TECHNICAL NOTE

INVESTMENTS AND OPERATING AND MAINTENANCE COSTS IN THE BIOFUEL SECTOR: 2026 - 2035

OCTOBER 2025

MINISTÉRIO DE MINAS E ENERGIA

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EPE CONDUCTS STUDIES AND RESEARCH TO SUBSIDIZE THE FORMULATION, IMPLEMENTATION AND EVALUATION OF BRAZILIAN ENERGY POLICY AND PLANNING.

WITH THIS TECHNICAL NOTE, EPE PRESENTS THE ASSUMPTIONS AND ESTIMATES OF INVESTMENTS (CAPEX) AND OPERATIONAL AND MAINTENANCE COSTS (OPEX) RELATED TO THE MAIN BIOFUELS FOR THE PERIOD 2025-2034.

INCLUDED ETHANOL (SUGAR CANE - 1G AND 2G - AND CORN), BIODIESEL, BIOMETHANE (FROM THE SUGAR ENERGY SECTOR), SUSTAINABLE AVIATION FUEL (SAF) AND GREEN DIESEL, IN ADDITION TO THE CO-PROCESSING OF VEGETABLE OIL AND TECHNIQUES SUCH AS BECCS.

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Introduction

The purpose of this Technical Note is to inform the assumptions and estimates of investments (CAPEX, capital expenditure) and operational and maintenance costs (OPEX, operational expenditure) related to biofuels for the period 2026-2035. These include ethanol (sugarcane, corn and lignocellulosic – 2G), biodiesel, biomethane, sustainable aviation fuel (SAF, sustainable aviation fuel) and green diesel, as well as the co-processing of vegetable oil and techniques such as bio-CCS. The supply and consumption volumes of biofuels are based on the Biofuels Supply Report of the Ten-Year Energy Expansion Plan 2035 (PDE 2035) and the reference scenario of the document Scenarios for Ethanol Supply and Otto Cycle Demand 2026-2035 (EPE, 2025a, 2025d).

The projected values for the period 2025-2035 are in the annex for comparing with the values of PDE 2035.

1. Ethanol

The projection for national ethanol production will reach 50,5 billion liters by 2035, according to EPE (2025a) and the reference case growth scenario presented in EPE (2025c)[1]. In addition to the contribution of first-generation sugarcane, volumes of corn ethanol and lignocellulosic ethanol will reach 16.3 billion and one billion liters, respectively, by 2035. The amount of sugarcane allocated for biofuel production is 384.4 million tons (52% of total harvested sugarcane). The remainder of sugarcane goes to sugar production.

1.1. First-Generation Sugarcane Ethanol

A new (greenfield) sugarcane processing plant will come online, with an ethanol production capacity[2] of 280 million liters per year for the period 2025-2035 (ANP, 2025a). Additionally, the expansion of ethanol production capacity in existing plants is 2.3 billion liters per year, according to the National Agency of Petroleum, Natural Gas, and Biofuels - ANP (2025a).

As of March 28, 2025, the nominal installed milling capacity was approximately 840 Mtc (effective capacity of approximately 750 Mtc, 90% of the nominal capacity), with a nominal ethanol production capacity of 48.3 billion liters, considering a 200-day harvest season. The corn ethanol production capacity was 11.6 billion liters, with a corn processing capacity of 21.9 million tons per year[3].

For the investments assessment, it is considered that the units would be mixed (being able to produce both ethanol and sugar), with an optimized technological profile and an average size of 4 million tons of nominal crushing capacity to greenfield units, with an average investment of R$ 730.1/tc[4] (IBGE, 2025; FGV, 2025; LNBR, 2022). For the expansion of existing units, the average investment is R$ 293.0/tc (IBGE, 2025; FGV, 2025; LNBR, 2022). These values consider land leasing, agricultural machinery, and the industrial section with optimized cogeneration, as detailed in Table 1.

[1] In the projection, the mandatory blending percentage of anhydrous ethanol in gasoline C is 27%.
[2] The harvest season is 200 days.
[3] For simplification, these units are analyzed together with those of corn. The capacity factor is 96%.
[4] CAPEX is per ton of sugarcane, as it is possible to allocate part of the ATR (Apparent Theoretical Recovery) to produce sugar, which does not occur in E2G (second-generation ethanol) and corn ethanol units.

