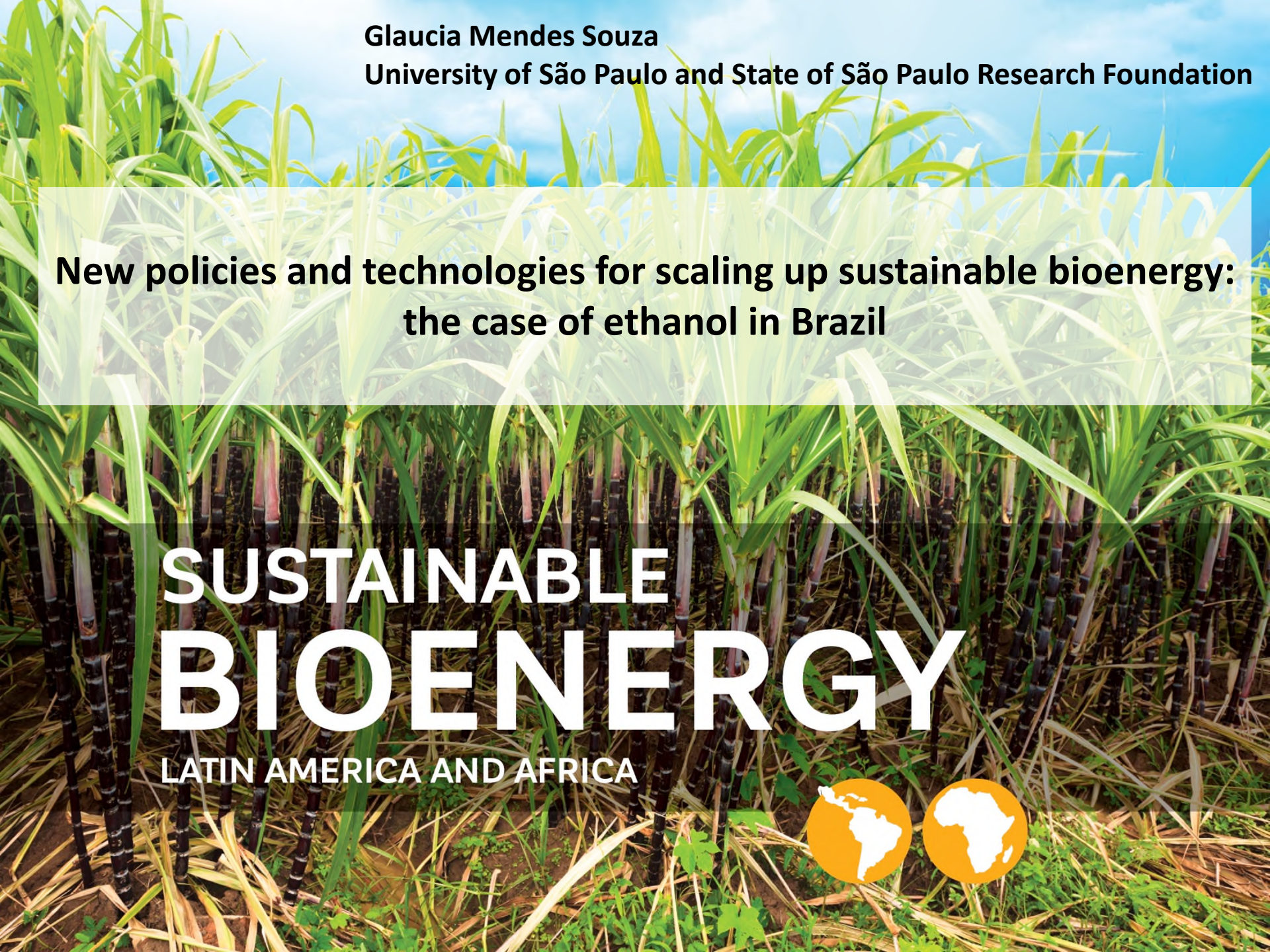
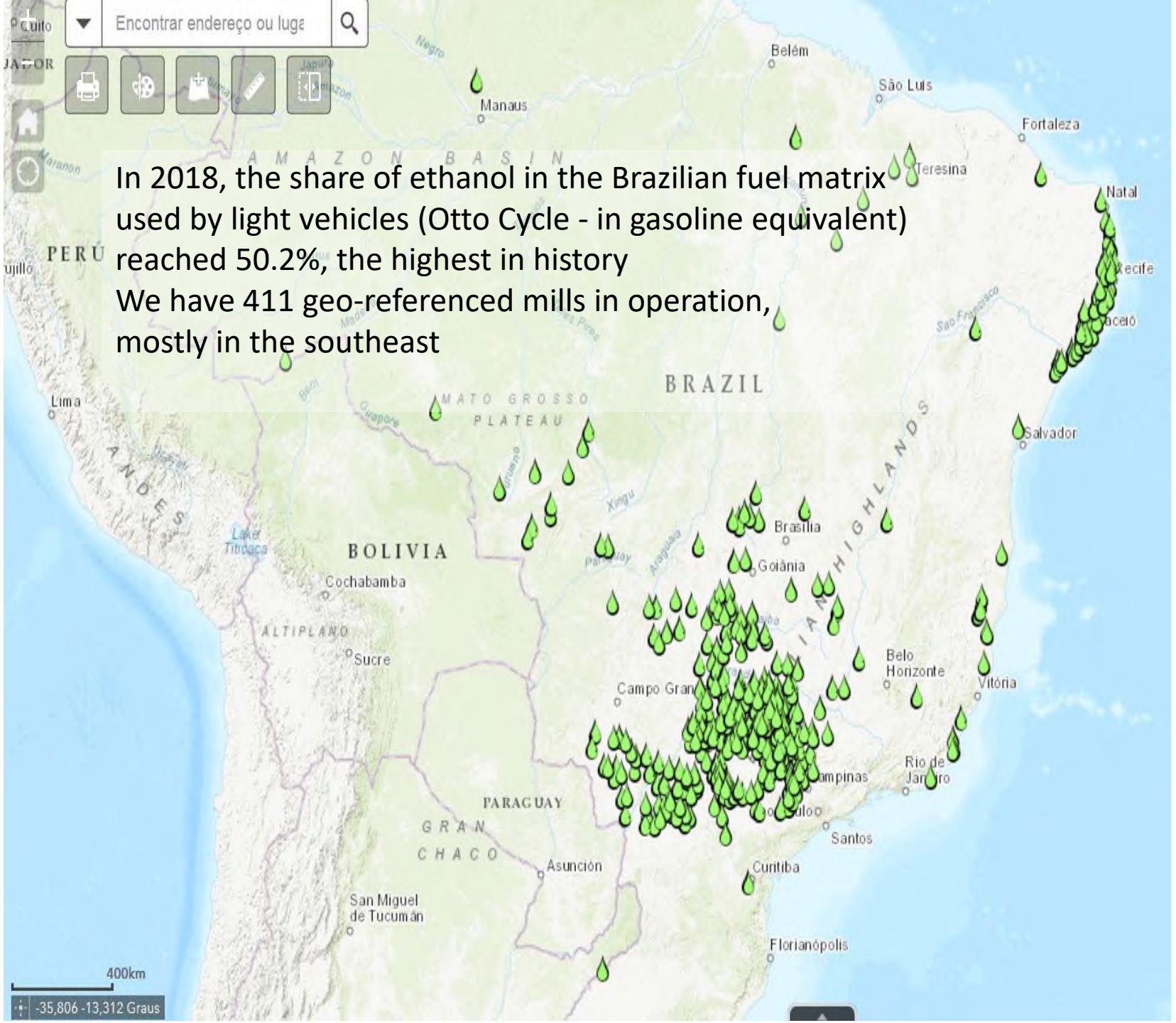
