

International Conference on Bioenergy in Russia **BIOENERGY-2012**

National Research Centre “Kurchatov Institute”
International Low-Carbon Energy Technology
Platform (IEA Technology Platform)
June - 2012

Global and regional market and policy perspectives for Bioenergy – Brazil

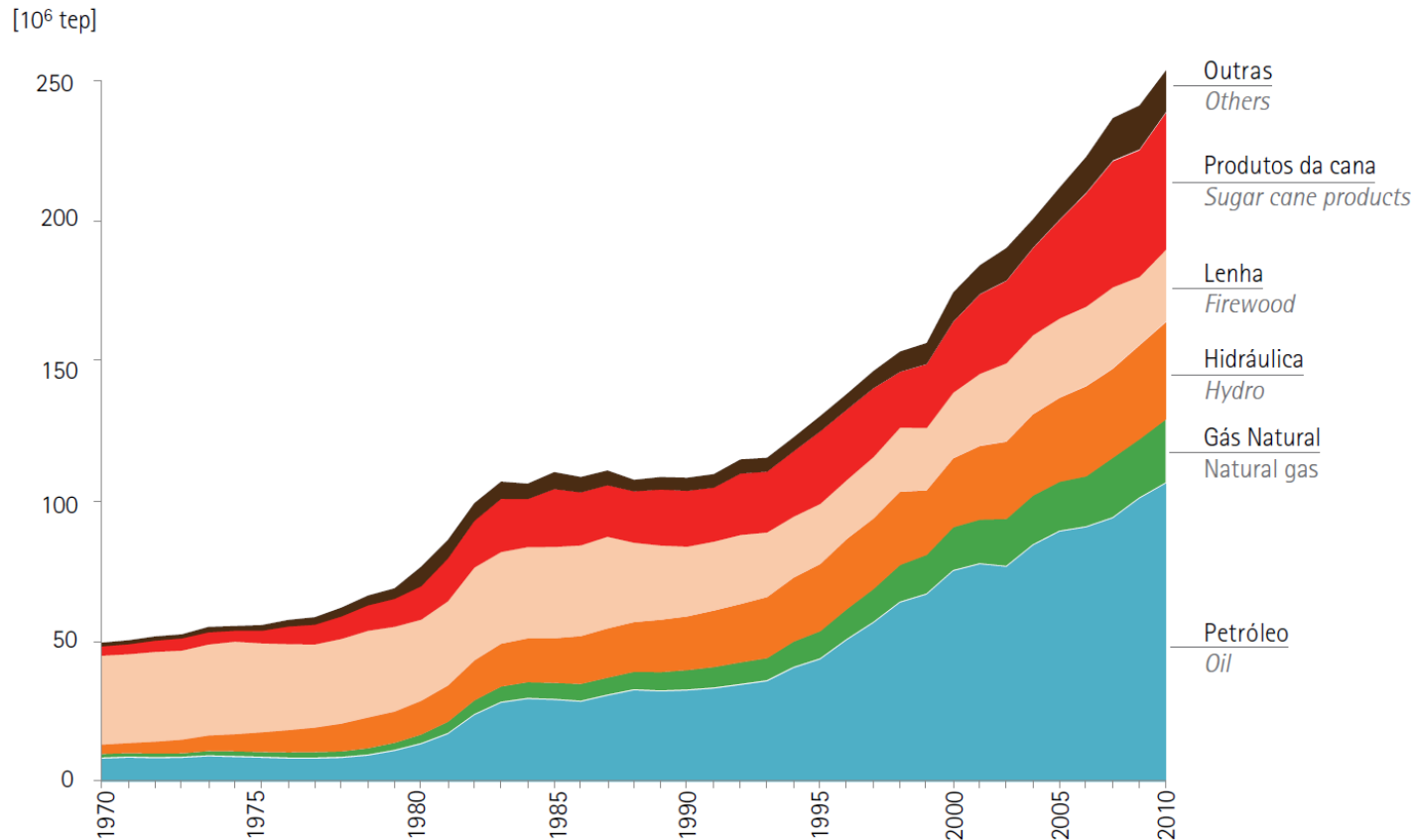
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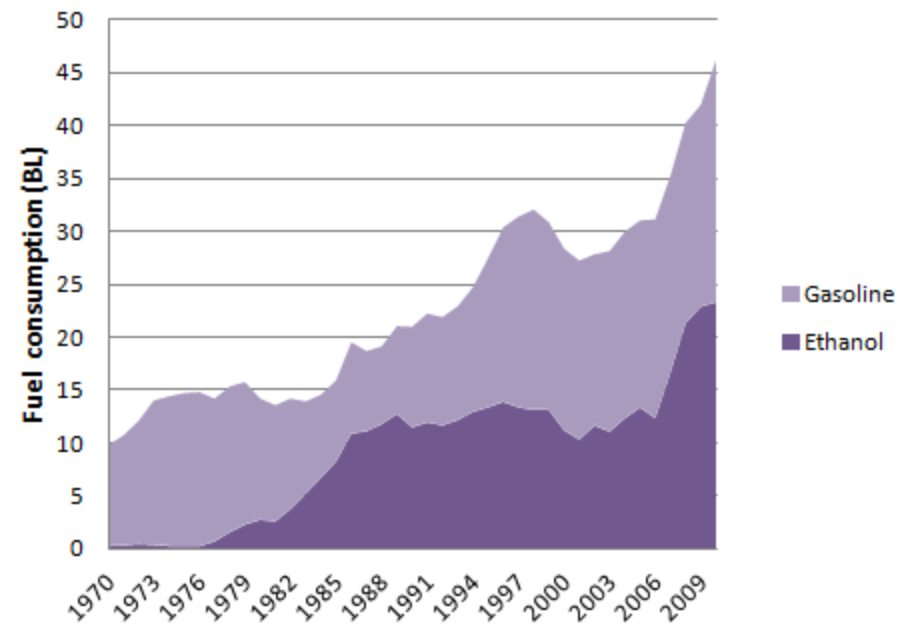
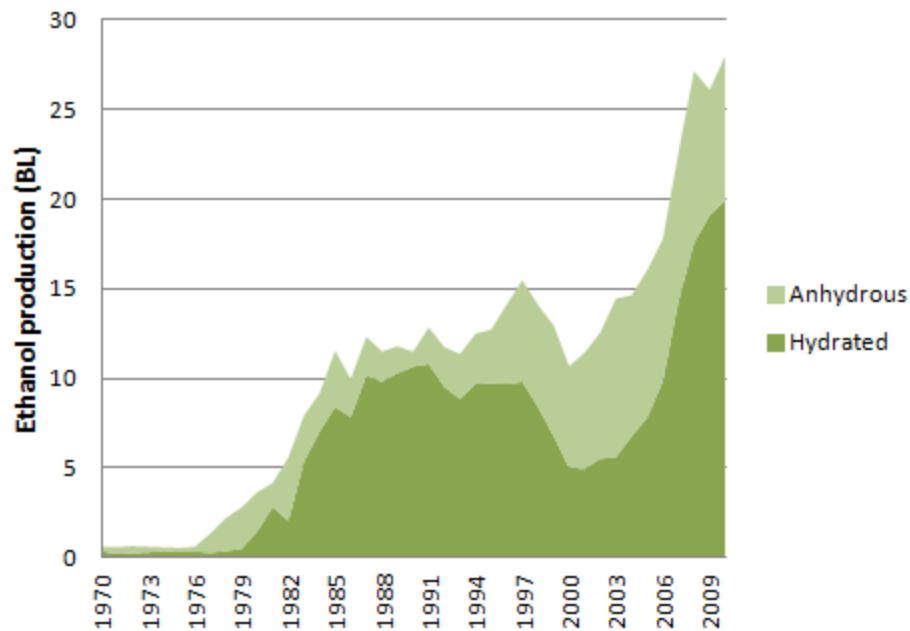
- ✓ The energy matrix in Brazil; the importance of biomass.
- ✓ Current and predicted figures (2020): ethanol, biodiesel and wood.
- ✓ An example on R&D: CTBE (Brazilian Bioethanol Science and Technology Lab.).
- ✓ Conclusions.