Table 1 - CAPEX estimate of first- generation sugarcane mills

CAPEX	R$ (dez. 2024) / tc
New units (Greenfield)	**730.1**
Industrial (including optimized cogeneration)	574.1
Agricultural machinery (including trucks)	123.3
Lease (Midwest Region)	32.7
Expansion of existing plants (Brownfield)	**293.0**

Fonte: EPE based on IBGE (2025), FGV (2025), LNBR (2022) and NOVACANA (2025a)

Thus, investments in industrial capacity, solely for first-generation sugarcane ethanol, will amount to R$ 10 billion, of which around R$ 8 billion are for expansions, and the remainder are for greenfield units.

The cost calculation of establishing a sugarcane field considers the participation of each producing region (Center-South and Northeast) in the country's total sugarcane area and their respective costs, based on the 2024/25 harvest (PECEGE, 2025). Also, 17% of the area is for planted sugarcane (new + renewed), relative to the total sugarcane area. This resulted in an average cost of R$ 40.75/tc. The investment in forming the sugarcane fields for ethanol is R$ 25,7 billion.

To calculate operating costs (OPEX), an indicator of R$2.28/liter was used, based on biomass costs (88%), industrial costs (12%) in the Central-South region, and annual ethanol production, resulting in a total value of R$691.5 billion for the period (PECEGE, 2024 and EPE, 2024b). The OPEX calculation considers the sugarcane allocated for ethanol production from all operating units each year.

1.2. Lignocellulosic Ethanol

For lignocellulosic (second-generation) ethanol – E2G, nine bagasse-based units will be attached to first-generation ones, with an average specific ethanol production capacity of 82 mil m^3/year during the period, which would amount a total of 738,000 m^3/year. The investment estimate is based on the values of currently operational commercial units in Brazil and the announcements made since 2022 for projects of this type, establishing a factor of R$ 16.92/liter (RAÍZEN, 2024a, 2024b; IBGE, 2025). Thus, the total investments amount to R$ 12.5 billion between 2026 and 2035.

The projected volume for E2G production is one billion liters by 2035 (EPE, 2025a). The estimated operational cost, updated to December 2024, is R$ 1.96/liter (LNBR, 2022), resulting in an OPEX of R$ 8,3 billion.

1.3. Corn Ethanol

The reference scenario projects an increase of corn ethanol[5] production capacity by 6.7 billion liters, considering the expansions and constructions authorized by ANP (22 units) and an indicating increased capacity, whether through new units or other expansions (six projects with a total capacity of 2.2 billion liters), most of which will be full type[6] (ANP, 2025a). Thus, the resulting total capacity will sustain a production of 18.3 billion liters in 2035.

[5] Ethanol from soybeans and other grains are included, to simplify the analysis.

[6] Full-type corn plants process only corn. Flex corn plants can process sugarcane too.

The installation CAPEX to a flex plant is R$ 1.54/liter and to a full plant is R$ 2.66/liter (LNBR, 2022; IBGE, 2025). The OPEX to a full plant is R$ 1.94/liter (IBGE, 2025; NOVACANA, 2025a). The operational costs of flex plants are allocated to the sugarcane ethanol production line.

Thus, between 2026 and 2035, the estimated investment in the construction of corn ethanol plants is around R$ 17.8 billion, and the operational costs are R$ 274.6 billion.

1.4. Summary of ethanol investments

Table 2 summarize ethanol investments between 2026 and 2035, to brownfield and greenfield plants.

Table 2 - CAPEX and OPEX Estimates for Ethanol Between 2026 and 2035

ETHANOL	*Added production capacity. (million liters)*	*CAPEX* (R$ Billion)	*OPEX* (R$ Billion)
1G sugarcane ethanol	2,554.8	10.2	82.2
Sugarcane field formation	n/a	25.7	609.3
2G sugarcane ethanol	738.0	12.5	8.3
Corn ethanol	6,697.8	17.8	274.6
TOTAL	**9,990.6**	**66.2**	**974.3**

Source: EPE based on IBGE (2025), FGV (2025), LNBR (2022), NOVACANA (2024a) and RAÍZEN (2024a, 2024b)

Chart 1 presents the participation and values of industrial and sugarcane field formation CAPEX for ethanol between 2026 and 2035.

