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Report Highlights:

Total Brazilian ethanol production for 2022 is estimated at 31.66 billion liters, an increase of six percent relative to 2021 due to the expected increase in sugarcane production and the steady increase in corn ethanol production. In June 2022, the Brazilian government approved Complementary Bill # 194, capping the state tax for circulation of goods and services (ICMS) on fuels at 17 -18 percent and reduced other taxes on gasoline and ethanol to zero to control escalated fuel prices. No tariff-rate quota (TRQ) and import duty are currently applied to ethanol imports to Brazil. The biodiesel blend has been set at ten percent since November 2021 to control escalated costs associated to feedstock prices. RenovaBio, Brazil's National Biofuels Policy, picked up momentum once Brazil's B3 stock exchange started trading CBios in April 2020. CBio average prices in 2022 (January - August) ranged from R\$50 to R\$196/mt of carbon or about US\$9.77 to US\$38.28/mt of carbon with the current exchange rate.

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I. Executive Summary

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 (GtCO₂e) as opposed to the previously calculated 2.8 billion tons of GtCO₂e (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 GtCO₂e.

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:

- 1) Annual carbon intensity reduction targets (CO₂/MJ) for a minimum of ten years.
- 2) Certification of biofuels by efficiency in reducing GHG emissions.
- 3) Decarbonization Credits (CBio).

Currently 316 biofuel plants (representing over 75 percent of the total plants in Brazil) are certified to issue CBios (269 sugarcane ethanol plants, six sugarcane and corn ethanol plants, one cellulosic ethanol plant, five corn-ethanol plants, 32 biodiesel plants, and three biomethane plants).

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 the National Agency for Petroleum, Natural Gas and Biofuels (ANP), Brazilian fuel distributors met 97 percent of RenovaBio's 2021 target by retiring 24.4 billion decarbonization credits (CBios). CBio average prices in 2021 ranged from R\$27 to R\$60/mt of carbon or about US\$5.27 to US\$11.72/mt of carbon with the current exchange rate.

CBio average prices in 2022 (January - August) ranged from R\$50 to R\$196/mt of carbon or about US\$9.77 to US\$38.28/mt of carbon with the current exchange rate. The overall bullish environment for CBio prices in 2022 is a consequence of several factors that could reduce the potential for credit generation this year, thus creating an imbalance between CBio supply and demand.

No changes have been made to the current ethanol mandate, which remains at 27 percent (E27) for Gasoline C (Gasolina comum) since March 16, 2015. 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.

The current biodiesel blend is set at ten percent (B10) since November 2021. ANP has been adjusting the biodiesel blend below the Brazilian National Council for Energy Policy's (CNPE) recommendation

to control the escalated costs associated with biodiesel production due to shortages in biodiesel feedstock, mostly soybeans and animal fat (tallow).

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 counted with great adhesion 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.

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.

Brazil remains the second largest producer and consumer of ethanol, following the United States, the top producer, consumer, and exporter. Total Brazilian ethanol production for 2022 is estimated at 31.66 billion liters, an increase of six percent relative to the revised figure for 2021 (29.98 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. High fuel prices in 2022 have not supported an increase in otto-cycle fuel consumption.

Total ethanol consumption for 2022 is estimated at 29.60 billion liters and total ethanol consumption for use as fuel is estimated at 27.67 billion liters. Total Brazilian ethanol imports for 2022 are estimated at 605 million liters, an increase of 173 million liters compared to the revised figure for 2021 (432 million liters). Ethanol imports are mostly for fuel use and originated mainly from the United States, followed by Paraguay.

Brazil is the third largest biodiesel producer, following Indonesia and the United States. Brazilian biodiesel production remains regulated by the government. Total Brazilian biodiesel production in 2022 is forecast at 6.37 billion liters, a seven percent drop compared to 2021. Despite the projected growth in diesel consumption for 2022, ANP has reduced the mandatory blend to 10 percent since November 2021 to manage the higher soybeans prices, a major biodiesel feedstock. Biodiesel trade is still nearly nonexistent.

II. Policy and Programs

Brazil's Commitments to Reduce Greenhouse Gas Emissions

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.

In November 2021, the country presented a new target for reducing greenhouse gas emissions (GHG) 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 (GtCO₂e) as opposed to the previously calculated 2.8 billion tons of GtCO₂e (third version of 2020). Therefore, in practice the new target is equivalent to 2015's commitments, with emissions limited to a maximum of 1.2 GtCO₂e.

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.

The goals of RenovaBio include:

- Contributing to meeting the country's commitments under the COP21 Paris Agreement under the UNFCCC.
- Contributing 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.
- Promoting the adequate expansion of the production and use of biofuels in the national energy matrix, emphasizing the continuity of fuel supply.
- Contributing to the predictability of biofuels in the national fuel market.

RenovaBio is based on three main instruments: annual carbon intensity reduction targets (CO₂/MJ), certification of biofuels by efficiency in reducing GHG emissions, and Decarbonization Credits (CBio). 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 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.

RenovaBio Program's 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). Out of 142 fuel distributors, 102 companies met their entire RenovaBio's 2021 targets, 16 retired 85 percent of their respective targets, seven companies met less than 85 percent of the target, and 17 did not retire CBios. According to the legislation, fuel distributors who do not meet given targets are subject to a penalty and must aggregate their unmet 2021 quota with their 2022 target. CBio average prices in 2021 ranged from R\$27 to R\$60/mt of carbon or about US\$5.27 to US\$11.72/mt of carbon with the current exchange rate.

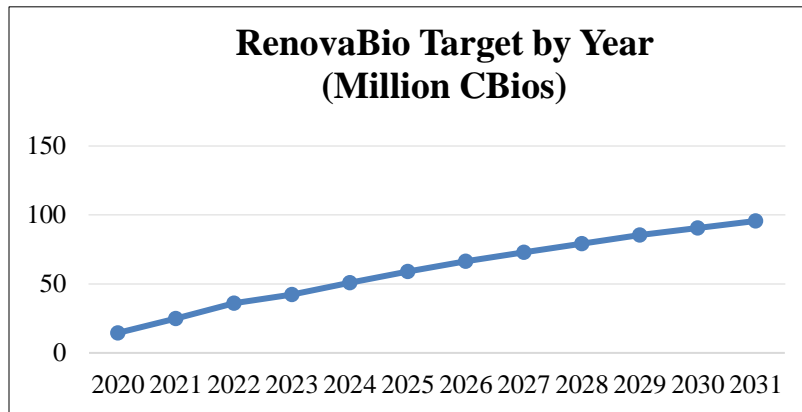
In October 2021, ANP set the annual compulsory targets for reducing GHG emissions from transport fuels for the 2022 through 2031 period, as illustrated in the Table and Graph below.

Table 01

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Annual Target (in million of CBios)	35.98	42.35	50.81	58.91	66.49	72.93	79.29	85.51	90.67	95.67
Tolerance Interval	--	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

Graph 01



Source: ANP

In March 2022, ANP established the 2022 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 (9.74 million CBios, equal to 27 percent of the total)
- Raizen (6.91 million CBios, equal to 19.2 percent of the total)
- Ipiranga (6.75 million CBios, equal to 18.7 percent of the total)
- Petroleo Sabbá (971,735 CBios, equal to 2.7 percent of the total)
- Alesat (947,573 CBios, equal to 2.6 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.

About 23.86 million CBios, roughly 66 percent of the compulsory target for 2022, were available for trade on the B3 exchange until the end of July 2022. CBio average prices in 2022 (January thru early August) ranged from R\$50 to R\$196/mt of carbon or about US\$9.77 to US\$38.28/mt of carbon with the current exchange rate. The graph below shows CBio prices traded at B3, the Brazilian stock exchange since the beginning of the RenovaBio program.

