COMPETE PROJECT

ECONOMICS OF BIOFUELS FEEDSTOCK TRANSFORMATION, AS A KEY CHALLENGE TO A SUSTAINABLE BIOFUELS INDUSTRY. "FROM A SOUTHERN AFRICAN PERSPECTIVE"

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INTRODUCTION

- Various challenges exist for attaining a sustainable biofuels industry. These include;
  - Markets,
  - Feedstocks availability at reasonable cost and quality,
  - Land suitability and availability,
  - Production/processing technologies,
  - Economics,
  - Social and environmental issues,
  - And research needs.

INTRODUCTION

- Among these, economics of feedstock transformation stand out as a main key challenge and driver for a sustainable biofuels industry.
- Economics of feedstock transformation in turn also affects land requirements and usage, biofuels end prices and financial viability
- Despite the existence of a range of conversion technologies, the biggest challenge is the availability of feedstocks in sufficient quantities at reasonable cost.
- Although there is often a long list of feedstocks available, economics of transformation are rarely competitive with current fossil fuel cost.
- In some cases, national feedstocks are not sufficient to satisfy technically acceptable blending ratios, such as 10% ethanol in petrol (E10) or 20% biodiesel in diesel B20).

INTRODUCTION

- Economics of production is crucial for successful implementation of biofuel development programmes.
- In this regard it is important that knowledge and capacity are available to select the appropriate technology and feedstock, which will yield production costs that are competitive with fossil fuel.
- The most important challenge for biofuels is the need for their prices to be competitive to those of fossil diesel and gasoline.
- Shown in figures 1 and 2 in the next slide are import parity prices against crude oil prices for the SADC region for diesel and gasoline, respectively.

INTRODUCTION

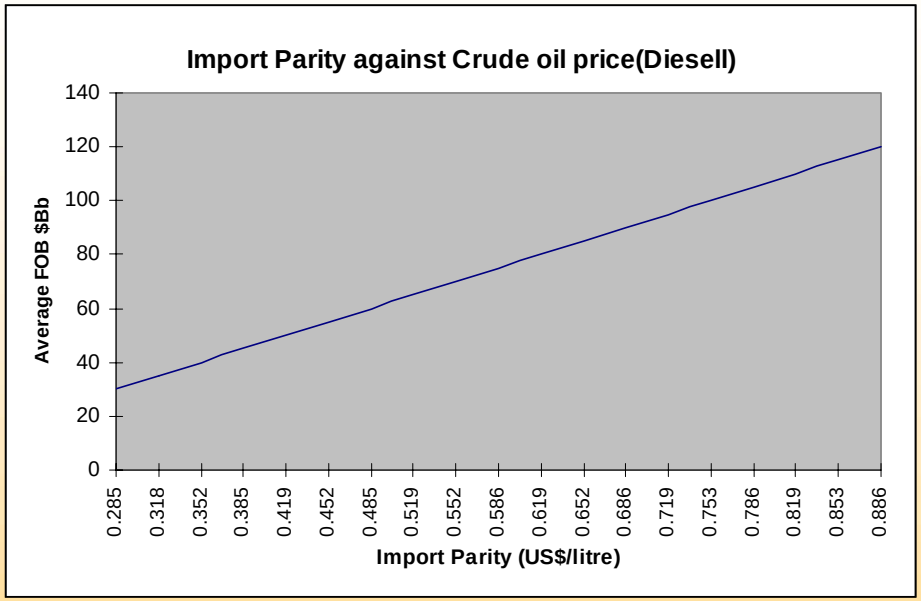


Figure 1 Import parity against crude oil prices (Diesel)

