

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

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GNESD

UNEP Risø Centre

DTU Management Engineering

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## ***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



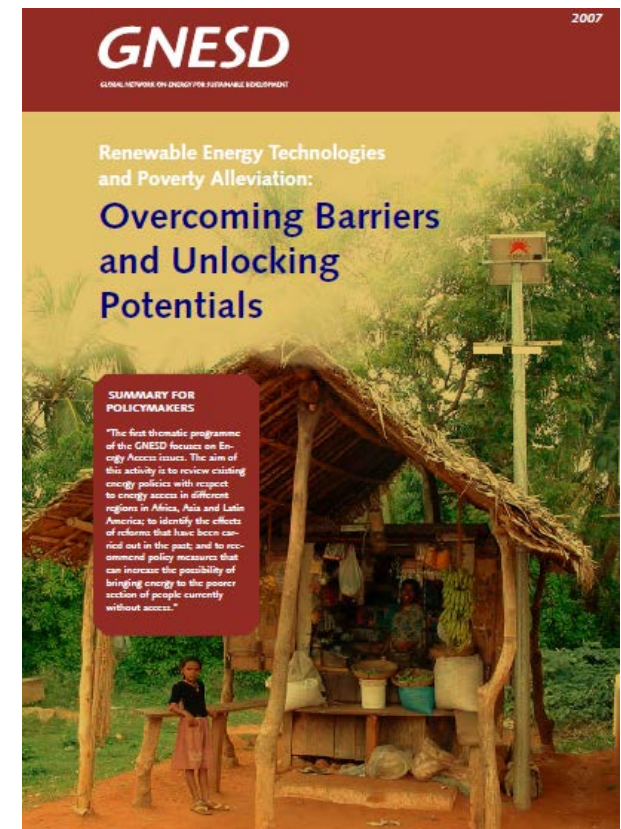
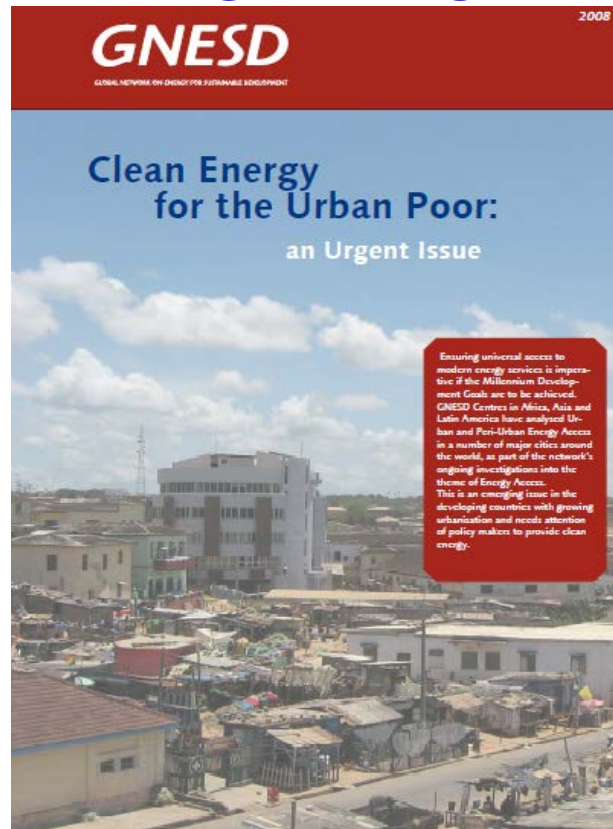
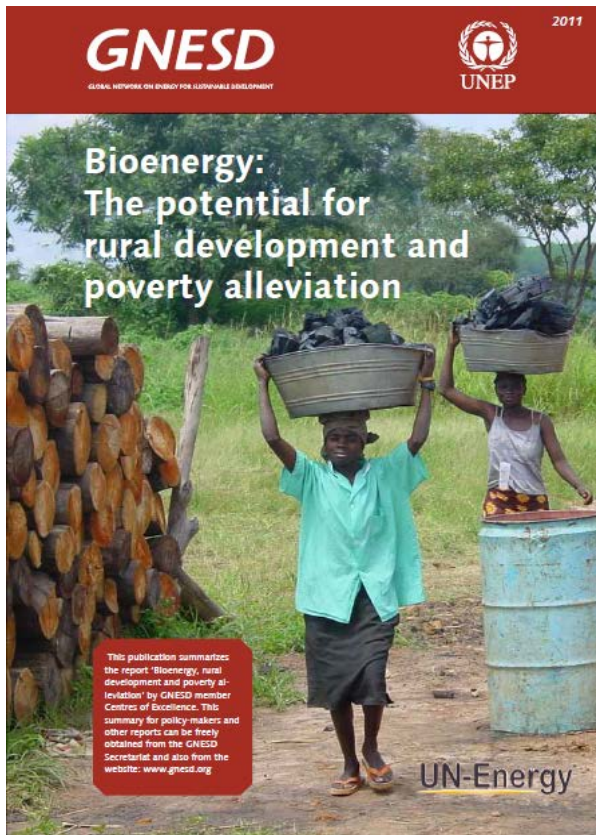
## How GNESD works ...