Primary Energy Supply in Brazil



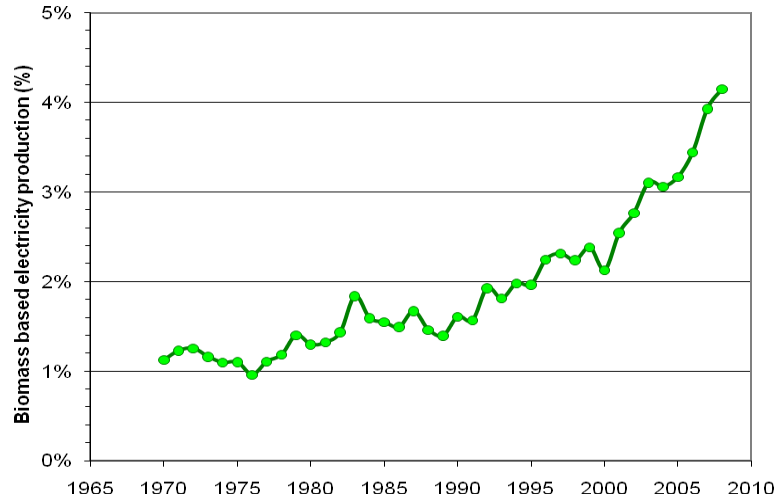
- ✓ 47.5% as renewable energy sources / sugarcane products 19.3% (~45% ethanol/~55% bagasse) // wood 10.3% (partially modern biomass use)

Ethanol in Brazil

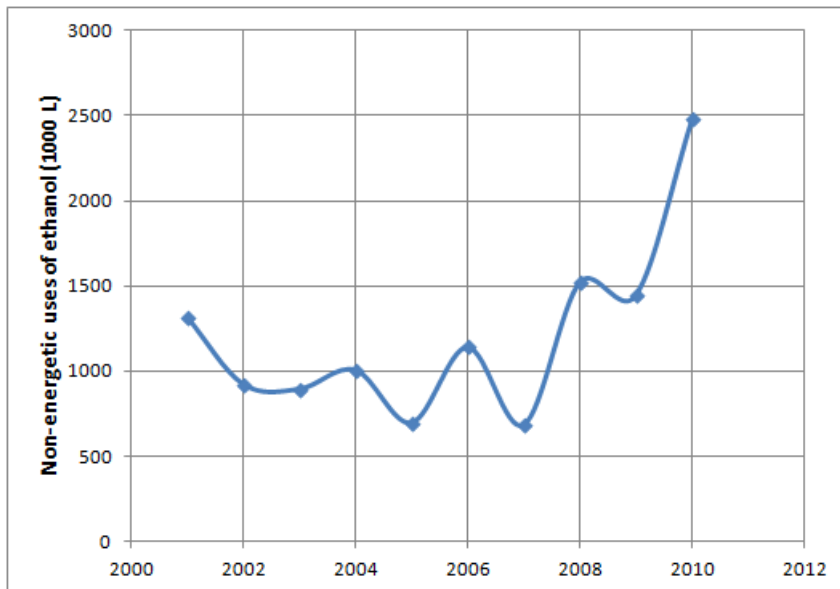


- ✓ Large-scale ethanol production as fuel since 1975 (hydrated and anhydrous).
- ✓ Production estimated as about 28 BL in 2010 (~70% hydrated ethanol)
- ✓ Consumption in the transport sector in 2010 estimated as 23.3 BL (roughly equivalent to the consumption of pure gasoline, volume basis).

Diversification of the production

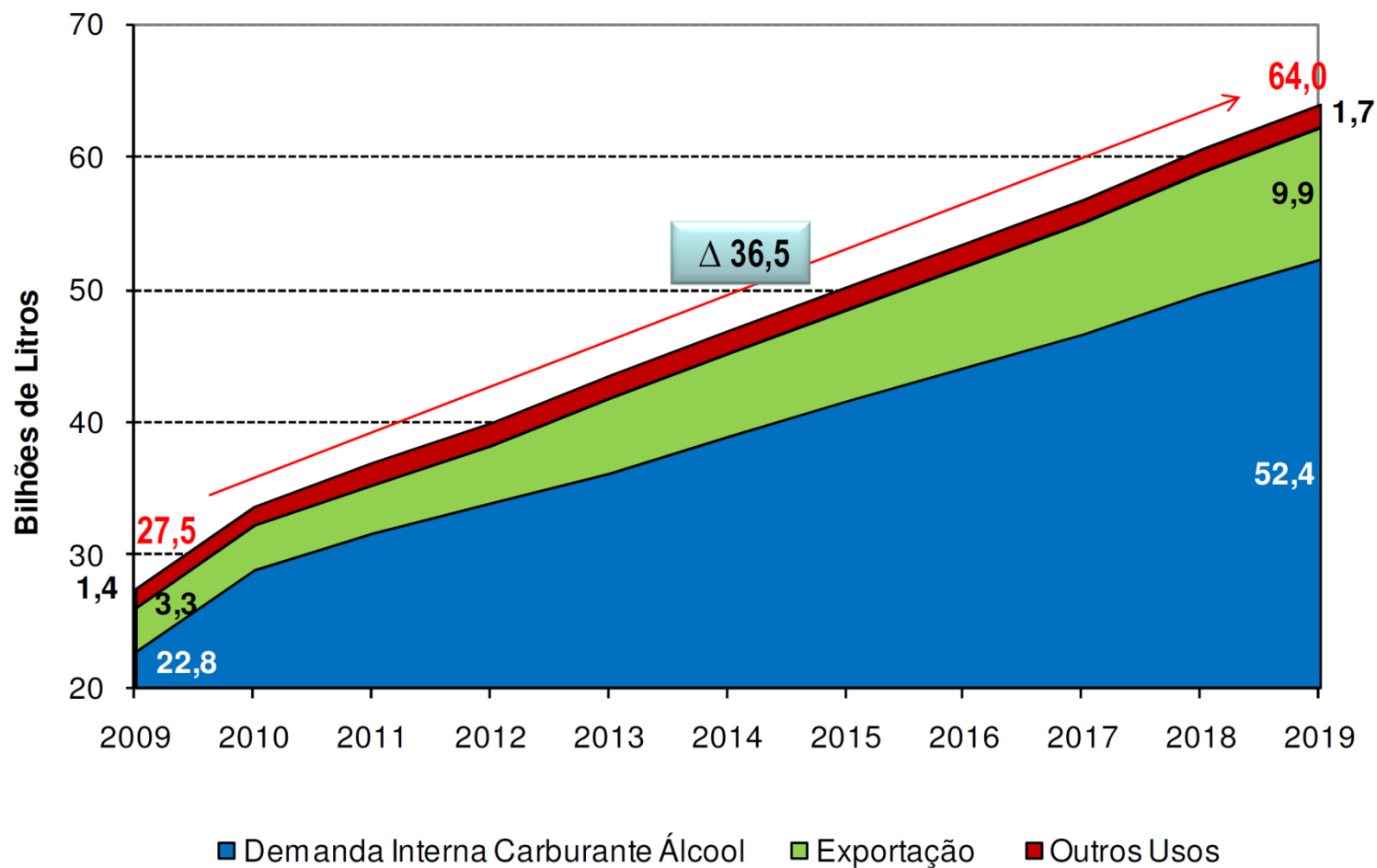


- ✓ Electricity production from sugarcane residues is about 4.5% of the total electricity production. **Surplus electricity is equivalent to the self-consumption, but could be much larger (3-4 times).**
- ✓ Other uses of ethanol are increasing, but still represents less than 10% of the total production. However, **some new mills aim at the production (exclusively) of plastics and chemicals** (ethylene, and polyethylene).



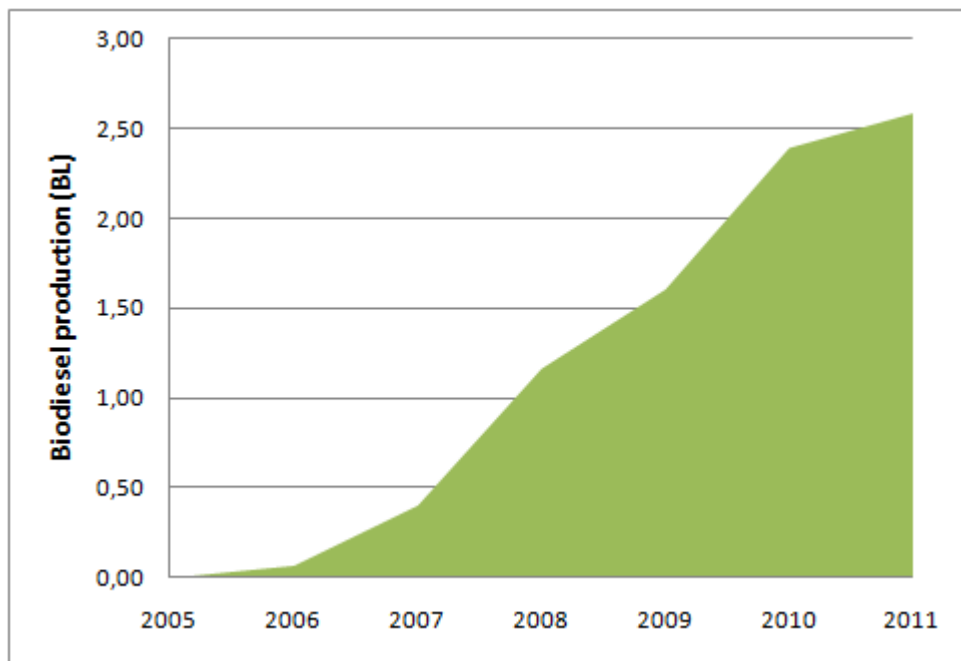
Source: MME-EPE (2010)

Predicted growth of ethanol production



Source: EPE (2011)

Biodiesel



- ✓ Biodiesel production started in March 2005.
- ✓ B5 blends have been mandatory since January 2010 (it was originally scheduled for 2013).
- ✓ The production in 2010 was 2.4 BL, large enough to fulfil the targets.
- ✓ The bulk of the production is based on soy oil (~85%) (~10% is produced from animal fats and 5% from other feedstocks).
- ✓ There is no aim on exporting biodiesel, at least in short term.

