Session I: Policy Perspectives on Biofuels

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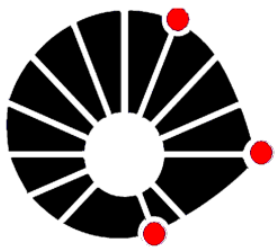
Biofuels production and their use in Brazil: the experience with ethanol and the new biodiesel program



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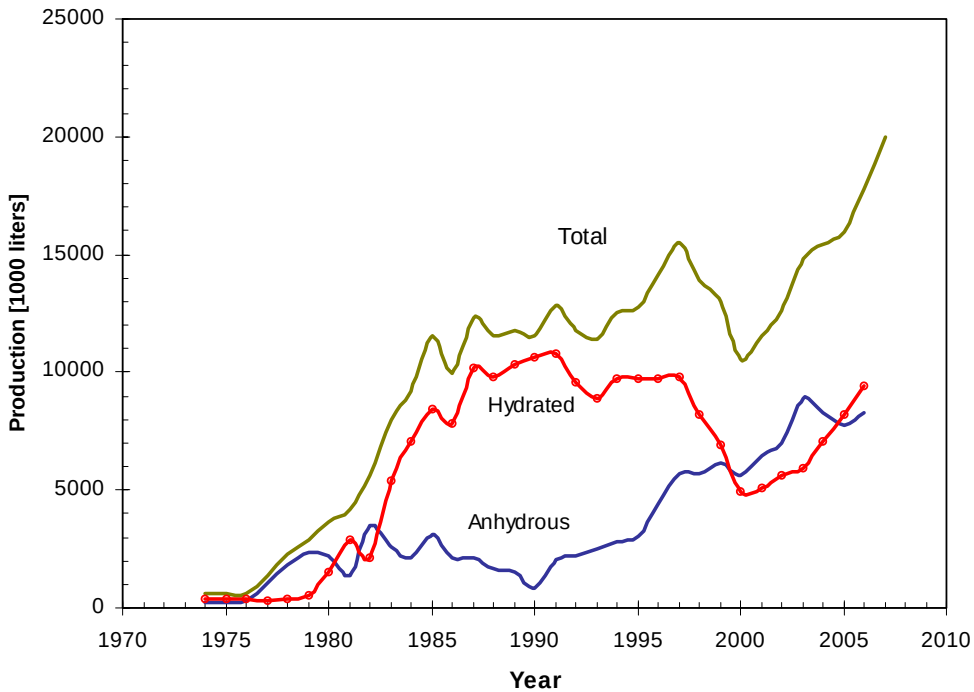
Outline of the presentation

- Introduction.
- Ethanol experience: historical facts, main results achieved, policy and regulatory issues, challenges.
- Biodiesel production: the program, the targets, results achieved, perspectives.
- Conclusions.

Introduction

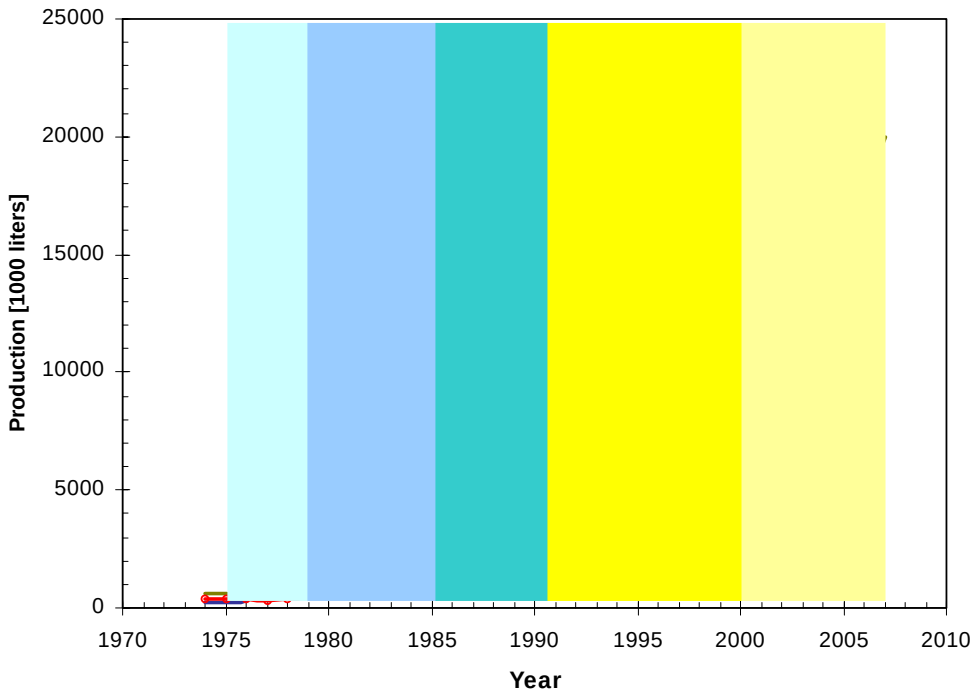
- Brazil has large-scale experience on ethanol production and its use as fuel since 1975.
- Brazil is the only country where ethanol is not subsidized and is fully competitive vis-à-vis gasoline.
- Brazil is worldwide the second largest producer of ethanol (US have surpassed Brazil in 2006).
- The adequate conditions for biofuels production and the ethanol experience were taken into account when the biodiesel program was proposed.
- However, the main driven-force for large-scale biodiesel production is social (strong support has been given to family farmers and to the production in poorest areas of the country).