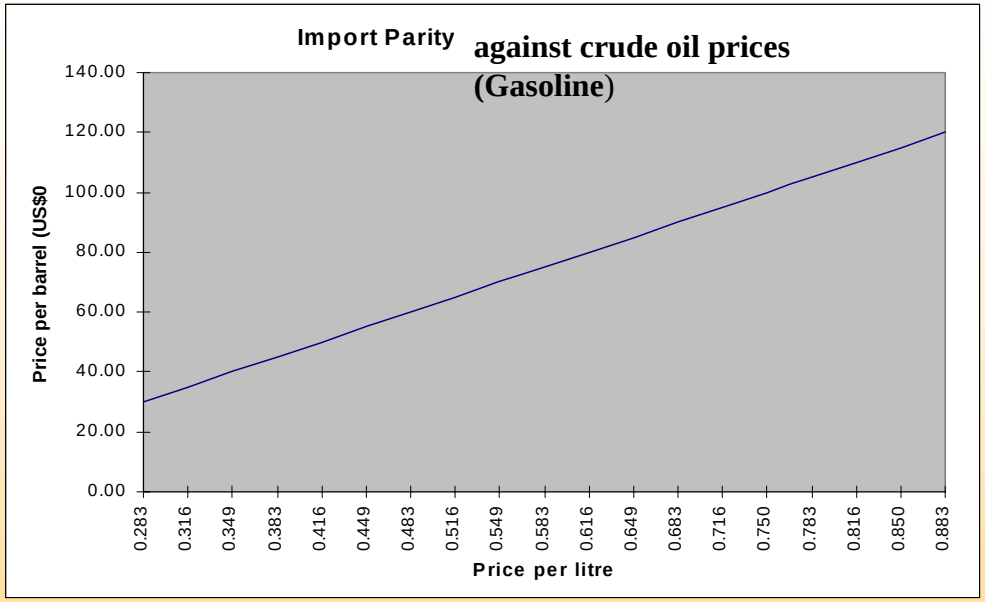


Figure 2. Import parity against crude oil prices (Gasoline)

INTRODUCTION

- These monograms from figures 1 and 2 can be used to assess competitiveness of biofuels production prices from different feedstocks.
- This paper assesses effects of use of different feedstocks on biofuels production prices, and associated land requirements, on one hand, and their competitiveness in relation to gasoline and diesel prices at different crude oil prices, on the other.

