



**The sustainable expansion of sugarcane ethanol in Brazil and the trends for others countries -The experience of ETH Bioenergia**

# ETH Bioenergy

*A new paradigm in the sector*

Build a leading Company in bioenergy  
(ethanol and co-generation of electricity),  
focused on value creation to the stakeholders.



**Competitiveness**



**Sustainability**



**Culture & People**

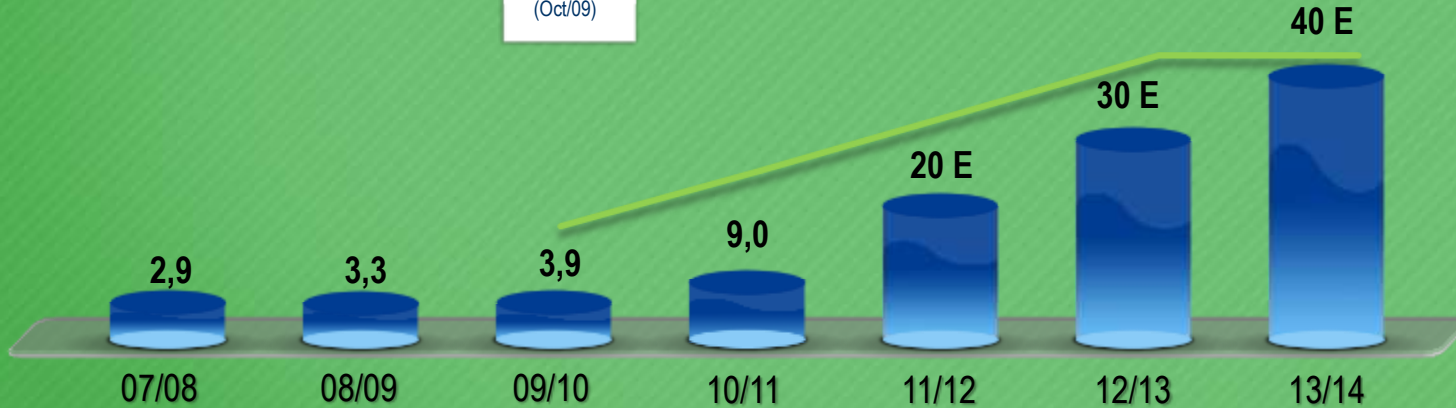
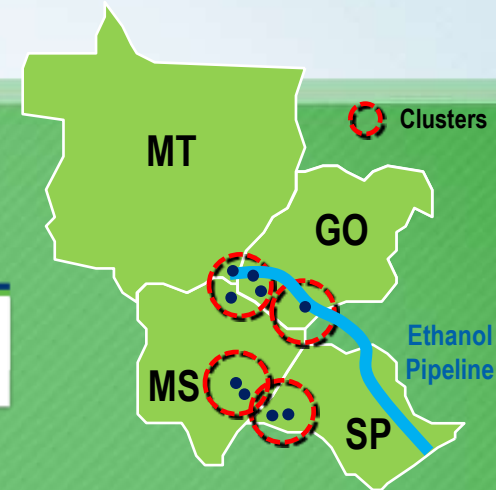
# ETH Bioenergy

## *Consistent business plan implementation*



# ETH - Growth plan

*Leader in ethanol and energy from biomass*



- New Projects
- Market Consolidation

Industrial capacity (MM ton)  
Crushing (MM ton)