Ethanol experience – basic facts



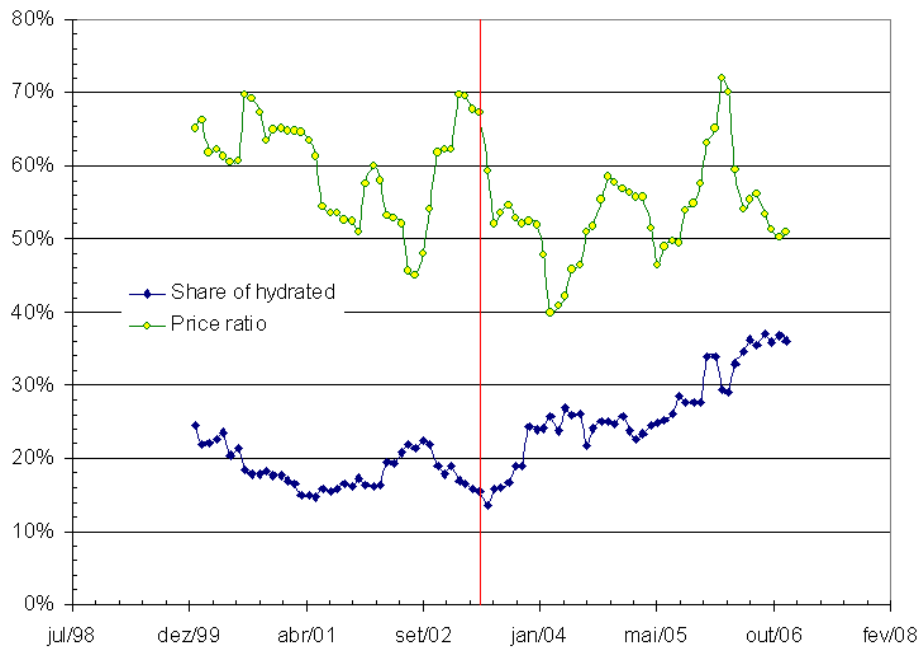
- More than 30 years of large-scale production.
- Anhydrous ethanol is used blended with gasoline (20-25% volume basis).
- Hydrated ethanol is used in neat-ethanol vehicles (now FFVs).
- All production is based on sugarcane.

Ethanol experience – after 1999



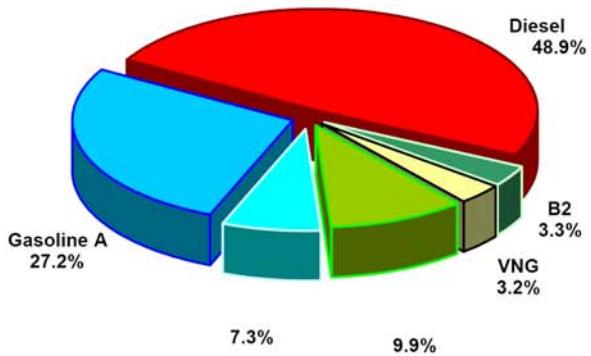
- The “revival“ of fuel ethanol production occurred after late 1990s, first with full deregulation of the industry and, second, with the launch of flex-fuel vehicles in 2003.
- Currently, 90% of the new vehicles are FFVs.
- FFVs can operate from E20 to E100.

