Wetland Officer, Forest Officer, Community Development Officer, District Engineer, other officials
- Sub-county level: sub-county chiefs, LC III chairmen/councillors

### **1-3-2 Land Acquisition and Resettlement**

The Project lines will be installed within the road reserve stipulated by the Roads Act 1949 Ch 358. On that basis, the road reserves of selected routes should be cleared according to road classification of national and district levels, if REA will use the road reserves for the Project. Even in case that REA will not use the road reserve, distances to be kept from them should be cleared. REA sent Uganda National Roads Authority (UNRA) a letter requesting to use the road reserves of national roads on 30th May. REA also sent district offices letters requesting to use road reserves on district roads on 5th July. REA will expect approvals within two months from them.

In the site survey, the buildings along the Project Routes were built set-back and the road reserves were secured even not 15m from the road centers. However, the other parts of them were mostly

cultivated. In any cases of road reserves or private lands, the Project lines will be installed to avoid any buildings and resettlement is not required for the Project.

Meanwhile, REA's policies and procedures how to secure the routes of 33kV distribution lines should be confirmed. Whether in the road reserves or private lands, REA will take the following steps for compensation on the routes. REA will communicate with local peoples, and obtain agreements to enter and use the lands with the consent form through explanation and discussion with them. REA also register crops and trees with their conditions, evaluate those values with district compensation rates and compensate the owners if they are removed by the distribution line installation works. REA takes the following steps for the compensation.

However, the survey will be started just before construction according to the REA's prior projects. Therefore, it is recommended that the first step of the process, the community meeting with related LCI Chairmen, will be conducted immediately after E/N and agreement are done. Besides, the local peoples will also be involved in the early meeting.

REA's Compensation Procedure:

- Community meeting with LCI Chairmen
- Survey and Explanation to persons whose properties are affected
- Agreement with the wayleaves consent form
- Evaluation of properties on the routes with the wayleaves assessment form
- Preparation of evaluation report
- Submission of the evaluation report to a Chief Government Valuer in Ministry of Land
- Assessment and authorization by a Chief Government Valuer
- Explanation of evaluation results to the affected owners and payment

REA does not acquire lands for the distribution lines based on the policy that REA asks local people's contributions for the spaces to install poles because the rural electrification supports local peoples and contributes to improve social services. However, REA makes the agreements with local peoples as mentioned above.

### **1-3-3 Others**

#### **1-3-3-1 Draft Monitoring Forms**

Draft monitoring forms before and during the construction phase are shown in Table 1-3-3.1.

**Table 1-3-3.1 Draft Monitoring Forms**

| Monitoring Item: 1. Community meetings and consent building with local leadership<br>- REA explains to the local leaders about the Project, schedule and establishes consensus before the installation work starts.                          |                |                           |                   |  |   |                       |
|--|----------------|---------------------------|-------------------|--|---|-----------------------|
| No.  | Date           | Location (LCI/Sub-county) | Consent Level     | Special Instructions (Questions & Answers, Opinions) | Frequency   |                       |
| 1  |                |                           |                   |  | After E/N and agreement, Monthly by Community             |                       |
| 2  |                |                           |                   |  |   |                       |
| 3  |                |                           |                   |  |   |                       |
|  |                |                           |                   |  |   |                       |
| Monitoring Item: 2. Consent building with Project Affected Persons (PAPs)<br>- REA explains to PAPs about the Project, schedule and establishes consensus before the installation work starts. (The consent forms of REA can be summarized.) |                |                           |                   |  |   |                       |
| No.  | Date (from-to) | Location (LCI/Sub-county) | Consent Level     | Special Instructions (Questions & Answers, Opinions) | Frequency   |                       |
| 1  |                |                           |                   |  | Before the installation work starts, Monthly by Community |                       |
| 2  |                |                           |                   |  |   |                       |
| 3  |                |                           |                   |  |   |                       |
|  |                |                           |                   |  |   |                       |
| Monitoring Item: 3. Loss of crops<br>- The crops removed due to the installation works are recorded. (The compensation assessment forms of REA can be summarized.)   |                |                           |                   |  |   |                       |
| No.  | Date (from-to) | Location (LCI/Sub-county) | Type of Crops     | Condition  | Number of Crops   | Frequency             |
| 1  |                |                           |                   |  |   | Monthly by Sub-county |
| 2  |                |                           |                   |  |   |                       |
| 3  |                |                           |                   |  |   |                       |
|  |                |                           |                   |  |   |                       |
| Monitoring Item: 4. Trees felled<br>- The trees felled due to the installation works are recorded. (The compensation assessment forms of REA can be summarized.)   |                |                           |                   |  |   |                       |
| No.  | Date (from-to) | Location (LCI/Sub-county) | Type of Tree      | Condition (height/age)                               | Number of Trees   | Frequency             |
| 1  |                |                           |                   |  |   | Monthly by Sub-county |
| 2  |                |                           |                   |  |   |                       |
| 3  |                |                           |                   |  |   |                       |
|  |                |                           |                   |  |   |                       |
| Monitoring Item: 5. Payment of compensation<br>- Payments of compensation for the crops and trees removed due to the installation works are recorded. (The payment vouchers of REA can be summarized.)                                       |                |                           |                   |  |   |                       |
| No.  | Date (from-to) | Location (LCI/Sub-county) | Number of Persons | Special Instructions (Questions & Answers, Opinions) | Frequency   |                       |
| 1  |                |                           |                   |  | Monthly by Sub-county                                     |                       |
| 2  |                |                           |                   |  |   |                       |
| 3  |                |                           |                   |  |   |                       |
|  |                |                           |                   |  |   |                       |
| Monitoring Item: 6. Re-planted trees<br>- Re-planted trees will be recorded.   |                |                           |                   |  |   |                       |
| No.  | Date (from-to) | Location (LCI/Sub-county) | Type of Tree      | Condition (height/age)                               | Number of Trees   | Frequency             |
| 1  |                |                           |                   |  |   | Monthly by Sub-county |
| 2  |                |                           |                   |  |   |                       |
| 3  |                |                           |                   |  |   |                       |
|  |                |                           |                   |  |   |                       |
| Monitoring Item: 7. Sensitization for safe use of electricity<br>- REA explains and sensitizes the local people safety and hazards related to electricity usage before commissioning.  |                |                           |                   |  |   |                       |

| No. | Date | Location<br>(District/Sub-county) | Type of<br>Media | Number of<br>Participants | Special Instructions (Questions &<br>Answers, Opinions) | Frequency  |
|-----|------|-----------------------------------|------------------|---------------------------|---|--|
| 1   |      |                                   |                  |                           |   | Before the<br>operation starts,<br>Monthly by<br>District or<br>Sub-county |
| 2   |      |                                   |                  |                           |   |  |
| 3   |      |                                   |                  |                           |   |  |
|     |      |                                   |                  |                           |   |  |

Source: REA, JICA Study Team

### 1-3-3-2 Environmental Check List

Based on the JICA's Guidelines for Environmental and Social Considerations (April, 2004 Version), the Study Team conducted an environmental review of the Project using the Environmental Checklist: Power Transmission and Distribution Lines with REA as shown in Table 1-3-3.2.

**Table 1-3-3.2 Environmental Checklist: Power Transmission and Distribution Lines**

| Category                   | Environmental Item                    | Main Check Items   | Yes:Y<br>No:N | Confirmation of Environmental Considerations<br>(Reasons for Yes/No, Mitigation Measures)  |
|----------------------------|---------------------------------------|--|---------------|--|
| 1. Permits and Explanation | (1) EIA and Environmental Permits     | (a) Have EIA reports been already prepared in official process?<br>(b) Have EIA reports been approved by authorities of the host country's government?<br>(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?<br>(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government? | Y             | (a) According to the National Environment Act, Cap.153, which stipulates the types of projects subject to EIA, a full EIA was not required for the Project. Full EIAs were not required for the former REA's projects for installation of 33kV distribution lines. REA, the Project implementing agency, prepared A Project Brief (PB) explaining the project activities, baseline conditions, evaluation of environmental and social impacts and mitigation measures. REA submitted the PB to NEMA for review and approval of the Environmental aspects of the project and obtaining an Environmental Certificate for the Project.<br>(b) (c): The review process of the PB by NEMA and other lead agencies and relevant districts is going on. NEMA will give REA Environmental Certificate for the Project once the review is concluded and comments obtained. The certificate is expected by end of November, 2011.<br>(d): No other environmental permits are required unless it comes up as a condition of approval in the Environmental Impact Assessment Certificate.. |
|                            | (2) Explanation to Local Stakeholders | (a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?<br>(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?   | Y             | (a) REA held public consultations with the local leaders along the project routes and conducted two stakeholder's meetings at two sites. Explanations about the project and presentation of the likely environmental and social impacts and with mitigation measures were done. The comments are reflected as mitigation measures  |



| Category               | Environmental Item              | Main Check Items  | Yes:Y<br>No:N | Confirmation of Environmental Considerations<br>(Reasons for Yes/No, Mitigation Measures)  |
|------------------------|---------------------------------|---|---------------|--|
|                        | (3) Examination of Alternatives | (a) Have alternative plans of the project been examined with social and environmental considerations?   | Y             | (a): Three alternative project sites and the zero option (the case without the Project) were examined with four evaluation items, benefits to expected consumers and public facilities, urgency (scale of TC and social service facilities), social environment, and natural environment.                        |
| 2. Pollution Control   | (1) Water Quality               | (a) Is there any possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? If the water quality degradation is anticipated, are adequate measures considered?   | N             | (a): The installation of distribution lines will not involve any major alteration of the local topography or large-scale civil engineering work. Consequently, there will be no soil runoff to the extent of worsening the water quality.  |
| 3. Natural Environment | (1) Protected Areas             | (a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?   | N             | (a): The Project sites are not located in protected areas. One central forest reserve named Irimbi aimed to industrial plantation is located along the Project Route but it is partially planted and mostly cultivated with maize. REA will compensate owners if the trees or crops are removed for the Project. |
|                        | (2) Ecosystem                   | (a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?<br>(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?<br>(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?<br>(d) Are adequate measures taken to prevent disruption of migration routes and habitat fragmentation of wildlife and livestock?<br>(e) Is there any possibility that the project will cause the negative impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystem due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered?<br>(f) In cases where the project site is located in undeveloped areas, is there any possibility that the new development will result in extensive loss of natural environments? | N             | (a)-(f): There are no special habitats of endangered fauna or flora. Seasonal and a few permanent wetlands that are highly modified and cultivated exist along the project area.   |
|                        | (3) Topography and Geology      | (a) Is there any soft ground on the route of power transmission and distribution lines that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed?<br>(b) Is there any possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or  | N             | (a)-(c): The Project site is almost gently hilly land. No major alterations of the local topography or large-scale civil engineering work will occur under the Project, making slope failures, landslides or soil runoff highly unlikely.  |

| Category              | Environmental Item        | Main Check Items  | Yes:Y<br>No:N                   | Confirmation of Environmental Considerations<br>(Reasons for Yes/No, Mitigation Measures)   |
|-----------------------|---------------------------|---|---------------------------------|---|
|                       |                           | landslides?<br>(c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?  |                                 |   |
| 4. Social Environment | (1) Resettlement          | (a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?<br>(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?<br>(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?<br>(d) Are the compensations going to be paid prior to the resettlement?<br>(e) Are the compensation policies prepared in document?<br>(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?<br>(g) Are agreements with the affected people obtained prior to resettlement?<br>(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?<br>(i) Are any plans developed to monitor the impacts of resettlement?<br>(j) Is the grievance redress mechanism established? | N                               | (a)-(j): No involuntary resettlement is expected in the Project. 33kV distribution lines will be installed within the road reserve along the present roads. Most buildings are built set-back from the carriageways and the lines will be installed to avoid the buildings.   |
|                       | (2) Living and Livelihood | (a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?<br>(b) Is there a possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?<br>(c) Is there any possibility that installation of structures, such as power line towers will cause a radio interference? If any significant radio interference is anticipated, are adequate measures considered?<br>(d) Are the compensations for transmission wires given in accordance with the domestic law?   | N<br><br><br><br>N<br><br><br>N | (a): Access to public services and traffic by the local people can be affected. However, the construction works will be done by humans at limited areas and in short-term. The adverse impact is not serious and is limited. Construction observers will direct the local people and traffic passing safely.<br>(b): No significant adverse impact is expected on hazards and infectious diseases because no massive influx of workers is expected as most labours can be supplied locally for the small-scale projects and construction works by humans. However, HIV might increase because the districts' prevalent rates are already high. Both workers and local peoples will be sensitized.<br>(c): The planned construction of the 33 kV distribution lines will not cause any radio interference which will negatively affect local people. |

| Category  | Environmental Item                           | Main Check Items  | Yes:Y<br>No:N | Confirmation of Environmental Considerations<br>(Reasons for Yes/No, Mitigation Measures)   |
|-----------|--|---|---------------|---|
|           |  |   | Y             | (d): 33kV distribution lines will be installed within road reserve. The installation works will remove crops and the Project route was designed to avoid massive cultivation and tall/large trees as much as possible. However, if the crops and trees are removed by necessity, they will be compensated by REA using district compensation rates.   |
|           | (3) Heritage                                 | (a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?   | N             | (a) There are no prominent archaeological, historical, cultural or religious sites to consider at the Project sites. Two traditional shrines were identified but the lines are designed and will be installed at the opposite side of them.   |
|           | (4) Landscape                                | (a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?  | N             | (a): No significant impact is expected on landscape because there are no special natural and cultural landscapes around the project sites. However, some trees will be felled on the Project Route. The Project lines are designed and will be installed to avoid tall/large trees as much as possible. Trees felled by necessity are compensated by REA but it could deteriorate the vegetation and green landscape along the Project Route. Re-plantation at public space is proposed for mitigation.                               |
|           | (5) Ethnic Minorities and Indigenous Peoples | (a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?<br>(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?  | N             | (a)(b): There are no settlements of ethnic minorities or indigenous peoples along the Project route.  |
|           | (6) Working Conditions                       | (a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?<br>(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?<br>(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?<br>(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents? | N<br>Y        | (a): All Policies, Laws, Regulations and ordinances were reviewed and the project is within the acceptable limits<br>(b)-(d): Supervising consultant and contractor take responsible to ensure safe working conditions in accordance with contractor's construction manuals which are required in the contract in order to prevent accidents at work and to the local residents during construction period. Personal protective wear will be provided for all the workers during construction according to the labour laws of Uganda. |
| 5. Others | (1) Impacts During Construction              | (a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?<br>(b) If construction activities adversely affect the   | N             | (a)-(c): The main work will be the erection of electric poles and overhead cables. While a small crane will be used to install trances on the poles, the work relating to the electric poles and overhead cables will be manually   |

| Category | Environmental Item                       | Main Check Items   | Yes:Y<br>No:N       | Confirmation of Environmental Considerations<br>(Reasons for Yes/No, Mitigation Measures)   |
|----------|--|--|---------------------|---|
|          |  | natural environment (ecosystem), are adequate measures considered to reduce impacts?<br>(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?  |                     | conducted. As such, the impacts of the work on the natural environment, social environment and pollution will be minimal.   |
|          | (2) Monitoring                           | (a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?<br>(b) What are the items, methods and frequencies of the monitoring program?<br>(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?<br>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities? | Y<br><br>Y<br><br>Y | (a) As part of the environmental assessment process, an Environmental Management & Monitoring Plan was prepared in the Project Brief and implemented by REA.<br>(b) The following items were agreed and will be included in the monitoring plan: Community meetings, Consent buildings with PAPs, Loss of crops, Trees Felled, Payment of compensation, Re-plantation of Trees and Sensitization. The other items including contractor's matters will also be comprised in the coordination with NEMA.<br>(c) An organizational structure consists of the wayleaves officer, the environment officer and the auditor in REA. REA and Contractor shall make budgetary allocations towards all environmental programmes.<br>(d) The environment officer of REA shall coordinate the production of internal monthly/quarterly reports for REA, and annual environmental audit report for submitting to NEMA. |
| 6. Note  | Reference to Checklist for Other Sectors | (a) Where necessary, pertinent items described in the Road checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities).  | N                   | (a): The items are irrelevant to the project as it only involves the project components consist of liner and limited areas, which are installations of distribution lines and is planned within the road reserve.   |
|          | Note on Using Environmental Checklist    | (a) If necessary, the impacts to transboundary or global issues should be confirmed, (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).  | N                   | (a) The item is irrelevant to the Project as it only involves the project components consist of liner and limited areas, which are installations of distribution lines.   |

Source: REA, JICA Study Team

## **Chapter 2 Contents of the Project**

### **2-1 Basic Concept of the Project**

#### **2-1-1 Objectives of the Project**

The Government of Uganda formulated a comprehensive national development plan called the Poverty Eradication Action Plan Phase III (PEAP III) for the period of 2004 to 2009. Rural electrification projects were a key element in PEAP as a means of achieving one of the plan's main plan goals, generating income for the rural poor. They have continued to develop rural areas under the five-year National Development Plan (NDP).

The 2001 Rural Electrification Strategy and Plan (RESP) set its target as improving rural electrification to 10% by 2012, making electricity accessible to approximately 480,000 rural residents. Electrification projects have stalled, however, due to a lack of funds by the Rural Electrification Agency (REA), which started operation in 2003. Power deficiencies in the yet unpowered districts force residents to live with kerosene lamps, firewood, and private diesel generators, and are an obstacle to administrative and public services at hospitals, schools and other public facilities.

This Project has selected high priority regions in terms of local economic and industrial development based on the Indicative Rural Electrification Master Plan (IREMP). Its targets are to supply steady power, steadily manage public facilities, stimulate socioeconomic activity and improve resident life for the local agricultural and fishing communities which make up the main industries of Uganda.

#### **2-1-2 Outline of the Project**

The aim of the Project is to develop distribution lines which are important social infrastructure, through the procurement and installation of equipment and materials for 33kV distribution lines by Japanese side necessary to accomplishing the above-mentioned goal, combined with the procurement and installation of low-voltage distribution lines by Ugandan side. The basic concept of the Project is outlined in Table 2-1-2.1.

**Table 2-1-2.1 Summary of the Project**

| <b>Summary of the Project</b>       |  |
|-------------------------------------|--|
| <b>Procurement and Installation</b> | <p>Procurement and installation of the following equipment and materials for 33 kV distribution line</p> <p>(1) 33 kV Distribution Line (Total Length: Approx. 134.4 km)</p> <ul style="list-style-type: none"> <li>➤ Trunk line from Mayuge Trading Center (T/C) to Nankoma T/C through Mpungwe T/C      Approx. 21.5 km</li> <li>➤ Branch line from Mpungwe T/C to Makutu T/C      Approx. 10.2 km</li> <li>➤ Trunk line from Nankoma T/C to Lumino T/C through Namayingo T/C and Hukemo T/C      Approx. 37.5 km</li> <li>➤ Branch line from Namayingo T/C to Bumeru A T/C and Bumeru B T/C      Approx. 29.9 km</li> <li>➤ Branch line from Namayingo T/C to Busiro Landing Site and Lugala      Approx. 24.8 km</li> <li>➤ Branch Line from Fukemo T/C to Munjinji T/C and Muwembe-Tayori T/C      Approx. 10.5 km</li> </ul> <p>(2) 33 / 0.415-0.240 kV Distribution transformer (Total Number: 50 units)</p> <ul style="list-style-type: none"> <li>➤ 200 kVA × 4 units, 100 kVA × 7 units, 50 kVA × 11 units, 25 kVA × 28 units</li> </ul> <p>(3) Metering Unit      4 units</p> <p>(4) Auto Re-closer      4 units</p> <p>(5) Load-break Switch      14 units</p> |
| <b>Procurement</b>                  | <p>Spare parts and maintenance tools for 33 kV distribution line</p> <p>(1) Emergency Spare Part      1 set</p> <p>(2) Replacement Spare Parts      1 set</p> <p>(3) Maintenance Tools      1 set</p>  |

Source: JICA Study Team

## **2-2 Outline Design of the Japanese Assistance**

### **2-2-1 Design Policy**

#### **2-2-1-1 Basic Policies**

In accordance with the first field survey, 33kV distribution lines and distribution transformers will be procured and installed for a total length of approximately 134.4km at five districts (Mayuge, Iganga, Bugiri, Namayingo and Busia) in the Eastern Region. Equipment and materials for low-voltage distribution lines will be procured and installed by Ugandan side.

In consideration of the urgency of the Project, the capacity of the 33kV distribution equipment and materials to be procured under the project will be of adequate scale to meet the forecast power demand five years after commencement of operation.

### **2-2-1-2 Natural Conditions**

#### **(1) Altitude**

The project sites are located at an altitude of approximately 1,200m. In general, the dielectric strength of electrical appliances drops 1% for every 100m increase in altitude when the altitude exceeds 1,000m. Therefore dielectric strength of electrical appliances drops approximately 2% at the project sites. As the value of 2% is within allowance, dielectric strength applies the standard value of 1,000m (Lightning Impulse Withstand Voltage: 170kV and Power Frequency Withstand Voltage: 70kV).

#### **(2) Ambient Temperature**

The temperature at projects sites is fairly constant and warm throughout the year and fall within a range of 15°C and 35°C. As the distribution equipment to be adopted under the Project will be designed less than 40°C, the consideration of ambient temperature is not required.

#### **(3) Humidity**

The humidity ranges from 40% to 60% throughout the year and it is relatively comfortable. As the distribution equipment to be adopted under the Project will be designed less than 85%, the consideration of humidity is not required.

### **2-2-1-3 Socioeconomic Conditions**

Although life in Kampala, the capital of Uganda, can be expected to be relatively convenient, the social infrastructure in rural areas as in the project sites has fallen behind, and so living conditions remain extremely poor. In addition, since English is not widely spoken and medical facilities have not been fully developed in some areas, the conditions for long-term stay for foreigners are quite inconvenient. Consequently, a construction schedule should be prepared at the nearest town (Jinja) as bases in order to secure safe accommodation and an emergency communication system during the construction period of the Project.

#### **2-2-1-4 Local Construction Industry**

Kampala, the capital of Uganda, is the center of the politics and economy so there is a boom in large-scale construction projects such as large hotels, commercial buildings and housing complexes. As several foreign general contractors (builders) have located in the capital territory, construction conditions are favorable. However, the infrastructure has fallen behind and construction conditions remain poor at the project sites under the Project. Consequently, in the formulation of a construction

plan, special attention should be given to the method of transporting construction machinery and materials from the capital or the nearest city and the environment in which a field office is to be built.

### **2-2-1-5 Use of Local Construction Companies and Local Materials**

#### **(1) Use of Local Construction**

Since there are foreign general contractors or electrical firms in Kampala, the capital of Uganda, it is relatively easy to procure local workers, transportation vehicles and construction work machinery and materials in Uganda. It is therefore possible to place orders with local companies for distribution line work under the Project.

Local companies have a lot of experience for electrical pole erection and stringing work in 33kV distribution line. However, adjustment and testing of the equipment (such as distribution transformers, load-break switches, metering units and auto re-closers) at the time of installation and after installation requires highly advanced engineers. It will be difficult to effectively utilize local companies. Consequently, it will be necessary to dispatch engineers from Japan in order to ensure quality control, technical transfer and management of work schedule.

#### **(2) Use of Local Materials**

The wooden poles utilized in 33kV distribution line under the Project are locally available and are frequently adopted. In the formulation of a construction plan, locally available equipment and materials should be adopted as much as possible. If an adequate quantity of wooden poles cannot be secured due to the construction scale, they will be procured from a third country (Kenya, Tanzania, etc.).

In Uganda, since the major components of 33kV distribution facilities required for the Project (distribution transformers, load-break switches, metering units, auto re-closers and lightning arresters) must be imported, it will be impossible to effectively utilize local equipment.

#### **(3) Use of Equipment and Materials from the Third Countries**

In the major components of 33kV distribution facilities required for the Project (distribution transformers, load-break switches, metering units, auto re-closers and lightning arresters), metering units and auto re-closers used in Uganda will be procured from third countries since the said equipment provided with similar specifications has not been manufactured in Japan. Aluminum conductor will be procured from Japan or third country. ASEAN countries shall be applied as the third country, where equipment holding similar grade as Japanese one can be



available in relatively low price.

Since power distribution and substation equipment procured under previous assistance through “The Project for Rural Electrification (1999, JICA) and The Project for Rural Electrification Phase II (2006, JICA) ” is currently being operated in a stable manner and without incident, operators (such as UMEME) who will conclude concession agreement with REA, and take charge of operation and maintenance after completion of the Project are familiar with the operation and maintenance of Japanese equipment and are confident that the after-sale service of Japanese manufacturers will enable to realize lower failure rate of main distribution and substation equipment.

As described above, the reliability of Japanese products is extremely high in Uganda, so they have requested that Japanese products be procured for the main components under the Project through Japan's Grant Aid.

Taking the above situation into consideration, the following equipment and materials will be procured for the Project.

**Table 2-2-1.1 Procurement of Equipment and Materials**

| Equipment and Materials                                    | Procurement |       |               |
|--|-------------|-------|---------------|
|  | Local       | Japan | Third Country |
| 1. Distribution Transformer                                |             | ○     |               |
| 2. Load-break Switch                                       |             | ○     | ○             |
| 3. Metering Unit   |             |       | ○             |
| 4. Auto Re-closer  |             |       | ○             |
| 5. Lightning Arrester                                      |             | ○     | ○             |
| 6. Aluminum Conductor                                      |             | ○     | ○             |
| 7. Wooden Pole   | ○           |       | ○             |
| 8. Other Materials (Insulators and Pole Fitting Materials) |             | ○     |               |
| 9. Emergency Spare Parts and Maintenance Tools             |             | ○     |               |

In the transportation of equipment and materials to be procured from Japan or third countries, a packaging method sufficient enough to endure long-term ocean transport, unloading at a port and inland transport to the project sites will be adopted.

The Port of Mombasa in Kenya can be considered as a candidate port for unloading equipment and materials. The said port has improved large-scale unloading facilities thus there is no difficulty to disembark those equipment and materials under the Project.

For import customs clearance, equipment suppliers should prepare necessary documents in advance and ensure the shortest possible period of custom clearance in order to meet the overall

implementation schedule.

With respect to construction machinery for equipment installation and transportation, 50-ton level cranes or trailers can be leased locally, so there are no specific problems in the implementation of the Project.

#### **2-2-1-6 Operation and Maintenance Capability of the Project Implementing Body**

Operators have ever operated and maintained the national power grid including 33kV distribution lines in a direct-management manner up to the present, with long-term concession agreement with REA for the purpose of inviting private enterprise. Generally speaking, substations and distribution lines in the 33kV distribution systems in Kampala and urban areas have been appropriately operated and maintained and the present operation conditions at each facility are favorable.

However, the substations and distribution lines, etc. in rural areas near from consumers have not been adequately maintained, and there are a lot of malfunction due to domestic economic conditions, insufficient spare parts and deterioration. In addition, engineers and technicians of operators may not fully understand the latest power distribution equipment. Japanese engineers will therefore provide on-the-job training (OJT) in the operation and maintenance of 33kV distribution facilities for the relevant equipment during the construction period of the Project. Simultaneously, special consideration will be given to effective and efficient operation of the facilities to be constructed by providing necessary spare parts, maintenance tools, operation and maintenance manuals, and recommendations on an operation and maintenance system after the commencement of operation.

#### **2-2-1-7 Scope and Grades of Facilities and Equipment**

In due consideration of the various conditions mentioned above, the scope, bill of quantities and engineering grade of procurement and installation of equipment and materials will be formulated based on the following principles.

##### **(1) Scope of Facilities and Equipment**

Since the target year of the Project is considered to be five years from the completion of installation, the minimum but necessary configuration and specifications of facilities will be selected through procurement and installation of new 33kV distribution lines by extending the existing 33kV distribution network in order to supply stable electric power to local residents and to social and public facilities such as hospitals and schools at the project sites.

In order to ensure a design that is both technically and economically appropriate, the minimum

but necessary configuration and specifications for facilities will be selected by adopting products that conform to international standards with regards to specifications of materials as much as possible and by keeping the types of materials and equipment to a minimum. In principle, the specifications of distribution transformers and distribution lines will be selected to meet the power demand five years after the commencement of operation.

## **(2) Grades**

In designing 33kV distribution lines to be constructed and procured under the Project, special attention will be given to ensure that the engineering level of operators entrusted by REA which will be responsible for operation and maintenance of the facilities, and technical standard of those operators will be observed after completion of installation.

### **2-2-1-8 Construction and Procurement Methods and Schedule**

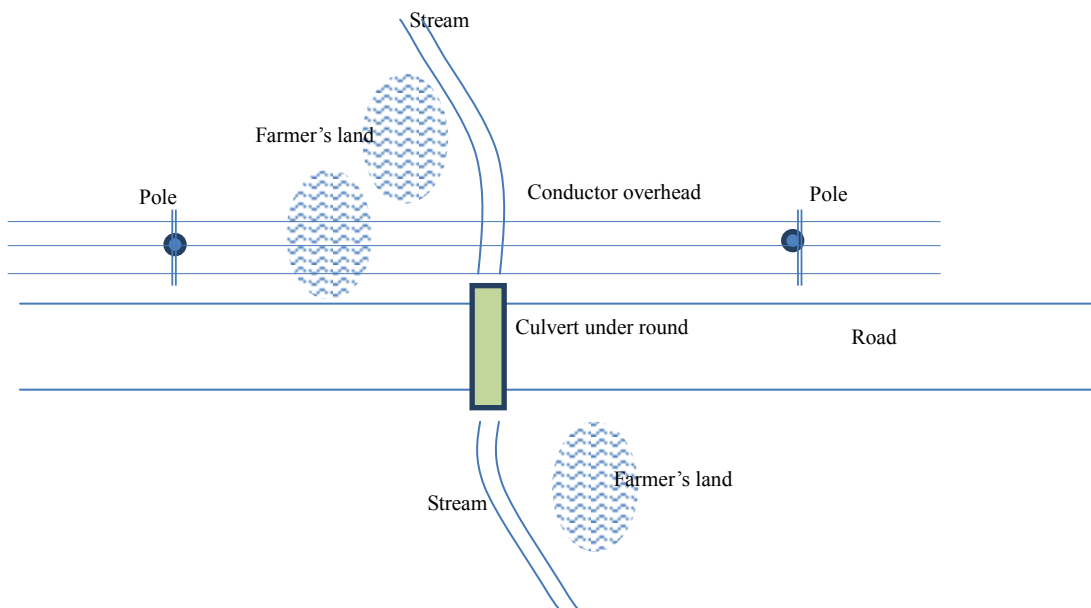
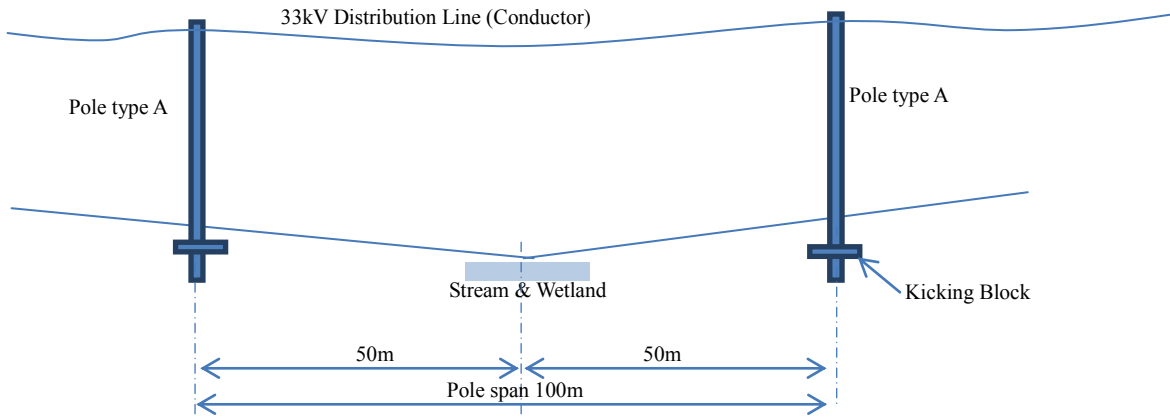
On the assumption of implementing the Project in accordance with the Japan's Grant Aid scheme, installation should be completed within a single year. In order to complete the Project within the scheduled installation period, and to effectively display the expected effects through the electrification, the installation schedule by Japanese side and Ugandan side should be coordinated, in due consideration of inland transportation routes, a transport method, period and various procedures, etc.

