rLG | Low-carbon fuel for global decarbonization

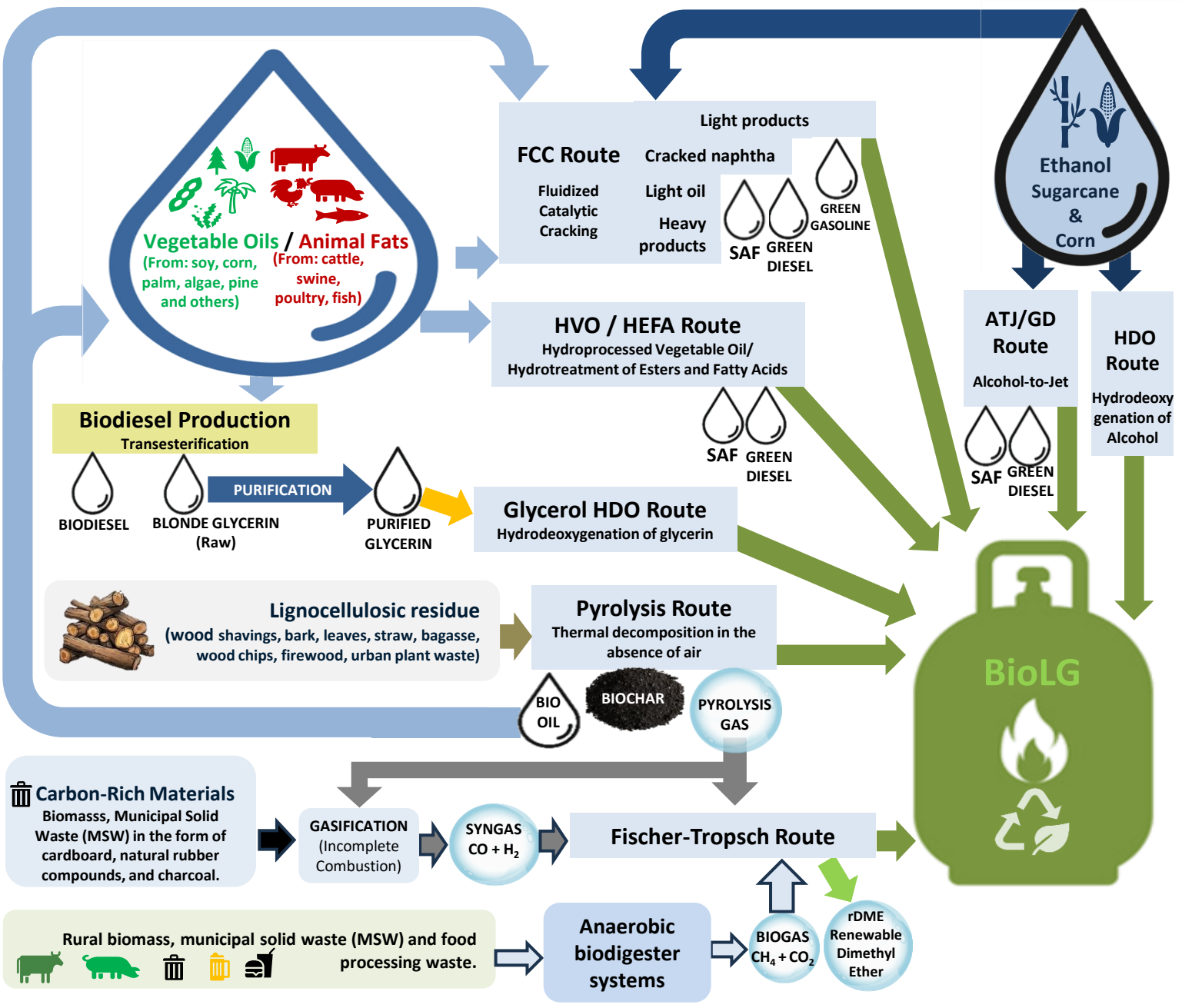
Renewable Liquid Gas (**rLG**) includes renewable propane, renewable butane and renewable dimethyl ether. It is co-produced through different physical-chemical-catalytic routes from different inputs. When its input comes from biomass, it can be called **BioLG**.