Ethanol experience - FFVs

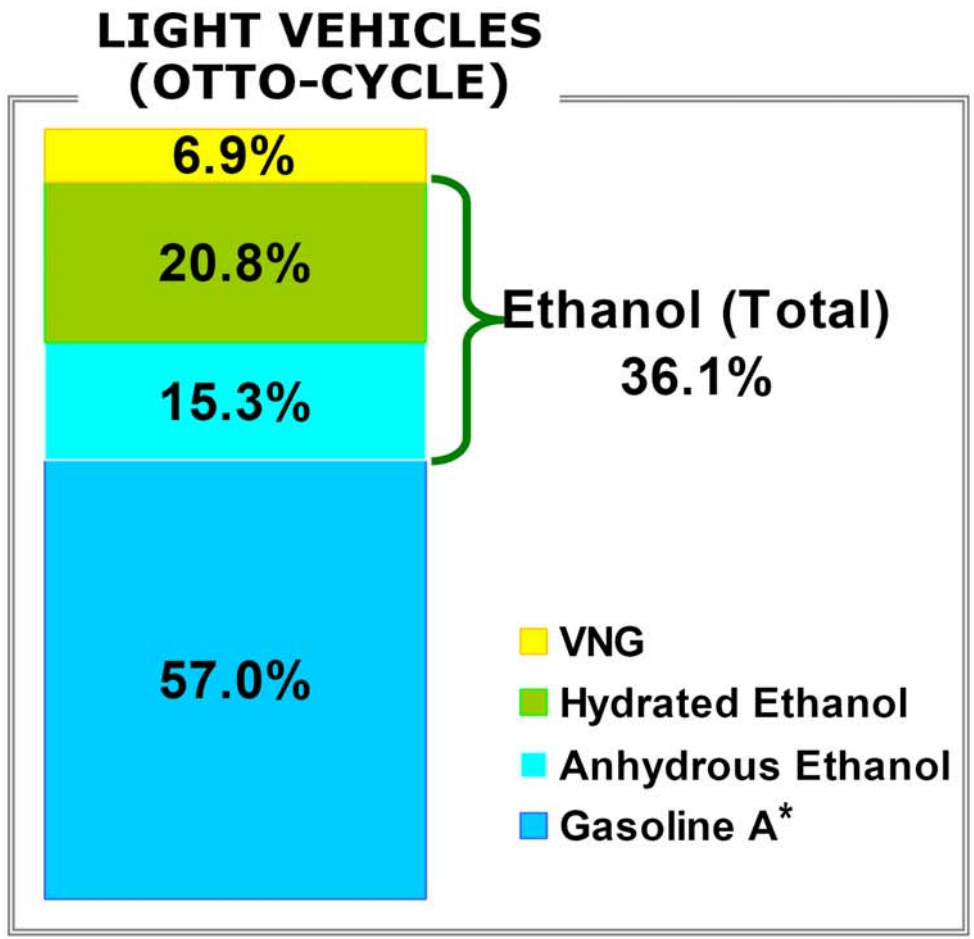


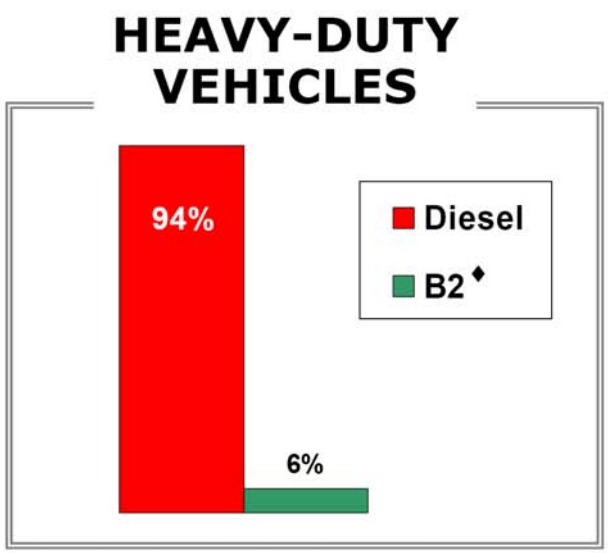
- With FFVs there is real competition between gasoline (E20-E25) and ethanol.
- Consumers take their decision at the moment of filling the tank, based on prices.
- For most of the car models the break even point is a price ratio = 70% (volume basis).

Vehicle fuels in 2006

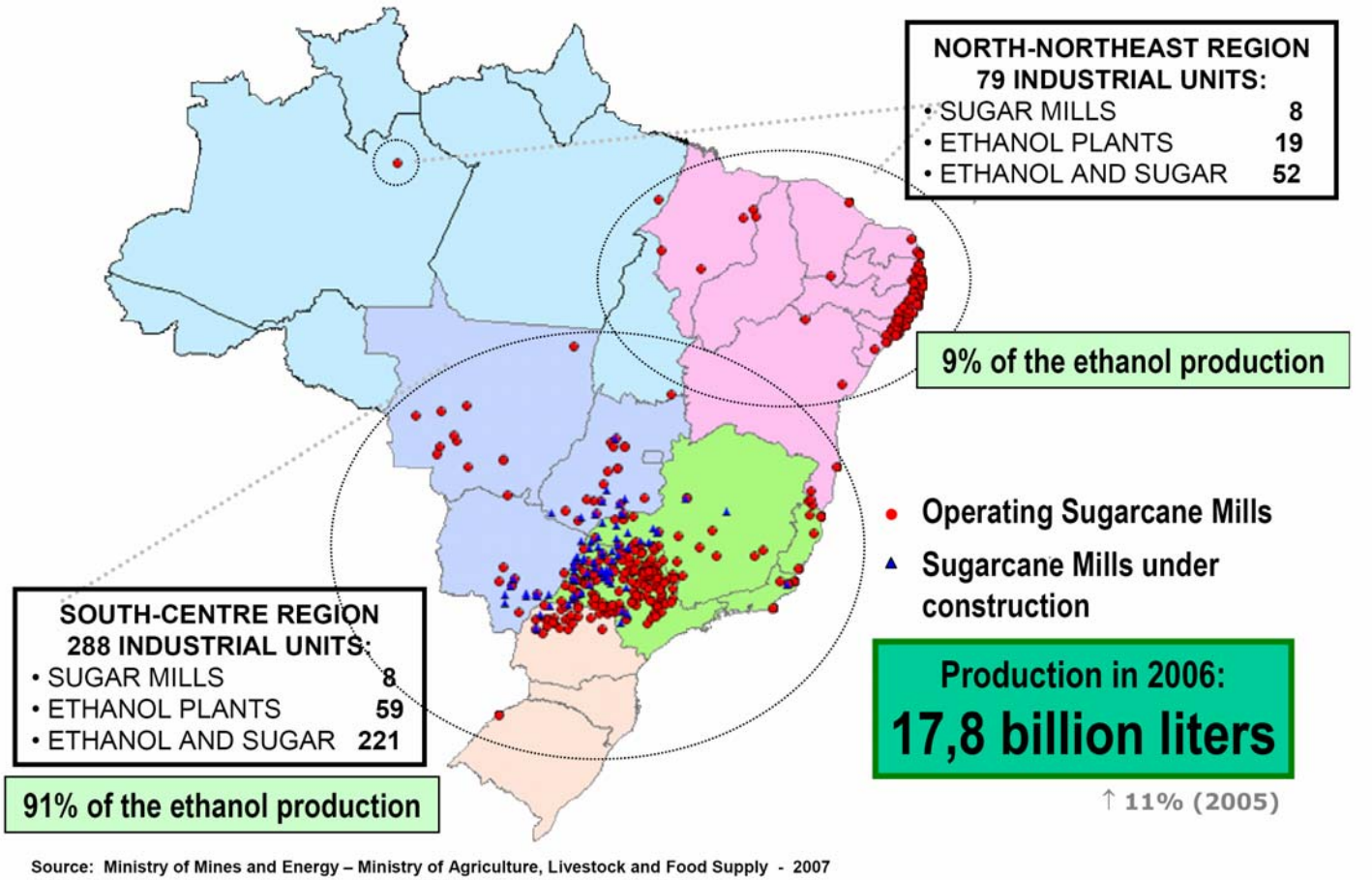


Source: MME (2007)





