Biofuels: The 35 Years Experience of Brazil

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Markestrat Research Center

Biofuels Debate – IAMA Forum 2009 – BUDAPEST - HUNGARY
Brazilian Experience: 1979

1979 starts the sale of the 100% ethanol cars

Fonte: MME, 2005
Brazil Is World's Ethanol Superpower

Seven Out Of Every 10 New Brazilian Cars Uses Alternate Fuel

SAO TOME, Brazil, March 13, 2006  by Bootie Cosgrove-Mather

Double-click any word (What's this?)

(AP) In an agroindustrial complex ringed by fields of 12-foot-high sugar cane, a giant mechanical claw dumps stalks by the tons into an even larger crushing machine. Here's where the renewable fuel used to power seven of every 10 new Brazilian cars gets its start.

Sugary slurry flows into a row of gleaming stainless steel distilling tanks, transforming cane harvested only hours earlier by machete-wielding farm laborers into ethanol, the alternative fuel now promoted by President Bush to end what he calls America's addiction to imported oil.
Value Generation

I cut down 25lbs of stomach fat in 1 month by obeying this 1 rule.

Brazil, the Ethanol Superpower

By ANDREW DOWNIE/SAO PAULO Wednesday, Mar. 07, 2007

A gas station attendant fills a car with ethanol in Sao Paulo, Brazil, March 3, 2007.

Victor R. Caivano / AP
Addressing Questions

1 - Will the world need energy?
2 - The Basics of sugar cane and the Company Network
3 - Is it efficient?
4 - Is it consumer driven?
5 - Where will the market be?
6 - Does it contribute to the environment?
7 - Is it destroying the Amazon? Where will it grow?
8 - What is the strategic agenda?
Important Question

1 – Will the world need energy?
**Per capita consumption of energy 2006**

<table>
<thead>
<tr>
<th>Region</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tropic of Cancer</td>
<td>Equador</td>
</tr>
<tr>
<td>Tropic of Capricorn</td>
<td>Região Tropical: favorável à produção de cana</td>
</tr>
</tbody>
</table>

Em toneladas de óleo equivalente
Future traffic jams
Forecasts of car ownership, m

United States
Per 100 people in 2040

Source: Goldman Sachs

Oil is not only gasoline and diesel

Fonte: Caio Carvalho – Polo Nacional de Biocombustíveis
Important Question

2 - What are the basics?
Source: Prof. Marcos Fava Neves
Energy equivalent of 1 tonne of sugarcane = 1.2 oil barrel

Source: UNICA
400 industrial units in the country

CIA. ENERGÉTICA SANTA ELISA

CIA AçUCAREIRA VALE DO ROSÁRIO

USINA DE AçÚCAR E ÁLCOOL MB LTDA

USINA MOEMA AçÚCAR E ÁLCOOL LTDA
The Complex Sugar Cane Energy Network

Insumos Produção Indústria Distribuição

Insumos
- Defensivos
- Fertilizantes
- Máquinas Implementos
- Peças
- Serviços
- Outros

Produção
- Arrendamento
- Parceria
- Fornecedores

Indústria
- Outras Usinas Concorrentes
- Usina Foco
- Outras Empresas Não Concorrentes

Distribuição
- Distribuidoras
- Indústrias
- Traders
- Postos
- Empresas Diversas
- Mercado Global
- Ind. Alimentos
- Ind. Químicas
- Ind. Empacotadora
- Mercado Global
- Traders
- Mercado Global
- Atacado/Varejo
- Consumo próprio
- Co-geração Energia
- Distribuidoras
- Ind. Fertilizantes
- Agricultura...
- Pecuária...
- Outros

Produtos+Serviços
$ + Informação

** CONSUMIDOR FINAL **

** CONSUMIDOR FINAL **
Important Question

3 - Is it efficient in supplying energy?
Efficiency of Biofuels Feedstocks

Fossil Energy Balances (estimates)

- ETHANOL
- BIODIESEL

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Ethanol Yields (liters per hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar Cane Brazil</td>
<td>7,000</td>
</tr>
<tr>
<td>Beet EU</td>
<td>6,000</td>
</tr>
<tr>
<td>Sugar Cane India</td>
<td>5,000</td>
</tr>
<tr>
<td>Corn US</td>
<td>4,000</td>
</tr>
<tr>
<td>Cassava Thailand</td>
<td>3,000</td>
</tr>
<tr>
<td>Wheat EU</td>
<td>2,000</td>
</tr>
</tbody>
</table>

Note: Figures represent the amount of energy contained in the listed fuel per unit of fossil fuel input.

