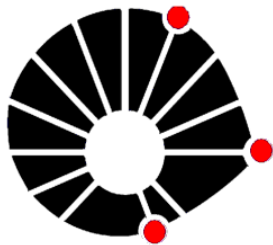

World Bioenergy 2008

How to speed up the processes to make things happen

Jönköping

May 28th 2008

Brazil as an Exporter of Ethanol; Views into the Future



UNICAMP

Arnaldo Walter (awalter@fem.unicamp.br)

State University of Campinas (Unicamp) – Brazil

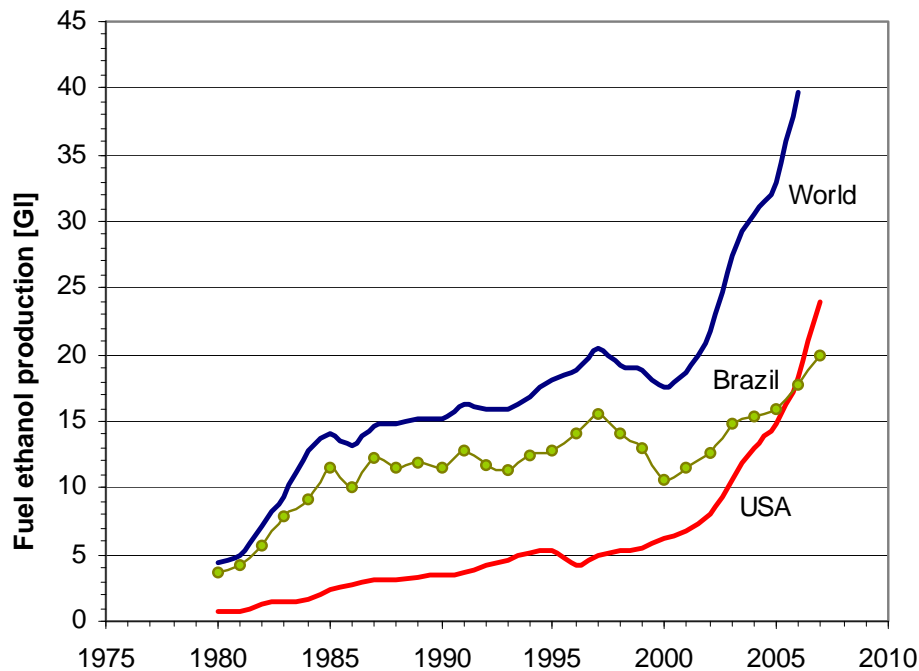
FEM & NIPE



Introduction

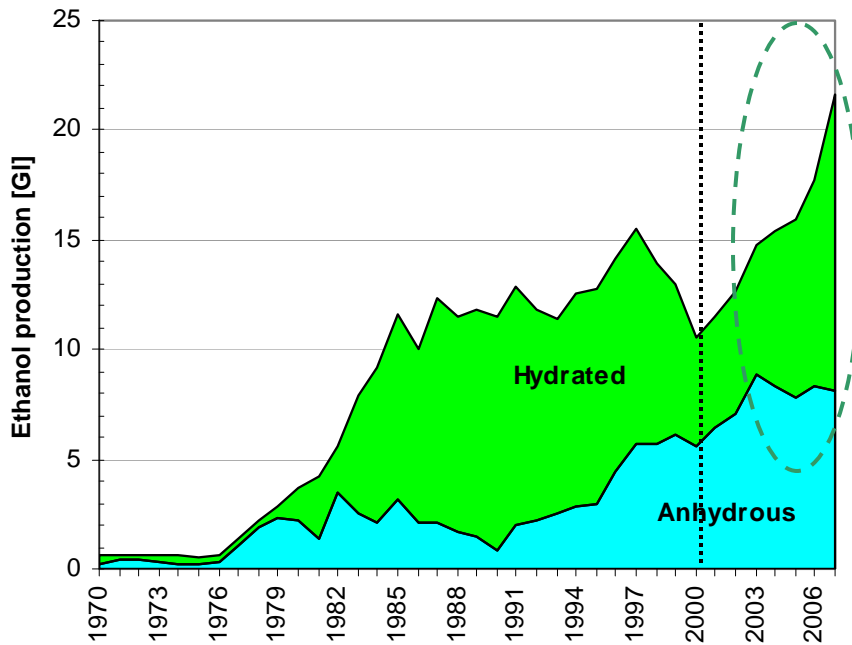
- ◆ Brazil has large-scale experience with ethanol production and its use as fuel since 1975.
- ◆ Brazil is the only country where ethanol is not subsidized and is fully competitive vis-à-vis gasoline.
- ◆ Brazil is worldwide the second largest producer of ethanol (US have surpassed Brazil in 2006).
- ◆ Brazil is worldwide the main exporter of fuel ethanol.
- ◆ Brazil has potential to enlarge its ethanol production and export a lot (e.g., 50 billion litres).

