CHINA-GHANA SOUTH-SOUTH COOPERATION ON RENEWABLE ENERGY TECHNOLOGY TRANSFER

SDC Meeting
29th November, 2016

Peduase Valley Resort
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Project Coordinator

PRESENTATION OUTLINE

Project Background

Progress Update

2017 Annual Workplan

Project Title	China-Ghana Renewable Energy Technology Transfer (RETT) Project
Sector	Renewable Energy, South-South Cooperation
Location	Ghana, China
Executing Agency	United Nations Development Program (Ghana and China)
Implementing Partners	1) Ghana Energy Commission under Ministry of Power 2) China ACCA 21 under Ministry of Science and Technology
Project Duration	4 Years
Project Budget	2,720,000.00 USD
Source of Funding	DANIDA

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PROJECT SUMMARY

Project Summary

As part of Denmark's focus on South-South Cooperation, to enable coherent cooperation between China and countries in Africa, UNDP China has been funded to develop the project in collaboration with the Energy Commission in Ghana, the Ministry of Science and Technology in China and the UNDP Country Offices in Accra and Beijing.

The project is facilitating exchange of expertise and technology between China and Ghana, thereby building on China's unique development experience.

- Funding from Danish Government:2,720,000 USD (including 1,764,000 USD for Ghana; 956,000 USD for China)

  Start date: September 2014
  End date: December 2018

PROJECT OUTCOME

This objective for be achieved through the implementation of the following four

Outcomes and Results:

1. Ghana has an enabling environment in place for the transfer, production and regulation of the use of Renewable Energy Technologies in Ghana.
2. Access to and use of relevant Renewable Energy Technologies (RETs) increased in Ghana
3. China's has strengthened capacity for South-South Cooperation in relation to RET transfer
4. Project management and coordination structures established

2016 WORKPLAN

Output	Activities	Estimated Budget (USD)
Outcome 1: Ghana has an enabling environment in place for the transfer, production and regulation of the use of Renewable Energy Technologies in Ghana.		
Output 1.1	**Activity Results 1.1.2: Draft and submit to Parliament the Renewable Energy Master Plan (REMP)**	**127,180** *
		127,180 *
Outcome 2: Access to and use of relevant Renewable Energy Technologies (RETs) increased in Ghana.		
Output 2.1	**Activity Result 2.1.1: Selection and adaptation of appropriate RETs to be transferred**	81,000
	Activity Result 2.1.2: Facilities to receive, test, demonstrate and exhibit equipment and publish performance results	165,000
	Activity Result 2.2.1: Support to training facilities within existing institutions for increased capacity building on RETs	15,000
		261,000
Outcome 4: Project management and coordination structures established		
Output 4.1	**Activity Result 4.1.2: Set up PSCs for Ghana -China project**	3,419
	Activity Result 4.1.3: Support project implementation	45,500
		48,919
	TOTAL 2016 BUDGET	***437,099***

* This includes baseline study - USD17,000

FINANCIAL UPDATE

January -September 2016	USD 300,983.55
Available Balance	USD 186,196.45

Allocation for Balance:

- Finalize payments to researchers
- Logistics for REMP
- Field visits/Travel
- Print finalized reports
- Procure stoves
- PMU administration

KEY RESULTS FOR 2016

RENEWABLE ENERGY MASTER PLAN

OBJECTIVES OF REMP

The specific objectives of the REMP are to:

- Set clear targets for the development of the various renewable energy resources in Ghana
- Define actions and strategies to be undertaken to achieve the targets
- Prioritise the renewable energy technologies
- Propose sustainable financing models, incentives and support systems
- Define institutional roles for the implementation of the masterplan
- Identify risks and mitigation measures for ensuring sustainability.

The process is being financed by DANIDA under the China-Ghana Renewable Energy Technology Transfer (RETT) project.

APPROACH

The Renewable Energy Masterplan for Ghana is developed by a taskforce comprising Ministry of Power, Energy Commission, the National Development Planning Commission and Energy Center.

The taskforce conducted an extensive desk and field study of past and on-going renewable energy initiatives and programmes to identify success factors and implementation gaps or failures and how gaps identified could be addressed to ensure sustainability of interventions. The taskforce consulted with a wide range of stakeholders (both local and international) throughout the process.

Renewable Energy Masterplans of other countries such as China were reviewed and lessons learnt were considered in the development of this masterplan.

