BEN

Summary Report 2025

Reference year 2024

Summary Report 2025

Reference year 2024

Ministry of Mines and Energy – MME

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Content

Public Value

In compliance with its creation law, the Energy Research Office (EPE) prepares and publishes the Brazilian Energy Balance (BEB – BEN, in Portuguese) annually, maintaining a tradition initiated by the Ministry of Mines and Energy (MME). The purpose of the BEB is to present the accounting for the supply and consumption of energy in Brazil, covering the activities of extraction of primary energy resources, their conversion into secondary forms, import and export, distribution and energy end-use.

BEB is the result of extensive research, constituting itself as a broad and systematic database, updated in annual cycles. Of paramount importance for studies related to national energy planning, BEB has also proved to be an important research tool for sectoral studies, as it presents reliable statistics, often revealing trends in energy supply and consumption. The document is taken as a reference for the country's energy data. The Summary Report of the Brazilian Energy Balance 2025 - Reference Year 2024, presents consolidated information on how much and how energy was used in Brazil in 2024.

BEB's product portfolio

Tools for monitoring energy statistics

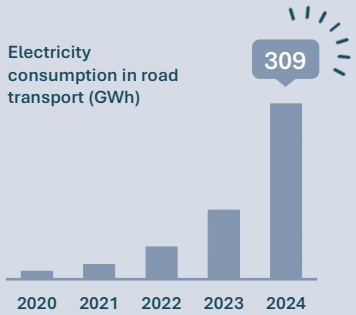
The National Energy Balance product portfolio has its origins in energy statistics and seeks to diversify the ways in which this data is consolidated, made available and visualized according to the different audiences interested in learning about the statistics. This portfolio has recently gained new products, such as the Interactive Energy Balance, BEN 50 years and the BEN Dynamic Report. The Summary Report of the Brazilian Energy Balance is a traditional EPE publication which is now in a new, more modern, didactic and explanatory format for Brazilian and international society.

What's new in the 2025 Synthesis Report?

See below what are the news in the national energy matrix and in BEB's summary report this year:

Introduction of electricity consumption in the road transport sector

The National Energy Balance accounted for the electricity consumption of the road transport sector in the Brazilian energy matrix as of 2020.



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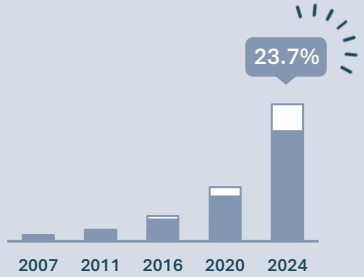
Evolution of the share of wind and solar sources in total electricity generation

Presentation of the evolution curve of the share of wind and solar sources in the Brazilian electricity matrix, pointing to a 23.7% share of these sources in 2024.



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Share of micro and mini generation in total electricity generation

Presentation of the evolution curve of the share of micro and mini distributed generation in total electricity generation, indicating that this modality will reach 5.6% by 2024.

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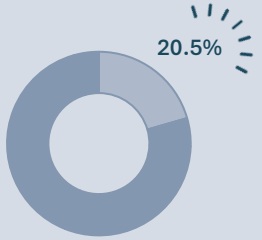
Share of the energy sector in total national emissions

Contextualization of the energy sector's emissions in the total national emissions of the National Inventory of Greenhouse Gas Emissions (GHG), identifying that in 2022 this sector represented 20.5% of net national emissions.



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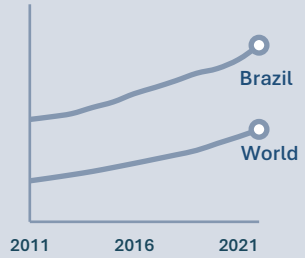
Indicators developed in partnership between EPE and IBGE for SDG 7: Clean and Affordable Energy

Presentation of the Brazilian indicators of the Sustainable Development Goals (SDG 7) in comparison with selected countries and the world.



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Total Energy Supply

In 2024, domestic energy supply (total energy made available[2] in the country) reached 322 Mtoe, an increase of 2.4% on the previous year. The share of renewables in the energy matrix was marked by a continued supply of hydroelectric power, an increase in the supply of other renewables (especially black liquor and biodiesel) and growth in wind and solar photovoltaic generation. Non-renewable sources remained stable, with a slight increase of 0.5%.

These movements contributed to the Brazilian energy matrix reaching a level of 50% renewability, much higher than that observed in the rest of the world and in OECD countries[1].

Electricity Supply

In the case of electricity, there was an increase in domestic supply of 39.7 TWh (+5.5%) compared to 2023.

The main highlights were:

- The share of renewables in the electricity matrix stood at 88.2% in 2024.
- Solar photovoltaic generation reached 70.7 TWh (centralized generation and MMDG), growing by 39.6%, and its installed capacity reached 48,468 MW, up 28.1% on the previous year.
- Hydroelectric generation remained practically stable, with a slight reduction of just 4.2 TWh, representing a 1% drop compared to 2023.
- Wind generation reached 107.7 TWh (up 12.4%) and its installed capacity reached 29,550 MW, an increase of 3%.
- Thermoelectric generation increased by 11.4%, totaling 151.2 TWh in 2024.
- In 2024, 40.6% of thermal generation came from biomass.

[1] Organisation for Economic Co-operation and Development
[2] The energy made available in the country includes the net balance of imports.

Final Consumption

Final consumption (both energy and non-energy) grew 1.9% in relation to the previous year.

Industry

The industrial sector added 1.2 million toe. Among the sources that contributed to the increase were electricity (+4.1%), mineral coal and its derivatives (+3.5%) and firewood and charcoal (+2.1%). In 2024, the main downward movements were in the use of sugarcane bagasse (-3.3%) and fuel oil (-17.4%), compared to 2023. There was a 5.2% increase in the use of black liquor due to the 5.2% growth in pulp production.

With the exception of the Chemicals, Cement, Ferroalloys and Food and Beverages segments, which fell by 0.6%, 1.1%, 1.9% and 2.1% respectively, all the other segments recorded an increase in consumption in 2024. The industry's renewability stood at 64.4%.

Transport

Energy consumption in transportation in 2024 showed an increase of 2.7% compared to 2023. The main highlights were the 30.1% increase in hydrated ethanol and the 19.3% increase in biodiesel. The movement in biodiesel was due to the increase in diesel oil consumption and the increase in its blending content with mineral diesel to 14% (B14) from March 2024. In the light vehicle market, consumption of C (automotive) gasoline fell by 3.9% compared to 2023.

In 2024, the transport sector had 25.7% renewability.

This year, the National Energy Balance incorporated electricity consumption in the road sector for the years 2020 to the base year of 2024.

Final Consumption by source

Electricity

Final electricity consumption in the country in 2024 grew by 5.5%. The sectors that contributed most to this growth in absolute values were Residential, which grew by 13.6 TWh (+8%), followed by Commercial, which increased its consumption by 7.7 TWh (+7.4%) and Industrial, which grew by 9.3 TWh (+4.1%).

Ethanol

Final ethanol consumption in the country (m^3) increased by 15.7% compared to 2023 and reached around 37.1 million cubic meters in 2024.

Biodiesel

Final biodiesel consumption in the country (m^3) in 2024 increased by 19.3%. The mandatory blending percentage in petroleum diesel was changed to 14% (by volume) from March 2024.

Emissions

In 2024, the total anthropogenic emissions associated with the Brazilian energy matrix reached 431.3 million tons of carbon dioxide equivalent (Mt CO_2 eq), the majority of which (214.3 Mt CO_2 eq) was generated in the transport sector.

In terms of emissions per inhabitant, each Brazilian, producing and consuming energy in 2024, emitted on average 2,0t CO_2 eq.

According to the latest data released by the International Energy Agency (IEA) for the year 2022, each Brazilian emitted the equivalent of 14.5% of what an American emitted, 37.3% of what an OECD European citizen and 26.7% of what a Chinese citizen issued.

The carbon intensity in the economy in 2024 was 0.13 kg CO_2/US$ppp [2015][1].

Also based on IEA data from 2022, the carbon intensity in the Brazilian economy is equivalent to 33% of the Chinese economy, 62% of the U.S. economy and practically the same level as the economy of European OECD countries.

For each ton of oil equivalent (toe) made available, Brazil emitted in 2022 the equivalent of 71% of the emission of European OECD countries, 66% of the emission of the United States (USA) and 50% of the emission of China.

The Brazilian electric sector emitted, on average, only 59.9 kg CO_2 eq to produce 1 MWh, a very low rate when comparing with European OECD countries, USA and China.

The digital version of this document can be accessed at http://www.epe.gov.br

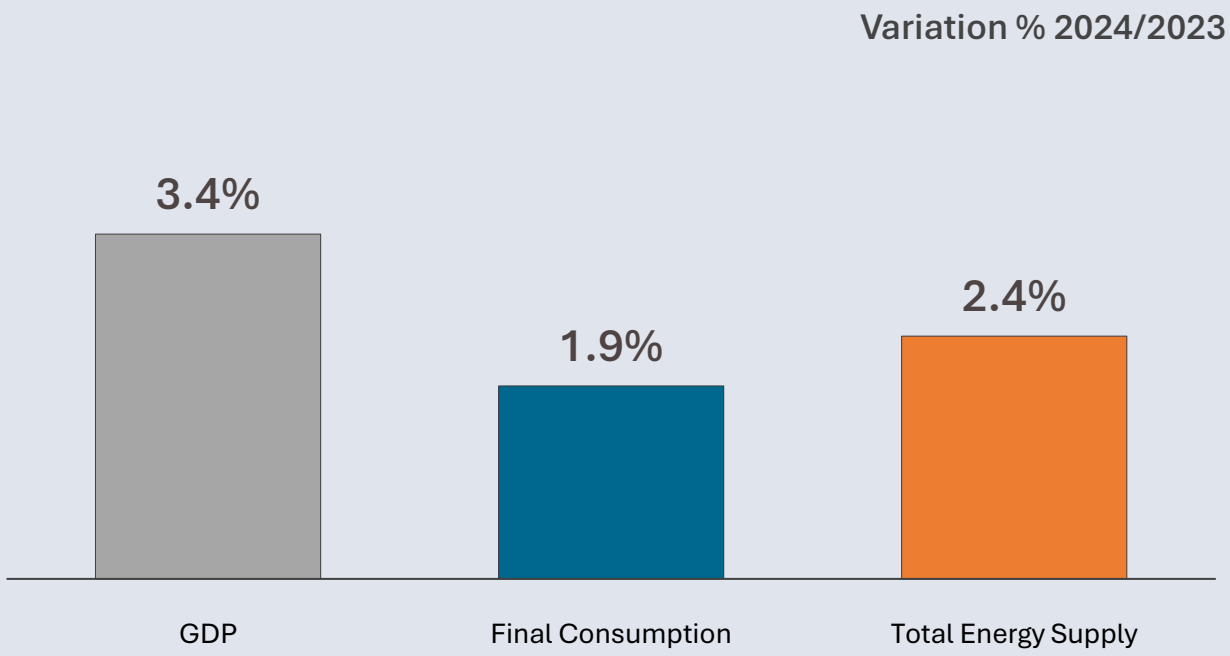
[1] In the concept of purchasing power parity.

How much Energy is used in Brazil?

The **Total Energy Supply (TES)** in Brazil recorded, in 2024, a growth of 2.4% compared to the previous year, with emphasis on the growth of natural gas, wind and solar. The growth rates of the TES and the Final Energy Consumption were lower than the GDP growth rate, implying a reduction in the energy intensity of the Brazilian economy.

Values in 10^6 toe		2023	2024
Total energy supply	↑	314.5	322.0
Final consumption	↑	282.9	288.3

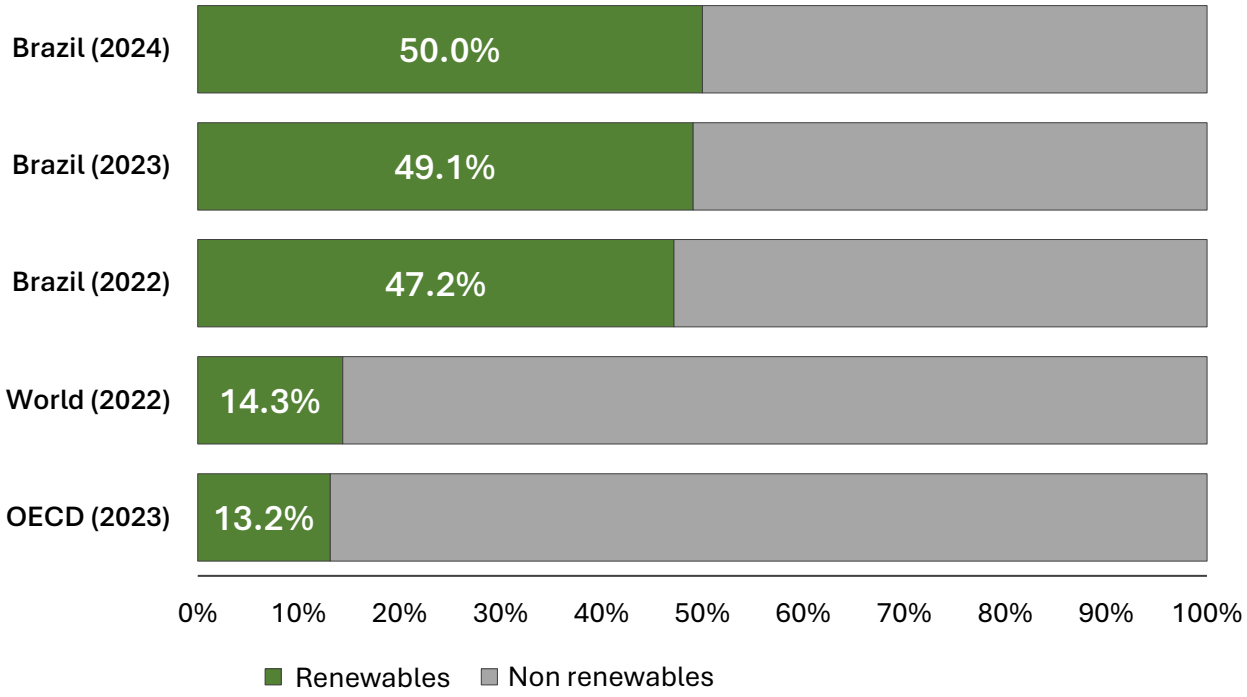
Energy Intensity toe/10^3 US$ [ppp2010]		2023	2024
TES/GDP	↓	0.097	0.096
Final Consumption/GDP	↓	0.088	0.086

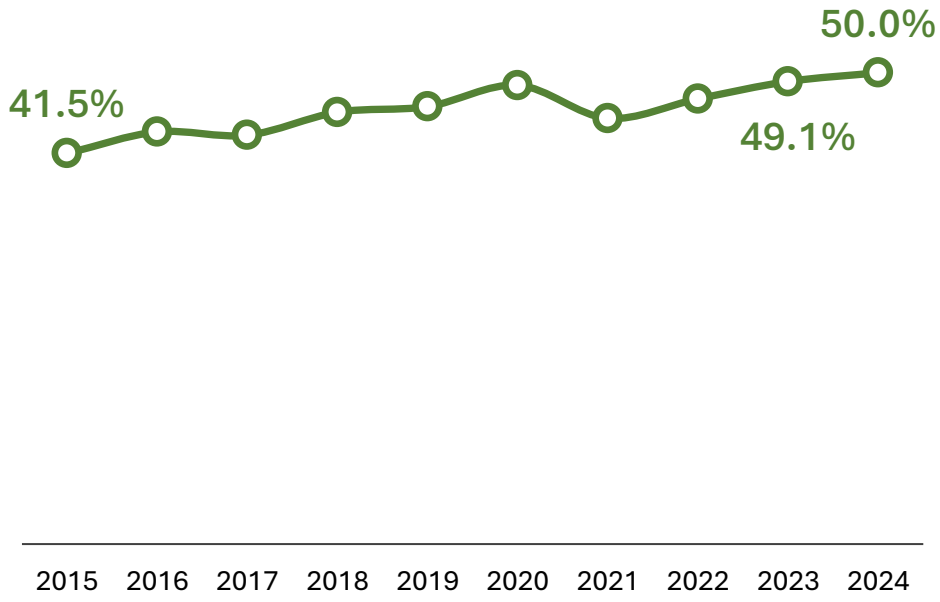


The **share of renewable in the energy mix**[1] was marked by an increase in the domestic supply of biomass, wind and solar, associated with the drop in oil and derivatives, providing the level of 50% renewability, a historic milestone since 1990[2].

Share of Renewables in the TES

Source: International Energy Agency (IEA) and EPE for Brazil. Prepared by: EPE

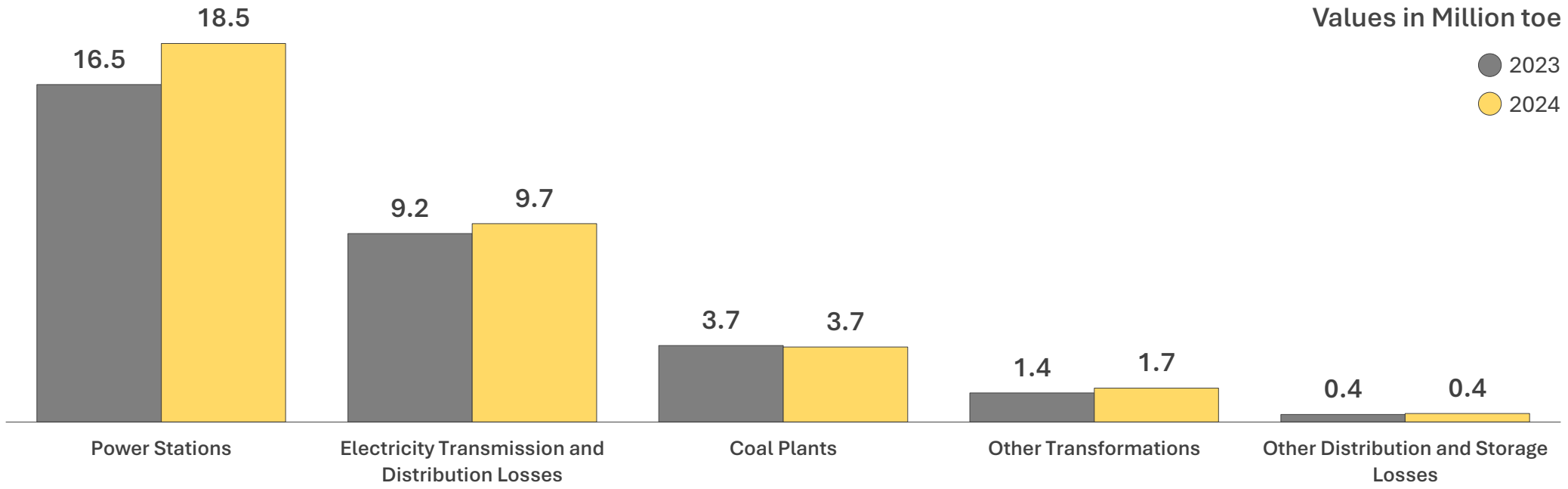




[1] Renewability is calculated based on the Total Energy Supply - TES

[2] The complete historical series of TES renewability can be found in Table 1.3.b (Chapter 1) of the historical series of the National Energy Balance, available by clicking HERE.

Distribution of losses among segments



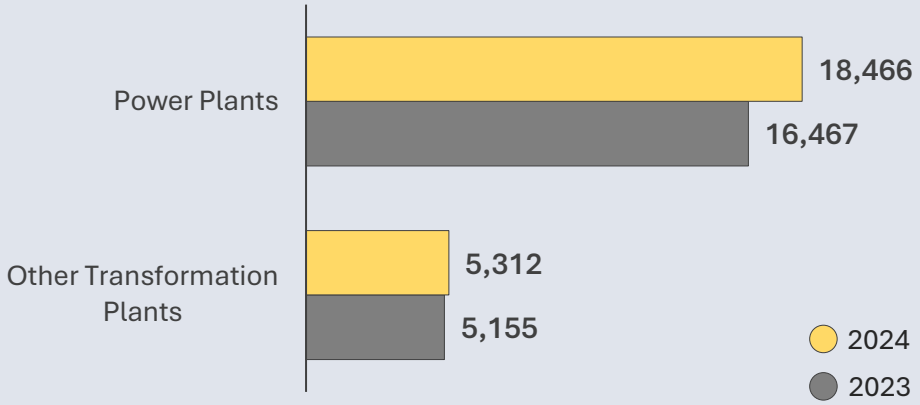
The three largest segments were responsible for more than 90% of the losses that occur in the country: power stations, electricity transmission and distribution and coal plants. The share of losses in Power Stations was higher in 2024, due to the increase in generation from thermal sources, such as natural gas, sugarcane bagasse, and black liquor.

[1] Other transformations include coal plants, refineries and natural gas plants, coke plants, nuclear fuel cycle, distilleries, biodiesel, petrochemical effluents and reformulators.

Losses in Transformation Centers

Distribution of losses (10^3 toe)

Source: EPE



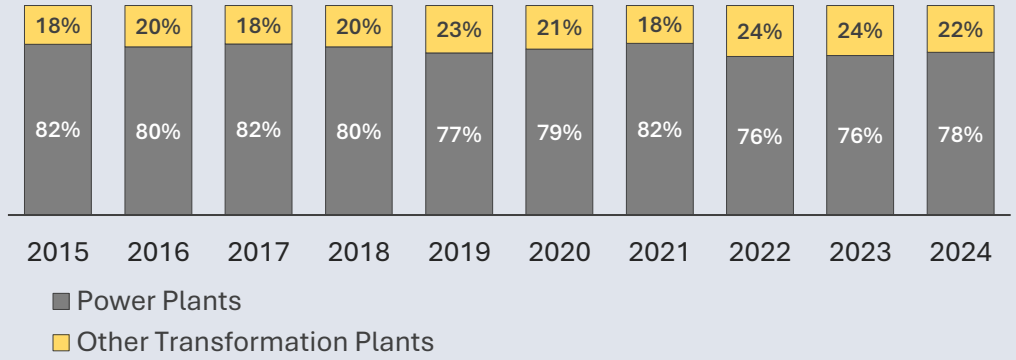
Other transformation plants

Include oil refineries, natural gas plants, coke plants, nuclear fuel cycle, coal stores, distilleries, other transformations.