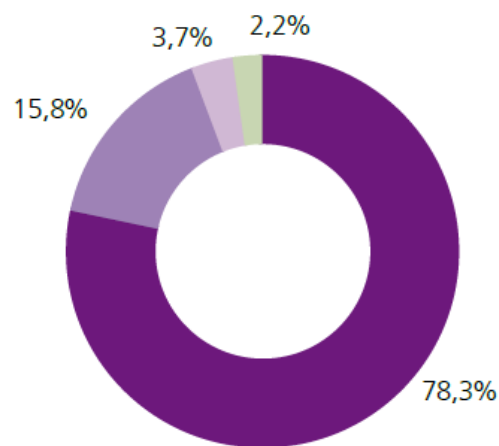
Source: ANP (2011)

Predicted biodiesel production in 2019

Tabela 20 – Consumo obrigatório de Biodiesel por região (ML)

Ano	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Região										
Norte	261	276	279	296	313	331	351	371	393	410
Nordeste	360	380	403	427	545	481	511	543	576	605
Sudeste	1.113	1.181	1.253	1.329	1.410	1.496	1.587	1.684	1.787	1.877
Sul	497	521	553	586	622	660	700	743	788	828
Centro-Oeste	281	298	316	335	356	377	400	425	452	475
Brasil	2.506	2.656	2.804	2.974	3.155	3.46	3.550	3.767	3.996	4.194

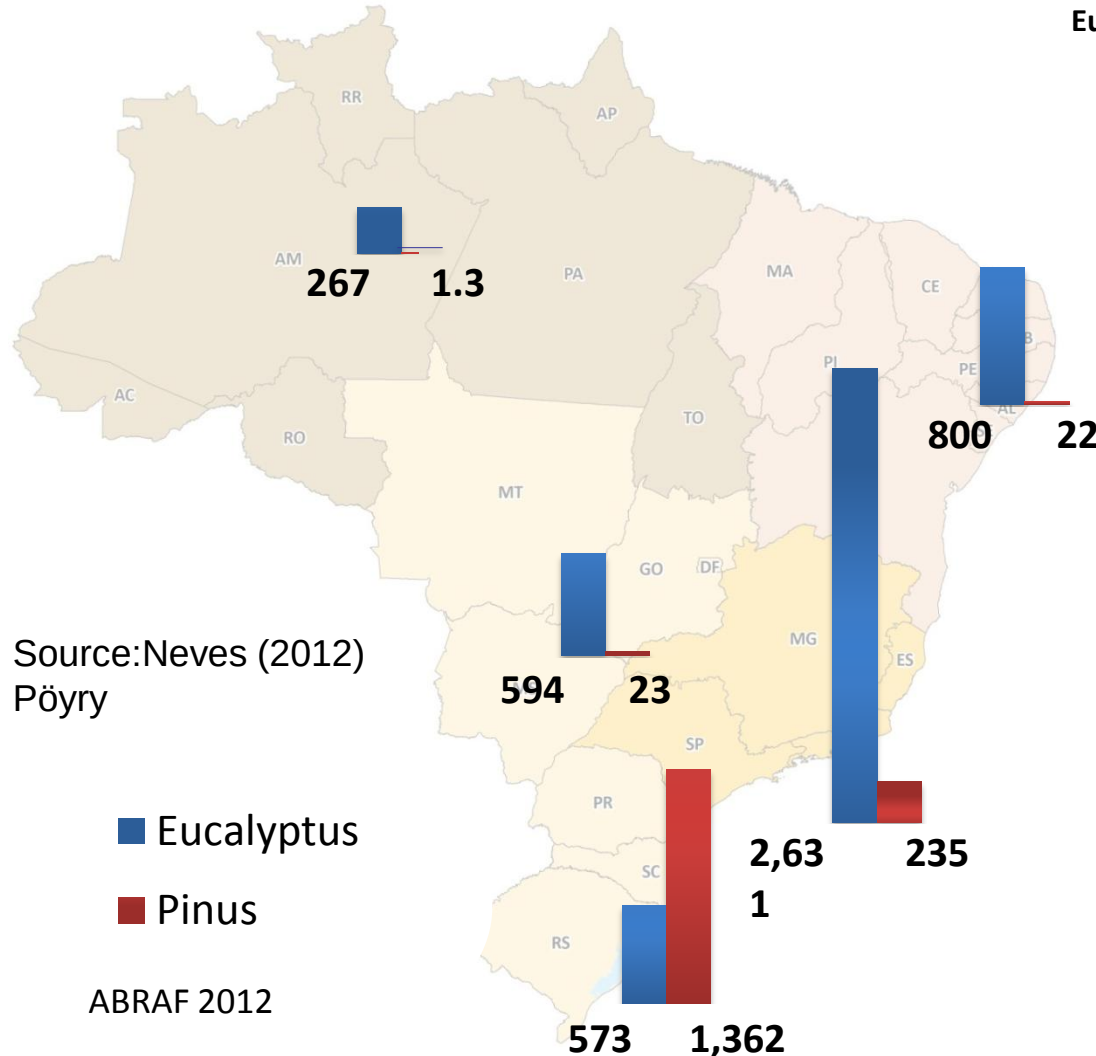
Fonte: EPE



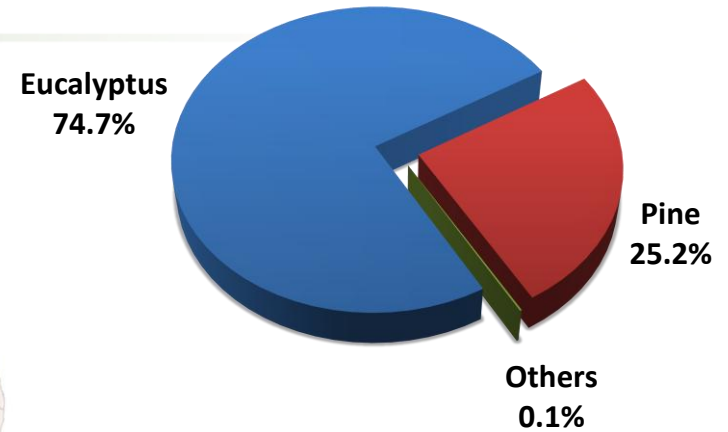
■ Soja ■ Gordura Animal ■ Algodão ■ Outros Materiais Graxos

Source: EPE (2011)

