A Brief History of Brazilian PróÁlcool Programme and developments of Biofuel and Biobased products in Brazil.

Eduardo Giacomazzi

biobrasil@fiesp.org.br

FIESP – Industry Federation of Sao Paulo State

Bioindustry Commitee

OECD – Global Forum Biotechnology
Paris, 1November 2012
Agenda

1- Sugarcane and biotechnology timeline
2- Proácool - The Ethanol Program
3- Future Perspectives
4- Case: Rural Biogas - Future Biofuel Programm
Sugarcane’s Timeline

- **~ 10,000 bc**: Papua New Guinea and Polynesia
- **400 bc**: Raw sugar production in China
- **9th century**: Description of cultivation and production of sugar - India
- **1516**: King D. Manuel Decree promoting cultivation and sugar mill in Brazil
- **1535**: 1st sugar mill in Northeast of Brazil Pernambuco
- **1802**: Chinese immigrants on Hawaiian Islands producing sugar
- **1815**: 1st steam driven mill in Brazil
- **1801**: 1st sugar beet factory in Kunern Germany
- **1838**: Paper start to be made from cane bagasse in Matinique
- **1933**: Sugar and Alcohol Institute in Brazil, after crisis
- **1939 - 1945**: Extraction of sugar from sweet potatoes by Japanese
- **1970's**: World’s oil crisis and Proálcool in Brazil

- **1,000 bc**: Indochina and Bay of Bengal
- **640 ac**: Expansion to Mediterranean
- **1425**: 1st plants brought from Sicily to Madeira Island (Portugal)
- **1532**: 1st sugar mill in Brazil – Coast of Sao Paulo
- **1806**: Jamaican train introduced in Brazil
- **1823**: First experiments in cultivating sugarcane in Australia
- **1933**: Sugar and Alcohol Insitute in Brazil, after crisis
brazilian biotechnology timeline

1761
- Charles Darwin visit Brazil during his „Origin of Species” Research

1808
- King D. João IV created Rio de Janeiro’s Botanical Garden

1861
- Reforestation of the Tijuca Forest at Rio de Janeiro

1887
- Foundation of the Agronomical Institute of Campinas - IAC

“For centuries, local communities research and develop Brazilian biodiversity”
1967
Foundation of Finep Research and Projects Financing by the Ministry of Science and Technology

1968
Dr. Euryclides Zerbini (1912-1993), performed the first heart transplant in Brazil

1972
Foundation of Embrapa Brazilian Enterprise for Agricultural Research

1975
Oswaldo Cruz Institute presents the first anti measles vaccine fully produced in Brazil

1979
Implementation of Pró-Alcool, the National Alcohol Program

1982
Development of artificial skin for treatment of injuries

1984
Implementation of 8 Regional Genome Networks by the Ministry of Science Technology

1988
The Universal Health System (SUS) is included approved in 1988 Constitution

1992
Production of the Recombinant human insulin in Brazil by Biobrás/UnB

1999
Brazilian researchers announce the genome sequence of the plant pathogen Xylella fastidiosa

2001
The Generic Drug Law was approved at Brazilian Congress

The Science and Technology Sector Funds, a project financing instruments for domestic research, development, and innovation was created

Implementation of 8 Regional Genome Networks by the Ministry of Science Technology
Copersucar & Eco-Energy Join Ethanol Operations to Become the Largest Biofuel Marketer in the World

Combined companies handle 12% global market share in growing ethanol space

Eco-Energy, a leading biofuel marketer and logistics company in North America, and Copersucar, the largest sugar and ethanol trader in Brazil, are pleased to announce today the internationalization of their ethanol operations with a joint investment in Eco-Energy to build and expand their integrated biofuel platform.

With this partnership, Copersucar and Eco-Energy add their global supply capacity of 2 billion gallons, (10 billion liters), of biofuel per year to become the largest ethanol trader in the world, with a significant presence in the two largest ethanol markets globally. This new structure creates the largest and most sophisticated biofuels platform in the world, which will help create significant efficiencies in the global supply chain as well as add value to both of the companies partner plants. The companies’ operations are very similar and complementary, focusing on the integration of world supply-demand and logistic solutions throughout the supply chain.

With 20 years of history, Eco-Energy operates in the marketing and distribution of biofuels, with solutions including exclusive alliances with ethanol producers, logistics, and marketing services to the downstream U.S. fuel distributors. Eco-Energy currently handles 9% of the U.S. ethanol market, with annual sales of over US$ 3 billion and has strong relationships with producers and access to the most relevant markets and customers, due to an efficient operating platform, best in class resources, and focus on distribution and logistics.