3 bi liters - Ethanol

2,700 GWh - Cogen

**MARKET LEADER**

# ETH - Acquired mills

## Alcídia



**Teodoro Sampaio, SP**

Startup: 1978

Acquisition (93%): Jul 2007

Capacity: 2,1 MM ton

## Eldorado



**Rio Brilhante, MS**

Startup: 2006

Acquisition (100%): Mar 2008

Capacity: 3,0 MM ton

Planned expansion to 6,0 MM ton

# ETH - Greenfield projects

## Conquista do Pontal



## Santa Luzia



## Rio Claro



### Mirante do Paranapanema, SP

Startup: Oct/2009

Capacity

- Startup: 3,0 MM ton
- Projected: 5,5 MM ton

### Nova Alvorada do Sul, MS

Startup: Oct/2009

Capacity

- Startup: 3,0 MM ton
- Projected: 6,0 MM ton

### Caçu, GO

Startup: Aug/2009

Capacity

- Startup: 3,0 MM ton
- Projected: 6,0 MM ton

# ETH - New mills (Brenco)

## Morro Vermelho



Mineiros, GO

Startup: Aug/2010

Capacity: 3,8 MM ton

Started up

## Alto Taquari



Alto Taquari, MT

Startup: Oct/2010

Capacity: 3,8 MM ton

Started up

## Under Construction

Costa Rica

Costa Rica, MS

Startup: Oct/2011

Capacity: 3,8 MM ton

Água Emendada

Perolândia, GO

Startup: Nov/2011

Capacity: 3,8 MM ton

# ETH Bioenergy

## Investments

1 US\$ ~ R\$ 1.62

Investments  
Accomplished  
until oct/10



R\$ 5,3 bi



Investments  
Commitment  
between 2011/12



R\$ 1,9 bi

**TOTAL  
INVESTMENTS**  
R\$ 7,2 bi

### Market Leader (2012)

Ethanol Sales

3.0 bi liters

Energy

2,700 GWh

Revenues

US\$ 2.5 bi

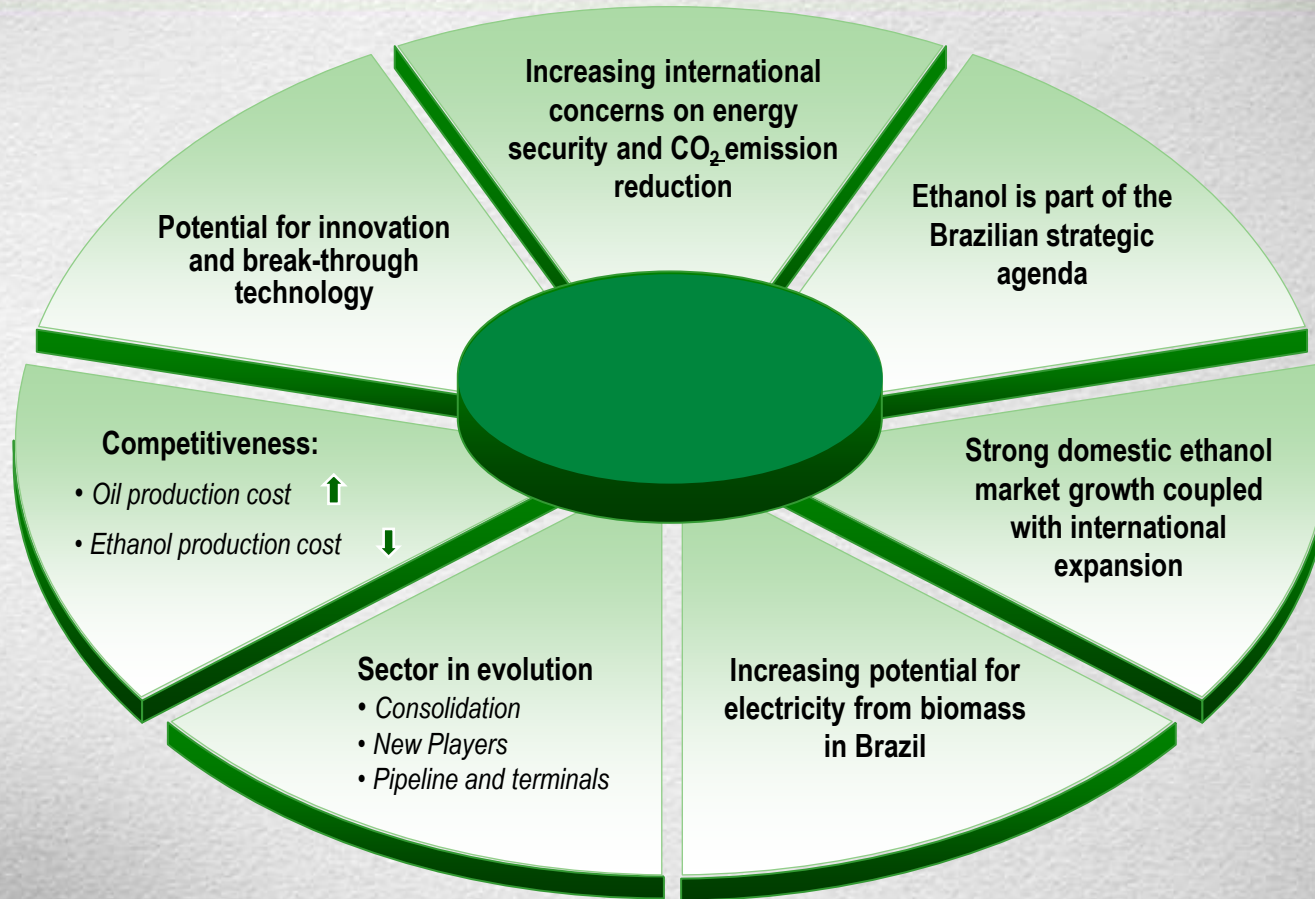
Potential EBITDA

50%



# Brazilian Trends

*Macro trends 2010-2020 open great opportunities for energy from biomass*



# ETH – International Expansion

*ETH is aiming to be the key driver in the international expansion of sugar and ethanol.*

Main parameters to identify target countries for the international expansion:

- **Climate** zones and adequate **soil** for sugarcane cultivation;
- The potential existence of **internal demand** for sugar, ethanol, and/or competitive tax and logistical cost benefits for **exportation to the US, Europe, and Asia**;
- Presence of **Odebrecht** in the country.



# World

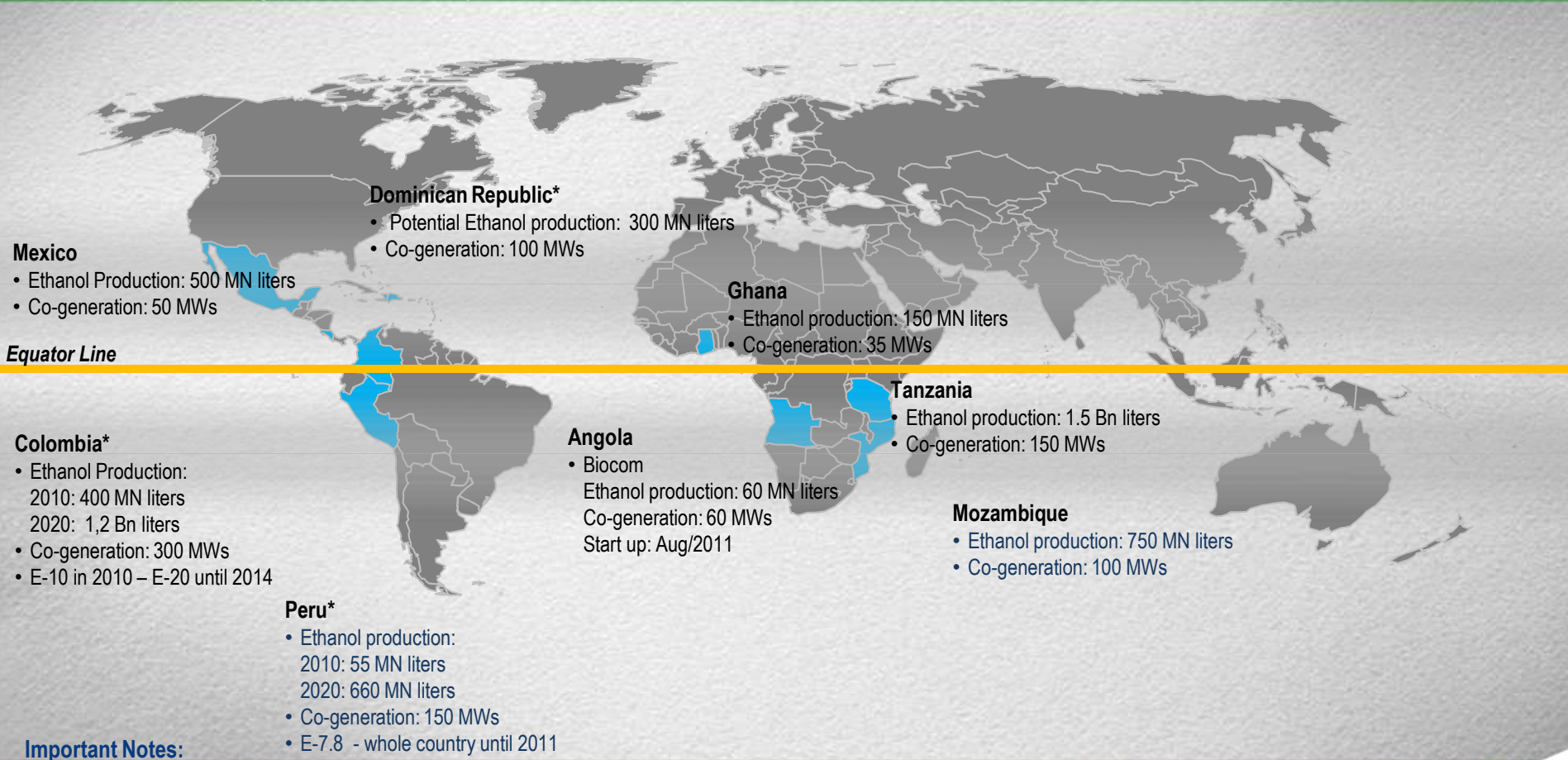
## *Sugar Cane Around the World – Climate and Soils*



