CoER : Biofuels

Department of Microbiology • Faculty of Natural Sciences

Strategic partnerships to unlock the potential of bioenergy production in Africa

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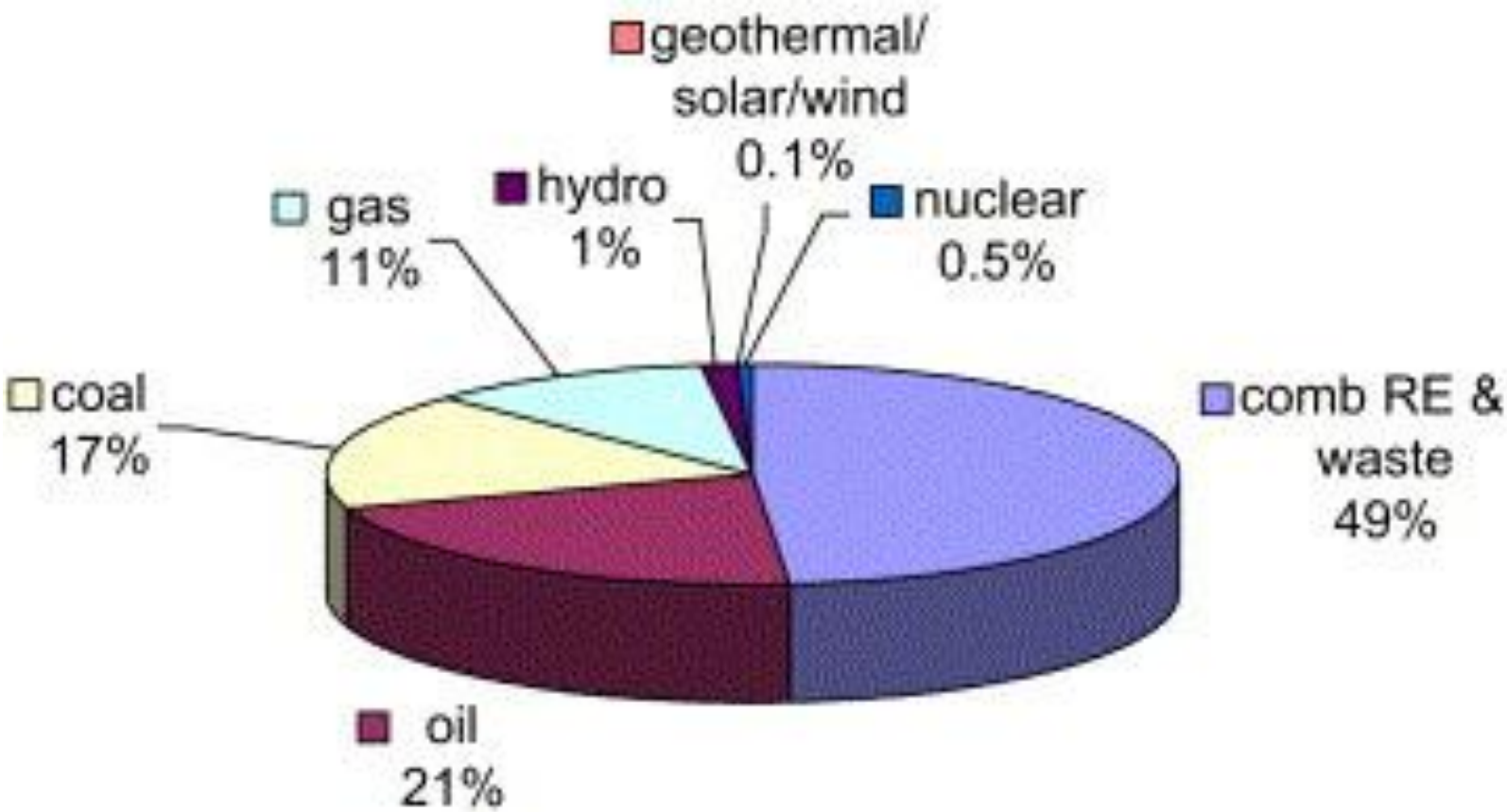
Traditional role of bioenergy/ biofuels in southern Africa and future potential

Traditional bioenergy in Africa



Share of total primary energy supply in Africa (2001)
[Amigun et. al., 2006. Renew. Sust. Energ. Rev. 12:690-711]

Availability of biomass (Malawi)