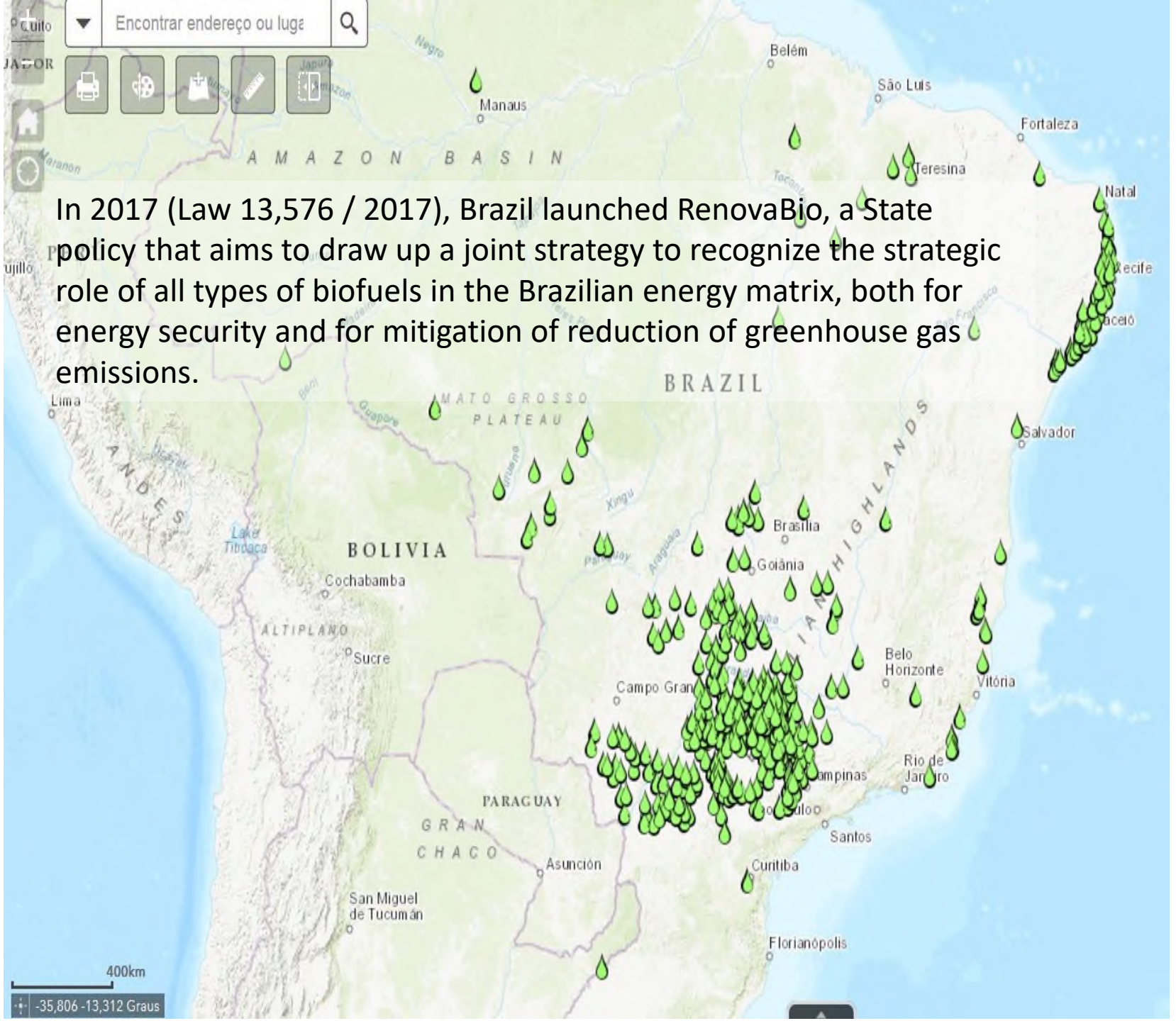
Glaucia Mendes Souza
University of São Paulo and State of São Paulo Research Foundation

