

# Prospects for integration of agriculture & energy markets in the SA Region



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Workshop*

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# Objective

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- Share (informally) some ideas on the potential biofuel production and trade in the SA region



# Biofuels

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Organic fuels derived from biomass from purpose-grown crops, multipurpose plantations, or residues and wastes.

## Demand for biofuels

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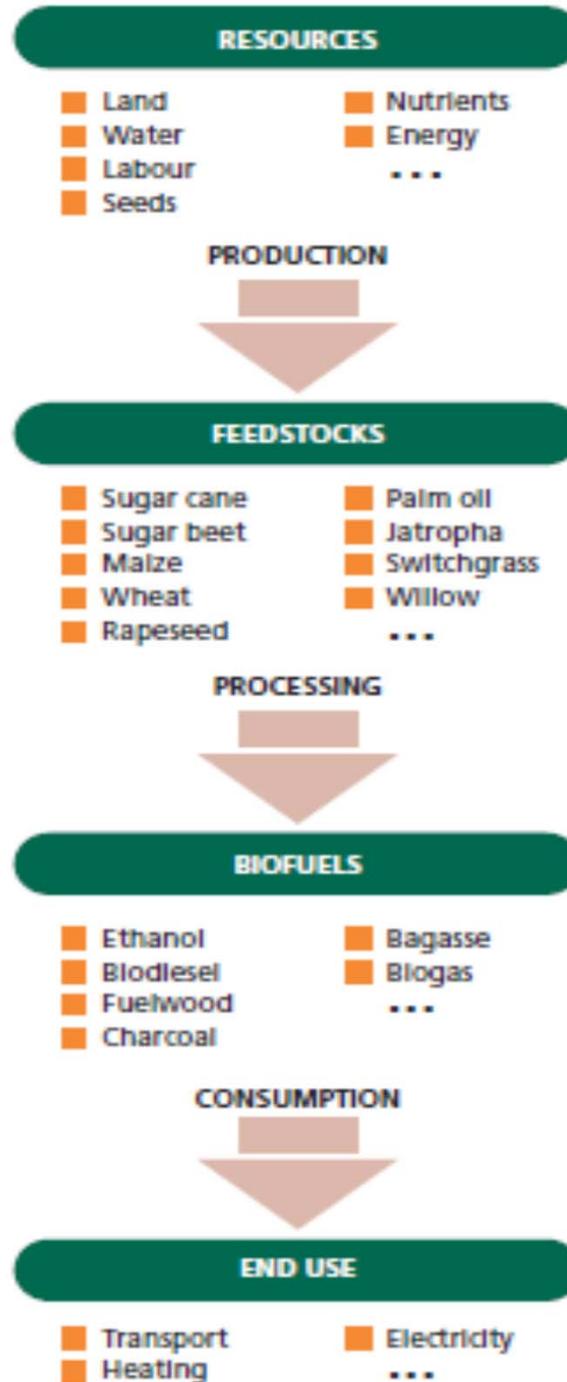
- Expansion and growth of energy markets:
  - Population and income are growing
  - Increased urbanization
  - Technological improvements
  
- ⇒ Continued high crude oil prices  
(\$10/barrel in 90's to over \$100 in 2011)
  
- New energy and environment policies supporting biofuels
  - energy security
  - reduce greenhouse gas emissions
  - Desire to link agriculture and energy markets.
  
- ⇒ **Upward pressure in prices of biofuels**

## The Question is

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- ***Could the agriculture and energy nexus provide an impetus for agriculture growth and trade in the SA region?***