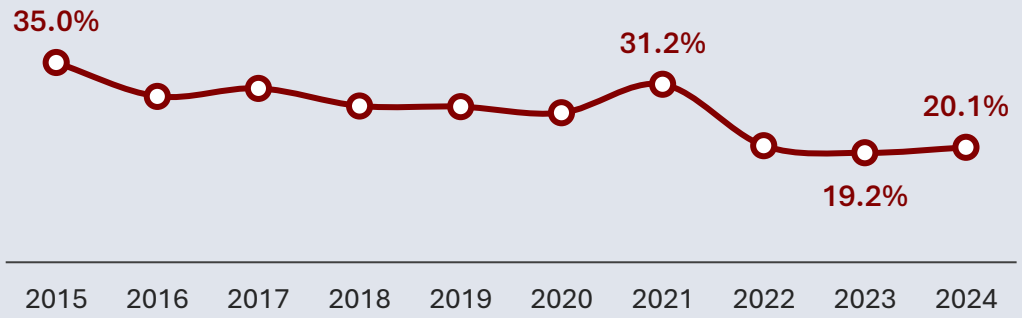
Thermoelectric power plants[1] (including nuclear power plants)

Concentrate all losses in power plants. Therefore, the greater the participation of this type of plant in the generation mix, the greater the losses associated with power plants.

Distribution of Losses



Share of termal plants in generation



[1] Thermoelectric power plants include biomass, fossil, industrial effluent thermal plants and Angra I and II thermonuclear power plants. More information can be found in Table I.2 of Annex I of the historical series of the National Energy Balance, available by clicking HERE.

Which Energy Resources are used in Brazil?

Breakdowns of Total Energy Supply (TES) 2024

RENEWABLES ▶ 50.0%

Sugarcane biomass

16.7%

Hydro power[1]

11.6%

Wind power

2.9%

Firewood[2] and Charcoal

8.5%

Black liquor and Other Renewables[3]

8.1%

Solar[4]

2.2%

NON-RENEWABLES ▶ 50.0%

Oil and oil products

34.0%

Natural gas

9.6%

Coal

4.5%

Uranium

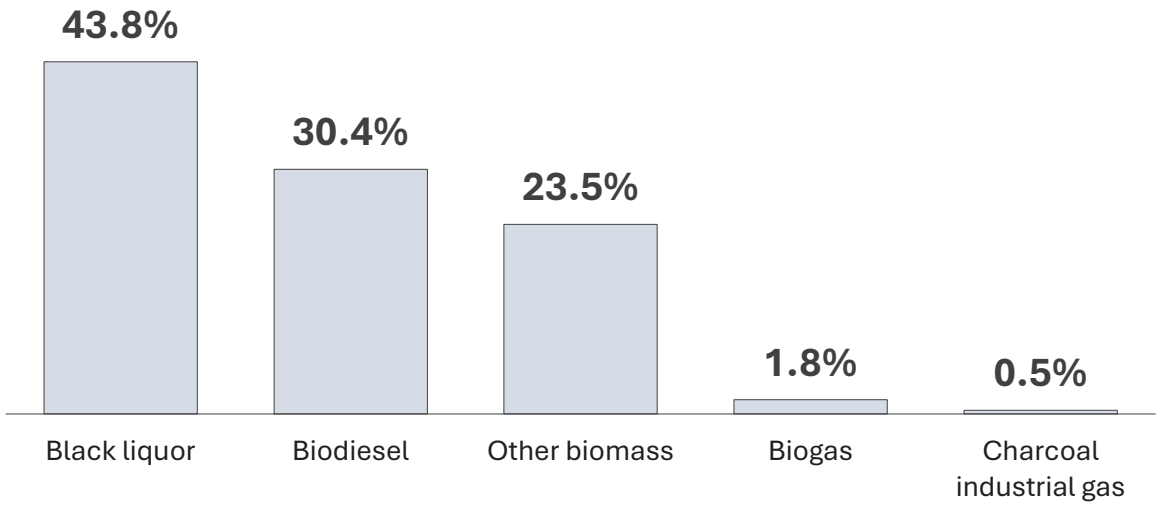
1.3%

Other non-renewables[5]

0.6%

[1] Includes electricity imports; [2] Includes wood chips; [3] Includes Black Liquor, Biodiesel, Other Biomass, Biogas and Industrial Charcoal Gas; [4] Includes Solar Photovoltaic (MMDG and centralized generation) and Solar thermal sources; [5] Other non-renewable includes natural gas liquids, blast furnace gas, steel plant gas, sulfur gas and others.

The supply of "Black Liquor and Other Renewables" is divided between 5 categories of energy sources, with greater shares of black liquor, biodiesel and other biomass, which together amount to 97.8%.

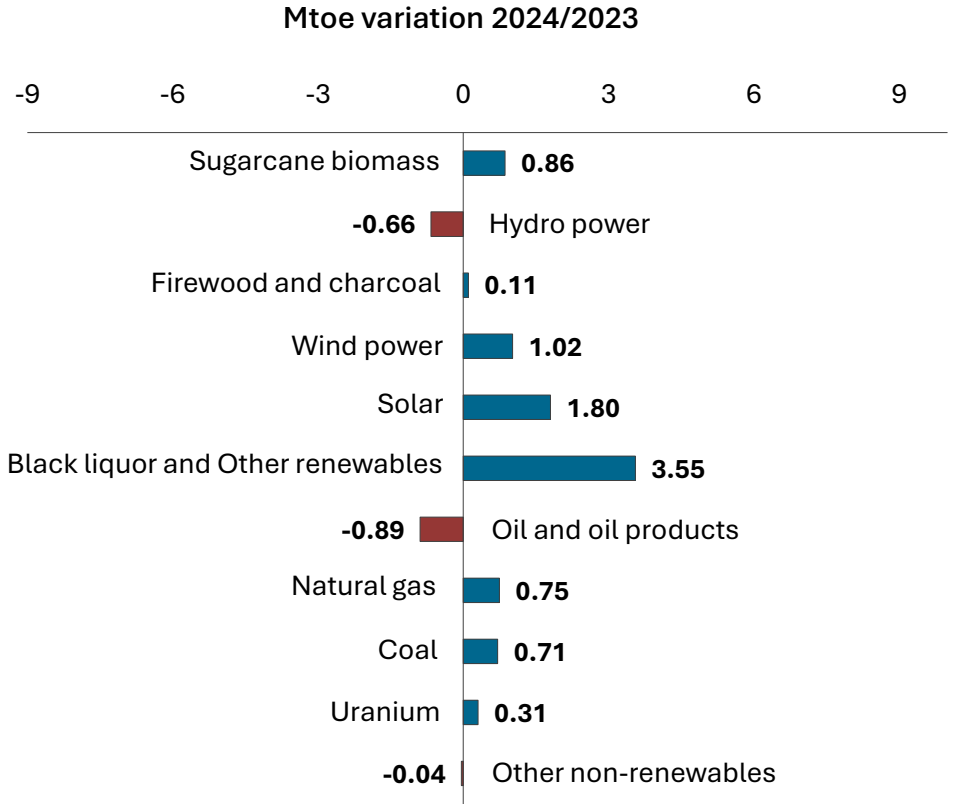


Black liquor and Other Renewables (10^6 toe)	2023	2024	Δ% 24/23
Black liquor	10.6	11.5	7.6%
Biodiesel	6.2	8.0	28.3%
Other biomass[1]	5.1	6.2	20.3%
Biogas	0.5	0.5	0.8%
Charcoal industrial gas[2]	0.2	0.1	-31.1%
Total	**22.6**	**26.2**	**15.7%**

[1] 73.4% of Other biomass corresponds to corn used in ethanol production, while the remaining portion includes rice husks, elephant grass and vegetable oils; [2] Gas from the steelmaking process with charcoal

Total Energy Supply 2023-2024

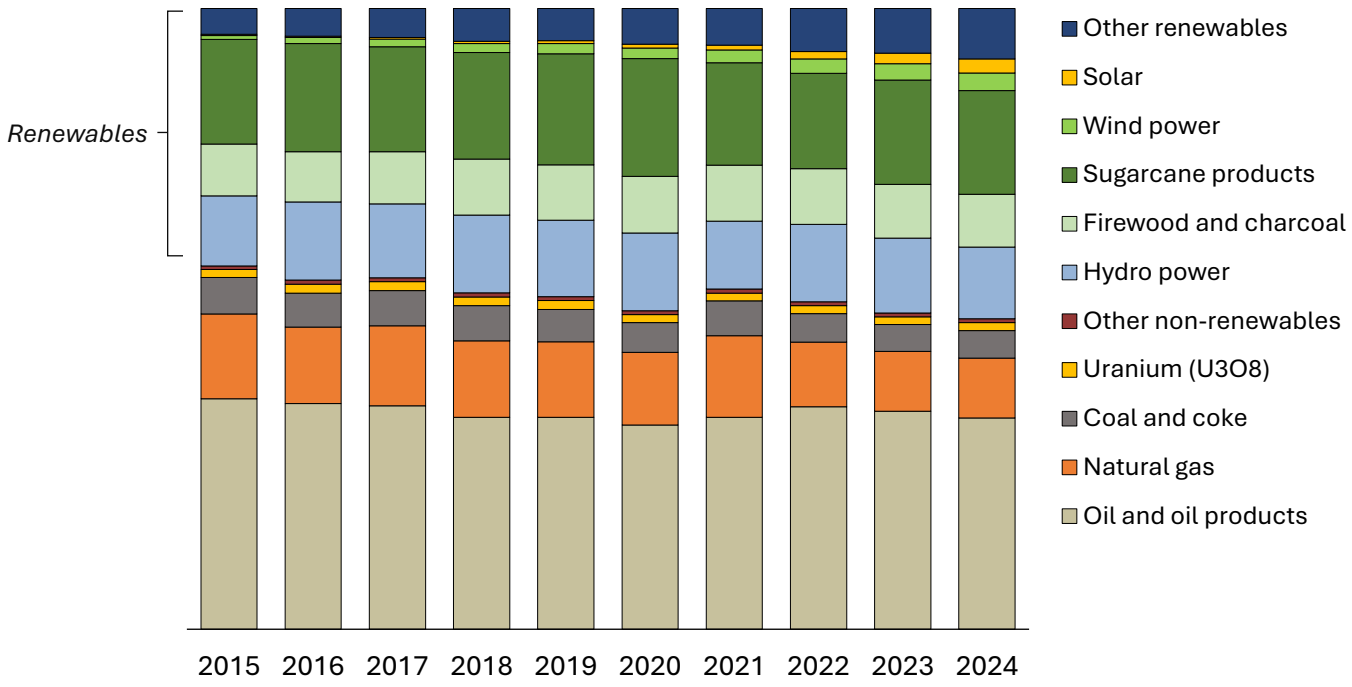
Source (Mtoe)	2023	2024	Δ% 24/23
RENEWABLES	**154.3**	**16.0**	**4.3%**
Sugarcane biomass	52.9	53.7	1.6%
Hydro power[1]	37.9	37.3	-1.7%
Firewood and charcoal	27.3	27.4	0.4%
Wind power	8.2	9.3	12.4%
Solar[2]	5.4	7.2	33.2%
Black liquor and Other renewables	22.6	26.2	15.7%
NON-RENEWABLES	**160.1**	**161.0**	**0.5%**
Oil and oil products	110.5	109.6	-0.8%
Natural gas	30.2	31.0	2.5%
Coal	13.7	14.4	5.2%
Uranium (U_3O_8)	3.8	4.2	8.0%
Other non-renewables	1.9	1.8	-2.0%
TOTAL	**314.5**	**322.0**	**2.4%**



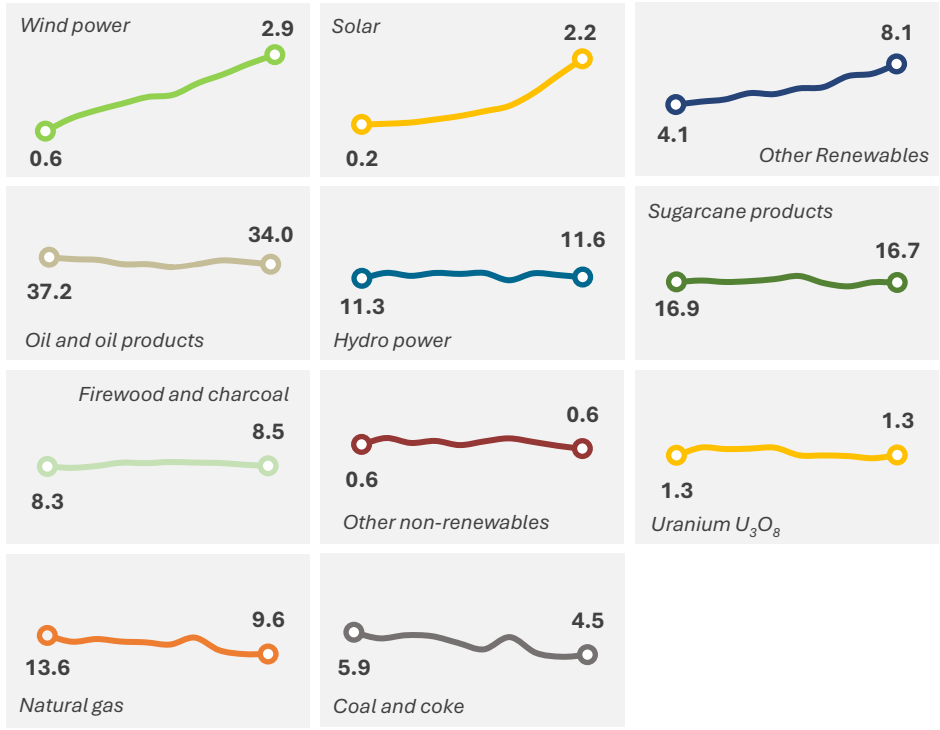
Main movements: increase in Black liquor and Other renewables associated with the growth of pulp production; evolution of Wind and Solar, following the trend of previous years; and expansion of the supply of Coal due to the increase in electricity generation and steel activity.

[1] Includes electricity imports
[2] Includes Solar photovoltaic and Solar thermal

Total Energy Supply 2015-2024

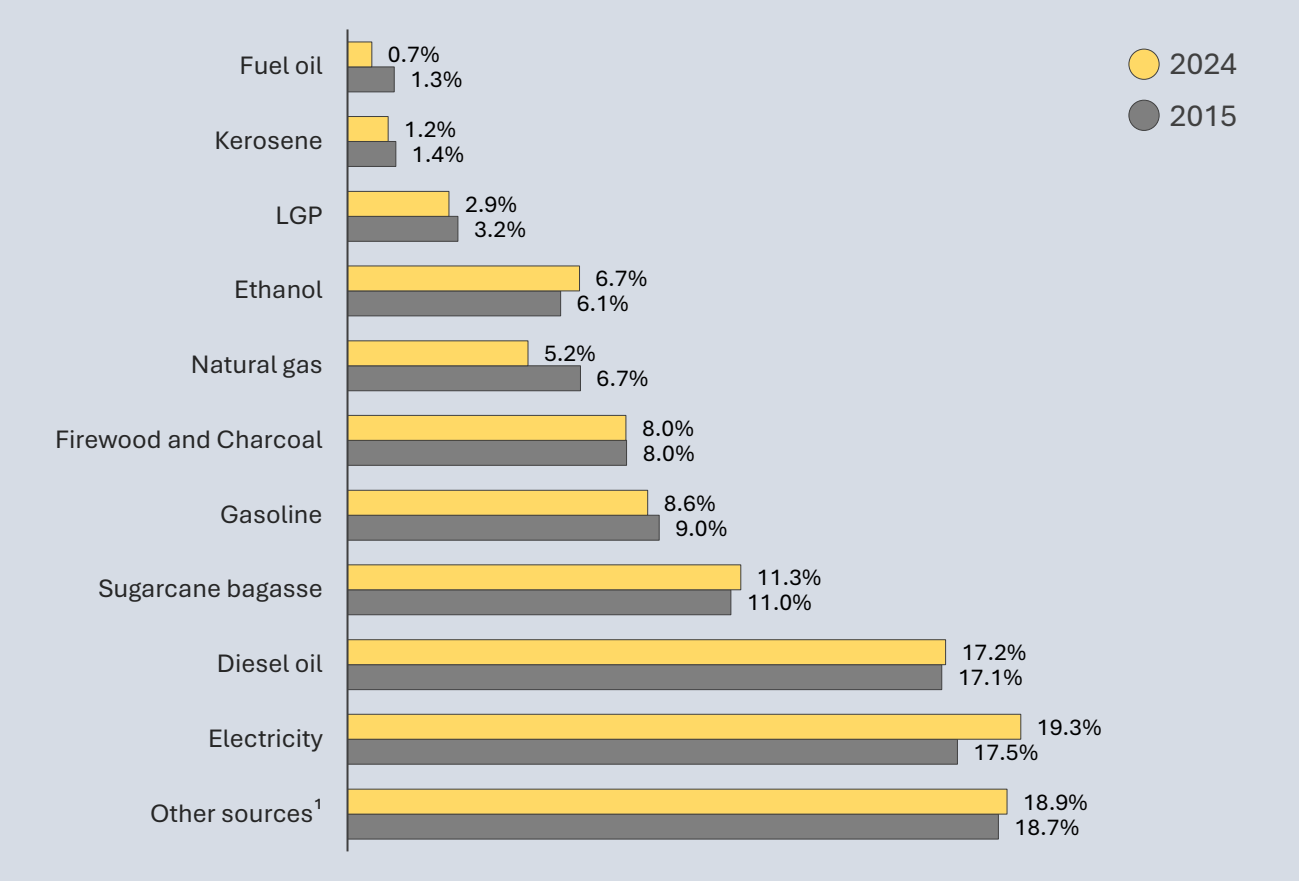


Share of sources in TES (%) between 2015 and 2024



Renewable sources have shown a growth trajectory in the last 10 years, reaching around **50% share in 2024.** The main movements of **gradual transition** were the increase in electricity generation from sources such as wind, solar and other renewables; stability of hydro power and sugarcane products; and, reduction of oil and oil products, natural gas and coal and coke.

Variation in the share of Final Energy Consumption by source in 10 years



Lower share in 2024 compared to 2015

Natural Gas | Fuel Oil | LPG | Gasoline | Kerosene | Firewood and Charcoal

Higher share in 2024 compared to 2015

Ethanol | Sugarcane bagasse | Electricity | Other Sources | Diesel Oil

6 energy sources

5 energy sources

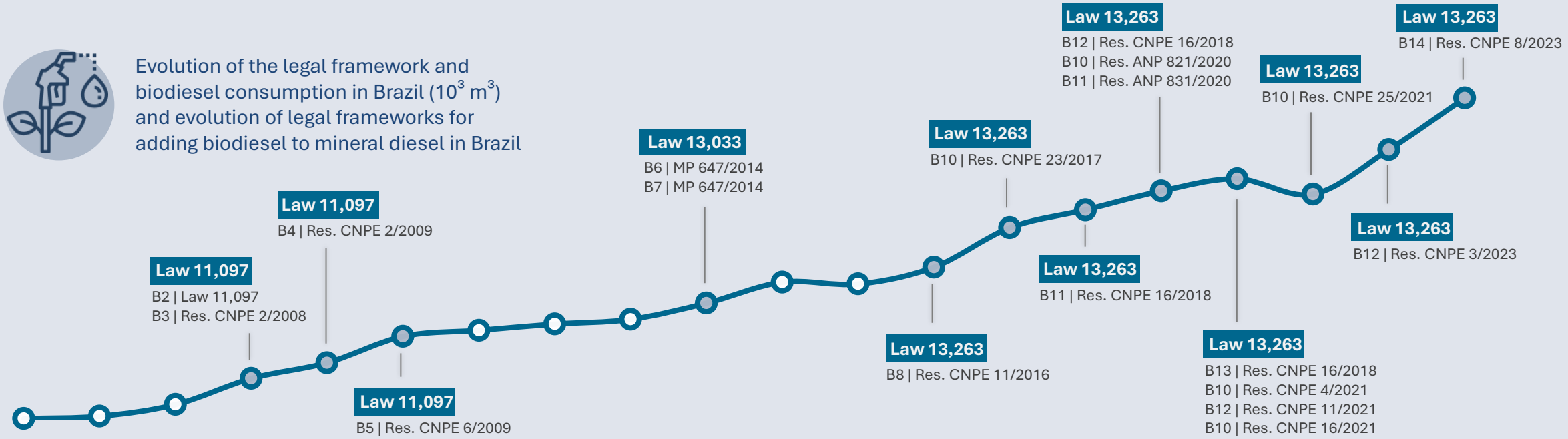
[1] Other sources include sources with less representation in the final energy consumption, such as Coal and coal products (coke and tar), other primary sources, biodiesel, coke oven gas, naphtha, gasworks gas, other secondary sources of petroleum, non-energy products.

Note: Final Energy Consumption does not include the raw material used in the transformation centers, for more information, visit the slide on consumption in the energy sector by clicking HERE.

Highlight: Biodiesel final consumption and CNPE resolutions

Brazil is one of the world's largest producers of biodiesel and soybean oil is the main national raw material. The consumption of this biofuel in the country is favored by the policy of adding biodiesel to fossil diesel, defined by the **National Energy Policy Council (CNPE)**, an advisory body to the President of Brazil for the formulation of energy policies and guidelines, chaired by the Minister of State for Mines and Energy.

Evolution of the legal framework and biodiesel consumption in Brazil (10^3 m^3) and evolution of legal frameworks for adding biodiesel to mineral diesel in Brazil



Biodiesel annual consumption (10^3 m^3)

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1	66	391	1,111	1,543	2,272	2,439	2,612	2,742	3,189	3,769	3,719	4,183	5,270	5,762	6,280	6,615	6,191	7,421	8,845

Note: The figure above shows the CNPE resolutions related to the evolution of the biodiesel content in mineral diesel, in addition to the Provisional Measures (MP) of 2014 and resolutions of the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP) in 2020.

