Motivating Factors Driving Renewable Natural Gas (RNG) Development in a Shifting Energy Landscape

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Abstract

Renewable Natural Gas (RNG) is an energy source created by capturing methane emitted from the decomposition of organic matter, such as manure, food waste, and wastewater. The process aims to eliminate methane emissions that would otherwise be lost to the atmosphere while simultaneously allowing for an additional fuel source.

Motivating factors for the demand of RNG development exist in a constantly shifting landscape crafted by political, environmental, societal, and financial market factors. By supporting the development and adoption of RNG, power producers can better provide for the energy needs of consumers. The combination of environmental benefits and supportive market incentives will help position RNG as a critical renewable energy pathway within the evolving, global energy transition.

This paper outlines the pathways, market dynamics, and processes through which adoption of RNG can become a reality and aims to frame the environment within which RNG exists today. Each section provides an overview of a different key element in the development of RNG as a resource, setting the stage for future technological improvements and a broader discussion on how renewable fuel sources as a whole can craft a more comprehensive energy environment.

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What is RNG

Renewable Natural Gas (RNG), often called biomethane, is a form of energy generated from the decomposition of organic materials, taking shape as a combination of primarily methane and carbon dioxide. This gas is upgraded to the extent that it is chemically similar to conventional natural gas, which in turn allows it to be used interchangeably in pipelines, appliances, vehicle engines, and fuel-gas applications. By removing the non-methane impurities in the natural occurring biomethane such as carbon dioxide, water, and other undesirables, biomethane becomes nearly indistinguishable from conventional natural gas fuel sources that can be used in a wide array of commercial energy uses.

In contrast to natural gas extracted from fossilized geological formations beneath our feet, RNG leverages existing organic waste streams. In the absence of being captured, the naturally released methane would otherwise be released uncontrolled to the atmosphere. This means that the development and use of RNG shifts at least some portion of energy production from unnatural collection, to instead synthesizing human involvement within a chain of naturally evolving events.[1]

Sources of RNG

The most common sources of Renewable Natural Gas are found within organic waste streams, all of which produce biogas through anaerobic decomposition. This is the most frequent source, as capturing biogas from these streams does not require developers to interrupt existing natural cycles of methane formation. Instead, producers capture biogas that would otherwise be expelled to the atmosphere naturally. Additionally, the added benefit of capture methane directly from waste sources reduces the potent greenhouse gas impacts of methane emissions, which in turn produces an attractive incentive for consumers who are interested in RNG for its environmentally friendly associations.[2]

[1] “Renewable Natural Gas Production.” Alternative Fuels Data Center, U.S. Department of Energy, https://afdc.energy.gov/fuels/natural-gas-renewable Accessed 25 Feb. 2026

[2] “Renewable Natural Gas (RNG).” Renewable Thermal Collaborative, https://www.renewablethermal.org/renewable-natural-gas-rng/ Accessed 25 Feb. 2026.

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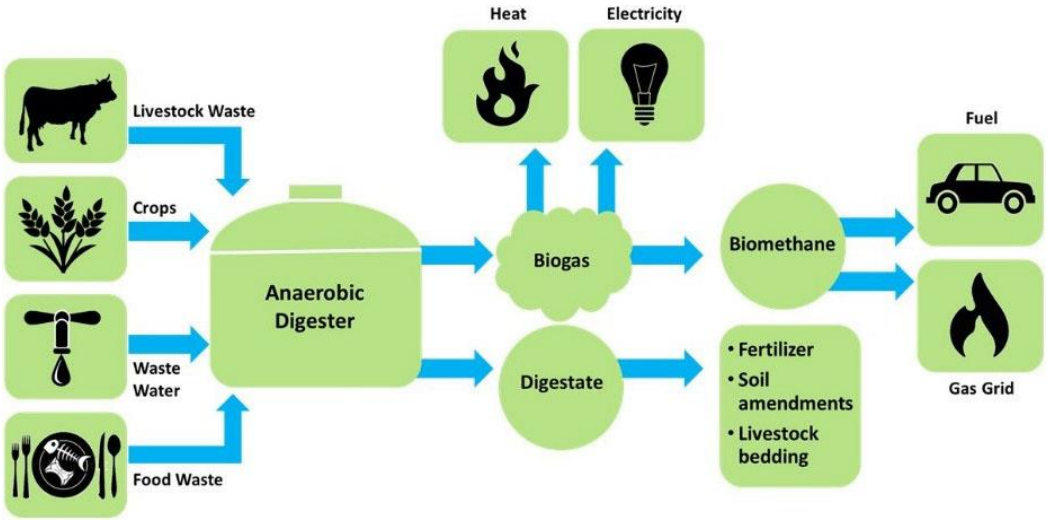