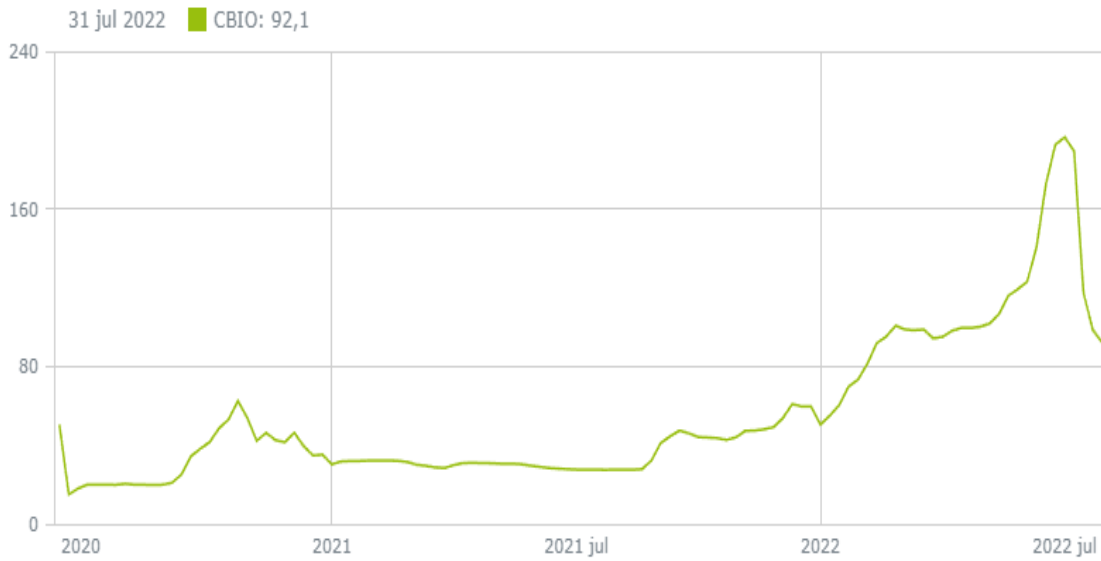
The overall bullish environment for CBio prices in 2022 is a consequence of several factors that could potentially reduce credit generation this year, thus creating an imbalance between CBio supply and

demand. Major factors include doubts about the size of the sugarcane crop in the center-south, the share of the sugarcane crop diverted to sugar and/or ethanol, and the reduction of the biodiesel blend from the expected B14 (in March 2023) to B10 (since November 2021).

The slowdown in fuel consumption is also raising concerns about the convergence between the generation of CBios and the RenovaBio targets, as well as the Russia-Ukraine war impacting price fluctuations in the energy market. Note that CBios prices dropped after the government decided to postpone the due date for distributors to prove that they met the 2022 individual target to purchase CBios from December 2022 to September 2023.

Graph 02

Average CBio Prices (R\$)



Source: Datagro based on B3.

There are currently 316 biofuel plants (representing over 75 percent of the total plants in Brazil) certified to issue CBios (269 sugarcane ethanol plants, six sugar and corn ethanol plants, one cellulosic ethanol plant, five corn ethanol plants, 32 biodiesel plants, and three biomethane plants). Another 12 plants are in the process of getting the required certification. Updated information can be found at <https://observatoriodacana.com.br/listagem.php?idMn=142>. ANP has authorized nine companies to certify plants aiming to issue CBios. The companies are Green Domus, SGS, Instituto Totum, Fundacao Vanzolini, KPMG, Benri, Verifit, Intertek, ABNT.

In June 2022, ANP made available the eighth version 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) 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 has also reviewed several aspects of Resolution #758 from 2018, which regulates the certification of the efficient production or importation of biofuels under RenovaBio.

Government Support for Ethanol Programs

Anhydrous Ethanol Use Mandate

No changes have been 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. There is no market for unblended fossil gasoline in Brazil.

The ethanol-use mandate has been mandatory since 1977, when 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. The table below shows the ethanol-use mandate since 2006.

Table 02

Anhydrous Ethanol Use Mandate		
Year	Month	Mandate
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 for Ethanol Fuel

Brazil has a complex tax system, including several federal, state, and municipal taxes. The Brazilian Government (GOB) can provide incentives for gasoline and/or ethanol at the pump depending on policymakers' economic and financial strategies. 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 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.

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.

Tax Incentives for Ethanol, Gasoline and Flex-Fuel Vehicles

Tax incentives have played an important role in supporting ethanol consumption since 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.

The table below updates taxes applied to ethanol, flex-fuel, and gasoline vehicles for 2013 through 2021. No changes have been made to the tax incentives for ethanol-flex-fuel vehicles compared to gasoline vehicles last year. Please refer to the "[Brazilian Biofuels Annual Gain Report 2015](#)" for historical information since 2004.

Table 03

Taxes Applied to Ethanol, Flex-Fuel and Gasoline Vehicles (Percentage)						
Year	Taxes	1000 cc	1001-2000 cc		Over 2000 cc	
		Gasoline/ Ethanol/ Flex	Gasoline	Ethanol / Flex	Gasoline	Ethanol/ Flex
2013	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
2014	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
2015/ thru 2021	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
Source: National Association of Motor Vehicle Manufacturers (ANFAVEA)						
MSRP = Manufacturer Suggested Retail Price. The aggregation of the individual taxes does not necessarily add up to the Average Retail Price (fourth row) percentage because each tax applies to different steps of the production chain and not to the final retail price. During 2013, the Brazilian government offered temporary tax breaks to some categories.						

Credit Lines

The Brazilian Agricultural Crop and Livestock Plan for 2022/23 was announced in June 2022 by MAPA. A total of R\$ 341 billion will be released to fund agricultural and livestock programs, a significant increase of 36 percent relative to the last season. 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.

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.

Ethanol Import Policy

No tariff-rate quota (TRQ) is currently applied to ethanol imports to Brazil. On March 21, 2022, the Brazilian federal government announced the drop of the ethanol import tariff to zero until December 31, 2022. 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, when it went into effect. According to the Ministry of Economy, the measure could make gasoline at fuel pumps cheaper by up to R\$0.20 per liter. Brazil has been adopting a series of measures to try to stop the rise in fuel prices at the pump since 2021, a situation that has worsened since Russia invaded Ukraine in February.

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 in the Energy Sector, Bioenergy, and Biofuels

The former Brazilian Minister of Mines and Energy, Bento Albuquerque, traveled to India in April 2022 at the invitation of the Minister of Petroleum & Natural Gas of the Republic of India. Former Minister Albuquerque was accompanied by a delegation of private sector leaders of the biofuels and automotive sectors. The leaders of both countries reviewed the existing bilateral cooperation across the entire energy sector spectrum and committed to enhancing the beneficial partnership between the countries. In this context, he expressed satisfaction at the important role bilateral energy cooperation plays in deepening the strategic partnership between the two countries.

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).

Government Support for Biodiesel Programs

The National Biodiesel Production Program

The National Biodiesel Production Program (PNPB) was created in 2004 to promote domestic biodiesel production, reduce petroleum import dependency, and lower 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*).

The Biodiesel 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.

Despite CNPE's Resolution #16, ANP has been adjusting the biodiesel blend below CNPE's recommendation since May 2021 to control the escalated 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*). The current biodiesel blend is set at ten percent (B10) since November 2021. The table below shows the evolution of the biodiesel use mandate as reported by ANP.

Table 04

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

Source: ANP

The New Model for the Biodiesel 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.

The biodiesel supply contracts have been successfully informed and validated by fuel distributors and producers through a system developed by ANP, called SRD-Biodiesel. The new model has counted with great adhesion of fuel distributors and producers. Aggregated contracts have reached volumes above the estimated demand, thus demonstrating that the new trade model is effective and ensures supply to the final consumer throughout the country. 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>.

Biodiesel Import Policy

According to CNPE's Resolution #14/2020, the Brazilian market should be open for biodiesel imports as of January 2023 (one year after the implementation of the new biodiesel market model). As reported by the Secretariat of Foreign Trade (SECEX), the regular import tariff applied to biodiesel blends above B30, including pure (B100) biodiesel (NCM 3826.00.00), is fixed at 14 percent. However, on May 13, 2022, Foreign Trade Chamber's Resolution # 353/2022 temporarily reduced the biodiesel import tariff to 11.4 percent until December 31, 2023. According to the Resolution, several other products also had their import duties temporarily reduced in an attempt to mitigate the supply/demand imbalances caused by the COVID-19 pandemic and the Russia-Ukraine war. The import tariff for petroleum oils containing biodiesel is zero, including B30 (NCM 2710.20).

Government Support for Advanced Biofuels

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.

