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FAOSTAT ANALYTICAL BRIEF 87

# Bioenergy

1990–2022

## HIGHLIGHTS

- **Global bioenergy production (excluding municipal and industrial waste) almost doubled, from 27.9 exajoules (EJ) in 1990 to 51.7 EJ in 2022.**
- **The year 2020 saw a slight dip to 49.3 EJ due to the COVID-19 pandemic, but production quickly rebounded in 2021 and further increased in 2022.**
- **In 2022, solid biofuels accounted for 90 percent of total bioenergy production (46.5 EJ), liquid biofuels for 8 percent (4.3 EJ) and gaseous biofuels for 2 percent (0.9 EJ).**
- **The production of liquid biofuels and gaseous biofuels grew by 8.9–9 percent on average each year between 1990 and 2022, while that of solid biofuels grew by 1.6 percent on average each year over the same period.**
- **In 2022, the most produced individual biofuels were all solid biofuels: fuelwood (30.2 EJ), other vegetal material and residues (10.2 EJ) and bagasse (4.0 EJ).**
- **In 2022, Asia was the largest producer of solid biofuels (17.7 EJ). The Americas led the production of liquid biofuels (2.8 EJ) and Europe that of gaseous biofuels (0.6 EJ).**
- **The top countries in bioenergy production in 2022 were India (8.4 EJ), Nigeria (5.2 EJ), Brazil (4.3 EJ), the United States of America (4.1 EJ) and China (3.9 EJ).**

## FAOSTAT BIOENERGY

### BACKGROUND

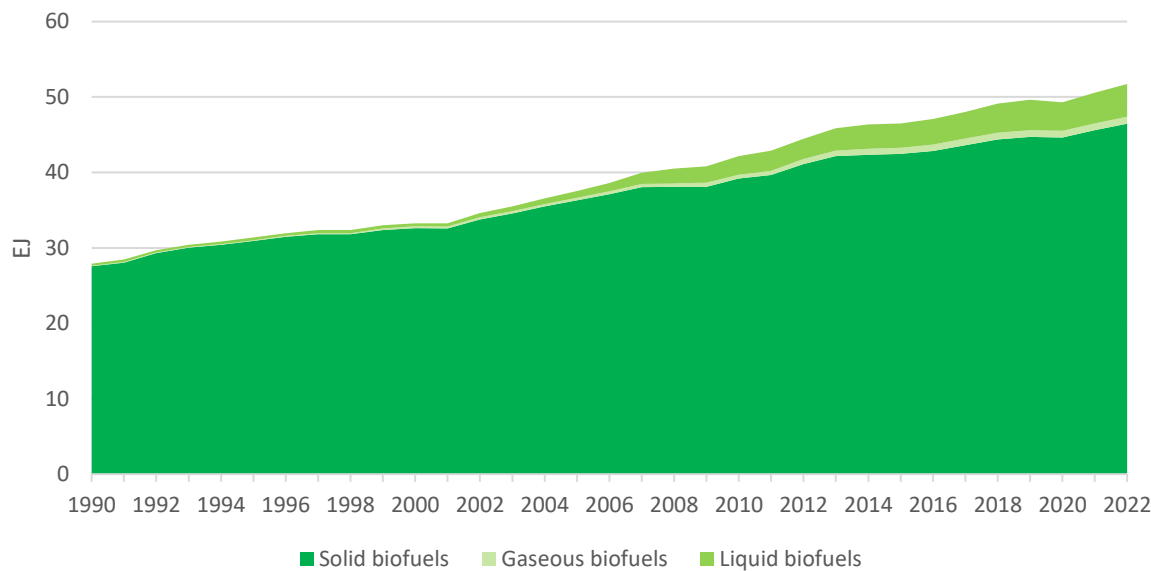
The Food and Agriculture Organization of the United Nations (FAO) provides statistics in FAOSTAT at the country, regional and global level on the production and consumption of bioenergy by type of biofuel: i) solid biofuels (animal waste, bagasse, black liquor, charcoal, fuelwood, other vegetal material and residues); ii) liquid biofuels (bio jet kerosene, biodiesel, biogasoline, other liquid biofuels); iii) gaseous biofuels (biogases). This brief discusses statistics of bioenergy from 1990 to 2022, both globally and by region.

