

GLOBAL FORUM ON SUSTAINABLE ENERGY – 6TH MEETING

”AFRICA IS ENERGISING ITSELF”

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**“Bio-ethanol from sugarcane and sweet sorghum in
Zambia: Opportunities and Challenges”**

Emmanuel Matsika

CEEEZ/CARENSA

Private Bag E721, Lusaka, ZAMBIA

Tel/Fax: +260 - 1 - 240267

Email: ematsika@yahoo.com

Where is Zambia Located?





DRIVERS (1)

Economic

- **High fuel prices (forex, balance of payment)**
- **Competitive and volatile sugar markets**
- **Stimulation of agriculture sector (by creating new markets)**
- **Export reductions under the EU Preferential Trade Agreement**
- **Security of fuel supply**



DRIVERS (2)

Environmental

- **Africa Dakar Declaration on phasing out lead**
- **Need to take action on climate change**
- **Improvements in air quality**
- **Sustainability of energy supplies**
- **Co-benefits: bagasse co-gen and other potential products**
- **CDM?**



DRIVERS (3)

Social

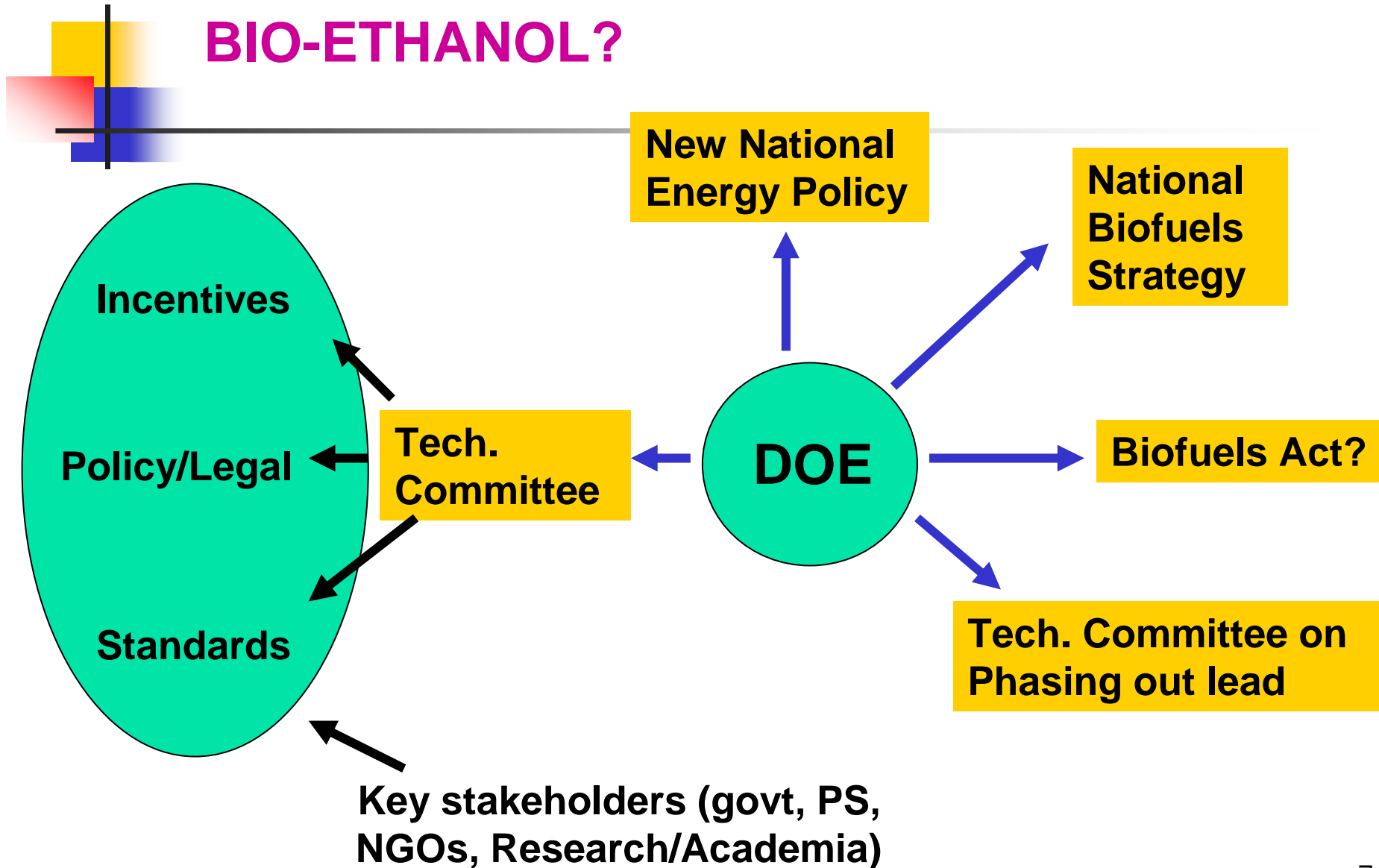
- Unemployment
- Poverty (70%)
- Rural development
- Social amenities



WHY ZAMBIA?

