



Making Sustainable Alternative Fuels Viable in Brazil

View from Brazilian Industry

Juan Diego Ferrés



Associate Members

BIODIESEL PRODUCERS



CHEMICALS



EQUIPMENTS



CO-PRODUCTS



COSTUMERS



TECHNOLOGY/OTHERS



PARTNERSHIPS



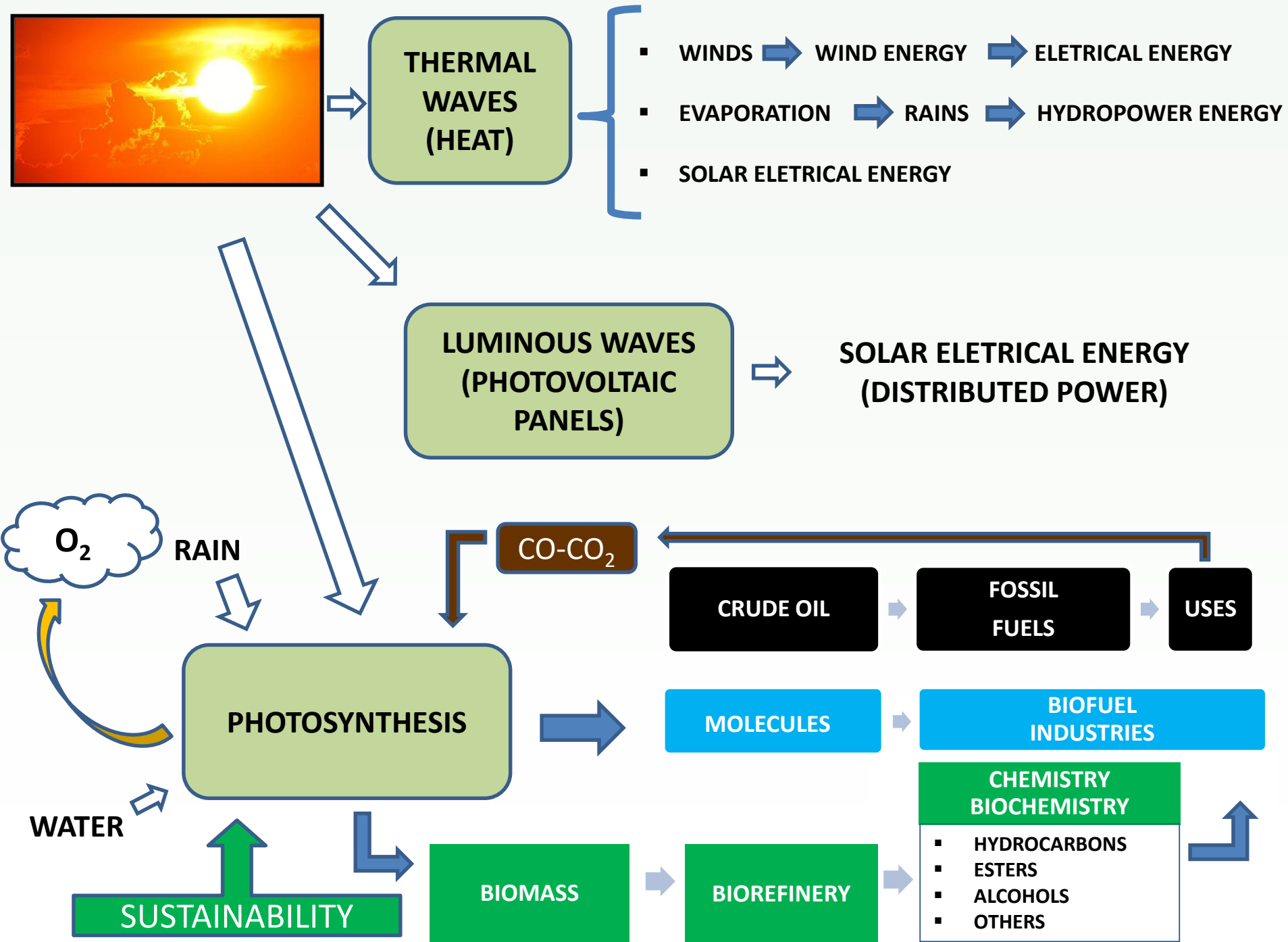
Ubrabio

União Brasileira do Biodiesel e Bioquerosene

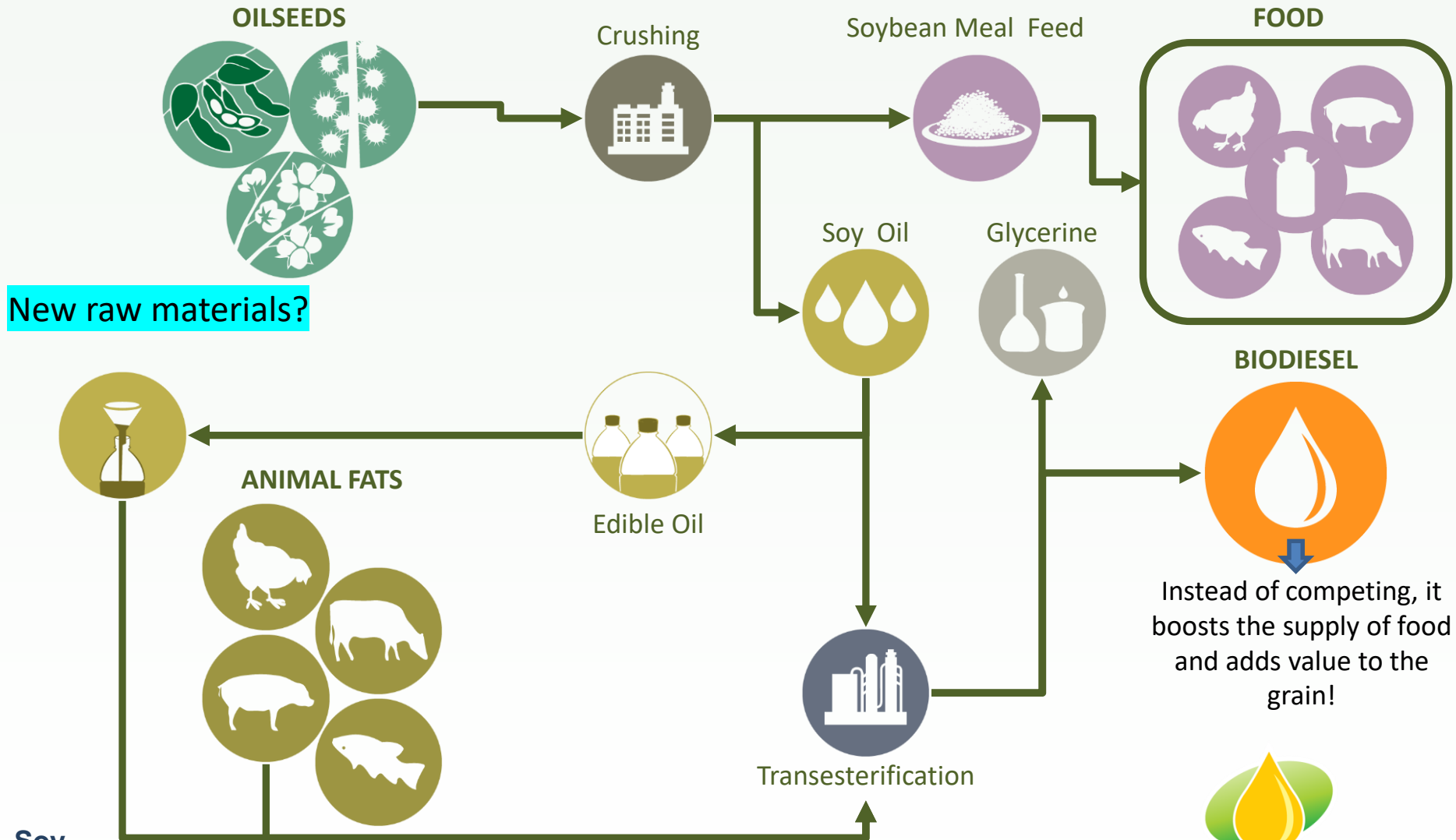
PARADIGM CHANGES IN ENERGY CONSUMPTION

- Global Warming and the Need for Sustainable Growth (transition to a low-carbon economy)
- Oil vs. Sustainable Production
 - ✓ Concepts and Different Costs: "Fossils" tend to make clean and sustainable alternatives unfeasible
- The "Poisons" of the Oil Dependency
 - ✓ Exhaustive Reserves / Climate Change (Greenhouse Effect)
 - ✓ Emissions and their Effects on Health: Deaths, Illnesses and Distress (Metropolitan Regions)
 - ✓ Accidents of serious impact
 - ✓ External Dependence - Massive Imports of Diesel Oil (Brazil: oil exporter)
- Potentials and Opportunities: (Externalities / Economic Reflexes)





Biodiesel Production Chain



New raw materials?

Soy

- Brazil to take the lead in world production - 2018/2019 harvest with 118 million tons
- Essential for food chains (bran in the composition of animal feed)
- Structured chain - commodity and leverage for development of other crops
- Only raw material capable of guaranteeing the start and expansion of biodiesel production
- About 70 million tonnes exported *in natura*

Brazil's Potential

Solar incidence



Temperature



Rainfall regime



Lands

Biodiversity



Brazil: Considered a privileged country in terms of agricultural vocation in the world for the production of food, fiber, bioenergy and bioproducts, although we do not incorporate biodiversity into economic activity.