### GLOBAL

Global bioenergy production almost doubled, from 27.9 EJ in 1990 to 51.7 EJ in 2022. Between 1990 and 2000, the average annual growth rate in bioenergy production was 1.8 percent. This growth rate increased to 2.4 percent between 2000 and 2010 and then decreased to 1.6 percent between 2010 and

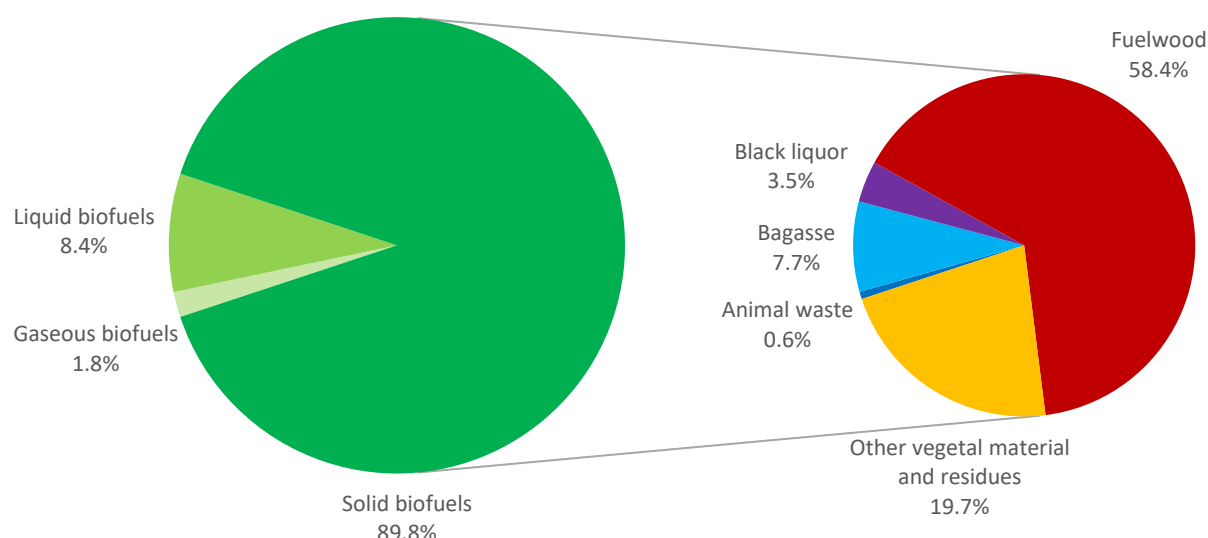
2020. The year 2020 saw a slight dip in production to 49.3 EJ due to the COVID-19 pandemic, but production quickly rebounded to 50.6 EJ in 2021 and further increased to 51.7 EJ in 2022 (Figure 1).

Figure 1: Total bioenergy production by bioenergy category



**Source:** FAO. 2024. FAOSTAT: Bioenergy. [Accessed June 2024].  
<http://www.fao.org/faostat/en/#data/BE>. Licence: CC-BY-4.0.

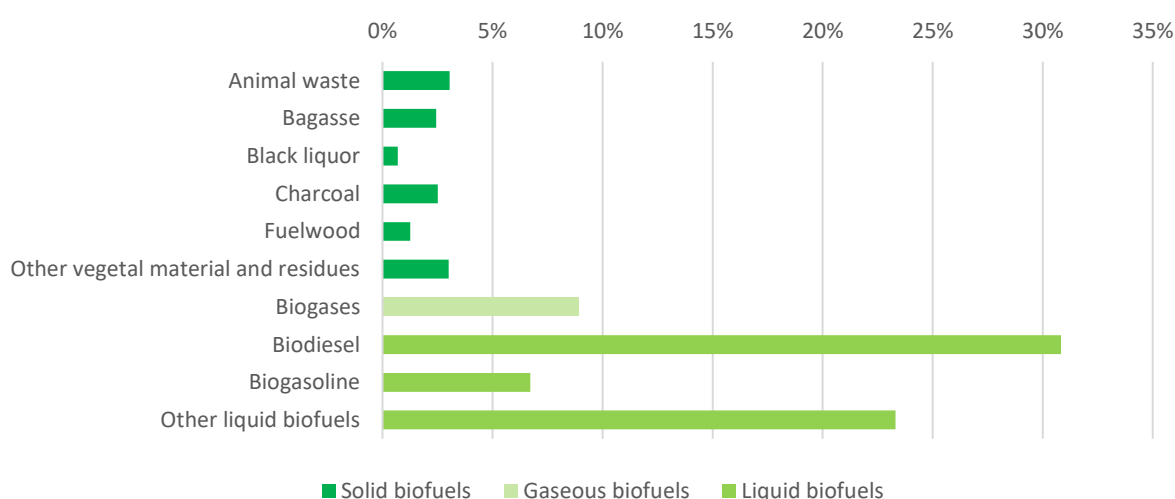
Solid biofuels account for the bulk of bioenergy production, driven by fuelwood and other vegetal material and residues. However, the share of solid biofuels in total bioenergy production fell from 98.8 percent in 2000 to 89.8 percent in 2022 as the production of gaseous and liquid biofuels took off following the adoption of renewable energy mandates and policies in many countries aiming at reducing greenhouse gas emissions and creating a market for these biofuels. The average annual growth rates of gaseous and liquid biofuels production between 1990 and 2022 were similar (around 8.9–9 percent), resulting in shares of 1.8 percent and 8.4 percent in total bioenergy production in 2022, respectively (Figure 2).