Ethanol experience – basic facts



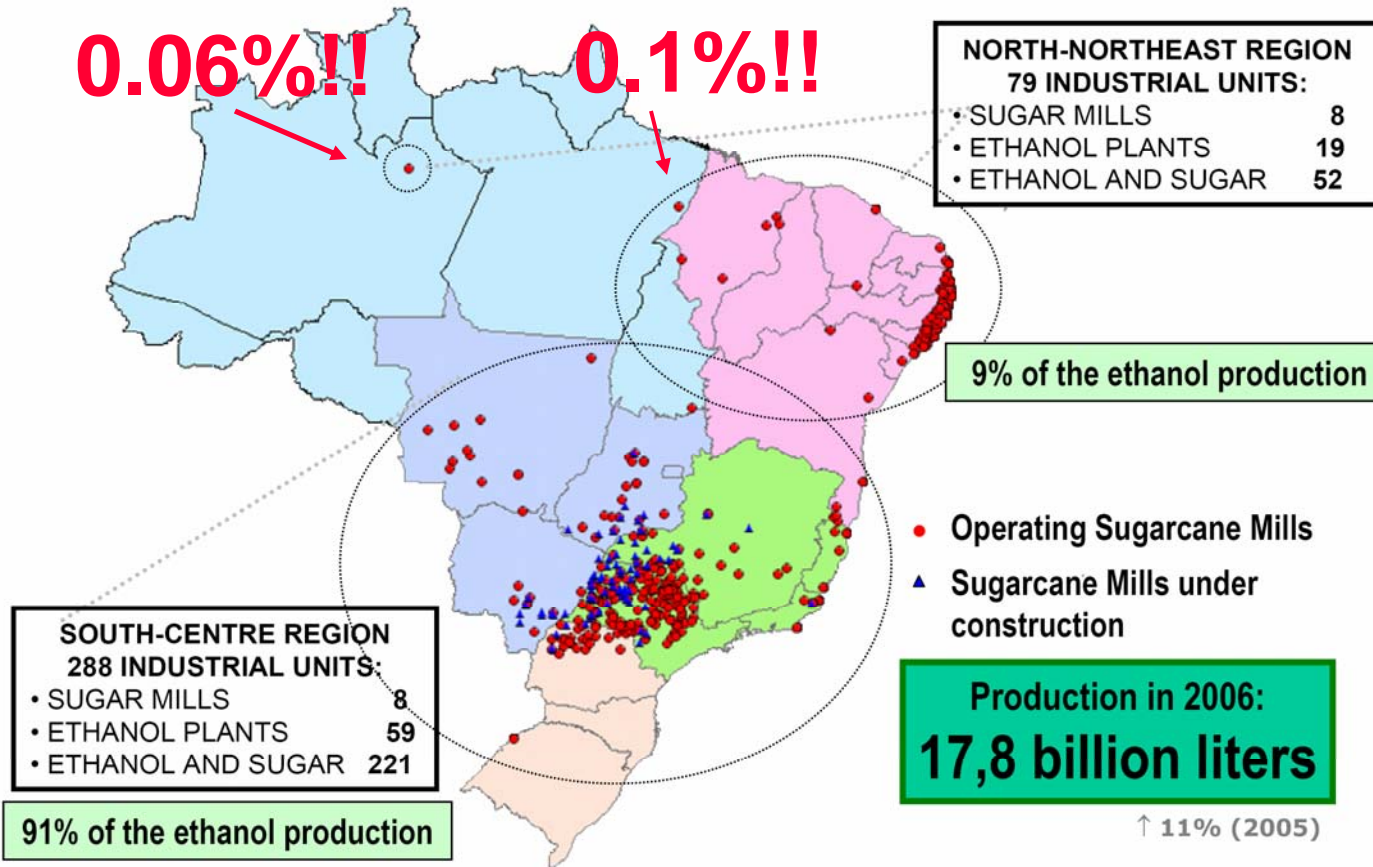
- ◆ More than 30 years of large-scale production.
- ◆ Anhydrous ethanol is used blended with gasoline (20-25% volume basis).
- ◆ Hydrated ethanol is used in neat-ethanol vehicles (now FFVs).
- ◆ All production is based on sugarcane.
- ◆ Domestic consumption was 18 Gt in 2007.