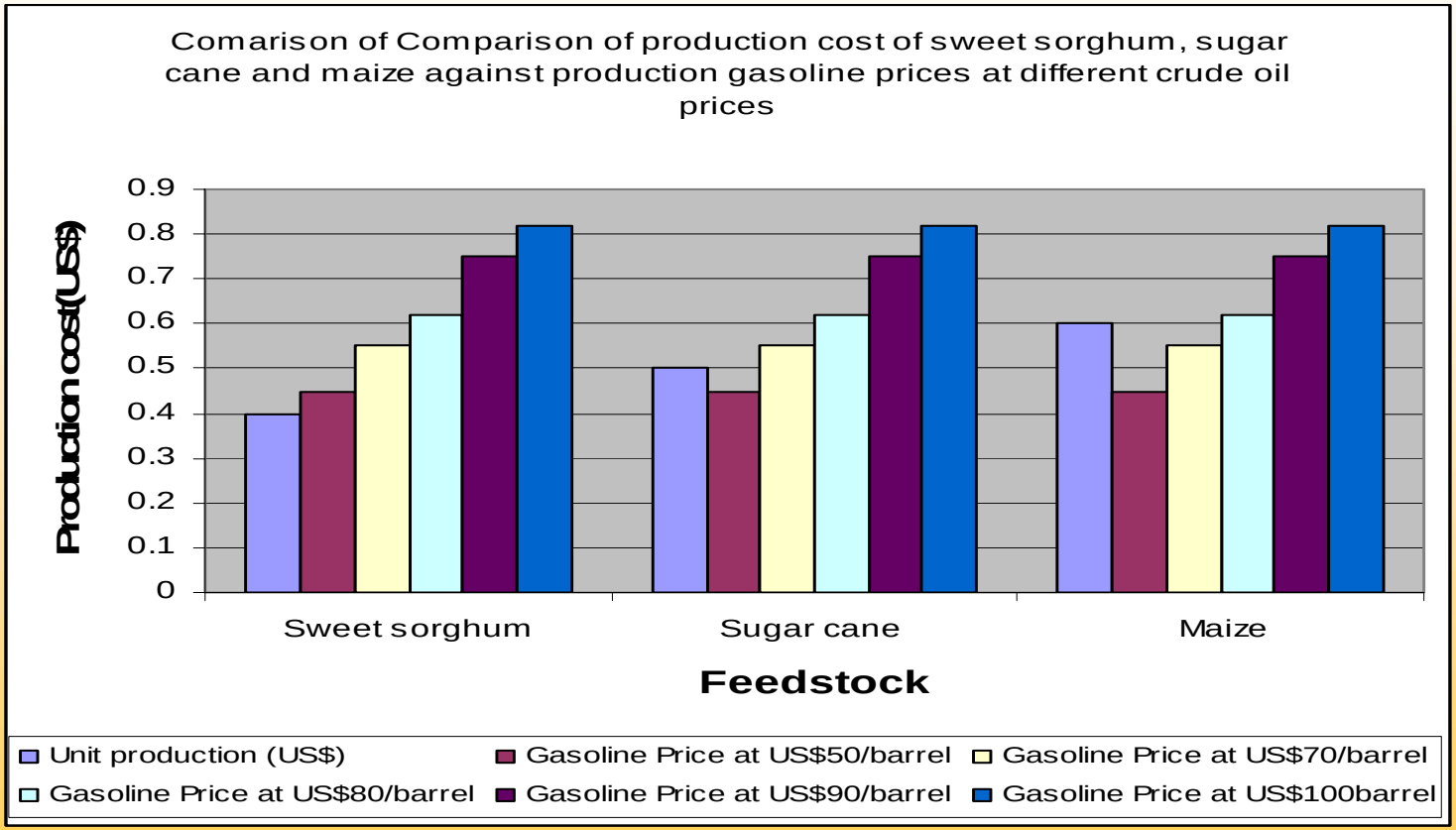
BIOETHANOL

- Bioethanol is made from a range of different feedstocks to include; sugar plants (sugar cane, sweet sorghum, and sugar beet), starch plants (corn, wheat, and cassava), and cellulose (trees and agriculture and forestry waste).
- Based on selected feedstocks from a Southern African perspective, an analysis was undertaken to assess production cost of selected feedstocks (sweet sorghum, sugar cane, and maize) based on resource and cost requirements for these feedstocks.
- Table and figure in the next two slides show comparison of production cost of sweet sorghum, sugar cane and maize against gasoline production prices at different crude oil prices.

BIOETHANOL

		Sweet sorghum	Sugar cane	Maize
1	**Ethanol production(million litres/annum)**	20	20	20
2	**Yield (litre/hectare)**	4000	4000	840
3	**Stalk production (hectares/tonne)**	70	70	2
4	**Raw material requirment (tonnes)**	350,000	350,000	50,000
5	**Unit Cost (US$)**	19	20	200
6	**Land requirements in (hectares)**	5000	5000	24,000
7	**Cost of raw materials(US$ millions)**	6.65	7.0	10.0
8	**O&M Cost plus depreciation (US$ millions)**	8.7	9.0	12.3
9	**Unit production (US$)**	0.4	0.5	0.6
10	**Gasoline Price at US$50/barrel**	0.45	0.45	0.45
12	**Gasoline Price at US$70/barrel**	0.55	0.55	0.55
13	**Gasoline Price at US$80/barrel**	0.62	0.62	0.62
14	**Gasoline Price at US$90/barrel**	0.75	0.75	0.75
15	**Gasoline Price at US$100barrel**	0.82	0.82	0.82