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 of producing routes for renewable diesel. Note that the ANP’s resolution does not allow Petrobras, the Brazilian oil company, to include co-processing fuel under the green or renewable diesel definition. Co-processing fuel is fossil fuel processed in a fuel refinery with a “x” percent of a biomass raw material added to the processing.

The Brazilian government has been conducting studies on whether to set a HDRD mandate in Brazil's biodiesel mixture. HDRD is considered less emissions-intensive than regular diesel and can be used directly in diesel-fueled engines or blended at any rate with fossil-based diesel.

The Brazilian government has also discussed introducing a sustainable aviation fuel (SAF) 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. The drop in GHG emissions by the Brazilian airlines would potentially reach ten percent with the ongoing development, production, and commercialization of SAF.

The Brazilian SAF mandate will likely be based on the reduction of GHG emissions, thus encouraging SAF producers to look for the best life cycle emission reduction perspective, and not for the volume blended, as it occurs with the current ethanol and biodiesel mandates. 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 aviation biokerosene economically viable. According to PED2031, by 2031, SAF's market share is estimated at 1.4 percent (about 130,000 m³) of total aviation 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, associated with the production of HVO (green diesel), bio-naphtha and liquefied petroleum gas (LPG), of about 400 thousand cubic meters per year.

III Ethanol

Brazilian Ethanol Production, Supply and Demand (PS&D) Tables

Sugarcane is the main source of feedstock for ethanol production in Brazil, followed by corn. The table below shows the Brazilian ethanol production, supply and demand (PS&D) spreadsheet for Ethanol Used as Fuel and Other Uses (Industrial and Chemicals, excluding ethanol for beverages) for calendar years 2013 through 2022. (Refer to Section VI: Notes on Statistical Data – Ethanol for further information on these tables).

No Brazilian government entity or trade source maintains production figures on use “for fuel” or “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 05

Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f
Beginning Stocks	7,894	8,995	10,167	8,232	8,012	8,973	10,401	12,327	14,451	13,370
Fuel Begin Stocks	7,490	8,590	9,713	7,765	7,520	8,475	9,899	11,820	13,939	12,853
Production	27,642	28,553	30,365	28,405	28,142	33,078	37,383	35,081	29,980	31,655
Fuel Production	24,377	25,585	27,248	25,546	25,170	30,233	34,407	30,897	26,195	28,421
>of which is cellulosic (a)	0	0	2	6	17	25	30	32	40	55
Imports	132	452	513	835	1,796	1,775	1,457	1,008	432	605
Fuel Imports	131	403	500	810	1,791	1,770	1,452	1,003	427	600
Exports	2,917	1,398	1,867	1,789	1,380	1,685	1,941	2,669	1,948	1,550
Fuel Exports	1,952	780	900	400	443	840	1,090	850	300	250
Consumption	23,756	26,435	30,946	27,671	27,597	31,740	34,973	31,296	29,545	29,599
Fuel Consumption	21,456	24,085	28,796	26,201	25,562	29,740	32,848	28,931	27,408	27,665
Ending Stocks	8,995	10,167	8,232	8,012	8,973	10,401	12,327	14,451	13,370	14,481
Fuel Ending Stocks	8,590	9,713	7,765	7,520	8,475	9,899	11,820	13,939	12,853	13,959
Refineries (Sugarcane-only) Producing First Generation Fuel Ethanol (Million Liters)										
Number of Refineries	399	382	382	383	384	369	359	347	343	337
Nameplate Capacity	40,700	37,930	38,050	39,677	40,012	43,105	43,105	42,800	50,500	54,280
Refineries (Corn-only and Corn/Sugarcane Flex) Producing First Generation Fuel Ethanol (Million Liters)										
Number of Refineries	n/a	n/a	n/a	n/a	n/a	n/a	n/a	11	19	18
Nameplate Capacity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,500	4,000	5,000
Capacity Use (%) – sugarcane and corn ethanol	n/a	n/a	n/a	n/a	n/a	n/a	n/a	68%	48%	48%

Refineries Producing Cellulosic Fuel Ethanol (Million Liters)										
Number of Refineries	0	1	3	3	3	3	3	3	3	2
Nameplate Capacity	0	82	127	127	127	127	127	127	75	75
Capacity Use (%)	--	0%	2%	5%	13%	20%	24%	25%	53%	73%
Co-product Production (1,000 MT)										
Bagasse	115,175	118,971	126,008	117,492	115,467	134,721	150,096	135,913	111,017	112,917
DDGs		33	91	151	310	541	998	1,824	2,474	3,378
Corn Oil		2	5	9	18	31	57	105	142	194
Feedstock Use for Fuel Ethanol (1,000 MT)										
Sugarcane	345,525	356,913	378,025	352,475	346,400	404,163	450,288	407,738	333,050	338,750
Corn	0	107	291	481	990	1,727	3,190	5,827	7,904	10,791
Bagasse for Cellulosic Fuel	0	0	0.011	0.033	0.094	0.139	0.167	0.178	0.222	0.306
Market Penetration (Million Liters)										
Fuel Ethanol Use	21,456	24,085	28,796	26,201	25,562	29,740	32,848	28,931	27,408	27,665
Hydrous Ethanol for Fuel	11,755	12,994	17,862	14,586	13,642	19,385	22,544	19,258	16,792	17,000
Anhydrous Ethanol in Gasoline C	9,701	11,091	10,934	11,615	11,920	10,355	10,304	9,673	10,616	10,665
Gasoline C (includes anydrous)	41,426	44,364	41,137	43,019	44,150	38,352	38,165	35,824	39,317	39,500
Gasoline C Blend Rate	23.4%	25.0%	26.6%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%
Ethanol Blend Rate Overall	40.3%	42.0%	48.8%	45.5%	44.2%	51.5%	54.1%	52.5%	48.8%	49.0%

Source: ATO Sao Paulo 1/ forecast

Production

Total ethanol production for 2022 is estimated at 31.66 billion liters, an increase of six percent relative to revised figure for 2021 (29.98 billion liters). Ethanol production for fuel use is estimated at 28.42 billion liters, an increase of 2.23 billion liters compared to the previous calendar year. The expected increase in production is related to higher sugarcane production for the 2022/23 crop, considering that sugar-ethanol plants should keep the sugarcane to sugar/ethanol ratio unchanged from the previous season. The expected increase in corn ethanol should also contribute to the overall larger ethanol output.