# World

## *Ethanol is becoming a reality in the international markets*

### Countries with projects underway in Africa and Latin America



- All plants should produce Ethanol, Sugar and Power;
- Beyond the countries under Odebrecht assessment, others like Zambia, Kenya and Uganda have been interested in local ethanol production.

\* Preliminary due diligence underway

# ETH – International Expansion

## *Actions underway in Africa*

### ● **Mozambique**

- Technical and financial viability analysis for the project EcoEnergy (Swedish company), at a hub for ethanol, sugar, and electric energy in Cabo Delgado, with crushed cane capacity of 4MM tons per year.
- Identification of new potential development areas.

### ● **Tanzania**

- Technical and financial viability analysis for the project EcoEnergy, at a hub for the production of ethanol, sugar, and electric energy in Rufiji, with crushed cane capacity of 4 MM tons per year.

### ● **Libya** *(Project suspended until the situation there normalizes)*

Analysis done in partnership with LIA (Libyan Investment Authority) for:

- ETH/LIA investment greater sugarcane production capacity in Brazil.
- Provision of sugar from ETH to Libya.
- Investment in a sugar refinery by Odebrecht in Libya.

Besides the aforementioned countries, Zambia, Kenya, and Uganda are interested in developing ethanol production capabilities, and will be evaluated from a joint perspective with Odebrecht.



# ETH – International Expansion

## *Actions underway in Africa - Angola Investments*

- **Biocom acquisition study** (investment in early stage)
  - 40% Odebrecht, 40% Damer, and 20% Sonangol;
  - Cacuso – Malanje: production of ethanol, sugar, and electric energy;
  - Capacity of 2MM tons of crushed cane per year;
  - Identification of other areas for new project development



**BIOCOM**  
Sugar and Ethanol



**Block 16**  
Oil



**Women Mechanical**  
Training Angola



# ETHANOL OPPORTUNITIES

**USES**



**Transportation  
(fuel)**



**Energy**

**PRODUCTION**



**Consumer goods**

# PRODUCTION ISSUES

## ● Brazilian Biomes

### ● Destruction of sensitive biomes

Amazon Rainforest

Cerrado (savanna)

Pantanal (wetlands)

### ● Risks to biodiversity

High Value Conservation Areas

Sugarcane expansion pushes  
agricultural activities into the  
rainforest



## PRODUCTION



# PRODUCTION FACTS

- Brazilian Biomes

ETH'S CASE:  
Nagoya / Cop -10

## The Evolution of Legislation

- **Agro-ecological zoning for sugarcane**  
Prohibition of any future sugarcane farming or processing in the Amazon, Pantanal, or in any area of native vegetation
- **Defined Areas for Permanent Preservation and Areas of Legal Reserve**
- Today in **Brazil, 65% of recent sugarcane expansion** took place on degraded pastures in the South-Central region



# PRODUCTION ISSUES

- Brazilian Biomes
- Land Use

- Sugarcane vs. other crops
- Expansion of sugarcane production

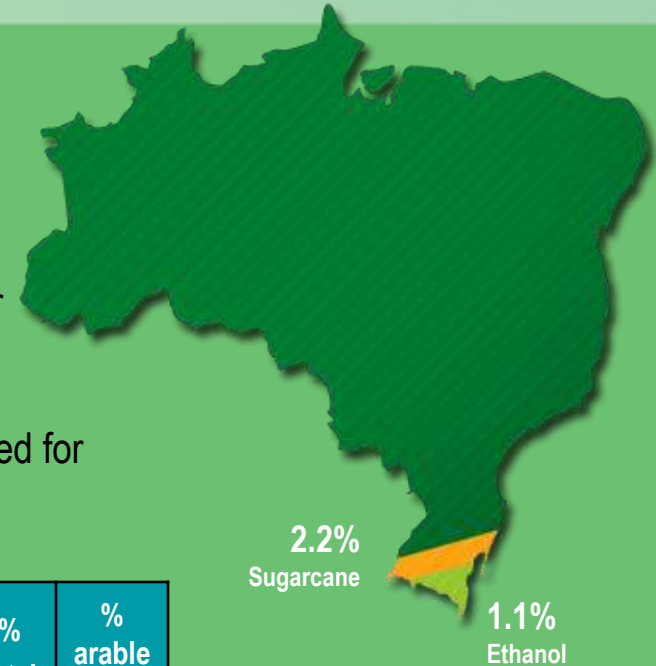


# PRODUCTION FACTS

- Brazilian Biomes
- Land Use

**ETH'S CASE:**  
Use of already cultivated land

- Arable land used for sugarcane: **1.1%**
- In 2017, ethanol dole production will be: **1.5 %**
- **Diversified agriculture makes Brazil** the world's leading exporter of beef, coffee, orange juice, soybeans, and sugar
- Degraded pasture land is being used for sugarcane production



