Challenges and Opportunities for Increased Development and Utilization of Renewable Natural Gas

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What is Renewable Natural Gas?
Renewable Natural Gas (RNG) is natural gas produced from organic waste products found in landfills, water treatment plants, farms, dairies and more. When organic waste decomposes, it releases biogas, or a mixture composed primarily of methane and carbon dioxide (CO_2). If we capture and process biogas before it escapes into the atmosphere, not only are we protecting the environment from harmful air emissions, we are providing an affordable, plentiful source of natural gas that is fully interchangeable with traditional geologic natural gas.

RNG can change the face of the fuel and energy industry in a clean way that's good for the environment. It does not require extensive operational changes, and it makes use of already-existing infrastructure. It's a proven and reliable product that is ultra-clean, domestic, abundant, affordable and sustainable.

And people are starting to notice. The use of RNG is gaining momentum throughout North America as industry leaders bring increased awareness to its attributes through advocacy and policy successes.

Where RNG Comes From
While geologic natural gas is formed deep underground as pressure and temperature transform organic matter into methane over millennia, RNG comes from organic waste abundantly available on our earth's surface. Sources of this organic waste are everywhere — our cities, towns, farms and more — but they have not yet been used to their full potential.

In an effort to reach that potential, the RNG industry has adapted proven technologies to produce waste-based biogas and process it into pipeline-ready RNG.

Anaerobic Digestion
Anaerobic digestion is used to turn high water content organics such as wastewater, animal waste and food waste into biogas. It occurs in an environment without oxygen (such as a tank), where microorganisms (usually bacteria) transform the waste product into gas – primarily methane. This gas is then dried, and trace constituents and CO_2 are removed. Anaerobic digestion can be adapted for use in varying scales – anywhere from a single farm application to a large urban wastewater plant that processes hundreds of millions of gallons a day.

Biogas from landfills is also collected and processed. In this case, the landfill acts as the anaerobic digester. Natural bacteria break down the organic portion of the waste into biogas. It is then collected by vacuuming the gas through buried pipes. Dedicated pipelines take the biogas to an on-site treating facility that removes CO_2 and other gas constituents to create pipeline ready RNG.

Anaerobic digesters are proven, scalable and can easily be built anywhere enough quantities of organic waste are generated. For instance, cities separate organic waste (as many now do), and process the waste using anaerobic digestion to produce RNG to power city trash trucks.[1]

Thermal Gasification
Thermal gasification works well with lower-moisture sources like agricultural waste and other forms of biomass. Oxygen and heat are added to biomass to produce a "synthesis gas" that is cleaned and then converted to methane. This gas must be dried out and compressed before it is pumped into the natural gas pipeline system.

This technology has not yet broken through in the United States, but has the potential to expand the production of RNG exponentially.

One of the biggest misconceptions about RNG is the idea that it is inferior to traditional natural gas. In fact, it is a strong complement that makes our most abundant and cleanest fossil energy source even more diverse. Traditional natural gas is typically made up of approximately 95 percent methane. The remaining portion is a mixture of hydrocarbon and non-hydrocarbon constituents, like ethane, propane and even water.

After biogas is processed, the resulting RNG will meet or even exceed the methane content of geologic natural gas. RNG can be transported in natural gas pipelines and utilized in any natural gas application, whether residential, commercial or industrial, and including transportation fuel, heating or cooling, or electric power generation.

RNG Potential
Sources of RNG are all around us – anywhere you find organic waste, you will find RNG. This includes landfills, wastewater treatment plants, food waste, wood and agricultural residues, dairy farms, energy crops and even waste from certain industrial processes, such as a brewery.

To give you an idea of the scale, here are some of the biggest sources of organic waste in the United States:

- Food Waste (66.5 million tons/year)[2]
- Wastewater (17,000 facilities)[3]
- Agricultural Waste (8,000 large farms and dairies)[4]
- Landfill Gas (1,750 landfills)[5]

While the supply of geologic natural gas in the United States is playing an increasing role in the domestic energy supply, that same infrastructure can be used to transport RNG to utilities, manufacturers and transportation companies around the country.

RNG affords the United States a proven strategy for job creation, energy security and supply diversification by utilizing an abundant domestic resource and existing infrastructure. The knowledge and technologies are available to expand the RNG industry in a major way today.

Renewable Fuel Standard
RNG industry growth has been aided by effective government policy. The Renewable Fuel Standard (RFS) was authorized by Congress as part of the Energy Policy Act of 2005 and then expanded by the Energy Independence and Security Act of 2007.

In an effort to strengthen American energy independence and national security, the RFS requires that the portfolio of transportation fuel sold in the United States include a minimum volume of fuel derived from renewable sources. Gasoline and petroleum diesel companies are obligated to adhere to this standard.

