RENEWABLE NATURAL GAS (RNG): A FUEL FOR A SUSTAINABLE FUTURE

Renewable Natural Gas (RNG), or biomethane*, is an important, yet largely underutilized, low-carbon fuel made from the methane released by decomposing organic waste streams. The technology is commercial; the fuel is interchangeable with fossil natural gas; and the climate, environmental and economic benefits are immense.*

What is RNG and where does the fuel come from?

Biogas, the precursor to RNG, is generated anywhere organic materials—food waste, animal manure, yard debris, crop cuttings, sewage—decompose without oxygen, a process called **anaerobic digestion** (*anaerobic* = "no oxygen"). Anaerobic digestion naturally happens in landfills, and can be replicated in purpose-built anaerobic digesters, which can be as simple as covered manure pits on farms or as complex as multi-stage processing facilities with storage tanks and high-tech control rooms.

Biogas contains methane (~55%), carbon dioxide (CO2, ~44%), trace amounts of other compounds, and moisture. When biogas has been **cleaned and upgraded to pipeline quality**—meaning the CO2, other impurities and moisture have been removed—you have **RNG**. Chemically, RNG is almost identical to geologic natural gas, *but it is not a fossil fuel and requires no drilling or other harmful extractive operations.*

How can RNG be used?

RNG is essentially chemically interchangeable with fossil natural gas It can be used to generate electricity, injected into pipelines for heating and cooling, or used as fuel for vehicles with natural gas engines. **Energy Vision's research indicates that its most effective use is as a replacement for diesel fuel in heavy duty vehicles given that sector's huge petroleum-based fuel use and negative climate/health impacts.**

How much of it is there?

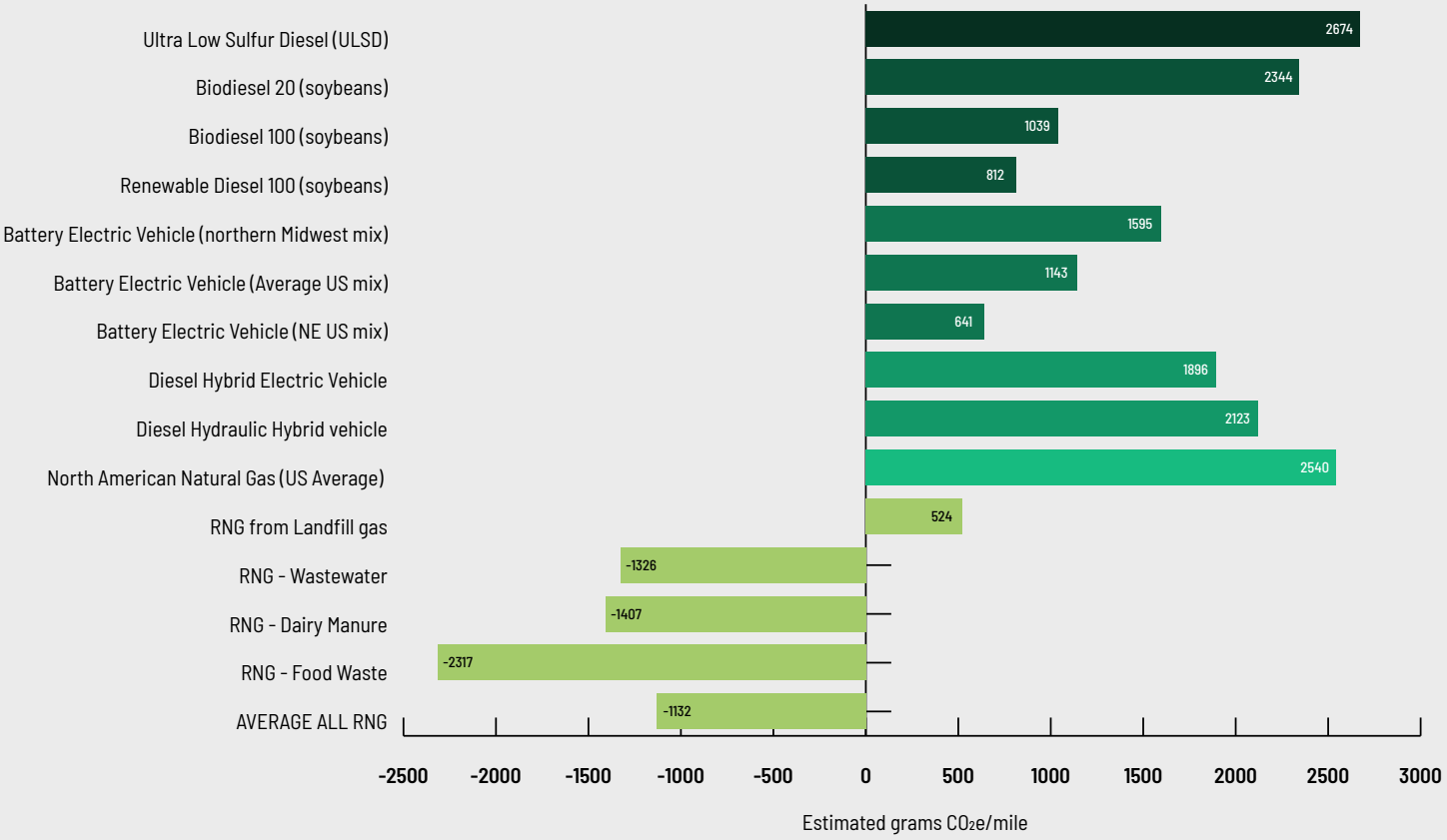
Each year in the US over 60 million tons of food waste[1] and 35 million tons of yard waste are generated,[2] roughly 12.4 trillion gallons of wastewater are processed,[3] and livestock produce over 1 billion tons of manure.[4] All of these sources emit biogas—and RNG— **"feedstocks."** According to a federal study, 2,100 biogas systems currently operate at landfills, farms and wastewater treatment plants, with the potential for nearly 14,000 more. ***Conservatively, the combined total annual output of RNG would be enough to fuel every urban bus and truck fleet in the US***.[5]

Why RNG instead of fossil natural gas?