BioLG differs from fossil LPG due to its renewable production chain, which enables the reduction of greenhouse gas (GHG) emissions from the combustion of its fossil equivalent.

BioLG is a low-carbon synthetic gaseous fuel, identical to fossil liquefied petroleum gas (LPG) in chemical structure, use, and performance.

Production of BioLG

BioLG is a co-product obtained through different technological routes in processes that transform biomass into renewable fuels and chemicals. In Brazil, there are many potential sources of raw materials for **BioLG** production, such as: vegetable oils, animal fats, and agro-industrial and urban waste.

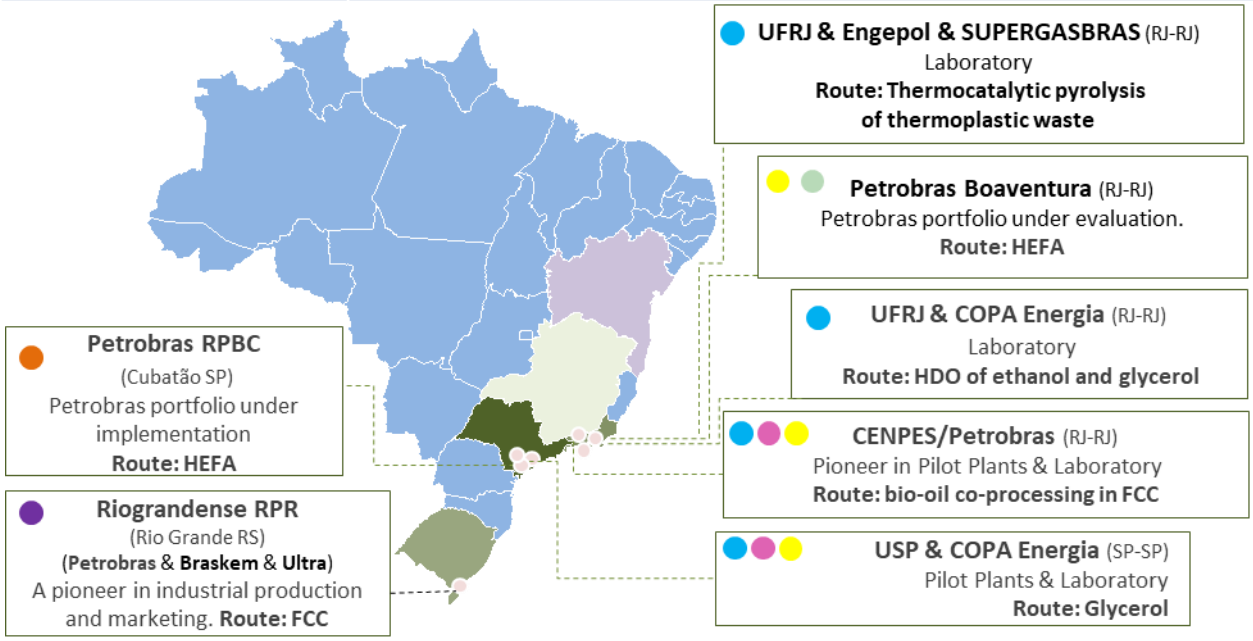


- The main route for producing BioLG is the hydrotreatment of vegetable oils, esters, and fatty acids (HEFA) to produce green diesel (GD) and sustainable aviation fuels (SAF).
- Among the emerging routes, fluidized catalytic cracking (FCC) processing of oils and fats stands out, as it makes the refinery more flexible in terms of input, since cracking can fractionate long chains of vegetable/animal oils into hydrocarbons with shorter carbon chains.
- BioLG can be obtained as a co-product of Green Diesel (GD), SAF e Biochar.

BioLG in Brazil

Current production is in its early stages, but growth is expected driven by incentive policies and the search for low-carbon energy sources.