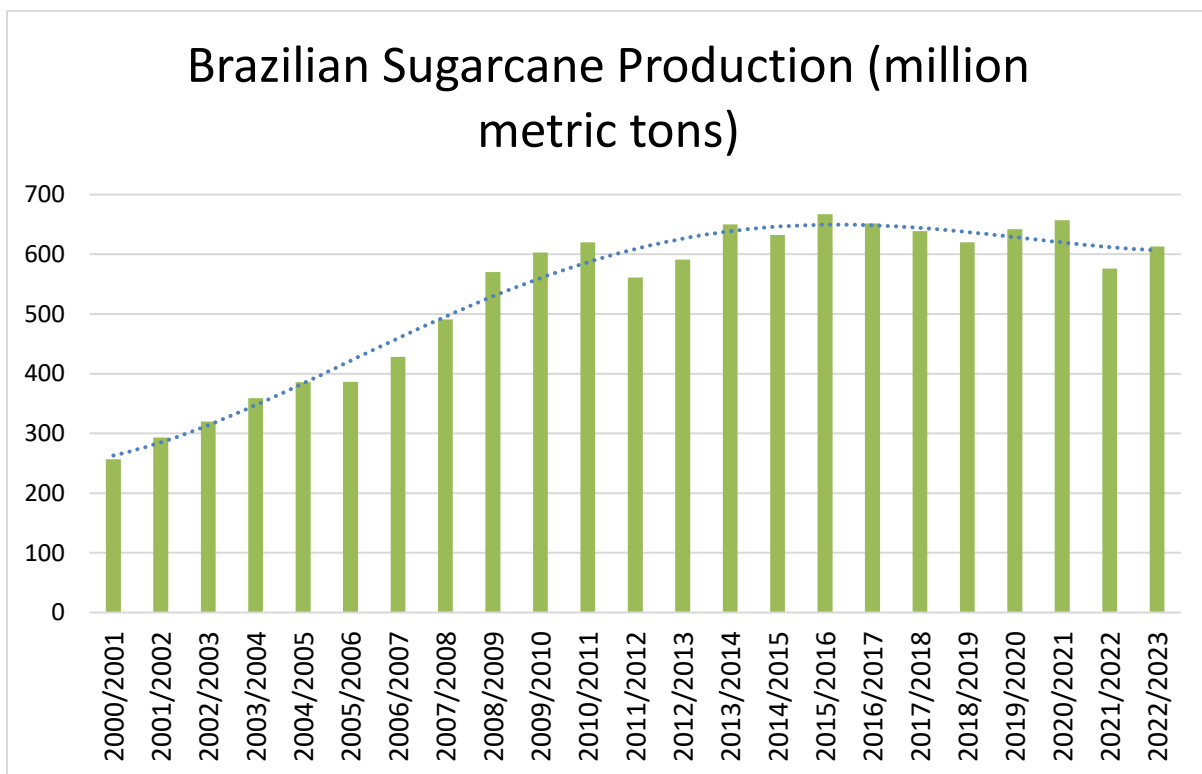
Sugarcane Ethanol

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) 2022/23 sugarcane crush at 613 million metric tons (mmt), an increase of six percent compared to MY 2021/22 (576 mmt). The Center-South (CS) region should harvest 560 mmt of sugarcane, up 37 mmt vis-a-vis the revised figure for the last crop (605 mmt). North-Northeastern (NNE) production for MY 2022/23 is forecast at 53 mmt, unchanged from the revised figure for MY 2021/22 (53 mmt).

Sugarcane fields in the CS have not recovered from the weather adversities in 2020 and 2021, e.g., the long and below-average rainfall period in 2020 and January-September 2021 and the severe frosts in late June and July. However, the good rainfall volume that has prevailed since October 2021, although irregularly distributed in the different production regions, should partially offset the negative impact of the adversities, thus supporting a partial recovery of the production potential. A marginal replacement of the sugarcane area with soybeans and corn is also expected, thus reducing the sugarcane crushing area. The current conflict in Ukraine has not significantly impacted the current sugarcane crop, given that fertilizer purchases/utilization have occurred beforehand. However, if the war persists, fertilizer supply might be an issue for next year’s crushing.

The late development of the sugarcane fields to be harvested in the first third of the crushing season has led sugar/ethanol plants to postpone the beginning of the 22/23 crushing season to late April and May. Updated statistics from the Brazilian Sugarcane Industry Association (UNICA) report that by the end of March, there were 16 units crushing sugarcane for sugar/ethanol production and nine units processing corn ethanol, as opposed to 37 units producing sugar/ethanol from sugarcane and 10 corn ethanol units in operation during the same period in the previous MY. The graph below shows the evolution of Brazilian sugarcane production since 2000.

Graph 03



Source: USDA/ATO/Sao Paulo

Sugar prices have recovered since March 2020 and have remained more attractive than ethanol prices (which also aggregate the value from CBios for Renovabio certified plants), especially for sugar sold in the domestic market. The graph below shows sugar #11 future prices reported by the Intercontinental Exchange (ICE), illustrating the upward trend of sugar prices since July 2020.

Graph 04



Source: Intercontinental Exchange (ICE)

In addition, ethanol consumption has not recovered from pre-pandemic volumes and producers are likely to keep the sugar-ethanol production mix unchanged from the previous MY. Therefore, ATO/Sao Paulo 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. Consequently, total Brazilian sugarcane-based ethanol production in 2022 is estimated at 27.1 billion liters, an increase of 456 million liters compared to revised figure for 2021 (26.64 billion liters).

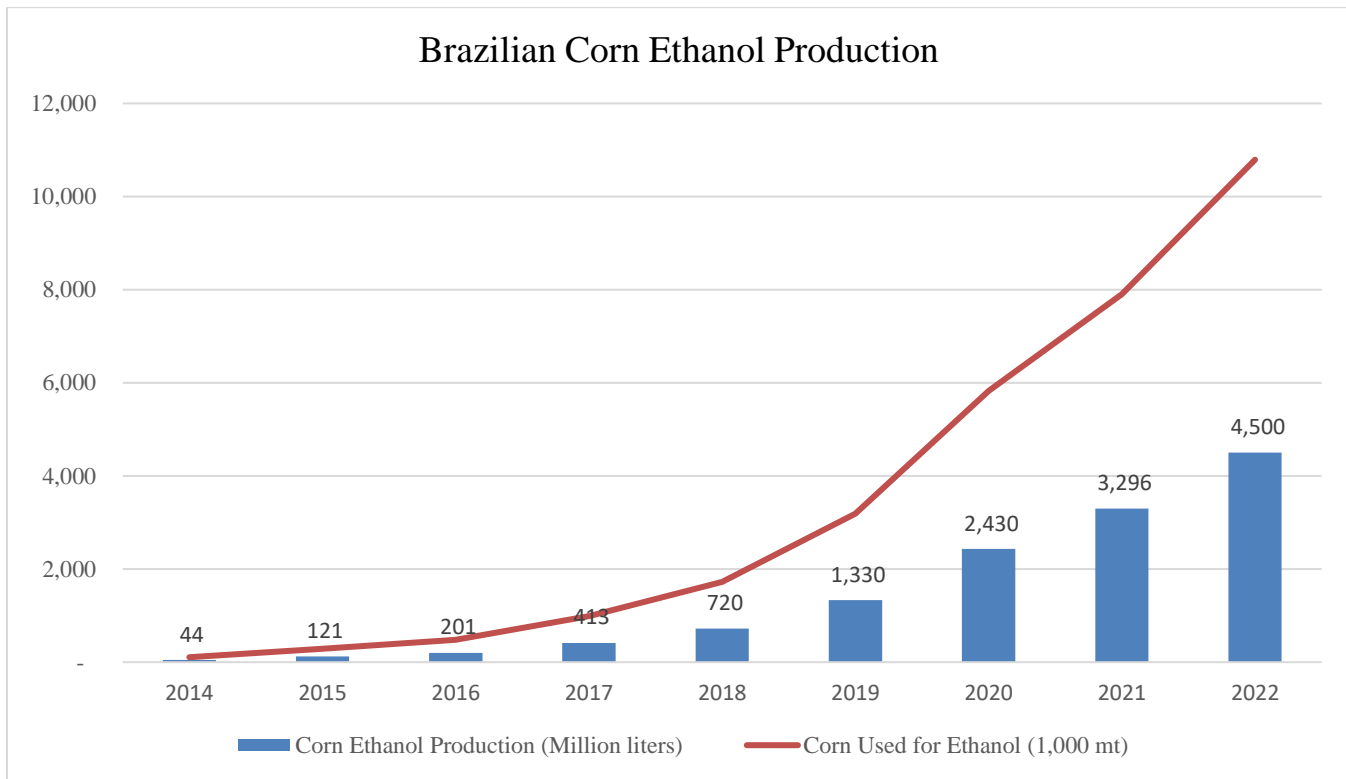
Corn Ethanol

Corn ethanol production remains growing in Brazil. Total Brazilian corn-ethanol output in 2022 is estimated at 4.5 billion liters, an increase of 37 percent relative to revised production figure for 2021 (3.29 billion liters), based on updated information from the Corn Ethanol National Union (UNEM) and UNICA.

Total corn used to produce corn-based ethanol in 2022 is estimated at roughly 10.79 mmt, an increase of 2.89 mmt compared to the corn volume consumed in 2020 (7.90 mmt), representing approximately nine percent of the corn crop in 2022 (116 mmt). (*Refer to the Brazilian Grain and Feed Update Gain Report - July 2021 for further information*).

The graph below shows the evolution of corn used for ethanol production and total corn ethanol production in Brazil since the early stages of the industry. 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.

Graph 05



Source: FAS Brazil chart based on data from UNEM and UNICA. 2022 1/ figure is an estimate.

Expansion potential for Brazil’s corn ethanol industry remains limited by local fuel demand, profitability, and logistical challenges. Corn ethanol production in Brazil is mostly concentrated in Brazil’s Center-West region, 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 four corn-ethanol plant projects in the planning, development, construction and/or expansion stage. These plants could potentially start operations as of 2023.

