

Renewable energy solutions for the manufacturing industry in Ghana

Presented by

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INTRODUCTION

- Access to energy is fundamental in advancing the well-being of any society and to promote economic growth as well as employment opportunities for the citizenry. Energy and energy security are key catalysts for macro-economic growth of a country and the prosperity of its people.
- The nation's strategic objectives/goal of expanding the economy through industrialization and infrastructure development as embedded in the ruling government's key economic development initiatives, namely establishing one factory in each of the 216 districts across the country and resuscitation of distressed companies under the Stimulus Package Initiative will require increase in the installed power generation capacity.

Constraint statement

- ❖ The convergence of factors such as global decline in fossil fuel reserves, damaging effects of global warming, and rising energy demand due to increasing population has necessitated the shift to the use of sustainable low-carbon emitting sources of energy
- ❖ Economic development in Ghana is constrained by inadequate generation capacity which, in turn, is limited by the insufficient supply of natural gas. To sustain the country's current rate of economic growth, it is estimated that some 200 MW of additional generation capacity will be required per annum over the next 20 years (an additional 4,000 MW) will require significant private capital both local and foreign investments, and foreign technical expertise
- ❖ The total installed electricity generation capacity was estimated as 3,933.6MW in 2015. . Over 98% of Ghana's electricity supply is primarily from hydro and thermal power sources.

Overview of the energy and manufacturing sector

- Ghana's total energy consumption in 2012 was 10.13 million tons of oil equivalent (mtoe)
- The most dominant form of energy is biomass (woodfuel) and petroleum (oil & gas) accounting for 90% of energy use
- About 70% of the population in Ghana have access to electricity, the remaining 30% are in remote communities, islands and lakeside communities (extension of the grid network to these places are constrained by geographical and financial factors)
- Off-grid network choices (mini-hydros, solar PV, wind etc.) would be the technological options for these areas
- The industrial sector (including manufacturing) of Ghana contributed about 24.3% of GDP in 2016
- The entire Industrial sector including manufacturing, mining etc. consumed about 930.7 (ktoe), the largest commercial consumer of energy after the transport sector in Ghana in 2016
- Majority of the energy used by industry is from petroleum products (biggest consumer of the product) 357.6 (ktoe) in 2016

Renewable energy in Ghana

- The main sources of energy are hydro and thermal
- According to the Energy commission`s national energy statistics in 2016, thermal forms 56.2% and Hydro forms 43.2% of Ghana`s electricity generation mix, a total in excess of 99 .4%
- Renewables account for only a miniscule 0.6% (22.5MW out of a total installed capacity of 29.94MW) in 2016 from 0.1% (2.5MW) of the energy mix in 2015
- The goal of Ghana`s renewable energy policy is to increase the share of renewable energy in the national electricity generation mix to 10% by 2030
- A net-metering code and feed-in-tariff scheme has been developed with technical assistance from the German Government

RE in Ghana cont'd

- Ghana is developing a renewable energy master plan under the Renewable Energy Technology Transfer project to meet the expected goal of 10% renewable energy mix by 2030
- Ghana has a Renewable Energy Law guiding the development of the industry under which a renewable energy fund is set up
- Also Renewable Energy development has been identified as a key pillar in Ghana's Nationally Determined Contributions (NDCs) under the Paris climate change agreement
- The country is committed to achieve the objectives of the sustainable energy for all (SE4All) by 2020
- The major sources of renewable energy in Ghana are; solar, wind, hydro, biomass and waste-to-energy, tidal

Policy Focus for the Energy Sector

- Four key factors which underpin any good policy on energy generation and distribution namely:
 - availability
 - reliability
 - affordability
 - sustainability

Potential of Renewable energy resource in Ghana

- **Hydropower**- the estimated total exploitable capacity of hydropower sites is about 800MW
- **Solar**- the solar irradiation in Ghana ranges from 6.0kWh/m²/day with the highest irradiation levels occurring in the northern part of Ghana
- **Wind**-the total wind energy potential is about 1100MW
- **Biomass and waste-to-energy**—nearly 50% of the overall primary energy use of the country is from biomass. Accra(capital of Ghana) alone produces 800m³ of liquid waste per month (good feedstock for biogas production for electricity). Potential to convert this volume of bio-waste to energy is enormous
- **Tidal**- Ghana has an enormous potential for tidal energy in excess of 1000MW

Regulatory framework

1. The renewable energy Act 832 (2011) provides the legal anchor for the development, management, utilization, sustainability and adequate supply of renewable energy. The four key mechanisms in RE Act are;
 - **Mandatory purchase policy**– distribution utilities are obliged to procure a specific percentage of total electricity purchase from renewable energy
 - **Mandatory connection policy**- transmission and distribution system operators are obliged to provide connection services for electricity from renewable energy
 - **Feed-in-tariff system**- the rate at which renewable energy is purchased by distribution utilities is guaranteed for 10 years and subsequently reviewed every 2 years. Any variation or cost increases may be covered by the renewable energy fund
 - **Renewable energy fund**- offers financial support such as financial incentives, feed-in-tariffs, capital subsidies etc.