With a long route for 33 kV distribution lines at approximately 134.4 km, care must be taken to keep scheduling efficient. Work teams need to be formed appropriately, the construction methods used need to be well known to local contractors and engineers, and a management system must be put in place so that work progresses safely and swiftly

## **(1) Environmental and Social Considerations**

The mitigation measures for environmental issues are shown in Figure 2-2-1.1. The standard span of poles for 33 kV distribution lines is 100 m in Uganda. Based on the results of the site survey, all the seasonal streams and wetlands will be able to be gone over by locating the poles at their both side 50 m apart from them. Without applying long span pole types

The structure of poles at the both side of seasonal streams and wetlands found in the site survey will be reinforced with kicking block.



Source: JICA Study Team

**Figure 2-2-1.1 Typical Arrangement around Wetland/Stream**

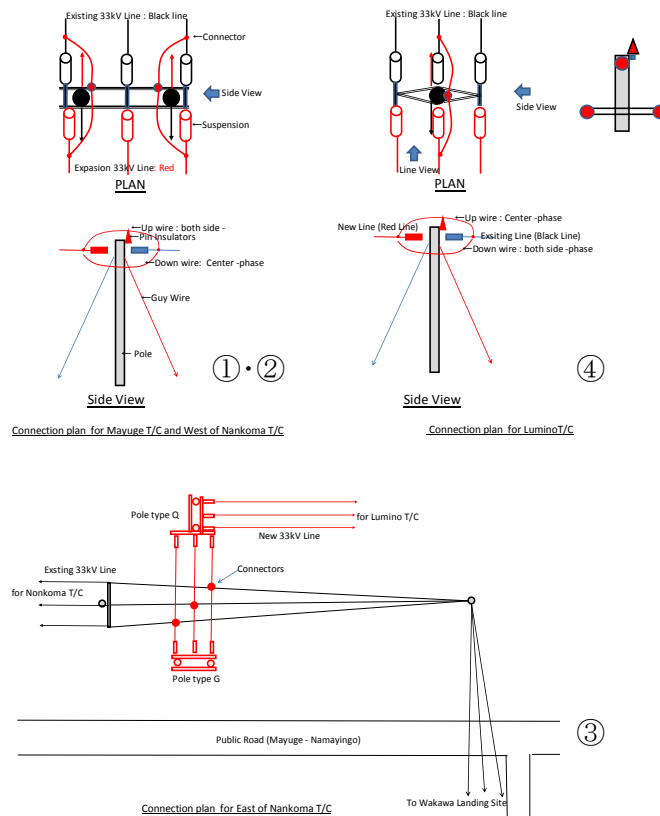
**(2) Connection Method to the Existing 33kV Distribution System**

New 33kV distribution lines shall be connected to the existing 33kV distribution lines and be extended to project sites. The connection method is shown in Table 2-2-1.2 and typical drawings are shown in Figure 2-2-1.2.

**Table 2-2-1.2 Connection Method between New 33kV Distribution Lines and Existing Distribution Lines**

| Project Site   | Connection Method   | No |
|----------------|---|----|
| Mayuge         | New line shall be extended from the existing line at dead end pole in Mayuge.                 | ①  |
| Nankoma (West) | New line shall be extended from the existing line at dead end pole in Nankoma (West).         | ②  |
| Nankoma (East) | New line shall be branched (T-off) from the existing line at dead end pole in Nankoma (East). | ③  |
| Lumino         | New line shall be extended from the existing line at dead end pole in Lumino.                 | ④  |

Source: JICA Study Team



Source: JICA Study Team

**Figure 2-2-1.2 Typical drawings of Connection method**

## 2-2-2 Basic Plan (Equipment Plan)

### 2-2-2-1 Preconditions for Planning

#### (1) Results of the Site Survey in the Previous Project Sites (JICA I and JICA II)

To design the equipment and materials for the Project appropriately and also take some measures to improve progress of customer connection after commissioning of 33 kV distribution line of the Project, progress of customer connection in the previous project sites was studied in the second field survey. The results are shown in Table 2-2-2.1.

**Table 2-2-2.1 Progress of customer connection in the previous project site**

JICA –I 2000~2001Fiscal Year

| District        | HOIMA         |        | KAYUNGA    |        | JINJA           |        | NAKASONGLA      |        | Total  |        | Progress of Connection |
|-----------------|---------------|--------|------------|--------|-----------------|--------|-----------------|--------|--------|--------|------------------------|
| Line            | Hoima–Munteme |        | Njeru–Bale |        | Buwenda–Kiyunga |        | Wabigalo–Migera |        |        |        |                        |
| 33kV D/L(km)    | 33            |        | 92         |        | 44              |        | 31              |        | 200    |        |                        |
| Connection      | Actual        | Design | Actual     | Design | Actual          | Design | Actual          | Design | Actual | Design |                        |
| Clinic          | 6             | 10     | 0          | 53     | 0               | 39     | 0               | 1      | 6      | 103    | 6%                     |
| School          | 7             | 11     | 0          | 42     | 0               | 22     | 0               | 5      | 7      | 80     | 9%                     |
| Office          | 3             | 4      | 0          | 5      | 0               | 5      | 0               | 0      | 3      | 14     | 21%                    |
| Mill            | 16            | 8      | 13         | 24     | 0               | 19     | 23              | 7      | 52     | 58     | 90%                    |
| Resid. and Shop | 139           | 570    | 2,118      | 2,100  | 602             | 1,272  | 390             | 800    | 3,249  | 4,742  | 69%                    |
| Total           | 171           | 603    | 2,131      | 2,224  | 602             | 1,357  | 413             | 813    | 3,317  | 4,997  | 66%                    |
| Total Load (kW) | –             | 439    | –          | 1,208  | –               | 1,046  | –               | 459    | –      | 3,152  |                        |

JICA–II 2007~2008 Fiscal Year

| District        | MASAKA          |        | HOIMA          |        | IGANGA           |        | BUGIRI        |        | Total  |        | Progress of Connection |
|-----------------|-----------------|--------|----------------|--------|------------------|--------|---------------|--------|--------|--------|------------------------|
| Line            | Masaka–Bukakata |        | Kagadi–Munteme |        | Nabitende–Itanda |        | Bugeso–Iwemba |        |        |        |                        |
| 33kV D/L(km)    | 53              |        | 65             |        | 29               |        | 21            |        | 168    |        |                        |
| Connection      | Actual          | Design | Actual         | Design | Actual           | Design | Actual        | Design | Actual | Design |                        |
| Clinic          | 2               | 3      | 4              | 7      | 0                | 8      | 0             | 3      | 6      | 21     | 29%                    |
| School          | 7               | 16     | 6              | 61     | 0                | 34     | 0             | 17     | 13     | 128    | 10%                    |
| Office          | 0               | 17     | 0              | 34     | 0                | 43     | 0             | 22     | 0      | 116    | 0%                     |
| Mill            | 5               | 1      | 13             | 23     | 1                | 6      | 1             | 42     | 20     | 72     | 28%                    |
| Resid. and Shop | 171             | 3,287  | 209            | 2,734  | 50               | 7,245  | 9             | 2,862  | 439    | 16,128 | 3%                     |
| Total           | 185             | 3,324  | 232            | 2,859  | 51               | 7,336  | 10            | 2,946  | 478    | 16,465 | 3%                     |
| Total Load (kW) | –               | 517    | –              | 747    | –                | 1,171  | –             | 630    | –      | 3,065  |                        |

Source: JICA Study Team

Note: All the data of JICA I is collected by Uganda Electricity Transmission Company Ltd from UMEME and Fredsult as of 22nd May, 2011.

Data of Bugiri, JICA II is collected from Iganga Office as of 16th June, 2011.

The other data of JICA II are collected by Uganda Electricity Transmission Company Ltd from UMEME and Fredsult as of 22nd May, 2011.

Installation work of Rural Electrification (JICA I) had completed in 2000, while Rural Electrification Phase II (JICA II) had completed in 2009. 11 years and 2 year passed already from completion of the Project, respectively. Table 2-2-2.1 is sorted based on terms after completion of the Project and the results is shown in Table 2-2-2.2. Connection of general households and shops has reached 66% of the projection in Basic Design Study 11 years after from the commissioning of the Project (JICA I). While, connection of general households and shops remains 3% of the projection in Basic Design Study 2 years after from the commissioning of the Project (JICA II).

In addition, Connection of mill machines has reached 90% of the projection in Basic Design Study 11 years after from the commissioning of the Project (JICA I). While, connection of mill machines has reached 28% of the projection in Basic Design Study 2 years after from the commissioning of the Project (JICA II). From the trend, it is understood that connection of mill machines progress faster than connection of general households and shops.

**Table 2-2-2.2 Outline of the survey results of the customer connection growth in the previous project sites**

| After commissioning          | 2 years after | 11 years after |
|------------------------------|---------------|----------------|
| General households and shops | 3%            | 69%            |
| Milling machines             | 28%           | 90%            |

Source: JICA Study Team

In past ten years, 1,362 km of 33 kV distribution lines have been installed in Uganda. As 368 km of 33 kV distribution lines have been installed by the past twice Japan's grant aid project, they contributed to 27 % of the achievement of provision of 1,362 km in the past 10 years. In case Approx. 135 km of 33 kV distribution lines is procured and installed by the Japan's grant aid based on this Preparatory Survey, it will reach additional 10 % of the achievement of provision of 1,362 km in the past 10 years.

**(2) Analysis of the Site Survey in the Previous Project Sites**

In the project site, milling machine owners are supplying grinding service of staple foods such as maize, cassava, rice and ground nuts to people living in each village. These people are paying milling charge (100 UGX / kg for maize) to the milling machine owners. Though milling machines driven by diesel engine are utilized for milling in areas not electrified, fuel cost and troubles in engine are burdened milling machine owners with. And these burdens are also troubling the living people. It is expected that release from these troubles by introduction of motor have caused such growth in connection of milling machine owners in Table 2-2-2.2.

Table 2-2-2.1 also shows low connections of public facilities, i.e., health centers and schools. In the site survey, the Team visited some districts offices of the previous project sites. It is confirmed that acceleration program for connection of these facilities are currently carried out with budget of each district government in addition to ordinal budget from the Ministry of Health. It will contribute to accelerate connection of public facilities in the area of JICA I and JICA II.

Table 2-2-2.2 also shows that connection of general households and shops in JICA II site is stayed in 3 % in average after 2 years from commissioning. JICA II was divided into two phase of installation terms. Phase I (Masaka and Hoima) was completed in February, 2009, while Phase II (Iganga and Bugiri) was completed in December, 2009. Connection rate in Phase I site is 7 %, while one in Phase II site is 1%. They are implying that 6 % growth of connection in Phase II site is possible in the next 10 month and connection of households and shops is improving gradually in the JICA II sites.

As the result of the socio-economic survey, it is revealed that main driving loads of demand are from general households, shops and small milling machine owners. Therefore, progress rate of

customer connection in the previous project site, calculated with applying the least square method to the data in Table 2-2-2.2, is considered in the demand forecast of the Project. The progress rate of customer connection in the previous project site, calculated with applying the least square method, is shown in Table 2-2-2.3. As shown in Table 2-2-2.3, the progress rate of connection for general customers and shops is 6 %/year. While, the progress rate of connection for milling machine owners is 10.0 %/year

**Table 2-2-2.3 Increase rate of customer connection**

| After commissioning        | Increase Rate of connection |
|----------------------------|-----------------------------|
| General customer and shops | 6.26 %/year                 |
| Milling machines           | 10.0 %/year                 |

Source: JICA Study Team

### (3) Power Demand Forecast in the Project Sites

The required capacity of transformers is decided based on the demand forecast targeting 5 years after commissioning of the Project, i.e. 2018, under assumption of Power Factor 0.85 and Load Factor 0.8. The minimum capacity is selected in consideration of the rated capacity of commercial transformers. The result is shown in Table 2-2-2.4.

Based on the result of the site survey, a number of transformers are installed within a trading center for some trading centers where the area to be supplied power to is spread topographically and important public facilities cannot be supplied by a transformer which is located at the center of the trading center. As the result with discussion with REA, the implementation agency of the Project, 9 trading centers where a number of transformers are installed within a trading center are requested.

#### **Conditions for the demand forecast**

- Increase rate of customer connection in the project site is assumed as 1.5 times of the rates in the previous project sites, which are shown in Table 2-2-2.3, in consideration of introduction of subsidy scheme for customer connection in the project site.
  - General households and shops: 9.39 %/year
  - Milling Machines: 15.0 %/year
- It was mentioned by REA that the subsidy system will be introduced only for customers who will connect to the grid within some years after commissioning of the Project. The period of subsidy system cannot be sure because the system is design henceforth. The subsidy period is assumed as 4 years in the demand forecast and coefficient 1.5 is multiplied to the customer connection growth rate during the period in the demand forecast.



- Demand of each public facility is assumed as follows based on information obtained from the socio-economic survey carried out in the site survey.
  - Primary School: 1,400 W
  - Secondary School and Tertiary School: 1,900 W
  - Health Center IV: 25,000 W
  - Health Center III and Health Center II 1,600 W
  
- In the project site, milling machine owners are supplying grinding service of staple foods such as maize, cassava, rice and ground nuts to people living in each village. Energy transformation to electricity from diesel occurred in the early stage after commissioning in the previous project site. In general, it takes a few years to occur first boost of connection of milling machines to the grid, as procurement of motor (Approx. 10kW to 25kW) require some cost to their owners. It is assumed that the first boost will occur 3 to 5 years after from the commissioning of the Project based on data in the previous project site. The time of first boost of connection of milling machines is assumed as four years after from the commissioning.

**Table 2-2-2.4 Demand Forecast for the Project**

| No. | Trading Center      | District | 2018 (kW) | Required Capacity (kVA) | Trans. Capacity (Kva) |                   |
|-----|---------------------|----------|-----------|-------------------------|-----------------------|-------------------|
| 1   | Maina               | Mayuge   | 15.01     | 22                      | 25                    |                   |
| 2   | Mpunugwe            |          | 69.20     | 101                     | 100+25                |                   |
| 3   | Namabundu           | Iganga   | 14.13     | 20                      | 25                    |                   |
| 4   | Buwongo             |          | 13.92     | 20                      | 25                    |                   |
| 5   | Makutu              |          | 38.55     | 56                      | 50+25                 |                   |
| 6   | Nondwe              | Bugiri   | 65.52     | 96                      | 100+25                |                   |
| 7   | Bwalula             |          | 38.89     | 57                      | 50+25                 |                   |
| 8   | Matovu              |          | 25.19     | 37                      | 50                    |                   |
| 9   | Nabigingo           |          | 26.07     | 38                      | 50                    |                   |
| 10  | Irimbi              |          | 8.75      | 12                      | 25                    |                   |
| 11  | Muterere            |          | 57.03     | 83                      | 100+25                |                   |
| 12  | Mayuge-Bukholi      |          | 149.91    | 220                     | 200+25                |                   |
| 13  | Budde               |          | 11.83     | 17                      | 25                    |                   |
| 14  | Nsango              |          | Namayingo | 46.08                   | 67                    | 100               |
| 15  | Namayingo           |          |           | 360.94                  | 530                   | 100+200+200+50+50 |
| 16  | Lwangosia           | 16.16    |           | 23                      | 25                    |                   |
| 17  | Nairobi             | 8.64     |           | 12                      | 25                    |                   |
| 18  | Lutolo              | 35.54    |           | 52                      | 100                   |                   |
| 19  | Kilindini           | 7.76     |           | 11                      | 25                    |                   |
| 20  | Lugala              | 90.12    |           | 132                     | 200                   |                   |
| 21  | Busuma              | 12.60    |           | 18                      | 25                    |                   |
| 22  | Busiro              | 14.24    |           | 20                      | 25                    |                   |
| 23  | Busiro Landing Site | 22.66    |           | 33                      | 50                    |                   |
| 24  | Farm                | 25.30    |           | 37                      | 50                    |                   |
| 25  | Nabusera            | 12.60    |           | 18                      | 25                    |                   |
| 26  | Hatumba-Banja       | 21.13    |           | 31                      | 50                    |                   |
| 27  | Mutumba             | 27.88    | 41        | 50                      |                       |                   |

| No. | Trading Center | District | 2018 (kW) | Required Capacity (kVA) | Trans. Capacity (Kva) |
|-----|----------------|----------|-----------|-------------------------|-----------------------|
| 28  | Butebey A      |          | 8.64      | 12                      | 25                    |
| 29  | Mulombi B      |          | 12.71     | 18                      | 25                    |
| 30  | Buchimo        |          | 10.45     | 15                      | 25                    |
| 31  | Bumeru A       |          | 12.37     | 18                      | 25                    |
| 32  | Bumeru B       |          | 12.60     | 18                      | 25                    |
| 33  | Lunyo          | Busia    | 35.26     | 51                      | 100                   |
| 34  | Buwanga        |          | 26.02     | 38                      | 25+25                 |
| 35  | Hukemo         |          | 22.66     | 33                      | 50                    |
| 36  | Mundindi       |          | 27.50     | 40                      | 25+25                 |
| 37  | Lumuli         |          | 9.30      | 13                      | 25                    |
| 38  | Mwembe-Tayari  |          | 9.30      | 13                      | 25                    |
|     | 合計             | -        | 1,422.46  | -                       | -                     |

Source: JICA Study Team

Note: “Required capacity” is calculated in consideration of Power Factor 0.85 and Demand Factor 0.8.  
“Transformer capacity” is the minimum rated capacity to meet “Required Capacity”.

## 2-2-2-2 Design Conditions

The design conditions for the Project are described in this section.

### (1) Climatic Conditions

Natural conditions which need considerations for the equipment and facilities design are shown in Table 2-2-2.5.

**Table 2-2-2.5 Climatic Conditions for the Equipment and Facilities Design**

| Item                  |         | The Project Area<br>Mayuge, Iganga, Bugiri, Namayingo and Busia Districts |
|-----------------------|---------|---|
| Altitude              |         | Less than 1,200 m   |
| Ambient Temperature   | Maximum | 35 °C   |
|                       | Minimum | 15 °C   |
|                       | Mean    | 25 °C   |
| Maximum Humidity      |         | 85 %  |
| Maximum Wind Velocity |         | 20 m/sec.   |
| Rainfall              |         | 2,200 mm/year   |
| Seismic Force         |         | Horizontal 0.1 G  |

Source: UGANDA DISTRICTS Information Handbook (2007-2008)

### (2) Electric System (Voltage and Wiring System)

Voltage, wiring, frequency and earthing system applied to the 33kV distribution line and distribution transformer LV side shall be the same as those of the existing facilities. The summary of the electrical system concerned with the Project is shown in Table 2-2-2.6.

**Table 2-2-2.6 Summary of Electrical System**

|  |  |   |
|--|--|---|
| Nominal Voltage                            | 33 kV  | 415-240 V   |
| Maximum Voltage                            | 36 kV  | 460 V   |
| Wiring Method                              | 3 phase, 3 wires   | 3 phase, 4 wires  |
| Frequency                                  | 50 Hz  | 50 Hz   |
| Earthing System                            | Effective Earth  | Effective Earth   |
| Short-circuit Current                      | Less than 25 kA (1 sec.)<br>at 33 kV switchgear in<br>substation | Less than 10 kA (1sec.)<br>at distribution<br>transformer LV side |
| Lightning Impulse Withstand Voltage (LIWV) | 170 kV   | -   |
| Power Frequency Withstand Voltage          | 70 kV  | -   |
| Creepage distance                          | 16 mm / kV   | -   |
| Overhead Grounding Wire                    | Not Required   | -   |

Source: JICA Study Team

**(3) Other Electrical Systems**

① Color coding

Applicable color coding shall be applied to IEC standard that is red, yellow, blue and black

② Safety factor

The following safety factor shall be applied to design and installation works.

|                           |     |
|---------------------------|-----|
| Pole and foundation:      | 2.0 |
| Conductor and cross-arms: | 2.5 |
| Insulators:               | 2.0 |

③ Clearance of conductors

The Clearance of 33kV overhead line shall be as follows.

- (a) Minimum Clearance
  - a) Phase to phase: 430 mm
  - b) Phase to ground: 380 mm
- (b) Minimum Height from Ground Level
  - a) Road Crossing: 7.5 m
  - b) Roadside: 6.5 m

④ Span length of electrical pole (Single pole and double poles): Maximum 100m

⑤ Location of section pole: Every 8 spans

⑥ Location of Load-break Switch

Load-break Switch shall be installed at connection point with existing 33kV distribution line, major branching point and at intervals of about 13km for inspection and maintenance

of the 33kV distribution line.

⑦ Location of Auto Re-closer

Auto Re-closer shall be installed at connection point with existing 33kV distribution line.

⑧ Metering Unit

Metering Unit shall be installed at connection point with existing 33kV distribution line.

**(4) Applicable Codes/Standards**

The following Japanese and International standards/codes shall be generally applied to the Project.

① International Electrotechnical Commission (IEC)

② British Standard (BS)

③ International Standardization Organization (ISO)

④ Japanese Industrial Standard (JIS)

⑤ Japanese Electrotechnical Commission (JEC)

⑥ The Standard of Japan Electrical Manufacturer's Association (JEM)

⑦ Japan Electric Association Code (JEAC)

⑧ Japan Cable Maker's Association Standard (JCS)

⑨ Technical standards on electrical equipment

**2-2-2-3 Outline of the Basic Plan**

**(1) Basic Plan**

The basic plan of components is shown in Table 2-2-2.7. The following components are designed based on the above mentioned design conditions.

**Table 2-2-2.7 Basic Plan of Components**

| <b>Basic plan of Components</b>     |   |
|-------------------------------------|---|
| <b>Procurement and Installation</b> | <p>Procurement and installation of the following equipment and materials for 33 kV distribution line</p> <p>(1) 33 kV Distribution Line (Total Length: Approx. 134.4 km)</p> <ul style="list-style-type: none"> <li>➤ Trunk line from Mayuge Trading Center (T/C) to Nankoma T/C through Mpungwe T/C      Approx. 21.5 km</li> <li>➤ Branch line from Mpungwe T/C to Makutu T/C      Approx. 10.2 km</li> <li>➤ Trunk line from Nankoma T/C to Lumino T/C through Namayingo T/C and Hukemo T/C      Approx. 37.5 km</li> <li>➤ Branch line from Namayingo T/C to Bumeru A T/C and Bumeru B T/C      Approx. 29.9 km</li> <li>➤ Branch line from Namayingo T/C to Busiro Landing Site and Lugala      Approx. 24.8 km</li> <li>➤ Branch Line from Fukemo T/C to Munjinji T/C and Muwembe-Tayori T/C      Approx. 10.5 km</li> </ul> <p>(2) 33 / 0.415-0.240 kV Distribution transformer (Total Number: 50 units)</p> <ul style="list-style-type: none"> <li>➤ 200 kVA × 4 units, 100 kVA × 7 units, 50 kVA × 11 units, 25 kVA × 28 units</li> </ul> <p>(3) Metering Unit (Total: 4 units)</p> <ul style="list-style-type: none"> <li>➤ Connection point at Mayuge: 1 unit</li> <li>➤ Connection point at Nankoma: 2 units</li> <li>➤ Connection point at Lumino: 1 unit</li> </ul> <p>(4) Auto Re-closer (Total: 4 units)</p> <ul style="list-style-type: none"> <li>➤ Connection point at Mayuge: 1 unit</li> <li>➤ Connection point at Nankoma: 2 units</li> <li>➤ Connection point at Lumino: 1 unit</li> </ul> <p>(5) Load-break Switch (Total: 14 units)</p> <ul style="list-style-type: none"> <li>➤ Connection point at Mayuge: 1 unit, Connection point at Nankoma: 2 units, Connection point at Lumino: 1 unit and Major branch point: 4 units and Intervals of 13 km: 6 units</li> </ul> |
| <b>Procurement</b>                  | <p>Spare parts and maintenance tools for 33 kV distribution line</p> <p>(1) Emergency Spare parts</p> <ul style="list-style-type: none"> <li>➤ Lightning Arrester      3 sets</li> <li>➤ Fused Cut-out Switch      3 sets</li> <li>➤ Distribution Transformer      200 kVA, 100kVA, 50 kVA, 25 kVA One for each</li> </ul> <p>(2) Replacement Spare Parts (1 lot)</p> <ul style="list-style-type: none"> <li>➤ Fuse element for cut-out switch and contacts for load-break switch</li> </ul> <p>(3) Maintenance Tools (1 lot)</p> <ul style="list-style-type: none"> <li>➤ Digital-type multi meter, Clip-on meter, Phase rotation meter, etc.</li> </ul>   |

Source: JICA Study Team

**(2) 33 kV Distribution Route Plan**

Design for this Project is based on the following basic policy and equipment outlines with regards to 33 kV distribution line equipment to be procured and installed by Japan.

**1) Basic Policy**

The 33 kV distribution facilities are designed based on Uganda standards. To the extent possible, specifications for equipment procured by Japan are made compatible with existing

equipment owned and used in Uganda to allow for centralized management.

## 2) Outline of 33 kV Distribution Route Plan

### ① Route Plan

The distribution route was decided using a route map made based on previously taken satellite imagery. Using GPS, we explored the locations together with Ugandan engineers to check for obstacles, landmarks, local natural conditions, environmental and social considerations, and other peculiarities along the route.

The basic routes are given in Basic Design Drawings R-01 and RD-01 to RD-38.

### ② Pole Design

We took gauge of the power lines, line tensile load, pole strength, local natural conditions, social and environmental conditions into account for deciding the span between utility poles. Designs use REA standard spans.

- Standard span (one pole or two pole configurations): 100 m maximum
- Across wetland sections: 100 m (50 m to either side of marsh center)
- Standard interval arrangement for section poles: Every 8 spans

### ③ Type of Overhead Distribution Conductor

REA standards for All Aluminum Alloy Conductor (AAAC) will be adopted for the specifications of conductors for 33kV overhead distribution lines and the size will be as follows.

- 33 kV distribution lines: AAAC 100 mm<sup>2</sup>

Procurement plan quantities are calculated by taking the plane distance (design quantity) measured in the drawing and adding 3% for dip and 5% as a supplemental quantity. Planned quantities for installation are calculated by adding 3% dip to the design quantity. Given this, quantities procured and installed for overhead distribution lines in this Project are as shown in Table 2-2-2.8 below:

**Table 2-2-2.8 Quantity of Conductors for 33 kV Distribution Lines**

| Item  | Quantity (km) |
|---|---------------|
| (1) Plane distance  | 134.4         |
| (2) Design quantity (3-phase, (1) x 3)                            | 403.2         |
| (3) Planned quantity ((2) x 1.05x1.03 and 6 kW for pole assembly) | 442.0         |
| (4) Installed quantity ((2) x 1.03 and 6 kW for pole assembly)    | 421.0         |

Notes: 1. (3) and (4) above include distribution lines shown in installation drawings.  
2. Standard 2 km line drums are used.

④ Type and Shape of Pole, Insulator and Cross Arms

Uganda standard wooden poles will be used for utility poles. Standard 33 kV distribution line poles are 12 m, but 2 poles of 12 m and 11 m are used for T-off poles (J-type) and transformer poles (L-type).

Surface leakage distance for pin and suspended insulation used on 33 kV distribution lines is the Uganda standard 16 mm/kV. Insulation mounting cross arms are hot-dip galvanized steel.

⑤ 33 kV/415-240 V Distribution Transformer

a) Capacity and Number of Units

Distribution transformers will be installed in order to degrade the voltage from 33kV distribution lines to low distribution voltage (415/240V) for each consumer at the project sites. In order that peak power demand for the target year will be met, the capacity of distribution transformers will be selected among the REA standard transformer capacity and the optimal number of units will be decided based on the particular condition at the project sites. In addition, good quality power should be provided by installing distribution transformers as close as possible to load centers in areas with high load density, especially for public facilities such as hospitals where large power demand is expected.

In order to ensure that the voltage fluctuation of distribution transformers procured under the Project remains within a range of  $\pm 7.5\%$ , distribution transformers will have  $\pm 2.5\%$ ,  $\pm 5\%$  tap (no-load tap changer on the high-voltage side). In order to ensure efficiency and economy of distribution lines, the low-voltage side will adopt a three-phase, four-wire system.

The capacity and quantity of distribution transformers at the project sites are shown in Table 2-2-2.9. Accordingly, the total number of units of distribution transformers to be procured under the Project will be 50.

b) Installation Method

All distribution transformers will be installed using a pole-mounted configuration. The REA standard pole dressing drawings will be utilized.

**Table 2-2-2.9 Quantity and Capacity of Distribution Transformers**

|    | Trading Center      | Quantities of Transformers [unit] |        |         |         | Total | Additional Transformer            |
|----|---------------------|-----------------------------------|--------|---------|---------|-------|-----------------------------------|
|    |                     | 25 kVA                            | 50 kVA | 100 kVA | 200 kVA |       |                                   |
| 1  | Maina               | 1                                 |        |         |         | 1     |                                   |
| 2  | Mpunugwe            | 1                                 |        | 1       |         | 2     | 25 kVA for secondary school       |
| 3  | Namabundu           | 1                                 |        |         |         | 1     |                                   |
| 4  | Buwongo             | 1                                 |        |         |         | 1     |                                   |
| 5  | Makutu              | 1                                 | 1      |         |         | 2     | 25 kVA for schools                |
| 6  | Nondwe              | 1                                 |        | 1       |         | 2     | 25 kVA for small town nearby      |
| 7  | Bwalula             | 1                                 | 1      |         |         | 2     | 25 kVA for primary school         |
| 8  | Matovu              |                                   | 1      |         |         | 1     |                                   |
| 9  | Nabigingo           |                                   | 1      |         |         | 1     |                                   |
| 10 | Irimbi              | 1                                 |        |         |         | 1     |                                   |
| 11 | Muterere            | 1                                 |        | 1       |         | 2     | 25 kVA for schools                |
| 12 | Mayuge-Bukholi      | 1                                 |        |         | 1       | 2     | 25 kVA for health center          |
| 13 | Budde               | 1                                 |        |         |         | 1     |                                   |
| 14 | Nsango              |                                   |        | 1       |         | 1     |                                   |
| 15 | Namayingo           |                                   | 2      | 1       | 2       | 5     | * District capital of Namayingo   |
| 16 | Lwangosia           | 1                                 |        |         |         | 1     |                                   |
| 17 | Nairobi             | 1                                 |        |         |         | 1     |                                   |
| 18 | Lutolo              |                                   |        | 1       |         | 1     |                                   |
| 19 | Kilindini           | 1                                 |        |         |         | 1     |                                   |
| 20 | Lugala              |                                   |        |         | 1       | 1     |                                   |
| 21 | Busuma              | 1                                 |        |         |         | 1     |                                   |
| 22 | Busiro              | 1                                 |        |         |         | 1     |                                   |
| 23 | Busiro Landing site |                                   | 1      |         |         | 1     |                                   |
| 24 | Farm                |                                   | 1      |         |         | 1     |                                   |
| 25 | Nabusera            | 1                                 |        |         |         | 1     |                                   |
| 26 | Hatumba-Banja       |                                   | 1      |         |         | 1     |                                   |
| 27 | Mutumba             |                                   | 1      |         |         | 1     |                                   |
| 28 | Butebey-A           | 1                                 |        |         |         | 1     |                                   |
| 29 | Mulombi-B           | 1                                 |        |         |         | 1     |                                   |
| 30 | Buchimo             | 1                                 |        |         |         | 1     |                                   |
| 31 | Bumeru-A            | 1                                 |        |         |         | 1     |                                   |
| 32 | Bumeru-B            | 1                                 |        |         |         | 1     |                                   |
| 33 | Lunyo               |                                   |        | 1       |         | 1     |                                   |
| 34 | Buwanga             | 2                                 |        |         |         | 2     | 25 kVA for Sub-county headquarter |
| 35 | Hukemo              |                                   | 1      |         |         | 1     |                                   |
| 36 | Mundindi            | 2                                 |        |         |         | 2     | 25 kVA for primary school         |
| 37 | Lumuli              | 1                                 |        |         |         | 1     |                                   |
| 38 | Mwembe-Tayari       | 1                                 |        |         |         | 1     |                                   |
|    | Total               | 28                                | 11     | 7       | 4       | 50    |                                   |

Source: JICA Study Team

Note: \* The District capital of Namayingo District expands widely. Based on the demand forecast for the project, 5 transformers of total capacity of 600 kVA are located.