**Figure 2: Bioenergy production by biofuel (2022)**


**Source:** FAO. 2024. FAOSTAT: Bioenergy. [Accessed June 2024].

<http://www.fao.org/faostat/en/#data/BE>. Licence: CC-BY-4.0.

The average annual percent change of biofuels production between 1990 and 2022 is the highest for the more modern biofuels as a result of the policy measures mentioned above: biodiesel (+30.8 percent, equivalent to a multiplication by nearly 5 500 over the period), other liquid biofuels (23.3 percent), biogases (8.9 percent) and biogasoline (6.7 percent). For all the solid biofuels, the average annual percent change of production was much lower, between 0.7 percent for black liquor and 3–3.1 percent for animal waste and other vegetal material and residues (Figure 3).

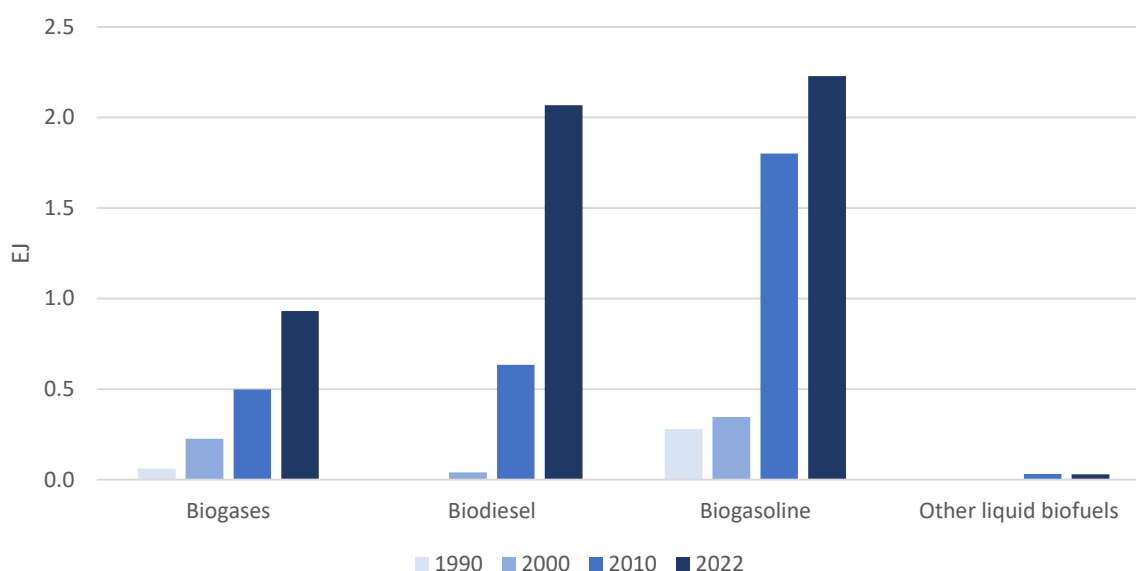
**Figure 3: Average annual percent change of biofuels production (1990–2022)**


**Source:** FAO. 2024. FAOSTAT: Bioenergy. [Accessed June 2024].

<http://www.fao.org/faostat/en/#data/BE>. Licence: CC-BY-4.0.

