

**Preparatory Survey for
Renewable Energy Promotion Program in Africa
— Business Promotion and Financial Mechanism —**

**Final Report
Executive Summary**

November 2009

Nippon Koei Co., Ltd.

IDD
JR
09-073

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Location Map

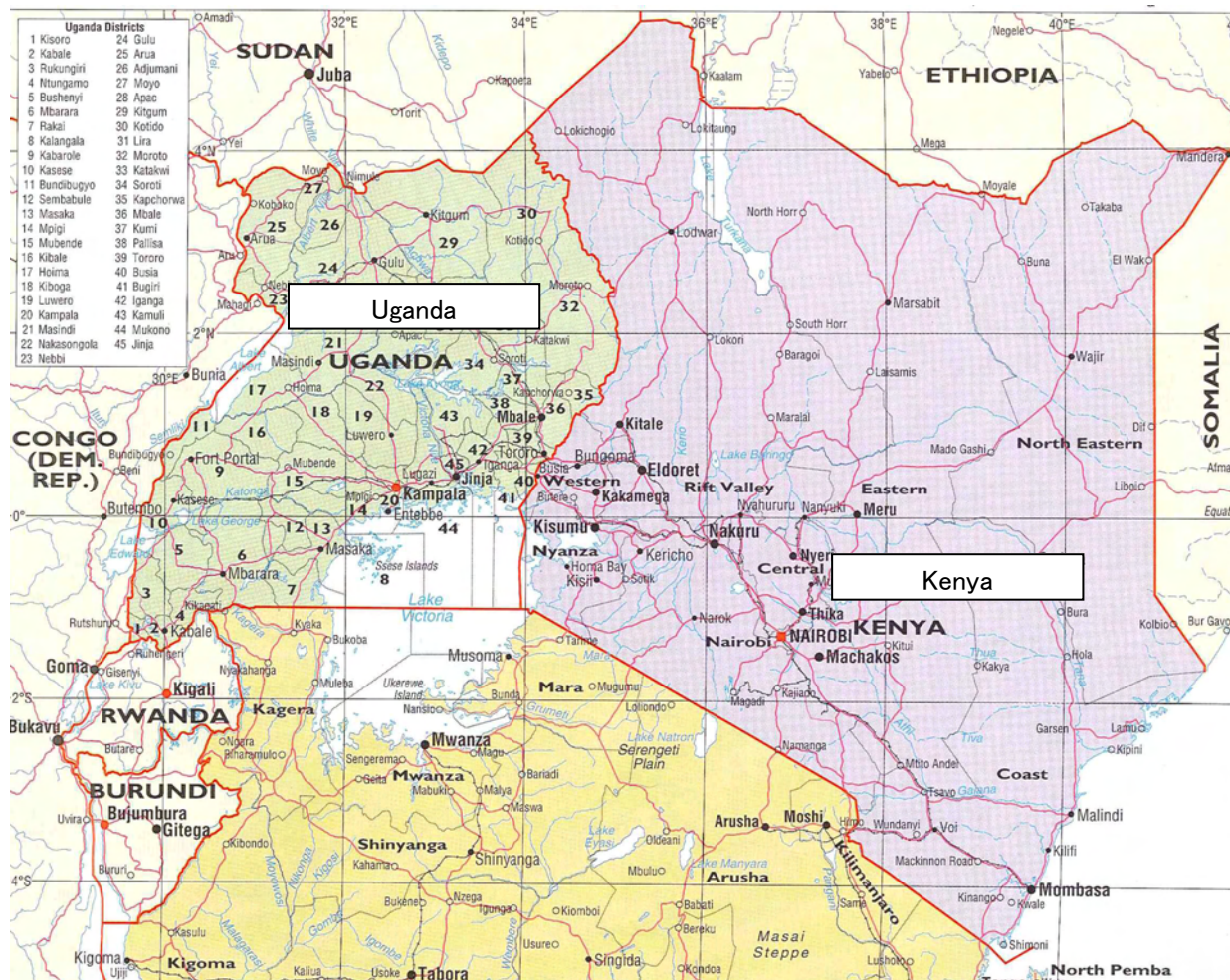


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Abbreviation

AFC	Agriculture Fund Corporation
AFD	Agence Francaise de Developpment
AfDB	African Development Bank
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (German Geological Study)
BOO	Build-Own-Operate
BoU	Bank of Uganda
CBK	Central Bank of Kenya
CBO	Community-Based Organization
CDC	CDC Group plc (formerly the Commonwealth Development Corporation)
CDF	Constituency Development Fund
CDM	Clean Development Mechanism
CREEC	Center for Research in Energy and Energy Conservation
DAC	Development Assistance Committee
DANIDA	Danish International Development Assistance
DDA	Dutch Development Agency
DEG	Deutsche Investitions- und Entwicklungsgesellschaft mbH (German Investment and Development Company)
DFID	Department for International Development
DSM	Demand Side Management
DWD	Department of Water Development
EAC	East African Community
EADB	East African Development Bank
EIB	European Investment Bank
EPC	Engineering, Procurement, Construction
ERA	Electricity Regulatory Authority
ERB	Electricity Regulatory Board
ERC	Energy Regulatory Commission
ERS	Economic Recovery Strategy for Wealth and Employment Creation
ERT	Energy for Rural Transformation
ESP	Energy Service Provider
ESRP	Energy Sector Recovery Project
EU	European Union
FMO	Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden N.V. (Netherlands Development Finance Company)
F/S	Feasibility Study
GDC	Geothermal Development Company
GEF	Global Environment Facility
GIS	Geographic Information System
GoJ	Government of Japan
GoK	Government of Kenya
GoU	Government of Uganda
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Society for Technical Co-operation)
IAEA	International Atomic Energy Agency
IBRD	International Bank for Reconstruction and Development
ICEDA	Icelandic International Development Agency
IDA	International Development Association
IFC	International Finance Cooperation
IMF	International Monetary Fund
IP-ERS	Investment Program for the ERS 2003-2007
IPP	Independent Power Producer
IREMP	Indicative Rural Electrification Master Plan
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KenGen	Kenya Electricity Generating Company Ltd.
KEREA	Kenya Renewable Energy Association