New policies and technologies for scaling up sustainable bioenergy: the case of ethanol in Brazil

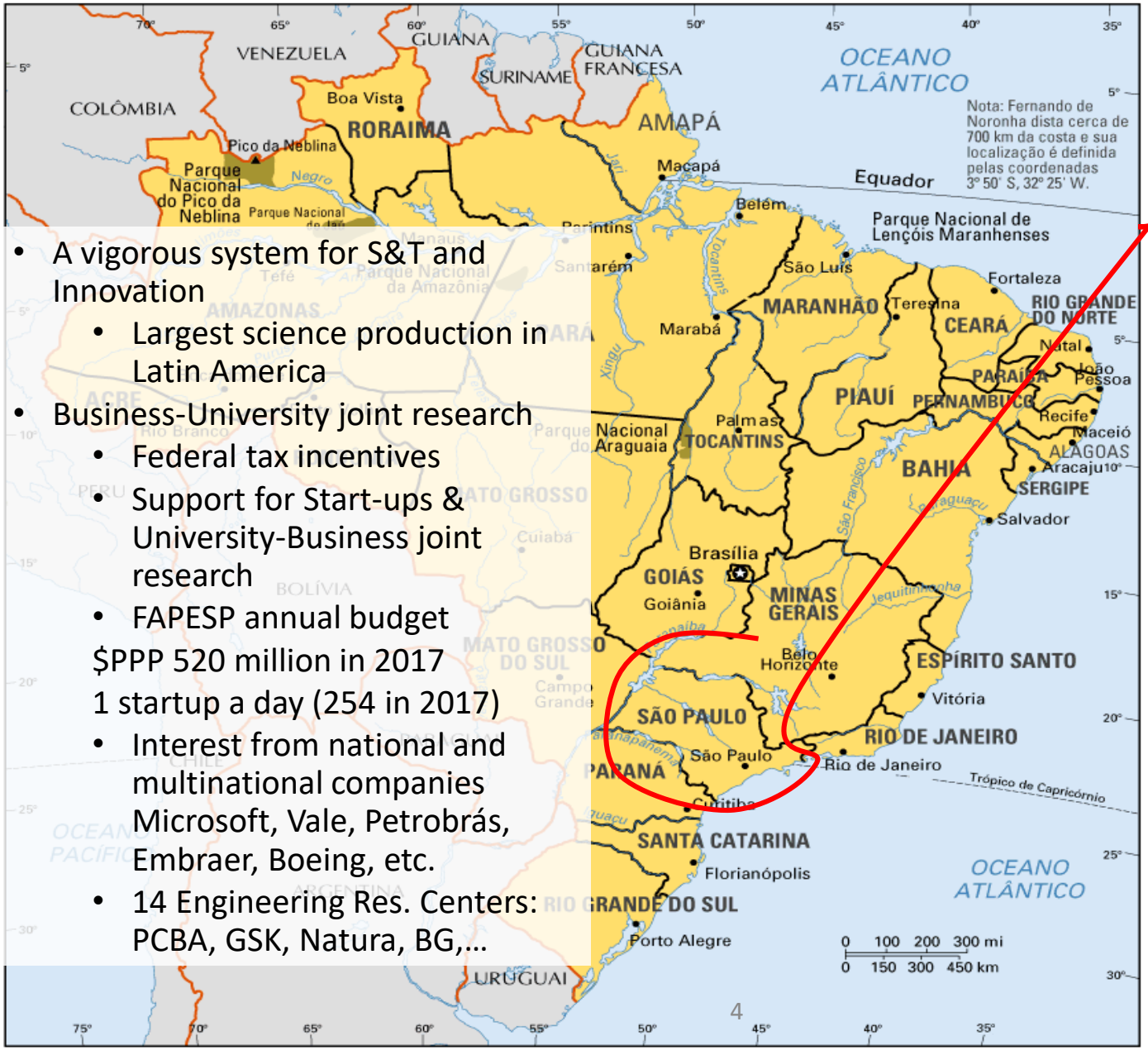



Encontrar endereço ou luga
In 2018, the share of ethanol in the Brazilian fuel matrix used by light vehicles (Otto Cycle - in gasoline equivalent) reached 50.2%, the highest in history
We have 411 geo-referenced mills in operation, mostly in the southeast
Belém
São Luis
Manaus
Fortaleza
Teresina
Natal
Recife
AMAZON BASIN
PERÚ
Lima
BRAZIL
MATO GROSSO PLATEAU
Salvador
Brasília
Goiânia
BOLIVIA
Cochabamba
ALTIPLANO
Sucre
Belo Horizonte
Vitória
Campo Gran
Rio de Janeiro
Campinas
Santos
PARAGUAY
GRAN CHACO
Asunción
Curitiba
San Miguel de Tucumán
Florianópolis
400km
-35,806 -13,312 Graus



In 2017 (Law 13,576 / 2017), Brazil launched RenovaBio, a State policy that aims to draw up a joint strategy to recognize the strategic role of all types of biofuels in the Brazilian energy matrix, both for energy security and for mitigation of reduction of greenhouse gas emissions.