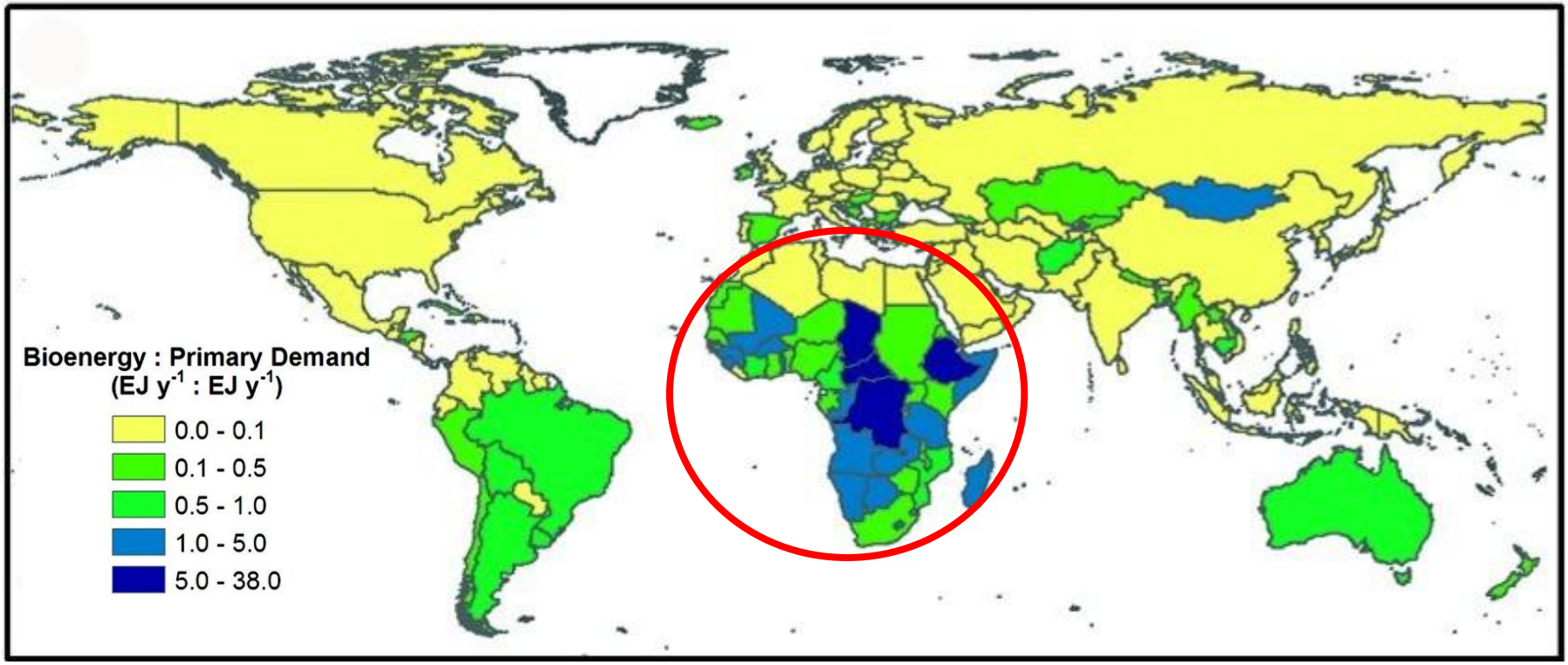
Malawi today

Malawi in the past

Brick-making using woody materials

Charcoal

Biomass potential of Africa at large



Ratio of the energy content of the biomass on abandoned agriculture lands relative to the current primary energy demand at the country level. The energy content of biomass is assumed to be 20 kJ g^{-1}. Source: Campbell et al. (2008)

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African Continental Convention on Global Sustainable Bioenergy

17 - 19 MARCH 2010

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Bioenergy Resolution for Africa

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As the world considers paths to a sustainable future and the role of bioenergy in this context, ***Africa*** *brings important* ***assets*** *and* ***wants*** *to be an* ***active partner.*** *However, Africa needs to ensure that bioenergy development is implemented in a way that* ***contributes to critical human needs****.*

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Bioenergy Resolution for Africa

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Bioenergy is one of the most cost effective solutions for a global sustainable low carbon energy future. This future demands ***sustainable agriculture*** and ***forestry*** in Africa to supply ***food and bioenergy*** in support of Africa and the world.

A sustainable globe requires a sustainable Africa!!

http://academic.sun.ac.za/biofuels/Convention/Draftresolution.html

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History of Strategic Partnership between Stellenbosch & NEPAD (and now FAPESP)

Strategic partnership with NEPAD

Prof. van Zyl met Dr. Mayaki (CEO of NEPAD) and Prof. Elmissiry (Head: Regional Integration and Infrastructure) when he helped facilitating a biofuels workshop for NEPAD in 2008. I then already appreciated Dr. Mayaki passion for the role biofuels could play in Africa.

Ibrahim Mayaki

We had a strategic meeting after 1st BBEST meeting in Aug 2011 and agreed to jointly promote sustainable biofuels/bioenergy in southern Africa.

