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Brazil

Drivers and Policies

Brazil has a long history with bioethanol dating back to the 1970s. Initial bioethanol efforts were associated with energy security issues related to the first oil crisis. As a result, the country has stimulated the production of ethanol and, since 2003, the use of hydrous ethanol in dedicated or fuel-flexible vehicles (FFVs). Since August 1, 2025, the mandatory blend level of ethanol is 30% in regular gasoline and 25% in premium gasoline (CNPE [Brazilian Energy Policy Council] 2025b). The limits range is between 22% and 35%, and the increase in ethanol limits above 30% must be in accordance with technical viability (Brazil 2024b). The Fuels of the Future Law (14993/2024), enacted by Brazilian President Luís Inácio Lula da Silva on October 9, 2024, allows for new biofuels mandatory blends for ethanol and biodiesel only after CNPE approval. Since 2005, Brazil has also imposed mandatory levels of biodiesel in diesel fuel, according to the Brazilian Program of Production and Use of Biodiesel (PNPB). The environmental agenda has supported the agricultural sector[1] and, in particular, the biofuels value chain, especially ethanol and biodiesel, and now biogas and advanced fuels, including sustainable aviation fuels (SAF) and hydrotreated vegetable oil (HVO). Note that Brazilian federal states apply differentiated consumption tax rates for gasoline (in general, higher rates) and hydrous ethanol (in a majority of the states, lower rates). Another public policy that promotes the production and consumption of biofuels is the National Biofuel Policy, known as RenovaBio (Brazil 2017), which has been operational since March 2020.

The official document driving Brazil's national policy framework for renewable energy is its Nationally Determined Contribution (NDC) (UNFCCC 2022) toward achieving the objective of the United Nations framework convention on climate change.

Under the fourth revision of its NDC concerning the Paris Agreement, Brazil committed to reducing its domestic greenhouse gas (GHG) emissions to between 59% and 67% below 2005 levels by 2035, which is consistent with an emission level of 1.05 to 0.85 gigatons CO_2 equivalent ($GtCO_2e$). The new commitment increases the emission reduction target set in the first NDC, consolidating a trajectory of increased ambition, as determined by the Paris Agreement. Between 2025 and 2030, the absolute emission reduction was 9% and, for the period from 2030 to 2035, the new NDC increases its goal to a reduction ranging from 13% to 29% (MMA 2024). Brazil is also committing to the long-term objective of becoming carbon neutral by 2050. Such measures continue to include all sectors of the economy, such as agriculture and energy, with transport in the latter sector. Brazil also intends to adopt further measures consistent and aligned with the 1.5°C temperature goal, especially in the energy sector (IEA 2023).[2]

Brazilian Policy Framework

The main policy instruments behind the evolutions that will subsidize the future growth of biofuels in Brazil include the following:

- The *Brazilian Alcohol Program (PROALCOOL)*, launched in the 1970s, promoted ethanol blending in gasoline and the use of hydrous ethanol (E100). After losing competitiveness in the 1990s, the program regained momentum with the widespread adoption of flex-fuel vehicles from the early 2000s (EPE 2023). Since then, PROALCOOL has strengthened Brazil's energy security, delivering cumulative savings equivalent to over 2.5 billion barrels of oil and significantly reducing gasoline imports (EPE, 2025g).
- The *Brazilian Program for Production and Use of Biodiesel (PNPB)* was created by Law No. 11,097/2005, on January 13, 2005 (Brazil 2005), to further stimulate energy, economic, and social objectives and foster feedstock production among small farmers.
- *Flex fuel technology* was established in 2003 to enable consumers to choose between E30 and E100.

[1] The agriculture sector represents 23.1% of Brazil's gross domestic product (GDP) in 2024 (CEPEA 2026).

[2] Additional measures include the following: Expanding the use of renewable energy sources other than hydropower in the total energy mix; Expanding the use of non-fossil fuel energy sources domestically; Achieving 10% efficiency gains in the electricity sector by 2030; In addition, in the transportation sector, Brazil intends to further promote efficiency measures and improve infrastructure for transport and public transportation in urban areas.