BIOETHANOL

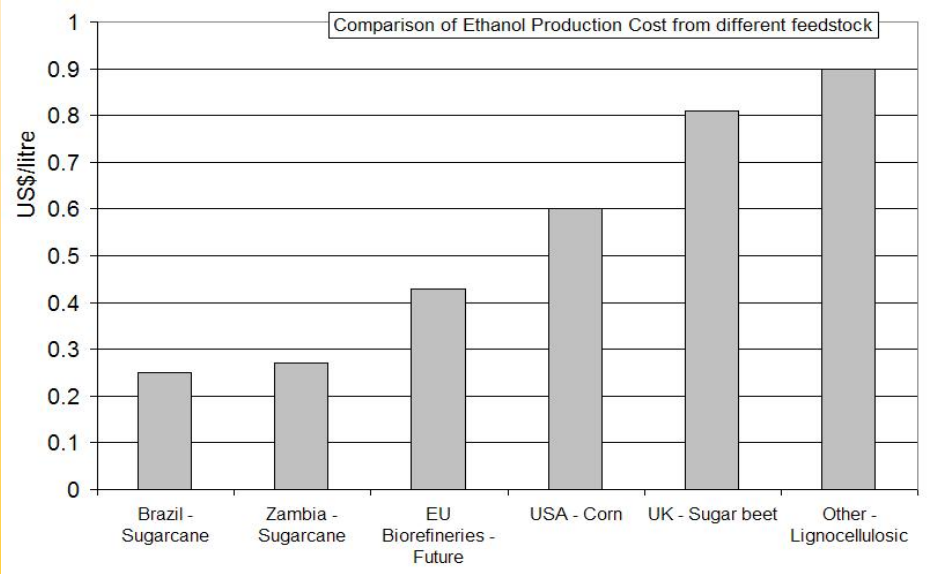

Comarison of Comparison of production cost of sweet sorghum, sugar cane and maize against production gasoline prices at different crude oil prices
Production cost(US$)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Sweet sorghum
Sugar cane
Maize
Feedstock
Unit production (US$)
Gasoline Price at US$50/barrel
Gasoline Price at US$70/barrel
Gasoline Price at US$80/barrel
Gasoline Price at US$90/barrel
Gasoline Price at US$100barrel

BIOETHANOL

- From the results displayed, unit production cost for sweet sorghum, sugar cane and maize have been calculated at US$ Cents 40, 50 and 60 per litre, respectively.
- In terms of competitiveness, sweet sorghum is competitive at US$50 per barrel and more, sugar cane at US$ 60 per barrel and more, and maize at US$80/barrel and more.
- Above US$80 per barrel , sweet sorghum, sugar cane, and maize are generally competitive, with sweet sorghum and sugar cane having an edge over maize.

BIOETHANOL

- However, in terms of land requirements, to produce 20 million litres of bioethanol per annum, requires 24, 000 hectares of land as compared to 5,000 hectares for sweet sorghum and sugarcane.
- Given in figure below is a comparison of ethanol production cost analysis from different feedstocks for selected countries.



Source IEA 2004 energy outlook, CEEEZ 2006

BIOETHANOL

- Results obtained from international comparisons are quite similar to those obtaining in Southern Africa as shown in in next slide.
- Cellulosic ethanol has an advantage from the supply point of view since it can be produced form a variety of abundant different biomass sources, however production cost is currently high averaging at US$ Cents 90 per litre and is not competitive even at US $ 100 per barrel .
- In the future however, production cost of cellulosic ethanol is likely to come down due to intensive research being undertaken world wide on the topic.

