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

Ackom, Emmanuel

Publication date:
2014

Document Version
Peer reviewed version

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
7th March, 2014, Chapel Hill, North Carolina.

UNEP

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

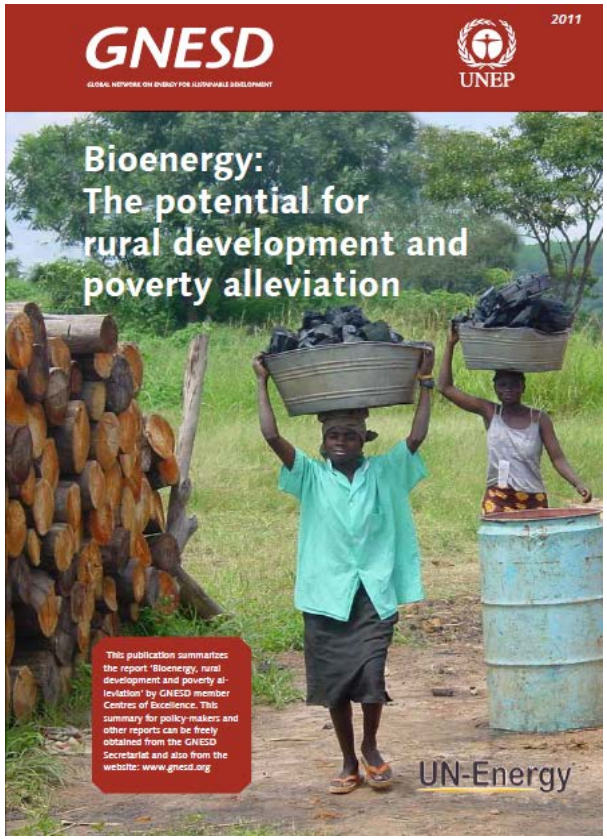
GNESD

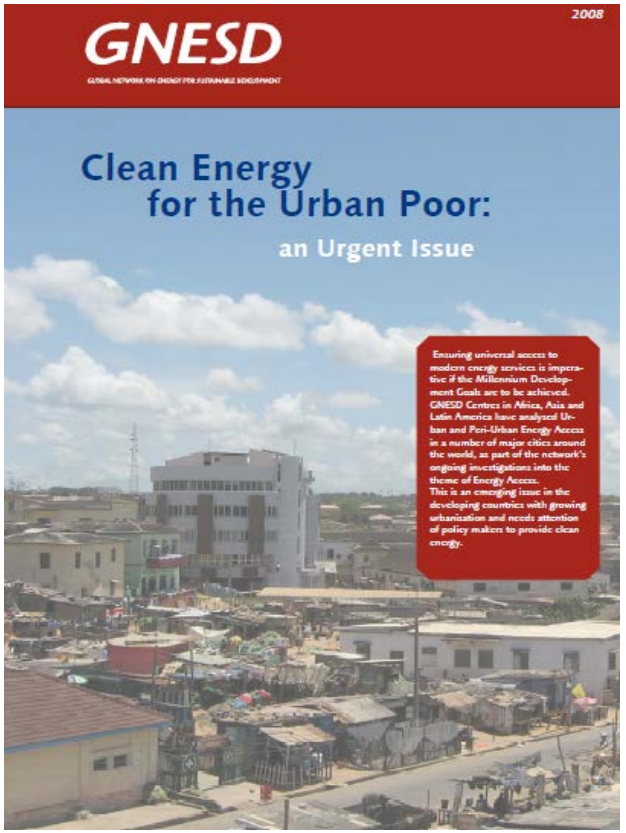
GLOBAL NETWORK ON ENERGY FOR SUSTAINABLE DEVELOPMENT

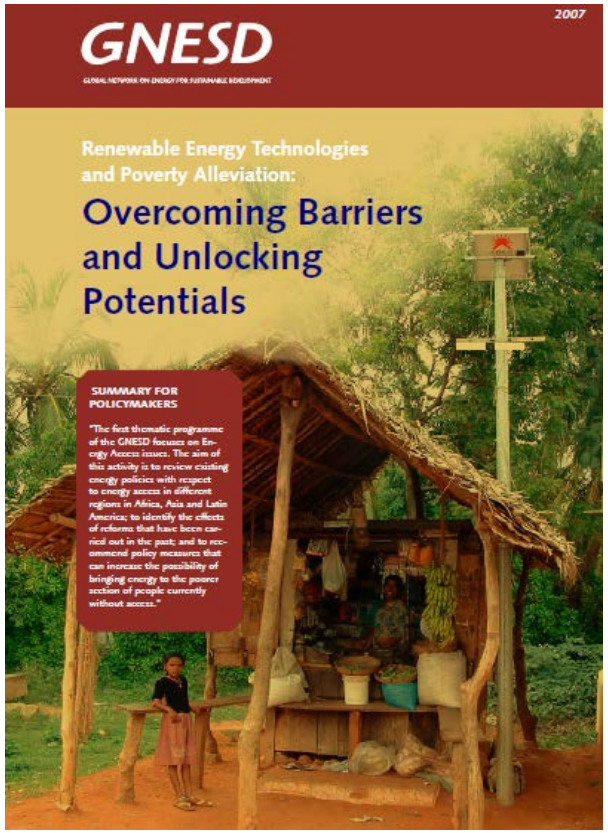
Facilitated by UNEP

UNEP RISØ CENTRE

Selected Summary for Policy Makers (SPM) Publications: download (free) at www.gnesd.org







