Onsite Production & Use of Bioenergy in Uganda

European Biomass Conference, Graz Austria | 18 – 20, January 2017

Nolbert Muhumuza
Founder and CEO – Awamu Biomass Energy Ltd.
Chairperson - Biomass Energy Efficient Technologies Association (BEETA).
## Contents

<table>
<thead>
<tr>
<th>Introductions</th>
</tr>
</thead>
<tbody>
<tr>
<td>About Uganda</td>
</tr>
<tr>
<td>Macro Environment in Uganda</td>
</tr>
<tr>
<td>Social Environment</td>
</tr>
<tr>
<td>Political Environment</td>
</tr>
<tr>
<td>Economic Environment</td>
</tr>
<tr>
<td>Biomass &amp; Biogas Situation</td>
</tr>
<tr>
<td>Funding &amp; Regulatory Framework</td>
</tr>
<tr>
<td>Case Examples</td>
</tr>
</tbody>
</table>
• Not-for-profit
• Membership organization
• Formed in 2011
• Has over 60 members (ICS, & Biofuels)
• Chairperson (2016 – 2019)
• Mission: to promote networking, understanding, knowledge and action ....
• Membership NGO
• Formed in 2014
• 4 other regional Biogas Associations
• **Vision:** To be a leading driver for a commercially viable biogas sector in Africa
• Largest producer in Uganda
• Capacity of 700 Kg /hr
• Employs 11 people
• Formed in 2012
• Mainly B2B model
• For-profit social enterprise (gasifier stoves + Biomass fuels)
• Formed in 2012
• Co-founder and CEO
• 12 employees (5 Female)
• Works with 21 Distributors
• Sold over 3,800 stoves + 20 tons of Woodchips
• Seeking investment for decentralized Pellets (at Grassroots)

• Large scale production of woodchips
<table>
<thead>
<tr>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductions</td>
</tr>
<tr>
<td><strong>About Uganda</strong></td>
</tr>
<tr>
<td>Macro Environment in Uganda</td>
</tr>
<tr>
<td>Social Environment</td>
</tr>
<tr>
<td>Political Environment</td>
</tr>
<tr>
<td>Economic Environment</td>
</tr>
<tr>
<td>Biomass &amp; Biogas Situation</td>
</tr>
<tr>
<td>Funding &amp; Regulatory Framework</td>
</tr>
<tr>
<td>Case Examples</td>
</tr>
</tbody>
</table>
Uganda

• Area: 241,038 Km$^2$
• Landlocked country
• Population: 34.6 Million (Census 2014)
• Currency: Uganda Shilling (UGX)
• Bordered by the **DR Congo** in the West, **South Sudan** in the North, **Kenya** in the East, **Rwanda** in the South West & **Tanzania** in the South
• Over 87% live in rural areas
• Has the lowest median age (15yrs) in the world
Energy

- Bioenergy Balance, 2015
- Biogas ~0.2%
- Major (~75%) used in rural areas
- Very limited electricity from Biogas
## Contents

<table>
<thead>
<tr>
<th>Introductions</th>
</tr>
</thead>
<tbody>
<tr>
<td>About Uganda</td>
</tr>
<tr>
<td><strong>Macro Environment in Uganda</strong></td>
</tr>
<tr>
<td>Social Environment</td>
</tr>
<tr>
<td>Political Environment</td>
</tr>
<tr>
<td>Economic Environment</td>
</tr>
<tr>
<td>Biomass &amp; Biogas Situation</td>
</tr>
<tr>
<td>Funding &amp; Regulatory Framework</td>
</tr>
<tr>
<td>Case Examples</td>
</tr>
</tbody>
</table>