#### ⑥ Installation of Load-break Switches

We will install load-break switches where load current can be opened for maintenance and inspection of Project 33 kV distribution lines. These switches will be installed at connection points with existing 33 kV distribution lines, major branch points, and at appropriate intervals on longer lines (every 8 mi., or about 13 km, based on REA



regulations).

⑦ Installation of Fused Cutout Switches

Fused cutout switches will be installed on the high-voltage side of distribution transformers (33kV side) to be procured at the project sites, for the purpose of protecting the transformers from overload and short circuit faults, and for opening circuits for line maintenance.

⑧ Installation of Lightning Arresters

Lightning arresters will be installed on the 33 kV side of lines to protect distribution transformers, load-break switches and metering impedance transformers (for electricity meter transactions).

**(3) Major Specifications of Equipment and Materials**

Major equipment and materials used in the project are shown below in Table 2-2-2.10.

**Table 2-2-2.10 Specifications of Major Equipment and Materials**

| Equipment   | Specifications  |
|---|---|
| <b>(1) Distribution Transformers</b><br>1) Applicable Standard<br>2) Type<br>3) Capacity<br>4) Nominal Voltage<br>5) Impedance Voltage<br>6) Tapping Voltage (%) on HV Side<br>7) Phase<br>8) Frequency<br>9) LIWV<br>10) Power Frequency Withstand Voltage<br>11) Vector Symbol<br>12) Accessories<br>13) Others | IEC, JIS, JEC, JEM or Equivalent<br>Oil immersed, ONAN, Hermetically-sealed, Outdoor, Pole-mount type<br>25 kVA, 50 kVA, 100 kVA, 200 kVA<br>33,000/433-250 V<br>4-5 %<br>±2.5 %, ±5.0 % (no voltage tap changer)<br>HV:3 phases, 3-wire, LV :3 phase, 4-wire<br>50 Hz<br>170 kV<br>70 kV<br>Dyn11<br>-Name Plate<br>-Oil level indicator and oil temperature indicators<br>Painting of voltage and capacity on transformer tank<br>(ex. 33 kV/433-250 V 200 kVA) |
| <b>(2) Load-break Switch</b><br>1) Applicable Standard<br>2) Type<br>3) Rated Voltage<br>4) Rated Nominal Current<br>5) Rated Frequency<br>6) LIWV<br>7) Power Frequency Withstand Voltage<br>8) Rated Breaking Capacity<br>9) Rated Short-Time Current<br>10) Creepage Distance<br>11) Accessories               | IEC, JIS, JEC, JEM or Equivalent<br>3 phase Manual Operation at the same time, Outdoor, Pole-mount type<br>33 kV<br>630 A<br>50 Hz<br>170 kV<br>70 kV<br>630 A (at load current)<br>16 kA (1 sec.)<br>min. 825 mm<br>-Name Plate<br>-Operation mechanism<br>-Hot-dipped galvanized steel support with fixing material   |

| Equipment  | Specifications  |
|--|---|
| <b>(3) Fused Cutout Switches</b><br>1) Applicable Standard<br>2) Type<br>3) Rated Voltage<br>4) Rated Current of Unit<br>5) Rated Frequency<br>6) LIWV<br>7) Power Frequency Withstand Voltage<br>8) Rated Interrupting Current<br>9) Fuse<br>10) Operation<br>11) Accessories   | IEC, JIS, JEC, JEM or Equivalent<br>Outdoor Type<br>33 kV<br>100 A<br>50 Hz<br>170 kV<br>70 kV<br>8 kA<br>3 A to 25 A (depending on the capacity of distribution transformer)<br>To be operated by rod from the ground<br>-Operation rod(Length:5 m)<br>-Hot-dipped galvanized steel support with fixing material   |
| <b>(4) Lightning Arrester</b><br>1) Applicable Standard<br>2) Type<br>3) Nominal System Voltage<br>4) Rated Voltage<br>5) Nominal Discharge Current<br>6) Accessories  | IEC, JIS, JEC, JEM or Equivalent<br>Outdoor, Zinc-oxide, Gapless Type<br>33 kV<br>Minimum 33 kV (rms)<br>5 kA (8/20 $\mu$ s)<br>Hot-dipped galvanized steel support with fixing material  |
| <b>(5) Metering Unit</b><br>1) Applicable Standard<br>2) CT/VT unit of MU <ul style="list-style-type: none"> <li>• Type</li> <li>• Rated Ampere</li> <li>• Short-time current</li> <li>• VT</li> <li>• CT</li> <li>• SA</li> </ul> 3) Electric meter of MU <ul style="list-style-type: none"> <li>• Type</li> <li>• Function</li> </ul> 4) Control Cable<br>5) Outdoor Metering Kiosk<br>6) Terminal Blocks<br>7) Cable Ties | Consisting of CT/VT unit and bulk metering unit<br>IEC or Equivalent<br>33 kV , Outdoor oil filled, Pole mounted<br>200 or 100 Amp<br>18 kA (1 sec.)<br>33,000/110 V, 50 VA, Accuracy class: 0.2<br>200-100-50/1 A , 10 VA, 2xCT, Accuracy class: 0.2<br>Surge arresters mounted (3 pcs)<br>2 units (Main and Checking)<br>3- Phase, 3-Wire, 50 Hz, Voltage 110 V, Current: 1 A, Class 0.2<br>Measurement : kWh (Import/Export), kvarh, kVAh<br>Load Profiling: 450 days, 1 channel, 30 min., 3-Phase<br>Min. 2.5 mm <sup>2</sup> , 7 cores, copper conductor, 10 m<br>Waterproof type, with pad-lock (spare key: 3 pcs)<br>13 way<br>1 lot |
| <b>(6) Auto Re-closer</b><br>1) Applicable Standard<br>2) Type<br>3) Continuous Current Capacity<br>4) Rated Short-Time Current<br>5) Control Cubicle<br>6) Accessories  | IEC or Equivalent<br>33 kV, Pole mounted, outdoor gas insulated auto circuit Re-closer<br>630 A<br>16 kA (1sec.)<br>Simple programming is provided from the control panel.<br>Closing and tripping is from high quality and long life batteries which charge capacitors.<br>Control cubicle is stainless steel enclosure.<br>- Voltage transformers (33 kV/110 V, Accuracy class 1.0, 50 VA)<br>- Control cables<br>- Fixing materials for electrical pole<br>- Relay software<br>- Technical and installation manual   |
| <b>(7) Conductor for 33kV Distribution Line</b><br>1) Applicable Standard<br>2) Type<br>3) Size<br>4) Length per a Drum  | IEC or Equivalent<br>All Aluminum Alloy Conductor (AAAC)<br>100 mm <sup>2</sup><br>2,000 m  |

| Equipment   | Specifications   |
|---|--|
| <p><b>(8) Wooden Pole with Pole Cap</b></p> <ol style="list-style-type: none"> <li>1) Material</li> <li>2) Shape</li> <li>3) Length</li> <li>4) Diameter of pole (at top)</li> <li>5) Type <ul style="list-style-type: none"> <li>• A type: Intermediate Pole</li> <li>• B type: Light Angle Pole (Vertical)</li> <li>• C type: Heavy Angle Pole (Vertical)</li> <li>• D type: Heavy Angle Pole (Vertical)</li> <li>• E type: Section Pole (Horizontal)</li> <li>• G type: Terminal Pole</li> <li>• H type: Load-break Switch Pole</li> <li>• J type: T-off Pole</li> <li>• K type: Transformer Pole (on Line)</li> <li>• L type: Transformer Pole (Terminal)</li> <li>• M type: Bulk Metering Unit Pole</li> <li>• Q type: Heavy Angle Pole (Horizontal)</li> <li>• R type: Auto Reclosure Pole</li> <li>• W type: Intermediate Pole (flood area)</li> </ul> </li> <li>6) Accessories</li> </ol> | <p>Creosoted wooden pole</p> <p>Round pole</p> <p>11 m /12 m</p> <p>11 m pole: 190-210 mm</p> <p>12m pole: 210-235 mm</p> <p>One pole, Angle: 0 to 5 deg.</p> <p>One pole, Angle: 5 to 30 deg.</p> <p>Two poles, Angle: 30 to 50 deg.</p> <p>Two poles, Angle: 50 to 90 deg.</p> <p>Two poles, Interval: 8 spans</p> <p>Two poles</p> <p>Two poles</p> <p>Two poles</p> <p>Two poles</p> <p>Two poles</p> <p>Two poles</p> <p>Two poles</p> <p>Two poles, Angle: 50 to 90 deg.</p> <p>One pole</p> <p>Two poles, Angle: 0 to 5 deg.</p> <p>Pole cap, nails (2 pcs/cap)</p> |
| <p><b>(9) Insulators</b></p> <ol style="list-style-type: none"> <li>1) Pin Insulator <ul style="list-style-type: none"> <li>• Applicable standard</li> <li>• Type</li> <li>• Material</li> <li>• Color of porcelain</li> <li>• Nominal Voltage</li> <li>• LIWV</li> <li>• Power Frequency Withstand Voltage</li> <li>• Creepage distance</li> </ul> </li> <li>2) Disc Insulator <ul style="list-style-type: none"> <li>• Applicable standard</li> <li>• Type</li> <li>• Material</li> <li>• Color of porcelain</li> <li>• Diameter of insulator</li> <li>• Nominal Voltage</li> <li>• LIWV</li> <li>• Power Frequency Withstand Voltage</li> <li>• Creepage distance</li> <li>• Number of insulator per string</li> </ul> </li> </ol>   | <p>IEC or Equivalent</p> <p>Solid core</p> <p>Porcelain</p> <p>Blown</p> <p>33 kV</p> <p>170 kV</p> <p>70 kV</p> <p>Min. 576mm</p> <p>IEC or Equivalent</p> <p>Disc type, Ball and socket type</p> <p>Porcelain</p> <p>Brown</p> <p>254 mm</p> <p>33 kV</p> <p>170 kV</p> <p>70 kV</p> <p>Min. 300 mm per one insulator</p> <p>3 pieces</p>  |
| <p><b>(10) Pole Fitting Materials</b></p> <ol style="list-style-type: none"> <li>1) Cross arm <ul style="list-style-type: none"> <li>• Materials</li> <li>• Coating</li> <li>• Section shape</li> </ul> </li> <li>2) Stay wire <ul style="list-style-type: none"> <li>• Materials</li> <li>• Size</li> </ul> </li> <li>3) Stay insulator <ul style="list-style-type: none"> <li>• Line voltage</li> <li>• Materials</li> <li>• Color</li> </ul> </li> <li>4) Stay anchor <ul style="list-style-type: none"> <li>• Materials</li> <li>• Tension load</li> </ul> </li> </ol>  | <p>Mild steel</p> <p>Hot-dipped galvanized</p> <p>L and C shape</p> <p>Zinc-coated steel wire</p> <p>45 mm<sup>2</sup> (2.9mm × 7) or equivalent</p> <p>33 kV</p> <p>Porcelaine</p> <p>Brown</p> <p>Mild steel</p> <p>6 ton</p>  |

| Equipment  | Specifications  |
|--|---|
| 5) Turnbuckle <ul style="list-style-type: none"> <li>• Materials</li> <li>• Coating</li> </ul> 6) Ivy protection <ul style="list-style-type: none"> <li>• Materials</li> </ul> 7) Nail           8) Staple           9) Plate           10) Anti climbing barbed wire           11) Earthing materials <ul style="list-style-type: none"> <li>• Earthing wire</li> <li>• Earthing rod</li> </ul> | Mild steel<br>Hot-dipped galvanized<br><br>Poly-vinyl chloride (PVC)<br><br>Low carbon steel<br>Low carbon steel<br>Japan's flag plate, Number plate and Danger plate<br>Low carbon steel<br><br>Bare Copper wire or equivalent, 38mm <sup>2</sup> (For distribution transformer),<br>14 mm <sup>2</sup> (For equipment except distribution transformer)<br>Copper clad steel rod with lead terminal, D 14 mm × L 1,500 mm or<br>equivalent |
| <b>(11) Straight joint and connector for 33 kV overhead distribution line</b> <ol style="list-style-type: none"> <li>1) Straight joint             <ul style="list-style-type: none"> <li>• Type</li> <li>• Materials</li> </ul> </li> <li>2) Connector             <ul style="list-style-type: none"> <li>• Type</li> <li>• Materials</li> </ul> </li> </ol>                                    | Compression type<br>Aluminum alloy casting<br><br>Bolt type<br>Aluminum alloy casting   |

Source: JICA Study Team

### 2-2-3 Outline Design Drawing

A list of Outline Design Drawings is shown below.

**Table 2-2-3.1 List of Outline Design Drawings**

| Categories   | Drawing No.    | Drawing Title   |
|--|----------------|---|
| 33kV Distribution Line Single Line Diagram of the Project            | UG3-E01        | 33kV Distribution Network Diagram on the Project                      |
| 33kV Distribution Line Route Map of the Project                      | R-01           | 33kV Distribution Line Route Map of the Project                       |
|  | RD-01~RD-38    | Detail Route Map of the Project                                       |
| 33kV Distribution Line Pole Assembly Drawings for Distribution Lines | T-01           | Pole Type A Intermediate Pole (Line Angle: 0 – 5 degree)              |
|  | T-02           | Pole Type B Light Angle Pole (Line Angle: 5 – 30 degree)              |
|  | T-03           | Pole Type C Heavy Angle Pole (Line Angle: 30 – 50 degree)             |
|  | T-04           | Pole Type D Heavy Angle Pole (Line Angle: 50 – 90 degree)             |
|  | T-05           | Pole Type E Section Pole (Horizontal Arrangement)                     |
|  | T-07           | Pole Type G Terminal Pole   |
|  | T-08           | Pole Type H Load-break Switch (LBS) Pole                              |
|  | T-09           | Pole Type J T-off Pole (Branch)                                       |
|  | T-10           | Pole Type L Transformer Pole (Line end)                               |
|  | T-11           | Pole Type K Transformer Pole (on Line)                                |
|  | T-12           | Pole Type M Bulk Metering Unit Pole                                   |
|  | T-13           | Pole Type N Connection Plan to the existing line (extension type)     |
|  | T-14           | Pole Type Q Sharp Angle Pole (Line Angle: 50 -90 degree) (Horizontal) |
|  | T-15           | Pole Type R Auto Re-closer Pole                                       |
|  | T-16           | Pole Type W Intermediate Pole (area to be flooded)                    |
|  | Other Drawings | A-1   |
| A-2  |                | Typical drawings of Connection method                                 |

## **2-2-4 Implementation Plan**

### **2-2-4-1 Implementation Policy**

As this project will be implemented in line with the Japan grant aid cooperative framework, it will be approved by the Government of Japanese and commence after an Exchange of Notes (E/N) between the two countries and a Grant Agreement (G/A) between JICA and Uganda are exchanged. Basic policy and special considerations needed if the Project is implemented are given below.

#### **(1) Project Implementing Body**

The Rural Electrification Agency (REA) is the responsible project implementing body for Uganda. The implementing department within REA will execute the Project, and is scheduled to outsource operation and maintenance (O&M) after the facilities are completed to private distribution companies, as with other distribution regions. To keep the Project moving smoothly, REA must appoint a project representative and keep close contact with Japanese consultants and contractors.

The appointed REA project representative must explain Project details sufficiently to REA project staff, related district and local organizations, and local residents so that they will cooperate with Project implementation.

#### **(2) Consultant**

Japanese consultant will conclude a consulting services agreement with REA and will provide a detail design and work supervision concerning the Project in order to implement procurement and installation of the equipment under the Project. The consultant will also prepare tender documents and open tender(s) for REA, the implementing agency of Project.

#### **(3) Contractor**

In accordance with Japan's Grant Aid scheme, equipment supplier(s) of a Japanese juridical person selected by the Ugandan side will carry out the procurement of equipment and materials and installation work through competitive tendering. As it is deemed necessary that the contract to provide after-sale service including continuous supply of spare parts and an appropriate measure to breakdowns even after completing the Project, the equipment supplier should provide adequate liaison system after handing over the equipment and materials.

#### **(4) Necessity to Dispatch Japanese Engineers**

The Project involves installation of 33 kV distribution lines spanning approximately 134.4 km,

requiring work to be completed by multiple construction teams. As such, construction must be coordinated. With the majority of the work being done concurrently, it is essential that foremen be dispatched from Japan to keep management and site guidance for the whole works consistent in terms of scheduling, quality, finished work quality and safety management.

## **2-2-4-2 Implementation Conditions**

### **(1) Conditions of the Construction Industry in Uganda**

There are foreign-funded local general construction and electrical contractors in Kampala which can accept orders for laborers, transportation vehicles and construction equipment within Uganda, as well as installation of distribution transformers and distribution lines for the Project. However, with this being a Japanese grant aid project, the delivery schedule must be followed strictly. In light of the quality of wooden poles and other materials that can be procured locally, dispatching Japanese engineers is essential in terms of schedule management, quality control and safety management.

On the other hand, since there is little installation work for power distribution facilities, and engineers with advanced skills are required for adjustment and testing, etc. at the time of installing the equipment and after installation, it will be difficult to effectively utilize local companies other than laborers. Accordingly, Japanese equipment suppliers should dispatch engineers from Japan and procure workers and machinery from local companies for installation work under the Project. In addition, Japanese engineers should provide on-the-job training (OJT) to Ugandan engineers during the relevant installation period in order to promote technical transfer.

### **(2) Use of Local Materials**

Uganda wood and other materials must be regulated in terms of quality and delivery schedules for use as distribution line equipment, but can be procured locally and have been used in previous projects. As such, equipment than can be procured locally is to be used to the extent possible when formulating the construction plan. That being said, we will rely on imports for the principle distribution equipment and materials needed for the Project. Local Ugandan materials are not usable, so materials and equipment will be procured from Japan or a third country.

### **(3) Safety and Security Measures**

While we have asked for project regions with few security problems, sufficient care must be taken to prevent equipment theft and ensure the safety of construction staff. Necessary steps

must be taken in line with Ugandan safety measures, but on the Japan side, we will consider installing a temporary fence around equipment storehouses, stationing guards and other safety measures.

**(4) Tax Exemption Measures**

The procedure for tax exemption for equipment and materials to be procured under the Project is as follows. An equipment supplier submits an application in advance (Commitment to Pay Deferred Taxes on Imports) to REA via the consultant and the Ministry of Energy and Mineral Development (MEMD) which is the responsible ministry, is requested to pay necessary custom duties to the Uganda Revenue Authority. Accordingly, it is important to pay special attention to the process of acquiring a tax exemption in order to prevent any delays in the above-mentioned applications which could have a negative impact on the transportation schedule. Since MEMD also bears value added taxes on equipment and materials to be locally procured in Uganda in a similar manner, it is therefore important to coordinate with the client in advance so that budgetary appropriation can be taken smoothly in addition to the above-mentioned custom duties.

**(5) Marine and Inland Transportation**

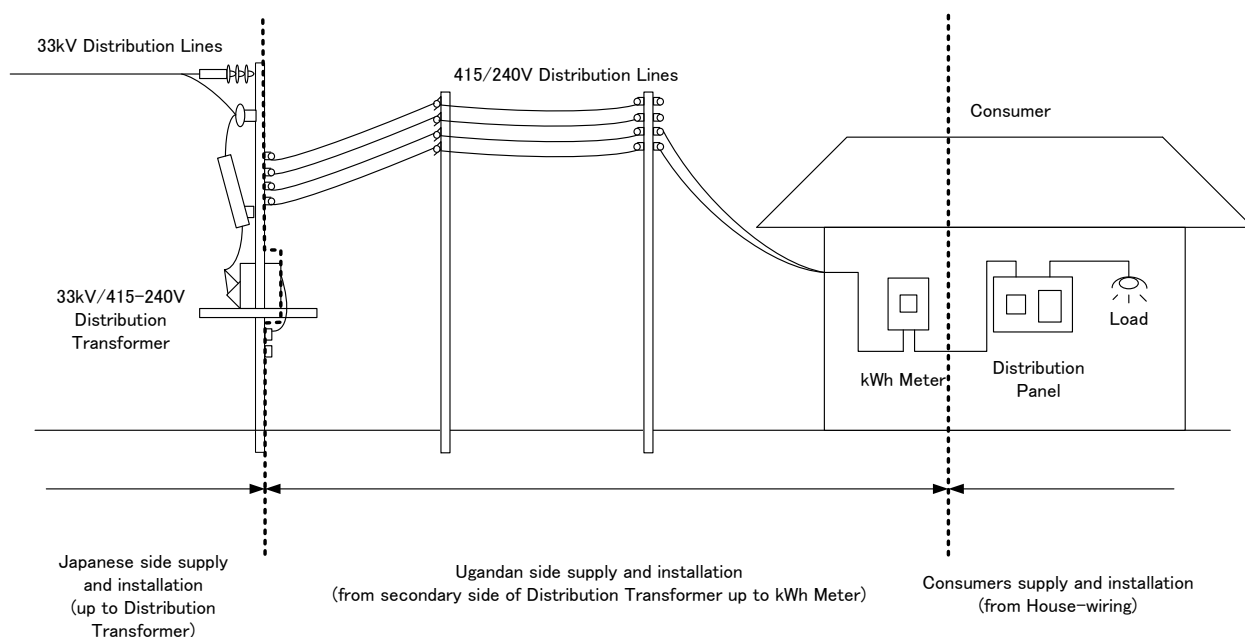
Normally, marine transport to Uganda unloads and passes through customs transit in Mombasa, Kenya, and then goes through customs clearance in the International Container Depot in Kampala after being checked at the Uganda-Kenya border. For this Project, we need equipment bound for sites to clear customs near the border in Maraba and be transported to each site directly. Further, keep in mind that customs transit in Mombasa, container loading and inland transport to the Uganda border takes a minimum of 15 days, and inland transport to Kampala and customs takes at least an additional 3 days.

Transport and construction conditions in some regions are poor. With the undeveloped infrastructure in the project region, vehicles carrying equipment will have trouble accessing certain locations. Also, vehicles will not be able to pass through certain sections during rainy seasons due to clay access roads. As such, equipment transportation methods and timing must be planned such that equipment can be brought to site during the dry season.

Items procured in Japan or third countries will also be packed to sufficiently withstand long marine transport, port unloading, inland transport to the project site and storage.

### 2-2-4-3 Scope of Works

New 33 kV distribution lines and distribution transformers for the project in the Japanese and Ugandan construction scopes will be procured, installed, tested and adjusted by Japan. As shown in Figure 2-2-4.1, 415/240V low voltage distribution line work is Uganda's scope and end consumers will procure and install internal wiring. Detailed Japan and Uganda scopes are as shown in Table 2-2-4.1.



Source: JICA Study Team

**Figure 2-2-4.1 Work Demarcations between the Japanese and Uganda Side**

**Table 2-2-4.1 Work Demarcations for Both Countries**

| No. | Undertakings  | To be covered by |        | Remarks   |
|-----|---|------------------|--------|---|
|     |   | Japan            | Uganda |   |
| *1  | (1) Securing of lands of the Project sites (routes of 33kV distribution lines)  |                  | ○      |   |
|     | (2) Land leveling and preparation, bush clearing and removal of obstacles in the Project sites  |                  | ○      |   |
| *2  | To construct the following facilities   |                  |        | Not Applicable (Building installation work does not include.) |
|     | (1) The building  | ○                |        |   |
|     | (2) The gates and fences in and around the site   |                  | ○      |   |
|     | (3) The parking lot   | ○                |        |   |
|     | (4) The road within the site  | ○                |        |   |
| *3  | (5) The road outside the site   |                  | ○      |   |
|     | To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the [site]/[sites] |                  |        | Not Applicable (Building installation work does not include.) |



| No. | Undertakings  | To be covered by |        | Remarks  |
|-----|---|------------------|--------|--|
|     |   | Japan            | Uganda |  |
|     | (1)Electricity  |                  |        |  |
|     | a. The distributing power line to the site  |                  | ○      |  |
|     | b. The drop wiring and internal wiring within the site  | ○                |        |  |
|     | c. The main circuit breaker and transformer   | ○                |        |  |
|     | (2) Water Supply  |                  |        |  |
|     | a. The city water distribution main to the site   |                  | ○      |  |
|     | b. The supply system within the site (receiving and elevated tanks)   | ○                |        |  |
|     | (3) Drainage  |                  |        |  |
|     | a. The city drainage main (for storm sewer and others to the site)  |                  | ○      |  |
|     | b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site  | ○                |        |  |
|     | (4) Gas Supply  |                  |        |  |
|     | a. The city gas main to the site  |                  | ○      |  |
|     | b. The gas supply system within the site  | ○                |        |  |
|     | (5) Telephone System  |                  |        |  |
|     | a. The telephone trunk line to the main distribution frame/panel (MDF) of the building  |                  | ○      |  |
|     | b. The MDF and the extension after the frame/panel  | ○                |        |  |
|     | (6) Furniture and Equipment   |                  |        |  |
|     | a. General furniture  |                  | ○      |  |
|     | b. Project equipment  | ○                |        |  |
| *4  | Transportation of the Equipment, customs procedures and tax procedures  |                  |        |  |
|     | (1) Marine/ air transportation to a port of disembarkation.   | ○                |        |  |
|     | (2) Procedures for tax exemption and customs clearance at the port of disembarkation  |                  | ○      |  |
|     | (3) Internal transportation from a port of disembarkation to the Project sites  | ○                |        | Delivery point: Storage Yard at Nankoma  |
|     | (4) Exemption or payment of value-added tax (VAT) on locally procured items   |                  | ○      |  |
| *5  | Procedures necessary to obtain the following permits for the Japanese Consultant and Contractor:<br>- Permits required for installation works<br>- Permits to access restricted areas |                  | ○      | The permits shall be obtained before project implementation.                   |
| *6  | Proper operation and maintenance of facilities and the Equipment after the Project  |                  | ○      | Including bush clearing and removal of obstacles along 33kV distribution lines |
| *7  | To bear all the expenses, other than those covered by Grant, necessary for the implementation of the project.   |                  | ○      |  |
| *8  | Payment of the following fees based on the Banking Arrangement:   |                  |        |  |
|     | (1) A/P (Authorization to Pay) advising commission  |                  | ○      | Approx. 100 USD  |
|     | (2) Payment commission  |                  | ○      | 0.1% of the grant aid amount   |
| *9  | Giving due environmental and social considerations in the implementation of the Project.  |                  | ○      |  |
| 10  | Securing of land of temporary material storage yard with fence and gate   |                  | ○      | To be utilized Storage Yard at Nankoma   |
| 11  | Securing parking space during installation period   |                  | ○      | To be secured, beside the road during the installation work                    |

| No. | Undertakings   | To be covered by |        | Remarks   |
|-----|--|------------------|--------|---|
|     |  | Japan            | Uganda |   |
| 12  | Site offices   | ○                |        | For the Japanese Consultant and Contractor  |
| 13  | Proper storage and safety management of the Equipment at temporary material storage yard   | ○                |        |   |
| 14  | Securing of working space along routes of 33kV distribution lines and traffic control  |                  | ○      | When necessary  |
| 15  | Relocation of existing overhead/underground cables or pipes of power, telephone, water supply/drainage, etc. and obtaining necessary permissions                         |                  | ○      | When necessary  |
| 16  | Obtaining permissions on road crossing during 33kV distribution line work  |                  | ○      | When necessary  |
| 17  | Providing of disposal site of soil and discharged water caused by the installation work  |                  | ○      |   |
| 18  | Manufacturing and procurement of the Equipment   | ○                |        | “The Equipment” is defined as the equipment and materials to be provided by the Japanese side under the Project.                            |
| 19  | Installation of the Equipment, adjust and testing  | ○                |        | The Ugandan side is required to lend test equipment and tools to be provided on the Project to the Japanese Contractor during installation. |
| 20  | Temporary shut down during installation  |                  | ○      |   |
| 21  | Installation of a load-break switch onto the existing pole at the connection point of 33kV distribution line in Nankoma  |                  | ○      |   |
| 22  | Final connection to the existing 33kV distribution lines   |                  | ○      | At Mayuge, Nankoma and Lumino connection points   |
| 23  | Provision of materials for the above mentioned final connection  | ○                |        |   |
| 24  | Provision of trainings for initial operation and maintenance of the Equipment  | ○                |        |   |
| 25  | Assuring security for personnel in the Project sites   |                  | ○      | On request  |
| 26  | Managing any dispute from customers regarding temporary shut down for installation work including compensation for customers   |                  | ○      | If necessary  |
| 27  | Public notice of scheduled shut down and implementation of the project during the implementation stage   |                  | ○      |   |
|     |  |                  |        |   |
| 28  | Design, procurement and installation of trunk line of low voltage distribution lines and connection to consumers (households and public facilities) in the Project sites |                  | ○      | The Ugandan side is required to implement the work in parallel with 33kV distribution line work done by Japanese side.                      |
| 29  | Safety   |                  | ○      | The Ugandan side is required to implement the work in parallel with 33kV distribution line work done by Japanese side.                      |

Source: JICA Study Team

Note: \* is described in the “Annex 7 of Minutes of Discussion” signed between the Ugandan and Japanese side.

#### **2-2-4-4 Consultant Supervision**

According to Japan's grant aid system, consultants are to form a project team consistent with the final design and construction supervision based on the spirit of the basic design and smoothly complete the work. During the construction supervision stage, consultants are to station at least one engineer in the project region to manage scheduling, quality and safety. As necessary, a domestic expert is also to attend factory inspections and pre-shipment inspections for equipment manufactured domestically, and also supervise to prevent problems after unloading equipment at the site.

##### **(1) Supervision Principles**

The consultant will supervise the work progress to ensure the completion of the construction work within a predetermined period and will supervise and guide equipment suppliers to ensure quality described in the contract and safe implementation of the construction work in principle.

Major points to be noted for supervision work are described as follows.

##### **1) Schedule Control**

The consultant will compare the actual progress of the following work items with the schedule to be planned by equipment supplier(s) at the time of a contract on a weekly and monthly basis. If any delay is foreseen, the consultant should issue a warning to the equipment supplier and request the supplier to submit recommended countermeasures so that the construction work can be completed within the agreed period. The above-mentioned comparison is mainly conducted by confirming the following items.

