

# Renewable Energy in Brazil

## The Biomass Side

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**General Director**  
**Embrapa Agroenergy**

# Sources of Energy in Agriculture



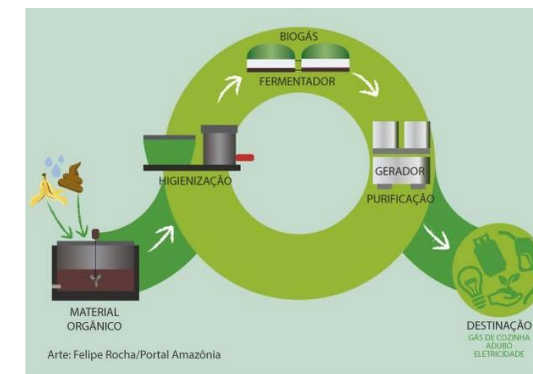
**Biodiesel**



**Ethanol**



**Biokerosene**



**Biogas**



**Charcoal**



**Firewood**



**Wood chip**



**Grasses**

# ETHANOL SECTOR

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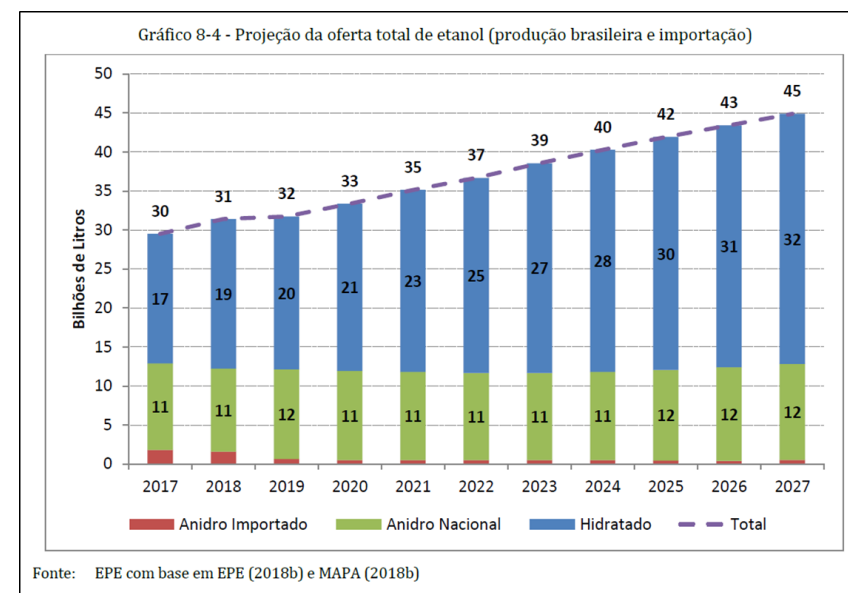
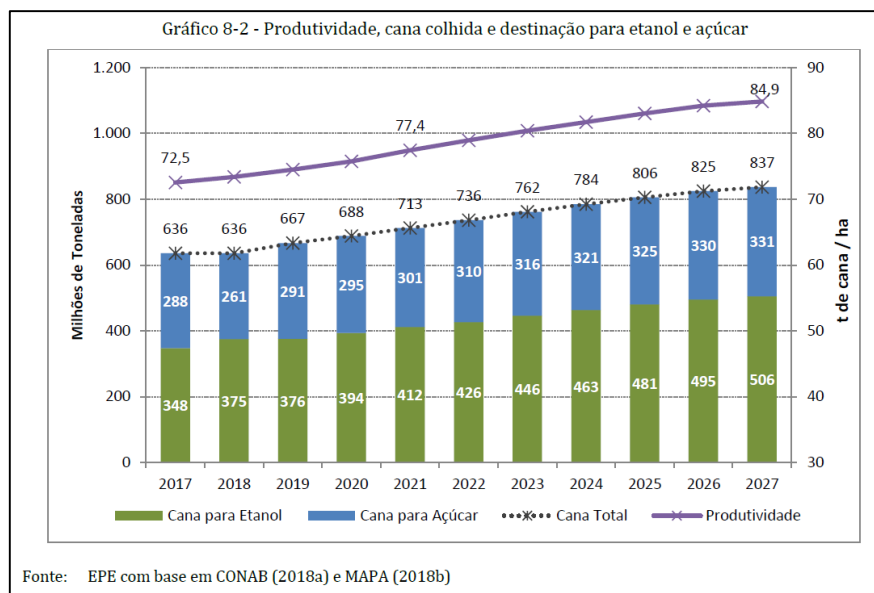
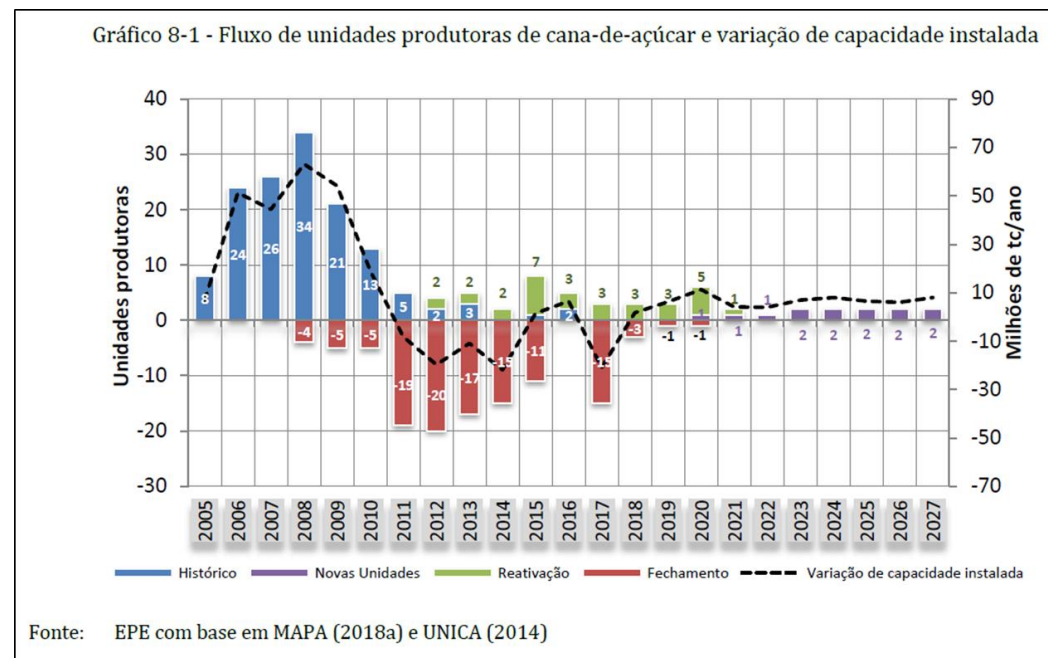
## SOME INDUSTRY NUMBERS of 2017

- 367 Sugar and ethanol Plants in activity
- Installed grinding capacity 744 Mtc - 90% nominal value
- 85.5% effective processing capacity - ~ 636 Mtc in 8.7 mi ha
- Anhydrous - 128 thousand M3 / day - 23 billion liters – 27.5% in the gasoline
- Hydrated - 237 thousand M3 / day - 43 billion liters – Used in Flex Cars
  
- Sector has been recovering from continuous losses that occurred in the past years
  
- Recovery will occur if there are investments in:
  - Renovation of sugarcane plantations
  - Use of appropriate production systems
  - Mechanization of harvesting and planting
  
- Substantial growth will come if:
  - Sector investments in R&D for the development of new cultivars, processes, assets, etc.
  - Use of technologies that reduce production cost
  - RENOVABIO is successful



