



Ministry of Foreign Affairs

MARKET RESEARCH:

BIOGAS AND BIOMETHANE CURRENT STAGE AND
OPPORTUNITIES FOR DUTCH COMPANIES IN BRAZIL

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MARKET RESEARCH

Biogas and Biomethane current stage
and opportunities for Dutch
companies in Brazil



MARKET RESEARCH – P125/2019

BIOGAS AND BIOMETHANE CURRENT STAGE AND OPPORTUNITIES FOR DUTCH COMPANIES IN BRAZIL

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Executive Summary

BIOGAS AND BIOMETHANE CURRENT STAGE AND OPPORTUNITIES FOR DUTCH COMPANIES IN BRAZIL

WELKOM IN BRAZILIË - HET LAND VAN DE BIOMASSA!

One of the main obstacles in Brazil for the spread of new biogas plants is not biomass supply, which is abundant and mostly free of charge. Biogas is yet quite unknown and treated as a venture instead of a consolidated technique.

The increase of the biogas production in Brazil has the potential to drastically improve the energy matrix through electrical, thermal or vehicular use. **The current potential can supply 36 % of the Brazilian electrical demand or replace 70 % of the diesel demand.**

This report aims to support Dutch companies to help develop the Brazilian biogas supply chain in a profitable, economically and environmentally sustainable manner. To this end, we studied the 5 main substrates available for biogas generation in Brazil (sugarcane, dairy products, swine, poultry and WWTP).

SUGAR CANE



Brazil is the world's largest producer of sugar and ethanol from sugar cane.

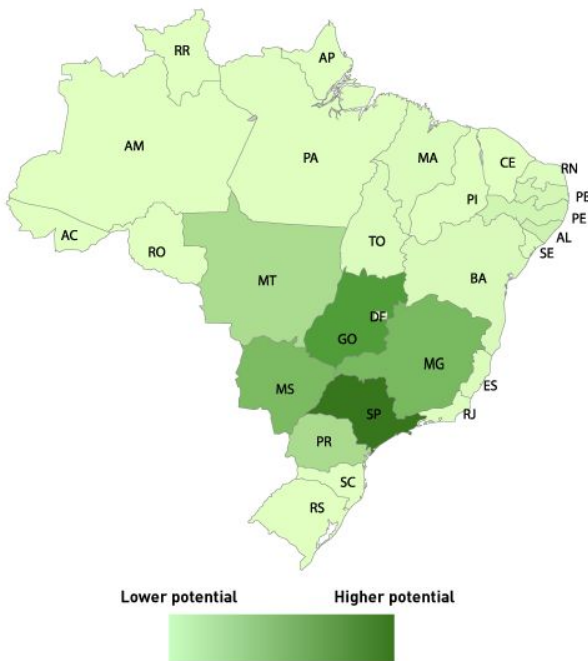
The main residues of the Sugar Cane industry are: bagasse, filter cake and vinasse. Bagasse and filter cake are produced either from sugar or ethanol production. Vinasse (figure) is exclusive for ethanol and registers the highest biogas potential.



Vinasse and filter cake, the main products available for biogas production, are generated inside the plant and can easily be directed to a bio digestion reactor. Bagasse are less

humid substrates than filter cake and vinasse and have a very high proportion of volatile solids. However, have a significant amount of lignocellulosic material that is difficult to degrade.

Sugar Cane - Methane Potential



Sugarcane may not be stored and is harvested during 9 months per year. During this gap there is no residues production, which is a problem for the biogas plant. Ethanol production from corn might be a solution.

The state of São Paulo (SP) accounts for 50 % of the whole Brazilian production. The methane potential in this state represents 1,8 billion m³ per year. The gas pipeline infrastructure in SP is the most attractive in Brazil for biomethane injection.

The high Brazilian knowledge in this sector, is related to the organization of sugarcane industries. In addition, it is notable that the high generation potential and the layout of the gas distribution lines support the production of biogas in this business.