Status of Initiatives	Highlights
TRL 1-3 Knowledge (Lab results and new studies)	Partnership between the University of São Paulo (USP) and Copa Energia in 2022 for modeling and optimizing the rLG production chain to identify better routes and scenarios. Partnership between the Federal University of Rio de Janeiro (UFRJ) and Copa Energia produced the first quantities of GLR on a laboratory scale from glycerol and ethanol in 2023/24.
TRL 1-3 Knowledge (Lab results and new studies)	Lab initiatives of the Federal University of Rio de Janeiro (UFRJ) / Engepol & SUPERGASBRAS: Route: Thermocatalytic pyrolysis of thermoplastic waste. Abroad, part of the group, with startups, carries out production and commercialization operations of BioLG.
TRL 4-5 Pilot Plant (results and new studies)	Pioneering pilot plants for fuels since the 1980s, the CENPES/PETROBRAS initiatives have used various technological routes, including Fluid Catalytic Cracking (FCC), due to the flexibility of existing equipment for processing and co-processing petroleum and/or animal/vegetable fatty biomass for the production of BioLG.
TRL 4-5 Pilot Plant (planning)	Copa Energia plans to build a pilot plant by 2027 to produce BioLG, aiming to make the Glycerol route viable.
TRL 7-9 Availability (operation)	Pioneering industrial production of the first commercial batch of BioLG in 2025 via the FCC Route: Riograndense Refinery (Ultragaz+Petrobras+Braskem Partnership), using technology developed at CENPES/PETROBRAS. In 2024, CBMM purchased 60 tons of BioLG.



"Brazil has the potential to become a major producer of bioLG due to the abundance and availability of biomass."

Source: Technical information obtained through site visits and direct communication with researchers and stakeholders in the BioGL production chain.

Environmental benefits of BioLG

The carbon intensity of BioLG varies significantly depending on the route, feedstock, and methodology.

Type of Fuel Gas	Carbon intensity (CI) (kg CO_2/kg fuel)	Carbon intensity (CI) (g CO_2 eq./MJ)	Emission Reduction Compared to Fossil LPG	Carbon credits per ton reduced
Fossil LPG	3.17 – 3.82 kg CO_2/kg	69 - 83 g CO_2 eq/MJ	-	None
BioLG	-23.07 – 3.69 kg CO_2/kg	-500 – 80 g CO_2 eq/MJ	0% - 725%	US$40-80 per ton of CO_2 avoided.

Source: Carbon Intensities, Renewable and Fossil Liquid Gases, LPG & DME 2023 - World Liquid Gas (WLGA)

OPPORTUNITIES: Use in cooking, no adaptations needed for LPG stoves (drop-in); Versatile use; Renewable origin; Abundant biomass in Brazil; Reduction of CO_2 emissions; Public policies for decarbonization and emission reduction targets; Growing renewable energy market.
In most technological routes, BioLG is a co-product of SAF and DV.
The FCC route already has the infrastructure and flexibility for large-scale production with different types of biomass; the glycerol route has high production efficiency.

CHALLENGES: Volatility in biomass prices; Competition with other biofuels for raw materials; National glycerin for biodiesel is crude and requires purification for the glycerol route; High production costs due to the cost of inputs; Market resistance due to higher costs (technological routes and inputs).
Reassess restrictions on the use of Liquid Gas, imposed by Law 8,176/91.
Small-scale production in Brazil; Requires specific regulations and tax incentives.
Regulatory changes that may influence investments.

Possible actions to boost BioLG in Brazil:

1 – Creation of incentives, calls for proposals/funding initiatives for the development of the low-carbon liquefied gas production chain;
2 – Inclusion of a special incentive regime for infrastructure development (REIDI) to boost industrial production;
3 – Establishment of a regulatory framework for production, blending, and marketing;
4 – Development of new routes and/or improvements to existing ones to reduce production costs to increase competitiveness.

BioLG: Eco-efficiency in food preparation, environmental comfort & industrial production with air quality and sustainability!

epe20

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To find out more:
- www.worldliquidgas.org/
- SAF no Brasil e sinergia com o diesel verde
- Factsheet - Biocarvão
- Factsheet - GLP

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