AREA (in million hectares)		% total	% arable land
<b>BRAZIL</b>	<b>851</b>		
<b>Total arable land</b>	<b>354.8</b>		
<b>1. Area cultivated – total</b>	76.7	9%	21.6%
Soy	20.6	2.4%	5.8%
Corn	14.0	1.6%	3.9%
<b>Sugarcane</b>	<b>7.8</b>	<b>0.9%</b>	<b>2.2%</b>
<b>Sugarcane for ethanol</b>	<b>4.0</b>	<b>0.5%</b>	<b>1.1%</b>
<b>2. Pasture</b>	172.3	20.2%	48.6%
<b>3. Available area (total arable/cultivated area/pasture)</b>	105.8	12.4%	29.8%

Source: IBGE and Conab 2009

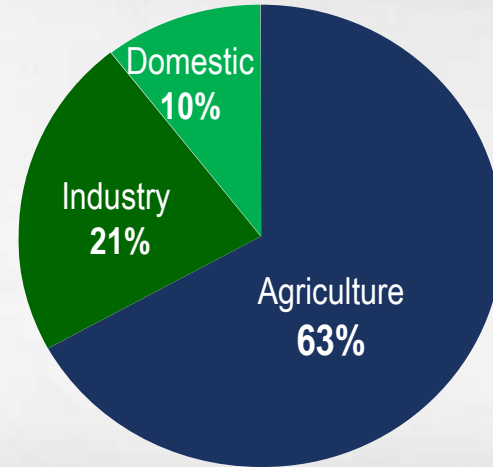
# PRODUCTION ISSUES

- Brazilian Biomes
- Land Use
- Water Usage



## World water supply and scarcity

Water use by sector (1995)



Water Supply



Agriculture



Industry



# PRODUCTION FACTS

- Brazilian Biomes
- Land Use
- Water Usage

## ETH'S CASE:

Consume 0.86m<sup>3</sup> water / ton of sugarcane while the sector consumes 1.81 m<sup>3</sup>



Minimum water consumption for sugarcane

## Water supply



Agriculture

Fertirrigation with vinasse

Mechanization



Industry

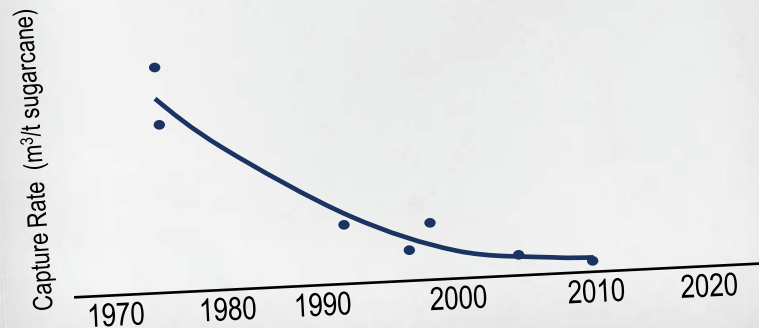
Future: Innovation

Sugarcane water

Self-sufficiency

Commercialization

Trend Curve: Water Capture Rate, Sugarcane Industry



# PRODUCTION ISSUES

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals

- Intensive use of agrochemicals and **loss of soil fertility**
- Climate change **impacting pest control**
- **Noxious effects on workers' health**

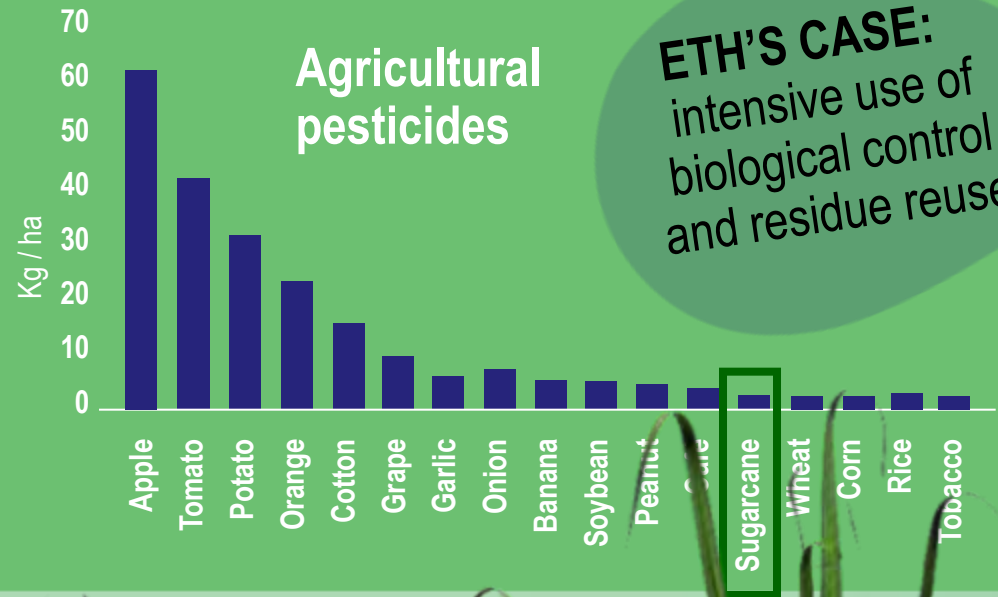
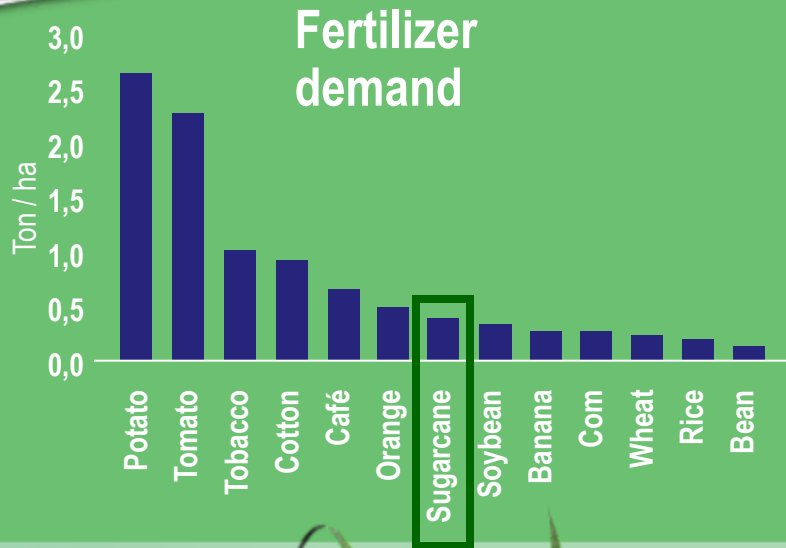


