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Gas into gold

The waste-to-energy opportunity

The production of renewable energy from agricultural, industrial, municipal and consumer waste has potential: a way to turn trash into treasure, while also combatting climate change.

Key takeaways

1

By capturing and converting methane from decomposing organic matter, renewable natural gas (RNG) can help reduce emissions, improve waste management and create more circular economies.

2

RNG is compatible with existing natural gas infrastructure and industrial processes, and it is directly interchangeable with fossil natural gas, rendering it a 'drop-in fuel'.

3

Demand for RNG is being supported by a combination of regulation and rising demand from companies seeking to meet net zero commitments.

In transitioning the global economy towards a low-emissions future, a portfolio of tools is needed to overcome challenges posed by sectors that have traditionally been hard-to-abate. Renewable natural gas (RNG) is an alternative fuel that can help industries lower emissions, improve waste management and create more circular economies. While we believe RNG has long been recognised as an investment with burgeoning potential, increasing demand and awareness of methane's relative impact on global warming has led to an acceleration of interest and capital in the sector.

A 'drop-in fuel'

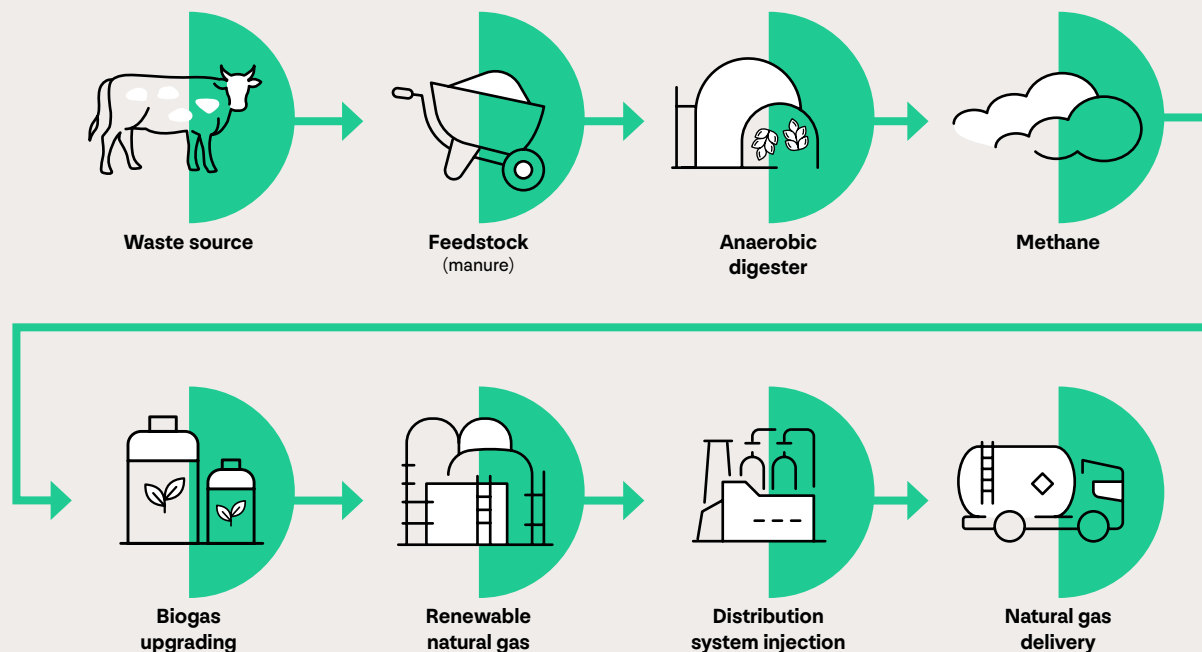
RNG shares many of the same attributes as fossil natural gas and the same basic chemistry – greater than 95% methane, or CH₄. RNG is compatible with existing natural gas infrastructure and industrial processes, and it is directly interchangeable with fossil natural gas, rendering it a 'drop-in fuel' (similar to renewable diesel and sustainable aviation fuel).

