



**Liquid  
biofuels  
Atlas  
2022 - 2023**

Liquid Biofuels Atlas  
2022-2023

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San Jose, Costa Rica

2023



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San Jose, Costa Rica

2023

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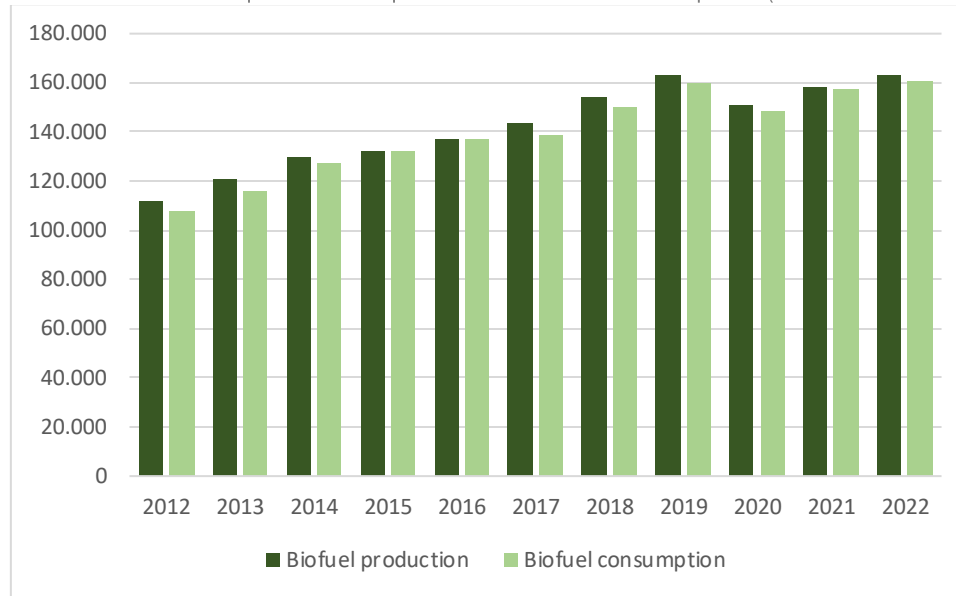


# INTRODUCTION

## 1. Introduction

Both the production and consumption of liquid biofuels increased by 3% compared to 2021. In the last ten years, growth in the consumption and production of biofuels was 37% and 38%, respectively.

Figure 1. Evolution of liquid biofuel production and consumption (in thousands of m<sup>3</sup>).



Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.

Traditional blend mandates continue to drive biofuel production and consumption throughout the world. India, in particular, bears mentioning, recording annual increases in bioethanol consumption.

In addition to traditional biofuel use mandates, new regulatory schemes are now being implemented, most notably the “low carbon fuel standards” (LCFSs), which are mechanisms aimed at decarbonizing the transport sector by providing incentives, and which are usually technology-agnostic. California is one of the forerunners in this area, among other U.S. states and Canada.

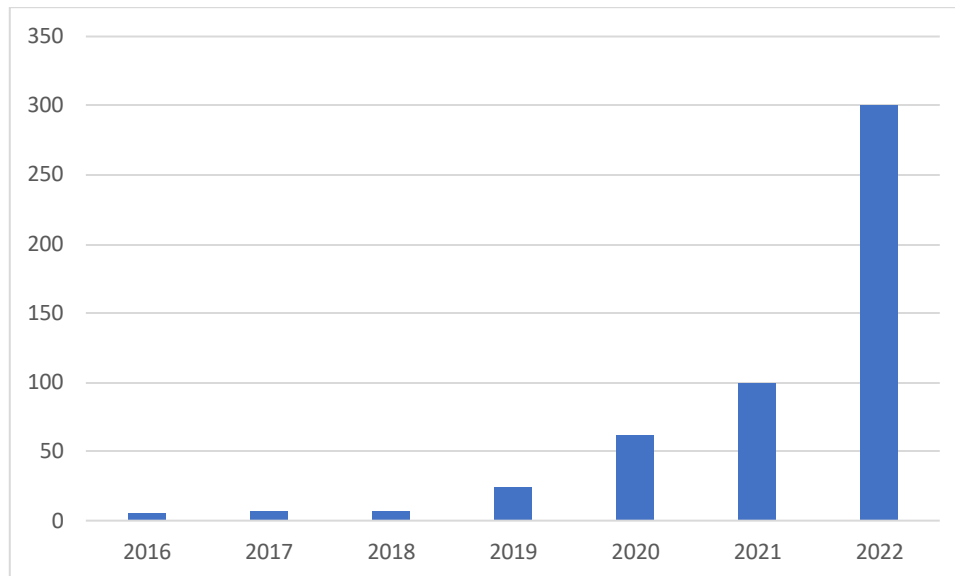
Of the different liquid biofuels, the most widely produced is bioethanol, which accounts for 65% of total production. In the last 15 years, bioethanol production has increasingly used corn as a raw material, in addition to the long-standing tradition of manufacturing sugarcane-based bioethanol, which Brazil has led for several decades.

On the other hand, over the last twenty years, the production and consumption of biodiesel—a biofuel made through the process of transesterification using primarily palm, soybean and rapeseed oil with alcohol—is growing more rapidly than bioethanol, despite starting from a much lower baseline. This product is known as FAME or fatty acid methyl ester. Another more recent development is the production of biodiesel from hydrotreated vegetable oil, commonly known as HVO. Over the last decade, HVO production has grown by 445% to replace diesel and today represents 24% of all biodiesel produced.

Similarly, liquid biofuel use for maritime transport and aviation has become more prevalent, albeit this is still in the incipient stage in the case of the former. Regular consumption of biojet fuel began in 2007

(van Dyk and Saddler 2021), increasing 200% from 2021 to 2022. Moreover, a number of countries began to implement public policies to promote the use of sustainable aviation fuels<sup>1</sup>.

**Figure 2.** Increase of sustainable aviation biofuel production (in thousands of m<sup>3</sup>).



**Note:** The figure for 2021 is estimated.

**Source:** Adapted from IATA 2023 and Torroba 2023.

Today, the use of liquid biofuels is being refined as part of a transition to cleaner forms of energy within the framework of a transportation paradigm based on internal combustion. While new transportation paradigms are being developed (electromobility, hydrogen propulsion, etc.) that will require considerable time for mass adoption, biofuels provide a more environmentally sustainable and immediately available alternative to fossil fuels, without calling for major technical changes in existing vehicles.

This document provides statistical information on the main variables (consumption, production, foreign trade and raw material use) and on the status of public policies regarding liquid biofuel mandates.

<sup>1</sup> The aviation industry uses the term “sustainable aviation fuels” as a generic term for various biofuels, with biojet, also known as aviation biofuel, being the only one that is currently being produced.





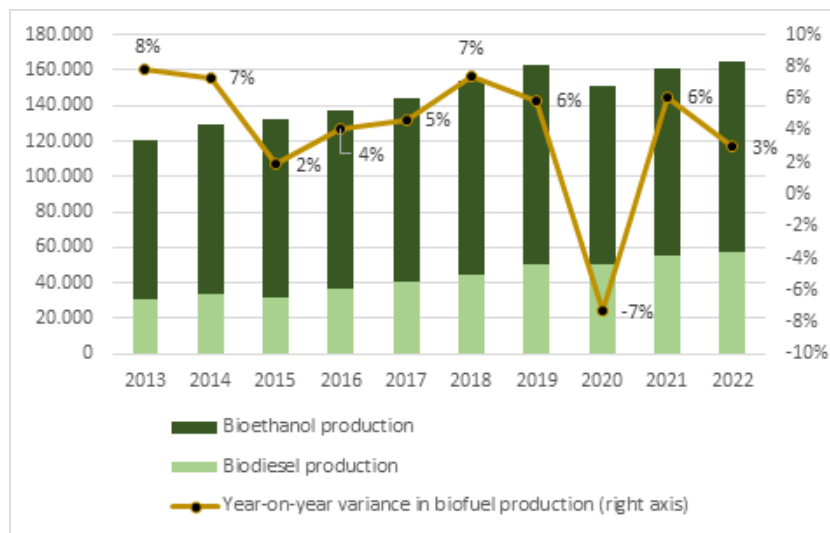
**PRODUCTION**

2

## 2. Production

Over the last decade (2013-2022), there was an accumulated increase of 37% in global liquid biofuel production. For the same period, the year-on-year variance ranged from -7% to 8%, with a clear upward trend in production, except for 2020, when it dropped to 151,377,000 m<sup>3</sup>, due to the effects of the global health crisis. Having shown a recovery of 6% in 2021 in relation to the previous year, in 2022 international production volumes grew to approximately 165,300,000 m<sup>3</sup>, representing a year-on-year increase of 3%.

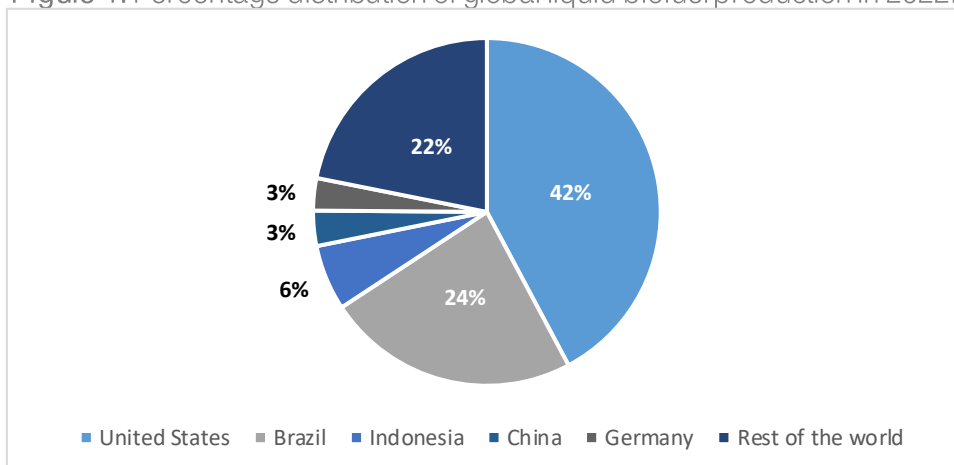
**Figure 3.** Year-on-year percentage variance, trend and total global liquid biofuel production (in thousands of m<sup>3</sup>)



Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.