R&D in São Paulo, Brazil



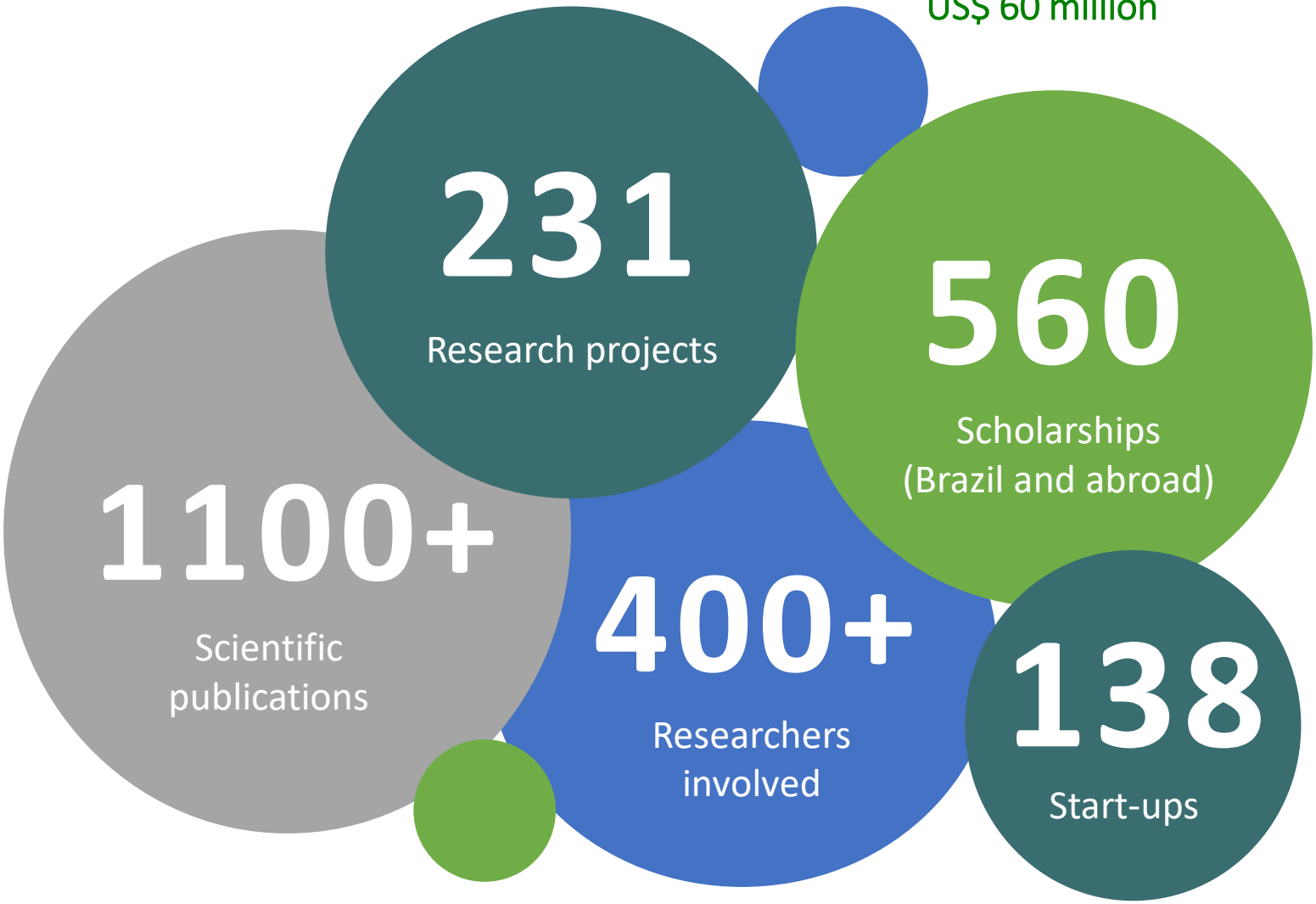
- A vigorous system for S&T and Innovation
  - Largest science production in Latin America
- Business-University joint research
  - Federal tax incentives
  - Support for Start-ups & University-Business joint research
  - FAPESP annual budget

  $PPP 520 million in 2017

  1 startup a day (254 in 2017)
  - Interest from national and multinational companies Microsoft, Vale, Petrobrás, Embraer, Boeing, etc.
  - 14 Engineering Res. Centers: PCBA, GSK, Natura, BG,…

1.4%	of GDP for R&D
42	Million people
32%	of Brazil's GDP
43%	of Brazilian science
7,288	PhDs graduated in 2017

Fundamental knowledge and new technologies for a bio-based society:
US$ 60 million



FAPESP BIOENERGY PROGRAM BIOEN

A total de US$ 21,398,813.51 in projects and scholarships was funded by FAPESP for research in advanced biofuels and bioproducts

25
Fields of knowledge

7
Private companies
co-funding projects

BIOEN

FAPESP

$ 239mi
Public investment
(BRL)

209 mills marketed electricity to the grid
Installed capacity in cogeneration plants 11.4 gigawatts
6.5 gigawatts could be added in the next years