# PRODUCTION FACTS

- Brazilian Biomass
- Land Use
- Water Usage
- Agrochemicals

## Less agrochemicals in sugarcane cultivation

- Use of pesticides is low
- Biological control and advanced genetic enhancement programs
- Innovative use of recycled residues as organic fertilizers: filter cake, vinasse.



**ETH'S CASE:**  
intensive use of  
biological control  
and residue reuse

# PRODUCTION ISSUES

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture

- Monoculture risk: biodiversity impacts and difficulty in **pest and disease** control
- **Exclusion** of small-scale producers from the market





# PRODUCTION FACTS

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture

**ETH'S CASE:** study of local fauna chain to evaluate how species adapt to new crop introduction

- Competitiveness requires quantity / quality / cost
- Leased areas
- Small suppliers
- Establishment of green corridors connecting Permanently Protected Areas and Regularized Legal Reserves



# PRODUCTION ISSUES

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes

- **Ethanol production process:** disposal and environmental impact of by-products and residues



# PRODUCTION FACTS

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes

100% of sugarcane processing wastes are reused internally to minimize environmental impacts:

- Vinasse, liquid effluent, filter cake → fertirrigation  
**Advantage:** replaces use of fertilizers and irrigation
- Bagasse and sugarcane straw → energy cogeneration  
**Advantage:** self sufficiency in energy and contribution to the country's energy supply



# PRODUCTION ISSUES

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes
- Social Responsibility

- Inadequate work conditions on the field
- Mechanization will **eliminate thousands of jobs** in the sector
- **Seasonal employment**
- Social impacts on neighboring communities



# PRODUCTION FACTS

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes
- Social Responsibility
  - Mechanized Harvest

**ETH'S CASE:** 70% of planting and 100% of harvesting is mechanized

## Mechanized harvest

- Increases productivity of the harvest by around **20%**
- Makes the **process safer**
- Improves work **life quality**



- Signed in **June 2009**
- Result of **three-party** negotiations:
  - Companies
  - Workers
  - Federal Government

- A huge program of training and requalification of **cane cutters** done by the **sugarcane sector**



# PRODUCTION FACTS

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes
- Social Responsibility
- Mechanized Harvest
- Job Creation



## Job Creation

- The sugarcane industry is the largest employer in Brazilian agriculture – 1.2 million workers (2010);
- Strict labor laws in Brazil, helping to improve occupational health conditions

**Widespread production of ethanol**

vs.

**Concentrated production of petroleum**

In units - 2007

Sector	States	Cities	Jobs	Establishments
Ethanol(*)	25	1042	465236	16829
Petroleum (**)	24	176	73075	1239

Note: (\*) includes sugarcane farming and ethanol production.

(\*\*) includes petroleum extraction and derivatives production.

Source: RAIS (2007), PNAD (2007)

### ETH'S CASE: Job creation

- Harvest of 2009/10: 3,500 workers
- Harvest of 2010/11: 11,000 workers
- Harvest of 2012/13: 15.000 workers

# PRODUCTION FACTS

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes
- Social Responsibility
  - Mechanized Harvest
  - Job Creation
  - Social Impacts



## Social impacts on neighboring communities

- Seasonality of labor balanced with mechanization alleviates local labor migration
- Training and use of local labor



**ETH'S CASE:** The Social Energy for Local Sustainability Program involves the government and community in investments in the region.



# PRODUCTION FACTS

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes
- Social Responsibility
  - Mechanized Harvest
  - Job Creation
  - Social Impacts



## Results of 2010's Program

- **Socio-environmental diagnostic** of the 9 towns where ETH operates;
- **Diagnostic of the relationship between ETH and the local communities** before implementing the program;
- Hosting of **242 forums** in 5 towns, involvement of **4,623 people** in the actions of the program ;
- Setting up of **27 training centers** with the participation of 508 people;
- 52 sessions of **Social Energy Cinema** were held with the participation of 1940 people;
- **20 projects** defined with the community.





# PRODUCTION ISSUE

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes
- Social Responsibility
- Certification

- International credibility
- International restrictions on  
**Brazilian ethanol**



# PRODUCTION FACTS

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes
- Social Responsibility
- Certification
- Credibility

## The Brazilian sugarcane sector is seeking a process for certification

The sugarcane sector has been seeking continual development of sustainable management of its chain:

- Participating in the creation of solid legislation;
- Encouraging producers to invest in the subject;
- Showing itself to be transparent in verifying its sustainable actions.