- ❑ **Has vast land**
 - **752, 000 km²**
 - **Agric area 47%**
 - **Cultivated area 7.1%**
- ❑ **Tropical climate**
- ❑ **One of the highest tc/ha in the region (at 106tc/ha)**
- ❑ **6th lowest sugar production cost out of 100 producers**
- ❑ **One of the most suited for sweet sorghum cultivation**
- ❑ **Holds about 40% of water resources in southern Africa**
- ❑ **Based on current molasses quantity, E10 can be meet**
NOW

HOW READY IS ZAMBIA FOR BIO-ETHANOL?





PRIVATE SECTOR IS ALREADY MOVING!

- Plans to form biofuels association**
- Largest sugar factory ready to start 13ml ethanol per year using molasses**
- Smaller factories ready to follow (Kafue Sugar, Kalungwishi and Luena)**
- Oil Marketing Co.s preparing for new stocks**
- Motor industry ready to introduce new models**
- Articles in the media**

Current Ethanol Production Potential

Factory	Cultivated area (Ha)	Ethanol (ml)	Installed power(MW)
Zambia Sugar	17,000	13	10
Kafue Sugar	4,200	4	3
Kalungwishi	3,000	2.9	0.6
Luena (proposed)	6,650	6.3	-
Totals	30,850	26.2	

- At E10 19ml ethanol reqd to meet mandatory RON 91
- There is expansion potential for sugarcane, and **SWEET SORGHUM...**



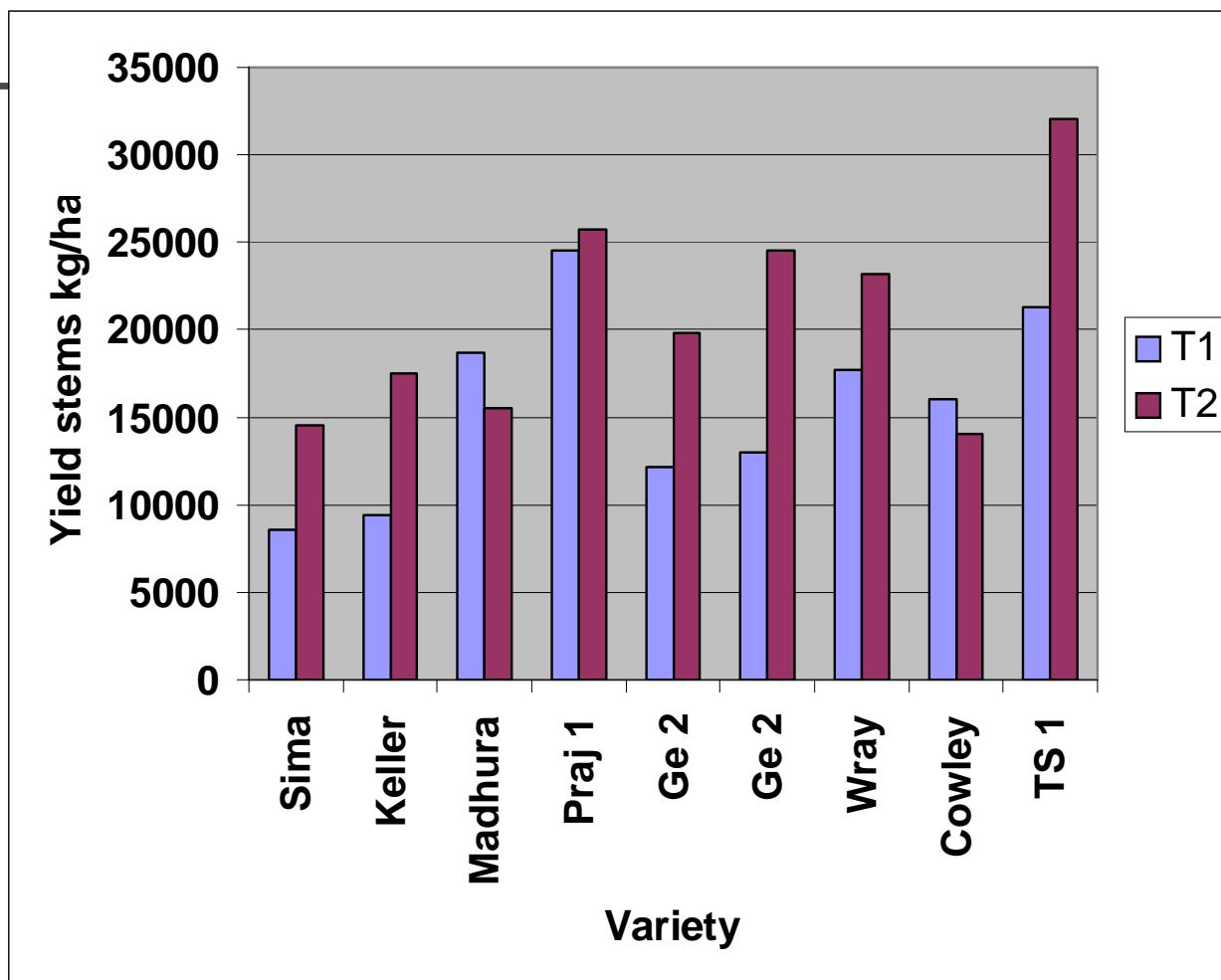
Why Sweet Sorghum?