UNEP

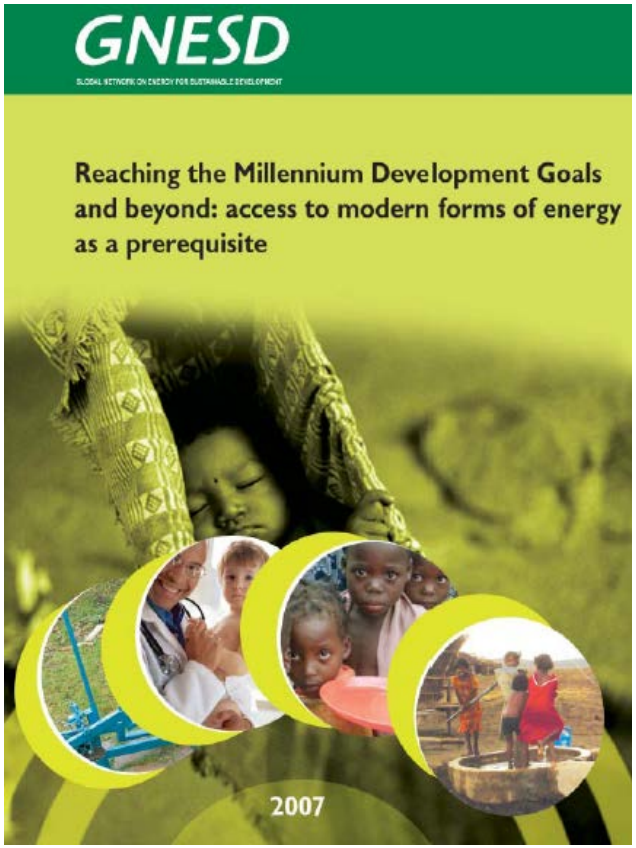
GNESD

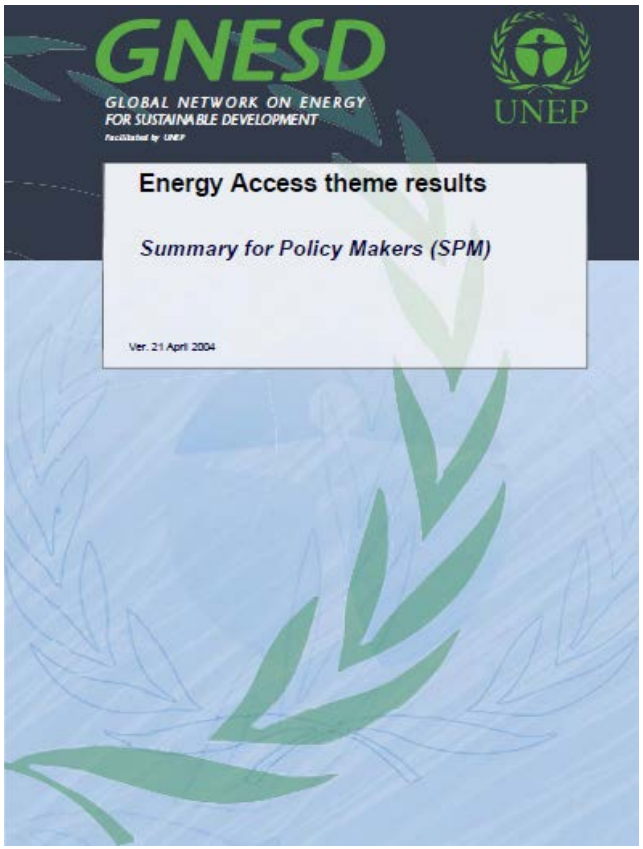
GLOBAL NETWORK ON ENERGY FOR SUSTAINABLE DEVELOPMENT

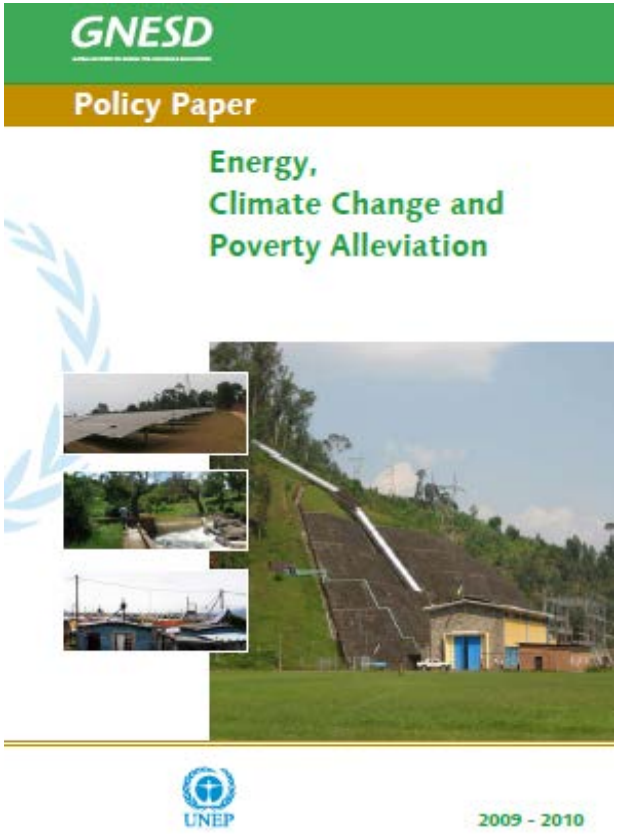
Facilitated by UNEP

UNEP RISØ CENTRE

Selected SPM Publications: download (free) at www.gnesd.org







UNEP

Publication (contd.):

Energy Policy 63 (2013) 101–113

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

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]

[a] 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
[b] World Agroforestry Centre Regional Office, PO Box 16317, Yaoundé, Cameroon
[c] Faculty of Engineering Sciences, University of Ghana, PO Box LG25, Legon, Ghana
[d] World Agroforestry Centre, PO Box 30677, Nairobi 00100, Kenya
[e] World Agroforestry Centre Regional Office, PO Box 16317, Yaoundé, Cameroon

HIGHLIGHTS

- Environmentally benign residues amount to 1.11×10^6 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
- 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

