Brazil Biomethane sector evolution & case study

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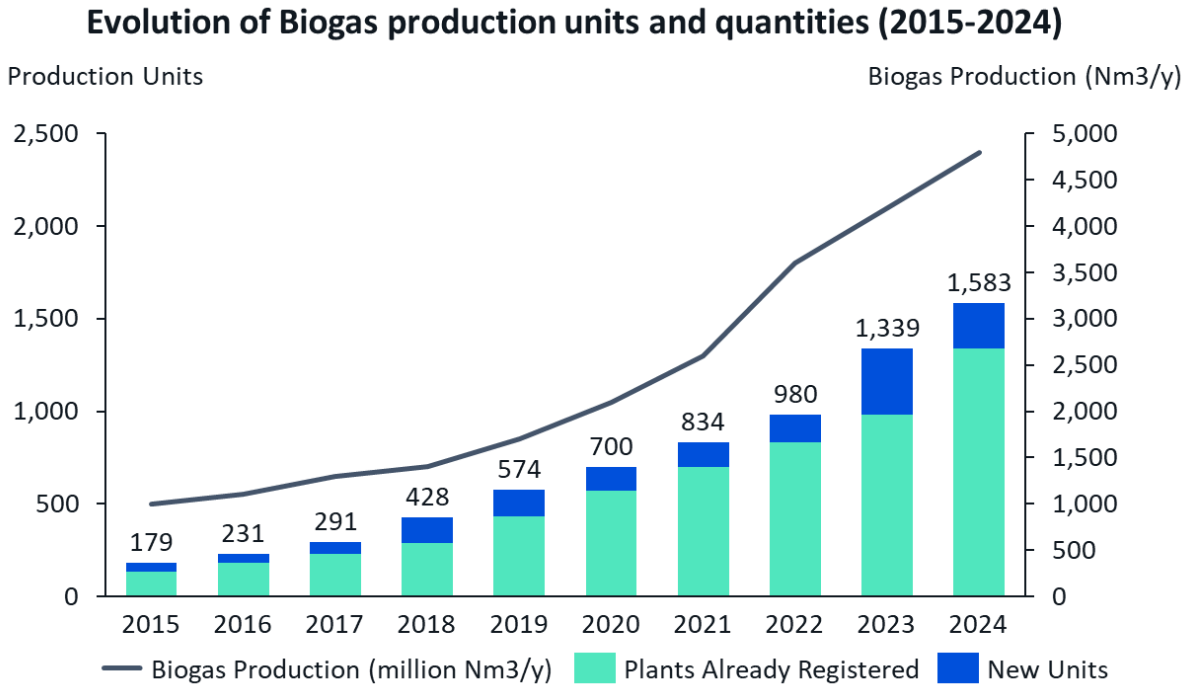
BIOMETHANE SECTOR IN BRAZIL

How did it grow so rapidly and what can we learn from it?

Introduction

As the Asia Pacific explores the development of biofuels to decarbonise its energy systems, biomethane stands out as a solution, while also presenting great challenges. In this context, it is worth examining other markets, particularly those with similar characteristics, that have successfully built and grown biomethane production capacities, enabling this green fuel to decarbonise various sectors.

Biogas is produced through the anaerobic digestion of organic matter and is composed of around 50% of methane (CH4), carbon dioxide, and trace gases. When upgraded, biogas becomes biomethane, a low-carbon fuel that can be a direct substitute for natural gas. As such, biomethane can be used to power combined-cycle gas turbines, combined heat-power plants (CHP), and used in any transportation applications that operate on compressed natural gas (CNG) or liquefied natural gas (LNG).



Source: CIBiogas Biogas Overview 2024

On the other side of the world, Brazil has been quietly growing its biomethane production over the past decade, based largely on its strong agricultural economy. While Brazil is widely known for its leadership in

bioethanol production, this article primarily focuses on its waste-based1 production of biogas/biomethane. Biogas production went from less than 1 billion cubic meters annually in 2015 to over 4.7 billion cubic meters in 2024. Today, about 57.5% of the biogas produced is used to generate electricity, while the remainder is upgraded to biomethane (1.7 billion cubic meters). The number of operating plants went from less than 200 in 2015 to over 1600 plants in a decade, across various regions in the country. Plant capacities have also increased, reflecting the maturation of the feedstock supply and consolidation of the demand.