Source: Various, compiled by World Watch Institute. IEA – International Energy Agency (2005) and MTEC.
Sugar Cane Productivity Evolution

6,6 million ha preserved

Production (million ton)

Área Preserved **

Área Planted (million ha)

Elaboração: GV Agro
Nota: * Estimativa
**Área calculada a partir da produtividade média de 1970
Important Question

4 - What was our major technological breakthrough?

We gave the power to the consumer!
Demand is Driven by Consumer Choice

90% of new cars sold are FlexFuel, representing over 25% of fleet

Sources: ANP, ANFAVEA & UNICA
Gasoline is Now the Alternative Fuel!

Sources: ANP, UNICA
Brazilian sugarcane ethanol
1% of arable land delivers
50% of Brazil’s petrol needs

You can help fight climate change by supporting a mandatory 10% target for renewables in transport by 2020

The successful Brazilian experience shows that the EU’s ambition to achieve 10% of renewable fuels in transport by 2020 is feasible. Brazil has replaced half its petrol needs with ethanol made from sugarcane, grown on only 1% of its arable land. Sugarcane expands primarily on degraded pastures and does not compete with food production or cause deforestation of the Amazon. In fact, 90% of the sugarcane harvest happens in South-Central Brazil and the remainder is in the Northeast. Both regions are more than 2,500 km from the Rainforest, or roughly the distance between Paris and Moscow. While sugarcane production has increased steadily in recent years, Brazil has doubled its grain production in the last decade and become the top global exporter of several key commodities. The Brazilian experience proves that food, fuel, feed and fiber can be produced simultaneously and sustainably.

More information:
www.unica.com.br/en
Recent Numbers on Ethanol

2 million new flex fuel cars entering on the market in 2009...

April retail costs:
- Gallon of gasoline: US$ 4.0/gallon
- Gallon of ethanol (E100): US$ 1.9/gallon
- Ethanol production cost: US$ 0.98/gallon

Prices of ethanol/gasoline: 50-65%
Economic benefit till 70-75%
Environment and employment benefit?
Important Question

5 - Where will the market of ethanol be?
NEW USES FOR ETHANOL IN THE FUTURE

Bus powered by ethanol in São Paulo. Released on 23 October.

Motorcycle powered by ethanol

Bio-Plastics (polyethylene produced from bioethene, PVC produced from bioethylene)

100% ethanol airplane, used for spraying plantations

Ethanol used on transesterification of biodiesel.

Ethanol and fuel cells

Source: UNICA
### Biofuels Mandatory Blending Targets

<table>
<thead>
<tr>
<th>Country</th>
<th>Target Date</th>
<th>Potential Demand (billion of liters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>Current</td>
<td>46.9</td>
</tr>
<tr>
<td>USA</td>
<td>Until 2022</td>
<td>136</td>
</tr>
<tr>
<td>China</td>
<td>Until 2020</td>
<td>13</td>
</tr>
<tr>
<td>EU</td>
<td>Until 2020</td>
<td>9.3</td>
</tr>
<tr>
<td>Japan</td>
<td>Until 2030</td>
<td>6</td>
</tr>
<tr>
<td>Australia</td>
<td>Until 2011</td>
<td>2.1</td>
</tr>
<tr>
<td>Canada</td>
<td>Until 2010</td>
<td>2.2</td>
</tr>
<tr>
<td>Thailand</td>
<td>Current</td>
<td>1.5</td>
</tr>
<tr>
<td>India</td>
<td>Current</td>
<td>1.1</td>
</tr>
<tr>
<td>Phillipines</td>
<td>Until 2010</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**% of ethanol into gasoline**

*Source: Conab, Anfavea, USDA, IEA, Estimativas BBI
1 Inclui auto-pecas
2 Mercado potencial estimado em 2022*
Important Question

6 - Does it contribute to the environment?
Mata Ciliar

- 30 ou 50 metros
- Carreador de 6 metros (sem vegetação)
- Aceiro de 3 metros (corta cana crua ou inclina a cana no sentido do canavial)
The “Green Protocol” in São Paulo State