Advanced Ethanol

Total cellulosic ethanol production for 2022 is estimated at 55 million liters, an increase of 15 million liters relative to 2021. This amount still represents an insignificant share of total ethanol production in Brazil.

Industrial Capacity

The total number of ethanol plants in 2022 is 357 units, a drop of eight units compared to 2021 (365 units). This figure includes 337 sugarcane-based ethanol plants, 12 corn-based ethanol plants, 6 flex plants producing ethanol from both sugarcane and/or corn, and two cellulosic ethanol plants. The map

below shows the location of the ethanol plants in the country. The total hydrated ethanol production capacity for 2022 is reported at 59.28 billion liters per year. This figure reflects the authorized hydrated ethanol production capacity of 247,015 million liters per day, as reported by ANP, and assumes an average of 240 crushing days. ANP reports anhydrous ethanol production capacity at 132,813 million per day or 31.88 billion liters/year assuming a 240-day crushing cycle.

Map 01

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 (cumulative through February 2022) for the state of Sao Paulo for the 2021/22 crop was R\$1.1931 per kilogram of TRS, or approximately R\$170 per ton of sugarcane, a sharp increase of 55 percent compared to the same period for MY 2020/21 (R\$0.7567 per kg of TRS, or approximately R\$110 per ton of sugarcane) due to high prices of sugar and ethanol.

The cumulative CONSECANA price for the current crop (March 2022 through June 2022) for the state of Sao Paulo is R\$1.2196 per kg of TRS or approximately R\$162 per ton of sugarcane delivered at the mill. Note that CONSECANA's prices are based on both sugar and ethanol prices in domestic and international markets.

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 06

Price for Fuel Hydrated Ethanol - State of Sao Paulo (R\$/000 liters).						
Period	2017	2018	2019	2020	2021	2022
January	1,815.80	1,836.20	1,605.60	2,067.70	2,090.90	3,316.80
February	1,686.10	1,852.20	1,677.10	2,118.20	2,280.80	2,860.10
March	1,526.40	1,868.20	1,776.40	1,875.10	2,676.80	3,222.90
April	1,471.80	1,538.70	1,814.80	1,360.60	2,543.90	3,631.00
May	1,414.20	1,568.00	1,644.90	1,432.10	2,928.50	3,329.40
June	1,327.70	1,633.70	1,617.70	1,637.10	2,922.40	--
July	1,304.00	1,457.90	1,673.60	1,639.60	2,927.00	--
August	1,406.40	1,461.60	1,729.10	1,726.10	3,127.10	--
September	1,442.30	1,678.00	1,714.60	1,797.20	3,261.20	--
October	1,533.90	1,792.80	1,803.00	1,985.20	3,552.10	--
November	1,651.10	1,648.70	1,908.90	2,062.80	3,698.60	--
December	1,748.00	1,664.80	1,998.50	2,044.30	3,349.50	--
Source: USP/ESALQ/CEPEA.						

Table 07

Price for Fuel Anhydrous Ethanol - State of Sao Paulo (R\$/000 liters).						
Period	2017	2018	2019	2020	2021	2022
January	2,047.10	2,015.70	1,798.80	2,241.90	2,305.20	3,820.80
February	1,916.90	2,050.90	1,811.80	2,294.80	2,496.90	3,346.50
March	1,697.60	2,076.10	2,010.10	2,134.40	2,980.60	3,509.20
April	1,635.30	1,807.40	1,984.70	1,556.10	2,774.20	4,148.10
May	1,610.30	1,697.40	1,878.60	1,522.40	3,219.50	3,859.30
June	1,509.90	1,817.90	1,798.20	1,781.80	3,335.30	--
July	1,424.70	1,632.30	1,822.70	1,798.90	3,328.60	--
August	1,552.30	1,557.20	1,906.40	1,882.50	3,531.20	--
September	1,592.80	1,817.70	1,865.40	1,985.40	3,729.80	--
October	1,669.70	1,957.90	1,943.70	2,160.50	3,881.90	--
November	1,806.70	1,856.60	2,052.50	2,282.60	4,332.20	--
December	1,928.80	1,829.60	2,165.70	2,258.10	3,878.50	--
Source: USP/ESALQ/CEPEA.						

Consumption

The table below shows ANP fuel consumption figures up to 2022 (January - June) for Otto-cycle fuel (gasoline and ethanol) vehicles.

Table 08

Brazilian Fuel Consumption Matrix (000 m3)						
	2017	2018	2019	2020	2021	2022 1/
Gasoline C*	44,150	38,352	38,165	35,824	39,317	19,722
Hydrated Ethanol	13,642	19,385	22,544	19,258	16,792	7,767
Source: ANP. * Gasoline C includes 18-27.5% of anhydrous ethanol. 2022 1/ refers to January-Jun.						

According to ANP, with the gradual reopening of the economy in 2021 after the beginning of the COVID-19 pandemic in 2020, gasoline C (pure gasoline plus anhydrous ethanol) consumption increased from 35.82 billion liters in 2020 to 39.31 billion liters in 2021, an increase of ten percent year on year. This represents an increase of 943 million liters in anhydrous ethanol consumption from 2020 to 2021, which reached a total of 10.62 billion liters in 2021. On the contrary, hydrous ethanol consumption decreased from 19.26 billion liters in 2010 to 16.79 billion liters in 2021, a decrease of 13 percent year on year, due to the lack of competitiveness of hydrous ethanol vis-à-vis gasoline C during 2021.

High fuel prices in 2022 have not supported an increase in otto-cycle fuel consumption. Therefore, ATO/Sao Paulo estimates total domestic demand for ethanol (fuel and other uses) for the calendar year

2022 will be relatively stable compared to 2021. Total ethanol consumption for 2022 is estimated at 29.60 billion liters and total ethanol consumption for use as fuel is estimated at 27.67 billion liters (as opposed to 29.55 and 27.41 billion liters for total ethanol and for ethanol for use as fuel in 2021, 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 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 and the fact that ethanol's calorific content is approximately 36 percent lower than pure fossil gasoline.

The tables below show ethanol and gasoline prices at the pump and the price ratio for selected states, cities, and months. Nearly all ethanol/gasoline price ratios for 2021 and the beginning months of 2022 favor gasoline consumption due to the overall increase in ethanol prices compared to gasoline. This is observed even in Sao Paulo, where ethanol prices were traditionally more competitive because of the lower ICMS tax compared to ethanol.

Table 09

Gasoline and Ethanol Prices in Selected States (average price, R\$/liter)									
		Gasoline				Ethanol			
		2019	2020	2021	2022	2019	2020	2021	2022
Sao Paulo State	Jan	4.058	4.390	4.336	6.35	2.625	3.045	3.057	4.84
	Feb	3.974	4.374	4.639	6.33	2.607	3.055	3.264	4.50
	Jun	4.193	3.798	5.398	6.84	2.607	2.467	4.160	4.55
	Aug	4.083	4.007	5.59		2.625	2.564	4.24	
Sao Paulo City	Jan	3.944	4.412	4.360	6.42	2.611	3.076	3.072	4.91
	Feb	3.933	4.384	4.657	6.39	2.579	3.062	3.270	4.60
	Jun	4.174	3.823	5.390	6.88	2.590	2.474	4.162	4.63
	Aug	4.045	4.017	5.58		2.610	2.548	4.25	
Minas Gerais	Jan	4.555	4.809	4.729	6.95	2.960	3.291	3.239	5.22
	Feb	4.509	4.776	5.089	6.92	2.929	3.339	3.444	4.90
	Jun	4.744	4.104	5.918	7.48	2.953	2.699	4.427	5.01
	Aug	4.579	4.377	6.14		2.856	2.840	4.53	
Belo Horizonte (MG Capital)	Jan	4.459	4.680	4.687	6.87	2.920	3.229	3.203	5.27
	Feb	4.398	4.667	5.039	6.86	2.900	3.281	3.465	4.97
	Jun	4.658	4.009	5.771	7.37	2.889	2.594	4.331	4.98

