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(EWURA)
Tanzania
Wind & Mini-hydro
Projects in Tanzania
Presentation Overview

- About EWURA
- Electricity Supply Industry Overview
  - Structure, Resources, and Available Network
- Rural Electrification
  - Key Drivers, Coverage, and Key Players
- Small Power Projects (SPP) Framework
- Large Power Projects and Review of PPAs
- Wind Power Development
- Mini-hydroelectric Power Development
- Challenges
ABOUT EWURA

- Autonomous regulatory authority, established by the EWURA Act of 2001
- Became Operational in September 2006
- Undertakes Economic and Technical regulation of Electricity, Natural Gas, Petroleum and Water
- Promotes and oversees regulated sector competition
## Electricity Supply Industry Overview - Potential Resources

<table>
<thead>
<tr>
<th>Sl/</th>
<th>Resource</th>
<th>Proven Total Potential</th>
<th>Developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydro Power</td>
<td>4,700MW, (firm Capacity (3,200)</td>
<td>12% (562 MW)</td>
</tr>
<tr>
<td>2</td>
<td>Natural gas</td>
<td>Songosongo-30mill.m3, Mnazi Bay-15mill.m3</td>
<td>361 MW</td>
</tr>
<tr>
<td>3</td>
<td>Coal</td>
<td>13200 Million Tons (300 Million Tons at Kiwira Field)</td>
<td>0.04% /annum</td>
</tr>
<tr>
<td>4</td>
<td>Biomass wood</td>
<td>1.8 Billion, m3</td>
<td>2.2% /annum</td>
</tr>
<tr>
<td>5</td>
<td>Biomass residues</td>
<td>- Crop residues= 15Million Tons/annum</td>
<td>- About 1,000 biogas digester units of 50m3.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Animal droppings=25Million Tons/annum</td>
<td>- 22.75 MW electricity from steam and sisal plants.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Volatile solids of sisal waste= 0.2Million Tons/annum.</td>
<td>- 3.5MW from forest residues.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Forest residues=1.1 Million Tons/annum</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Wind</td>
<td>Speed 0.9 – 9.9 m/s</td>
<td>129 windmills (8.5kWp)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(studies for electricity generation are being undertaken)</td>
</tr>
<tr>
<td>7</td>
<td>Solar</td>
<td>Approximately 215 W/m2/day</td>
<td>More than 2MWelect.</td>
</tr>
<tr>
<td>8</td>
<td>Geothermal</td>
<td>There are indications of potential</td>
<td>Studies are being undertaken.</td>
</tr>
<tr>
<td>9</td>
<td>Nuclear</td>
<td>Uranium potential exists but not yet assessed</td>
<td>Not exploited (No studies)</td>
</tr>
<tr>
<td>10</td>
<td>Tidal wave</td>
<td>There are indications of potential</td>
<td>Studies are being undertaken.</td>
</tr>
</tbody>
</table>
Rural Electrification – Key Drivers

- Key Drivers:
  - Electrification of the district headquarters, rural townships, villages, and commercial centers in rural areas
  - Improvement of standard of living, poverty alleviation and social development of the rural population
  - Environmental conservation to avoid land degradation, deforestation, climate change, and air pollution
Rural Electrification – Coverage

Coverage

- Less than 20% of the country’s population has access to electricity
- About 2% of the rural population has access to electricity compared to about 40% in urban areas
- A large part of Tanzania is not grid connected
- Thus, more than 80% of the population has inadequate energy services, a situation hindering development of the rural population
Rural Electrification – Key Players

- Key Players
  - Central Government
  - Ministry of Energy and Minerals
  - Rural Energy Agency
  - EWURA
  - TANESCO
  - Ministry of Water
  - National Environment Management Council
  - Investors
  - Lenders and Donors
Small Power Projects (SPP) Framework

- Objective is to support the enabling environment for sustainable development of renewable energy sources through Light-handed regulation
  - Minimizing amount of information that is required
  - Minimizing the number of separate regulatory requirements and decisions
  - Use of standardized documents so as to reduce need for case-by-case analysis and negotiation
SPP Framework…continued

- Structure
  - Standardized Power Purchase Agreement
    - Grid and Off-grid Connections
  - Standardized Tariff Methodologies
    - Grid and Off-grid Connections
  - Rules and Guidelines
  - Standard Forms
Large Power Procurement and Review of PPAs