- ① Confirmation of quantity of work completed (progress of equipment manufacturing at factories and distribution site work)
- ② Confirmation of quantity of equipment and materials delivered (distribution equipment)
- ③ Confirmation of conditions of temporary work and preparation of construction machinery
- ④ Confirmation of actual number of engineers, skilled workers and laborers and their comparison with the original plan

##### **2) Safety Control**

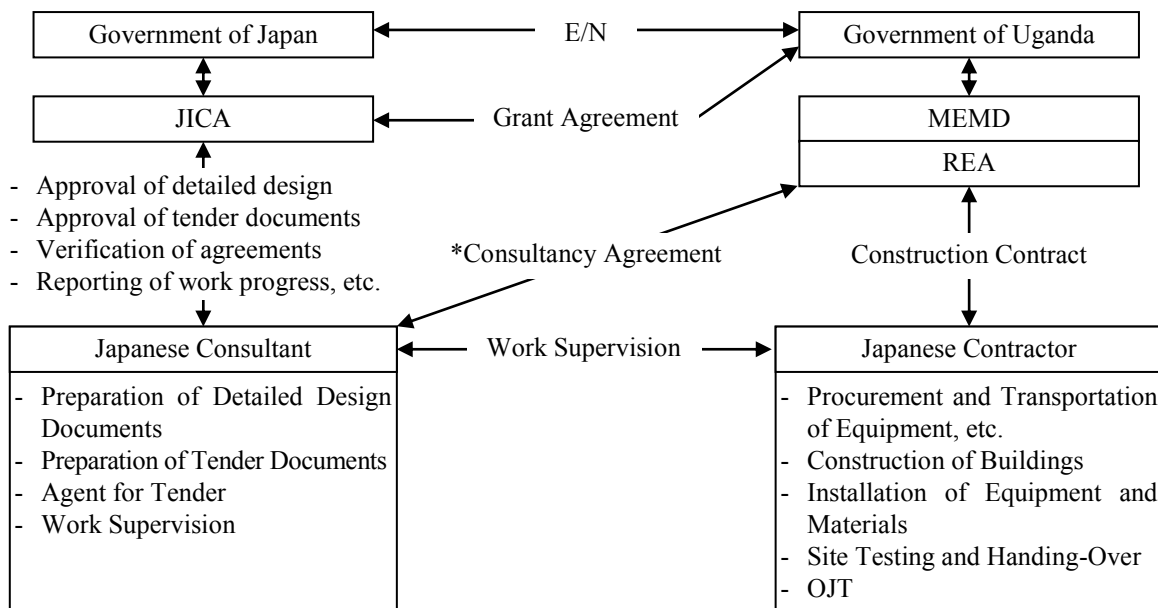
The consultant will provide safety supervision to prevent industrial accidents involving workers and third persons during the construction period through consultations and cooperation with subcontractor's site managers. The following points regarding safety control on-site should be carefully noted.

- ① Establishment of safety control rules and appointment of a safety control manager

- ② Prevention of accidents through regular inspection of construction machinery
- ③ Establishment of travel routes for construction vehicles and construction machinery and strict enforcement of safe driving speeds
- ④ Enforcement of welfare measures for workers and work holidays

**(2) Project Implementation Regime**

Role correlations for the project, including those during construction supervision, are as shown in Figure 2-2-4.2.



\* The consultancy agreement and construction agreement must be verified by the JICA.

**Figure 2-2-4.2 Project Implementation Regime**

**(3) Work Supervisors**

The contractors will procure and install equipment for the 33 kV distribution line work. Further, they will subcontract local Ugandan contractors to perform the work. Accordingly, the contractor is required to get subcontractors to fully comply with the work schedule, quality and safety measures given in the work contract. To accomplish this, contractors will deploy engineers with experience in similar overseas work to guide and advise local contractors.

Given the scale and details of the 33 kV distribution line construction work for this project, we recommend contractors station at least the number of engineers given in Table 2-2-4.2.

**Table 2-2-4.2 Engineers to be Dispatched by the Contractor**

| Technician Deployed                | No. | Work Duties   | Deployment Period           |
|------------------------------------|-----|---|-----------------------------|
| Local procurement management staff | 1   | General construction management; consultation, coordination and related agency approval; OJT responsibilities; equipment procurement management; customs procedures; labor management; accounting | Full duration of the work   |
| Distribution engineer 1            | 1   | Checking distribution routes and pole positions   | Confirmation work periods   |
|                                    | 1   | Managing installation of 33 kV distribution lines   | Full duration of the work   |
| Distribution engineer 2            | 1   | Testing and adjusting segment switches, distribution transformers, etc.; OJT  | Test and adjustment periods |

#### **2-2-4-5 Quality Control Plan**

A site supervisor of the consultant will determine whether or not the quality of facilities, equipment and materials specified in contract documents (such as technical specifications and detailed design drawings) has been secured by an equipment supplier based on the following items. If some doubt exists on whether or not quality has been ensured, the consultant should ask the equipment supplier to make corrections, changes or modifications.

- ① Check shop drawings and specifications of equipment and materials
- ② Witness factory inspections for equipment and materials and check factory inspection results
- ③ Check method of packaging and transportation and method of onsite temporary storage
- ④ Check work drawings of equipment and installation manuals
- ⑤ Check trial operation and adjustment at a factory and at sites related to equipment and materials and inspection manuals
- ⑥ Supervise on-site installation work for equipment and witness trial operation, adjustment and inspections
- ⑦ Check equipment fabrication drawings, working drawings, and finished work quality
- ⑧ Check as-built drawings

#### **2-2-4-6 Procurement Plan**

Equipment and materials for 33kV distribution facilities (except for wooden poles) to be procured and installed under the Project are not manufactured in Uganda. Due to the limited budget in project financing, various equipment and materials such as distribution transformers, load-break switch, auto

re-closers and various other distribution facility equipment are procured from African nations (such as South Africa, Tanzania and Kenya), Asian nations (such as China and India) and European nations.

Although some European substation equipment manufacturers have agents in Uganda, few manufacturers provide local after-sale service or spare parts, etc. for high voltage substation equipment. Consequently, during the selection of supply sources for the substation equipment and materials for the Project, it is necessary to carefully examine the latest situation in Uganda. To be more specific, the easy operation and maintenance of the equipment by the Ugandan engineers and the availability of after-sale service and spare parts in Uganda should be taken into consideration.

Operators that will be responsible for operation and maintenance of equipment and materials to be commissioned by REA after completion of the Project are quite familiar with the operation and maintenance of Japanese equipment since Japanese-manufactured 33kV substations, automatic voltage regulators and other distribution transformers procured during previous projects are still in good operating condition. REA is confident with the performance of the Japanese-manufactured main substation equipment and after-sale services provided by Japanese manufacturers. Therefore, they have requested procurement of Japanese equipment and materials for the Project through the Grant Aid by the Government of Japan.

With respect to equipment installation and construction machinery for transportation, cranes or trucks can be leased locally so that no specific problems are expected during the implementation of the Project.

As described above, the country of origin for equipment and materials under the Project are shown as follows.

**(1) Equipment and Materials for Local Procurement**

**1) Work Equipment and Materials**

Gasoline, Diesel, construction vehicles, cranes, trucks, and other temporary equipment and materials

**2) Distribution Line Materials**

Wooden poles

**(2) Equipment for Procurement in Japan**

Aluminum conductors, distribution transformers, lightning arresters, insulator and load-break switches, etc.

### **(3) Materials for Third Country Procurement**

- ① Automatic voltage regulators, section switches, power metering equipment, etc. (DAC countries)
  - ② Aluminum wire (ASEAN countries)
  - ③ Wooden poles (Kenya, Tanzania and South Africa)
- \* If required amount cannot be procured in Uganda

#### **2-2-4-7 Operational Guidance Plan**

Before completion of the installation work, guidance on initial operations, operation and maintenance (O&M) training for the equipment and materials to be procured for the Project will be carried out. The said guidance will be provided by instructors from equipment suppliers in accordance with O&M manuals through OJT on site.

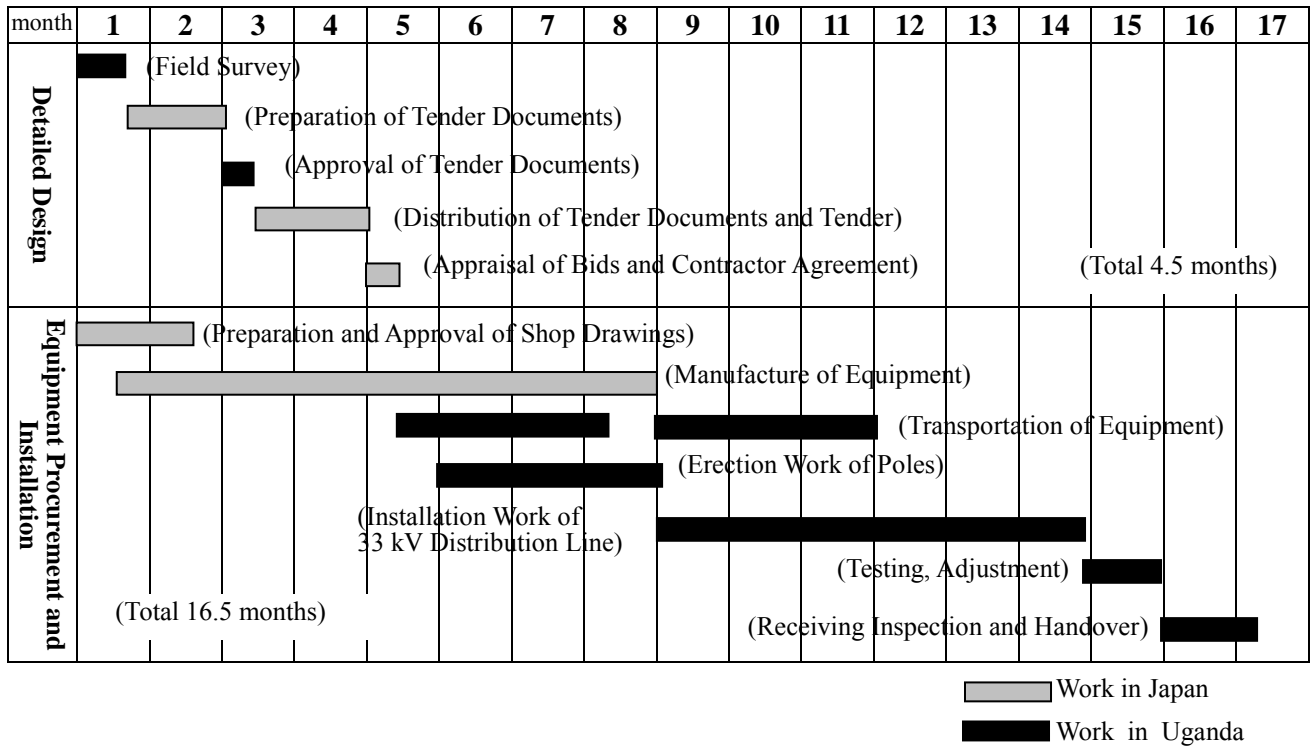
It will, therefore, be necessary for REA to maintain close contact and consultation with Japanese consultants and equipment suppliers and appoint a full-time engineer who will participate in OJT to ensure smooth progress of guidance. The appointed engineer will be required to train other personnel who cannot participate in the guidance and develop skills horizontally in order to improve the maintenance capacity of REA as a whole.

#### **2-2-4-8 Soft Component (Technical Assistance) Plan**

After installation and delivery of the 33 kV distribution lines is completed, REA will subcontract O&M of the distribution equipment procured and installed by Japan for the Project to a private contractor. Umeme and Ferdsult, two possible distribution companies which could be subcontracted, have operated and maintained 33 kV distribution facilities well, including those installed in the previous JICA project. Additionally, REA can be trained in O&M techniques through OJT for commissioning, adjustments and other functions during the construction period. We will also create and submit the manuals needed for operation and maintenance. Given the above, we do not deem any additional soft components to be necessary.

#### **2-2-4-9 Implementation Schedule**

The project implementation schedule is as shown in Figure 2-2-4.3 based on the Japanese grant aid system.



**Figure 2-2-4.3 Project Implementation Schedule of the Project**

### 2-3 Obligations of the Recipient Country

Other than the items assigned to Uganda in Section 2-2-4-3 Scope of Works, Uganda is responsible for the following:

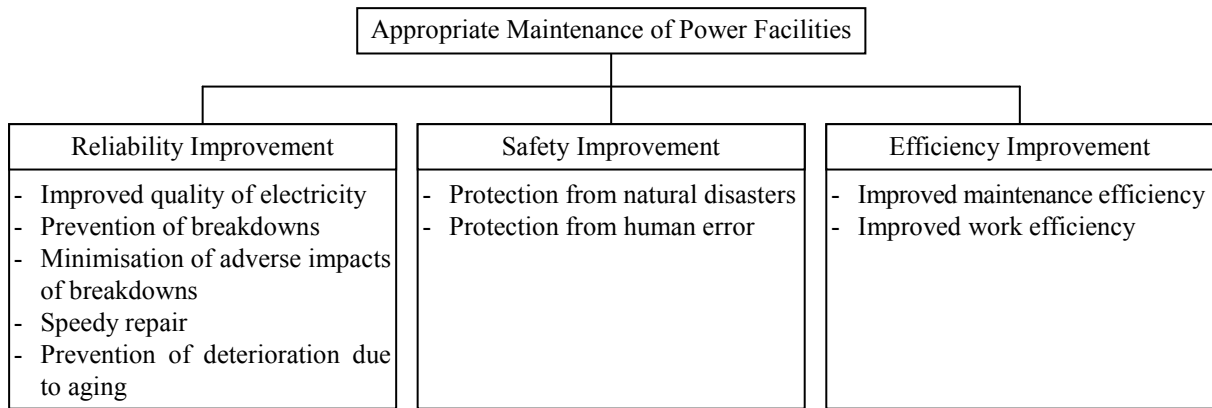
- (1) Providing information and data needed for the project.
- (2) Appointing a specialist technician to teach O&M techniques for the facilities developed in the project, confirming work during the installation period and attending quality inspections.

### 2-4 Project Operation Plan

#### 2-4-1 Basic Policy

It is essential to ensure the appropriate O&M of power distribution facilities and to preserve the surrounding environment in order to improve the reliability of the power supply to consumers at the project sites and to provide stable electric power. Consequently, appropriate preventive maintenance and proper maintenance for the purpose of reducing the rate of faults and attaining improved reliability, safety and efficiency are strongly recommended.





**Figure 2-4-1.1 Basic Concept of the Maintenance of the Transforming, Transmission and Distribution Facilities**

Figure 2-4-1.1 illustrates the basic concept for the maintenance of power distribution facilities. The equipment and facilities to be procured and installed under the Project should be maintained based mainly on the concept of preventive maintenance.

Engineers are scheduled to be dispatched from Japanese equipment supplier(s) to conduct OJT on the operation and maintenance of relevant switchgears during installation work, testing and adjustment under the Project. At the same time, the Japanese side will provide necessary spare parts, testing instruments and maintenance tools, operation and maintenance manuals by recommending an operation and maintenance system after commencement of operation, in order to display sufficient effects.

In addition, as an implementing agency of the Project, REA entrusts the operation and maintenance of the 33kV distribution lines to a private-sector company called operator(s) after completion of the installation work. During the selection of operator(s), REA will conduct Pre-Qualification process before competitive bidding, to confirm operation experience in similar rural electrification projects, technical capacity and financial soundness. The Project plan includes an implementation system through office(s) of operator(s) entrusted by REA for the purpose of ensuring the organization and personnel for appropriate operation of the electrification project.

## 2-4-2 Regular Check Items

The most important service one can provide to consumers is to detect faults, damage or breakdowns through daily patrol inspections and to immediately carry out restoration work. In addition, if an outbreak of ground faults is anticipated due to the contact of distribution lines with trees, etc., preventive measures such as bush clearing should be taken in advance. Inspection items for daily patrol inspection are listed as follows.

- ① Presence of electric line cuts

- ② Presence of insulator damage
- ③ Presence of contact of distribution lines with trees, etc.
- ④ Presence of electric pole damage
- ⑤ Presence of electric pole inclination
- ⑥ Installing conditions and oil leakage from distribution transformers
- ⑦ Load-break switch, auto re-closer and electricity meter condition

### **2-4-3 Spare Parts Procurement Plan**

#### **(1) Classification of Spare Parts**

Spare parts for the project can be classified into the following.

- ① Emergency spare parts : Necessary replacement equipment during an emergency which involves malfunction of the distribution system due to equipment failure
- ② Replacement parts : Parts required for replacement due to breakdown of equipment part

#### **(2) Subject Equipment and Systems for the Supply of Spare Parts**

Emergency spare equipment and standard spare parts procured for this project are for 33 kV distribution line facilities.

#### **(3) Selection Criteria by Category**

##### **1) Emergency Spare Equipment**

Emergency spare parts are required when equipment or materials breakdown due to some unexpected event, which has a huge impact on the stability of the power supply and makes it difficult to conduct onsite repairs at an early stage.

- ① As lightning arresters protect distribution transformers and other equipment from lightning impulses, grounding faults, switching surges, and other abnormal current and voltage, they must be immediately replaced if damaged. With frequent lightning in the project region, we expect significant damage to lightning arresters and need to have emergency spares on hand.
- ② Fused cutout switches protect distribution transformers from current overload and short circuits on the low voltage end. If such an irregularity occurs on the low voltage end, the internal fuse on the switch will burn out, leaving the cutout switch susceptible to damage. As such, emergency spare fused cutout switches need to be on hand.

- ③ Distribution transformers step down distributed voltages from 33 kV to 415/240V electricity for supply to consumers. Since power cannot be supplied to consumers if the transformers fail, emergency spare distribution transformers need to be on hand.

**2) Standard Spare Parts**

A one-year supply based on expected need for parts highly likely to need replacement due to damage is to be prepared. Standard spare parts for the project are as follows:

- ① Cutout switch fuses
- ② Contacts for load-break switches

**(4) Budgetary Appropriation for Spare Parts**

Japan plans to procure the minimum required emergency spare equipment and standard spare parts for one year for the Project. These items are given in 2-4-3.1. Uganda is responsible for preparing a budget for purchasing necessary spare parts at latest one year after project completion.

**(5) Testing Instruments and Maintenance Tools**

We will procure tools needed to properly maintain the 33 kV distribution lines for the Project. Maintenance tools must be procured as follows:

- ① As REA will outsource O&M to a distribution operator, new maintenance tools for O&M of the distribution facilities installed in the project will be required.
- ② The minimum amount of maintenance tools needed for the distribution facilities procured in the Project will be newly procured.
- ③ Maintenance tools used by Japanese contractors when working on the 33 kV distribution lines will be handed over to REA after work is completed.

Japan will procure the maintenance tools for the Project given in Table 2-4-3.1.

**Table 2-4-3.1 Spare Parts and Maintenance Tools Procured by the Project**

| Equipment                          | Q'ty               | Description             |
|------------------------------------|--------------------|-------------------------|
| <b>1. Spare Parts List</b>         |                    |                         |
| (1) Emergency Spare Part           |                    |                         |
| 1) Lightning Arrester              | 3 pcs              | 33kV, 5kA, single phase |
| 2) Fused Cut-out switch            | 3 pcs              | 33kV, single phase      |
| 3) Distribution Transformer        | 1 set of each type | 25, 50, 100, 200kVA     |
| (2) Replacement Spare Parts        |                    |                         |
| 1) Fuse element for cut-out switch | 3 pcs of each type | -                       |
| 2) Contacts for load-break switch  | 3 pcs              | -                       |
| <b>2. Maintenance Tool List</b>    |                    |                         |
| (1) Digital-type multi meter       | 1 set              | For general purpose     |

| Equipment                        | Q'ty  | Description                   |
|----------------------------------|-------|-------------------------------|
| (2) Clip-on meter                | 1 set | For checking of metering unit |
| (3) Phase rotation meter         | 1 set | For general purpose           |
| (4) Voltage detector             | 1 set | For 33kV line                 |
| (5) Voltage detector             | 1 set | For low voltage               |
| (6) Insulation resistance tester | 1 set | For megger test, 33kV line    |
| (7) Insulation resistance tester | 1 set | For megger test, low voltage  |
| (8) Earth resistance tester      | 1 set | For general purpose           |
| (9) Operation rod                | 1 set | For fused cut-out switch      |

Source: JICA Study Team

## 2-5 Project Cost Estimation

### 2-5-1 Initial Cost Estimation

In the case of the actual implementation of the Project under the grant aid scheme of the Government of Japan, The Ugandan side is expected to pay the costs of its undertakings as listed below.

Estimated overall cost for the Ugandan side: Approx. 200 million JPY

| No. | Items   | Amounts (approx.) |                             |
|-----|---|-------------------|-----------------------------|
|     |   | USD<br>(thousand) | Equivalent JPY<br>(million) |
| (1) | <b>Route survey and clearing site for 33 kV distribution line (Approx. 134.4 km)</b>                      | <b>45</b>         | <b>4</b>                    |
| (2) | <b>Provision of low voltage distribution trunk line (1.5 km/trans. x 50 transformers x 21,000USD/ km)</b> | <b>1,575</b>      | <b>131</b>                  |
| (3) | <b>Procurement and installation of meters and drop wires (4,800 consumers)</b>                            | <b>768</b>        | <b>64</b>                   |
| (4) | <b>Payment of bank commission</b>   | <b>17</b>         | <b>1</b>                    |
|     | <b>Total</b>  | <b>2,405</b>      | <b>200</b>                  |

<Estimation Conditions>

Date of estimation: July, 2011

Foreign exchange rates:

US\$ 1 = ¥83.00 (TTS average from Jan., 2011 to Jun., 2011)

1 UGX = ¥0.03437 (TTS average from Jan., 2011 to Jun., 2011)

1 EURO = ¥116.53 (TTS average from Jan., 2011 to Jun., 2011)

Procurement and construction periods:

The detailed design, equipment procurement and installation periods are as shown in the project implementation schedule.

Other:

The Project will be implemented in accordance with the grant aid scheme of the Government of

## Japan

### 2-5-2 Operation and Maintenance Cost

The equipment of 33 kV distribution lines of the project will be operated and maintained by a private distribution concessionaire. The concessionaire will be elected in a general competitive tendering, and such companies as UMEME, Fredsult and etc. are assumed as the concessionaire.

The equipment of the Project will not consume any fuel, as the Project is not including power generation facilities and only composed of 33 kV distribution line. Replacement of chipped insulators caused of their brittleness or melted fuses by overload is assumed only as cases that maintenance is required, as it is not also including substation facilities (1 % of the total number procured is assumed in a year as the required quantity). In addition, two patrol staffs are required for their operation and maintenance, as the length reaches 135 km though the voltage level of the equipment of the Project is not so high (33 kV). The required cost for the above mentioned operation and maintenance is shown in Table 2-5-2.1. Approx. 5 million JPY is required.

Table 2-5-2.1 Cost for Operation and Maintenance of 33kV Distribution Line in the Project Site

| Items                       | Unit Price |             | Installed Q'ty |       | Required Q'ty |                                 | Maintenance Cost (USD) |          | Maintenance Cost (JPY) |
|-----------------------------|------------|-------------|----------------|-------|---------------|---------------------------------|------------------------|----------|------------------------|
|                             |            |             |                |       |               |                                 |                        |          |                        |
| String Insulator            | 7,840      | JPY/piece   | 11,592         | piece | 116           | piece<br>(1% of installed Q'ty) | 909,440                | JPY/year | 909,440                |
| Pin Insulator               | 20,400     | JPY/piece   | 4,586          | piece | 46            | piece<br>(1% of installed Q'ty) | 938,400                | JPY/year | 938,400                |
| Fuse                        | 24         | USD/3 phase |                |       | 12            | phase                           | 288                    | USD/year | 23,904                 |
| Electrical Engineer (Local) | 1,720      | USD/month   |                |       | 24            | people · month                  | 41,280                 | USD/year | 3,426,240              |
|                             |            |             |                |       |               |                                 |                        |          | 5,297,984              |

Source : JICA Study Team

Note : Exchange Rate 83.00 JPY/USD

The assumed operation income based on the demand forecast estimated in the Study is shown in Table 2-5-2.2. The annual income will reach approx. 12 million JPY in the first year after commissioning, will growth gradually and is assumed to go over 100 million JPY in the target year of the Project (2018). Therefore, it is considered that the cost will be secured enough from the income from operation of the distribution lines of the Project (5 % of the operation income).

Table 2-5-2.2 Income from Electricity Charge in the Project Site

| Items                  | Unit Price | 2013            | 2014         | 2015          | 2016          | 2017          | 2018          |
|------------------------|------------|-----------------|--------------|---------------|---------------|---------------|---------------|
|                        |            | (Commissioning) | 1 year later | 2 year later  | 3 year later  | 4 year later  | 5 year later  |
| Sold Energy            | kWh/year   | 939,955         | 1,911,445    | 2,914,097     | 3,949,525     | 7,585,132     | 8,830,066     |
| Operation Profit (UGX) | UGX/year   | 362,446,717     | 737,053,184  | 1,123,675,782 | 1,522,936,860 | 2,924,826,762 | 3,404,873,579 |
| Operation Profit (JPY) | JPY/year   | 12,457,294      | 25,332,518   | 37,620,737    | 52,343,340    | 100,526,296   | 117,025,505   |

Source : JICA Study Team

Note : Load Factor of Power System 71%, Electricity Charge 385.6 UGX/kWh,

Exchange Rate 83.00 JPY/USD and 0.03437 JPY/UGX

## **Chapter 3 Project Evaluation**

### **3-1 Preconditions**

The preconditions for implementation of the Project are describe in follows, such as land acquisition of new distribution lines, the environmental permit for the Project, and etc. There are no particular issues for satisfaction for the preconditions, because the Ugandan side has experiences of implementation of the Japan's grant aid projects.

- ① The Ugandan side is required to obtain permits from the Ugandan National Road Authority and land owners for the use of the road reserve along the planned routes of the new 33 kV distribution lines.
- ② The Ugandan side is required to submit the Project Brief of the Project to National Environment Management Authority and obtain the Environmental Permit.

### **3-2 Necessary Inputs by the Recipient Country**

The Ugandan side must fully meet the following requirements.

#### **(1) Prior to the Commencement of the Construction Work**

- ① The Ugandan side is required to appropriate the necessary budget to cover the Project cost for the Ugandan side without delay so that the work to be completed by the Ugandan side before the start of the Japanese work will be duly completed.
- ② The Ugandan side is required to design and enforce the subsidy system for the consumers in the project site, which is discussed and agreed in the Minutes of Discussion during the Preparatory Survey without delay, so that the the customer connection will start imedeately after the Japanese work is completed.
- ③ The Ugandan side is required to complete the weeding and removal of obstacles along the planned routes of the new 33 kV distribution lines before the start of the Japanese work.
- ④ The Ugandan side is required to consult and coordinate with the Japanese Contractor and local stakeholders whenever necessary to check any impacts on or interference to underground public utility systems (water supply pipes, sewers and broadcasting/telephone lines) on and around the planned routes of the new 33 kV distribution lines before the start of the Japanese work.

#### **(2) During the Construction Work and After the Commencement of Operation**

- ① In line with the installation work schedule for 33 kV distribution lines for which equipment

is procured and installed by the Japanese side, the Ugandan side is required to fulfil its obligations, including final connection of the 33 kV feeders, installation of load-break switch on the existing 33 kV line in Nankoma and the planning and execution of power outages. The Ugandan side is also required to appoint an engineer in charge for each Project site and to facilitate the smooth implementation of the construction work through the preparation and execution of a schedule plan, personnel plan, equipment procurement plan and other relevant plans.

- ② The Ugandan side is required to implement design, tendering, procurement and installation of low voltage network for the Project without delay, so that effect of the project will develop immediately after completion of the Work by the Japanese side.
- ③ 33 kV distribution equipment will be procured under the Project to meet the assumed power demand up to five years from the commencement of their operation. Nevertheless, the Ugandan side is required to review the estimated power demand from time to time to prepare a plan for the installation of additional distribution transformers and to expand the systems after the completion of the Project together with allocation of the necessary budget.
- ④ To reduce the number of accidents and ensure a stable power supply, the Ugandan side is required to conduct regular patrols with a view to preventing damage to the electric poles and cables due to cutting and open burning along the distribution routes by local residents.
- ⑤ The Ugandan side is required to swiftly appoint engineers to participate in the OJT under the Project so that these engineers can spread their newly acquired knowledge and skills to other non-participating engineers.
- ⑥ The Ugandan side shall undertake the procedures concerned for tax exemption for the materials and equipment for the Project and giving conveniences for persons concerned from Japan

### **3-3 Important Assumptions**

The following assumptions are crucial to produce and sustain the expected outputs and effects of the Project.

#### **(1) Regarding the Higher Goal**

- The rural electrification policy of Uganda will not be changed.
- The politics and economy of Uganda will remain stable.

**(2) Regarding the Project Targets**

- The operation and maintenance of the new equipment and systems will be continually conducted in a proper manner.
- The collection of the service charge and financial support will continue.
- The security of the new facilities will be maintained.

**(3) Regarding the Expected Outputs**

- The generating facilities will remain fully operational.
- The operation and maintenance plan will be properly implemented.
- The connection charge and service charge will be borne by consumers (and/or the government).

**3-4 Project Evaluation**

**3-4-1 Relevance**

The appropriateness of the Project to the spirit of Japan's grant aid scheme is judged to be strong as it not only contributes to the realisation of the development programme and energy policy of Uganda but also benefits the people of the project site including the poor and public facilities.

**(1) Conformity with the upper layer plans**

**1) Conformity with National Development Plan**

In the Poverty Eradication Action Plan, Phase III (PEAP III; target period: 2004-2009), the Government of Uganda used rural electrification projects as an important means of achieving its goal of generating income for the rural poor. They have continued to develop rural areas based on the five-year National Development Plan (NDP; target period: 2010-2014).

In terms of electrification, the NDP has set a target of increasing nationwide electrification 20% by 2014 from their 2008 levels. Electrification of district capitals and trading centers, the name used for regional centers for economic activity, are given the highest priority. Of the important issues for each sector shown in the NDP, those with particularly strong ties to electrification are shown in Table 3-4-1.1.



**Table 3-4-1.1 Prioritized Subjects related to Power Sector**

| Sector                        | Prioritized Subjects  |
|-------------------------------|---|
| Medical                       | <ul style="list-style-type: none"> <li>➤ Stable supply of gas cylinders for gas vaccine refrigerators. (Electric refrigerators will eliminate the need to collect, refill and distribute gas cylinders.)</li> <li>➤ Digitize medical records to make analysis of clinical information possible.</li> </ul>  |
| Educational                   | <ul style="list-style-type: none"> <li>➤ Install office equipment in educational facilities to improve teacher work environments.</li> <li>➤ Provide teacher residential facilities near schools to improve their ability to prepare for classes. (Nighttime lighting is essential to classroom preparation)</li> <li>➤ Install computers in secondary and technical schools to provide ICT education.</li> <li>➤ Instate double-shift schooling to effectively use educational resources.</li> <li>➤ (Securing nighttime lighting is essential)</li> </ul> |
| Agricultural / Fishery        | <ul style="list-style-type: none"> <li>➤ Modernize equipment to improve processing techniques for milling and other technologies, as well as increase product added value.</li> <li>➤ Improve refrigeration and other storing technology to maintain product quality.</li> </ul>  |
| Forestry                      | <ul style="list-style-type: none"> <li>➤ Develop a power distribution grid and diversify thermal energy sources to reduce wood fuel consumption.</li> <li>➤ (Uganda energy consumption: wood – 92%, petroleum fuels – 7%, electricity – 1%)</li> </ul>  |
| Manufacturing                 | <ul style="list-style-type: none"> <li>➤ Help GDP in manufacturing sector recover its losses from unstable power supply (7% in 2004-&gt; 6.7% in 2009)</li> </ul>   |
| Information and Communication | <ul style="list-style-type: none"> <li>➤ Secure power source for cellular phone base station antennas to strengthen the phone communications grid.</li> </ul>   |

Source: Prepared by JICA Study Team based on NDP

## 2) **Conformity with Indicative Rural Electrification Master Plan: IREMP**

Disparities between rural and urban living standards have become an important issue in promoting agricultural policy and preventing an exodus to urban centers. The 2001 Rural Electrification Strategy and Plan (RESP) set its target as improving rural electrification to 10% by 2012.