Elimination of sugarcane straw burning
State of São Paulo – mechanized areas

Note: the highlighted dots in the graphic lines show the specific years cited by the Law or in the Protocol. Prepared by: UNICA.
ABRIGO/REFEITÓRIO/SANITÁRIO: FR. CARREGAMENTO
### General Motors S 10

Emissão de gases (viagem de 100km percorrida pelo mesmo veículo)

<table>
<thead>
<tr>
<th>Modelo</th>
<th>S 10 cabine simples</th>
<th>S 10 cabine simples</th>
<th>S 10 cabine simples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td>2.8 turbo</td>
<td>2.4 flexpower</td>
<td>2.4 flexpower</td>
</tr>
<tr>
<td>Combustível</td>
<td>Diesel</td>
<td>Gasolina pura</td>
<td>Álcool</td>
</tr>
<tr>
<td>Rendimento</td>
<td>13,5 km/ litro</td>
<td>10,4 km/ litro</td>
<td>7,2 km/ litro</td>
</tr>
<tr>
<td>Potência máxima</td>
<td>140cv</td>
<td>141cv</td>
<td>147cv</td>
</tr>
<tr>
<td>Emissão de GEE* (Kg CO2)</td>
<td>29,69</td>
<td>35,1</td>
<td>9,44</td>
</tr>
<tr>
<td>Quantidade de litros gastos</td>
<td>7,41</td>
<td>9,62</td>
<td>13,89</td>
</tr>
</tbody>
</table>

Elaborado por: Markestrat
Fonte: Embrapa *Gases de efeito estufa
Important Question

7 - Is it destroying the Amazon?
And where will it grow?
Sugarcane producing regions in Brazil

Sources: NIPE-Unicamp, IBGE and CTC
Soil and climate possibilities for sugar cane

Excluídas a Região Amazônica, Pantanal e declividades superiores a 12%

Fonte: UNICAMP
Still a lot of Land to be Used in a Sustainable Way

Availability of arable land in Brazil

<table>
<thead>
<tr>
<th>Million Acres and Million Hectares (2007)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>2100</td>
<td>850</td>
</tr>
<tr>
<td>Total preserved areas and other uses*</td>
<td>1260</td>
<td>510 (60%)</td>
</tr>
<tr>
<td>Total Arable Land</td>
<td>840</td>
<td>340 (40%)</td>
</tr>
<tr>
<td>1 Cultivated Land: All crops</td>
<td>155</td>
<td>63.1</td>
</tr>
<tr>
<td>Soybeans</td>
<td>49</td>
<td>20.6</td>
</tr>
<tr>
<td>Corn</td>
<td>35</td>
<td>14.0</td>
</tr>
<tr>
<td>Sugar cane **</td>
<td>17</td>
<td>7.8</td>
</tr>
<tr>
<td>Sugar cane for ethanol ***</td>
<td>8</td>
<td>3.4</td>
</tr>
<tr>
<td>Oranges</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>2 Pastures</td>
<td>494</td>
<td>200</td>
</tr>
<tr>
<td>3 Available land (ag, livestock)</td>
<td>190</td>
<td>77</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% of total land</th>
<th>% arable land</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.4%</td>
<td>18.6%</td>
</tr>
<tr>
<td>2.4%</td>
<td>6.1%</td>
</tr>
<tr>
<td>1.6%</td>
<td>4.1%</td>
</tr>
<tr>
<td>0.9%</td>
<td>2.3%</td>
</tr>
<tr>
<td>0.4%</td>
<td>1.0%</td>
</tr>
<tr>
<td>0.1%</td>
<td>0.3%</td>
</tr>
<tr>
<td>23.5%</td>
<td>58.8%</td>
</tr>
<tr>
<td>9.1%</td>
<td>22.6%</td>
</tr>
</tbody>
</table>

Notes: e = estimated data; * These areas include Amazon Rain Forest, protected areas, conservation areas and reforestation, cities and towns, roads, lakes and rivers; ** cultivated area; *** harvested area for ethanol production.
Sources: IBGE, Conab and Unica  Data compiled by Icone and Unica.