## SOME PROJECTIONS FOR THE SECTOR

### FLOW OF SUGARCANE PRODUCING UNITS AND VARIATION OF INSTALLED CAPACITY



# Ethanol from other sources

Sorghum



1<sup>st</sup> Generation

Corn



Energy Cane



2<sup>nd</sup> Generation

Cane Bagasse



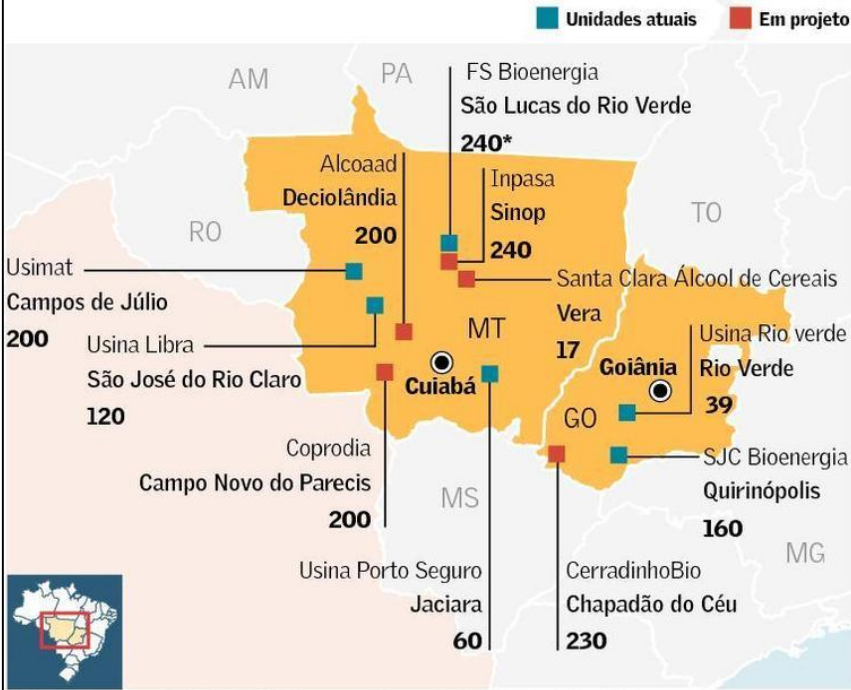
Photo UDOP

Sugarcane Products  
16.9% of the Energy Matrix  
41% of Renewable Energies

Corn Power Plant Growth

## Usinas de etanol de milho

Localização e capacidade de produção anual (em milhões de litros)

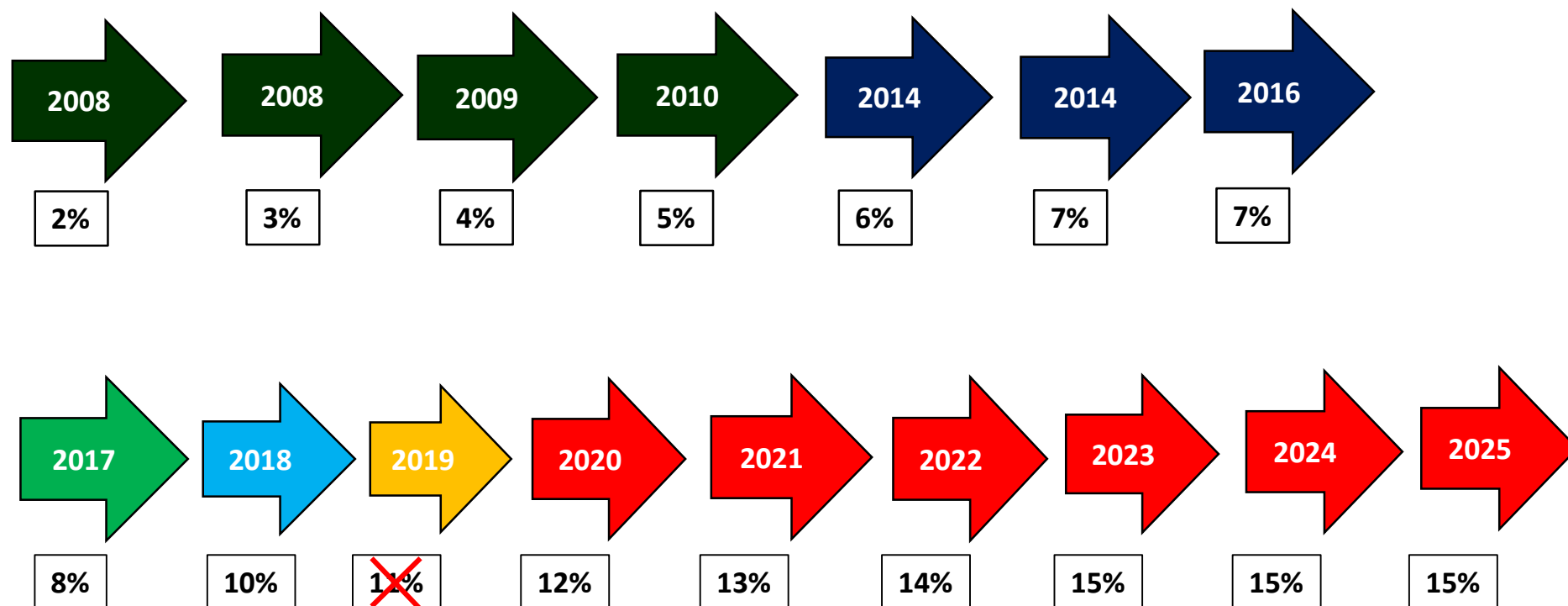


Fontes: Empresas, Unem, Sindalcool-MT. \* Com a expansão, capacidade vai a 530 milhões de litros por safra

# BIODIESEL SECTOR

# BIODIESEL

## POST PNPB AND NATIONAL AGROENERGY PLAN



### Art. 4º da Lei nº 13.033/14

- B20 for road vehicles
- B30 for railway or agricultural and industrial vehicles
- Up to B100 for experimental or specific purposes, but subject to prior ANP consent

# BIODIESEL SECTOR

## Produção de biodiesel nas diferentes regiões do Brasil

O Centro-Oeste e o Sul do País concentram a maioria das usinas de biodiesel autorizadas.

Proporção entre a produção regional e a total



Produção em bilhões de litros

Fonte: ANP, conforme Resolução ANP nº 729/2018 e Resolução ANP nº 30/2013.

Produção em relação à capacidade autorizada (%)





## SOME PROJECTIONS FOR THE SECTOR

Ministério de Minas e Energia

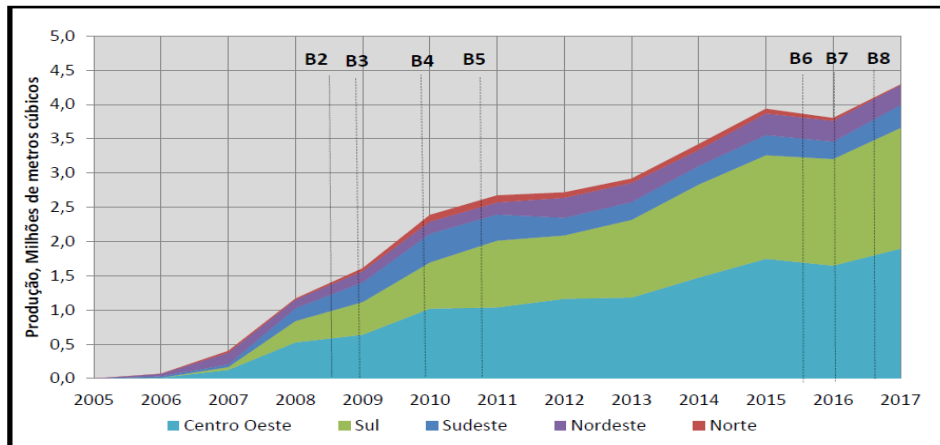
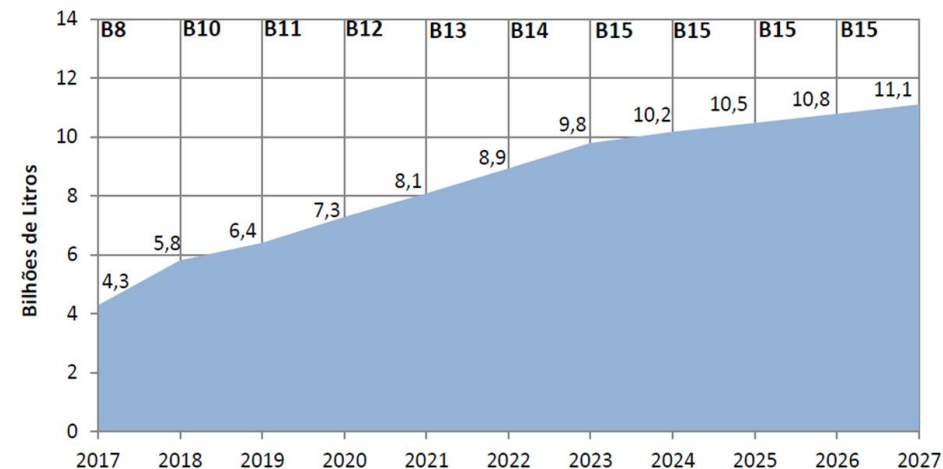


Figura 21 - Evolução da produção de biodiesel no Brasil.