The Government of Uganda formulated the Indicative Rural Electrification Master Plan (IREMP) in 2009 to achieve this target. They requested Japanese aid for this cooperative project based on the IREMP.

IREMP sets a target duration, but does not define a base year or target year. The rural electrification promotion plan in IREMP, which uses 2007 as its base year and rural housing connectivity demand as its data, is shown in Table 3-4-1.2. This project is vital to increasing rural connectivity and will directly help achieve IREMP targets if implemented.

**Table 3-4-1.2 Target of IREMP for Improvement of Rural Electrification**

|   | 2007      | 2008      | 2012      | 2017      |
|---|-----------|-----------|-----------|-----------|
|   | Base      | 1 year    | 5 years   | 10 years  |
| Target of IREMP for Increase of Electrified Households in Rural Area (Estimation)                       | -         | 150,000   | 250,000   | 350,000   |
| Expected Increase of Electrified Households in Rural Area by implementation of the Project (Estimation) | -         | 156,316   | 312,847   | 478,740   |
| Number of Electrified Households in Rural Area  | 165,000   | 321,316   | 477,847   | 643,740   |
| Total Number of Households in Rural Area (including Public Facilities)                                  | 4,735,943 | 4,887,493 | 5,543,768 | 6,489,385 |
| Electrification Rate in Rural Area  | 3%        | 7%        | 9%        | 10%       |

Source: Prepared by JICA Study Team based on IREMP

## (2) Beneficial Effects of the Project

Along with helping bridge the disparities between rural and urban living standards, this project will stabilize power supply available for general households, as well as regional hospitals, schools and other public facilities. We expect it to produce the following benefits.

### 1) Contribution to Operation of Medical Facilities

Buyinja Health Center IV is located in the project area, and is scheduled to expand its role to become a Namayingo District hospital (Namayingo population of service area: 221,700). The center currently gets its power from diesel generators and photovoltaic installations. It still struggles with power instability and lacking generation capacities, however, due to malfunctioning equipment and decreased sunlight with weather changes. These power issues make it impossible to install sufficient diagnostic equipment despite having the doctors to operate them. This project will greatly improve health services by allowing installation of an ultrasound scanner, radiographic X-ray equipment, endoscope, and other basic equipment the doctors need to diagnose their patients.

Lighting is another issue. The hospital was using kerosene lamps at night due to deficient electric lighting. The lamps started a fire which burned down the main building (November 20, 2000). Since the fire they have been using rechargeable flashlights, but with limited charge capacity the flashlights lose their charge over the course of lengthy medical services. By ensuring stable electricity, this project will greatly help in preventing fires and improving night medical service.

Health Center III serves several towns in the project area (Total population of service area: 239,900). The center uses gas refrigerators for medicine and vaccine storage, as well as sterilization equipment fueled by gas burners, coal and kerosene. Gas-powered equipment needs its gas canisters to be refilled regularly (1-3 times/month for refrigerators). It can be hard to gauge how much gas is left, however, and gas will run out, frequently leaving the equipment unusable. Unlike electric equipment, output for gas equipment changes with atmospheric

temperature, making it hard to store medicines and vaccines. Lack of electricity also prevents doctors from using the electrical medical equipment needed for primary health care. By making power supply available, this project will improve such situations.

## **2) Contribution to Operation of Educational Facilities**

Higher educational facilities operating in the project region include Nalwire Technical Institute (8 courses: mechanical, electrical, plumbing, construction, carpentry, painting, clothing, hairdressing and beauty) and Namayingo High School, among others. These schools train the work force which will shoulder the industry and economy into the next generation. They are currently powered by solar power, which poses a few issues. First, the high costs of photovoltaic installations mean the schools do not have sufficient capacity to use educational equipment, lighting or computers. Additionally, no power can be generated on rainy days.

There are many primary and secondary schools (total schools: 106) built along the 135 km in extensions of 33 kV distribution lines planned in this cooperative project. Power deficiencies hinder Ugandans from learning the knowledge and skills they need, preventing installation of common computers and televisions (for educational programs). Also, the high fuel costs for nighttime lighting in the dormitories adjoining schools are an obstacle to student life and studies, as well as teacher classroom preparations. This project will supply power that will improve these situations in the project region.

## **3) Contribution to Operation of Other Public Facilities**

The project region includes the district capital of Namayingo, which is given as a priority area for rural electrification in the NDP.

The Namayingo District Headquarters (Staff: 138) provides services from its Production, Social Infrastructure, Health, Resources, Education, Planning, Finance, and General Affairs Departments (11 departments total). They use office equipment to manage the extensive amounts of data for residents and businesses, but are currently using a smaller, inefficient diesel generator for each building to provide power. Power outages due to high fuel costs, running out of fuel and equipment failure are a major obstacle to their operations. This project is expected to improve these conditions.

The Namayingo Police Station is also in the project area. The station manages 18 local precinct stations, and helps maintain peace throughout the district (there are about 70 crimes/month). They currently use radio equipment running on photovoltaic power to secure their communication network, but rainy day power outages are a major obstacle to peacekeeping activity. Not having street lights also severely limits both police crime fighting activity and the

suppression of crime. Electrifying these public facilities to improve their operation would help improve the lives of all 221,700 district residents.

**(3) Urgency**

Power supply deficiencies in the project area impair resident livelihoods and lifestyles, industry, medical services, and learning in schools. The project region also includes the district capital, which is denoted as a priority area for rural electrification in the NDP.

Buyinja Health Center IV is located in the project area, and is scheduled to expand its functions to become a Namayingo District hospital (Service area population: 221,700). Power supply deficiencies make it impossible to install basic diagnostic equipment at the center to sufficiently treat patients, despite having the doctors to operate such equipment. Power deficiencies also limit use of vaccine refrigerators and sterilization equipment at Health Center III, a local medical center.

Power supply deficiencies are also a major obstacle to the District Headquarters, Police Station and local precincts, important public services, and peacekeeping activity. Power deficiencies also limit Nalwire Technical Institute and other educational facilities in the project area which help the young acquire practical skills—these facilities cannot install teaching and self-educational equipment, and do not have sufficient lighting for studying at night. Given the above, urgency for this project is high.

**(4) Operation and Maintenance Capability**

Japan has offered grant aid for Ugandan power sector cooperative projects four times since 1991, including the Project for Rural Electrification Phase II. Specifications for the 33 kV distribution facilities to be procured and installed in this collaboration are the same level as equipment procured for past grant aid collaborations. The Ugandan power companies expected to handle operation and maintenance, Umeme and Fersult, have sufficient technical standards to operate and maintain the power distribution equipment to be procured and installed in this cooperative project. As their operation, maintenance and management was satisfactory for equipment provided in the past, we see no special problems in implementing this cooperative project.

**3-4-2 Effectiveness**

Main points of effects expected by implementation of the Project are shown as follows. The detail quantitative effects and qualitative effects are shown after them.

- Approx. 4,800 customer connections (approx. 38,400 beneficiaries) to the grid are expected until the target year (2018) of the project after commissioning of the project. Though 9,500 households (76,000 populations) exist in the Project site, half of them are expected to connect to the grid until the target year in consideration of progress rate of customer connections in the previous project site.
- The Project provides distribution lines supplying power to Mayuge, Iganga, Bugiri, Namaingo and Busia Districts in the Eastern Region. The distribution lines includes power supply to the district capital; i.e., Namaingo District Headquqrter, which electrification is highly prioritized in the National Development Plan.
- Buyinja Health Center IV, which works as the referral hospital around the area, is located in the Project site. Lack of power at the hospital makes it impossible to install sufficient diagnostic equipment despite having the doctors to operate them. Electrification around the area improves the situations.
- 93 primary schools (Approx. 54,000 students), 13 secondary schools (6,700 students) and a technical school holding total 8 courses (mechanical, electrical, plumbing, architectural, painting, carpentry, dress designing and barber) are located in the Project site. Power supply to these facilities will allow stable use of lighting, computers, practice and testing equipment and more, and stimulate education at facilities in the project site. Stable lighting in dorms also allows students to study at night, improving learning efficiency.
- The Namayingo Police Station is also located in the project site. The station manages 18 local precinct stations, and helps maintain peace throughout the district (there are about 70 crimes/month). Improve the peacekeeping communication system by ensuring power for the radio used in the Namayingo police system communications grid. Control night crime by installing street lights and electric lighting in residential areas is expected by the Project.

**(1) Quantitative Effects (Size of Population Directly Benefitting: Approx. 38,400)**

| Indicator              | Reference Value (2011)  | Target Value (2018:Five years after commissioning)   |
|------------------------|---|--|
| Reference Value (2011) | Target Value (2018:Five years after commissioning)  | <ul style="list-style-type: none"> <li>➤ Number of general customers connected to the grid : 4,800 Connection (Approx. 38,400 People)</li> <li>※ It is estimated that 50% of Approx. 9,500 households (Approx. 76,000 people) will be connected to the grid.</li> </ul>  |
|                        | <Contribution to Achievement of IREMP> <ul style="list-style-type: none"> <li>➤ To increase 250,000 connected customers to the grid within 5 years in Uganda</li> <li>➤ To Extend 7,300 km of 33 kV distribution lines within 5 years in Uganda</li> </ul>  | <ul style="list-style-type: none"> <li>➤ 4,800 Customer will be connected to the grid within 5 years in the project site and it will contributed to Approx. 2 % of the target of IREMP</li> <li>➤ Approx. 135 km of 33 kV distribution line will be extended in the project site and it will contributed to Approx. 2 % of the target of IREMP</li> </ul>  |
|                        | <Power Supply from the Grid to Public Facilities> <ul style="list-style-type: none"> <li>➤ Namayingo District Office : Not Connected</li> <li>➤ Namayingo Police Station : Not Connected</li> <li>➤ Medical Facilities<br/>Buyinja Health Center IV : Not Connected<br/>Health Centers : No Connection</li> <li>➤ Educational Facilities : No Connection</li> </ul> | <ul style="list-style-type: none"> <li>➤ Namayingo District Office : Connected</li> <li>➤ Namayingo Police Station : Connected</li> <li>➤ Medical Facilities<br/>Buyinja Health Center IV : Connected<br/>Health Centers : Seven Facilities</li> <li>※ It is estimated that 50% of total 14 facilities will be connected to the grid.</li> <li>➤ Educational Facilities : Approx. 50 schools</li> <li>※ It is estimated that 50% of total 100 facilities will be connected to the grid.</li> </ul> |

**(2) Qualitative Effects**

| Current Situation and Problems  | Improvement Measures Under the Project   | Project Effects and Degree of Improvement   |
|---|--|---|
| <Medical Facilities><br><br>The Buyinja Health Center IV in the project area currently gets its power from diesel generators and photovoltaic installations. It still struggles with power instability and lacking generation capacities, however, due to malfunctioning equipment and other issues. These power issues make it impossible to install sufficient diagnostic equipment despite having the doctors to operate them.<br><br>Lighting is another issue. The hospital was using kerosene lamps at night due to deficient electric lighting. The lamps started a fire which burned down the main building (November 20, 2000).<br><br>Health Center III, which serves several towns, uses gas refrigerators for medicine and vaccine storage, as well | Equipment and Materials for Procurement and Installation of Approx. 134.4 km of 33 kV distribution line lying on Mayuge, Iganga, Bugiri, Nmayingo and Busia Districts<br><br>(1) 33 kV Distribution Lines (Length : Approx. 134.4 km)<br><br>(2) 33 / 0.415-0.240 kV Distribution Transformers (Number of Units : 50 Units)<br><br>(3) Metering Unit : 4 Units<br><br>(4) Auto Re-closer : 4 Units<br><br>(5) Load-break Switch : 14 Units | This project will allow power supply, in turn letting facilities install radiographic X-ray equipment and other basic diagnostic equipment doctors need for medical exams and stabilize health practices. In addition to local residents, this will also improve medical conditions for emergency patients and outpatients from other regions.<br><br>Power supply will ensure medicines and vaccines are stably refrigerated, and that items are sterilized. It will ensure basic medical care in the hospital and vaccination community visits are stable. With many infants and expectant mothers among the patients, this activity will contributes to their health. Doctors will also be able to safely treat patients at night.<br><br><Buyinja Health Center IV > <ul style="list-style-type: none"> <li>• Number of Patient :<br/>450 patients/day</li> </ul> |

| Current Situation and Problems  | Improvement Measures Under the Project           | Project Effects and Degree of Improvement  |
|---|--|--|
| <p>as sterilization equipment fueled by gas burners, coal and kerosene. Gas-powered equipment needs its gas canisters to be refilled regularly (1-3 times/month for refrigerators); however, it can be hard to gauge how much gas is left, and gas will run out, frequently leaving the equipment unusable. Unlike electric equipment, output for gas equipment changes with atmospheric temperature, making it hard to store medicines and vaccines. Lack of electricity also prevents doctors from using the electrical medical equipment needed for primary health care.</p>   |  | <ul style="list-style-type: none"> <li>• Population of Coverage Area :<br/>Approx. 222,000 people_</li> </ul> <p>&lt;Other Health Centers III &gt;</p> <ul style="list-style-type: none"> <li>• Number of Patient :<br/>562 patients/day</li> <li>• Population of Coverage Area :<br/>Approx. 240,000 people_</li> </ul>   |
| <p>&lt;Educational Facilities &gt;</p> <p>There are technical schools, tertiary schools and other schools in the project region. These schools train the work force which will shoulder the industry and economy into the next generation. Power supply deficiencies make it so these facilities cannot use electronics, which lowers the efficiency of student learning.</p> <p>Nalwire Technical Institute is currently powered by solar power, which poses a few issues. First, the high costs of photovoltaic installations mean the schools do not have sufficient capacity to use educational equipment, lighting or computers. Additionally, no power can be generated on rainy days.</p> <p>Lastly, lack of nighttime lighting in the dormitories adjoining schools are an obstacle to student life and studies, as well as teacher classroom preparations.</p> | <p style="text-align: center;">Same as above</p> | <p>Power supply will allow stable use of lighting, computers, practice and testing equipment and more, and stimulate education at facilities in the project region.</p> <p>Stable lighting in dorms also allows students to study at night, improving learning efficiency.</p> <p>&lt;Nalwire Technical Institute &gt;</p> <ul style="list-style-type: none"> <li>• Educational Courses :<br/>Total 8 courses<br/>Mechanical / Electrical / Plumbing / Architectual / Painting / Carpentry / Dress Designing / Barber</li> <li>• Number of Students :<br/>Approx. 200 students</li> </ul> <p>&lt;Secondary School &gt;</p> <ul style="list-style-type: none"> <li>• Number of Schools :<br/>13 schools</li> <li>• Number of Students :<br/>Approx. 6,700 students</li> </ul> <p>&lt;Primary School &gt;</p> <ul style="list-style-type: none"> <li>• Number of Schools :<br/>93 schools</li> <li>• Number of Students :<br/>Approx. 54,000 students</li> </ul> |
| <p>&lt;Namayingo District Office &gt;</p> <p>The Namayingo District Headquarters, staff of 138, provides services from its Production, Social Infrastructure, Health, Resources, Education, Planning, Finance, and General Affairs Departments (11 departments total).</p>  | <p style="text-align: center;">Same as above</p> | <p>This project is expected to make the following improvements:</p> <ul style="list-style-type: none"> <li>• Improve work efficiency by ensuring power for office equipment to manage district government work</li> </ul>  |

| Current Situation and Problems  | Improvement Measures Under the Project | Project Effects and Degree of Improvement  |
|---|--|--|
| They use office equipment to manage extensive amounts of data for residents and businesses, but are currently using a smaller, inefficient diesel generator for each building to provide power. Power outages due to high fuel costs, running out of fuel and equipment failure are a major obstacle to their operations.   |  | and resident data.<br><ul style="list-style-type: none"> <li>• Eliminate the need for the current inefficient small diesel generators and greatly decrease fuel expenses.</li> <li>• Electrifying these public facilities to improve their operation would help improve the lives of all 222,000 district residents.</li> </ul>  |
| <p>&lt; Namayingo Police Station &gt;</p> <p>The Namayingo Police Station is also in the project area. The station manages 18 local precinct stations, and helps maintain peace throughout the district (there are about 70 crimes/month). They currently use radio equipment running on photovoltaic power to secure their communication network, but rainy day power outages are a major obstacle to peacekeeping activity. Not having street lights also severely limits both police crime fighting activity and the suppression of crime.</p> | Same as above                          | <p>This project is expected to make the following improvements:</p> <ul style="list-style-type: none"> <li>• Improve the peacekeeping communication system by ensuring power for the radio used in the Namayingo police system communications grid.</li> <li>• Control night crime by installing street lights and electric lighting in residential areas.</li> <li>• Electrifying these public facilities to improve their operation would help improve the lives of all 222,000 district residents.</li> </ul> |
| <p>&lt; Local Industries &gt;</p> <p>Small-scale flour milling, wood processing, steel works and other local industries in the project region operate at low production efficiency with no power.</p>   | Same as above                          | Secure power supply for the industrial area in the project region to improve operation of processing equipment, quality and other production factors to stimulate local industry.  |

**(3) Calculation of the Reduction Amount of GHG Emission by the Project**

In the project site, kerosene lumps are applied for lighting in the project site. The fuel cost for kerosene lumps, which people’s living are born with, is not small, their brightness is not enough and soot coursed of burning of kerosene is harming health people using them. Therefore, it is assumed that enrgy for lighting will be changed to electricity from kerosene in the early stage after electrification by the Project. Reduction of CO<sub>2</sub> emission and cost for energy for lighting by transformation of energy type is calculated below.

The GHG emission from power consumption is calculated as follows, applying the emission factors shown in Table 3-4-2.1.

- ① Calculation of the Consumed Power Energy (GWh/year)
- ② Consumed Power Energy (GWh/year) × 3,600 (GJ/GWh) ÷ Thermal efficiency of power generating system (0.40) = Consumed calorific value (GJ/year)



- ③ Consumed calorific value (GJ/year) × Emission constant × 44/12 = Reduction amount of CO<sub>2</sub> emission

**Table 3-4-2.1 Emission Factor by Type of Fuel**

| Type of Fuel | Unit Calorific Value                    | Emission Factor |
|--------------|---|-----------------|
| Coal         | 28.9 GJ/t                               | 0.0247 tC/GJ    |
| Crude Oil    | 38.2 GJ/kl                              | 0.0187 tC/GJ    |
| Gas Oil      | 38.2 GJ/kl                              | 0.0187 tC/GJ    |
| Bunker A Oil | 39.1 GJ/kl                              | 0.0189 tC/GJ    |
| Natural Gas  | 40.9 GJ/10 <sup>3</sup> Nm <sup>3</sup> | 0.0139 tC/GJ    |

Source: Ministry of the Environment and METI, "Manual for Calculation of GHG Emission Amount and Reporting", June, 2007

### 1) Reduction of Energy Cost by Energy Transformation

The monthly lighting expenditure is calculated below for the case where kerosene lamps for lighting are replaced by fluorescent lamps while assuming the continuity of the general living standard.

The socio-economic survey was carried out in the project site, and it is found that un-electrified local households possess approximately two kerosene lamps and that their monthly fuel expenditure is approximately 42,000 UGX.

After electrification by the Project, it is assumed that two lumps of 13 W/bulbs will be aduptted per household and used for 9 hours judging from duration of sunshine hours In case that a kerosene lump is displace to a 13 W of a fluorescent lamp, monthly energy consumption per household for lighting is assumed as follows.

$$13 \text{ W} \times 2 \text{ Lumps} \times 9 \text{ hours/day} \times 30 \text{ days/month} \times 1/1,000 \text{ kW/W} = 7.020 \text{ kWh/month}$$

As the metered electricity charge is 385.6 UGX/kWh as of 2010, the consumption of the above amount of electric energy will result in a monthly charge of some 2,700 UGX/month which is approximately one-fifteenth of the cost of using two kerosene lamps.

$$7.020 \text{ kWh/month} \times 385.6 \text{ UGX/kWh} = 2,706 \text{ UGX/month}$$

### 2) Effect of Change of Energy Source for Lighting on GHG Reduction

The effect on GHG reduction is calculated assuming that kerosene lamps are replaced by fluorescent lamps in the project site after implementation of the Project.

The number of households awaiting connection at the two Project sites is approximately 9,500. Assuming monthly power consumption of 7.020 kWh/month per household for lighting, the annual consumption is approximately 0.8 GWh.

$$7.020 \text{ kWh/month/household} \times 9,500 \times 12 \text{ months/year} = 800,280 \text{ kWh/year}$$

$$= 0.8003 \text{ GWh/year}$$

Assuming that this electric energy consumed comes from diesel engine generators, the annual emission volume of CO<sub>2</sub> is approximately 500 tons. In the following equation, the thermal efficiency of this generation system and emission factor for natural gas are assumed to be 40% and 0.0187 Ct/GJ respectively.

$$0.8003 \text{ GWh/year} \times 3,600 \text{ GJ/GWh} \div 0.40 \times 0.0187 \text{ Ct/GJ} \times 44/12 \text{ CO}_2 \text{ t/Ct}$$

$$= 493.9 \text{ CO}_2 \text{ t/year}$$

As an average monthly expenditure of 42,000 UGX/month for fuel is assumed, and the unit cost of kerosene in the project site is some 2,800 UGX/L as of 2011, the total annual consumption of kerosene in the project site is approximately 1,710 kL.

$$42,000 \text{ UGX /month/household} \div 2,800 \text{ UGX /L} \times 12 \text{ months/year} \times$$

$$9,500 \text{ households} \times 1/1,000 \text{ kL/L} = 1,710 \text{ kL}$$

The volume of CO<sub>2</sub> emission from the burning of this amount of fossil fuel is approximately 4,300 tons as calculated below, meaning that the use of electricity as the energy source for lighting reduces the CO<sub>2</sub> emission by some 3,800 tons a year. For this calculation, the unit calorific value and emission factor of kerosene are assumed to be 36.7 GJ/kl and 0.0139 Ct/GJ respectively.

$$1,710 \text{ kL} \times 36.7 \text{ GJ/kL} \times 0.0185 \text{ Ct/GJ} \times 44/12 \text{ CO}_2 \text{ t/Ct} = 4,257 \text{ CO}_2 \text{ t/year}$$

## Appendices

## A-1 Member List of the Study Team

## A-1. Member of List of Study Team

### 【First Survey】

| Name             | Job Tittle   | Occupation  |
|------------------|--|---|
| Akira Niwa       | Team Leader  | Japan International Cooperation Agency                  |
| Masae Iijima     | Planning Management  | Japan International Cooperation Agency<br>Uganda Office |
| Masatsugu Komiya | Chief Consultant /<br>Power Supply Planning                    | Yachiyo Engineering Co., Ltd.                           |
| Kazunari Nogami  | Deputy Chief Consultant/<br>Distribution Equipment Planning    | Yachiyo Engineering Co., Ltd.                           |
| Masayuki Tamai   | Distribution System Planning                                   | Yachiyo Engineering Co., Ltd.                           |
| Takeshi Omura    | Social and Environmental<br>Considerations                     | Yachiyo Engineering Co., Ltd.                           |
| Ayumi Koyama     | Coordinator/<br>Assistance for Distribution<br>System Planning | Yachiyo Engineering Co., Ltd.                           |

### 【Second Survey】

| Name             | Job Tittle   | Occupation                             |
|------------------|--|--|
| Akira Niwa       | Team Leader  | Japan International Cooperation Agency |
| Shinichi Wada    | Planning Management  | Japan International Cooperation Agency |
| Masatsugu Komiya | Chief Consultant /<br>Power Supply Planning                    | Yachiyo Engineering Co., Ltd.          |
| Kazunari Nogami  | Deputy Chief Consultant/<br>Distribution Equipment Planning    | Yachiyo Engineering Co., Ltd.          |
| Masayuki Tamai   | Distribution System Planning                                   | Yachiyo Engineering Co., Ltd.          |
| Takeshi Omura    | Social and Environmental<br>Considerations                     | Yachiyo Engineering Co., Ltd.          |
| Uruno Atsuhito   | Procurement and Installation<br>Plan/Cost Estimation           | Yachiyo Engineering Co., Ltd.          |
| Ayumi Koyama     | Coordinator/<br>Assistance for Distribution<br>System Planning | Yachiyo Engineering Co., Ltd.          |

**【Third Survey】**

| Name             | Job Tittle  | Occupation                             |
|------------------|---|--|
| Akira Niwa       | Team Leader   | Japan International Cooperation Agency |
| Masatsugu Komiya | Chief Consultant /<br>Power Supply Planning                 | Yachiyo Engineering Co., Ltd.          |
| Kazunari Nogami  | Deputy Chief Consultant/<br>Distribution Equipment Planning | Yachiyo Engineering Co., Ltd.          |
| Takeshi Omura    | Social and Environmental<br>Considerations                  | Yachiyo Engineering Co., Ltd.          |

## A-2 Study Schedule

## [First Survey]

| No.        | Date         | Day              | Contents of Survey   |                     |   |   |                              |   | Accommodation |
|------------|--------------|------------------|--|---------------------|---|---|------------------------------|---|---------------|
|            |              |                  | JICA   |                     | Consultant (Yachiyo Engineering Co., Ltd.)  |   |                              |   |               |
|            |              |                  | Team Leader  | Planning Management | Chief Consultant / Power Supply Planning  | Deputy Chief Consultant/ Distribution Equipment Planning  | Distribution System Planning | Social and Environmental Considerations |               |
| Akira Niwa | Masae Iijima | Masatsugu Komiya | Kazunari Nogami  | Masayuki Tamai      | Takeshi Omura   | Ayumi Koyama  |                              |   |               |
| 1          | 2-Apr        | Sat              | · Trip by air (Tokyo 22:00→Dubai 04:55 by EK-319)  |                     |   |   |                              |   | Airplane      |
| 2          | 3-Apr        | Sun              | · Trip by air (Dubai 08:25→Entebbe14:45 by EK-723)   |                     |   |   |                              |   | Kampala       |
| 3          | 4-Apr        | Mon              | <ul style="list-style-type: none"> <li>· Courtesy call to JICA Uganda Office, explanation of and discussion on the schedule of the field survey</li> <li>· Courtesy call to MEMD, explanation of and discussion on the Inception Report and schedule of the field survey</li> <li>· Courtesy call to REA, explanation of and discussion on the Inception Report and schedule of the field survey</li> <li>· Courtesy call to UETCL</li> <li>· Kick-off meeting at MEMD (Participants: MEMD, UETCL, REA, NEMA, WB, KfW, UMEME)</li> </ul> |                     |   |   |                              |   | Kampala       |
| 4          | 5-Apr        | Tue              | <ul style="list-style-type: none"> <li>· Discussion on priority criteria of the site selection with MEMD</li> <li>· Discussion on priority criteria of the site selection with REA</li> <li>· Data collection from UETCL</li> </ul>  |                     |   |   |                              |   | Kampala       |
| 5          | 6-Apr        | Wed              | <ul style="list-style-type: none"> <li>· Data collection from NORAD</li> <li>· Data collection from KfW</li> <li>· Data collection from WB</li> <li>· Discussion on MD (draft) with REA</li> </ul>   |                     |   | <ul style="list-style-type: none"> <li>· Data collection from NEMA</li> <li>· Data collection from NFA</li> <li>· Data collection from MWT</li> </ul> |                              |   | Kampala       |
| 6          | 7-Apr        | Thu              | <ul style="list-style-type: none"> <li>· Discussion on MD (draft) with MEMD</li> <li>· Discussion on MD (draft) with REA</li> </ul>  |                     |   |   |                              |   | Kampala       |
| 7          | 8-Apr        | Fri              | <ul style="list-style-type: none"> <li>· Wrap-up meeting and signing on MD</li> <li>· Report the results of the Survey to EOJ</li> <li>· Report the results of the Survey to JICA Uganda Office</li> </ul>   |                     |   |   |                              |   | Kampala       |
| 8          | 9-Apr        | Sat              | · Trip by Air (Entebbe→Dubai)  |                     | · Area-3(Around Mubende) site survey  |   |                              |   | Kampala       |
| 9          | 10-Apr       | Sun              | · Trip by Air (Dubai→Tokyo)  |                     | · Area-3(Around Mubende) site survey  |   |                              |   | Kampala       |
| 10         | 11-Apr       | Mon              |  |                     | · Area-3(Around Mubende) site survey  |   |                              |   | Kampala       |
| 11         | 12-Apr       | Tue              |  |                     | · Area-3(Around Mubende) site survey  |   |                              |   | Kampala       |
| 12         | 13-Apr       | Wed              |  |                     | · Area-3(Around Mubende) site survey  |   |                              |   | Kampala       |
| 13         | 14-Apr       | Thu              |  |                     | <ul style="list-style-type: none"> <li>· Trip by car (2H: Kampala→Jinja)</li> <li>· Area-4 (Around Iganga) site survey</li> </ul>   |   |                              |   | Jinja         |
| 14         | 15-Apr       | Fri              |  |                     | · Area-4 (Around Iganga) site survey  |   |                              |   | Jinja         |
| 15         | 16-Apr       | Sat              |  |                     | · Area-4 (Around previous site, Bugiri and Nabitende) site survey   |   |                              |   | Jinja         |
| 16         | 17-Apr       | Sun              |  |                     | · Sorting data  |   |                              |   | Jinja         |
| 17         | 18-Apr       | Mon              |  |                     | · Area-4 (Around Iganga) site survey  |   |                              |   | Jinja         |
| 18         | 19-Apr       | Tue              |  |                     | <ul style="list-style-type: none"> <li>· Trip by car(2H:Jinja→Kampala)</li> <li>· Preparation of Field Report (English)</li> </ul>  |   |                              |   | Kampala       |
| 19         | 20-Apr       | Wed              |  |                     | · Preparation of Field Report (English)   |   |                              |   | Kampala       |
| 20         | 21-Apr       | Thu              |  |                     | <ul style="list-style-type: none"> <li>· Explanation of and signing on field report with MEMD</li> <li>· Explanation of and signing on field report with REA</li> </ul>   |   |                              |   | Kampala       |
| 21         | 22-Apr       | Fri              |  |                     | · Preparation of Field Report (Japanese)  |   |                              |   | Kampala       |
| 22         | 23-Apr       | Sat              |  |                     | · Preparation of Field Report (Japanese)  |   |                              |   | Kampala       |
| 23         | 24-Apr       | Sun              |  |                     | · Preparation of Field Report (Japanese)  |   |                              |   | Kampala       |
| 24         | 25-Apr       | Mon              |  |                     | · Preparation of Field Report (Japanese)  |   |                              |   | Kampala       |
| 25         | 26-Apr       | Tue              |  |                     | <ul style="list-style-type: none"> <li>· Report result of first field survey and submission the report to EOJ</li> <li>· Report result of first field survey and submission the report to JICA Uganda Office</li> </ul> |   |                              |   | Kampala       |
| 26         | 27-Apr       | Wed              |  |                     | · Trip by air (Entebbe 16:20→Dubai 00:35 by EK-724)   |   |                              |   | Airplane      |
| 27         | 28-Apr       | Thu              |  |                     | · Trip by air (Dubai 02:50→Tokyo 17:20 by EK-318)   |   |                              |   | Return to JP  |