KfW	Kreditanstalt für Wiederaufbau (Reconstruction Credit Institute)
KIRDI	Kenya Industrial Research and Development Institute
KPC	Kenya Power Corporation
KPLC	Kenya Power & Lighting Company Limited
Ksh	Kenya Shilling
KTDA	Kenya Tea Development Agency Ltd.
KWFT	Kenya Women Finance Trust
LCPDP	Kenya's Least Cost Power Development Plan
LED	Light Emitting Diode
LIBOR	London Inter-Bank Offered Rate
MEMD	Ministry of Energy and Mineral Development
MDIs	Microfinance Depository Institutions
MFI	Microfinance Institutions
MFPEd	Ministry of Finance, Planning and Economic Development
MFSC	Microfinance Support Center Limited
MIS	Management Information System
MoE	Ministry of Energy
MoF	Ministry of Finance
MoU	Minute of Understanding
M/P	Master Plan
MSME	Micro, Small and Medium Enterprises
NARO	National Agricultural Research Organization
NDF	Nordic Development Fund
NGO	Non-Governmental Organization
NORAD	Norwegian Agency for Development Cooperation
ODA	Official Development Assistance
OJT	On-the-Job Training
p.a.	per annum
PEAP	Poverty Eradication Action Plan
PPA	Power Purchase Agreement
PPP	Public Private Partnership
Pre-F/S	Pre-Feasibility Study
PRSP	Poverty Reduction Strategy Paper
PSFU	Private Sector Foundation Uganda
PSRP	Power Sector Recovery Project
PSRPS	The Power Sector Reform and Privatization Strategy
PV	Photovoltaic
PVMTI	Photovoltaic Market Transformation Initiative
REA	Rural Electrification Agency (Kenya)
REA	Rural Electrification Authority (Uganda)
REB	Rural Electrification Board
REEEP	Renewable Energy & Energy Efficiency Partnership
REF	Rural Electrification Fund
REM	Rural Electrification Master Plan
REP	Rural Electrification Program
REIP	Renewable Energy Investment Plan for Uganda
RESP	Rural Electrification Strategy and Plan
SACCO	Savings and Credit Cooperative Society
SACCOs	Savings and Credit Cooperative Societies
SADC	Southern African Development Community
SAPP	Southern Africa Power Pool
SCADA	Supervisory Control And Data Acquisition
SHS	Solar Home System
SIDA	Swedish International Development Agency
SME	Small and Medium Enterprises
SMEP	Small and Micro Enterprises
SVO	Straight Vegetable Oil
TICAD	Tokyo International Conference on African Development
UBoS	Uganda Bureau of Statistics
UDB	Uganda Development Bank
UEB	Uganda Electricity Board
UECCC	Uganda Energy Credit Capitalization Company Limited

UEDCL	Uganda Electricity Distribution Co. Ltd.
UEGCL	Uganda Electricity Generation Co. Ltd.
UETCL	Uganda Electricity Transmission Co. Ltd.
ULC	Uganda Land Commission
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
US\$	US Dollar
US¢	US Cent
Ush	Uganda Shilling
UWA	Uganda Wildlife Authority
VAT	Value Added Tax
WENRECO	West Nile Rural Electrical Company

Exchange Rates (as of April 2009)

- US\$ 1 = JPY 97.29
- Ksh 1 = JPY 1.258
- US\$ 1 = Ksh 77.34
- Ush 1 = JPY 0.046
- US\$ 1 = Ush 2,115

Electrical Terminology

- V (Volt) Unit of voltage
- kV (kilovolt) 1,000 volts
- W (Watt) Unit of active power
- kW (kilowatt) 1,000 watts
- MW (Megawatt) 1,000 kW
- Wh (Watt-hour) Unit of Energy
- kWh (kilowatt-hour) 1,000 Wh
- MWh (Megawatt-hour) 1,000 kWh
- GWh (Gigawatt-hour) 1,000 MWh
- VA (Volt-ampere) Unit of apparent power
- kVA (kilovolt-ampere) 1,000 VA
- MVA (Megavolt-ampere) 1,000 kVA
- Wp (Watt-peak) Unit of PV output¹
- kWp (kilowatt-peak) 1,000 Wp
- MWp (Megawatt-peak) 1,000 kWp

¹ Maximum watt of PV module DC output under standard conditions of 1,000 W/m² intensity, 25 °C ambient temperature and a spectrum that relates to sunlight that has passed through the atmosphere (AM or Air Mass 1.5).