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, about 90% of the new vehicles are FFVs.
- ◆ FFVs can operate from E20 to E100.
- ◆ In 2007 ethanol consumption was equivalent to 38% of the gasoline consumption (energy basis).

The industry in 2007



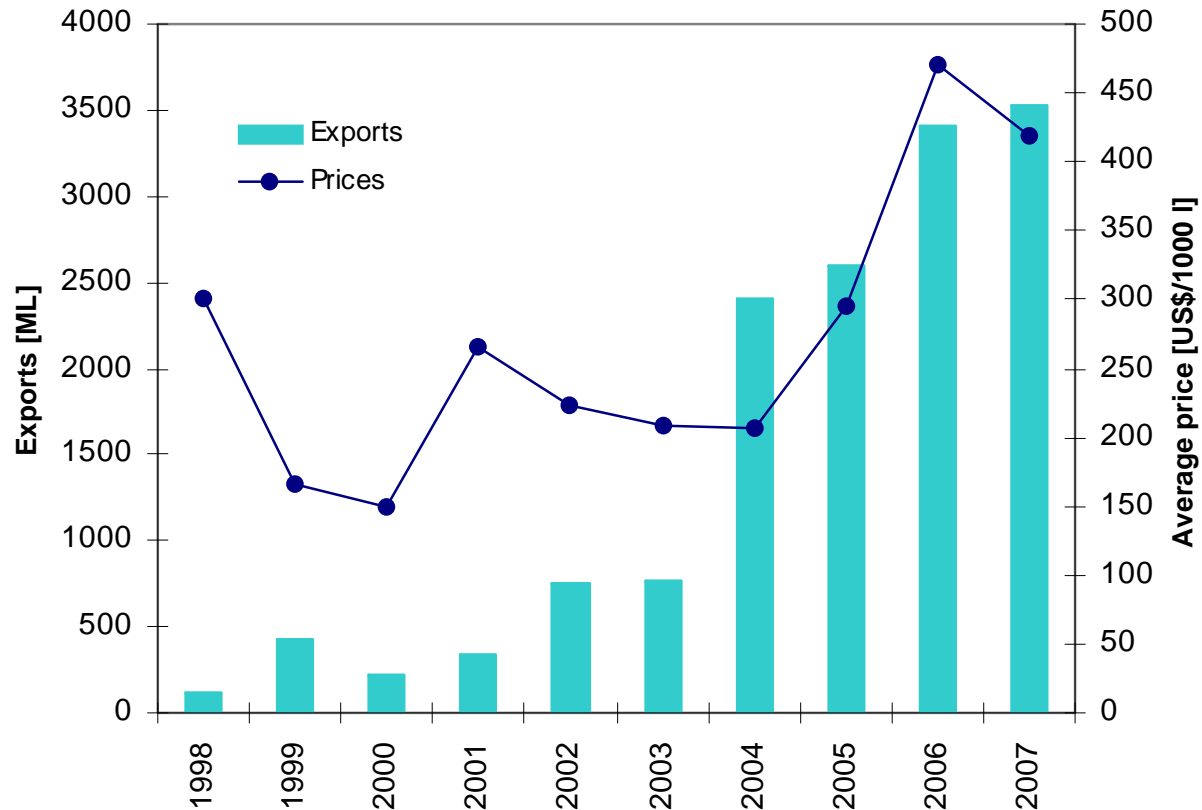
273 integrated plants;
78 ethanol plants;
361 plants producing ethanol;
About 80 plants under construction;
6.3 Mha planted with sugarcane.