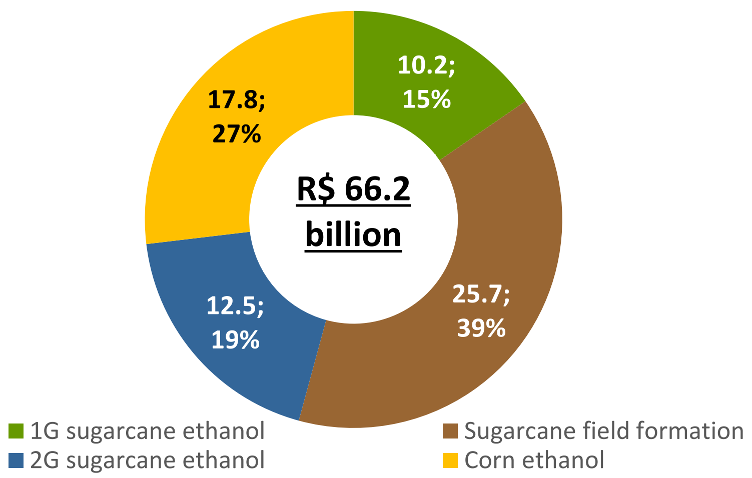

Chart 1 – Ethanol CAPEX between 2026 and 2035 (R$ billion; %)

Source: EPE based on IBGE (2025), FGV (2025), LNBR (2022), NOVACANA (2025a) and RAÍZEN (2024a, 2024b)

If investments related to sugar production were added, the industrial values related to 1G sugarcane would be R$ 17.4 billion and the values for the establishment of the sugarcane field would be R$ 48.7 billion. Operational costs would be R$ 1.3 trillion at the end of the period.

2. Biodiesel

Biodiesel consumption is determined by its percentage in the projected demand volumes for type B diesel, which reaches 82.5 billion liters in 2035 (EPE, 2025a). Furthermore, the use of biodiesel in the water transport sector is becoming increasingly common, serving as an alternative for the decarbonization of this transport segment.

The percentage of the mandatory biodiesel content in effect between January and July 2025 was 14%, increasing to 15% from August 1st, according to CNPE Resolution No. 8/2025 (CNPE, 2025x). According to the Future Fuel Law, sanctioned by President Lula on October 8, 2024, the CNPE (National Energy Policy Council) can alter the percentage of biodiesel added between the limits of 13% and 25% at any time, for justified reasons of public interest (BRASIL, 2024). The PDE2035 projections use the percentual of 15%, according to the law.

In 2024, ANP exceptionally authorized the commercialization of the marine fuel oil (bunker oil), by Petrobras, with a blend up to 24% biodiesel by volume. Some companies are already presenting pilot projects that add up to 30% biodiesel to marine diesel, while others have operating with pure biodiesel (B100) in their vessels. Hence, the additional consumption of biodiesel can be up to 1.1 billion liters to add to bunker in 2035 (EPE, 2025a).

Investments calculations were based on data from ANP about the expansion and construction of new biodiesel units. The two expansion requests total 770 million liters, and the construction of three new units adds up to 900 million liters (ANP, 2025a), totalizing 1.7 billion liters. Then, an average CAPEX of R$ 0.81/liter per year was applied to new units and R$ 0.28/liter per year to expansions (BIODIESELBR, 2025; IBGE, 2025), representing investments of R$ 946 million from 2026 to 2035.

With a utilization factor (UF) of 92% due to planned shutdowns and adverse events, the effective biodiesel production capacity would be 16.2 billion liters by the end of the period. This represents an idle capacity of 24% when compared to the production of 12.4 billion liters, and 14% when adding biodiesel for bunker fuel export (EPE, 2025a).

The projected investment in processing capacity is based on the implementation of 10 new units by 2035, each with a capacity of 4,000 tons/day, equivalent to a total of 14.6 million tons per year, at an estimated cost of R$ 8.6 billion. Soybeans will remain the main feedstock used in biodiesel production, with a share of about 70% of the feedstock total demand, based on historical data (ABIOVE, 2025).