- *Biofuel addition on petroleum products* — Since August 1, 2025, all automotive gasoline sold at retail establishments contains, by mandate, a blend of 30% anhydrous ethanol, or E30, according to CNPE (2025b).[3][4]
- *National Biofuel Policy (RenovaBio)* (Law 13,576/2017) (Brazil 2017) — A state policy recognizing the strategic role of all types of biofuels in the national energy matrix, both for energy security and for the mitigation of GHG emissions.
- *Law 14,993/2024* (Brazil 2024b), sanctioned by Brazilian President Luís Inácio Lula da Silva on October 9, 2024. This law, based on discussions under the Fuels of the Future Program, aims to further increase the use of sustainable and low-carbon fuels to decarbonize the Brazilian transport energy matrix. The law establishes new regulatory instruments, including the biomethane guarantee origin certificate (CGOB).[5]
- *Federal and state tax differentiation* between renewables and fossil fuels[6] establishes credit lines to support rural sugarcane producers and their cooperatives to select business plans and promote projects that consider the development, production, and commercialization of new industrial technologies for sugarcane biomass (E2G [second-generation ethanol], gasification, and more).[7]
- *Law 14,948/2024* (Brazil 2024c) establishes the regulatory framework to produce low-carbon hydrogen.
- *Consolidation of the National Hydrogen Program (PNH2)* — The Brazilian government organized and published a strategy for developing the country's hydrogen economy (Brazil 2023b), which would harmonize with other sources of its energy matrix.[8]
- *Brazil is a member* in the International Maritime Organization (IMO) and International Civil Aviation (ICAO)/Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).[9]
- *Brazil has a pledged commitment to efficiency programs,* such as INOVAR-Auto, INOVA-E, and other governmental initiatives dedicated to improving efficiency and innovation.
- *The Federal government approved* the framework of the Rota 2030 program (Law 13,755/2018) in December 2018 to foster efficiency and safety in vehicles produced in Brazil (Brazil 2018).
- Provisional Measure 1,205 (December 30, 2023), enacted June 27, 2024, the *Green Mobility and Innovation Program (MOVER)*, offers a broader approach for mobility than Rota 2030. MOVER's goals include a well-to-wheel perspective, which will measure energetic efficiency and an objective for car manufacturers to use at least 50% recyclable components to achieve tax differentiation. After 2027, vehicles commercialized in Brazil will be evaluated using a "cradle to grave" life-cycle model. MOVER also includes a financial bonus for automakers that consider some sustainable indicators.

[3] Premium gasoline contains 25% anhydrous ethanol and accounts for a very small fraction of fuel sales.

[4] The government also mandated that biodiesel be added to fossil diesel. According to the chronogram stipulated by CNPE, there was a gradual increase in the mandatory blend of biodiesel in diesel fuel. Since August 2025, the established mix was set at 15%. Blend definition for ethanol and biodiesel is in accordance with CNPE Resolutions (CNPE 2025a and CNPE 2025b).

[5] GCOB incentivizes, through mandatory blending, the increased use of biomethane in the natural gas market, aiming to reach the maximum blending level of 10% over a 10 year-period, alongside the ProBioQAV program, designed to promote the production and use of SAF in Brazil. In addition, the law established a new limit of ethanol blend in gasoline from the current 30% to 35% and a chronogram to increase biodiesel blend in diesel up to 25%, subject to technical feasibility assessments and CNPE authorization.

[6] Regarding federal taxes, gasoline and ethanol are subject to the following levies: Contribution to the Social Integration Program and the Civil Service Asset Formation Program (PIS/Pasep), Contribution to Social Security Financing (Cofins), and Contribution for Intervention in the Economic Domain (Cide). The current PIS/Pasep and Cofins rates are R$ 892.50/m³ for gasoline A (pure gasoline, without ethanol). For gasoline and anhydrous ethanol, a monophase system has been in effect since May 2025, with unified PIS/Pasep and Cofins rates of R$ 192.20/m³ for both hydrous and anhydrous ethanol. The current Cide rate is R$ 100/m³ for gasoline, while for both anhydrous and hydrous ethanol, it has been set at zero since 2004. At the state level, ICMS is levied under a single-phase system with a uniform national rate of R$ 1.47/l for gasoline and anhydrous ethanol. For hydrous ethanol, ICMS is applied through ad valorem rates that vary by state, ranging from 11.33% to 22% in 2024 (EPE 2025c).