POSITIVE EXTERNALITIES OF BIOFUELS

*Social
Inclusion*



Jobs



Industry



Environmental



*Public
Health*



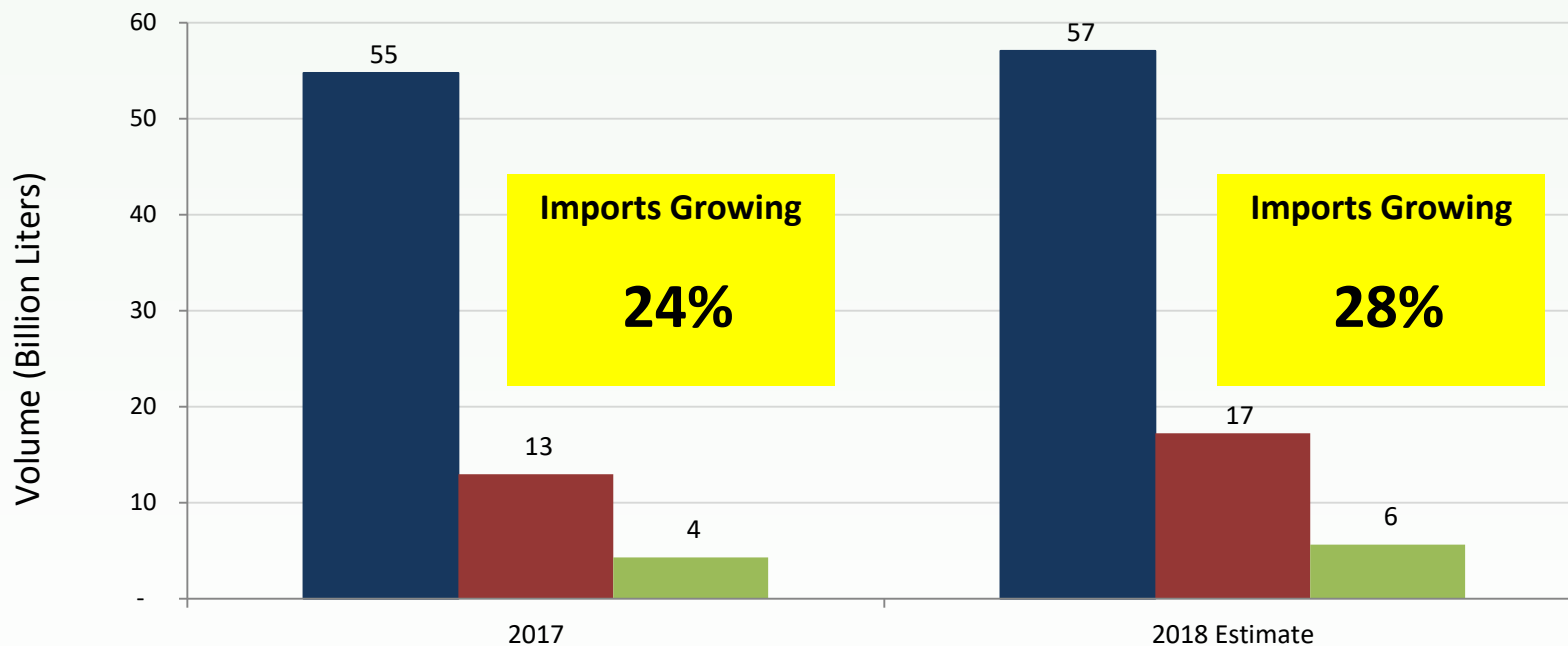
*Trade
Balance*



Ubrabio

União Brasileira do Biodiesel
e Bioquerosene

Annual comparison of the volume (billion liters) of consumption, diesel imports and biodiesel production 2017 and 2018



Notes:

■ Diesel Consumption¹

■ Diesel Imports²

■ Biodiesel Production³

1) Diesel consumption data from May to Dec / 2018 were estimated by extrapolating the accumulated variation (4.2%) from Jan to Apr / 2018 over the same period of 2017.