Looking at the biofuels with the strongest production growth, different patterns emerge. The increase in the production of biogases and biodiesel was the largest during the most recent period (+1.4 EJ for biodiesel between 2010 and 2022, and +0.4 EJ for biogases). The production of biogasoline and other liquid biofuels had its largest increase between 2000 and 2010 (+1.5 EJ for biogasoline) and slowed down afterwards (Figure 4).

**Figure 4: Production of biogases and liquid biofuels by biofuel**



**Source:** FAO. 2024. FAOSTAT: Bioenergy. [Accessed June 2024].

<http://www.fao.org/faostat/en/#data/BE>. Licence: CC-BY-4.0.

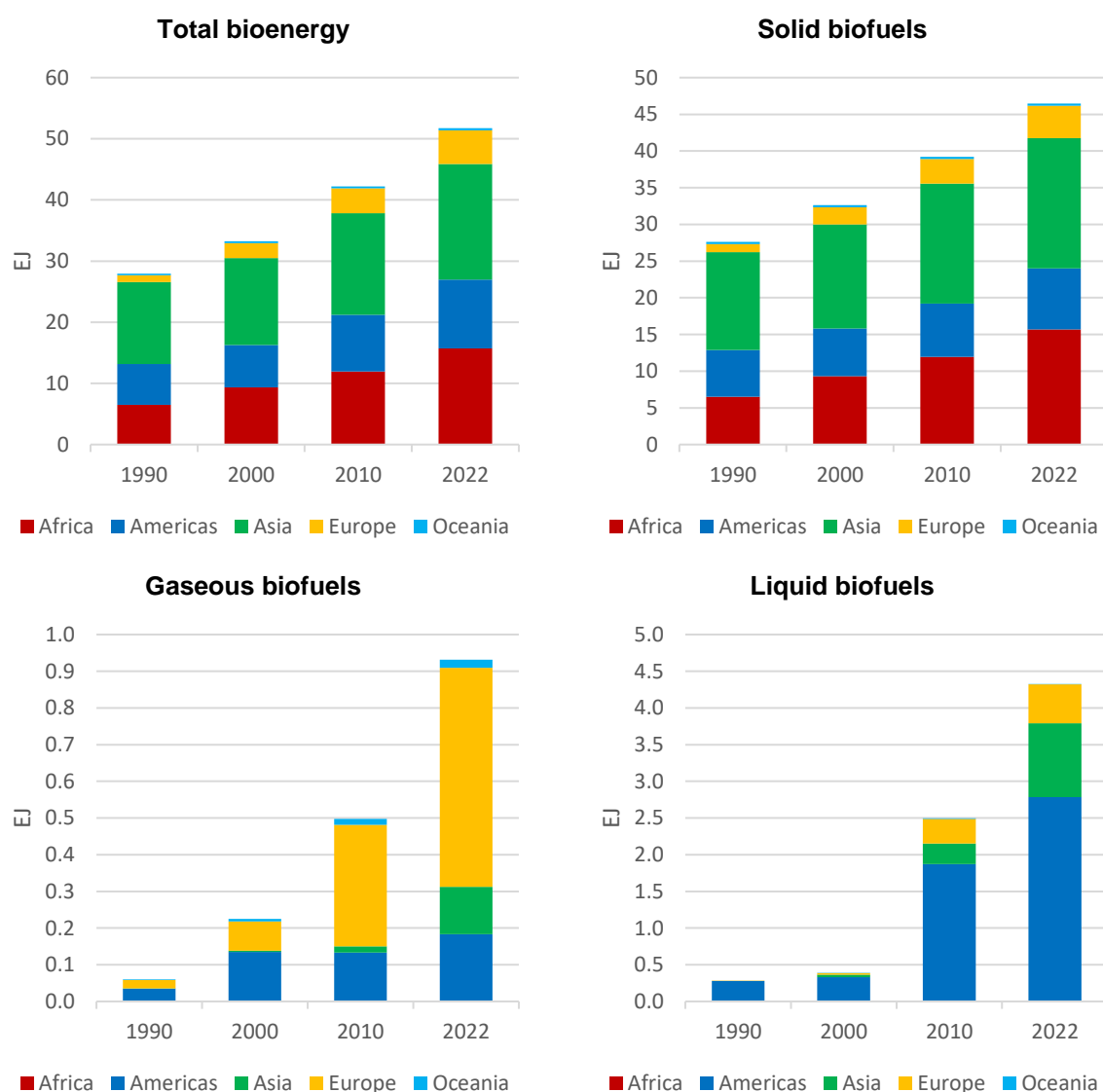
## REGIONAL

Asia (18.9 EJ) and Africa (15.7 EJ) were the leading producers of bioenergy in 2022, followed by the Americas (11.3 EJ), Europe (5.6 EJ) and Oceania (0.3 EJ).