Brazil presents an interesting case study worth delving into when it comes to the mix of bottom-up efforts and advocacy that helped drive greater awareness, understanding, and policy leadership to unlock a massive supply of biogas into a market that had already traditionally used natural gas for a range of industrial and commercial activities.

Regulatory Framework

Even though pioneering biomethane production projects have been operating in Brazil since 2014, the first dedicated technical regulation was published only in 2015 (ANP[2] Resolution 8/2015). This technical regulation established the first quality standards for biomethane from agricultural waste, and was followed by one for landfill and sewage gas (Resolution 685/2017). This early-stage initiative was triggered by the mobilisation of producers, regulators, and network operators to jointly address technical, safety and interoperability challenges, and started the regulatory development that created the conditions for scaling biomethane.

RenovaBio

The National Biofuels Policy (RenovaBio), enacted in late 2017, was born out of Brazil's commitments to the Paris Agreement (NDC). The government recognized that while the country was a leader in liquid biofuels (ethanol), its gaseous potential was being flared or wasted.


Brasilia, João Pavese, Pexels

The policy was designed as a market-driven mechanism rather than a subsidy. It introduced CBIOs (Decarbonization Credits), which represent one tonne of CO2 avoided. The kink in the production growth curve seen in 2017 corresponds directly to the policy's launch, which provided the long-term predictability developers needed. By assigning a financial value to the green attributes of the fuel, RenovaBio transformed biogas from a waste-treatment expense into a revenue-generating energy asset.

To ensure the integrity of the credits market, Brazil implemented a rigorous certification system. Biomethane's identity is audited and verified through a system of enablers:

- **RENOVACALC:** A scientific tool that performs a Life Cycle Assessment (LCA) of the biomethane. Producers are assigned an efficiency score based on their specific feedstock and production process.

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[1] While Bioethanol in Brazil is produced from sugarcane feedstocks that is cultivated (1st generation biofuels), biomethane production is from agriculture residues and waste (2nd generation biofuels)

[2] Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (ANP) - Brazilian National Agency for Petroleum, Natural Gas and Biofuels

- **CBIO ISSUANCE:** Only certified producers can issue CBIOs, which are then traded on the stock exchange (B3).
- **GUARANTEES OF ORIGIN (CGOB & GAS-RECS):** Beyond RenovaBio, the market evolved to include **Gas-RECs** (managed by Instituto Totum) and the more recent **Biomethane Guarantee of Origin Certificate (CGOB)**. These allow companies to "claim" renewable gas usage even if they are not physically connected to the producer, facilitating a book-and-claim system similar to the I-REC market for electricity.

Nevertheless, several key challenges remained for developers. Biomethane injection was needed to help this market take off, but there were issues in achieving that:

- **STRICT STANDARDS:** Early developers struggled with the strict ANP requirement of 96.5% methane concentration[3]. Small-scale plants often lacked the expensive membrane or water-scrubbing technology needed to achieve this level of purity, leading many projects to remain as "captive power" (onsite electricity) rather than injecting gas into the grid.
- **COASTAL VS. INLAND DIVIDE:** Most Brazilian gas pipelines run along the coast, while the massive sugarcane and livestock feedstock hubs are located deep in the interior. This created a logistical bottleneck, forcing the development of "virtual pipelines" (transporting compressed biomethane by truck), which adds significant cost.
- **GRID ACCESS NEGOTIATIONS:** Despite the New Gas Law, early developers faced complex negotiations with state-level gas distributors who were often unaccustomed to receiving gas from dozens of small, decentralised injection points rather than a few large offshore platforms.

Fuels of the Future

The Fuels of the Future law, published in 2024, is a set of measures by the Brazilian government to accelerate the energy transition and decarbonize the transportation matrix. It encourages the use of renewable fuels, such as ethanol, biodiesel, and biomethane, and sets targets for reducing greenhouse gas (GHG) emissions.

The program introduces the National Program for the Decarbonization of Natural Gas Producers and Importers and Incentives for Biomethane, which sets mandatory targets for the gradual increase of biomethane in the gas mix, ranging from 1% to 10%, starting in January of 2026.