EPE, 2017

SUGARCANE AND ENERGY-CANE

Sugarcane

1G Ethanol

Sugar

Bioelectricity

Fibre content **below** **15%**

Sucrose content **above** **15%**

Two types of Energy-cane

1G and 2G Ethanol

Bioelectricity

Fibre content **above** **18%**

Sucrose content **above** **15%**

Fibre content **above** **28%**

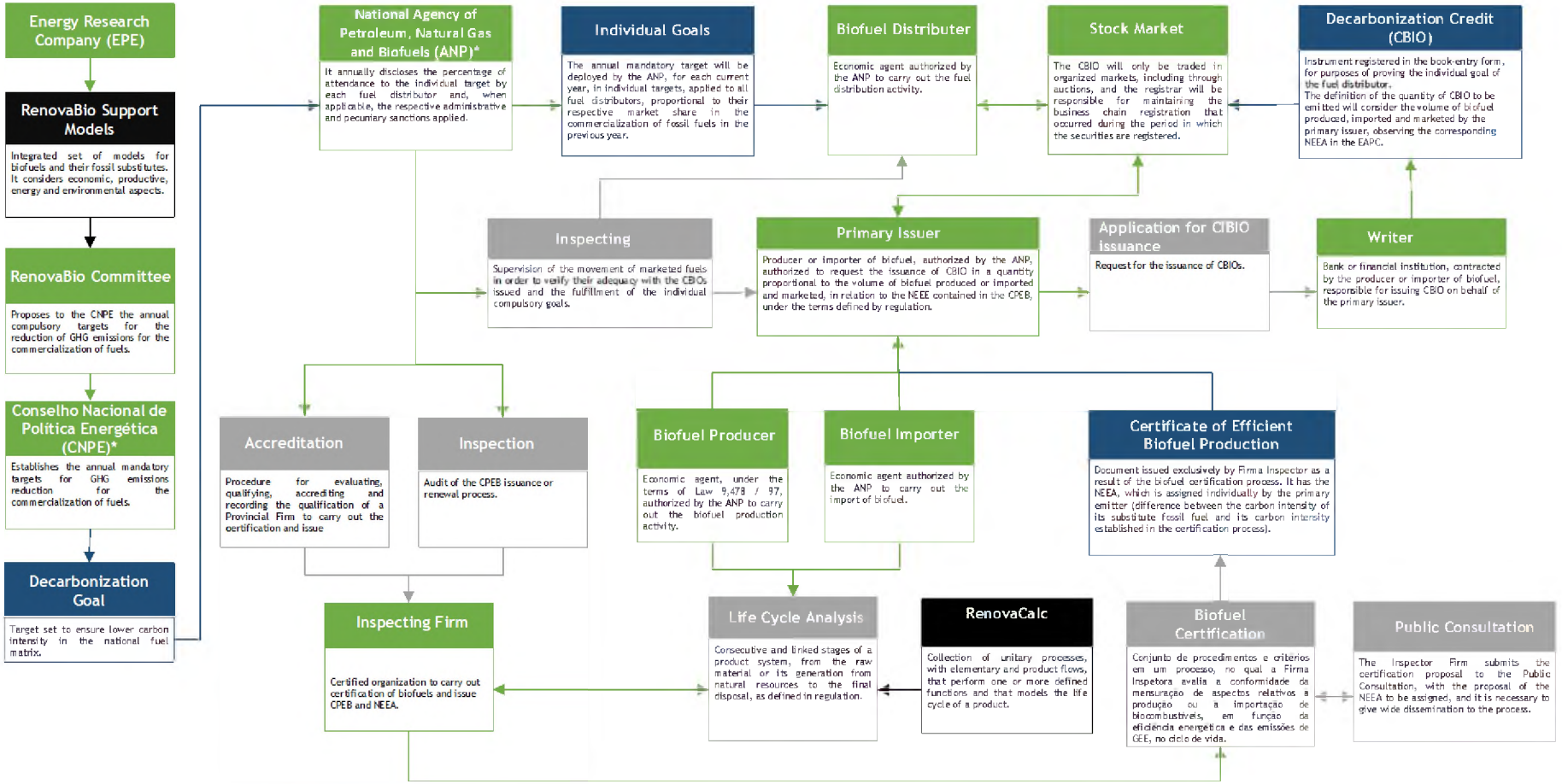
Sucrose content **below** **15%**

Energy Cane and Common Cane

RENOVABIO

50 billion liters by 2030

Empresa de Pesquisa Energética



Version 2.3 - 12/04/2018

*In addition to their respective legal powers

RenovaCalc - LCA

E1GC	Sugarcane 1G Ethanol
E1G2G	Integrated 1G 2G Ethanol Mills
E2G	2G Ethanol
E1GFlex	Integrated Sugarcane and Corn Ethanol Mills
E1GM	Corn 1G Ethanol

E1GMI	Corn 1G Ethanol with Imported Grain
Bioqav	Soy Parafinic Biokerosene from fatty acidsand hydroprocessed esters (SPK-HEFA)
	Biodiesel
	Biomethane