(INTRODUCTION)

1. Background

(1) Assistance in Africa

Nowadays, Africa is getting world attention as it leads towards economic development following Asia. The investment to developing natural resources is increasing. Hence, African economy is gaining the opportunity in taking off from long-term stagnation due to shortage in natural resources.

On the other hand, there are a lot of problems and issues to be solved in Africa. African countries are the first to suffer the impacts of food price hike and climate change. Poverty reduction is set as their long-range goal. However, they simultaneously need to respond to meet challenges on climate change. Thus, they need to achieve development with minimum CO₂ emission and environmental impacts to ensure economical development expected in the future.

In such condition, the Government of Japan (GoJ) announced its policy in promoting active assistance to African countries. In the Tokyo International Conference on African Development (TICAD) IV, the GoJ announced its initiative package for the development of Africa, including the commitment to increase Japanese Official Development Assistance (ODA), to double the amount within 5 years.

The GoJ also announced policies like support in promoting renewable energy through the “Cool Earth Partnership”, as countermeasure against climate change.

(2) Assistance to Promote Renewable Energy

The Japan International Cooperation Agency (JICA) has learnt a lesson regarding the importance of condition improvement for the popularization and business promotion of renewable energy. A study² held in Kenya and Uganda for four months from July 2008 shows the necessity of such condition improvement as well as promoting electrification of public facilities in rural areas like schools and health facilities.

As a result, JICA conducts this study to gather basic information in formulating new projects, and study the possibility of cooperation in the future. This is executed by grasping and analyzing the current situation on the business promotion of renewable energy.

2. Objectives of the Study

The following are the objectives of the study:

- Understand the present situation of business and its environment related to renewable energy in Kenya and Uganda;
- Figure out the barrier or bottleneck in formulating the mechanism with policy and institutional arrangement, to disseminate renewable energy as a private business;
- Propose countermeasures to mitigate the barriers or bottlenecks; and
- Explore the possibility for cooperation by Japanese ODA related to the above countermeasures.

3. Study Team

The JICA Study Team consists of the following four experts:

² Dissemination of renewable energy to rural communities: study on photovoltaic and small-hydro projects in East Africa, JICA, 2008

- Mr. Tomoyasu FUKUCHI: Team Leader / Promotion Policies and Institution
- Mr. Shisei SAKODA: Renewable Energy Business
- Mr. Hidehito WAKABAYASHI: Financial Policies and Institution / Microfinance
- Mr. Takeshi SAGAWA: Reality of Lending and Issues

4. Record of Major Activities

The overall schedule of the study is shown below.

	2009/4	2009/5	2009/6	2009/7	2009/8	2009/9	2009/10	2009/11
Site Survey	Kenya	Uganda						
Report				Draft	Final Report *		Final Report	*

Note: In addition, Mr. Sagawa visited the headquarters of World Bank, International Finance Cooperation (IFC), AfDB (African Development Bank) and UNIDO (United Nations Industrial Development Organization).

Scopes of the study include the following:

1) Deliberation with counterpart organizations

- Kenya: Ministry of Energy (MoE) and Rural Electrification Agency (REA)
- Uganda: Ministry of Energy and Mineral Development (MEMD) and Rural Electrification Authority (REA)

2) Interview with organizations concerned on renewable energy business

3) Interview with financial institutions

4) Site Surveys

- Kenya:
 - (1) Kibae hybrid CPC (Community Power Center) in Kirinyaga District,
 - (2) Kamahuha CPC in Muranga South District,
 - (3) Ngong Hills wind and photovoltaic power (PV) power generation project site and Mbuuni CPC in Machakos District,
 - (4) James Finlays Ltd., Gilgil,
 - (5) Chemosit CPC in Kericho District,
 - (6) Homa Bay CPC, and others.
- Uganda:
 - (1) Bwindi mini-hydro in Kanungu District,
 - (2) Kisiizi mini-hydro in Rukungiri District,
 - (3) Finlays tea factory (biogas power generation) in Kibale District,
 - (4) Gomba Fishing Industry in Jinya District,
 - (5) Kakira sugar works in Jinya District,
 - (6) Hydropower potential site in Mbale District,
 - (7) Hydropower potential sites of Karuma and Ayago hydropower in Masindi District, and others.

(KENYA: PRESENT SITUATION OF RENEWABLE ENERGY SECTOR)

5. National Policy on Renewable Energy

There is no comprehensive policy in positively promoting renewable energy in Kenya at present, although there are preferential taxation system and feed-in tariff.

When the Sessional Paper No. 4 was passed in the parliament in October 2004, Kenya was operating without a comprehensive energy policy. By implementing this paper, Kenya recognizes the importance of renewable energy as well as energy efficiency.

The Energy Act 2006 sets out the national policies and strategies for short to long-term energy development. The broad objective of the new energy policy is to ensure the provision of adequate, quality, cost-effective, affordable supply of energy while ascertaining environmental conservation.

In Vision 2030, Kenya set the country's new development blueprint covering the period 2008 to 2030. It aims to transform Kenya into an industrialized, middle-income country providing high quality life to all its citizens by the year 2030. This long-term development plan will directly lead to the availability of energy and provision of related services. The Government of Kenya (GoK) recognized that without adequate and affordable energy services, Vision 2030 will not be achieved. Moreover, the importance of renewable energy and its efficiency will not be realized.