The five leading liquid biofuel producers are the United States (42%), Brazil (24%), Indonesia (6%), China (3%) and Germany (3%). The remaining 22% of production is distributed among the rest of the countries in the world, with France, India, Thailand, Argentina, the Netherlands, Spain and Canada also commanding a significant share of the market.

**Figure 4.** Percentage distribution of global liquid biofuel production in 2022.

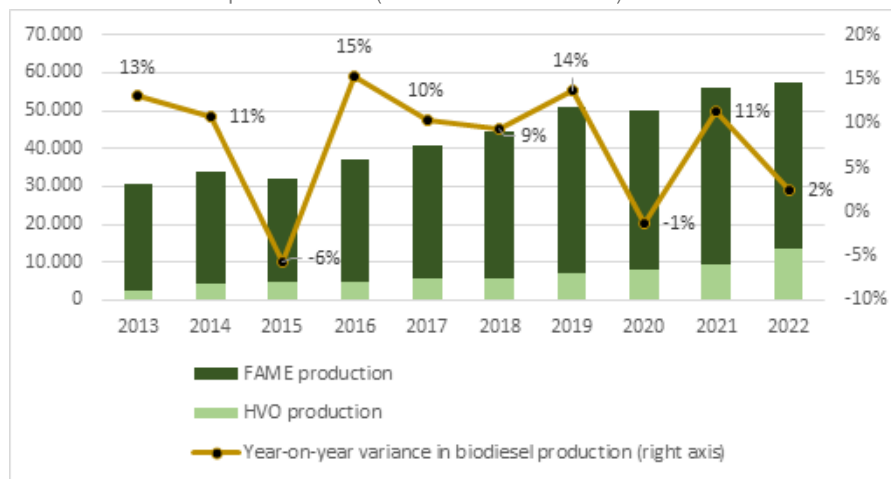


Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.

Over the last decade (2013-2023), there was an accumulated increase of 87% in global biodiesel production. For the same period, the year-on-year variance ranged from -6% to 15%, demonstrating a clear upward trend in production, which climbed to 55,784,000 m<sup>3</sup> in 2021. In 2022, production showed a year-on-year increase of 2%, for the first time surpassing 57,000,000 m<sup>3</sup>.

Specifically, over the last 10 years, HVO production grew by approximately 445%. The year-on-year variance in the final year was 44.5%, amounting to nearly 13,620,000 m<sup>3</sup>. On the other hand, the overall production of FAME grew 55% over the last decade, with production in 2022 declining from 46,359,000 m<sup>3</sup> to 43,537,000 m<sup>3</sup>.

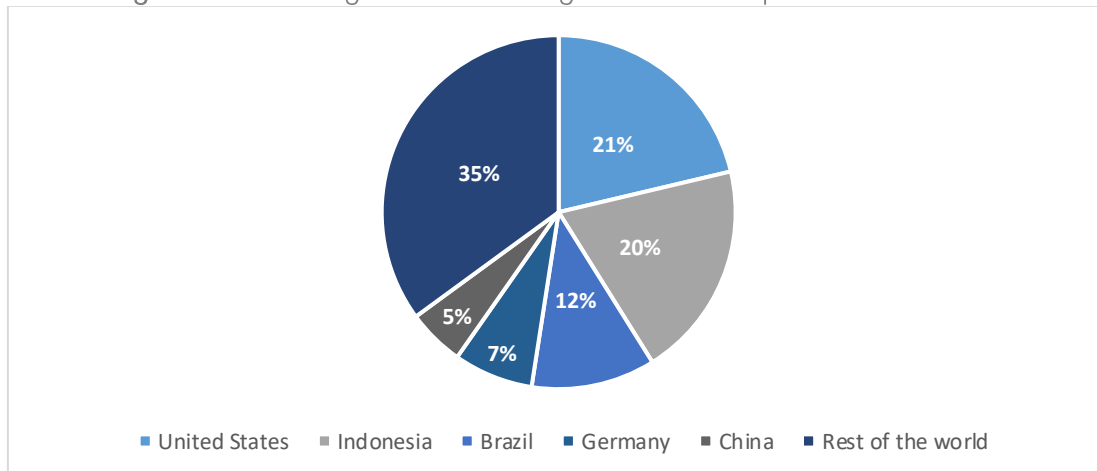
Figure 5. Year-on-year percentage variance, trend and total global biodiesel (FAME & HVO) production (in thousands of m<sup>3</sup>).



Source: Adapted from Torroba and Orozco 2022 and USDA 2023a.

The five leading biodiesel producers in the world are the United States (21%), Indonesia (20%), Brazil (12%), Germany (7%) and China (5%). The remaining 35% of production is distributed among the rest of the countries in the world, with the Netherlands, Argentina, France, Spain, China, Thailand and Singapore also holding a notable share of the market.

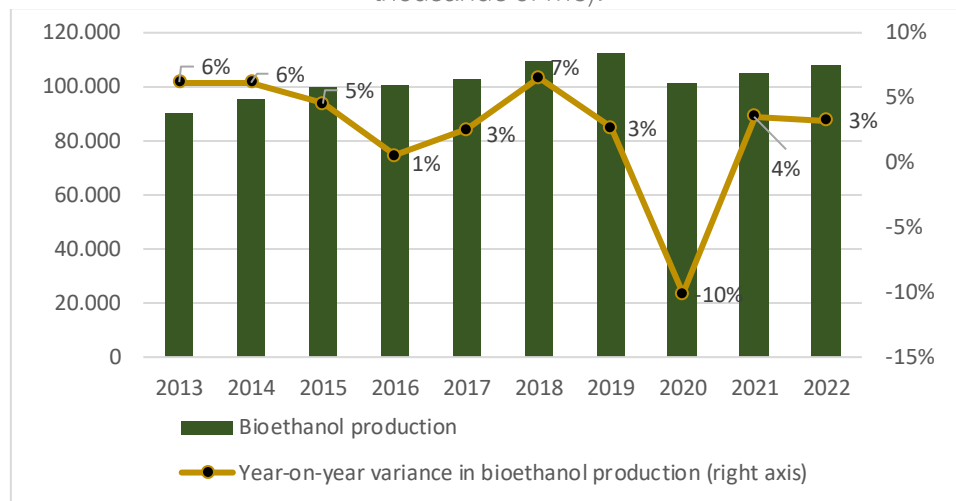
Figure 6. Percentage distribution of global biodiesel production in 2022.



Source: Adapted from Torroba and Orozco 2022 and USDA 2023a.

Globally, the accumulated growth of bioethanol production was 20% over the last decade (2013-2022). The year-on-year variance ranged from -10% to 7%, with a clear upward trend in production, except in 2020, when it dropped to 101,249,000 m<sup>3</sup>, due to the global health crisis. Having recovered once again in 2021, bioethanol production recorded a year-on-year increase of 3% over the previous year, amounting to more than 108,200,000 m<sup>3</sup>.

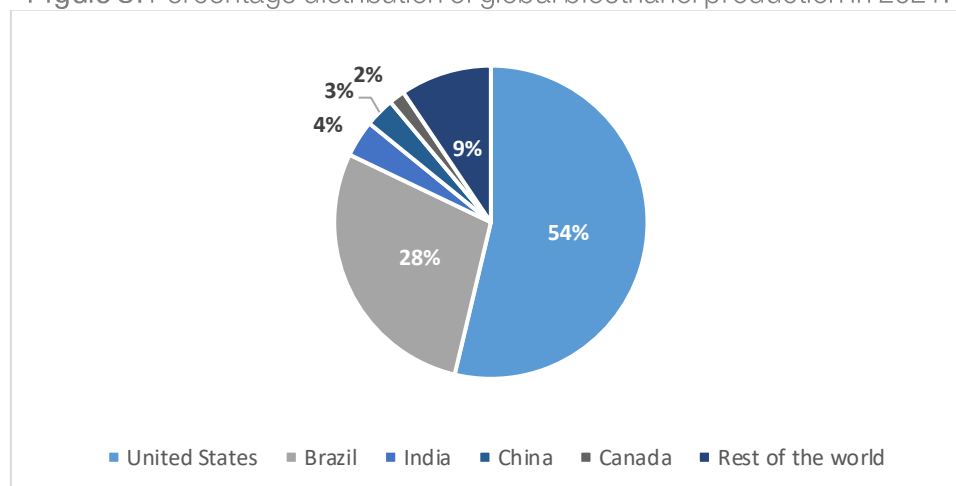
Figure 7. Year-on-year percentage variance, trend and total global bioethanol production (in thousands of m<sup>3</sup>).



Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.

The five leading bioethanol producers are the United States (54%), Brazil (28%), India (4%), China (3%), and Canada (2%). The remaining 9% of production is distributed among the rest of the countries in the world, with Thailand, Argentina, Germany and France also commanding a notable share of the market.

Figure 8. Percentage distribution of global bioethanol production in 2021.



Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.