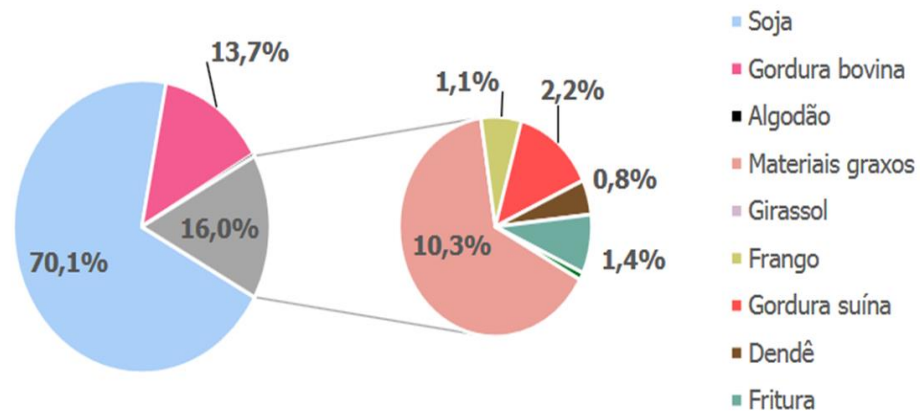
Fonte: EPE (2015).

Gráfico 8-8 - Demanda de biodiesel



Fonte: EPE com base em ANP (2018a)

Gráfico 29 – Participação de matérias-primas para a produção de biodiesel (%)



Fonte: EPE a partir de ANP (2018e)

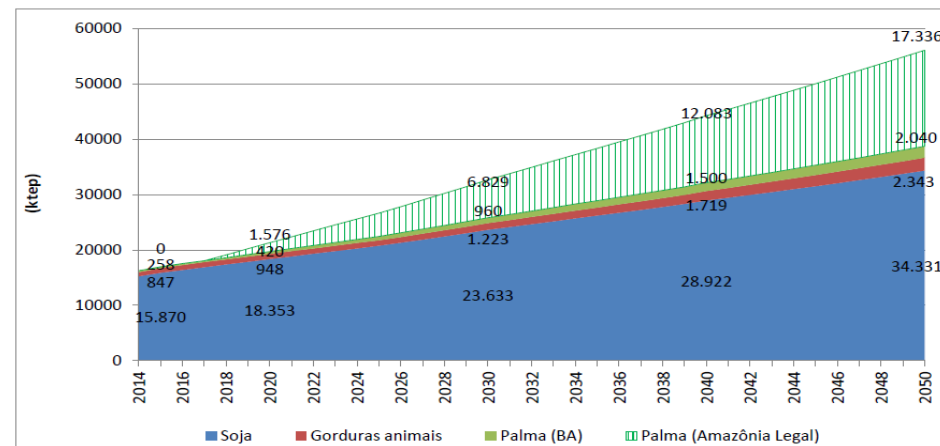
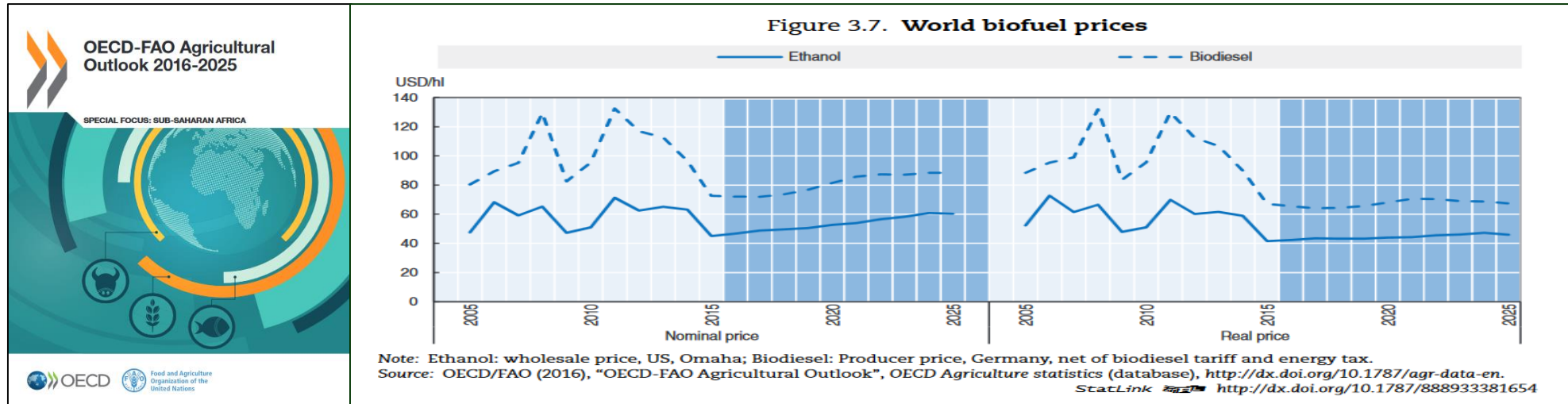


Figura 22 - Projeção da produção de óleos vegetais e gorduras animais, insumos para biodiesel.

# PROJECTIONS OF PRODUCTION AND MARKET FOR BIOFUELS IN THE WORLD



- Decline in ethanol and biodiesel prices in 2015
- High commodity price
- Low oil price
- Price recovery is expected until 2025
- Demand is mainly driven by the mandatory mix
- Expansion of ethanol will be modest (116 BL - 128 BL)
- Biodiesel Expansion 31 BL - 41 BL (USA, Arg, Brazil, Indonesia)
- Advanced biofuels will not take off in the
- In the US ethanol will be limited by the blend, biodiesel will grow
- 2G Ethanol Will Not Be Available

## Diversity vs Availability of Oilseeds for Bioenergy...

### Short term



- Technological domain
- Production scale
- Logistics

### Medium term



### Long term





How to promote the diversification of oilseeds with production scale?