- Draught resistant (can be grown in many places)
- Short growing cycle
- Low initial investment
- Rural Development and Poverty reduction
- Supplement that can make distilleries running during sugarcane off-season
- Limitations in sugarcane expansion vs growth in ethanol requirements

Sugarcane Vs Sweet Sorghum

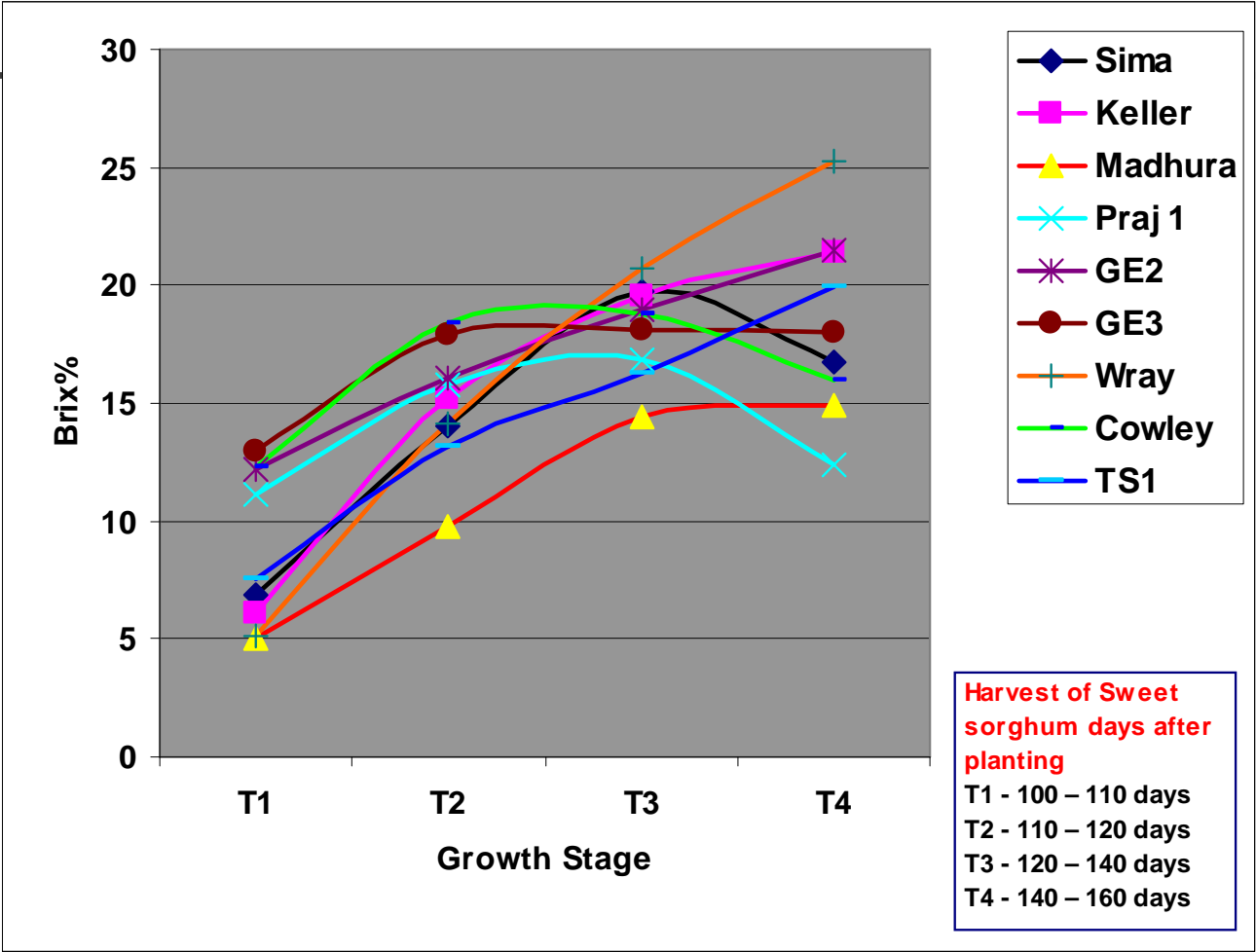
Properties	Sugarcane	Sweet Sorghum
Crop Cycle	10-11 months	3.5 – 4 months (Grown twice / year)
Yield per Acre	28 – 32 tonnes	17 – 22 tonnes x twice/year = 34 – 44 tonnes
Sugar content	11 – 13 %	9 – 11 %
Conventional ethanol yield	68 – 74 litres/tonne	45 – 55 litres / tonne of stalks
Water requirement	100%	65 – 70 % of cane
Fertiliser	100%	35 – 40 % of cane
Bagasse availability	30 % of cane	28 – 30 % of sweet sorghum
photosynthetic efficiency (carbohydrate sythesis)	15 litres Et/ha/day	48 litres Et/ha/day
Ethanol production cost	USD0.25 – 0.45	USD 0.20