**NATURAL 95**

**bio**  
**DIESEL**

Bezolovnatý automobilový benzín  
**Super BA - 95**  
Vyrobení vzhovuje ČSN EN 228

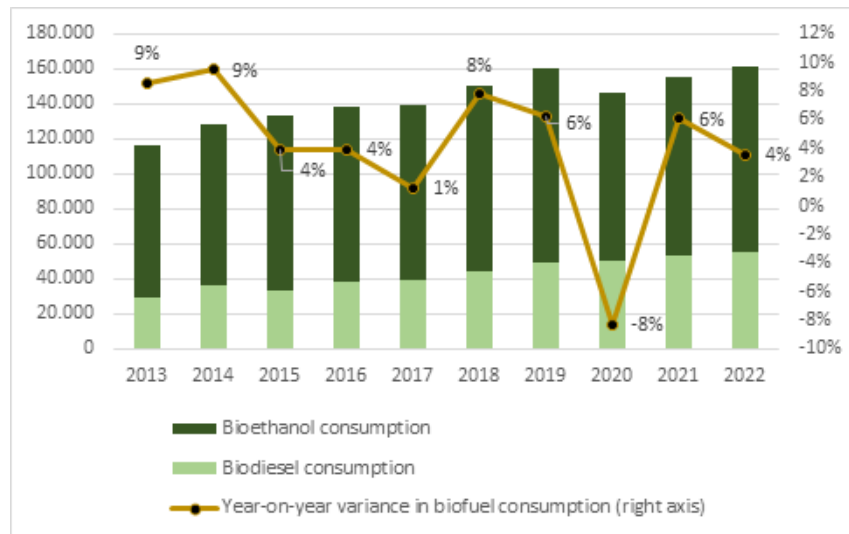
**CONSUMPTION**

**3**

### 3. Consumption

Over the last decade (2013-2022) global liquid biofuel consumption increased by 38% overall, with a year-on-year variance ranging from -8% to 9%. After a fall-off in 2020 amidst the global health crisis, the volume of biofuel consumption increased once again in 2021 and 2022. Indeed, in 2022 there was a year-on-year increase of 4%, topping out at slightly over 161,000,000 m<sup>3</sup>.

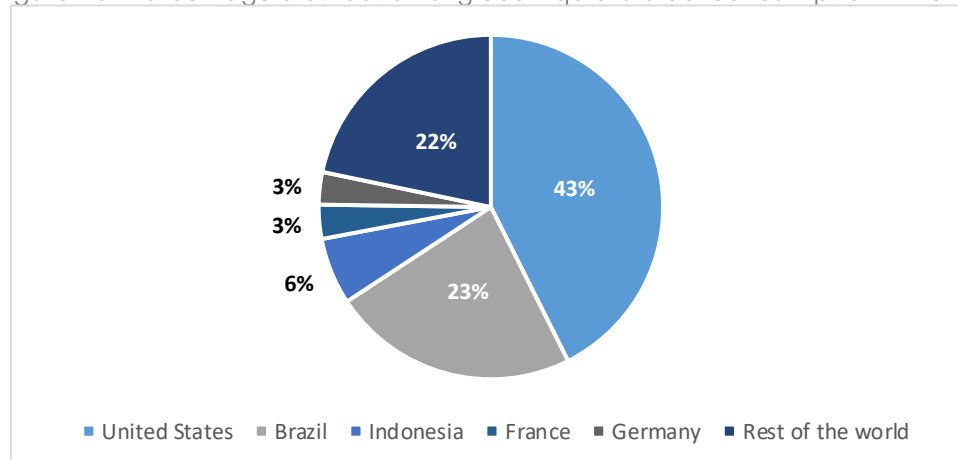
Figure 9. Year-on-year percentage variance, trend and total global liquid biofuel consumption (in thousands of m<sup>3</sup>)



Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.

Liquid biofuel consumption is largely concentrated in two countries: the United States and Brazil, with 43% and 23% of total consumption, respectively. They are followed by Indonesia (6%), France (3%) and Germany (3%). The remaining 22% is distributed among the rest of the countries in the world, with Canada, India, Thailand, China, the United Kingdom, Spain, Argentina and Sweden also commanding a significant share of the market.

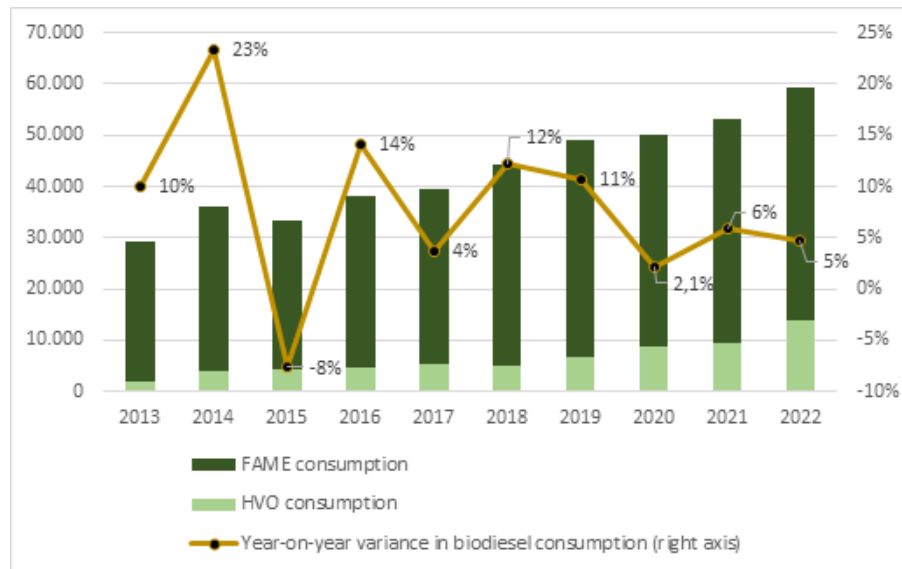
Figure 10. Percentage distribution of global liquid biofuel consumption in 2022.



Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.

On the other hand, over the last decade (2013-2022), global biodiesel consumption increased 89 % overall, with a year-on-year variance ranging from -8% to 23% and surpassing 55,367,000 m<sup>3</sup> in 2022. Moreover, in the last 10 years, consumption of HVO increased by 646%, with a 46.2% increase recorded in 2022.

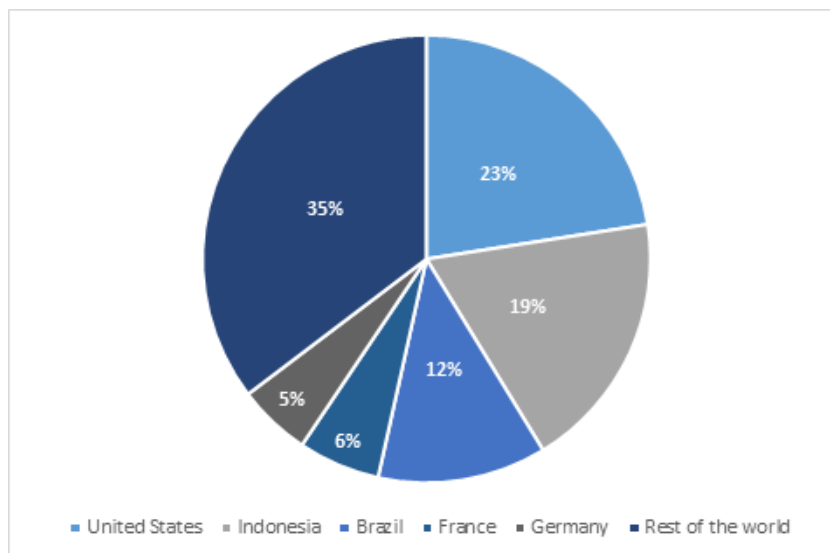
Figure 11. Year-on-year percentage variance, trend and total global biodiesel (FAME & HVO) consumption (in thousands of m<sup>3</sup>).



Source: Adapted from Torroba and Orozco 2022.

Global consumption of biodiesel is more dispersed than bioethanol consumption. The United States, Indonesia, Brazil, France and Germany account for 23%, 19%, 12%, 6% and 5% of the world total, respectively. The remaining 35% is distributed among the rest of the countries, with Spain, Sweden, Thailand, the United Kingdom, and Italy also accounting for a notable share of the total.

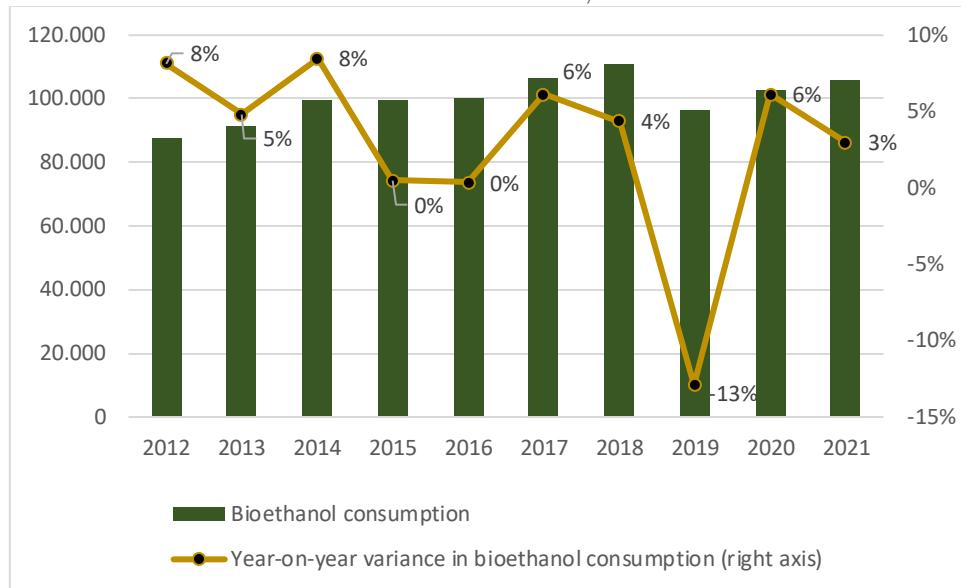
Figure 12. Percentage distribution of global biodiesel consumption in 2022.



Source: Based on Torroba and Orozco 2022.

Over the last decade (2012-2022), global consumption of bioethanol increased by 21% overall, with a year-on-year variance ranging from -13% to 8%. In 2022, there was a year-on-year variance of 3% in relation to 2021, climbing to approximately 105,642,000 m<sup>3</sup>.