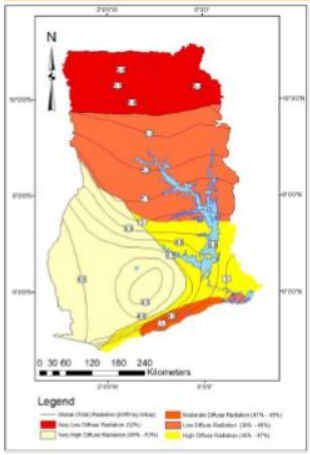
RENEWABLE ENERGY MASTERPLAN FOR GHANA

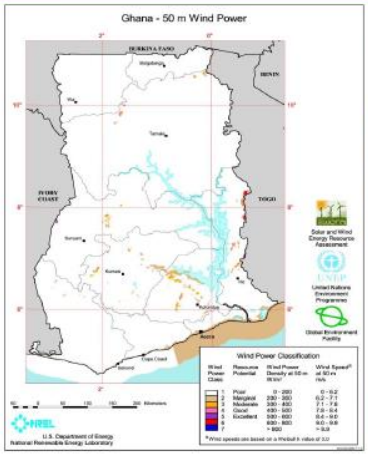
TABLE OF CONTENTS FOR THE REMP

CONTENTS OF THE REMP:

Resource Potential and Energy Demand

The REMP considers all the available resources and demand scenarios to establish target that will support economic growth





RENEWABLE ENERGY MASTERPLAN FOR GHANA

OUTCOME 1: ACTIVITY RESULT 1.1.2: DRAFT AND SUBMIT TO PARLIAMENT THE RENEWABLE ENERGY MASTER PLAN (REMP)

What was done:

Taskforce meetings:

- 9 meetings have been held - average of 2 days per session.
- Meetings with several stakeholders including the ECG, VRA, GRIDCO, Ministries of Agriculture, MoFEP etc
- Taskforce has carried out assessments on a number of RE projects round the country to inform their decisions.
- Taskforce has held meetings with Chinese counterparts to receive feedback – 1st meeting was in 29-31 March, 2016 in Ghana and second meeting was held on 15th October in Beijing

NEXT STEPS

Taskforce does not have all the answers as such it is seeking to engage and obtain feedback Continue engagement with Stakeholders

Consider and incorporate feedback from various sector

Finalize document 1st Quarter of 2016

Establish a monitoring cycle for the REMP

Adoption and alignment of the REMP in the country's planning cycle

POLICY REVIEW AND GAP ANALYSIS

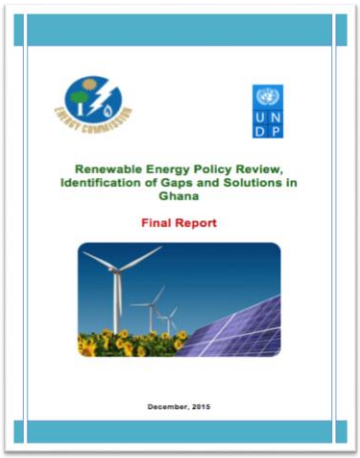
OUTPUT

Utilized some of the key findings in the development of a Masterplan for Renewable Energy

Report has been published on the Energy Commission Website:

http://www.energycom.gov.gh/renewables/renewable-energy-technology-transfer-project

Hardcopies to be printed before the end of year



OUTPUTS – REPORTS BY CHINESE COUNTERPARTS

- **Consultancy on China-Ghana Renewable Energy Technology Transfer Financing Vol I,II, III**
- **Investigation of Ghana Electrification, Renewable Energy Development, Policy Research and Market Analysis**
- **Utilization Report of Renewable Energy and Rural Renewable Energy in China**
- **Renewable Energy Research Report**