INTEGRATED PRODUCTION OF PERENIALS AND ANNUAL CROPS

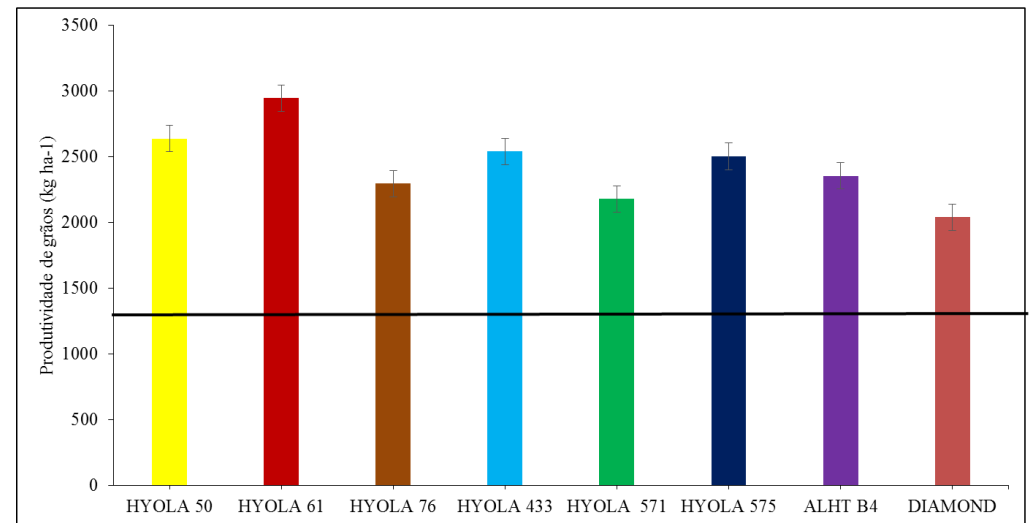


## Opportunities for diversification of raw materials for bioenergy production

### Adapting canola to tropical climate



**Desempenho (kg/ha) de genótipos de Canola no Cerrado (Planaltina-DF) com irrigação suplementar**



— Média Nacional = 1.289 kg/ha de grãos

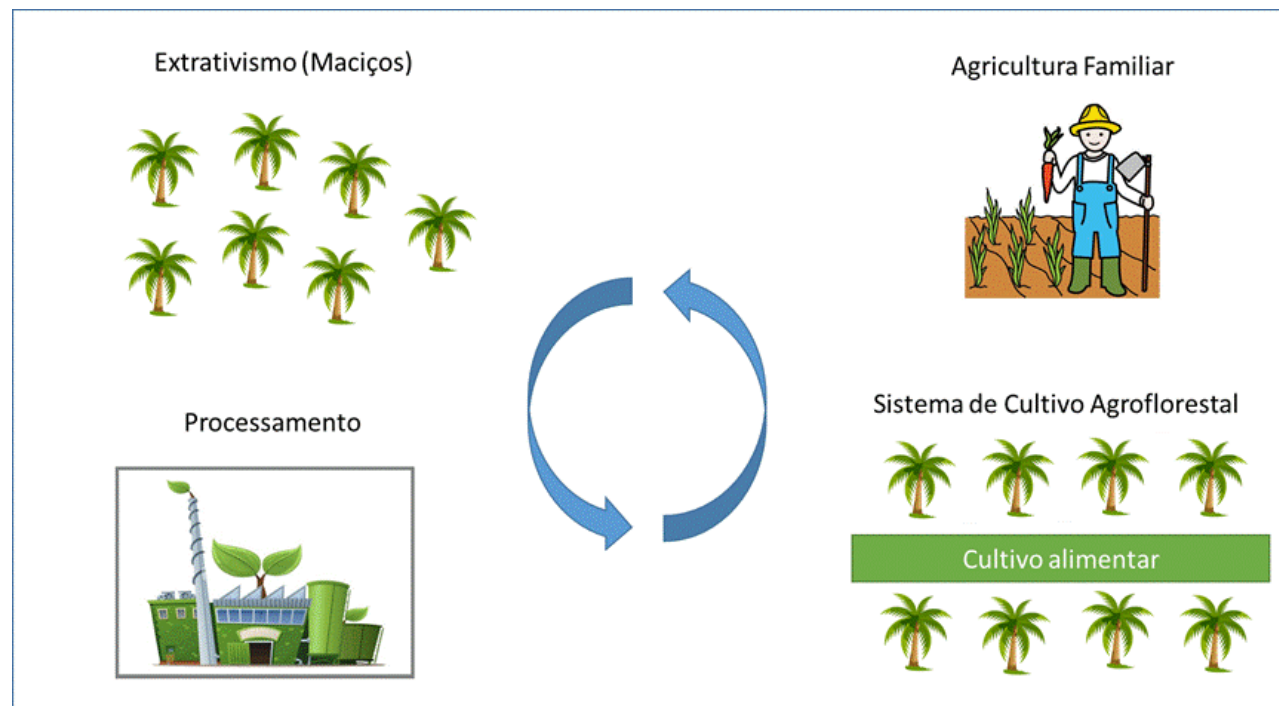


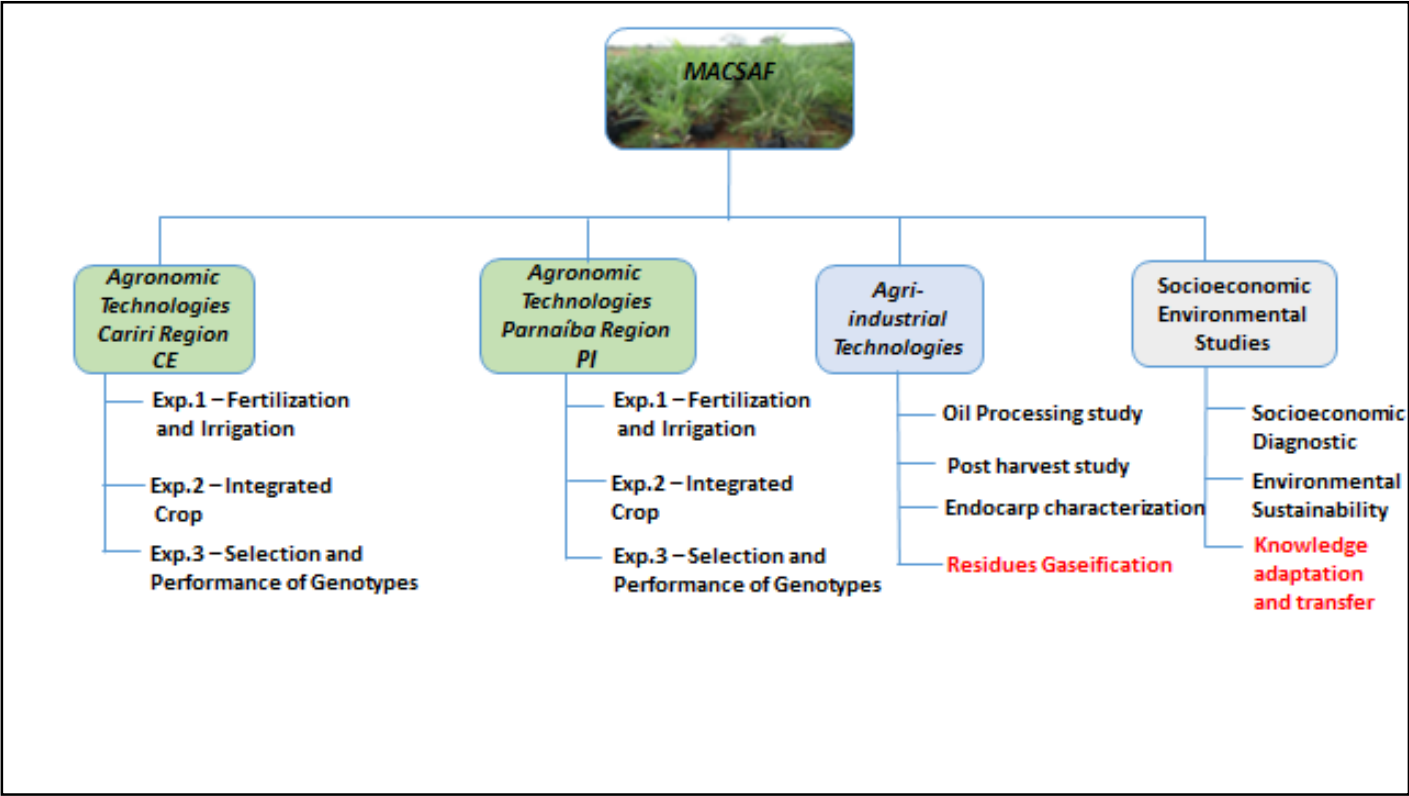
## Assurance of food and energy supply using multi use agroforestry models in Brazil northeast region (MACSAF)



### Project focus:

- Evaluation of Selected Genotypes
- Agroforestry models (energy + food)
- Fertilization and Irrigation
- Extraction and exploitation of oil
- Socioeconomic-environmental studies















