

The Challenges of Climate Change for the Future Supply of Safe and Sustainable Energy

The Potential of Renewable Energies in Tanzania

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Introduction to climate change

- Climate includes patterns of temperature, precipitation, humidity, wind and seasons.
- Climate change affects more than just a change in the weather; it refers to seasonal changes over a long period of time.
- These climate patterns play a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them.
- Because so many systems are tied to climate, a change in climate can affect many related aspects of where and how people, plants and animals live, such as food production, availability and use of water, and health risks.

Main Factors Contributing to Climate Change

- Many factors are contributing to climate change, from fossil fuel use, and land use to the burning and clearing of tropical forests.
- The World energy system is responsible for more than half the anthropogenic greenhouse gas emissions (GHGs)—mainly carbon dioxide (CO₂) and methane—in the Earth's atmosphere. Majority of these emissions is due to fossil fuel use, which represents about 75% of total energy use.
- The burning and clearing of tropical forests is a major source of greenhouse gas emissions. It accounts for roughly 16 percent of total global emissions, more than all of the world's cars, trucks, ships, trains and planes combined. Protecting an acre of rainforest reduces emissions as much as removing 14 cars from the road
- There is a widespread view that this increase is leading to climate change, with adverse effects on the environment.

Features Attributed to CC in Tanzania

- We are already seeing changing weather patterns impacting on food production and species migration.
- Higher temperatures from GHG exposing millions of people to new health risks, especially from “vector-based” diseases like malaria – already mosquitoes are common in Kilimanjaro which used not to be the case before.
- Higher temperatures from GHG causing melting of ice on the peak of mount Kilimanjaro
- Changing weather patterns, rising sea levels and other climate change impacting on the decrease of water availability by up to 50 percent in some locations. Fresh water scarcity risks becoming even more acute in drought-stricken zones.

CC Features Cont.

- Prolonged dry seasons and unpredictable rain seasons.
- The IPCC estimates that the average sea level will rise between 0.18 to 0.59 meters (0.6 and 2 feet) in the next century. Sea level rise is already contaminating freshwater supplies in Thailand, Israel, the Pacific Islands, China and Vietnam.
- About 25 percent of mammals and 12 percent of birds may become extinct over the next few decades, as warmer conditions alter their habitats and human development blocks them from migrating elsewhere.

Challenges of Climate Change in General

- Climate change has the potential for major impact on food security, employment, incomes, and economic growth.
- Increased temperature in tropics and varying rainfall patterns has resulted into reductions in crop yields which can be expected to lead to localized food price hiking.
- Climate change is predicted to deepen poverty both directly and indirectly. Direct impacts include the loss of life, livelihoods, assets, infrastructure, etc., from climatic extreme events
- Malnutrition from the reduction in crop yields would increase the severity of the above mentioned “vector based” diseases feature. With more than 75% of Tanzanians being employed in agriculture, the country remains not exclusive.
- Conflict is increasing over strained ecosystems and local communities are being forced from their homes.

Challenges of Climate Change Cont.

- Climate Change has a direct impact on energy availability for communities, households and for economic undertakings. The impact is even higher for countries and communities with limited purchasing power.
- Poorer developing countries are most at risk since they are more reliant on agriculture, more vulnerable to coastal and water resource changes, and have less financial, technical and institutional capacity for 'adaptation'.
- Africa is particularly susceptible due to the desertification process, declining run-off from water catchments areas, declining soil fertility, dependence on subsistence agriculture, the prevalence of AIDS and vector-borne diseases, inadequate governance mechanisms, and rapid population growth.

Energy Supply Situation of Tanzania

- Similar to all other East African countries, the majority of Tanzanian population lives on biomass (90%) - against the other lower energy consumption shares (petroleum 8%, electricity 1.2% and others as solar, wind, etc. 0.8%).
- **Biomass:** Resources in Tanzania include woody, biogas, liquid biofuel and biomass co-generation. Administration of the forests in Tanzania includes 38.83 million hectares.
- **Total installed grid capacity** by end of 2010= 1,051 MW; Hydro= 561; and thermal (HFO and NG) = 490 MW. (Hydro in 2002 = 98%); **Electricity import from Zambia and Uganda ≈ 12 MW**
- **Hydro:** Only 12% of the 4700 MW potential is exploited; **Small hydropower – potential** ≈ 388MW, less than 8MW developed.
- **Natural Gas:** Proven potential of natural gas is about 45 billion cubic metres. Recently more discovered in Mkuranga. Contribution of NG in thermal power generation **>60%**.

Energy Supply in Tanzania Cont.

- **Coal:** Reserves are estimated at about 1,200 million tones. 304 million tones are proven and less than 150,000 t/a are being utilized. Plans underway to generate up to 600MW electricity from coal – sites include Kiwira, Mchuchuma and Katewaka.
- **Solar:** Between 2800 -3500 hours of sunshine per year with a global radiation between 4- 7kWh/m²/day. Average solar flux in some parts based on 24 hours can be as high as 300W/m² or more. However only about 1.8 MW is installed.
- **Wind:** Proven wind power generation sites exist including Makambako in Njombe district, Kititimo in Singida and around Mkumbara of Kilimanjaro region. In Makambako and Kititimo wind speeds recorded are in excess of 7m/s.
- **Geothermal:** Estimated potential of up to 600 MWe - identified geothermal sites include Mbeya Area - between Lake Rukwa and Lake Nyasa, Arusha near the Kenyan border (Lake Manyara, Lake Eyasi, Lake Natron, Rufiji Basin, 60 km east of Musoma and areas around Mt. Kilimanjaro and Mt. Meru.

