PAISS

BNDES/Finep Joint Plan to Support Industrial Technology Innovation for the Sugarcane Industry

March 2013
1) The technological race for 2nd gen ethanol: a compared diagnostic

2) PAISS Program: Strategy, objectives and results

3) Summary
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3) Summary
Since the beginning of the last decade, the US federal government and the European Union, with budgets that surpassed US$ 2 billion, have supported the development of new technologies in bioenergy, primarily concerned with:

- Coordination of efforts;
- Diversification of raw materials;
- Viability of new technologies (support for pilot plants and semi-industrial).
The technological race: Brazil

BNDES/Finep portfolio for the sugarcane industry in 2010

- New Products: 19%
- Industrial 2nd Gen: 14%
- Industrial 1st Gen: 15%
- Byproducts utilization: 16%
- Agricultural: 36%

In 2010, the BNDES/Finep aggregate budget reached US$ 200 million and only US$ 30 million was focused on 2nd gen projects.
The technological race: Brazil

<table>
<thead>
<tr>
<th>Institutions / R&amp;D Focus</th>
<th>Pre-treatment</th>
<th>Hidrolysis</th>
<th>C5 Fermentation</th>
<th>Plot Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Enzymatic (HE)</td>
<td>Acid (HA)</td>
<td>HA</td>
</tr>
<tr>
<td>CTC</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dedini</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Novozymes</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTBE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Petrobras</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Fapesp-Bioen</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Rede de Hidrólise</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>IPT</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Source: Various, including interviews.

An excessive number of initiatives made coordination and concentration of the scarce resources for 2nd gen projects difficult.
## Compared Diagnostic (2010)

<table>
<thead>
<tr>
<th>Program</th>
<th>Coordination</th>
<th>Budget</th>
<th>Main technological challenges</th>
<th>Achievements (2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>High</td>
<td>High</td>
<td>Biomass &amp; industrial conversion</td>
<td>9 pilot plants</td>
</tr>
<tr>
<td>EU</td>
<td>Medium</td>
<td>High</td>
<td>Biomass &amp; industrial conversion</td>
<td>9 pilot plants and 1 demo plant</td>
</tr>
<tr>
<td>Brazil</td>
<td>Low</td>
<td>Low</td>
<td>Industrial conversion</td>
<td>2 pilot plants</td>
</tr>
</tbody>
</table>

Source: Biofuels Digest and the BNDES
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**PAISS in brief**

**What?**
Joint plan (BNDES and FINEP) to finance innovation in the sugar-based ethanol and chemical sectors

**Why?**
To foster, select and finance initiatives (business plans) that focus on developing, producing and commercializing new industrial technologies to process the sugarcane biomass

**What did it offer?**
Coordination of the efforts between the BNDES and FINEP focusing on specific research lines: **BRL 1bn** (~ USD 625m)

**What were the focus points?**
i) Cellulosic Based Ethanol; ii) New sugarcane products; iii) Gasification
Line 1: 2nd Generation Bioethanol
1.1 Straw Gathering and Transportation;
1.2 Pre-treatment of biomass for hydrolysis;
1.3 Processes for enzyme production and/or hydrolysis processes of lignocellulosic material;
1.4 Microorganisms and/or processes for C5 fermentation; and
1.5 Integration and scaling of processes for cellulosic ethanol production.

Line 2: New Products from Sugarcane
2.1 New products from sugarcane biomass; and
2.2 Integration and scaling of processes for the production of new products.

Line 3: Gasification
3.1 Pre-treatment of sugarcane biomass for gasification;
3.2 Biomass gasification technologies for sugarcane;
3.3 Gas purification systems; and
3.4 Catalysts associated with the conversion of syngas into products.
The 35 Business Plans approved will result in a potential investment of **BRL 3.1 billion** (~USD 1.5 billion).

<table>
<thead>
<tr>
<th>Financial Instrument</th>
<th>Original Budget</th>
<th>Total Investment of 35 BPs selected</th>
<th>Portfolio apr/2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>2013</td>
</tr>
<tr>
<td>FINEP</td>
<td>500.000</td>
<td>195.121</td>
<td>327.734</td>
</tr>
<tr>
<td>Credit</td>
<td>200.000</td>
<td>129.072</td>
<td>270.184</td>
</tr>
<tr>
<td>Grant for companies</td>
<td>200.000</td>
<td>47.438</td>
<td>47.027</td>
</tr>
<tr>
<td>Grant for STI *</td>
<td>100.000</td>
<td>18.611</td>
<td>10.524</td>
</tr>
<tr>
<td>BNDES</td>
<td>500.000</td>
<td>436.024</td>
<td>650.102</td>
</tr>
<tr>
<td>Credit</td>
<td>300.000</td>
<td>404.331</td>
<td>487.432</td>
</tr>
<tr>
<td>Equity</td>
<td>100.000</td>
<td>8.282</td>
<td>151.929</td>
</tr>
<tr>
<td>Grant for STI</td>
<td>100.000</td>
<td>23.411</td>
<td>10.741</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.000.000</strong></td>
<td><strong>631.145</strong></td>
<td><strong>977.836</strong></td>
</tr>
</tbody>
</table>

(*) Scientific and Technological Institutions

**Significant growth of innovation projects in the sugarcane industry**
But what makes Brazil so appealing?

- Ready availability and **low cost of feedstocks**, mainly sugarcane bagasse and straw;
- Need for **locally developed pathways** with dedicated technology due to the specific complexity of domestic feedstocks;
- Large amount of **available land** that can be converted into agricultural crops for energy or chemical purposes;
- Well-established first generation industry, which facilitates the **integration of new technologies** (reduced CAPEX and OPEX);
- Fuel market growth and heavy dependence on imports of chemicals creates an excellent opportunity for **domestic investment**;
- Increasing investment in infrastructure, such as pipelines and waterways dedicated to biofuels, combined with the lowest carbon footprint of products derived from sugarcane, rank Brazil as an excellent **export platform**.
Vision for the future

- **1970**: Oil Crisis, Proalcool
- **2003**: Introduction of flex-fuel cars: the sugar based ethanol boom
- **2004**: PROINFA & BNDES biopower credit line
- **2005**: Biopower projects in retrofits
- **2015-20**: Biotech & building blocks, Advanced fuels, Bio-based chemicals, Biorefinery concept

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PAISS represents an opportunity to join initiatives from the government, business and technological institutions to improve coordination and create synergies;

The main characteristic of fostered projects will be the concern for industrial scaling-up, and not just for technological development;

One of PAISS main roles is to create technological and business partnerships, increasing their chances of success;

It is hoped that, if successful, PAISS will contribute to maintaining Brazil’s technological leadership in the sugarcane industry.
Thanks for your attention!

For any further information please contact us:

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