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Renewable Natural Gas Overview and Trends

What is Renewable Natural Gas (RNG)?

RNG is any pipeline compatible gaseous fuel that is derived from organic matter, such as agricultural waste, landfills and wastewater treatment facilities.

- As organic matter decomposes, it creates biogas, a methane-rich gas that can be cleaned and purified to create biomethane, known more commonly as RNG
- RNG is an ultra-clean and ultra-low carbon gas alternative
- It is fully interchangeable with traditional natural gas



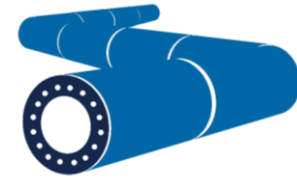
Where does RNG come from?



RNG is fossil-free natural gas that is produced by cleaning and processing biogas into pipeline quality gas.



Anaerobic Digestion is the most often used technology to produce biogas from feedstocks such as animal manure, agricultural byproducts and wastewater facilities.



Biogas must be treated and cleaned, raising it to a standard where it can be injected into gas pipelines.

Landfills capture biogas from on-site collection systems.

Sources and Production of RNG

13,000 Biogas Facilities

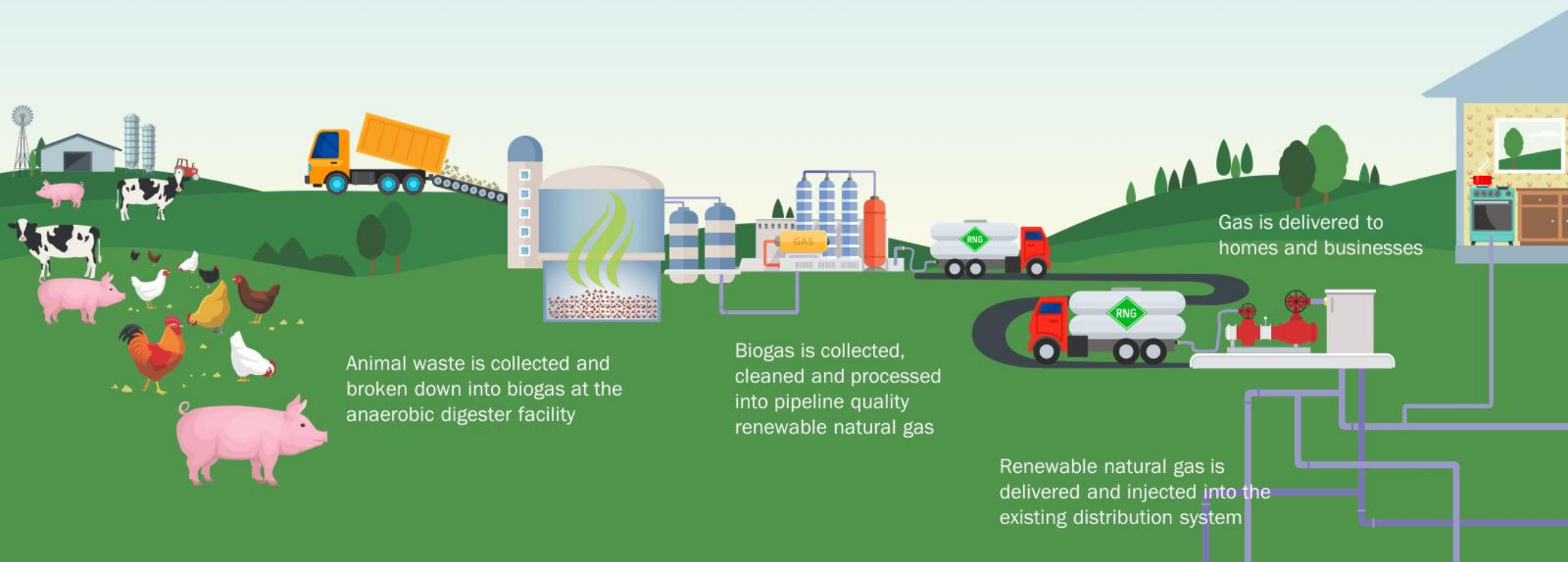
Today, the EPA estimates the United States alone as an opportunity to develop 13,000 biogas facilities to produce RNG. This would be enough RNG produced to power **3 million** homes!

Potential sources of organics used to produce RNG include:

- Food Waste – 66.5 million tons per year
- Wastewater – 17,000 facilities
- Agriculture Waste – 8,000 large farms and dairies
- Landfill Gas – 1,750 landfills



What does the RNG process look like?