However, while fossil natural gas involves the extraction of carbon sequestered beneath the earth's surface, RNG is produced from the natural decomposition of organic matter, through a process commonly known as anaerobic digestion. The source of organic matter giving rise to methane emissions can vary, from landfills, to dairy farming (and the associated decomposition of manure), waste water processes and organic consumer waste. All are significant generators of methane emissions, with the source of these methane emissions often referred to in the RNG industry as the 'feedstock type.'

Methane emissions are widely known to have significant adverse environmental impacts. The United States Environmental Protection Agency (EPA) points to methane as being “more than 28 times as potent as carbon dioxide at trapping heat in the atmosphere²”. Against this backdrop, RNG projects have the potential to deliver significant methane emissions reductions – not only by displacing fossil natural gas (and thereby avoiding the release of carbon sequestered in the earth) but also by capturing naturally occurring methane emissions that would otherwise be released into the atmosphere.

FIGURE 1

ANAEROBIC DIGESTION IS RESPONSIBLE FOR GENERATING METHANE, WHICH CAN THEN BE CAPTURED AND UPGRADED TO PRODUCE RNG¹



¹ The Coalition for Renewable Natural Gas

Market growth spurred by regulatory support

In the United States, the RNG industry has long been supported by regulation, including the Renewable Fuels Standard (RFS). Introduced in 2005, the RFS requires a certain volume of renewable fuels be used to replace or reduce the quantity of fossil fuels used in transportation, and in the heating of homes. For each molecule of renewable fuel injected into the interstate pipeline system, the RFS provides for the generation of a regulatory credit, which is then purchased by obligated parties (such as refiners, importers and blenders) who produce fossil fuels (and specifically, gasoline) for consumption in the United States.

Further support for the development of RNG projects in the United States is provided by California’s Low Carbon Fuel Standard (LCFS), which is designed to lower the carbon intensity of California’s transportation fuel sources. This is done through the development of low carbon intensity (CI) feedstock types, including both dairy manure and organic

consumer waste. A similar programme in Canada known as the Clean Fuel Regulations (CFR) aims to significantly reduce greenhouse gas emissions from transportation fuels, by requiring fuel suppliers to gradually decrease the CI of gasoline and diesel.

We believe these regulatory programmes have been an effective tool in encouraging the development of RNG projects over the last 20 years, particularly for certain feedstock types. According to the Coalition for Renewable Natural Gas and Office of Energy Efficiency and Renewable Energy, 70% of RNG production in the United States is derived from landfills, with a further 20% derived from agricultural waste – primarily manure from dairy farms³. However, as demand for RNG continues to grow, the industry is bracing for the development of RNG feedstocks outside of landfill and dairy manure, with fugitive methane emissions from waste water and organic consumer waste generally seen as the next frontier for RNG feedstocks.

² United States Environmental Protection Agency
³ Bloomberg New Energy Finance

CASE STUDY

The benefits of an on-site RNG project to global food producers⁴

Many global food producers believe that they have a dual responsibility: feeding a future world, while also helping the food system – which is a significant contributor to global emissions – mitigate its environmental impacts. We believe a critical strategy in addressing these responsibilities is to adopt circular economy technologies, repurposing waste streams and food byproducts into RNG through the application of on-site methane capture and upgrading systems.

While the installation and operation of such systems is typically outside the core competency of food producers, partnering with an experienced RNG developer can facilitate

methane capture, while also driving improvements to waste operations, and local air and water quality. In most cases, a royalty or fee can be earned from sale of the captured methane, thereby providing an incremental and reliable source of long-term income. And where an RNG project is effective in mitigating fugitive methane emissions, food producers can lay claim to the reduction in greenhouse gas emissions flowing from the project.

