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**Report Highlights:**

Total Brazilian ethanol production for 2023 is estimated at 32.95 billion liters, an increase of seven percent relative to 2022 due to the expected increase in sugarcane production and the steady increase in corn ethanol production. On January 31, 2023 the Government of Brazil increased the import duty on ethanol to Brazil to 16 percent. The Government of Brazil increased the biodiesel blend to 12 percent, effective April 1, 2023. RenovaBio, Brazil's National Biofuels Policy, picked up momentum once Brazil's B3 stock exchange started trading CBios in April 2020. CBio average prices reached record highs not previously seen. NOTE: this version corrects a number of formatting errors from its original publication on September 1, 2023.

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## I. Executive Summary

The recently implemented National Biofuels Policy, known as RenovaBio, is an important tool to support Brazil in reaching its climate goals. The RenovaBio operation is based on three main instruments: annual carbon intensity reduction targets (CO<sub>2</sub>/MJ) for a minimum of ten years, certification of biofuels by efficiency in reducing GHG emissions, and decarbonization Credits (CBios).

The RenovaBio program was officially launched on December 24, 2019. The program's implementation picked up momentum once Brazil's B3 stock exchange started to trade CBios on April 27, 2020. Currently 339 biofuel plants (representing over 75 percent of the total plants in Brazil) are certified to issue CBios (283 sugarcane ethanol plants, six sugarcane and corn ethanol plants, one cellulosic ethanol plant, five corn-ethanol plants, 38 biodiesel plants, and six biomethane plants). Currently there are no foreign plants that have been certified. As managed, the CBio program has become a barrier to trade for those foreign plants who are as yet unable to generate CBios which add value to lower GHG emission biofuels they are able to supply. The average price of Decarbonization Credits (CBios) in June 2023 reached levels that had not been registered for almost a year on the São Paulo stock exchange. On June 22, the average trading price was R\$144.30/CBio, with a high of R\$146.94/CBio and a low of R\$136.75/CBio.

The ethanol mandate remains at 27 percent (E27) for Gasoline C (Gasolina comum) remains unchanged since March 16, 2015. However, the Ministry of Mines and Energy (MME) have begun discussions in 2023 to raise the ethanol mandate to 30 percent (E30). In June 2022, the Brazilian government approved Complementary Bill # 194, capping the state tax for circulation of goods and services (ICMS) on fuels between 17-18 percent and reduced the Contribution to the Social Integration Program/Contribution for Financing Social Security (PIS/COFINS) and CIDE taxes on gasoline and ethanol to zero to control fuel prices. In mid-July, the Brazilian government also approved the Constitutional Amendment Project (PEC) 15/2022 preserving the tax differential between hydrous ethanol and gasoline. No tariff-rate quota (TRQ) and import duty are applied to ethanol imports to Brazil.

Compared to the United States or Europe, Brazil has yet to commercialize sustainable aviation fuel (SAF) and renewable diesel.

On March 17, 2023, Brazil increased the current biodiesel rate from 10 percent to 12 percent effective April 1<sup>st</sup>. The decision was taken by the Brazilian National Council for Energy Policy (CNPE). The CNPE decided to increase the biofuel mandate to 13 percent in 2024, 14 percent in 2025 and 15 percent in 2026. Based on past history, these "mandates" can be considered aspirational goals rather than true mandates because conditions have and can again arise to sidetrack such goals.

The new biodiesel market model is effective as of January 1, 2022. The model allows biodiesel producers and distributors to settle over-the-counter (OTC) contracts to guarantee 80 percent of biodiesel supply for two months, using the same calendar used for the public auctions. The new model has a high participation rate of fuel distributors and producers. On May 13, 2022, a Foreign Trade Chamber Resolution temporarily reduced the biodiesel import tariff from 14 to 11.4 percent until December 31, 2023. According to the resolution, several other products also had their import duties temporarily reduced to mitigate the supply/demand imbalances caused by the COVID-19 pandemic and the Russia-Ukraine war.

Following the United States, Brazil remains the second largest producer and consumer of fuel ethanol. Total Brazilian ethanol production for 2023 is estimated at 32.2 billion liters, an increase of five percent relative to the revised figure for 2022 (30.75 billion liters). The expected increase in production is related to higher sugarcane production for the 2022/23 crop and a steady increase in corn ethanol production.

Total ethanol consumption for 2022 is estimated at 31 billion liters and total ethanol consumption for use as fuel is estimated at 29.6 billion liters. Total Brazilian imports of ethanol used as fuel for 2023 are estimated at 400 million liters mainly from Paraguay. The US position as the main fuel ethanol supplier has collapsed over the last couple of years.

Brazil is the third largest biodiesel producer, following Indonesia and the United States. Brazilian biodiesel production remains more heavily regulated by the government and imports are not permitted to supply the market. Total Brazilian biodiesel production in 2023 is forecast at 7.1 billion liters, a five percent increase compared to 2022.

## **II. Policy and Programs**

### *Brazil's Commitments to Reduce Greenhouse Gas Emissions*

In November 2021, the country presented a new target for reducing greenhouse gas (GHG) emissions from 43 percent to 50 percent by 2030 and to achieve a carbon-neutral target by 2050. However, the fourth and updated version of Brazil's national 2005 inventory of GHG, released in 2021, shows total emission of 2.4 billion tons of carbon dioxide equivalent (GtCO<sub>2e</sub>) as opposed to the previously calculated 2.8 billion tons of GtCO<sub>2e</sub> (third version of 2020). The new target set by the Brazilian government is equivalent to that from 2015, with emissions limited to a maximum of 1.2 GtCO<sub>2e</sub>.

In December 2015, Brazil joined COP21 of the United Nations Framework Convention on Climate Change (UNFCCC) in Paris. At COP21, each country submitted a plan to reduce domestic emissions of greenhouse gases, called an "Intended Nationally Determined Contribution (NDC)." At that time, Brazil committed to reducing domestic emissions of GHG by 37 percent by 2025 and 43 percent by 2030, both based on 2005 levels.

Environmental groups reacted to the announcement at COP26, warning that Brazil's new target was insufficient to control the foreseen damages of climate change and that the Brazilian government has not clearly explained the basis for calculating the emission reduction. According to post contacts, despite the pandemic, Brazil had a 9.5 percent increase in polluting gas emissions in 2020.

To monitor important agricultural issues related to climate change, the Brazilian Ministry of Agriculture, Livestock and Food Supply (MAPA) created four working groups coordinated by the Commission of Sustainable Development of Agriculture as follow:

- Livestock Methane focusing on the "reduction of methane emissions of Brazil's agriculture, without compromising the sustainable development of production chains.
- Land Use Change focusing on land use change due to agricultural practices and mechanisms to identify production in legal deforested areas.

- Carbon Market focusing on how international carbon markets involving governments should function, as well as options for financing.
- Forests and Biodiversity seeking to promote the forest economy, conservation and environmental recovery, and the sustainable use of biodiversity.

### *RenovaBio's Legislative Framework*

This report updates the “[Brazilian Biofuels Annual Gain Report 2018](#)”, “[Brazilian Biofuels Annual Gain Report 2019](#)”, and “[Brazilian Biofuels Annual Gain Report 2020](#)”, and [Brazilian Biofuels Annual Gain Report 2021](#), illustrating the legislative framework and the progress of the RenovaBio program.

The RenovaBio program's design was launched in December 2016 by the Ministry of Mines and Energy (MME). The Brazilian congress formalized the program on December 26, 2017, as the “National Biofuels Policy” through Bill #13,576. RenovaBio has several goals which include contributing to meeting the country's commitments under the COP21 Paris Agreement under the UNFCCC. As designed, it has potential to contribute to the predictability of biofuels in the national fuel market, promote the adequate expansion of the production and use of biofuels in the national energy matrix, emphasizing the continuity of fuel supply, and contribute to the adequate ratio between energy efficiency and reduction of GHG emissions in the production, commercialization, and use of biofuels, including mechanisms for lifecycle assessment.

RenovaBio is based on three main instruments: annual carbon intensity reduction targets (CO<sub>2</sub>/MJ), certification of biofuels marketed to reduce GHG emissions, and Decarbonization Credits (CBios). The annual carbon intensity reduction targets drive the program for a minimum period of ten years. RenovaBio provides the framework to certify biofuel production by its efficiency (using Life Cycle Analysis) in reducing GHG emissions and allows for the sale and trade of decarbonization credits (CBios). Each CBio represents one metric ton of CO<sub>2</sub>e carbon saved through the utilization of biofuels versus fossil fuels, thereby incentivizing lower GHG-emitting biofuels over higher-emitting ones. By creating a market for CBios, RenovaBio formalizes the environmental benefits of biofuels and increases remuneration for producers enrolled in the program, and builds in a market-oriented tool for change as opposed to a command and control system where government picks winners and losers.

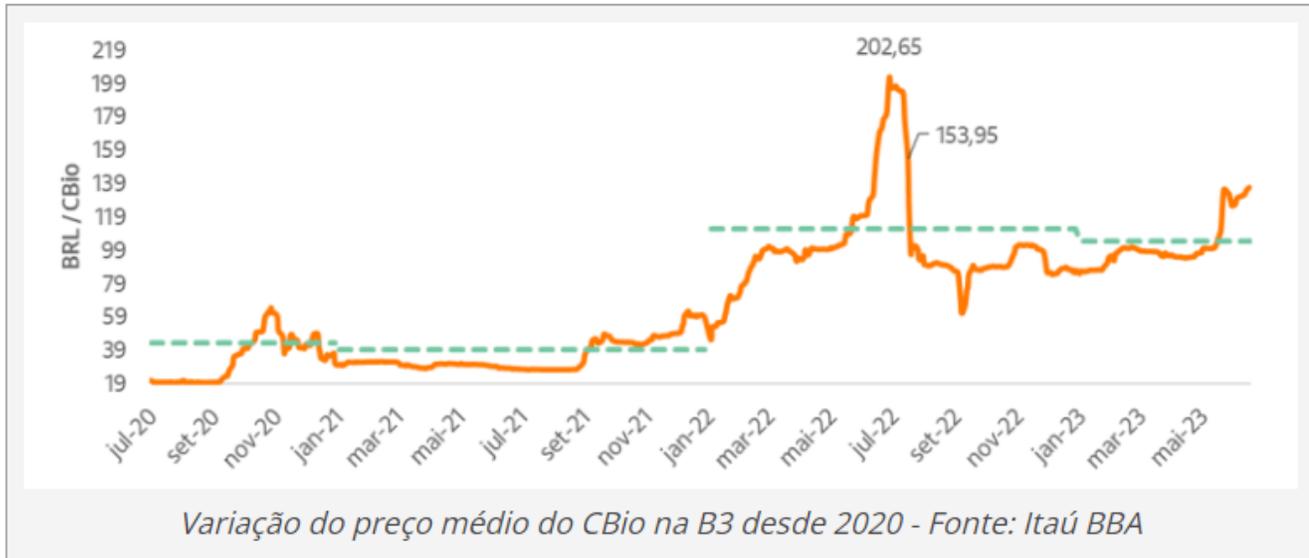
### *RenovaBio Program's Milestones and Updates*

The RenovaBio program was officially launched on December 24, 2019. The program's implementation picked up momentum once Brazil's B3 stock exchange started to trade CBios on April 27, 2020. According to ANP, Brazilian fuel distributors met 97 percent of RenovaBio's 2021 target by retiring 24.4 billion decarbonization credits (CBios). Decree No. 11,141/2022 established a deadline of September 30, 2023 for the fulfillment of targets for 2022, thus ANP will publish the 2022 targets in October 2023. For the individual targets published for the year 2023, the fuel distributor must add the amounts of CBios eventually not met in its target for the year 2022. This is outlined in paragraph 1, art 10 of ANP Resolution No. 791/2019.