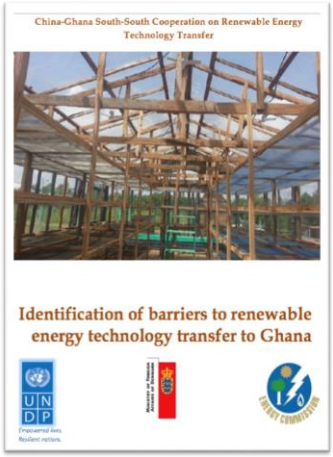
BARRIERS TO RE TECHNOLOGY TRANSFER

IDENTIFIED BARRIERS AND MITIGATION ACTION

Barriers	Mitigation actions
Political	a. Expedite the development of RE master plan b. Operationalize the RE fund under RE law c. Develop national programmes on prioritised RETs d. Develop/adopt standards, codes and labels for biogas plants, SWH, solar dryers, wind mills and other RETs.
Economic	a. Provide financial support for RET investment in prioritised sectors
Technical	a. Strengthen existing training facilities b. Build capacity of researchers and trainers in RETs c. Conduct capacity building programmes for entrepreneurs and local enterprises d. Arrange networks and partnerships for local enterprises with counterparts in other countries
Socio-cultural	a. Run cost benefit campaign on the use of RE products b. Include RETs in technology catalogue

PROVIDING CLARITY IN A COMPLEX ENVIRONMENT

- Comprehensive report produced
- Findings fed into development of REMP



http://www.energycom.gov.gh/index.php/renewables/renewable-energy-technology-transfer-project

CHINA-GHANA RE TECHNOLOGY TRANSFER PROJECT

REVIEW OF RE PROJECTS IN GHANA - BASELINE

OBJECTIVES OF THE STUDY

As part of activities for the first year of project implementation, the project conducted a review of renewable energy facilities under some projects

Obtain relevant information to estimate the state of development in the RE sector which will serve as a useful baseline for the project.

To interact with project implementers to understand some of the issues underlined in developing and operating such projects.

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METHODOLOGY

Identification and extraction of Renewable Energy projects through desk study and research.

Field trips involving semi-structured interviews with the project implementers.

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RE TECHNOLOGIES ACCESSED

Biomass fired Cogeneration plants

Solar irrigation

Solar Water Purification

Solar Still

Solar mini-grid

Gasifier plant

Biogas plants

Solar cooker prototypes

Solar dyers

- Poldaw windpump
- Solar battery charging
- Grid connected solar plant
- Solar vaccine refrigerators
- Landfill and sewerage treatment site

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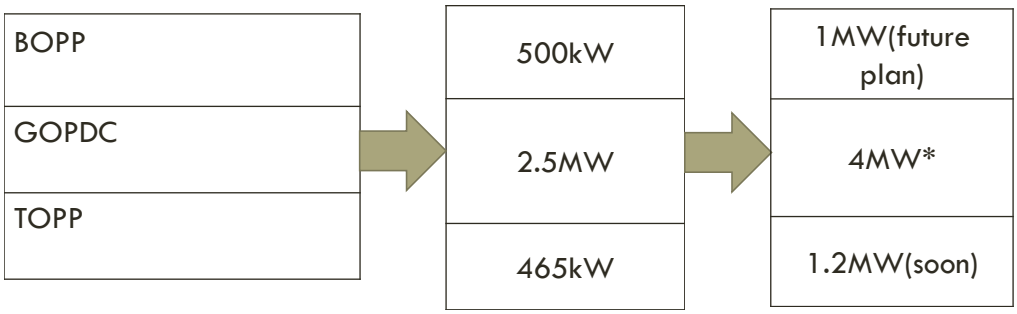
Biomass Fired Co-generation Plants

- All the palm oil mills are sufficient in fuel and in power
- Palm fruit fibre and kernel are used as fuel for the CHP plant
- The main challenge of the palm oil mills is the inadequate palm fruit for processing and power generation



*Potential to power upto 2,000 homes

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Biomass Fired Co-generation

Ghana Oil Plam Development Company

2.5MW steam turbine alternator and one of the 2 biogas reactors

- GOPDC is now owned by a Belgium company (Societe d'Investissement pour l'Agriculture Tropicale)
- 4MW CHP generation capacity (from 1.5MW and 2.5MW alternator)
- Currently generates 2.5MW for plant and Kwae community
- 2 X 1000m3 Biogas reactors generates 18,000m3 of biogas per day for the refinery facility
- The 4.5 million euros biogas plant was completed in September, 2014
- This has displaced the about 615,000 litres of diesel that was used initially per year
- GOPDC is willing to sell 1.5MW excess power provided there is a good proposal for off-take

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SOLAR AND WIND POWER

- Solar Water Purification
- Solar vaccine refrigerator
- Grid connected solar plant
- Solar battery charging
- Poldaw windpumps for Irrigation
- Solar Irrigation System