Mosad Elmissiry

Strategic partnership with NEPAD

The objectives of this NEPAD/ Stellenbosch alliance were:

1. Developing bioenergy policies and program roll-out.
2. Support and participation in the monitoring and evaluation of evidence-based projects.
3. Establishment of a technical network between universities, research institutions and other bioenergy stakeholders in Africa.
4. Held a workshop to discuss the strategy of the new alliance between NPCA and Stellenbosch.

Strategic partnership with NEPAD

From the new alliance, a workshop was held May 2012 in Stellenbosch where international partners, including Jeremy Woods, Lee Lynd and Gideon Wolfaardt, participated. Strategic decisions taken at the workshop, include:

1. The group agreed that bioenergy should not be developed separately in Africa, but integrated with food security.

2. The bioenergy initiative should be closely aligned with the CAADP Framework for African Food Security (FAFS) of NEPAD, supported by FAO as vehicle.

Jeremy Woods

CAADP = Comprehensive African Agriculture Development Programme

Strategic partnership with NEPAD

Action plans from the workshop included:

1. Setting up periodic/rotating meetings of a network of research institutions, farmers 'organisations, regional economic communities, private sector and Government officials for increased interaction and consensus building on a bioenergy framework.

2. Introducing bioenergy/food security related projects and reviewing national and regional investment plans in regards to bioenergy development.

3. Develop scalable demonstration projects within CAADP investment plans, based on best practices and lessons learned.

Stellenbosch Declaration

During the ISAF2013 meeting in March at the Spier Wine Estate, a strategic meeting between FAPESP and NEPAD was facilitated by Stellenbosch University. Lee Lynd and a representative from SASOL also participated in the meeting. From the meeting resulted the "Stellenbosch Declaration" with the following objectives:

1. Foster synergies between institutions (NEPAD/ FAPESP/Stellenbosch University)
2. Realize coherent (bio)energy mapping of what exist on the continent today.
    a. NEPAD will initiate the process with deadlines.
    b. The coherent mapping would also utilize key people from FAPESP, specifically within the LACAf project.

Stellenbosch Declaration

Stellenbosch Declaration objectives:

3. At the same time, address the question of unconstraint sustainable bioenergy potential, but simultaneously promote social and economic development. The GSB project can assist with this question.
4. On the basis of energy mapping and the unconstraint potential for sustainable bioenergy potential – crystalize a bioenergy vision for Southern Africa.
5. Organize interaction between Africa regions and adapt a broad framework.

Biofuels: a stimulant for rural socioeconomic development in Africa

Food security vs Bioenergy debate

1. The lack of modern bioenergy has adversely affected the economy, environment and health of rural populations.

2. Sustainable bioenergy systems are essential to eradicate energy and food poverty in Africa.

3. The real potential of bioenergy systems in Africa today is limited by inefficiencies in the value chain or lack thereof. Bioenergy's potential is far from being realized today!

Food insecurity

1. The chronic nature of food insecurity in Africa is a result of many complex factors, one of which is the low crop yields.
2. In-part due to **low energy inputs** in agriculture compared to **capital intensive** and **highly subsidised agricultural systems** deployed in developed countries, the green revolution passed Africa by!
3. Lack of real development increases the vulnerability of farmers (of all scales) to economic shocks e.g.
   i. volatile energy input costs to agriculture;
   ii. High energy costs in getting surplus harvested crops safely stored and transported on to markets, thus high postharvest losses

"double penalty"

Food security…

… exists when all people, at all times, have **physical and economic access** to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

(UN-FAO World Food Summit 1996)

… is more than food production
… is underpinned by food systems

Key questions in bioenergy/ food production systems integration

1. Deliberately seeking positive pathways to future development (not a "nice-to-have").
2. This is in direct contrast to bioenergy vs food systems debate as separate and competitive entities.
3. Requires a better understanding of the multiple benefits that can be gained if bioenergy systems are integrated directly into food systems.
4. Determine the required sustainability indicators for sustainable bioenergy in Africa.

Which Bioenergy development path?

1. Current studies (GSB & LACAf) try to assess the potential for sustainable bioenergy based on 'unused,' 'degraded' or 'idle' land for production of bioenergy crops.
2. In practice maximum value and utility may only be gained when bioenergy is integrated directly into local agricultural (and livestock) systems.

2 possible outcomes:

1. Bioenergy competes with food production or is marginalised to low productivity / high cost land
2. ***Bioenergy supports food production through close integration***

Only smart policy and support for integrated (knowledge intensive) farming can enable option '2'

Way forward?

1. More understanding of the threats and opportunities arising from integrated bioenergy and food production systems

2. Development of bioenergy technologies for more efficient utilization of Africa's vast bioenergy capacity and for integrated application to develop sustainable societies, both in urban and rural context.