The average price of Decarbonization Credits (CBios) in June 2023 reached levels that had not been registered for almost a year on the São Paulo stock exchange. On June 22, the average trading price was R\$144.30/CBio, with a high of R\$146.94/CBio and a low of R\$136.75/CBio.

## Graph 1

Price of CBios from July 2020 - May 2023



Source: Itaú BBA

In October 2021, ANP set the annual compulsory targets (indicated by the green line above) or reducing GHG emissions from transport fuels for the 2022 through 2031 period, as illustrated in the Table and Graph below.

**Table 1**

Annual Target for CBios

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
<b>Annual Target (in million of CBios)</b>	35.98	42.35	50.81	58.91	66.49	72.93	79.29	85.51	90.67	95.67
<b>Tolerance Interval</b>	--	50.85	59.31	67.41	74.99	81.43	87.79	94.01	99.17	104.17
	--	33.85	42.31	50.41	57.99	64.43	70.79	77.01	82.17	87.17

Source: ANP

In March 2023, ANP established the 2023 individual targets that fuel distributors listed below must meet. Together, these five distributors represent roughly 70 percent of the total combined target for 2022.

- Vibra Energia (10.17 million CBios, equal to 27.1 percent of the total)
- Raizen (7.17 million CBios, equal to 19.1 percent of the total)
- Ipiranga (7.09 million CBios, equal to 18.7 percent of the total)
- Petroleo Sabbá (902,632 CBios, equal to 2.4 percent of the total)
- Alesat (859,489 CBios, equal to 2.2 percent of the total)

Decree # 11,141, of July 21, 2022, extended the deadline for fuel distributors to prove that they met the individual annual targets for 2022 from December 31, 2022 to September 2023. The Brazilian government took the measure to mitigate the price escalation of CBios due to the current imbalances between CBio supply and demand. Members of the Parliamentary Agricultural Front (“Frente Parlamentar da Agricultura”) filed a Bill Proposal at the Lower House to suspend the effects of the postponement of individual goals for the purchase of CBios. According to the proposal, the change made by the federal government to the deadline for meeting the CBios targets hurts one of the basic principles of RenovaBio, the annual periodicity of the program, which allows predictability to the policy. Members of the Parliamentary Agricultural Front argue that future investments to decarbonize the Brazilian fuel matrix might be jeopardized due to the lack of stable rules.

Currently 339 biofuel plants (representing over 75 percent of the total plants in Brazil) are certified to issue CBios (283 sugarcane ethanol plants, six sugarcane and corn ethanol plants, one cellulosic ethanol plant, five corn-ethanol plants, 38 biodiesel plants, and six biomethane plants). Currently no foreign plants have been certified.

In January 2023, ANP made available version 8.1 of RenovaCalc – Biodiesel Route for biofuels certification. RenovaCalc works as a calculator for the biofuel production unit's environmental performance within the RenovaBio program's scope. The instrument assigns an Energy-Environmental Efficiency Score (EEA), assigned by Embrapa, to the biofuel producer based on information on its production process and data on the cultivation of the biomass used to produce the biofuel. The note composes the factor for issuing Decarbonization Credits (CBIOS), which can be negotiated later by the biofuel producer.

In July 2022, ANP also released the preliminary version of the custody chain approach that includes a mass balance method to overcome some of the obstacles biodiesel and corn-ethanol producers face to getting certified under RenovaBio, such as acquiring feedstock from many different suppliers (as opposed to sugarcane-ethanol). ANP is undergoing review of its 2018 Resolution #758, which is the overarching regulation on the efficient production or importation of biofuels under RenovaBio.

As of July 2023, B3 data indicates the issuance of 17.79 million CBios in 2023. This is roughly 33 percent of the compulsory target for 2023. The value considers the carry-over stock of the obligated amount in 2021 plus the credits acquired in 2022 and 2023.

## Government Support for Fuel Ethanol

### *Social Impacts of Biodiesel*

The launch of the National program for the Production and Use of Biodiesel (PNPB) in 2005 established a goal of promoting family farming in the north and northeast of Brazil. The impacts of this program on this region have been minimal and according to the most recent report of the Social Biofuel Seal program that encourages manufactures to buy raw materials from smaller farms, of the R\$ 8.82 billion that these mills invested, less than R\$ 478.5 million, 5.4 percent of the total was produced in the north and northeast. From June- July 2023, MME and the Ministry of Agrarian Development and Family Agriculture (MDA) opened a public consultation for a new ordinance that will make it mandatory for at least 20 percent of raw materials come from these two regions. The ordinance establishes participation targets for the North, Northeast and Semi-arid regions, within the scope of at least 10 percent in 2024, 15 percent in 2025 and 20 percent in 2026.

### *Gasoline C Use Mandate*

No changes were made to the current ethanol mandate, which remains at 27 percent (E27) for Gasoline C (*Gasolina comum*) since March 16, 2015. *Gasolina comum* is the official term used in Brazil for ethanol-blended gasoline, which uses anhydrous ethanol. The only other liquid fuel used for Brazil's light-duty fleet is pure E100 "hydrous" ethanol.

The ethanol-use mandate has been mandatory since 1931 with Decree No. 19,717. In 1977 legislation required a 4.5 percent blend of anhydrous ethanol to gasoline. According to the current legislation, the ethanol blend can vary from 18 to 27.5 percent and it is currently set at 27 percent.

While no changes have been made to the current ethanol mandate, the Lula Administration announced a study that would evaluate increasing the mandate to 30 percent. This announcement was made in March 2023; a follow-up announcement is expected in the second half of this year. The Ministry of Mines and Energy (MME) have indicated plans to gradually increase the amount to 30 percent in the coming years.

**Table 2***Anhydrous Ethanol Use Mandate*

<b>Anhydrous Ethanol Use Mandate</b>		
<b>Year</b>	<b>Month</b>	<b>Mandate</b>
2006	Jan-Feb	E25
	Mar-Oct	E20
	Nov-Dec	E23
2007	Jan-May	E23
	Jun-Dec	E25
2008	Jan-Dec	E25
2009	Jan-Dec	E25
2010	Jan	E25
	Feb-Apr	E20
	May-Dec	E25
2011	Jan-Sep	E25
	Oct-Dec	E20
2012	Jan-Dec	E20
2013	Jan-Apr	E20
	May-Dec	E25
2014	Jan-Dec	E25
2015	Jan-Mar 15th	E25
	Mar 16th-Dec	E27
2016	Jan-present	E27

Source: MME

As of January 14, 2022, Decree 10,940/2022 provides the National Energy Policy Council (CNPE) with the authority to set the anhydrous ethanol blend into Gasoline C. Previously, the authority to determine the ethanol blended was delegated to the Ministry of Agriculture, Livestock and Supply (MAPA), subject to the approval of the Inter-ministerial Council for Sugar and Alcohol (CIMA).

CIMA was extinguished in April 2019 and the authority to set the ethanol blend was then transferred to the Executive Branch. Considering that the policies for the production and use of fuel ethanol are in line with those of CNPE, the current Decree transfers the delegation for setting the current anhydrous ethanol blend percentage to the highest decision-making body of the National Energy Policy.

Decree 10,940/2022 also altered the composition of the CNPE, which now includes the Special Secretary for Strategic Affairs of the Presidency of the Republic in addition to the Ministers of Mines and Energy, Civil House, Foreign Affairs, Economy, Infrastructure, Agriculture, Science and Technology, Environment, Regional Development and Institutional Security Office, and the President of the Brazilian Energy Research Enterprise (EPE).

## *Tax Incentives*

### *Light Duty Fuels*

Brazil has a complex tax system, including several federal, state, and municipal taxes. The Brazilian Government (GOB) can provide incentives and disincentives for gasoline and/or ethanol at the pump depending on policymakers' economic and financial strategies and actively uses tax policy to do so. The federal taxes applied on fuels are the Contribution for Intervention in Economic Domain (CIDE) and the Contribution to the Social Integration Program/Contribution for Financing Social Security (PIS/COFINS). In addition, governments from several Brazilian states provide differential treatment for ethanol by using the Tax for Circulation of Goods and Services (ICMS) for ethanol and gasoline.

In June 2022, the Brazilian government approved Complementary Bill # 194, capping the ICMS state tax on fuels at 17-18 percent depending on the State and reduced the PIS/COFINS and CIDE taxes on gasoline and ethanol to zero with the intent to control escalated fuel prices. The bill capping the ICMS tax took effect June 27, and the revised PIS/COFINS and CIDE taxes took effect June 23.

The ICMS tax capped at 17-18 percent would potentially increase gasoline's competitiveness over ethanol in many regions of Brazil and ultimately cause ethanol prices to fall in the near term. Therefore, the Brazilian Congress approved in mid-July the Constitutional Amendment Project (PEC) 15/2022 preserving the tax differential between hydrous ethanol and gasoline. The approval of PEC 15/2022 also included a cash-transfer program through a tax credit (subsidy) of R\$ 3.8 billion to be split amongst states according to the share of hydrous ethanol consumption.

The single and fixed rate of the Tax on Circulation of Goods and Services (ICMS) on gasoline and ethanol came into force in June 2023. The charge will be R\$ 1.22 per liter throughout the country. Currently, the rates are proportional to the value and are defined by each state, generally carrying between 17 and 23 percent.

Please refer to "[Brazilian Biofuels Annual Gain Report 2015](#)", "[Brazilian Biofuels Annual Gain Report 2017](#)" and "[Brazilian Biofuels Annual Gain Report 2020](#)" for historical information on CIDE and PIS/COFINS.