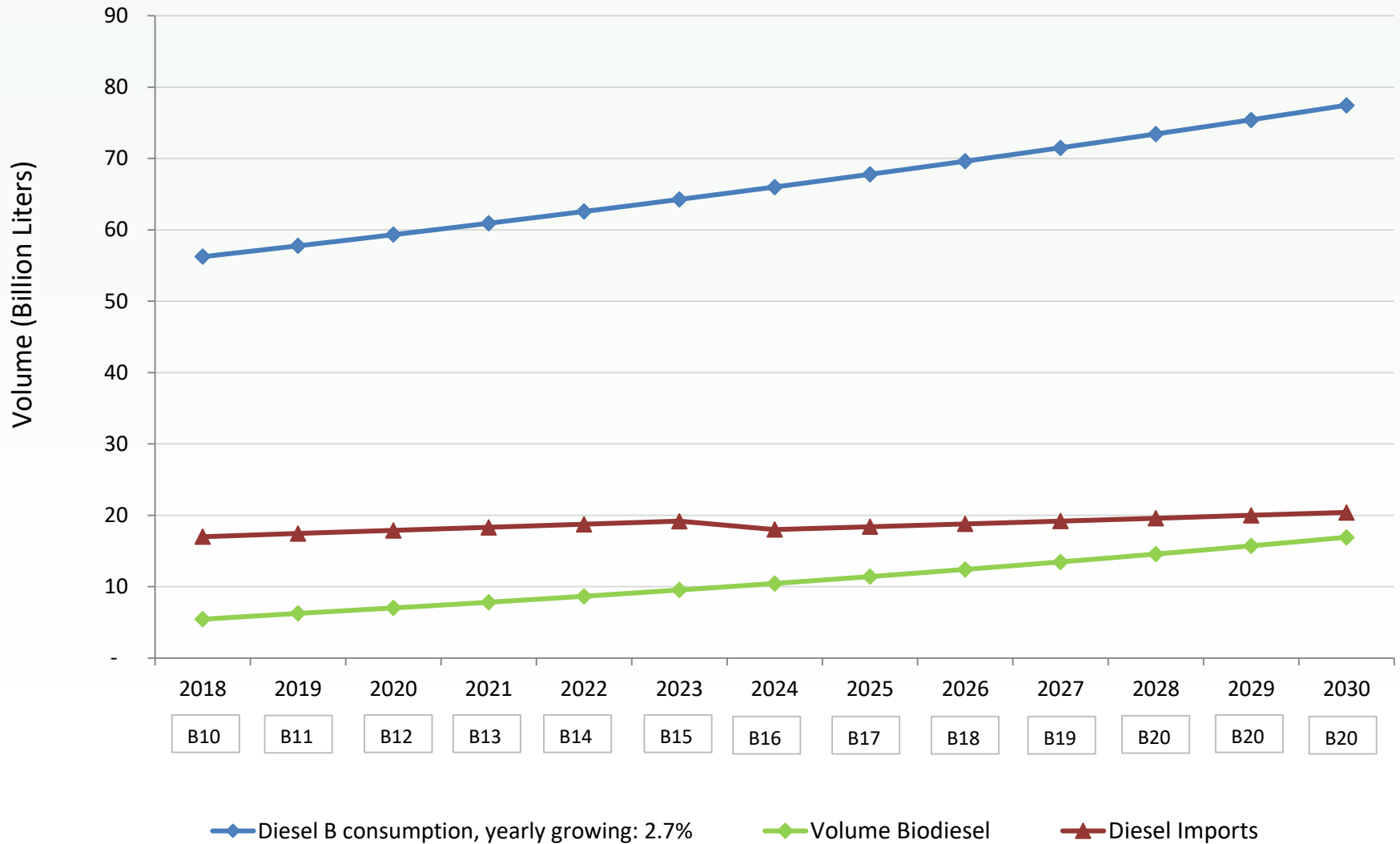
2) Diesel import data from May to December 2018 were estimated by extrapolating the accumulated variation (32.9%) from Jan to Apr / 2018 over the same period of 2017.

3) Data from biodiesel production from May to Dec / 18 were estimated by extrapolating the accumulated variation (31.5%) from Jan to Apr / 18 over the same period of 2017.

Source: Ubrabio from ANP data.



Comparison of the estimates of the Diesel B consumption, Diesel Imports and Biodiesel Volume with a yearly increase of the mandatory 1% blend in the period 2018-2030 (in billions of liters)