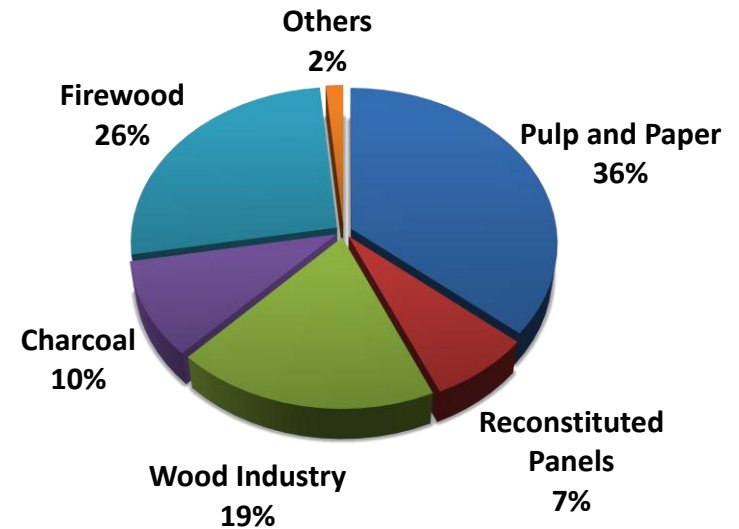
Forest planted area



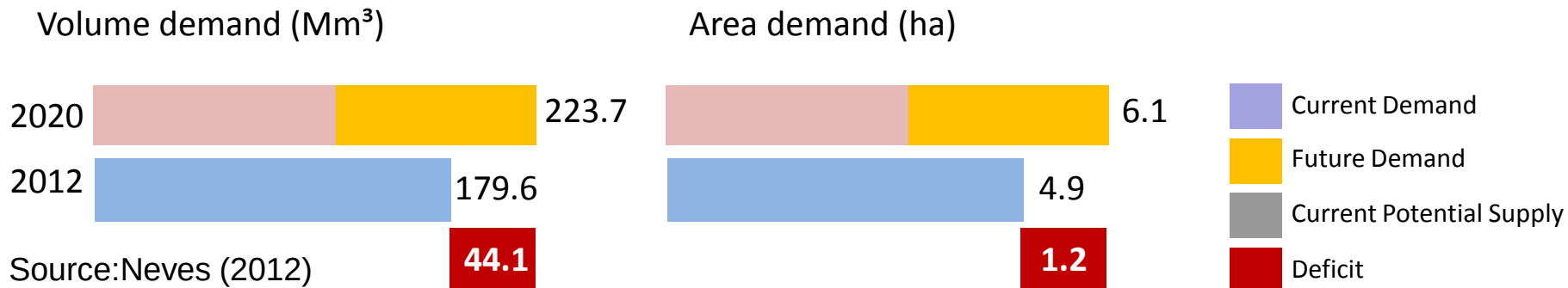
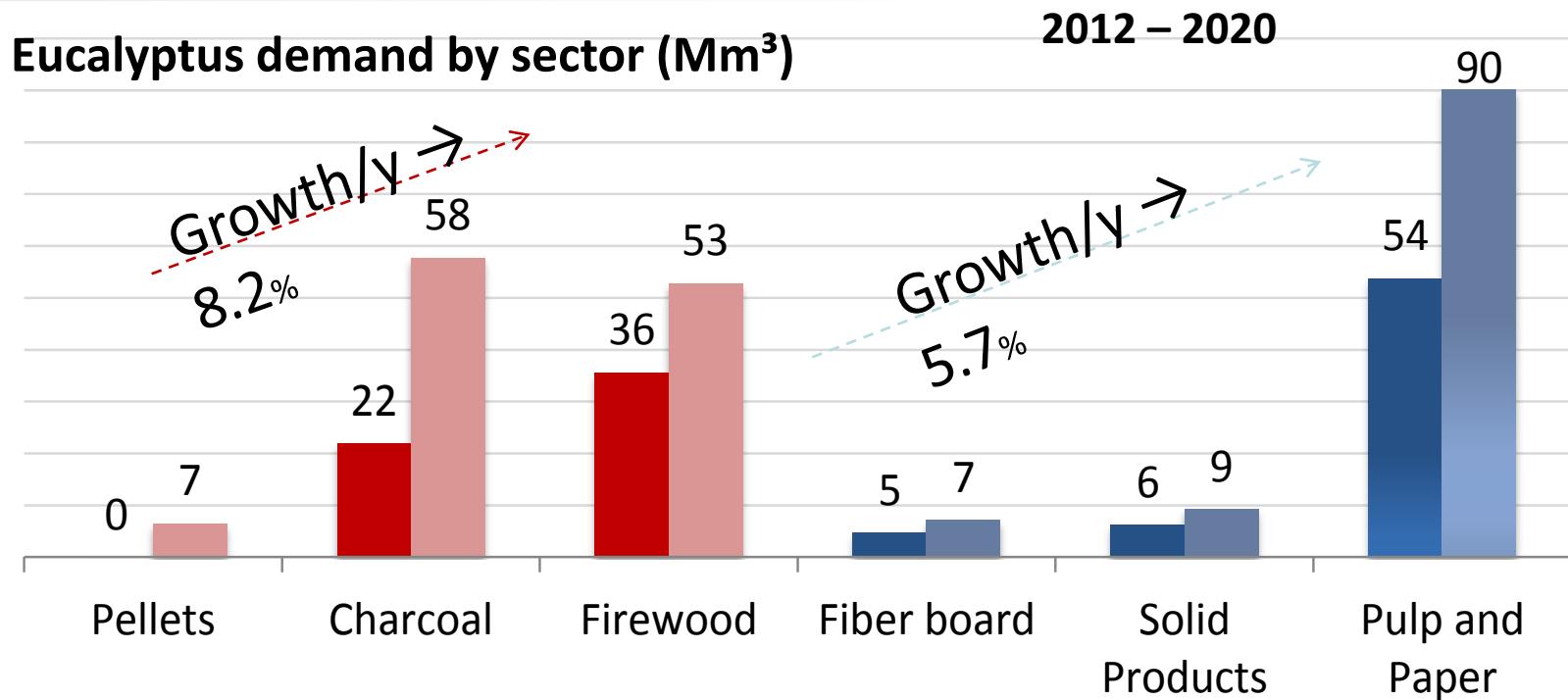
Planted Area (thousand ha) - 2012



Planted Forests : ≈ 6,5 Mha

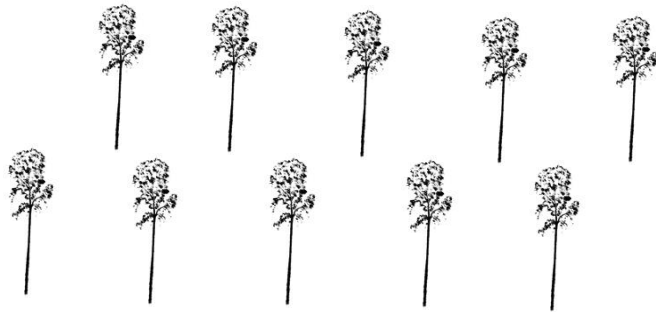


Industrial Wood Consumption ≈ 170 Mm³



Pöyry

Short rotation wood crops – Fundamentals



Conventional Forestry

- Regular Clone
- Regular spacing between trees (3x3 m)
- Forest Yield~ 45 (m³/ha/year)
- Harvest in 7 years
- Low Lignin content
 - (regular calorific value)
- Can be used to make pulp or generate energy.



Energy Oriented Short Rotation Forestry

- Special Clone
- Short spacing between trees (high forest density; 3 x 0,5 m up to 1 m)
- Forest Yield ~ 70 (m³/ha/year)
- Harvest in 2 – 3 years
- High Lignin content
 - (high calorific value)
- Cannot be used to produce pulp.

Source:Neves (2012); Pöyry

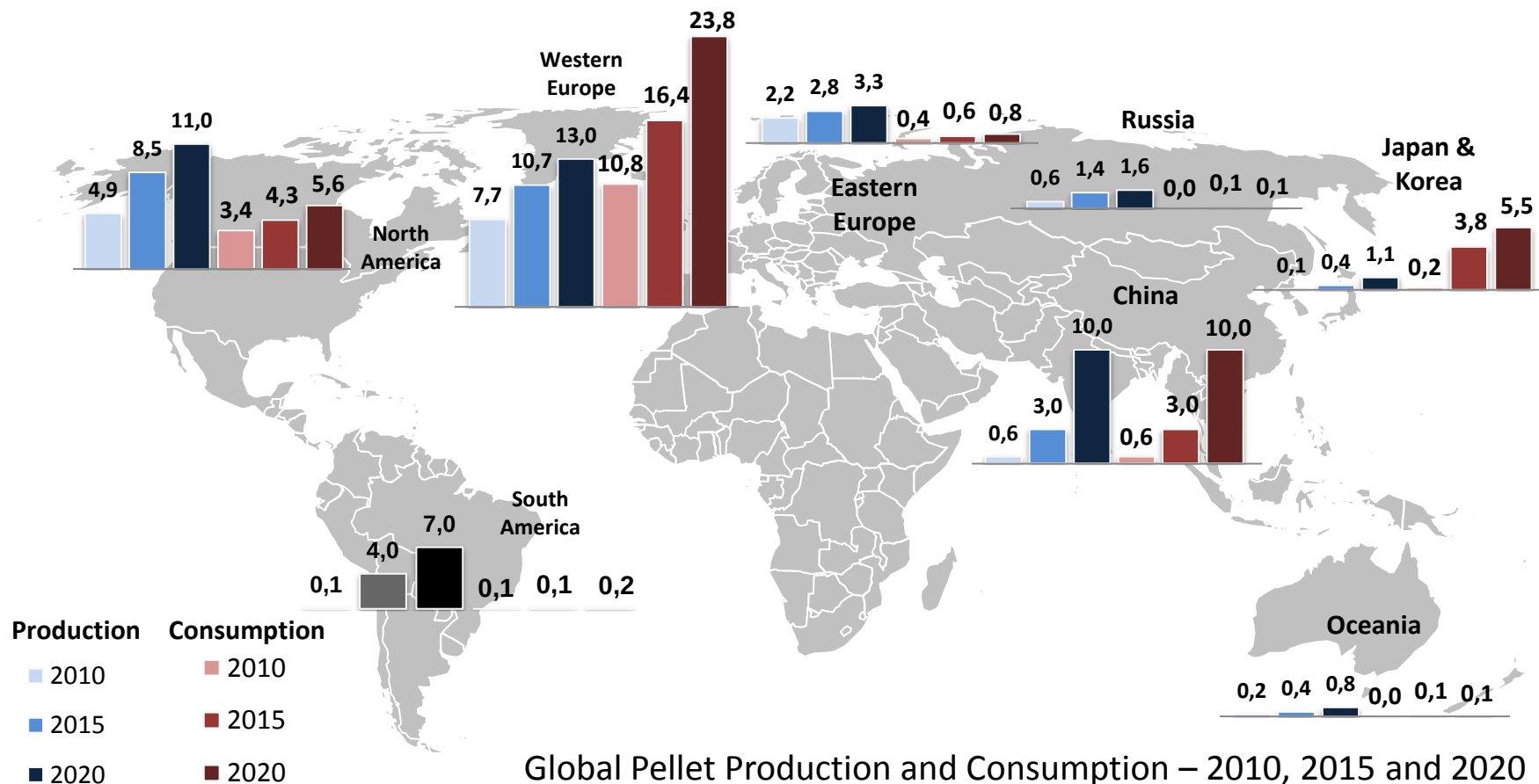
Charcoal industry – Pig Iron industrial clusters