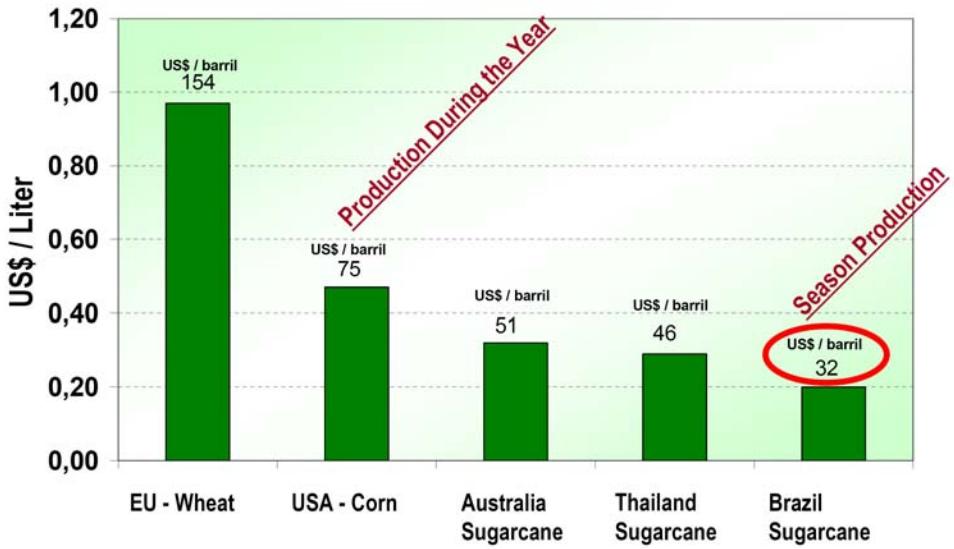
The industry in 2007



273 integrated plants;
78 ethanol plants;
361 plants producing ethanol;
About 80 plants under construction;
6.3 Mha planted with sugarcane.

It is predicted that the total production of ethanol (domestic market + exports) shall reach 30 Gl by 2010, 47 Gl by 2015 (35+ 12) and 65 GL by 2020.

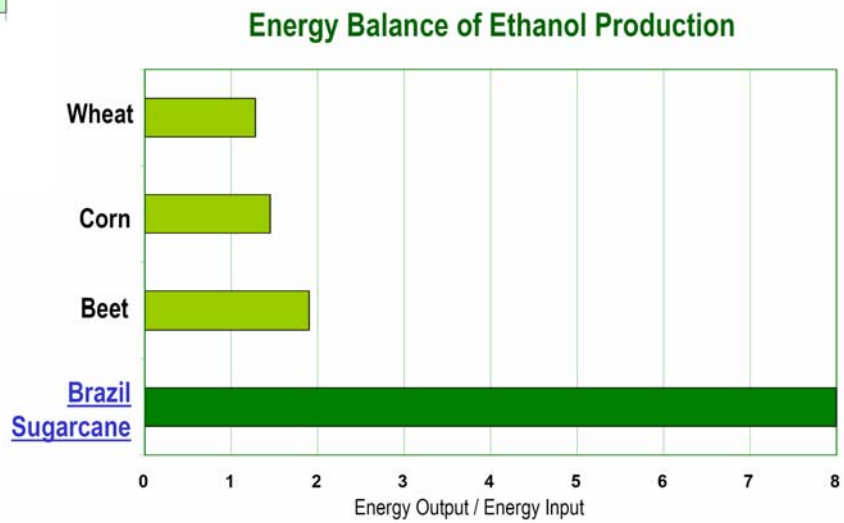
Costs and GHG balance



Source: DATAGRO (*in* "New trends to the ethanol supply chain in Brazil", Simoes, R.B., Master Thesis, Universiteit Van Tilburg, Holanda, Jul-2006)

Ethanol produced from sugarcane, according to the Brazilian conditions of production: 80-90% of the GHG emissions can be reduced regarding to the use of gasoline. Avoided emissions regarding the production of ethanol from starches (e.g., corn and wheat) are evaluated as 15-40% (IEA, 2004).

Ethanol produced from sugarcane, according to the Brazilian conditions: less than 50 Euro/$tCO_{2\ eq}$ vis-à-vis about 500 Euro/$tCO_{2\ eq}$ for the production from corn and more than 700 50 Euro/$tCO_{2\ eq}$ for the production from wheat (IEA, 2004).