247 million acres to be developed for agriculture
Land Use in Brazil

Estimativa de safra 2007/2008

EM MILHÕES DE HECTARES

<table>
<thead>
<tr>
<th>Cultura</th>
<th>Hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soja</td>
<td>211,1</td>
</tr>
<tr>
<td>Milho</td>
<td>14,5</td>
</tr>
<tr>
<td>Cana</td>
<td>7,8</td>
</tr>
<tr>
<td>Feijão</td>
<td>3,8</td>
</tr>
<tr>
<td>Arroz</td>
<td>2,9</td>
</tr>
<tr>
<td>Trigo</td>
<td>1,8</td>
</tr>
<tr>
<td>Algodão</td>
<td>1,0</td>
</tr>
</tbody>
</table>

Produção de açúcar e álcool

EM MILHÕES DE TONELADAS

<table>
<thead>
<tr>
<th>Ano</th>
<th>Açúcar</th>
<th>Álcool</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005/2006</td>
<td>26,2</td>
<td>20,3</td>
</tr>
<tr>
<td>2006/2007</td>
<td>28,6</td>
<td>24,3</td>
</tr>
</tbody>
</table>

Expansão

Na safra atual, 32 novas usinas entrarão em funcionamento no Centro-Sul do País, totalizando 84 abertas na região desde 2005.
EXPANSION OF PRODUCTION IN SÃO PAULO
RESULT ANALYSIS (Sugar Cane)

Figure 2: Production, Productivity and total area of Brazilian sugar cane from 1975 to 2006. 
Source: Prepared by the authors based on UDOP.
RESULT ANALYSIS (Com - SP)

Figure 3: Production and Productivity of corn in the state of São Paulo between 1976 and 2008*.
Source: Prepared by the authors based on data from (CONAB, 2008).
* Estimate.
Important Question

8 - What is the strategic agenda?
My Views of US Ethanol: Win Win Strategy

**BENEFITS**
- Environment (contribution to climate and others)
- Employment (a lot of jobs generated)
- Empowerment (money moving to inlands)
- Energy (another source + diversified)
- Exports (trade balance)
- Economy (distribution of income)

**RECENT EVIDENCE**
- Mandates of 15-20%
- Corn ethanol as additive to gasoline
- Flex Fuel Cars using E85 when oil prices climb
- Second generation ethanol being developed for 2015-2020, more blending and more use as E85
- Possible imports from Brazil to supply blending needs towards coast states (California, Florida and Texas). Makes sense in logistic terms.

**NEW ERA**
- Ethanol can bring a reconfiguration of the relationships of the USA with Central and South America

Source: Prof. Marcos Fava Neves
ARE WE THERE YET? When it comes to cheaper gas, the answer is no. Gas prices are at record highs and they keep increasing. Congress has the ability to eliminate the tariff on imported ethanol, which would lead to lower prices at the gas pump. Unfortunately, Congress has not yet lifted the tariff— and American drivers continue to hit a Congressional roadblock when it comes to finding cheap gas.
# Ethanol Strategic Agenda

**Internally**
- Taxes reduced to 12% (ICMS) in all states.
- From E 20/25%, to E 18/28%.
- Flex Fuel Vehicles Incentives.
- Directs sales of ethanol from industry to gas stations.
- Motorcycles flex and larger engines flex (diesel).
- Joint-ventures to enter on the market of wholesaling and retailing.
- The Concept of Green Gas Stations.
- City buses moved by ethanol.
- Petrobras exporting gasoline blended with ethanol.
- Continuous communication plan

**Externally**
- Fight against protectionism
- Stimulate overall production (Africa and Asia)
- Stimulate and follow mandates of percentages of added ethanol to gasoline
- Work on ethanol myths: Amazon, Land shortage, slaves and others.
- Certification and global patterns
- Image: differentiation of cane ethanol based on superior energy balance and future potential
- Global adoption of flex-fuel cars and ethanol retailing system
- Joint-ventures with oil companies (BP, Petrobras e Shell).

Fonte: Prof. Marcos Fava Neves
Mozambique's sugar cane to be used in making ethanol

Wednesday, 15 April 2009

Foreign companies have invested about $710 million in Mozambique to produce an annual 440 million litres of ethanol a from sugar cane.

Roberto Albino, director of Mozambique’s Centre for Agricultural Promotion (Cepagri), said that 48,000 hectares has been set aside for the production of sugar cane across six provinces.

"The money is coming from three foreign companies, ProCana, Principle Energy and Groun Resources," he said.

ProCana has an investment agreement with Mozambique’s government ethanol plant.

Principle Energy is a renewables energy company in which London-listed fund manager Principle Capital has a significant undisclosed stake.

The projects could generate as many as 7,000 and 10,000 jobs.
Value Generation

Thank you!