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Solar irrigation

Solar Irrigation System at Tamalugu

15kW solar PV and 30kW pump for irrigation

- UNDP sponsored project implemented by NewEnergy
- 30kW DC pump with advanced communication and monitoring capabilities
- Pump is powered with a 15kW PV module
- PV array can be sized to match the pump to increase the pumping capacity
- Pumps 166,000 litres of water per hour from a tributary of the white volta
- Furrow irrigation – 28 acres, Drip irrigation – 3 acres
- Irrigation tariff – GHC100/acre for the whole season

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Solar Irrigation System at Datoyili

Datayoli Solar Irrigation Setup

- UNDP sponsored project implemented by NewEnergy
- 2.3kW PV array powers a DC pump
- Irrigation tariff – GHC5/acre for a day
- Water from a nearby stream is pumped into a polytank for drip irrigation
- Drip irrigation capacity – 30 acres

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KEY FINDINGS

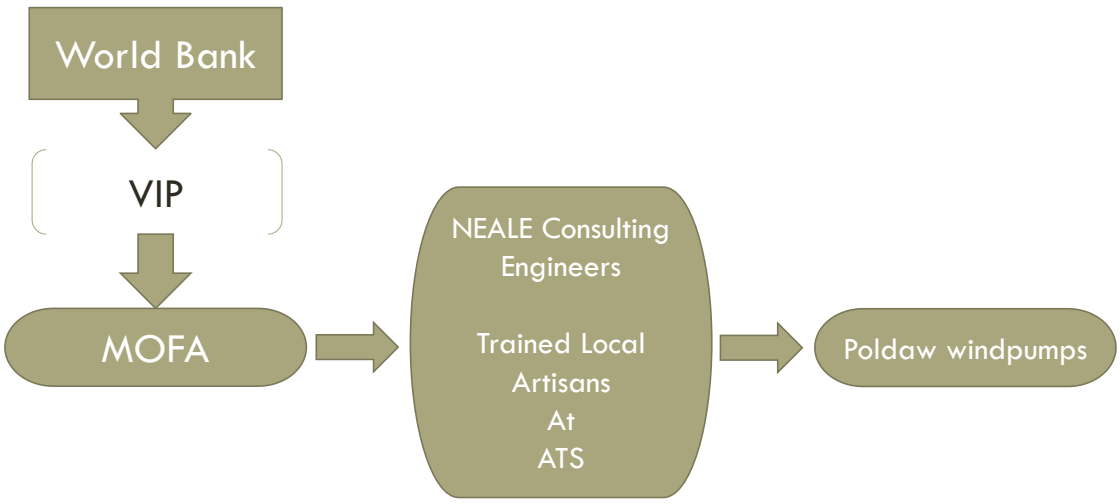
Pediatorkope Microgrid Plant

Solar PV Panels mounted on high structures and distribution lines

- Solar/Wind Hybrid AC Microgrid
- This USD 800,000 facility was constructed by a Spanish company, TTA under GEDAP
- The project is funded by MOEP, World Bank and ECA
- Hybrid system of 39 kW solar, 11 kW wind with a 30 kVA diesel back-up generator
- Load limiting prepaid meters (0.5 kW, 1 kW and 1.5 kW) installed for metering
- Similar installations at Kudorkope,

KEY FINDINGS

Poldaw Windpumps



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Poldaw Windpump at Gwollu

Poldaw windpump and storage tank provided for irrigation

- The windpump was designed to pump water from a borehole into a nearby concrete water reservoir to provide water for dry season irrigation.
- The Poldaw windpump has a turbine diameter of 3.5m and can pump a rated maximum of 21,000 litres of water daily.
- Underground pipes connected the reservoir to nearby farms to provide water for irrigation.
- The pump was non-operational at the time of visit.
- Operated for 6 months, following its installation. During this period, it proved to be very helpful as it provided the inhabitants with water in a period of severe draught.