Source: F.O.Licht (in "New trends to the ethanol supply chain in Brazil", Simoes, R.B., Master Thesis, Universiteit Van Tilburg, Holanda, Jul-2006)

Social impacts

Table 1. Comparison between municipalities with and without sugar and ethanol production in state of São Paulo – 2000

Parameter	Cities with sugarcane activity	Cities with no sugarcane activity
Number of municipalities	96	499
Population range (1000)	2.4 – 500	2.4 – 500
Average income (R$ 2000) x 1000	17,193	12,441
Income/habitant (R$ 2000)[1]	308.7 ± 72.7	272.7 ± 85.2
Average Gini index[2]	0.519	0.528
Share of total income of 20% poorest[1]	3.97% ± 0.84%	3.61% ± 1.04%
Share of households with electricity supply	99,6%	98,8%
Human development index (HDI)[1]	0.80 ± 0.03	0.78 ± 0.03

Source: Walter (2008) forthcoming

Note: [1] Average values ± standard deviation

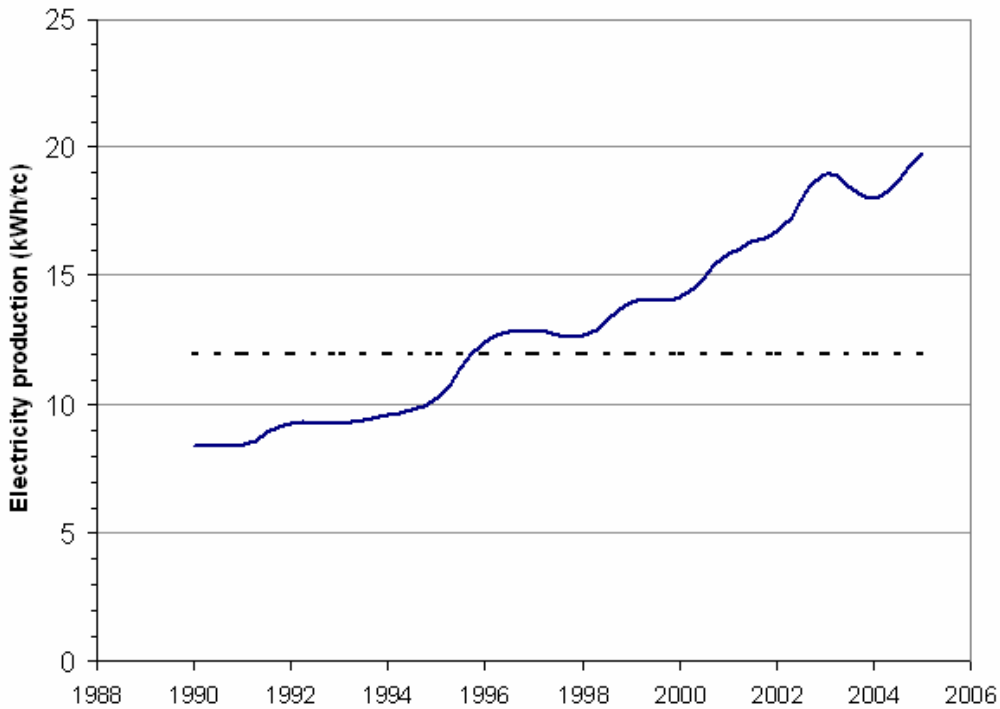
[2] The Gini index is a measure of statistical dispersion and is commonly used as a measure of inequality of income distribution. The index varies from 0 to 1, being 0 equivalent to perfectly equality and 1 to a hypothetical situation in which just one person has all income.

- It is estimated that 1.3 billion people are working in the sugar and ethanol sector. Often it is mentioned that salaries, in general, are higher than in other sectors (considering people of lower skills).

Social aspects - problems

- Working conditions during manual cane harvesting: most of the direct jobs are for harvesting and the workers are migrants who move to the areas of plantations due to the lack of economic alternatives in their native regions.
- With mechanical harvesting (to be fully implemented up to 2017 in São Paulo), the problem will be reduced, but it will be necessary to create jobs.
- Worker‘s rights: unfortunately there are still cases of people working and living in very bad conditions (slavery conditions!)

Electricity generation



- Currently, electricity generation from biomass is as important as generation from natural gas.
- In 2006, electricity generated from bagasse contributed with 3% of total generation
- However, the potential is al least 2-3 times higher considering the current level of sugarcane production.

Early (and current) policies

- Control of prices to keep ethanol cheaper than gasoline to the consumers. Subsidies to ethanol producers.
- Tax reduction for neat-ethanol vehicles.
- Financial support to ethanol producers and loans with low interest rates.
- Control of the sugarcane and of ethanol production.
- Support to technological development.
- PETROBRAS (the national oil company) has assumed many duties regarding storage, distribution, etc., including investments. The company is still acting, but now due to the business potential.
- Mandates regarding use of anhydrous ethanol (still existing).
- Tax exemptions in some states (e.g., in São Paulo regarding taxes applies to gasoline, but similar to the taxes applied to diesel oil).

Challenges

- Domestic market can reach 50-55 Gl in about 25 years.
- Considering export opportunities, the production should be enlarged 3-4 times up to 2030.
- Production costs should be kept at low level; technology development is necessary, including development of 2nd generation technologies and production diversification.
- Land-use regulation is required.
- Expansion should be planned in order to reduce costs.
- Worker‘s conditions should be improved and new job opportunities should be created in other sectors.
- Sustainability should be a target in itself.