DAIRY INDUSTRY



Cow milk production in Brazil is the third largest in the world with 33,5 billion liters of milk per year. In 2018 22 % was used by dairy companies, totaling 7,5 billion liters of milk.

The dairy industry stands out for having a large generation of waste (figure¹) rich in biodegradable organic matter. In the food processing sector, the dairy industry is

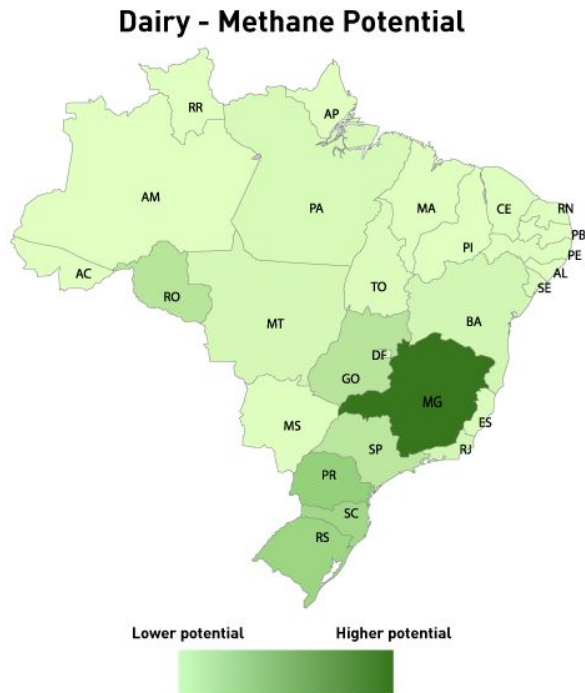


¹ Picture source: Dairy WasteWater <http://efluenteslaticinios.weebly.com>

considered the largest generator of wastewater.

For every liter of milk approximately 4 liters of organic effluent is generated, which must be treated and holds **strong biogas production potential**.

In addition to having high generation, biogas produced from residues from the dairy industry contains a high content of methane in its composition, reaching more than 60 % in its concentration.



The state of **Minas Gerais (MG)** represents **25 % of the Brazilian potential for methane generation** from dairy waste equivalent to 67 million m³ per year.

In spite of the leading role of MG in this branch of industry, the **potential of the southern region of Brazil** also deserves to be highlighted. Together, the states of PR, SC and RS represent 39 % of the national methane generation potential from this type of waste.

SWINE PRODUCTION



Brazil holds the 4th position on world swine herd with 24 million animals, behind China, EU and USA.

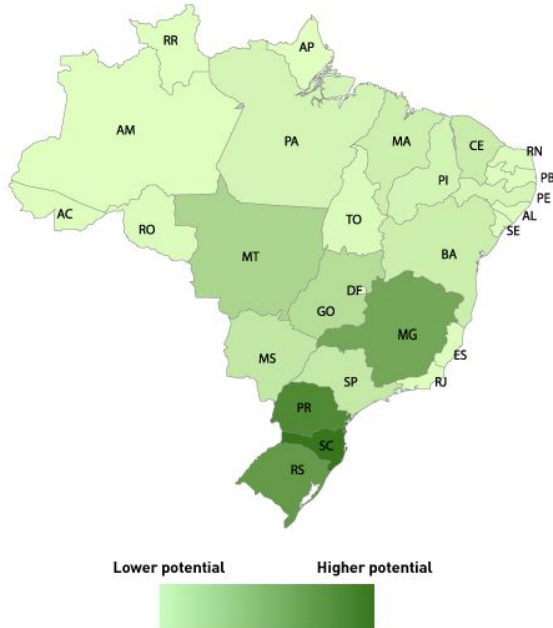
The residues from the swine termination units (figure) are the most appropriate for bio digestion, given the proportion of organic load, constant residue production and higher volume.