[7] CPNE did all of this through CNPE Resolution number 07, April 20, 2021.

[8] The Triennial Work Plan of Brazil's National Hydrogen Program (covering the period 2023–2025) was approved in December 2023 by the PNH2 Governing Committee and establishes the main priorities for the development of the low-carbon hydrogen market in Brazil.

[9] CORSIA is a global market-based measure designed to offset international aviation CO_2 emissions in order to stabilize the levels of such emissions (ICAO 2023).

- *Decree number 11,902* (January 30, 2024), which restructures the Social Biofuel Seal (Brazil 2024a) and creates significant investments. Starting in 2024 with Brazilian real (BRL) 740 million, in 2026, BRL 1.6 billion will be allocated to strengthen biodiesel production and support family farming.[10] This policy aims to strengthen family farming, especially in the North, Northeast, and semi-arid regions of Brazil (Brazil 2024a).
- *Brazilian Sustainable Taxonomy* — A classification system that defines clearly, objectively, and scientifically activities, assets, and/or project categories that contribute to climate, environmental, and/or social objectives through specific criteria (Brazil 2023a).
- PPI Program — Created by Law No. 13,334 of 2016, the Investment Partnerships Program (PPI) aims to modernize and increase the logistical efficiency of Brazil, covering all modes of transport (air, road, rail, waterway, and pipeline).
- Energy Efficiency Programs (PEE) (linked to Law No. 9,991/2000) — These programs require public electricity distribution concessionaires and permit holders to annually invest in R&D of the electricity sector and in energy efficiency programs for end use.
- Brazilian Emissions Trading System **(**Sistema Brasileiro de Comércio de Emissões [SBCE], instituted by Law No. 15,042, December 11, 2024) — The SBCE regulates the carbon market in Brazil, establishing an emissions trading system to reduce greenhouse gases and stimulate low-carbon technological innovations.
- Energy Transition Acceleration Program [Paten], instituted by Law No. 15,103, January 22, 2025) — Paten facilitates access to credit for sustainable projects, promoting clean technologies and boosting Brazil's renewable energy matrix.
- PLANTE National Energy Transition Plan — Part of the PLANTE is a long-term action plan to achieve the goals of the National Energy Transition Policy, aiming for a more sustainable energy matrix and neutrality in greenhouse gas emissions.
- National Integrated Plan for Natural Gas and Biomethane Infrastructure, instituted by Decree 12,153/2024. This plan aims to integrate and develop natural gas and biomethane infrastructure in Brazil, promoting a more sustainable energy matrix.

Advanced Motor Fuels Statistics

Transport

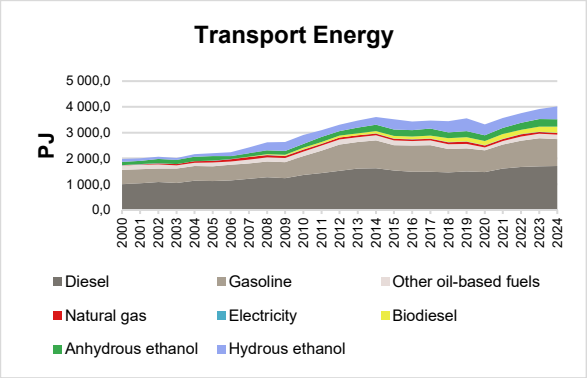
Figures 1 and 2 provide an overview of the energy used for transport in Brazil, categorized by different fuels/energy carriers. Note that Brazilian statistics define biogasoline (E30, per CNPE 2025b[11]) as anhydrous bioethanol blended with gasoline and that hydrous ethanol is used in dedicated or FFVs. Bioethanol represented 42.8% (by energy) of combined gasoline and ethanol use in 2024 in Otto cycle engines.