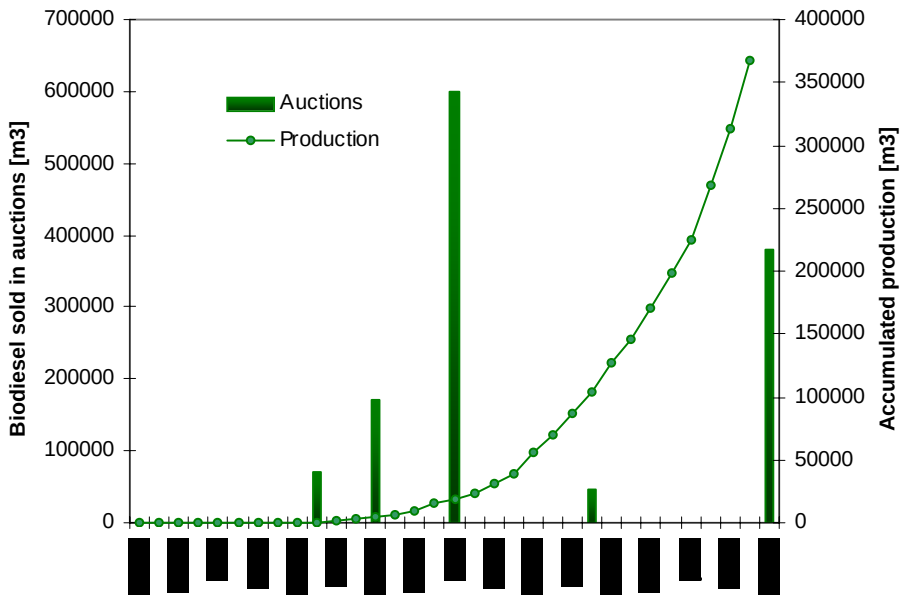
Biodiesel program

- Launched by the end of 2004.
- The main targets of the program are generating jobs and income in rural areas and reducing regional inequalities.
- Are also considered as targets the potential contribution to foreign-exchange savings (about 10% of diesel oil is imported) and the improvement of environmental conditions.
- From 2005 to 2007 it was possible to use B2 blends.
- Starting from January 2008, B2 blends will be mandatory across the country (about 840 Ml in 2008).
- In January 2013, this mandatory mix will increase to 5% of biodiesel (B5) (about 2.4 Gl in 2013).
- Blends with higher shares of biodiesel or even pure biodiesel (B100) can be used, but in this case an authorization is required.

Support to family farmers

- Engagement of small farmers and producers of the poorest regions has been fostered by means of tax incentives granted to firms that purchase oil-producing crops grown by small farmers.
- Producers that acquire raw material from family farmers, anywhere in Brazil, are eligible to reduction of up to 68% in federal taxes. If these purchases are made from family-based producers of palm oil in the North Region or of castor oil in the Northeast and in the Semi-Arid Region (Northeast and Centre regions), the reduction may reach 100%.
- In order to qualify for these tax benefits, biodiesel producers have to hold a certificate, called Social Fuel Stamp. The Ministry of Agrarian Development (MDA) issues the Social Fuel Stamp to biodiesel producers.

Production and auctions



- The production of biodiesel has been encouraged through purchase auctions organized by ANP.
- Seven auctions have occurred between 2005 and 2007, and the total amount of biodiesel sold summed up almost 1.3 Gl.
- The auctions that occurred in November 2007 – 380 Ml were sold – aimed at assure the supply of biodiesel during the first semester of 2008.
- So far (until October 2007) 367 Ml have been produced in Brazil, i.e., rough 50% of the volume required in 2008.

Biodiesel plants in Brazil

Biodiesel plants	*Number of units*	*Capacity MML/year*
Under commercial operation	*7*	*91*
Under licensing process	*15*	*366*
Under construction	*15*	*813*
New projects	*15*	*687*
Total	*52*	*1957*

- The existing capacity of biodiesel production is estimated as almost 2.6 Gl (in 46 industrial units). At least more 50 industrial units are planned to be built in the months to come.

Biodiesel plants in Brazil

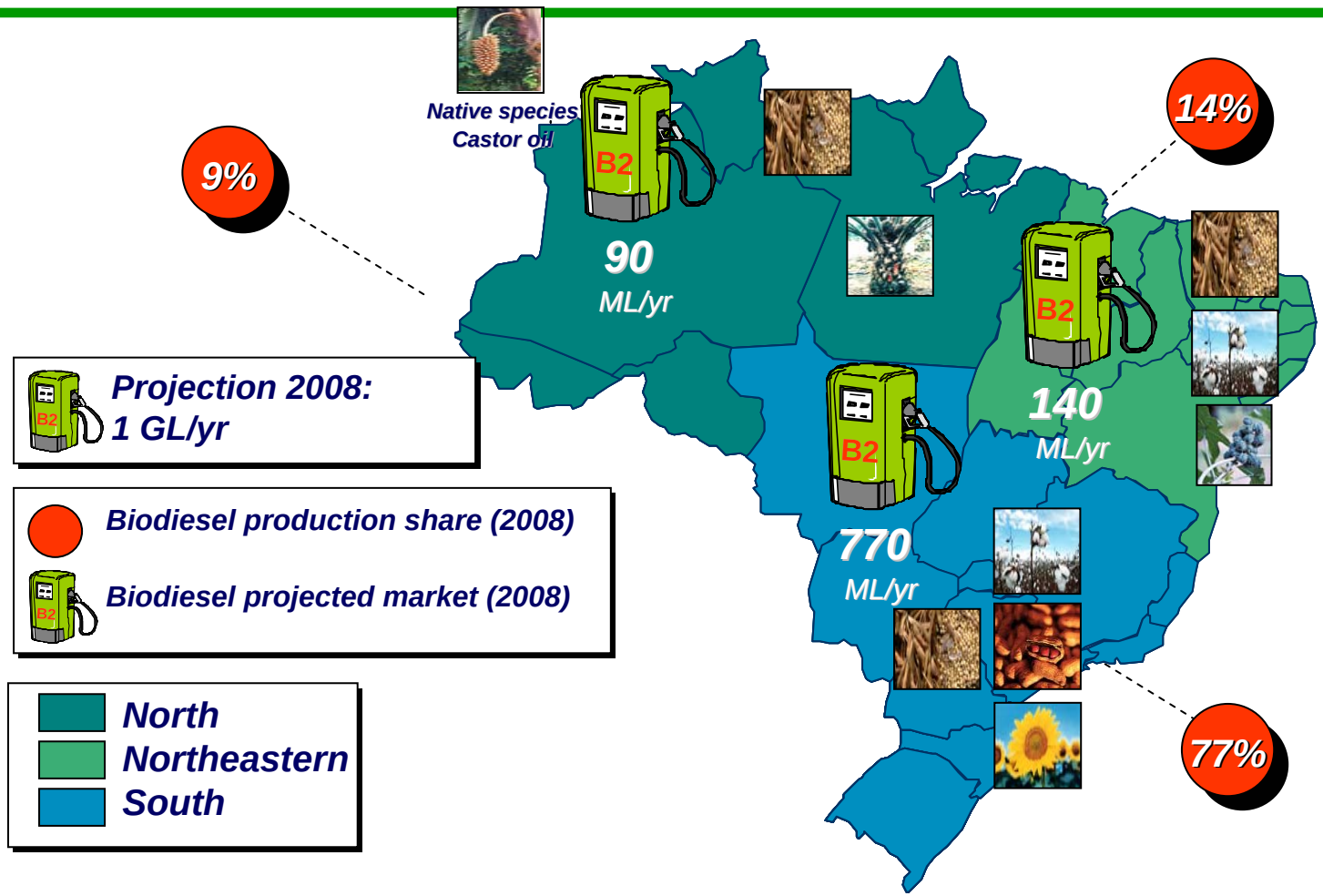
Existing capacity of biodiesel production – Brazil, end of 2007

