PEREZ-GUERRERO TRUST FUND FOR ECONOMIC AND TECHNICAL COOPERATION AMONG DEVELOPING COUNTRIES

(G77 Project)

Final Report

on

Seminar on Renewable Energy and Off-grid Power System

for East African Countries

NATIONAL RESEARCH INSTITUTE FOR RURAL ELECTRIFICATION,
MINISTRY OF WATER RESOURCES, P. R. CHINA
/HANGZHOU REGIONAL CENTER (ASIA-PACIFIC)
FOR SMALL HYDRO POWER

JANUARY 2018, HANGZHOU, CHINA

G77 PGTF Project Final Report

Introduction

The Group of 77 approved the project entitled "Seminar on Renewable Energy and Off-grid Power System for East African Countries" with the funding source from the Perez-Guerrero Trust Fund (PGTF)-Reference Number INT-17-K04 at the 40th Annual Meeting of Ministers for Foreign Affairs of the Group of 77, which was submitted by National Research Institute for Rural Electrification, Ministry of Water Resources, P. R. China (hereinafter referred to as NRIRE). The duration of the project is 1 year, according to the signed project document started in January 2017, and completed in December 2017.

The Final Report included the project implementation activities and expenses and other related content.

I. Project Overview

1. **Project Title**: Seminar on Renewable Energy and Off-grid Power System for East African Countries
2. **Abstract**: With the development of economy in East African countries, renewable energy sources are going to be tapped and the significant role in promoting the sustainable and green development is getting more and more important. However, there is lack of competent expertise for power sector in Eastern Africa where deficiency of electric power makes their local residents not accessible to electricity, which becomes a barrier for the further socioeconomic development. The seminar aims to improve the concept awareness and capacity building in the field of renewable energy within East Africa. Through technical exchanges and cooperation, know-how can be popularized, experience can be shared, the leadership and management skills can be built, the cooperative projects can be planned and accomplished, thus the problems and causes can be effectively and appropriately addressed at the regional level.

3. **Background Analysis**: The East African countries in this proposal embrace those called Burundi, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda in the African Great Lakes region, where not only possess abundant water resources of large rivers with big flow, but also have got vast potential in the fields of geothermal, solar, wind power and other renewable energy sources. With the rapid development of economy in this region, the development of renewable energy sources and the sustainable and green development are getting more and more important. There are a lot of activities in the East Africa as the partner states are enhancing the development of their respective energy sources to meet the ever-growing demand and also save the environment by providing affordable renewable energy. As the society advances, people's idea of developing renewable energy sources changes, which brings new opportunities and challenges to the correlation

between technical research and application. However, there is lack of competent expertise for power sector in these East African countries where deficiency of electric power makes their local residents not accessible to power because of long-distance transmission cost and high power-tariff, which becomes a barrier for the further socioeconomic development. How to develop the rich renewable energy sources in scientific, reliable and sustainable way constitutes the new challenges in Eastern Africa.

The problem is actually a regional issue, since most of the East African countries mainly rely on coal or natural gas which is not sufficiently available there, and with the rapid development of local economy, the shortage of electric power there is getting worse day by day. As energy issue nearly exists in every major challenge and opportunity the world faces today, the governments recognize the need to resume the inter-state cooperation for developing their renewable energy potential and introducing the advanced technology. The UN Sustainable Development Goal (SDG) No.7 targets to have universal access to affordable, reliable and modern energy services by 2030, and for achieving this, significant resources are required for the development and long-term sustainability of the energy sector.

Renewable energies are considered clean and green, and an optimal use of these resources shall minimize environmental impacts, produce minimum secondary wastes and are sustainable based on current and future economic and social needs. Rivers can supply drinking water, power the cities with hydro-energy, support fish and other aquatic species, and provide recreational and commercial opportunities. Small hydropower (SHP), as a proven and environmentally sound energy, has been universally accepted by the international society and embraces obvious advantages of rich resources, proven technology, economic viability, easy dispatching and high return rate. The off-grid hybrid power (hydropower & solar power) generating technology, can not only better the living conditions of rural and hilly areas, but also mitigate the GHG emission and slow down the global warming. Through technical exchanges and cooperation, know-how can be popularized, experience can be shared, leadership and management skills in renewable energy development and operation can be built, and cooperative projects can be planned, thus problems and causes can be effectively and appropriately addressed at the regional level.

In Eastern Africa, the issues of social sustainable development, natural resources exploitation, rural lighting & electrification, and environmental protection are prominent, which have seriously hindered the economic development and social stability. To tackle all these issues, the East African countries have shown great concern and strong intention, desiring to address these common issues with cooperative approaches. A series of multilateral and bilateral cooperative activities are initiated for improving the expertise and public awareness of integrated development of renewable energy, including the proposal of setting up a Renewable Energy Research and Training Centre to help the capacity building of the region such as Kenya, Rwanda, Tanzania, Burundi and Ethiopia by Uganda Electricity Generation Company Limited. International organizations and other countries also intervened in some ways, with great assistance and support. However,

the difficulty of renewable energy development is not fundamentally eased yet.

II. Implementation

The project is divided into four distinct stages. Only the first three stages are relevant to this current project document, with the last stage representing ongoing strategies into the future.

Supporting and Partner Institutions:

★Addis Ababa Science and Technology University (AASTU)
★Mission of the People's Republic of China to the African Union
★ZTE (H.K) Limited Ethiopia Branch (ZTE)
★Uganda Electricity Generation Company Limited (UEGCL)

•The first phase of the project involves the selection and compilation of training materials, allocation of lecturers and recruitment of participants from East African Countries for the Seminar.

•The second phase of the project involves the organization of the Seminar on Renewable Energy and Off-grid Power System for East African Countries in Ethiopia.

•The third phase of the project involves the arrangement of nameplate unveiling of *Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa* and the signature of a Cooperation Initiative among NRIRE and participants.