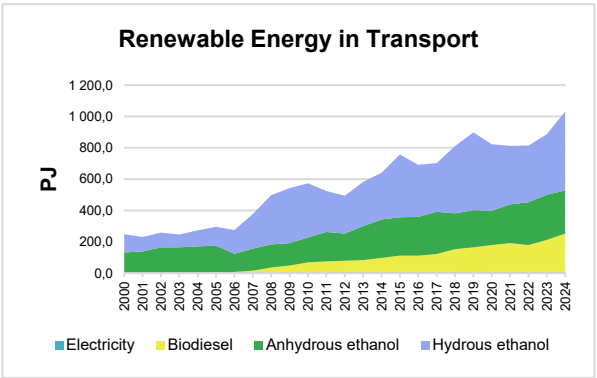
Transport fuel consumption in Brazil has stabilized over the past five years, and the use of biofuels has grown steadily over the past 20 years. In particular, the use of hydrous ethanol in FFVs has substantially increased. The consumption of anhydrous ethanol has grown with gasoline consumption, as evidenced in Figure 1. Biodiesel was introduced in 2005 and has also steadily grown as a substitute for fossil diesel consumption, mainly for heavy-duty transport. On average, biodiesel represented 12.5% (by energy) of diesel consumption in 2024, as Figure 2 shows.

Also as shown in Figure 1, electricity represents a share of 0.2% of total transport energy use in 2024, maintaining the share of previous years. This is mostly in rail — Brazil has just started to register electricity used in road vehicles. Table 1 displays the growth of the Brazilian fleet from 2014 to 2024.

[10] Compared to 2022, the number of registered families is estimated to grow by 120% this year. The Social Biofuel Seal is a fundamental instrument that has already guaranteed the participation of more than 54,000 family farmers in the biodiesel production chain (Brazil 2024e).

[11] According to CNPE 2025b, the anhydrous ethanol content in C-type gasoline is 30% by volume for regular C gasoline and 25% for premium C gasoline.





Figures 1 and 2. Evolution of Transport Fuels in Brazil, 2000–2024 (Source: EPE 2025a).

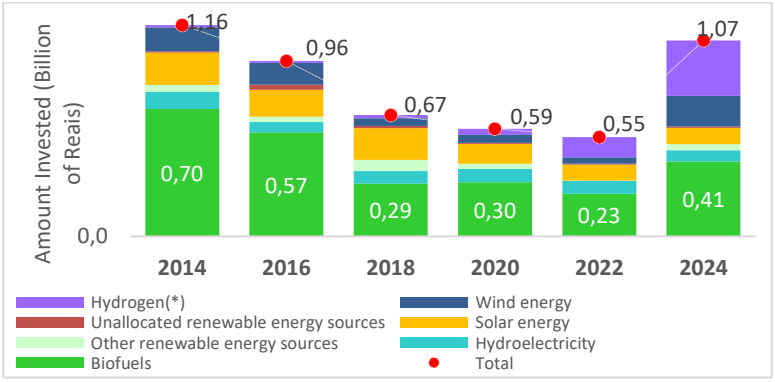
Table 1. Growth of the Brazilian Fleet, 2014–2024

Stock of Vehicles	Unit	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Motor spirit cars	10^6	0.8	0.8	0.7	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.2
Diesel oil cars	10^6	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.7	2.8
Electricity cars	10^6	0.0	0.000	0.000	0.000	0.000	0.001	0.001	0.004	0.011	0.028	0.083
Other type of cars (hybrid)	10^6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3
Flex fuel cars	10^6	21.6	23.4	24.7	26.2	27.8	29.5	30.5	30.4	30.6	30.9	31.3

Source: EPE 2025e.

Research and Demonstration Focus

Brazil has several government-backed mechanisms providing support for biofuels research, development, and demonstration (RD&D) plants. Public and publicly oriented support totaled more than BRL 410 million (USD 75 million) in 2024,[12] which includes support in the form of loans, equity participation, and grants and is also available via the PAISS programme for ethanol and other biofuel production (including cellulosic ethanol) and drop-in biofuels (including aviation fuels). Note that, within the scope of the Fuels of the Future (Law 14,993/2024, Brazil 2024b), the government created and launched lines of financing and incentive mechanisms for biofuels. Furthermore, Law 14,948/2024 (Brazil 2024c) established the National Low Carbon Hydrogen Policy, having as one of its principles the promotion of R&D for the use of low carbon hydrogen. Figure 3 illustrates the annual distribution of public investments in renewable energy, including research, development, and innovation (RD&I), by source. The figure shows that the last four years, under President Lula's government, investments in innovation increased to roughly BRL 1,0 billion in 2024.