Ethanol 1G – Energetic optimization

Base

- Low pressure boilers
- 30,8 kWh/TC

GHG Emissions (g CO_2 eq / MJ etanol): 23,5

Cbios (thousand Cbios/year): 484

Optimization

- High pressure boilers
- Energetic integration
- 84,1 kWh/TC

GHG Emissions (g CO_2 eq / MJ etanol): 21,6

Cbios (thousand Cbios/year): 498

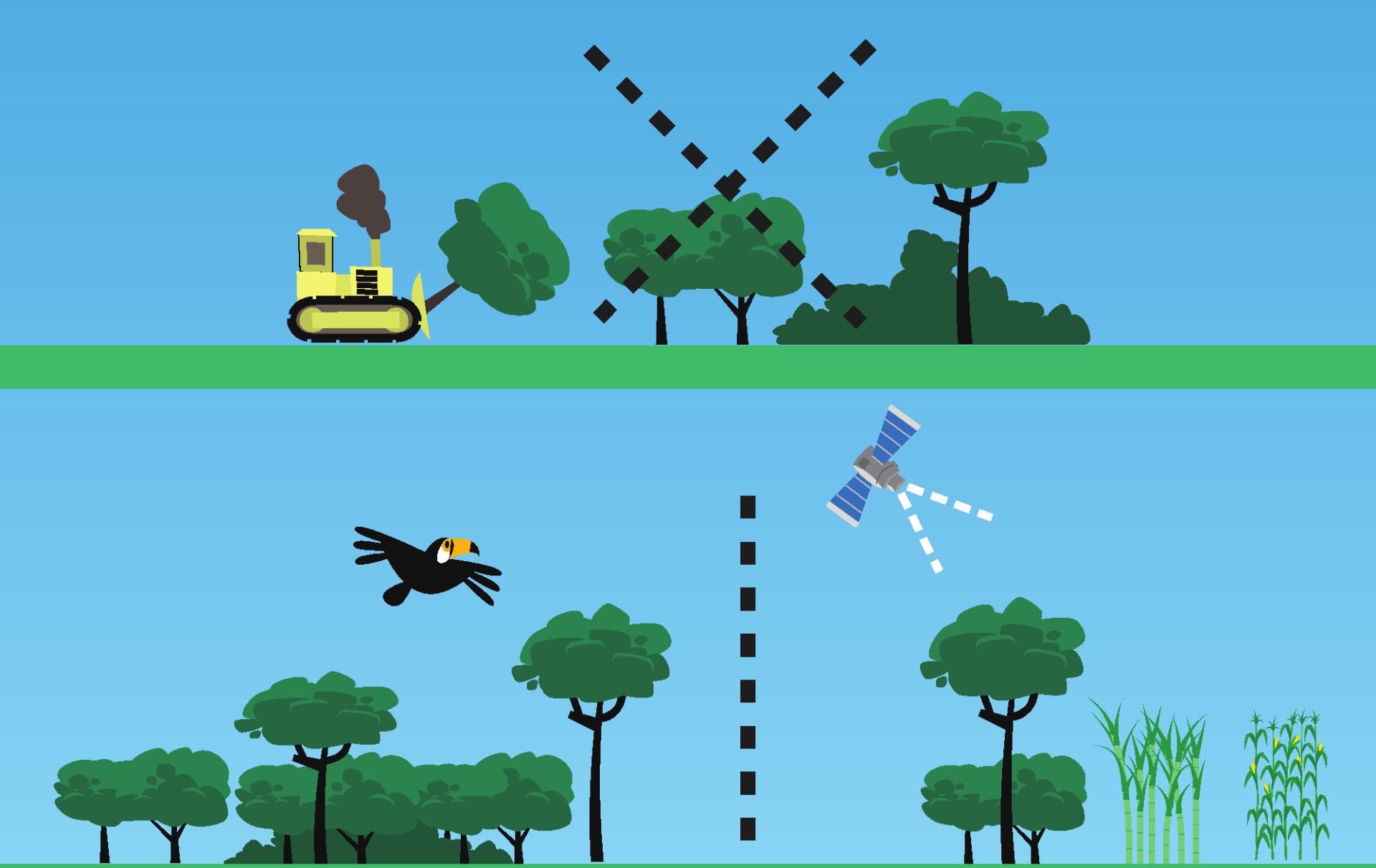
Straw

- 50% of straw collection
- 174,3 kWh/TC

GHG Emissions (g CO_2 eq / MJ etanol): 19,8

Cbios (thousand Cbios/year): 511

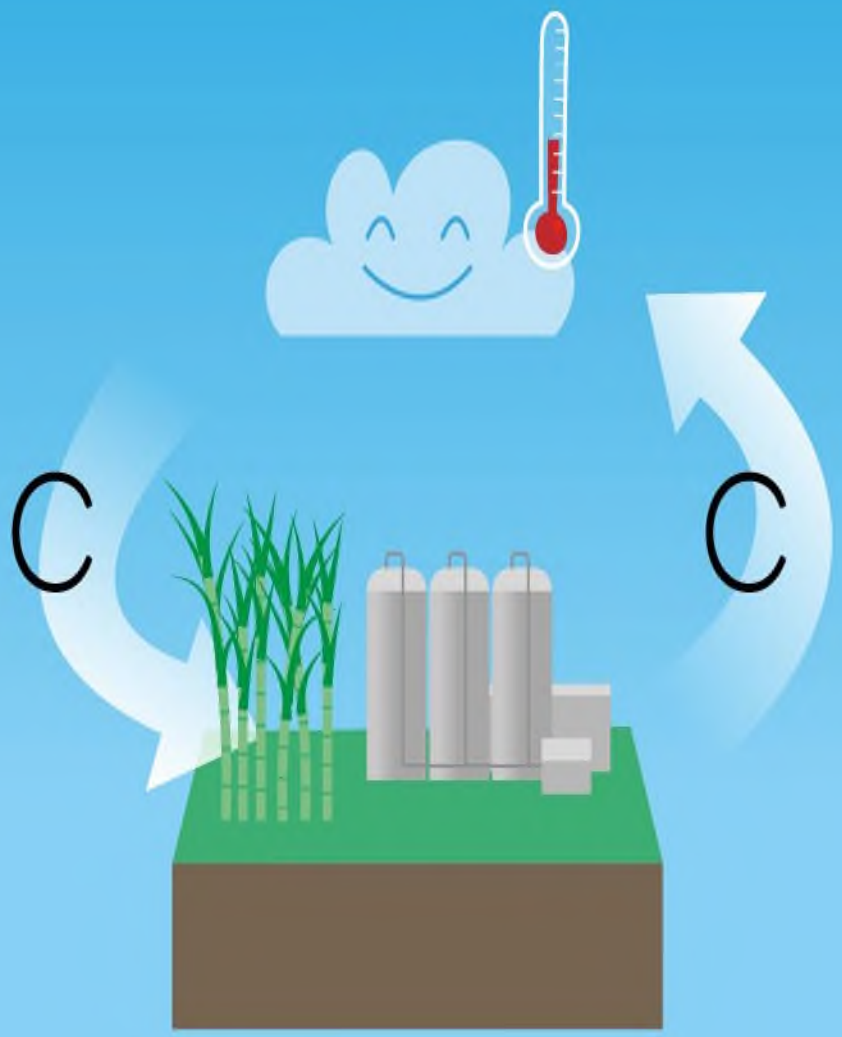
A. Bonomi, CTBE, 2018



All certified production must originate from land that was not deforested after December, 26th, 2017
All area must be in conformity with the Forest Code and regularized through CAR
Sugarcane and palm must comply with the Brazilian agroforestry zoning (Decrees 6961 and 7172

Bioenergy has large scalability and sustainability potential

The Brazilian ethanol production by 2045 could displace up to 13.7% of crude oil consumption and 5.6% of the world's CO_2 emissions relative to 2014



Currently, bioethanol and biodiesel provide about 3% of the world's transportation fuels

Biofuels could provide up to 30% by 2060 with projected improvements in technology

BIOEN BIOTA PFPMCG SEI ICRAF SCOPE