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Solar-Biomass Dryer

Solar biomass hybrid dryer

- Built by Pens Food Bank in collaboration with the Agricultural Engineering Department of KNUST in July 2015
- The total cost of the facility is USD 18,000
- The project was funded by Pens Food Bank Ent. (20%) and a UK based organization (80%)
- The project was implemented by The Energy Centre (KNUST)
- Dries 5mt of produce per batch (2 batches/day) for 8 hours
- The biomass furnace uses 30 kilos of corn husk for drying harvests per batch during the major season
- The drying tariff of the solar biomass dryer is ₵4
- Major challenge is the high cost of maintenance as the perspex glass is scarce and expensive

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BIOGAS AND LANDFILL

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KEY FINDINGS

Landfill and sewerage treatment

Dompoase Landfill Site

Landfill Sited at Dompoase

- 100-acre landfill project with modern waste management facilities
- Project funded by the World Bank
- The landfill site is managed by the Kumasi Metropolitan Assembly (KMA)
- J Stanley-Owusu (JSO) operates the engineered landfill and sewerage treatment plant under a contract with the KMA
- The site is designed for a period of 15 years with three phases and has been used for 11years
- Nine ponds at the site for treatment of sewage waste after which it is channeled into a nearby river body
- The tapped gas was being flared after testing on site at the time of visit
- KMA plans to use the landfill gas for power generation for Guinness Ghana Ltd. in Kumasi

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KEY FINDINGS:
Biogas Plants

Ntiamoah Hotel

Mfatsipim SHS Biogas

- 16-seater 200m^3 fixed dome biogas toilet facility with effluent filtration system
- constructed 2011 by Beta Construction Engineers Limited
- Funded by the Mfantsipim Old Boys Association
- Gas lamps in the toilet facility is powered with biogas
- Filtered effluent is pumped to an overhead tank for flashing toilets on campus
- The school has a 3500kVA biogas generator. Inability to use the biogas generator because of the lack of gas storage
- Major challenge is the lack of funds for maintenance

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KEY FINDINGS:
Biogas Plants

Ntiamoah Hotel

Mfatsipim SHS Biogas

CRIG Biogas, Bole

- 50m^3 and is capable of generating 12m^3 of biogas daily.
- Shea butter processing effluent used as feedstock for the digester
- Biogas used as fuel in roasting shea kernels
- Biogas is also used to power the shea kernel grinding mill
- Major challenge is the pungent smell of the biogas due to the absence of a H2S scrapper.

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KEY FINDINGS:

Biogas Plants

Ntiamoah Hotel

Mfatsipim SHS Biogas

CRIG Biogas, Bole

Ejura Slaughter House

- The 50m^3 twin bio-digester slaughterhouse biogas plant was built to treat the slaughter waste and to produce biogas for singeing cattle in 2000
- Project funded by GTZ and implemented by TEC
- The facility has been inoperative since 2005
- Explosion of the gasholder rendered the facility useless
- The digesters filled with sand and rubbish as the area gets flooded when it rains

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KEY FINDINGS:

Biogas Plants

Ntiamoah Hotel

Mfatsipim SHS Biogas

CRIG Biogas, Bole

Ejura Slaughter House

Tamale SOS Biogas

- 70m^3 biogas plant with effluent filtration system
- Constructed by Beta Construction Engineers Limited
- Constructed in 2009 with funding from a German Organisation
- The biogas was used for cooking. Feacal sludge and left over foods channelled to digesters as feedstock
- The plant broke down in 2012 due to blockages in the channels
- Effluent filtration pumps damaged due to flooding of the area

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KEY FINDINGS:

Biogas Plants

Ntiamoah Hotel

Mfatsipim SHS Biogas

CRIG Biogas, Bole

Ejura Slaughter House

Tamale SOS Biogas

Cocoa Board Warehouse

- 200m^3 fixed dome biogas digester constructed by Biogas Technologies West Africa Limited in 2014
- Facility has never been operational after its construction
- Residents had no clue of the existence of such facility on their premises
- The facility has been turned into a waste treatment facility

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KEY FINDINGS:

Biogas Plants

Mfatsipim SHS Biogas

CRIG Biogas, Bole

Ejura Slaughter House

Tamale SOS Biogas

Cocoa Board Warehouse

Koforidua General Hospital

- Facility was constructed by Biogas Technologies West Africa Limited
- The hospital has no data about the facility
- The biogas was never used due to the pungent smell of the gas

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INITIATIVES BY EDUCATIONAL INSTITUTIONS

The Energy Centre, KNUST

- Smart Energy Management System
- Solar Water Pump and Solar Thermal System – Photovoltaic Training Centre
- Solar PV Testing Laboratory
- Biogas Testing Laboratory
- Wind Tunnel at the Aerospace Lab
- Wind Turbine Prototype