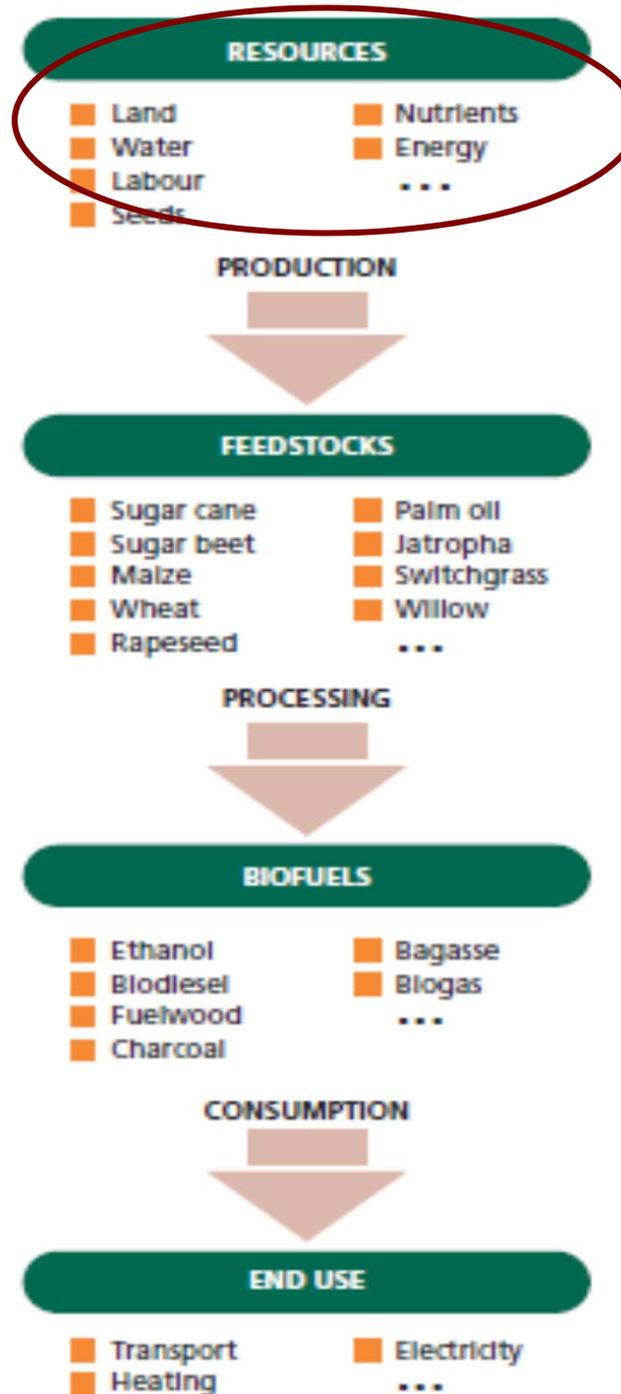
Value chain mapping of biofuel production from feedstock to end use



Resources are location specific, so must define geographical region & a crop

Source: FAO

Value chain mapping of biofuel production from feedstock to end use



Resources are location specific, so must define geographical region & a crop

We consider...

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- **Zambezi Valley &**
- **Ethanol from sugarcane**

# The Zambezi Valley

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- ❑ Major watershed in Southern Africa, 4<sup>th</sup> largest basin in Africa.
- ❑ Has 225.000 km<sup>2</sup> in Moz (27,7% of Moz).
- ❑ runs through 4 provinces in Moz:
  - Tete, Manica, Sofala e Zambézia
  - Home for 4.9 million people (25% of Moz. Pop.)
- ❑ Home of the Cahora Bassa dam.
- ❑ Hosts Marromeu and Mafambisse sugar plantations, and Moatize coal mine.

Why Ethanol from sugarcane?

## Biofuel yields for different feedstocks and countries

CROP	GLOBAL/NATIONAL ESTIMATES	BIOFUEL	CROP YIELD	CONVERSION EFFICIENCY	BIOFUEL YIELD
			(Tonnes/ha)	(Litres/tonne)	(Litres/ha)
Sugar beet	Global	Ethanol	46.0	110	5 060
Sugar cane	Global	Ethanol	65.0	70	4 550
Cassava	Global	Ethanol	12.0	180	2 070
Maize	Global	Ethanol	4.9	400	1 960
Rice	Global	Ethanol	4.2	430	1 806
Wheat	Global	Ethanol	2.8	340	952
Sorghum	Global	Ethanol	1.3	380	494
Sugar cane	Brazil	Ethanol	73.5	74.5	5 476
Sugar cane	India	Ethanol	60.7	74.5	4 522
Oil palm	Malaysia	Biodiesel	20.6	230	4 736
Oil palm	Indonesia	Biodiesel	17.8	230	4 092
Maize	United States of America	Ethanol	9.4	399	3 751
Maize	China	Ethanol	5.0	399	1 995
Cassava	Brazil	Ethanol	13.6	137	1 863
Cassava	Nigeria	Ethanol	10.8	137	1 480
Soybean	United States of America	Biodiesel	2.7	205	552
Soybean	Brazil	Biodiesel	2.4	205	491