6. Outline of Institutional Support for Renewable Energy Promotion

Historically, GoK has not actively supported renewable energy by not allotting the necessary budget for its promotion. Several measures which provided basic support to renewable energy are as follows:

- Removal of duties and Value Added Tax (VAT) on solar energy equipment and removal of duties on renewable energy equipment
- Development of feed-in tariffs
- Provision of renewable energy systems through the REA

7. Related Plans

There are rural electrification plans related to familiarization and promotion of renewable energy. Although MoE previously managed rural electrification in Kenya, REA established in 2007 actually manages rural electrification matters since 2009.

The following are plans on rural electrification.

- Rural Electrification Program
- Rural Electrification Authority Strategic Plan 2008-2012
- Rural Electrification Master Plan (REM)

The Rural Electrification Program was published in 1973. It sets government supports for rural electrification due to low economic efficiency and lack of progress in terms of business. Subsequently, Energy Act No.12 was published in 2006 to enhance the rural electrification project and hence, REA was established under the act. REA formulated the Rural Electrification Authority Strategic Plan to realize its mission.

About 100% electrified area coverage is targeted by 2012. By 2030, the current 10% household

electrification is planned to be improved to 100%, which also include 100% electrification of public facilities like trading centers, schools, health facilities, public water supply systems and administrative offices.

Draft final report of the REM being prepared since 2007, was submitted in May 2009. It shows plans for ten years from 2009 to 2018, and detailed action plans for five years from 2009 to 2013. According to the action plan, the target by 2013 is to improve the rural electrification ratio, including off-grid, to 22%.

8. Present Situation of Renewable Energy Market

(1) PV System

There are about 6.06 million households in the rural areas of Kenya as of 2007/08. Among these, there are 360,000 electrified households, equivalent to about 5% of the total households. Households electrified with PV are about 200,000, (3.3%), and is increasing at a rate of 20,000 per annum (p.a.). It means electrification in the rural areas is provided with PV system for 56% of electrified households. Separately the information from the GoK and NGO's, another estimate is made in accordance with data from a leading wholesale dealer, Davis & Shirliff Limited (D&S). PV sold in Kenya was 1.2 MW in total in 2008.

(2) Hydropower

Out of the hydropower potential of 3,000 MW to 6,000 MW in Kenya, hydropower of 700 MW has been developed. Those with installed capacity of less than 10 MW are defined as small hydropower in Kenya. From the economic point of view, the GoK has developed large-scale hydropower to connect with the national grid rather than small hydropower. Some communities developed several small hydropower facilities by themselves. There are many small hydropower stations constructed at various places in Kenya. However, the renewable energy section in the MoE does not grasp the status of existing small hydropower stations. Hence, the Energy Regulatory Commission (ERC) established in 2007 plans to identify the status of small hydropower stations by utilizing the system on reporting and application for license of hydropower stations.

(3) Wind Power

The wind power stations under operation in Kenya consists of one unit of 200 kW and 150 kW at Ngong Hills by KenGen and one unit of 200 kW at Marsabet by KPLC. D&S sold 25 sets of wind power units of 400 W to 5 kW for well pumps and telecommunication relay stations. A wind power station of 5.1 MW, consisting of 6 units of 850 kW in installed capacity, is under construction at Ngong Hills with the Belgian loan. According to the information at site, this wind power station started operation in August 2009. Another wind power station of 10 MW is also planned to be constructed with the Belgian loan. In addition, other wind power stations are planned by IPPs such as the 100 MW at Turkana/Marsabet, 50 MW at Kinangop, and another 100 MW at Ngong Hills.

(4) Bio-energy

a) Bio-fuel

Bio-ethanol has not yet been produced in Kenya. However, jatropha as material for biodiesel is cultivated on a large scale. It is grown in a 1,000 ha area in Kajiado District. There is a plan to extend said area to 26,000 ha in the future.

b) Biogas power generation

Biogas production system with dung was introduced to 1,000 households in the 1980s. About 30 to 50% of the existing systems are presently out of order. Fixed dome type system is recently adopted.

c) Bagasse cogeneration

There is a potential for bagasse cogeneration of 500,000 ton p.a. from seven sugar factories. Mumias sugar factory has generated 2 MW power since 2005 and has a project which involves selling of 26 MW power to KPLC, out of its total generated power of 35 MW in May 2009. This project was approved by GoJ in 2006³ as a CDM project of Japan Carbon Finance, Ltd..

(5) Geothermal Power Generation

The present power generation capacity is 1,296 MW in the entire national grid system, including 128 MW from geothermal power plants. By now, the framework for geothermal utilization has been modified to the one where the government has risk of geothermal steam supply. Moreover, since firms, not limited to KenGen, can engage in the power generation aspect, it is expected that private business opportunities will expand eventually.

9. Present Situation of Financial Market related to Renewable Energy

Financial institutions can be divided into the following categories. It is noted that many are not responding to the expansion of renewable energy utilization.

- 1) Government-owned commercial banks (IDC Capital, Kenya Development Bank, Kenya Commercial Bank)
- 2) Foreign-owned banks (Barclays Bank, HSBC, Stanbic Bank)
- 3) Private commercial banks⁴ (Diamond Trust Bank, Fina Bank, Equity Bank, K-Rep Bank)
- 4) SACCOs and microfinance institutions

The banks in the second category tend to cooperate with collaterals. However, there are no large scale projects like IPPs on a project finance basis. As for the banks in the third category, Equity Bank⁵ and K-Rep Bank started originally from small scale lending, while Diamond Trust Bank and Fina Bank are trying to enter into small scale markets, calling the strategy as downstreaming. Microfinancing businesses including SACCOs are lending in the framework where a borrower forms a group and the members guarantee the borrower on a joint and several basis. However, their lending is intended for income-generating businesses in order to secure funds for debt services (repayment and interest payment).