•The fourth phase of the project will involve substantial cooperation and promotion of potential projects on renewable energy and rural electrification.

2. Benefits:

- an in-depth understanding of energy situation and facing problems of most East African countries
- dissemination and sharing of experience, technology and research findings of China and East African countries in relevant areas of renewable energy
- awareness of the great importance to improve capacity building in the field of renewable energy (especially hydropower and solar power) within East Africa
- enhancement of understanding, communication and cooperation among relevant governmental authorities of China and East African countries
- establishment of a bilateral as well as multilateral relationship and cooperation between China and East African Countries in order to exchange knowledge, transfer technologies and carry out R&D on renewable energy to resolve the common issues and problems faced by the participating countries through the efforts of the institutions and agencies involved
- promotion of research collaboration for the mutual interest on off-grid hybrid power generating technology and sustainable development of renewable energy projects to protect the ecological environment, reduce the GHG emission and achieve sustainable

social and economic development

- Acceleration of the setting-up of “Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa”

III. Completed Activities in the First Stage

Activity – 1: Selection and compilation of training materials, allocation of lecturers

Time: January – March 2017

Location: China, Ethiopia

Participants: NRIRE, AASTU

Implementation: Entrusted by Chinese Ministry of Commerce, Ministry of Water Resources, Ministry of Science & Technology, UNDP, UNIDO etc., NRIRE has hosted with success more than 95 training workshops and seminars for over 2000 participants from 113 countries. Based on the experience in training programs and considering the features of this project, NRIRE appointed one expert who is quite experienced in the research on applied technology of renewable energy development, international development tendency of renewable energy, hybrid power system, etc. to give a lecture on special topics for the coming Seminar after many discussions. Meanwhile, through extensive contact with NRIRE’s cooperative sectors in Ethiopia, NRIRE ultimately decided to invite two experts respectively from AASTU and ZTE of Ethiopia to share their experience in their own research fields on the Seminar. Training materials of the lectures were well prepared, checked, translated and compiled.

The lectures on special topics include:

• The Technology of Renewable Energy Applied in the Rural Areas (by NRIRE)

•Renewable Energy Development in Ethiopia (by AASTU)

•Green Energy, Brighten Future--ZTE Renewable Energy Business Introduction (by ZTE)

Excerpts of PPT Training Materials

The Technology of Renewable Energy applied in the rural areas

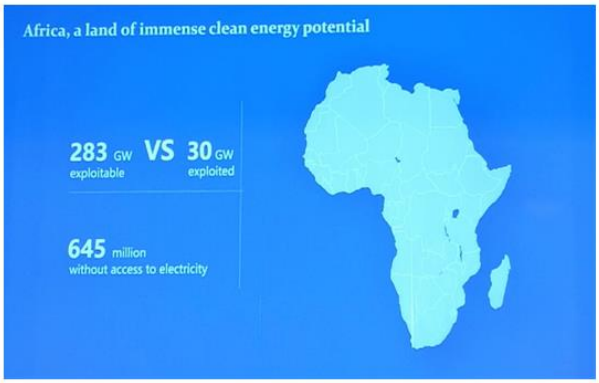
Xu JinCai

Hangzhou Regional(Asia-Pacific)Center For Small Hydro Power (HRC)
National Research Institute For Rural Electrification (NRIRE)

sustainable energy development for African economies

- Hydro 12%
- Solar 40%
- Wind 30%

Of the Global



- **Inadequate power generation.**
- **Low electrification rate**
- **Instable power supply.**

Challenges in terms of :
Financing、Technology、Management
human resources
infrastructure construction
international cooperation

The contents of "The Technology of Renewable Energy Applied in the Rural Areas" include the development of clean and renewable energy in China, international development tendency of renewable energy, a prediction of China's (mid & long term) power generation capacity and power demand, the robust development of solar energy in Africa, Sino-Africa energy cooperation, the utilization of renewable energy in rural area, packaged turbine-generating unit and so on.

Renewable Energy Development in Ethiopia

Dean: Prof. Dr. Yasuyuki Nemoto
Sustainable Energy Research CoE
Addis Ababa Science and Technology University

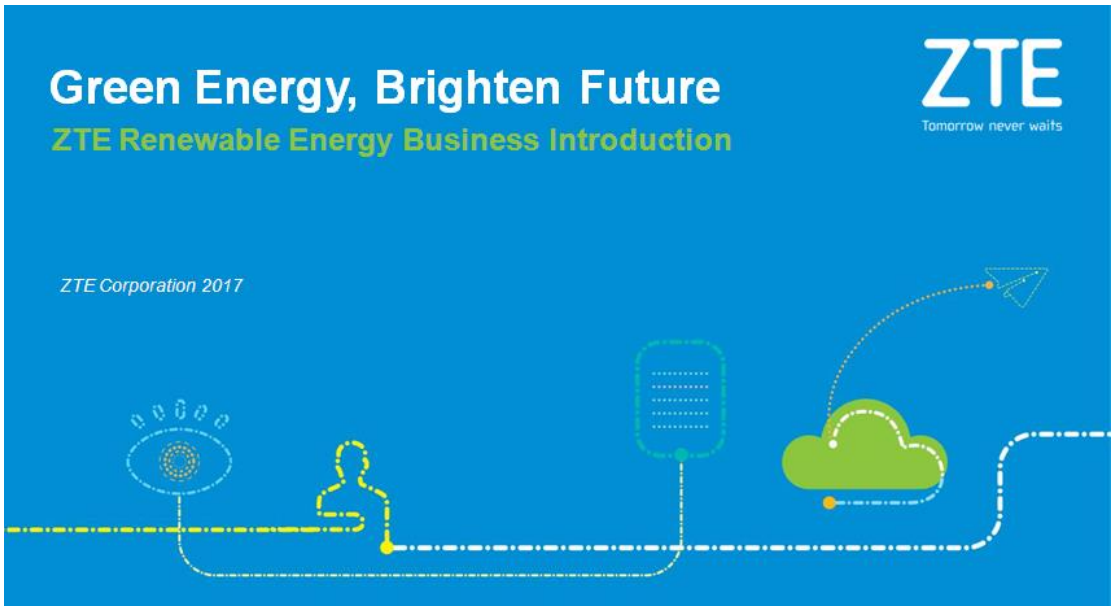
6. Sustainable Energy Research CoE in AASTU