### *Light Duty Vehicles*

Tax incentives have played an important role in supporting increased ethanol consumption thru the introduction of flex-fuel cars. The table below shows the value of Tax on Industrialized Products (IPI), Contribution to the Social Integration Program/Contribution for Financing Social Security (PIS/COFINS), and state tax for circulation of goods and services (ICMS) for different categories of vehicles as reported by the National Association of Motor Vehicle Manufacturers (ANFAVEA). Note that IPI on flex cars has been lowered compared to gasoline-only powered vehicles.

**Table 3**  
*Taxes Applied to Ethanol, Flex-Fuel and Gasoline Vehicles*

<b>Taxes Applied to Ethanol, Flex-Fuel and Gasoline Vehicles (Percentage)</b>						
<b>Year</b>	<b>Taxes</b>	<b>1000 cc</b>	<b>1001-2000 cc</b>		<b>Over 2000 cc</b>	
		<b>Gasoline/ Ethanol/ Flex</b>	<b>Gasoline</b>	<b>Ethanol / Flex</b>	<b>Gasoline</b>	<b>Ethanol/ Flex</b>
<b>2013</b>	IPI	2	8	7	25	18
	ICMS	12	12	12	12	12
	PIS/COFINS	11.6	11.6	11.6	11.6	11.6
	% of Avg MSRP	23.6	27.4	26.8	36.4	33.1
<b>2014</b>	IPI	3	10	9	25	18
	ICMS	12	12	12	12	12
	PIS/COFINS	11.6	11.6	11.6	11.6	11.6
	% of Avg MSRP	24.4	28.6	28	36.4	33.1
<b>2015/ thru 2021</b>	IPI	7	13	11	25	18
	ICMS	12	12	12	12	12
	PIS/COFINS	11.6	11.6	11.6	11.6	11.6
	% of Avg MSRP	27.1	30.4	29.2	36.4	33.1
<b>2022</b>	IPI	5.27	9.78	8.28	18.81	13.55
	ICMS	12	12	12	12	12
	PIS/COFINS	11.6	11.6	11.6	11.6	11.6
	% of Avg MSRP	24.7	27.3	26.4	32.3	29.5

Source: National Association of Motor Vehicle Manufacturers (ANFAVEA)

Note: Please refer to the “Brazilian Biofuels Annual Gain Report 2015” for historical information since 2004.

#### *Low-interest (Subsidized) Credit Lines*

The Brazilian Agricultural Crop and Livestock Plan for 2023/24 was announced in June 2023 by MAPA. A total of R\$ 364 billion will be released to fund agricultural and livestock programs, an increase compared to last season’s amount of R\$ 341 billion. The emphasis on credit lines to support sustainable agricultural practices remains. The Greenhouse Gases Emission Reduction Program (“Programa ABC”) credit line is set at R\$6.19 billion, 23 percent higher than the amount available last season (R\$ 5.05 billion) at seven to 8.5 percent interest rate and the repayment period to be determined depending on the use of the funds.

There are no specific credit lines for sugarcane ethanol, soybeans or biodiesel plants. However, biofuel producers can request access to financing through specific programs such as RenovAgro, InovaAgro or Moderagro. RenovAgro is a program to finance sustainable agricultural production with an interest rate of seven percent, limited to BRL 5 million and a duration of between ten and twelve years. InovaAgro is a program to incentive agricultural technological innovation. It provides lines of credit at 10.5 percent

interest for ten years. The purpose of the program is for the adoption of technologies in rural areas aimed at increasing productivity and good agricultural practices. Moderagro is a program for the modernization of agriculture and conservation of natural resources. Credit lines are offered with 10.5 percent interest for ten years to finance equipment related to health and environmental compliance.

Moreover, the Brazilian National Economic and Social Development Bank (BNDES) regularly announces specific credit lines to support the renewal and/or development of new sugarcane fields (BNDES Prorenova); to support the acquisition, marketing or production of machinery and equipment (BNDES Finame Direto), among others.

### *Import Policy*

On March 21, 2022, the Brazilian federal government announced the drop of the ethanol import tariff to zero until December 31, 2022 and was subsequently extended until January 31, 2023. The decision was made by the Foreign Trade Chamber (Camex) of the Ministry of Economy and was published in the Official Gazette on March 23, 2022, when it went into effect. Currently, the TRQ has increased to 16 percent until December 31, 2023 and will increase to 18 percent January 1, 2024.

**Table 4**

#### *Tariff Rate for Ethanol Imports to Brazil*

Year	TRQ (percent)	TRQ pro-rated duty-free quota
From January 1 <sup>st</sup> , 2024	18	
From Feb 1 <sup>st</sup> , 2023, to December 31 <sup>st</sup> , 2023	16	
March 2022 to January 2023	Free Flow (zero tariff)	
August 2017 to February 2022	20	In 2017, the duty-free quota was 150 million liters quarterly/600 million liters annually.  In 2019, the quota expanded to 750 million liters annually.
2011 to 2017	Free flow (zero tariff)	

Source: ANP

Please refer to “[Brazilian Biofuels Annual Gain Report 2017](#)” and “[Brazilian Biofuels Annual Gain Report 2020](#)” and “[Brazilian Biofuels Annual Gain Report 2021](#)” for historical information on the ethanol import tariff and duty-free tariff-rate quota (TRQ).

### *Cooperation between India and Brazil on Ethanol*

Brazil and India identified priorities for further bilateral cooperation in nine key areas as follows under two broad focus zones: A) Implementation and scaling up (technical aspects of vehicle use of E20

blends in current fleets, technical aspects of higher blends of ethanol use in flex-fuel vehicles, flex-fuel technologies – four-stroke and two-stroke engines (Otto Cycle), biodiesel implementation, biogas/biomethane policy and incentives, and efficient heat and power generation in sugar and ethanol plants); B) Technology and future fuels (sustainable aviation fuels – policies, feedstocks and implementation steps; second generation ethanol – policy and technologies and; synthetic biology cooperation).

Please refer to “[2022 Biofuels Annual Report](#)” for historical information on the cooperation between India and Brazil

### Government Support for Biodiesel

#### *The National Biodiesel Production Program*

The National Biodiesel Production Program (PNPB) was created in 2004 to promote domestic biodiesel production, reduce diesel fuel import dependency, and lower diesel fuel pollutant emissions and health-related costs. In addition, PNPB was established to generate jobs and income and alleviate regional economic disparities by passing on benefits to family farmers, especially those in North and Northeastern Brazil.

Federal Law #11,097, enacted in January 2005, included biodiesel in the Brazilian energy matrix and delegated authority to ANP to regulate and monitor all activities related to biodiesel production, the mandatory blend (Bx), quality control, product distribution, and marketing. (*Please refer to [Brazilian Biofuels Annual Gain Report 2021](#) for additional information re: ANP biodiesel public auction system*).

#### *Use Mandate*

Federal Law #11,097/2005 defined and established a legal mandate for the use of biodiesel as a fuel. The law authorized using a two percent blend of biodiesel (B2) until 2008, when B2 became compulsory nationwide, i.e., all mineral diesel must have a two percent biodiesel blend. However, the rapid increase of the Brazilian industrial capacity and the likely oversupply of biodiesel in the domestic market led the CNPE to adopt requirements for higher blends.

CNPE Resolution #16, from October 2018, recommends the annual increase of the biodiesel blend by one percent, from B11 in June 2019 (which was effective in September 2019), to B12 in March 2020, B13 in March 2021, B14 in March 2022, and up to B15 by March 2023. Some of these earlier goals were met ahead of schedule.

Despite CNPE’s Resolution #16, ANP adjusted the biodiesel blend below CNPEs recommendation since May 2021 to control energy price inflation impact and elevated costs associated with biodiesel production due to shortages in biodiesel feedstock, primarily soybeans and animal fat (tallow). Biodiesel prices have remained sharply elevated even after the biodiesel blend reduction (*Refer to Section IV – Biodiesel: Market Prices for further information*). On March 17, 2023, Brazil increased the November 2021 reset of 10 percent to 12 percent effective April 1<sup>st</sup> 2023. Brazil also stated there will be further

gradual increases to the biofuel mandate until 15 percent, or B15, is reached in 2026. Post’s estimates include a 12 percent biofuel mandate.

**Table 5**  
*Brazil Biofuel Use Mandate*

Biodiesel Use Mandate	
Year	Mandate
2003	optional
Jan-08	B2
Jul-08	B3
Jul-09	B4
Jan-10	B5
Aug-14	B6
Nov-14	B7
Mar-17	B8
Mar-18	B10
Sep-19	B11
Mar-20	B12
Sep-20	B10
Nov-20	B11
Jan-21	B12
Mar-21	B13
May-21	B10
Sep-21	B12
Nov-21	B10
Jan-22	B10
Apr-23	B12

Source: ANP

*The New Model for the Auction Market*

On December 30, 2020, CNPE issued Resolution #14 with guidelines to implement a new market environment for biodiesel trade to replace the traditional biodiesel public auctions. The new biodiesel market model is effective as of January 1, 2022. The model allows biodiesel producers and distributors to settle over-the-counter (OTC) contracts to guarantee 80 percent of biodiesel supply for two months, using the same calendar used for the public auctions. The remaining 20 percent can be traded in the spot market. Only fuel distributors with at least five percent of the market share in any fuel in 2020 must commit 80 percent of the traded volume to OTC contracts.

Detailed information about the new biodiesel commercialization model, covering the contracting targets of fuel distributors and producers, as well as the SRD-Biodiesel system, can be accessed at <https://www.gov.br/anp/pt-br/assuntos/distribuicao-e-revenda/comercializacao-de-biodiesel>.

### *Import Policy*

Biodiesel is not imported because there are still not any authorized by ANP, except under “exceptional circumstances”.

### *Government Support for Advanced Biofuels*

A lack of attention to policy and program support has left the cellulosic ethanol industry undeveloped despite massive feedstock availability, and renewable diesel and sustainable aviation fuel (SAF) remains at the precommercial stage.

Resolution # 7/2021 from the Brazilian National Council for Energy Policy (CNPE) enacted the “Fuel of the Future” Federal Government Program, designed to promote measures for expanding the use of sustainable fuels and the development of fuel technologies covering land, water, and air transportation. The Fuel of the Future program is comprised of six guiding principles, including environmental protection, consumer protection, and economic efficiency and of four strategic guidelines:

- Integrating related policies, e.g., Renovabio, the National Biodiesel Production Program (PNPB), the Program for Vehicle Emission Control (PROCONVE), Rota 2030, and the Program for Conscious Use of Natural Resources (CONPET),
- Fostering the reduction of the average carbon intensity in the Brazilian energy matrix,
- Assessing the environmental-energy efficiency in the fuel lifecycle, over land, water or air transportation,
- Promoting innovation and technological development.