Sweet Sorghum Trials at UNZA (1)



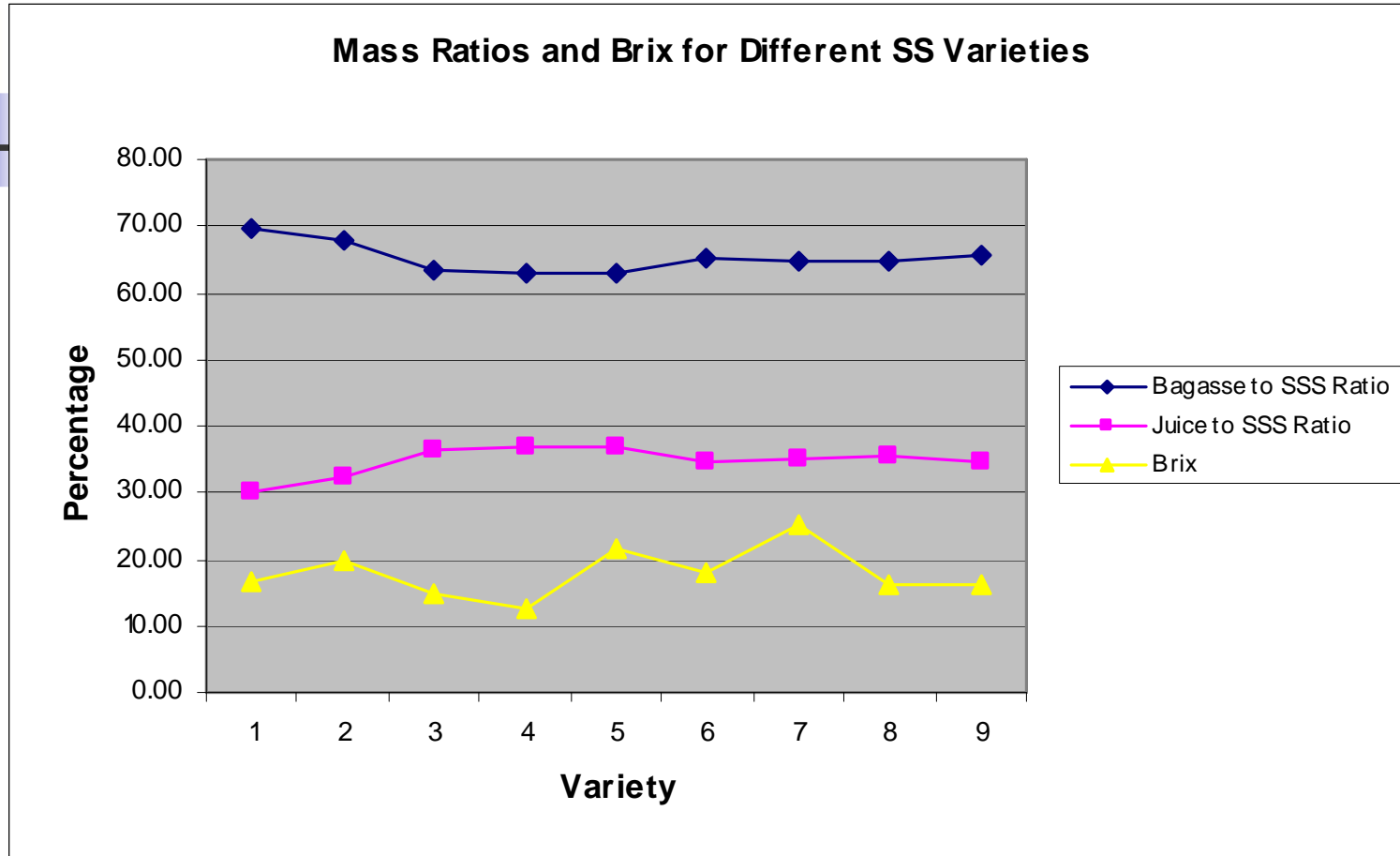
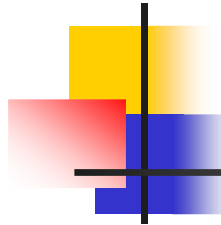
Harvest of sweet sorghum at different growth stages
T1 - Boot stage T2 - Soft dough stage