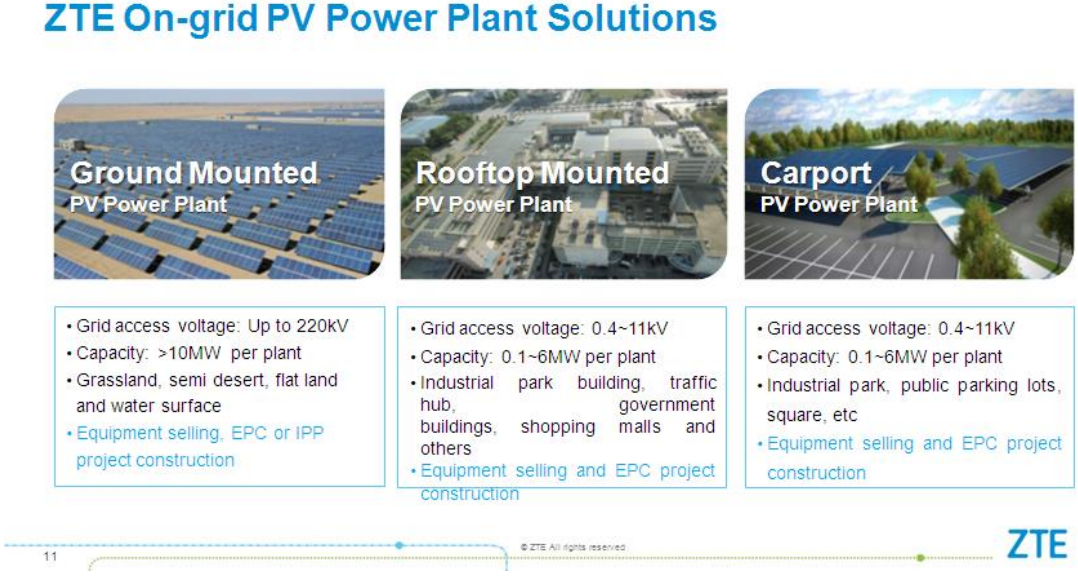
- Sustainable energy technology is divided into two categories; Renewable Energy Technology and Energy Saving Technology.
- Renewable energy is a form of energy that can be used repeatedly for an extremely long period in comparison with human's life, without depletion.
- Energy Saving is the method to use energy efficiently.

Renewable Energy Technology

Energy Saving Technology

The contents of "Renewable Energy Development in Ethiopia" cover the introduction of the renewable energy development in Japan, energy utilization in Ethiopia, renewable energy utilization in Ethiopia, renewable energy resource in Ethiopia, renewable energy research in Ethiopia, sustainable energy research CoE in AASTU, etc. and also some comparison researches are made.





The contents of “Green Energy, Brighten Future--ZTE Renewable Energy Business Introduction” cover ZTE company & energy product-line overview, ZTE renewable energy solution introduction (including on-grid/mini-grid/ PV power plant, portable/fixed solar home power, solar street lighting, solar water pumping, solar video security solutions), professional PV plant operation and management system, case study, etc.

Activity – 2: Recruitment of participants from East African Countries
Time: March-April 2017
Location: China, Ethiopia, Kenya, Rwanda, Tanzania and Uganda
Participants: NRIRE, Chinese Mission to the African Union, AASTU, UEGCL
Implementation: With the great support of Addis Ababa Science and Technology University (AASTU) and related institutes and agencies in East Africa, project information was disseminated to relevant departments of East African countries. 24 officials from 5 East African countries are selected to participate in the coming Seminar. After that, NRIRE sent special invitation letters and admission letters to all the selected participants for their visa application or going through the go-abroad formalities to Ethiopia.

Participants' Information

Seminar on Renewable Energy and Off-grid Power System for East African Countries

No.	Name	Country	Working Institute/Company	Position	Tel	E-mail
1	Osacae AVUKUSE	Kenya	Kenya Power and Lighting Company Limited (KPLC)	Electrical Engineer	00254 726949124	omashetiavukuse@kplc.co.ke
2	John Maina CHEGE	Kenya	Kenya Power and Lighting Company Limited (KPLC)	Principal Lecturer	00254 722814801	jchege@kplc.co.ke mwalimuchege@yahoo.com
3	Anicet MUSHUTI	Rwanda	Energy Development Corporation LTD (EDCL)	Hydropower Development Specialist	00250 788641878	anicetmu@gmail.com amushuti@edcl.reg.rw
4	James TWESIGYE	Rwanda	Energy Development Corporation LTD (EDCL)	Off-grid Solution Manager	00250 782133325	jamestwesigye@gmail.com jtwesigye@edcl.reg.rw
5	Daniel NGWENYA	Tanzania	Tanzania Renewable Energy Association (TAREA)	Renewable Energy Consultant	00255 766848767	tareanorthernzone@gmail.comka kadanny@gmail.com
6	Elibariki KINYAWA	Tanzania	Dar Es Salaam Institute of Technology (DIT)	Lecturer	00255 715566717	ekinyawa@yahoo.co.uk
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9	Sandra Matty KAJUMBA	Uganda	Uganda Electricity Generation Company Limited (UEGCL)	Control and Instrumentation Engineer	00256 703954971	skajumba@uegcl.co.ug
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11	Teketel Yohannes ASHEBO	Ethiopia	Addis Ababa Science and Technology University (AASTU)	Vice President	00251 929928592	tektel.yohannes62@gmail.com
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13	Balew DEMISSIE	Ethiopia	Addis Ababa Science and Technology University (AASTU)	Director for International Cooperation	00251 913431885	balew.demissie@aastu.edu.et
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23	Gebru BEDASE	Ethiopia	Addis Ababa Science and Technology University (AASTU)	Researcher	00251 913706568	gebru.bedase@aastu.edu.et
24	Tamrat KEBEDE	Ethiopia	Addis Ababa Science and Technology University (AASTU)	Researcher	00251 913748059	tamrat.kebede@aastu.edu.et