**Why ethanol from sugar cane?**

**1. High biofuel yield**

**2. There are already 2 sugar plantations in the valley**

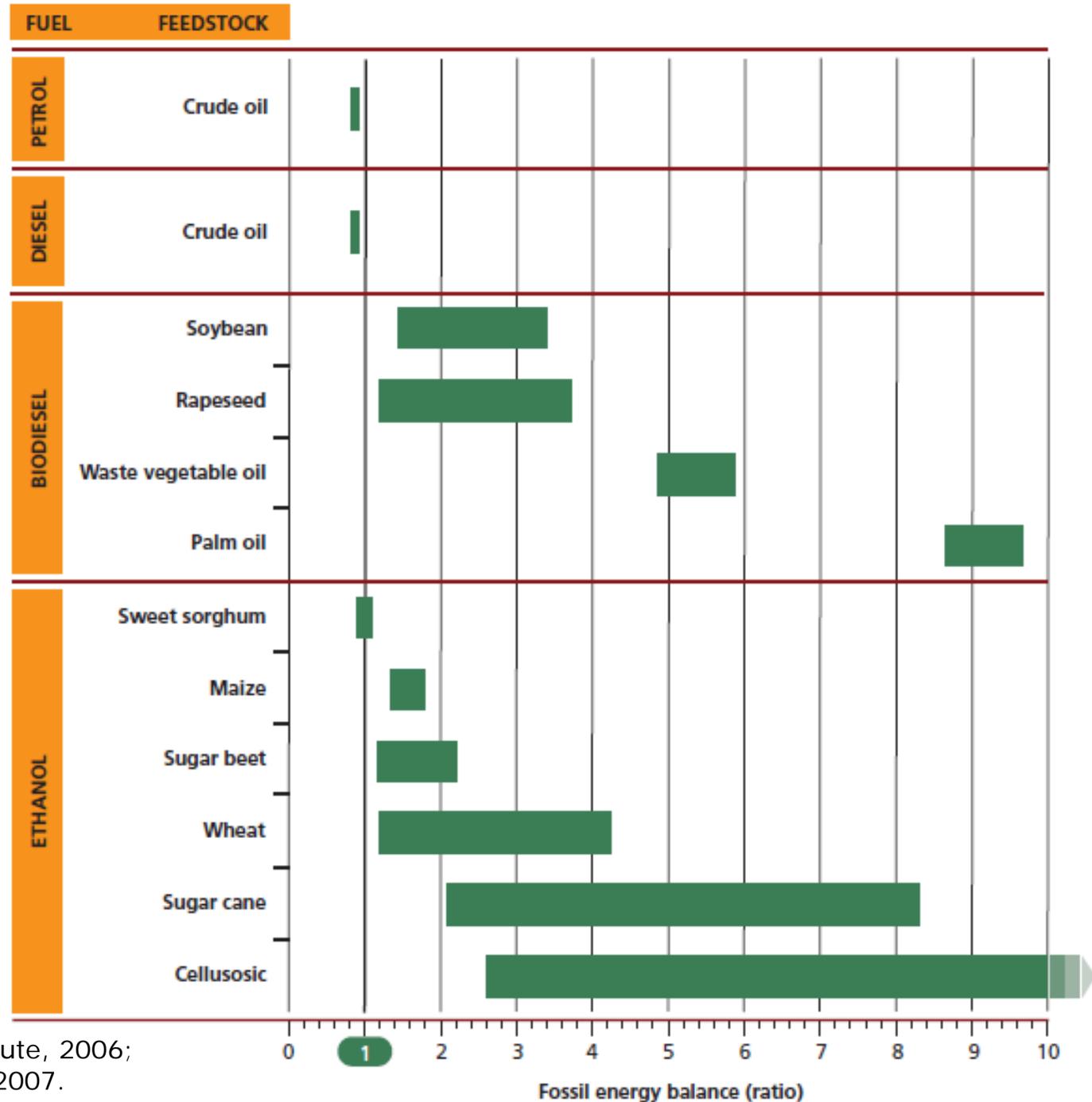
**3. sugar exports contribute to 25% of total ag exports**

Sources: Rajagopal *et al.*, 2007, for global data; Naylor *et al.*, 2007.