PPP Policy / Driver of investments into Renewable energy

2. There is also a public-private partnership policy to drive investments in Renewable Energy

Under the policy there are two principles which cover Renewable Energy development

- ✓ Local content and technology transfer
- ✓ Environmental, climate and social safeguards

Key stakeholders

- Private Enterprise Federation (PEF) advocating for the benefit of the private sector business community
- Energy commission
- Ministry of energy and petroleum
- Ministry of environment, science, technology and innovation
- Environmental Protection Agency
- Ghana Standards Authority
- Lands Commission
- Forestry Commission
- IPPs
- Public Utilities Regulatory Commission seeking the interest of the general public

Available Renewable Energy technologies for the manufacturing sector in Ghana=vvip

- Off-grid solar PV systems to supply power to the offices during the day and night with battery storage to free up conventional energy for production
- Hybrid solar-biomass system to supply 24/7 electricity from free solar energy and biomass waste from factory
- Biogas systems using liquid and solid waste from industry to produce gas to run engines and organic compost for backyard farming
- Thermal energy storage systems to run boilers and water heaters in factories
- Waste to energy plants from industrial/agricultural waste to supply basic energy requirements depending on size

Partnership with CSIR to deploy RE technologies for Industry

- Mobile controlled Solar Power Pump Stations for Irrigation (Cyber Farming)
- Solar PV Energy for Artisans and Small Scale Industries
- Small concentrated solar power units:
 - ✓ Concentrating power producing plants (1-5MW systems) for 1D1F.
 - ✓ Solar dishes to provide process heat for industries
- Community-based Pay-as-you-irrigate system (controlled by mobile phone)
- Eco-toilets to produce Biogas and Manure
- Promoting use of Solar PV Sources to power homes and Offices
 - ✓ To help free energy for the industry

Comparative cost of power per kWh (average) (non-RE)

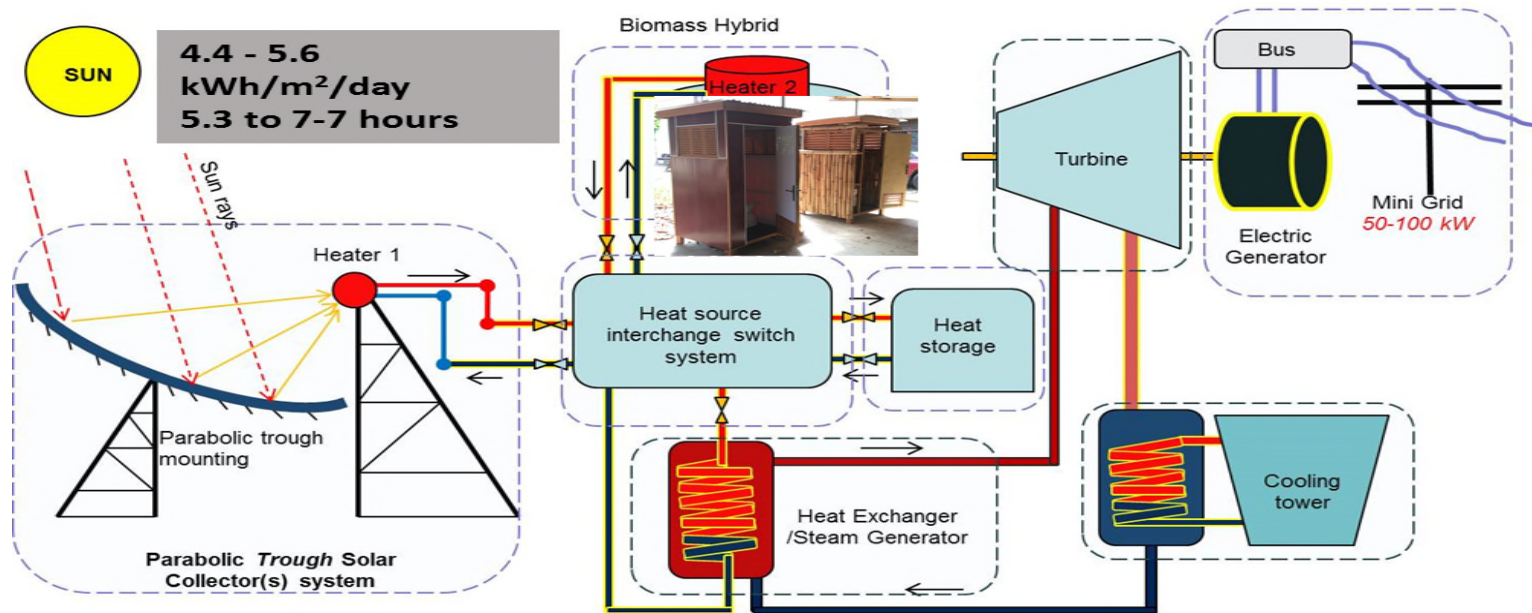
- Ghana- \$26.8/kWh
- UK- \$0.17/kWh
- Ivory Coast- \$0.14/kWh
- Kenya- \$0.13/kWh
- Nigeria- \$0.13/kWh
- USA- \$0.12/kWh