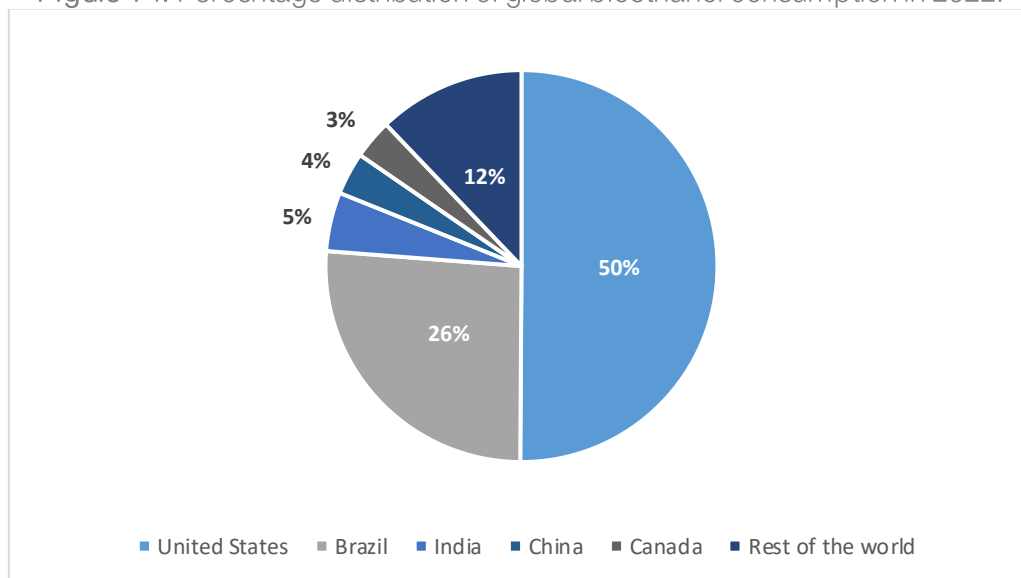
Figure 13. Year-on-year percentage variance, trend and total global bioethanol consumption (in thousands of m<sup>3</sup>).



Source: Adapted from Torroba and Orozco 2022, OIA 2023 y USDA 2023a.

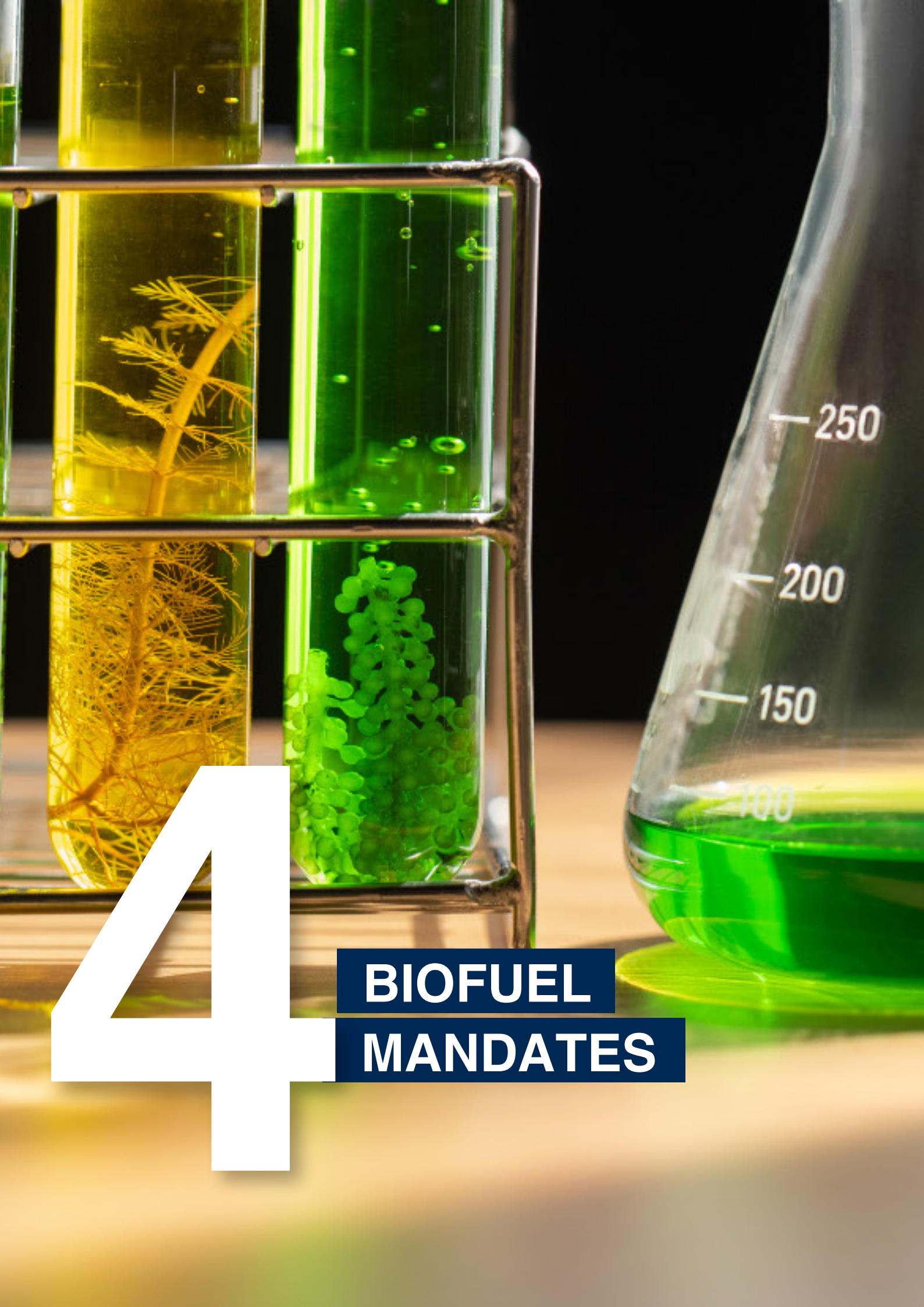
Bioethanol consumption is largely concentrated in the United States and Brazil, with 50% and 26% of total consumption, respectively. They are followed by India (5%), China (4%) and Canada (3%). The remaining 12% is distributed among the rest of the countries in the world, with Thailand, Germany, France, the United Kingdom, Japan and Argentina also accounting for a significant share of the total.

Figure 14. Percentage distribution of global bioethanol consumption in 2022.



Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.





4

**BIOFUEL  
MANDATES**

## 4. Biofuel mandates

According to Torroba (2021), biofuel and fossil fuel blending requirements are fulfilled through a variety of mechanisms, the most widespread of which is the “required blend mandate” to mix bioethanol with gasoline or biodiesel with fossil-based diesel fuel. These blends are usually expressed as a percentage by volume (volume/volume blends) or by energy (energy/energy blends).

Biofuel use requirements are also established through “overall mandates” regarding biofuel/fossil fuel blends. These requirements are met in aggregated form, regardless of which type of biofuel is used.

An additional mechanism is to establish greenhouse gas (GHG) emission reduction targets, while promoting the use of biofuels to achieve them. Low Carbon Fuel Standards (LCFSs) fall under this category. As mentioned before, they have been adopted in the U.S. state of California, as one noteworthy example.

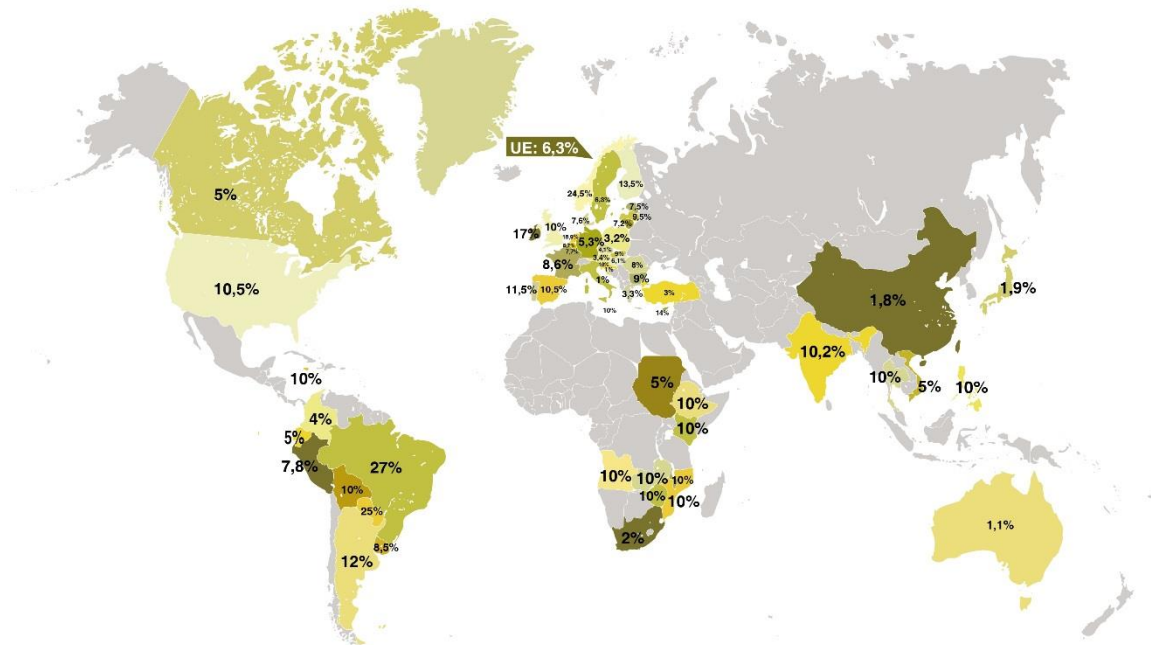
A total of 58 countries have established bioethanol use requirements<sup>2</sup> through one of the three aforementioned mechanisms. Brazil is a frontrunner in terms of “required blend mandates” with a gasoline-bioethanol blend requirement of 27%. In second place is Paraguay, with a mandate of 25%<sup>3</sup>. Argentina comes in third with 12%, followed by a long list of countries with a 10% requirement, which is most commonly used in the world. An interesting case that bears mentioning is India, a country that has recently begun to blend bioethanol and that in 2022 recorded an average blend of 10.4%, which it hopes to expand to 20% in 2025.