22.2 GI in 2007
25% growth ethanol
15% growth cane

Source: Ministry of Mines and Energy – Ministry of Agriculture, Livestock and Food Supply - 2007

It is predicted that the total production of ethanol (domestic market + exports) shall reach 30 GI by 2010, 47 GI by 2015 (35 + 12) and 65 GL by 2020 (50 + 15).

Ethanol exports: Brazil



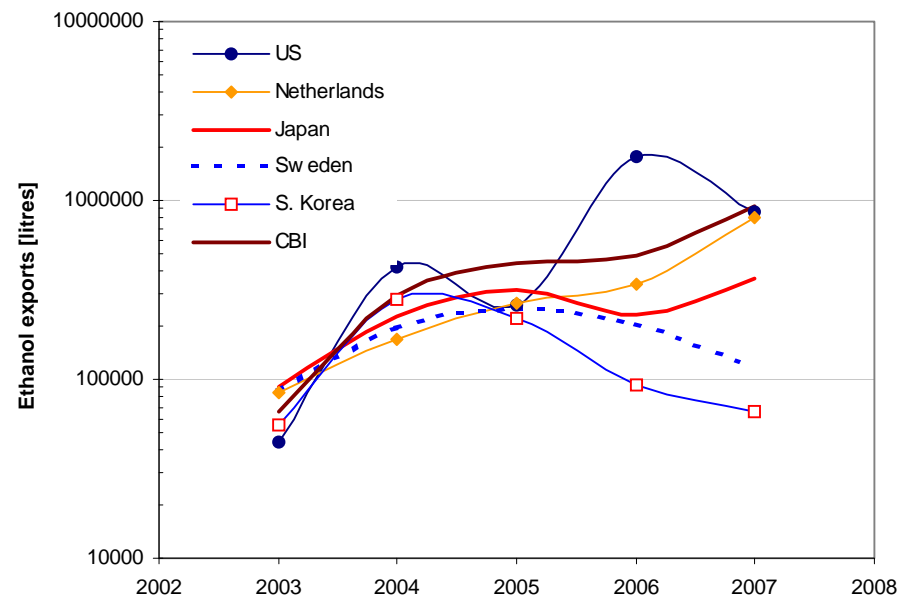
Source: Based on MAPA (www.agriculture.gov.br)