*Hydrogen investments may include non-renewable hydrogen research.

Figure 3. Public Investments in Renewable Energy RD&I, 2014–2024 (Source: EPE 2025f).

[12] The average 2024 USD to BRL exchange rate was 5.39 (BCB 2026).

Figure 4 displays the total amount of public financing specific to the sugar-energy sector. In 2024, total disbursements of the Brazilian Bank for Economic and Social Development (BNDES) in the agricultural area for the cultivation of sugarcane totaled USD 110 million (or roughly BRL 600 million) (BNDES 2026).[13]

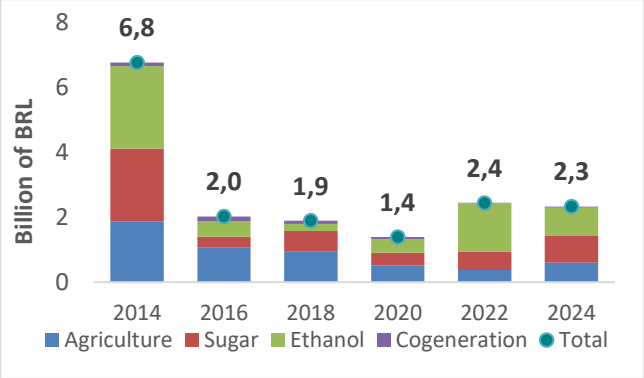


Figure 4. Public Funding for Sugar-energy Sector (Source: EPE, based on BNDES 2026).

Outlook

Figure 5 consolidates the demand for fuel ethanol and other (non-energy) uses, which grows at an annual rate of 3.2%, in a 10-year period, reaching an estimated 50.5 billion liters in 2035, with the major increase coming from the demand for hydrous ethanol fuel. By 2035, the Brazilian fleet should achieve 44.0 million vehicles, according to the EPE (EPE 2025b).

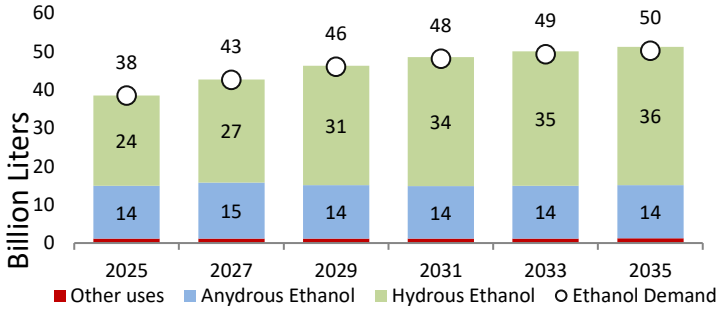


Figure 5. Forecast of Total Ethanol Demand, 2025–2035 (Source: EPE 2025b).

When added to imports — 0.5 billion liters — the total value of ethanol (split into sugarcane and corn) amounts to 51.0 billion liters. Figure 6 shows the forecast for total ethanol supply.

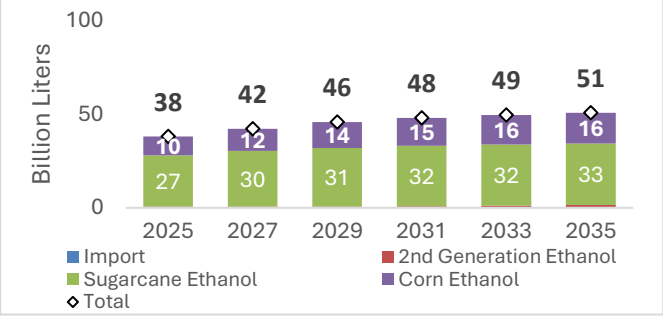


Figure 6. Forecast of Total Ethanol Supply, 2026–2035 (Source: EPE 2025b).