	Aug	4.505	4.292	5.99		2.834	2.733	4.46	
Rio Janeiro State	Jan	4.780	5.041	5.017	7.17	3.595	4.214	4.031	6.01
	Feb	4.707	5.012	5.347	7.18	3.620	4.247	4.232	5.86
	Jun	4.946	4.492	6.236	7.74	3.810	3.598	5.325	6.03
	Aug	4.814	4.717	6.45		3.775	3.727	5.37	
Rio Janeiro Capital	Jan	4.853	5.030	5.014	7.08	3.644	4.267	4.033	5.94
	Feb	4.679	4.978	5.334	7.11	3.637	4.261	4.244	5.80
	Jun	4.916	4.477	6.212	7.66	3.804	3.625	5.307	5.94
	Aug	4.799	4.726	6.41		3.810	3.772	5.36	
Porto Alegre (RS Capital)	Jan	4.401	4.754	4.743	6.52	3.971	4.314	4.323	6.42
	Feb	4.155	4.597	5.045	6.29	3.872	4.388	4.506	6.21
	Jun	4.916	3.971	5.983	6.87	4.072	3.887	5.747	6.31
	Aug	4.380	4.121	6.09		3.966	3.930	5.88	
Goiania (GO Capital)	Jan	4.387	4.780	4.815	7.10	2.974	3.423	3.326	5.04
	Feb	4.435	4.681	5.057	6.78	2.939	3.381	3.553	4.70
	Jun	4.668	4.033	5.954	7.34	2.943	2.851	4.447	4.77
	Aug	4.393	4.532	6.33		2.768	2.874	4.62	
Fortaleza (CE Capital)	Jan	4.206	4.679	4.744	6.60	3.462	3.701	3.810	5.61
	Feb	4.184	4.657	5.100	6.52	3.477	3.716	4.034	5.56
	Jun	4.726	3.984	5.723	7.46	3.798	3.457	5.153	6.22
	Aug	4.576	4.333	5.89		3.782	3.541	5.34	
Source: Petroleum, Natural Gas and Biofuels National Agency (ANP).									

Table 10

Ratio Ethanol/Gasoline Prices					
		2019	2020	2021	2022
Sao Paulo State	Jan	65%	69%	71%	76%
	Feb	66%	70%	70%	71%
	Jun	62%	65%	77%	67%
	Aug	64%	64%	76%	
Sao Paulo City	Jan	66%	70%	70%	76%
	Feb	66%	70%	70%	72%
	Jun	62%	65%	77%	67%
	Aug	65%	63%	76%	
Minas Gerais	Jan	65%	68%	68%	75%
	Feb	65%	70%	68%	71%
	Jun	62%	66%	75%	67%

	Aug	62%	65%	74%	
Belo Horizonte (MG Capital)	Jan	65%	69%	68%	77%
	Feb	66%	70%	69%	72%
	Jun	62%	65%	75%	68%
	Aug	63%	64%	74%	
Rio Janeiro State	Jan	75%	84%	80%	84%
	Feb	77%	85%	79%	82%
	Jun	77%	80%	85%	78%
	Aug	78%	79%	83%	
Rio Janeiro Capital	Jan	75%	85%	80%	84%
	Feb	78%	86%	80%	82%
	Jun	77%	81%	85%	78%
	Aug	79%	80%	84%	
Porto Alegre (RS Capital)	Jan	90%	91%	91%	98%
	Feb	93%	95%	89%	99%
	Jun	83%	98%	96%	92%
	Aug	91%	95%	97%	
Goiania (GO Capital)	Jan	68%	72%	69%	71%
	Feb	66%	72%	70%	69%
	Jun	63%	71%	75%	65%
	Aug	63%	63%	73%	
Fortaleza (CE Capital)	Jan	82%	79%	80%	85%
	Feb	83%	80%	79%	85%
	Jun	80%	87%	90%	83%
	Aug	83%	82%	91%	
Source: Petroleum, Natural Gas and Biofuels National Agency (ANP).					
Gray Area means gasoline prices more attractive than ethanol					

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 36.67 million units in July 2022 and pure hydrous ethanol/flex fuel-powered vehicles represent roughly 84 percent (30.8 million units) of the total fleet.

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 has sharply reduced the sales of new cars, as seen in the table below.

Table 11

Licensing of Ethanol Powered Vehicles (pure ethanol & flex fuel units)								
2014	2015	2016	2017	2018	2019	2020	2021	2022/1
2,940,508	2,194,020	1,750,754	1,927,221	2,168,173	2,328,650	1,664,999	1,624,348	628,199

Source: National Association of Vehicle Manufacturers (ANFAVEA) 1/ January-June

*Trade**Exports*

ATO/Sao Paulo estimates total Brazilian ethanol exports for 2022 at 1.55 billion liters, a drop of 398 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, followed by the Netherlands and the United States in 2022 (January - June). Brazilian ethanol exports reached 1.95 billion liters in 2021, a reduction of 27 percent compared to the previous year (2.67 billion liters) due to the lower ethanol availability. Major export destinations in 2021 were South Korea, the United States, and the Netherlands.

The majority of ethanol shipped to the U.S. goes to California due to the favorable Carbon Intensity (CI) rating that Brazilian sugarcane ethanol receives under Californian Low Carbon Fuel Standard (LCFS). The Environmental Protection Agency (EPA)'s Renewable Fuel Standard (RFS) also 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, thus encouraging exports to the U.S. Note that Brazilian ethanol is also frequently shipped to the Gulf Coast and converted to ethyl tertiary butyl ether (ETBE) for further shipment to Japan.

The tables below show ethanol exports (NCM 2207.10 through 2207.20.19) for 2019, 2020 and 2021 and 2020, 2021 and 2022 (January through June), as reported by Trade Data Monitor based on figures provided by SECEX.

Table 12

Brazilian Ethanol Exports (NCM 2207.10, 2207.20.11, 2207.20.19, M3, US\$ 000 FOB)						
Country	CY 2019		CY 2020		CY 2021	
	Value	Volume	Value	Volume	Value	Volume
South Korea	250,892	517,591	386,086	915,900	392,945	778,440
United States	626,761	1,211,725	428,629	994,829	267,914	465,461
Netherlands	36,175	67,404	129,859	274,152	68,650	118,384
Nigeria	10,292	15,950	4,704	7,191	43,382	79,730
Japan	30,687	56,982	17,181	36,843	46,367	77,175
India	0	0	35	72	36,170	70,497

China	-	-	11,867	28,393	28,241	65,257
Philippines	6,521	11,937	23,459	46,289	27,181	41,843
Ghana	5,474	9,405	20,759	34,851	25,984	41,269
Turkey	136	246	30,648	56,824	17,806	38,831
Others	31,140	49,636	138,297	273,628	106,500	171,292
Total	998,078	1,940,877	1,191,523	2,668,972	1,061,140	1,948,180

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

Table 13

Brazilian Ethanol Exports (NCM 2207.10, 2207.20.11, 2207.20.19, M3, US\$ 000 FOB)						
Country	CY 2020 1/		CY 2021 1/		CY 2022 1/	
	Value	Volume	Value	Volume	Value	Volume
South Korea	141,857	290,337	170,105	379,528	187,195	282,246
Netherlands	39,284	68,350	25,961	52,415	139,165	185,170
United States	139,186	323,609	118,091	225,024	119,489	158,455
Japan	12,457	26,857	17,332	37,937	29,934	38,569
United Kingdom	7,252	10,218	53	48	24,422	33,595
Ghana	1,259	1,910	16,564	26,239	9,745	13,472
Turkey	4,913	8,295	7,396	20,458	8,824	13,074
Cameroon	1,802	2,642	4,653	6,704	9,372	11,521
Angola	2,413	3,537	7,116	10,925	4,816	6,726
Dominican Republic	2,048	3,406	3,036	5,582	3,627	5,211
Others	36,010	73,970	121,651	231,597	12,815	16,717
Total	388,480	813,130	491,957	996,457	549,405	764,754

Data Source: Trade Data Monitor (TDM) based on the Brazilian Secretariat of Foreign Trade (SECEX). Note: Numbers may not add due to rounding 1/Jan-June

Imports

ATO/Sao Paulo estimates total Brazilian ethanol imports for 2022 at 605 million liters, an increase of 173 million liters compared to the revised figure for 2021 (432 million liters). Ethanol imports are mostly for fuel use and originated mainly from the United States, followed by Paraguay. The temporary waiver in the Brazilian import tariff applied on March 21, combined with the fluctuation of the Brazilian real against the U.S. dollar has opened opportunity windows for ethanol imports.