Highlight: Diversification of raw materials for ethanol production

The growth of corn ethanol has been favored by the increase in grain production, with the planting of second crops becoming predominant to produce biofuel. This practice uses the same area in rotation with other crops, notably soybeans. Ethanol production reached 7.5 billion liters in 2024. **This industry, concentrated in the Central-West region, generates important co-products such as distiller's dried grains with solubles[1] and corn oil and can operate throughout the year, as corn can be stored.**

Corn, used as a raw material for ethanol production, accounted for about 20% of the production of this biofuel in 2024. Soybeans and other biomass contributed less than 0.1% of hydrous ethanol production.

[1] Used for animal feed.

Who uses Energy in Brazil?

About 65% of the country's energy consumption in 2024 was destined for **cargo and passenger transport** and for the **industrial sector**...

Transports
33.2%

Industries
31.7%

Households
10.8%

Energy Sector
8.5%

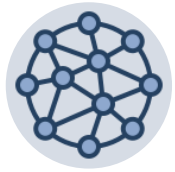
Agriculture And Livestock
5.0%

Services
5.3%

2024
288.3 Mtoe

2023
282.9 Mtoe

1.9% increase

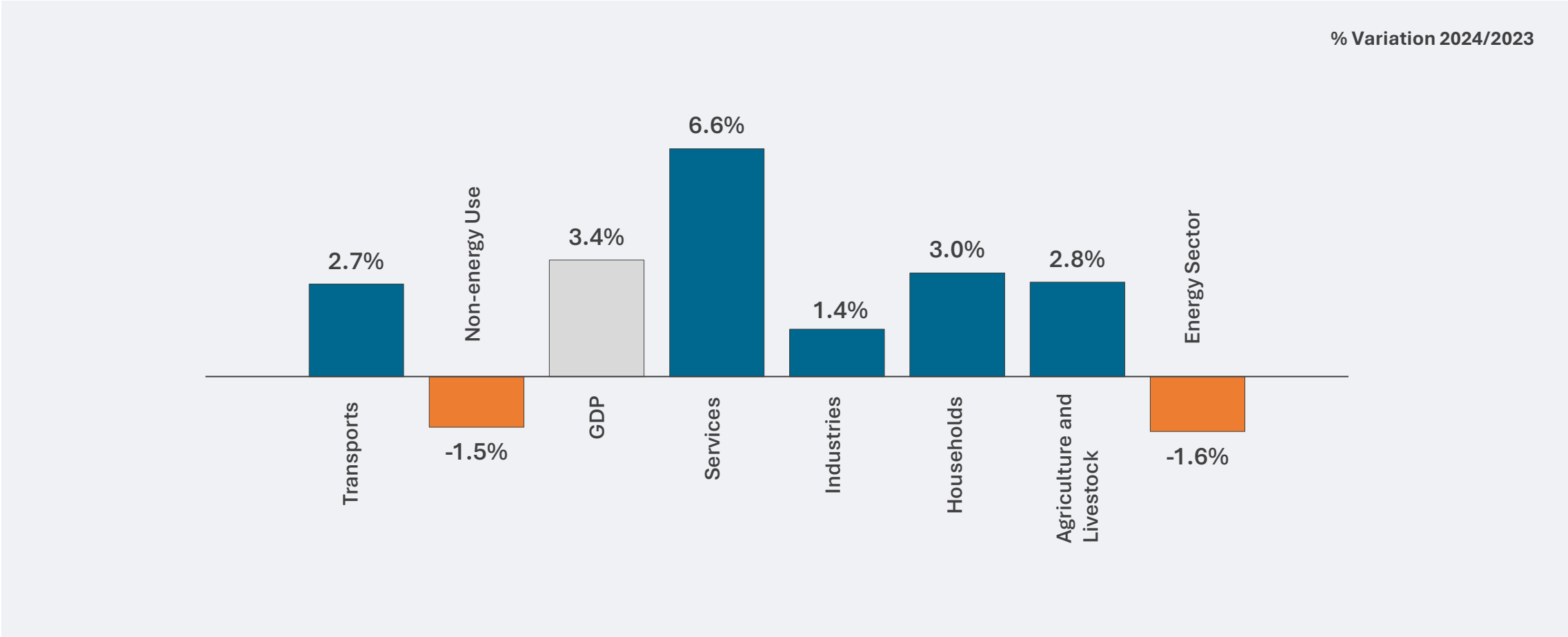


Non-energy Use
5.5%

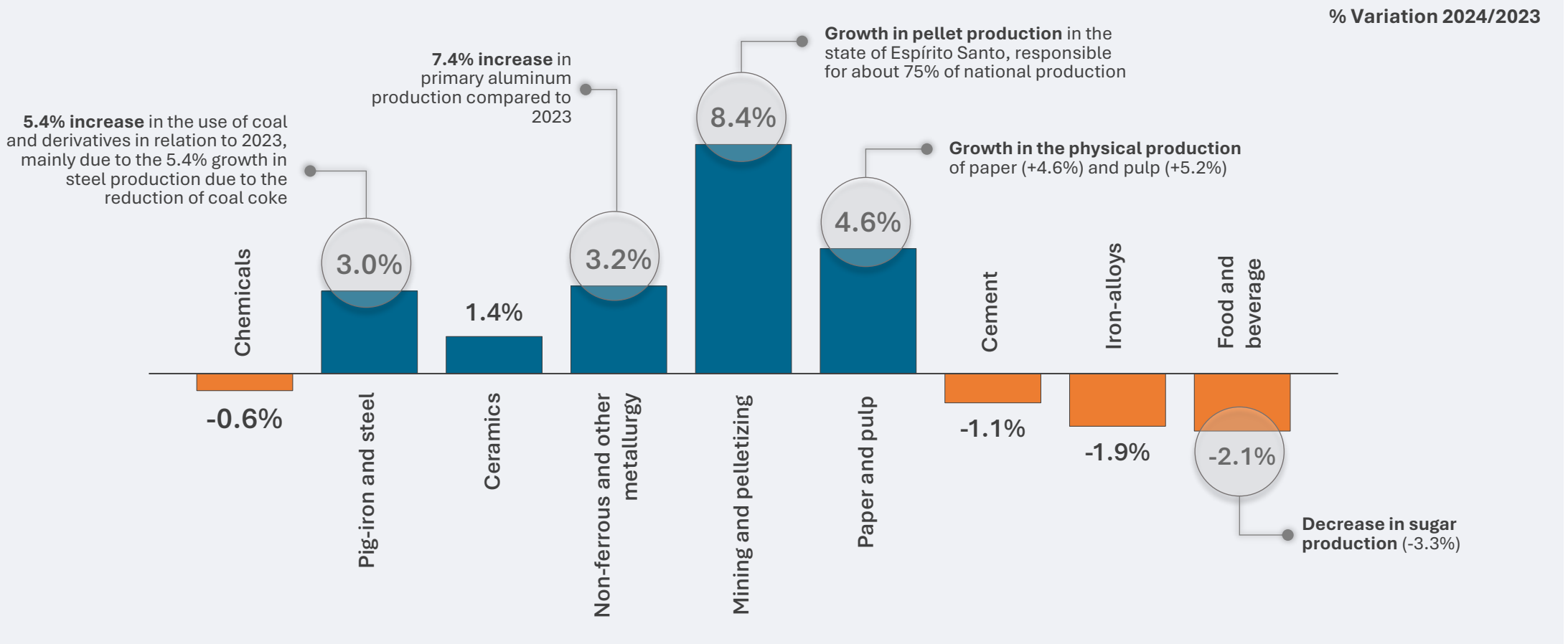
There was a 1.9% increase in energy use in 2024 compared to 2023. In this scenario, the transportation sector had the largest share among the sectors and remains the leader in the country in terms of energy consumption.

Note: Non-energy use can be exemplified by the use of raw material in petrochemical production.

...but **how did the energy consumption of the sectors vary**, in relation to the Brazilian economic activity, between the years 2023 and 2024?



As a noteworthy sector, energy consumption in the energy-intensive segments of the industry showed the following changes.



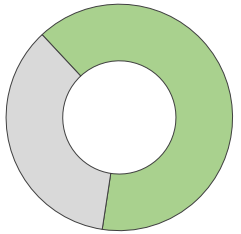
Energy consumption in industry, besides presenting 1.4% growth compared to 2023, it had 64.4% renewability in its energy mix.

Total energy consumption:

2024
91.4 Mtoe

2023
90.2 Mtoe

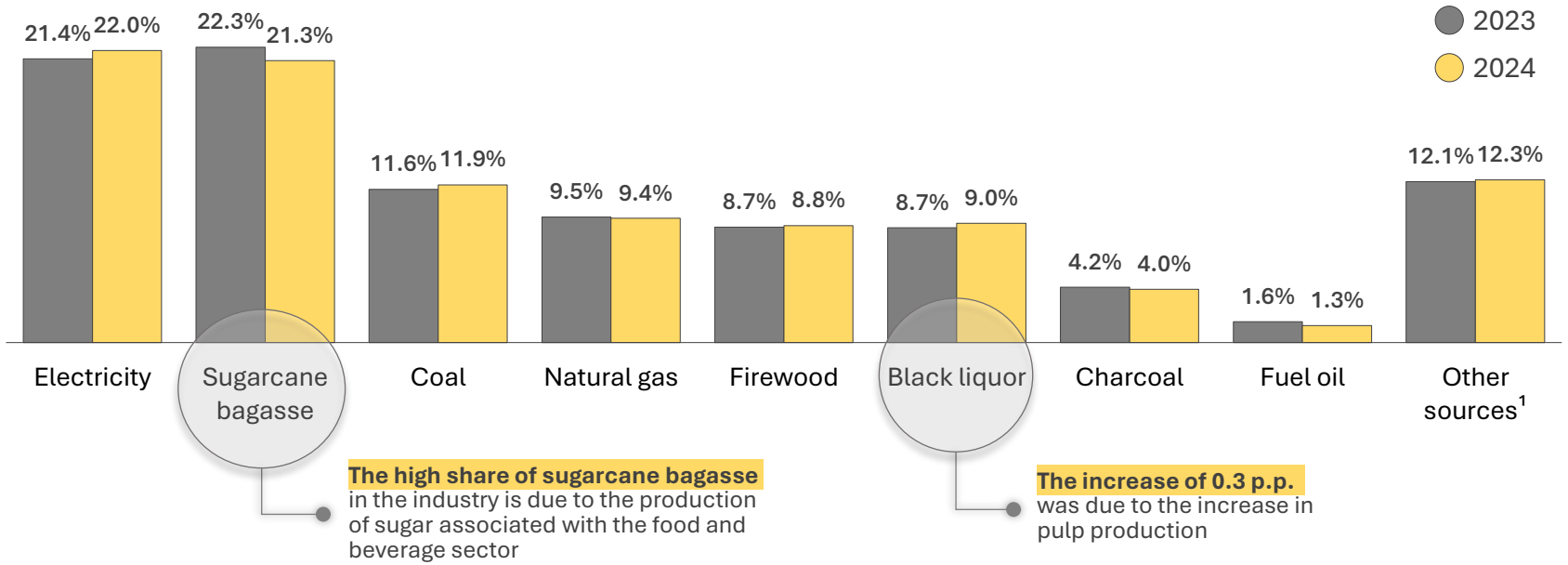
↑ 1.4% increase



64.4%
renewable

Note: In the case of Electricity, only its share generated from renewable sources is considered, which corresponded to 88.2% of total electricity generation in 2024.

Share of sources energy in industry:



The high share of sugarcane bagasse in the industry is due to the production of sugar associated with the food and beverage sector

The increase of 0.3 p.p. was due to the increase in pulp production

[1] "Other sources" include diesel, LPG, naphtha, kerosene, coke oven gas, tar, refinery gas, petroleum coke, among other renewable and non-renewable.

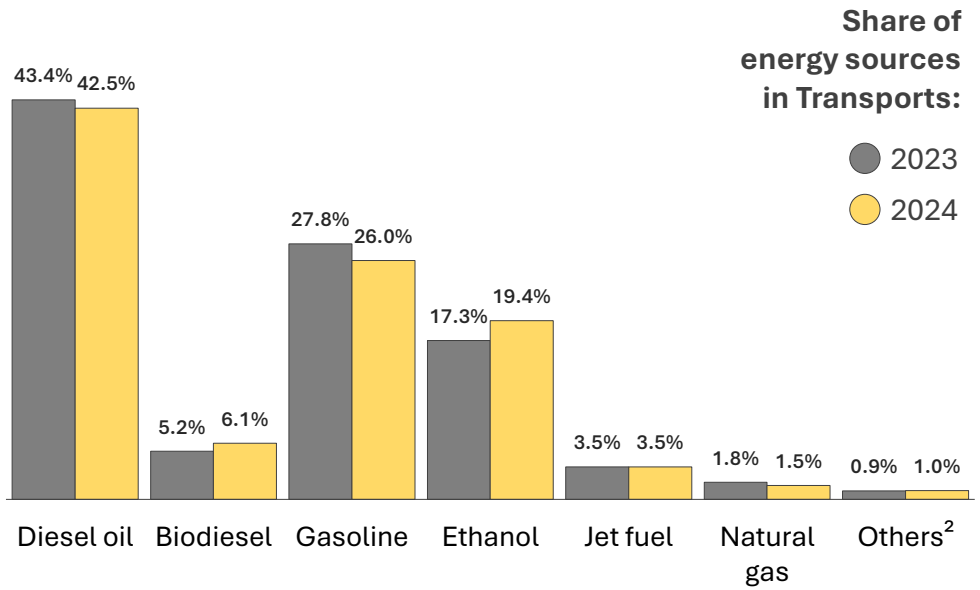
Energy consumption in transport in 2024[1] showed an increase of 2.7% compared to 2023. The main highlights were the increases in the consumption of biodiesel (+19.3%) and hydrous ethanol (+30.1%), which led to an increase in the sector's renewability to 25.7%.

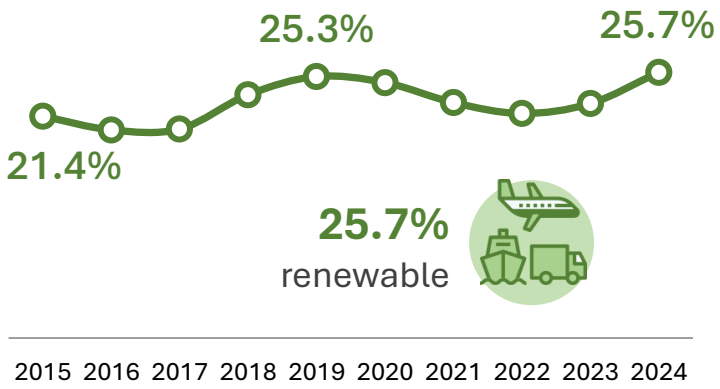
Total energy consumption:

2024
95.8 Mtoe

2023
93.3 Mtoe

2.7% increase



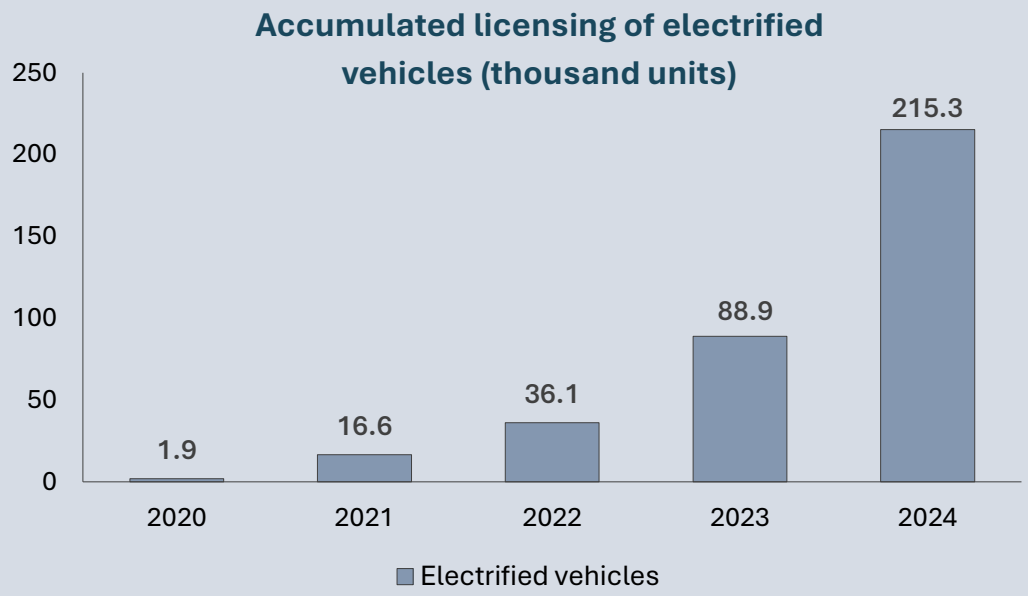


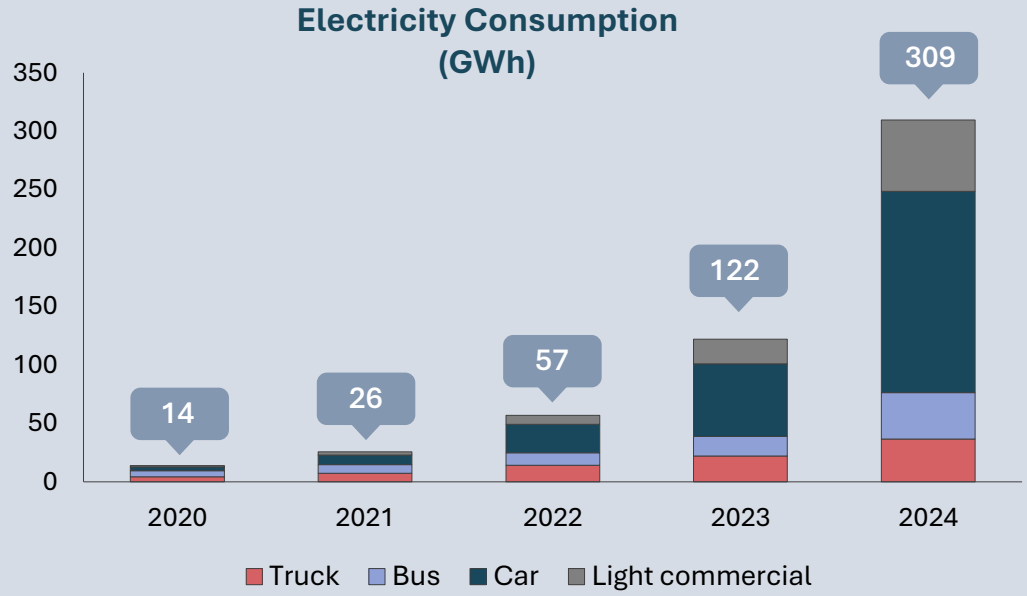
The increase in the consumption of Hydrous Ethanol was largely due to the greater competitiveness of the biofuel in relation to Gasoline C and its greater availability, since the production of corn ethanol has grown significantly. The increase in Biodiesel consumption, on the other hand, was driven by the increase in diesel consumption, associated with the increase in the percentage of biodiesel addition to mineral diesel to 14% by volume (B14) as of March 2024.

[1] The percentage variation in consumption is expressed on an energy basis, not a volumetric one.
[2] Others correspond to Fuel oil and Electricity.

Highlights: Electricity consumption in road transport

The National Energy Balance now publishes, in this edition of the base year 2024, the electricity consumption in the road transport sector since the year 2020. Licensing data includes electrified trucks, buses, light commercial vehicles and cars, which accounts for more than 90% of total vehicles.





The significant increase in the demand for electricity from road transport observed in the last five years is mainly linked to the increase in the number of electrified vehicle models available in the Brazilian market, the reduction in prices and the increase in the autonomy of these new models.

For further information, please visit:
(a) Technical Note Energy Demand of Light Vehicles: 2025-2034; (b) Electromobility Notebook: Road Transport; (c) Transport Sector Energy Demand Notebook.

Final consumption in the energy sector decreased by 1.6% compared to 2023, that is, less energy was used for transformation in Brazil in 2024.

Source (10^3 toe)	2023	2024	Δ% 24/23
Sugarcane bagasse	13,452	13,177	-2.0%
Natural gas	4,096	3,839	-6.3%
Oil products	4,003	4,086	2.1%
Electricity	3,169	3,193	0.8%
Coke oven gas	164	189	15.0%
Total	**24,884**	**24,485**	**-1.6%**

But what is energy transformation?

Transforming energy is carrying out processes to change the way energy presents itself.

For example: to transform oil into gasoline, diesel oil, kerosene and other oil products in the refinery, it is necessary to expend energy.

The consumption of **sugarcane bagasse** in the energy sector decreased by 2.0% in relation to 2023, due to the reduction of 2.0% in ethanol production in the **sugar-alcohol sector** in 2024. **Natural gas**, on the other hand, suffered a reduction due to the decrease in oil exploration, production and refining activities.

[1] The change in the way energy is presented can be by the transformations of a primary source into a secondary (e.g., oil into diesel oil) or from a secondary source into another secondary source (e.g., diesel oil into electricity).