10. Human Resources of Renewable Energy in Business Sector

(1) PV Equipment Sales Business

Wholesalers and sales shops carry out design, sale, installation, repair and other services for PV system. They are expected to design PV system and select modules, charge controllers, batteries, invertors, etc., to

³ The project is "35 MW Bagasse Based Cogeneration Project" by Mumias Sugar Company Limited (MSCL), which was registered in 3rd September 2008 and its host country is Kenya. Estimated amount of reductions of CO₂ is 129,591 metric tonnes and the project was applied by Japan Carbon Finance Limited. The project was approved by the Government of Japan as investor country. CER (Certified Emission Reductions) has not been issued. (Source: <http://www.kyomecha.org/cdm.html>)

⁴ The original business was to provide rural households with microfinance.

⁵ Building Society was the original organization: Poor family those who were not able to afford bank accounts, organized society to provide its members with mutual financial assistance to build houses.

meet the purpose and requirements of users. They install PV equipment including wiring and provide guidance on how to operate and maintain the equipment, if necessary. There is lack of shop staff and electrical technicians who have sufficient knowledge from design to operation and repair of PV system.

(2) Hydropower

Since it was foreign engineers who have been engaged in implementing hydropower projects in Kenya, local human resource in private enterprises remain insufficient in carrying out such projects.

(3) Wind Power and Bio-energy

As there are few businesses in wind power and bio-energy, human resource with specialized techniques on such fields are very limited.

(UGANDA: PRESENT SITUATION OF RENEWABLE ENERGY SECTOR)

11. National Policy on Renewable Energy

Uganda is one of the very few countries in Sub-Saharan Africa, which has come out with an elaborate national policy and strategy for renewable energy development, as well as created the necessary infrastructure needed for its implementation. On April 2nd, 2007, the Ministry of Energy and Mineral Development (MEMD) published a Renewable Energy Policy, which was approved by the Cabinet on March 29th, 2007. This document sets out targets for power generation, rural and urban-poor electrification access, modern energy services, biofuel, wastes to energy, and energy efficiency.

The overall government policy vision for the role of renewable energy in the national energy economy is to make modern renewable energy a substantial part of the national energy consumption. The overall renewable energy policy goal aims to increase the use of modern renewable energy from the current 4% to 61% of the total energy consumption by the year 2017.

The need for an appropriate energy policy is also recognized by the Constitution of the Republic of Uganda (1995) which states: "The State shall promote and implement energy policies that will ensure that people's basic needs and those of environmental preservation are met". The Energy Policy was announced in September 2002.

12. Outline of Institutional Support for Renewable Energy Promotion

The overall responsibility for renewable energy promotion lies with MEMD. It has the mechanisms to oversee and coordinate the implementation of the renewable energy policy of various stakeholders. For this, the following activities have been done.

- 1) A renewable energy section is created in MEMD to specifically focus on the promotion of renewable energy and related technologies.
- 2) In MEMD, an Energy Efficiency and Conservation Department is also established.
- 3) MEMD has also constituted a National Energy Committee to provide strategic policy guidance to the energy sector.
- 4) MEMD works with the municipal authorities and industries that generate lots of waste, which are included in the policy as renewable energy sources.

The major institutional supports for renewable energy promotion are as follows:

- Removal of duties and value-added tax (VAT) on solar energy equipment
- Development of feed-in tariffs
- Subsidy for renewable energy promotion
- Financial support for renewable energy promotion

13. Related Plans

There are rural electrification plans related to familiarization and promotion of renewable energy. Electricity Act is published in 1999 and it states that promotion of electrification in non-electrified area by grid or off-grid is the role of GoU. The following are plans related to rural electrification.

- Rural Electrification Strategy and Plan (RESP)
- Rural Electrification Fund (REF)
- Energy for Rural Transformation (ERT)

- **Indicative Rural Electrification Master Plan (IREMP)**

The RESP, prepared in 2001, is a framework plan based on Electricity Act 1999. This is intended for big policy targets such as correcting imbalance between the urban and the rural communities, increasing opportunity of income generation and effective utilization of existing renewable energy resources in rural areas. Additionally, RESP shows that the target electrification ratio in 2010⁶ is 10% in rural area. RESP also shows that the GoU provides necessary subsidy to rural electrification project from REF. The REF, established in 2001, is a financial support mechanism for promoting rural electrification project to improve rural electrification ratio. Fund sources of REF are a levy of 5% on transmission bulk purchases of electricity from generation stations, money appropriated by parliament and funds from donors. The REA was established in 2003 to manage related projects using REF.

The ERT is a rural electrification program by the World Bank. It is implemented under corroboration with REA to achieve 10% target rural electrification ratio of RESP in the electrification sector. The program implements and supports various projects related to energy development and utilization, such as power source development, grid extension and off-grid electrification including public facility electrification. Under ERT Phase I (ERT 1) which completed on February 28th, 2009, PV systems were installed to public facilities. The installation plan of PV system to schools, health and water supply facilities is big theme even under ERT Phase II (ERT 2) which commenced in July 2009.

