Panel II - Biofuels

Alfred Szwarc

IPC’s Fall Seminar “Sustainability in the Food & Agricultural Sector”
UNICA is the leading Brazilian association of sugar & ethanol producers

Ethanol related UNICA’s goals:

• structure an international fuel ethanol market
• consolidate ethanol as a global energy commodity
• develop new applications and markets
• incentive adoption of best practices
Ethanol from Sugar Cane

- The Industry in Brazil
- Sustainability Issues
- Trade Issues
- Concluding Remarks
Sugar Cane is the prime ethanol feedstock in Brazil

Semi-perennial plant: lasts for about 5 crop seasons with high yields and has many benefits over traditional row crops:

- less energy to plant & cultivate;
- root system reduces erosion & effective carbon uptake;
- relatively low defensive & fertilizer requirements;
- many varieties.
Sugar Cane: Source of Energy

Cellulosic ethanol revolution: when will it take place?

Source: Unica.
Where is the Sugar Cane?

Source: NIPE-UNICAMP, IBGE and CTC.
Crop Season 2006/07

Sugar Cane in Brazil

Source: Unica
Availability of Arable Land

Note: Area harvested in 2004. Arable land in equivalent potential.
Agricultural Defensives Consumption

Main Crops - 2006

Source: Sindag, IBGE, 2007
Main Crops - 2006

Agriculture Related Soil Losses

![Graph showing soil losses for various crops.]

In most of the Brazilian territory “Dry Farming” is the dominant practice because of sufficient rainfall.

Irrigation in Brazil’s crop areas has been required in less than 4 M ha (< 6% of present agriculture land).

Irrigation in sugar cane production is more widespread in the NE, however “Salvation Irrigation” and “Suplementary Irrigation” are adopted according to the need.

Rational use of water in the sugar cane industry has increased considerably with reuse and recycle practices.

Presently the average consumption of water in São Paulo State’s sugar cane industry is in the order of 1.8 m$^3$/tonne of sugar cane (65% less than in 1997); ongoing efforts to reduce further this volume.
Ferti-Irrigation with stllage (vinasse) helps to reduce use of water & chemical fertilizers and is a good practice to recover soil fertility
Ethanol Productivity

End of Pre-Harvest Field Burning

Note: 2007 refers to harvested area until August.
Source: CTC, Unica.
Ethanol Productivity

Agricultural and Industrial Gains

Source: CTC, Unica
## Energy Balance

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Renewable Energy Output / Fossil Energy Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat (EU)</td>
<td>1.2</td>
</tr>
<tr>
<td>Cassava (Asia)</td>
<td>1.2</td>
</tr>
<tr>
<td>Sugar Beet (EU)</td>
<td>1.9</td>
</tr>
<tr>
<td>Corn (USA)</td>
<td>1.3 – 1.8</td>
</tr>
<tr>
<td>Sugar Cane (Brazil)</td>
<td>8.3</td>
</tr>
<tr>
<td>Gasoline/Diesel</td>
<td>0.8 (life-cycle fossil energy output/fossil energy input)</td>
</tr>
</tbody>
</table>

(*) Current practice  (***) Biorefinery concept using biogas to generate energy

Typical Sugar & Ethanol Plant in Brazil

- Ethanol storage tanks
- Distillery
- Sugar plant
- Bagasse
- Sugar cane field
Sugar & Ethanol plants produce own thermal & electric energy using bagasse as a fuel and co-generation systems and sell excess electricity to the public grid.
Brazilian Ethanol Has the Lowest Cost

Source: F.O.Licht, Unica
Jobs in the Sugar Cane Industry

Formal Jobs

Formal Jobs Registration Rate

### Environmental Merits

#### Selected Fuel Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Ethanol</th>
<th>Gasoline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur content &amp; sulfur compounds emission</td>
<td>☺</td>
<td>☹ $$$</td>
</tr>
<tr>
<td>CO\textsubscript{2}, CO, VOC and fine particles</td>
<td>☺</td>
<td>☹</td>
</tr>
<tr>
<td>NO\textsubscript{x}</td>
<td>☺</td>
<td>☺</td>
</tr>
<tr>
<td>Volatility</td>
<td>☺ / ☹ ☹</td>
<td>☹</td>
</tr>
<tr>
<td>Toxicity of fuel &amp; combustion products</td>
<td>☺</td>
<td>☹ $$$</td>
</tr>
<tr>
<td>Life-cycle Greenhouse impact</td>
<td>☺</td>
<td>☹ $$$</td>
</tr>
<tr>
<td>Renewability</td>
<td>☺</td>
<td>☹</td>
</tr>
<tr>
<td>Biodegradability in soil &amp; water</td>
<td>☺</td>
<td>☹ $$$</td>
</tr>
</tbody>
</table>
Avoided GHG emissions in Brazil in 2003 due to the sugar cane industry are equivalent to the emission of GHG by Norway:

- Ethanol substituting for gasoline: 27.5 M t CO2 eq.
- Bagasse in sugar production: 5.7 M t CO2 eq.