January 2017 | © Awamu Biomass Energy
## Social Environment

### Population Demographic

<table>
<thead>
<tr>
<th>Population Demographic</th>
<th>Uganda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population (2014)</td>
<td>34,634,650</td>
</tr>
<tr>
<td>Population Growth Rate (CAGR)</td>
<td>3.0%</td>
</tr>
<tr>
<td>Rural/Urban Split (%)</td>
<td>79% / 21%</td>
</tr>
<tr>
<td>Rural Population (2014)</td>
<td>27,208,786</td>
</tr>
<tr>
<td>Average Household Size</td>
<td>4.7</td>
</tr>
<tr>
<td>Literacy – Total (%)</td>
<td>72%</td>
</tr>
<tr>
<td>Literacy – Female (%)</td>
<td>68%</td>
</tr>
<tr>
<td>Life Expectancy (years)</td>
<td>63.3</td>
</tr>
<tr>
<td>Population below poverty line</td>
<td>19.7%</td>
</tr>
</tbody>
</table>

### Context
- Former British colony which gained independence in 1962
- This was followed by a long period of political unrest into Yoweri Museveni came to power in 1986.
- Languages: English (Official), Luganda, other Niger-Congo languages, Nilo-Saharan languages, Swahili, Arabic
- Roman Catholic 39.3%, Protestant 32% Muslim 11.1%, other 1.4%, none 0.2% (2014 census)

### Implications
- *High population growth rates and increasing urbanisation are driving up fuel prices*
Political Environment

Working with the Government
- Several government policies address issues related to the bioenergy use.
- Uganda is a relatively easy place to do business by sub-Saharan Africa standards, though challenging by international norms.

Administrative Map
- Kampala is the capital city
- Uganda is divided into 112 districts across 4 administrative zones.
- Each district is further divided into sub-districts, counties, sub-counties, parishes and villages.

Current Government
- President Yoweri Kaguta Museveni has been in power since 26 January 1986.
- Vice President - Edward Ssekandi, Prime Minister – Ruhakana Rugunda.

Political Structure
- Parliamentary Democracy
- The president is both chief of state and head of government. The cabinet is appointed by the president from among elected legislators.
- The president is reelected by popular vote for a five-year term; election we held on 18 February 2016

-Implications-
Biomass energy programs should seek support from the government. Private sector involvement is encouraged.
Uganda has substantial natural resources. Agriculture is the most important sector of the economy, employing over 70% of the work force. The global economic downturn has hurt Uganda’s exports; however, Uganda’s GDP growth is still relatively strong.

<table>
<thead>
<tr>
<th>Key Economic Indicators</th>
<th>($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP (2013 Est)</td>
<td>$22.6 Billion</td>
</tr>
<tr>
<td>GDP Per Capita (PPP) (2016)</td>
<td>$2,071</td>
</tr>
<tr>
<td>GDP Growth Rate (2013)</td>
<td>5.6%</td>
</tr>
<tr>
<td>Inflation Rate (2016 est.)</td>
<td>4.6%</td>
</tr>
<tr>
<td>Youth Unemployment</td>
<td>62%</td>
</tr>
<tr>
<td>Household income by percentage share – Lowest 10%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Household income by percentage share – Highest 10%</td>
<td>36.1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Economic Indicators</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>$3.156 billion (2013 est.): coffee, fish and fish products, tea, cotton, flowers, horticultural products; gold</td>
</tr>
<tr>
<td></td>
<td>Major markets: Kenya, Rwanda &amp; UAE</td>
</tr>
<tr>
<td>Imports</td>
<td>$4.858 billion (2013 est.): capital equipment, vehicles, petroleum, medical supplies; cereals</td>
</tr>
<tr>
<td></td>
<td>Major suppliers: Kenya, UAE, China, India,</td>
</tr>
<tr>
<td>GDP composition</td>
<td>Agriculture: 23.1%, Industry: 26.9% and Services: 50% (2013 est.)</td>
</tr>
</tbody>
</table>

Sources: World Bank, CIA World fact book

-Implies-

Rising incomes for some plus rising fuel prices mean more households are potentially in the market for improved stoves
Bioenergy Situation

• 96% use Firewood or Charcoal for cooking

• Biogas usage <1% (mainly for cooking)