## **III. Ethanol**

### *Production, Supply and Demand (PS&D) Table*

Sugarcane is the main source of feedstock for ethanol production in Brazil, followed by corn covering virtually all of the rest. No Brazilian government agency or trade source maintains production figures on ethanol use for ‘fuel’ vs other uses. All ethanol production figures are reported solely as hydrous and anhydrous volumes. According to ATO/Sao Paulo contacts, ethanol plants produce different specifications of hydrous and/or anhydrous but make no distinction between fuel and other uses. The actual use for fuels and other uses (industrial and chemical, refined, and/or neutral) are determined at end-use.

**Table 6**  
*Production, Supply and Distribution of Ethanol in Brazil*

<b>Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)</b>										
Calendar Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
<b>Beginning Stocks</b>	8,995	10,167	8,232	8,012	8,973	10,401	12,327	14,451	13,370	12,293
Fuel Begin Stocks	8,590	9,713	7,765	7,520	8,475	9,899	11,820	13,939	12,853	12,849
<b>Production</b>	28,553	30,365	28,405	28,142	33,078	37,383	35,081	29,980	30,746	32,950
Fuel Production	25,585	27,248	25,546	25,170	30,233	34,407	30,897	26,195	27,600	29,965
>of which is cellulosic (a)	0	2	6	17	25	30	32	40	53	51
<b>Imports</b>	452	513	835	1,796	1,775	1,457	1,008	432	322	405
Fuel Imports	403	500	810	1,791	1,770	1,452	1,003	427	316	400
<b>Exports</b>	1,398	1,867	1,789	1,380	1,685	1,941	2,669	1,948	2,445	2,205
Fuel Exports	780	900	400	443	840	1,090	850	300	320	315
<b>Consumption</b>	26,435	30,946	27,671	27,597	31,740	34,973	31,296	29,545	29,700	31,750
Fuel Consumption	24,085	28,796	26,201	25,562	29,740	32,848	28,931	27,408	27,600	29,600
<b>Ending Stocks</b>	10,167	8,232	8,012	8,973	10,401	12,327	14,451	13,370	12,293	11,693
Fuel Ending Stocks	9,713	7,765	7,520	8,475	9,899	11,820	13,939	12,853	12,849	13,299
<b>Refineries (Sugarcane-only) Producing First Generation Fuel Ethanol (Million Liters)</b>										
Number of Refineries	382	382	383	384	369	359	347	343	337	333
Nameplate Capacity	37,930	38,050	39,677	40,012	43,105	43,105	42,800	50,500	54,280	54,800
<b>Refineries (Corn-only and Corn/Sugarcane Flex) Producing First Generation Fuel Ethanol (Million Liters)</b>										
Number of Refineries	n/a	n/a	n/a	n/a	n/a	n/a	11	19	17	18
Nameplate Capacity	n/a	n/a	n/a	n/a	n/a	n/a	2,500	4,000	5000	5200
Capacity Use (%)	n/a	n/a	n/a	n/a	n/a	n/a	68%	48%	50%	52%
<b>Refineries Producing Cellulosic Fuel Ethanol (Million Liters)</b>										
Number of Refineries	1	3	3	3	3	3	3	3	2	2
Nameplate Capacity	82	127	127	127	127	127	127	75	75	70
Capacity Use (%)	0%	2%	5%	13%	20%	24%	25%	53%	51%	53%
<b>Co-product Production (1,000 MT)</b>										
Bagasse	118,971	126,008	117,492	115,467	134,721	150,096	135,913	111,017	120,897	132,987
DDGs	33	91	151	310	541	998	1,824	2,474	2,993	3,622
Com Oil	2	5	9	18	31	57	105	142	172	208
<b>Feedstock Use for Fuel Ethanol (1,000 MT)</b>										
Sugarcane	356,913	378,025	352,475	346,400	404,163	450,288	407,738	333,050	366,355	402,991
Corn	107	291	481	990	1,727	3,190	5,827	7,904	9,564	11,572
Bagasse for Cellulosic Fuel	0	0.011	0.033	0.094	0.139	0.167	0.178	0.222	0.35	0.4
<b>Market Penetration (Million Liters)</b>										
Fuel Ethanol Use	24,085	28,796	26,201	25,562	29,740	32,848	28,931	27,408	27,600	29,600
Hydrous Ethanol for Fuel	12,994	17,862	14,586	13,642	19,385	22,544	19,258	16,792	15,986	17,477
Anhydrous Ethanol in Gasoline C	11,091	10,934	11,615	11,920	10,355	10,304	9,673	10,616	11,614	12,123
Gasoline C (includes anydrous)	44,364	41,137	43,019	44,150	38,352	38,165	35,824	39,317	43,014	44,900
Gasoline C Blend Rate	25.0%	26.6%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%
Ethanol Blend Rate Overall	42.0%	48.8%	45.5%	44.2%	51.5%	54.1%	52.5%	48.8%	<b>46.8%</b>	<b>47.5%</b>

Note: See Section VI: Notes on Statistical Data covering sources and certain calculations.  
Forecasts developed by USDA Brasilia.

## *Production*

Total ethanol production for 2023 is estimated at 32.95 billion liters, an increase of seven percent relative to revised figure for 2022 (30.75 billion liters). Ethanol production for fuel use is estimated at 29.9 billion liters, an increase of 2.37 billion liters compared to the previous calendar year. The expected increase in production is related to higher sugarcane production for the 2023/24 crop. The expected increase in corn ethanol should also contribute to the overall larger ethanol output.

## *Sugarcane Ethanol*

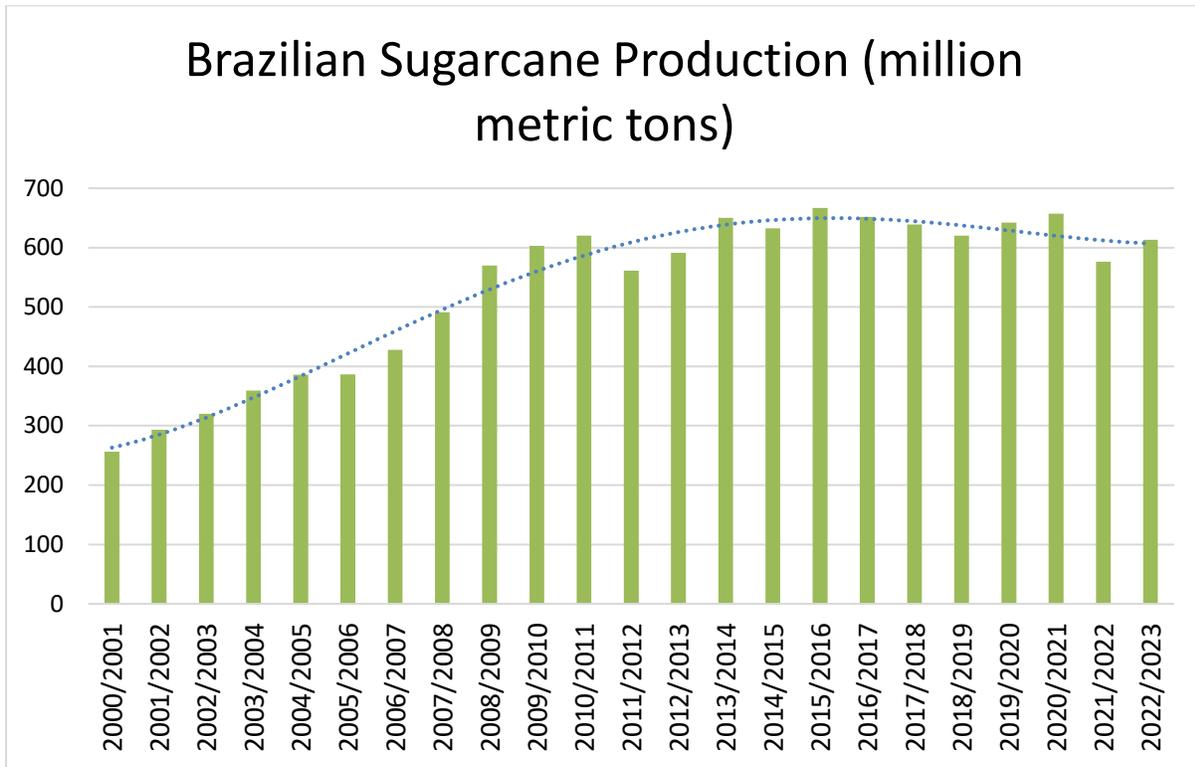
To be in accordance with the actual feedstock production cycle, the following narrative describes sugarcane and ethanol production in marketing years. Post currently estimates Brazil's marketing year (MY April through March, unless otherwise stated) 2023/24 sugarcane crush at 661.4 million metric tons (mmt), an increase of 6.5 percent compared to MY 2022/23 (621 mmt). The Center-South (CS) region should harvest 590 MMT of sugarcane, up 46.1 MMT vis-a-vis the revised figure for the last crop (543.9 MMT). North-Northeastern (NNE) production for MY 2023/24 is forecast at 58 MMT, an increase of 2 MMT from the revised figure for MY 2022/23 (56 MMT).

The CS region sugarcane harvest performed well in 2022/23 because of favorable weather conditions. The high sugar prices also ensured that farmers maintained their marginal areas for sugarcane plantations. The El Nino effect should cause heavier rainfall during the second half of 2023 that may have a favorable effect on the sugarcane harvests.

The conflict in Ukraine had only a slight impact on the current sugarcane crop because Brazil managed to find alternative sources of fertilizers since the onset of the war, thanks in part to the 'Fertilizer Diplomacy' undertaken by the Brazilian Ministry of Agriculture. Although in 2022 Brazil's total imports fell 10 percent in volume, the impact on agricultural production/productivity was minor because farmers used more efficient application methods of the input. However, the rise in fertilizer prices caused a proportional increase in production costs of agricultural crops, including sugarcane production. Considering that the conflict in Eastern Europe began 13 months ago, traders and fertilizer producers have had time to adapt themselves to the new situation. Fertilizer prices have fallen over recent months, so it is unlikely that the conflict will cause any drop in fertilizer availability to Brazilian farmers in the next planting season.

**Graph 2**

*Sugarcane Production in Brazil*



Source: USDA/ATO/Sao Paulo

CONSECANA reports that the average sugarcane price (cumulative through February 2023) for the state of São Paulo for the 2022/23 crop was R\$ 1.168 per kilogram of TRS, or approximately R\$ 143.83 per ton of sugarcane, which is 2.2 lower than for MY 2021/22, after the high increases of sugar prices during the pandemic.

### Graph 3

#### International Sugar Prices



#### International Sugar Prices (Two Years) ICE Futures No. 11

Source: Intercontinental Exchange (ICE)

In addition, ethanol consumption has not recovered to pre-pandemic volumes and producers are likely to keep the sugar-ethanol production mix unchanged from the previous MY. Therefore, Post projects the total sucrose (total reducing sugar, TRS) content diverted to sugar and ethanol production for MY 2022/23 at 45 and 55 percent, respectively, unchanged from MY 2021/22.