BIODIESEL

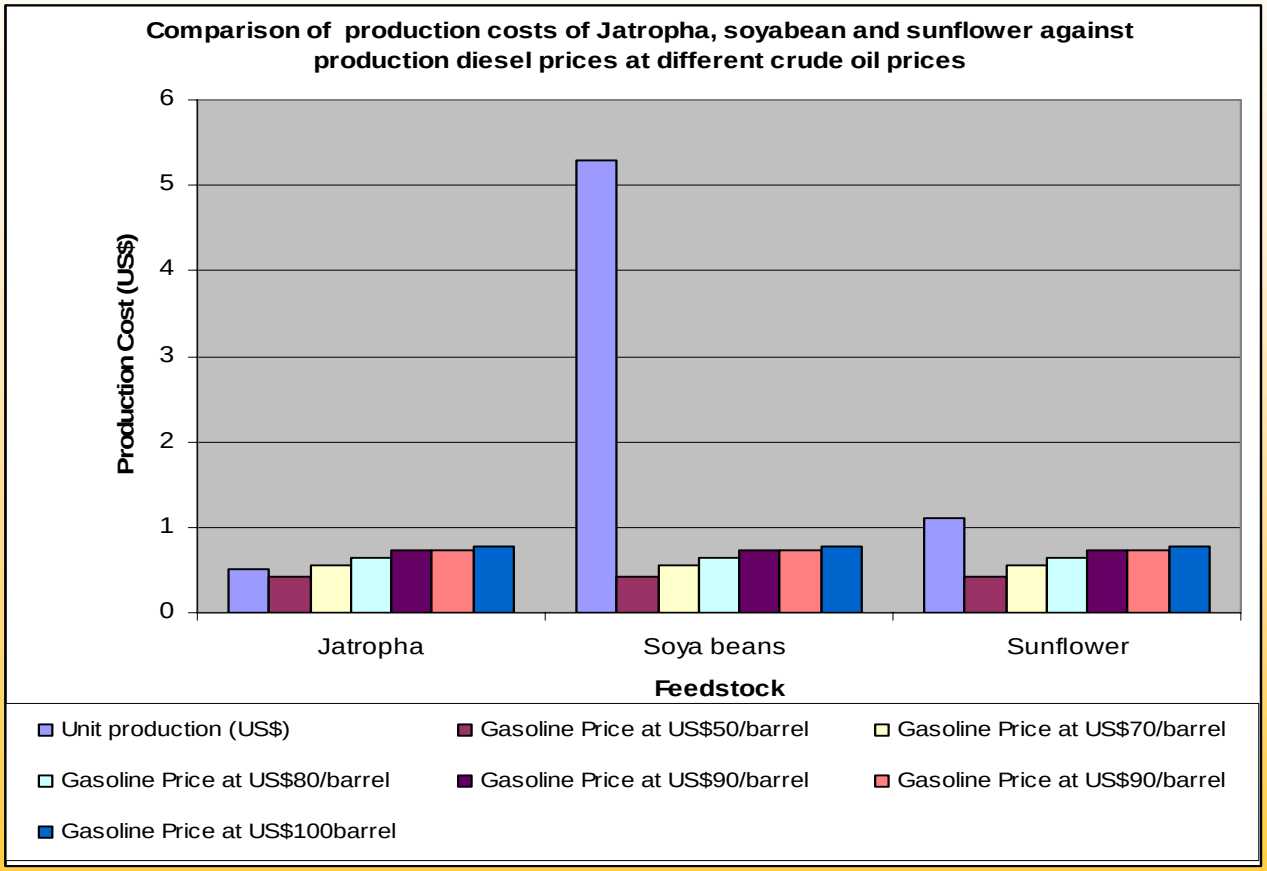
- Biodiesel is produced from oil bearing crops to include rape seed, soya beans, sunflower, and recently Jatropha.
- A similar analysis was undertaken for biodiesel to assess production cost of selected feedstocks (jatropha, soyabean and sunflower) based on resource and cost requirements for these feedstocks.
- Given in table and figure in the next two slides are comparison of production costs of jatropha, soyabean and sunflower against production diesel prices at different crude oil prices .

BIODIESEL

		Jatropha	Soya beans	Sunflower
1	Biodiesel production(thousand tonnes/annum)	50	50	50
2	Biodiesel production(million litres /annum	55.6	55.6	55.6
3	Yield (tonone/hectare)	4	3	1.5
3	Oil Content (%)	40	18	40
4	Extraction Efficiency(%)	75	75	75
3	Seed requirements (tonne)	175,000	370,370	170,000
4	Land requirements (Hectares)	44,000	124,000	57,000
5	Unit Cost (US$)/tonne	120	780	330
7	Cost of raw materials(US$ millions)	21.70	289	56.1
8	O&M Cost plus depreciation (US$ millions)	29.5	294.5	61.6
9	Unit production (US$)	0.5	5.3	1.1
10	Gasoline Price at US$50/barrel	0.42	0.42	0.42
12	Gasoline Price at US$70/barrel	0.55	0.55	0.55
13	Gasoline Price at US$80/barrel	0.65	0.65	0.65
14	Gasoline Price at US$90/barrel	0.72	0.72	0.72
15	Gasoline Price at US$100barrel	0.78	0.78	0.78