For the analysis of additional crushing capacity required, the complementary demand for soybean oil for the production of diesel cycle biofuels is considered, which includes: the mandatory percentage of biodiesel, its use in addition to bunker fuel, green diesel, co-processed diesel and SAF (in the HEFA route), (EPE, 2025a), in addition to the soybean crushing capacity of 72.3 million tons per year in December 2024 (ABIOVE, 2025). The investments needed for processing other types of oilseeds were not considered, although there are public policies underway for greater diversification of inputs, valuing regional biomasses[7].

The OPEX for biodiesel production was calculated based on the average sales prices of volumes traded between producers and distributors in 2024 (ANP, 2025b) and information from industry experts (UBRABIO, 2019; FGV, 2025), resulting in a factor of R$ 0,78/liter. The operational costs between 2025 and 2034 are estimated at R$ 96.9 billion. Biodiesel production units have an intermittent profile throughout the year, and since January 2022, the sector has a commercialization system based on free negotiations between producers and distributors (CNPE, 2020). Therefore, this cost indicator has a wide range.

[7] Fatty materials (mixture that arrives at the plants without specific characterization) and beef tallow account for 15% and 7% of raw materials in biodiesel production, respectively (still significantly below soybean oil).

Box	Sensitivity analysis for biodiesel

This item seeks to verify the need for additional investments in installed capacity for biodiesel production and vegetable oil extraction, considering the Future Fuel Law, which proposes a gradual increase in its blending percentage with B diesel, when compared to that estimated for the PDE 2035 reference scenario (B15).

Seeking possible alternatives to the national supply of diesel fuels, the PDE 2035 (EPE, 2025a) conducts two sensitivity analyses in which the percentage of biodiesel in B diesel reaches 20% blend (B20) in 2030, remaining at that level until 2035, and another increasing 1% per year until reaching 25% (B25) in 2035. This results in a demand for biofuel of 16.6 billion liters and 20.6 billion liters, respectively, in 2035.

In addition to the increased percentage of the blend, the demand for biodiesel for waterborne transport (river and bunker fuels) could reach 1.5 billion liters in 2035, which would lead to a total demand of 18 billion liters and 22.2 billion liters, respectively, in each scenario, in that same year.

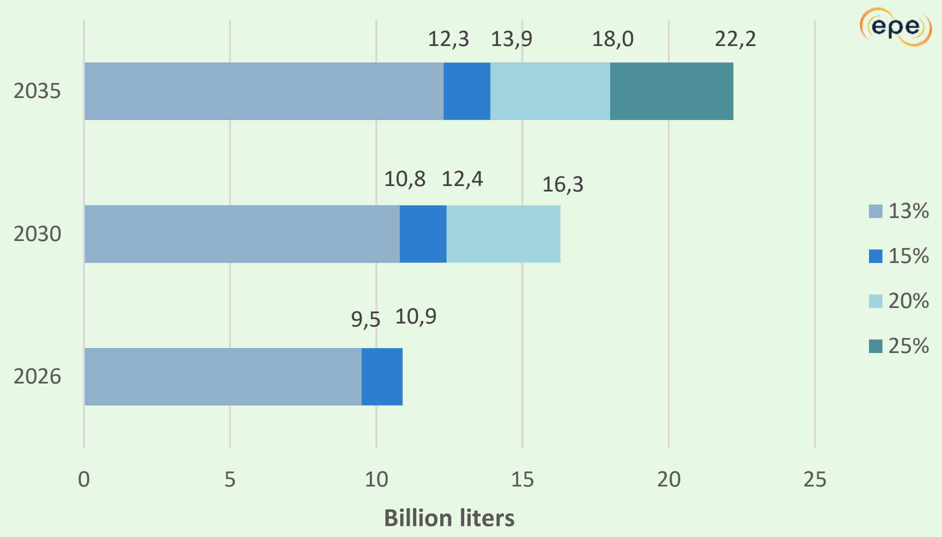

Chart 2 - Trajectories for biodiesel demand.

Source: EPE

In turn, effective production capacity could reach 16.3 billion liters in 2035, according to ANP's requests for expansion and construction authorization in May 2025. Thus, under the given infrastructure and projected demand conditions, the country would present a deficit of 1.8 billion liters and 6 billion liters in production capacity, in the B20 and B25 sensitivities, and an additional need of between 17.5 million and 27.7 million tons in soybean crushing capacity, when compared to the reference scenario.

These scenarios would require additional investments in biodiesel production capacity of R$1.5 billion and R$4.8 billion, respectively, as well as in processing capacity of R$10.3 billion and R$16.3 billion, distributed between 2028 and 2035.