- From 2000 to 2008 the charcoal consumption growth had been 3,5% per year. From 25 to 33 million mdc¹
- From 2009 to 2010 the charcoal consumption decreased 35% due to the global economy crisis
- In 2011 Brazil produced around 27 million mdc¹ of charcoal (69% from planted forests)

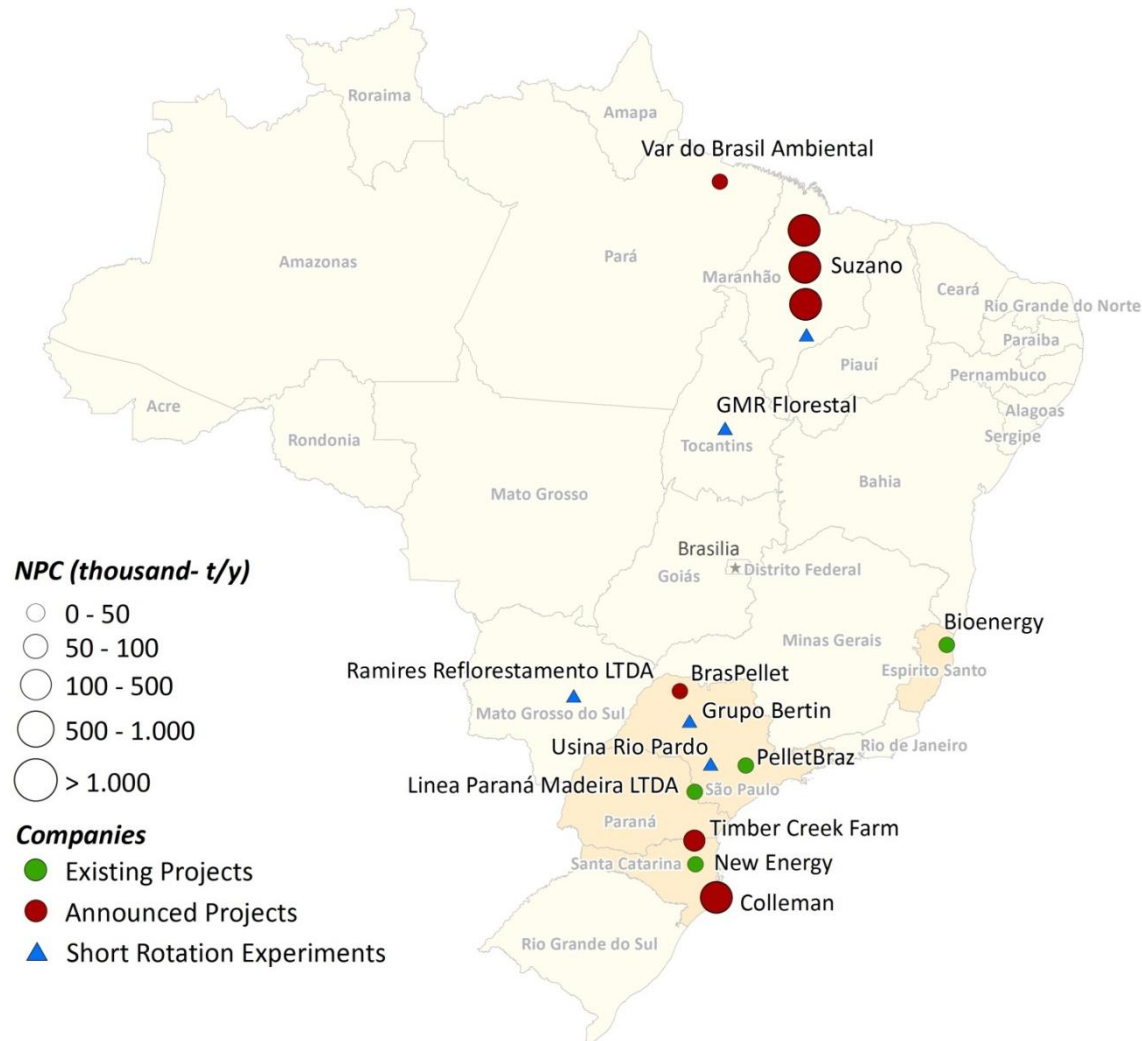
Source: Neves (2012)
Pöyry

- Although the largest pellet production capacities are forecast to remain in Europe, the strong competition for raw material in this continent will drive an increasingly demand by imports from regions with a biomass surplus.



Source: Neves (2012); Pöyry

Main players in Brazil

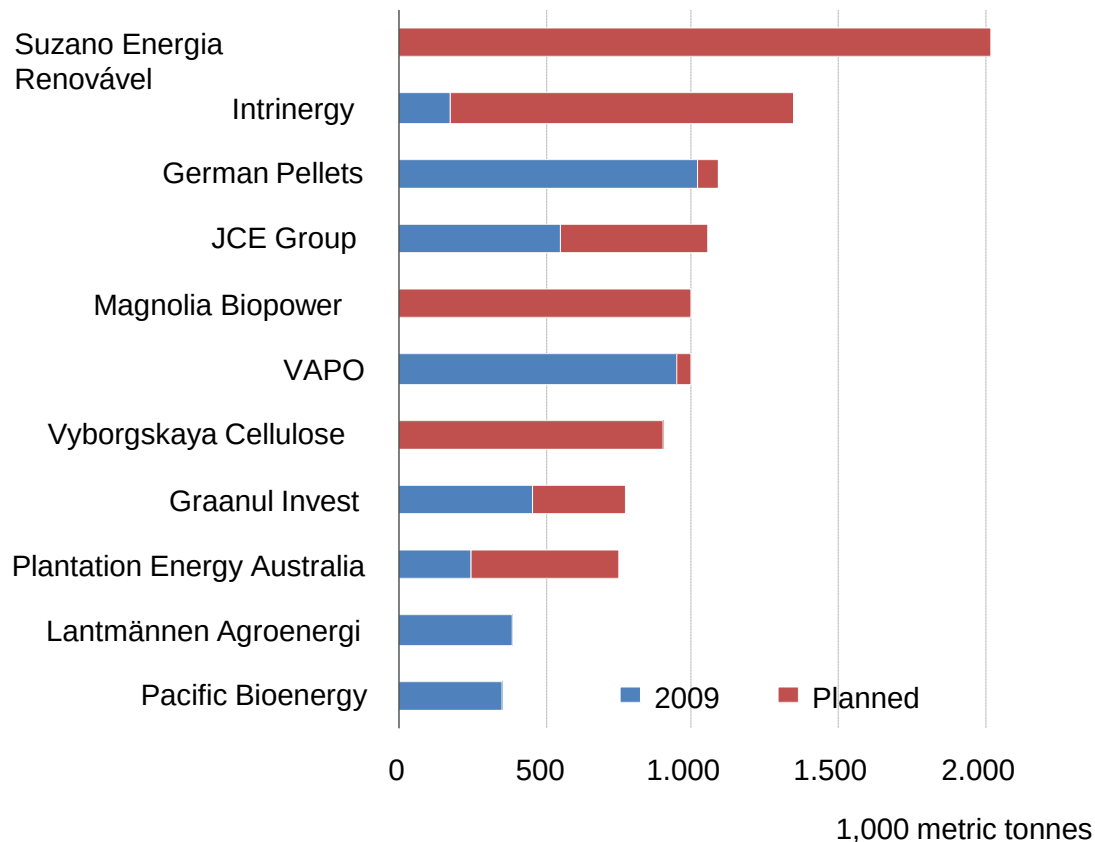


Source: Neves (2012); Pöyry

Major Pellet Producers – Present and Projected

The pellet supply structure can change significantly in the next five years.