The policy has already triggered relevant investments, including a R$ 345.3 million project by Raízen for its second biomethane plant, and a R$1.3 billion initiative by Virtu GNL, Eneva, and Edge to develop a 3,000 km green LNG corridor connecting Port of Santos to Port of São Luís.

State-level policies

Beyond federal instruments, Brazil's biomethane expansion was significantly shaped by local policies, some of which were published earlier. Several states have developed their own regulatory frameworks, incentives, and mandates, often tailored to local resource availability and infrastructure conditions.

States such as São Paulo, Paraná, and Rio de Janeiro have taken the lead by introducing measures, including funding, tax incentives, regulations on biomethane injection into gas distribution networks, and, in some cases, mandatory blending targets for biomethane in natural gas grids.

This dynamic can be highly correlated with ASEAN countries. Much like Brazilian states, ASEAN member countries operate with regulatory autonomy, reflecting diverse energy mixes, institutional capacities, and

[3] This was the requirement from Resolution No. 08/2015 for the South and Southeastern grid that represented majority of the demand; and subsequently relaxed to 95% purity as part of Resolution No. 906/2022.

stages of market development. While this flexibility enables tailored national strategies, it can also slow regional market formation for emerging fuels such as biomethane.

Local incentives, aligned with federal regulations, are a key lesson from Brazil for catalyzing biomethane projects. However, as the market matures, coordination mechanisms become critical. For ASEAN, this could translate into the gradual development of regional standards for biomethane quality, certification systems, and cross-border trade frameworks.

Biomethane upgrading and grid injection

The ability to upgrade biogas into biomethane and inject them into the gas grid was a very important milestone for the biogas markets for two reasons: (1) it radically reduces transport cost of delivering the gas to customers and enables you to serve customers who are further out but connected to the gas grid; (2) it enables market-based instruments for biomethane (eg. Guarantees of origin or renewable gas certificates) to be traded to realise the green premium present in the market. The challenges outlined above remain, and the perceived risks made it difficult for financiers to provide financing for these projects, while offtakers were unable to commit.

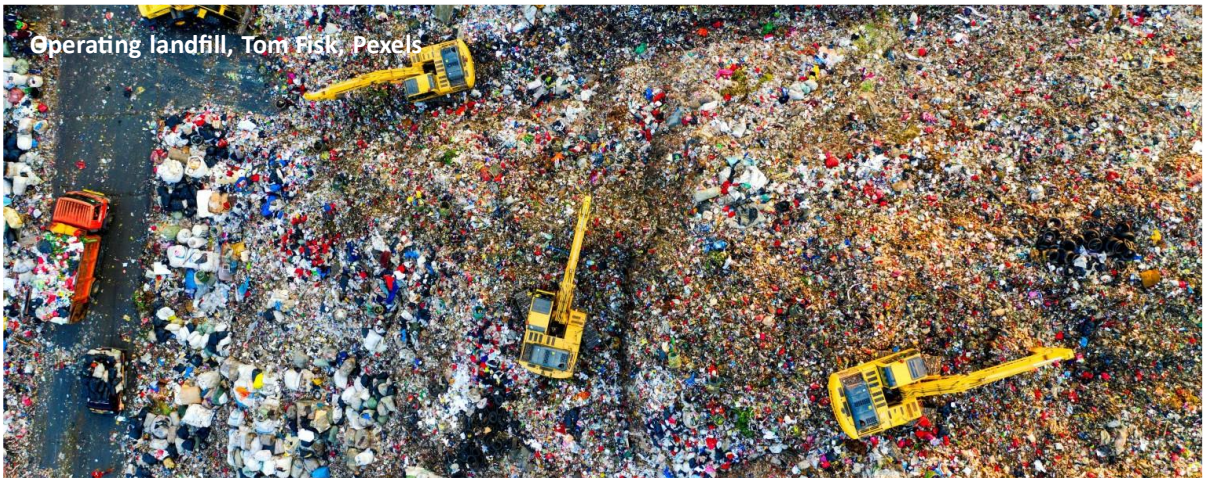
The development of Brazil's biomethane sector began with pioneering initiatives in landfill gas upgrading. The first facility to convert biogas into biomethane was GNR Dois Arcos in Rio de Janeiro, which began operating in 2014 under incentives established by state legislation. Despite this early initiative, the regulatory framework for landfill-derived biomethane was slower to be established due to the technical complexities of this feedstock, so the project compressed the biomethane to supply industrial consumers.