Ubrabio Vision for Biodiesel

RenovaBio
BIOFUTURO

Law 13.263/2016

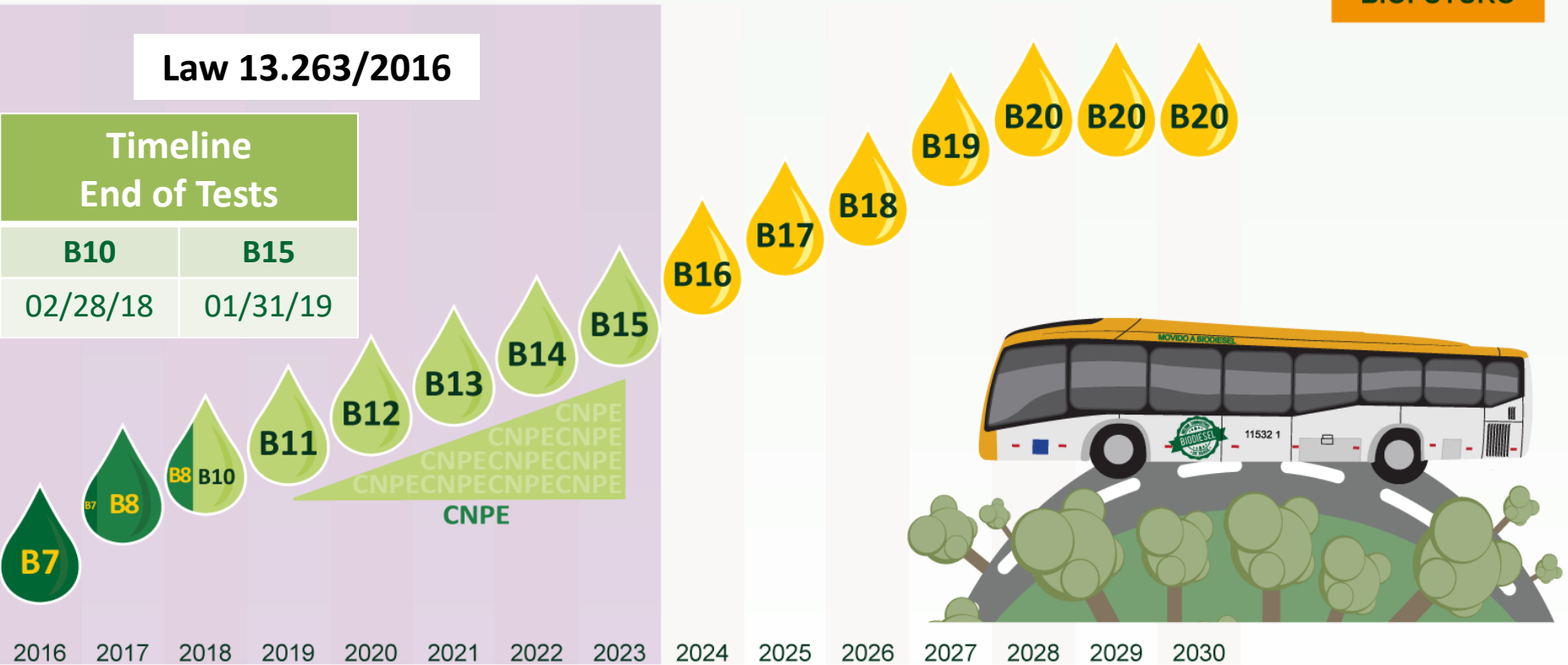
Timeline
End of Tests

B10

B15

02/28/18

01/31/19



From the maturity of the ethanol market through mandates, Biodiesel was actually started in 2008 and introduced unprecedented components of great impact:

- Multi raw materials
- Social - with around 200 thousand farmers (only in 2017) supplying raw materials and receiving technical assistance and inputs



The RenovaBio in line with the Contemporary Strategic Vision

Intensify Production in a Sustainable Way

Raising Productivity and Quality with Low Impact Technologies

Reducing Risks - Reducing Emissions - Saving Resources - Raising Income and Social Inclusion

Add Value, Diversify, and Specialize

Meeting the expectations of a more demanding society

Attending to more sophisticated, competitive and profitable markets



Recognize the value of the public good in the relative prices of fuels from their different externalities with Energy and Environmental Efficiency

RenovaBio



RenovaBio

- The program brings predictability and important market inducer for the expansion of production
- Promotes competitiveness among fuels, encouraging efficiency gains and new biofuels
- Allows meeting COP 21 commitments
- encourages the use of Raw Materials with Lower Carbon Footprint, such as Recycled Frying Oil and New Reforestation Cultures, such as the Macaúba
- Sector is optimistic with the guidelines, speed, transparency and the good level of interlocution

Necessary to align strategies of Government with Strategic Planning interconnected in the growth

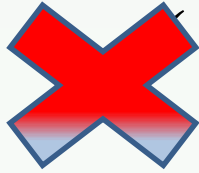
- Compatible RenovaBio with the Brazilian Fuel Program (Combustível Brasil), defining the role of each fuel in the transport matrix
- Importance of the Biofuel Production Scale
- Prioritization of low-carbon fuels in the automotive industry's efficiency targets (Rota 2030) and the ICAO targets for BioQav





RenovaBio

Proposals presented by Ubrabio



Extend the Carbon Intensity Goal (CI) from 10.1% to 12%

- ✓ B20 required in 2028 -1%/year from 2019 (B11 March 2019)
- ✓ B20 Volunteer in Public Transport of cities

Year	Inhabitant (mil)
2019	>500
2021	>250
2023	>100

Predictability means attractiveness and stability!

- ✓ Review of the gCO_2 / MJ concept "From well to wheel"

accounting for CO_2 emissions on the effective energy, mechanics of the fuel and not on the chemical energy (calorific value) of the fuel

Treatment of co-products: The allocation of LCA should be on a mass basis and not on an energy basis