As with total bioenergy, Asia (17.7 EJ) and Africa (15.7 EJ) were the largest producers of solid biofuels, which also accounted for nearly all bioenergy produced in Africa. In contrast, the other regions had a lower share of solid biofuels in total bioenergy production in 2022: 94 percent for Asia, 92 percent for Oceania, 80 percent for Europe and 74 percent for the Americas. In large parts of Africa and Asia, the majority of solid biofuels is consumed in the residential sector for cooking, which has a major impact on the environment (through deforestation), public health (due to the inhalation of hazardous smoke) and socioeconomic development.

Europe – led by Germany – was the largest producer of biogases (64 percent of the 2022 total), followed by the Americas (20 percent), Asia (14 percent) and Oceania (2 percent). The Americas – led by the United States of America and Brazil – was the top producer of liquid biofuels in 2022. As Europe and Asia developed their production of liquid biofuels, which represented 12 percent and 23 percent, respectively, of the world total in 2022, the share of the Americas in the global liquid biofuels production kept decreasing (from 100 percent in 1990 to 85 percent in 2000, 75 percent in 2010 and 64 percent in 2022) (Figure 5).

**Figure 5: Bioenergy production by region**



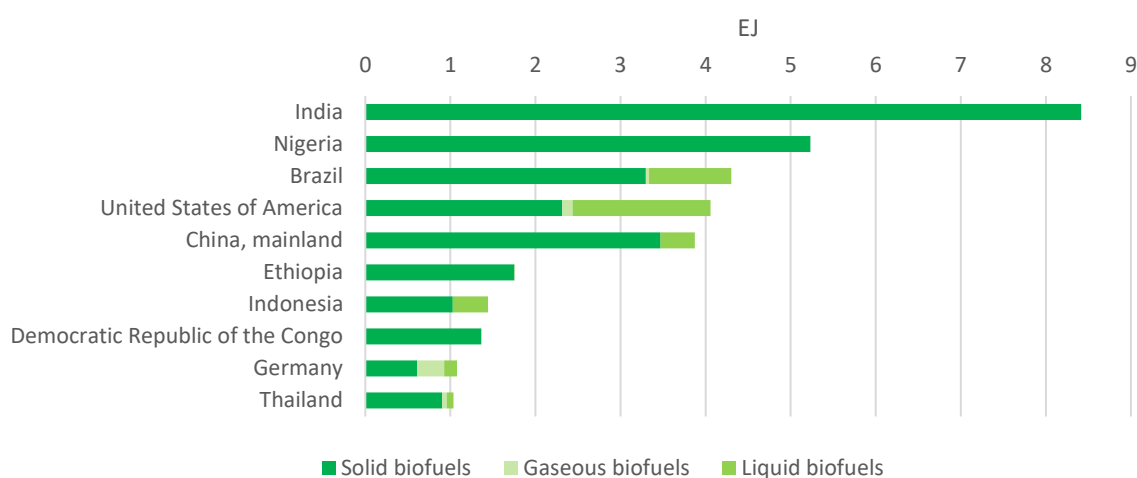
**Source:** FAO. 2024. FAOSTAT: Bioenergy. [Accessed June 2024].

<http://www.fao.org/faostat/en/#data/BE>. Licence: CC-BY-4.0.

## COUNTRY

The top bioenergy producing countries in 2022 were India (8.4 EJ), Nigeria (5.2 EJ), Brazil (4.3 EJ), the United States of America (4.1 EJ) and China (3.9 EJ). The next five largest bioenergy producers were Ethiopia, Indonesia, the Democratic Republic of the Congo, Germany and Thailand, all between 1 and 1.8 EJ (Figure 7). Solid biofuels accounted for nearly all bioenergy production in India, Nigeria, Ethiopia and the Democratic Republic of the Congo (illustrating the size of the energy consumption of the residential sector), compared to 57 percent in the United States of America and Germany (Figure 6).