The business model is very similar to that of Copersucar, a Brazilian company with 53 years of tradition in the sugar and ethanol industry. For the current season (2012-13), Copersucar will market the equivalent of 24% of the production from the sugarcane production in the Center-South region of Brazil, with a volume of 1.3 billion gallons (4.8 billion liters) of ethanol and 8.7 million tons of sugar, and revenues estimated at US$ 7.5 billion (R$ 15 billion). For the 2011/2012 season, ethanol sales accounted for 41% of the Company’s revenues. Its operations are supported by an integrated logistics system of transport and storage, and a large scale commercialization, both in the domestic and international markets.
There are 469 sugar cane and ethanol plants in Brazil;

Concentrated in Sao Paulo, Parana and Goias and in the northeast coast (Sergipe, Alagoas, Pernambuco and Paraiba).

Source: BrBiotec Brasil/Cebrap, "Brazil Biotech Map 2011".
70 cities
293 bases of dealer

Source: ANP/SINDICOM
Sugarcane as Energy

- **Sugar**
  - Food
  - Pharmaceutical industry

- **Ethanol**
  - Fuel (anhydrous and hydrous)
  - Pharmaceutical industry

- **Bagasse**
  - Co-generation of electricity
  - Animal food
  - Paper

- **Vinasse**
  - Fertilizer

- **Levedure**
  - Animal food

- **Straw**
  - Fertilizer
Ethanol as Fuel

- **19th century**
  - Basis for studies of Nicolaus August Otto
- **Between 1905 and middle 1920’s**
  - Experiments in Brazil
  - Ethanol motor
  - Ford 4 cylinders
- **20.02.1931**
  - Mixture of 5% in the imported gasoline
- **23.09.1938**
  - Mixture of 5% extended to gasoline produced in Brazil
- **1942-1946**
  - Mixture achieved 42%
- **1950-1960**
  - Decrease of interest by government and business community
- **Early 1970’s**
  - Mixture in the city of Sao Paulo: 7.0%
  - Mixture allover the country: 2.9%

The oil crisis and its influence

Expenses with oil imports
- 1973: US$ 600 million
- 1974: US$ 2.5 billion

Commercial balance
- Deficit of US$ 4.7 billion

Inflation
- 1973: 15.5%
- 1974: 34.5%

80% of oil was imported

98% of public and material transportation used derivates of oil

1974: „Photosynthesis as a source of energy“

14.11.1975: Program for ethanol (Proálcool) launched by government
Incentives established at the time:

• Ethanol price lower than gasoline’s
• Guaranteed remuneration of the producer
• Financing to producers – increasing of production’s capacity
• Gas stations obliged to sell ethanol
• Maintenance of strategical reserves of ethanol
• Reduction of taxes for vehicles moved by hydrous ethanol (still valid)
Proálcool – Implementation

Initial phase (1975 – 1979)

- Efforts on production of anhydrous (mixture with gasoline)
- Growth of ethanol production
  - 1975/76: 600 million liter/year
  - 1979/80: 3.4 billion liter/year
- 1978
  - First cars moved exclusively by ethanol
- Mixture in Gasoline
  - 1975: <5%
  - 1979: 15%

Proálcool – Implementation

Affirmation phase (1979 – 1987)

• Price of oil 3 times higher

• 1980: oil imports accounted for 46% of total Brazilian imports

• Growth of ethanol production
  » 1979/80: 3.4 billion liter
  » 1886/87: 12.3 billion liter

• Mixture in Gasoline
  » 1979: 15%
  » 1987: 22%

• Production of cars moved by alcohol
  » 1979: 0.3%
  » 1980: 24.5%
  » 1986: 80.6%


- "Petroleum Counter-Shock"
  - from US$30-40 to US$12-20

- Public resource shortage
  - Decreasing investments for internal production of energy

- 1988
  - World sugar price increased

- 1990
  - 5 million vehicles – 85% of the car's fleet

- Severe shortage of ethanol

- Imports of ethanol and methanol from USA
  - More than 1 billion liters

- Automotive industry
  - World standardization – gasoline motor
  - Popular cars (1.0 – gasoline)

- Lost of credibility
New Proálcool – Implementation

  - 1997
    » CIMA: Sugar and Alcohol Inter-Ministerial Council
    » Regulation for highly competitive products
  - 1997
    » Liberalization of alcohol's (anhydrous) price
    » „Oil Law“: defines transition to sector's opening
  - 1999
    » Liberalization of alcohol's (hydrous) price with reduction of subsidy
  - 2000
    » End of subsidy for alcohol (hydrous)
    » Total deregulation of the sector

Brazil sugar cane conversion rate

New Proálcool – Implementation

- **Current phase (2000 – …)**
  - **01.2002**
    - Complete liberalization of prices
  - **03.2003**
    - „Flexfuel technology“ – Bosch
  - **Ethanol production:** 28 billion liter/year
  - **Consumption:**
    - Gasoline (C): 28 billion liter/year
      - Mixture of 20-25%
    - Ethanol (hydrous): 18.5 billion liter/year
    - Ethanol (anhydrous): 9.5 billion liter/year
  - **Growers of sugar cane:** 60,000
  - **Industries in operation:** ~400
  - **Productivity growth:** >3% per year
  - **2.2% of GDP**
  - **~ 1 million direct jobs**