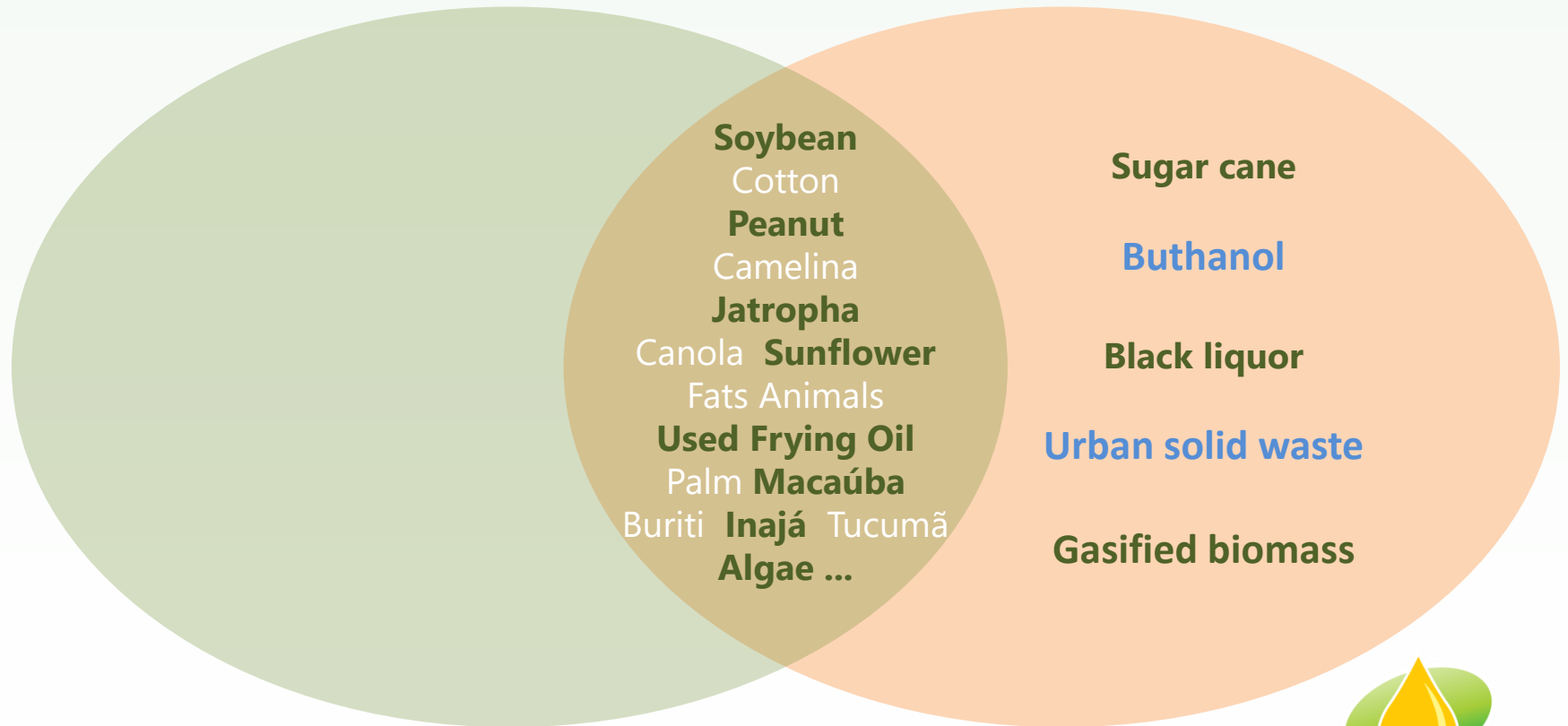
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Biodiesel and Biojet Raw Materials

BIODIESEL

BIOJET



Ubrabio

União Brasileira do Biodiesel e Bioquerosene

**BIOFUELS
(LIQUIDS)**



**FOSSIL FUELS
(LIQUIDS)**

**OTTO
CYCLE**

**ALCOHOL
(BIO-ETHANOL)**



**GASOLINE
(HYDROCARBONS)**

DIFFERENT MOLECULES

**DIESEL
CYCLE**

**BIODIESEL
(ESTERS)**



**DIESEL
(HYDROCARBONS)**

**SIMILAR
PROPERTIES**

EQUIVALENT USE

AVIATION

**BIOJET
(HYDROCARBONS)**



**JET FUEL
(HYDROCARBONS)**

EQUAL MOLECULES

**IDENTICAL USE
(DROP IN)**

IDENTICAL PROPERTIES

Specific Features

BIODIESEL

Larger volume

Different molecule

Life Cycle and technology already maturing
(threats for replacement)