Pellet Production Capacity by 2015 Investment Intention Projects Announced



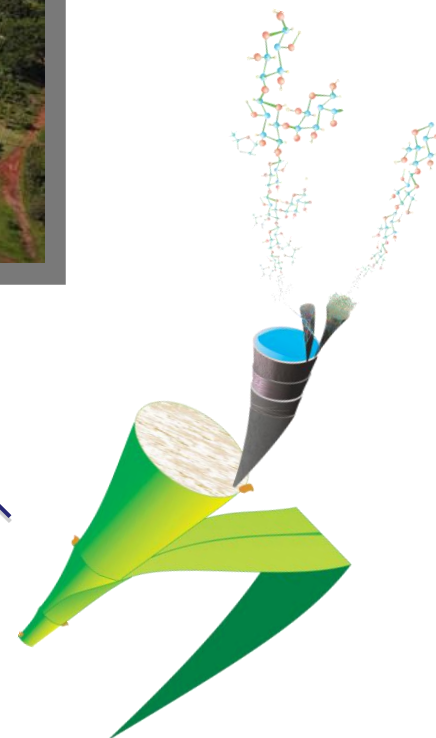
Source: Neves (2012); Pöyry

A National Lab on Bioethanol

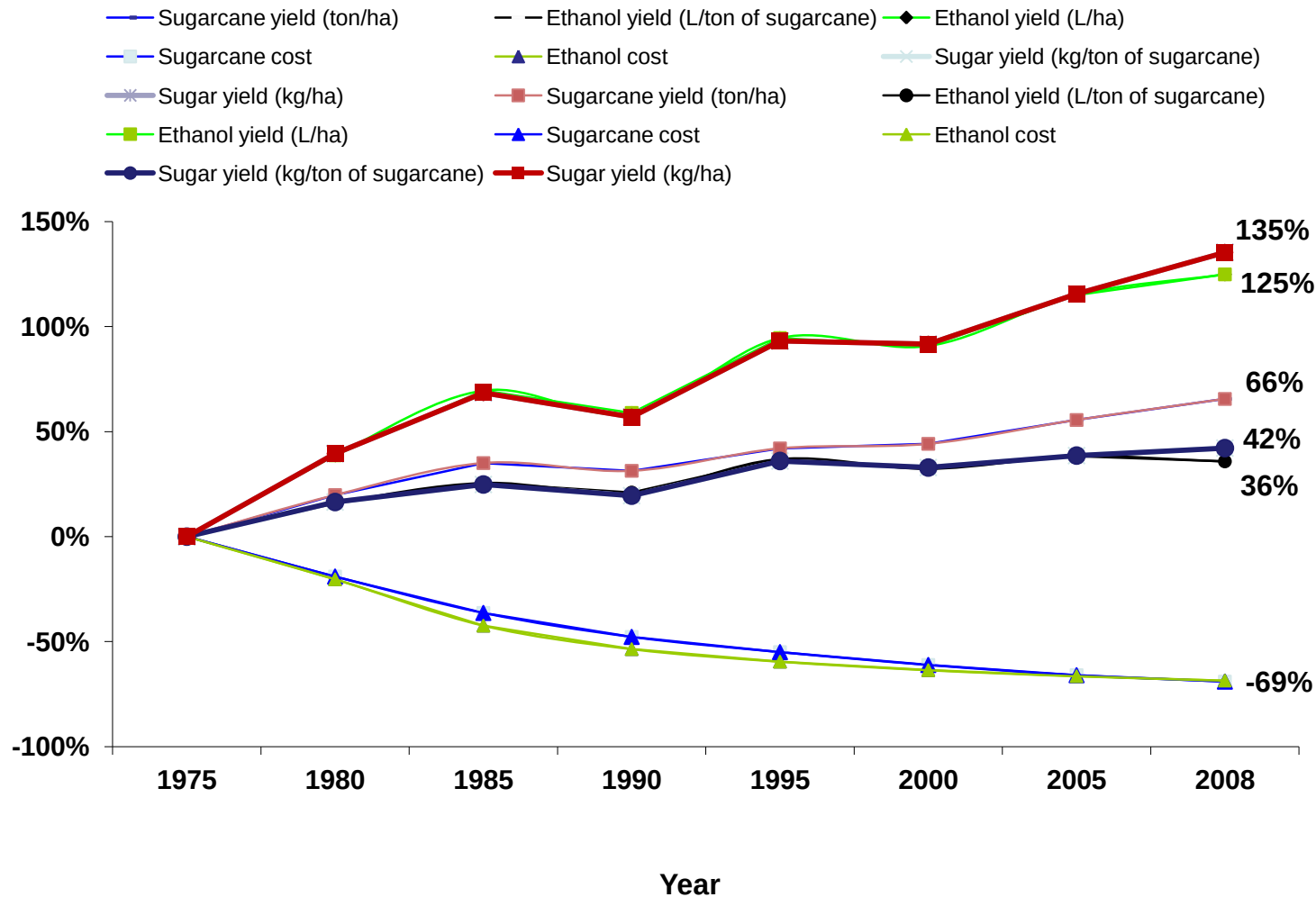


Numbers

- . Federal investment (2008-2010): **Euro 35 million**
- . Built area: **8,722.28 m²**
- . Predicted research team in 2013: **110-120**



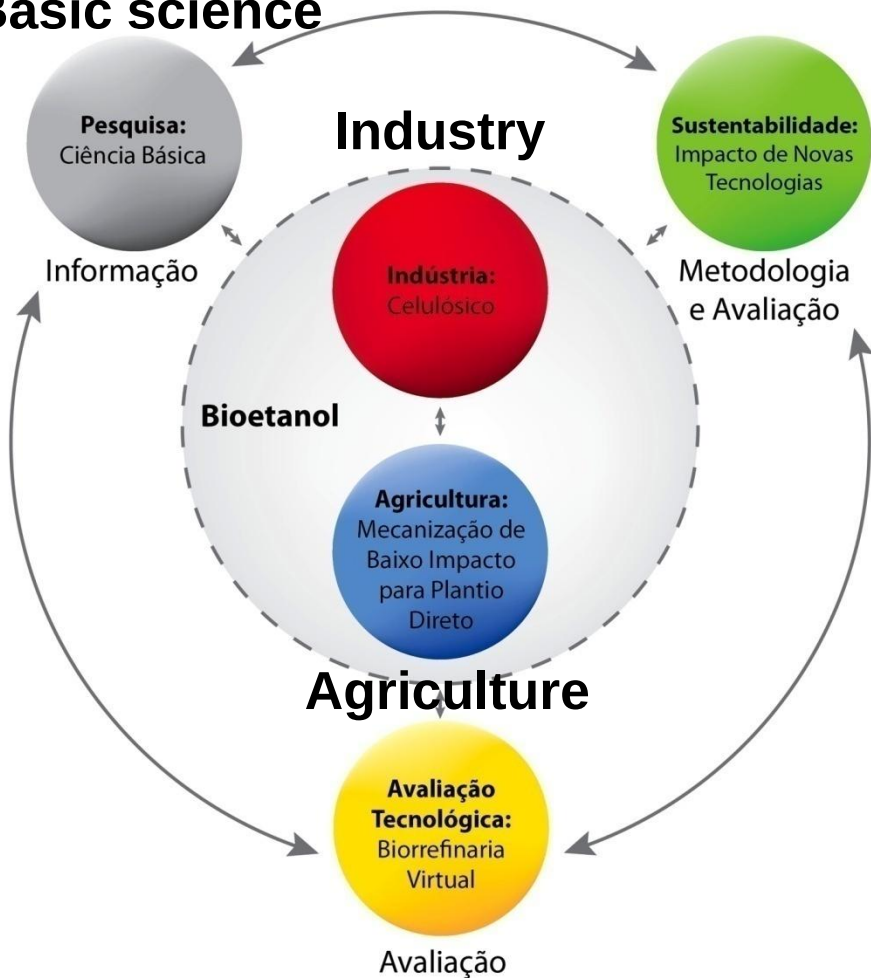
Yields, efficiency and costs – sugarcane industry in Brazil



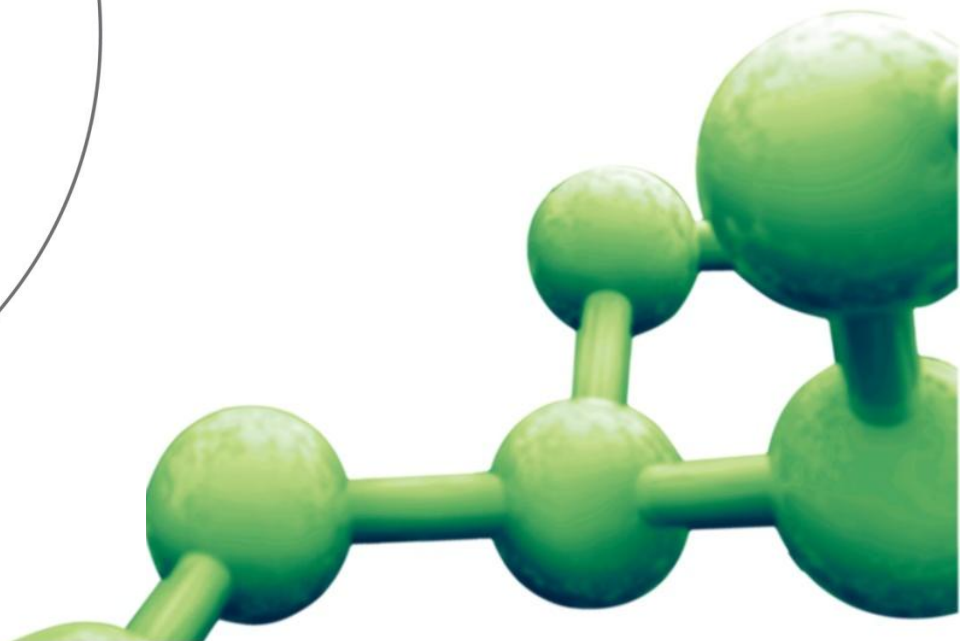
Research Programs

Basic science

Sustainability



Technology assessment



Pilot Plant for Process Development



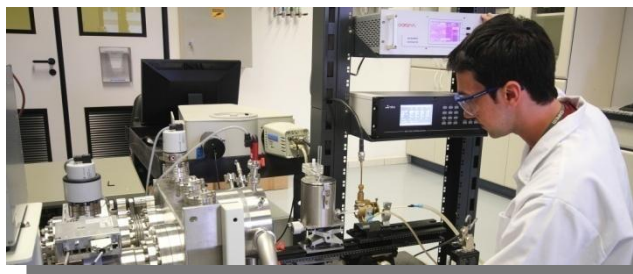
- Development of **ethanol production process through hydrolysis** (ethanol production from sugarcane could be 40% higher).
- Facilities will be operated as a National Laboratory, and companies could be in there.
- **Scaling-up and integration of industrial process.**
- Bottlenecks should be identified and solutions developed.