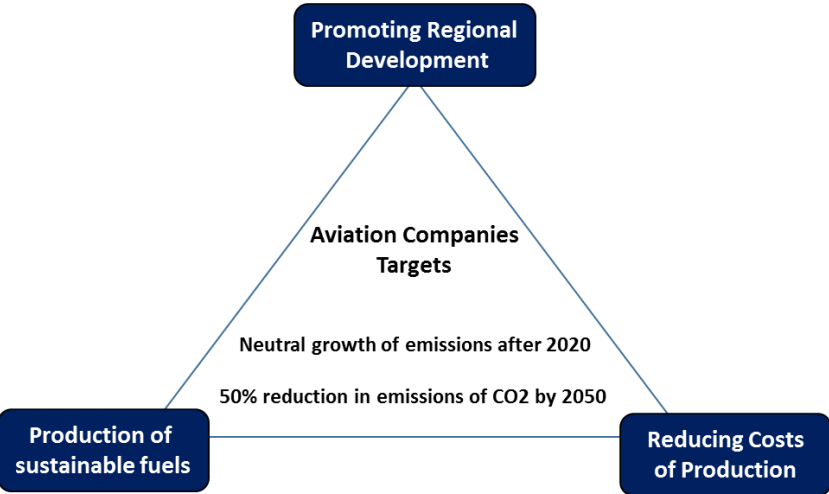


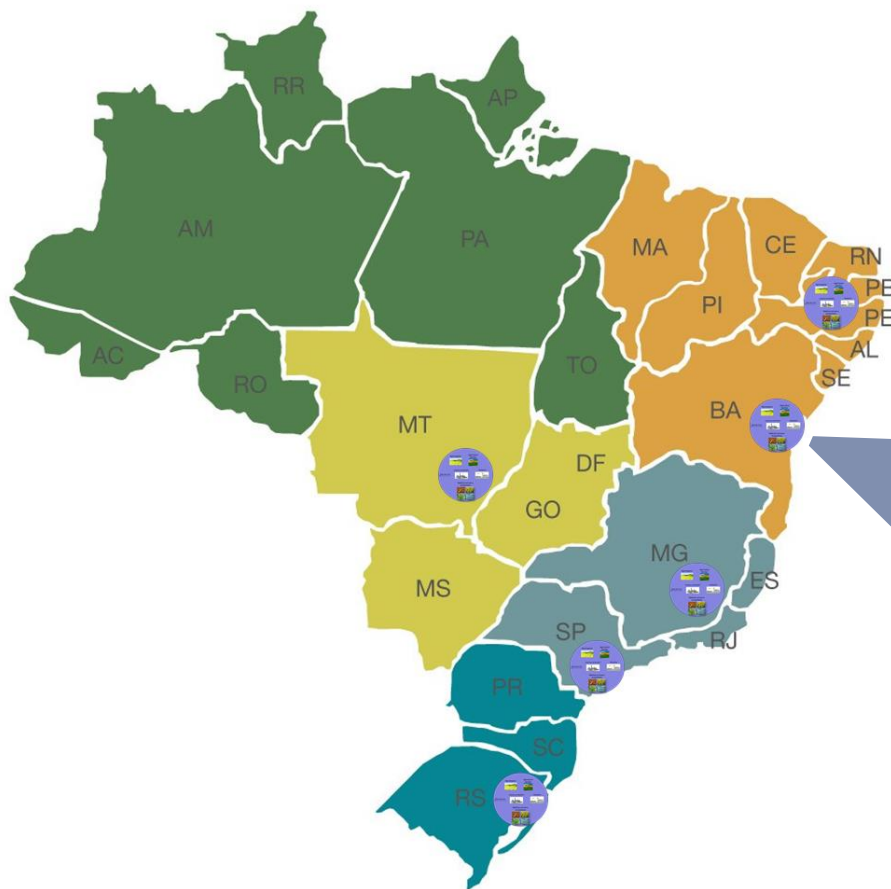
Tabela 8-3 - Rotas tecnológicas aprovadas para a produção de Querosene de Aviação Alternativo

Nome da Rota	Matéria –Prima	Principal produto	Mistura máxima	Empresas produtoras
HEFA-SPK	gorduras, óleos e graxas	Iso- e N-parafinas	50%	UOP, Neste e Syntroleum
FT-SPK	resíduos agrícolas e florestais, madeira, e resíduos sólidos	Iso- e N-parafinas	50%	SASOL, Shell e Syntroleum,
FT-SPK/A	resíduos agrícolas e florestais, madeira, e resíduos sólidos	Iso- , N-parafinas e aromáticos	50%	SASOL, Shell e Syntroleum,
ATJ-SPK	matérias-primas renováveis (cana-de-açúcar, milho ou resíduos florestais)	Iso- e N-parafinas	50%	GEVO, Cobalt e Lanzatech
SIP	açúcares	Parafinas	10%	Amyris

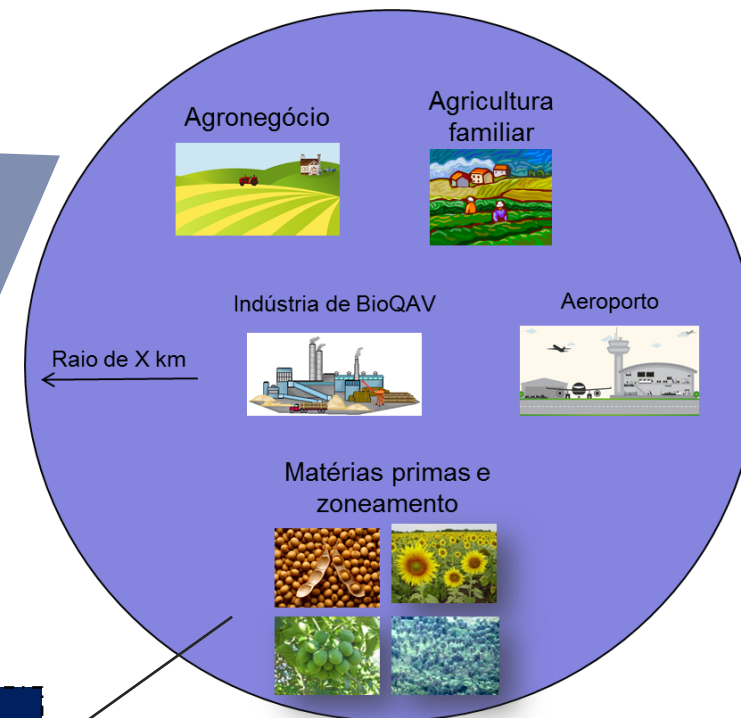
Fonte: ASTM (2015) e (2018)



The production of the raw material for Bioquerosene must be organized around the major airports of Brazil

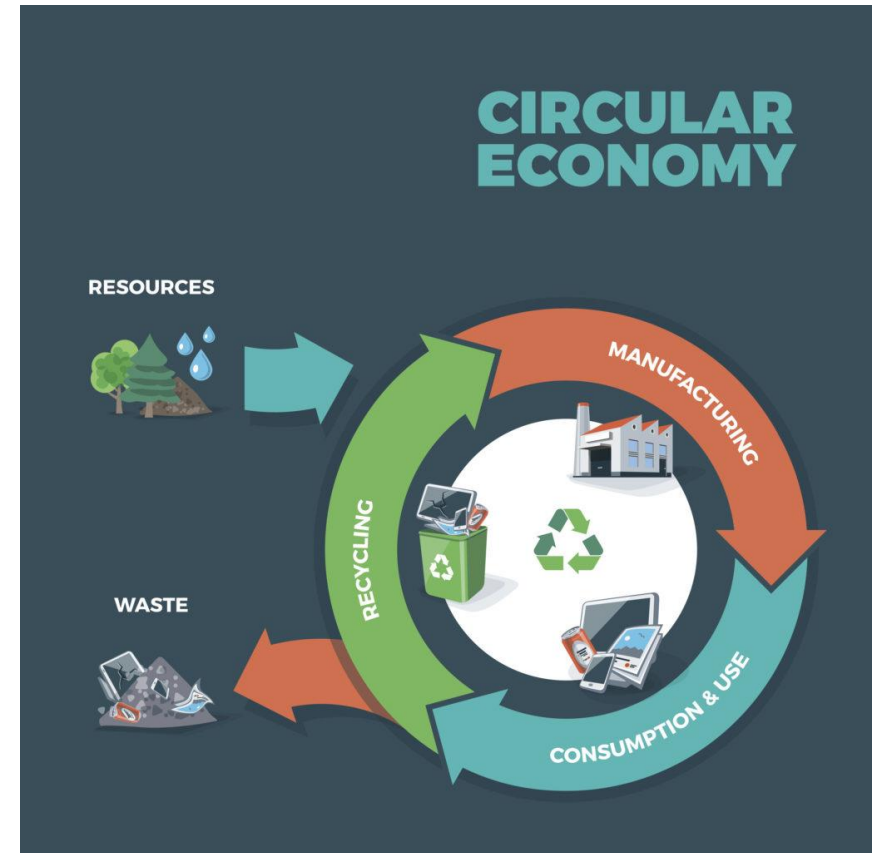
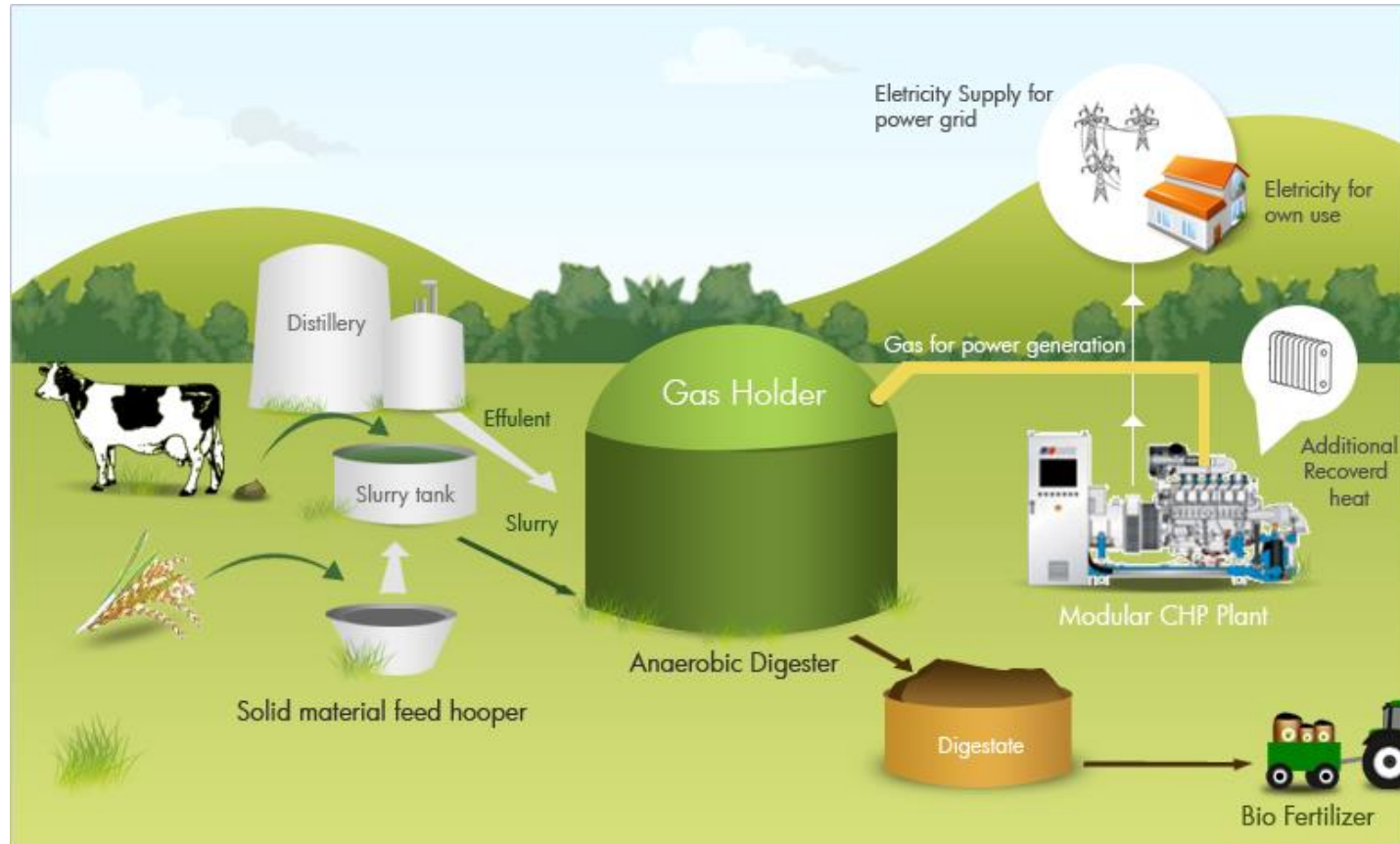