## The Agro Environmental Protocol defines directives for promoting environmental sustainability, including:

- Burning reduction;
- Protecting of streamside woodlands and headwaters;
- Minimizing water usage;
- Minimizing pollution, among other things;
- Auditing annually with a three-party executive group



# PRODUCTION FACTS

- Brazilian Biomes
- Land Use
- Water Usage
- Agrochemicals
- Monoculture
- Wastes
- Social Responsibility
- Certification
- Credibility

## INTERNATIONAL CREDIBILITY

- Considering the vast quantity of initiatives, the Brazilian industry is actively involved in a specific scheme: the Better Sugarcane Initiative – **BSI/BONSUCRO** and **RFS2**.



- BSI defines criteria, indicators, and standards for producing sugarcane, taking into consideration local conditions and circumstances, involving the whole sugarcane chain;
- It promotes measurable improvements in social, environmental, and economic impacts of growing and processing sugarcane;
- System for certification/ **external recognition**.

# ETHANOL OPPORTUNITIES

## USES



Transportation  
(fuel)



Energy



Consumer goods

# USES

## Transportation

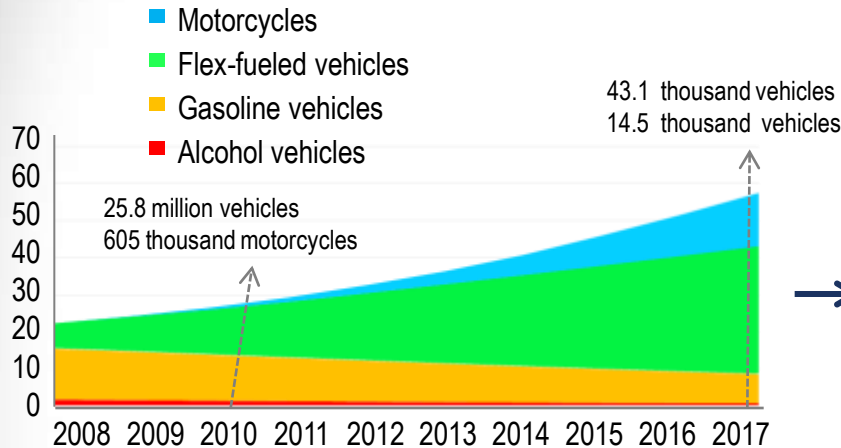
*Renewable fuel*

Brazilian technology for the production of flex-fueled cars

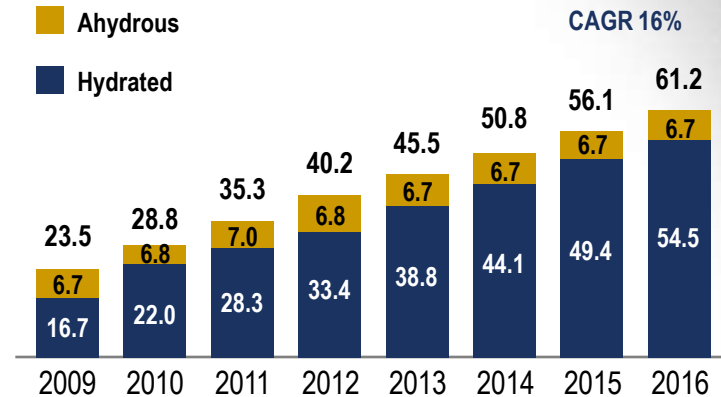


### Flex-fueled cars

#### Projected fleet in millions of vehicles



#### Potential ethanol demand in Brazil (Billions of liters)



Source: LCA

# USES

## Transportation

*Ethanol cycle (Kg CO<sub>2</sub>/1000 l)*

The cars emissions  
are absorbed by the  
sugarcane

### 1 GROWING AND HARVESTING

Tractors, harvesters and inputs in the field\*

**Emissions: 2,961**



### 2 GROWTH

Sugarcane is a natural sponge for carbon gases as it grows

**Absorption: 7,650**

2

### 3 PROCESSING

Fermentation and bagasse burning for energy generation

**Emissions: 3,604**



3

### 6 ON THE STREETS

Car motors burning ethanol

**Emissions: 1,520**



Ethanol is transported to gas stations in diesel lorries

**Emissions: 50**

5

### 4 BIO-ELECTRICITY

Use of bagasse to generate electricity and energy surplus

**Emissions Avoided: 225**



4

**89%** of carbon emission reduction vs. gasoline production

\*Assuming 50% mechanized and 50% manual harvest.

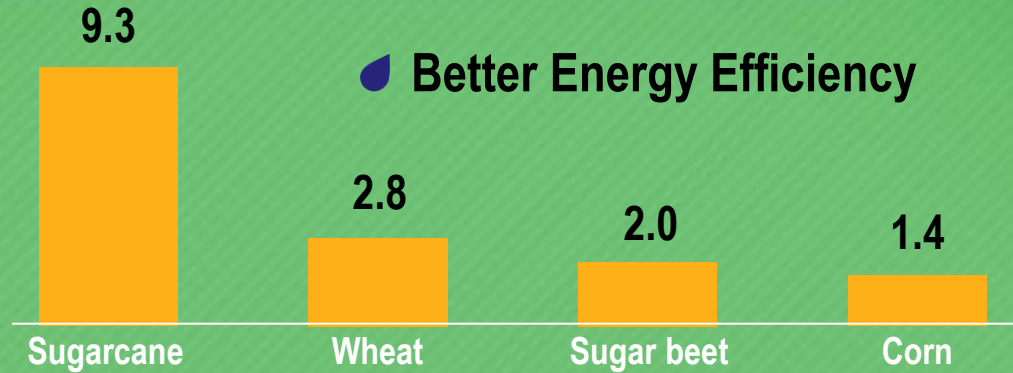
Source: Isaias Macedo and Joaquim Seabra  
Unicamp, 2008