## Why ethanol from sugar cane?

### 4. Decent fossil energy balance:

A fossil fuel energy balance of 2.0 means that a litre of biofuel contains twice the amount of energy as that required in its production

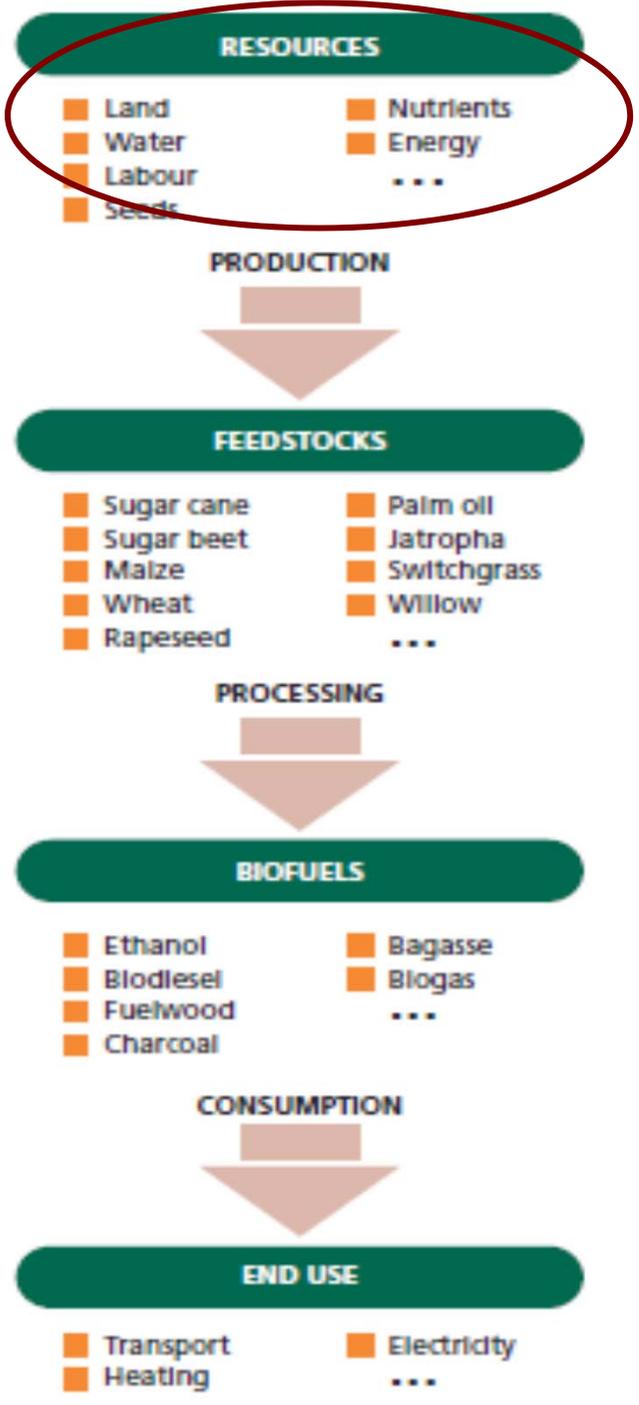


Sources: Worldwatch Institute, 2006; Rajagopal and Zilberman, 2007.

## The Question now is

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- ***If large scale production of Ethanol from sugarcane is to be undertaken in the Zambezi river, what are the implications?***



## Land availability

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- ❑ 79 million ha in Moz, of which 36 million are arable
- ❑ Only about 5 million ha under production
- ❑ Potential for land expansion:  $36 - 5 - 9 = 19$  million ha
- ❑ But there is no *unclaimed land* in Moz, so cannot be done without political support since
- ❑ Need to deal w/ land grab (psychological?) claims
- ❑ What production system? Coops or *out grower schemes*?
- ❑ Effect of biofuels on land cost/access understood?

