



Pennsylvania Chamber
of Business & Industry
Annual Environmental
Conference

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UGI Energy Services RNG NY Projects



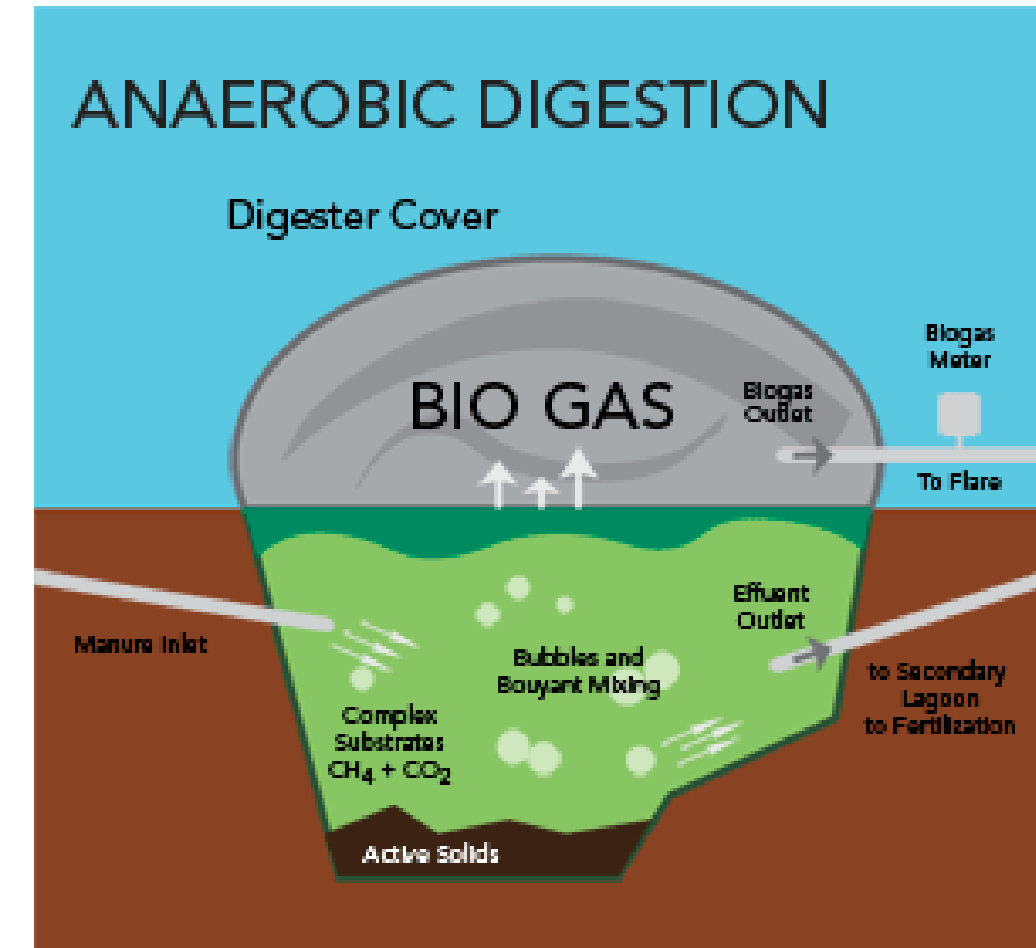
Cayuga RNG, a joint venture of UGI Energy Services, LLC, a subsidiary of UGI Corporation, and Global Common Holdings, LLC. Cayuga RNG is developing three projects to produce renewable natural gas (“RNG”) in upstate New York.

- Spruce Haven Farms
 - Located in Cayuga County, New York
 - Collection of manure from 2,600 cows
 - Carbon Intensity Score = -308
- Allen Farm
 - Located in Cayuga County, New York
 - Collection of manure from 4,000 cows
 - Carbon Intensity Score = -180
- EL-VI Farm
 - Located in Wayne & Ontario Counties, New York
 - Collection of manure from 2,000 cows
 - Carbon Intensity Score = -298
- Bergen Farm & Glenview Dairy
 - Located in Schuyler County, New York
 - Collection of manure from 7,400 cows
 - Carbon Intensity Score = -200

How is RNG Produced?