- 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

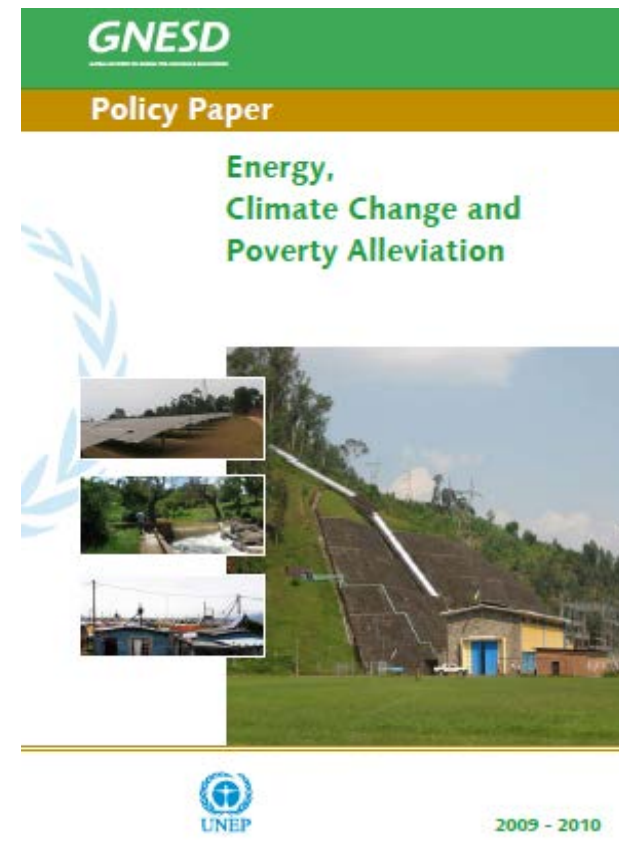
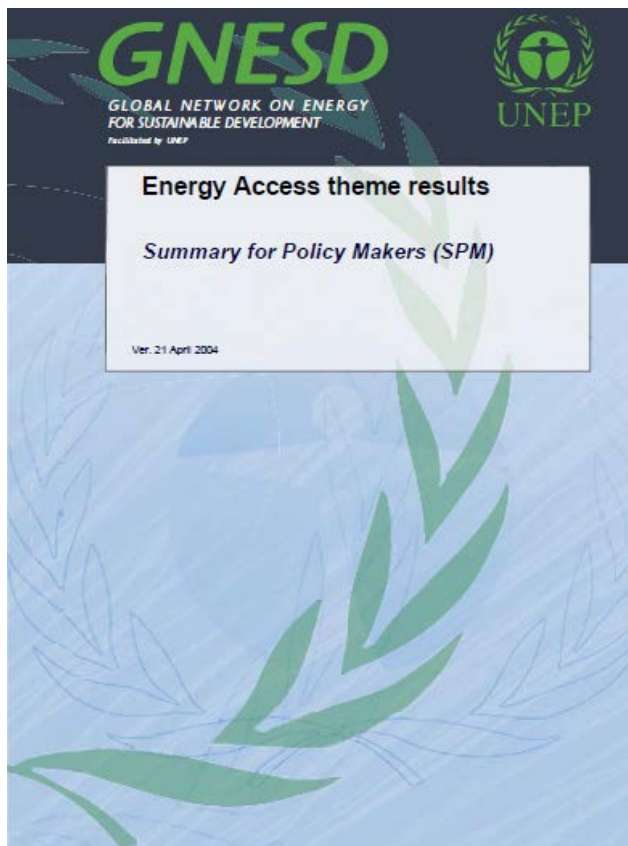
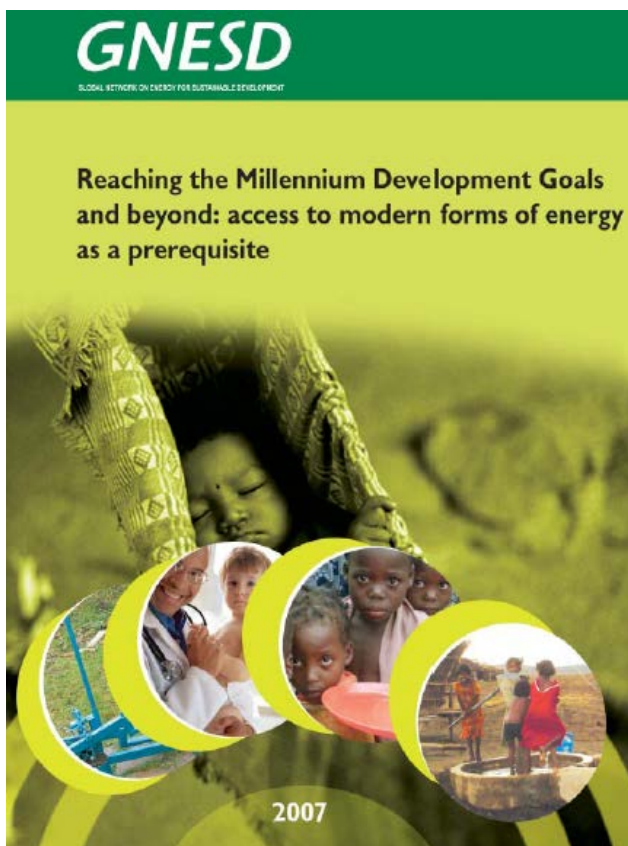