IV. Completed Activities in the Second Stage

Activity – 1: Preparations of the Seminar
Time: April-May 2017
Location: China, Ethiopia
Participants: NRIRE, AASTU
Implementation: NRIRE established cooperative relationship with AASTU. The two institutes made considerable preparations for the Seminar together, including:

1. Round-trip international air tickets and relevant insurances purchasing for all the participants, lecturers and organizers;
2. Establishment of working team for implementing the Seminar and submission of work reports to the related authority on the preparation to launch the project;
3. Selection and determination of the Seminar venue, a hotel to stay, and a wind farm to visit during the Seminar;
4. Arrangement of the necessary meeting facilities, the meals, meeting room decoration, seminar material packages for the participants, gifts, etc.;
5. Arrangement of airport and point-to-point pick-up & see-off services for all the participants, lecturers and officials from relevant departments who will attend the Seminar;
6. Drafting of the speeches on the opening and closing ceremony of the seminar and the cooperative initiative.

Activity – 2： Implementation of the Seminar
Time: May 12th-14th, 2017
Location: Addis Ababa, Ethiopia
Participants: Mission of the People's Republic of China to the African Union, AASTU, ZTE Ethiopian Branch, NRIRE
Implementation: Just before the "Belt and Road Forum for International Cooperation" held in Beijing, from May 12 to May 14, the "Seminar on Renewable Energy and Off-grid Hybrid Power Generation System for East African Countries" sponsored by Perez-Guerrero Trust Fund (PGTF) for South-South Cooperation was held in Addis Ababa, the capital of Ethiopia and the headquarters of the African Union, by National Research Institute for Rural Electrification (NRIRE), MWR of China (also known as Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power) (HRC). There were in total 24 participants from East Africa countries including Ethiopia, Kenya, Rwanda, Tanzania, and Uganda present at the 3-day-long seminar. Mr. Chen Ning, the Counsellor of the Mission of the People's Republic of China to the African Union, Dr. Nurelegne Tefera, President of Addis Ababa Science and Technology University (AASTU) and Dr. Xu Jincai, Director General of NRIRE attended and addressed the opening ceremony.

The seminar covered lectures, study tour and technical discussions. Representatives from NRIRE, AASTU and ZTE Ethiopian Branch made presentations on renewable energy technologies and development. Participating representatives from Kenya, Rwanda, Tanzania and Uganda made country reports at the seminar, sharing the expertise of renewable energy

and the status of development in East Africa. Besides, the participants visited a wind farm, for which Chinese company provided EPC services with joint investment. Resolution for future cooperation was also reached and signed.

Speech at the Opening Ceremony

Speech on the Nameplate Unveiling of Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa & Opening Ceremony of
Seminar on Renewable Energy and Off-grid Hybrid Power System for East African Countries
(Dr. Xu Jincai, Director General of HRC)

Respected Representative from Ministry of Science and Technology of Ethiopia,

Respected Mr. Chen, Counselor of Chinese Mission to the African Union,

Respected Mr. President of Addis Ababa University of Science and Technology,

Respected Section Manager of ZTE Ethiopia Branch,

Dear Participants,

Ladies and Gentlemen,

Good Morning!

It's a great pleasure to attend the Nameplate Unveiling of Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa and the Opening Ceremony of the Seminar on Renewable Energy and Off-grid Hybrid Power System for East African Countries. First of all, on behalf of Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power, I would like to extend our warmly

welcome and sincere gratitude to all of our distinguished guests and participants here.↵

Co-sponsored by the United Nations Development Program (UNDP), the United Nations Industrial Development Organization (UNIDO) and the Chinese government, HRC was established in 1981 in Hangzhou, China, which is committed to international training, research and development, information exchange, small hydropower planning, design, consultancy and etc. in the world. Domestically, HRC is also called National Research Institute for Rural Electrification under the leadership of the Ministry of Water Resources. Entrusted by the Chinese Government and the international organizations, HRC has successfully organized 88 international training workshops and seminars on small hydropower and rural electrification with more than 1,700 participants from 112 countries, among which 800 officials and engineers from 47 African countries. After about forty years of engagements in renewable energy and rural electrification, HRC has successfully completed over 500 renewable energy projects regarding the development planning, joint research and construction of demonstrative bases. ↵

Recently, I have taken part in the 6th World Hydropower Forum which was organized for the first time in the African continent. As my understanding, the population in Africa without electricity is 600 million, and one of the main challenges in the Africa countries is the unstable

power grid. Also, in July of 2016, the participating African countries to the 27th African Union Summit called on to pay more attention to rural electrification for sustainable development in African countries.

Here in Addis Ababa, supported by Chinese Government, especially with the high guidance from Chinese Mission to the African Union, HRC works together with Addis Ababa Science and Technology University and the ZTE Ethiopia Branch to set up this clean energy and rural electrification center which aims to the capacity building and technical development by means of technical training, seminar organization, joint research and project demonstration.