Low-impact mechanization



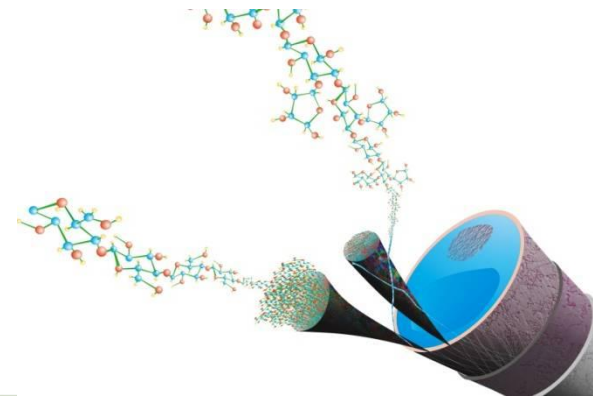
- Mid-term focus on the use of **no-tillage technology**, with cost reduction and better soil protection.
- The machine under construction will allow **reduction of the area compacted**, from 60% to 13%.
- Field tests will be performed with the support of EMBRAPA
- **Estimated cost is about 7.5 million Euro**. Financial support from BNDES and partnership with JACTO.

Basic Science



- Research agenda goes from photosynthesis to celluloses conversion to sugars, with focus on sugarcane bagasse and sugarcane trash.

- Besides its own research program, the team gives support to all other CTBE's research programs.

