Validation Workshop on the ECOWAS Bioenergy Policy:

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Bioelectricity production and prospects for Africa

Dr Smail Khennas  
Senior energy and climate change expert  
Smail_khennas@yahoo.fr
Summary:

- Importance of bioelectricity
- Environmental impact
- Feedstocks
- Technologies
- Costs
- Policy options to promote bioelectricity
Importance of bioelectricity:

- Globally, an estimated **72 GW** of biomass power capacity was in operation at the end of 2011, a **9 percent increase from 2010**.
- In 2011, the **electric power sector** produced 51 percent of biopower capacity and 49 percent of biopower generation while **commercial** and **industrial** sectors made up the remaining percentage.[5]

Environmental impact

- If grown in a **sustainable manner**, biomass is **carbon-neutral** energy source: greenhouse gas (GHG) emissions, from converting biomass to energy are equivalent to the amount of CO2 absorbed by the biomass plants during their growing cycles. If coupled with future **carbon capture and storage** (CCS) technology biopower could be a **net carbon-negative energy source** by removing carbon from the atmosphere.[12]

- According to IEA: biopower produced through gasification with carbon capture and storage (BECCS): GHG emission reductions of more than **6.5 gigatons (Gt) per year by 2050**.
Life cycle GHG emissions of electricity generation technologies (gCO2eq/kWh)

<table>
<thead>
<tr>
<th></th>
<th>Lowest (25%)</th>
<th>AVERAGE</th>
<th>Highest (25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>883</td>
<td>1001</td>
<td>1141</td>
</tr>
<tr>
<td>Natural gas</td>
<td>427</td>
<td>477</td>
<td>543</td>
</tr>
<tr>
<td>Biopower</td>
<td>-3</td>
<td>52</td>
<td>69</td>
</tr>
</tbody>
</table>

About 20 times less emissions than coal and 10 times than natural gas

Source: Avoided GHG are primarily from using methane from landfill and biomass wastes NREL 2012
Feedstocks, technology and costs

**Feedstocks:**

- Large range of feedstocks including co-firing (fossil fuels and biomass). Greatest potential lies in the **sugar cane and wood processing industries**, as the feedstock is readily available at low cost and the process heat needs are onsite.
- In Africa, **bagasse and biogas** are the main feedstocks for electricity generation. In Europe and North America: feedstocks from wood industries.
Feedstocks, technology and costs

Bagasse and biogas

- woodgas
- wood
- landfill gas
- sewage gas
- liquid fuel
- biogas
- bagasse
- biomass

MW

Europe, North America, Africa, China, India, Rest Asia/Oceania, Brazil, Rest South America, Rest world
Feedstocks for electricity generation and Africa
Examples of bio-electricity power plants in Africa (apart from bagasse)

- 11 wood based power plants, with a total installed capacity of almost 30 MW, in Ghana, Congo, Ethiopia, Tanzania, Namibia and Swaziland, several new plants planned or under construction (Platts McGraw Hill Financial, 2015).

- In South Africa, the Durban municipality has implemented a landfill gas-to-electricity project with an installed power generation capacity of 7.5 MW (IEA, 2014b).

- Several biogas-generation projects initiated in Kenya, such as producing off-grid electricity from biogas generated by manure utilizing slaughterhouse waste to produce biogas for electricity production; also 20 kW of electricity from vegetable waste (IRENA, forthcoming b).
<table>
<thead>
<tr>
<th>Technology</th>
<th>Investment costs (US$/kW)</th>
<th>LCOE (US$/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler combustion</td>
<td>1880-4260</td>
<td>0.06-0.21</td>
</tr>
<tr>
<td>CHP (cogeneration)</td>
<td>2170-4500</td>
<td>0.07-0.21</td>
</tr>
<tr>
<td>Landfill gas (MW)</td>
<td>1917-2436</td>
<td>0.09-0.12</td>
</tr>
<tr>
<td>Co-firing</td>
<td>140-850</td>
<td>0.04-0.13</td>
</tr>
<tr>
<td>Digesters</td>
<td>2574-6104</td>
<td>0.06-0.15</td>
</tr>
</tbody>
</table>
LCOE
Assessing mature technologies for Africa

Landfill gas and digesters are proven technologies, but can be limited in scale by feedstock availability

• Largescale plants using municipal solid waste (MSW), agricultural waste and industrial organic wastes: 8 000 to 9 000 tonnes of MSW/MW/year.

• Biogas is readily used as a fuel in power or combined heat and power units

• potential to be used as a substitute for natural gas after appropriate cleaning and upgrading (IEA Bioenergy, 2011)
Policy options to promote Bio-electricity

- Bio-energy policy framework and specific focus on bioelectricity
- **Market and regulatory barriers**: removing investment uncertainty for private sector, reduce gap between policy and incentive programmes
- **Loan guarantees**: funding large projects become more feasible, relieve project developers from a degree of risk
- **Fiscal incentives**: VAT, import duties, tax exemption for a certain number of years (typically 5)
- **Price on carbon emissions**: fossil fuel power plants face no direct financial consequences for CO₂ emissions.
Policy options to promote Bio-electricity

- **Renewable portfolio schemes**: ensuring inclusion of biopower as a renewable energy source and setting targets (mandatory??)
- **Certifiable standards for bioelectricity production**: An independently certifiable standard: focus on supply chain and feedstock production. A certification system would monitor and guarantee biomass is sustainable by addressing undesirable LUC, pollution, etc.
- **Government funding or financial incentives for RD&D** can advance biopower technology adaptation to the African context.
Thank you for your attention
Merci pour votre attention

smail_khennas@yahoo.fr