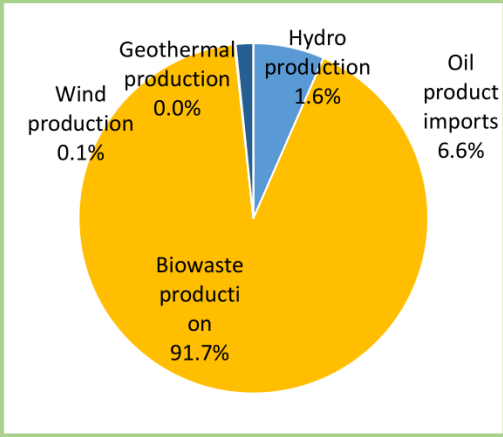
We do hope that, the center, starting from the Seminar on Renewable Energy and Off-grid Hybrid Power System for East African Countries, will improve our mutual understanding, promote the capability-building and deepen our cooperation as well as the friendship.

Finally, I wish the seminar a great success! Thank you very much.

Excerpts of Country Reports

2. Energy Utilization in Ethiopia

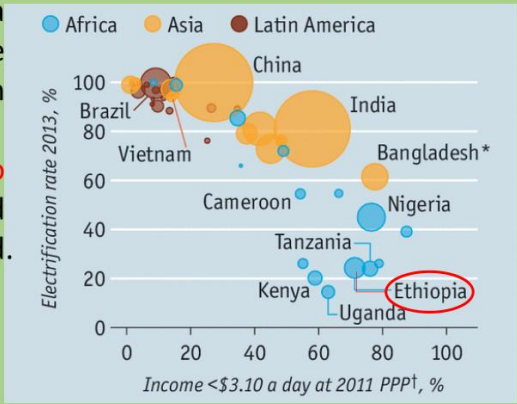
- As the proportion of primary energy, biowaste such as fuel wood is predominant (92%), and oil is second (less than 7 %).
- Green house gas emission from fossil fuel is only a little at this stage.



Primary energy in Ethiopia

2. Energy Utilization in Ethiopia

- In Ethiopia, government sets a target of the electricity service coverage 90%, in the Growth and Transformation Plan II.
- However the accessibility to electricity is low even now, and stable energy source is needed.

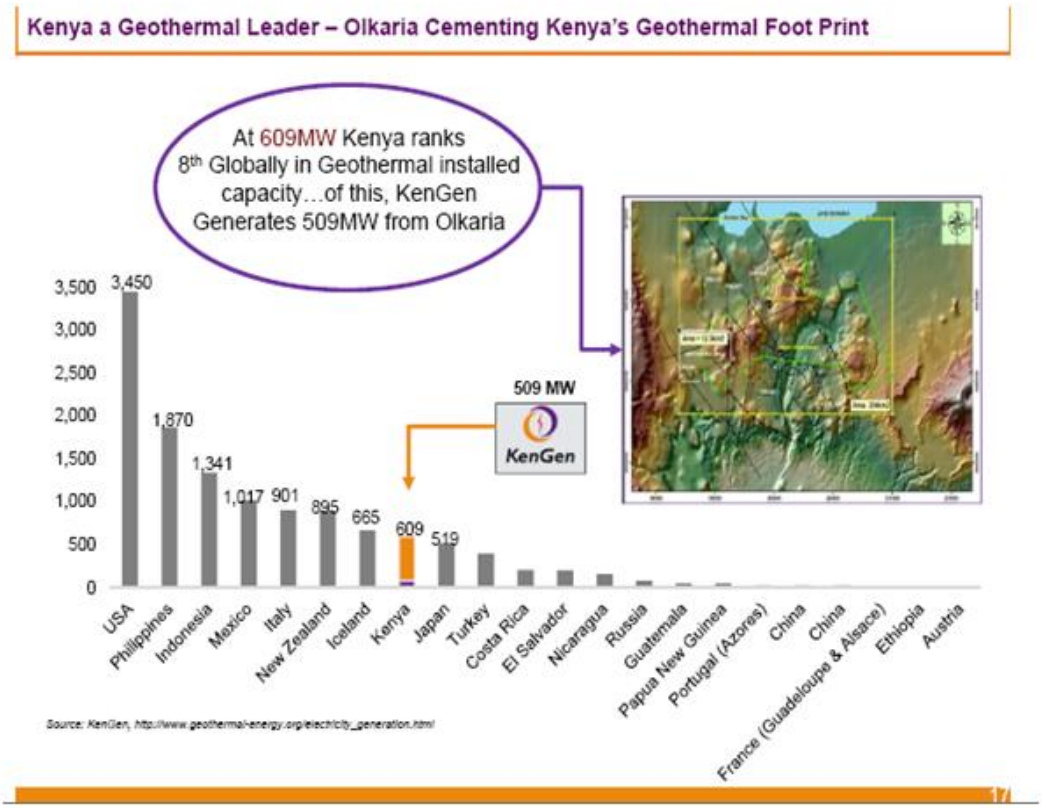


Electrification rate and low income household

Country Report by Ethiopian Delegate

Wind farm candidates

Wind farm	Installed capacity [MW]	Annual generated electricity [GWh]	Capacity factor [%]	Earliest COD*
Ngong 1 - Phase III	10	30	35%	2018
Aeolus Kinangop	60	176	34%	2018
Kipeto - Phase I	50	201	46%	2017
Lake Turkana - Phase I, Stage 1	100	482	55%	2017
Prunus	51	154	35%	2019
Meru Phase I	80	222	32%	2018
Ol-Danyat Energy	10	not provided	not provided	2017
Kipeto - Phase II	50	201	46%	2018
Lake Turkana - Phase I, Stage 2	100	482	55%	2018
Malindi	50	126	29%	2018
Lake Turkana - Phase I, Stage 3	100	482	55%	2019
Limuru Wind - Transcentury	50	not provided	not provided	2019
Kajiado Wind - Chagem Power	50	not provided	not provided	2019
Meru Phase II	320	888	32%	2024
Marsabit Phase I	300	1,043	40%	2025
Lake Turkana - Phase II, Stage 1	100	482	55%	2025
Lake Turkana - Phase II, Stage 2	100	482	55%	2026
Lake Turkana - Phase II, Stage 3	150	723	55%	2027
Marsabit Phase II	300	1,043	40%	2027
Lake Turkana - Phase III, Stage 1	100	482	55%	2030
Lake Turkana - Phase III, Stage 2	100	482	55%	2031
Lake Turkana - Phase III, Stage 3	150	723	55%	2032



Country Report by Kenyan Delegate

Power Generation Targets

- Biomass (wood energy) to drop from 86.3% to 50% by 2020;
- Generation capacity to reach 563 MW by 2017/18;
- Access to electricity to expand to 70% by2017/18;
- Public institutions to be connected 100% by 2017/18.