3. Biomethane

Biomethane production projects can apply to receive the benefits from REIDI – *Regime Especial de Incentivos para o Desenvolvimento da Infraestrutura* (Special Incentive Scheme for Infrastructure Development) since 2022. This encourages investments in production plants with the promise of cost reduction through the suspension of certain federal taxes. Thus, the number of biomethane production plants authorized to operate by the ANP doubled, going from six units in July 2024 to 12 in July 2025.

The Future Fuel Law (BRASIL, 2024) create the National Program for Decarbonizing Natural Gas Producers and Importers and Incentivizing Biomethane, in addition to establishing the mandatory purchase of biomethane (or equivalent certificates), with increasing percentages over time, by natural gas producers and importers, starting in 2026. Furthermore, there is the Gas for Employment Program (MME, 2023), promoted by the Federal Government, aiming at better utilization of natural gas produced in the country, which could also have a positive impact on biomethane.

Therefore, the convergence of Future Fuel and Gas for Employment is evident, with biomethane becoming a fundamental element in expanding the supply of gas in the grid, while reducing its carbon footprint. The use of biomethane as fuel in the transport sector, especially for supplying heavy vehicles, also combines the legacy of RenovaBio. With four certified producers in 2024, biomethane was the biofuel with the highest energy-environmental efficiency rating. (EPE, 2025a).

The number of biomethane projects has increased in the last five years, considering the requests for construction and expansion of plants registered with the ANP (2025a). In 2024, 23 projects were registered, linked to both the sugar-ethanol sector and the municipal solid waste (MSW)[8]. In 2025, 36 new projects were registered, while one plant was seeking expansion. Of the total registered in 2025, 25 units are projected to open between 2026 and 2035, with 4 originating from the sugar-ethanol sector, two located in the Central-West region and the others in the Southeast and Northeast regions.

Projects lacking information received specific investment factors, based on information from applications for inclusion in the REIDI program. The 25 projects planned for 2025 add up to 770,000 Nm^3/day of production capacity and a CAPEX of R$ 3.0 billion (ANP, 2025a; BNDES, 2020; MME, 2022), resulting in an investment factor of R$ 3,734.9 per Nm^3/day. The OPEX over the period is R$ 1.1 billion.

The resources needed to develop the biomethane potential from sugarcane waste can be evaluated based on the same investment premise. Based on the PDE 2035 (EPE, 2025a), the potential for biogas production through anaerobic digestion of vinasse and filter cake[9] in 2035, the reference scenario, is 6.4 billion Nm^3 of biogas, equivalent to 3.5 billion Nm^3 of biomethane[10]. Thus, the estimated CAPEX for installing the capacity necessary to achieve this biomethane supply would be around R$ 35 billion. That biomethane production would take place in areas adjacent to the sugarcane plants, utilizing part of the existing facilities.

Operating and maintenance costs were calculated based on data provided by BNDES (2020a; 2020b), referring to the profile of a biogas production plant with a capacity of 33 million Nm^3/year and 18.2 million Nm^3/year of biomethane. Considering the sector's production potential, an accumulated expenditure (OPEX) of approximately R$ 5.0 billion is obtained for biomethane between 2026 and 2035, based on a factor of R$ 0.150/Nm^3.

4. Sustainable Aviation Fuel and Green Diesel

Considering that the production of sustainable aviation fuel (SAF) and green diesel occurs in a combined manner in the plants identified in this study, the investments for these fuels were not separated and are indicated in aggregate form in item 4.1.

[8] In recent years, more municipal plans for urban solid waste and sanitation have been structured, and in 2022 the National Solid Waste Plan document was launched (MMA, 2022). This document already elucidates the potential for linking waste and biomethane production.
[9] If the collection of 20% of straw and tops were made sustainable, it would add 5.4 billion Nm^3/year of biogas to the sector's potential, representing 3 billion Nm^3 of biomethane, totaling 11.8 billion Nm^3/year of biogas and 6.5 billion Nm^3 of biomethane in 2035, with a total investment of R$ 52 billion.
[10] To simplify, all biogas production will be purified to generate biomethane, meaning there will be no allocation for electricity generation from this input.