Ethanol exports: Brazil

Brazilian exports of ethanol (all grades) in recent years

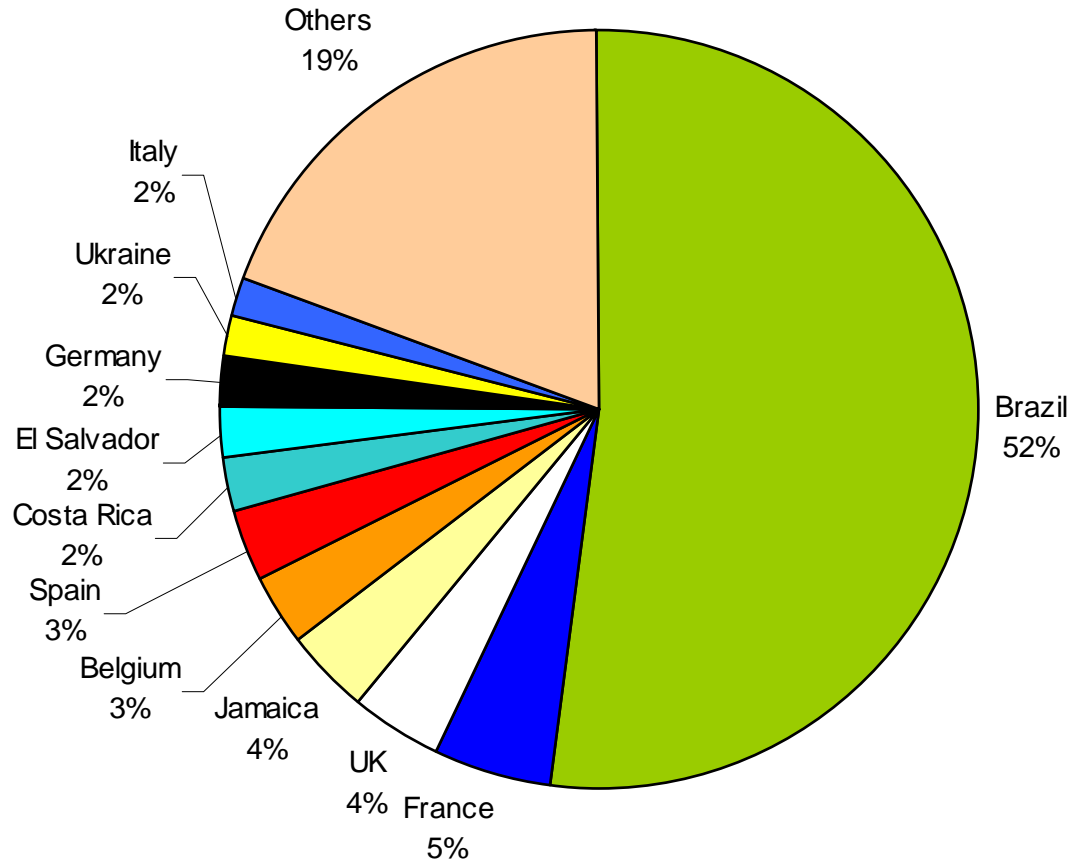
2006			2005			2004		
Country	[Ml]	US\$/m ³	Country	[Ml]	US\$/m ³	Country	[Ml]	US\$/m ³
US	1,749.2	504.43	India	414.2	278.07	India	478.6	194.24
Netherlands	344.5	439.35	Japan	317.9	292.75	US	424.6	189.46
Japan	227.7	418.15	Netherlands	264.3	301.01	S Korea	278.4	201.19
Sweden	201.3	394.04	US	260.6	297.28	Japan	223.2	198.73
El Salvador	182.7	439.41	Sweden	245.1	286.03	Sweden	193.4	238.98
Total/avg	3,416.6	469.69	Total/avg	2,598.5	294.29	Total/avg	2,408.3	206.68

Source: MAPA (www.agriculture.gov.br)