The IREMP completed in 2009 is prepared as the ERT. The IREMP shows specific drafts of rural electrification projects to minimize project cost considering factors like extension plan of transmission line, population and geological conditions, and prompt investments to the projects.

14. Present Situation of Renewable Energy Market

(1) **PV System**

The REIP estimates annual new installation of PV with 200 kWp for private houses, enterprises and commercial use. According to the Annual Rural Electrification Report, ERT 1 installed 3,500 sets of PV with 370 kWp in two years from 2004 to 2006, at a cost of US\$ 650,000. According to Incafex Solar System Ltd. in Kampala, annual growth rate of sales of PV is about 50% since 2000, with PV facilities of 50 Wp being sold out.

(2) **Hydropower**

Hydropower potential in Uganda is estimated at about 2,600 MW for large hydropower in the Nile River, and about 200 MW for small hydropower in other rivers.

Regarding the hydropower potential of the Nile River, up to now, 340 MW has been developed while 250 MW will be developed by Bujagali hydropower station, which is under construction and planned to be completed in 2011. Hydropower with installed capacity of less than 20 MW is defined as small hydropower in Uganda. The Renewable Energy Policy, 2007 shows the 64 sites as potential candidate sites of small hydropower development. Out of said sites, 14 sites of 17.4 MW have been developed.

(3) **Wind Power**

Average wind velocity in Uganda is 2 to 4 m/sec. There is a possibility of utilizing wind power to operate

⁶ The target year is changed to 2012 from 2012 according to subsidy policy published later.

small-scale pump in the Kamolamoja areas. It is reported that it would likely utilize wind power generation of 2.5 to 10 kW for small industry and rural areas. However, wind power station has actually not yet been constructed.

(4) Bio-energy

a) Biofuel

Small quantity of bio-ethanol is produced from cereals and molasses, by-product in sugar factories. Production of jatropha for raw material of bio-diesel and straight oil production for bio-diesel were not found by the Study Team while in Uganda.

b) Biogas

Private enterprises, NGOs, GoU and donors are encouraging construction of biogas production facilities at homes, since 1980. Around 500 facilities are presently operational in Uganda.

c) Cogeneration with bagasse

About 240,000 tons of sugar was produced in Uganda in 2008. Major sugar factories are Kakira Sugar Works Ltd., Kinyara Sugar Works Ltd., and Sugar Corporation of Uganda Limited.

Kakira Sugar Works Ltd. owns a cogeneration facility and sells part of generated power to UETCL.

d) Power generation with biogas gasification plant

Research works on gasification plant for generating power with biomass are being made in Nyabyeya Forestry College for 100 kW and 50 kW plants, Kyambogo University for 10 kW plant and CREEC (Center for Research in Energy and Energy Conservation in Makerere University) for 10 kW plant.

Since 2006, the Muzizi tea factory of James Finlays Ltd. is operating a gasification plant of 205 kW made in India. The actual power output is 100 to 185 kW.

(5) Geothermal Power Generation

There are some geothermal potential sites along Lake Bunyonyi, Lake Edward and Lake Albert in Western Uganda and at the western end of Great Rift Valley. Most promising geothermal sites at present are Katwe in Queen Elizabeth National Park, Buranga in Semliki National Park and Kibiro. The total power potential is estimated at 450 MW.

At present, it is proposed to execute deep boring exploration at Katwe and Kibiro sites for feasibility study, and further study at Buranga site.

15. Present Situation of Financial Market related to Renewable Energy

Long-term finance for social and economic development is available only through the World Bank/IDA, AfDB, EADB and other donors. In Uganda, AfDB, EADB and Uganda Development Bank (UDB) offers loans for private investment. However, the appraisal process is not business-like, i.e. response is very slow. Hence, business opportunities will be lost due to time constraints. Furthermore, commercial banks do not allow long-term financing of more than four years, due to government's control concerning risk management. It is noted that commercial banks fund source are from the savings deposits of households and private companies.

Micro-credit is disseminated to both urban and rural communities, for poor as well as ordinary residents. Especially in rural communities, available financial opportunities are less since the limited numbers of commercial banks branches do not lend money to the poorer population. This is because cash demands of rural households are usually too small to earn business profits as required by bank loan schemes. Therefore, the microfinance services delivered by MFIs and SACCOs are indispensable in the rural communities.

16. Human Resources of Renewable Energy in Business Sector

(1) PV Equipment Sale Business

Wholesalers and sales shops carry out design, sales, installation, repair and so on for PV system. They design PV system and select PV modules, charge controllers, batteries, invertors and other components to meet the purpose and requirements of users. They install PV equipment including wiring and provide guidance on how to operate and maintain the equipment, if necessary.

(2) Hydropower

Since it was the foreign engineers who have been engaged in implementing hydropower projects in Uganda, local human resource in private enterprises remain insufficient in carrying out such projects.

(3) Wind Power and Bio-energy

As there are few businesses in wind power and bio-energy, human resource with specialized techniques on such fields are very limited.

(KENYA: ISSUES FOR PROMOTION OF RENEWABLE ENERGY IN THE PRIVATE SECTOR)

Issues for promotion of renewable energy to the private sector is sorted out like (1) policy and institution, (2) private sector's participation environment, (3) financing environment, (4) capacity development and (5) technology introduction.

17. Policy and Institution

Provision of policy and institution about installation of renewable energy appears late, although Photovoltaic (PV) is becoming popular in the private sector. There are schemes on preferential taxation and feed-in-tariff. However, there is no clear keynote or policy documented. Therefore, what should be done at first is to prepare a renewable energy policy and publish it as national basic keynote similar to Uganda.