4.1. Sustainable Aviation Fuels

Similarly to the case of biomethane, the Future Fuels Law also aims to promote the expansion of domestic SAF production. To achieve this, one of its guidelines is the National Sustainable Aviation Fuel Program, ProBioQAV, which mandates airlines to reduce greenhouse gas emissions on domestic flights through the utilization of SAF. The mandatory reduction period begins in 2027, with an annual reduction target of 1%, which will gradually increase until it reaches 10% in 2037.

On the international stage, the International Civil Aviation Organization (ICAO) has set carbon-neutral growth targets starting in 2020 and aims for net-zero emissions by 2050, through CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation), a market-based mechanism designed to support the process of emission reductions in the sector.

To estimate investments for the next ten years, a survey was conducted of commercial projects already announced by companies in the sector. Figure 1 identifies the projects with the highest probability of implementation, which utilize HEFA and ATJ routes, and which have joint production of SAF and Green Diesel, in addition to the co-processing of vegetable oils.

Petrobras has included several SAF and HVO processing plants in its 2025-2029 Strategic Plan. The RPBC refinery project in Cubatão (SP) and the Boaventura complex project in Itaboraí (RJ) will use the HEFA route: the first is scheduled to begin operations in 2029 and the second in 2032. In addition, the REPLAN refinery in Paulínia (SP) will produce SAF via the ATJ route starting in 2033. In its portfolio, Petrobras also plans to introduce co-processed SAF to the market, starting in 2025 at the REGAP, REVAP, and REDUC refineries. In 2027, REPLAN would also begin producing by this process (PETROBRAS, 2025a; 2025b).

Two other companies have projects underway to produce SAF in the country: Riograndense (RS) announced an investment in a HEFA route project, with operations scheduled to begin in 2028. Meanwhile, an ACELEN plant, operating on the HEFA route, is expected to start operations in 2027 in Bahia (ACELEN, 2025).

The total production capacity from these projects is 4.5 billion liters/year, with 75% going to SAF and 25% to green diesel in all plants, except at Replan, where the percentage for SAF reaches 90%. Estimated investments will be around R$ 27.9 billion, including the HEFA and ATJ routes; it is not possible to separate the estimated CAPEX from announced projects on these routes. Due to a lack of information, it was not possible to estimate the operational costs related to the production of these biofuels.