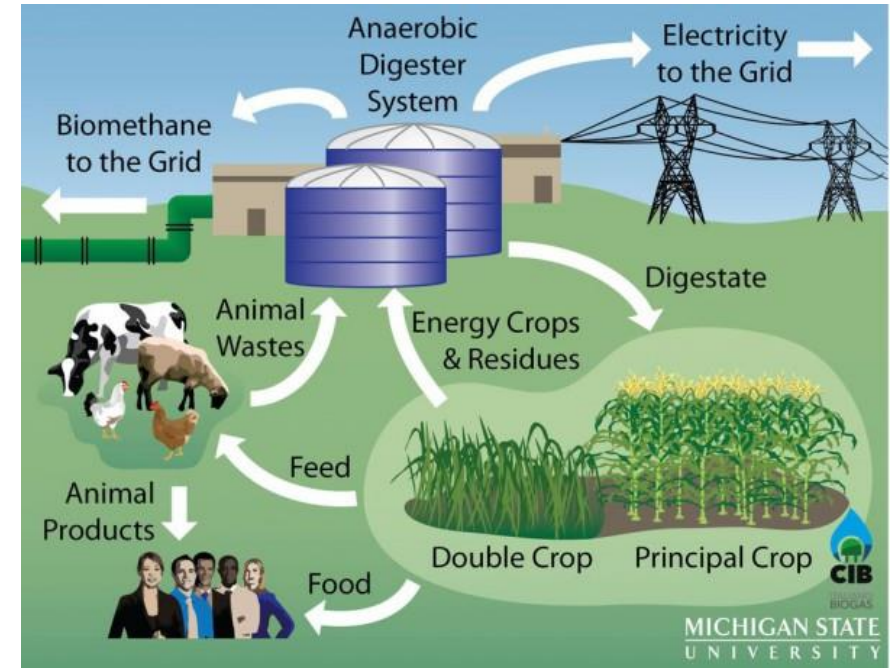
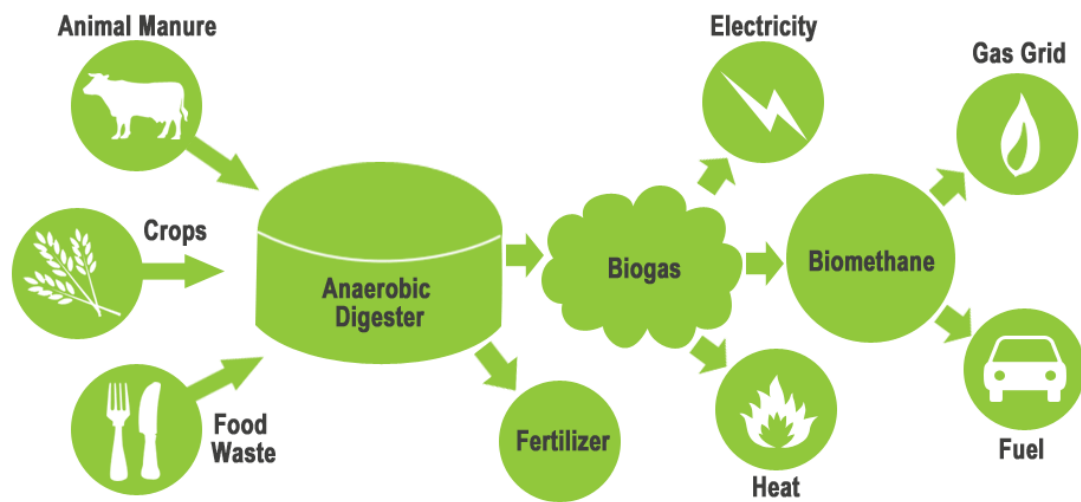
## Local Productive Arrangements