Besides these “required blend mandates”, some countries have introduced “overall mandates”, most notably Norway, the Netherlands and Finland, with mandates of 24.5%, 18.9% and 13.5%, respectively. However, in practice, these are not always met, given that they apply to the entire land transportation sector in aggregate form.

<sup>2</sup> Excludes countries with ranges starting at 0% and that do not use bioethanol, or countries that, despite having mandates, do not comply with them. Includes countries whose mandates were temporarily suspended in 2021 due to the health and geopolitical situation, but that nevertheless continue to utilize bioethanol.

<sup>3</sup> The following quality specifications for naphtha (gasoline) and its blends are applied in Paraguay:

- a) Naptha RON 85, RON 90 and RON 95: 24 to 27% of anhydrous alcohol (pursuant to Resolution No. 385/2018)
- b) Naptha RON 97: 10 % of anhydrous alcohol (pursuant to Resolution No. 770/2017)
- c) Naptha E85: 85 % of anhydrous alcohol (pursuant to Decree No. 4652/15).
- d) Ethyl alcohol: 100 % hydrated alcohol.

Figure 15. Direct and indirect mandates on the use of bioethanol in gasoline<sup>4</sup> in 2022.

Note: Required and overall mandates and average biofuel use in countries with GHG reduction targets. For countries with subnational mandates, the current national gasoline-bioethanol (v/v) blend mandate is used as a reference. Excludes voluntary blends or countries with mandated ranges starting at 0% and with zero biofuel consumption. See Annex III for more detailed information.

Source: Adapted from Torroba2021, ISO 2023, The Daily Digest's Biofuels Mandates Around the World 2023, as well as from USDA 2023a and 2023b.

In terms of biodiesel, in 2022, 48 countries had biodiesel use requirements<sup>5</sup>, using one of the three aforementioned mechanisms.

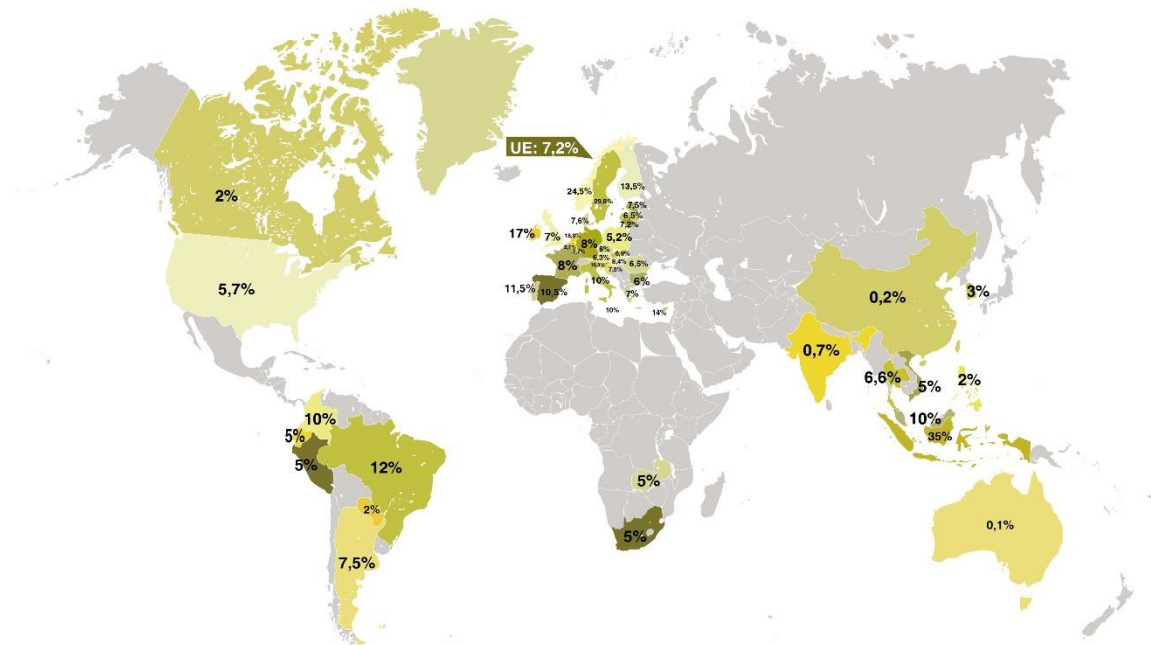
Topping the list of countries with “required blend mandates” is Indonesia, with 35% in 2022, which the Government plans to increase to 40%. Second is Brazil<sup>6</sup>, with a required mandate of 12%. Finally, tied for third are Colombia and Malaysia, with 10% mandates.

Countries with “overall blending” mandates for biodiesel include Norway (24.5%), the Netherlands (18.9%) and Finland (13.5%). Another noteworthy case is Sweden, which has set significant GHG emission reduction targets, consequently achieving a biodiesel (with a high percentage of HVO) penetration rate of 29.79%.

<sup>4</sup> See Annex III for more information.

<sup>5</sup> Excludes countries with ranges starting at 0% and that do not use biodiesel.

<sup>6</sup> In the case of Brazil, the 12% mandate became effective in January of 2021, and, following some modifications throughout the year, was implemented again in September.

Figure 16. Direct and indirect biodiesel<sup>7</sup> in fossil diesel mandates in 2022.

**Note:** Required and overall mandates and average biofuel use in countries with GHG reduction targets. For countries with subnational mandates, the current national gasoline-bioethanol (v/v) blend mandate is used as reference. Excludes voluntary blends and countries with mandated ranges starting at 0% and with zero bioethanol consumption.

**Source:** Adapted from Torroba and Orozco 2022, ISO 2023, The Daily Digest's Biofuels Mandates Around the World 2023, as well as USDA 2023a and 2023b.

<sup>7</sup>See Annex III for more information.



5

**FOREIGN**

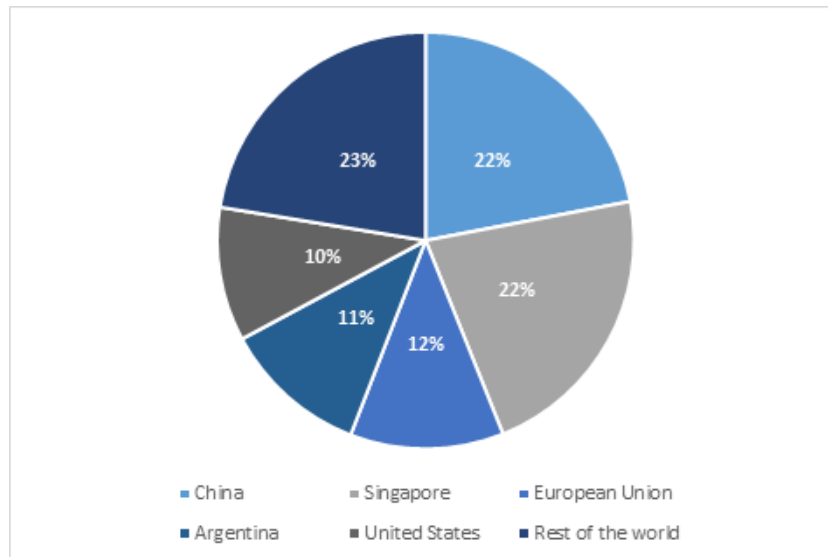
**TRADE**

## 5. Foreign Trade

Foreign trade of biodiesel represents 19.75% of global consumption, with a volume exceeding 10,900,000 m<sup>3</sup>.

In terms of biodiesel exports, the bulk of the market share is concentrated among China (22%), Singapore (22%), the European Union (12%) Argentina (11%), and the United States (10%). The remaining 23% is distributed among the rest of the countries in the world, with Indonesia, the United Kingdom and Malaysia also holding a notable share of the market.

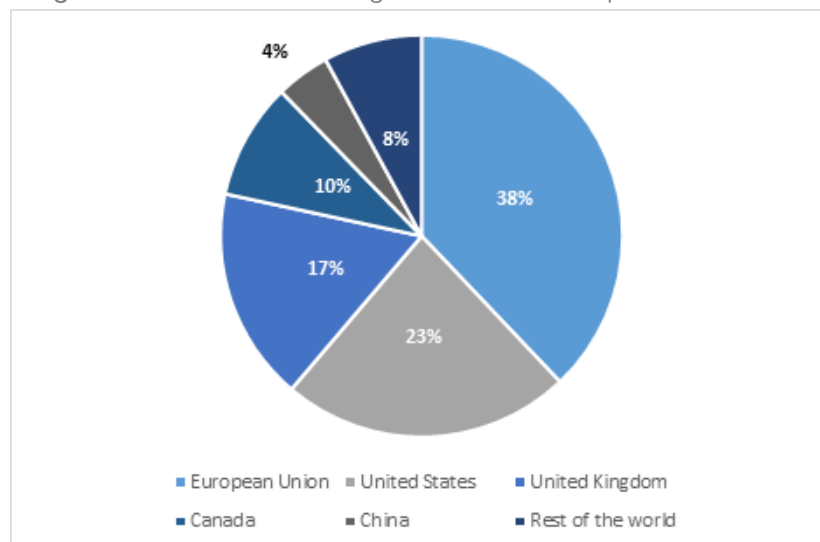
Figure 17. Market share of global biodiesel exports in 2022.



Source: Based on Torroba and Orozco 2022 and USDA 2023a.

In terms of biodiesel imports, the EU is the top net importer (38%), followed by the United States (23%), the United Kingdom (17%), Canada (10%) and China (4%). The remaining 8% is distributed among the rest of the countries in the world, with Norway and Switzerland also commanding a significant share of the market.

Figure 18. Market share of global biodiesel imports in 2022.