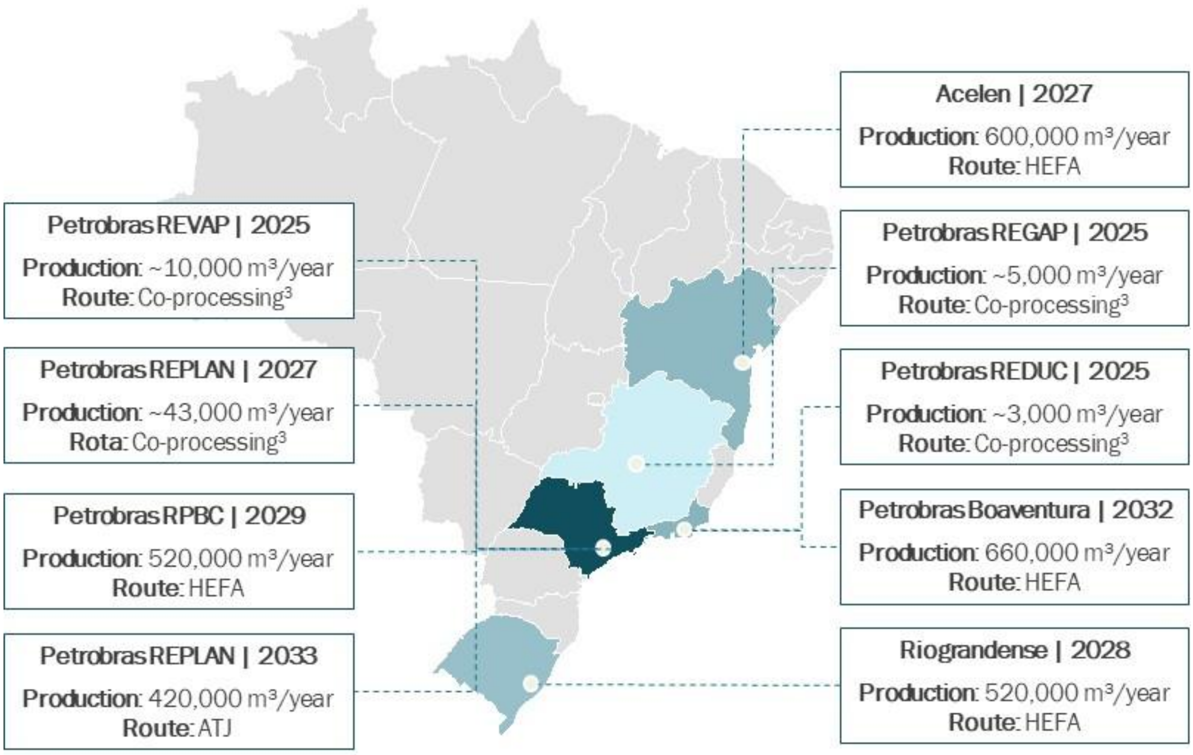

Figure 1 – Sustainable Aviation Fuel (SAF) Projects
Source: EPE based on Acelen (2025) and Petrobras (2025a; 2025b).

4.2. Green Diesel

Green diesel, a renewable fuel formed by a mixture of hydrocarbons with a chemical composition similar to fossil fuels, stands out as a drop-in alternative for use in diesel cycle engines. It can be produced from soybean, palm, and macauba oils, for example.

ANP, through Resolution 842/2021 (ANP, 2021), regulated the specifications and obligations necessary for quality control of green diesel, so that it can be marketed in Brazil.

Future Fuel Law also includes a specific program to stimulate green diesel, expanding its public policies. The National Green Diesel Program (PNDV) aims to encourage production from renewable biomass, establishing an annual minimum mandatory share of up to 3% in diesel fuel. The CNPE will be responsible for determining the minimum annual share of biofuel. A voluntary addition exceeding 3% is also permitted, provided it is reported to the ANP.

With the PNDV and the announced projects, investments in green diesel should increase in the coming years. As an alternative to diesel that requires no modifications for its use, the demand for this biofuel should increase in the future, contributing to the high share of biofuels in the country's transportation matrix.

Information regarding green diesel is included in subitem 4.1, considering that, in the announced projects, the production of SAF will occur in a consortium with that of HVO.

5. Innovations and future perspectives

5.1. Co-processing of vegetable oil for the sector

Another process related to the Diesel cycle is the production of co-processed diesel from vegetable oil with mineral diesel. This process, carried out in the refinery, produces a fuel with renewable content, therefore with a low carbon footprint. Petrobras, through the Biorefining program, which is part of its strategic planning, aims to commercialize co-processed diesel, totaling a production capacity of 60,000 m^3/year, from the REPLAN, REDUC, REVAP and REGAP units[11] (PETROBRAS, 2025b).

5.2. Carbon Capture and Geological Storage of Biogenic Carbon (Bio-CCS)

Among the solutions that could be developed from Future Fuel Law and other programs such as RenovaBio, there is also bio-CCS or BECCS (Bioenergy with Carbon Capture and Storage). Bio-CCS refers to the capture and geological storage of carbon dioxide derived from biomass. Because of this characteristic, the development of bio-CCS is proving to be a vital strategy for mitigating climate change, thus, it is being progressively promoted by scholars and decision-makers.

The main opportunity for carbon capture in ethanol production occurs in ethanol plants. The potential for carbon capture in alcohol fermentation could reach 35 million tons of CO_2/year by 2035 (EPE, 2025a). Bio-CCS can significantly reduce the carbon intensity in ethanol, making it competitive and strategic, stimulating investment in it.

The projected investment for a Bio-CCS plant, with a soil injection capacity of 423,000 tons per year, for 30 years, is in the order of R$ 500 million, as a project announced by FS Bioenergia (NOVACANA, 2025 e FS BIOENERGIA, 2025), for which approximately R$ 400 million has already been invested and a further R$ 100 million are planned for the next 10 years. From this project, the first of its kind for Bio-CCS in Brazil, it is expected that, with progress in the learning curve, the costs of subsequent projects will be lower. The regulatory security offered by Future Fuel Law can also contribute to unlocking the CCS supply chain in the country and favor the viability of future projects.