Confinement of the animals and the usually liquid consistency of the manure is favorable to the collection, transportation and treatment

of the residue. Consequently, it favours enterprises for the energetic recovery and biogas production.

Swine - Methane Potential



Biogas production is significant, recorded at a rate of 550 liters per kilogram of digested volatile solid.

75 % of all farming biogas plants benefits from swine production properties. Brazilian potential refers to an estimated herd of **23.5 million animals**.

The 3 states from South of Brazil (PR, SC and RS) account for 52 % of national production and registers a methane generation potential of 323 million m³ per year.

POULTRY PRODUCTION



Poultry protein surpassed pork as the most consumed protein in the world. Brazil has 11 % of the export market share.



There are two main types of poultry production in Brazil: broilers and layers. The left figure shows the effluent from the poultry barn of commercial egg production, which consists of the water used to wash the conveyor belts plus the manure. On the other hand, the figure on the right shows a 1 m² and 30 cm thick cut of broiler litter bed and details of thickness and composition can be observed.

Egg production results an effluent that may trouble-freely inputed in biogas plants. Meat on the other side produces the Broiler Bed, which is still a challenge (market price of

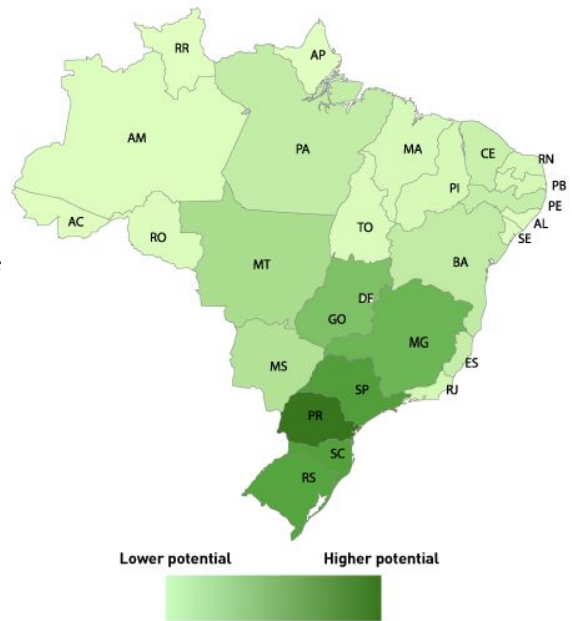
R\$ 60 per ton and demands extensive pre-treatment). The national biogas potential from Broiler Bed is 18x larger than layers' effluent.

The solution for highly efficient Broiler Bed biodigestion still does not exist.

The Brazilian potential for methane generation of broilers is 4.9 billion m³/year.

The potential of laying chickens corresponds to 270 million m³/year. The state of **Paraná (PR)** is the largest producer of broilers while **São Paulo (SP)** concentrates the largest share of egg production yield.