[13] Average 2024 USD to BRL exchange rate (BCB 2026).

The biodiesel demand projections of this study — obtained based on the forecast of the regional consumption of oil diesel type-B (EPE 2025e) and the evolution of the biodiesel blend (which follows the CNPE-stipulated chronogram according to Law No. 13,263/2016_— will maintain 15% levels from 2025 onwards (Figure 7). Although there is no blend obligation for the maritime sector, voluntary tests using a 24% blend on maritime fuels have been completed. EPE estimates around 1.5 billion liters in 2035.

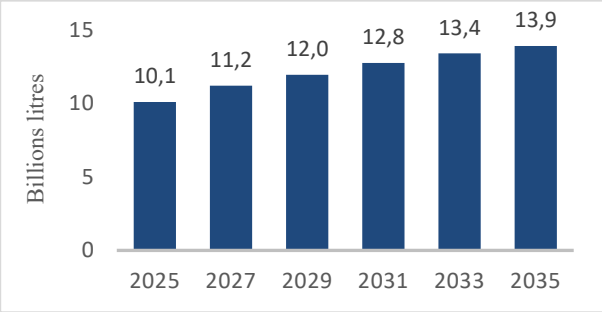


Figure 7. Forecast of Total Biodiesel Demand 2025–2035 (Source: Based on EPE 2025e)

Projections for ethanol and sugar production presented in this study indicate a high amount of residues from this sector that can be used for biogas production. The methodology applied to this item considered both the vinasse and filter cake as part of the biogas production, which will be destined for biodigestion. In this case, the technical potential of biogas from residual sugarcane biomass through monodigestion reaches 6.4 billion Nm³ in 2035, representing 3.6 billion Nm³ of biomethane (Figure 8).

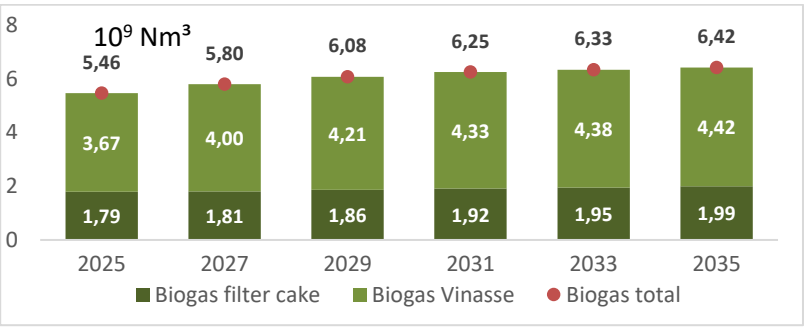


Figure 8. Biogas Potential with Sugarcane Residual Biomass, 2025–2035 (Source: EPE 2025b).

Recent Developments

As of 2024, Raízen consolidated the scaleup of E2G, operating the Bonfim unit in Guariba (São Paulo), the world's largest E2G facility (82 million liters/year) (Raízen 2024b). The Piracicaba unit was reverted to pilot status (Raizen 2024a). In 2025, BNDES approved BRL 1 billion in financing for a new E2G plant in Andradina (São Paulo) (BNDES 2025a). Despite these advances, financial constraints may affect future E2G investments (NovaCana 2026). GranBio's E2G production remains suspended since 2021/22, with recent investments redirected to biomethane production, while E2G resumption depends on market conditions (Visão Agro 2025). Overall, E2G expansion in Brazil remains limited and largely export-oriented. In the refining sector, Petrobras began commercial sales of R5 diesel in late 2024. (Agência Petrobras 2024). Acelen Renováveis announced a BRL 12 billion (or USD 2,20 billion) investment to convert the Mataripe Refinery into a biorefinery for SAF and renewable diesel by 2035 (Acelen 2024). Biogas participation in Brazil´s energy matrix remains modest but growing rapidly over the last five years (EPE 2025a), with biomethane potential from sugarcane at 1.7 billion Nm³ (or 3.0 billion Nm³ of biogas) by 2035 (EPE, 2025b). Petrobras' 2025–2029 Strategic Plan foresees significant expansion of biofuel co-processing and the development of SAF and HVO plants (Petrobras 2024).

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