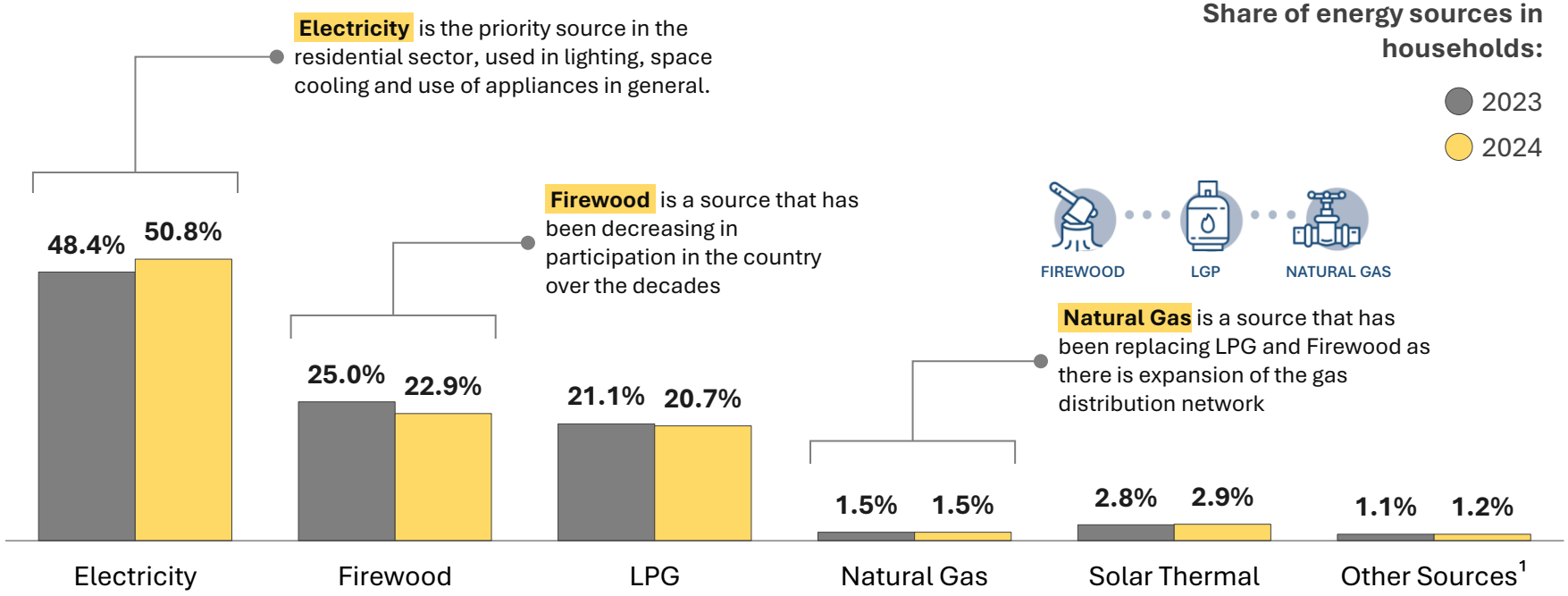
Residential energy consumption grew by 3% compared to 2024, with the following distribution in the use of energy sources...

Total energy consumption:

2024
31.0 Mtoe

2023
30.1 Mtoe

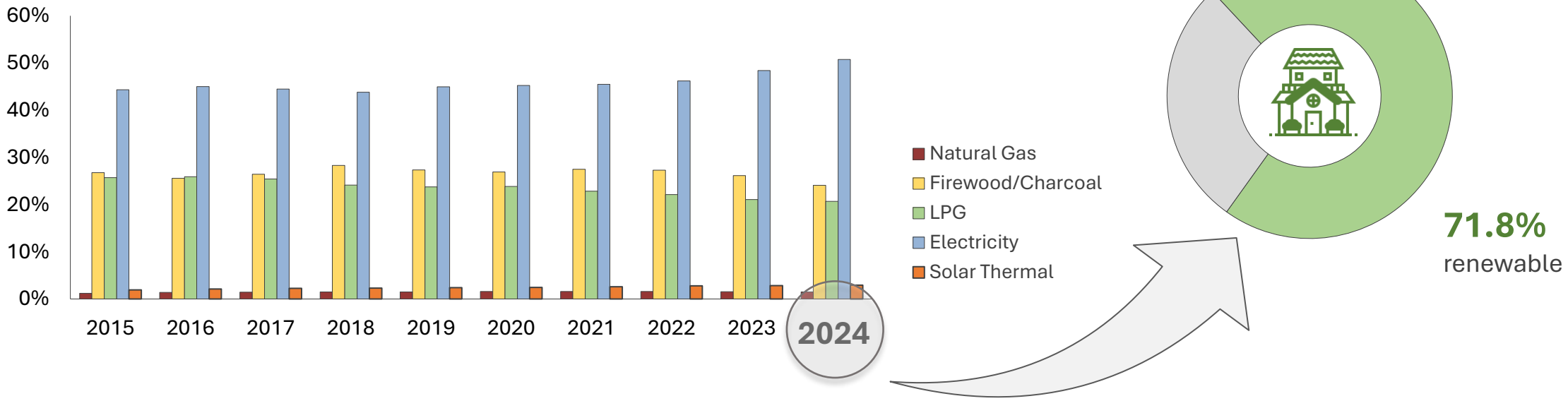
3.0% increase



The consumption of firewood in households fell by 5.5%, causing a reduction in its participation in the energy mix of the residential sector by 2.1 p.p. The consumption of LPG and Natural Gas, the most direct substitutes for firewood in food cooking, grew in 2024 at lower rates in relation to other energy sources, suffering a slight drop in participation.

[1] Kerosene and charcoal. **Note:** More details on energy consumption in the residential sector can be found in the Fact Sheet "Residential Consumption by Income Classes", published by EPE and available HERE.

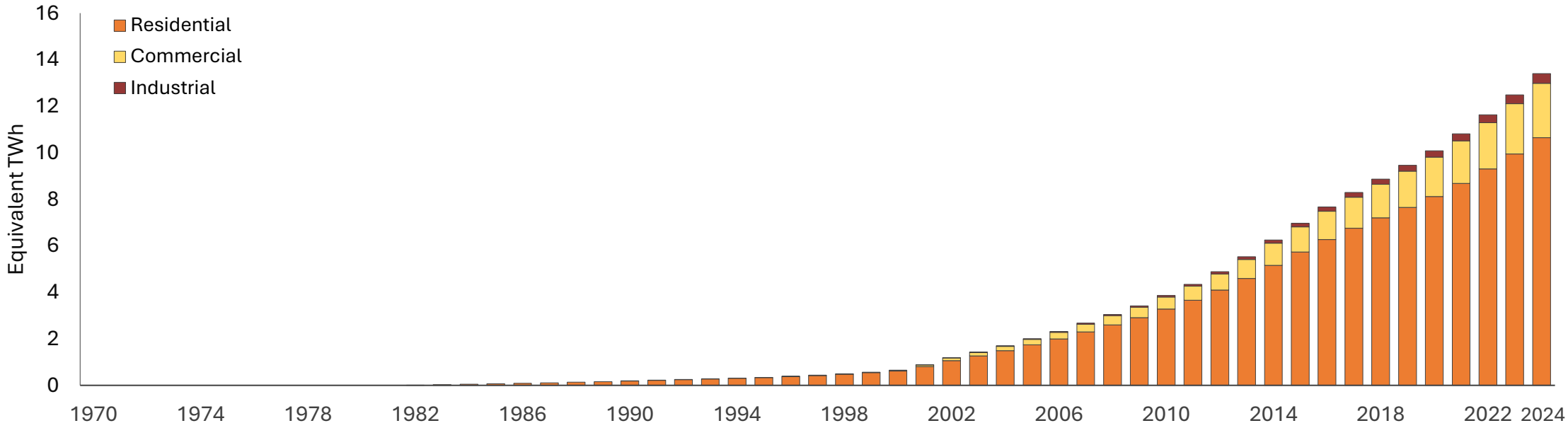
The evolution of the participation of **sources in the energy matrix of the residential sector** is marked, over the last ten years, by the use of electricity, firewood and charcoal, and LPG.



The renewability index of the residential sector reached 71.8% due to the use of renewable sources such as Firewood, Charcoal and Solar Thermal energy, along with Electricity (mostly from renewable sources). The electrification process in residential energy consumption is essentially due to the increase in the ownership of household appliances.

Note: Wood stoves have an efficiency of around one-tenth the efficiencies of gas stoves.

The **Solar Thermal** source, used for heating water in open, closed and vacuum tube collectors, reached 13.4 Equivalent TWh[1], if this energy service was supplied by electric showers.



In 2024, the residential sector accounted for almost 80% of solar thermal consumption in Brazil. Secondly, the commercial sector accounted for about 17.4% of consumption. Lastly, industry with 3.1%.

[1] The equivalent TWh value represents a theoretical equivalence of when electricity would be needed in electric showers, for example, to perform the same water heating that solar thermal performs.

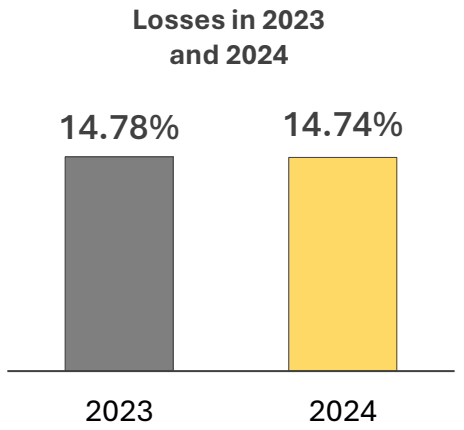
The use of **Electricity**

Electricity consumption grew by 5.5% in Brazil, the same rate at which electricity was made available to the population.

Values in TWh		2023	2024	Δ% 24/23
Total Electric Power Supply[1]	↑	723.2	762.9	5.5%
PS Power plants[2]	↑	565.8	594.7	5.1%
EAP power plants[3]	↑	142.3	156.6	10.1%
Electricity imports[4]	↑	15.1	11.6	-23.3%
Final consumption[5]	↑	616.3	650.4	5.5%

↑ **5.5% increase** in the electricity made available to the society

↑ **5.5% increase** in final electricity consumption

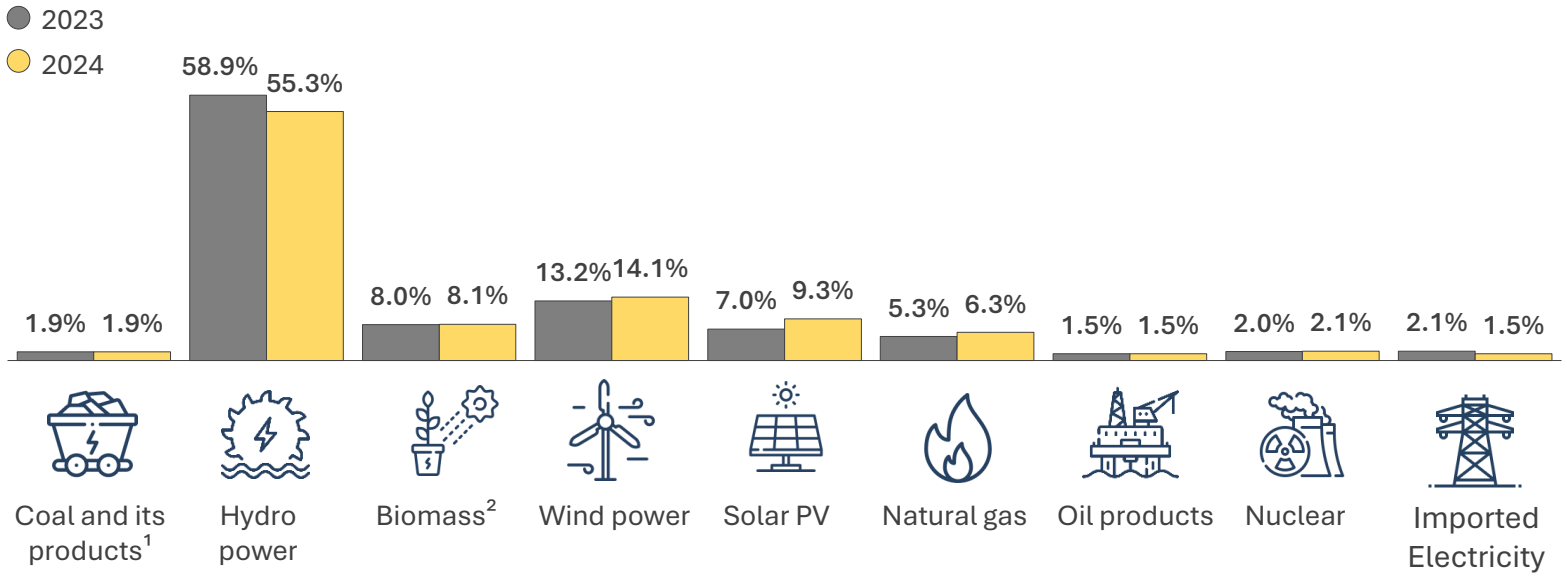


Losses (commercial + technical) remained stable in relation to 2023, with a slight decrease of 0.04 percentage points.

[1] TEPS (import and Export balance) + Total national generation; [2] Public Service; [3] Electricity Autoproduction; [4] Imports (-) Exports; [5] Final electricity consumption: National Interconnected System + Isolated System + Autoproduction

In 2024, the **Brazilian electrical mix** will show a drop in the share of hydroelectric power combined with an increase in the share of wind, solar and natural gas.

Share of sources in the electricity mix:



2024 (TWh)

Total supply: 762.9

Hydro power supply: 433.4

2023 (TWh)

Total supply: 723.2

Hydro power supply: 441.1

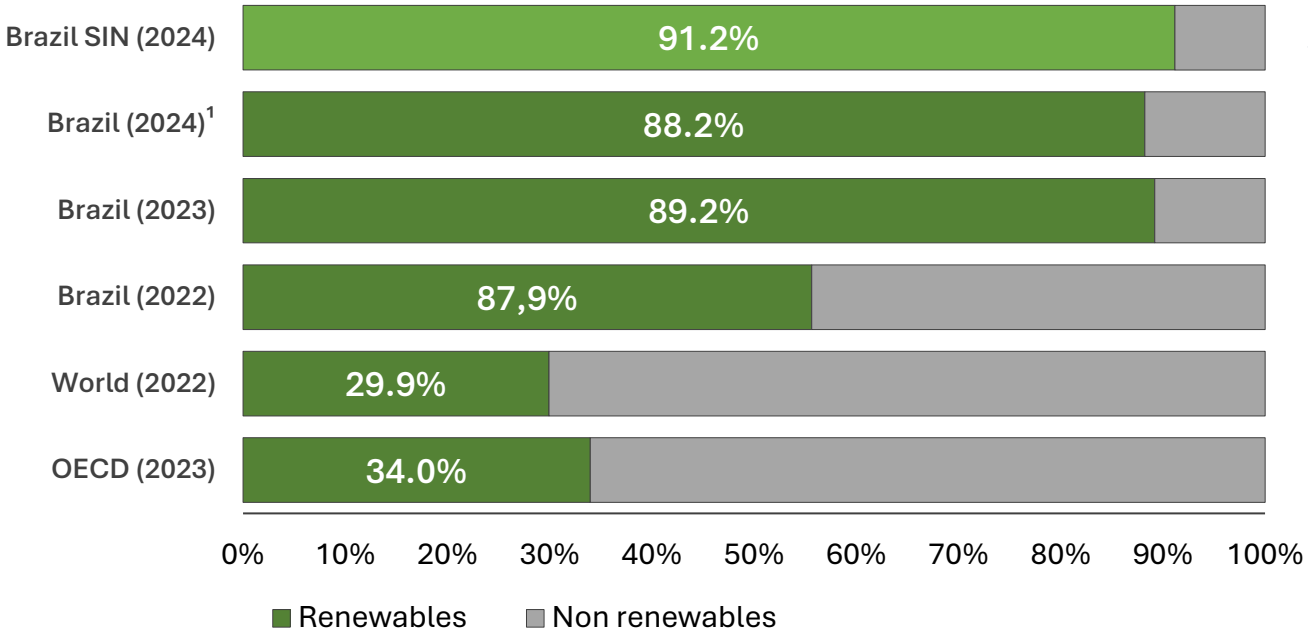
5.5% increase
in the Total supply

1.7% decrease
In the Hydro power supply

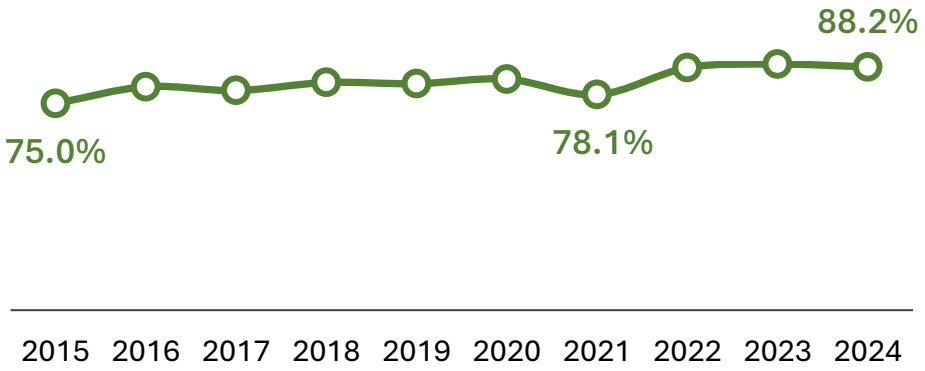
The main movements in electricity generation were the expansion of solar photovoltaic generation (+39.6%) and wind power (+12.4%), the slight drop in hydroelectric generation (-1.0%), and the increase in generation from natural gas (+23.9%).

[1] Includes coke oven gas, blast furnace gas, steelmaking gas and tar
[2] Includes firewood, sugarcane bagasse, black liquor, biodiesel and other primary sources

The share of renewables in the Brazilian electricity mix (including the entire "National Interconnected System (SIN)", the "Isolated Systems" and "Self-production not injected into the grid") reached 88.2% renewability in 2024...



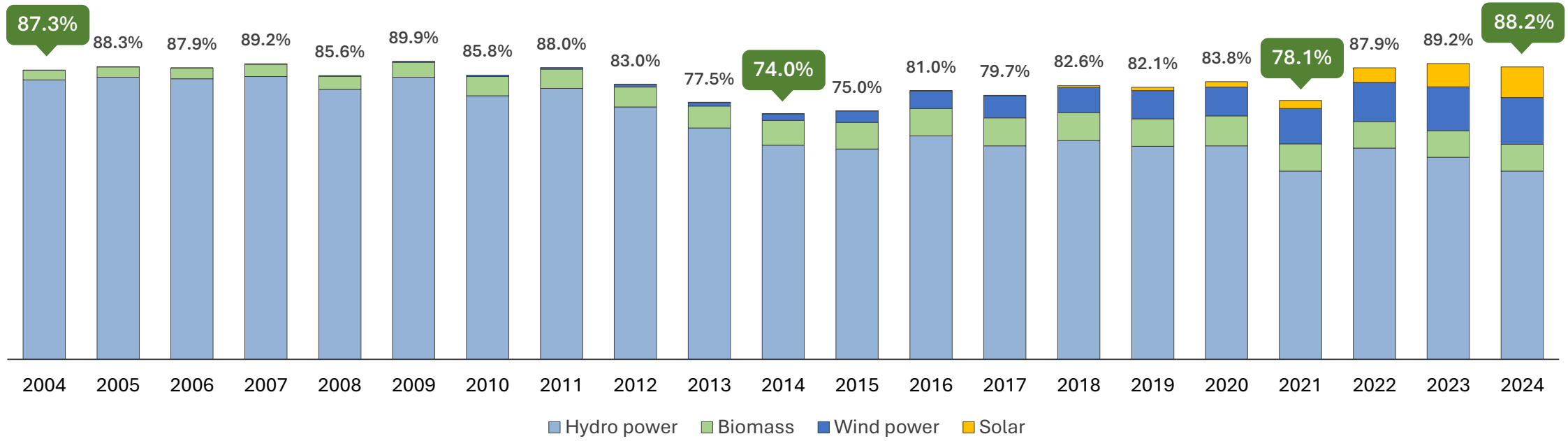
Considering only the National Interconnected System (SIN), which excludes Isolated Systems, Electricity Imports, Self-Production not injected into the grid and MMGD, renewability stood at 91.2%.



The renewability of the Brazilian electricity matrix in 2024 fell by 1.0 p.p. as a result of the reduction in national hydroelectric generation and the import of electricity from Itaipu, combined with the increase in natural gas generation. **It is important to highlight that the increase in wind and solar photovoltaic generation has helped to maintain the high degree of renewability of the Brazilian electricity matrix.**

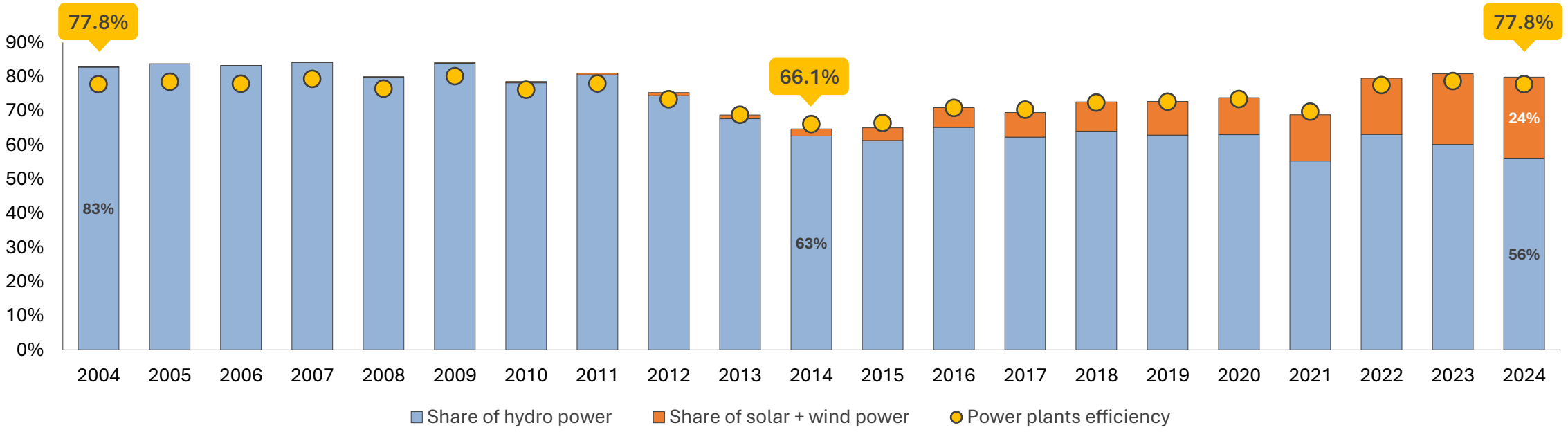
[1] Renewability is calculated based on the Internal Electricity Supply, i.e. all domestic generation plus net imports, which includes the portion imported from Itaipu.

Since 2004, the share of renewable sources in the electricity matrix has remained above 70%, a level considered high in relation to world figures, indicating the energy transition process that has been underway for several years...



During this period, the increase in wind and solar PV generation helped to maintain the renewability of the Total Electricity Supply, even during periods of greater water stress in the country. Policies to encourage the generation of electricity from renewable sources have contributed to the diversification of the electricity mix, demonstrating the country's efforts to continue the **energy transition** process aimed at reducing emissions and ensuring the energy security.