Current situation of energy use and potential future needs for Tanzania

- **Biomass-** More than 90% of primary energy consumption in Tanzania is from biomass. Studies and reports put woody fuel consumption in Tanzania in 2005 at 46.2 million cubic metres of solid round wood.
- **Biomass co-generation-** The following private companies are generating electricity from biomass either for own use or for selling to TANESCO, Sugar factories (generating 38MW), TANWAT (Wood/Forestry generating 2.5MW), Sao Hill (Wood/Paper generating 1.0MW), Mufindi Paper Mills (generating 15MW). Sugar factories have capacity to generate 200MW from Bagasse.
- **Wind** – use of wind for mechanical and electric power exist but not thorough documented. Plans are underway to generate 50MW in Singida region. More power could be generated.
- **Geothermal-** Not yet in use- studies estimate potential of up to 600 MWe – **could be exploited**
- **Solar- only** about 1.8MWp are in use and thermal applications not well coordinated and documented –resource is locally available and use could be intensified

Current situation of energy use and potential future needs for Tanzania

- **Petroleum** consumption by sector: Transport \approx 40%; Industry \approx 20%; Households \approx 20%; Agriculture \approx 10%; commerce and others \approx 10%
- **Electricity** connectivity rate: In urban areas \approx 30%; in rural areas \approx 2% ; on average \approx 14% countrywide
- **Natural gas**: \approx 83% for power generation and \approx 17% thermal application in industries.
- **Coal**: 2MW generated at Kiwira
- **Oil exploration** being pursued by >11 companies-No oil discoveries so far
- **Oil import 2008** - 1.8 million tonnes/annum; significant depletion of the foreign currency reserve

Climate change related challenges to the current and future supply of safe and sustainable energy

- Electricity capacity generation depend 53% on hydro systems experiencing prolonged dry seasons and less rainfall
- Unreliable rainfall adversely impact on the existence of natural forests which are primary source of energy (90%) for majority of poor and rural Tanzanians
- Unreliable availability of fuel wood, the only affordable energy option for the poor, is a crisis as will result in an increased price increasing further poverty of the poor.
- Increased poverty further deprives the poor capabilities to acquire alternative energy sources

Potentials for RE in Tanzania

- Abundant and locally available sources and resources in Tanzania including solar radiation, wind, hydro, biomass and wastes.
- Most RETs and services are proven and are able to provide energy for both domestic and commercial purposes; some local capacity and technical know-how is available.
- There exist inherent carbon credit benefits in most RE projects and activities that could be tapped by Tanzanians
- There is an increased development partners interest and opportunities for LDCs, Tanzania inclusive, to benefit from carbon credits – standardised baselines, automatic additionality for projects less than 5MW and less than 20GWh, no registration fee for CDM projects in LDCs and availability of EB loans to prepare PDD, validation and first verification.
- Hiking price of petroleum products, of which Tanzania is fully dependent on imports.

Cases of some RE pilot projects already well functioning in Tanzania

- **Decentralized RE mini and micro hydro grids** - Mawengi mini hydro 300kW – operated by LUMAMA power users supplying power to 3 villages downstream with a plan of extending to other 4 villages upstream
- Matembwe micro hydro 90 kW (operating even after TANESCO arrival in the area, competing with TANESCO (cheaper) with no power shed.
- Mavanga mini hydro 145kW and Lugarawa mini hydro 150kW in Njombe.
- **Waste to energy project-** Sisal waste turned to energy (300 KW) at Katani Limited in Tanga (with a plan to increase capacity to more than 1MW)
- Slaughter houses waste to energy – Kisakasaka village in Zanzibar, Nyangao village in Lindi and Ilagala village in Kigoma @ 10kW each.

RE Pilot Projects Cont.

- **Fuel switch from HFO to NG** – already about 18 industries have switched since 2004 including Tanzania Portland Cement, Kioo Ltd, Tanzania Breweries Ltd, Aluminum Africa Ltd, Karibu Textile Mills, Friendship Textile Mills, Bora Industries, NIDA Textile Mills, Tanzania Cigarettes Co. Ltd, Lakhani Textiles Mill, Mukwamo Industries, Murzar Oil Mills Ltd, and Murzah Soap Industries Ltd.
- **UNDP solar PV Market transformation project in Mwanza region** –where more than 15 solar companies are operational as a result of the solar PV pilot project sustaining the market.
- **Uzi Island Solar battery charging stations for rural electrification** – initially 10 SBCS system installed for every 5 households within 300 metres diameter @120Wp each and batteries @70 -100Ah each.

Priority areas and opportunities for future action – some within UNDAF

- Develop policy, strategy and legal institutional framework for daily planning and implementation of safe energy activities at district and local level.
- Develop and support implementation of programmes and projects on low carbon efficient energy technologies and services in partnership of the private sector, DP and other relevant stakeholders at district and local level.
- Plan and support increased use of decentralized modern safe energy systems for powering rural economy, communities, institutions and households
- Enhance RE knowledge management at all levels
- Establish robust forest management systems to stop forest fires and unsustainable deforestation of catchments areas.

Priority and opportunities for future action Cont.

- Develop capacity of public and private sector of Tanzania to partner, formulate, raise investment capital, implement and tap inherent carbon credit benefits in clean and safe energy projects.
- Develop mitigation and adaptation strategies/programmes and resources for tapping both national and international resources and opportunities
- Protect natural ecosystems and tropical forests such as wetlands, wetlands, peatlands, coral reefs and mangroves – which also reduce the risk of catastrophic impacts like floods and droughts, contributing to food and freshwater security for both rural and urban communities.
- Deliberate support and enhancement of local R&D on TE systems and commercialization of such developments in collaboration with the private sector and interested stakeholders

Thank you for Your Attention

Asanteni kwa Kunisikiliza