Information such as contents, benefits and economic effects has not been disseminated to the general public, politicians, government officials and business entrepreneurs. One of the issues is the political activation of educational campaigns.

With the trend on formulating countermeasures against global warming, developing countries will be strongly advised to reduce CO₂ emission. Regarding this, policy and institution related to said countermeasures will surely be required including establishment of institution to ensure quantification of emission.

18. Environment for Private Sector's Participation

Environment for private sector's participation is defined as the circumstance of risk and burden in the private businesses' participation in the renewable energy business. Currently, any private business cannot easily participate in the renewable energy business because of risk and burden barriers. The risk signifies that business could possibly fail and be discontinued. Usually, detailed survey and plan preparation are done before starting the business to reduce the risk. Since the process is not profitable, the incurred cost becomes a big burden to the business. Private sector's participation can therefore be promoted by mitigating the risk and burden.

19. Financing Environment

The biggest issue in promoting renewable energy is the improvement of the financing environment. Whenever an occasion to exchange views with IFC in Sub-Saharan Africa⁷ is possible, the important topic is the necessity of support to financial institutions. It is difficult to finance the construction for any renewable energy sector like PV, hydro, geothermal, biogas and wind. Demand of PV system is recently increasing. However, its dissemination is limited because the price of SHS is high relative to people's income. Although there are large development projects on hydropower and geothermal by Kenya Electricity Generating Company Ltd. (KenGen), these are all regarded as national projects.

Installation of mini-hydro, biogas and wind power stations has begun. Although there are already many proposed construction plans, most of them are unrealizable. The main reason for this is the difficulty in financing.

⁷ Africa north of the Sahara is called "White Africa" and the south is called "Black Africa" or "Sub-Saharan Africa".

20. Capacity Development

The issue in capacity development is the strategic planning and implementation towards promoting renewable energy. Private business engaged in renewable energy has recently existed. Therefore, human resources related to renewable energy is limited. Since there is not much demand on such human resources at present, it can be considered that this is not bottle neck for dissemination and expansion. If businesses related to said sector is promoted and required employment is expanded, effect of capacity building will be assured considering that the demand to human resources and needs of capacity building are expected to increase. At present, strategic planning and implementation of capacity development is important to achieve the target of effective dissemination and expansion of renewable energy.

21. Technology Introduction

The issue on technology introduction is that the selection of technology to be supported by the country, among to be introduced and to be disseminated by the private sector, has not been done. Effect of support will be better if a suitable technology is selected. Most technology on renewable energy is new, and is either not yet introduced or is still in its earlier stage. It is also noted that some existing technologies are not extensively introduced. The merit of introduction should be confirmed based on a long-term perspective, with the selection of technology to be supported.

It is important to consider in the selection process that new technology becomes closer to maintenance-free and has lesser impacts to environment. Therefore, the new technology has more merit to be introduced to the nation. Usually, it is necessary to perform such selection considering price fluctuation in the future because of the fact that technology in early stage of development is expensive and could become less costly as it becomes popular.

(UGANDA: ISSUES FOR PROMOTION OF RENEWABLE ENERGY IN THE PRIVATE SECTOR)

Issues for promotion of renewable energy in Uganda are almost similar to those of Kenya. The differences are in policy and institution, and financing environment, which are described as follows.

22. Policy and Institution

Unlike Kenya, the clear keynotes and policies are documented in Uganda and the framework of institution for promoting renewable energy is ready. The matter to be addressed as a next step is to monitor the effectiveness of the existing institutions and enhance them if necessary.

The other two issues, political activation of educational campaign and countermeasure to global warming, are similar to that of Kenya.

23. Financing Environment

Similar to Kenya, the biggest issue in promoting renewable energy is the difficulty in financing. Its difference with the case in Kenya is that there is already an existing framework of financing in Uganda: the Energy for Rural Transformation (ERT). It is effective to utilize such framework to solve issues in Uganda.

(POTENTIAL AREA OF INTERVENTION FOR OFFICIAL ASSISTANCE FROM JAPAN)

24. Kenya: Potential Area of Intervention for Promotion of Renewable Energy in Private Sector

It is thought that there is high possibility for Japan to contribute to promoting renewable energy in the field of private business in Kenya.

Based on the preceding discussions, the challenges, countermeasures, and cooperation of Japan related to renewable energy promotion are summarized in five aspects, as shown in **Table 1** below.

Table 1 Cooperation of Japan for Promoting Renewable Energy as Private Business

Aspect	Challenge	Countermeasures	Cooperation of Japan
(1) Policy and Institution	No progress and more efforts needed for enhancement.	- Stipulation of basic policy - Review and monitoring of existing bylaws - Improvement of individual bylaws - Dissemination and educational campaign - Addressing global warming	Technical Cooperation
(2) Environment for Private Participation	Not good environment; necessary lowering hurdle and risk for private entities to enter the renewable energy business.	- Conduct of feasibility study by the government prior to implementation	Technical Cooperation
(3) Funding Environment	Strong requirement for long-term and low-interest funds and necessity for money supply.	- Introduction of grant money or soft loan from donors	Grant and/or Soft loan
(4) Capacity Development	Small demand for employment of related business to renewable energy and need for strategic human resource development.	- Training for personnel who can establish business of renewable energy - Training for personnel working in the category of business in which the personnel earns living by training - Preparation of the training framework to promotes establishment of renewable energy business	Technical Cooperation
(5) Introduction of Technology	Low priority given to technology that should be supported by the government and need prioritizing.	(Priority Technologies recommended by the Study Team) - Rechargeable LED Capacitor Lantern - Straight Vegetable Oil (SVO) - Solar Water Heater	-Technical Cooperation -Grant and/or Soft loan

Prepared by JICA Study Team

25. Uganda: Potential Area of Intervention for Promotion of Renewable Energy in Private Sector

It is thought that there is high possibility for Japan to contribute to promoting renewable energy in the field of private business in Uganda.