In addition to the high rate of renewability, **the Brazilian electrical mix has also proven to be highly efficient since 2004**, maintaining the efficiency of power plants above 66% in the period due to the large share of sources such as hydraulic, wind and solar, reaching **77.8% in 2024.**

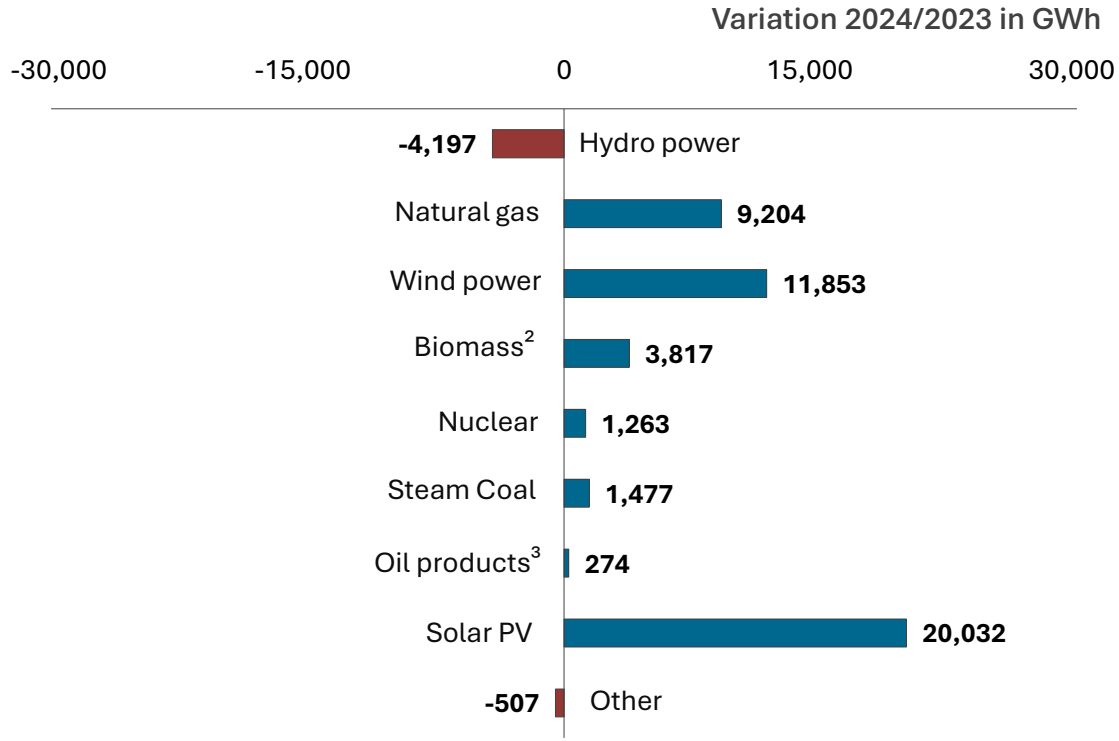


Primary sources such as hydraulic, wind and solar, by convention, are fully converted into electricity in power plants and, therefore, do not present generation losses. The lowest efficiency rates occurred in 2014 and 2015, when hydraulic participation reached its lowest values. **In the following years, this movement began to be compensated by wind and solar, enabling higher levels of efficiency, even in periods of water stress.**

Note: More details are available at Factsheet "O perfil da matriz elétrica brasileira".

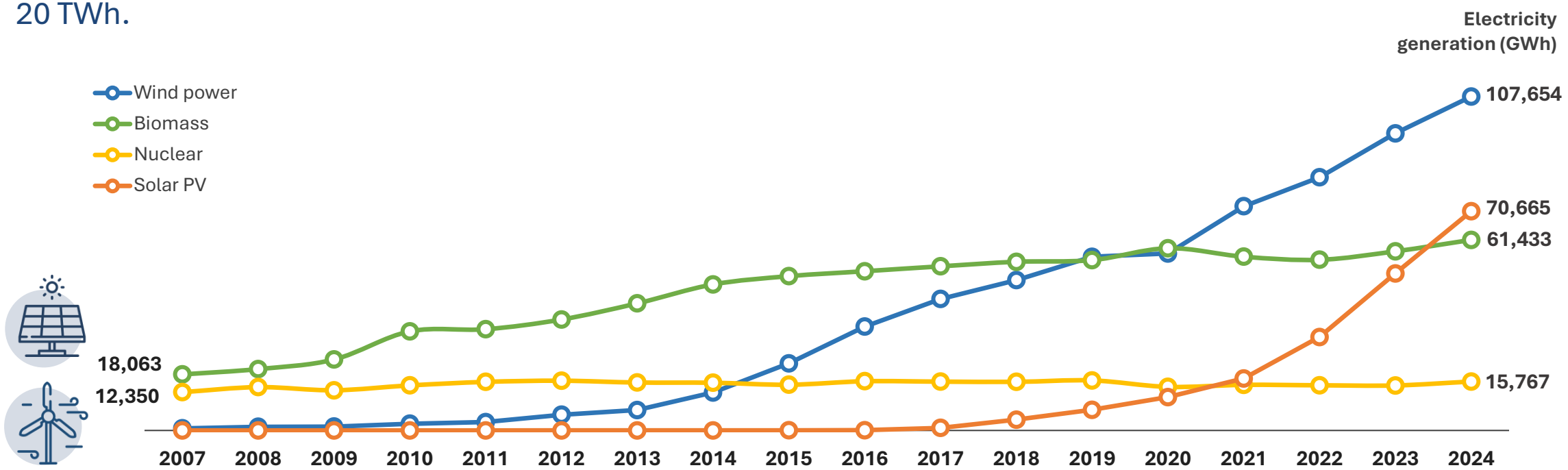
… and in fact, when analyzing **electricity generation[1] (GWh)** in 2024, it is possible to identify this combination of factors that have increased the renewability of the electricity mix.

Source (GWh)	2023	2024	Δ% 24/23
Hidro power	425,996	421,799	-1.0%
Natural gas	38,589	47,792	23.9%
Wind power	95,801	107,654	12.4%
Biomass[2]	54,210	58,027	7.0%
Nuclear	14,504	15,767	8.7%
Steam Coal	8,770	10,247	16.8%
Oil products[3]	5,686	5,960	4.8%
Solar PV	50,633	70,665	39.6%
Other[4]	13,932	13,425	-3.6%
Total generation	**708,119**	**751,335**	**6.1%**



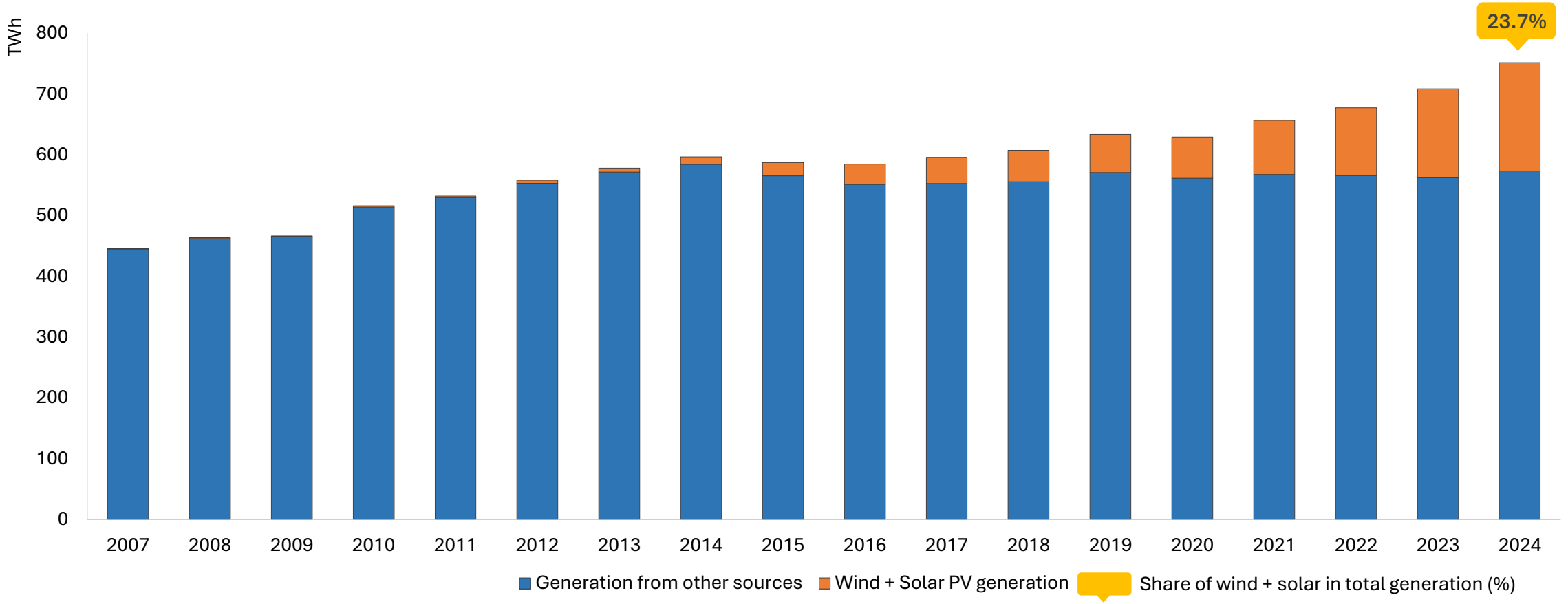
[1] Includes distributed generation
[2] Includes firewood, sugarcane bagasse, biodiesel and back liquor
[3] Includes diesel oil and fuel oil
[4] Includes other primary sources, coke plant and other secondary sources

In 2024, wind generation increased by about 11.9 TWh, while solar photovoltaic generation grew by more than 20 TWh.



Wind generation grew by 12.4% compared to 2023, consolidating the leadership among the four sources. However, the biggest evolution took place in the Solar Photovoltaic source, with 39.6% growth compared to 2023, surpassing biomass generation.

Together, wind and solar photovoltaics will account for 23.7% of the country's total electricity generation in 2024, demonstrating the evolution of these sources in the Brazilian electricity mix.



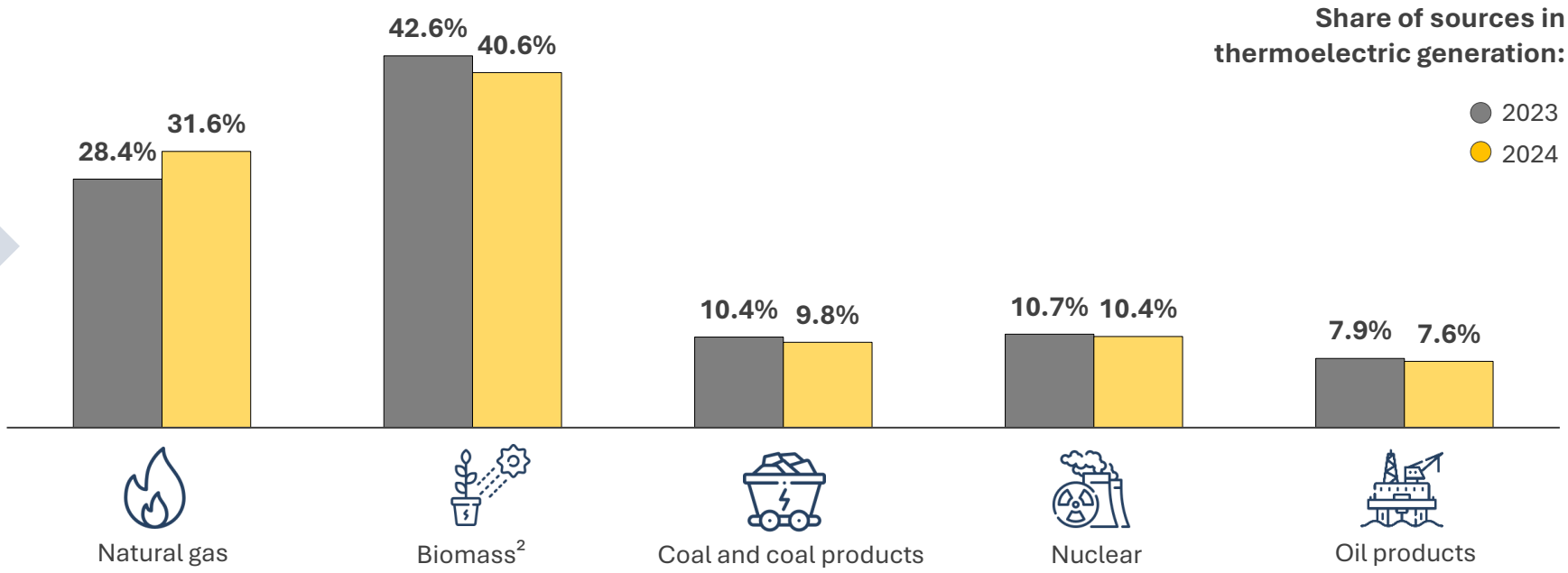
In 2024, there was a 11.4% reduction in **thermoelectric generation**. As a result, its **share** of total electricity generation[1] reduced from 19.2% in 2023 to 20.1% in 2024.

Share of thermal plants in total generation:

2024
151.2 TWh

2023
135.7 TWh

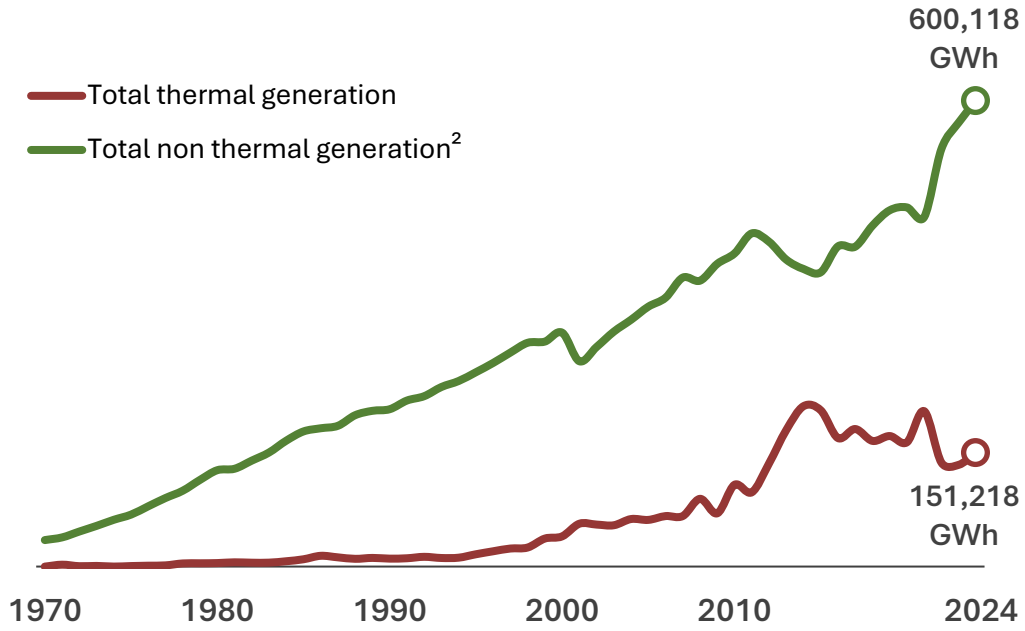
11.4% increase
In thermal generation

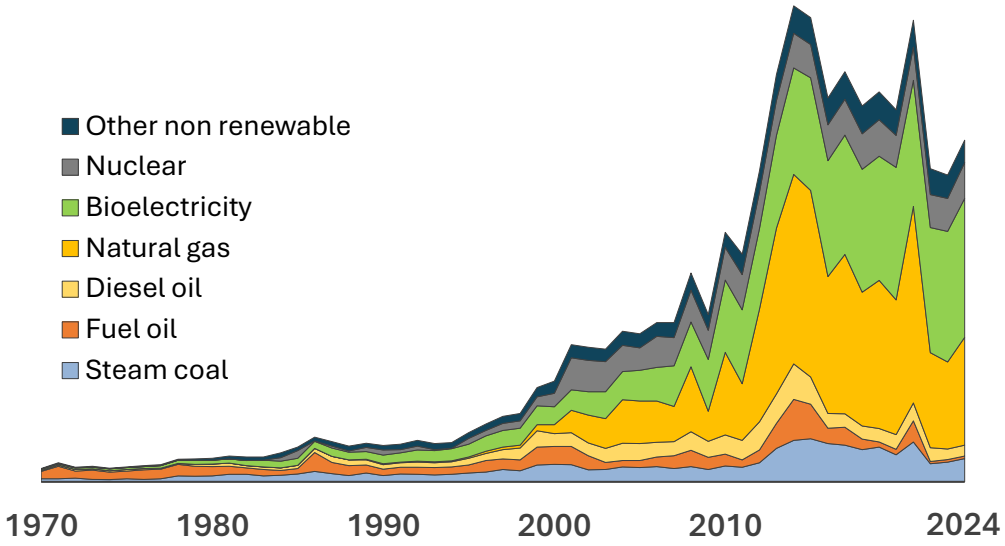


The increase in thermoelectric generation was due to the growth in natural gas (23.9%), above the average for thermal plants (11.4%).

[1] Does not include imports (hydro) in total electric power generation
[2] Includes firewood, sugarcane bagasse, black liquor, firewood and other primary sources
Note: details about losses are available at page 14.

Among the thermal sources, natural gas (31.6%) and **bioelectricity**[1] (40.6%) will be used in 2024.

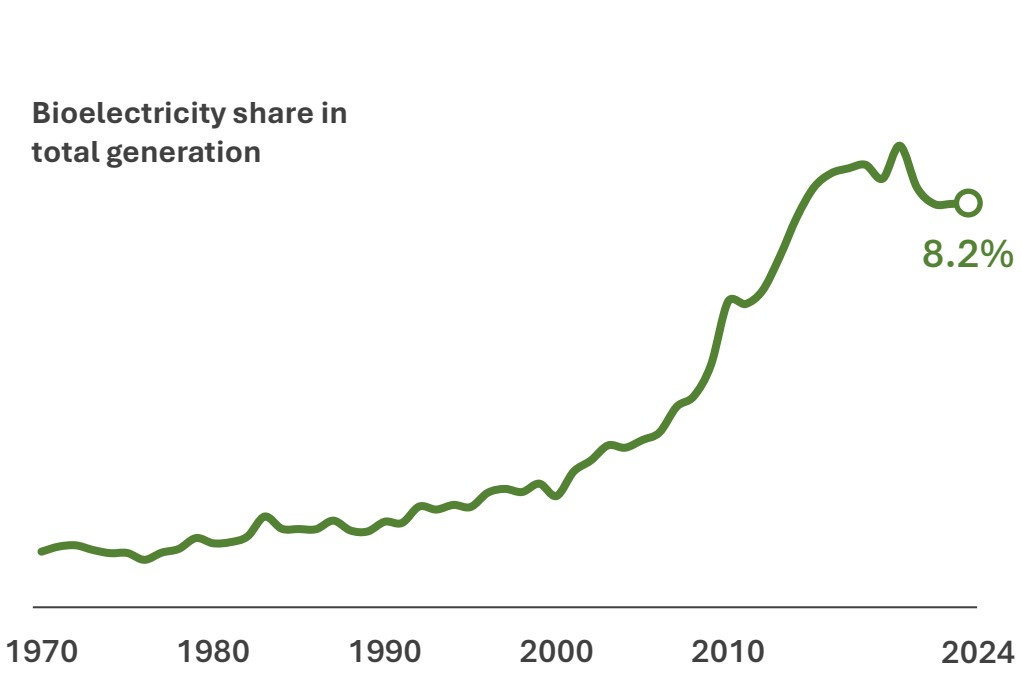


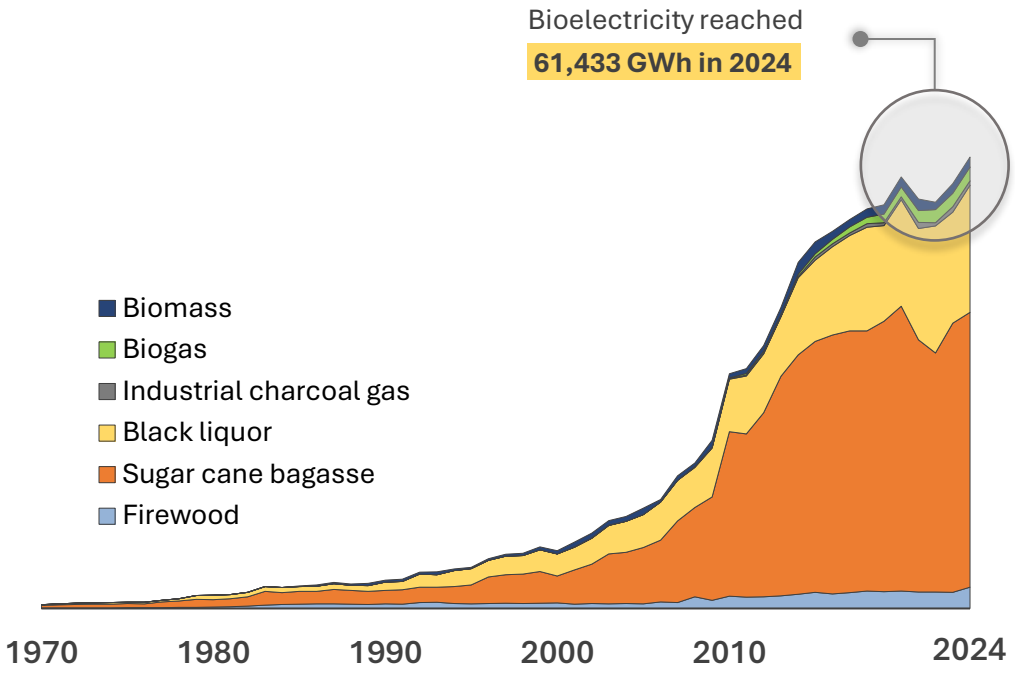


Bioelectricity has seen an average growth rate of 2.3% per year over the last 10 years.

[1] Bioelectricity is made up of firewood, sugarcane bagasse, black liquor, industrial gas from charcoal, biogas and vegetable oils. [2] Hydraulic, Wind and Solar (Photovoltaic Plant)

Bioelectricity, mainly composed of Sugarcane bagasse (60.9%) and Black liquor (28.1%) in 2024, maintained an 8.2% share in electricity generation[1].