Region	Industrial units	Capacity (1000 m^3/year)	Share of total capacity (%)
North	2	29	1.1
Northeast	8	634	24.5
Centre	16	739	28.6
Southeast	14	710	27.4
South	6	477	18.4

Source: ANP (2007)

- More than 80% of the biodiesel production have been based on soybeans that is not produced by small farmers. Soybeans production in Brazil is based on plantations and most of the production occurs in the South and Centre regions (more 10% of the biodiesel production have been based on residual oil and fats and about 10% on other raw materials).
- Just one company has more than 620 Ml of the total capacity of production – i.e., almost 25% of the total – and has produced more than 185 Ml – i.e., about 50% of the production so far achieved.

Oilseed production in Brazil




Castor


Soybean

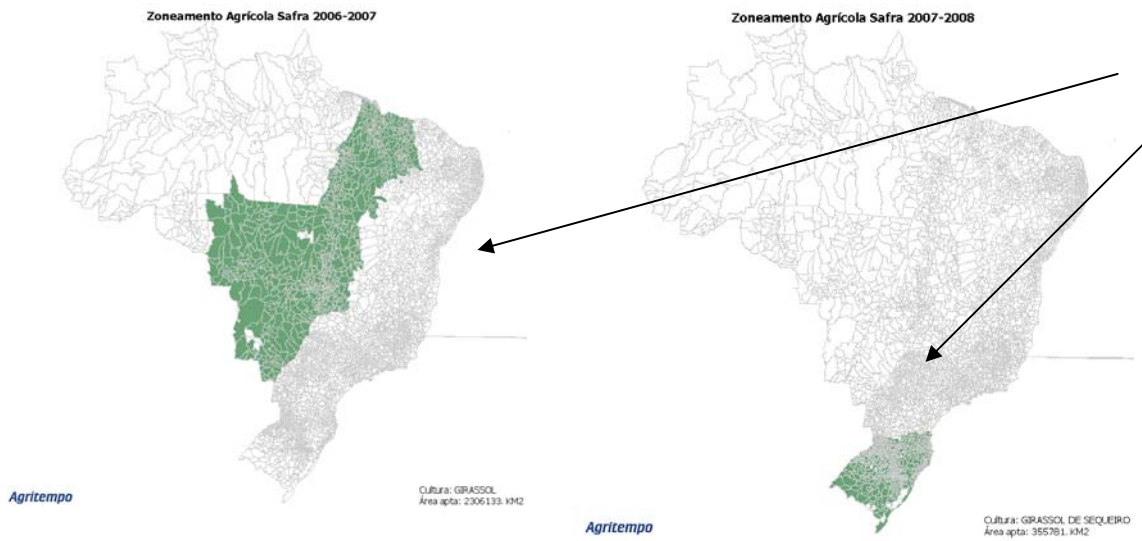

Palm


Sunflower


Peanut


Cotton

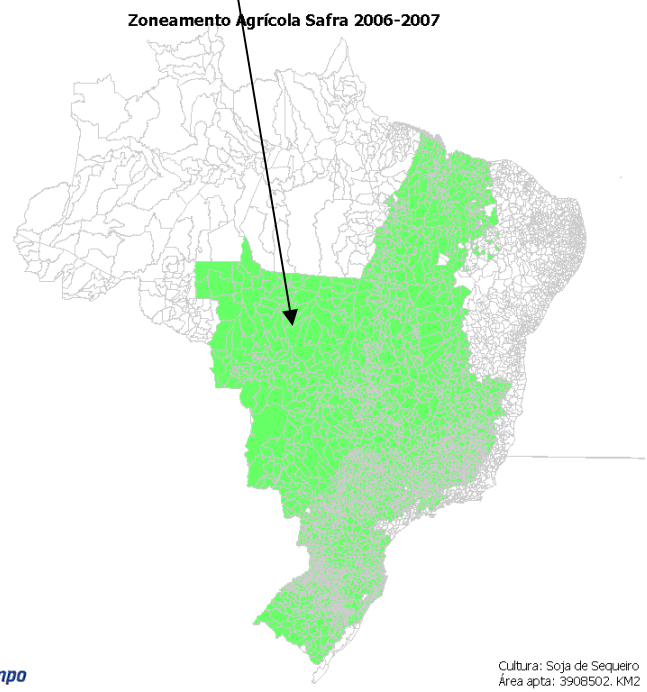
Areas of higher potential



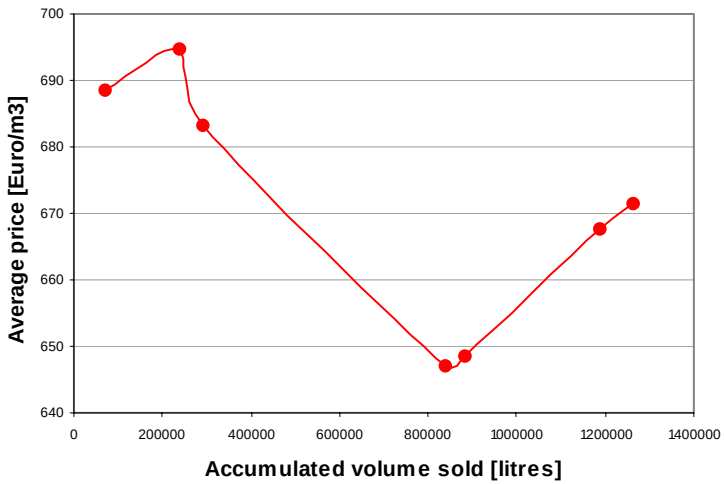
Sunflower = 430 kg/ha/year

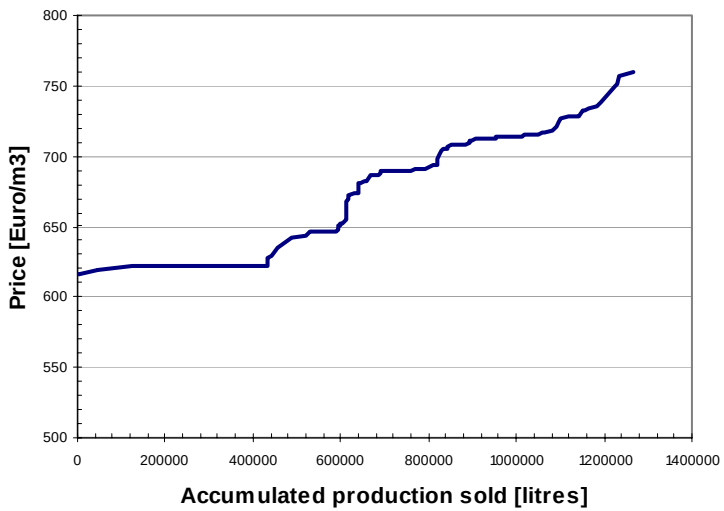
Castor beans = 1 t/ha/year

Soybeans = 500 kg/ha/year



Current feasibility





- Prices raised significantly by the end of 2007, due to the production concentrated in soybeans.
- Production costs have been higher than the prices gotten in last auctions and are higher than the prices of conventional diesel oil to consumers.
- The opportunity cost of the soy oil has been about 30 to 45% higher than the price paid in the auctions.
- Taking into account the average prices recently paid, only about 600 Ml of the total production sold (i.e., less than 50%) would be feasible.

The role of PETROBRAS

- PETROBRAS is so far the only buyer of biodiesel.
- The company has also been engaged in programs aiming at induce the production of raw materials in poorest regions, development of technology and also the enlargement of the production capacity.
- The company is building three industrial units with total capacity of production of 240 Ml of biodiesel per year. More ten units can be build up to 2012, summing up a production capacity of 850 Ml.