In contrast, the specification for biomethane produced from agro-industrial and commercial sources was previously regulated by ANP Resolution No. 8/2015. Specific national regulations for biomethane from landfills were introduced only in June 2017, via ANP Resolution No. 685/2017. GNR Dois Arcos in Rio de Janeiro sold their biomethane via compressed natural gas (CNG) trucks to industrial consumers.

Shortly thereafter, additional projects began to emerge. One of the most notable was GNR Fortaleza, a large-scale facility in the state of Ceará that became the first plant in Brazil to effectively inject biomethane into a natural gas pipeline, with a daily production capacity of around 100,000 m^3. The project also marked another milestone by becoming the first biomethane plant certified under RenovaBio, enabling it to generate and trade CBIO decarbonization credits.

From 2018 onward, new initiatives rapidly moved from planning to implementation. Production volumes accelerated significantly, driven in particular by the entry of major players from Brazil's sugar-energy sector, which began developing large-scale biomethane projects based on residues from sugarcane processing.

The proof of concept to get across the gap came through landmark projects like the GNR Dois Arcos landfill in Rio de Janeiro, which in 2017 became the first in Brazil to inject biomethane directly into a piped


Operating landfill, Tom Fisk, Pexels

distribution network (CEG). Shortly after, the sugarcane sector, —led by giants like Raízen through its joint venture with Geo Biogás—proved that agricultural waste could meet the same rigorous ANP standards. These early movers were critical because they forced Federal- and state-level gas players to develop regulatory, commercial, financial, and technical protocols for reverse-flow injection in biomethane projects. By demonstrating that biomethane was chemically indistinguishable from fossil natural gas at the point of delivery, they lowered the perceived risk for industrial off-takers in the ceramics and glass sectors, who require extremely stable gas quality for their furnaces. These projects were fundamental to enabling the commercialization of biomethane and the development of the market, while also ensuring its equivalence and full interchangeability with natural gas, regardless of blending levels. In addition, the establishment of these regulatory standards enabled the effective incorporation of biomethane into Brazil's national energy planning over the short, medium, and long term.

The sector truly took off when it bridged the infrastructure gap using virtual pipelines. In regions where the physical grid does not reach the agricultural interior, companies like Cocal and Adecoagro deployed fleets of high-pressure trucks to transport compressed biomethane directly to industrial clusters. This hybrid approach allowed producers to secure long-term contracts and scale up production before committing to the heavy CAPEX of pipeline construction. This momentum has culminated in the 2024 Fuels of the Future law, which as of January 2026, officially mandates a gradual reduction in greenhouse gas emissions from natural gas importers and producers. This mandate has effectively shifted biomethane from a niche ESG project to a mandatory industrial commodity, sparking a new wave of investment in mega-plants capable of producing over 100,000 m3 per day.

Gas Market and end-uses

The Brazilian natural gas market operates within a complex regulatory and geographic context, shaped by the country's continental scale and a division of competencies between the federal government and the states. While the Union is responsible for regulating upstream activities and gas transportation, state governments retain authority over gas distribution to final consumers. This interposition of regulatory frameworks, combined with long distances between supply and demand centres, adds structural complexity to market development and requires careful coordination across different levels of government.