Sweet Sorghum Trials at UNZA (2)



Accumulation of sugar in different varieties of sweet sorghum at UNZA Farm.

Sweet Sorghum Trials at UNZA (3)



1- Sima, 2- TS1, 3-Madhura, 4-Praj 1, 5- GE2,
6-GE3, 7-Wray, 8-Cowley, 9-Keller

Sweet Sorghum Trials at UNZA (4)



OBSERVATIONS...

- ❑ Average juice = 35%, with low variance
- ❑ Average bagasse = 65%
- ❑ Average brix = 18.2%, max = 25.31%, min = 12.52%
- ❑ Suitable brix for ethanol production = 15 – 20%
- ❑ Varieties with highest ethanol potential (both high juice and brix)
 - Wray (Juice 35.14%, Brix 25.31 %)
 - GE2 (Juice 36.96%, Brix 21.66%)



Potential Export Markets

Regional deficit at E10:

- > 0.74billion litres at E10 (present)
- > 1.0 billion litres (2015).

International:

- EU?
- Asia?

KEY CHALLENGES & ISSUES TO CONSIDER

- No policy on mandatory blending
- No standards developed for ethanol as a transport fuel
- Over 80% of land is customary (under chiefs!)
- Lack of policy on bioenergy outgrower schemes with extension service backup
- Inadequate supporting infrastructure
- Announcement of oil reserves in north western Zambia. What next?
- Export potential faced with international trade barriers



CONCLUDING REMARKS

- Zambia has great potential produce bio-ethanol for sustainable development
- The climate, soils and area gives it high potential to grow sugarcane and sweet sorghum to export ethanol regionally and internationally
- Need for a conducive regulatory, fiscal and policy framework
- Land locked: need for regional linkages
- SADC biofuels market can benefit from expansion of Zambia's ethanol industry due to centre location

THANKS ARE EXTENDED TO:

- Global Forum on Sustainable Energy (GFSE)
- Austrian Development Agency and Austrian Energy Agency
- Swedish International Development Cooperation Agency (Sida)
- European Commission DG-Research
- Common Fund for Commodities (CFC)
- Partners in the Cane Resources Network for Southern Africa (CARENESA)



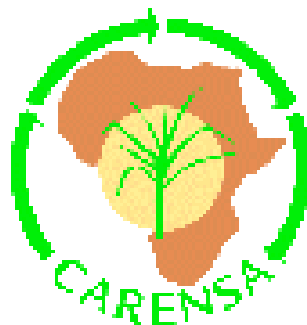
Scientific Coordinator



EUROPEAN COMMISSION
Research Directorate-General

CEEEZ

Centre for
Energy, Environment and
Engineering Zambia Limited

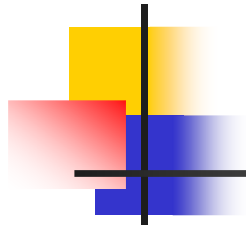


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DANKKE!