RNG is made from methane that is already "above ground." Unlike fossil natural gas extracted from the earth, producing RNG involves capturing the biogases emitted by decomposing organics before it escapes into the atmosphere, worsening climate change. This is why on a "lifecycle" basis (including product transport and use of a fuel), RNG can be net-carbon-neutral or even net-carbon negative fuel.

RNG has been hailed by the United Nations as a renewable fuel with significant greenhouse gas mitigation potential.[6] These qualities have been recognized in California, where the state is providing significant subsidies for development of RNG from dairy manure; in India, which in 2022 announced plans to build 5,000 RNG stations for transport fuel by 2025; and in Europe, where biomethane use is growing in countries like Sweden, Denmark, France, Germany, Italy and the UK.

Comparative Lifecycle GHG Emissions of Various Transport Fuels
Source: Derived from Argonne GREET (2022)



Why use it for transportation?

In 2022, transportation accounted for 28% of all US energy consumption[7] and 28.5% of total US greenhouse gas (GHG) emissions[8]—the largest single source of GHGs. Other renewable technologies—solar, wind, hydropower—are established as sources of electricity, and are growing in their share of production. But there remains a gap in renewable vehicle fuels – petroleum still accounted for 92% of all transportation fuel use in the US in 2021.[9] Vehicles equipped to use natural gas—and therefore RNG—are already proven and commercially available in medium and heavy-duty models. Electric vehicles will play a large role, particularly for passenger vehicles, but in the heavy duty classes they are limited in range and power in the short term, come with the toxic metals production liabilities of battery manufacture and disposal, and cost nearly 70% more than comparable models.[10]

Why replace diesel specifically?

Diesel, used primarily by heavy-duty vehicles, has been identified as a carcinogen by the World Health Organization.[11] In 2021, the nearly 12.5 million commercial trucks and buses in the US represented just around 4% of the total vehicles on the road, but they consumed about a quarter of on-road vehicle fuel: over 42 billion gallons out of a total of 164 billion gallons per year, of which 39 billion gallons were diesel.[12] These commercial buses and trucks emitted roughly 25% of all GHGs for transportation, or 7.1% of total U.S. GHG emissions in 2021.[13]

Natural gas (fossil or renewable) is among the only proven non-diesel options that exist today. At present, electric vehicles cannot fill the gap: while all-electric commercial vehicles like delivery and refuse trucks are in use, they lack power and tend to be tied to short, generally urban routes with depots and recharging facilities; heavy-duty and/or long-haul electric commercial vehicles are not yet a scalable option. Moreover, the power demands for medium and heavy-duty electric vehicles are immense. For example, the power requirements to recharge a fleet of 50 heavy duty trucks is on par with that of the Empire State Building.[14]

RNG is already in use

- 30% of urban transit buses in the US are equipped with a natural gas engine[15] and could readily use RNG.
- Over 17,000 refuse trucks currently operate on natural gas and 60% of refuse truck orders are for natural gas models that could use RNG.[16] Commercial waste hauler WM is investing $825 million between 2022 and 2025 to expand its RNG infrastructure at its landfills with the goal of outfitting its entire natural gas fleet with RNG by 2026.[17]
- In 2020, logistics giant UPS committed to buying enough RNG to displace 250 million gallons of diesel over 7 years, which would eliminate 2.8 million tons of CO2e.[18]
- 98% of the fuel used in California's natural gas vehicles in 2021 (174.28 million gallons out of 178.37 million gallons of diesel equivalent) was RNG, with those fleets achieving carbon negative operations for the second year in a row.[19] In February 2022, California approved by far the most ambitious mandated RNG purchasing program in the country. The state's investor-owned gas utilities will collectively procure up to 72.6 billion cubic feet (~72 million MMBTU) of RNG produced in the state by 2030 - nearly equal to *total* national RNG production in 2022, which was just under 75 million MMBTU.[20]
- RNG not only qualifies for credits under the federal Renewable Fuel Standard, it also earns credits under the Low-Carbon Fuel Standard implemented in California, Oregon, and Washington (markets in which suppliers from elsewhere can sell RNG, too). California utility SoCalGas has committed to 20% of all the gas it delivers to homes and businesses being RNG by 2030, and to all of its operations and energy delivered being net-zero carbon by 2045.[21]

NYC's Big RNG Opportunity

An average NYC bus travels 71 miles per day and burns about 17 gallons of diesel.[22] An average NYC garbage truck travels 50 miles per day, and consumes close to 19 gallons of diesel.[23]

Meanwhile, New York City discards roughly 1,800 tons of commercial food waste daily.[24] 50% of that total—900 tons—could provide enough RNG to power 950 buses or 850 refuse trucks, displacing over 16,000 gallons of diesel and 180 tons of CO2e daily. This would be more than enough to fuel the 734 CNG buses that already run year-round on RNG in NYC's 5,881-vehicle bus fleet.[25]

RNG represents an immense but mostly untapped resource.

The US has ample organic waste feedstocks to make RNG – the key to its wider use as a vehicle fuel lies in proven, deployable technology: digesters, upgrading facilities, fueling stations and more natural gas vehicles. With policy leadership, especially at the City and State level, RNG can be an integral component of our low-carbon energy future.

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