Poultry - Methane Potential



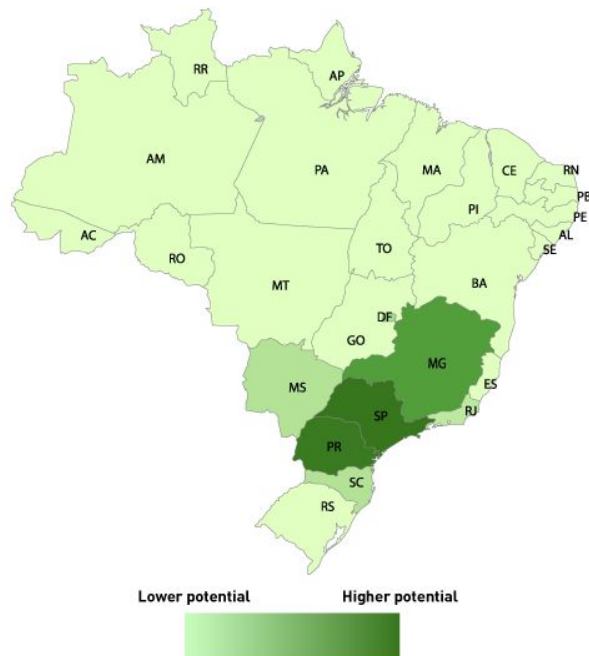
WASTE WATER TREATMENT PLANTS



Sanitation is still an issue in Brazil. In 2017 only 52 % of Brazil's total sewage was collected and, of this amount just 74 % was treated. Therefore, 38 % of the population has sewage treatment, and 62 % are improperly discharged.

Domestic sewage, or simply sewage, is the effluent generated when water is used to meet physiological needs and human hygiene, and sludge is the effluent generated during the treatment of domestic sewage; both can be used to biogas generation.

Waste Water Treatment Plant - Methane Potential



Two technical routes are suggested: UASB or CSTR reactors. Both have a weak spot. Effluent from a UASB may holds up to 40 % of the produced methane diluted in liquid form and



cannot be monetized. CSTR reactors work well on more extensive period of retention time and require extensive pre-treatment.

SP, PR and MG are the states with the largest sanitation infrastructure and consequently greatest biogas production potential. Only 14 WWTP in Brazil

benefit from biogas.

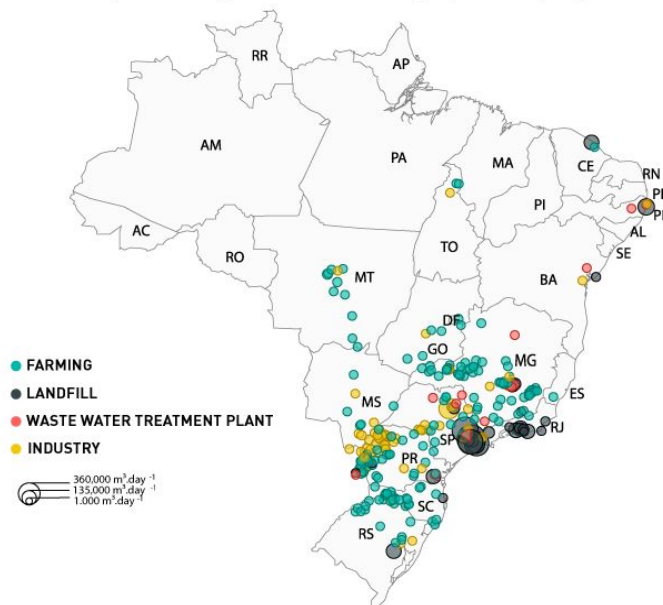
The use of biogas in these facilities (figure²) is restricted to regions of the country where there is a higher rate of collection and treatment of sewage. In addition, it should be noted that the **UASB technology is a point to be explored**, due to the great knowledge already disseminated in the country.

MARKET ANALYSIS



There are only 366 biogas plants listed in Brazil (<https://mapbiogas.cibiogas.org/>). Concentrated mostly in MG, SP, PR, SC and

Map with location, substrate type and volume of biogas produced per plant in Brazil



RS. Firstly it is important to highlight the **very small quantity of biodigesters in Brazil, which reflects the huge not yet fully explored engineering market.** Secondly, also important to preview, the extreme difference between sectors and country regions.