### Abbreviation

|       |   |
|-------|---|
| EOJ   | Embassy of Japan in Uganda                      |
| JICA  | Japan International Cooperation Agency          |
| KfW   | Kreditanstalt für Wiederaufbau                  |
| MEMD  | Ministry of Energy and Mineral Development      |
| MD    | Minutes of Discussion                           |
| MWT   | Ministry of Works and Transport                 |
| NEMA  | National Environmental Management Agency        |
| NFA   | National Forest Authority                       |
| NORAD | Norwegian Agency for Development Cooperation    |
| REA   | Rural Electrification Agency                    |
| UETCL | Uganda Electricity Transmission Company Limited |
| WB    | World Bank                                      |



[Second Survey]

| No.        | Date          | Day              | Contents of Survey  |                     |  |  |  |  |                              | Accommodation     |
|------------|---------------|------------------|---|---------------------|--|--|--|--|------------------------------|-------------------|
|            |               |                  | Officials   |                     | Consultant (Yachiyo Engineering Co., Ltd.)   |  |  |  |                              |                   |
|            |               |                  | JICA  |                     | Group A  |  | Group B  | Group C  |                              |                   |
|            |               |                  | Team Leader   | Planning Management | Chief Consultant / Power Supply Planning   | Deputy Chief Consultant/ Distribution Equipment Planning   | Coordinator/ Assistance for Distribution System Planning | Social and Environmental Considerations  | Distribution System Planning |                   |
| Akira Niwa | Shinichi Wada | Masatsugu Komiya | Kazunari Nogami   | Ayumi Koyama        | Takeshi Omura  | Masayuki Tamai   | Uruno Atsuhito   |  |                              |                   |
| 1          | 11-Jun        | Sat              | · Trip by air (Tokyo 22:00→ Dubai 04:55 by EK-319)  |                     |  |  |  |  |                              | in plane          |
| 2          | 12-Jun        | Sun              | · Trip by air (Dubai 08:25→ Entebbe 14:45 by EK-723)  |                     |  |  |  |  |                              | Kampala           |
| 3          | 13-Jun        | Mon              | · Courtesy Call to JICA Uganda Office and explanation of policy, contents and schedule<br>· Kick-off meeting with MEMD, REA, UETCL, UEDCL and UMEME, and explanation of policy, contents and schedule   |                     |  |  |  |  |                              | Kampala           |
| 4          | 14-Jun        | Tue              | · Discussion with REA on policy for distribution route selection, environmental and social considerations, preparation schedule for the Project Brief and plan for the Stake Holder Meeting<br>· Discussion with REA and UMEME on current conditions of related power system and necessity of upgrading of the existing equipment |                     |  |  |  |  |                              | Kampala           |
| 5          | 15-Jun        | Wed              | · Discussion with REA (Policy for distribution route selection, environmental and social considerations, preparation schedule for the Project Brief)<br>· Discussion with REA and MEMD (The draft Minutes of Discussion (M/D))  |                     |  |  |  | · Trip (Kampala→ Jinja)<br>· Site Survey at Jinja Industrial Substation  |                              | Kampala/<br>Jinja |
| 6          | 16-Jun        | Thu              | · Signing on M/D<br>· Interim report of results of the to EOJ   |                     |  | · Discussion with REA on contents of Stake Holder Meeting  |  | · Site survey in the project sites of JICA II  |                              | Kampala/<br>Jinja |
| 7          | 17-Jun        | Fri              | · Discussion with UETCL   |                     |  | · Discussion with REA on contents of Stake Holder Meeting  |  | · Site survey at Tororo Substation   |                              | Kampala/<br>Jinja |
| 8          | 18-Jun        | Sat              | · Internal meeting  |                     |  |  |  |  |                              | Kampala/<br>Jinja |
| 9          | 19-Jun        | Sun              | · Trip by air (Entebbe 16:20→ Dubai 00:35 by EK-724)  |                     | · Trip by car (Kampala to Jinja)   |  |  |  |                              | Kampala/<br>Jinja |
| 10         | 20-Jun        | Mon              | · Site Survey in Area-4 (Mayuge—Mpungwe)  |                     |  |  |  |  |                              | Jinja             |
| 11         | 21-Jun        | Tue              | · Site Survey in Area-4 (Mayuge—Mpungwe)  |                     |  |  |  |  |                              | Jinja             |
|            |               |                  | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.)<br>· Same as Group B   |                     |  | · Site survey for environmental and social considerations<br>· Hearing survey from sub-county office and local communities<br>· Wrap-up Meeting with the environmental officer of the district |  | · Distribution Route Survey  |                              |                   |
| 12         | 22-Jun        | Wed              | · Site Survey in Area-4 (Mpungwe—Bwalula)   |                     |  |  |  |  |                              | Jinja             |
| 13         | 23-Jun        | Thu              | · Site Survey in Area-4 (Mpungwe—Bwalula)   |                     |  |  |  |  |                              | Jinja             |
|            |               |                  | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.)<br>· Same as Group B   |                     |  | · Site survey for environmental and social considerations<br>· Hearing survey from sub-county office and local communities<br>· Wrap-up Meeting with the environmental officer of the district |  | · Distribution Route Survey  |                              |                   |
| 14         | 24-Jun        | Fri              | · Site Survey in Area-4 (Bwalula—Namayingo)   |                     |  |  |  |  |                              | Jinja             |
| 15         | 25-Jun        | Sat              | · Site Survey in Area-4 (Bwalula—Namayingo)   |                     |  |  |  |  |                              | Jinja             |
|            |               |                  | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.)  |                     |  | · Site survey for environmental and social considerations<br>· Hearing survey from sub-county office and local communities   |  | · Distribution Route Survey  |                              |                   |
| 16         | 26-Jun        | Sun              | · Internal meeting  |                     |  |  |  |  |                              | Jinja             |
| 17         | 27-Jun        | Mon              | · Site Survey in Area-4 (Bwalula—Namayingo)   |                     |  |  |  |  |                              | Jinja             |
|            |               |                  | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.)<br>· 15:00-16:00 Same as Group B   |                     | · Distribution Equipment Planning  | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.)<br>· 15:00-16:00 Same as Group B                                    |  | · Site survey for environmental and social considerations<br>· Hearing survey from sub-county office and local communities<br>· Wrap-up Meeting with the environmental officer of the district |                              |                   |
| 18         | 28-Jun        | Tue              | · Site Survey in Area-4 (Namayingo-Lumino, Bwanga- Mwembe-Tayari, Bwalula-Mundindi)   |                     |  |  |  |  |                              | Jinja             |
| 19         | 29-Jun        | Wed              | · Trip by air (Jinja→Kampala)<br>· Meeting with UMEME<br>· Meeting with MEMD  |                     | · Site Survey in Area-4 (Namayingo-Lumino, Bwanga- Mwembe-Tayari, Bwalula-Mundindi)  |  |  |  |                              | Jinja             |
|            |               |                  | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.)  |                     |  | · Site survey for environmental and social considerations<br>· Hearing survey from sub-county office and local communities   |  | · Distribution Route Survey  |                              |                   |
| 20         | 30-Jun        | Thu              | · Report to JICA Uganda Office<br>· Meeting with MEMD<br>· Report to EOJ<br>· Meeting with UETCL  |                     | · Site Survey in Area-4 (Namayingo-Lumino, Bwanga- Mwembe-Tayari, Bwalula-Mundindi)  |  |  |  |                              | Kampala/Jinja     |
|            |               |                  | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.)  |                     |  | · Site survey for environmental and social considerations<br>· Hearing survey from sub-county office and local communities<br>· Wrap-up Meeting with the environmental officer of the district |  | · Distribution Route Survey  |                              |                   |
| 21         | 1-Jul         | Rri              | · Inspection of the previous project sites with EOJ, JICA, MEMD, REA and UMEME  |                     |  |  |  |  |                              | Kampala/Jinja     |
| 22         | 2-Jul         | Sat              | · Site Survey in Area-4 (Namayingo—Bumeru A, Lutolo—Lugala)   |                     |  |  |  |  |                              | in plane/Jinja    |
|            |               |                  | · Trip by air (Entebbe 16:20→ Dubai 00:35 by EK-724)  |                     | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.) |  |  | · Data sorting   |                              |                   |
| 23         | 3-Jul         | Sun              | · Trip by air (Dubai 02:50→ Tokyo 17:20 by EK-319)  |                     |  |  |  |  |                              | Jinja             |
| 24         | 4-Jul         | Mon              | · Internal Meeting  |                     |  |  |  |  |                              | Jinja             |
| 25         | 5-Jul         | Tue              | · Site Survey in Area-4 (Namayingo—Busiro Landing Site)   |                     |  |  |  |  |                              | Jinja             |
|            |               |                  | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.)  |                     |  | · Site survey for environmental and social considerations<br>· Hearing survey from sub-county office and local communities   |  | · Distribution Route Survey  |                              |                   |
| 26         | 6-Jul         | Wed              | · Site Survey in Area-4 (Namayingo—Busiro Landing Site)   |                     |  |  |  |  |                              | Jinja             |
|            |               |                  | · Site survey for positive effects of the Project (Educational facilities, medical facilities, general customers and etc.)<br>· Same as Group B   |                     |  | · Site survey for environmental and social considerations<br>· Hearing survey from sub-county office and local communities<br>· Wrap-up Meeting with the environmental officer of the district |  | · Distribution Equipment Planning  |                              |                   |
| 27         | 7-Jul         | Thu              | · Preparation of the second field report  |                     |  |  |  |  |                              | Jinja             |
| 28         | 8-Jul         | Fri              | · Preparation of the second field report  |                     |  |  |  |  |                              | Jinja             |
| 29         | 9-Jul         | Sat              | · Preparation of the second field report  |                     |  |  |  |  |                              | Jinja             |
| 30         | 10-Jul        | Sun              | · Internal Meeting and data sorting   |                     |  |  |  |  |                              | Jinja             |

| No.        | Date          | Day              | Contents of Survey |                     |  |   |  |   |                              | Accommodation |
|------------|---------------|------------------|--------------------|---------------------|--|---|--|---|------------------------------|---------------|
|            |               |                  | Officials          |                     | Consultant (Yachiyo Engineering Co., Ltd.) |   |  |   |                              |               |
|            |               |                  | JICA               |                     | Group A                                    |   | Group B  | Group C                                 |                              |               |
|            |               |                  | Team Leader        | Planning Management | Chief Consultant / Power Supply Planning   | Deputy Chief Consultant/ Distribution Equipment Planning  | Coordinator/ Assistance for Distribution System Planning                                     | Social and Environmental Considerations | Distribution System Planning |               |
| Akira Niwa | Shinichi Wada | Masatsugu Komiya | Kazunari Nogami    | Ayumi Koyama        | Takeshi Omura                              | Masayuki Tamai  | Uruno Atsuhito   |   |                              |               |
| 31         | 11-Jul        | Mon              |                    |                     |  | Site Survey in Area-4 (spare day)   |  |   | Jinja                        |               |
| 32         | 12-Jul        | Tue              |                    |                     |  | Trip to Kampala<br>Site survey for O&M  | Preparation for Stake Holder Meetings<br>Review of the second field report                   | Trip to Kampala<br>Site survey for O&M  | Kampala/Jinja                |               |
| 33         | 13-Jul        | Wed              |                    |                     |  | Review of the second field report<br>Site survey for O&M  | Stake Holder Meeting in Namayingo District<br>Review of the second field report              | Market Survey                           | Kampala/Jinja                |               |
| 34         | 14-Jul        | Thu              |                    |                     |  | Review of the second field report<br>Site survey for O&M  | Stake Holder Meeting in Mayuge District<br>Review of the second field report                 | Market Survey                           | Kampala/Jinja                |               |
| 35         | 15-Jul        | Fri              |                    |                     |  | Review of the second field report<br>Site survey for O&M  | Trip by car ( Jinja to Kampala)<br>Preparation of the second field survey report in Japanese | Market Survey                           | Kampala                      |               |
| 36         | 16-Jul        | Sat              |                    |                     |  | Preparation of the second field survey report in Japanese   |  |   | Kampala                      |               |
| 37         | 17-Jul        | Sun              |                    |                     |  | Preparation of the second field survey report in Japanese   |  |   | Kampala                      |               |
| 38         | 18-Jul        | Mon              |                    |                     |  | Explanation of and Signing on the second field report to MEMED and REAMEMD<br>Preparation of the second field survey report in Japanese |  | Market Survey                           | Kampala                      |               |
| 39         | 19-Jul        | Tue              |                    |                     |  | Preparation of the second field survey report in Japanese   |  |   | Kampala                      |               |
| 40         | 20-Jul        | Wed              |                    |                     |  | Report of results of the second field to JICA Uganda Office and EOJ   |  |   | Kampala                      |               |
| 41         | 21-Jul        | Thu              |                    |                     |  | Trip by air [Entebbe 16:20→ Dubai 00:35 by EK-724]  |  |   | in plane                     |               |
| 42         | 22-Jul        | Fri              |                    |                     |  | Trip by air [Dubai 02:50→ Tokyo 17:20 by EK-318]  |  |   | Japan                        |               |

Abbreviation

|        |  |
|--------|--|
| EOJ    | Embassy of Japan in Uganda                             |
| JICA   | Japan International Cooperation Agency                 |
| MEMD   | Ministry of Energy and Mineral Development             |
| MoFPED | Ministry of Finance, Planning and Economic Development |
| NORAD  | Norwegian Agency for Development Cooperation           |
| REA    | Rural Electrification Agency                           |
| UEDCL  | Uganda Electricity Distribution Company Ltd.           |
| UETCL  | Uganda Electricity Transmission Company Limited        |
| UMEME  | Umeme Limited  |

[Third Survey]

| No. | Date      | Day  | Survey Schedule   |   |  | Accommodation |  |
|-----|-----------|------|---|---|--|---------------|--|
|     |           |      | Officials   | Consultant (Yachiyo Engineering Co., Ltd.)  |  |               |  |
|     |           |      | JICA  | Chief Consultant/<br>Power Development<br>Planning  | Deputy Chief Consultant/<br>Distribution Equipment |               | Environmental and Social<br>Considerations |
|     |           |      |   | Masatsugu KOMIYA  | Kazunari NOGAMI                                    |               | Takeshi OMURA                              |
| 1   | 3rd Oct.  | Mon. | · Trip {Tokyo 22:00 → Dubai 04:55 by EK-319}  |   |  | in Plane      |  |
| 2   | 4th Oct.  | Tue. | · Trip {Dubai 08:25 → Entebbe 14:45 by EK-723}  |   |  | Kampala       |  |
| 3   | 5th Oct.  | Wed. | · Courtesy call to EOJ and JICA Uganda Office, and Explanation of the draft Preparatory Survey Report<br>· Courtesy call to MEMD and REA, and Explanation of the draft Preparatory Survey Report<br>· Confirmation of progress of acquisition of the environmental permit |   |  | Kampala       |  |
| 4   | 6th Oct.  | Thu. | · Discussion on draft Preparatory Survey Report and Technical Specifications with REA<br>· Discussion on the draft Minutes of Discussion (M/D) with the Ugandan side  |   |  | Kampala       |  |
| 5   | 7th Oct.  | Fri. | · Signing on M/D<br>· Report to EOJ and JICA Uganda Office  |   |  | Kampala       |  |
| 6   | 8th Oct.  | Sat. | · Trip {Entebbe 16:20→<br>Dubai 00:35 by EK-724}  | · Review of draft Preparatory Survey Report and Technical Specifications<br>based on discussion with the Ugandan side |  | Kampala       |  |
| 7   | 9th Oct.  | Sun. | · Trip {Dubai 02:50→<br>Tokyo 17:20 by EK-<br>318}  | · Internal Meeting  |  | Kampala       |  |
| 8   | 10th Oct. | Mon. |   | · Confirmation of modification points of the draft Preparatory Survey Report<br>and Technical Specifications          |  | Kampala       |  |
| 9   | 11th Oct. | Tue. |   | · Confirmation of modification points of the draft Preparatory Survey Report<br>and Technical Specifications          |  | Kampala       |  |
| 10  | 12th Oct. | Wed. |   | · Report of results of the Third Field Survey to MEMD and REA<br>· Report to JICA Uganda Office                       |  | Kampala       |  |
| 11  | 13th Oct. | Thu. |   | · Trip {Entebbe 16:20→ Dubai 00:35 by EK-724}   |  | Kampala       |  |
| 12  | 14th Oct. | Fri. |   | · Trip {Dubai 02:50→ Tokyo 17:20 by EK-318}   |  | in Plane      |  |

Abbreviation

|      |  |
|------|--|
| EOJ  | Embassy of Japan                           |
| JICA | Japan International Cooperation Agency     |
| MEMD | Ministry of Energy and Mineral Development |
| REA  | Rural Electrification Agency               |

A-3 List of Parties Concerned  
In Recipient Country

### **A-3. List of Parties Concerned in the Recipient Country**

| <u>Name</u>  | <u>Job Title</u>   |
|--|--|
| <b>The World Bank Uganda Country Office</b>                            |  |
| Somin Mukherji   | Senior Financial Analyst<br>Sustainable Development Department Africa Region |
| <b>Royal Norwegian Embassy</b>   |  |
| Ms. Katrin C. Lervik   | Energy Counsellor  |
| <b>KfW Development Bank</b>  |  |
| Dr. Jan Martin Witte   | Senior Project Manager   |
| Mr. Klaus Gihir  | Division Chief Sub-Saharan Africa<br>Energy Transport Telecommunication      |
| <b>Ministry of Finance, Planning and Economic Development (MoFPED)</b> |  |
| Mr. Lawrence K Kiiza   | Director Economic Affairs  |
| Mr. Muhumuza NTACYO Juvenal  | Senior Economist/ Finance Officer Aid Liaison<br>Department                  |
| Ms. Jennifer Muwuliza  | AG. Commissioner Aid Liaison Department                                      |
| Mr. Mugagga Denis  | Economist – Aid Liaison Department   |
| Mr. Tomohito Kanaizuka   | ODA Loan Advisor Aid Liaison Department                                      |
| <b>Ministry of Energy and Mineral Development (MEMD)</b>               |  |
| Ms. Irene Nafuna Muloni  | Minister of Energy and Minerals  |
| Mr. Simon D’Janga  | Minister of State for Energy   |
| Mr. Ssegawa Ronald Gyagenda  | Undersecretary   |
| Eng. Henry Bidasala-Igaga  | Assistant Commissioner (Electric Power)                                      |
| Eng. Moses Murengezi   | Advisor to Chairman (EMSWG)  |
| Mr. Sam Barasa   | Personal Assistant to Minister   |
| Mr. James Baanabe Isingoma   | Acting Commissioner Energy Resources Department                              |
| Mr. Sajjabi J. Fredrick  | Senior Energy Officer  |
| Ms. Aguti Caroline   | Senior Petroleum Officer/ Environment  |
| Ms. Cecilia Menya  | Principal Energy Officer   |
| Mr. Julius Wamala  | Senior Engineering Officer   |
| Ms. Mary Mwogeza   | Civil Engineer   |
| Mr. Nabagereka Bridget   | Electrical Engineer  |
| Mr. Emmanuel Sande Nsubuga   | Energy Officer (Electrical)  |

**Ministry of Water and Environment (MWE)**

Ms. Lucy Iyango Assistant Commissioner Wetlands

**Electricity Regulatory Authority (ERA)**

Eng. Semitala Norbert Director, Technical Regulation  
Mr. Patrick J. Mwesige Director Financial & Admin' Services

**Rural Electrification Agency (REA)**

Mr. Godfrey R. Turyahilayo Executive Director  
Mr. Werike K. Godfrey Manager Project Monitoring & Evaluation  
Mr. Benon Bena Manager Investment Planning & Promotion  
Mr. Muguwa Andrew Principal Planning Engineer  
Mr. Philip F.P.Ggayi Senior Planning Engineer  
Mr. Thomas Amaku Senior Project Engineer  
Ms. Deborah Nantume Senior Construction Engineer  
Ms. Joan Kayanga Mutiibwa Project Engineer Construction  
Ms. Flavia Uwayezu Project Engineer Planning  
Mr. James Gideon Litta Wayleaves Officer  
Mr. Godfrey Tmiynhiwg Staff  
Mr. Daniel Mugarura Intern

**Uganda Electricity Transmission Company Ltd. (UETCL)**

Mr. Eriasi Kiyenba CEO  
Mr. Gerald Muganga Manager, Planning and Investments  
Mr. Andrew Geno Omalla Technical Officer, Projects  
Mr. Ziria Tibalwa Principal Planning Engineer  
Ms. Stephen Kyeganwa Senior Planning Engineer  
Mr. Pius Odoch UETCL Tororo Substation Manager

**Uganda Electricity Distribution Company Ltd. (UEDCL)**

Mr. Lurn Bamanya Project Manager

**Uganda Electricity Generation Company Ltd. (UEGCL)**

Mr. Dan W Mayanja Technical Manager  
Mr. Kitayimwa Godfrey Electrical Engineer  
Mr. Kanzira Milton Procurement Financial Specialist  
Mr. Jimmy. C. Oconel Hedonic Engineer / Consultant  
Mr. Otim Moses Environmental Specialist

**National Environment Management Authority (NEMA)**

|                      |   |
|----------------------|---|
| Mr. Francis Ogwal    | Natural Resource Management Specialist<br>(Biodiversity & Rangelands) |
| Mr. Alex Winyi Kiiza | Environmental Impact Assessment Officer                               |

**Uganda National Road Authority (UNRA)**

|                    |                                       |
|--------------------|---------------------------------------|
| Mr. Patrick Muleme | Project Engineer – Technical Services |
|--------------------|---------------------------------------|

**National Forestry Authority (NFA)**

|                           |                            |
|---------------------------|----------------------------|
| Mr. Paul Musamali Buyerah | Director Corporate Affairs |
|---------------------------|----------------------------|

**Wildlife Conservation Society**

|                    |                         |
|--------------------|-------------------------|
| Mr. Andy Plumptre  | Director Albertine Rift |
| Ms. Sarah Prinsloo | Staff                   |

**Masaka District**

|                    |                     |
|--------------------|---------------------|
| Ms. Rose Nakyejwe  | Environment Officer |
| Mr. Behwera Wilson | Wetland Officer     |

**Rakai District**

|                   |                 |
|-------------------|-----------------|
| Mr. Kiyingi Jamil | Wetland Officer |
|-------------------|-----------------|

**Mayuge District**

|                        |  |
|------------------------|--|
| Mr. Omar Bongo Ductoor | District Chiarmen, Mayuge District     |
| Mr. Kabakubya Samuel   | Assistant Chief Administration Officer |
| Mr. Lubanga            | District Natural Resource Officer      |
| Mr. Alan Thomas        | District Environment Officer           |
| Mr. Mr. Aramu Thomas   | Environment Officer                    |

**Iganga District**

|                         |  |
|-------------------------|--|
| Ms. Epodoi Pauline Opio | Principal Assistant Secretary          |
| Mr. Wamala Jotham       | Assistant Chief Administrative Officer |
| Mr. Samanya Abdul       | District Forest Officer                |
| Mr. Dhikusooka Joseph   | District Agricultural Officer          |
| Mr. Batuuka Samuel      | District Community Officer             |
| Mr. Kayemba Jonan Fred  | District Planner                       |
| Mr. Kagere Reinhard     | Project Support Officer CAIIP          |
| Mr. Neluswu Mwamud      | Chairperson Nondwe Town Board          |
| Mr. Mubikirwa Sulayi    | Councilor of Nondwe                    |

**Bugiri District**

|                         |                                |
|-------------------------|--------------------------------|
| Ms. Margaret Mwanamoiza | Resident District Commissioner |
| Mr. Luke L.L. Lokuda    | Chief Administrative Officer   |
| Ms. Benadet Kauma       | Environmental Officer          |
| Mr. Kyondha Mnadmudy    | District Planner               |
| Mr. Ngia Abebi          | Water pump Operator            |
| Mr. Bogere Muzammu      | Water pump Operator            |

**Namayingo District**

|                       |  |
|-----------------------|--|
| Mr. Richard Mugolo    | Chief Administrative Officer           |
| Mr. Kaleeba Peter     | Assistant Chief Administrative Officer |
| Mr. Mayede Ebwoni     | Accountant                             |
| Mr. Kaawo Kawere Naay | District Educational Officer           |
| Mr. Bwamiki Michael   | District Health Educator               |
| Mr. Kaleeba Peter     | District Health Inspector              |

**Busia District**

|                          |                                     |
|--------------------------|-------------------------------------|
| Mr. Senteza Yusuf        | Chief Administrative Officer        |
| Mr. Adeya Vincent        | Deputy Chief Administrative Officer |
| Mr. Wabwire Patric       | District Planner                    |
| Ms. Teopista Namajja     | Municipality Environmental Officer  |
| Mr. Omingo Matuta Julius | Chief of Busime sub-county          |
| Mr. Ondworo James        | Accountant of Busime sub-county     |
| Ms. Kisakye Moureen      | Intern                              |
| Mr. Johnson Erienyu      | Forest Officer                      |

**Ferdsult Engineering Services Ltd.**

|                  |                  |
|------------------|------------------|
| Mr. Simbwa Emeil | Projects Manager |
|------------------|------------------|

**Umeme Limited**

|                     |   |
|---------------------|---|
| Mr. Charles Chapman | Managing Director                               |
| Mr. Sam Zimbe       | General Manager Corporate & Regulatory Affaires |
| Mr. Robert Kisubi   | Support Service Manager                         |
| Mr. Zach Human      | Network Manager Planning & Loss Reduction       |
| Mr. Isaac Serwadda  | Project Manager                                 |
| Mr. Robert Mubiru   | Area Manager Eastern                            |
| Mr. Fred Wandira    | Power Transformer Maintenance Manager           |
| Mr. Charles Magembe | Switchgear Maintenance Manager                  |
| Ms. Patricia Ocan   | Planning & Design Manager                       |
| Mr. Ssonko Asuman   | Supervisor of Hamanve s/s                       |



Mr. Michael Oputo  
Mr. Mulondo Henry  
Mr. Sande John Baptist

District Manager Iganga and Kamuli  
Assistant Engineer in Tororo Regional Office  
Technical Officer

**Hydromax Limited**

Mr. Maheshwara Reddy  
Mr. Sentumbwe Godfrey

Executive Director  
General Manager

**Embassy of Japan in Uganda**

Mr. Kazuo Minagawa  
Ms. Eri Ogawa  
Mr. Shugo Sinohara

Ambassador Extraordinary and Plenipotentiary  
Third Secretary  
Coordinator for Economic Cooperation

**JICA Uganda Office**

Mr. Tetsuo Seki  
Ms. Akiko Nanami  
Ms. Masae Iijima  
Mr. Daniel Rutabingwa

Chief Representative  
Representative  
Project Formulation Advisor  
Consultant for Infrastructure Sector