Figure 1: Sources of Biogas [3]

Many organized waste streams that produce biogas can be found in concentrated locations, often engineered by human involvement, such that the methane capturing process is much more efficient. These locations include landfills, livestock operations, waste water treatment plants, and many more. Most of these locations provide a concentrated source of RNG, and allow for producers to take advantage of the 'economies of scale' present at large facilities that engage in these activities. In addition to RNG feedstock sourced via conventional means, there are also growing considerations for purpose-built feedstock specifically designed for RNG production. These resources, coined 'energy crops,' allow for the producers to optimize the growth of otherwise underutilized agricultural regions specifically for use in RNG development. As shown in Figure 2 below, agricultural waste, forestry waste, and energy crops are forecasted to make up the vast majority of future RNG development over the next several decades.

[3] Fact Sheet: Biogas: Converting Waste to Energy. Edited by Jessie Stolark, Environmental and Energy Study Institute (EESI), 3 Oct. 2017, https://www.eesi.org/papers/view/fact-sheet-biogasconverting-waste-to-energy Accessed 25 Feb. 2026.

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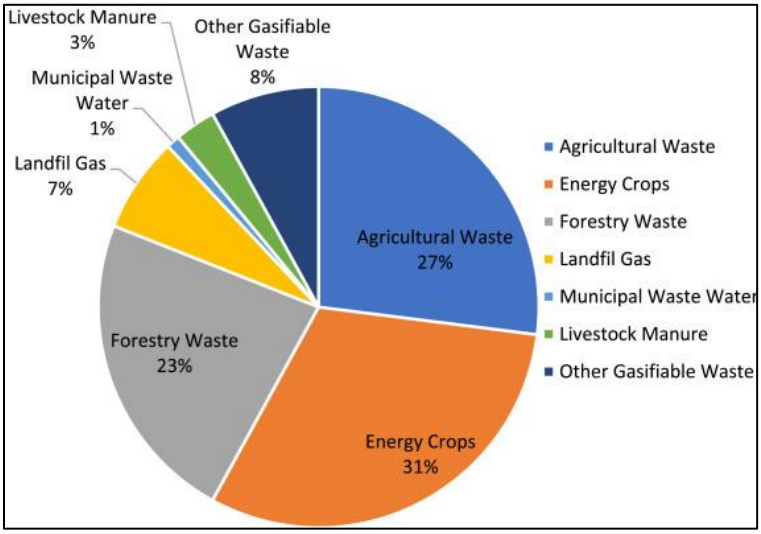


Figure 2: US RNG Practical Potential, Estimates for 2035-2050 [4]

Biogas from Landfills

Landfills provide an especially concentrated source of RNG, as they contain organic matter from countless human operations. According to a 2021 study by the U.S. Environmental Protection Agency, or EPA, landfills represent the third-largest source of human-related methane emissions in the United States. Biomethane from landfill operations, also called landfill gas (LFG), provides a concentrated location for organic digestion to take place rather than in an anaerobic digester. [5]

Biogas from Livestock Operations

Livestock operations, such as those involving dairy, poultry and hog farms, use concentrated locations of animal waste to convert organic matter into methane. This methane is then captured, cleaned, and transported as RNG within already existing natural gas infrastructure, as the chemical composition is identical between the two forms. Biogas recovery methods of similar architecture to those serving landfills and wastewater treatment plants can be used to capture methane from livestock operations, making this form of biogas production more simple to implement than most might anticipate.

Biogas from Wastewater Treatment

In similar fashion to biogas produced from livestock operations, RNG can also be produced from organic digestion of the solids removed from most wastewater treatment processes. The EPA estimates that this

[4] "Overcoming Challenges in the Expanding RNG Market." ScienceDirect, 2024, https://www.sciencedirect.com/science/article/pii/S2772427124000019 Accessed 25 Feb. 2026.