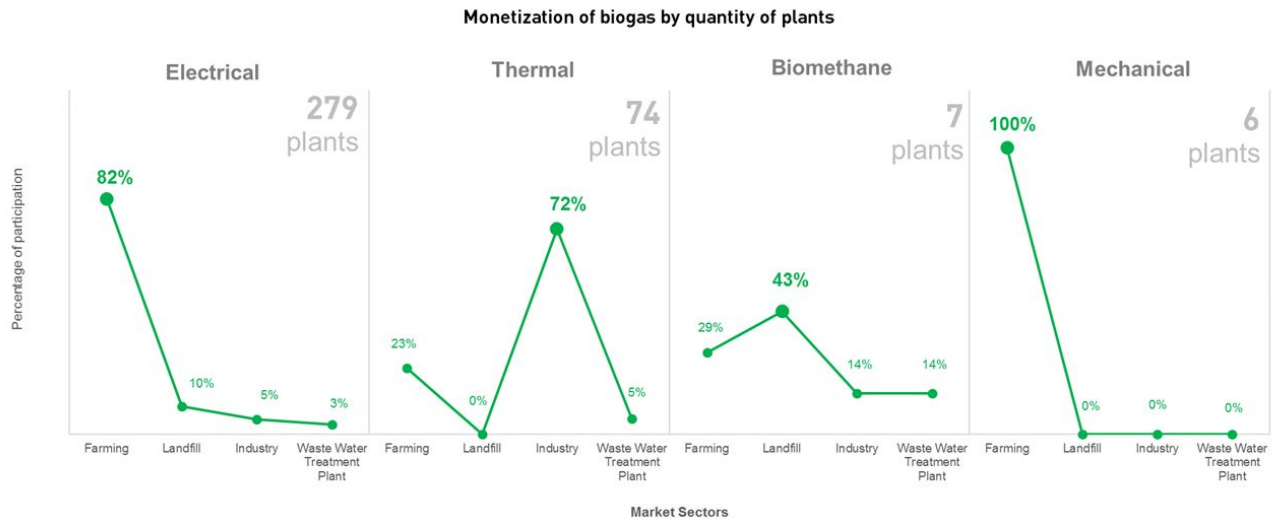
Farming sector benefits most from biogas.

Concentration of plants where the agribusiness is strong. Very few plants on industries,

² Picture source: WWTP - Ouro Verde/ SANEPAR - Foz do Iguaçu - Pr <http://site.sanepar.com.br/>

landfills or WWTPs. **Main business model option overall is electric power generation.** In the industry sector, thermal generation is most common.

22 % of all plants are still under construction; of which 100 % are for power generation and 85 % are being built to treat swine waste.



Biomethane must be highlighted. There are only 7 biogas refineries operating. State regulation for biomethane pipeline injection is from 2018. Germany has 114 times more biodigesters per m² than Brazil. The cities of Castro and Carambeí in the state of Paraná (PR) are reference on cow milk production, have a strong presence of dutch families and very few bio digestors.

REGULATORY MILESTONES



Furthermore, the legal conditions for the use of biogas and its by-products are not very clear to all parties involved. The consequence of the lack of precise information is mainly insecurity, which inhibits the willingness of actors to invest in this market and, on the other hand, reduces the profitability of projects by increasing costs and the time for their evaluation and approval.

The production and use of biogas is generally framed as ancillary activities within the enterprise as a whole. In cases of small plants, environmental licensing is dispensed in

most states. Brazil does not have a unified environmental law, so it is suggested that the state environmental agency be consulted prior to installation.

According to the CIBiogás database, **the average size installed capacity on a brazilian biodigester is of 67 kW** (or 0,067 MW). This is considered by the legislation standards as insignificant or small and, therefore, do not require great efforts for licensing.

The most representative bureaucratic effort is the license to export electric energy to the regional utility company in turn of consume compensation, also called net metering.

Electric generation is commonly monetized on-gridly through net-metering.

There is no minimum capacity restrictions in order to supply it with selling contracts on the Free Chamber. The major challenge is economical.

Net metering regulation will face new rules from 1st semester 2020. It is yet unknown the impact of the regulatory changes. ANEEL has suggested 5 alternatives of grid use fee. Some of them may turn net metering unfeasible

Problems with environmental licenses for plants in farming is uncommon.

Brazil is Federative Republic. Each state has particularities. This report holds instructive tables, lists the most relevant pieces and recommendations.