## A-4 Socio-economic Data

Socio-economic data in the project site (Farmer) (1/2)

| Trading Center             | Makutu  | Nabigingo   | Mayuge-Bukholi  | Mayuge-Bukholi   | Mayuge-Bukholi  |
|----------------------------|---|---|---|--|---|
| Parish                     | Makutu  | Nabigingo   | Mayuge  | Mayuge   | Mayuge  |
| Sub-county                 | Makutu  | Bulidha   | Budaya  | Budaya   | Budaya  |
| District                   | Iganga  | Bugiri  | Bugiri  | Bugiri   | Bugiri  |
| Occupation                 | Farmer  | Farmer  | Farmer  | Farmer and cloth shop  | Farmer  |
| Number of family           | 10 people   | 10 people   | 7 people  | 12 people  | 6 people  |
| Income                     | 200,000 UGX/month   | 90,000 UGX/month  | 50,000 UGX/month  | 331,250 UGX/month  | 60,000 UGX/month  |
| Income source              |   |   |   |  |   |
| Cash crops                 | maize, coffee bean  | maize, coffee bean  | maize, ground nut, coffee bean, bean  | cotton, coffee bean, maize, bean   | maize, cassava  |
| Food crops                 | cassava, matoke   | bean  | bean  | cassava, maize, bean   |   |
| Number of Employee         | Non   | Non   | Non   | 5 (farming: 4, cloth shop: 1)  | Non   |
| Wage for Employee          | Non   | Non   | Non   | 8,000 people/month : farming   | Non   |
|                            |   |   |   | 45,000 people/month : cloth shop   |   |
| Energy Consumption         |   |   |   |  |   |
| Lighting                   |   |   |   |  |   |
| Equipments                 | kerosene lump   | kerosene lump   | kerosene lump   | kerosene lump  | tadoba  |
| Cost                       | 42,000 UGX/month  | 42,000 UGX/month  | 42,000 UGX/month  | 56,000 UGX/month   | 18,000 UGX/month  |
| Cooking                    |   |   |   |  |   |
| Equipments                 | wood  | wood  | wood, charcoal  | wood   | wood  |
| Cost                       | 60,000 UGX/month  | collect themselves  | 10,000 UGX/month  | 30,000 UGX/month   | 15,000 UGX/month  |
| Amusement                  |   |   |   |  |   |
| Equipments                 | 4 pairs of dry cell   | 4 pairs of dry cell   | radio   | radio  | 1 radio   |
| Cost                       | 4,800 UGX/month   | 4,800 UGX/month   | 14,400 UGX/month  | 7,200 UGX/month  | 1,200 UGX/month   |
| Others                     |   |   |   |  |   |
| Equipments                 | Non   | Non   | Non   | boreholl maintenance fee   | Non   |
| Cost                       | Non   | Non   | Non   | 500 UGX/month  | Non   |
| Total Energy Cost          | 106,800 UGX/month   | 46,800 UGX/month  | 66,400 UGX/month  | 93,700 UGX/month   | 34,200 UGX/month  |
| Prospect after electrified | <ul style="list-style-type: none"> <li>install lights</li> <li>use milling machine</li> <li>use fridge and open drinkings shop</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use milling machine</li> <li>open theater</li> <li>use fridge and open drinkings shop</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use milling machine</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use fridge and open drinkings shop</li> <li>use radio and TV</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use TV, radio, cooker and ironing</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Socio-economic data in the project site (Farmer) (2/2)

| Trading Center             | Muterere  | Lunyo   | Nondwe  | Irimbi  |
|----------------------------|---|---|---|---|
| Parish                     | Muterere  | Busiabaa  | Kasozi  | Kitumba   |
| Sub-county                 | Muterere  | Lunyo   | Makutu  | Muterere  |
| District                   | Bugiri  | Busia   | Iganga  | Bugiri  |
| Occupation                 | Farmer and livestock  | Farmer and drug store   | Farmer  | Farmer  |
| Number of family           | 10 people   | 16 people   | 13 people   | 15 people   |
| Income                     | 83,000 UGX/month  | 300,000 UGX/month   | 117,000 UGX/month   | 33,000 UGX/month  |
| Income source              |   |   |   |   |
| Cash crops                 | maize   | ground nut  | maize, coffee bean  | maize   |
| Food crops                 | bean  | cassava   | maize   |   |
| Number of Employee         | Non   | 10 (14 people/year)   | Non   | Non   |
| Wage for Employee          | Non   | 2,500/day • people  | Non   | Non   |
| Energy Consumption         |   |   |   |   |
| Lighting                   |   |   |   |   |
| Equipments                 | kerosene lump   | kerosene lump, battery lump   | tadoba  | tadoba  |
| Cost                       | 84,000 UGX/month  | 57,200 UGX/month  | 11,200 UGX/month  | 25,200 UGX/month  |
| Cooking                    |   |   |   |   |
| Equipments                 | wood  | wood  | wood  | wood  |
| Cost                       | collect themselves  | collect themselves  | collect themselves  | 10,000 UGX/month  |
| Amusement                  |   |   |   |   |
| Equipments                 | radio   | radio   | 1 radio   | 1 radio   |
| Cost                       | 2,400 UGX/month   | 3,600 UGX/month   | 4,800 UGX/month   | 9,600 UGX/month   |
| Others                     |   |   |   |   |
| Equipments                 | Non   | solar panel with battery  | Non   | Non   |
| Cost                       | Non   | Non   | Non   | Non   |
| Total Energy Cost          | 86,400 UGX/month  | 60,800 UGX/month  | 16,000 UGX/month  | 44,800 UGX/month  |
| Prospect after electrified | <ul style="list-style-type: none"> <li>install lights</li> <li>install lights for security (livestock)</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use milling machine</li> <li>use refrigerator for house</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use refrigerator, iron for house</li> <li>start poultry farming</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use milling machine</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Socio-economic data in the project site (General consumers) (1/3)

| Trading Center             | Bwalula   | Mundindi  | Lugala   | Lugala  | Busiro  |
|----------------------------|---|---|--|---|---|
| Parish                     | Isegero   | Mundindi  | Lugala   | Lugala  | Bujuwanga   |
| Sub-county                 | Nankoma   | Busime  | Banda  | Banda   | Banda   |
| District                   | Bugiri  | Busia   | Namayingo  | Namayingo   | Namayingo   |
| Occupation                 | Retail shop   | Bar and retail shop   | Milling machine and broker   | Milling machine operator and broker   | boat owner  |
| Number of family           | 20 people   | 4 people  | 8 people   | 5 people  | 13 people   |
| Income                     | 600,000 UGX/month   | 120,000 UGX/month   | 5,850,000 UGX/month  | 100,000 UGX/month   | 2,250,000 UGX/month   |
| Outline                    |   |   |  |   |   |
| Income source              | selling breads, beverages, snacks and etc.  | bar business and selling electrical equipment   |  |   |   |
| Number of Employee         | Non   | 2 people (only bar)   | 1 people   | Non   | 2 people  |
| Wage for Employee          | Non   | 30,000 UGX/month  | 105,000 UGX/month  | Non   | 150,000 UGX/month   |
| Working hour               | 7:00-22:00  | 7:00-19:00 shop, 12:00-0:00 bar   |  |   |   |
| Power generation           |   |   |  |   |   |
| Equipments                 | Non   | car battery   | Non  | Non   | Non   |
| Cost                       | Non   | 16,000 UGX/month  | Non  | Non   | Non   |
| Lighting                   |   |   |  |   |   |
| Equipments                 | battery lump  | battery lump  | battery lump   | kerosene lump, candles  | torch   |
| Cost                       | 42,000 UGX/month  | 14,400 UGX/month  | 14,400 UGX/month   | 102,000 UGX/month   | 36,000 UGX/month  |
| Others                     |   |   |  |   |   |
| Equipment                  | kerosene refrigerator   | Non   | miling machine   | Non   | gasoline engine for boat  |
| Use                        | sell drinkings  | Non   | maize, cassava   | Non   | fish  |
| Cost                       | 168,000 UGX/month   | Non   | 1,152,000 UGX/month  | Non   | 1,080,000 UGX/month   |
| Energy Consumption         |   |   |  |   |   |
| Lighting                   |   |   |  |   |   |
| Equipments                 | tadoba  | battery lump (same as for work)   | candle   | battery lump  | solar panel with battery  |
| Cost                       | 126,000 UGX/month   |   | 12,000 UGX/month   | 25,800 UGX/month  | 9,000 UGX/month   |
| Cooking                    |   |   |  |   |   |
| Equipments                 | wood  | charcoal and 1 kerosen stooove  | charcoal   | charcoal  | charcoal  |
| Cost                       | 310,000 UGX/month   | 79,500 UGX/month  | 49,000 UGX/month   | 80,000 UGX/month  | 8,000 UGX/month   |
| Amusement                  |   |   |  |   |   |
| Equipments                 | 2 radio   | radio   | cassetteradio  | cassetteradio   | radio   |
| Cost                       | 14,400 UGX/month  | 9,600 UGX/month   | 7,500 UGX/month  | 3,000 UGX/month   | 7,200 UGX/month   |
| Total Energy Cost          | 660,400 UGX/month   | 119,500 UGX/month   | 1,234,900 UGX/month  | 210,800 UGX/month   | 1,140,200 UGX/month   |
| Prospect after electrified | <ul style="list-style-type: none"> <li>install lights</li> <li>use fridge and open drinkings shop</li> <li>use milling machine</li> <li>use TV</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use fridge and open drinkings shop</li> <li>open battery charging shop</li> <li>open phone repairing shop</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use motor for milling machine</li> <li>use refrigerator for house</li> <li>use higher quality milling machine</li> <li>open welding shop</li> </ul> | <ul style="list-style-type: none"> <li>open phone battery charging shop</li> <li>use motor for milling machine</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use fridge and keep fish cool</li> <li>open welding shop</li> <li>purchase TV, cooker and ironing</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Socio-economic data in the project site (General consumers) (2/3)

| Trading Center             | Namayingo   | Namayingo  | Namayingo  | Namayingo North  | Namayingo North   |
|----------------------------|---|--|--|--|---|
| Parish                     | Namayingo   | Namayingo  | Namayingo  | Namayingo  | Namayingo   |
| Sub-county                 | Namayingo T.C.  | Namayingo T.C.   | Namayingo T.C.   | Namayingo T.C.   | Namayingo T.C.  |
| District                   | Namayingo   | Namayingo  | Namayingo  | Namayingo  | Namayingo   |
| Occupation                 | Bike taxi and bicycle shop  | Capentor   | Rice milling and whole sale shop owner   | Welding shop owner   | Welding workshop owner  |
| Number of family           | 11 people   | 10 people  | 8 people   | 11 people  | 8 people  |
| Income                     | 450,000 UGX/month   | 3,000,000 UGX/month  | 15,090,000 UGX/month   | 240,000 UGX/month  | 3,027,000 UGX/month   |
| Outline                    |   |  |  |  |   |
| Income source              | bike taxi 300,000<br>bicycle shop 150,000   |  |  |  |   |
| Number of Employee         | Non   | 7 people   | 2 people   | 1 people   | 3 people  |
| Wage for Employee          | Non   | 180,000 UGX/month  | 150,000 UGX/month  | 80,000 UGX/month   | 150,000 UGX/month   |
| Working hour               | 7:30-17:30  |  |  |  |   |
| Power generation           |   |  |  |  |   |
| Equipments                 | Non   | engine motor   | solar panel with battery   | generator  | generator   |
| Cost                       | Non   | 480,000 UGX/month  | Non  | 38,400 UGX/month   | 864,000 UGX/month   |
| Lighting                   |   |  |  |  |   |
| Equipments                 | Non   | Non  | torch  | Non  | Non   |
| Cost                       | Non   | Non  | 18,000 UGX/month   | Non  | Non   |
| Others                     |   |  |  |  |   |
| Equipment                  | Non   | Non  | diesel engine  | Non  | Non   |
| Use                        | Non   | Non  | grinding rice  | Non  | Non   |
| Cost                       | Non   | Non  | 960,000 UGX/month  | Non  | Non   |
| Energy Consumption         |   |  |  |  |   |
| Lighting                   |   |  |  |  |   |
| Equipments                 | light   | battery lumps  | battery lumps  | kerosene lump  | generator   |
| Cost                       | 2,400 UGX/month   | 14,400 UGX/month   | 36,000 UGX/month   | 42,000 UGX/month   | 108,000 UGX/month   |
| Cooking                    |   |  |  |  |   |
| Equipments                 | charcoal  | charcoal   | charcoal   | wood   | charcoal and water  |
| Cost                       | 6,000 UGX/month   | 18,000 UGX/month   | 90,000 UGX/month   | Non  | 105,000 UGX/month   |
| Amusement                  |   |  |  |  |   |
| Equipments                 | radio   | 2 radio  | 1 radio  | 2 radios   | 2 radios (by generator)   |
| Cost                       | 2,400 UGX/month   | 48,000 UGX/month   | 36,000 UGX/month   | 2,400 UGX/month  | Non   |
| Total Energy Cost          | 10,800 UGX/month  | 560,400 UGX/month  | 1,140,000 UGX/month  | 82,800 UGX/month   | 1,077,000 UGX/month   |
| Prospect after electrified | <ul style="list-style-type: none"> <li>install lights</li> <li>use TV, radio and ironing</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use sanding, cutting, tuming machine</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use fridge and open drinkings shop</li> <li>open battery charging shop</li> <li>purchase motor for electricity</li> <li>purchase TV, radio</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>purchase TV, refrigerator</li> <li>The electrification of the tool</li> </ul> | <ul style="list-style-type: none"> <li>purchase motor for electricity</li> <li>The electrification of the tool</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair



Socio-economic data in the project site (Health) (1/3)

|                                    |  |   |  |   |  |
|------------------------------------|--|---|--|---|--|
| Trading Center                     | Namayingo  | Makutu  | Mayuge-Bukholi   | Muterere  | Lwangosia  |
| Parish                             | Namayingo  | Makutu  | Mayuge   | Muterere  | Lwangosia  |
| Sub-county                         | Namayingo T.C.   | Makutu  | Budaya   | Muterere  | Buyinja  |
| District                           | Namayingo  | Iganga  | Bugiri   | Bugiri  | Namayingo  |
| Grade                              | IV   | III   | III  | III   | III (NGO)  |
| Type of medical services           | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenatal</li> <li>• delivery</li> <li>• inpatient</li> <li>• outreach</li> <li>• immunization</li> <li>• dentistry</li> <li>• ophthalmology</li> <li>• psychiatric</li> <li>• surgery</li> </ul> | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenatal</li> <li>• delivery</li> <li>• immunization</li> <li>• HIV/AIDS counselling</li> <li>• blood test</li> </ul> | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenatal</li> <li>• delivery</li> <li>• outreach</li> <li>• immunization</li> <li>• family planning</li> </ul> | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenatal</li> <li>• delivery</li> <li>• inpatient</li> <li>• outreach</li> <li>• immunization</li> <li>• health education</li> </ul>                              | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenatal</li> <li>• delivery</li> <li>• inpatient</li> <li>• outreach</li> <li>• immunization</li> <li>• prevention education</li> </ul> |
| Number of coverage villages        | whole Namayingo  | 27 villages   | 8 villages   | 9 villages  | 7 villages   |
| Doctor                             | Yes  | Non   | Non  | Yes   | Non  |
| Operaton theatre                   | Yes  | Non   | Non  | Non   | Non  |
| Number of staff                    | 17 people  | 3 people  | 4 people   | 5 people  | 6 people   |
| Number of outpatients              | 450 people   | 75 people   | 142 people   | 70 people   | 70 people  |
| The number of the urgent treatment | 9/day  | Non (transferring to near hospitals)  | Non (transferring to near hospitals)   | Non (transferring to near hospitals)  | 5/day  |
| outpatient                         | (Adults 300, children 70, Pregnant mothers 80)   | (Adults 50, children 20, Pregnant mothers 5)  | (Adults 60, children 80)   | (Adults 30, children 20, Pregnant mothers 20)   | (Adults 25, children 30, Pregnant mothers 15)  |
| Number of beds                     | 25   | 10  | 3  | 3   | 6  |
| Existe equipments                  | <ul style="list-style-type: none"> <li>• microscope</li> <li>• blood pressure scale</li> <li>• sterilizer</li> <li>• gas refrigerator</li> <li>• other basic equipments</li> </ul>   | <ul style="list-style-type: none"> <li>• microscope</li> <li>• blood pressure scale</li> <li>• weight scale</li> <li>• fetus scope</li> <li>• gas refrigerator</li> </ul>             | <ul style="list-style-type: none"> <li>• weight scale</li> <li>• sterilizer</li> <li>• gas refrigerator</li> <li>• simple kit for surgeries</li> </ul>                         | <ul style="list-style-type: none"> <li>• blood pressure scale</li> <li>• weight scale</li> <li>• sterilizer</li> <li>• clinical thermometer</li> <li>• fetus scope</li> <li>• delivery kit</li> <li>• gas refrigerator</li> </ul> | <ul style="list-style-type: none"> <li>• microscope</li> <li>• stethoscope</li> <li>• blood pressure scale</li> <li>• fetus scope</li> <li>• HIV and TB check kit</li> <li>• delivery kit</li> </ul>     |
| Power generation                   |  |   |  |   |  |
| Equipments                         | generator (20kV/A), solar panel with battery   | Solar panel with battery  | Non  | Non   | generator, solar panel with battery  |
| Cost                               | 1,440,000 UGX/month  | Non   | Non  | Non   | 672,000 UGX/month  |



|                            |   |   |   |  |  |
|----------------------------|---|---|---|--|--|
| Trading Center             | Namayingo   | Makutu  | Mayuge-Bukholi  | Muterere   | Lwangosia  |
| Parish                     | Namayingo   | Makutu  | Mayuge  | Muterere   | Lwangosia  |
| Sub-county                 | Namayingo T.C.  | Makutu  | Budaya  | Muterere   | Buyinja  |
| District                   | Namayingo   | Iganga  | Bugiri  | Bugiri   | Namayingo  |
| Lighting                   |   |   |   |  |  |
| Equipments                 | torch   | kerosene lump   | kerosene lump   | kerosene lump  | kerosene lump  |
| Cost                       | 12,000 UGX/month  | 22,400 UGX/month  | 168,000 UGX/month   | 168,000 UGX/month  | 84,000 UGX/month   |
| Others                     |   |   |   |  |  |
| Equipment                  | gas refrigerator  | gas refrigerator, sterilizer  | gas refrigerator, sterilizer  | gas refrigerator, sterilizer   | sterilizer   |
| Use                        | keeping vaccine cool  | keeping vaccine cool, sterilize equipments  | keeping vaccine cool, sterilize equipments  | keeping vaccine cool, sterilize equipments   | sterilize equipments   |
| Cost                       | 600,000 UGX/month   | 490,000 UGX/month   | 327,000 UGX/month   | 300,000 UGX/month  | 252,000 UGX/month  |
| Prospect after electrified | <ul style="list-style-type: none"> <li>install lights</li> <li>use steam sterilizer</li> <li>dental chair</li> <li>x-ray</li> <li>centrifuge</li> <li>endoscope</li> <li>super sonic scale</li> <li>computers for registration</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>night treatment</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use steam sterilizer</li> <li>use refrigerator</li> <li>expand of outpatient</li> <li>operate surgeries</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use steam sterilizer</li> <li>use refrigerator</li> <li>Examination of Malaria</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use steam sterilizer</li> <li>use refrigerator</li> <li>use water warmer</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Socio-economic data in the project site (Health) (2/3)

| Trading Center                     | Lutolo  | Lumyo  | Mutumba   | Mundindi   | Busiro  |
|------------------------------------|---|--|---|--|---|
| Parish                             | Lutolo  | Busiabaa   | Mutumba   | Mundindi   | Bujuwanga   |
| Sub-county                         | Banda   | Lumyo  | Mutumba   | Busime   | Banda   |
| District                           | Namayingo   | Busia  | Namayingo   | Busia  | Namayingo   |
| Grade                              | III   | III  | III   | II   | II  |
| Type of medical services           | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenental</li> <li>• delivery</li> <li>• inpatient (only antenental)</li> <li>• outreach</li> <li>• immunization</li> </ul>             | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenental</li> <li>• delivery</li> <li>• inpatient</li> <li>• outreach</li> <li>• immunization</li> <li>• health education</li> <li>• HIV/AIDS test and counselling</li> <li>• prevention education</li> </ul> | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenental</li> <li>• delivery</li> <li>• immunization</li> <li>• family planning</li> </ul>   | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenental</li> <li>• delivery</li> <li>• immunization</li> <li>• outreach</li> <li>• immunization</li> <li>• health education</li> </ul> |   |
| Number of coverage villages        | 4 villages  | 80 villages  | 24 villages   | 12 villages  | 14 villages   |
| Doctor                             | Non   | Non  | Non   | Non  | Yes   |
| Operation theatre                  | Non   | Non  | Non   | Yes  | Non   |
| Number of staff                    | 6 people  | 7 people   | 3 people  | 2 people   | 7 people  |
| Number of outpatients              | 75 people   | 70 people  | 60 people   | 55 people  | 34 people   |
| The number of the urgent treatment | transferring to near hospitals  |  |   | 2/month  |   |
| outpatient                         | (Adults 25, children 20, Pregnant mothers 25)   |  |   | (Adults 28, children 15, Pregnant mothers 12)  |   |
| Number of beds                     | 3   | 7  | Non   | 2  | 10  |
| Existe equipments                  | <ul style="list-style-type: none"> <li>• microscope</li> <li>• blood pressure</li> <li>• weight scale</li> <li>• sterilizer</li> <li>• inspection bed</li> <li>• refrigerator (out of order)</li> </ul> | <ul style="list-style-type: none"> <li>• microscope</li> <li>• blood pressure</li> <li>• sterilizer</li> <li>• clinical thermometer</li> <li>• fetus scope</li> <li>• delivery kit</li> <li>• gas refrigerator</li> </ul>  | <ul style="list-style-type: none"> <li>• microscope</li> <li>• blood pressure</li> <li>• sterilizer</li> <li>• fetus scope</li> <li>• delivery kit</li> <li>• gas refrigerator</li> <li>• weight scale</li> </ul> | <ul style="list-style-type: none"> <li>• weight scale</li> <li>• fetus scope</li> <li>• sterilizer</li> <li>• delivery kit</li> </ul>  | <ul style="list-style-type: none"> <li>• microscope</li> <li>• blood pressure</li> <li>• sterilizer</li> <li>• clinical thermometer</li> <li>• fetus scope</li> <li>• delivery kit</li> <li>• gas refrigerator</li> </ul> |
| Power generation                   |   |  |   |  |   |
| Equipments                         | 2 solar panel with battery (one is out of order)  | solar panel with battery   | solar panel with battery  | Non  | solar panel   |
| Cost                               | Non   | Non  | Non   | Non  | Non   |

|                            |   |  |  |  |   |
|----------------------------|---|--|--|--|---|
| Trading Center             | Lutolo  | Lunyo  | Mutumba  | Mundindi   | Busiro  |
| Parish                     | Lutolo  | Busiabaa   | Mutumba  | Mundindi   | Bujuwanga   |
| Sub-county                 | Banda   | Lunyo  | Mutumba  | Busime   | Banda   |
| District                   | Namayingo   | Busia  | Namayingo  | Busia  | Namayingo   |
| Lighting                   |   |  |  |  |   |
| Equipments                 | kerosene lump   | kerosene lumps (support solar)   | Non (patient should bring light )  | kerosene lump  | kerosene lump   |
| Cost                       | 7,000 UGX/month   | 28,000 UGX/month   | Non  | 30,000 UGX/month   | 42,000 UGX/month  |
| Others                     |   |  |  |  |   |
| Equipment                  | sterilizer  | gas refrigerator, sterilizer   | gas refrigerator, sterilizer   | sterilizer   | 2 gas refrigerator, sterilizer  |
| Use                        | sterilize equipments  | keeping vaccine cool, sterilize equipments   | keeping vaccine cool, sterilize equipments   | sterilize equipments   | keeping vaccine cool, sterilize equipments  |
| Cost                       | 15,000 UGX/month  | 228,000 UGX/month  | 456,000 UGX/month  | 8,400 UGX/month  | 688,806 UGX/month   |
| Prospect after electrified | <ul style="list-style-type: none"> <li>install lights</li> <li>use steam sterilizer</li> <li>use refrigerator</li> <li>operate blood tests</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use steam sterilizer</li> <li>use refrigerator</li> <li>operate blood tests</li> <li>use incubator</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use steam sterilizer</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use steam sterilizer</li> <li>use refrigerator</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use refrigerator</li> <li>use scan machine</li> <li>use incubator</li> <li>use centrifuge</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Socio-economic data in the project site (Health) (3/3)

|                                    |  |  |
|------------------------------------|--|--|
| Trading Center                     | Maina  | Nabigingo  |
| Parish                             | Maina  | Nabigingo  |
| Sub-county                         | Mpungwe  | Bulidha  |
| District                           | Mayuge   | Bugiri   |
| Grade                              | II   | II   |
| Type of medical services           | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenatal</li> <li>• outreach</li> <li>• immunization</li> <li>• health education</li> <li>• family planning</li> </ul> | <ul style="list-style-type: none"> <li>• outpatient</li> <li>• antenatal</li> <li>• inpatient</li> <li>• outreach</li> <li>• immunization</li> <li>• HIV/AIDS counselling</li> </ul> |
| Number of coverage villages        | 6 villages   | 5 villages   |
| Doctor                             | Yes (once/week)  | Yes (only outreach)  |
| Operation theatre                  | Non  | Non  |
| Number of staff                    | 4 people   | 3 people   |
| Number of outpatients              | 30 people  | 30 people  |
| The number of the urgent treatment |  |  |
| outpatient                         |  |  |
| Number of beds                     | 1  | 3  |
| Existe equipments                  | <ul style="list-style-type: none"> <li>• blood pressure</li> <li>• clinical thermometer</li> <li>• fetus scope</li> <li>• weight scale</li> </ul>                                      | <ul style="list-style-type: none"> <li>• stethoscope</li> <li>• blood pressure</li> <li>• sterilizer</li> <li>• weight scale</li> </ul>  |
| Power generation                   |  |  |
| Equipments                         | Non  | Non  |
| Cost                               | Non  | Non  |
| Lighting                           |  |  |
| Equipments                         | kerosene lump (only emergency at night)  | kerosene lump  |
| Cost                               | 1,400 UGX/month  | 42,000 UGX/month   |
| Others                             |  |  |
| Equipment                          | Non  | sterilizer   |
| Use                                | Non  | sterilize equipments   |
| Cost                               | Non  | 3,750 UGX/month  |
| Prospect after electrified         | <ul style="list-style-type: none"> <li>• install lights</li> <li>• use steam sterilizer</li> <li>• use refrigerator</li> <li>• accept outpatient at night</li> </ul>                   | <ul style="list-style-type: none"> <li>• install lights</li> <li>• use steam sterilizer</li> <li>• use refrigerator</li> <li>• operate blood tests</li> </ul>                        |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Socio-economic data in the project site (Primary school) (1/2)

| School Name                | Mpungwe primary school  | Talent nursery and primary school  | Busiro church of God primary school   | Mutumba primary school  | Bulule primary school  |
|----------------------------|---|--|---|---|--|
| Trading Center             | Mpungwe   | Namayingo South  | Busiro  | Mutumba   | Hatumba-Banja  |
| Parish                     | Muji  | Namayingo  | Bujuwanga   | Mutumba   | Bulule   |
| Sub-county                 | Mpungwe   | Namayingo T.C.   | Banda   | Mutumba   | Mutumba  |
| District                   | Mayuge  | Namayingo  | Namayingo   | Namayingo   | Namayingo  |
| Grade                      | P1-P7   | P1-P7  | P1-P7   | P1-P7   | P1-P7  |
| Number of coverage village | 6 villages  | 6 villages   | 8 villages  | 7 villages  | 6 villages   |
| Number of students         | 780 people  | 1,200 people   | 1,069 people  | 870 people  | 1,470 people   |
| Number of boarders         | 50 people   | 140 people   | Non   | Non   | Non  |
| Number of teachers         | 18 people   | 26 people  | 14 people   | 7 people  | 17 people  |
| Number of class rooms      | 18  | 11   | 8 villages  | 8   | 8  |
| Number of boarding rooms   | 4   | 2  | Non   | Non   | Non  |
| Morning or Night preps     | Yes   | Yes  | Yes   | Non   | Yes  |
| Power generation           |   |  |   |   |  |
| Equipments                 | Non   | solar panel with battery 300W  | Non   | Non   | Non  |
| Cost                       | Non   | Non  | Non   | Non   | Non  |
| Lighting                   |   |  |   |   |  |
| Equipments                 | kerosene lump   | light  | Non   | Non   | kerosene lump  |
| Cost                       | 300,000 UGX/month   | Non  | Non   | Non   | 22,400 UGX/month   |
| Others                     |   |  |   |   |  |
| Equipment                  | Non   | Non  |   |   |  |
| Use                        | Non   | Non  |   |   |  |
| Cost                       | Non   | Non  |   |   |  |
| Educational Equipment      | Non   | Non  |   |   |  |
| Office Equipment           | Non   | Non  |   |   |  |
| Prospect after electrified | <ul style="list-style-type: none"> <li>install lights</li> <li>use computer, printer and photocopy machine</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use computer and video machine</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use computer, printer and photocopy machine</li> <li>open morning and night prep</li> <li>open computer class</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use computer, printer and photocopy machine</li> <li>start class using TV</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use computer, printer and photocopy machine</li> <li>start class using TV</li> <li>start boarding school</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Educational System in Uganda Primary P1-P7, Ordinal Secondary S1-S4, Advanced Secondary S5-S

Socio-economic data in the project site (Primary school) (2/2)

| School Name                | Maina primary school  | Kifuyo primary school  | St. Lawrence primary school   |
|----------------------------|---|--|---|
| Trading Center             | Maina   | Nsango   | Muterere  |
| Parish                     | Maina   | Kifuyo   | Muterere  |
| Sub-county                 | Mpungwe   | Buyinja  | Muterere  |
| District                   | Mayuge  | Namayingo  | Bugiri  |
| Grade                      | P1-P7   | P1-P7  | P1-P7   |
| Number of coverage village | 5 villages  | 5 villages   | 10 villages   |
| Number of students         | 785 people  | 1,103 people   | 1,348 people  |
| Number of boarders         | 138 people  | Non  | Non   |
| Number of teachers         | 13 people   | 15 people  | 10 people   |
| Number of class rooms      | 6   | 10   | 11  |
| Number of boarding rooms   | 2   | Non  | Non   |
| Morning or Night preps     | Yes   | Yes  | Yes   |
| Power generation           |   |  |   |
| Equipments                 | car battery   | Non  | Non   |
| Cost                       | 8,000 UGX/month   | Non  | Non   |
| Lighting                   |   |  |   |
| Equipments                 | kerosene lump   | Non  | Non   |
| Cost                       | 126,000 UGX/month   | Non  | Non   |
| Others                     |   |  |   |
| Equipment                  |   |  |   |
| Use                        |   |  |   |
| Cost                       |   |  |   |
| Educational Equipment      |   |  |   |
| Office Equipment           |   |  |   |
| Prospect after electrified | <ul style="list-style-type: none"> <li>install lights</li> <li>use computer, printer and photocopy machine</li> <li>start class using TV</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use computer, printer and photocopy machine</li> <li>start class using TV</li> <li>use broadcasting equipments</li> </ul> | <ul style="list-style-type: none"> <li>install lights</li> <li>use computer, printer and photocopy machine</li> <li>use cooker in home economic class</li> <li>start boarding school</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Educational System in Uganda Primary P1-P7, Ordinal Secondary S1-S4, Advanced Secondary S5-S6

Socio-economic data in the project site (Secondary school) (1/2)

| School Name                | Mpungwe secondary school   | Makutu secondary school  | Makutu hillside secondary school  | Muterere secondary school   | Dede secondary school  |
|----------------------------|--|--|---|---|--|
| Trading Center             | Mpungwe  | Makutu   | Makutu  | Muterere  | Namayingo  |
| Parish                     | Muji   | Makutu   | Makutu  | Muterere  | Namayingo  |
| Sub-county                 | Mpungwe  | Makutu   | Makutu  | Muterere  | Namayingo T.C.   |
| District                   | Mayuge   | Iganga   | Iganga  | Bugiri  | Namayingo  |
| Grade                      | S1-S3  | S1-S4  | S1-S5   | S1-S4   | S1-S6  |
| Number of coverage village | 7 villages   | 9 villages   | 14 villages   | 13 villages   | 11 villages  |
| Number of students         | 50 people  | 142 people   | 647 people  | 643 people  | 1,200 people   |
| Number of boarders         | Non  | Non  | 150 people  | Non   | 224 people   |
| Number of teachers         | 10 people  | 19 people  | 19 people   | 13 people   | 25 people  |
| Number of class rooms      | 3  | 6  | 7   | 4   | 13   |
| Number of boarding rooms   | Non  | Non  | 4   | Non   | 4  |
| Morning or Night preps     | Non  | Non  | Yes   | Non   | Yes  |
| Power generation           |  |  |   |   |  |
| Equipments                 | Non  | Non  | solar panel with battery  | solar panel with battery  | solar panel with battery   |
| Cost                       | Non  | Non  | Non   | Non   | Non  |
| Lighting                   |  |  |   |   |  |
| Equipments                 | Non  | Non  | Non   | Non   | kerosene lump  |
| Cost                       | Non  | Non  | Non   | Non   | 135,000 UGX/month  |
| Others                     |  |  |   |   |  |
| Equipment                  | Non  | Non  | gas cylinder  | Non   | Non  |
| Use                        | Non  | Non  | Experiment  | Non   | Non  |
| Cost                       | Non  | Non  | 200,000 UGX/month   | Non   | Non  |
| Educational Equipment      | Non  | Non  | micro scope, balance scale  | Non   | gas cylinder. cooker   |
| Office Equipment           | Non  | Non  | Non   | manual type-writer, manual printer  | manual type-writer, radio  |
| Prospect after electrified | <ul style="list-style-type: none"> <li>use computer, printer and photocopy machine</li> <li>start boarding school</li> </ul> | <ul style="list-style-type: none"> <li>use computer, printer and photocopy machine</li> <li>built laboratory</li> <li>open night prep</li> </ul> | <ul style="list-style-type: none"> <li>use computer</li> <li>expand morning and night prep</li> </ul> | <ul style="list-style-type: none"> <li>use computer and projector</li> <li>open night prep</li> </ul> | <ul style="list-style-type: none"> <li>install light</li> <li>use computer, printer and photocopy machine</li> <li>use TV</li> <li>built laboratory</li> <li>start class using TV</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Educational System in Uganda Primary P1-P7, Ordinal Secondary S1-S4, Advanced Secondary S5-S6

Socio-economic data in the project site (Secondary school) (2/2)

| School Name                | St. philip secondary school   | Banda secondary school  | Kifiyo secondary school  |
|----------------------------|---|---|--|
| Trading Center             | Lwangosia   | Lutolo  | Nsango   |
| Parish                     | Lwangosia   | Lutolo  | Kifiyo   |
| Sub-county                 | Buyinja   | Banda   | Buyinja  |
| District                   | Namayingo   | Namayingo   | Namayingo  |
| Grade                      | S1-S4   | S1-S4   | S1-S4  |
| Number of coverage village | 12 villages   | 16 villages   | 5 villages   |
| Number of students         | 400 people  | 534 people  | 110 people   |
| Number of boarders         | Non   | Non   | Non  |
| Number of teachers         | 14 people   | 15 people   | 11 people  |
| Number of class rooms      | 5   | 5   | 4  |
| Number of boarding rooms   | Non   | Non   | Non  |
| Morning or Night preps     | Yes   | Yes   | Yes  |
| Power generation           |   |   |  |
| Equipments                 | Non   | Non   | Non  |
| Cost                       | Non   | Non   | Non  |
| Lighting                   |   |   |  |
| Equipments                 | Non   | Non   | kerosene lump  |
| Cost                       | Non   | Non   | 84,000 UGX/month   |
| Others                     |   |   |  |
| Equipment                  | Non   | charcoal  | cooker   |
| Use                        | Non   | preparation of lunch  | experiment   |
| Cost                       | Non   | 120,000 UGX/month   | 42,000 UGX/month   |
| Educational Equipment      | gas burner, micro scope, equipment for experiments  | gas burner, beaker  | Non  |
| Office Equipment           | manual type-writer, manual printer  | manual type-writer, manual printer  | Non  |
| Prospect after electrified | <ul style="list-style-type: none"> <li>install light</li> <li>use computer, printer and photocopy machine</li> <li>use TV</li> <li>start computer class</li> <li>open morning and night prep</li> <li>start class using TV</li> </ul> | <ul style="list-style-type: none"> <li>install light</li> <li>use computer, printer and photocopy machine</li> <li>use TV</li> <li>start computer class</li> <li>open morning and night prep</li> <li>start class using TV</li> </ul> | <ul style="list-style-type: none"> <li>install light</li> <li>use computer, printer and photocopy machine</li> <li>built laboratory</li> <li>start computer class</li> </ul> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Educational System in Uganda Primary P1-P7, Ordinal Secondary S1-S4, Advanced Secondary S5-S6



Socio-economic data in the project site (High school)

|                            |  |
|----------------------------|--|
| School Name                | Nalwire technical institute  |
| Trading Center             | Buwanga  |
| Parish                     | Nalwire  |
| Sub-county                 | Lunyo  |
| District                   | Busia  |
| Grade                      | 2 years  |
| Course                     | <ul style="list-style-type: none"> <li>• carpentry and joinery</li> <li>• block brick and concrete products</li> <li>• electrical installation</li> <li>• plumbing</li> <li>• painting decoration</li> <li>• tailoring</li> <li>• motor vehicle technology</li> <li>• salon (3 months course)</li> </ul> |
| Number of coverage village | Whole Uganda   |
| Number of students         | 200 people   |
| Number of boarders         | 200 people   |
| Number of teachers         | 25 people  |
| Number of class rooms      | 4  |
| Number of boarding rooms   | 3  |
| Morning or Night preps     | Yes  |
| Power generation           |  |
| Equipments                 | solar panel with battery (70W)   |
| Cost                       | Non  |
| Lighting                   |  |
| Equipments                 | kerosene lump  |
| Cost                       | 168,000 UGX/month  |
| Others                     |  |
| Equipment                  | Non  |
| Use                        | Non  |
| Cost                       | Non  |
| Educational Equipment      | sewing machine, socket, switching, motor   |
| Office Equipment           | 2 manual type-writer, manual printer   |
| Prospect after electrified | <ul style="list-style-type: none"> <li>• use computer, scanner, printer and photocopy machine</li> <li>• use electrified equipments need in each class</li> </ul>  |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

Educational System in Uganda Primary P1-P7, Ordinal Secondary S1-S4, Advanced Secondary S5-S6

Socio-economic data in the project site (Public institution)

|                            |   |  |
|----------------------------|---|--|
| Trading Center             | Namayingo   | Namayingo  |
| Parish                     | Namayingo   | Namayingo  |
| Sub-county                 | Namayingo T.C.  | Namayingo T.C.   |
| District                   | Namayingo   | Namayingo  |
| Institutions               | District HQ   | Police Station   |
| Number of staffs           | 188 people  | 30 people  |
| Power generation           |   |  |
| Equipments                 | generator   | solar panel with battery   |
| Cost                       | Non   | Non  |
| Lighting                   |   |  |
| Equipments                 | lights for security   | kerosene lump  |
| Cost                       | Non   | 42,000 UGX/month   |
| Others                     |   |  |
| Equipment                  | Non   | Non  |
| Use                        | Non   | Non  |
| Cost                       | Non   | Non  |
| Existed equipments         | 18 computers, 8 printers  | radio communication, typewriter  |
| Prospect after electrified | Install lights, steady use of computers and printers and refrigerator | Steady use of radio equipments   |
| Others                     |   | <p><b>[Crimes situations]</b><br/>                     robbers, thefts, child abuses etc.,,<br/> <b>[Number of Crimes]</b> 70/month<br/>                     Much expectations of lights for security.</p> |

Notes: The following unit prices are applied for calculation

Kerosene : 2,800 UGX/L, Diesel : 3,200 UGX/L, Petrol : 3,600 UGX/L, Gas : 200,000 UGX/cylinder, Charcoal : 15,000 UGX/Sac, Dry cell : 1,200 UGX/pair

A-5 Minutes of Discussions (MD)

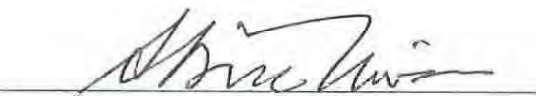
**Minutes of Discussions**  
**on the Preparatory Survey on the Project for**  
**Rural Electrification Phase III in the Republic of Uganda**  
**(First Field Survey)**

In response to the request from the Government of the Republic of Uganda (hereinafter referred to as "Uganda"), the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with the Government of Japan, decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Rural Electrification Phase III (hereinafter referred to as "the Project").