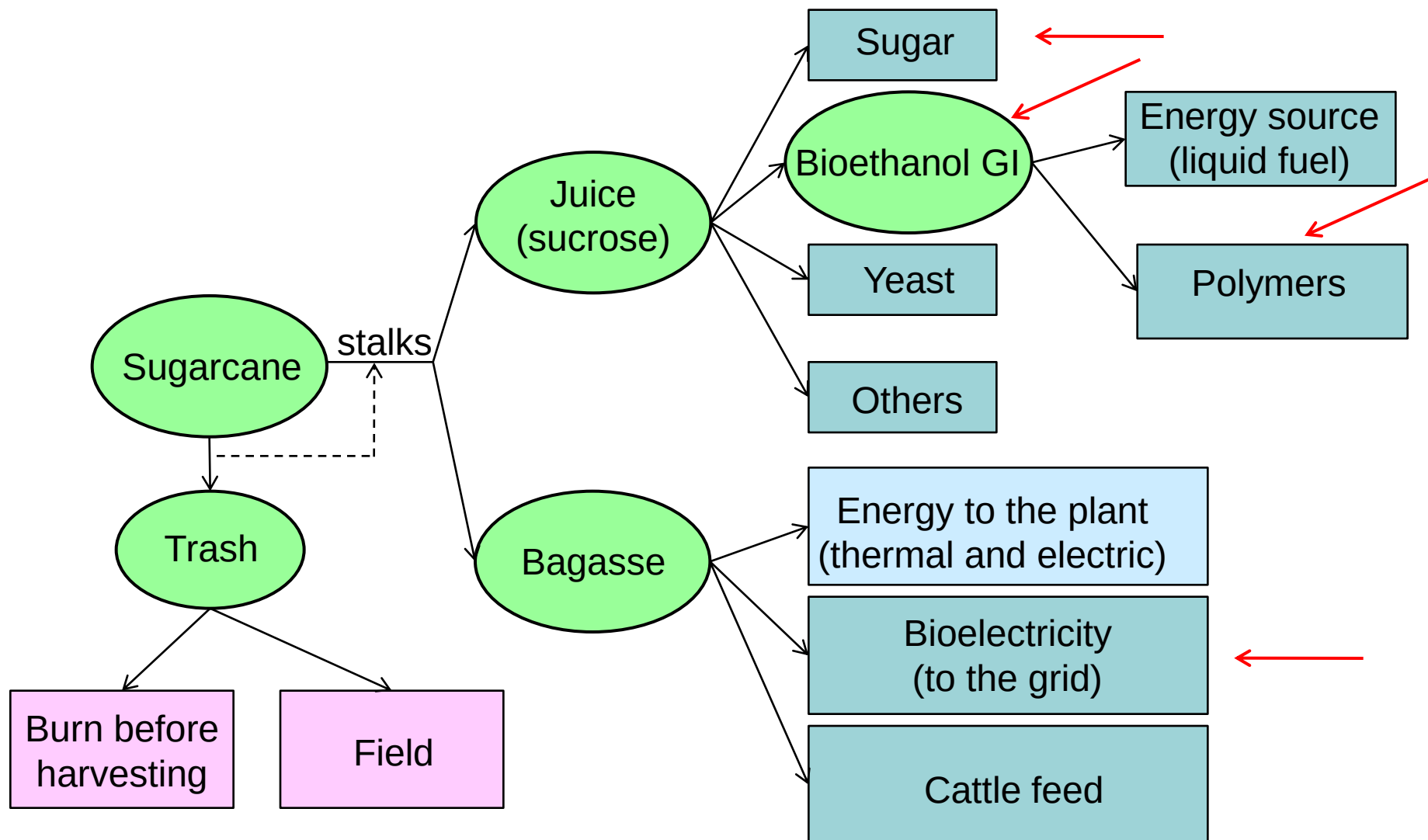


Technological assessment – Virtual Biorefinery

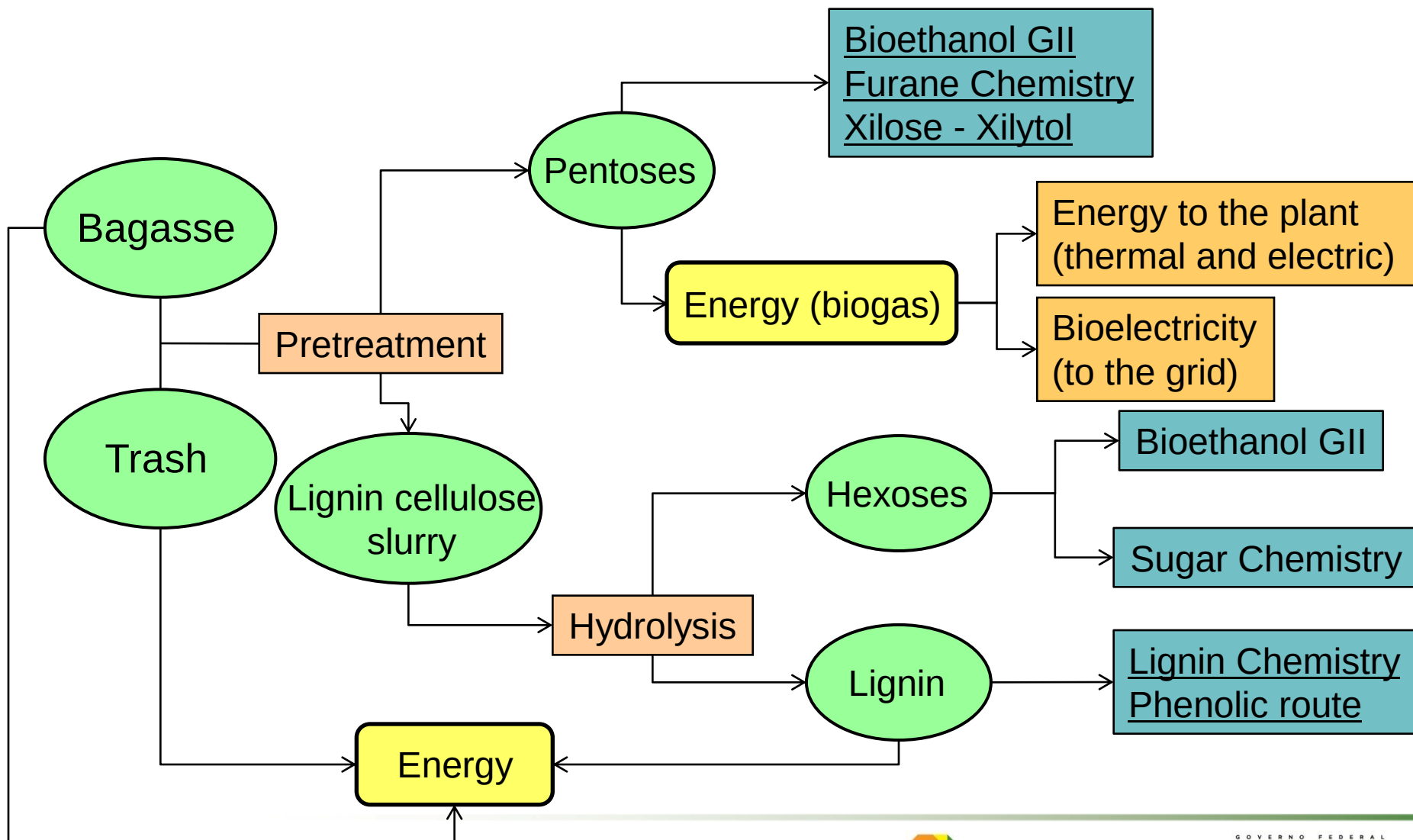


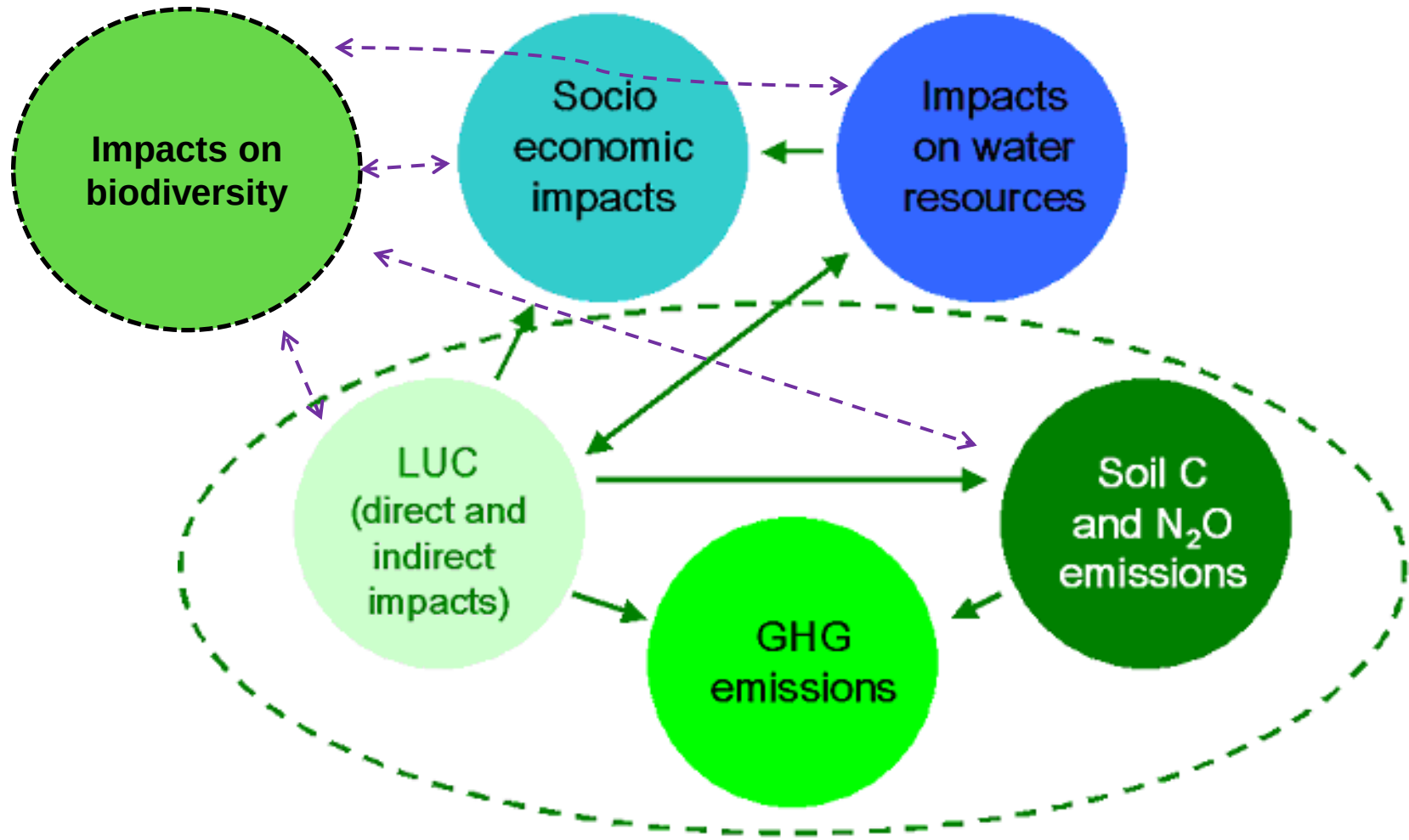
- **Impact assessment** of the new technologies of the sugarcane production cycle.
- **Optimization and processes integration** to the existing facilities.
- Assessment with focus on priorities definition and investment planning
- **Sugarcane biomass is a very efficient carbon source!**

First Generation Industrial Unit

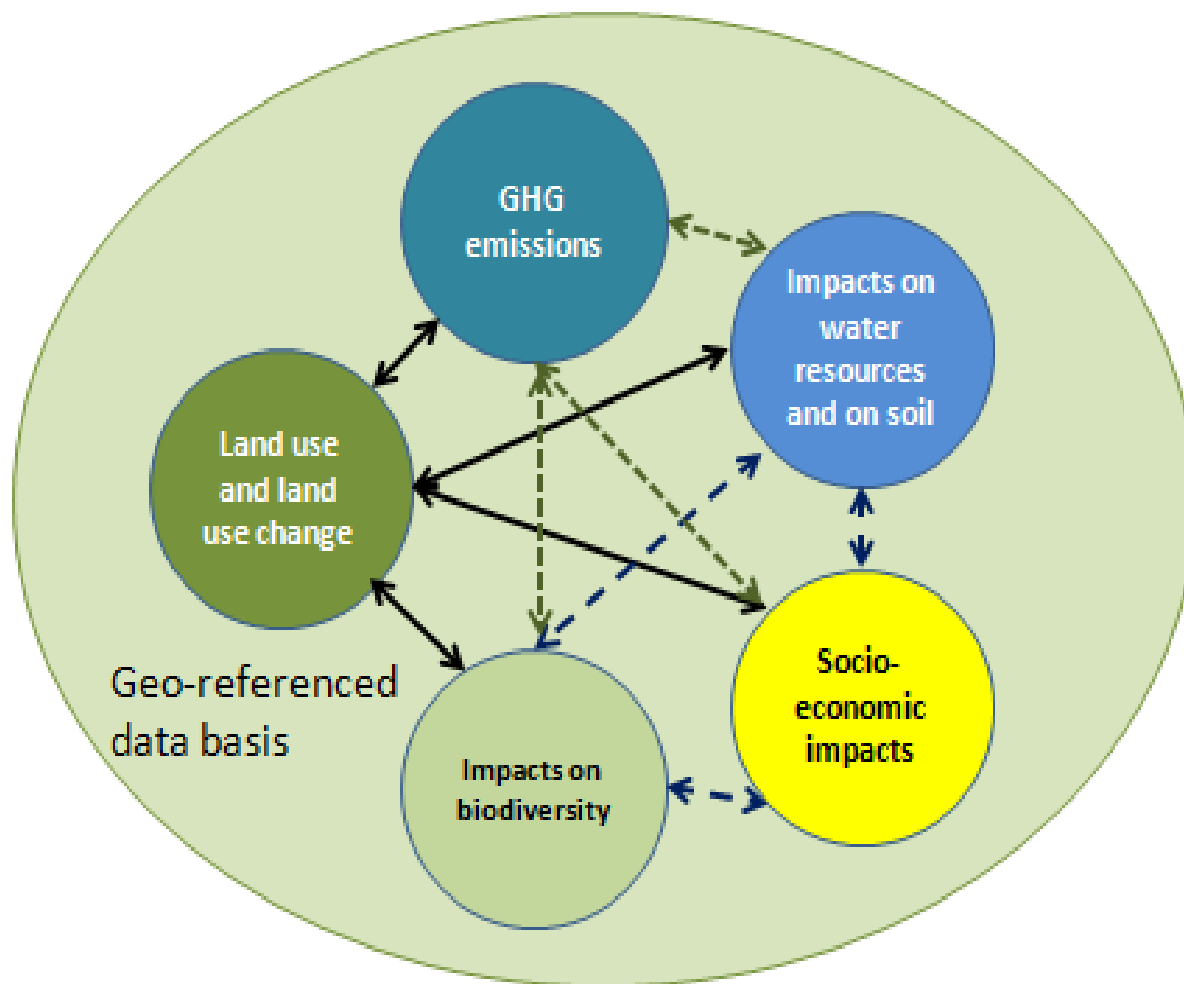


Second Generation Industrial Unit





Sustainability Research Program





Laboratório Nacional de Ciência
e Tecnologia do Bioetanol



Sustainability Research Program

- **Short-term goal:** the aim is evaluating the sustainability of bioethanol production from sugarcane, considering current technology and all changes that can be implemented in the years to come.
- **Mid-term goal:** the aim is on evaluating the bioethanol production from a sustainability point of view, taking into account all science and technology innovations that shall be incorporated to the production chain.

Concluding remarks

- The importance of biomass in Brazil.
- The large potential in the sugarcane and forest industries.
- Required actions for fostering the potential: science and technology and policies and regulation.



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