Source: Macedo, I et alii, 2004
## Social Responsibility Programs

Programs conducted by UNICA’s associates since 2004

<table>
<thead>
<tr>
<th>Subject</th>
<th>Programs</th>
<th>People Engaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culture</td>
<td>26</td>
<td>2.075</td>
</tr>
<tr>
<td>Environment</td>
<td>44</td>
<td>4.058</td>
</tr>
<tr>
<td>Sport</td>
<td>33</td>
<td>7.740</td>
</tr>
<tr>
<td>Education</td>
<td>55</td>
<td>35.060</td>
</tr>
<tr>
<td>Health</td>
<td>63</td>
<td>28.785</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>221</strong></td>
<td><strong>77.718</strong></td>
</tr>
</tbody>
</table>

Source: Unica
### Sugar Cane Industry Expansion

<table>
<thead>
<tr>
<th></th>
<th>2006/07</th>
<th>2010/11</th>
<th>2015/16</th>
<th>2020/21</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sugar Cane Production (M t)</strong></td>
<td>430</td>
<td>601</td>
<td>829</td>
<td>1,038</td>
</tr>
<tr>
<td><strong>Cultivated area (M ha)</strong></td>
<td>15.6</td>
<td>21.2</td>
<td>28.1</td>
<td>34.3</td>
</tr>
<tr>
<td><strong>Sugar (million t)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Market</td>
<td>30.2</td>
<td>34.6</td>
<td>41.3</td>
<td>45.0</td>
</tr>
<tr>
<td>Export</td>
<td>9.9</td>
<td>10.5</td>
<td>11.4</td>
<td>12.1</td>
</tr>
<tr>
<td><strong>Ethanol (billion liters)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Market</td>
<td>17.9</td>
<td>29.7</td>
<td>46.9</td>
<td>65.3</td>
</tr>
<tr>
<td>Export</td>
<td>14.2</td>
<td>23.2</td>
<td>34.6</td>
<td>49.6</td>
</tr>
<tr>
<td><strong>Bioelectricity (MW)</strong></td>
<td>1,400</td>
<td>3,300</td>
<td>11,500</td>
<td>14,400</td>
</tr>
<tr>
<td>Share (%)</td>
<td>3%</td>
<td>6%</td>
<td>15%</td>
<td>15%</td>
</tr>
</tbody>
</table>

**Pasture Land in Brazil:** 220 M ha. Expansion is being carried out mostly in reclaimed pasture land in the Center-South Region

Source: Unica, Copersucar and Cogen.
Agroenergy Dilemma

- Rapid demand growth for ethanol, dry climate and strong demand from Asia have all been contributing to grain prices increase;

- While ethanol production has been increasing in Brazil, sugar prices (sugar is food) have been low and stable;

- Debate has been fueled by a campaign against biofuels and ethanol has become the preferred scapegoat to justify price increase;

- Hunger has been due primarily to inadequate income distribution not food scarcity;

- Agriculture productivity is increasing and there is considerable arable land to be used;

- Cellulosic ethanol is a good promise;
Ethanol Sustainability

- Based on the “Triple Bottom Line” requirements: **SOCIAL, ECONOMICAL** and **ENVIRONMENTAL**.
- **BENCHMARKED** against fossil fuels.
- **UNIVERSAL**: applied internationally to all producers, feedstocks & production processes.
- Agreed within a **MULTI-STAKEHOLDER** negotiation process.
- Based on a transparent process defined by **CLEAR PRINCIPLES, BALANCED CRITERIA** and **OBJECTIVE INDICATORS**.
- **VOLUNTARY**: to reward those who invest in the process.
- Applied **PROGRESSIVELY**.
Ethanol International Trade

Drivers

- Energy Security
- Diversification of Energy Sources & Energy Mix
- Environmental Issues (global warming, urban pollution)
- Rural Development

Challenges

- Doha?
- Reduction/Elimination of Trade Barriers
- More Producers & Consumers
- Harmonization of Product Quality Standards
- Closer Relationship with Stakeholders (motor industry, oil industry, fuel distributors, governments, NGO’s etc.)
- Wider Use of Futures Market Contracts (BM&F, NYBOT, CBOT etc.)
Concluding Remarks

Growing popularity of bioethanol has created momentum for the development of an international market.

Sound policies, environmental care, social responsibility, technological development, standards harmonization, trade barriers elimination and partnership are key for the successful development of a well structured international market.