6. Consolidation of CAPEX and OPEX Estimates

The Future Fuel Law, along with resolutions from the ANP (National Agency of Petroleum, Natural Gas and Biofuels) and CNPE (National Council for Energy Policy), is already impacting biofuel production in Brazil, encouraging local generation and increased use for the country's decarbonization. In the coming years, it is estimated that investments in the sector will increase even further.

Thus, based on PDE 2035 (EPE, 2025a), the investments (CAPEX) and operational costs (OPEX) for ethanol, biodiesel, biomethane, SAF, green diesel, co-processing of vegetable oils, and bio-CCS are estimated to be approximately R$ 107 billion and R$ 1,072.3 billion, respectively.

[11] Presidente Getúlio Vargas Refinery (REPAR), 29 million barrels per day (Operating); Presidente Bernardes Refinery, in Cubatão (RPBC), 9 million barrels per day (Operating); Paulínia Refinery (REPLAN), 6 million barrels per day; Duque de Caxias Refinery (REDUC), 6 million barrels per day; Gabriel Passos Refinery (REGAP), 13 million barrels per day.

Table 3 - CAPEX and OPEX estimates for biofuels between 2026 and 2035

	CAPEX (R$ Billion)	OPEX (R$ Billion)
Ethanol	66.2	974.3
Biodiesel[1]	9.5	96.9
Biomethane[2]	3.0	1.1
SAF / Green Diesel	27.9	n/e
Bio-CCS	0.1	n/e
TOTAL	**106.7**	**1,072.3**

Note 1: CAPEX includes soybean crushing, and OPEX includes only biodiesel production.
Note 2: For biomethane, only projects under construction in the sugarcane energy sector are considered.
Source: EPE

Chart 3 presents the share and CAPEX values for biofuels, including the formation of sugarcane fields for ethanol production, between 2026 and 2035.

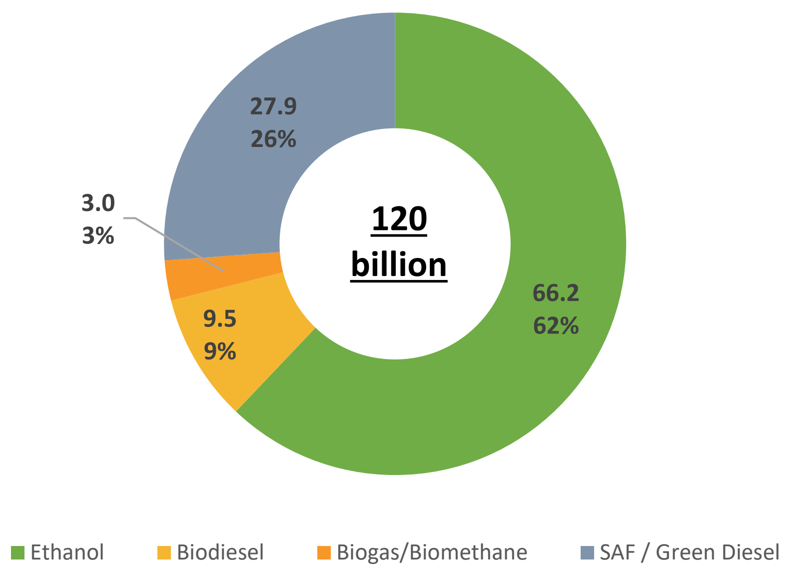

Chart 3 - CAPEX for biofuels between 2026 e 2035 (billion R$ and %)
Source: EPE

Considering investments related to sugar production (1st generation sugarcane), the total *CAPEX* for biofuels is R$ 137 billion and the OPEX R$ 1.688 billion.

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Annex

2026-2035 Results

Table 4 presents the CAPEX and OPEX for the 2025-2035 period, deflated to December 2024, to enable comparison with the investment, results outlined in the PDE 2035.

Table 4 - CAPEX and OPEX Estimates for Biofuels between 2025 and 2036

	CAPEX (R$ Billions)	*OPEX* (R$ Billions)
Ethanol	72.0	1,054.9
1G Sugarcane	10.9	89.4
Sugarcane Field Formation	28.0	663.1
2G Sugarcane	15.3	8.4
Corn	17.8	294.0
Biodiesel	9.9	104.7
Biogas/Biomethane	5.4	1.12
SAF / Green Diesel	27.9	n/e
Bio-CCS	0.1	n/e
TOTAL	115.2	1,160.8

Source: EPE

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