Bioelectricity generation reached its maximum value in the historical series in 2024, reaching 61,433 GWh, and surpassing the previous record of 58,742 GWh in 2020.

[1] Does not include imports (hydro) in total electricity generation

Highlight: electrical generation in Isolated Systems

Electricity generation in Isolated Systems was 4,221 GWh in 2024 compared to 4,030 GWh in 2023, an increase of 4.7%. The majority of electrical generation comes from diesel oil and natural gas. However, isolated systems represent only 0.6% of Brazil's total electricity generation.

Generation in Isolated Systems (GWh):

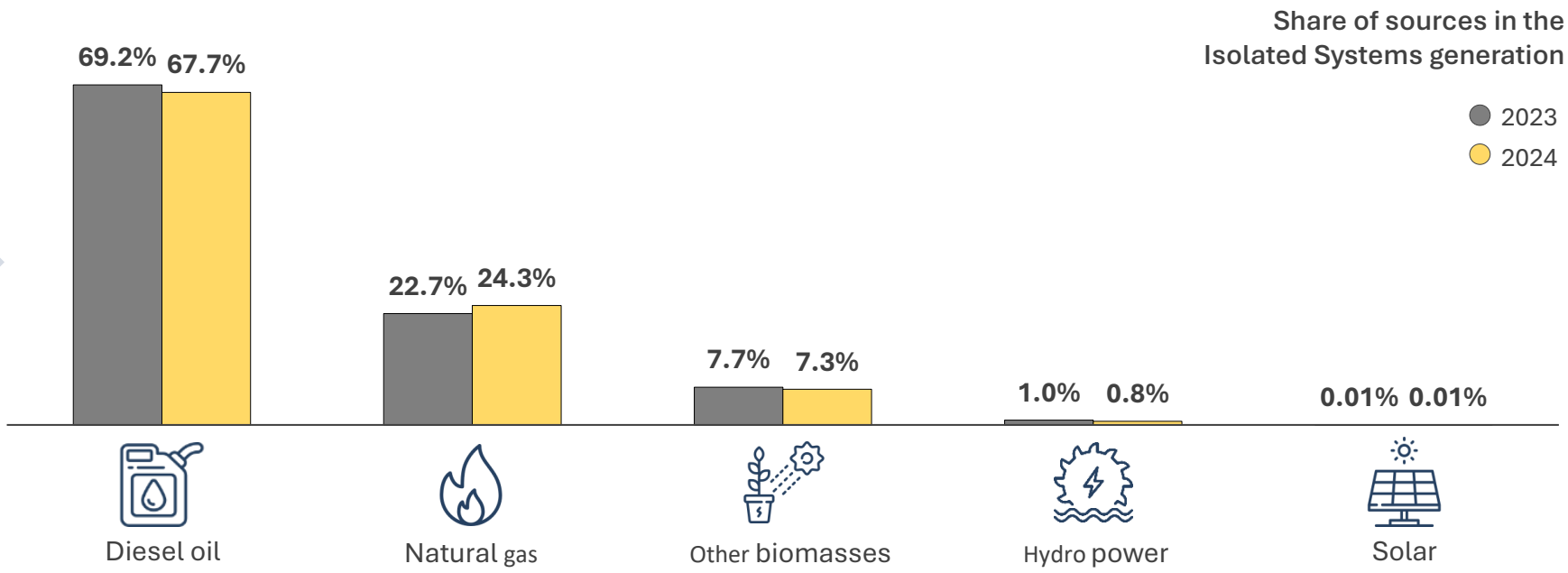
2024

4,221 GWh

2023

4,030 GWh

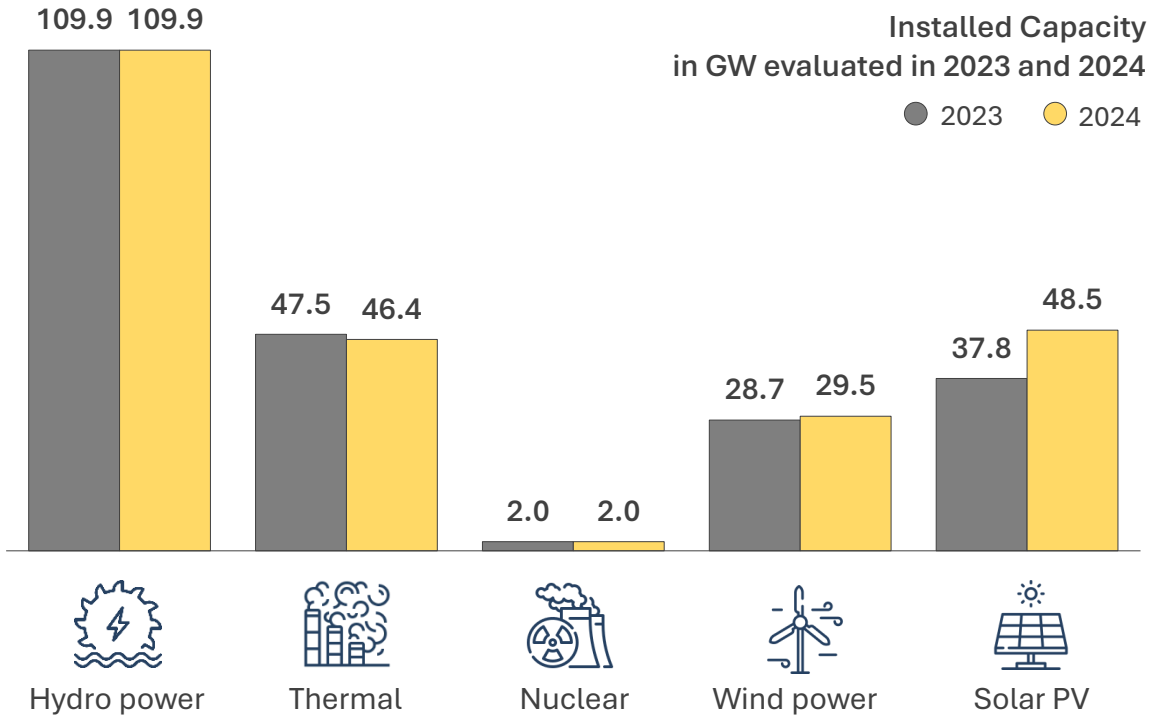
4.7% increase



Most of these systems are found in the North region, with 2 of them in Mato Grosso, in addition to Fernando de Noronha Island. Isolated Systems range from small communities to larger cities, such as Boa Vista, in Roraima, which is the only Brazilian capital not yet interconnected.

Note: More information about Isolated Systems can be found at: Fact Sheet Sistemas Isolados de Energia no Brasil; Portal de Acompanhamento e Informações dos Sistemas Isolados (PASI); Caderno de Planejamento do Atendimento aos Sistemas Isolados – Ciclo 2024 | Horizonte 2025 a 2029

Installed Capacity (GW)[1] in 2024 increased by 4.6% compared to 2023, with wind power and solar PV growing by 3.0% and 28.1% respectively.



Variation in installed capacity per source (MW)

Source	2023	2024	Δ% 24/23
Hydro power	109,922	109,922	0.0%
Thermal[2]	47,515	46,439	-2.3%
Nuclear	1,990	1,990	0.0%
Wind power	28,682	29,550	3.0%
Solar	37,843	48,468	28.1%
Available capacity	225,952	236,370	4.6%

[1] Includes micro and mini distributed generation
[2] Includes biomass, gas, oil and coal

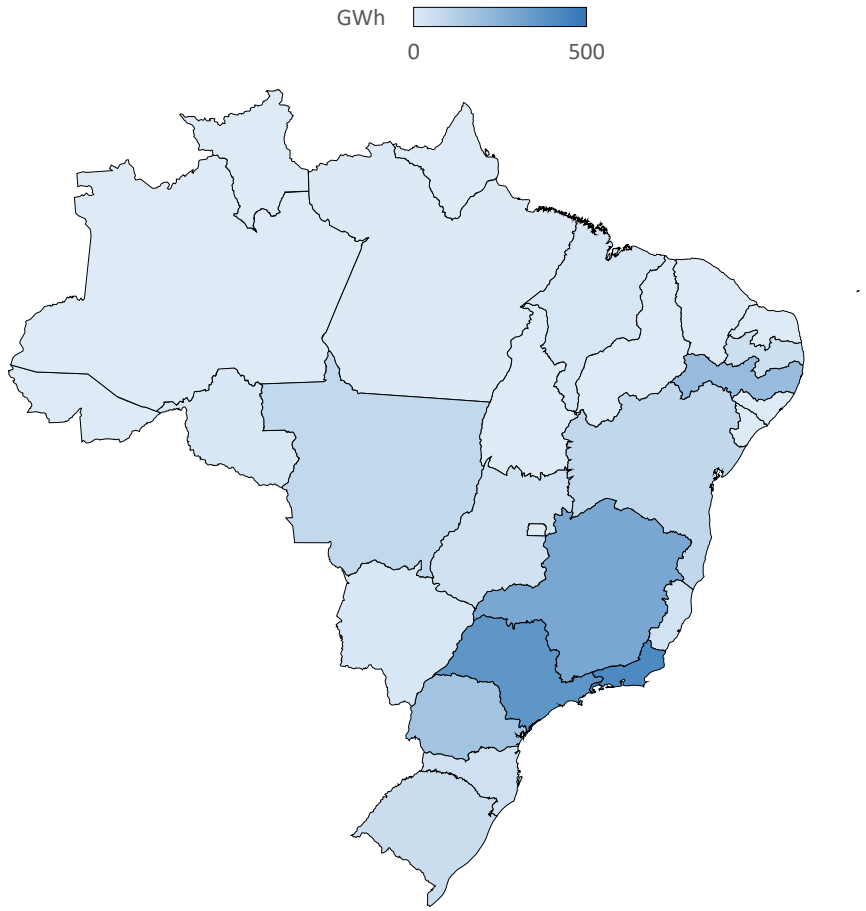
The Installed Capacity of Biogas generation by state (MW) is more concentrated in the regions with greater potential for organic matter production, agricultural, urban, industrial, and forestry waste.

Did you know?

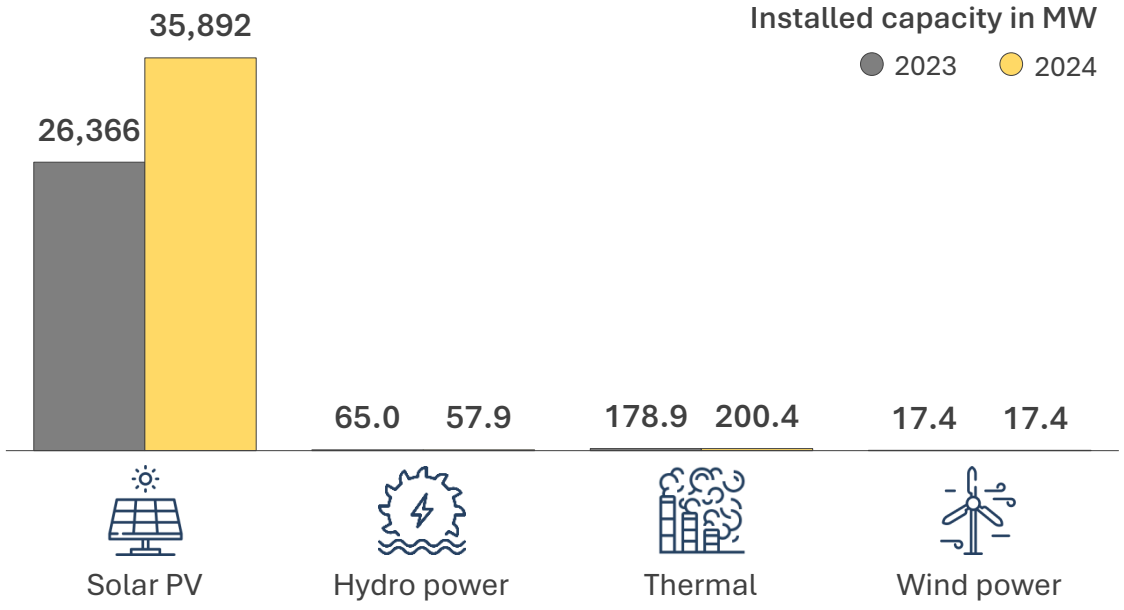
Biogas is an energy source produced by bacteria active in the decomposition of organic matter, agricultural, urban, industrial and forest residues, among others.

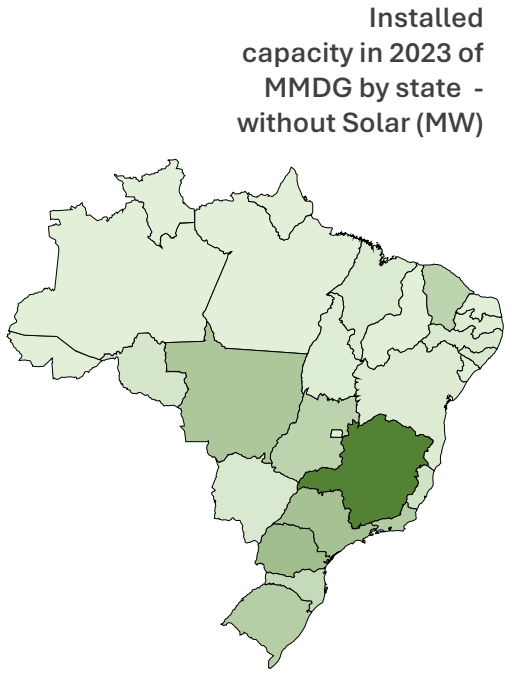
Present in the Brazilian energy mix, it is a renewable biofuel and has a good calorific value and can be used for electricity generation.

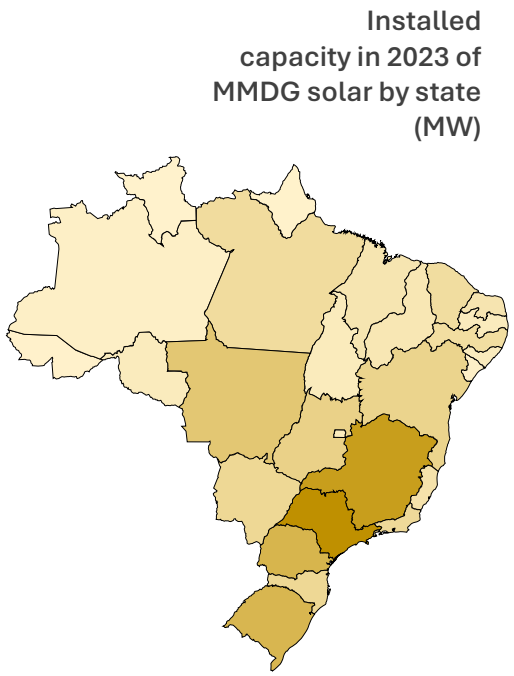
The map on the side shows the installed capacity for generating electricity from biogas in the states of Brazil.



The additional installed capacity for MMDG[1] was concentrated in the center and south of Brazil, influenced by the expansion of the solar source in federal units such as Minas Gerais, São Paulo, Santa Catarina, Rio Grande do Sul, and Mato Grosso.



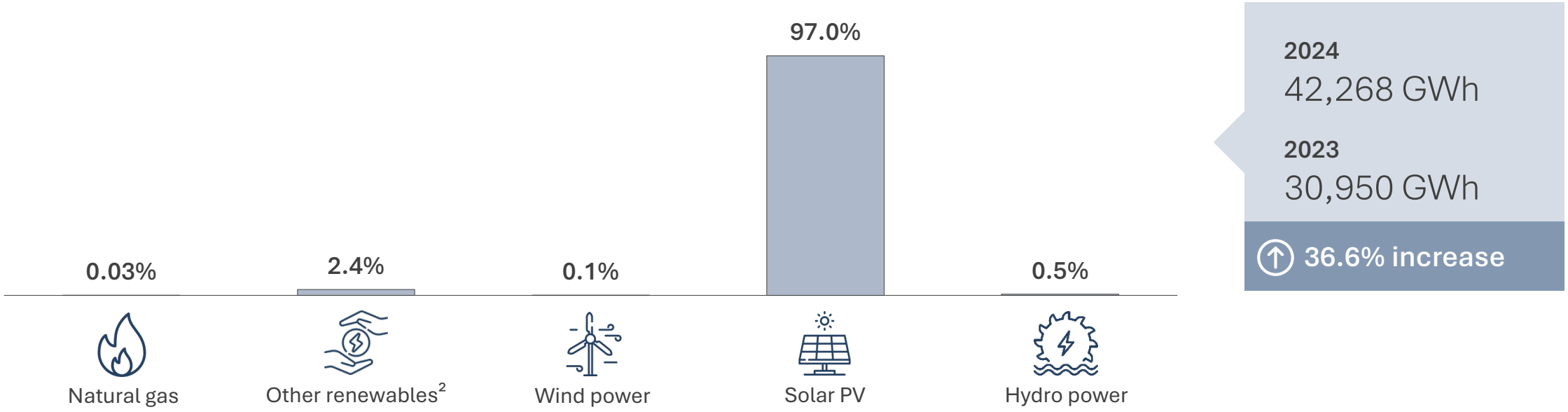




Photovoltaic solar distributed micro and mini generation in Brazil has reached **35,892 MW** of installed capacity. **The majority of installed capacity using photovoltaic panels is what defines the pace of expansion of the MMDG segment in Brazil**

[1] Law 14,300/2022

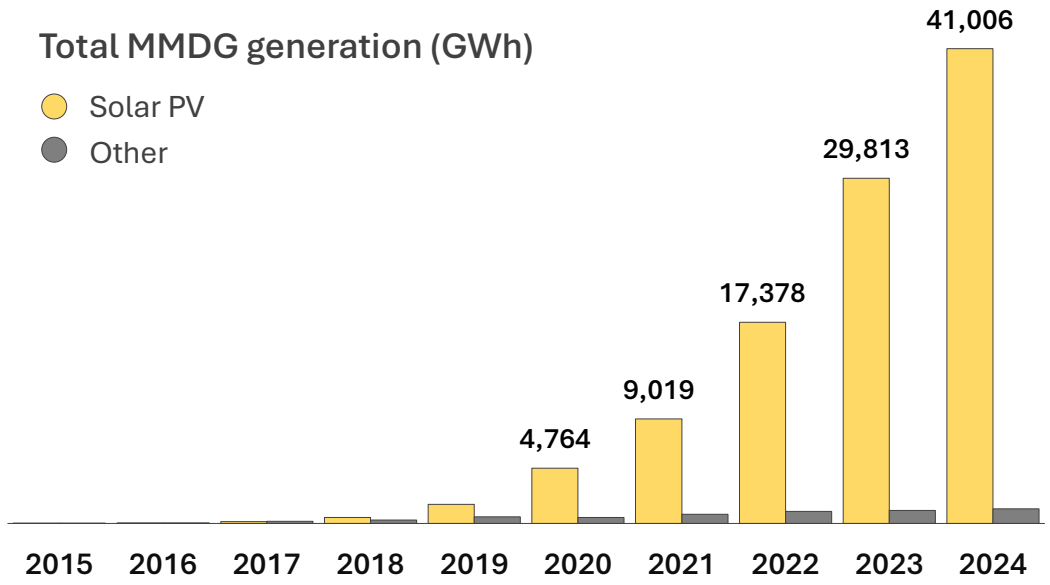
Micro and Mini Distributed Generation (MMDG)[1] in 2024 showed na increase of almost 36.6% compared to 2023, maintaining the following configuration of the participation of sources in energy generation:

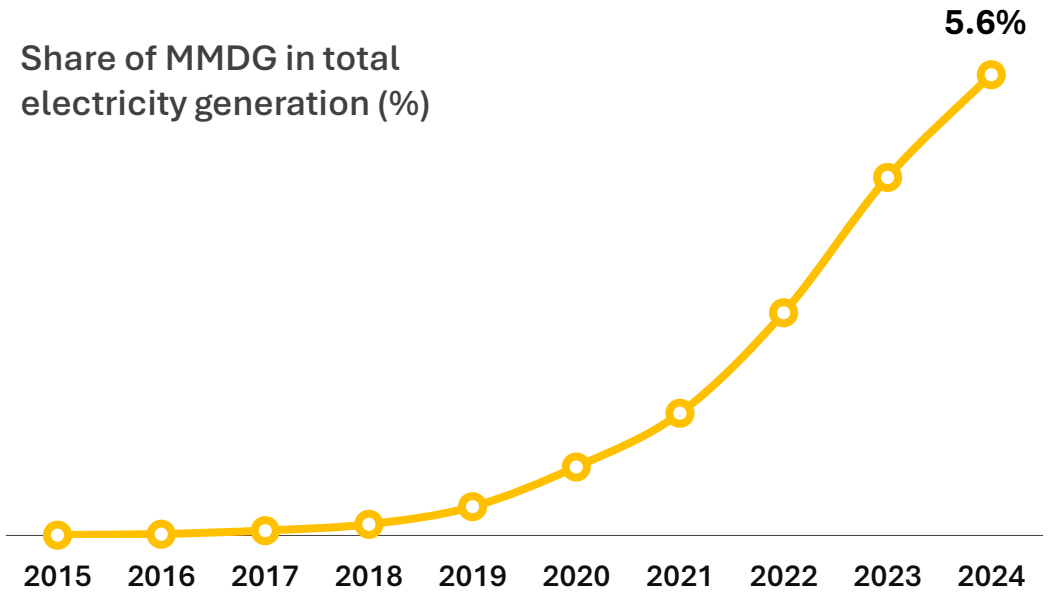


Solar photovoltaic energy represented 97% of MMDG in 2024, once again being the main **source responsible for the increase recorded in micro and mini distributed generation in the country.**

[1] Law 14,300/2022
[2] Includes biogas from agricultural and urban waste, rice hulls, blast furnace gas (biomass) and forest waste.

This fact has been built up over time, note that the evolution of **MMDG**[1] indicates the continuous growth trajectory of **solar PV generation** at a higher rate than other sources...