By 2021 it is expected to be implemented the free float of energy prices for residential consumption. This is a great opportunity for dispatchable plants.

By 2026 it is expected that there will be no demand restriction to buy energy from the Free Chamber. Today the minimum capacity is of 2.5 MW. Important to highlight, the Free Chamber of energy commerce shall not be affected by the new net metering regulation discussion by ANEEL.

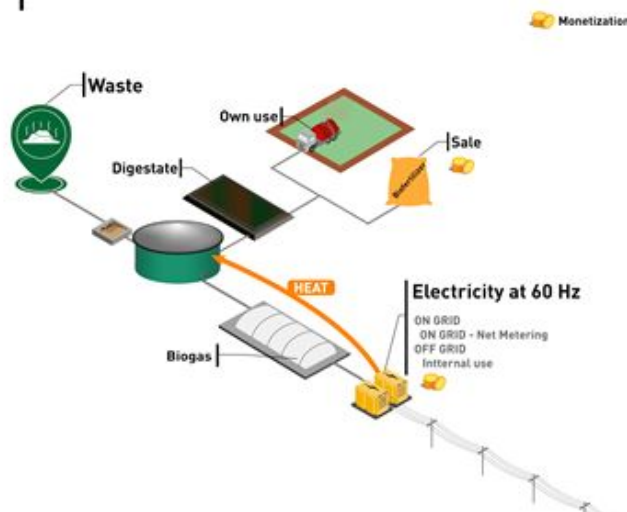
BUSINESS MODELS



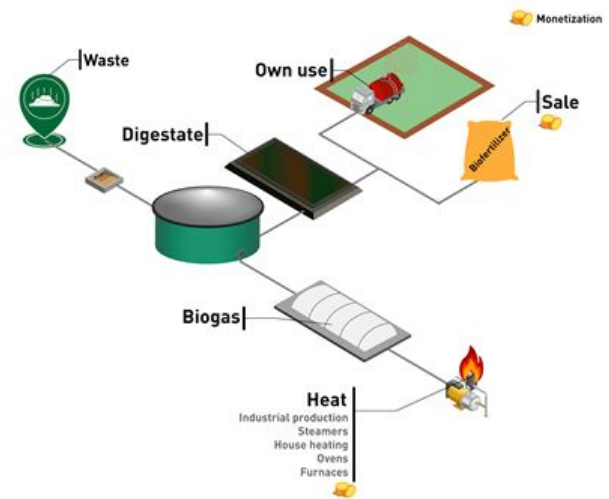
In one of the studies on technical arrangements carried out by CIBiogás, **270** alternative arrangements for monetization of biogas with **electrical energy** and **405** for **thermal** use were identified.

Biogas plants include in the cash flow the monetization of **electrical or thermal energy or biomethane**. Avoided expenses with treatment is also expressive.

Electricity utilization

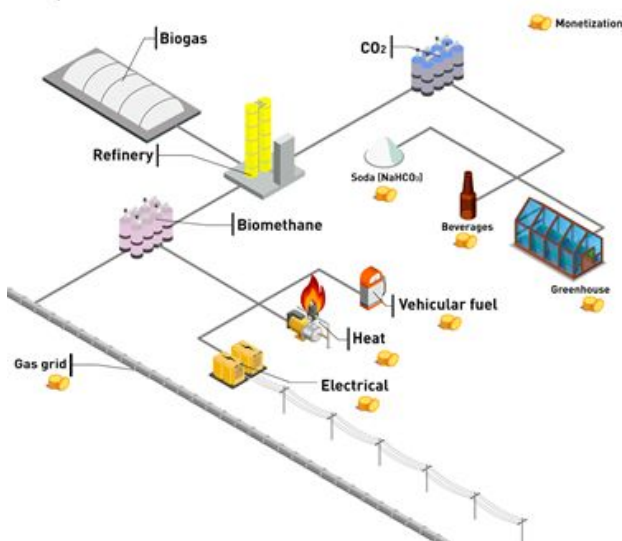


Possibilities of heat utilization



Electrical model involves a biodigester that produces biofertilizer and biogas, which in turn uses biogas as an energy source in a generator to produce electricity.