Based on the preceding discussions, the challenges, countermeasures, and cooperation of Japan related to renewable energy promotion are summarized in five aspects, as shown in **Table 2** below.

Table 2 Cooperation of Japan for Promoting Renewable Energy as Private Business

Aspect	Challenge	Countermeasure	Cooperation of Japan
(1) Policy and Institution	Well provision. Improvement of effectiveness and other policy action required.	- Monitoring/review of existing institutions - Dissemination and educational campaign - Addressing global warming	Technical Cooperation
(2) Environment for Private Participation	Not good environment; it is necessary to lower the hurdles and risks for private entities to enter into the renewable energy business.	- Conduct of feasibility study by the government prior to implementation	Technical Cooperation
(3) Funding Environment	Strong requirement for long-term and low-interest funds and necessity for money supply. Utilization of existing framework, ERT is effective.	- Introduction of grant money or soft loan from donors	Grant and/or Soft loan
(4) Capacity Development	Small demand for employment of related business to renewable energy and need for strategic human resource development.	- Training for personnel who can establish business of renewable energy - Training for personnel working in the category of business in which the personnel earns living by training - Preparation of the training framework to promotes establishment of renewable energy business	Technical Cooperation
(5) Introduction of Technology	Low priority given to technology that should be supported by the government and need prioritizing.	(Priority Technologies recommended by the Study Team) - Rechargeable LED Capacitor Lantern - Straight Vegetable Oil (SVO) - Solar Water Heater	-Technical Cooperation -Grant and/or Soft loan

Prepared by JICA Study Team

(CONCLUSIONS)

26. Present Situation

Renewable energy has not prevailed much as a private business in both Kenya and Uganda except for PV system for rural electrification. Introduction of PV system is progressing more in Kenya than in Uganda. The number of rural households electrified by PV system in Kenya is about 56% of the total number of rural electrified households based on the data in 2007/08. Other cases of renewable energy introduction are cogeneration with bagasse in sugar mills and hydropower development in tea factory in both Kenya and Uganda.

27. Policy and Institution

Policies and institutions for promotion of renewable energy are still underdeveloped in Kenya. Although there are the tax incentives for renewable energy equipment and the feed-in tariff for electricity generated by renewable energy, the related policy documented has not been formulated. In Uganda, meanwhile, under a comprehensive policy document, various institutions are already prepared for renewable energy promotion. In addition, there are needs related to the development of institutions to address global warming in both Kenya and Uganda.

28. Financial Situation

The biggest bottleneck for promoting renewable energy is the lack of long-term and low-interest financing in both countries. The maximum loan term is five to seven years, and is usually four years even in the case of development finance. Furthermore, the interest rates are around 10% per year. Micro-credit in both countries is prevailed by SACCOs and others, with interest rate of around 30 percent per year and repayment period of around 24 months.

29. Cooperation of Japan

The following cooperation is considered effective in promoting renewable energy in Kenya and Uganda: (1) development of institutions to address global warming; (2) development of environments to facilitate private sector's participation in renewable energy projects; (3) providing two-step loans - the expected borrowers are IPPs, captive power developers like sugar factories and tea factories, and the organization handling micro-credit; (4) human resource development; (5) promotion of rechargeable LED capacitor lanterns as Public Private Partnership (PPP) utilizing grant aid scheme, promotion of SVO under the scheme of technical cooperation project, and promotion of solar water heaters under the technical cooperation for energy conservation.

(RECOMMENDATIONS)

30. Cooperation Order

It is important to set the order of cooperation properly. If it is a two-step loan, implementing a master plan study or F/S to facilitate participation of private entities like IPP is expected to develop renewable energy business. Subsequently, this order will bring about effective cooperation. In case of human training, conduct trainings or human resource development intended for the entrepreneur, education staff and researchers. It is then recommended to execute vocational trainings that specialize in renewable energy technology according to the increase of manpower needs in the field of renewable energy business.

31. Packaging of Cooperation

Packaging of two or more cooperation projects or with private business for formulating PPP is proposed. For instance, it is effective to execute a two-step loan and personnel training on financial field together as a package. In case of implementing electrification of public facilities with the function of charging station under grant aid scheme, it is proposed to include rechargeable LED capacitor lantern as grant aid materials and initiate partnership with private business entity who lend the lanterns to residents around the public facility. This packaging of grant aid and private business will significantly contribute to the promotion of rural electrification.

32. Creating New Demand

The borrowers of the two-step loan are anticipated to be IPP entrepreneurs and captive power developers. The effects of such loan improve further if it creates new demand of renewable energy, hence, the loan borrowers. An example of potential demand with high possibility includes the tourism field such as eco-tourism lodges. It proposes the execution of the work to create such new demand in an organized manner.