Strategies

- Diversification of Energy sources;
- Focus on domestic sources of energy and phasing out heavy/fossil-fuel generation;
- Involvement of the private sector in power generation through Independent Power Producers (IPP's) and Private Public Partnerships (PPP's) structures;
- Provision of Power Purchase Agreement, underpinned with a minimum 25 years concession Agreement.

Incentives to private developers in the power sector

- Infrastructure support,
- A variety of non-fiscal and fiscal incentives (tax exemption including VAT on importation of power equipment, investment allowance up to 50%, free repatriation of profits, 100% written-off development and research costs,…)
- Provision of key account managers to fast-track the project in the implementation process

Estimated Power Generation Costs

- The installation cost for 1MW from Methane is estimated to $3,700,000;
- The installation cost for 1MW from Geothermal is estimated to $ 3,500,000;
- The installation cost for 1MW from Peat is estimated to $3,200,000
- The installation cost for 1MW from Hydropower is estimated to $4,000,000
- The installation cost for 1MW from solar is estimated to $2,000,000

Country Report by Rwandan Delegate

Current Energy Status

(Cont…)

The country's installed electricity generation capacity is around 1,564 MW

- **1,438.24 MW are available from the main grid,**
- **125.9 MW accounted for by SPPs, mini grids and imports.**
- **About 65% of grid generation capacity is from thermal (33% from natural gas and 32% from oil)**
- **35% is from large hydropower.**
- **The rest comes from small renewable-energy power and imports from neighboring countries.**

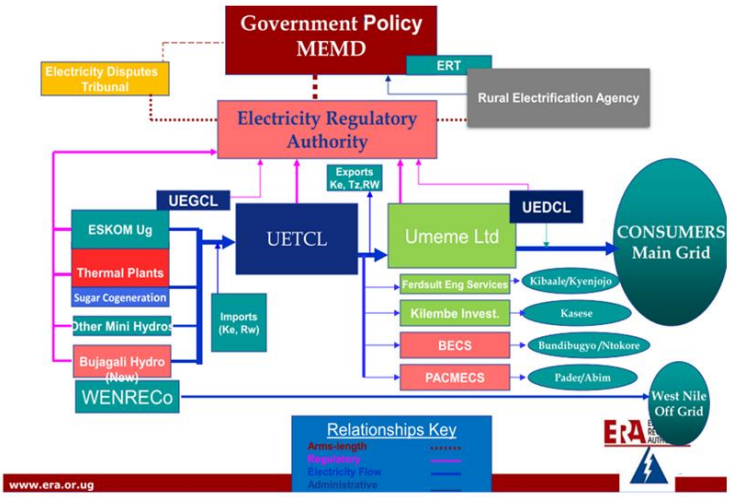
Location of SHP

Potential small hydropower sites in Tanzania

S/N	*Site*	*Load Centres*	*District/ Region*	*Head (m)*	*Discharge (m3/sec)*	*Capacity (kW)*
1	Luwika	Mbamba Bay	Mbinga	359.5	1.500	5 800.0
2	Sunda Falls	Tunduru	Ruvuma	13.5	26.000	3 000.0
3	Mtambo	Mpanda	Rukwa	17.0	13.500	2 000.0
4	Malindindo	Malindindo	Mbinga	38.0	0.500	1 58.4
5	Lingatunda	Madaba	Songea Rural	160.0	2.500	3 400.0
6	Macheke	Ludewa	Ludewa	23.0	1.500	287.0
7	Isigula	Ludewa	Ludewa	200.0	1.200	2 000.0
8	Imalinyi	Imalinyi village	Njombe	13.0	2.500	270.0
9	Maruruma	Maruruma	Mufindi	20.0	2.000	333.5
10	Luganga	Luganga	Iringa Rural	77.0	2.000	1 300.0
11	Songwe	Idunda	Rungwe -Mbeya	75.0	1.500	720.0
12	Kiboigizi	Karagwe District	Kagera	90.0	3.800	3 200.0
13	Kenge	Bukoba	Kagera	10.0	24.000	2 400.0
14	Luamfi	Namanyere	Rukwa	40.0	9.000	1 200.0
15	Kawa	Kasanga and Ngorotwa	Sumbawanga	65.0	0.300	130.0
16	Mkuti	Kigoma Rural	Kigoma	23.0	3.300	650.0
17	Ngongi	Ngongi	Ruvuma	270.7	1.090	3 100.0
18	Mngaka	Paradiso	Mbinga -Ruvuma	15.0	7.640	900.0
19	Mngaka	Lipumba	Mbinga- Ruvuma	25.0	4.424	870.0
20	Lumeme	Mbinga	Ruvuma	301.2	1.310	4 200.0
21	Kiwira	Ibililo	Rungwe - Mbeya	20.0	10.000	1 350.0
22	Kitewaka	Ludewa township,	Ludewa	50.0	9.884	4 200.0
23	Mtigalala falls	Kitonga Kilolo -	Iringa	70.0	10.000	5 000.0

Source: Rural Energy Agency[4]

INSTITUTIONAL SET UP AFTER UNBUNDLING



RENEWABLE ENERGY SOURCES IN UGANDA

- Uganda is endowed with abundant energy resources, which are fairly distributed throughout the country. These include hydropower, biomass, solar, geothermal, peat and fossil fuels.
- The energy resource potential of the country includes an estimated 2,000 MW of hydro power, 450 MW of geothermal, 1,650 MW of biomass cogeneration, 460 million tons of biomass standing stock with a sustainable annual yield of 50 million tons, an average of 5.1 kWh/m^2 of solar energy, and about 250 Mtoe of peat (800 MW).
- The overall renewable energy power generation potential is estimated to be 5,300 MW.