Possibilities with biomethane



In some cases the monetization of biogas in the form of heat is more advantageous. This happens in enterprises that produce organic waste and that demand thermal energy in their production line, such as starch mills, sugarcane mills, dairy plants and poultry incubators.

The refining of biogas results in biomethane. Biomethane can be injected into the gas pipeline network or used as a vehicle fuel or even as an input for the production of thermal

or electrical energy.

Biogas upgrading or refining produces by-products as CO₂ (carbonated beverages, soda or greenhouses).

Cerâmica Stein is a highly efficient farming biogas plant that works off-grid and should be used as an example of technical arrangement. See section 3.4.2 for details.

Some new energy surplus monetization is crypto mining and H₂ production.

In order to “sell” energy through net-metering legislation the plant owner may construct a rent contract of the plant to the energy customer.

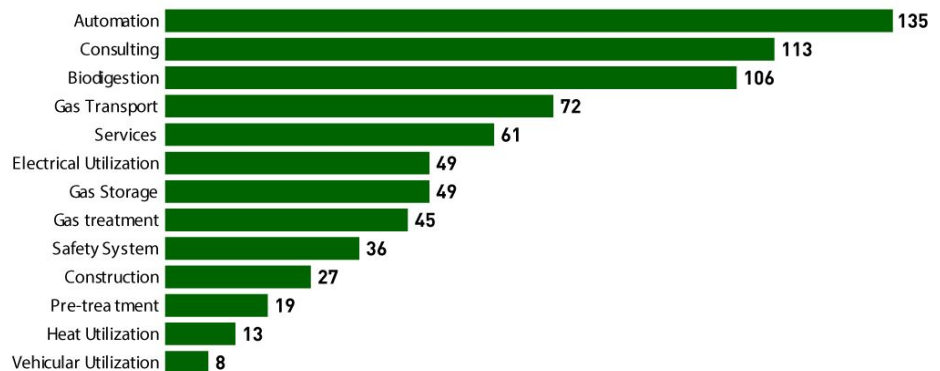
The first Microgrid is under construction by CIBiogás in PR and opens new markets.

SUPPLY CHAIN



This report contains a list of 418 companies with actuation branches and contact details. All of them had their fiscal status checked.

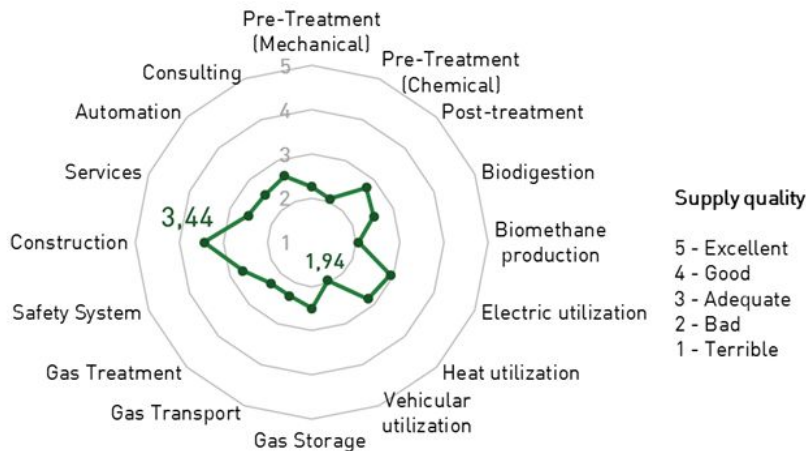
Many suppliers of services and products have been identified. The products with the largest number of suppliers in Brazil are of civil biodigesters works and consulting and maintenance services, while the products with the greatest lack of options are related to vehicle and thermal use.