Distributed solar photovoltaic micro and mini-generation in Brazil reached **41,006 GWh** of electricity generation in 2024, representing **5.6% of total electricity generation in Brazil.**

[1] Law 14,300/2022

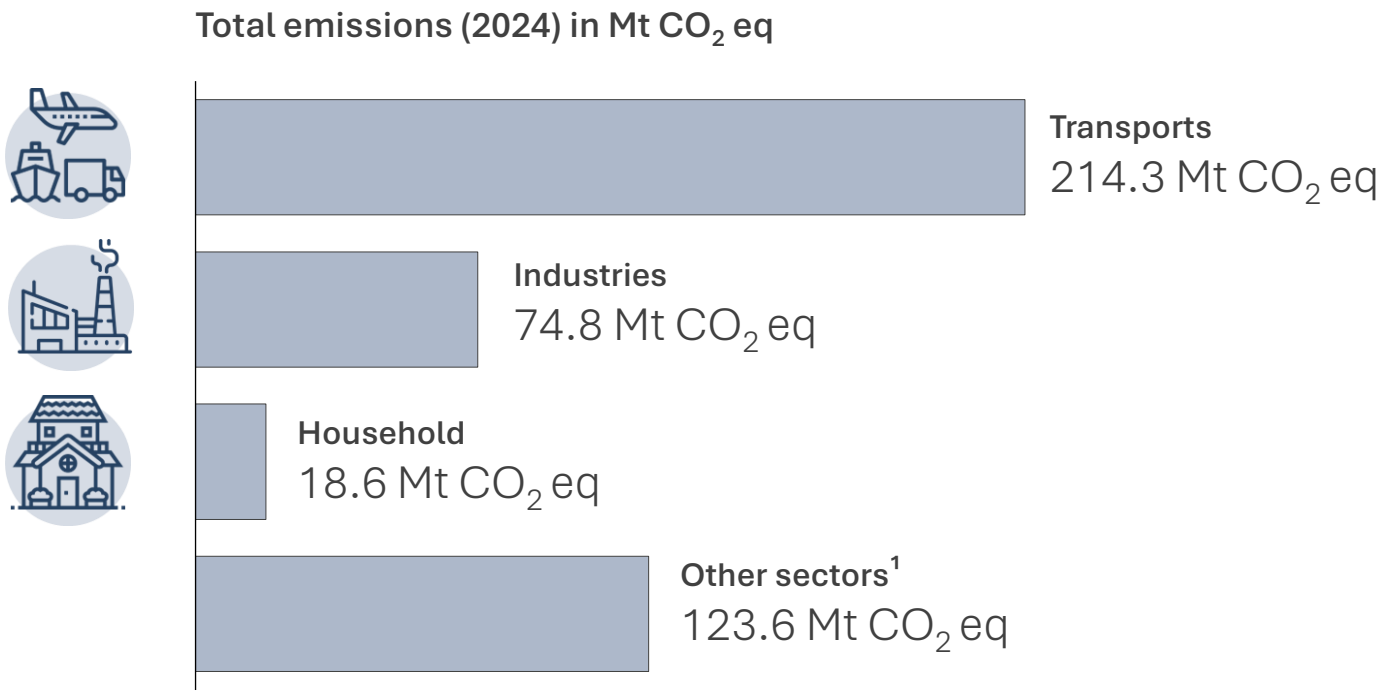
Emissions in Energy Production and Use

In 2024, the total anthropogenic **CO_2 emissions** associated with the Brazilian **energy mix** reached 431.3 million tons of CO_2 equivalent, an increase of 0.6% compared to 2023.

2024
431.3 Mt CO_2 eq

2023
428.7 Mt CO_2 eq

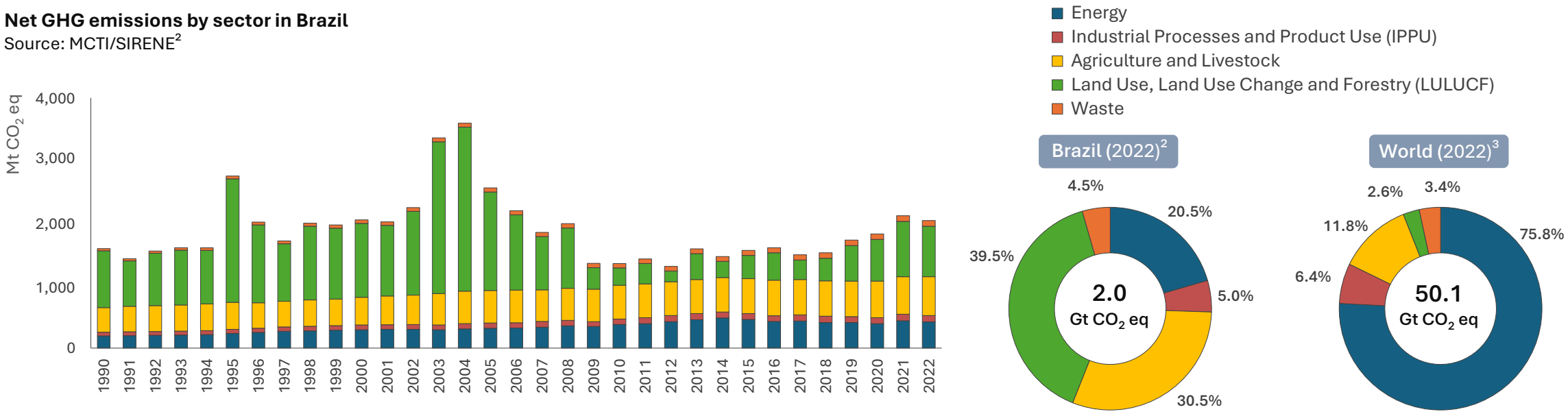
0.6% increase



[1] Includes the agricultural, services, energy, electric and fugitive emissions sectors

About 70% of Brazilian GHG emissions[1] are focused on the Agriculture and Land Use, Land Use Change and Forestry (LULUCF) sectors, while emissions from the Energy sector corresponded to 20.5% of the total inventoried in 2022.

Net GHG emissions by sector in Brazil
Source: MCTI/SIRENE[2]

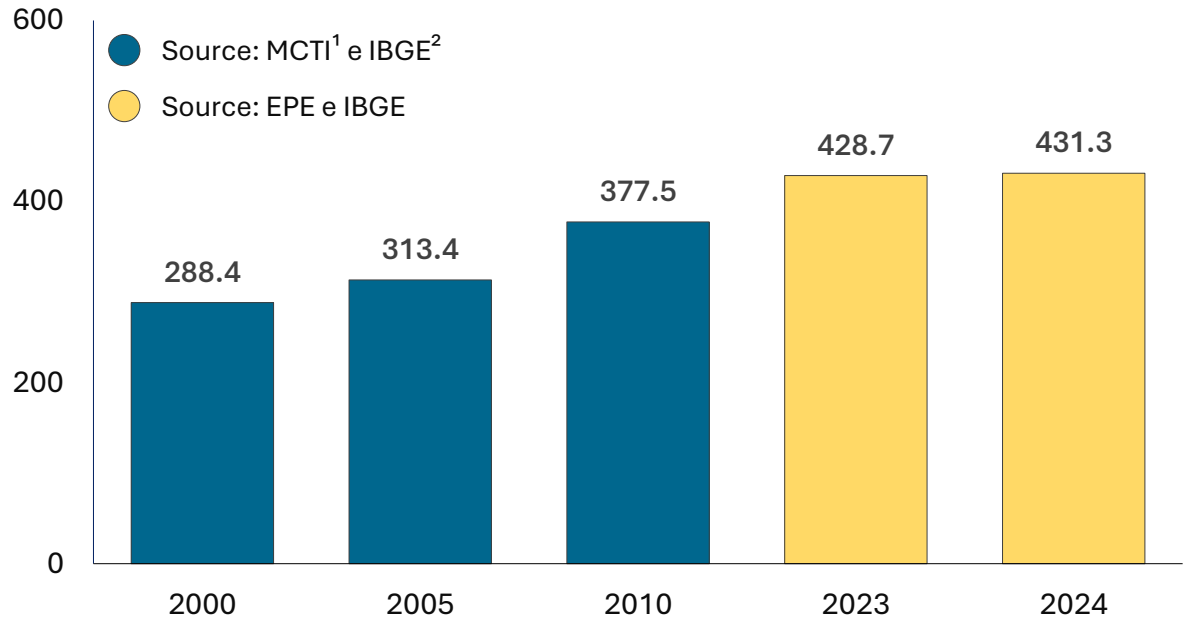


While the **energy sector in the world** accounts for **75.8% of net GHG emissions**, in Brazil the emissions profile is in a different position due to the high renewability of its energy matrix.

[1] GHG refers to Greenhouse Gases; [2] Access the National Inventory data by clicking HERE.
[3] Access the data on global net emissions by clicking HERE.

Evolution of CO_2 (Mt CO_2 eq) emissions associated with the energy matrix

Total emissions growth (Mt CO_2 eq)	
Indicator	2000 a 2024
Average annual growth rate	1.69%

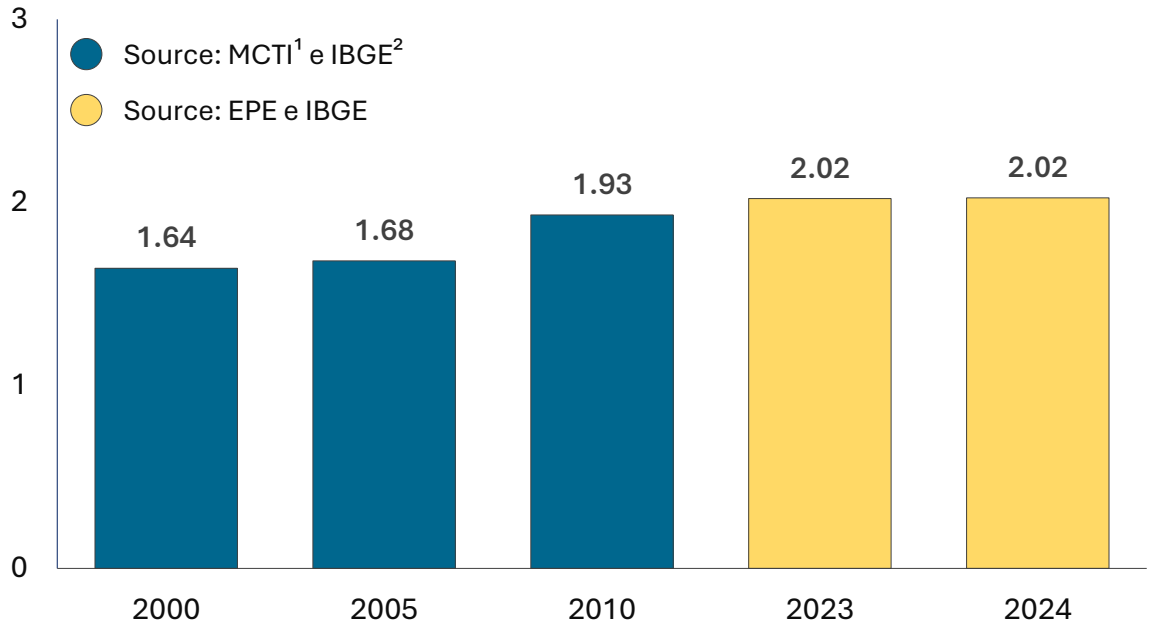


It is noted that the **increase in emissions in 2024 (+0.6%) was lower than the increase in Total Energy Supply (+2.4%)**, as a consequence of the higher share (50%) of renewable sources in the TES.

[1] Ministry of Science, Technology and Innovation
[2] Brazilian Institute of Geography and Statistics

Evolution of per capita CO_2 emissions (t CO_2 eq/inhabitant) associated with the energy mix

Emissions per capita growth – t CO_2 eq/inhabitant	
Indicator	2000 a 2024
Average annual growth rate	0.88%



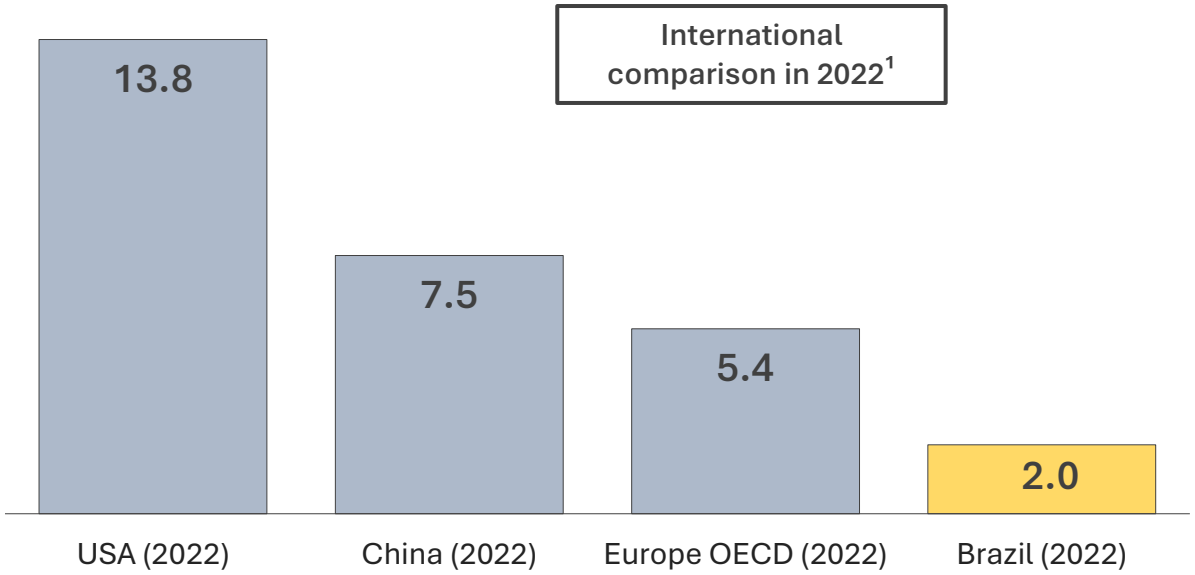
Maintenance of **per capita CO_2 emissions associated with the Brazilian energy mix**, reflecting the good performance of renewable sources in 2024.

[1] Ministry of Science, Technology and Innovation
[2] Brazilian Institute of Geography and Statistics

CO_2 emissions per capita

CO_2 emissions per capita (2022) em t CO_2/inhab.

Source: International Energy Agency. Prepared by: EPE



Brazil in 2024

Brazilian emissions per capita

2.0 t CO_2 eq/inhab.

Source: EPE

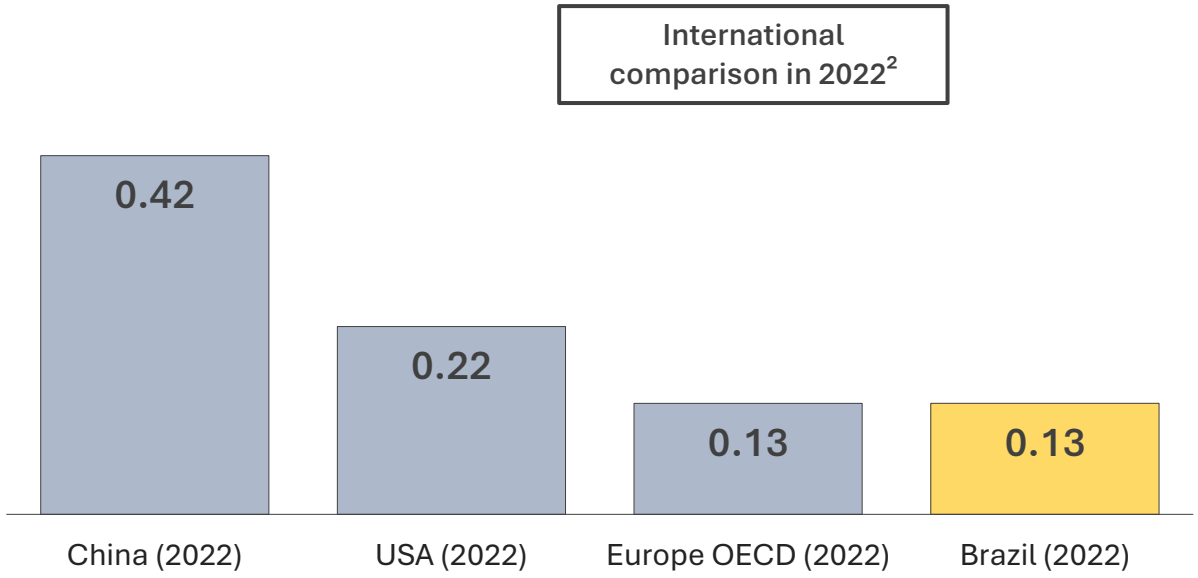
On average, in energy production and consumption**, each Brazilian emits the equivalent of 15% of what a US citizen emits, 37% of what an OECD European citizen emits and 27% of what a Chinese citizen emits.**

[1] Data in 2022 for international comparison due to the availability of data from the International Energy Agency for the USA, China and Europe OECD.

Carbon intensity in the economy

[1] **Carbon intensity (2021) in kg CO_2/US$_{ppp}$ [2015]**

Source: International Energy Agency. Prepared by: EPE



Brazil in 2024

Carbon intensity in the Brazilian economy

0.13 kg CO_2 eq/US$_{ppp}$ [2015]

Source: EPE

To generate a unit of product, **the Brazilian economy emits,** in energy production and consumption, the equivalent of **33% of the Chinese economy, 66% of the US economy and the same level as the economy of the European OECD countries.**

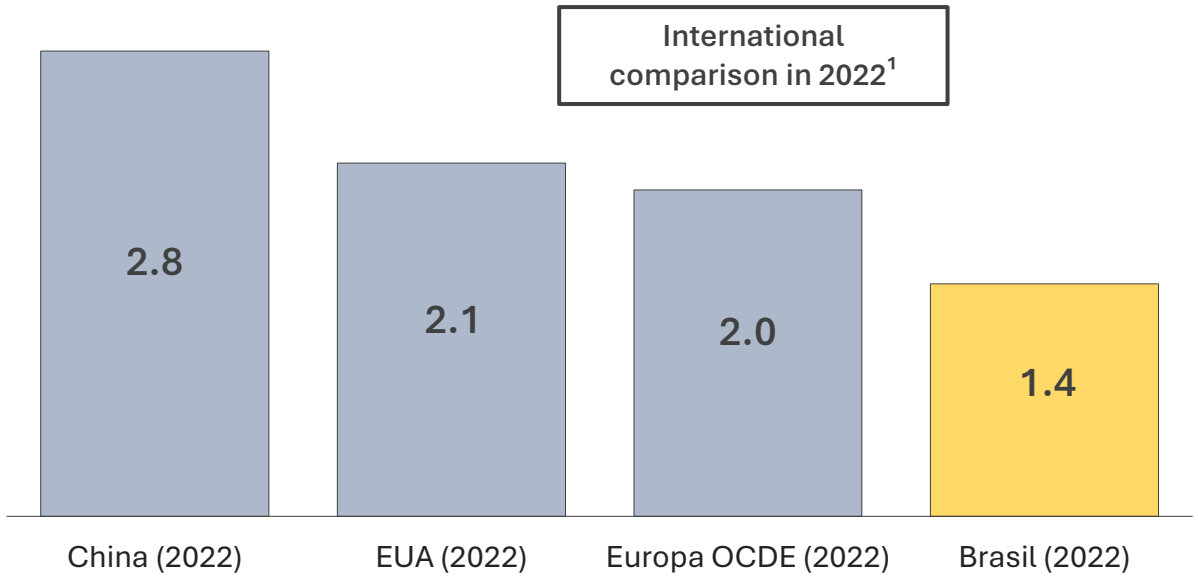
[1] US$ppp [2015] refers to the value in constant 2015 dollars in purchasing power parity

[2] Data in 2022 for international comparison due to the availability of data from the International Energy Agency for the USA, China and OECD Europe.

Emissions per unit of Total Energy Supply

CO_2 emissions (t) per toe (2022)

Source: International Energy Agency. Prepared by: EPE



Brazil in 2024

Emissions associated with total energy supply

1.3 t CO_2 eq/toe

Source: EPE

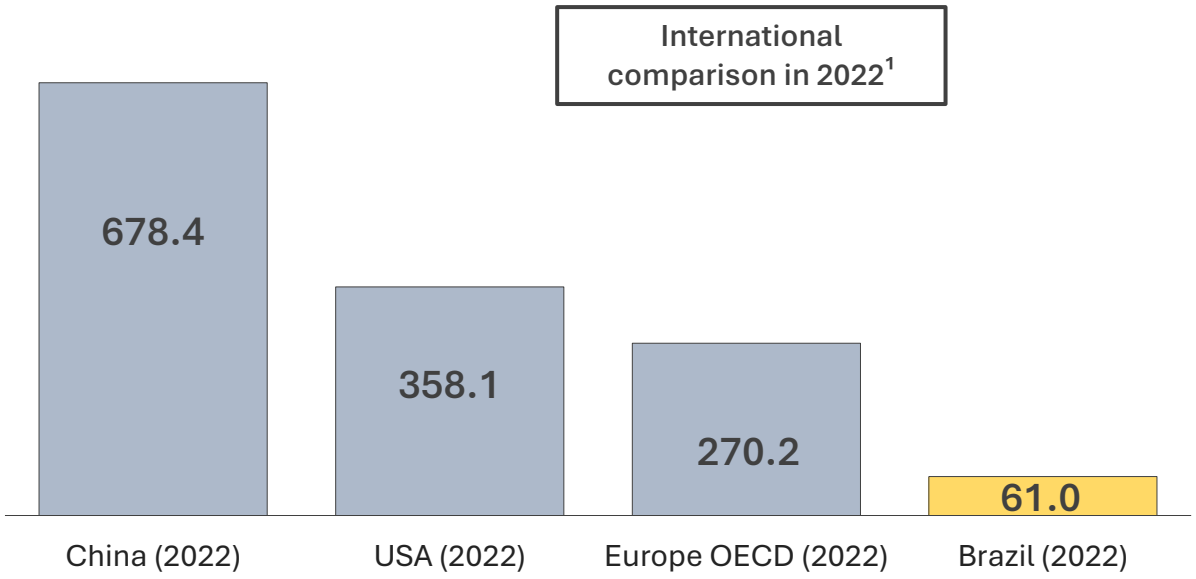
For each ton of oil equivalent (toe) made available, Brazil emits the equivalent of **71% of what European OECD countries emit, 6966 of what the United States (US) emits and 50% of what China emits.**

[1] Data in 2022 for international comparison due to the availability of data from the International Energy Agency for the USA, China and OECD Europe.