JICA dispatched the 1<sup>st</sup> Preparatory Survey Team (hereinafter referred to as "the Team") to Uganda, headed by Dr. Akira NIWA, Senior Advisor, Department of Human Resources for International Cooperation, JICA. The Team is scheduled to stay in Uganda from April 3 to April 26, 2011.

The Team held discussions with the officials of authorities concerned of the Government of Uganda (hereinafter referred to as "the Ugandan side"), and conducted a series of field survey. In the course of the discussions, both the Ugandan side and the Team (hereinafter referred to as "Both parties") have confirmed the main items described in the sheets attached hereto.

Kampala, April 8, 2011



Dr. Akira NIWA  
Leader,  
Preparatory Survey Team,  
Japan International Cooperation Agency  
(JICA)



Mr. Fred Kabagambe-Kaliisa  
Permanent Secretary,  
Ministry of Energy and Mineral Development  
(MEMD)  
/ Chairman of Rural Electrification Board

Witness:



Ms. Jennifer Muwuliza  
Ag. Commissioner,  
Aid Liaison Department,  
Ministry of Finance Planning and  
Economic Development (MoFPED)



Mr. Godfrey R. Turyahikayo  
Executive Director,  
Rural Electrification Agency (REA),  
Ministry of Energy and Mineral Development  
(MEMD)

## ATTACHMENT

### 1. Objective of the Project

The objective of the Project is to extend the distribution system for reliable and stable supply of electricity to the rural communities within the Project sites.

### 2. Project Site

The Project sites will be identified through the Survey. Both sides confirmed that the Area-2, Area-4, and Area-5 shown in Annex-1 will be surveyed during the First Field Survey.

### 3. Responsible and Implementing Organizations

- (1) The responsible organization for the Project is the Ministry of Energy and Mineral Development (MEMD).
- (2) The implementing organization is the Rural Electrification Agency (REA).
- (3) The organization charts of MEMD and REA are shown in Annex-2 and Annex-3, respectively.

### 4. Components Confirmed by Both parties

Both parties confirmed the necessity and urgency of the requested sites, and evaluated the priority of the sites in terms of contributions to rural development through electrification, technical features, and environmental & social considerations. Contents of main components and priority ranking confirmed by Both parties are shown in Annex-4.

JICA will assess the appropriateness of the components for Japan's Grant Aid and report the findings to the Government of Japan.

### 5. Japan's Grant Aid Scheme

- (1) The Ugandan side has understood the Japan's Grant Aid Scheme explained by the Team as described in Annex-5 and Annex-6.
- (2) The Ugandan side will take the necessary measures, as described in Annex-7, for smooth implementation of the Project as prerequisites for the Japan's Grant Aid to be implemented.

### 6. Environmental and Social Considerations

Both parties reviewed the results of Initial Environmental Examination (IEE) in the previous JICA survey, which is Data Collection Survey conducted in June to July 2010, and additional input from National Environmental Management Authority (NEMA), National Forest Authority (NFA), and the Ministry of Water and Environment, and examined the required procedures on environmental and social consideration for the Project in accordance with the national environmental laws and regulations.

- (1) Both parties confirmed that a project brief document is required for the Project to obtain approval from NEMA. The project brief document shall duly include IEE level study and mitigation measures for the selected section of distribution line.
- (2) The Ugandan side agreed to the followings subsequent to the approval of the Project sites by the Government of Japan;
  - To obtain the approval of the project brief document from NEMA
  - To hold stakeholder meeting during the Second field survey by inviting representatives from

district offices and communities related to the selected site for Outline Design for dissemination of the Project to the people being potentially affected by the Project.

- (3) The Ugandan side agreed to comply with the JICA Guidelines for Environmental and Social Considerations (April 2004) (hereinafter referred to as "JICA Guidelines") as well as Ugandan laws and regulations, and to prepare Environmental Checklist and Monitoring Form which are designated by JICA Guidelines for an outline design.
- (4) The Ugandan side agreed to make necessary arrangements with governmental organizations concerned in order to secure funding for and execution of the above environmental matters in a schedule as required for smooth execution of the Project.

## 7. Schedule of the Survey

The Team will continue with the First Field Survey in Uganda until April 26, 2011 and report the result to the Government of Japan. Based on the results of the Survey, JICA will dispatch the next Preparatory Survey Team to Uganda to carry out Outline Design subject to the approval of the Government of Japan.

## 8. Other Relevant Issues

### (1) Status of the Survey

The Team explained that the purpose of the Survey is to collect necessary information and data for 1) the evaluation of the relevance, appropriateness and urgency of the Project, 2) the identification of the priorities of the components of the Project, and 3) the identification of the issues to be cleared for implementation of the Project. Therefore the project site for the Survey and components confirmed by Both parties may not necessarily be approved by the Government of Japan.

### (2) Intervention/Improvements by MEMD/REA

MEMD/REA agreed on the following measures to minimize the constraints on realization of the electrification benefit of rural communities in the Project sites.

- To revise policy, which is specifically the Rural Electrification Strategy and Plan, and update the GIS database by the end of June 2011, which shall be incorporated into the revised Indicative Rural Electrification Master Plan (IREMP) later. The Ugandan side shall avail them to JICA Uganda Office in a timely manner.
- Social and economic data in the selected sites for Outline Design shall be confirmed during the Second Field Survey of the Project scheduled in June/July 2011.
- To facilitate connections for households within the areas of the previous projects (JICA I and II) through subsidy scheme under the Output-based Aid project, which commences in June 2011 for the period of four years with the assistance of the World Bank and KfW.
- To secure government funding to subsidize consumer connections in the Project sites. The Ugandan side explained that REA had examined the past project assisted by the Swedish International Development Cooperation Agency (SIDA), and proposed to introduce such subsidy scheme to other rural electrification projects as well, including the Project sites. The precise detail of the subsidy scheme is still under consideration. The Ugandan side agreed to allocate necessary budget for the subsidy scheme for the Project through the budgetary process in Uganda,
- To realize timely implementation of low voltage connection to the communities for the Project by making necessary arrangements including measures for avoiding a delay in the

procurement procedures by initiating the contract as soon as the Outline Design completed.

(3) Coordination among relevant donors and agencies

The Team requested the Ugandan side to ensure coordination among relevant donors and agencies for smooth implementation of the Project.

(4) Counterpart Personnel

The Team requested the Ugandan side that necessary number of counterpart personnel shall be assigned to the Team and necessary arrangements with related organizations shall be made during the Survey in Uganda. The Ugandan side agreed to support the Team based on the request.

(5) Questionnaires

The Team explained that the record of the number of connected customers, customer category, collection rate, and electricity consumption for the sites of the previous projects (JICA I and II) are absolutely essential, among other data and information, for the evaluation and improvement of the benefit of the Project. The Ugandan side agreed to provide answers for the questionnaire by April 26, 2011.

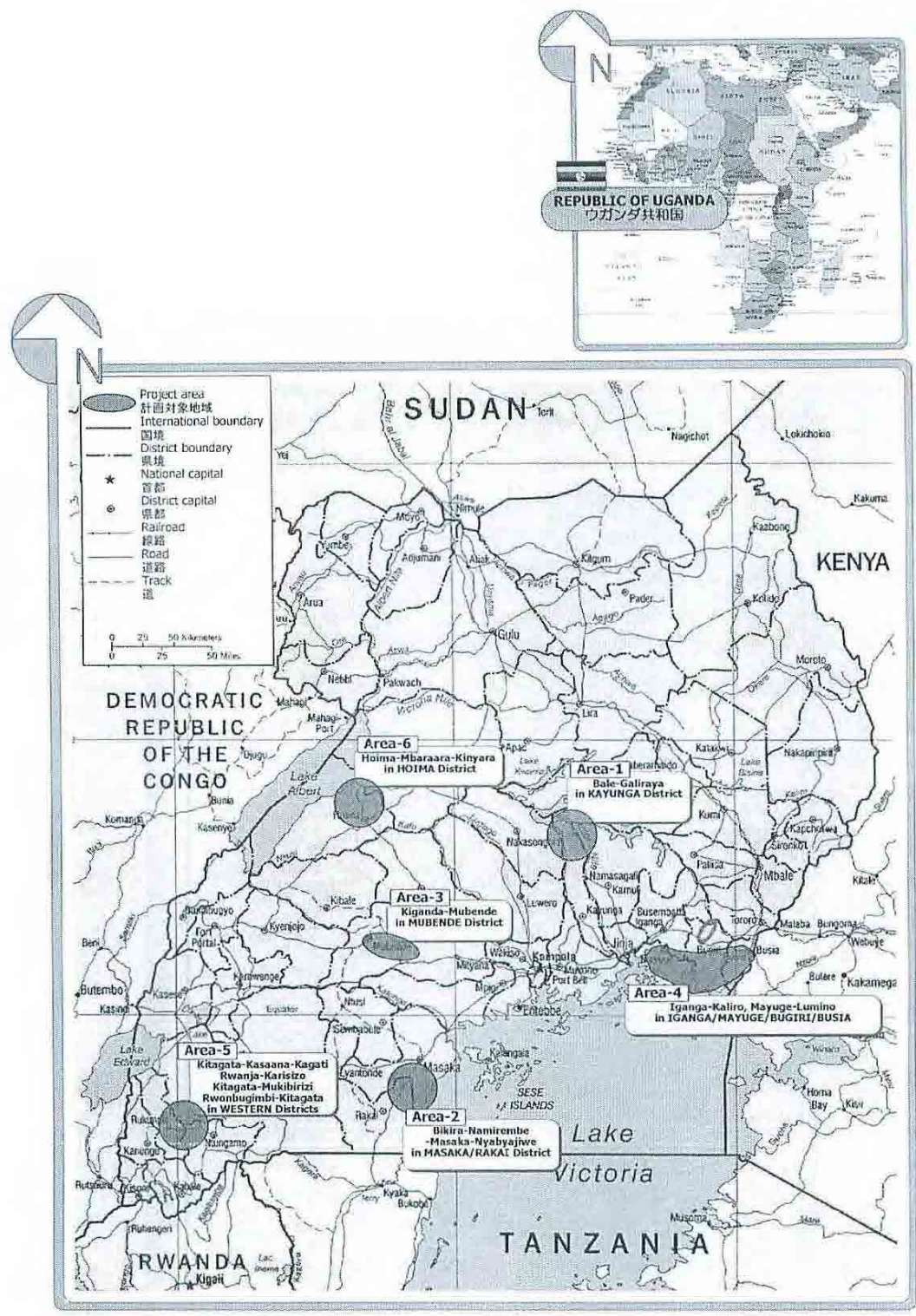
(End)

- Annex-1 Sites for the Survey
- Annex-2 Organization charts of MEMD
- Annex-3 Organization charts of REA
- Annex-4 Components for the Project proposed by the Ugandan side
- Annex-5 Japan's Grant Aid
- Annex-6 Flow Chart of Japan's Grant Aid Procedures
- Annex-7 Major Undertakings to be taken by Each Government

 J.M.J.



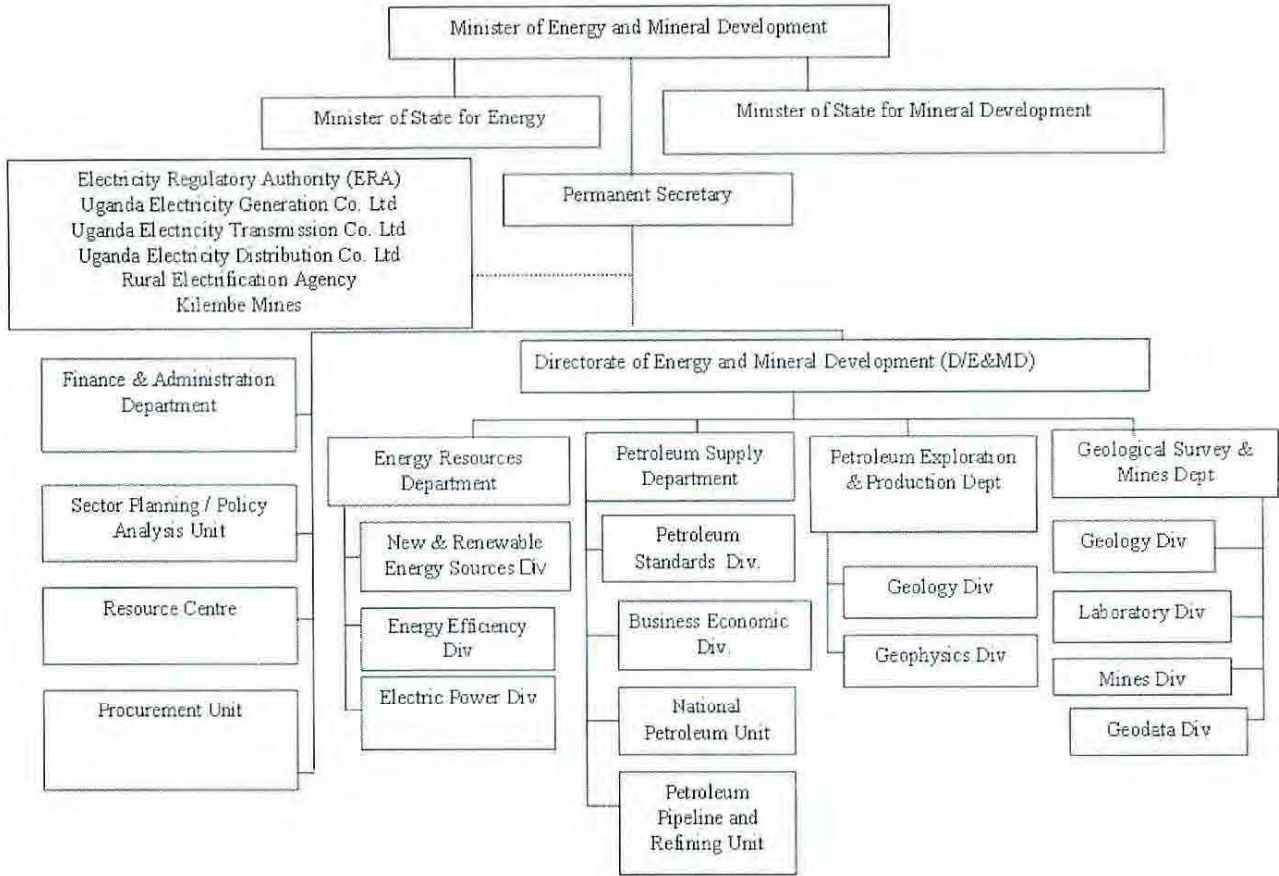




Sites for the Survey

Handwritten signatures and initials: A, J.M., mlf, Gw





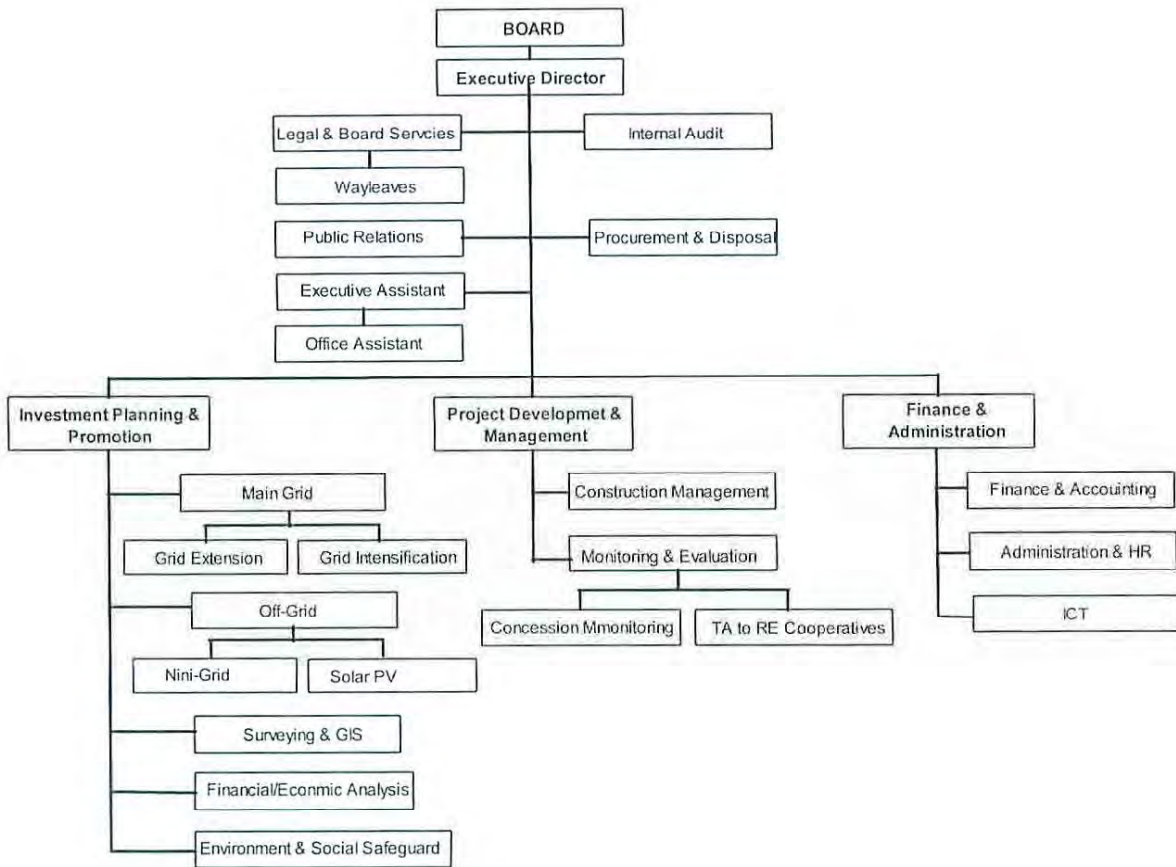
Organization charts of MEMD

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*JMG*

*mf*

*GH*

Organization charts of REA

**Components of the Requested Project confirmed by the Ugandan side and the Japanese side**

| Project Site | Area(Region)   | Priority Ranking <sup>(1)</sup> | Contents of main components <sup>(2)</sup>   | Project Features   |
|--------------|--|---------------------------------|--|--|
| 1            | Baale-Galiraya (Central) <sup>(3)</sup>                      | C                               | - Supply and installation of 33kV distribution Lines (approx. 44.1km) and distribution transformers (33kV/415-230V)  | Need socio-economic justification for 44km extension of the existing Kayunga-Baale line (JICA I)<br>Length of line passing CFRs*: approx. 10km   |
| 2            | Bikira-Namirembe & Masaka-Nyabyajjwe (Central)               | B                               | - Supply and installation of 33kV distribution Lines (approx. 93.9km) and distribution transformers (33kV/415-230V)  | Recommendable for strengthening private participation in rural electrification<br>Length of line passing CFRs*: approx. 8km  |
| 3            | Kiganda-Mubende (Central)                                    | C                               | - Supply and installation of 33kV distribution Lines (approx. 57.1km) and distribution transformers (33kV/415-230V)  | Power to Kiganda will be supplied from Myanzi (Mityana)-Kiganda line, which is on-going grant project by Norway. This reduces on number of connections and consequently project benefit.<br>Length of line passing CFRs*: approx. 4.5km  |
| 4            | Iganga-Kaliro & Mayuge-Lumino (Eastern) <sup>(4)</sup>       | A                               | - Supply and installation of 33kV distribution Lines (approx. 160.8km) and distribution transformers (33kV/415-230V) | Highly recommendable for electrification of new district headquarters (Namayingo) and synergy with Interconnection of Electric Grids of Nile Equatorial Lakes Countries Project (NEI.SAP )<br>Length of line passing CFRs*: approx. 1.5km  |
| 5            | Kitagata-Kasaana & Kitagata-Kabwohe (Western) <sup>(5)</sup> | B                               | - Supply and installation of 33kV distribution Lines (approx. 58.7km) and distribution transformers (33kV/415-230V)  | Highly recommendable for synergy with OVOP and NEI.SAP<br>Length of line passing CFRs*: None   |
| 6            | Hoima-Mbaraara-Kinyara (Western)                             | C                               | - Supply and installation of 33kV distribution Lines (approx. 61.8km) and distribution transformers (33kV/415-230V)  | Project scope has been reduced by various rural Electrification Projects funded by the Government of Uganda. The remaining project scope proposed to JICA is now limited to Kitagata-Kasaana-Kagati with spur to Rukondo, Rwanja-Karisizo, Kitagata-Mukibirizi and Rwobugimbi-Kitagata. Need clarification of socio-economic benefit produced after connecting |

|  |  |  |  |   |
|--|--|--|--|---|
|  |  |  |  | trading centers.<br>Length of line passing CFRs*: approx. 7.5km |
|--|--|--|--|---|

Notes:

- (1) Factors which are considered in evaluation of priority ranking are: impacts to rural economy and development, features of benefits in electrification, access to electricity in the underserved area and environment.
- (2) Content of main components is based on the results of the previous survey and additional information provided by REA. Modification in the quantities and additional new items/equipments will be determined based on the site survey.
- (3) Length of the line originally requested was approx. 91.2km. However, project component of Kayunga-Busaana and associated t-offs is under implementation with financing from the Government of Uganda.
- (4) The line originally requested was Iganga-Nakabugu. However, it has been changed as Iganga-Karilo because the project to supply the District headquarters at Luuka (Nakabugu) from Karilo has been funded by the Government of Uganda.
- (5) \*CFR stands for Central Forest Reserve managed by NEA. The proposed alignments including those passing CFRs are along the existing roads.
- (6) Information on wetland will be confirmed during the Second Field Survey of the Project.






## JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as “the GOJ”) is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on the law and the decision of the Government of Japan, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

### 1. Grant Aid Procedures

The Japanese Grant Aid is conducted as follows-

- Preparatory Survey (hereinafter referred to as “the Survey”)
  - The Survey conducted by JICA
- Appraisal & Approval
  - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Determination of Implementation
  - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as “the G/A”)
  - Agreement concluded between JICA and a recipient country
- Implementation
  - Implementation of the Project on the basis of the G/A

### 2. Preparatory Survey

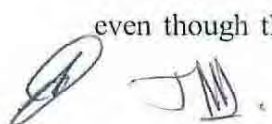
#### (1) Contents of the Survey

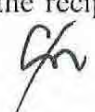
The aim of the Survey is to provide a basic document necessary for the appraisal of the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country





actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

### 3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the recipient country to make a plea for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex-7.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign

staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA socio-environmental guideline.



**Flow Chart of Japan's Grant Aid Procedures**

| Stage                             | Flow & Works   | Recipient Government | Japanese Government | JICA | Consultant | Contract | Others |
|-----------------------------------|--|----------------------|---------------------|------|------------|----------|--------|
| Application                       | <p>(T/R : Terms of Reference)</p> <p>Request → Screening of Project → Evaluation of T/R → Project Identification Survey*</p>   |                      |                     |      |            |          |        |
| Project Formulation & Preparation | <p>Preparatory Survey</p> <p>Preliminary Survey* → Field Survey Home Office Work Reporting</p> <p>Outline Design → Selection &amp; Contracting of Consultant by Proposal → Field Survey Home Office Work Reporting</p> <p>Explanation of Draft → Final Report</p> <p>*if necessary</p>   |                      |                     |      |            |          |        |
| Appraisal & Approval              | <p>Appraisal of Project</p> <p>Inter Ministerial Consultation</p> <p>Presentation of Draft Notes</p> <p>Approval by the Cabinet</p>  |                      |                     |      |            |          |        |
| Implementation                    | <p>(E/N: Exchange of Notes)</p> <p>(G/A: Grant Agreement)</p> <p>(A/P: Authorization to Pay)</p> <p>E/N and G/A → Banking Arrangement</p> <p>Consultant Contract → Verification → Issuance of A/P</p> <p>Detailed Design &amp; Tender Documents → Approval by Recipient Government → Preparation for Tendering</p> <p>Tendering &amp; Evaluation</p> <p>Procurement / Construction Contract → Verification → A/P</p> <p>Construction → Completion Certificate → A/P</p> <p>Operation → Post Evaluation Study</p> |                      |                     |      |            |          |        |
| Evaluation & Follow up            | <p>Ex-past Evaluation → Follow up</p>  |                      |                     |      |            |          |        |



**Major Undertakings to be taken by Each Government**

| No. | Items  | To be covered by Grant Aid | To be covered by Recipient Side |
|-----|--|----------------------------|---------------------------------|
| 1   | to secure [a lot] / [lots] of land necessary for the implementation of the Project and to clear the [site] / [sites];  |                            | •                               |
| 2   | To construct the following facilities  |                            |                                 |
|     | 1) The building  | •                          |                                 |
|     | 2) The gates and fences in and around the site   |                            | •                               |
|     | 3) The parking lot   | •                          |                                 |
|     | 4) The road within the site  | •                          |                                 |
|     | 5) The road outside the site   |                            | •                               |
| 3   | To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the [site] / [sites]  |                            |                                 |
|     | 1) Electricity   |                            |                                 |
|     | a. The distributing power line to the site   |                            | •                               |
|     | b. The drop wiring and internal wiring within the site   | •                          |                                 |
|     | c. The main circuit breaker and transformer  | •                          |                                 |
|     | 2) Water Supply  |                            |                                 |
|     | a. The city water distribution main to the site  |                            | •                               |
|     | b. The supply system within the site (receiving and elevated tanks)  | •                          |                                 |
|     | 3) Drainage  |                            |                                 |
|     | a. The city drainage main (for storm sewer and others to the site)   |                            | •                               |
|     | b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site   | •                          |                                 |
|     | 4) Gas Supply  |                            |                                 |
|     | a. The city gas main to the site   |                            | •                               |
|     | b. The gas supply system within the site   | •                          |                                 |
|     | 5) Telephone System  |                            |                                 |
|     | a. The telephone trunk line to the main distribution frame/panel (MDF) of the building   |                            | •                               |
|     | b. The MDF and the extension after the frame/panel   | •                          |                                 |
|     | 6) Furniture and Equipment   |                            |                                 |
|     | a. General furniture   |                            | •                               |
|     | b. Project equipment   | •                          |                                 |
| 4   | To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products   |                            |                                 |
|     | 1) Marine (Air) transportation of the Products from Japan to the recipient country   | •                          |                                 |
|     | 2) Tax exemption and custom clearance of the Products at the port of disembarkation  |                            | •                               |
|     | 3) Internal transportation from the port of disembarkation to the project site   | •                          |                                 |
| 5   | To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services [ be exempted] / [be borne by the Authority without using the Grant]       |                            | •                               |
| 6   | To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work |                            | •                               |
| 7   | To ensure that [the Facilities and the products] / [the Facilities] / [the products] be maintained and used properly and effectively for the implementation of the Project   |                            | •                               |
| 8   | To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project   |                            | •                               |
| 9   | To bear the following commissions paid to the Japanese bank for banking services based upon the B/A  |                            |                                 |
|     | 1) Advising commission of A/P  |                            | •                               |
|     | 2) Payment commission  |                            | •                               |
| 10  | To give due environmental and social consideration in the implementation of the Project.   |                            | •                               |