Petrobras and Biofuels
Legislation - Act 11097 of 01/13/05

Defines percentage and time for using biodiesel

Provides that mandatory acquisition and use times may be accelerated and define criteria for acceleration
First phase of Petrobras’ program: implementation of 3 biodiesel units in Northeast region and Brazilian semiarid. Each unit consists of a plant for multi-oleaginous species of 50 thousand tons/year.

Production Route: Oil

Oleaginous species considered: soybean, castor bean, cotton, and *jatropha*

Species Location:
- Quixadá (CE)
- Candeias (BA)
- Montes Claros (MG)

Other phases: production units to be installed in other regions

Goal: in 2011 produce 855 thousand cu.m/y

Partnerships are being studied to implement other units

Plants will be producing in January 2008
HBIO Process - Diesel Oil Production from Vegetal Oil in Refinery
HBIO is a process of:

- Oil Refining that uses vegetable oil as raw material to get diesel oil.
- Hydrogenation of the mixture diesel + vegetable oil
HBIO and Biodiesel – Complementary Processes

**Agribusiness**
- **Crops**
- **Seeds**
- **Crusher / Extractor**

**Transesterification**
- **Vegetable Oil**
- **Ethanol**
- **Methanol**
- **Glycerine + Others**

**Biodiesel**
- **Distribution**
- **mixture B2 ou B5**
- **Diesel**

**HBIO**
- **Hydrogen**
- **Diesel fractions**
- **Diesel**

**Refinery**
- **Crusher / Extractor**
- **Vegetable Oil**

**Fuel Station**
Ethanol
Ethanol in Brazil: 30 years of experience

Fuel Ethanol Program Evolution

- Ethanol Program Implanted (BLENDS)
- Gasohol and Ethanol Cars (2\textsuperscript{nd} oil shock)
- Program of Emission Controls (PROCONVE)
- Gasohol and Flex fuel Cars
- Renewable Hydrogen

Program for oil imports reduction

70’s 80’s 90’s 00’s Future

Environmental Benefits
Ethanol Global Market – 49.9 Billion Liters

North and Central America: 39.6%
Brazil: 33.5%
South America: 35.1%
USA: 38.3%
Europe: 9.5%
Asia: 14.3%

Ethanol Production Forecast:
35.3 Billion Liters (2005) → 77.3 Billion Liters (2010)
PIRA 2007
F.O.Licht 2006
Driving Forces for Fuel Ethanol Adoption

- Reduction of the oil dependence
- Energy diversification
- Agribusiness development
- Kyoto Protocol
- Carbon Credit Opportunities

**Ethanol Investments**

Goal: Export 3,5 MM cu.m/year in 2011

Logistic to export – New investments in pipelines, water way and vessels (US$ 750 MM)
Ethanol Logistic to Export

- New Ethanol Pipeline (800 km)
- New Water Way for Ethanol

Ethanol Export Capacity
8.0 Millions cu.m/ year in 2012

Marine Terminal
Rio de Janeiro

Marine Terminal
São Paulo
**Ethanol from sugar cane to lignocelluloses**

Today: Sugar cane has the highest energy output/input ratio

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Energy output / energy input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>1.2</td>
</tr>
<tr>
<td>Corn</td>
<td>1.3 – 1.8</td>
</tr>
<tr>
<td>Sugar Beet</td>
<td>1.9</td>
</tr>
<tr>
<td>Sugar Cane (under Brazilian Production Conditions)</td>
<td><strong>8.3</strong></td>
</tr>
</tbody>
</table>

**Tomorrow**

Lignocelluloses Biomass technology will double ethanol per ha. yield

1 metric ton of sugar cane

- Molasses yields only 85 L of ethanol,
- But Cane bagasse yields 185 L of ethanol

Base calculation
Research & Development Investments
R&D Petrobras Projects on Bio-fuels

HBIO –
Vegetable oil hydrogenation

Biodiesel
3 plants: 1th Q 2008

Non-conventional bioethanol
Lignocellulosic (mainly bagasse) bioethanol
Pilot plant: 2th Q 2007
Castor oil seed cake bioethanol

Synthetic bio-fuel (BTL)
Pilot plant: 4th Q 2007
Final Comments
Biofuels will play a significative role in the fuel transportation market;

Competitive price and overall efficiency will be demanded by the market;

Need to qualify the work force and keep the pace of the technological development by the domestic ethanol industry, aiming competitive costs;

PETROBRAS shall keep on investing to adjust the profile of the production to the profile of the demand of oil products and for the production of cleaner fuels;

Petrobras’ HBIO process is a technological breakthrough which yields renewable fuels;

PETROBRAS shall keep on investing to develop fuel ethanol international markets, improving brazilian logistics infrastructure and researching new technologies for ethanol production (lignocellulosic process).