Production and consumption
Distributed

Viability forwarded

Convergent Routes

BIOJET

Smaller volume

Same molecule

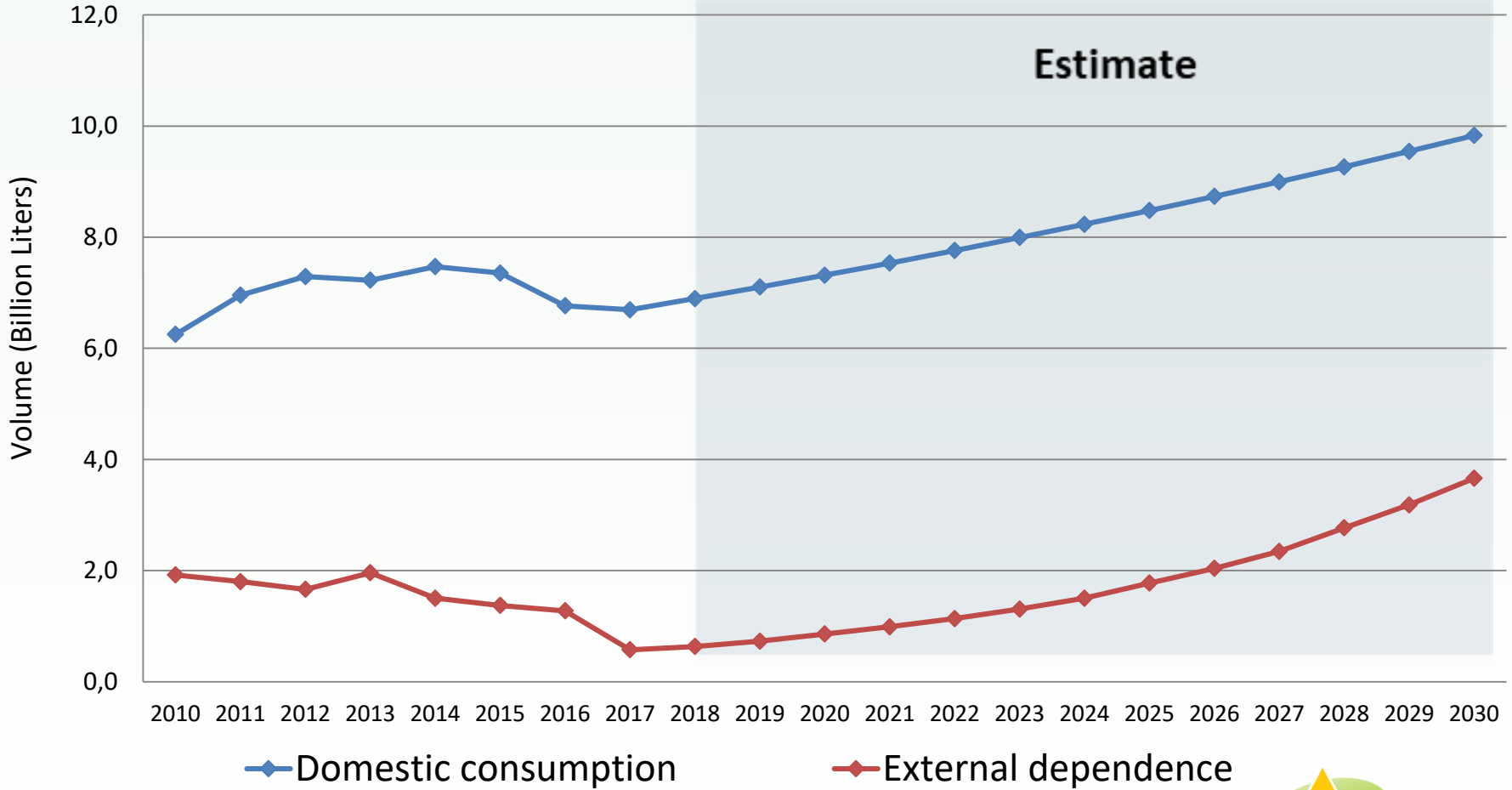
Incipient Life Cycle
(Continued threats of viability)

Concentrated production at large
consumption centers
Return / return consumption

Indefinite feasibility

Competitive Routes

Jetfuel - Internal Consumption and External Dependence (billion liters)



Source: Ubrabio with ANP data



What is the most promising route for Biojet?

One of the success factors of Biodiesel: High Yield, Biodiesel (**Yield, key factor**)

In the Ethanol Process for Biojet, more than 2 liters of Ethanol are required for Generate 1 Liter of Biojet

In the Process of Iso-Synthetic Paraffins (Amyris) the production costs are very high

4 kg of sugar is required for 1 liter of Biojet

In the HEFA process, 1 liter of oil generates approximately 1 liter of Biojet. This is the most promising process in Brazil, more than 90% of Biojet produced In the World comes from this TECHNOLOGICAL ROUTE (**HEFA, better yield**)

Fisher-tropsch process from biomass gasification (Big scale)



CONCLUSIONS

1. The HEFA process is considered mature in the AltAir plant (Paramount-USA)
2. The Fischer-Tropsch process, using syngas from biomass gasification, has advanced a great deal but still needs a few years to be considered truly competitive, using residual biomass.
3. Both technologies consider the other processes to be far from techno-economic viability. The ATJ route has a very low yield and the pyrolysis route generates a bio-oil which is too complex and difficult to hydrotreat. Therefore, in the short term, HEFA is the most competitive technology. In the medium term, Fischer-Tropsch can become competitive.

Externalities of the Production and Use of Biojet in Brazil

- Contributes to the compliance with the Brazilian commitment to reduce emissions (NDC-COP 21)
- It encourages the creation of a new sector
- It contributes to diversify the sustainable energy matrix
- May favor regional aviation
- It drives the generation of jobs and income
- Increases regional development
- Reduces imports of fossil jetfuel
- Allows offer of other products of very high value
- Aggregate for green chemistry (biorefinery co-products)
- It induces the contribution of resources in RD & I
- Provides greater security of supply



BIOJET

What Does the Sector Want?