Long-haul transport, Messala Ciulla, Pexels

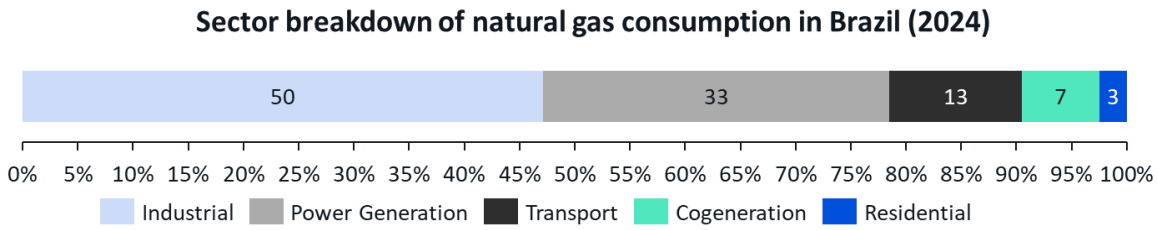
Historically, the production and transportation of natural gas in Brazil was a vertical monopoly controlled by the state-owned giant, Petrobras. However, the New Gas Law (Law 14.134/2021) fundamentally redesigned the landscape, by replacing the concession model with an authorisation-based regime for gas transportation services, covering the construction, expansion, operation and maintenance of transportation facilities. In practical terms, this change significantly reduced regulatory and administrative barriers to accessing the midstream segment, facilitating the entry of new players and improving access to gas transportation infrastructure.

Brazil's gas transportation network is relatively limited in territorial reach and largely concentrated along the coast, and the New Gas Law primarily affected access to this gas pipeline, while gas distribution to final consumers remains a state-level monopoly. However, for the biomethane sector, third-party access to transportation pipelines was a key catalyst, as major biomethane production hubs are often located in

different states from those with the largest gas demand. By easing access to the midstream segment, the new regulatory framework has enabled biomethane producers to better connect supply with demand across regions, supporting the expansion of this low-carbon fuel in Brazil.

Three main sectors account for over 90% of natural gas consumption in Brazil annually.:

- **INDUSTRIAL SECTOR (~47%):** Heavy reliance on natural gas for the ceramics, glass, chemical, and pulp and paper industries. These sectors require high-calorific heat that electricity often cannot efficiently provide
- **POWER GENERATION (~31%):** Used in gas-fired power plants that provide baseload stability when hydropower levels are low.
- **TRANSPORT (~12%):** Brazil has one of the world's most mature markets for compressed natural gas (CNG) vehicles. There is a nationwide network of fueling stations and a fleet of light and heavy vehicles equipped to run on CNG.



Source: ANP (National Agency of Petroleum, Natural Gas and Biofuels) Statistical Yearbook 2025

Biogas plants in Brazil, prior to systematic policies, were typically small-scale, decentralised, and generating power for self-consumption. Most of them were anaerobic lagoons or ponds that used agricultural waste. A lot of the biogas were flared due to overproduction relative to the onsite electricity generation capacity.

The turning point came when the industry stopped viewing biogas as a waste-management byproduct and started treating it as a refinable energy commodity. By shifting from raw biogas (used for inefficient onsite power) to upgraded biomethane, producers tapped into the massive, pre-existing natural gas infrastructure. Instead of flaring excess gas, they began upgrading it to meet ANP standards, allowing it to be sold at a premium to industrial off-takers eager to meet ESG targets.

Vision for the future

The transition from voluntary adoption to a regulated, high-growth market reached its zenith with the enactment of the Fuels of the Future Law (Law 14.993/2024). This legislation has fundamentally shifted the market dynamic from mere incentives to a decarbonisation mandate. Under this framework, all natural gas producers and importers are now required to reduce their greenhouse gas emissions by an initial of 0.5% for 2026[4], with a trajectory designed to reach 10% by 2034. This mandate provides the long-term visibility that could enable large-scale institutional investment, effectively de-risking the construction of mega-plants that require decade-long off-take certainty.

The political feasibility of such a bold mandate was rooted in a unique alignment between Brazil's powerful agribusiness sector and industrial energy consumers and producers. Agribusiness saw the law as a way to

[4] While the Fuels of the Future Law originally established a statutory floor of 1% for emissions reductions, the National Energy Policy Council (CNPE) officially set the mandate at 0.5% for 2026 during its meeting on 1 April 2026

turn environmental liabilities into a high-value energy commodity, while industrial sectors, facing international pressure to green their supply chains, needed a reliable domestic source of renewable fuel.

Specifically for the biomethane, the Program established the Biomethane Guarantee of Origin Certificate (CGOB) and the tool to guarantee the proper valuation of the environmental attribute of biomethane. The CGOB certify the targets' accomplishment by the natural gas producers and importers. This instrument allows for the decoupling of the physical molecule from its environmental attribute. Meaning that a factory in the coastal industrial south can now meet its regulatory obligations by purchasing CGOBs from a biomethane plant located thousands of miles away in the agricultural interior, bypassing the immediate need for a physical pipeline connection.