Emissions in electricity production

CO_2 emissions (kg) per MWh (2022)

Source: International Energy Agency. Prepared by: EPE



Brazil in 2024

Carbon emissions in Brazilian power generation

59.9 kg CO_2 eq/MWh

Source: EPE

To produce 1 MWh, the Brazilian electricity sector emits around **23% of the amount emitted by European OECD countries, 17% of what is emitted by the American electricity sector and 9% of what is emitted by the Chinese electricity sector.**

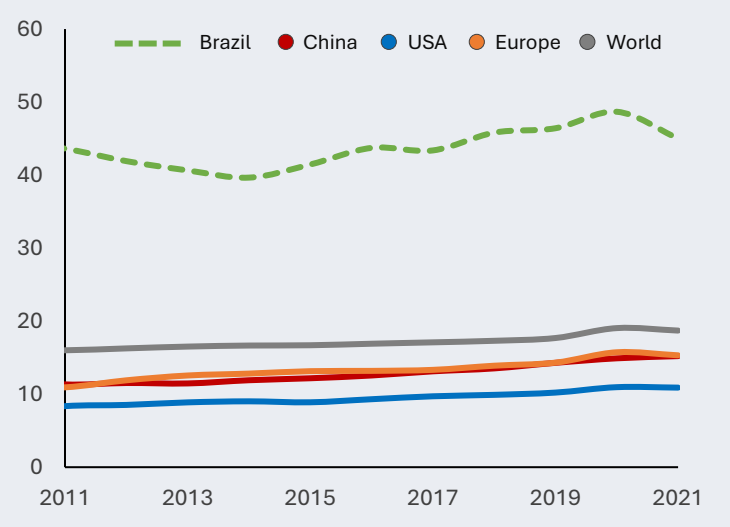
[1] Data in 2022 for international comparison due to the availability of data from the International Energy Agency for the USA, China and OECD Europe.

SDG 7 (Affordable and Clean Energy) Indicators

The figures below show the indicators of Brazil's Sustainable Development Goals in comparison with the world and with selected countries. Brazil's indicators are calculated annually by EPE and IBGE. In the case of the TES Energy Intensity, for the purposes of international comparison, the EPE calculated from a series of GDP in US$ppp of 2017.

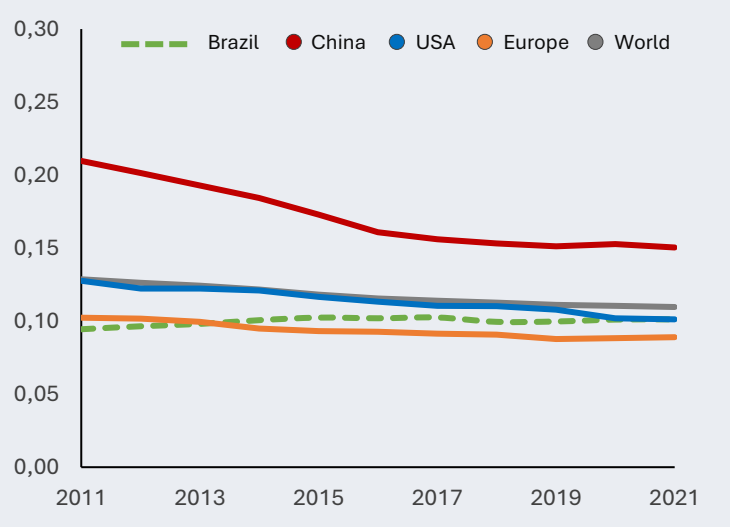
SDG 7.2.1

Share of renewables in the Total Energy Supply (TES)



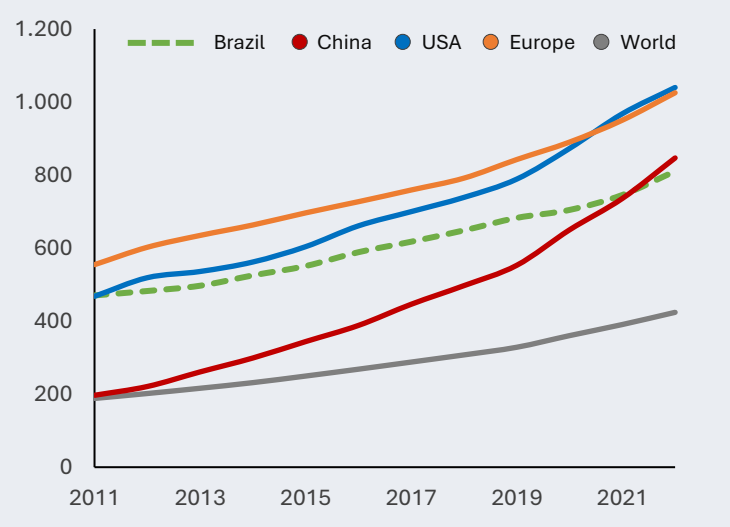
SDG 7.3.1

Energy intensity of the TES [toe/thousand US$ppp (2017)]



SDG 7.b.1

Installed capacity of renewables per capita [W per capita]



The SDG 7 indicators are available on the IBGE portal and can be accessed by clicking HERE

Note: PPP is the acronym for Purchasing Power Parity

Main movements in 2024

Domestic Supply and Power Consumption:

- Renewable sources reach a 50% share in the Brazilian energy matrix, a historical milestone since 1990;
- The share of renewables in the electricity mix stood at 88.2% in 2024;
- Total solar photovoltaic generation grew 39.6% and its installed capacity expanded 28.1% compared to the previous year;
- Wind generation grew by 12.4%;
- The renewability of the industry stood at 64.4%, with emphasis on the sources of sugarcane bagasse and black liquor;
- The transportation sector reached 25.7% renewability in 2024, with increases of 30.1% in hydrous ethanol and 19.3% in biodiesel.

Emissions:

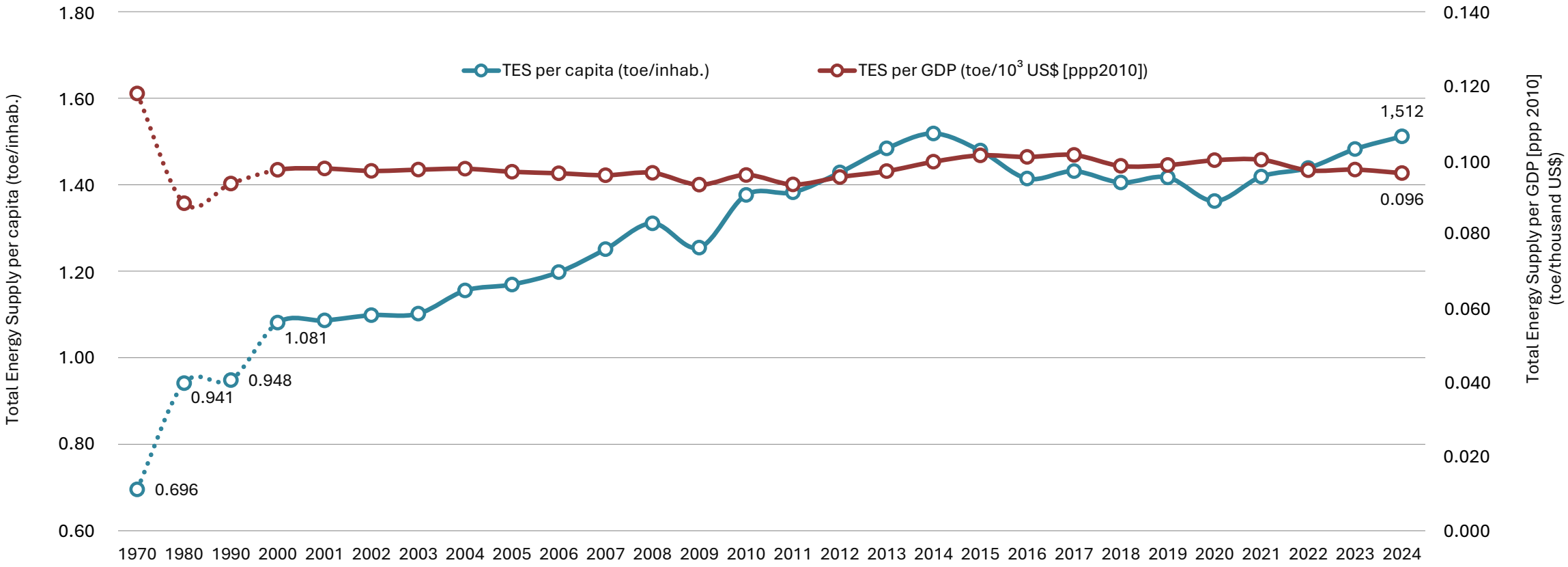
- Only 20% of Brazil's total emissions were due to the energy sector, a figure below the global average of 76%;
- Brazil's per capita emissions in energy production and use accounted for 37% of the emissions of a European OECD citizen;
- Emissions from the Brazilian electricity sector remained low compared to European OECD countries, the US and China.

Annexes

Evolution of indicators: energy

Total Energy Supply per capita vs. Total Energy Supply per GDP

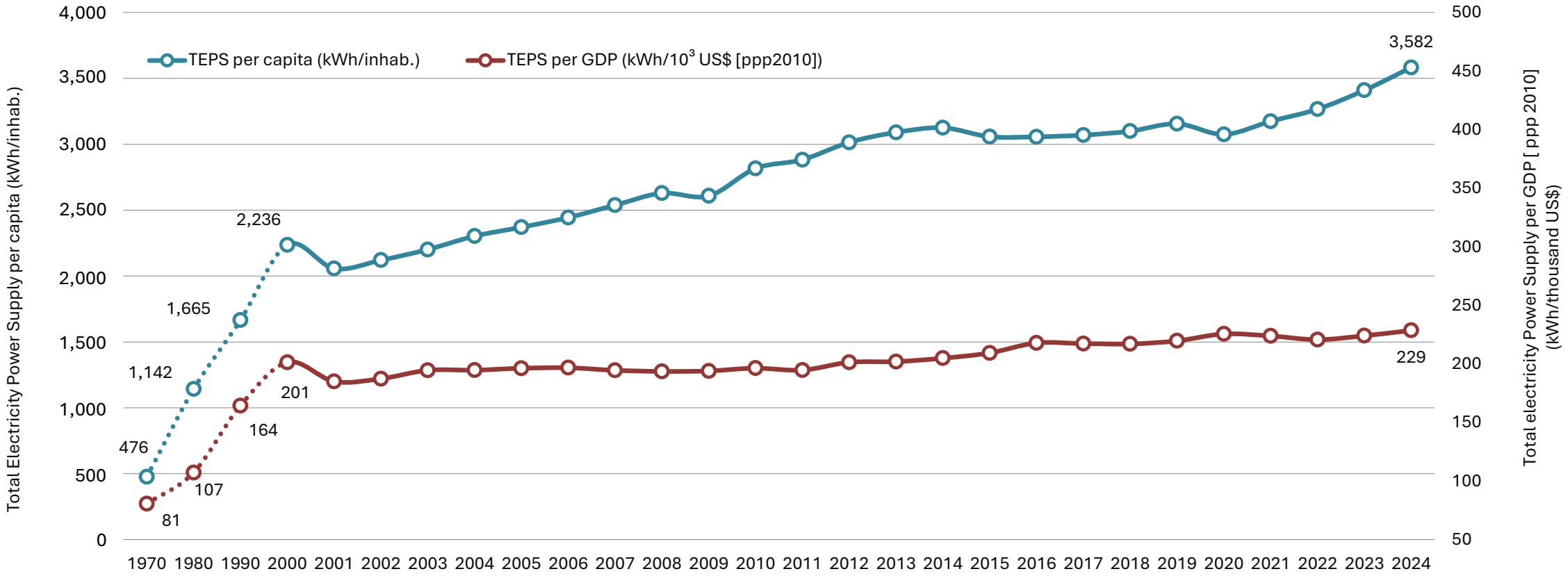
Source: EPE



Evolution of the indicators: electricity

Total Electricity Power Supply per Capita vs. Total Electricity Power Supply by GDP

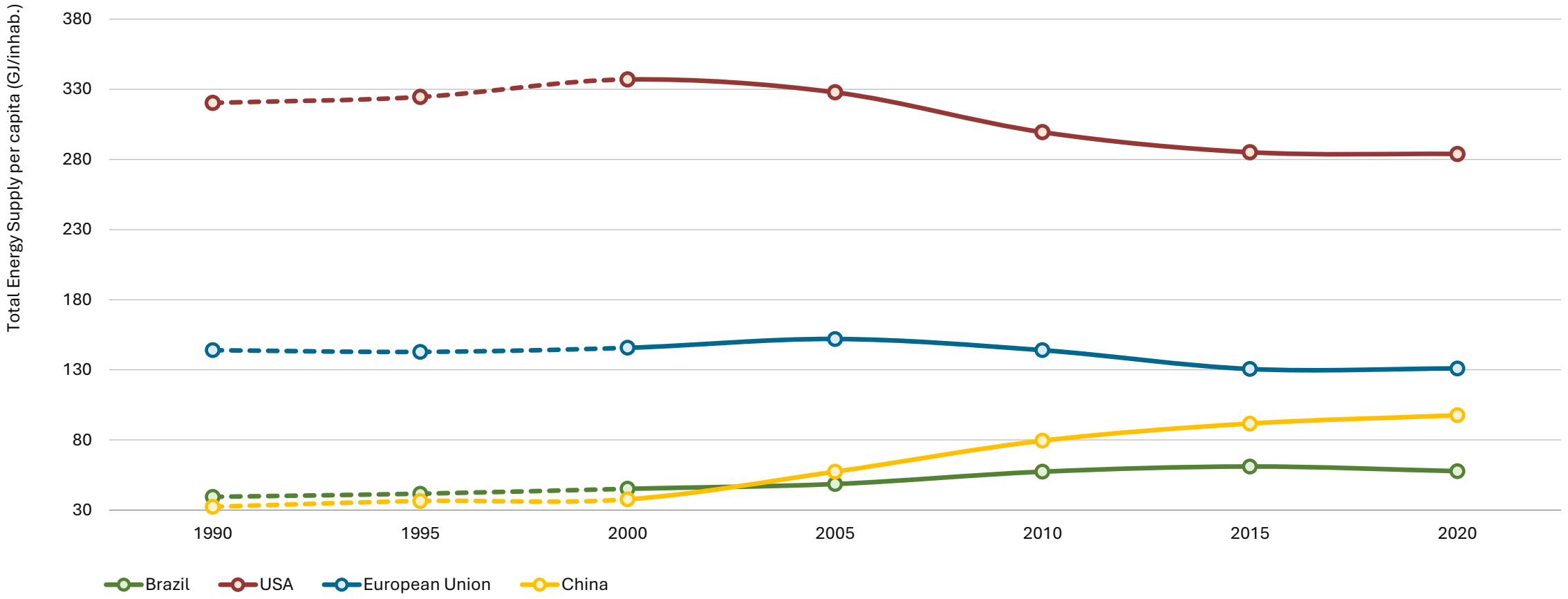
Source: EPE



Evolution of indicators: Brazil and the World

Total Energy Supply per capita

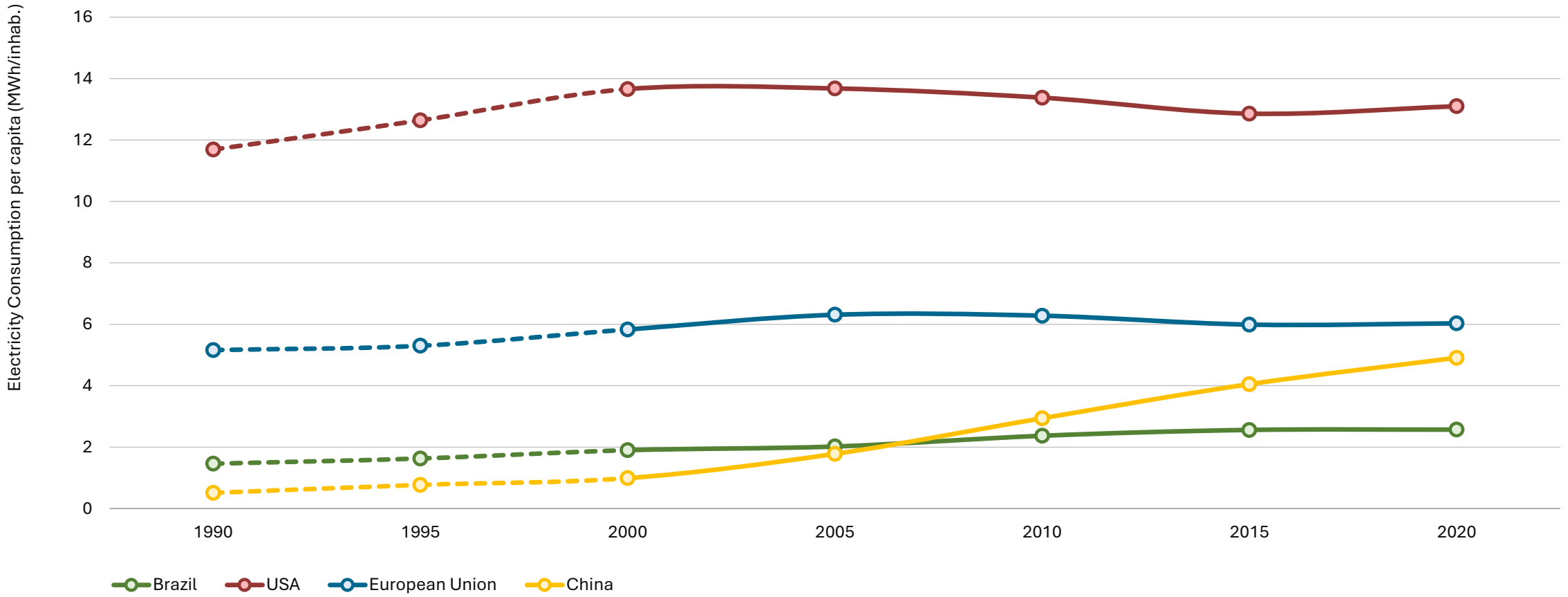
Source: International Energy Agency. Prepared by EPE



Evolution of indicators: Brazil and the World

Electricity Consumption per capita

Source: International Energy Agency. Prepared by EPE



Key Statistics

Source	Unit	2023	2024	Δ% 24/23
Oil Production[1]	10^3 bbl/day	3,404.4	3,372.1	-0.9%
Natural Gas Production	10^6 m^3/day	149.8	153.5	2.5%
Electric Power Generation	TWh	708.1	751.3	6.1%
Consumption of Liquid Fuels	10^6 l/day	411.1	426.1	3.6%
Electric power consumption	TWh	616.3	650.4	5.5%
Total Energy Supply (TES)	10^6 toe	314.5	322.0	2.4%
Total Electric Power Supply (TEPS)[2]	TWh	723.2	762.9	5.5%
Population	10^6 inhab.	211.3	212.1	0.4%
GDP [2010][3]	10^9 US$	3,126.9	3,228.2	3.2%

[1] bbl = barrel; includes liquids of natural gas and LPG
[3] Includes import and autoproduction
[3] Values in constant 2010 reais converted to dollars in 2010 purchasing power parity (ppp).

Final energy consumption by source[1]

Unit: 10^3 toe

Source	2023	2024	Δ% 24/23
Diesel Oil[2]	55,218	56,589	2.5%
Electricity	53,002	55,937	5.5%
Sugarcane Bagasse	33,537	32,599	-2.8%
Gasoline[3]	25,906	24,878	-4.0%
Natural Gas	14,975	14,467	-3.4%
Firewood	18,843	18,976	0.7%
Ethanol	16,115	18,632	15.6%
LPG	8,240	8,411	2.1%
Black liquor	7,815	8,220	5.2%
Fuel oil	2,227	2,005	-10.0%
Kerosene	3,296	3,372	2.3%
Other Sources[4]	27,688	28,390	2.5%
TOTAL	**266,862**	**272,476**	**2.1%**

[1] Exclusive non-energy final consumption;
[2] Includes biodiesel; [3] Includes gasoline A and aviation gasoline;
[4] Includes refinery gas, coal coke and charcoal, among others

Selected indicators

Indicators	Unit	2023	2024	Δ% 24/23
GDP per capita	US$/inhab.	14,800	15,218	2.8%
TES per capita	toe/inhab.	1.488	1.518	2.0%
TES per GDP [2010]	toe/10^3 US$	0.101	0.100	-0.8%
TEPS per capita	kWh/inhab.	3,423	3,596	5.1%
TEPS per GDP [2010]	kWh/10^3 US$	231	236	2.2%

Evolution of indicators

Parameters	Unit	1970	1980	1990	2000	2010	2023	2024
Total Energy Supply (TES)	10^6 toe	66.9	114.7	141.9	190.1	268.8	314.5	322.0
Total Electric Power Supply (TEPS)[1]	TWh	45.7	139.2	249.4	393.2	550.4	723.2	762.9
Population	10^6 inhab.	95.7	122.2	148.1	174.7	196.4	211.3	212.1
GDP [2010][2]	10^9 US$	567.3	1,297.7	1,517.1	1,953.0	2,803.6	3,126.9	3,228.2
Indicators	**Unit**	**1970**	**1980**	**1990**	**2000**	**2010**	**2023**	**2024**
GDP per capita	US$/inhab.	5,928	10,619	10,244	11,179	14,275	14,800	15,218
TES per capita	toe/inhab.	0.699	0.939	0.958	1.088	1.369	1.488	1.518
TES per GDP [2010]	toe/10^3 US$	0.118	0.088	0.094	0.097	0.096	0.101	0.100
TEPS per capita	kWh/inhab.	478	1,139	1,684	2,251	2,802	3,423	3,596
TEPS per GDP [2010]	kWh/10^3 US$	81	107	164	201	196	231	236

[1] Includes import and autoproduction
[2] Values in constant 2010 reais converted to dollars in 2010 purchasing power parity (ppp)

Matrices

The matrices are available on the EPE portal by clicking on the QR code below or by clicking on the following link: https://www.epe.gov.br/pt/publicacoes-dados-abertos/publicacoes/BEN-Series-Historicas-Completas

The matrices can be obtained directly by going to:

Matrices and Time series

BEN

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