**Selected Summary for Policy Makers (SPM) Publications: download (free) at [www.gnesd.org](http://www.gnesd.org)**



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## Publication (contd.):

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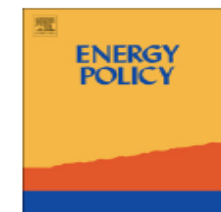


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### Energy Policy

journal homepage: [www.elsevier.com/locate/enpol](http://www.elsevier.com/locate/enpol)



## Modern bioenergy from agricultural and forestry residues in Cameroon: Potential, challenges and the way forward



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### HIGHLIGHTS

- Environmentally benign residues amount to  $1.11 \times 10^6$  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

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- GHG emissions reduction potential relative to the use of crude oil electricity
- Concluding comments



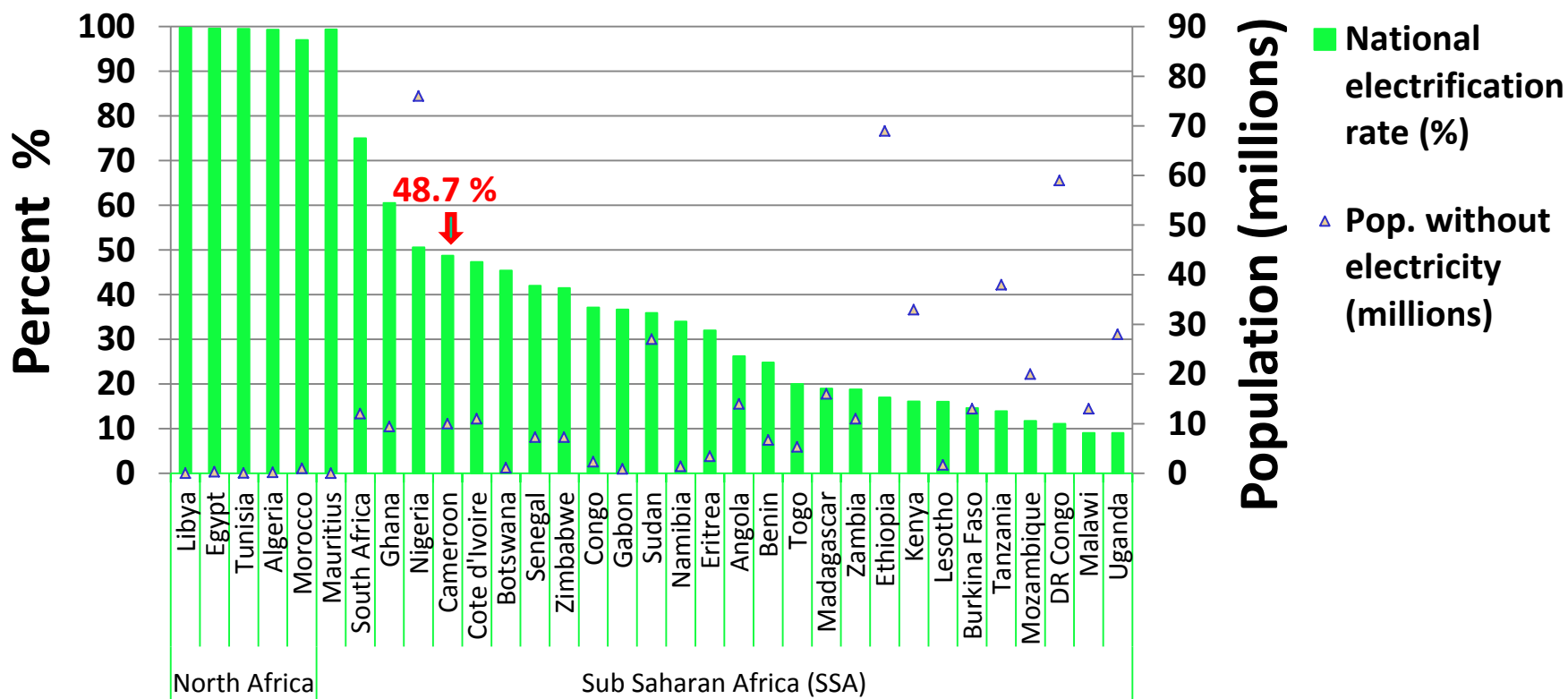
## Cameroon:



Map source: [www.cigarinspector.com](http://www.cigarinspector.com)

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

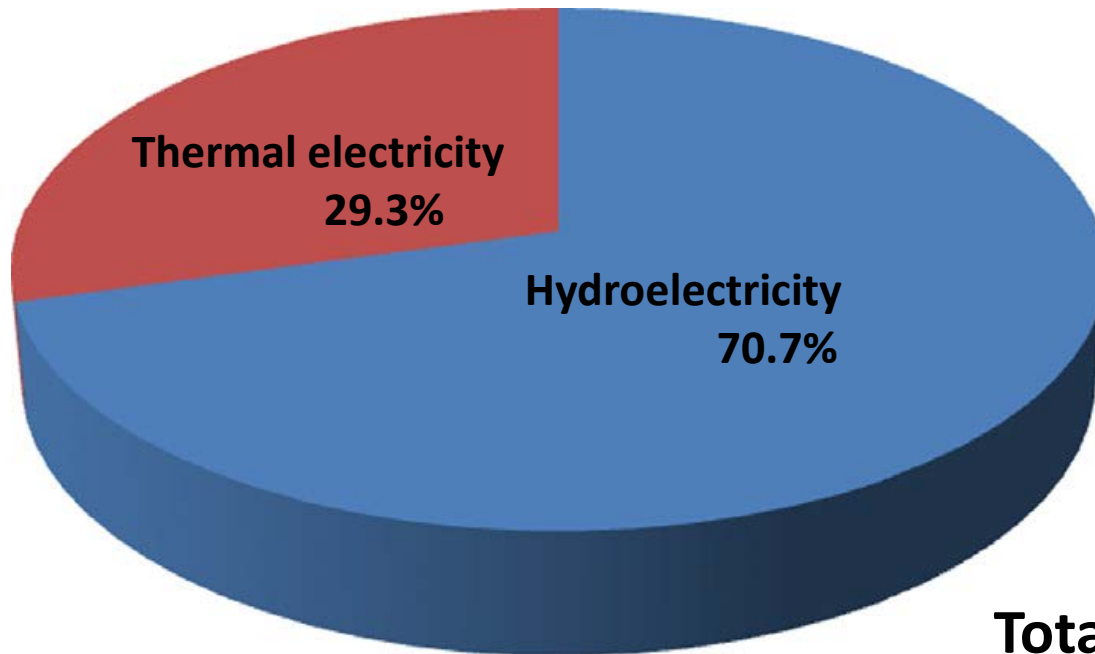
### Cameroon: Electricity Access = 48.7 % population (in)accessibility = 51.3% population



Source: IEA, 2009



## ***Current Electricity Generation:***



**Total: 1016 MW**





Agricultural crop residues	Production (tons)	Residue type	Residue to product ratio (RPR)	Moisture content (%)	Lower heating Value (MJ/kg)	Residue (wet tons)	Residue (bone dry tons)	Residue, 20% sustainable extraction (bone dry tons)	Energy Potential (bone dry tons X MJ/kg) GJ	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	<sup>f</sup> 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
<b>Sub-total</b>	<b>4.59E+06</b>							<b>9.92E+05</b>		<b>6.66E+05</b>	<b>1.78E+06</b>

Food

Energy

<sup>a</sup> Agricultural crop production based on year 2010 statistics information (FAOSTAT, 2012).

