

# A Multi-Level Perspective of Brazil's Transport Decarbonisation Potential, Focusing on the Biodiesel Technological Innovation System

LANDSCAPE

## Infrastructure

Poor infrastructure until 1960.  
1970-1990: mainly road projects leading to deforestation and settlers immigration.  
Limited railway expansion.  
After 1990: many ports were constructed.

## Social Acceptance

The transition from dictatorship to democracy affected the policy regarding the use of biofuels.  
The Pro-Alcool policy was legislated by the military regime and faced significant criticism in 1989 due to that fact.  
Lately food security issues have also risen.  
On the other hand, Latin America is demonstrating greater approval regarding genetically modified agricultural resources; hence soybean cultivation is generally more accepted than in other regions such as Europe.

## Sugarcane Prices

The high prices of sugarcane combined with the low energy threshold of biofuels led to reduced production.

## Domestic Oil Resources

First oil drilling in 1897.  
Important oil resources.

## Domestic Biofuels Resources

Brazil is the second largest producer of biofuels globally.

## Economic growth in 1960s

## Oil Crises (1973 & 1978)

The increase in oil prices led to a change of strategy, leading to higher biofuels usage.

## Financial Crises

The financial crisis of 2014 coupled with the financial crisis of 2008 has led to the creation of new opportunities for the industry of biofuels.

TRANSPORT REGIME

Window of opportunity: Changed strategy towards ethanol due to oil crises

Window of opportunity: Biofuels restarted due to financial crises

Window for more environmental policies

NDCs set after Paris Agreement

### First Period (1970-1990)

		1970	1990
<b>Gasoline</b>	Mainly used on passenger vehicles.	55%	Reduced to 22%
<b>Diesel</b>	Mainly used in freight transportation and passenger buses. It stayed protected from the ethanol diffusion that reduced gasoline usage.	34%	Increased to 51%
<b>Other oil products</b>	Used in maritime and airplane transportation. Mainly intact towards this period.	10%	Steady at almost 10%
<b>Biofuels</b>	The main type of biofuels used in this period is ethanol, substituting gasoline.	Nearly 0%	Increased to 18%
<b>Natural Gas</b>		10%	Nearly 0%

<b>Actors</b>	<ul style="list-style-type: none"> <li>Petrobras, global oil company located in Brazil</li> <li>IBP (Brazilian Petroleum, Gas and Biofuels Institute), introduced to represent the industry's companies</li> </ul>
<b>Legislation</b>	Pro-Alcool: Promoting the use of ethanol instead of imported oil.

### Second Period (1990-2005)

		1990	2005
<b>Oil Products</b>	They also include diesel and gasoline. Slight increase (topped at 87,5% in 2001). Passenger vehicles used solely gasoline. Freight transport, on the other hand, is heavily dependent on diesel.		Increased to almost 84%
<b>Gasoline</b>	Mainly used in passenger vehicles. Faced an important decrease because of the oil crises and the introduction of ethanol.	Reduced to 22%	
<b>Diesel</b>	Mainly used in freight transportation and passenger buses. It stayed protected from the ethanol diffusion that reduced gasoline usage.	Increased to 51%	
<b>Other oil products</b>	Used in maritime and airplane transportation. Mainly intact throughout this period.	Steady at almost 10%	
<b>Biofuels</b>	The main type of biofuels used in this period is ethanol, substituting gasoline. This transition started in 1976, but demonstrated great pace after 1980 mainly due to the Pro-Alcool policy. High sugarcane prices reduced ethanol production.	Increased to 18%	Reduced to 13%
<b>Natural Gas</b>	No important increase in this period. No policies related to this fuel type.	Nearly 0%	Around 3%

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<b>Legislation</b>	1997: New framework for the distribution of oil.

### Third Period (2005-2018)

		2005	2018
<b>Oil Products</b>	They also include diesel and gasoline. New LDVs introduced in 2003 that led to a more efficient fleet. Passenger vehicles used solely gasoline. Freight transport, on the other hand, is heavily dependent on diesel.	Almost 84%	Reduced at 77%
<b>Biofuels</b>	Mainly increased due to national environmental policy. Brazil focuses on self-consumption. 10% mandate. Key policy questions: How do we move forward? How to improve variety in biofuel feedstock?	13%	Increased to almost 20%
<b>Natural Gas</b>	No important increase in this period. No policies related to this fuel type.	Around 3%	Around 3%

<b>Actors</b>	<ul style="list-style-type: none"> <li>Petrobras, global oil company located in Brazil</li> <li>IBP (Brazilian Petroleum, Gas and Biofuels Institute), introduced to represent the industry's companies.</li> <li>National Petroleum Agency (ANP)</li> <li>National Council for Energy Policy (CNPE)</li> </ul>
<b>Legislation</b>	2005: PNPB (Brazilian Biodiesel Program): Aiming for the increased use of biofuels such as biodiesel. 2017: RenovaBio with higher biofuel targets, affected by the NDCs set in the Paris Agreement.

BIODIESEL TIS

## 1. Entrepreneurial Activities

10 large companies and many smaller ones.  
The companies have mainly focused on soybean, although there are requirements for other biofuels too.

## 2. Knowledge Development

Many institutions since the early 20th century have been involved in research related to biofuels. This led to cumulative knowledge that contributed to biodiesel diffusion.  
Sugar and Alcohol Institute, National Institute of Technology, Industrial Technological Institute, etc.

## 3. Knowledge Diffusion

Knowledge diffusion is mainly achieved through legislation that encourages the use of biofuels.

## 4. Guidance of the Search

Lately research is focused on agricultural issues such as the cultivation of soybean. Brazil is one of the global powerhouses of soybean production possessing a significant knowledge base on this sector.  
Guidance is also provided with national programs such as OVEG (National Energy Program from Vegetable Oils).  
Expansion of research towards other biofuels crops instead of focusing only on soybean production is deemed necessary.

## 5. Market Formation

The sector has been expanded in recent years, mainly due to the important natural resources and the diversity of its stakeholders  
Ethanol increased; no competition from biodiesel.  
Brazil focuses on self-consumption.  
Biodiesel production seems to be driven less by environmental benefits, and rather by political and financial motives, due to pressures from associations like ABIOVE and powerful lobbies operating in the soy sector.  
Biodiesel is also slightly used in rail transportation.

## 6. Resource Mobilisation

The PNPB legislation has led to mobilisation of important resources towards the use of biofuels and especially biodiesel since it has set specific targets.  
Concerns on financial viability due to tax incentives.  
Only soybean can scale up production to meet demand: Concerns over appropriability and capability of other feedstock to meet demand.  
Moreover, the broad participation of stakeholders in soybean production has attracted private investments.  
Automotive industries are not heavily concerned since the current biofuel mix targets do not require important modifications.

## 7. Creation of legitimacy/ counteract resistance to change

Significant societal approval.  
The low prices of biofuels in the region have attracted the attention of media.  
Strong community engagement.