The tables below show ethanol imports (NCM 2207.10 through 2207.20.19) for 2019, 2020 and 2021 and 2020, 2021 and 2022 (January through June), as reported by Trade Data Monitor based on figures provided by the Brazilian Secretariat of Foreign Trade (SECEX).

Table 14

Brazilian Ethanol Imports (NCM 2207.10, 2207.20.11, 2207.2019, M3, US\$ 000 FOB)						
Country	CY 2019		CY 2020		CY 2021	
	Value	Volume	Value	Volume	Value	Volume
United States	543,044	1,321,216	340,894	836,097	136,958	269,483
Paraguay	58,551	136,012	70,724	164,101	88,834	162,535
Canada	0	0	216	149	229	140
Germany	460	104	328	112	268	82
Argentina	60	63	3,925	8,183	16	13
United Kingdom	3	0	17	2	9	4
France	90	67	4	2	4	1
Spain	14	2	14	2	7	1
Mexico	12	2	2	0	8	1
South Africa	-	-	0	0	2	0
Others	190	135	119	75	150	0
Total	602,424	1,457,602	416,243	1,008,723	226,485	432,261

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

Table 15

Brazilian Ethanol Imports (NCM 2207.10, 2207.20.11, 2207.2019, M3, US\$ 000 FOB)						
Country	CY 2020 1/		CY 2021 1/		CY 2022 1/	
	Value	Volume	Value	Volume	Value	Volume
United States	301,784	739,509	60,549	133,389	145,497	231,302
Paraguay	33,563	73,495	43,948	93,405	32,637	48,041
Canada	89	67	91	55	199	114
Argentina	3,899	8,157	16	13	88	89
Germany	168	51	147	42	86	28
Poland	60	44	-	-	24	24
Spain	6	1	4	1	8	1
France	0	1	0	1	4	1
South Africa	2	-	3	0	2	0
Switzerland	0	0	-	0	1	0
Others	49	24	164	5	1	0
Total	339,619	821,348	104,922	226,911	178,545	279,601

Source: Trade Data Monitor (TDM) based on the Brazilian Secretariat of Foreign Trade (SECEX).
Note: Numbers may not add due to rounding 1/Jan-June

IV. Biodiesel

Brazilian Biodiesel Production, Supply and Demand (PS&D) Table

The table below shows Brazil's biodiesel supply and demand (PS&D) table for calendar years 2013 through 2022.

Table 16

Biodiesel (Million Liters)										
Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f
Beginning Stocks	137	105	85	89	90	99	111	112	113	49
Production	2,935	3,430	4,020	3,801	4,310	5,410	5,925	6,500	6,870	6,370
Imports	0	0	0	0	0	0	0	1	2	20
Exports	39	40	12	0	0	0	0	4	8	30
Consumption	2,928	3,410	4,004	3,800	4,301	5,398	5,924	6,496	6,928	6,335
Ending Stocks	105	85	89	90	99	111	112	113	49	74
Production Capacity (Million Liters)										
Number of Biorefineries	64	58	57	51	51	51	51	51	50	57
Nameplate Capacity	7,900	7,722	7,860	7,191	8,140	8,500	8,500	9,792	11,190	13,259
Capacity Use (%)	37.2%	44.4%	51.1%	52.9%	52.9%	63.6%	69.7%	66.4%	61.4%	48.0%
Feedstock Use (1,000 MT)										
Soybean oil, crude	1,937	2,300	2,760	2,615	2,714	3,406	3,609	4,159	4,445	3,892
Animal Fat (Tallow)	590	704	775	612	699	834	792	718	695	733
Used Cooking Oil	30	25	17	27	57	86	89	77	111	104
Pal Oil	0	0	0	0	32	66	112	155	158	147
Market Penetration (Million Liters)										
Biodiesel, on-road use	2,125	2,458	2,927	2,759	3,122	3,918	4,300	4,715	5,029	4,599
Diesel Pool, on-road use 1/	42,518	43,283	41,813	39,402	39,759	40,381	41,593	41,719	45,087	45,989
Blend Rate (%)	5.00%	5.68%	7.00%	7.00%	7.85%	9.70%	10.34%	11.30%	11.15%	10.00%
Diesel Pool, total 1/	58,572	60,032	57,211	54,279	54,772	55,629	57,298	57,472	62,112	63,354

Production

Brazil is one of the world's largest producers and consumers of biodiesel. However, unlike other major markets in Europe and the United States, Brazil has yet to commercialize renewable diesel, specifically hydrogenation-derived renewable diesel (HDRD), the only type of renewable diesel commercially available at scale.

Biodiesel is trans esterified vegetable oil, known as Fatty Acid Methyl Ester (FAME), produced from plant and animal oils and fats. According to updated information reported by ANP, about 66 percent of cumulative biodiesel production in 2022 (January through June) is made from soybean oil and 12

percent is made from animal fat (tallow). The remaining feedstock is palm oil (2.50 percent) and cooking oil (1.70 percent). In addition, 17 percent of the production is generated from other fatty materials such as different raw materials blended in tanks and co-products from biodiesel production.

Total Brazilian biodiesel production in 2022 is estimated at 6.37 billion liters, a seven percent reduction compared to total production in 2021 (6.87 billion liters). Despite the projected growth in diesel consumption for 2022, ANP has reduced the mandatory blend to 10 percent since November 2021 to manage with increased prices of soybeans, major biodiesel feedstock (*Refer to Section IV: Biodiesel Consumption for further reference*). According to ANP, cumulative January through June 2022 production is approximately 2.97 billion liters. Biodiesel production by month, as reported by ANP is shown below.

Table 17

Brazilian Biodiesel Monthly Production/Deliveries (000 liters)					
Month	2018	2019	2020	2021	2022
January	337,256	446,508	467,596	506,705	458,145
February	338,321	415,249	483,199	528,606	489,455
March	455,039	462,134	550,298	643,058	497,906
April	448,706	464,902	439,527	630,955	479,670
May	382,497	448,352	481,494	541,733	536,145
June	466,892	461,613	535,180	527,666	508,638
July	489,079	495,344	603,331	560,642	
August	485,843	503,146	625,418	572,322	
September	479,745	558,466	595,088	578,633	
October	500,376	583,725	590,536	621,451	
November	479,105	539,820	556,218	528,353	
December	473,671	523,508	517,104	525,725	
Total	5,336,529	5,902,766	6,444,990	6,765,850	2,969,960
Source: ANP					

Brazil currently has 57 plants authorized to produce biodiesel. The map below shows the location of the biodiesel plants in the country. Approximately 60 percent of the plants are in the Center-West region, with an abundant soybean supply. According to ANP, the authorized industrial capacity for 2022 is estimated at 36.83 million liters of biodiesel per day or 13.26 billion liters per year, based on a 360-day operational cycle, an increase of 18 percent compared to 2021 (11.19 billion liters). The increased industry capacity represents over twice the estimated mandatory biodiesel production to be blended in mineral diesel into 2022.

Map 02

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 reference).

The new market model has provided more market flexibility since it allows biodiesel producers and distributors to settle over-the-counter (OTC) contracts. ANP has tracked weekly prices for biodiesel under the new market model. Prices ranged from R\$ 6,214.55/m³ to 7,387.34/m³ between January and July 2022.

The table below updates the results of the 79th through the 82nd auctions from April to October 2021, the last four biodiesel auctions, as published by ANP, before the shifting to the current SRD-Biodiesel system (*Please refer to [Brazilian Biofuels Annual Gain Report 2021](#) for additional information re: ANP biodiesel public auction system*).

Table 18

Biodiesel Auctions				
Auction	79th Auction	80th Auction	81th Auction	82th Auction
Date	Apr-2021	Jun-2021	Aug-2021	Oct-2021
Number of Suppliers	45	43	45	44
Offered Quantity (m3)	1,501,700	1,457,780	1,534,960	1,369,750
Purchased Quantity (m3)	1,050,349	1,102,242	1,293,587	1,072,626
Opening/Reference Price (R\$/m3) 1/	7,529.00	7,907.00	7,811.00	7,759.00
Average Price (R\$/m3) 2 /	5,536.00	5,485.00	5,658.00	5,907.00
Delivery Date	May- Jun/2021	Jul- Aug/2021	Sep- Oct/2021	Nov- Dec/2021
Source: ANP. 1/ Reference prices refer according to the producing region.				
2/ Price FOB, including PIS/PASEP and COFINS, excluding ICMS, including Petrobras margin.				