Digester Gas

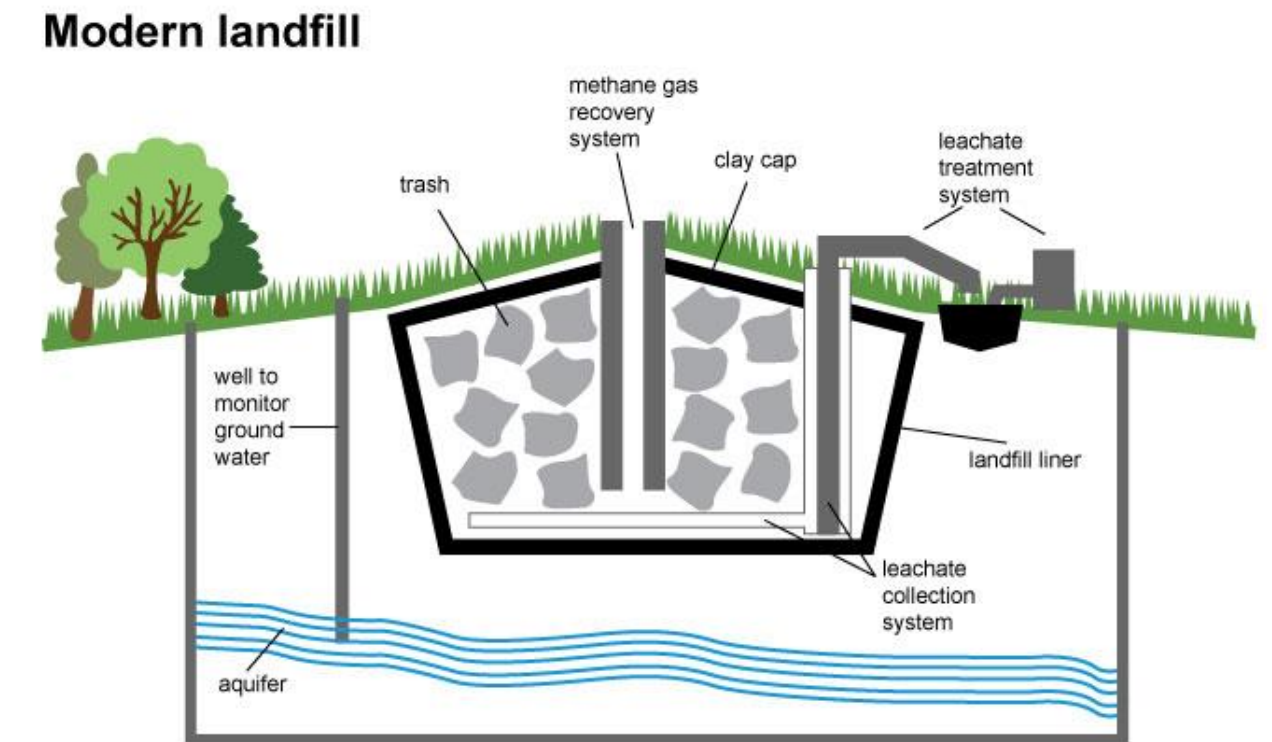
- Digester gas produces gas from anaerobic digestion
- Long operational history in Europe (Netherlands, Germany)
- Common feedstock are wastewater, manure, and food waste
- Gas stream is primarily methane requiring less purification
- Feedstock security and variability create operational challenges
- Most successful projects are small to medium scale reducing economies of scale resulting in higher cost RNG
- Major benefit is low Carbon Intensity scores that drive significant environmental attribute value



How is RNG Produced?

Landfill Gas

- Most common form of RNG historically produced in the US
- Landfill gas can be challenging to process due to variability of the waste streams accepted by landfill operator
- High levels of impurities can significantly increase purification costs
- Landfills produce significant gas streams providing economies of scale resulting in the lowest cost RNG compared to other sources
- Highest Carbon Intensity scores mean least attractive source to reduce carbon goals
- UGIES has working knowledge of landfill gas – Broad Mountain landfill power generation



About the Projects

- Anaerobic digester breaks down manure, producing biogas
- Gas upgrading skid cleans the biogas to pipeline quality methane
- Methane checked for quality, metered, pressure controlled, then injected into local distribution system
- Waste heat from combined heat and power (CHP) used to heat digester
- Electricity generated from CHP used onsite to offset grid demand



Economic Benefits

- Approximately \$82 million investment in renewable energy projects in New York by Cayuga RNG
 - Spruce Haven Farm- \$11 million
 - Allen Farm- \$23 million
 - EL-VI- \$13 million
 - Bergen/Glenview- \$35 million
- Benefits to the farms:
 - Revenue from gas sales
 - Improved efficiency on sand separation process, reducing the need to purchase sand bedding
 - Reduced electricity costs
- 300+ construction jobs with two-thirds coming from local workforce



Environmental Benefits

- Reduced greenhouse gas emissions:
 - Replacing traditional diesel or gasoline with RNG can significantly reduce emissions of nitrogen oxides and particulate matter
 - Captures methane that would otherwise be released into the atmosphere
- Reduces manure odor produced on the farm, by breaking down the manure within the air tight digester
- Process converts nutrients in the waste into more accessible forms resulting in increased crop productivity and yield
- Eliminates nitrogen that would otherwise runoff into local streams and lakes- a leading cause of algae blooms



What are the markets for RNG?

Environmental Subsidies

- Most lucrative market is driven by environmental regulations in transportation fuel markets
 - Federal Renewable Fuel Standard (RFS) allows for generation of **RIN credits**
 - California Low Carbon Fuel Standard (LCFS) allows for generation of **LCFS credits**
 - Current California CNG market is 60,000 MMBtu / day
- Goal of program is to reduce emissions from gasoline and diesel transportation segment
- Majority of the program is centered on ethanol production; RNG is secondary
- Transportation Fuel markets require filling Compressed Natural Gas (CNG) vehicles with RNG
 - UPS Fleet
 - California Public Transit Authorities
- Majority of current RNG investment centers on monetization in these markets