The concentration is mainly in SP followed behind by PR, SC and MG.

This report brings up to date technical research results on the quality of national and international services and products for biogas in Brazil per step of the chain. The overall grade is of 2.5. An intermediate value between the classifications "bad" and "adequate".

The **best evaluated** sector was the **construction sector**, reaching **3.44** (value between adequate and good), while the one with the **worst evaluation** was the **vehicular use sector**, **1.94** (bad).



Shredders, refining, compressors and modern equipments are highly demanded.

One of the main technologies to be explored in the Brazilian biogas market is **refineries the biogas to biomethane.**

The options currently

available have configurations incompatible with the practical conditions found in Brazil, which implies the need for tropicalization of this technology.

Furthermore, currently, the Brazilian market of equipment in this field needs suppliers that ensure products and **after-sales services** with adequate quality.

BRAZILIAN BUSINESS CULTURE

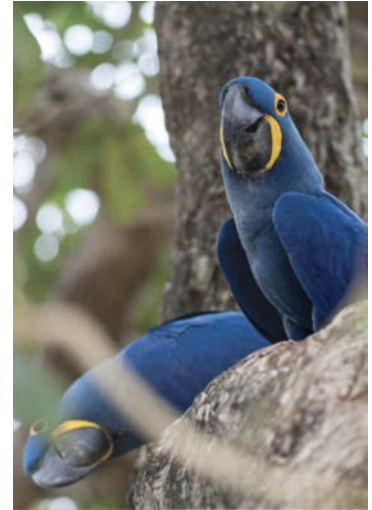


“Brazil is not for amateurs”, “Brazilian *jeitinho* (~shortcut)”, “tons of bureaucracy” and “I know someone that will help” are common sentences when talking about doing business in Brazil.

The [Embassy of the Kingdom of the Netherlands in Brazil](#) and [Dutcham](#) have promoted two very interesting publications on the Brazilian Business Culture with testimonials of important dutch companies in Brazil as of Makro, ING, Heineken, Boskalis, KLM and AkzoNobel. See on references. Some tips on how to deal it with brazilians:

- **Personal contact** is essential to building a successful business relationship, so do spend some time on personal contact and don't jump straight to business.

- Brazilian³ negotiate with people and not with companies. **Personal relationships take priority over institutions, laws and regulations.**
- Being too direct or avoiding the **usual small talk** may be seen as unpolite.
- Brazilians avoid conflicts. It is hard to hear a straight NO. More often a YES, BUT...
- Communication in Brazil has a strong presence of **non-verbal** or between the lines.
- Silence is also a communication and may be interpreted as lack of interest.
- Using a few words of Portuguese in a conversation generates a lot of goodwill. **Brazilian Portuguese** is different from Portuguese in Portugal. Brazilians do understand a bit of Spanish, but if possible, better speak in English.
- **Lack of punctuality** and **postponement of important decisions** and common.
- **Speech interruptions** may be interpreted as sign of interest and not of disrespect.
- Brazil has the **size of a continent**. There are many consumer cultures in it.
- **Appearance** is very important in the Brazilian culture.



³ Picture source: (DUTCHAM, 2019)

Dear Dutch Companies,

hopefully this summary has awoken your interests on the Brazilian biogas market.

The full report contains many interesting data, pictures and tips gathered specially for You by effort of your Netherlands Business Support Office (NBSO) in Brazil.

Throughout this report You will be able to:

- identify the main regions and substrates for biogas production and suppliers;
- analyse supply gaps on equipment and services for national biogas industry;
- access a quick guide on electric sector regulation;
- get tips on how to deal business in Brazil;
- learn about successful and yet-to-be-built business models;
- explore the location and profile of every classified biogas plant in the country;
- identify CIBiogás as an international, neutral and optimal associate partner to support Your business venture in Brazil.

We will be glad to hear from You! Please contact us!



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