- H-BIO process: vegetable oil stream blended with mineral diesel is hydroconverted in hydrotreating units (HDT – mainly used for diesel sulphur content reduction), under controlled conditions of high temperature and pressure. The conversion yield is at least 95%, volume basis, without generation of residues.

Conclusions

- Brazil has produced fuel ethanol at large-scale for more than 30 years.
- Ethanol production in Brazil is a success from an economic point of view.
- There are still criticisms regarding large-scale production of ethanol from social and environmental point of views.
- Social aspects should be improved with the phasing-out of manual harvesting, as long as new job opportunities would be created during the following ten years. Strict enforcement of labour laws is also an aspect that must be improved in Brazil.
- Regulation of land use should be improved in Brazil. Brazilian government has stated that land zoning will be applied, avoiding plantations in most sensible areas.
- Sugarcane is not directly responsible for deforestation in Brazil, but is impossible to get the same conclusion as long as indirect impacts are concerned.

Conclusions

- Biodiesel production is new event, and just along 2008 it would be possible to reach more accurate conclusions.
- The B2 target in 2008 will be barely achieved and just a small share of the production of raw materials will be based on family farmers and will occur in the poorest areas of the country.
- All drawbacks should be carefully analysed and problems should be addressed properly.
- Brazilian government had a very optimistic evaluation of the existing conditions for large-scale production of biodiesel.
- More support and planning is required in order to get a reasonable share of the production based on small farmers.
- It seems more adequate to accept a partial failure on the results in the following years rather than accept the pressures of large farmers and companies that can go faster with the production.

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Thanks for your attention!

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