Ingenious Brain

Case Study

*How We Drove*

# R&D Excellence in Refining Low Carbon Products and Tapped into Brazil's Biomass Opportunities

## Objective

A global client partnered with IeB to accelerate its decarbonization roadmap by assessing the R&D landscape for low-carbon products in Brazil's refining and petrochemicals sector. The study focused on identifying innovation opportunities in biomass valorization and waste recycling to reduce Scope 3 emissions and enable sustainable feedstock diversification.

## Our Strategic Approach

**To highlight Brazil's leadership potential in sustainable refining, we applied a research- and technology-driven framework integrating innovation scouting, feedstock assessment, and ecosystem mapping.**

### Technology & Innovation Assessment

Evaluated emerging low-carbon pathways such as second-generation ethanol, biohydrogen, and green chemicals derived from bio-based feedstocks. Analyzed key R&D themes, including enzyme engineering, green catalysis, dark fermentation, and single-step conversion processes for efficient biofuel and biochemical production.

### Feedstock & Regional Opportunity Analysis

Assessed the availability and processing potential of Brazilian biomass resources, focusing on agricultural residues like sugarcane and corn stover. Identified how integrated biorefineries could enhance carbon circularity while reducing lifecycle emissions across petrochemical and refining operations.

### Ecosystem & Collaboration Mapping

Mapped academic, industrial, and government initiatives driving innovation in Brazil's low-carbon sector. IeB identified strategic collaboration opportunities with local R&D institutions, bioenergy startups, and chemical producers to accelerate the commercialization of sustainable technologies.

# Snippets

## Executive Summary – Comparative Assessment of R&D Strength



Brazil offers promising opportunities for biomass valorization, leveraging its abundant sugarcane resources and a commitment to innovative strategies, both of which drive the development of sustainable bioenergy and bioproducts in the region

| Key Information | | | | R&D Strengths | | | | | | Other Details | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Key attributes | | | | | | | | | |
| Entity | Founded year | Overall IP publications | Number of scientific research articles | Count of patent focus | Average impact factor of journals | Identified weak signals | Feedstock focus (biomass \| waste) | Key processes | Key products | Patents in collaboration | Articles in collaboration | Total number of collaborators | Key funding agency |
| UNICAMP (>>) | 1966 | 24 | 377 | 10 | 5.71 | 22 | ▪ Biomass: 309<br>▪ Waste: 92 | ▪ Transesterification<br>▪ Fermentation<br>▪ Gasification<br>▪ Enzymatic hydrolysis | ▪ Ethanol<br>▪ Biofuels<br>▪ Bioplastic | 2 | 270 | 269 | ▪ FAPESP<br>▪ EMBRAPII<br>▪ CAPES<br>▪ CNPQ,<br>▪ FAPEX<br>▪ FINEP |
| UFRJ (>>) | 1920 | 27 | 212 | 13 | 6.1 | 22 | ▪ Biomass: 176<br>▪ Waste: 66 | ▪ Fermentation<br>▪ Transesterification<br>▪ Hydrolysis<br>▪ Anerobic digestion | ▪ Ethanol<br>▪ Biofuels<br>▪ Bioplastic<br>▪ Bio lubricants | 16 | 81 | 165 | ▪ CAPES<br>▪ CNPQ<br>▪ FAPERJ |
| USP (>>) | 1934 | 21 | 480 | 13 | 6.08 | 36 | ▪ Biomass: 388<br>▪ Waste: 113 | ▪ Fermentation<br>▪ Transesterification<br>▪ Enzymatic hydrolysis<br>▪ Anaerobic Digestion | ▪ Biofuels<br>▪ Biopolymers<br>▪ Ethanol | 4 | 48 | 397 | ▪ FAPESP<br>▪ CNPQ |
| UFPR (>>) | 1912 | 21 | 145 | 11 | 6.07 | 27 | ▪ Biomass: 121<br>▪ Waste: 46 | ▪ Fermentation<br>▪ Transesterification<br>▪ Enzymatic hydrolysis<br>▪ Depolymerization | ▪ Biofuels<br>▪ Biopolymers<br>▪ Lipids<br>▪ Hydrogen<br>▪ Esters | 4 | 44 | 123 | ▪ CNPQ<br>▪ CAPES<br>▪ Fundação Araucária de Pesquisa |
| UFMG (>>) | 1927 | 15 | 100 | 11 | 6.0 | 14 | ▪ Biomass: 75<br>▪ Waste: 39 | ▪ Transesterification<br>▪ Fermentation<br>▪ Carbonization<br>▪ Anaerobic digestion | ▪ Ethanol<br>▪ Biofuels<br>▪ Bioplastic | 7 | 35 | 119 | ▪ WUN RDF<br>▪ CAPES<br>▪ FAPEMIG<br>▪ CNPQ<br>▪ FAPESP<br>▪ BNDES |