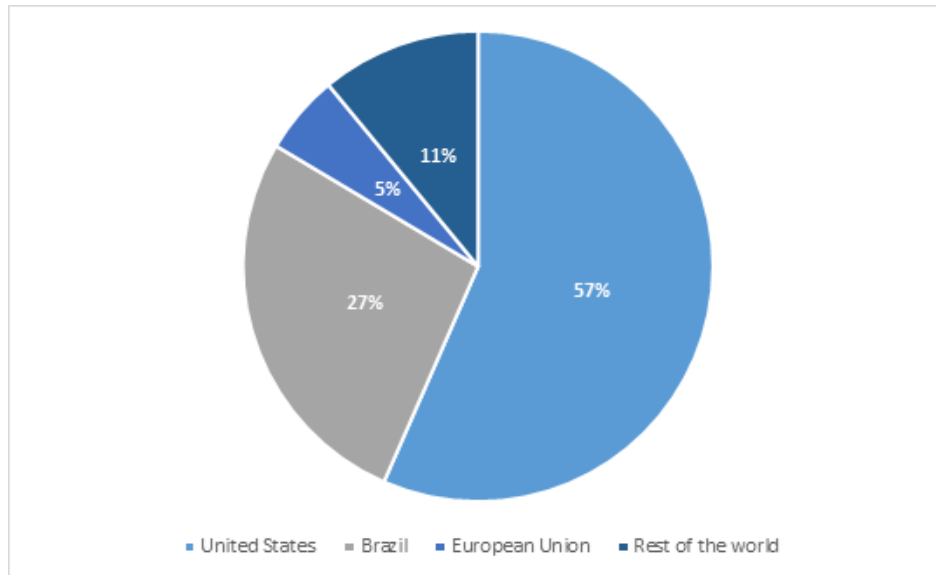


Source: Adapted from Torroba and Orozco 2022 and USDA 2023a.

Foreign trade of bioethanol represents 8.08% of global consumption, with a volume of approximately 8,540,000 m<sup>3</sup>.

In terms of exports, the United States was responsible for 57%, followed by Brazil (27%) and the EU (5%). The remaining 11% is distributed among the rest of the countries in the world, with India, Paraguay and Peru also holding a significant market share.

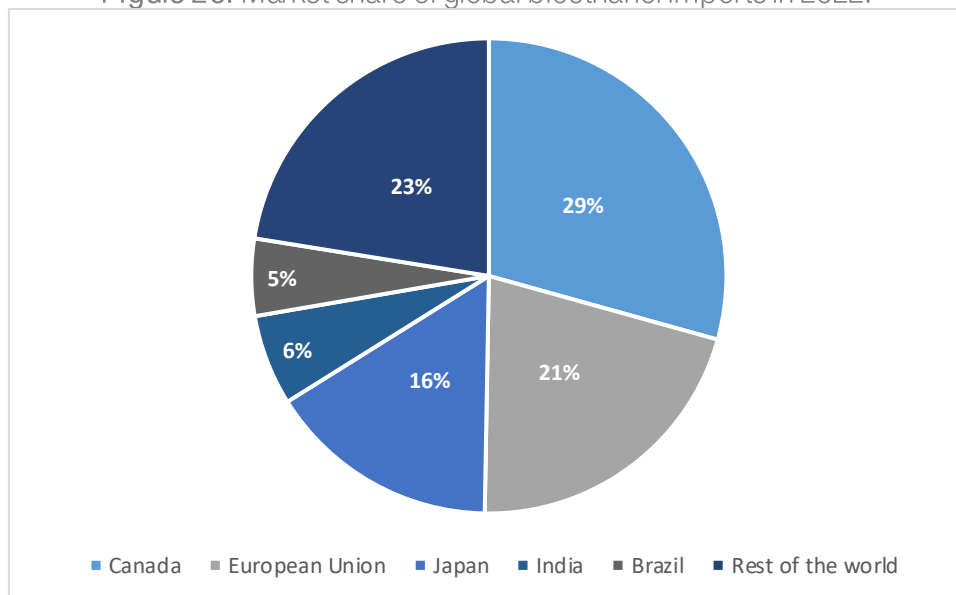
Figure 19. Market share of global bioethanol exports in 2022.



Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.

With respect to bioethanol imports, Canada and the EU are the largest bioethanol importers, accounting for 29% and 21% of sales respectively, followed by Japan (16%), India (6%) and Brazil (5%). The remaining 23% of imports are distributed among the rest of the countries in the world.

Figure 20. Market share of global bioethanol imports in 2022.



Source: Adapted from Torroba and Orozco 2022, ISO 2023 and USDA 2023a.



**RAW  
MATERIALS**

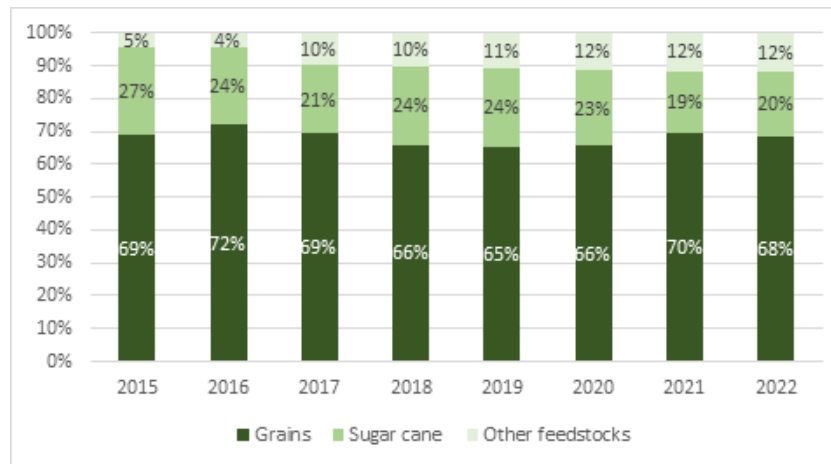
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## 6. Raw materials

In 2022, grains and sugarcane were the most commonly used raw materials in bioethanol production, representing 68% and 20%, respectively. In the case of grains, over 176,200,000 tons were used to produce bioethanol, the main one being corn. In the United States, China, Canada, Argentina and several EU nations, corn is used in mass quantities, whereas in Brazil, where sugarcane is the traditional input, the use of corn is just starting to gain ground. In the case of sugarcane, more than 304,000,000 tons of the crop<sup>8</sup> were employed in bioethanol production, primarily in Brazil, Colombia, Paraguay, Argentina and India. The remaining 12% was based on other raw materials, such as beetroot and molasses.

Figure 21. Bioethanol production by type of raw material used in 2022.

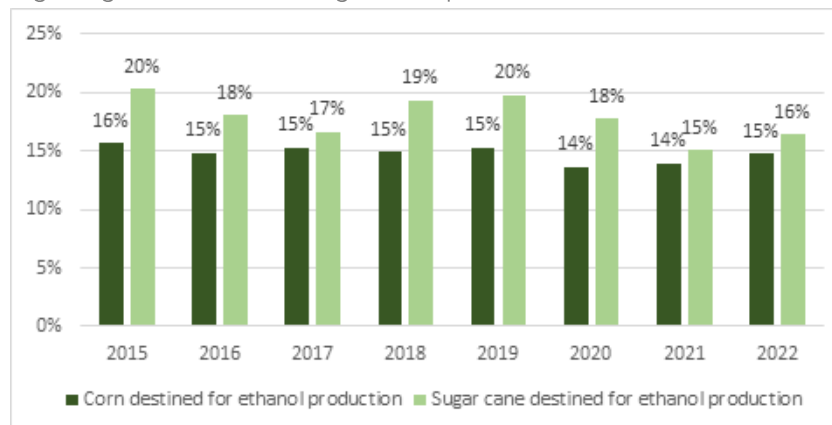


Note: Molasses is included under the “other feedstocks” category.

Source: Adapted from Torroba and Orozco 2022 and ISO 2023.

During the 2021-2022 harvest, 15% of harvested corn<sup>9</sup> and 16 % of processed sugarcane were allocated for bioethanol production.

Figure 22. Percentage of global corn and sugarcane production earmarked for bioethanol production.



Note: The entire amount of corn utilized in the bioethanol production process is attributed to bioethanol, without excluding the byproducts.

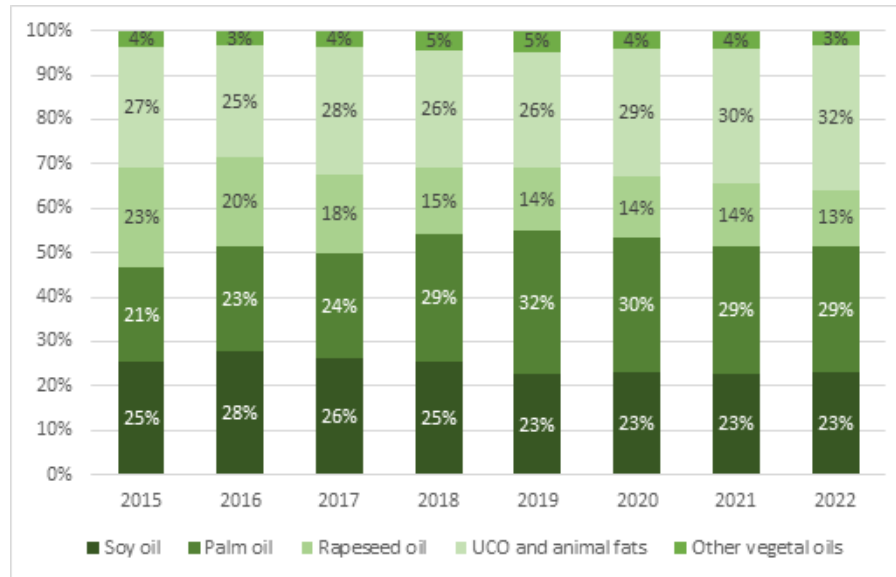
Source: Adapted from Torroba and Orozco 2022, AMIS 2023 and USDA 2023c.

