Biogas Development in Brazil
Cicero Bley Jr
ITAIPU Binacional
1 - BACKGROUND

- 70's - Start with “modern agriculture”. Protein conversion.
  Chinese and Indian biodigester model.

- 90's - To CDM / Carbon credit.
  Canadian biodigester model

- 2012 – The new edge - As an energy and mobility source
  Reactors – Biogas 2nd Generation
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2 - KEY ISSUES

Dificulties

- Energy systems (electric & combustible) focused in energy demand
- Natural Gas pipeline – restricted
- Territory size
- Economics
- No Regulations to biogas
- Potential producers absence
- Cultural issues

- Competitive advantages

- Tropical conditions
  - Climate
  - Biodiversity
2 - KEY ISSUES

- Residual Biomass to produce Biogas/Biomethane:

- 220 million inhabitants - 80% Urban areas

- Food Production, Biofuels/Ethanol and other commodities

  - Agribusiness sector: 40% GDP

- 37% Total Energy Consumption

- Poultry - 1.032 Million
- Swine - 38.7 Million
- Livestock feedlot - 180 Million
- Sugarcane area: 908 M ha
2 - STRATEGY -

“Lights on Biogas” - Concepts

Because biogas was an invisible source in Brasil

Paradigmatic transition - In parallel
- Offered Energy - Brazil Conventional System - big scale, to
- Systemic Energy - Brazil non conventional - small scale, synconized

- Territory energy sources to productive systems
- Avoiding costs - Transmission and distribution grids

- Energy Efficiency - Energy Systemic

- Tropicalizing technologies (assuming advantages)

- Biogas Producers Cadastre

- REGULATORY AGENDA - Biogas Qualifying – Biogas = crude gas
- Offer - steady

- Capacity Building
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- **3 - REGULATORY AGENDA**

  - **ANP – National Agency of Gas and Petroleum**
    - Resolution 8/2015- Biogas and Biomethane definitions

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>UN</th>
<th>LIMIT</th>
<th>NBR</th>
<th>ASTM</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane, mín.</td>
<td>% mol.</td>
<td>96,5</td>
<td>14903</td>
<td>D1945</td>
<td>6974</td>
</tr>
<tr>
<td>Oxigen, máx.</td>
<td>% mol.</td>
<td>0,5</td>
<td>14903</td>
<td>D1945</td>
<td>6974</td>
</tr>
<tr>
<td>CO₂, máx.</td>
<td>% mol.</td>
<td>3,0</td>
<td>14903</td>
<td>D1945</td>
<td>6974</td>
</tr>
<tr>
<td>CO₂+O₂+N₂, máx.</td>
<td></td>
<td>3,5</td>
<td>14903</td>
<td>D1945</td>
<td>6974</td>
</tr>
<tr>
<td>Sulfur Total, máx. (3)</td>
<td>mg/m³</td>
<td>70</td>
<td>15631</td>
<td>D5504</td>
<td>6326-3,6326-5,19739</td>
</tr>
<tr>
<td>Sulfídrico Gas (H₂S), máx.</td>
<td>mg/m³</td>
<td>10</td>
<td>15631</td>
<td>D5504</td>
<td>6326-3,19739</td>
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<tr>
<td>Water dew point</td>
<td>°C</td>
<td>-45</td>
<td>15765</td>
<td>D5454</td>
<td>6327,10101-2,10101-3,11541(4)</td>
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</tbody>
</table>
### Consumo

<table>
<thead>
<tr>
<th>Combustible</th>
<th>Diesel (litros/10 km)</th>
<th>Biodiesel (litros/10 km)</th>
<th>Biometano (Nm3/10 km)</th>
<th>CNG (Nm3/10 km)</th>
<th>Etanol (litros/10 km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4,50</td>
<td>4,70</td>
<td>5,00</td>
<td>5,00</td>
<td>7,52</td>
</tr>
</tbody>
</table>

### Emisión de CO2 a 10km (gramos/10 km)

<table>
<thead>
<tr>
<th></th>
<th>Diesel</th>
<th>Biodiesel</th>
<th>Biometano</th>
<th>CNG</th>
<th>Etanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 km</td>
<td>1341</td>
<td>794</td>
<td>204</td>
<td>1032</td>
<td>406</td>
</tr>
</tbody>
</table>