Country Report by Ugandan Delegate

V. Completed Activities in the Third Stage

Activity – 1： Nameplate Unveiling of Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa

Time: May 12th, 2017

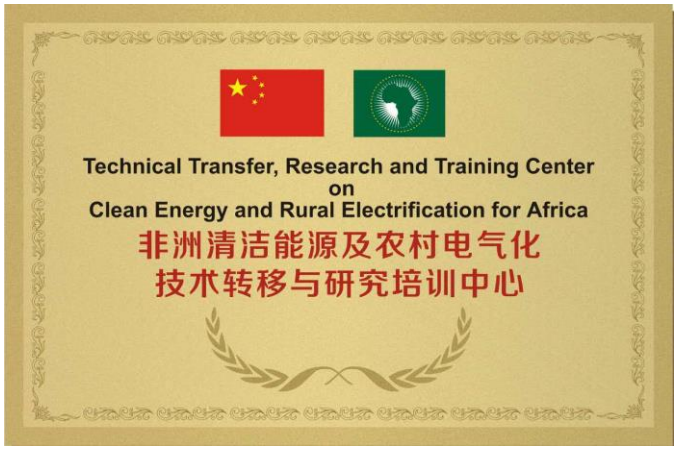
Location: Addis Ababa, Ethiopia

Participants: NRIRE, AASTU, ZTE Ethiopian Branch, and all the participants

Implementation: On May 12, 2017, the inauguration ceremony of "Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa" was held in Addis Ababa Science and Technology University (briefed as AASTU). Mr. Chen Ning, Counsellor of the Mission of the People's Republic of China to the African Union, Dr. Nurelegne Tefera, President of AASTU, and Dr. Xu Jincai, Director General of National Research Institute for Rural Electrification (NRIRE) were present and addressed on the ceremony. Present at the ceremony were also representatives from ZTE Ethiopian Branch, Kenya Power & Lighting Co. Ltd., Rwanda Energy Group, Tanzania Renewable Energy Association and Uganda Electricity Generation Company Limited.

The "Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa" is the second technical transfer & training center that NRIRE set up abroad. On April 20, 2015, NRIRE set up the first technical transfer & training center in Pakistan, which is called "China-Pakistan Joint Research Center for Small Hydropower". Chinese President Xi Jinping, together with the former Pakistani Prime Minister Nawaz Sharif, unveiled for 8 China-Pakistan cooperative projects during his visit to Pakistan.

As the follow-up work of the seminar, the "Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa" was set up in Addis Ababa, Ethiopia. It is open to all African countries and help to promote agricultural modernization, infrastructure construction, green development and poverty alleviation of Africa with the cooperation between China and Africa in the field of rural energy and infrastructure development towards a goal of common development and double wins through capacity-building, joint R+D, technical transfer and project demonstration.



Nameplate of the Center

Nameplate Unveiling

Activity – 2： Signature of a Cooperation Resolution among NRIRE and participants

Time: May 13th, 2017

Location: Addis Ababa, Ethiopia

Participants: NRIRE and all the participants

Implementation: On 13th May, base on technical presentations, field study, in-depth communications and discussions, the Cooperation Resolution was agreed unanimously and signed jointly, laying a good foundation to promote the concrete cooperation on renewable energies and rural electrification between China and participating East African countries in near future.

Signed Cooperation Resolution

COOPERATIVE RESOLUTION

of

Seminar on Renewable Energy and Off-grid Hybrid Power Generation for East African Countries

14th May, 2017, Addis Ababa, Ethiopia

Over 25 delegates of different institutions and agencies from Ethiopia, Kenya, Rwanda, Tanzania and Uganda participate in and deliberate on the **Seminar on Renewable Energy and Off-grid Hybrid Power Generation for East African Countries** held during May 12-14, 2017 in Addis Ababa, Ethiopia, and jointly organized by Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power (HRC) and Addis Ababa Science and Technology University (AASTU). All the deliberations and discussions lead to a general consensus demanding:

1. To enhance the initiatives and activities for the development of renewable energies and rural electrification in Eastern and Even all African Countries and China through the participating institutions and agencies in order to improve access of rural people to clean and green energy.

2. To ensure the effective role of renewable energy for poverty-alleviation, improving the livelihood and promoting the social-economic development in rural areas of Africa.

3. To support the development of the **Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification** which was inaugurated on 12th May, 2017 in AASTU, Ethiopia.

The seminar, in its concluding session, held on 14th May, has reached the following recommendations:

1. To enhance network among participating institutions and agencies to support, cooperate and transfer technologies to achieve the objectives of the development of renewable energy and rural electrification.

2. To support technical, managerial and other capacity-building activities to all stakeholders of small hydropower plants, wind farms and solar power plants and etc. regarding project planning, design, operation, maintenance and rehabilitation through the expertise and practices shared among the participating institutions and agencies in similar seminars.

3. To strengthen the capacity of local manufacturers in order to produce the reliable and qualified electro-mechanical equipment.

4. To strengthen and promote R+D collaboration under the cooperative framework of the **Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa**.

5. To develop academic curricula for different levels of

education and training related to renewable energy and rural electrification, through the to-be-built **China-African Institute for Rural Electrification**.

6. To involve the efforts of all Parties to implement the project called **China-Africa Union Technical Transfer and Capacity-building on Rural Electrification Technology**.