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

<sup>e</sup> Lower heating values were based on published information (NREL, 2008), except for wheat, industrial roundwood and sawnwood.

<sup>f</sup> Lower heating values on wheat were based on published information (Maas et al., 2008).

<sup>h</sup> Decentralized bioelectricity generation method, based on Mendu et al., 2012.



## ***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***



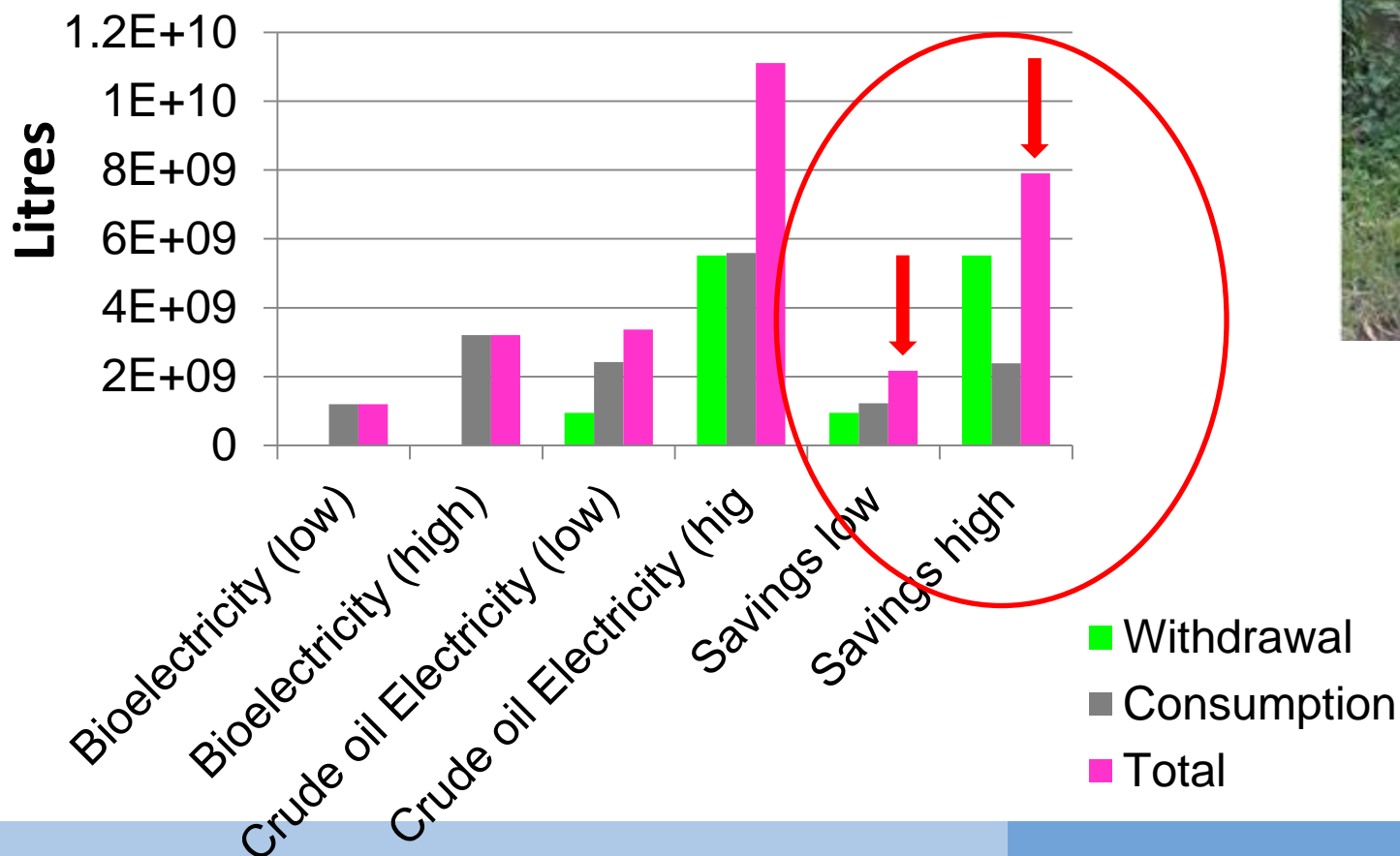


## ***GHG emission reduction potential (bioelectricity) from residues - (reference to crude oil powered electricity)***

- ***Best case:  
1.7 Mt CO<sub>2</sub>***
- ***Least case:  
0.6 Mt CO<sub>2</sub>***



## Water: Estimated 2 to 8 billion litres/year potential savings



Source: [www.ewb-dc.org](http://www.ewb-dc.org)

## **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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