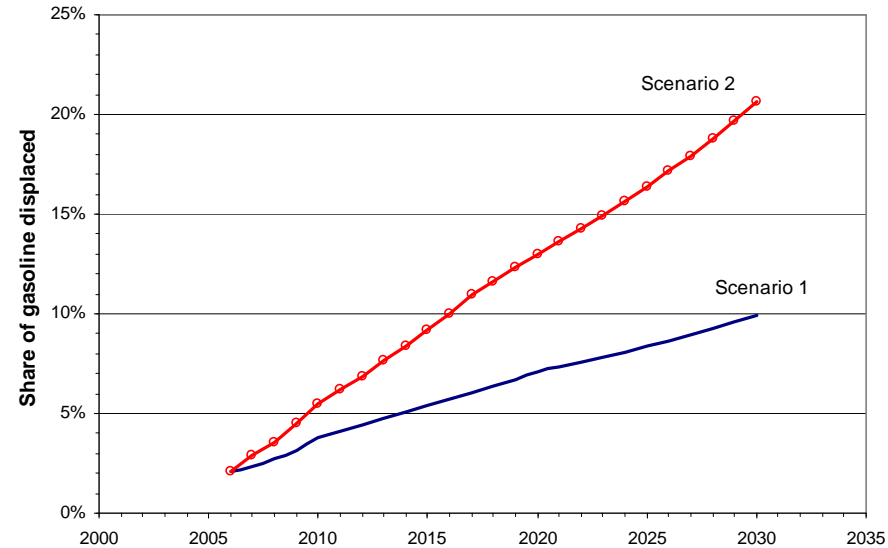
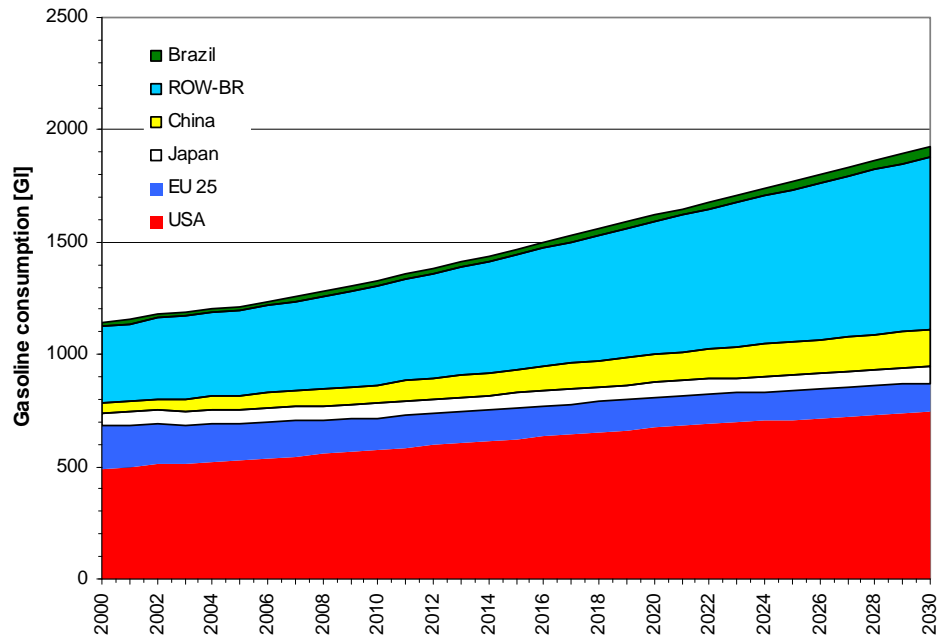
Source: Based on MAPA (www.agriculture.gov.br)

Ethanol exports in 2006: World



Source: Based on FO Licht

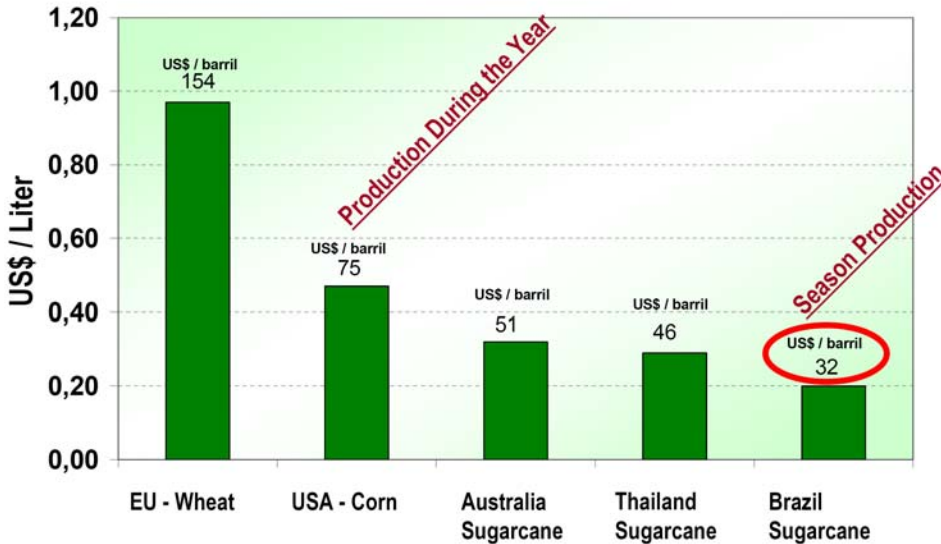
Predictions of ethanol market



Source: Walter et al. (2008)