Argentina Australia Belgium Brazil Canada Colombia Costa Rica Denmark Egypt France Germany Ghana India Israel Italy Japan Kenya Malaysia Mauritius Mozambique Norway Portugal South Africa Sweden Switzerland Thailand The Netherlands UK Uruguay USA Zambia

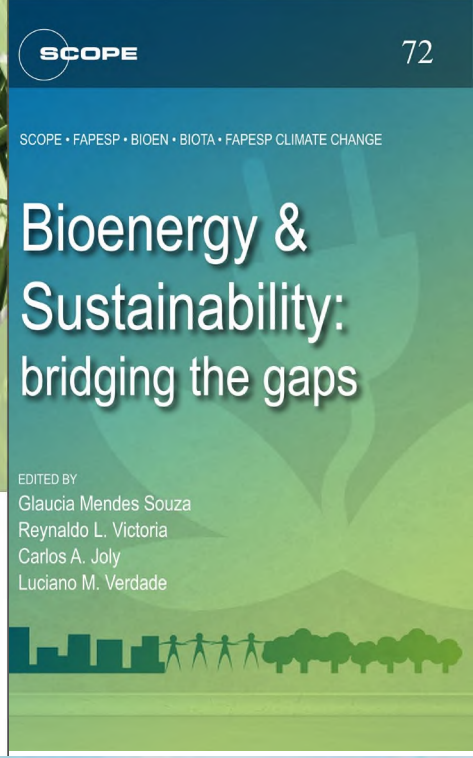
Hydro, solar an wind provide electricity, but bioenergy is a more resourceful option

- *Biomass can be stored to produce steady energy, for immediate use and integration into power grids*
- *Bioenergy uses locally available resources*
- *Bioenergy provide fuels that fit in the present infrastructure*
- *Bioenergy as gas, solid, liquid, heat and electricity, provides versatility for various applications*
- *Ethanol, biodiesel already used in transportation,* ***help a fast transition to renewable energy alongside solar and wind energy***

Thank you!

SCOPE Bioenergy & Sustainability
A global assessment of Bioenergy & Sustainability
154 experts from 31 countries

Scientific assessments
English printed (hard copy): ISSN 2411-6149
English online: ISSN 2412-0286
Portuguese online: ISSN 2413-4473



http://bioenfapesp.org/scopebioenergy/index.php/policy-brief/2018
http://bioenfapesp.org/images/Web_July26_SCOPE_Sustainable_Bioenergy.pdf

http://bioenfapesp.org/scopebioenergy

BIOEN YouTube Channel