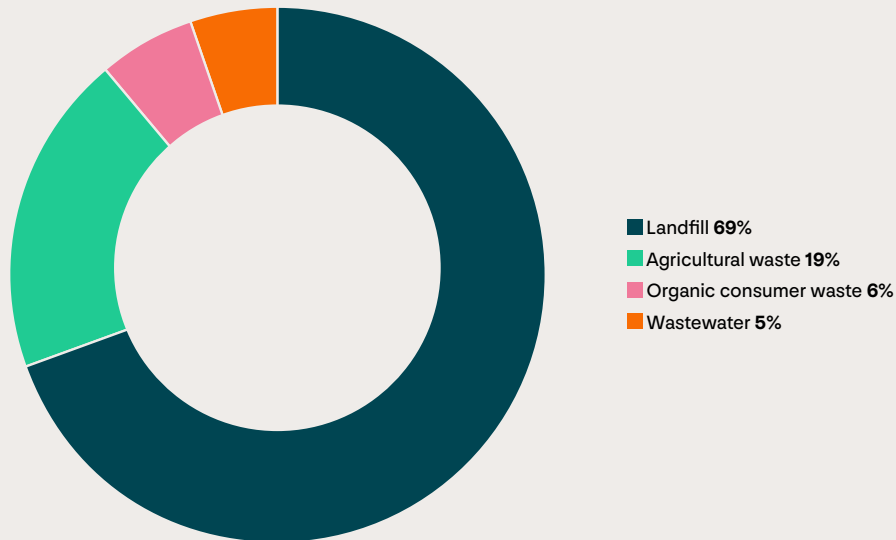
Critical to the success of these projects is a clear delineation of roles and responsibilities, and alignment around the mutual benefits to each party.



⁴ Case studies are provided for illustrative purposes only and should not be relied on to make an investment decision.

FIGURE 2

**NOT GOING TO WASTE:
SHARE OF RNG PRODUCTION CAPACITY BY FEEDSTOCK TYPE (2021)**



Source: Bloomberg New Energy Finance

The introduction of the Inflation Reduction Act (IRA) in 2022 gave rise to significant tax credits in support of RNG projects, through the introduction of an Investment Tax Credit (ITC), and in providing for ITC bonus credits that facilitate the recovery of up to 50% of eligible expenditures.

While recent shifts in the political environment in both the United States and Canada have introduced some near-term uncertainty to the future of these regulatory programmes, it is important to note that biofuels have historically enjoyed bipartisan support in the United States. Regulation such as the RFS works to support the agricultural industry in Midwest Republican strongholds, while the environmental benefits of biofuels have long been recognised and touted by Democrats. Indeed, the Trump administration has specifically identified biofuels as a domestic energy resource in need of further attention and development⁵.

However, favourable policy developments at both the regional and local level are beginning to drive the development of new RNG feedstocks that have historically been overlooked by RNG developers. California continues to lead the way in this regard, with SB1383, a law that requires a 75% reduction in organic waste being sent to landfill this year, from 2016 levels. This paves the way for RNG projects that focus on the aggregation of organic consumer waste as a feedstock. And in coupling SB1383 with SB1440 – a separate mandate that sets minimum RNG procurement targets for Californian natural gas utilities – the local market is poised for significant growth in the coming years. While the implementation of these programmes has not been without its challenges, with landfill diversion mandates beginning to spread to other parts of the country, sector tailwinds are growing for the RNG industry as it seeks to expand to relatively untapped sources of feedstock.