- ◆ By 2020, the gasoline consumption is estimated as 1,620 GJ.
- ◆ Scenario 1 = 165 GJ of ethanol (7 %); Scenario 2 = 305 GJ (13%).
- ◆ Thus, the prediction of exporting 15 GJ is not ambitious.

Costs and GHG balance - advantages

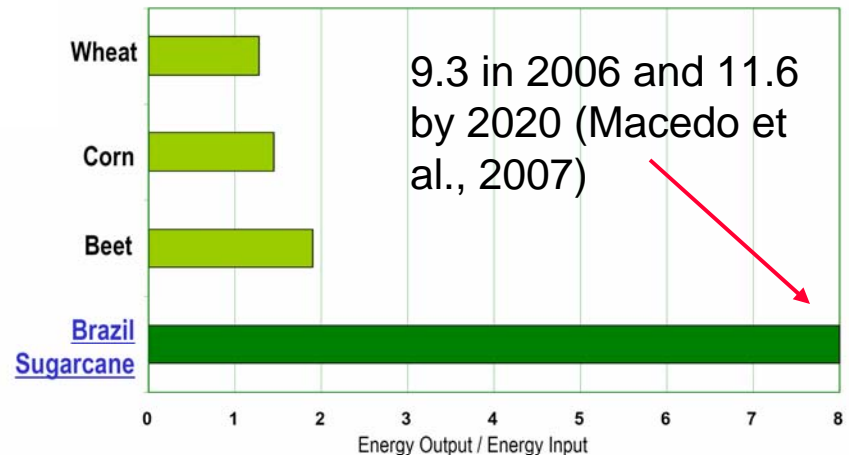


Source: DATAGRO (in "New trends to the ethanol supply chain in Brazil", Simoes, R.B., Master Thesis, Universiteit Van Tilburg, Holanda, Jul-2006)

Ethanol produced from sugarcane, according to the Brazilian conditions: 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 Euro/tCO_{2 eq} for the production from wheat (IEA, 2004).

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).

Energy Balance of Ethanol Production



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)



Trade barriers - tariffs

- ◆ US impose MFN (most-favoured nations) import duties of 142.7 US\$/m³ (54 ¢US\$/gallon) plus a 2.5% *ad valorem* tariff on ethanol.
- ◆ Under MFN regime EU imposes a duty of 192 Euro/m³ on undenatured alcohol and a duty of 102 Euro/m³ in case of denatured alcohol. All exports from Brazil to EU are under MFN rules (most as undenatured ethanol).

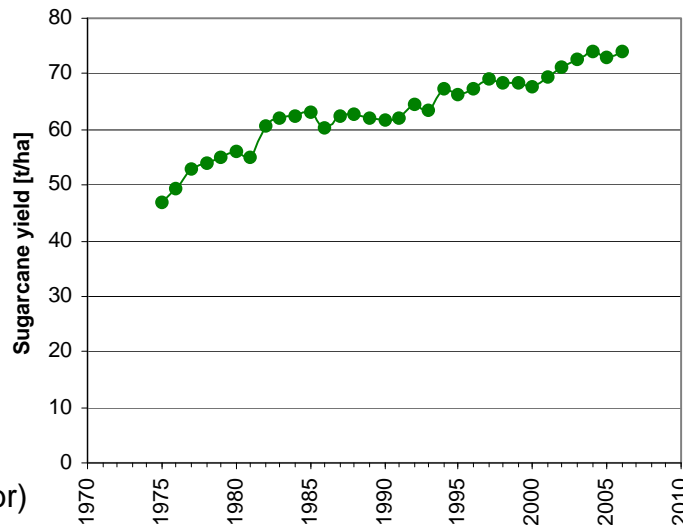


Sustainability – principles (Cramer Report)