<sup>8</sup> In this case, bioethanol is produced through a process of juice extraction. This excludes molasses.

<sup>9</sup> For every 1,000 kg of corn processed to produce bioethanol, the following approximate amounts of byproducts are also obtained: a) 900 kg of wet distillers grains or 320 kg of dry distillers grains, also known globally as DDGS/WDGS; b) 0.3 tons of vinasse (water included); and c) 300 kg of CO<sub>2</sub>. That is why a large part of the corn allocated for bioethanol production produces a multiplicity of food products. In terms of volume, less than half of the corn produced generates bioethanol.

In 2022, the most used raw materials in biodiesel production were vegetable oils, the most notable of which were palm (29%), soybean (23%) and rapeseed (13%). Moreover, recycled vegetable oils and animal fats account already account for 32% of the raw materials used.

Figure 23. Biodiesel production by type of raw material used in 2022.

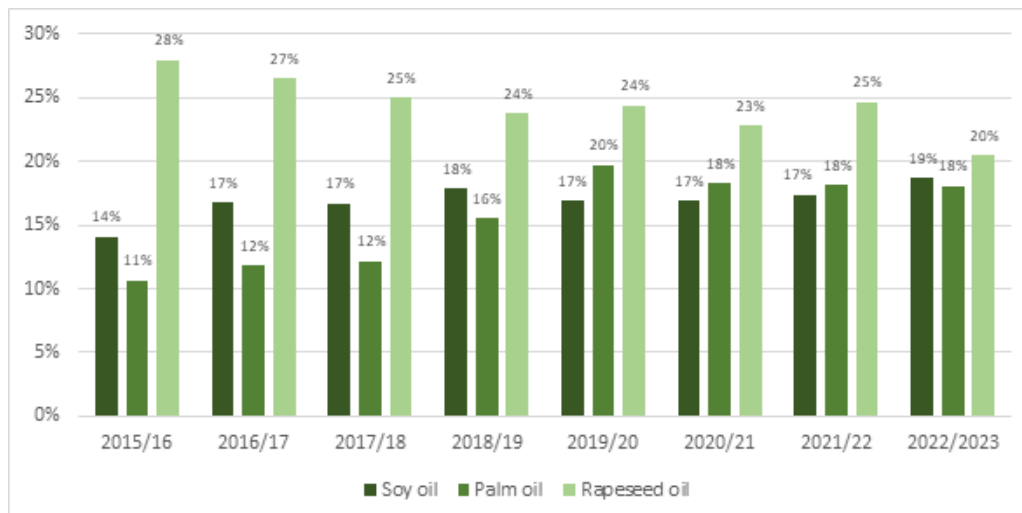


Source: Adapted from Torroba and Orozco 2022.

The United States, Argentina, Brazil and the E.U. produce biodiesel mainly from soybean oil. The use of rapeseed oil as an input for production is also widespread in the E.U., while palm oil is the most used input in Colombia, Indonesia and the rest of Southeast Asia.

In 2022, 20% of global rapeseed oil production, 19% of soybean oil production and 18% of palm oil production were earmarked for biodiesel production.

Figure 24. Percentage of global palm, soybean and rapeseed oil production earmarked for biodiesel production.



Source: Adapted from Torroba and Orozco 2022 and USDA 2023c.

Annex I. Biofuel production (in thousands of m<sup>3</sup>).

Year	Biodiesel production	Bioethanol production	Biofuel production
2013	30,623	90,019	120,641
2014	33,927	95,558	129,485
2015	32,020	99,896	131,916
2016	36,920	100,404	137,324
2017	40,764	102,954	143,718
2018	44,617	109,677	154,294
2019	50,751	112,619	163,370
2020	50,128	101,249	151,377
2021	55,784	104,815	160,599
2022	57,157	108,210	165,367

Annex II. Biofuel consumption (in thousands of m<sup>3</sup>).

Year	Biodiesel consumption	Bioethanol consumption	Biofuel consumption
2013	29,220	87,482	116,702
2014	36,055	91,687	127,742
2015	33,296	99,450	132,746
2016	37,987	99,922	137,909
2017	39,396	100,262	139,658
2018	44,182	106,363	150,545
2019	48,929	110,981	159,911
2020	49,943	96,662	146,605
2021	52,888	102,585	155,473
2022	55,567	105,642	161,009

Annex III. Biodiesel and bioethanol mandates by country, volume by volume (except clarifications) in 2022.

Country	Bioethanol mandate	Biodiesel mandate	Observations
Angola	10%	0%	
Argentina	12%	7.5%	<p>The new bioeconomy law, <i>Ley de Biocombustibles</i> 27640, approved in mid-2021, established a mandatory bioethanol blend rate of 12%, with half of it (6%) to be derived from sugar cane and the remaining 6% from the corn industry. However, if it considers it necessary, the government may reduce the percentage of corn-based ethanol by up to half, to a minimum of 3%</p> <p>On the other hand, the law establishes a mandatory blend of at least 5% biodiesel with fossil-based diesel, which may be reduced to 3% if price increases of the raw material are distorting the price of fuels. In June 2022, a resolution was passed increasing the blend mandate to 7.5%.</p>
Australia	1.1%	0.1%	There is no national mandate; however, two states have mandates for both biofuels. The figure shown is the effective blend rate.
<i>Australia (New South Wales)</i>	6%	5%	There are a number of exceptions and so the effective blend is less. In 2020, the figure was 2.1% for both biofuels.
<i>Australia (Queensland)</i>	4%	0.5%	In 2020, the effective blends were 1.5 % for bioethanol and 0.1 % for biodiesel.
Austria	3.4%	6.3%	Expressed as a percentage of energy content, with an advanced biofuel target of 0.2% and a target to reduce GHG emission intensity by 6%. A 7% limit has been established on the use of conventional fuels.
Belgium	5.7%	5.7%	Expressed as a percentage of energy content, with an overall target of 10.5%. Double counting permitted up to a maximum of 0.95%.
Bolivia	10%	0%	Although E12 and E8 gasoline blends are sold in Bolivia, there is no ethanol mandate. Various measures have been introduced to promote the production and sale of ethanol fuel. In 2017, the Bolivian government highlighted the

			benefits of a national ethanol policy (with a potential 15% blend with gasoline), which would spur economic growth, reduce the importation of gasoline and reduce greenhouse gas (GHG) emissions.
Brazil	27%	12%	The biodiesel blend mandate of B10 remained in place until it was changed to B12 in April 2023.
Bulgaria	9%	6%	Expressed as a percent by volume. There is a 6% biodiesel mandate, which stipulates that 5% must be first-generation biodiesel and 1% advanced biodiesel. There is also a 7% limit on conventional biofuels and a 0.05% advanced biofuels mandate.
Canada	5%	2%	Six provinces have biofuel mandates ranging from 5% to 10% for bioethanol and 2% to 5% for biodiesel.
<i>Canada (Alberta)</i>	5%	2%	
<i>Canada (British Columbia)</i>	5%	4%	
<i>Canada (Manitoba)</i>	10%	5%	
<i>Canada (Ontario)</i>	10%	4%	
<i>Canada (Quebec)</i>	10%	3%	
<i>Canada (Saskatchewan)</i>	7.5%	2%	
China	1.8%	0.2%	A national E10 mandate exists on paper. However, an unofficial suspension—that resulted from the pandemic—remains in place. By 2019, seven provinces and cities had fully implemented the E10 blend, with partial implementation in five others to varying degrees. Three other provinces launched pilot programs in some cities, but they have been reduced or suspended. In the case of biodiesel, only Shanghai has implemented a B5 program. The estimated national blend ratio for 2022 is shown.
Colombia	4%	10%	On 31 March 2021, the Colombian government issued an emergency resolution to reduce the ethanol blend mandate from E10 to E4, starting on 1 April 2021 and up to June 2021. After June 2021, the blend mandate was to gradually increase to E10 by the end of 2021. However, the Ministry of Mines

			and Energy has continued to issue new resolutions to reduce the ethanol blend mandate, which has not reverted to E10 since March 2021. The last mandate in effect was E4. On the other hand, a 10% biodiesel mandate was established as of March 2022.
Costa Rica	8%	5%	The mandate stipulates from 0% to 8% for bioethanol and from 0% to 5% for biodiesel. In 2020, the blending of both biofuels in fossil fuels was 0%. The country is working to tentatively apply a 10% bioethanol blend in gasoline by 2024.
Croatia	1%	7.49%	Expressed as a percentage of energy content. The country has established an overall biofuel percentage of 8.81%; double counting for advanced and waste-based biofuels; a 0.2% advanced biofuels target; and a 6% GHG emission intensity reduction target.
Cyprus	14%	14%	In 2023, Cyprus eliminated mandates expressed in overall percentages and in energy content. The advanced biofuel target of 0.2% remains in place and there is a 6% target reduction in fuel GHG emission intensity. The overall percentages in effect in 2022 are shown.
Czech Republic	4.1%	6%	The Czech Republic implemented voluntary blend mandates in 2022, with a required 6% reduction of GHG emissions. The country introduced a double counting system for biofuels made from recycled cooking oils and animal fats classified in Categories 1 and 2, in accordance with Regulation (EC) No. 1069/2009, which are considered low risk in terms of land use changes. There is also a 0.22% target for biomethane-based advanced biofuels. The former mandates are shown.
Denmark	7.6%	7.6%	In 2023, Denmark eliminated overall percentages defined in energy content. Currently, there is an advanced biofuel target of 0.2% and palm- and soya-based biofuels are prohibited. The GHG intensity reduction target for fuels is 3.4%. The former overall percentages are shown.