### CO2 por pasajero (gramos/pasajero-km)

<table>
<thead>
<tr>
<th></th>
<th>Diesel</th>
<th>Biodiesel</th>
<th>Biometano</th>
<th>CNG</th>
<th>Etanol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>

### Reducción del Emision CO2 Comparación con el Referencial Diesel

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<th>Biometano</th>
<th>CNG</th>
<th>Etanol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0%</td>
<td>-41%</td>
<td>-85%</td>
<td>-23%</td>
<td>-70%</td>
</tr>
</tbody>
</table>
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3 - REGULATORY AGENDA

- **ANEEL** - National Agency for Electric Energy
  - Resolution 482/12 – Mini and small generation in grid connections
  - Energy Efficiency Handbook/2013 – Consider 1MW as limit to self-supplying
  - Reserved Energy Auction to 2017 (A/3) - Biogas Generation Included

- **EPE** – Planning Energy Company
  - Technical Note 13/2014 – Part of the Brasil Energy Plan – Scenario 2023
  - Decentralized Energy Production – Distributed Generation of Energy
  - Decentralized Generation of combustible
3 - REGULATORY AGENDA

- Federal Government - Ministry of Mines and Energy

  - Portaria 44/2015 – Public call to mini and micro generators in backup already installed - 3,2 GW

- Articulating the Biogas and Biomethane National Program
BIOGAS & BIOMETHANE PROGRAM – MME (under discussion)

MAIN SOURCES OF RESIDUAL BIOMASS

- BIOMETHANE POTENTIAL
- URBAN SOLID WASTES
  - Landfills
  - 3 MM m3/year
- WASTEWATER
  - Sanitation, sewage

APPLICATIONS

- ELECTRICITY
  - 1 MW
    - Netmetering (ANEEL 487/12)
    - Energy Efficiency
- THERMAL
  - Direct use as fuel to heat
    - Co-Generation;
    - Diesel, GLP, firewood substituting.
- MOBILITY
  - BIOGAS UPGRADE TO BIOMETHANE
  - ANP Resolutions
    - Diesel & gasoline subst
    - Buses, Trucks, Cars, Tractors
    - GNV PIPELINE
- BIOFERTILIZER
  - Soil conditioner
- CARBON CERTIFICATION
  - Phosphates & Nitrogenates
    - Mineral fertilizers subst
  - GHG Emission Reduction
    - 1 Billion CO2Tons/2020
PRODUCT DEVELOPMENT
Focused on decentralized and collective production of Biogas and Upgrading to Biomethane
Biogas Development in Brazil

4 - PROCESS PRODUCT DEVELOPMENT

- Biomethane applications

- Distributed Generation of Power

Descentralized Production of Combustible
BIOMETHANE DEVELOPMENT IN BRASIL

- Biomethane: The Itaipu/Scania Case

- 86,000 CHICKENS
  Egg production

- BIOMETHANE
  700 m³/day

- Biogas
  21 DAYS – 3000 KM

- EURO 6
  100% GNV/BIOMETHANE
## Itaipu – Scania case

### Results

<table>
<thead>
<tr>
<th></th>
<th>Km</th>
<th>Km/m3 or/l</th>
<th>PRICE R$</th>
<th>Consum. m3 or l</th>
<th>Cost R$</th>
<th>Km Cost R$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomethane</td>
<td>1500</td>
<td>2.02</td>
<td>0.90</td>
<td>743</td>
<td>668.00</td>
<td>0.44</td>
</tr>
<tr>
<td>Diesel</td>
<td></td>
<td>2.10</td>
<td>2.60</td>
<td>682</td>
<td>1.773.00</td>
<td>1.18</td>
</tr>
</tbody>
</table>

37.2 %
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- COMMUNITY AGENDA

- ABIOGAS – Brasilien Biogas Association

- EMBRAPA – Agricultural Research Company

- CIBIOGAS – International Center of Renewable Energy - Biogas

- SENAI – Industry Federation Service
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THANK YOU

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