Results

Ethanol Production - Billion liters

- Self prepared after Unica
Flexfuel vehicles

Vehicles Produced

- GASOLINE
- ETHANOL
- FLEX-FUEL

Self prepared after Unica and Anfavea
Past & Future

Brazilian Ethanol Production

1st Stage: sugar cane destined only for sugar
2nd Stage: hydrous ethanol.
  Governmental intervention on the market.
3rd Stage: anhydrous ethanol.
  High sugar exports.
  Oil prices stabilized
4th Stage: free market.
  Flex fuel vehicles.
  High international sugar and ethanol demands.
  GHG emission targets.

Oil crisis

PROÁLCOOL

Kyoto Protocol

Brazil’s energy Matrix

Internal Offer of Energy (%)

241 Mtoe

- Hidropower and electricity
- Sugarcane's derivatives
- Wood and vegetable coal
- Other renewables
- Natural gas
- Oil and derivatives
- Mineral coal and derivatives
- Uranium and derivatives

Energy distribution over time from 1970 to 2008.
Some facts about Brazilian agribusiness:

- World’s biggest producer of coffee;
- World’s biggest producer of sugar and alcohol;
- World’s biggest producer of juice of fruits;
- World’s biggest exporter of soy;
- World’s biggest exporter of cattle meat;
- World’s biggest exporter of chicken meat;
- World’s biggest exporter of tobacco;
- World’s biggest exporter of leather and leather shoes.
Global Leadership in Biopolymers

Ethylene from Ethanol: COMMITMENT WITH SUSTAINABILITY

- Investment: US$ 290 million
- Ethylene from ethanol dehydration plant – 200 kt/year
- Ethanol consumption: 460 million liters/year
- Industries: Food, Automotive and Cosmetics
- 70% of the production sold before start-up
- Several governments invitations to invest in new production plants abroad;
- Investment in 3 additional plants by 2015
- Cornerstone Ceremony of the Green Ethylene Industrial Plant on April, 22nd 2009 and Start-up ceremony in Sept, 24th 2010 (17 months)
Some predictions about Brazilian agribusiness:

- World’s biggest producer of cotton in the next years;
- World’s biggest producer of biofuel in the next years;
- World’s biggest producer of food in the next decade (UNCTAD);
The agribusiness in numbers:

- 20-30% of GDP;
- 37% of all employment;
- 62 million hectares cultivated;
- 30 million more hectares expected to be cultivated in the next 15 years;
- 8 million hectares for sugarcane
- Production of grains: ~150 million tons on the 2010/2011 harvest;
- Bovine herd: 205 million heads in 2010
Future Perspectives – Itaipu Case

BIOGAS
Rural Biofuel for the Future
Rio+20
BIOGAS

BIO-ENERGY IN FAMILY FARMING: A NEW SUSTAINABLE PERSPECTIVE FOR THE RURAL SECTOR

Bley C.
ITAIPU Binacional Renewable Energy Coordination, Av. Tancredo Neves, 6731 Foz do Iguaçu/PR, Zip Code 85856-970, Brazil. Tel +55-45-3520.6508 – cbley@itaipu.gov.br

Amon D.
Division of Agricultural Engineering, University of Boku Peter-Jordanstrasse postcode 82 A-1190, Vienna. Tel: +43-147654-3502 - barbara.amon@boku.ac.at
The small scale family farming represents 85% of the agrarian structure in the State of Paraná. According to the National Institute of Settlement and Agrarian Reform/INCRA, and the Food and Agriculture Organisation of the United Nations/FAO, employs about 13.8 million people, or 77% of the population working in agriculture. There are about 4.1 million family establishments, which produce almost 40% of the Gross Value of Agricultural and Livestock Production, or 60% of the food consumed by the Brazilian population.
Itaipu Binational, the most important hydroelectric power plant in the world, turned its attention in 2003 to the support to new decentralized ways of generating energy. Among other actions for demonstrating the viability of bioenergy, the Company has developed the Project “Agri-energy Cooperative for Family Farming”, in the Ajuricaba hydro basin, in the Municipality of Marechal Cândido Rondon, state of Paraná.
FIGURE 1  Ajuricaba hydro basin and rural properties

Source: CIER-BIOGAS - Itaipu
Implementation

These farmers’ herds, dairy cattle and swine, annually generate around 16 thousand tons of residues. Submitted to anaerobic bio-digestion, it will yield around 319 thousand m\(^3\) of biogas a year.

If used as fuel for engine-generators, this biogas will produce about 507 thousand kWh a year, enough to provide electricity to 170 households with a monthly consumption of 250 kWh each.

The analysis of the economic viability of the project presents the following indicators:

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Obrigado

Merci Beaucoup