KEY FINDINGS: INITIATIVES BY EDUCATIONAL INSTITUTIONS
The Energy Centre, KNUST

- **Smart Energy Management System**


Part of the 44kW solar PV installed at KNUST

- SEMS switches between the grid and the batteries for uninterrupted power supply
- Project sponsored by GIZ with support from the Federal Government of North Rhine Westphalia (NRW).
- The 44kWp Solar PV System is grid tied through a net meter
- Battery storage with capacity of 54kWh, enough to last for 12 hours.
- A 17kVA Jatropha oil generator is available for charging batteries
- The College has a 4acre field where it cultivates Jatropha to power the generator

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KEY FINDINGS: INITIATIVES BY EDUCATIONAL INSTITUTIONS
The Energy Centre, KNUST

- **Solar Water Pump and Solar Thermal System – Photovoltaic Training Centre**


Solar PV for DC water pump, TEC-KNUST

- Demonstration facility to create awareness on the benefits of RE
- Sponsored by the Federal Government of North Rhine Westphalia (NRW) and GIZ.
- The facility cost is about €24,000
- The centre was completed in May, 2015
- A DC submersible pump powered by a 750Wp panel pumps water to the Petroleum Engineering block

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KEY FINDINGS: INITIATIVES BY EDUCATIONAL INSTITUTIONS
The Energy Centre, KNUST

- **Biogas Laboratory**

- Located at the College of Health Sciences, KNUST
- Run by TEC and the Chemical Engineering Department
- Sponsored by the Federal Government of North Rhine Westphalia (NRW) and GIZ
- Lab for testing the methane potential, biodegradable content of feedstock and the methane gas produced by a digester

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KEY FINDINGS: INITIATIVES BY EDUCATIONAL INSTITUTIONS
The Energy Centre, KNUST

- **Wind Turbine Prototype**

100 W Wind Generator

- **Wind Turbine Blade Prototype**

Wind turbine prototype

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KEY FINDINGS: INITIATIVES BY EDUCATIONAL INSTITUTIONS

Technology Consultancy Centre, KNUST

- **The Cookstove Testing and Expertise Lab (C-lab)**

- **Institutional Rocket Cookstoves**

- **Ferro Cement Charcoal Gasifier**

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KEY FINDINGS: INITIATIVES BY EDUCATIONAL INSTITUTIONS

Technology Consultancy Centre, KNUST

- **The Cookstove Testing and Expertise Lab (C-lab)**

Some equipment installed at the C-lab, TCC-KNUST

- Project sponsored by UNDP and USAID
- The project cost US$150,000
- The Lab was commissioned on 31st March, 2015
- The lab is purely commercial and revenue raised is used to run the lab
- The lab designs cookstove prototypes and transfers the knowledge acquired to the industry
- Used for testing the efficiency, performance, emissions levels and heat content of locally-produced and imported cookstoves
- Low patronage of facility the industry is unaware of its existence
- The relatively high testing charges also accounts for its low patronage

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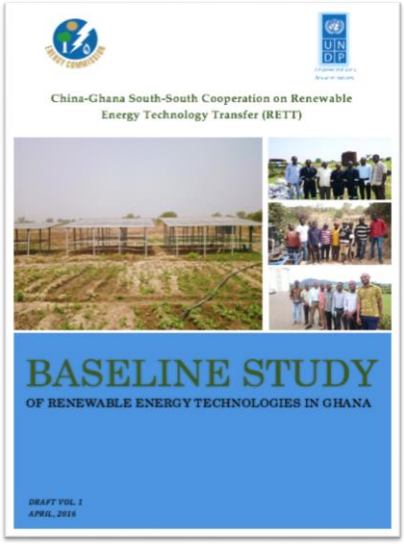
OUTCOME

- The review has enabled the project to determine what has worked and failed in the RE sector
- The RE sector is also experiencing duplication of some initiatives and the exercise helped to identify areas which was receiving some attention and
- The project maintains a database of all RE projects and will continue to update this during the project life



RE TECHNOLOGY SELECTION AND DEMONSTRATION PROJECT IDENTIFICATION

OUTCOME 2 – ACTIVITY RESULT 2.1.1: SELECTION AND ADAPTATION OF APPROPRIATE RETS TO BE TRANSFERRED

What was done:

- Project has signed MOUs with 5 research organizations:
  - CSIR-IIR, CSIR-WRI, Energy Center, Koforidua Polytechnic, Center for Renewable Energy, Kumasi(CREK)
- ACAA21 have provided a comprehensive list of available technology to assist with the work. (http://energycom.gov.gh/files/Catalogue%20(Other%20Technologies).pdf)
- Work has started on the development of pre-feasibility study for demonstration project

EXPERIENCE SHARING BETWEEN CHINA, ZAMBIA AND GHANA

OUTCOME 2 – ACTIVITY RESULT 2.1.1: SELECTION AND ADAPTATION OF APPROPRIATE RETS TO BE TRANSFERRED

What was done:

China-Ghana-Zambia joint stakeholders meeting:

12th – 19th October, 2016

Ghana delegation including selected members from the REMP Taskforce, Research Organizations and Private Sector in RE participated in the Chinese delegation to provide the platform for China-Ghana experience sharing in RE technologies and policy.

- Task-force discussed the REMP with Chinese Counterparts and obtained feedback. They also participated in the site visits
- Research Organizations from Ghana had the opportunity to meet their counterparts in China and have initiated the process to collaborate.
- Business-to-Business Match making sessions were held between Ghanaian and Chinese companies explore demands and possible options

OUTCOME 2 – ACTIVITY RESULT 2.1.1: SELECTION AND ADAPTATION OF APPROPRIATE RETS TO BE TRANSFERRED

What was done:

Experience sharing workshops

29th – 31st March, 2016

Hosted a 10-member Chinese delegation to provide the platform for China-Ghana experience sharing in RE technologies and policy.

Objective: To receive inputs on the development of the criteria for the selection of the RETs appropriate for transfer from China to Ghana and elicit concept notes for the deployment of viable renewable energy projects.

It also provided the platform for the Chinese counterparts to review the RE masterplan.

OUTCOME 4: PROJECT MANAGEMENT AND COORDINATION MECHANISMS ESTABLISHED

- The project coordinator participated in the global steering committee meeting and PMU meeting with Chinese counterparts in China to review the project reports and plan activities for the year 2016.
- The Ghana PMU continued the biweekly Skype teleconferencing to discuss project updates.
- Two Technical Officers attached to the project have been trained in China on Solar and Biogas through the support of the Chinese Government.
- PMU meeting held in Beijing on 15th October, 2016

- Project Website established: http://www.rettc.org/en/index.html
- Whatsapp and WeChat group established to promote information sharing

PROJECT IMPLEMENTATION CHALLENGES

- We have experienced delays on some of the studies that were commissioned. This will however not have significant impact on project delivery since the assignment was divided among a number of consultants to focus on different zones of the country. All will complete before end of year.
- The project is developing the REMP using experts in the various energy related government institutions. It has been challenging organizing meetings as planned due to the conflicting task of these high profile members.
- Communication between China PMU and Ghana PMUs was a challenge most part of the year however this is being resolved with the adoption of wechat for project communication whilst a file sharing platform is also being worked on. – Feedback on certain studies have not been received.

LESSONS LEARNED AND OPPORTUNITIES

- Significant result could be made through networking at relevant conferences – both local and abroad - These issues came up after the Project Coordinator participated in COP22 and made a presentation during a side event.
  - There is significant opportunity for the project to leverage funds from Green Climate Funds to upscale the demonstration projects. The project should therefore collaborate with relevant stakeholders to access these funds.
  - UNDP is conducting similar activities in other countries and conference and meetings are perfect opportunities to bring likeminded people together

RECOMMENDATIONS AND PROPOSED ACTIONS

- The PMU has recommended the formation of a Technical Committee(TC) mainly drawn from the Energy Commission. Representatives from the Ministry of Power and UNDP are part of the TC.
- The TC will review project reports and provide feedback and also build a matrix team drawn from the various departments of the Energy Commission to offer relevant support.

KEY ACTIVITIES FOR 2017

- Finalize and submit Renewable Energy Master Plan
- Implement at least 4 demonstration projects on Renewable Energy Technologies
- Conduct training on Renewable Energy Technology design, construction and maintenance
- Exchange visits between various PMUs – China, Zambia and Ghana for experience sharing
- Develop work plans and long term funding and outreach strategies for the training facilities

THANK YOU FOR YOUR ATTENTION
QUESTION TIME