## Water availability

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- ❑ Potential for irrigation can only be limited by quality of soils and the economics of irrigated agriculture (B&F, 1996).
- ❑ Small scale rain fed agriculture is predominant
- ❑ About 50% of the areas Mafambisse and Marromeu plantations are rain fed.
- ❑ Rain: 800-1000 mm/year
- ❑ underinvestment in irrigation: policy change?
- ❑ For large scale investment, may need to know demand for multiple water uses in the whole ZV

## Labor availability

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- ❑ ZV home to 4.9 million people in Moz., over 50% of people in the central Moz. and about 25% of Moz. Pop
- ❑ Majority of people work in ag., and are unskilled
- ❑ What is the expected change in employment patterns as biofuel sector grows?
- ❑ How to deal with seasonality of employment associated with biofuel production?
- ❑ Food security concerns: time spent on sugar cane vs time on producing own food; Gender
- ❑ Dutch disease concerns(?) on tradable industries like the sugar industry (raising labor cost)

# Sugar cane processing

- ❑ One distillery in Buzi, 50 km of Beira harbor
- ❑ It produces 10,000 ltrs/day
- ❑ Invest in Processing: upfront, scale, seasonality
- ❑ cost estimates of producing ethanol in Moz

	<i>Custo de Produção de Matéria Prima</i>	<i>Custos de refinação do etanol</i>	<i>Custo Final de Produção</i>	
	<i>USD/ton etanol</i>	<i>USD/ton etanol</i>	<i>USD/ton etanol</i>	<i>USD/liter etanol</i>
Mandioca	314.9	169.0	483.9	0.38
Cana de Açúcar	309.3	137.8	447.1	0.35
Sorgo	198.2	137.8	336.0	0.27
Melaço	251.9	120.6	372.5	0.30
Milho	492.2	169.0	661.2	0.53

Source: Econergy & others

# Transport & logistics

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- ❑ Get sugar cane to a refinery &
- ❑ Get ethanol to the point of sale
- ❑ Poor roads & high costs of transportation
- ❑ How to take advantage of investment on rail?
- ❑ Transport by sea? consider pipelines?
- ❑ How to best utilize corridors and harbors?
  - Moz imports of fuel are re-exported to Malawi, Zambia, Zimbabwe
- ❑ Regional policies and coordination must be considered before scaling up

## Ethanol Trade

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- ❑ With current fossil fuel consumption & 4% growth in demand, Malawi, Zambia, Zimbabwe and Botswana generate a combined market of 105-120 million l/yr of ethanol in 2010-2015 (Econergy, 2008)
- ❑ If also consider Angola, DRC, Lesotho, Mauritius, Swaziland, Tanzania, then projections indicate 250-300 million l/yr of ethanol
- ❑ South Africa: 280-330 million l/yr (2010-15).

## Ethanol Trade

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- ❑ South Africa is the biggest potential market of ethanol production in SA region
- ❑ Production could take place in the ZV, in Mozambique, Malawi, and Zambia
- ❑ Policy coordination and synchronization & is important
- ❑ Competitive advantage will in the end determine the size of the market captured by each country

# Trade and Competitiveness

<b>Comparative Advantages</b>	<b>Competitive Advantages</b>
Land availability; land costs	Labor productivity
Arable land; fertility	Process efficiencies
Taxation	Quality of product, service
Labor costs	Skills base
Raw materials	Technology
Business environment	Research and development (R&D)
Transport	Knowledge base; core competencies
Proximity to markets	Differentiation
Scenery, beaches, etc.	Social capital/trust
Economies of scale	Market knowledge
<b>Collaborative advantages</b>	

**Source:** SPEED

# Effects of biofuels on Poverty

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- Difficulty to generalize because of:
  - different feedstocks production systems;
  - varying transportation costs;
  - Varying production and processing patterns;
  - patterns of land holding
  - Effects of biofuels on the cost of land
  - Varying regulation and its effect on investment
  - Varying environmental impacts

= > Empirical question



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*Muito obrigado*