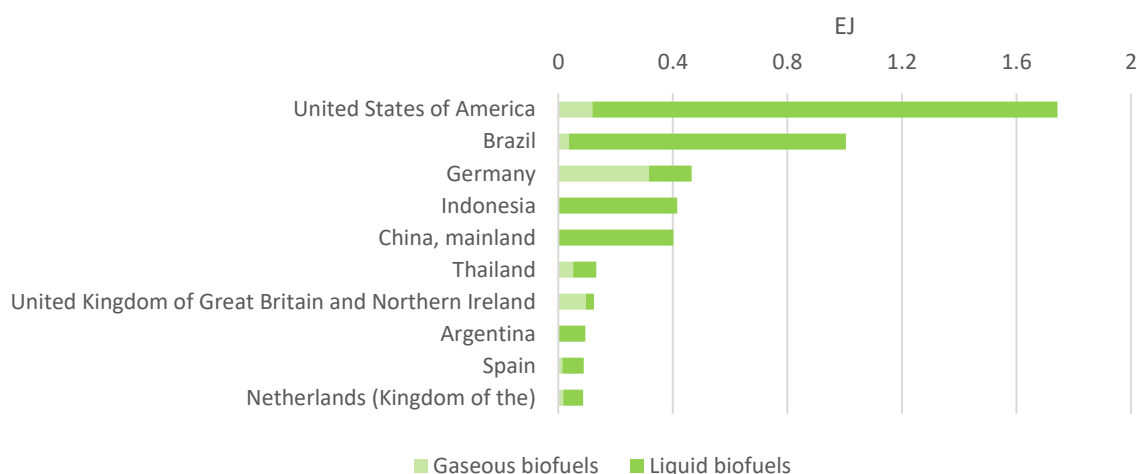
**Figure 6: Top bioenergy producers (2022)**



**Source:** FAO. 2024. FAOSTAT: Bioenergy. [Accessed June 2024].  
<http://www.fao.org/faostat/en/#data/BE>. Licence: CC-BY-4.0.

When considering only gaseous and liquid biofuels, the situation changes significantly. The United States of America (1.7 EJ) and Brazil (1 EJ) were the largest producers, and especially of biogasoline (produced mostly from maize in the United States of America and sugar cane in Brazil). The next tier of top producers comprised Germany, Indonesia and China, all around 0.4 EJ. While Indonesia and China only reported liquid biofuels production, biogases accounted for the majority of Germany's production of these more modern biofuels. In Thailand, the United Kingdom of Great Britain and Northern Ireland, Argentina and the Kingdom of the Netherlands, bioenergy production (excluding solid biofuels) was around 1 EJ in 2022.

**Figure 7: Top liquid and gaseous biofuels producers (2022)**



**Source:** FAO. 2024. FAOSTAT: Bioenergy. [Accessed June 2024].  
<http://www.fao.org/faostat/en/#data/BE>. Licence: CC-BY-4.0.

## EXPLANATORY NOTES

### Data sources

The main data source for the *production* and *consumption* of bioenergy is the United Nations Statistics Division (UNSD) Energy Statistics database, available at: <http://data.un.org/Explorer.aspx?d=EDATA>.

To address missing data in each fuel type's time series, a two-step methodology was employed: 1) linear interpolation is applied to estimate values between existing data points within the UNSD dataset; 2) any missing data in the period 2018–2022 is linearly projected forward on the basis of the last five available years, and five years backwards to 0 from the first available data.

The definitions, conversion factors and calorific values used are consistent with the [International Recommendations for Energy Statistics](#) (IRES), prepared by the Department of Economic and Social Affairs of the United Nations Secretariat (UNDESA).

### Data structure in FAOSTAT

The data on bioenergy in FAOSTAT are organised as follows:

- > **'Bioenergy consumption'** provides data on the final consumption of energy products, expressed in energy content. The conversion from physical units to energy is done by FAO according to the IRES and UNSD guidelines.
- > **'Bioenergy production'** provides information on the production of energy products, expressed in energy content. The conversion from physical units to energy is done by FAO according to the IRES and UNSD guidelines.

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