[5] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022 — Main Text. EPA Office of Atmospheric Programs, Apr. 15, 2022, EPA 430-R-22-003, https://www.epa.gov/system/files/documents/2022-04/us-ghg-inventory-2022-main-text.pdf Accessed 25 Feb. 2026

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form of biogas has the potential to produce 1 cubic foot of methane per every 100 gallons of wastewater.[6]

RNG Market Drivers

RNG is particularly attractive to modern energy consumers, as the source trail of its production allows consumers to support cleaner, fully renewable energy sources, while still providing the same quality, timeliness, and combustibility that conventional natural gas has provided users for ages. Sovereign entities, social movements, and conventional fuel scarcity have all motivated the continued pursuit of RNG development in recent decades. In the United States, for instance, both federal and state renewable fuel mandates, such as the Renewable Fuel Standard (RFS) and California's Low Carbon Fuel Standard (LCFS), have described the general movement of the US economy towards supporting renewable-based fuel sources. These policy incentives often align with environmental goals produced by an administration or state-level leadership team and aim to provide economic incentives to help motivate conventional energy producers and consumers.[7][8]

At the global level, increasing emphasis on carbon reduction commitments and energy security objectives are encouraging the expansion of RNG production. National and regional policies throughout the globe that price carbon, subsidize renewable energy, or mandate greenhouse gas (GHG) reductions make RNG an attractive option for producers and consumers alike. Utilities, waste management companies, and industrial players are all able to benefit from RNG development when sovereign entities recognize and incentivize the benefits of RNG. According to recent market research, the global RNG market, valued at roughly $15 billion USD in 2023, is expected to grow significantly over the next decade. This reflects an expanding utilization rate across electricity generation, residential and commercial energy, transportation, and industrial use.[9]

Market drivers of RNG adoption have a competing effect, with some factors combining in force to support the implementation of RNG, while others have a detrimental effect. A scorecard of sorts can be used to measure this delicate balance and inform consumers and producers alike as to the cost/benefit

[6] Opportunities for Combined Heat and Power at Wastewater Treatment Facilities: Market Analysis and Lessons from the Field. EPA, Oct. 2011, https://www.epa.gov/sites/default/files/2015-07/documents/opportunities_for_combined_heat_and_power_at_wastewater_treatment_facilities_market_analysis_and_lessons_from_the_field.pdf Accessed 25 Feb. 2026.

[7] An Overview of Renewable Natural Gas from Biogas. EPA Landfill Methane Outreach Program, Jan. 2024, https://www.epa.gov/system/files/documents/2024-01/lmop_rng_document.pdf Accessed 25 Feb. 2026.

[8] Renewable Fuel Standard (RFS). Alternative Fuels Data Center, https://afdc.energy.gov/laws/RFS Accessed 25 Feb. 2026

[9] Renewable Natural Gas Market: Hidden Growth Drivers. Green Gas Inc., 28 Aug. 2025, https://greengasinc.com/energy/renewable-natural-gas-market/ Accessed 25 Feb. 2026.

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of RNG use. Figure 3 below illustrates this in greater detail. An impact analysis such as this must be reproduced on an ongoing basis to evaluate the factors to be discussed below.

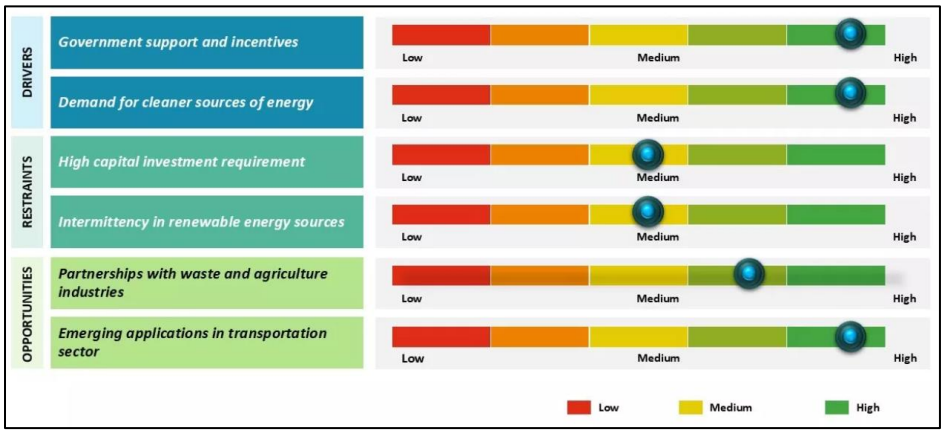


Figure 3: Impact Analysis of Key Factors in RNG [10]

Benefits to RNG Adoption

The adoption of Renewable Natural Gas offers a multitude of environmental, economic, and energy system benefits. These benefits differ from many other renewable resource arguments, as RNG represents a renewable fuel that burns exactly the same as conventionally depended upon fuel sources, while still being fully renewable. In contrast to solar energy, for instance, the use of RNG is not tied to any weather pattern or intermittent source of energy, but instead is a direct replacement to the most common form of electricity generating fuel we have today in conventional natural gas.