⁵ Unleashing American Energy – The White House

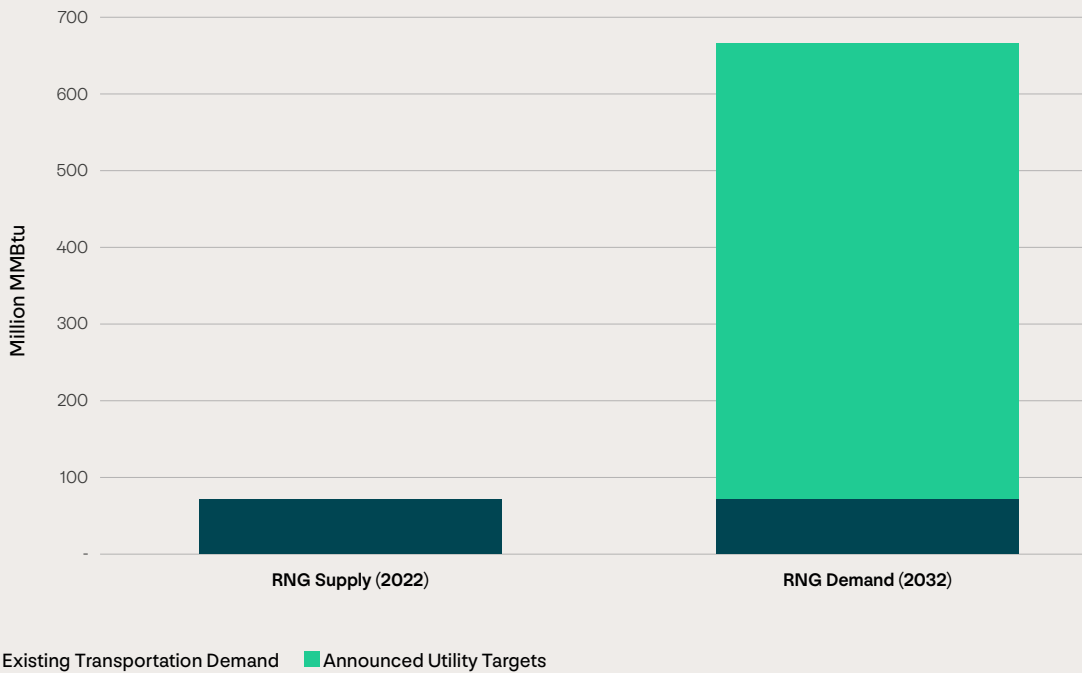
Demand-driven growth from voluntary buyers

Regulatory programmes have provided, and are expected to continue to provide, a robust baseline of demand for RNG. However, industry attention is rapidly shifting toward the recent and rapid growth in the voluntary market, where RNG is sold directly to end-users, such as natural gas utilities and commercial and industrial (C&I) customers. These end-users are seeking to displace fossil natural gas to help meet net zero commitments. Natural gas utilities are typically driven by mandated procurement targets, C&I customers by limited decarbonisation alternatives. For these types of buyers, which operate in hard to abate sectors, RNG is a simple and effective 'transition fuel', particularly where electrification and/or green hydrogen are either cost prohibitive, or dependent on significant technological advancements and infrastructure build-out.



FIGURE 3

**DEMAND TO SIGNIFICANTLY OUTSTRIP SUPPLY:
US RNG SUPPLY VS IDENTIFIED DEMAND BY MILLION MMBTU⁶**



⁶ Argonne National Laboratory RNG Database, ICF, publicly-disclosed RNG purchase agreements and procurement targets

CASE STUDY

IFM Investors and GreenGasUSA⁷

In March 2023, IFM Investors (through one of its managed funds) acquired a majority stake in GreenGasUSA (GreenGas), a vertically integrated US-based developer, owner and operator of RNG projects, headquartered in Charleston, South Carolina.

Unlike most RNG developers, GreenGas specialises in the capture, upgrade, transportation and injection of RNG from on-site sources of feedstock at large-scale wastewater treatment plants. These plants, which are often co-located with industrial protein processing facilities, accept biogenic material from various sources, including poultry, cows and pigs.

GreenGas has historically succeeded in marketing and selling RNG produced from these sources under long-term, fixed price offtake agreements, selling RNG to investment grade C&I customers, such as Mercedes Benz and Carolina Gas Transmission (a subsidiary of Berkshire Hathaway Energy). In capping these wastewater “lagoons” and capturing the associated methane, GreenGas has historically reduced environmental emissions from waste streams and helped several feedstock partner sites avoid being listed as top state-level emitters by the EPA.



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Conclusion

With nearly half of listed utilities having already set emissions reduction targets, announced utility mandates alone are expected to see RNG demand outstrip supply by more than 8.5 times, over a 10-year period⁸. This favourable supply-demand dynamic is expected to both drive RNG pricing higher and encourage the development of higher cost RNG sources. With this, the RNG industry is poised for significant growth in the years to come.

⁸ Argonne National Laboratory RNG Database, ICF, publicly-disclosed RNG purchase agreements and procurement targets

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IFM-26March2025-4317494