• Biogas mainly from animal waste

• Agricultural waste ~ 3%
Bioenergy Sources

• Tree biomass - 51%
• Bushes – 21%
• Farm vegetal waste – 12%
• Papyrus & Reeds – 9%
• Agro processing waste – 3%
• Grass, Forbs – 2%
Bioenergy Consumption

• Firewood - 44 million tons

• Vegetal waste briquettes (maize cobs, coffee husks, Ground nut shells, Rice husks, Sun Flower, Palm shells) – 9 million tons

• Municipal waste – 360,000 tons produced annually
Bioenergy Demand

- The households utilize 74% of delivered energy
- The industrial sector utilizes 18%
- The commercial sector takes at least 5%
- Institutions utilize 3%
Biogas situation

- Biogas systems in Uganda since 1980s
- 7,000+ operating domestic biogas
- Household sizes range from 3 to 12 m³
- Institutional plants range from 20 to 200 m³
Common Biogas Digesters

• Camartec fixed dome design ~80% (e.g. promoted under the UDBP)

• Floating drum system ~10%

• Horizontal tube/balloon system ~6%

• Bio-latrines ~4%
Funding Sources

Biogas
• NGOs ~72%
• Individual ~26%
• Government ~2%

Biomass
• Individual ~84%
• NGOs ~12%
• Government ~4%
Key Issues

- **Awareness**: Inadequate awareness of the availability of appropriate technologies to harness the biomass.

- **Priority**: Despite the economic importance and significance as a major fuel, bioenergy has received little recognition in terms of prioritization and funding.

- **Funding**: High upfront cost is a critical barrier to adaptation of improved biomass technologies.
Budget Allocations

• Biomass technology is one of the least funded among the energy sector in Uganda

• In addition to limited funding, biomass project underperform mainly due to bureaucracy

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>11/12</th>
<th>12/13</th>
<th>13/14</th>
<th>14/15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved development budget</td>
<td>1,325</td>
<td>1,547</td>
<td>1,335</td>
<td>1,768</td>
</tr>
<tr>
<td>Average project Funding</td>
<td>76.88</td>
<td>67.8</td>
<td>68.6</td>
<td>75.9</td>
</tr>
<tr>
<td>Biomass technology</td>
<td>0.2</td>
<td>1</td>
<td>1</td>
<td>3.93</td>
</tr>
<tr>
<td>% of Social Sector</td>
<td>0.01</td>
<td>0.06</td>
<td>0.07</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Source: Approved Budget Estimates FY 2011/12-14/15

MOFPED
Regulatory Framework

• Regulatory framework of the biomass sector is scattered amongst various government agencies, lacks cohesion and clear mandates

• Historically, the concern of the forestry sector was sustainable supply of timber

• Research, production, marketing, and utilisation of biomass is spread among so many institutions without a coordination mechanism

• Legislation targets specific components of a sector rather than having a multi-sectoral and comprehensive approach

• Many good policies but poorly implemented
Supportive Legal & Regulatory Framework for Bioenergy

- Biofuels Bill
- National Biomass Energy Strategy (BEST), 2014
- Sector Strategic Investment Plan (2015)
- National Development Plan Phase II
Contents

- Introductions
- About Uganda
- Macro Environment in Uganda
  - Social Environment
  - Political Environment
  - Economic Environment
- Biomass & Biogas Situation
- Funding & Regulatory Framework
- Case Examples
Examples

Un-Carbonized Briquettes

• 2 main companies

• Capacity of 60 Tons/ day

• Utilize Coffee & Rice husks, Sawdust, Ground nut shells, wastes from Cereals etc.
Examples

Carbonized Briquettes

• Many small (Cottage) producers

• Relay heavily on charcoal dust

• No proper documentation on production procedures
Examples

Biogas
Examples

OTHER Bioenergy efforts

- Pellets (only two known), otherwise chicken feed.
- Wood chips (mainly as research projects)
Thank you...

Nolbert Muhumuza

P: +256-776-346724
muhumuza@gmail.com
www.awamu.ug