# Agricultural Residues For Distributed Generation Via Direct Combustion

How much can be harnessed and converted into electricity in a competitive way?

Elaboração: epe

**This fact sheet presents an assessment of the technical and economic potential for electricity generation through micro and mini distributed generation (MMDG) using agricultural residues.**

As a major food producer, Brazil generates billions of tonnes of residues every year. Studies show that, depending on the crop, between 30% and 50% of rural residues can be used for other purposes without harming low-carbon agricultural practices. Agricultural residual biomass can be used as fuel in thermal power plants. This model has been applied in various contexts for decades, with full domestic technological capability across the entire value chain.

If they have an installed capacity of up to 5 MW, these thermal power plants qualify as micro and mini distributed generation (MMGD) and participate in a net-metering system. This model, established under Law No. 14,300/2022, allows consumers to generate their own electricity and to inject surplus energy into the grid, which is credited and can be used for up to 60 months to offset electricity bills. Given the decentralized nature of agricultural production, there is a clear opportunity to harness the energy potential of agricultural residues under the MMGD framework.

The technical potential for the energy use of residues has been analyzed by EPE for several years. **The plataform SIEnergia consolidates historical data** on the potential of diferent substrates and conversion technologies

The map alongside shows the potential of agricultural residues and their geographic concentrations. A color-intensity scale is used, with lighter shades indicating lower potential.

**The technical potential for electricity generation via direct combustion (2022 data) reaches 175 TWh, corresponding to approximately 25 GW of installed capacity.**

The crops considered in the analysis were: cotton, rice, banana, sugarcane, beans, cassava, corn, soybeans, and wheat.

**Technical potential for electric Generation (data from SIEnergia 2022)**


## WHAT SHARE OF THE TECHNICAL POTENTIAL IS ECONOMICALLY VIABLE? SIENERGIA HAS THE ANSWER

Despite the high technical potential for biomethane production from residues, it is known that part of this potential is not economically viable for exploitation. EPE, through a Technical Cooperation Agreement with Itaipu Parquetec, developed a **simulator to assess economic viability**, which is available for installation on EPE's GitHub repository.

The tool enables the assessment of economic viability for the following technological pathways and applications:

- Anaerobic digestion of agricultural and livestock residues for biofuel production (here);
- Anaerobic digestion of agricultural and livestock residues for electricity generation;
- **Densification of agricultural residues for combustion in boilers for electricity generation and/or industrial uses – the focus of this fact sheet.**

## Assessment of Economic Potential Using SIEnergia

To carry out the assessments, the tool uses direct costs, operational and financial indicators, revenues, and the low-voltage market consumption capacity within the electricity distributor's concession area. More information about the tool can be found at the Usser's Manual and at Documentation.

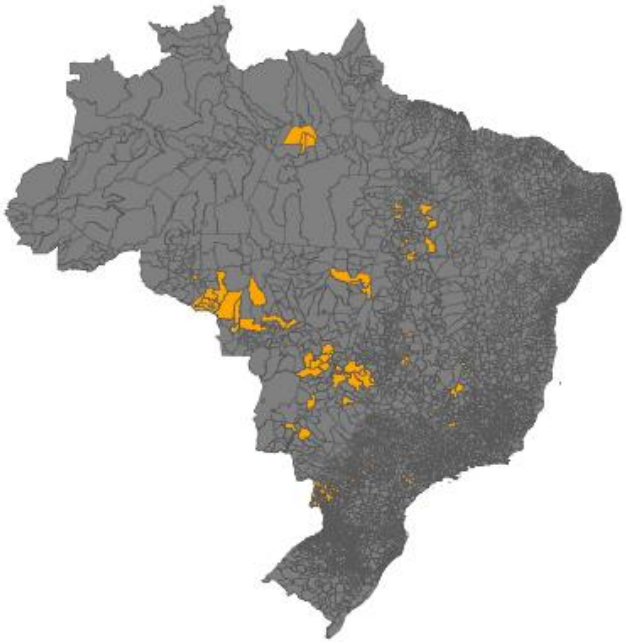
In this assessment, the tool's default parameters were used, assuming a revenue of R$ 500/MWh[1], which resulted in the identification of 526 plants in 25 cities, all with an installed capacity of 5 MW, consuming agricultural residues from 133 municipalities. Subsequently, simulations were carried out assuming a revenue of R$ 600/MWh, identifying 849 plants in 47 cities—one with 4 MW and the others with 5 MW—consuming residues from 307 municipalities. The results are presented in the maps below. These revenues can be considered conservative, given that electricity tariffs for low-voltage consumers range from R$ 527/MWh to R$ 940/MWh, excluding taxes, and from R$ 677/MWh to R$ 1,214/MWh, including taxes, according to ANEEL (July 2025 data), for end consumers.

[1]1 US$ = 5.50 reais in 2025

### Economic potential for electricity generation through direct combustion of dry biomass (2022 data)

**Electricity compensated at R$ 500/MWh**

**Total: 18 TWh/year with 2.6 GW of installed capacity**



**Electricity compensated at R$ 600/MWh**

**Total: 30 TWh/year with 4.2 GW of installed capacity**

Municipalities with economically viable biomass utilization

Municipalities without economically viable biomass utilization

Note: The map results represent a preliminary analysis based on the parameters used in the simulation. Economic viability may vary according to the specific characteristics of each project.

### WHAT DO THE RESULTS SHOW?

**Considering a conservative remuneration of R$ 500/MWh, the tool indicates the feasibility of producing 18 TWh/year, equivalent to about 3.2% of national electricity consumption. By increasing the compensation value to R$ 600/MWh, the potential generation reaches 30 TWh/year. Within the total agricultural residue potential, utilization increases from 5.4% to 10.4% when the compensation value is raised.**

- In the base case (R$ 500/MWh), utilization would rely on residues from more than 130 municipalities, supplying biomass to 526 plants located in 25 host municipalities (not shown on the maps).
- With higher remuneration (R$ 600/MWh), utilization would reach more than 800 plants across over 300 municipalities.
- This initial exercise indicates economic viability. However, there are additional market challenges to realizing this potential in practice, such as the lower modularity of projects and the more limited availability of suppliers when compared with photovoltaic generation, for example. Further studies are needed to explore these barriers and identify solutions for the development of this market..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