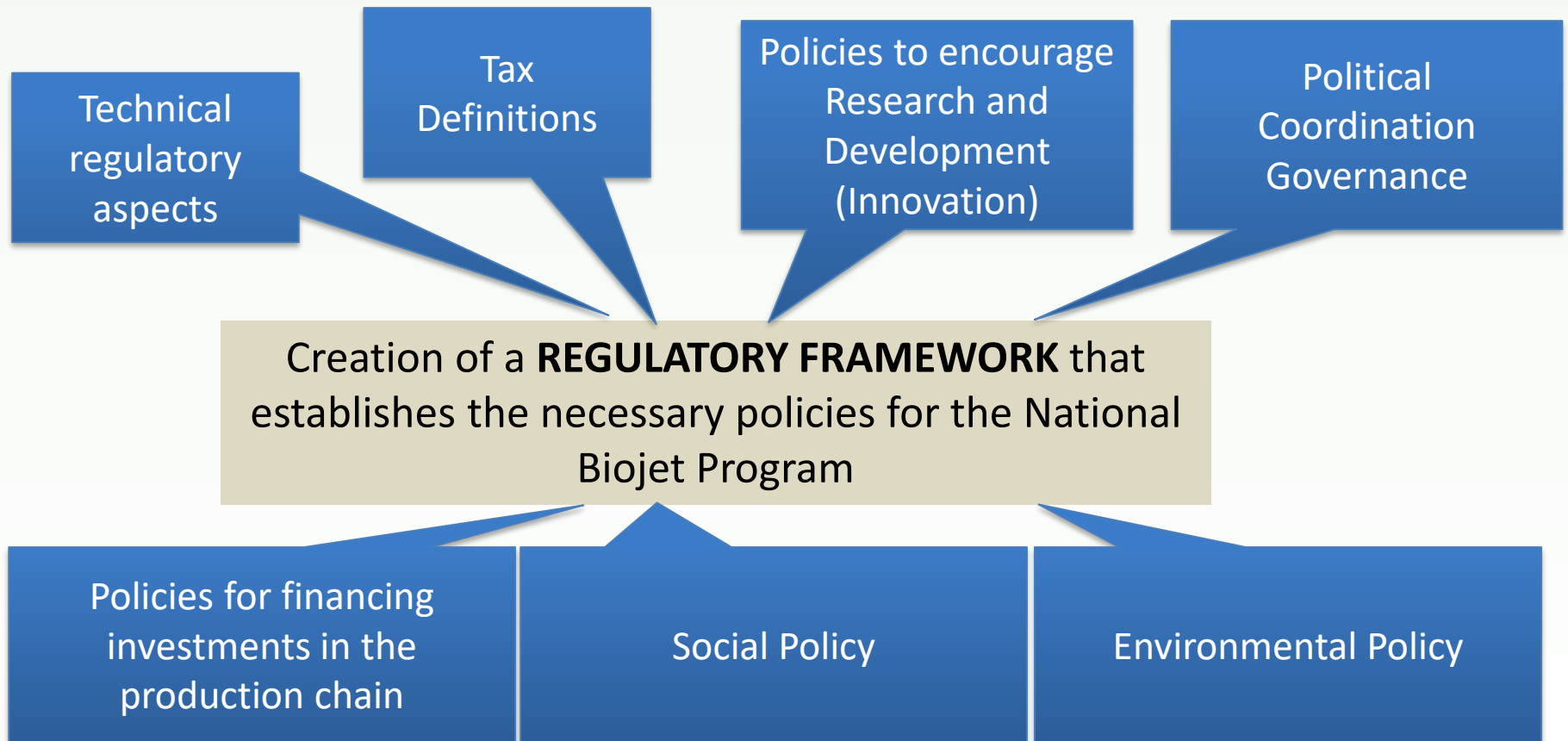
✓ Public Policy Building aligned with:

- National
- Renovabio → CBIOS X BIOJET
 - Biojet's role in meeting NDC goals
 - Integrated Investment in R&D / social / economic / environmental arrangement
 - Regulatory Framework: what can be taken advantage of the models: Ethanol and Biodiesel
 - Additional stimuli

- International
- Biofuture Platform
 - ICAO
 - CORSIA
 - ASTM - USA Specification
 - Paris Agreement



How can the Brazilian Government help??



Role of
Ubrabio

Thank you, Juan Diego Ferrés



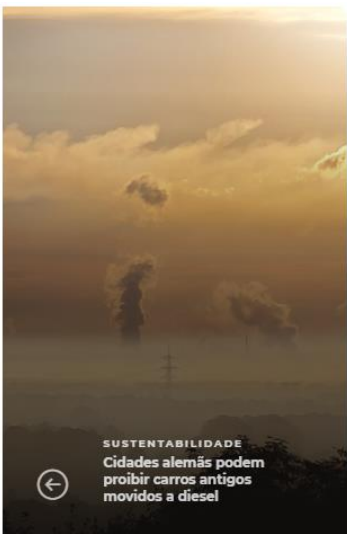


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