Feed-in-tariffs for utility scale RE technologies in Ghana

- Wind with grid stability systems(≤ 300 MW)- \$0.17/kWh
- Solar PV with grid stability systems (≤ 150 MW)- \$0.16/kWh
- Mini-hydro- \$0.17/kWh
- Biomass- \$0.19/kWh

Hybrid Power systems to power manufacturing

- Feasibility, reliability and economic analyses conducted in a number of studies showed that hybrid power systems are more reliable and cheaper than single source energy systems
- Offer tariff less than \$0.10/kWh



Barriers, gaps and policy challenges

- Ineffective feed-in-tariff system limited to 10 years
- Lack of adequate local capacity to scale up deployment and financing of RE technologies
- Unstable local currency
- Ineffective implementation of the Renewable Energy Act
- ✓ RE fund not resourced
- High cost of Renewable Energy systems currently
- Cumbersome licensing regime for RE investments
- Poor financing regime for RE systems
- Inadequate public knowledge on RE technologies
- Low political commitment

PEF's Role & Contribution

- PEF in collaboration with the UNDP and the Ministry of Environment, Science, Technology and Innovation under the Nationally Appropriate Mitigation Actions (NAMA) has set up a private sector platform to sensitize and drive private investments into renewable energy and other green business models towards climate change mitigation
- PEF is working with the UNDP and the Ministry of Finance to build the capacity of private sector businesses to develop bankable projects that will enable them access funding from the Green Climate Fund and other sources to scale up impact and ensure sustainability of their operations
- PEF is also engaged in a B2B and matchmaking under the Renewable Energy Technology Transfer Project to link Ghanaian renewable energy entrepreneurs with their Chinese counterparts for local expertise development and equity financing of RE business ventures

Recommendations

- Government should be encouraged to increase support for research and development in Renewable Energy
- Government should provide incentives for private sector investments into Renewable Energy
- Review feed-in-tariff system to extend duration beyond 10 years in line with the international norm
- Develop clear regulatory guidelines on renewable energy off-grid and mini-grid systems
- Streamline the acquisition of licenses to develop Renewable technologies
- Ensure a conscious local content development and capacity building to incentivize local businesses as the driver of the industry
- PEF as the advocacy body for the promotion of private sector businesses in Ghana is seeking partnership with like-minded organizations to enhance the development and deployment of renewables in Ghana's energy mix.

**THANK YOU FOR YOUR
ATTENTION**



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False starts

The Namibia hydropower plant has been in development for over 30 years, but previous administrations have made little progress.



Hide Caption
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Photos: The clean energy giants powering Africa
Nigeria: President Muhammadu Buhari and Chinese President Xi Jinping shake hands in Beijing, during the former's state visit in 2016.

Lake Turkana Wind Project, Kenya – At least 100 turbines are expected to be ready on site by September, 2016. On completion, the project will comprise 365 wind turbines, each with

Power shortage

Despite being one of the largest economies in Africa, over 40% of Nigerians live without access to electricity, according to World Bank [figures](#).

Hydropower, one of the cleanest and cheapest forms of power, is a key target for development as Nigeria is currently exploiting just a fraction of its potential resources.²¹

Photos: The clean energy giants powering Africa
The country is also seeking to shift away from oil dependency, after plummeting oil prices triggered a recession.

– **The Rwanda Solar Power Field** – An Africa-shaped 8.5 megawatt solar plant east of Rwanda's capital Kigali came into full production in December 2015. Its 28,360 photovoltaic panels

will have an outgoing power capacity of 1,870 megawatts -- a record for a solar farm.

of Complex is being built in the Moroccan desert. Noor 1, the first solar plant, but the agreement broke down soon after. Noor 1, the first solar plant, but the agreement broke down soon after. Noor 1, the first solar plant, but the agreement broke down soon after. Noor 1, the first solar plant, but the agreement broke down soon after.

generation to 42% by 2020.

lkaria, Kenya, harvesting the power of underground geothermal energy. The plant is located east of the capital, Nairobi.

er project

is expected to power over 250,000 households in Kenya, supporting the country's energy needs. Kenya, where it accounts for [nearly half the country's energy supply](#).

country's North-East, will cover 40,000 acres. The 70 billion K