BIODIESEL

Comparison of production costs of jatropha, soyabean and sunflower against production diesel prices at different crude oil prices



BIODIESEL

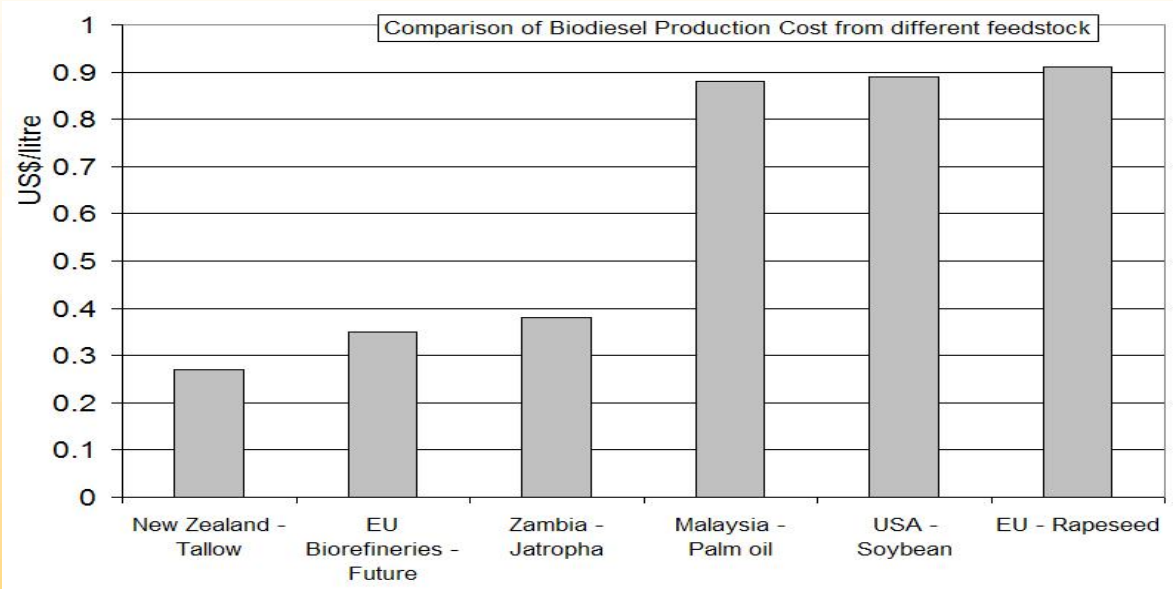
- From the results displayed, unit production cost for jatropha, soya bean and sunflower have been calculated at US$0.50, 5.3 and 1.10 per litre, respectively.
- In terms of competitiveness, only Jatropha is mostly competitive (at more than US$ 60/barrel) and to a lesser extent (sunflower at slightly more than US$100/barrel).
- However, soyabean has been found to be totally uncompetitive at US$5.3 per litre mainly due to low oil content and high cost of raw material.

BIODIESEL

- In terms, of land requirements, Jatropha required 44,000, soya bean 124,000 and sunflower 57,000 hectares to produce 55.6 million litres of biodiesel per annum.
- Apart from being completive in production cost, Jatropha also requires less land compared to sunflower and worst of them all soya bean.

BIODIESEL

Given in figure below is comparison of biodiesel production cost from different countries



Source IEA 2004 energy outlook, CEEEZ 2006

BIODIESEL

- In view of high productivity in USA, soya bean production price is far greater than that obtaining in Southern Africa by a factor of 5 (US$ 0.9 and US$ 1.10 per litre respectively)

CONCLUSION

- Despite high productivity in USA, soya bean production price is close to that obtaining in Southern Africa (US$ 0.9 and US$ 5.30 per litre respectively)

THE END

Thank You For Your Attention