Key environmental advantages include substantial greenhouse gas emission reductions through the capture and utilization of methane, which is many times more potent than carbon dioxide over short timeframes. The use of RNG then has two core forces:

1.) Capturing methane that would otherwise be released to the atmosphere

2.) Displacing conventional methane production methods that would otherwise produce significant carbon dioxide emissions as a byproduct.

By converting methane into useful energy, RNG helps prevent the release of harmful emissions into the atmosphere.

RNG also bolsters fuel diversity by creating a renewable input to the existing natural gas infrastructure. This fuel diversity in turn creates energy security for whole communities, states, regions, and possibly

[10] Renewable Natural Gas Market Size, Share, Trends, Growth, and Forecast Report 2025–2032. Coherent Market Insights, 27 Feb. 2025, https://www.coherentmarketinsights.com/industry-reports/renewable-natural-gas-market Accessed 25 Feb. 2026.

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even nations that would otherwise depend on imported forms of energy from major producers. Areas that have conventional industries such as farming and agricultural production can now be players in the global energy market, aiding both themselves through energy independence and the world economy/ecology through renewable energy production. Because RNG can be injected into pipelines and distributed without major changes to infrastructure, it complements existing energy systems while reducing reliance on imported or fossil-derived fuels.

Barriers to RNG Adoption

While the benefits of RNG are widespread, the production, implementation, and consumer adoption of RNG as a reliable resource available for consumers has several major hurdles to overcome. Chief among these is the economic cost of RNG production. When viewed from the perspective of opportunity cost against competing fuel alternatives, RNG fails to be consistently competitive. The equipment needed for upgrading existing systems, compression equipment, and purification systems all require substantial upfront capital. Without robust subsidies, tax incentives, and credit-based markets, these economics can stifle investment. Additionally, feedstock availability, supply chain reliability, and policy uncertainty all also police the likelihood that RNG can be effectively developed and maintained.

The total cost of RNG production ranges widely, with estimates varying in significant ways across projects, territories, and nations. Some recent estimates have proposed that, in the US, RNG production ranges from less than $10/mmBtu to over $40/mmBtu. These variances are often driven by the methods through which the feedstock is obtained, as landfill-to-RNG projects are considerably cheaper than alternative means. Even at the cheapest cost estimate of $10/mmBtu, RNG production still stands in the wake of the much more cost-friendly estimates for natural gas production, which stands at $3-4/mmBTU.[11]

Subsidies and tax credits also have a significant impact on RNG development across the globe. In the US, for instance, the Inflation Reduction Act (IRA) of 2022 significantly boosted RNG projects by providing long-term tax certainty via Investment Tax Credits (ITCs) and Production Tax Credits (PTCs) to producers. Biomass, landfill gas, and several other forms of RNG were eligible for PTCs through at least 2025, beyond which the Clean Electricity Production Tax Credit and the Clean Electricity Investment Tax Credit will takeover.[12]

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[11] "Renewable Natural Gas: Growing Significance in a Niche Market." ING, 30 Apr. 2025, https://think.ing.com/articles/renewable-natural-gas-growing-significance-in-a-niche-market/#:~:text=Nevertheless%2C%20cost%20remains%20a%20challenge,around%20%243%2D4/mmBtu Accessed 25 Feb. 2026.

[12] Summary of Inflation Reduction Act Provisions Related to Renewable Energy. EPA Green Power Markets, https://www.epa.gov/green-power-markets/summary-inflation-reduction-act-provisions-related-renewable-energy Accessed 25 Feb. 2026.

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However useful these tax credits are for RNG development, depending on them invites an ongoing conversation around risk and long-term project viability. Repeal efforts aimed at the IRA, such as the GOP-led "One Big Beautiful Bill Act of 2025," inject this component of RNG support with uncertainty, motivating producers to diversify their financial outlook for RNG development beyond dependence on tax credits. While full repeal is difficult, a successful, partial repeal was accomplished in July 2025, affecting several of the IRA's climate-related motives. This activity of tax credit support and withdraw only stands to create additional instability in the RNG market, prompting producers to think twice before investing heavily in RNG as a resource.[13]

Past, In-Progress, and Future RNG Projects

While a multitude of supporting, detracting, and complicating factors exist in the market surrounding RNG development and adoption, the project funnel for RNG as a resource stands strong. There are currently well over 500 fully operational RNG facilities across all of North America, with 300+ of those being in the US alone. Not only is the number growing year-over-year, but this growth is exponential in nature as shown by Figure 4 below. This exponential growth is fueled in part by the changing proportions of RNG production methods. Agricultural digesters sourcing feedstock from livestock farms, energy crops, and forestry waste are growing as RNG demand expands to the Western US.