How is RNG used?

Primary existing drivers of RNG development are policies and incentives to decarbonize the transportation market.

Federal and state programs, such as the Renewable Fuel Standard (RFS) and California's Low Carbon Fuel Standard (LCFS), provide a monetary credit to RNG that is used as a transportation fuel.

Use in Local Distribution Companies (LDCs)

- Economic issues around premiums that can be paid
- Regulatory matters

Industrial and Companies with Renewable Portfolios

Since the climate impact of methane is greater than that of carbon dioxide, eliminating methane emissions from waste streams yields a net life-cycle GHG reduction when that methane is combusted in lieu of traditional gas, rather than being emitted to the atmosphere or flared.



Renewable Fuel Standard (RFS)

The Renewable Fuel Standard is a Federal Program that requires transportation fuel sold in the United States to contain a minimum volume of renewable fuels.

The U.S. Environmental Protection Agency (EPA) administers the RFS program and establishes the volume requirements for oil refiners, gasoline and diesel importers. The EPA tracks compliance through the Renewable Identification Number (RIN) system, which assigns a RIN to each gallon of renewable fuel.

To generate a RIN, the EPA certifies that RNG was produced, injected into the pipeline and was used solely for transportation fuel. Four different types of RINs exist based on feedstock and each have their own market value.

The volumes required of each obligated party are based on a percentage of its petroleum product sales. Obligated parties can meet their renewable volume obligations (RVOs) by either selling required biofuels volumes or purchasing RINs from parties that exceed their requirements.

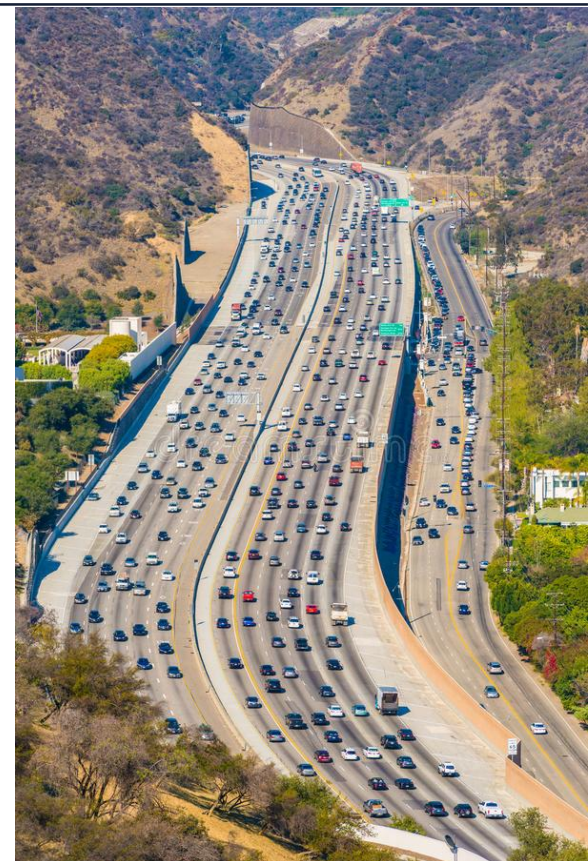


California Low Carbon Fuel Standard (LCFS)

As a State Program, LCFS requires refineries and fuel suppliers in California to reduce the carbon intensity of its transportation fuels. Transportation fuels must meet an annual carbon intensity (CI) target that decreases each year. Refineries and fuel suppliers can meet these targets by mixing in fuels with lower CI into the overall supply or by purchasing credits.

Fuels with CI below the target level (based on a lifecycle analysis) are able to generate credits. Under the rule, RNG is considered a low carbon fuel and can generate credits.

To generate LCFS credit, California Air Resource Board (CARB) certifies that RNG was produced, injected into the pipeline and was used solely for transportation fuel in California. Oregon and other states are also implementing state-run credit programs.

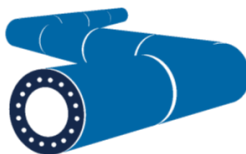


Success of RNG

Success in the development and expansion of existing RNG facilities, or creation of new RNG markets is dependent upon:



Environmental policies and markets



Access to and interconnection with the natural gas infrastructure



Development of natural gas fueling stations and deployment of natural gas vehicles



Overcoming bias against natural gas in favor of other alternatives



Need to be proactive! Educate and advocate – needs to be an industry-wide effort

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Thank you!