- Project Size: > 10 MW
- Type of generation: PPAs for all generation types (thermal, renewable)
- Location: all PPAs that involve impacts on Tanzanian consumers, including cross border electricity trades
- Timeframe: PPAs of any duration (including emergency PPAs). This may be amended in the future to exclude day ahead or spot market trades with the emergence of the EAPP
Wind Power Development - Inception

- Its inception
  - Wind energy development in Tanzania started about 3 decades ago
  - First windmills were installed to pump water for human and animal consumption, and irrigation
  - The first two wind systems were installed in Sikonge Moravian Mission and the Kili wind project at Bukene, both in Tabora region
  - To date over 100 windmills have been installed countrywide, totaling 8.5kWp
Wind Power Development - Overview

- Overview
  - There is an estimated short-term potential for 300-500 MW of grid-connected wind farms
  - No grid connected wind system; two known projects of over 50 MW in planning stages
  - Wind Speed 0.9 – 9.9 m/s
  - Low turbulence, high average speeds and unidirectional nature of the flow
  - In some sites, net annual capacity factors as high as 40 % would be possible
Wind Power Development – Proven Sites for Power Generation

- Makambako

- Average wind speed: 7 m/s (at 30 m); 8.6 m/s (at 60 m)
- Approximate Capacity Factor 40%
- Potential Developer: Makambako Energy Ltd.
Wind Power Development – Proven Sites for Power Generation…contd

- Singida
  - Average wind speed:
    - 7.6m/s (at 30m); 9m/s (at 60m)
  - Approximate Capacity Factor: 40%
  - Potential Developers:
    - Wind East Africa; and
    - Power Pool East Africa (PPP arrangement with TANESCO and NDC)
Wind Power Development – Undeveloped Market

- Stand-Alone Wind Systems for Commercial Battery Charging Stations (1.5 – 10 kW)
- Stand-Alone Wind Generators for Tourism in Off-Grid Locations (3 kW to 100 kW+)
- Stand-Alone Wind Generators in Hybrid Systems for Telecommunication (3kW)
- Wind-Diesel Hybrid Systems for Rural Electrification through Mini-Grids (50kW – 1MW)
Mini-hydroelectric Power Development Overview

✓ Hydropower Potential in Tanzania is estimated to be 4700 MW
✓ Only about 561 MW has been exploited
✓ This implies that about 10% of this potential has been exploited
✓ The estimated small hydro power (SHP) potential in Tanzania is 300 ~ 500MW in total
✓ Only 15MW has been harnessed
✓ Developed small hydropower is about 3% of the total Small Hydropower potential
Mini-hydroelectric Power Development
Identified Sites
## Classification of hydropower by size

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large-hydro</td>
<td>Above 100 MW</td>
<td>Usually feeds into a large electricity grid</td>
</tr>
<tr>
<td>Medium-hydro</td>
<td>From 10 MW to 100 MW</td>
<td>Usually feeds into a grid</td>
</tr>
<tr>
<td>Small-hydro</td>
<td>From 1 MW to 10 MW</td>
<td>Usually feeds into a grid</td>
</tr>
<tr>
<td>Mini-hydro</td>
<td>Above 100 kW but below 1 MW</td>
<td>Either standalone schemes or feeds into mini-grid</td>
</tr>
</tbody>
</table>
Mini-hydroelectric Power Development Water Basins

- Pangani (1991)
- Rufiji (1993)
- Lake Victoria (2001)
- Wami – Ruvu (2001)
- Lake Rukwa (2001)
- Lake Nyasa (2001)
- Lake Tanganyika (2004)
- Ruvuma and Southern coast (2004)
- Internal drainage to Eyasi, Manyara and Bubu Depression (2004)
Mwenga Small Hydro Power Project

✓ 1st SHP to have regulatory approved tariffs
✓ Retail tariffs equivalent to TANESCO’s D1 and T1 (Low Voltage) customers
✓ About 2,600 retail rural customers in villages surrounding the project to be connected
✓ The project will serve retail customers, the Tea Factory, and excess to the Grid under SPPT rate
Challenges

- Financing
- Technical Know How
- Government Policy on Renewable Energy
- Pricing
- Institutional Framework
Thank You

Asante

Karibuni Tanzania
References

- Energy Policy, 2003
- Ferrey, Steven, “Standardised Power Purchase Agreement for purchase of grid-connected capacity and associated electric energy between TANESCO and a small power project” (revised draft). June 2007