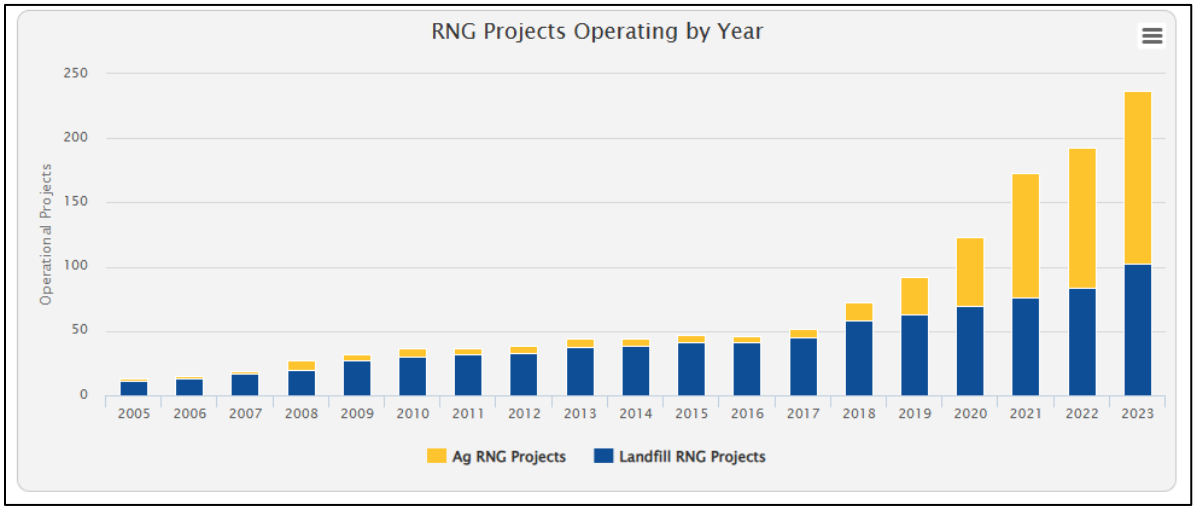


Figure 4: RNG Project Operating by Year [14]

[13] "Congress Passes Budget Bill, Rescinding Funds and Repealing IRA Programs and Tax Credits." IRATracker, 3 July 2025, https://iratracker.org/actions/congress-passes-budget-bill-rescinding-funds-and-repealing-ira-programs-and-tax-credits/ Accessed 25 Feb. 2026.

[14] Renewable Natural Gas. EPA Landfill Methane Outreach Program, updated 29 Jan. 2025, https://www.epa.gov/lmop/renewable-natural-gas Accessed 25 Feb. 2026.

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While there are over 500 RNG projects already online and operational, there are also several hundred more either currently under construction or planned. A 2025 estimate by the RNG Coalition suggests that there are 179 district RNG projects under construction currently, while nearly 300 additional projects are planned, as shown in Figure 5 below.



Figure 5: RNG Facilities Operational Progress (North America) [15]

Summary

Renewable Natural Gas represents a vital bridge fuel in the global transition to low-carbon energy systems, using organic waste streams to produce a methane-rich, pipeline compatible renewable gas with little to no infrastructure accommodations on the side of the consumer. RNG's production and adoption are driven by a multitude of environmental imperatives, political policy, and ever evolving market opportunities. While barriers such as high production costs, production infrastructure constraints, and feedstock limitations persist, the need for alternative fuels to supplement existing resources and facilitate the transition to a cleaner future cannot be overstated. Continued innovation in biogas production, upgrading technologies, and policy frameworks will be essential for maximizing the full potential of RNG. Renewable Natural Gas is poised to play a meaningful role in reducing greenhouse gas emissions and advancing sustainable energy goals in the years ahead.

[15] Renewable Natural Gas Infographics. RNG Coalition, https://www.rngcoalition.com/infographic

Accessed 25 Feb. 2026.