Raw materials represent approximately 70 to 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. Any changes in the international soybean oil market and/or the Brazilian exchange rate directly impact the biodiesel production costs.

Soybean prices remain escalated in 2022 due to steady international demand for the product, imbalances between world supply and demand, and the continued devaluation of the Brazilian currency, the real. The tables below show soybean oil prices in 2021 and 2022 (January through June). The average crude price in Sao Paulo virtually doubled from January 2021 (US\$976 per ton) to May 2022 (US\$1,904 per ton).

Table 19

Soybean Oil, Crude - Prices (2021)						
Location	Jan	Feb	Mar	Apr	May	Jun
Chicago (US\$/ton)	944	1,019	1,183	1,292	1,457	1,461
Premium (US\$/ton)	45	29	10	-22	-118	-243
Port of Paranaguá - Fob (US\$/ton)	989	1,048	1,193	1,270	1,340	1,218
Sao Paulo - (US\$/ton com ICMS 12%)	976	1,041	1,178	1,257	1,354	1,239
Elaborated by ABIOVE based on several sources.						

Table 20

Soybean Oil, Crude - Prices (2021)						
Location	Jul	Aug	Sep	Oct	Nov	Dec
Chicago (US\$/ton)	1,429	1,369	1,270	1,356	1,325	1,216
Premium (US\$/ton)	-176	-46	39	28	73	112
Port of Paranaguá - Fob (US\$/ton)	1,253	1,323	1,309	1,384	1,398	1,328
Sao Paulo - (US\$/ton com ICMS 12%)	1,258	1,346	1,266	1,356	1,382	1,369
Elaborated by ABIOVE based on several sources.						

Table 21

Soybean Oil, Crude - Prices (2022)						
Location	Jan	Feb	Mar	Apr	May	Jun
Chicago (US\$/ton)	1,341	1,476	1,681	1,756	1,844	1,720
Premium (US\$/ton)	34	42	118	75	24	(72)
Port of Paranaguá - Fob (US\$/ton)	1,376	1,518	1,800	1,831	1,867	1,648
Sao Paulo - (US\$/ton com ICMS 12%)	1,411	1,528	1,872	1,771	1,904	1,591
Elaborated by ABIOVE based on several sources.						

Consumption

ATO/Sao Paulo forecasts biodiesel consumption for 2022 at 6.34 billion liters, a drop of nine percent vis-à-vis the revised figure for 2021 (6.93 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 consumption. 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 to ten percent since November 2021 to control the escalated costs associated to biodiesel production (*Refer to Section II – Policy and Programs: Biodiesel Mandate and Section IV – Biodiesel: Market Prices for further information*).

On the other hand, the return of the domestic economic activity created growth in demand for diesel in 2021. Indeed, diesel consumption increased by eight percent in 2021, reaching 62.1 billion liters amid strong demand from the country's agriculture, mining and e-commerce sectors. Brazil consumed 57.3 billion liters in 2019, before the global COVID-19 pandemic. In addition, post contacts project diesel consumption to advance another 2 percent to 63.35 billion liters in 2022, following the expected growth for the Brazilian Gross Domestic Product (GDP). The table below shows ANP diesel consumption figures for 2021 (January - June).

Table 22

Brazilian Diesel Consumption Matrix (million Liters)						
2016	2017	2018	2019	2020	2021	2022 1/
54,279	54,772	55,629	57,298	57,472	62,112	30,465
Source: ANP. * Diesel includes Bx Biodiesel as of 2008. 2021 1/ refers to January-June.						

Trade

Brazil's biodiesel exports remain low because it is not cost-competitive. Biodiesel imports are still not authorized by ANP, except under “exceptional circumstances”, thus limiting import volumes. The tables below show biodiesel exports and imports reported by Trade Data Monitor (TDM) based on SECEX.

Table 23

Brazilian Biodiesel Exports by Country of Destination (M3, US\$ 000 FOB)								
	CY 2020		CY 2021		YTD 2021 / 1		YTD 2022 / 1	
Country	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Netherlands	-	-	-	-	0	0	13,674	18,921
Switzerland	-	-	-	-	0	0	10,877	12,479
India	-	-	80	117	0	0	700	1,339
Israel	150	179	-	-	0	0	25	44
Belgium	3,586	2,995	5,168	6,534	0	0	-	-
Italy	-	-	2,313	2,412	0	0	-	-
Total	3,736	3,174	7,561	9,064	0	0	25,276	32,783

Source: Trade Data Monitor (TDM) based on the Brazilian Secretariat of Foreign Trade (SECEX) Note NCM: 3826.00.00 / 1/ Year to Date - Jan-June

Table 24

Brazilian Biodiesel Imports by Country of Origin (M3, US\$ 000 FOB)								
	CY 2020		CY 2021		YTD 2021 / 1		YTD 2022 / 1	
Country	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Spain	-	-	-	-	-	-	9,900	21
France	702	6	1,575	6	1,050	4	700	4
Belgium	10	16	40	74	10	16	20	44
Argentina	-	-	33	38	-	-	-	-
Germany	3	2	-	1	-	1	-	-
Total	715	24	1,648	119	1,060	21	10,620	69

Source: Trade Data Monitor (TDM) based on the Brazilian Secretariat of Foreign Trade (SECEX) Note NCM: 3826.00.00 / 1/ Year to Date - Jan-June

Trade under NCM 2710.20 remains insignificant. In 2021, Brazil exported only 15.9 metric tons of biodiesel, an increase of 11.1 mt from 2020 (4.8 mt). Imports for 2021 were 9.45 metric tons (mt), up 2.40 mt compared to 2020 (7.05 mt). Given that petroleum oils may contain biodiesel up to 30 percent by volume, ATO/Sao Paulo considers an average of 15 percent of biodiesel included under NCM 2710.20. All trade occurring under 3826.00 is assumed to be pure biodiesel (B100).

Brazil exported 28,203 metric tons (mt) of animal fat (NCM 15.01 and 15.02) in 2021, up 14,611 and 18,340 mt from 2019 and 2020, respectively. Major export markets for 2021 were the United States (9,759 mt) and China (6,501 mt).

Brazil imported 78,766 metric tons (mt) of animal fat (NCM 15.01 and 15.02) in 2021, down 16,245 mt from 2020, but up 20,265 mt from 2019. The major suppliers were Paraguay (45,829 mt) and Uruguay (17,221 mt).

V. Advanced Biofuels

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. As reported by Raizen, the announcement of the new plant meets the growing demand for the product in the international market, with 100 percent of its volume already sold in a long-term contract with a global energy player. The new facility will render Raizen the only global producer operating two cellulosic ethanol plants on an industrial.

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. Advanced ethanol production capacity from cellulosic ethanol is currently estimated at 75 million liters and should reach 310 million liters in 2023.

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.

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 75,700 liters/day, 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.

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

Brazil's Geographic Division

The map below shows Brazil's division by regions and states.

Map 03



Exchange Rate

Table 25

Exchange Rate (R\$/US\$1.00 - official rate, last day of period)							
Month	2016	2017	2018	2019	2020	2021	2022
January	4.04	3.13	3.16	3.65	4.25	5.48	5.36
February	3.98	3.10	3.24	3.74	4.50	5.53	5.14
March	3.56	3.17	3.32	3.90	5.20	5.70	4.74
April	3.45	3.20	3.48	3.94	5.43	5.40	4.92
May	3.60	3.26	3.74	3.94	5.43	5.23	4.73
June	3.21	3.30	3.86	3.83	5.48	5.00	5.24
July	3.24	3.13	3.75	3.76	5.20	5.12	5.19
August 1/	3.24	3.15	4.14	4.14	5.47	5.14	5.11
September	3.25	3.17	4.00	4.16	5.64	5.44	
October	3.18	3.27	3.72	4.00	5.77	5.64	
November	3.40	3.26	3.86	4.22	5.33	5.62	
December	3.47	3.31	3.87	4.03	5.20	5.58	

Source: Brazilian Central Bank (BACEN) 1/ August 2022 refers to August 11.

Attachments:

No Attachments