#### Corn Ethanol

Corn ethanol production continues in a strong expansion phase accounting for an ever-increasing share of total ethanol production. Total Brazilian corn-ethanol output in 2023 is estimated at 6 billion liters, an increase of 33 percent relative to revised production figure for 2022 (4.5 billion liters), based on updated information from the Corn Ethanol National Union (UNEM) and UNICA.

Total corn used to produce ethanol in 2022 is estimated at roughly 14.38 mmt, an increase of 3.59 mmt compared to the corn volume consumed in 2021 (10.79 mmt), representing approximately eleven percent of the corn crop in 2022 (129 mmt). (Refer to the [Brazilian Grain and Feed Update Gain Report - July 2022](#) for further information). Note that each ton of corn can produce on average 417 liters of ethanol, 313 kilograms of DDGS, and 18 liters of corn oil, as well as the co-generation of electric power, which most plants sell back to the grid.

Expansion potential for Brazil's corn ethanol industry remains constrained at least until pipeline and rail connections are developed. Corn ethanol production in Brazil is mostly concentrated in Brazil's Center-West region, specifically Mato Grosso, close to relatively cheap corn supplies and poultry operations that consume some of the DDGS produced as a co-product of ethanol distillation. (Please refer to [Brazil: Corn Ethanol Production Booms in Brazil Gain Report](#) for further information). Industry sources report at least nine corn-ethanol plant projects in the planning, development, construction and/or expansion stage.

### *Wheat Ethanol*

The first wheat ethanol plant in Brazil is expected to open in Rio Grande do Sul in 2024. The company anticipates the processing capacity to be 750 tons of wheat per day, generating an annual production of 111 million liters of ethanol. Post increased its forecast for total wheat consumption for MY 2023/24 (October 2023 – September 2024) at 12.7 MMT, a 1.2 percent increase from the original estimate.

The total number of ethanol plants in 2023 is 359 units, an increase of two units compared to 2022 (357 units). This figure includes 333 sugarcane-based plants, 18 corn-based plants, 6 sugarcane/corn flex plants, and two cellulosic plants.

### **Map 1**

*Distribution of Ethanol Plants in Brazil*

**Distribution of Ethanol Plants in Brazil**



Source: ANP

Ethanol installed industrial capacity for sugarcane ethanol depends mostly on annual decisions made by individual sugar-ethanol plants to produce sugar and/or ethanol. Post contacts report that the industry responds to the ratio of 40:60 to switch between sugar and ethanol production or vice versa from harvest to harvest. Once producing units adjust their plants to produce a set ratio of sugar/ethanol in a given year, there is much less flexibility to change it during the crushing season.

*Sugarcane and Ethanol Prices Received by Producers*

Sugarcane prices received by third-party suppliers for major producing states are based on a formula that considers prices for sugar and ethanol in both the domestic and international markets. The State of Sao Paulo Sugarcane, Sugar and Ethanol Growers Council (CONSECANA) was the first to develop this formula for the state of Sao Paulo, the major producing state, which accounts for roughly 60 percent of Center-South production.

CONSECANA reports that the average sugarcane price for the month of June 2023 was R\$1.22 per kilogram of TRS, a 1.7 percent increase from March 2023, when sugarcane reached 1.20 per kilogram of TRS.

The tables below include the latest information publicly available for the Ethanol Indexes released by the University of Sao Paulo’s College of Agriculture "Luiz de Queiroz" (ESALQ). The indexes track anhydrous and hydrous ethanol for fuel prices received by producers in the domestic spot market.

**Table 7**  
*Price of Hydrated Fuel Ethanol*

<b>Price for Fuel Hydrated Ethanol - State of Sao Paulo (R\$/000 liters).</b>						
<b>Period</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
January	1,836.20	1,605.60	2,067.70	2,090.90	3,316.80	2,662.07
February	1,852.20	1,677.10	2,118.20	2,280.80	2,860.10	2,691.40
March	1,868.20	1,776.40	1,875.10	2,676.80	3,222.90	2,711.00
April	1,538.70	1,814.80	1,360.60	2,543.90	3,631.00	2,937.70
May	1,568.00	1,644.90	1,432.10	2,928.50	3,329.40	2,598.45
June	1,633.70	1,617.70	1,637.10	2,922.40	3,061.50	2,539.08
July	1,457.90	1,673.60	1,639.60	2,927.00	2,934.30	2,157.92
August	1,461.60	1,729.10	1,726.10	3,127.10	2,668.00	
September	1,678.00	1,714.60	1,797.20	3,261.20	2,365.00	
October	1,792.80	1,803.00	1,985.20	3,552.10	2,680.30	
November	1,648.70	1,908.90	2,062.80	3,698.60	2,832.90	
December	1,664.80	1,998.50	2,044.30	3,349.50	2,774.40	

Source: USP/ESALQ/CEPEA.

**Table 8***Price of Anhydrous Fuel Ethanol*

<b>Price for Fuel Anhydrous Ethanol - State of Sao Paulo (R\$/000 liters).</b>						
<b>Period</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
January	2,015.70	1,798.80	2,241.90	2,305.20	3,820.80	3,059.82
February	2,050.90	1,811.80	2,294.80	2,496.90	3,346.50	3,098.05
March	2,076.10	2,010.10	2,134.40	2,980.60	3,509.20	3,104.58
April	1,807.40	1,984.70	1,556.10	2,774.20	4,148.10	3,326.32
May	1,697.40	1,878.60	1,522.40	3,219.50	3,859.30	3,039.70
June	1,817.90	1,798.20	1,781.80	3,335.30	3,572.90	2,979.24
July	1,632.30	1,822.70	1,798.90	3,328.60	3,481.00	2,703.62
August	1,557.20	1,906.40	1,882.50	3,531.20	3,210.80	
September	1,817.70	1,865.40	1,985.40	3,729.80	2,851.00	
October	1,957.90	1,943.70	2,160.50	3,881.90	3,033.60	
November	1,856.60	2,052.50	2,282.60	4,332.20	3,250.60	
December	1,829.60	2,165.70	2,258.10	3,878.50	3,183.30	
Source: USP/ESALQ/CEPEA.						

*Consumption***Table 9***Brazilian Fuel Consumption Matrix*

<b>Brazilian Fuel Consumption Matrix (000 m3)</b>						
	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023 (Jan-Jun)</b>
<b>Gasoline C*</b>	38,352	38,165	35,824	39,317	43,014	23,138
<b>Hydrated Ethanol</b>	19,385	22,544	19,258	16,792	15,986	6,980
Source: ANP. * Gasoline C includes 18-27.5% of anhydrous ethanol. 2022 1/ refers to January-Jun.						

High fuel prices in 2022/2023 have not supported an increase in otto-cycle fuel consumption. Therefore, Post estimates total domestic demand for ethanol (fuel and other uses) for the calendar year 2023 will be relatively stable compared to 2022. Total ethanol consumption for 2023 is estimated at 31.75 billion liters and total ethanol consumption for use as fuel is estimated at 29.6 billion liters (as opposed to 29.7 and 27.6 billion liters for total ethanol and for ethanol for use as fuel in 2022, respectively). Estimates are based on updated numbers from ANP and the current pace of the Brazilian economy. No changes

have been made to the current ethanol mandate, which was set at 27 percent (E27) for Gasoline C as of March 16, 2015.

Note that gasoline C (which includes 27 percent of anhydrous ethanol) and hydrous fuel ethanol consumption are usually strongly negatively correlated given that most of the Brazilian light vehicle fleet is flex-fuel and consumers choose one or another fuel depending on the price parity. Consumers' decisions to buy hydrous ethanol or gasoline at the pump are mainly driven by the ratio between hydrous ethanol and gasoline prices. The 70 percent ratio between hydrous ethanol and gasoline prices is a rule of thumb in determining whether flex car owners can fill up with hydrous ethanol (price ratio below 70 percent) or gasoline (price ratio above 70 percent). This decision is tied to the energy content of each fuel with ethanol's energy content 36 percent lower than pure fossil gasoline.

The size and composition of the Brazilian light vehicle fleet affect the opportunity for ethanol consumption depending on the ethanol/gasoline price ratio. The fleet is estimated at 31.8 million units in July 2023. The table below shows the licensing of flex-fuel vehicles (FFV) and hydrous ethanol-powered cars, as reported by the Brazilian Association of Vehicle Manufacturers (ANFAVEA). Sales of FFV represent over 95 percent of total monthly vehicle sales. The COVID-19 pandemic inflation's impact on consumer spending has sharply reduced the sales of new cars.

**Table 10**  
*Licensing of Ethanol Powered Vehicles*

<b>Licensing of Ethanol Powered Vehicles (pure ethanol &amp; flex fuel units)</b>								
<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
2,940,508	2,194,020	1,750,754	1,927,221	2,168,173	2,328,650	1,664,999	1,624,348	1,633,280
Source: National Association of Vehicle Manufacturers (ANFAVEA)								

*Trade*

*Exports*

Post estimates total Brazilian ethanol exports for 2023 at 2.21 billion liters, a drop of 239 million liters compared to the previous year, based on the current export pace as reported by the Secretariat of Foreign Trade (SECEX). South Korea remains the primary export market for the Brazilian product (this is ethanol used in non-fuel applications and some is likely transhipped regularly to Japan), followed by the Netherlands and the United States in 2023 (January - June). Brazilian ethanol exports reached 2.44 billion liters in 2022, an increase of 25 percent compared to the previous year (1.95 billion liters). Major export destinations in 2022 were South Korea, the Netherlands, and the United States.

All or nearly all ethanol shipped to the United States is consumed as fuel in California due to the favorable Carbon Intensity (CI) rating that Brazilian sugarcane ethanol receives under Californian Low Carbon Fuel Standard (LCFS) and the state's carbon credit/debit market. Further advantaging Brazilian

ethanol, the U.S. Environmental Protection Agency's (EPA) Renewable Fuel Standard (RFS) recognizes sugarcane ethanol as an advanced biofuel, and the Renewable Identification Number (RIN) for advanced biofuels (D5 RINs) has historically been valued at a considerable premium relative to the conventional corn ethanol (D6) RIN. Note that depending on price relationships with US corn ethanol, Brazilian sugarcane ethanol may be shipped to the Gulf Coast and converted to ethyl tertiary butyl ether (ETBE) for further shipment to Japan. This trade is thus transshipped and although included in these tables should be excluded from stats on U.S. ethanol imports. It is difficult to estimate this portion of trade (when it exists) in recent years with the frequent flip flop between U.S. and Brazilian price competitiveness that has persisted since the beginning of the pandemic and its aftermath.