# USES

## Transportation

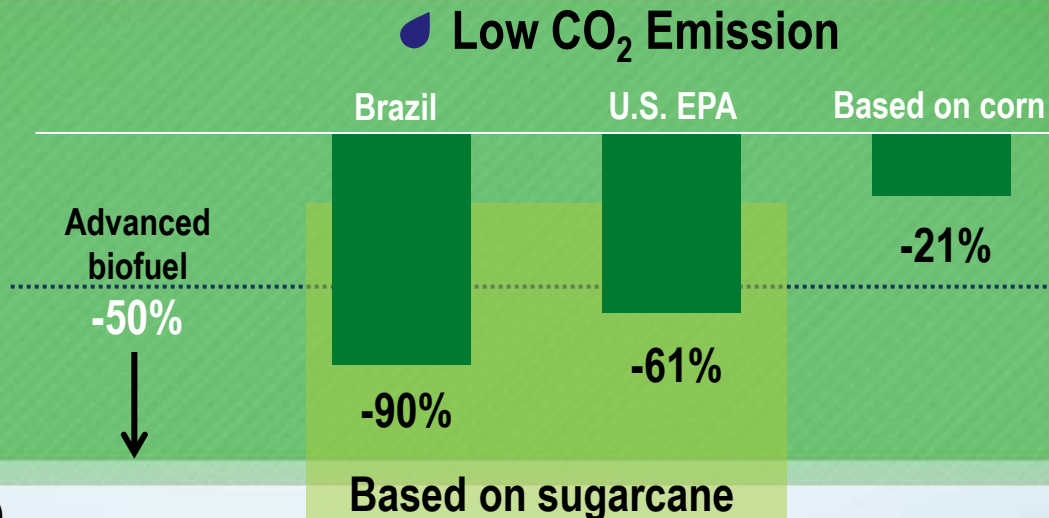
### *Fuel Quality*

Energy contained in ethanol per unit of fossil fuel used to produce it



Source: World Watch Institute and MACEDO et al (2008)

**Biofuel  
Advanced  
(EPA)**



Source: Renewable Fuel Standards (I and II)

# ETHANOL OPPORTUNITIES

## USES



Transportation  
(fuel)



Energy



Consumer goods



# USES Energy

Renewable + Clean



Self-sufficient industry



Produces excess energy



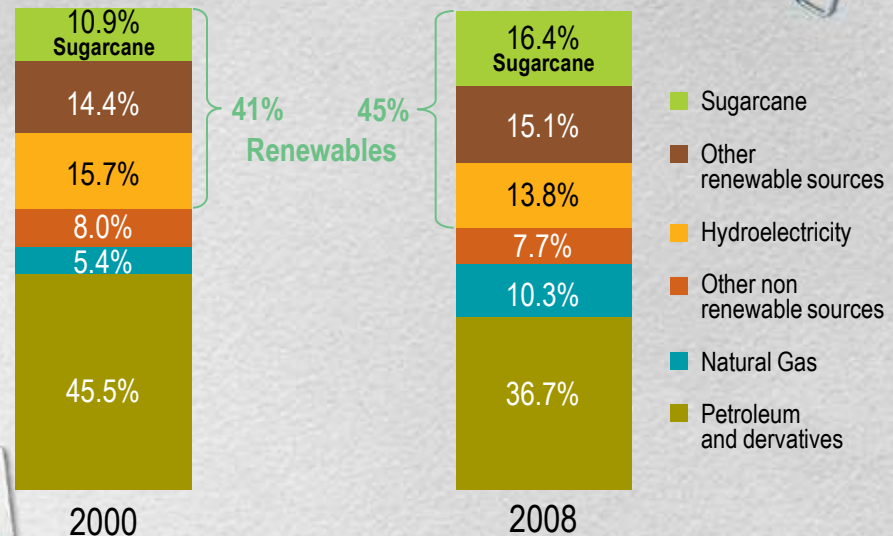
contributes to a



**CLEANER NATIONAL  
ENERGY GRID**



## Brazil's green energy matrix



Source: BEN (2009). Elaboration: UNICA

### ETH'S CASE

Project to earn carbon credits on energy cogeneration with a reduction of 3 million tons of CO<sub>2</sub> in the next 7 years (4 mills)

# ETHANOL OPPORTUNITIES

## USES



Transportation  
(fuel)



