Food, Energy, Water, Climate Nexus: Potential in Cameroon

Akom, Emmanuel

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Food, Energy, Water, Climate Nexus: Potential in Cameroon

Emmanuel Ackom, PhD
GNESD
UNEP Risø Centre
DTU Management Engineering

Nexus 2014 - Water, Food, Climate and Energy Conference
Outline of today's presentation

Background on the GNESD Network (facilitated by UNEP)

Food, Energy, Water, Climate Nexus: Potential in Cameroon

- Food production
- Bioelectricity production potential from agricultural residues (20% use)
- Water savings (potential) relative to the use of crude oil electricity
- GHG emissions reduction potential relative to the use of crude oil electricity
- Concluding comments
- Acknowledging our donors/sponsors
What is GNESD?

GNESD:

launched at the World Summit on Sustainable Development (2002)

is a global knowledge network involving 10 Centres of Excellence and Network Partners.
Objectives of GNESD:

Knowledge network

Policy analysis on environmentally benign energy systems and services that:

- can help achieve Millennium Development Goals
- are not harmful to human health;
- do not conflict with our food supply;
- result in poverty alleviation and
- achieving sustainable development in member countries
Centres of Excellence from developing countries

- Energy Research Centre, Univ. of Cape Town, (South Africa)
- AFREPREN (Kenya)
- ENDA-TM (Senegal)
- Mediterranean Renewable Energy Centre MEDREC (Tunisia)
- Asian Institute of Technology (Thailand)
- TERI (India)
- Energy Research Institute (China)
- Fundación Bariloche (Argentina)
- CENBIO/Univ. of São Paulo & CENTROCLIMA/Fed. Univ. of Rio de Janeiro (Brazil)
- Molina Centre on Energy and Environment, Mexico
How GNESD works ... 

- Network Centres cooperate through activity based working groups
- Multi-regional (or country) efforts and cross learning
- Annual assemblies, teleconferences etc
- A steering committee provides strategic direction and oversight
- Management structure
- UNEP affiliated secretariat based in Denmark
Selected Summary for Policy Makers (SPM) Publications: download (free) at www.gnesd.org
Selected SPM Publications: download (free) at www.gnesd.org
Modern bioenergy from agricultural and forestry residues in Cameroon: Potential, challenges and the way forward

Emmanuel K. Ackom a,⁎, Dieudonne Alemagi b,1, Nana B. Ackom c,2, Peter A. Minang d,3, Zac Tchoundjeu e,4

⁎ Global Network on Energy for Sustainable Development (GNESD), UNEP Risø Centre on Energy, Climate and Sustainable Development, Frederiksborgvej, 399, Department of Management Engineering, Technical University Denmark, 4000 Roskilde, Denmark
1 World Agroforestry Centre Regional Office, PO Box 16317, Yaoundé, Cameroon
2 Faculty of Engineering Sciences, University of Ghana, PO Box LG25, Legon, Ghana
3 World Agroforestry Centre, PO Box 30677, Nairobi 00100, Kenya
4 World Agroforestry Centre Regional Office, PO Box 16317, Yaoundé, Cameroon

HIGHLIGHTS
- Environmentally benign residues amount to 1.11 × 10⁶ bone dry tonnes per annum.
- 0.12–0.32 billion litres of bio ethanol annually to displace 18–48% national gasoline use.
- 0.08–0.22 billion litres of biomass to BTL diesel per year to offset 17–45% of diesel use.
- 0.76–2.02 TW h of electricity, representing 15–38% of Cameroon’s consumption.
- Residues could offset only 3% of national consumption of traditional biomass.
Food, Energy, Water, Climate Nexus: Potential in Cameroon

- Food production
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Cameroon:

- Total area of 475 440 km\(^2\)
- 3 times the size of North Carolina
- 1/21 times size of USA

Map source: www.cigarinspector.com
Cameroon: Electricity Access = 48.7 % population
(in)accessibility = 51.3 % population

Source: IEA, 2009
Current Electricity Generation:

- Thermal electricity: 29.3%
- Hydroelectricity: 70.7%

Total: 1016 MW
<table>
<thead>
<tr>
<th>Unit</th>
<th>Production (tons)</th>
<th>Residue type</th>
<th>Residue to product ratio (RPR)</th>
<th>Moisture content (%)</th>
<th>Lower heating Value (MJ/kg)</th>
<th>Residue (wet tons)</th>
<th>Residue (bone dry tons)</th>
<th>Residue 20% sustainable extraction (bone dry tons)</th>
<th>Energy Potential (GJ)</th>
<th>15% MW h (Low)</th>
<th>40% MW h (High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>1.67E+06</td>
<td>Stalk</td>
<td>1.5</td>
<td>15</td>
<td>15.48</td>
<td>2.51E+06</td>
<td>2.13E+06</td>
<td>4.27E+05</td>
<td>6.61E+06</td>
<td>2.78E+05</td>
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<tr>
<td>Sorghum</td>
<td>9.00E+05</td>
<td>Stalk</td>
<td>2.62</td>
<td>15</td>
<td>17.00</td>
<td>2.36E+06</td>
<td>2.00E+06</td>
<td>4.01E+05</td>
<td>6.81E+06</td>
<td>2.86E+05</td>
<td>7.63E+05</td>
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<tr>
<td>Rice</td>
<td>1.75E+05</td>
<td>Straw</td>
<td>1.5</td>
<td>15</td>
<td>15.56</td>
<td>2.62E+05</td>
<td>2.23E+05</td>
<td>4.46E+04</td>
<td>6.94E+05</td>
<td>2.91E+04</td>
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<tr>
<td>Millet</td>
<td>5.53E+04</td>
<td>Stalk</td>
<td>3</td>
<td>15</td>
<td>15.51</td>
<td>1.66E+05</td>
<td>1.41E+05</td>
<td>2.82E+04</td>
<td>4.37E+05</td>
<td>1.84E+04</td>
<td>4.90E+04</td>
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<td>Wheat</td>
<td>9.00E+02</td>
<td>Straw</td>
<td>1.2</td>
<td>15</td>
<td>15.60</td>
<td>1.08E+03</td>
<td>9.18E+02</td>
<td>1.84E+02</td>
<td>2.86E+03</td>
<td>1.20E+02</td>
<td>3.21E+02</td>
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<tr>
<td>Sugarcane</td>
<td>1.45E+06</td>
<td>Bagasse</td>
<td>0.3</td>
<td>75</td>
<td>13.38</td>
<td>4.35E+05</td>
<td>1.09E+05</td>
<td>2.18E+04</td>
<td>2.91E+05</td>
<td>1.22E+04</td>
<td>3.26E+04</td>
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<tr>
<td>Cocoa</td>
<td>2.64E+05</td>
<td>Pods</td>
<td>1</td>
<td>15</td>
<td>15.48</td>
<td>2.64E+05</td>
<td>2.24E+05</td>
<td>4.49E+04</td>
<td>6.95E+05</td>
<td>2.92E+04</td>
<td>7.78E+04</td>
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<tr>
<td>Coconut</td>
<td>5.00E+03</td>
<td>Shell</td>
<td>0.6</td>
<td>10</td>
<td>10.61</td>
<td>3.00E+03</td>
<td>2.70E+03</td>
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<td>5.73E+03</td>
<td>2.41E+02</td>
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<td>Coffee</td>
<td>6.66E+04</td>
<td>Husk</td>
<td>2.1</td>
<td>15</td>
<td>12.56</td>
<td>1.40E+05</td>
<td>1.19E+05</td>
<td>2.38E+04</td>
<td>2.99E+05</td>
<td>1.25E+04</td>
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<td>Sub-total</td>
<td>4.59E+06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9.92E+05</td>
<td></td>
<td></td>
<td>6.66E+05</td>
<td>1.78E+06</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Agricultural crop production based on year 2010 statistics information (FAOSTAT, 2012).

\(^c\) Residue to product ratio (RPR) was based on published information (OECD/IEA, 2010), except for industrial roundwood RPR.

\(^e\) Lower heating values were based on published information (NREL, 2008), except for wheat, industrial roundwood and sawnwood.

\(^f\) Lower heating values on wheat were based on published information (Maas et al., 2008).

\(^h\) Decentralized bioelectricity generation method, based on Mendu et al., 2012.

Source: Ackom, et al., 2013 (with modifications)
Energy potential (bioelectricity) from residues:

- **Best case:**
  33% of national electricity consumption

- **Least case:**
  13% of national electricity consumption

- Residues could essentially power most farming communities at decentralized power system scales
GHG emission reduction potential (bioelectricity) from residues - (reference to crude oil powered electricity)

- **Best case:**
  
  \[1.7 \text{ Mt CO}_2\]

- **Least case:**
  
  \[0.6 \text{ Mt CO}_2\]
Water: Estimated 2 to 8 billion litres/year potential savings

![Graph showing water savings](source: www.ewb-dc.org)

Source: Ackom, 2014
Conclusion

- **Bioelectricity from agricultural residues exhibit good food-energy-water-climate nexus**

- **Extending electricity access should not always be about long transmission lines but decentralized systems could play key roles especially in rural farming areas**

- **The knowledge could possibly help inform decision makers regarding the good potential of residues for social and environmentally benign development**
Acknowledgement – donor gov'ts/organizations

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THANK YOU

Emmanuel Ackom, Programme Manager, UNEP Riso Centre
Email: emac@dtu.dk