**Table 11**  
*Brazilian Ethanol Exports*

<b>Brazilian Ethanol Exports (NCM 2207.10, 2207.20.11, 2207.2019)</b>							
<b>Value US\$ 1,000 &amp; Volume 1,000 Liters</b>							
<b>Country</b>	<b>CY 2020</b>		<b>CY 2021</b>		<b>CY 2022</b>		<b>CY 2023*</b>
	<b>Value</b>	<b>Volume</b>	<b>Value</b>	<b>Volume</b>	<b>Value</b>	<b>Volume</b>	<b>Value</b>
South Korea	386,086	915,900	392,945	778,440	527,984	739,542	339,452
Netherlands	129,859	274,152	68,650	118,384	533,330	710,866	210,312
United States	428,629	994,829	267,914	465,461	308,528	461,980	142,494
United Kingdom	27,921	58,456	11,595	18,366	75,824	105,780	657,420
Japan	17,181	36,843	46,367	77,175	61,140	88,243	224,061
Nigeria	4,704	7,191	43,382	79,730	31,969	52,988	116,906
Philippines	23,459	46,289	27,181	41,843	27,728	43,315	152,880
Ghana	20,759	34,851	25,984	41,269	34,513	43,150	188,369
India	35	72	36,170	70,497	15,942	31,475	-
Cameroon	8,767	13,272	11,305	16,141	22,529	28,369	112,553
<b>Total</b>	<b>1,191,523</b>	<b>2,668,972</b>	<b>1,061,140</b>	<b>1,948,180</b>	<b>1,739,100</b>	<b>2,439,885</b>	<b>2,144,447</b>
Data Source: Trade Data Monitor (TDM) and Brazilian Secretariat of Foreign Trade (SECEX). Note: Numbers may not add due to rounding. / *2023 = January to July							

## Imports

Post estimates total Brazilian ethanol imports for 2023 at 405 million liters, an increase of 83 million liters compared to the revised figure for 2022 (322 million liters). In 2023 imports of fuel ethanol from the U.S. dropped to zero and the majority of imports are now from Paraguay.

**Table 12**  
*Brazilian Ethanol Imports*

<b>Brazilian Ethanol Imports (NCM 2207.10, 2207.20.11, 2207.20.19)</b>								
<b>Value US\$ 1,000 &amp; Volume 1,000 Liters</b>								
<b>Country</b>	<b>CY 2020</b>		<b>CY 2021</b>		<b>CY 2022</b>		<b>CY 2023*</b>	
	<b>Value</b>	<b>Volume</b>	<b>Value</b>	<b>Volume</b>	<b>Value</b>	<b>Volume</b>	<b>Value</b>	<b>Volume</b>
United States	340,894	836,097	136,958	269,483	133,945	212,325	367	239
Paraguay	70,724	164,101	88,834	162,535	69,587	103,207	28,139	45,011
Canada	216	149	229	140	232	137	0	0
Argentina	3,925	8,183	16	13	88	89	10	9
Germany	328	112	268	82	225	68	199	65
Poland	60	44	-	-	24	24	0	0
Spain	14	2	7	1	18	2	7	1
France	4	2	4	1	3	2	9	4
Belgium	0.32	0.04	0	-	17	1	4	1
South Africa	0	0	2	0	0	0	0	0
<b>Total</b>	<b>416,243</b>	<b>1,008,723</b>	<b>226,485</b>	<b>432,261</b>	<b>204,148</b>	<b>315,856</b>	<b>28,782</b>	<b>45,332</b>

Data Source: Trade Data Monitor (TDM) and Brazilian Secretariat of Foreign Trade (SECEX). Note: Numbers may not add due to rounding. / \*2023 = January to July

**Table 13**  
*Brazilian Ethanol Imports January-June*

<b>Brazilian Ethanol Imports (NCM 2207.10, 2207.20.11, 2207.2019)</b>						
<b>Value US\$ 1,000 &amp; Volume 1,000 Liters</b>						
<b>Country</b>	<b>2021 (January-June)</b>		<b>2022 (January-June)</b>		<b>2023 (January-June)</b>	
	<b>Value</b>	<b>Volume</b>	<b>Value</b>	<b>Volume</b>	<b>Value</b>	<b>Volume</b>
Paraguay	43,948	93,405	32,637	48,041	28,140	45,012
United States	60,549	133,389	133,820	212,299	284	183
Germany	147	42	86	28	196	64
France	3	1	2	1	10	4
Spain	4	1	8	1	7	1
Switzerland	0.10	0.01	4	0.05	39	0.45
Belgium	-	-	-	-	4	0.18
Denmark	-	-	-	-	0.50	0.14
Mexico	6	1	-	-	1	0.09
United Kingdom	9	4	-	-	0.41	0.06
Others	257	68	313	227	0.12	0.03
<b>Total</b>	<b>104,922</b>	<b>226,911</b>	<b>166,868</b>	<b>260,598</b>	<b>28,681</b>	<b>45,266</b>

Data Source: Trade Data Monitor (TDM) based on the Brazilian Secretariat of Foreign Trade (SECEX). Note: Numbers may not add due to rounding.

#### **IV. Biodiesel**

Brazil is the third largest producer and consumer of biodiesel following Indonesia and the United States. Recognizing the fact that RenovaBio and CBios also apply to biodiesel (which have had little market impact thus far) and an incremental change in auctions management (which continue to leave imports excluded), it is not a much of a stretch to conclude that Brazil’s biodiesel policy and programs are at risk of stagnating. Key to the issue of stagnation are whether or not blending of renewables in diesel is trending upwards, and if policy targeting environmental sustainability exist to incentivize lower carbon intensity of marketed fuels over time. Since the onset of the pandemic, the program has fallen victim to

fears over price inflation with considerable backpedaling on blends rates and no overall upward movement. Also, most noteworthy, there remains no effort to set minimal GHG reduction criteria for biodiesel and no certification scheme established to independently verified fuel carbon intensities using full LCA. This has raised concern over the impact of direct and indirect land use change in general and the true carbon intensity of palm-oil based biodiesel and even soyoil-based biodiesel in Brazil.

**Table 14**  
*Production, Supply and Distribution Table for Biodiesel in Brazil*

<b>Biodiesel (Million Liters)</b>										
Calendar Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023f
<b>Beginning Stocks</b>	65	85	101	102	111	123	124	128	70	85
<b>Production</b>	3,430	4,020	3,801	4,310	5,410	5,925	6,500	6,870	6,765	7,100
<b>Imports</b>	0	0	0	0	0	0	0	0	0	0
<b>Exports</b>	0	0	0	0	0	0	0	0	0	0
<b>Consumption</b>	3,410	4,004	3,800	4,301	5,398	5,924	6,496	6,928	6,750	7,150
<b>Ending Stocks</b>	85	101	102	111	123	124	128	70	85	35
<b>Production Capacity (Million Liters)</b>										
Number of Biorefineries	58	57	51	51	51	51	51	50	57	59
Nameplate Capacity	7,722	7,860	7,191	8,140	8,500	8,500	9,792	11,190	13,661	15,200
Capacity Use (%)	44%	51%	53%	53%	64%	70%	66%	61%	50%	66%
<b>Feedstock Use (1,000 MT)</b>										
Soybean oil, crude	2,280	2,600	2,440	2,714	3,400	3,680	4,000	4,180	4,070	4,300
Animal Fat (Tallow)	240	290	270	300	380	430	460	480	490	500
Used Cooking Oil	380	510	500	600	750	830	940	1,000	1,000	1,050
Palm Oil	25	30	30	40	80	100	110	130	130	140
Other	200	250	240	280	340	380	430	500	500	520
<b>Market Penetration (Million Liters)</b>										
Biodiesel, on-road use	2,458	2,927	2,759	3,122	3,918	4,300	4,715	5,029	5,420	5,520
Diesel Pool, on-road use 1/	43,283	41,813	39,402	39,759	40,381	41,593	41,719	45,087	46,000	46,500
Blend Rate (%)	5.7%	7.0%	7.0%	7.9%	9.7%	10.3%	11.3%	11.2%	10.7%	11.0%
Diesel Pool, total 1/	60,032	57,211	54,279	54,772	55,629	57,298	57,472	62,112	63,161	64,900

### *Production*

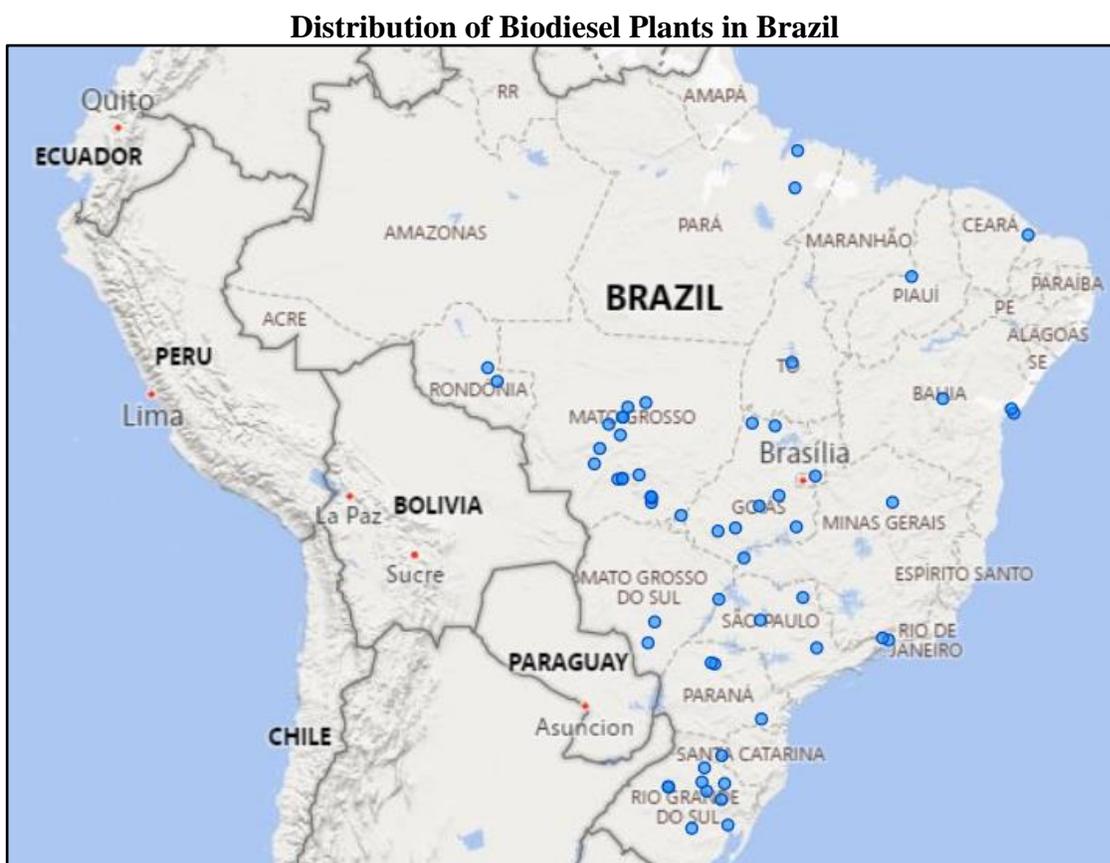
According to updated information reported by ANP, about 65.8 percent of the biodiesel production in 2022 is made from soybean oil and 16.2 percent is made from greasy material. The remaining feedstock is animal fat (tallow; 7.9 percent), and palm oil (2.1 percent). In addition, 8 percent of the production is generated from other fatty materials such as different raw materials blended in tanks and co-products from biodiesel production. For January to June 2023, 68.3 percent of biodiesel production is made from soybean oil. Tallow is 6.8 percent of the biodiesel production and palm oil is 2.3 percent. The remaining 15 percent is greasy material and 7.5 percent is different raw materials.