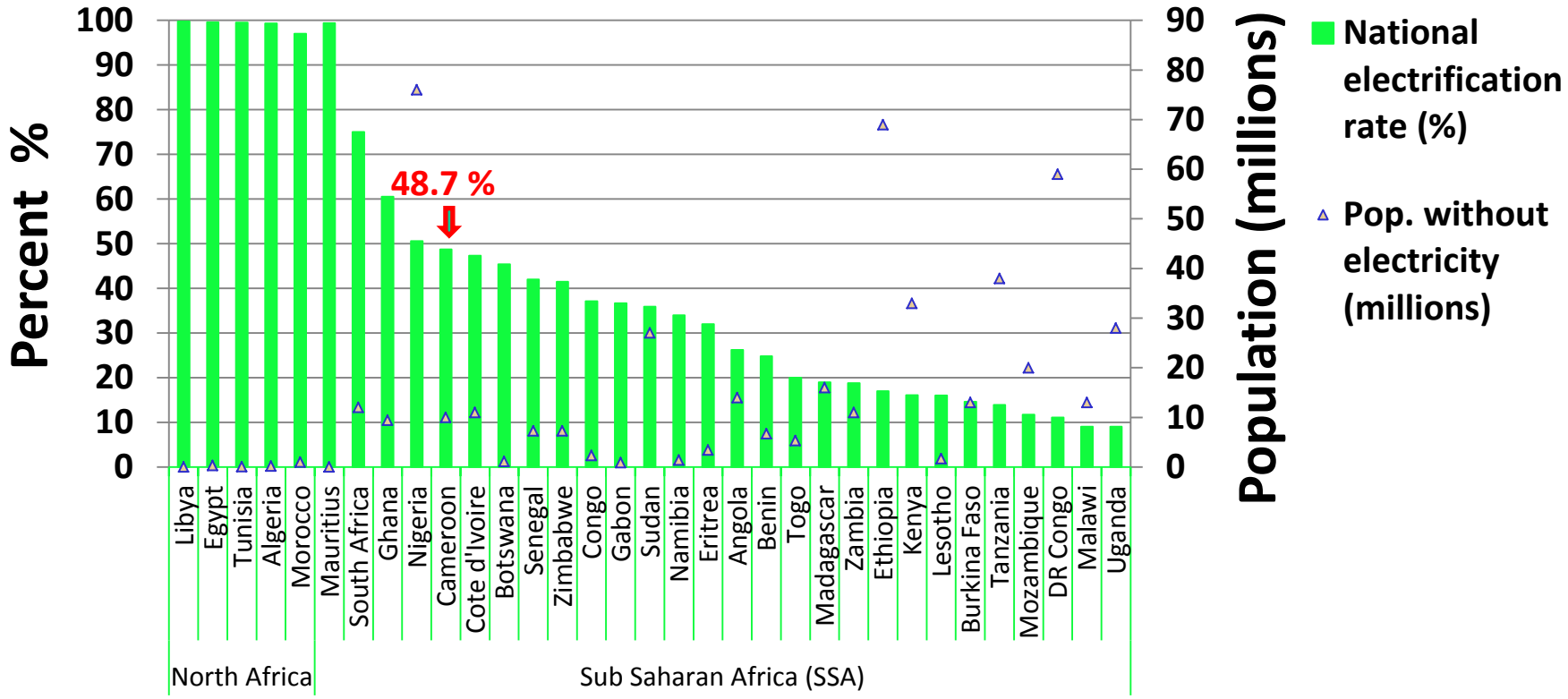
Cameroon:

Map source: www.cigarinspector.com

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

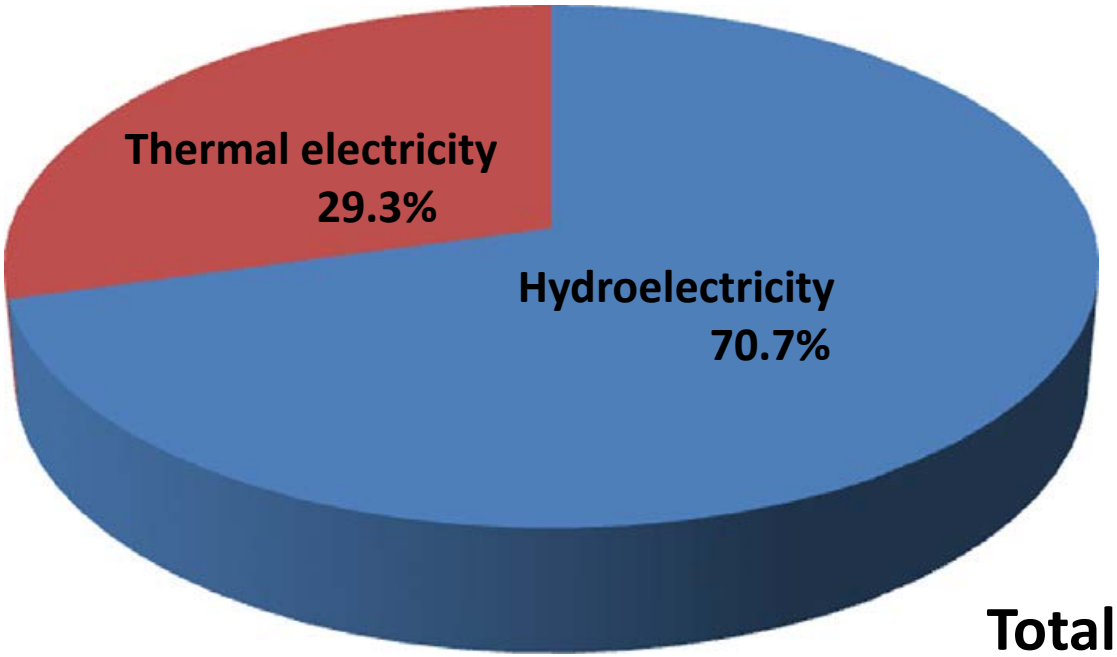
UNEP

Cameroon: Electricity Access = 48.7 % population
(in)accessibility = 51.3% population



Source: IEA, 2009

Current Electricity Generation:



Total: 1016 MW

[a]Agricultural crop residues	Production	Residue type	[c]Residue to product ratio (RPR)	Moisture content	[e]Lower heating Value	Residue	Residue	Residue. 20% sustainable extraction	Energy Potential (bone dry tons X MJ/kg)	[h]MW h, (GJ × 0.28 × efficiency)	
										15% efficiency	40% efficiency
Units	(tons)	n/a	n/a	(%)	(MJ/kg)	(wet tons)	(bone dry tons)	(bone dry tons)	GJ	MW h (Low)	MW h (High)
Maize	1.67E+06	Stalk	1.5	15	15.48	2.51E+06	2.13E+06	4.27E+05	6.61E+06	2.78E+05	7.40E+05
Sorghum	9.00E+05	Stalk	2.62	15	17.00	2.36E+06	2.00E+06	4.01E+05	6.81E+06	2.86E+05	7.63E+05
Rice	1.75E+05	Straw	1.5	15	15.56	2.62E+05	2.23E+05	4.46E+04	6.94E+05	2.91E+04	7.77E+04
Millet	5.53E+04	Stalk	3	15	15.51	1.66E+05	1.41E+05	2.82E+04	4.37E+05	1.84E+04	4.90E+04
Wheat	9.00E+02	Straw	1.2	15	[f]15.60	1.08E+03	9.18E+02	1.84E+02	2.86E+03	1.20E+02	3.21E+02
Sugarcane	1.45E+06	Bagasse	0.3	75	13.38	4.35E+05	1.09E+05	2.18E+04	2.91E+05	1.22E+04	3.26E+04
Cocoa	2.64E+05	Pods, Husk	1	15	15.48	2.64E+05	2.24E+05	4.49E+04	6.95E+05	2.92E+04	7.78E+04
Coconut	5.00E+03	Shell	0.6	10	10.61	3.00E+03	2.70E+03	5.40E+02	5.73E+03	2.41E+02	6.42E+02
Coffee	6.66E+04	Husk	2.1	15	12.56	1.40E+05	1.19E+05	2.38E+04	2.99E+05	1.25E+04	3.34E+04
Sub-total	**4.59E+06**							**9.92E+05**		**6.66E+05**	**1.78E+06**

Food

Energy

[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)

UNEP

Energy potential (bioelectricity) from residues:

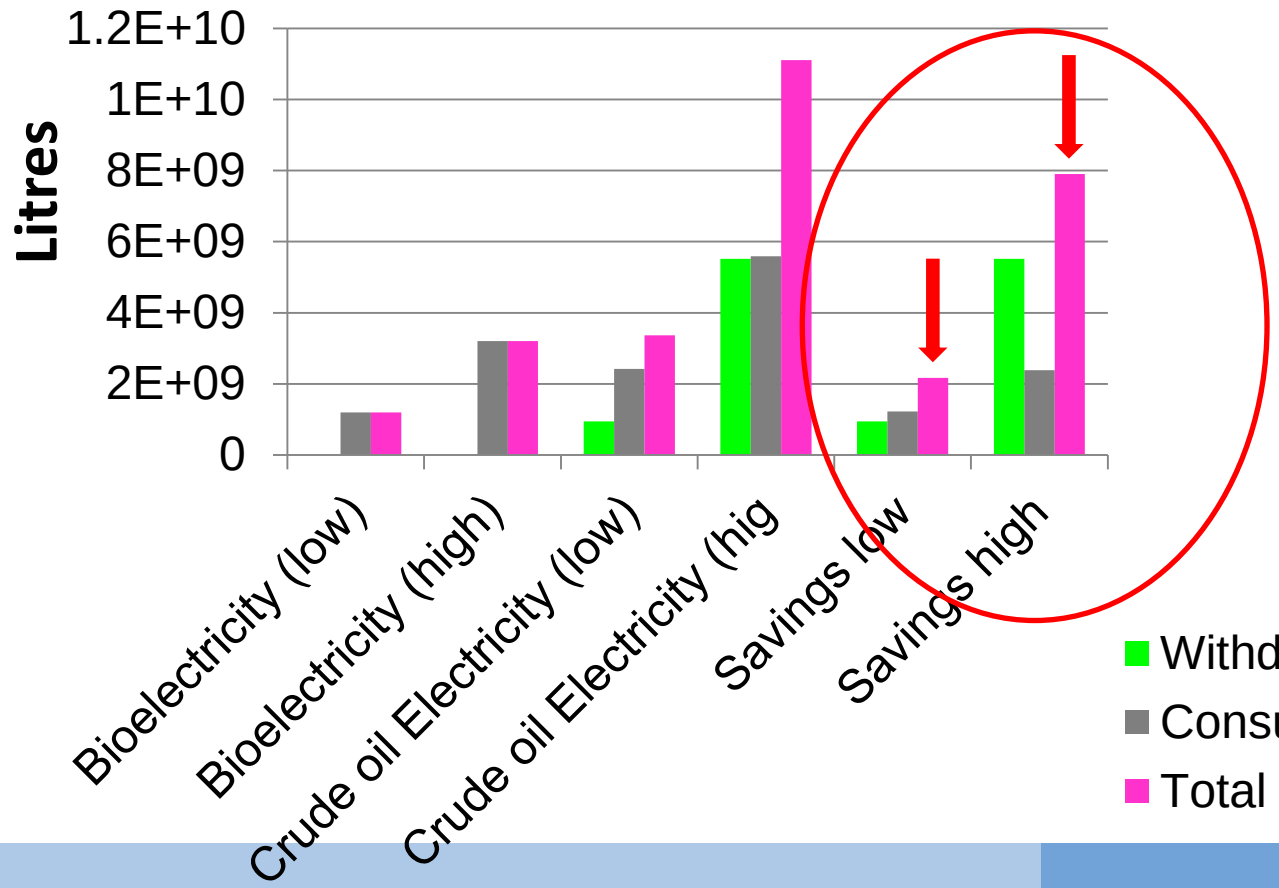
- Best case:
  33% of national electricity consumption
- Least case:
  13% of national electricity consumption
- Residues could essentially power most farming communities at decentralized power system scales

GHG emission reduction potential (bioelectricity) from residues - (reference to crude oil powered electricity)

- **Best case:**
  1.7 Mt CO_2

- **Least case:**
  0.6 Mt CO_2

Water: Estimated 2 to 8 billion litres/year potential 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 tranmission 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

GNESD secretariat wish to thank:

- Government of Germany;
- Government of Denmark;
- Government of France;
- Government of Italy;
- Government of the United Kingdom;
- UN Foundation;
- UNDP (supported Energy Access activities & outreach activities in the RET theme)
- UNEP

THANK YOU

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