Need to map raw materials around large airports and Bioquerosene plants

# Biogas



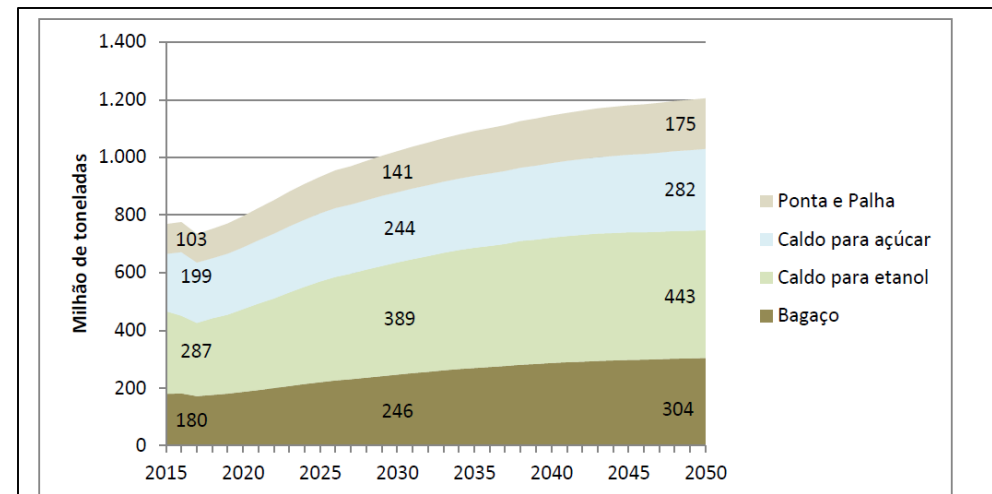
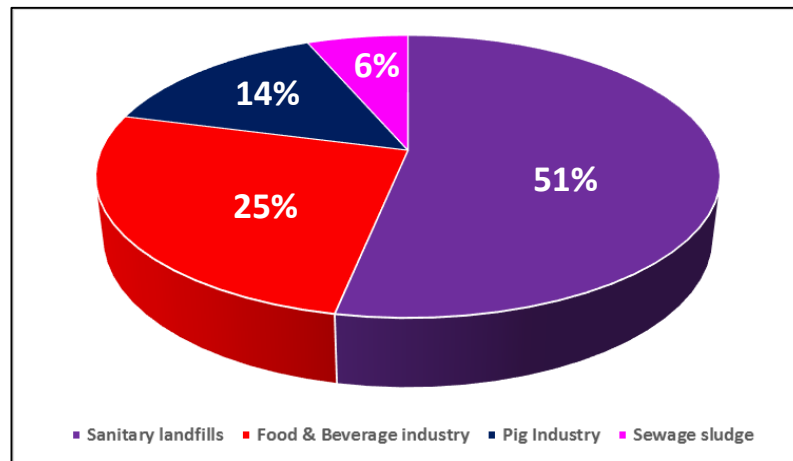
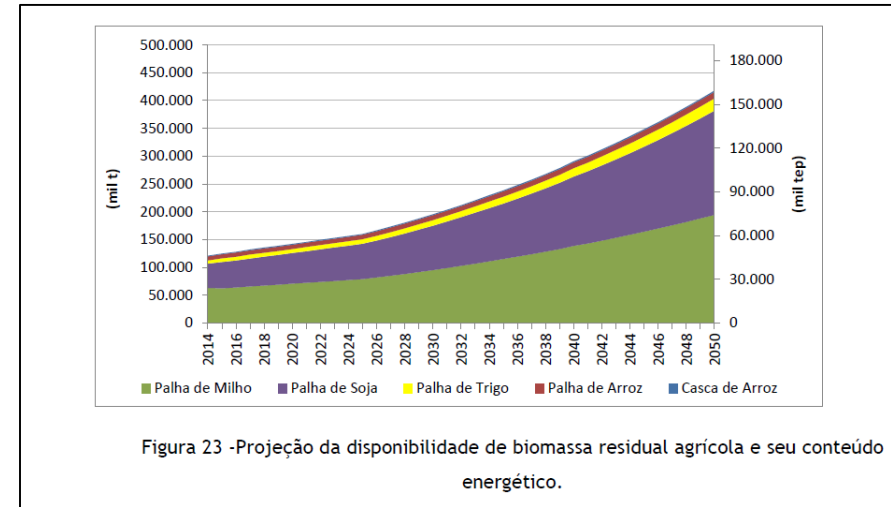
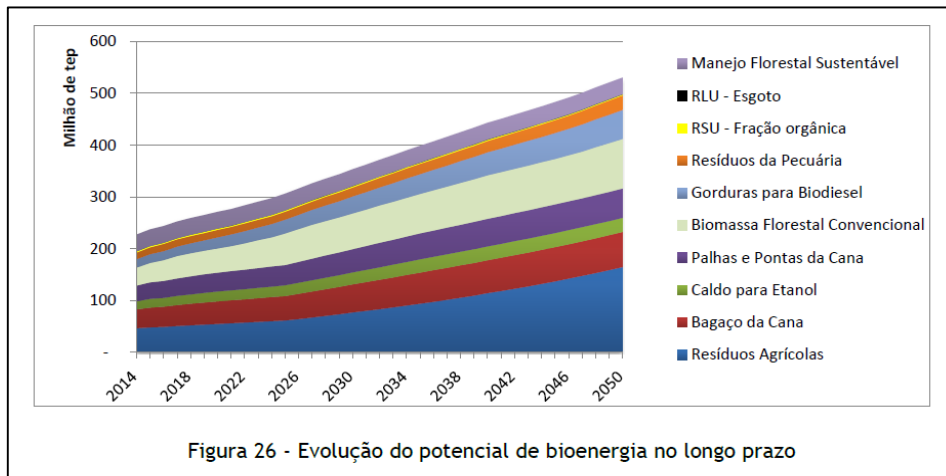


# ENERGY FROM BIOMASS AND RESIDUES



In 2017 bioenergy accounted for:

- 29.6% of the domestic energy supply:
- Cane products 17.0%;
- Firewood and charcoal 8.0%;
- Bleach 2.3%.



Fonte: EPE.



## How to form 30 thousand ha of eucalyptus in a region traditionally producing grains?

20/02/2018 - 15H46 - POR REUTERS

### FS Bioenergia investirá R\$ 1 bi em usina de etanol de milho em MT

Empreendimento terá capacidade de produção de 680 milhões de litros por ano e será construída em Sorriso

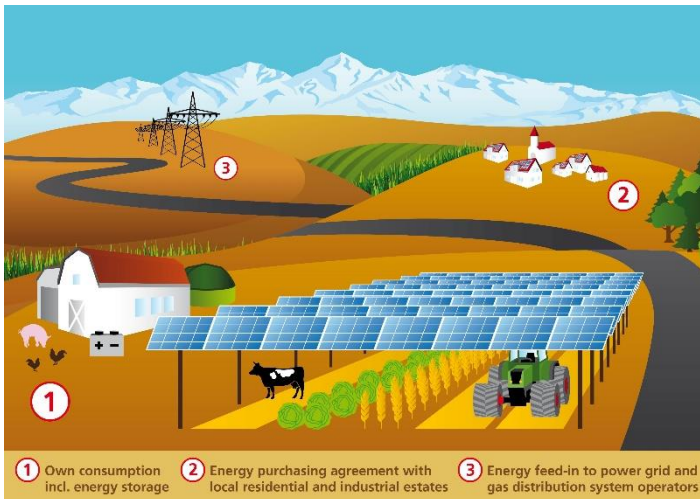
[Compartilhar](#) [Assine já!](#)



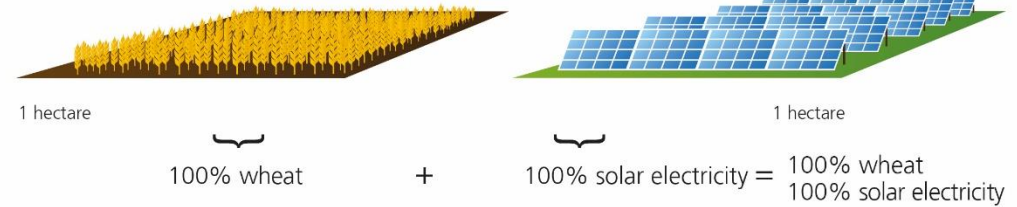
FS BIOENERGIA CONSTRUIRÁ USINA EM SORRISO (MT) PARA PRODUÇÃO ETANOL A PARTIR DO MILHO. EMPRESA JÁ HAVIA ANUNCIADO INVESTIMENTOS DE R\$ 800 MILHÕES NA UNIDADE DE LUCAS DO RIO VERDE (MT) (FOTO: GETTY IMAGES)