Post estimates total Brazilian biodiesel production in 2023 at 7.1 billion liters, a five percent increase compared to total production in 2022 (6.77 billion liters). On March 17, 2023, Brazil increased the current rate from 10 percent to 12 percent effective April 1<sup>st</sup>. Brazil also stated there will be further increases to the biofuel mandate until 15 percent (B15) is reached in 2026. Post's estimates include 12 percent reached late in 2023. The cumulative production of biodiesel from January to June 2023 is 3.3 billion liters, an increase of 13 percent compared to the same period of 2022 (2.9 billion liters).

According to ANP, Brazil currently has 59 plants authorized to produce biodiesel. Nearly 60 percent of the plants are in the Center-West region, with an abundant soybean supply. According to ANP, the authorized industrial capacity for 2023 is estimated at 38.6 million liters of biodiesel per day or 14.1 billion liters per year, based on a 360-day operational cycle, an increase of 3.2 percent compared to 2022 (14 billion liters).

## Map 2

*Distribution of Biodiesel Plants in Brazil*



Source: ANP

## Market Prices

The new market model for sale of biodiesel set by CNPE Resolution # 14/2020 and regulated by ANP through Resolution # 857/2021 started in January 2022. The new model developed by ANP (SRD-Biodiesel system) replaces the longstanding public auction system which ended in December 2021. (Refer to Section II: Policy and Programs - The New Model for the Biodiesel Market for further details).

The new market model has provided more market flexibility since it allows biodiesel producers and distributors to settle over-the-counter (OTC) contracts. Minimum prices floors for contracts remain regulated. ANP has tracked weekly prices for biodiesel under the new market model. Weekly prices ranged from R\$ 6,5028/liter to 5,7370/liter between January and December 2022. From January to July 2023, the average biodiesel weekly prices ranged from R\$5,7111/liters to R\$4,1894/liters.

(Please refer to [Brazilian Biofuels Annual Gain Report 2022](#) for additional information on past use of the ANP biodiesel public auction system).

Raw materials represent approximately 80 percent of the biodiesel production cost, whereas other inputs such as methanol and additives represent 10 percent of the total cost. According to post contacts, feedstocks like animal fat (tallow) and other vegetable oils follow soybean oil prices. Changes in the international soybean oil prices, Brazil’s real exchange rate, and plant energy operating costs directly impact biodiesel production costs.

Soybean prices remained elevated until March 2023 due to steady international demand for the product, imbalances between world supply and demand, and the continued weakness of the Brazil’s real via-a-vis the U.S. dollar. However, soybean oil prices dropped sharply since then to the lowest levels experienced in the last several years.

**Table 15**  
*Crude Soybean Oil Prices in January – May 2023*

<b>Soybean Oil, Crude - Prices (2023)</b>					
<b>Location</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>
<b>Chicago (US\$/ton)</b>	1,378.76	1,352.74	1,258.34	1,192.25	1,079.50
<b>Premium (US\$/ton)</b>	-200.07	-179.12	-194	-236.99	-177.25
<b>Port of Paranaguá - Fob (US\$/ton)</b>	1,178.69	1,173.62	1,064.34	955.25	902.25
<b>Sao Paulo - (R\$/ton com ICMS 12%)</b>	6,138.61	6,065.63	5,566.02	4,800.08	4,515.87
Elaborated by ABIOVE based on several sources.					

**Table 16***Crude Soybean Oil Prices in July - December 2022*

<b>Soybean Oil, Crude - Prices (2022)</b>						
<b>Location</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
<b>Chicago (US\$/ton)</b>	1,331	1,519	1,492	1,554	1,645	1,441
<b>Premium (US\$/ton)</b>	-31	-143.30	-292	-245	-315	-191
<b>Port of Paranaguá - Fob (US\$/ton)</b>	524.	511	508	483	476	543
<b>Sao Paulo - (R\$/ton com ICMS 12%)</b>	6,923	6,949	6,142	6,683	7,038	6,482
Elaborated by ABIOVE based on several sources.						

**Table 17***Crude Soybean Oil Prices in January – June 2022*

<b>Soybean Oil, Crude - Prices (2022)</b>						
<b>Location</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>
<b>Chicago (US\$/ton)</b>	1,341	1,476	1,681	1,756	1,844	1,696
<b>Premium (US\$/ton)</b>	34	42	118	75	24	-88
<b>Port of Paranaguá - Fob (US\$/ton)</b>	1,376	1,518	1,800	1,831	1,867	1,607
<b>Sao Paulo - (R\$/ton com ICMS 12%)</b>	7,564	7,853	8,874	8,714	9,005	8,004
Elaborated by ABIOVE based on several sources.						

### *Consumption*

Post forecasts biodiesel consumption for 2023 at 7.15 billion liters, a six percent increase from 2022 (6.75 billion liters). Biodiesel domestic consumption in Brazil remains regulated by the government and is a function of two variables: 1) the mandatory biodiesel blend rate and 2) overall diesel pool size. Despite CNPE's Resolution #16 from 2018, which recommends the annual increase of the biodiesel blend by one percent from B11 in 2019 to B15 by March 2023. ANP has adjusted the biodiesel blend multiple times since and most recently to 12 percent in April 2023. (*Refer to Section II – Policy and Programs: Biodiesel Mandate and Section IV – Biodiesel: Market Prices for further information*).

The return of the post-pandemic domestic economic activity has supported growth in the demand for heavy-duty transportation ongoing since 2020 that persists today. The total diesel pool (which included biodiesel) increased by two percent in 2022, reaching 63.2 billion liters amid strong demand from the country's agriculture, mining and e-commerce sectors. In addition, Post contacts project the total diesel pool will advance another three percent to 64.9 billion liters in 2023, following the expected growth for the Brazilian Gross Domestic Product (GDP).

### *Trade*

Brazil does not export biodiesel because it is not generally cost-competitive due to its auction pricing scheme and because potential nearby markets like Argentina and Colombia prohibit imports. Biodiesel

imports are still not authorized by ANP, except under “exceptional circumstances”, and thus in practice remain zero.

## **V. Advanced Biofuels**

### Cellulosic Ethanol

Total cellulosic ethanol production for 2023 is estimated at 51 million liters. This amount still represents an insignificant share of total ethanol production in Brazil. This industry remains stymied with the lack of specific policies targeting and supporting its expansion.

In April 2022, Acelen signed a memorandum of understanding with the Government of Bahia for the investment of \$R 12 billion in biorefining in Bahia based on the existing infrastructure of the Mataripe Refinery. This was signed between representatives of the company, the United Arab Emirates fund and the Governor of Bahia. The project will result in the production of 20,000 barrels a day of renewable diesel plus SAF, with the goal of export starting in 2026.

Petrobras entered the biorefining market with coprocessing. This was launched in September 2022 from Getulio Vargas in Parana with the diesel production capacity of 5 million liters per day with renewable content. The company plans to reach 21 million with three new units. Vibra Energia established a contract with Brasil BioFuels to commercialize advanced biofuels from 2025 from palm oil produced in Roraima and a unit in the Manaus Free Trade Zone.

Raizen, the 50-50 joint venture between Shell and Brazil's Cosan, has invested R\$ 2.8 billion in the construction of three new cellulosic ethanol plants in Brazil in addition to the existing plant in Piracicaba, state of Sao Paulo. The new E2G plants are expected to begin operating in 2023 and will have approximately double the capacity of Raizen's existing E2G plant. Therefore, the aggregated industrial capacity for the four plants will be 280 million liters of second-generation ethanol (E2G) per year.

Despite the investments by Raizen, total cellulosic ethanol production is still an insignificant fraction of total ethanol production in Brazil. In addition to Raizen, Bioflex from Grambio, in the state of Alagoa, has an industrial capacity to produce 30 million liters of second-generation ethanol.

### *Government Support for Fuel Ethanol*

#### *Social Impacts of Biodiesel*

The launch of the National program for the Production and Use of Biodiesel (PNPB) in 2005 established a goal of promoting family farming in the north and northeast of Brazil. The impacts of this program on this region have been minimal and according to the most recent report of the Social Biofuel Seal program that encourages manufacturers to buy raw materials from smaller farms, of the R\$ 8.82 billion that these mills invested, less than R\$ 478.5 million, 5.4 percent of the total was produced in the north and northeast. From June- July 2023, MME and the Ministry of Agrarian Development and Family Agriculture (MDA) opened a public consultation for a new ordinance that will make it

mandatory for at least 20 percent of raw materials come from these two regions. The ordinance establishes participation targets for the North, Northeast and Semi-arid regions, within the scope of at least 10 percent in 2024, 15 percent in 2025 and 20 percent in 2026.

### *Renewable Diesel (HDRD) and Sustainable Aviation Fuel (SAF)*

Unlike other major markets for renewable diesel in Europe, the United States and Canada, Brazil is only now only focusing on the possibility of supporting a renewable diesel market. To date, hydrogenation-derived renewable diesel (HDRD) is the only type of renewable diesel commercially available at scale. A similar situation is true for sustainable aviation fuel (SAF). Brazil is one of the few countries who have recently developed a focus in SAF, and unfortunately if goal setting remains focused on , nor has a SAF market emerged. Mandates and/or effective incentive policy/financial support mechanisms have yet to emerge causing Brazil to fall behind those with more dynamic policy environments.

Hydrogenation-derived Renewable Diesel (HDRD) production and commercialization in the Brazilian market have been recently regulated by ANP. (Refer to Section II: Policy and Programs - Government Support for Advanced Biofuels for further reference). Palm oil producer Brazil Biofuels (BBF) and Vibra Energia, the main fuel distributor in Brazil, set an agreement to build the first HDRD plant in the country. BBF will invest R\$1.8 billion (\$340 million) in the new unit that will use palm oil as feedstock and is expected to start operations by 2025 in the tax-free zone of the city of Manaus in the state of Amazonas. Under the agreement, Vibra Energia will trade the whole output of the plant that will have an initial capacity to produce 500 million liters of the palm oil-based HDRD per year. The international community will have credible and substantial concerns about the true carbon intensity as well as the direct and indirect land use change impacts of the fuel produced.