- ◆ (i) a minimum reduction of GHG emissions should be reached vis-à-vis life cycle of conventional fuels;
- ◆ (ii) biofuels production should not jeopardize food production neither contribute to significant raise of food prices;
- ◆ (iii) production of biofuels should not negatively impact natural ecological systems neither contribute to the reduction of water availability;
- ◆ (iv) biofuels production should not cause any important impact on soil and water bodies as consequence of the large-scale use of agrochemicals;
- ◆ (v) biofuels production should positively impact the region where it takes place; and
- ◆ (vi) biofuels production should positively impact social conditions of the employees and the local population.

Principles x Brazilian conditions

- ◆ (i) a minimum reduction of GHG emissions should be reached vis-à-vis life cycle of conventional fuels – The best result (80-90%) regarding GHG emission reductions, at the lower cost.
- ◆ (ii) biofuels production should not jeopardize food production neither contribute to significant raise of food prices – Sugarcane for ethanol occupies about 1% of agricultural lands in Brazil (less than 4 Mha). There are about 200 Mha occupied with pastures and more 90 Mha with no specific use. Agricultural yields have increased in last 30 years about 2% per year, one average (e.g., corn, soybeans and rice).





Principles x Brazilian conditions

- ◆ (iii) production of biofuels should not negatively impact natural ecological systems neither contribute to the reduction of water availability – in 2007 78% of the sugarcane expansion was in São Paulo and surrounds; 65% of the expansion in (degraded) pasture-lands. Just moving from 1 head/ha to 1.4 head/ha it would be possible to have 57 Mha additional. **Monoculture in huge areas is a problem. Water consumption in industries should be reduced.**
- ◆ (iv) biofuels production should not cause any important impact on soil and water bodies as consequence of the large-scale use of agrochemicals – the use of chemicals is, in general, lower than in other crops. Contamination of soil and water bodies has not been proved. **Problems may exist, and use of chemicals should be reduced. Organic production is feasible!**



Principles x Brazilian conditions

- ◆ (v) biofuels production should positively impact the region where it takes place – results so far achieved are reasonable to good, considering Brazilian conditions (see next slide). Obviously that improvements are desired, but sugarcane industry has the same inequalities problems of Brazilian society.
- ◆ (vi) biofuels production should positively impact social conditions of the employees and the local population – this issue is controversial, but results should be analysed considering local conditions. Improvements are necessary: mechanical harvesting, but with reduction of jobs; some companies have adopted social-responsible practices.

Principles x Brazilian conditions

- ◆ (v) biofuels production should positively impact the region where it takes place

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.



Challenges

- ◆ Domestic market can reach 50-55 GI 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.
- ◆ Regulation of land-use is required.
- ◆ Expansion should be planned in order to reduce costs.
- ◆ Working conditions should be improved and new job opportunities should be created in other sectors.
- ◆ Sustainability should be a target in itself.



Concluding remarks

- ◆ Brazil could produce 100 GI (about 75 GL additional, being 50 GI for exports) using 14 Mha (about 10 Mha additional, considering 7,000 l/ha – conservative figure). 14 Mha is the area currently occupied with corn. 14 Mha is 25% of the additional area that could be available in case of intensive cattle.
- ◆ Brazilian plans regarding ethanol trade are not so ambitious, and there are many challenges.
- ◆ Trade is just possible with many suppliers. Brazilian strategy should be based (and it seems it is) on disseminating the ethanol production to countries with good potential. But in these countries there are also many challenges.
- ◆ Fair trade is only possible if competitive advantages are accepted and if additional barriers are not imposed. In this sense, certification of biofuels production should be as clear as possible.



UNICAMP

Thanks for your attention!

awalter@fem.unicamp.br