Energy



Consumer goods


# USES

## Consumer goods

### *Industry*

#### Green Plastics

Improving quality of life with renewable raw materials

 Ethanol - Industrial Uses



Sugarcane



Ethanol



Green PE

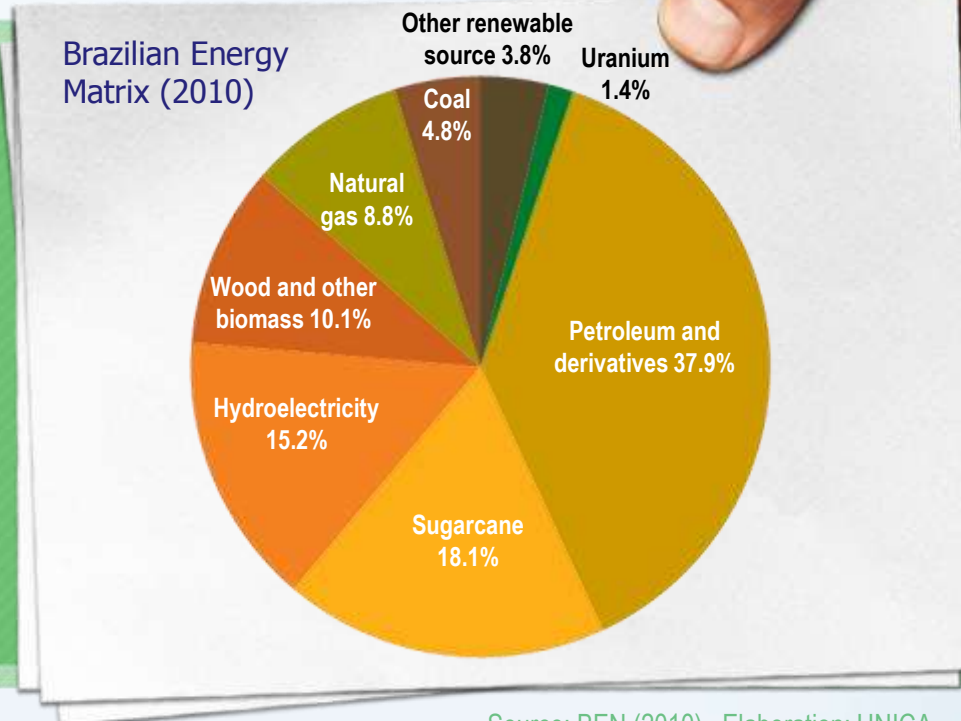


Consumer goods with renewable origins

Capture & Sequestration 2,5 t CO<sub>2</sub>/ t green PE

# BRAZIL

## Brazilian ethanol: successful business without government subsidies



Source: BEN (2010). Elaboration: UNICA



Reduction of GHG from the use of ethanol : transportation + energy

2006 - 22% GHG  
2020 - 43% GHG

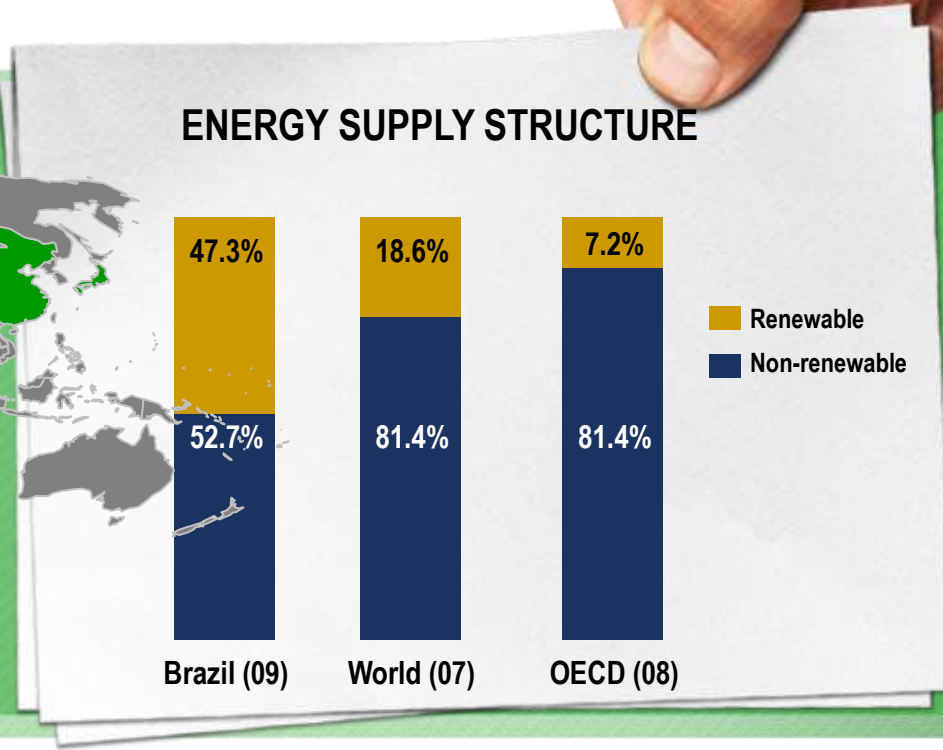
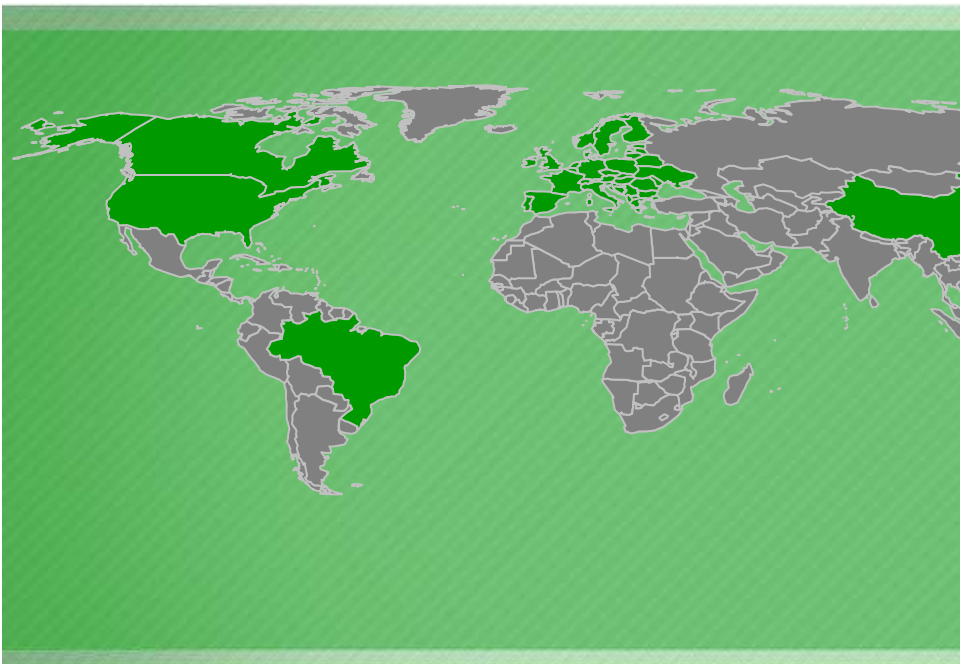


Business

2010 - US\$ 28 billion  
2020 - US\$ ????

→ US\$ 10 billion collected in taxes

# WORLD ?



Source: BEN (2010). Elaboration: UNICA



Reduction of GHG from the use of alcohol transportation + energy

2020 - ??? GHG



Business

2020 - US\$ ??? + jobs ???

# Final Considerations

## *Ethanol as a sustainable alternative to the transport energy*

### Ethanol Contributions in Brazilian Experience

- **Environment :**
  - Clean and Renewable Fuel
  - Climate Changes Mitigation
  - Biodiversity
- **Social Impacts:**
  - Largest employer in agriculture
  - Rural Development
- **Food Security:**
  - Not affected
- **Limitations:**
  - Climate and Soil conditions
  - International credibility





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**Thank you very much  
for your attention!**