In addition, the Brazilian group ECB is building a plant in Paraguay, the Omega Green plant, which is expected to be operating by 2024. Omega Green has an estimated production capacity of 27.6 million liters/year, shared between renewable diesel, sustainable aviation fuel and green naphtha. ECB Group plans to use soybean oil, animal fats, and used cooking oil as feedstock.

Brazil's state-controlled Petrobras and fuel distributor Vibra Energia (formerly BR Distribuidora) are testing Petrobras “renewable diesel” blend made partly from edible oils in public buses in the city of Curitiba. The company's R5 diesel, produced by co-processing vegetable oils and animal fats with petroleum diesel, has a five percent renewable component. Under the testing plan, Vibra Energia will be responsible for blending ten percent biodiesel with the R5 diesel, meaning the final product delivered to customers will have a 15 percent renewable content. Note that ANP does not allow co-processing fuels to be classified under the green or renewable diesel definition.

The program aims to foster the use of sustainable fuels by designing policies to introduce biofuels to water and air transportation and improve current biofuels product specifications; proposing improvements to the regulatory stock related to carbon capture and storage technologies; and developing incentives to invest in sustainable fuel Research, Development, and Innovation (RDI) initiatives. In May 2021, ANP approved [Resolution #842](#), setting up the routes, specifications, and quality requirements to be followed by the Brazilian market for renewable diesel (“diesel verde”). Hydrotreatment of vegetable oil, algae oil, microalgae oil, animal fat and fatty acids from biomass; which results in a Hydrogenation-derived Renewable Diesel (HDRD) is one type of renewable diesel

and the only pathway commercialize at scale today, almost entirely restricted to the United States and Europe with limited production in China and Indonesia. ANP's resolution does not allow Petrobras, Brazil's national oil company, to include co-processing fuel under the green or renewable diesel definition. Co-processed fuel is fossil fuel processed in a petroleum refinery with lower percentages of fats or oils (lipids) biomass added as feedstock along with crude oil.

The Brazilian government has been conducting studies on whether to set an HDRD use mandate for Brazil's diesel pool. In North America and Europe, HDRD is credited with significant GHG reductions over its fossil fuel equivalent, and is far cleaner burning than both biodiesel and fossil diesel emitting less NOX, toxins and fine particulate matter. Unlike biodiesel, HDRD is 100% fungible with fossil diesel requiring no engine modification for 100 replacement of fossil diesel nor separate supply chain infrastructure.

The Brazilian government has also discussed introducing a sustainable aviation fuel (SAF) use mandate that would take effect in January 2027, targeting the reduction of Brazilian airline GHG emissions by one percent of total emissions generated by the industry in 2026. GHG emissions reductions for the Brazilian airlines would potentially reach ten percent with the ongoing development, production, and commercialization of SAF.

Market stakeholders are rushing to meet the 2027 deadline, when aviation companies operating in Brazil will also need to commit to the decarbonization targets set under CORSIA, the Carbon Offsetting and Reduction Scheme for International Aviation. Note that the Brazilian government will most likely further connect RenovaBio to CORSIA, thus potentially increasing the international liquidity of CBIO decarbonization credits.

In July 2022, Embraer, a Brazilian aircraft manufacturer and the third largest worldwide, signed a letter of intention with Raízen, the largest Brazilian biofuels producer, to encourage the development of sustainable aviation fuel production (SAF) ecosystem. According to the statement, Embraer will become the first aircraft manufacturer to consume SAF that Raízen can distribute.

The Ministry of Mines and Energy/Energy Research Enterprise (MME/EPE) has released the Brazilian Decennial Energy Plan (PDE2031). It has already included SAF in the energy matrix for the upcoming years, assuming that public policies will be made available to make SAF economically viable. According to PED2031, by 2031, SAF's market share is estimated at 1.4 percent (about 130,000 m<sup>3</sup>) of total jet fuel demand, with specific airlines adopting certified technology routes. EPE's projection assumes investments of US\$ 100 million in the construction of an industrial plant to produce biokerosene (likely HEFA type) in tandem with the production of HDRD, bio-naphtha and liquefied petroleum gas (LPG), of about 400 million liters.

## VI. Notes on Statistical Data

### *Ethanol*

The beginning stocks for the Ethanol Used as Fuel and Other Industrial Chemicals table (excluding ethanol for beverages) are based on information from the Ministry of Agriculture, Livestock and Supply (MAPA) and reflect all stocks at the ethanol plants as of January 1, each year. Beginning Stocks for the ethanol “For Fuel Only” are estimated based on the historical average use of bioethanol for fuel/other uses. On average, ethanol for fuel has represented 87 percent of the total ethanol disappearance (use).

ATO/Sao Paulo historically reported all figures related to the sugar-ethanol industry in marketing years and made necessary adjustments to convert from marketing to calendar years. As determined by the Brazilian Government, the official Brazil marketing year for sugarcane, sugar, and ethanol production is April through March for the center-south producing states. The official marketing year for the north-northeast region is September through August.

MAPA provides ethanol production estimates for Fuel and Other Industrial Chemicals. Given that all Brazilian official publications and industry sources report production in hydrous/anhydrous ethanol only, production estimates “For Fuel Only” are taken as the difference between “production for all uses” minus estimates for “disappearance for other uses” (domestic consumption and exports).

Trade figures were based on the Brazilian Secretariat of Foreign Trade (SECEX). SECEX breaks down trade numbers into four categories as described below:

- NCM 2207.10.10 – Undenatured ethylic alcohol with ethanol content equal to or over 80 percent with water content equal to or below 1 percent volume. Undenatured alcohol is defined as pure ethanol with no additives and is suitable for consumption.
- NCM 2207.10.90 - Undenatured ethylic alcohol with ethanol content equal to or over 80 percent, others. Undenatured alcohol is defined as pure ethanol with no additives and suitable for consumption.
- NCM 2207.20.11 - Denatured ethylic alcohol with any ethanol content and water content equal to or below 1 percent volume. Denatured alcohol is defined as ethanol with additives that make it poisonous and/or unpalatable, thus not suitable for human consumption. Denatured alcohol is used as a solvent and as fuel for spirit burners and camping stoves. Different additives like methanol are used to make it difficult to use distillation or other simple processes to reverse the denaturation.
- NCM 2207.20.19 - Denatured ethylic alcohol with any ethanol content, others. Denatured alcohol is defined as ethanol with additives that make it poisonous and/or unpalatable, thus not suitable for human consumption. Denatured alcohol is used as a solvent and as fuel for spirit burners and camping stoves. Different additives like methanol are used to make it difficult to use distillation or other simple processes to reverse the denaturation.

There are no figures for ethanol exports for fuel and/or other uses. Post estimated ethanol “for fuel” based on industry sources.

Domestic consumption figures were taken from information provided by Datagro, the National Agency for Petroleum, Natural Gas and Biofuels (ANP), the Sugarcane Industry Union (UNICA) and other Post contact information.

The number of biorefineries is taken from MAPA and UNICA up to 2013. As of 2014, ANP started to report the total number of units.

Ethanol production capacity was based on production figures as reported by UNICA up to 2013. Using UNICA's source material, Post took the highest ethanol production figure in a given 15-day period, as reported by the institution, and extrapolated it to the entire center-south crushing season. A similar procedure was performed for northeast production based on MAPA reports. As of 2014, ANP became the source, with no adjustments needed. ANP provides the daily industrial capacity for hydrated ethanol production and ATO/Sao Paulo multiplies it by 185 through 240 days, depending on the estimate for the sugarcane crushing period in a given year.

Sugarcane crushed for ethanol production was calculated based on the actual production breakdown for sugar/ethanol as described in previous GAIN reports. Feedstock use and co-product data are consistent with fuel ethanol production figures and based on the following conversion rates:

- 1 metric ton of sugarcane = 80 liters of ethanol
- 1 metric ton of corn = 417 liters of ethanol
- 1 metric ton of corn yields 313 kg of Dried Distilled Grains (DDGs)
- 1 metric ton of corn yields 18 liters of corn oil

### *Biodiesel*

Historical production numbers are based on figures reported by ANP and forecasts are based on projections for diesel consumption and the results from the public auctions. Consumption figures are based on mineral diesel consumption and the mandatory mixture of biodiesel in mineral diesel set by Brazilian legislation.

Trade figures are based on the Brazilian Secretariat of Foreign Trade (SECEX), as reported below:

- From 2006 through 2011 - NCM 3824.90.29 – Other industrial fatty acid derivatives, mixtures and preparations containing fatty alcohols or carboxylic acids or their derivatives.
- As of 2012 – NCM 3826.00.00 – Pure biodiesel (B100) and their blends above B30.
- As of 2012 – NCM 2710.20 – Petroleum oils containing biodiesel up to and including 30% by volume. The following assumption was made: 1 metric ton of petroleum oils and oils obtained from bituminous minerals which fall under NCM 2710.20 is equivalent to 0.15 metric tons of pure biodiesel (B100).

The number of biorefineries and production capacity are based on ANP reports. Feedstock use data are consistent with biodiesel production figures and based on the following conversion rates:

- 1 metric ton of soy oil, crude = 1,113 liters of biodiesel
- 1 metric ton of animal fat/grease = 1,043 liters of biodiesel
- 1 metric ton of biodiesel = 1,143 liters of biodiesel

## APPENDIX

### Map 3

*Brazil's Division by Regions and States*



**Table 18***Exchange Rate between Brazilian Real and U.S. Dollar*

<b>Exchange Rate (R\$/US\$1.00 - official rate, last day of period)</b>							
<b>Month</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
January	3.13	3.16	3.65	4.25	5.48	5.36	5.10
February	3.10	3.24	3.74	4.50	5.53	5.14	5.21
March	3.17	3.32	3.90	5.20	5.70	4.74	5.08
April	3.20	3.48	3.94	5.43	5.40	4.92	5.00
May 1/	3.26	3.74	3.94	5.43	5.23	4.79	4.97
June	3.30	3.86	3.83	5.48	5.00	5.23	
July	3.13	3.75	3.76	5.20	5.12	5.18	
August	3.15	4.14	4.14	5.47	5.14	5.17	
September	3.17	4.00	4.16	5.64	5.44	5.40	
October	3.27	3.72	4.00	5.77	5.64	5.26	
November	3.26	3.86	4.22	5.33	5.62	5.29	
December	3.31	3.87	4.03	5.20	5.58	5.21	
Source: Brazilian Central Bank (BACEN) 1/ May 2022 refers to May 11							

**Attachments:**

No Attachments