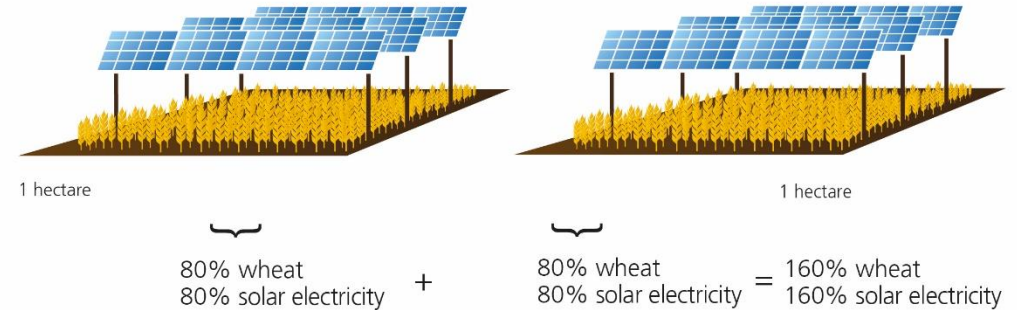
## Energy Farms



### Separate Land Use on 2 Hectare Cropland



### Combined Land Use on 2 Hectare Cropland: Efficiency increases over 60%



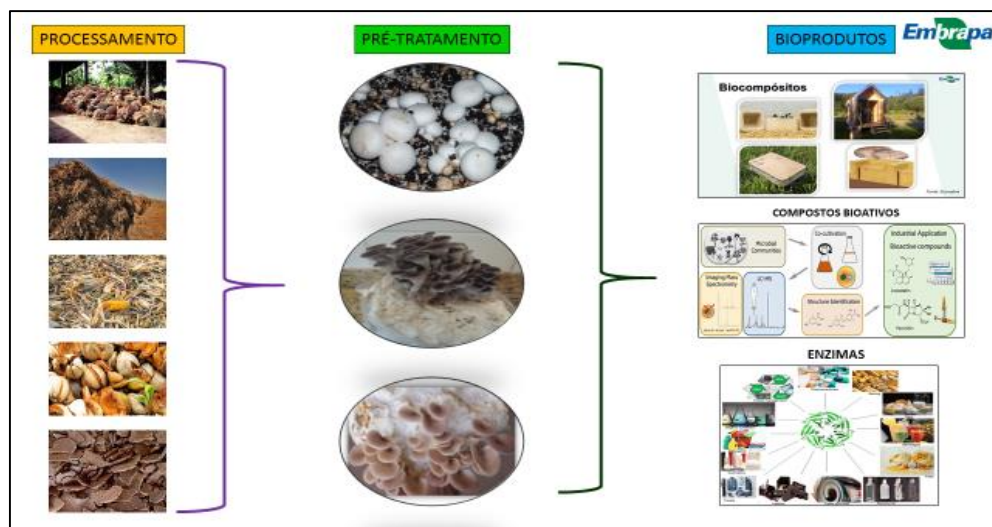
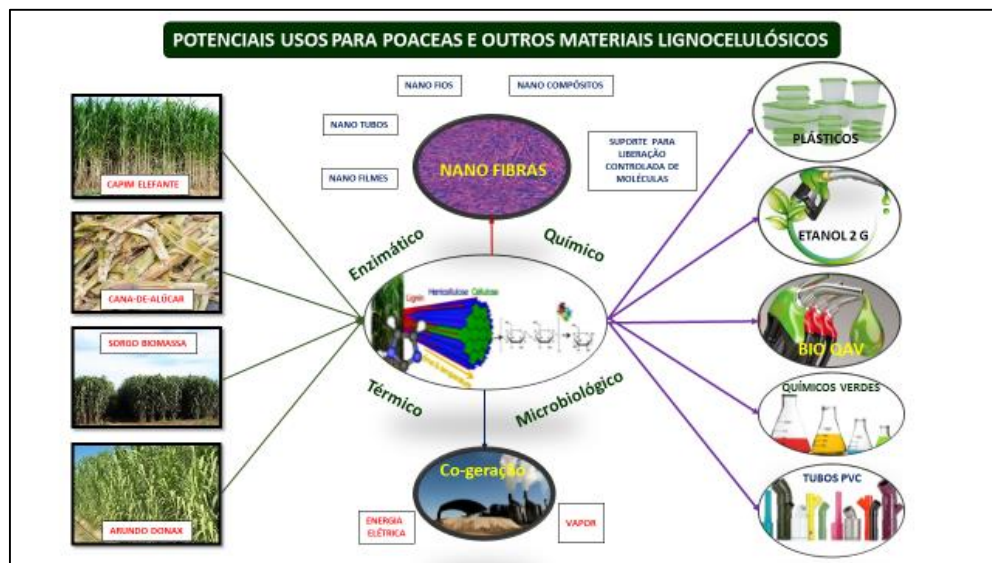


# Integrated Renewable Energy Systems





## Energy Production and Aggregation of Value to Biomass, Waste and Effluents

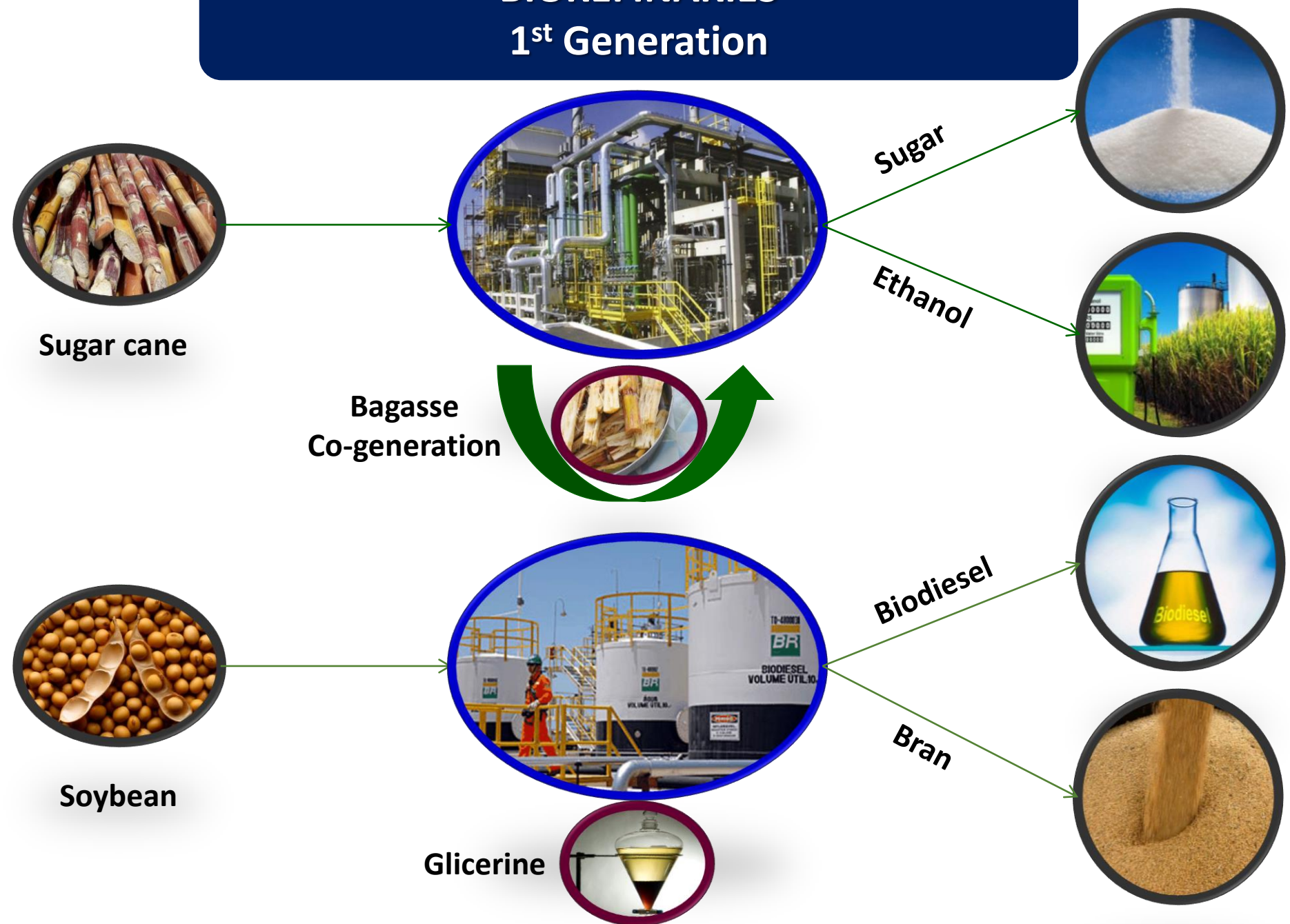


Opportunities  
for the ILPF  
system

Remediation of the  
environmental  
impact of waste  
and effluents while  
adding value to  
them

# BIOREFINERIES

## 1<sup>st</sup> Generation





# FUTURE BIOREFINERIES

2<sup>nd</sup> Geração

## FLEX BIOREFINERY

DIVERSIFICATION OF RENEWABLE RAW MATERIALS  
WITH CHARACTERISTICS OF INDUSTRIAL INTEREST



FOCO NA 1<sup>a</sup> e 2<sup>a</sup> GERAÇÕES  
BIOCOMBUSTÍVEIS

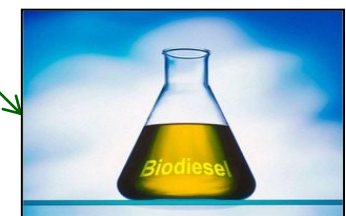


TECHNOLOGICAL ROUTES

INPUTS

Chemicals, Materials and Polimers

DIVERSIFICATION OF BIOLOGICAL BASED PRODUCTS  
CHEMICALS, BIOFUELS AND BIOMATERIALS



# CHALLENGES FOR THE IMPLEMENTATION OF THE BIOREFINERIES OF THE FUTURE

## 1) Biomass Challenges

- Availability of genetic material (seeds, clones, etc.)
- Availability of production systems adapted to different regions
- Adequate characterization of biomass utilization potential

## 2) Logistic Challenges

- Availability of biomass near production plants
- Possibility of transport
- Warehouse logistics

## 3) Process Challenges

- Development or adaptation of conversion processes for different biomasses
- Microorganisms / Efficient enzymes in the deconstruction and conversion of biomass

## 4) Economic Challenges

- Efficiency in conversion (increase of product and reduction of residues and effluents / unit of M.P.)
- Mass / energy balance
- Availability of financing

## 5) Environmental Challenges

- Environmental sustainability of processes
- Emission reduction (Renewal)
- Reduction in waste and effluent volume

**THANK YOU FOR YOUR ATTENTION**

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