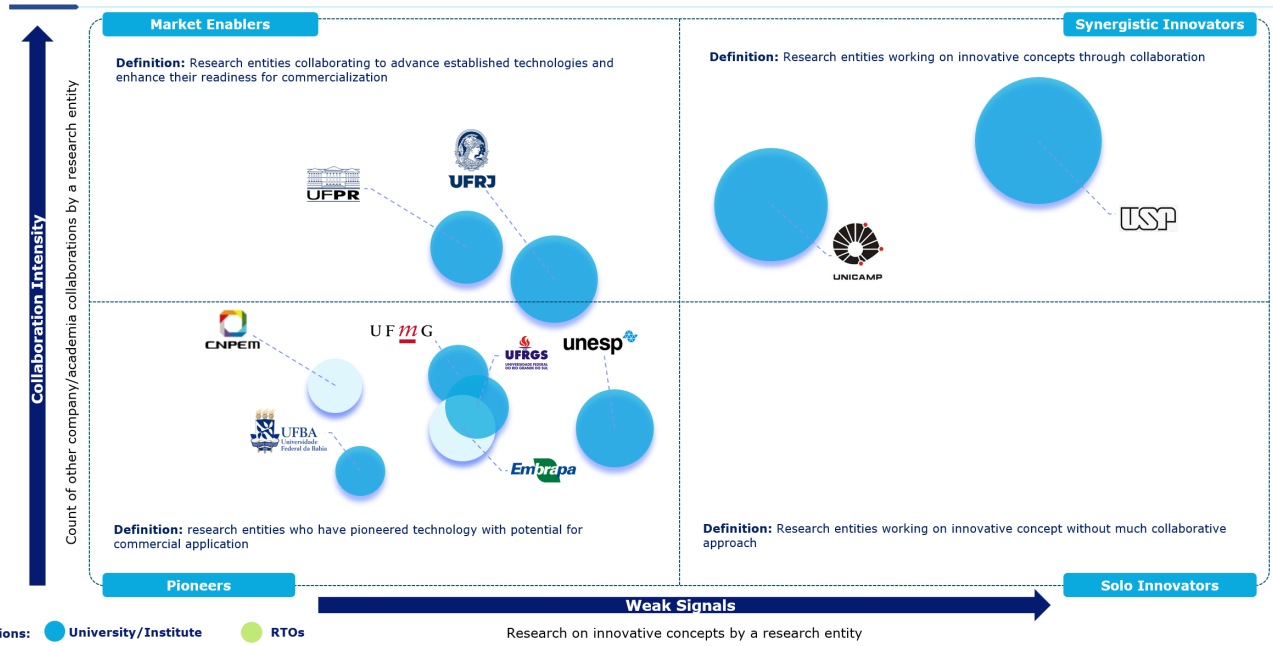
**Notations:** University/Institute, RTOs

**Note: Biomass** – All the natural/plant-based feedstock including agricultural waste | **Waste** – Organic wastes such as industrial waste, municipal solid waste, textile, and plastic waste

Source: IEBS analysis

## Assessment of Research Potential

Researchers are working on various innovative concepts, such as the development of enzyme cocktails, green catalysts, single-step processes for biofuel production, dark fermentation to produce hydrogen, the use of supercritical routes, etc.




**Notations:** University/Institute, RTOs

**Note:** Bubble size denotes the total of patent and scientific literature publication of the key academia/RTO

Source: IEBS analysis

## Impact

- Helped the client recognize Brazil as a key hub for biomass valorization and circular carbon technologies in the refining and petrochemical sectors.
- Guided the client to channel R&D toward scalable, next-generation technologies by highlighting high-impact innovation areas such as enzyme cocktails, green catalysts, single-step biofuel conversion, and dark fermentation for biohydrogen.
- Explored collaboration pathways that positioned the client to build strategic alliances with regional innovators, accelerating commercialization and ensuring regulatory alignment.

## Conclusion

IeB equipped the client with a strategic R&D and investment roadmap to drive low-carbon innovation in refining and petrochemicals. The analysis of technology potential, feedstock advantages, and innovation ecosystems positioned the client to achieve Scope 3 emission reductions and lead in the global bio-based energy shift.

Ingenious e-Brain

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