Ecuador	5%	5%	There is no specific ethanol mandate in Ecuador. The distribution and sale of an ethanol-gasoline blend is based on the supply of anhydrous ethanol, which is produced in the country. In this case, the most popular blend sold is the E5 mix in gasoline, known as Eco- país.
Estonia	7.5%	7.5%	The country uses overall percentages expressed in energy content. RON 98 petrol is exempt from blending obligations. There is a 0.5% advanced biofuel target and the limit for conventional biofuels is 2.5%. There is also a 6% target reduction in fuel GHG emission intensity. Double counting is applied.
Ethiopia	10%	0%	
European Union	6.3%	7.2%	The estimated final blend for 2022 is shown.
Finland	13.5%	13.5%	Utilizes overall percentages of energy content. The advanced biofuel target is 2% and the limit on conventional biofuels is 2.6%.
France	8.6%	8%	Targets are expressed as percentages of energy content. A double counting mechanism is in place for cellulosic and waste-based biofuels, and those produced from the raw materials listed in Annex IX of Directive 2009/28/EC, except for pine oil and pine tar. The advanced biofuels target is 1.2% in ethanol and 0.4% in biodiesel. The GHG intensity reduction target is 10%. There is widespread use of E85 throughout the country.
Germany	5.29%	8%	The country has set a greenhouse gas (GHG) emission reduction target of 8% and a 4.4% limit on the use of conventional fuels. There is also a 1.9% target on the use of biofuels based on used cooking oils (UCO) and animal fats and another 0.3% on the use of advanced biofuels. The effective blends for bioethanol and biodiesel for 2021 are shown.
Greece	3.3%	7%	Expressed as a percentage of energy content in the case of bioethanol and as a percentage by volume in the case of

			biodiesel. There is 0.2% advanced biofuels target for biodiesel.
Guatemala	5%	0%	The government approved a law that establishes a 5% minimal bioethanol blend of 5% as of 2025.
Hungary	6.1%	8.4%	Expressed as a percentage of energy content. Double counting of biofuels from recycled trash, used cooking oil or animal fat. The advanced biofuels target is 0.2%, whereas the GHG emission intensity reduction target is 6%.
India	10.2%	0.07%	The Biofuel Policy of the Ethanol Blended Petrol Program has set an E20 target for 2025. The current ethanol target in effect is E10. The estimated blend for 2022 was 10.2%. In the case of biodiesel, there is a 5% target for 2030. However, the final estimated blend in 2022 was only 0.07%.
Indonesia	0%	35%	With respect to biodiesel, in 2021 the blend percentage increased to 35%. The country has in place a 5% bioethanol mandate for Public Service Obligation (PSO) transportation and a 10% mandate for non-PSO transportation, but they have yet to be implemented.
Ireland	17%	17%	Overall percentages expressed as a percent volume of total fuel used. Double counting of biofuels made from recycled vegetable oil and animal fat. The advanced biofuels target is 0.3%, while the target reduction in fuel GHG emission intensity is 6%.
Italy	0.5%	10%	A bioethanol blend mandate of 0.5% was established for 2023, whereas biodiesel continues to fall under the regime of overall percentages expressed in energy content, which is 10%. The advanced biofuels target is 3.4%, of which 2.3% is for advanced biomethane. A double counting mechanism is applied for advanced biofuels. The reduction target for fuel GHG intensity is 6%.
Jamaica	10%	0%	
Japan	1.9%	0%	Japan's only commitment with respect to biofuels for transport, which is in effect until the 2022 fiscal year, is a de facto mandate of 500 million liters of oil equivalent (LOE) for road transportation.



			To meet this objective, Japan utilizes ethyl tertiary-butyl ether (ETBE) derived from bioethanol, which Japanese oil refineries blend with gasoline. Gasoline blended with bio-ETBE is much more common than E3 gasoline and is widely distributed. There are two methods for blending bioethanol with gasoline: direct blending and ETBE. The Japanese oil industry promotes the use of the ETBE method. The final estimated blend for 2022 is shown.
Kenya	10%	0%	The province of Kisumu has implemented an E10 mandate.
Latvia	9.5% & 5%	6.5%	Latvia suspended blending mandate obligations as of July 2022, making blending optional. The target reduction of fuel GHG emission intensity is 6%, while there is a 7% limit on conventional biofuels. The blend mandates that were previously in effect are shown.
Lithuania	7.2%	7.2%	Expressed in energy content. There is a 0.4% advanced biofuel target. Conventional biofuels have been capped at no more than 1% greater than the 2020 total and there is a 1.7% limit on biofuels made from used cooking oil and animal fat. The reduction target for fuel GHG intensity is 6%.
Luxembourg	7.7%	7.7%	Overall percentages expressed in energy content. The percentages are 7.7% before double counting and 9.7% after. Advanced biofuels should be at least 50% after double counting. The limit on conventional biofuels is 5% and there is a 6% target reduction in fuel GHG emission intensity.
Malaysia	0%	10%	The country had planned to expand the biodiesel mandate to achieve a 20% blend in the first quarter of 2020; however, the plan was delayed due to the pandemic.
Malawi	0%	0%	Implementation of the mandate depends on availability.
Malta	10%	10%	Up until 2023, no mandate has been established. The advanced biofuel target is 0.2%. The previously defined overall percentages are shown.
Mexico	5.8%	0%	Not mandatory.

Mozambique	10%	0%	
The Netherlands	18.9%	18.9%	Expressed as overall percentages of energy content, which is 2.4% in the case of advanced biofuels. There is 1.4% limit on conventional biofuels and 0% on fuels derived from palm and soy, except with the corresponding certification. Double counting is applied for biofuel from waste and residues. There is a 6% target reduction in fuel GHG emission intensity.
New Zealand	10%	7%	Not mandatory. In the case of biodiesel, it ranges from 5% to 7%.
Norway	24.5%	24.5%	These are overall percentages of energy content, which is 9% in the case of advanced biofuels. Double counting for advanced biofuels is applied, resulting in an effective blend rate of 12.25-15.5%.
Paraguay	25%	2%	In the case of biodiesel, Paraguay established a gradual target increase of 1% each year, starting in 2020. However, the resolution was repealed.
Peru	7.8%	5%	
Philippines	10%	2%	
Poland	3.2%	5.2%	There is an overall mandate of 8.9% expressed as percentages of energy content. Double counting is applied. There is a 0.1% advanced biofuels target.
Portugal	11.5%	11.5%	Overall percentages of energy content. There is an advanced biofuels target of 0.7% with double counting and a 7% cap on conventional biofuels.
Romania	8%	6.5%	There is a 10% overall percentage expressed as a percentage of energy content. Double counting is applied.
Slovakia	9%	6.9%	Minimum blends have been established for both biofuels, expressed as a percentage of volume, with an overall percentage of 8.6%, expressed as a percentage of energy content. The percentage of second-generation biofuels is 0.5% with double counting. Moreover, there is a 6% target reduction in fuel GHG emission intensity.

Slovenia	10.1%	10.1%	Expressed as percentages of energy content. Double counting is applied for biofuels made from waste, residue, non-food cellulosic materials and lignocellulose materials. There is a 7% limit on conventional biofuels and the reduction target for fuel GHG emission intensity is 6%. There is also an advanced biofuels target of 0.2%.
South Africa	2%	5%	Bioethanol ranges from 2% to 10%.
South Korea	0%	3%	
Spain	10.5%	10.5%	Overall percentages expressed in energy content. A double counting mechanism is in place and there is an advanced biofuel target of 0.3%. The limit on conventional biofuels is 3.5% and the GHG emission intensity reduction target is 6%.
Sudan	5%	0%	
Sweden	6.34%	29.79%	The country has established a 7.8% minimum required reduction of GHG emissions for gasoline and 30.5% for diesel. The final blend for 2021 is shown.
Thailand	10%	10%	There is no mandatory blend for bioethanol, but rather a consumption target of 2.7 billion liters by 2037. Three blend rates are used: E10, E20 and E85. A mandate is in place for biodiesel, with the exception of diesel used in industry and agriculture. Although the mandate remained at 10% in 2021, in October the government mandated that the rate be decreased to 5%.
Turkey	3%	0%	A mandate of 3% was in place up to 2021. However, it was suspended in 2021 due to the impact of the COVID-19 pandemic on consumption.
Ukraine	7%	0%	The Alternative Fuel Types Act of 2000, amended in 2014, sets targets for the transport sector (mandatory bioethanol blend of 7% as of 2016). These provisions do not currently apply. Ukraine has started to use the Euro-5 fuel standard, which provides for the addition of 5% biofuel. This standard includes a range from 0% to 5%. At present, this fuel is sold almost without bio-additives.
The United Kingdom	10%	7%	E10 is the standard petrol grade of bioethanol mixed with gasoline and sold

			in the country. No mandate has been established.
The United States	10.5%	5.67%	E10 is the most used blend, followed by E15 and E85 in other places in the country. Individual states have varying levels of alternative mixes.
<i>United States (Louisiana)</i>	2%	2%	
<i>United States (Massachusetts)</i>	0%	15%	The mandate stipulating a minimum of 15% biodiesel will be applicable if the Commonwealth of Massachusetts Office of Vehicle Management and other specialized agencies determine that the blend target is appropriate. Agencies may request exemptions in certain cases, such as when the alternative fuel cannot be sourced within an appropriate distance, when the price is prohibitive, etc.
<i>United States (Minnesota)</i>	10%	20%	The biodiesel mandate ranges from 5% to 20%, depending on the season of the year.
<i>United States (Missouri)</i>	10%	0%	
<i>United States (New Mexico)</i>	0%	5%	
<i>United States (Oregon)</i>	10%	5%	
<i>United States (Pennsylvania)</i>	10%	2%	
<i>United States (Washington)</i>	2%	2%	
Uruguay	8.5%	0%	The biodiesel mandate in effect was suspended in 2022.
Vietnam	5%	0%	In keeping with regulations, E5 blends have been sold in 7 provinces since 2015. A target of E10 was initially planned for 2017 but has not been implemented.
Zambia	10%	5%	
Zimbabwe	10%	0%	Ranges from 5% to 20%, based on local production levels.

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