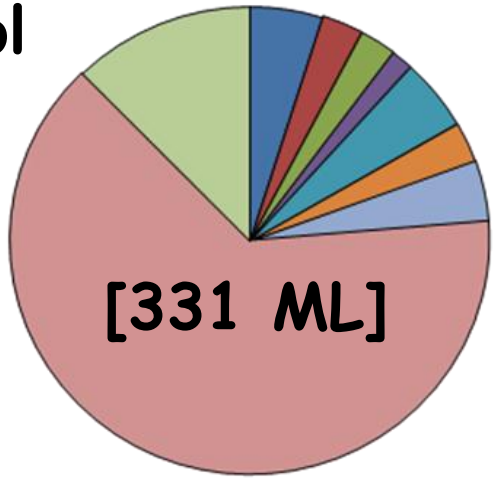
Integrating 1st and 2nd generation technologies could create opportunities for sub-Saharan Africa

Biofuel production in southern Africa

1. In developed countries, the main thrust for ethanol production is the replacement of fossil fuels in the transportation sector.
2. Africa has a great potential to produce and meet the growing demand to phase-out fossil fuels for transport.
3. *However*, the situation is different for developing countries, such as the SADC region because of their unique socio-economic needs, especially:
   a) the chronic food and energy insecurity;
   b) extreme poverty;
   c) high unemployment rate, and
   d) degradation of the natural environment.

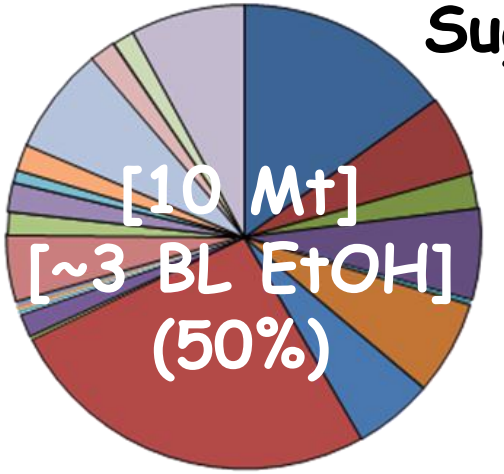
Biofuels production in southern Africa

Ethanol



- Egypt [30 ML]
- Kenya [17 ML]
- Malawi [15 ML]
- Mauritius [9 ML]
- Nigeria [30 ML]
- Swaziland [17 ML]
- Zimbabwe [25 ML]
- South Africa [388 ML]
- Other Africa [75 ML]

Sugar



- Egypt [1600 Kt]
- Kenya [600 Kt]
- Malawi [261 Kt]
- Mauritius [685 Kt]
- Nigeria [30 Kt]
- Swaziland [700 Kt]
- Zimbabwe [585 Kt]
- South Africa [2780 Kt]
- Angola [31 Kt]
- Cote d'Ivoire [170 Kt]
- Guinea [25 Kt]
- Madagaskar [32 Kt]
- Male [32 Kt]
- Morocco [505 Kt]
- Mozambique [170 Kt]
- Reunion [210 Kt]
- Senegal [95 Kt]
- Somalia [200 Kt]
- Sudan [800 Kt]
- Tanzania [187 Kt]
- Uganda [160 Kt]
- Other Africa [830 Kt]

Sources: RAF Outlook (2007) and Hassan (2008).

[Ambali *et al.* 2011. A review of sustainable development of bioenergy in Africa: An outlook for the future bioenergy industry. *Sci. Res. Essays* 6: 1697-1708]

Opportunities for sugarcane in SADC

1. Currently, Africa only produce a fraction of the world ethanol, and even Africa's sugar production is rather modest with South Africa been the biggest producer, producing about half of the sugarcane in SADC (~20 Mt/annum), using an area of ~325 000 Ha!
2. However, a recent study (Watson, 2011) estimated that about 6 MHa of arable land in SADC countries (primarily Mozambique, Angola, Tanzania, Zambia, Zimbabwe and Malawi) are suitable for sugarcane production at an average yield of >65 t/Ha or more.
3. Conservatively, this means that the total South Africa sugar industry can be replicated every year for at least 15 -20 years in southern Africa!

[Watson, HK. 2011. Potential to expand sustainable bioenergy from sugarcane in southern Africa. *Energy Policy* **39**: 5746–5750.]

Opportunities for sugarcane in SADC

1. Currently, Africa is producing 331 ML;
2. If 50% of the total current sugar production is converted to ethanol, Africa can producing 3 BL, five time more!;
3. However, if optimal sugarcane is produced in 6 SADC countries only and about 50% of total biomass converted to biofuels, the potential can increase with another order of magnitude, +35 BL, *representing ~10-13% of Africa's total petroleum consumption!*
4. Theoretically, Africa is producing at present only 1% of its potential and can, together with Brazil, be a major player in the future!

Thank you!