This attribute-based trading system also enables the liable players for the mandate to fulfil their share of the requirement without changing the underlying physical flow of gas. This market-based approach is expected to spark a massive influx of capital into the biomethane sector, with over R$ 25 billion in investments projected by 2030[5]. Major players like Petrobras have already initiated procurement calls to fulfil their mandates, which has in turn stabilised the market for smaller independent producers.


Oil palm plantation, Pok Rie, Pexels

Lessons for Asia Pacific

The experience of Brazil brings fresh insights for the biogas industry and players in Asia Pacific, as it differs slightly from the strong government-directed approach that is common in Europe, which has also seen very strong growth and uptake of biomethane.

The first lesson from Brazil is the power of a unified industry voice to change the narrative. The Brazilian Biogas Association (ABiogás) succeeded by reshaping the narrative and reframing agricultural residues previously seen as environmental liabilities as strategic and valuable green energy resource.

For markets like Indonesia, Malaysia, or Thailand, the narrative could shift from "treating waste" to "valuing co-products". Instead of focusing on the disposal of Palm Oil Mill Effluent (POME) or rice husks, advocacy could frame these as "Domestic Energy Hubs" that reduce reliance on imported gas. By positioning biomethane as a pillar of national energy sovereignty, the sector can secure the high-level political support necessary to unlock subsidies and grid access.

Brazil's biomethane market growth wasn't an overnight miracle; but the sequence of policies enabled it to take root and develop. It started with a market-driven incentive (RenovaBio) that rewarded carbon

[5] ABEGAS, Association of Brazilian biogas distributors (2025) news release here (Portuguese).

reduction, followed by infrastructure liberalization (the New Gas Law), and finally, a mandatory decarbonization mandate (the "Fuels of the Future" Law).

Asia Pacific governments could design a policy sequence that gradually converges toward a mandate by first nurturing the ecosystem. They could first ensure that enablers such as certification standards, green attribute instruments, and frameworks are in place. A successful roadmap for APAC would begin by establishing Guarantees of Origin (GOs) or Renewable Gas Certificates to allow early adopters to pay a green premium. These systems also play a role in ensuring rigorous land-use and environmental safeguards that would ensure the sustainability of the fuel produced[6]. Once the certification infrastructure is mature, governments can then introduce blending mandates for industrial gas users, providing the long-term price certainty that lenders require to finance large-scale projects.

The third lesson is that biomethane is rarely profitable as a standalone energy product; its success depends on a multi-stream revenue model. In Brazil, the most resilient projects operate as bio-refineries, selling not just the gas, but also biogenic carbon dioxide for the food and beverage industry and high-quality bio-fertilisers for the surrounding farms. Biogenic carbon dioxide certification is beginning to emerge though not yet common in the market, with a system from Instituto Totum[7], which was previously involved in renewable energy certificates.

In many APAC countries, the high cost of imported chemical fertilizers is a major pain point for the agricultural sector. By positioning biomethane plants as bio-fertilizer factories that happen to produce green gas, developers can tap into agricultural subsidies and create a circular economy that benefits local farmers. This circular approach makes the project's bottom line less vulnerable to fluctuations in global natural gas prices. Countries in APAC that are still developing and yet have large agriculture sectors can view this biomethane production as part of the agricultural industrialisation that continues to bring livelihood, benefit the agriculture sector while growing the low-carbon energy space and generating less waste.

Brazil has proven that a rapid scale-up is possible when agricultural waste is treated with the same regulatory rigor as a traditional gas field. For APAC, the opportunity lies in its massive, decentralized biomass base. Developing an ambition for the bioeconomy and providing a clear pathway from voluntary incentives to mandatory integration, the region can transform its rural heartlands into the backbone of its future energy system.

[6] For Asia Pacific markets looking to supply Europe and global markets, it would be necessary to ensure the frameworks are in line with CSRD and EU Taxonomy expectations

[7] Instituto Totum's CO2-REC Certification framework