Annex I: Representatives in the Seminar

No.	Institutions and Agencies	Representatives	Signatures
1.	Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power (HRC)	Lin Ning	
2.	Addis Ababa Science and Technology University	Balew Demissie	Balew Demissie (Dr.)
3.	Institute of Energy Studies & Research, Kenya Power & Lighting Co., Ltd.(KPLC)	Oscar Avukuse	
		John Chege	
4.	Energy Development Corporation Ltd. (EDCL),	Anicet Mushuti	
		James Twesigye	
5.	Tanzania Renewable Energy Association (TAREA)	Daniel Ngwenya	
6.	Dar Es Salam Institute of Technology, Tanzania (DIT)	Elibariki Kinyawa	
7.	Uganda Electricity Generation Co., Ltd. (UEGCL)	Musa Mukulu	
		Proscovia Nankya	
		Sandra Matty	

Photos of Main Activities

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Opening Ceremony</td><td>Nameplate Unveiling</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Group Photos</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Honorable Guests of the Seminar</td><td>Visit to the Vice President of AASTU</td></tr>
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<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Visit to the ECCO of Chinese Embassy in Ethiopia</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Visit to the Chinese Mission to AU</td><td>Meeting with AASTU President and his Team</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Lectures on Special Topic</td></tr>
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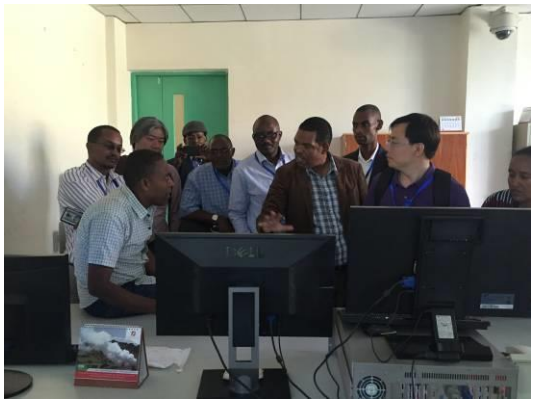
Country Reports

Technical and Cooperative Discussions

Visit to ADAMA Wind Farm



Visiting the Central Control Room of ADAMA Wind Farm

Discussion and Signing the Cooperation Resolution

VI. Work Plans in the Fourth Stage

1. On October 31, 2017, a delegation including Prof. Nurelegne Tefera Shibeshi, the President of Addis Ababa Science and Technology University (AASTU) of Ethiopia visit NRIRE. At the meeting, Director General of NRIRE Dr. Xu Jincai introduced the international cooperation and foreign-aid trainings accomplished by NRIRE under China's "Belt and Road" initiative, emphasizing on the layout and planning of NRIRE's four overseas technical transfer and training centers. President Nurelegne expressed his appreciation for NRIRE's achievements, and together with NRIRE, he is willing to seek supports from both governments for further cooperation, and promote the establishment of the "Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification" in Ethiopia, so as to provide better technical support for the renewable energy development and utilization in Africa. Moreover, two parties discussed the follow-up work and other cooperative issues.

2. By virtue of good international relationship between China and East African countries and with the backing of incentive policies of all countries in the field of renewable energy, NRIRE shall make efforts together with relevant departments in East Africa to win the financial support from respective government and international organizations which shall be the powerful guarantee for substantive cooperation in the future;

3. NRIRE shall create opportunities as well as work together the related sectors in East African Countries to strengthen R+D collaboration under the cooperative framework of the *Technical Transfer, Research and Training Center on Clean Energy and Rural Electrification for Africa* and to promote research on the compilation of related standards on renewable energy development etc.;

4. NRIRE shall actively seek opportunities to launch the bilateral and multilateral projects to improve the capacity building, popularize the know-how for the rural electrification construction of East African countries, and promote the sustainable development of renewable energy to preserve the ecological environment for these countries, etc.;

5. In response to the national "Belt and Road" Initiative, NRIRE shall develop academic curricula for different levels of education and trainings related to renewable energy and rural electrification through the to-be–built *China-African Institute for Rural Electrification*, and implement a project called *China-Africa Union Technical Transfer and Capacity-building on Rural Electrification Technology* together with relevant authorities in African countries.

VII. Financial Costs and Expenses

The project costing for those activities is strictly based on the budget. NRIRE organized financial staffs specifically for evaluation and review of the expenses for the project. Project leaders are also responsible for monitoring of the cost for each activity regarding to the project and required for submission of periodical report to the General Director of NRIRE for

supervising the project better at its each stage.

No.	Items	PGTF Fund	NRIRE Fund	Total
1	Seminar materials	1,560 USD	1,800 USD	3,360 USD
2	International travel	7,340 USD	10,000 USD	17,340 USD
3	Accommodation and food	12,300 USD	15,500 USD	27,800 USD
4	Allowances for Chinese consultants	2,000 USD	2,800 USD	4,800 USD
5	Allowances for local consultants	2,500 USD	3,500 USD	6,000 USD
6	Local insurance	600 USD	900 USD	1,500 USD
7	Seminar	2,200 USD	2,600 USD	4,800 USD
8	Local transport	3,000 USD	3,500 USD	6,500 USD
	Grand Total	31,500 USD	40,600 USD	72,100 USD
	Unpaid PGTF fund			3,500 USD

Bank Information:

Organization: 水利部农村电气化研究所

Bank Account: 1202026209008801954

Bank Name: 工行杭州高新支行

VIII. Conclusion

The project is implemented by National Research Institute for Rural Electrification, Ministry of Water Resources, P. R. China (NRIRE). The rewarding event, designated to provide a platform for China and the East African countries to fully discuss and communicate in the field of renewable energies and related technologies, has achieved great success. The officials and experts from different countries shared not only the technology, but also the development methodology and cooperation confidence, which is deemed to make much contribution to China-East African economic and technical cooperation on renewable energies. It is expected that the participants, as the direct beneficiaries, can apply the knowledge gained during the seminar and at the same time, transfer the knowledge and technologies to other people in their respective country.