While geologic natural gas does not qualify as a “renewable fuel” under the program, RNG qualifies as an “advanced biofuel” and, importantly, as cellulosic biofuel, based on the type of feedstock used. To qualify as cellulosic biofuel, EPA must find that the fuel has lifecycle greenhouse gas emissions reductions compared to the baseline petroleum fuel of at least 60 percent, compared to 20 percent for “renewable fuel” and 50 percent for other “advanced biofuel.” Since its approval as cellulosic biofuel by EPA, RNG has comprised the vast majority of the cellulosic biofuel category under the RFS. Accordingly, RNG is a high-value product that petroleum companies need to meet their compliance obligations.

When a gallon of RNG (11.727 MMBTU) is dedicated to transportation fuel use, it generates a Renewable Identification Number (RIN). Obligated parties purchase RINs to count the qualifying biofuel as part of

their total production. The value of the RIN is combined with the value of the natural gas commodity, making RNG cost competitive and supporting investment and growth of the RNG industry.

Consequently, production of RNG under the RFS, based on EPA reported data, increased from 32.5 million gallons (EGE) in 2014 to 139.8 million EGE in 2015 – a four-fold increase. Significant growth has continued with production reaching 240 million EGE in 2017. With new projects and production capacity continuing to increase, RNG producers are likely to multiply production of RNG transportation fuel by more than 10 times in less than five years.

BENEFITS OF RNG

RNG has the potential to address multiple challenges and positively impact a range of industry sectors in the United States – everything from climate change to energy supply to waste management to the economy. It also has a ready-made distribution network – RNG can tap right into the 2.5 million miles of natural gas distribution and transmission pipeline in use in the United States. In fact, at least 70 projects in North America are already adding RNG into natural gas pipelines.[6]

Here's a look at the biggest tools in the RNG toolbox:

Promoting Jobs and Economic Development

RNG is good for the economy. In 2017, the United States imported more than ten million barrels of petroleum products per day from more than 80 countries,[7] many of which have interests at odds with ours. Increasing RNG production can displace a portion of these imports and thereby reduce money going overseas – money that could stay right here at home while increasing our independence from the rest of the world.

Developing RNG has been estimated to result in the creation of more than 250,000 new jobs to design, construct and operate RNG plants.[8] This is not limited to urban areas, either – every small town and rural area in America produces waste that can be converted to RNG. In fact, RNG projects are under construction or already operating in more than half of the 50 states.

Capturing biogas for productive application can greatly improve on-farm economics. This is especially true on farms with a high concentration of livestock like in the dairy industry. Methane that would otherwise escape into the atmosphere can be harnessed and sold as a valuable energy resource.

Increasing Energy Security

Diversifying our energy supply by replacing foreign oil with domestic RNG will protect the U.S. from volatility caused by price fluctuations, political conflicts, hurricanes and foreign competition. Many of our communities rely heavily on vehicles that run on petroleum-derived fuels, such as emergency vehicles, sanitation fleets, public transportation and road repair crews. Providing these fleets with a locally-produced source of energy protects the local and national economies.

A domestic energy supply is also more secure than foreign oil imports. An RNG system is much less vulnerable to attacks that could cripple the U.S. economy than the global supply chain could ever hope to be.

Developing Sustainable Waste Practices

It's no surprise that we produce a lot of waste in the United States. We throw away about 250 million tons of solid waste every year, including 70 million tons of food and yard waste.[9] (If global food waste were a country, it would be the third largest GHG emitter in the world, behind only the U.S. and China.[10])

As U.S. population grows, we must take meaningful steps to reduce the incredible volume of discarded products that make their way into our waste streams. Edible food should first and always be prioritized to feed the hungry among us. But for spoiled or otherwise inedible food, the decaying process is inevitable.

RNG provides an actionable, innovative solution to the waste management issues in our country. By capturing the biogas from decomposing organics, the RNG industry is helping ensure that waste is never truly wasted.

Humans and animals will always produce waste. This means that the U.S. is guaranteed a continuous supply of biogas that can be transformed into RNG. Given this reality, it is common sense for communities to work together to put this domestic, clean, secure and renewable resource to work in a sustainable way.

Modernizing the Transportation Industry
RNG has the potential to radically change the transportation industry as we know it. Many transporters have already begun moving to use natural gas as a fuel in the form of compressed natural gas (CNG) and liquid natural gas (LNG). Close to 17 percent of transit buses run on natural gas[11] and more than 50 percent of new orders for trash trucks include natural gas engines.[12]

RNG is a complement to this shift toward Natural Gas Vehicles. RNG has among the lowest carbon intensity of all transportation fuels. It reduces carbon dioxide emissions by more than 80 percent compared to diesel,[13] but we will need much more of it. The 10 million trucks and buses on our roads make up only four percent of all vehicles, but they use 23 percent of all fuel as they haul goods worth 70 percent of the country's GDP.[14] Traditional natural gas and RNG offer a way to help diversify our fuel supply.

Promoting Clean Air and Reducing Harmful Air Emissions
In addition to all of the energy security and economic reasons to support it, RNG production and use provides significant benefits to public health and the environment, as a result of:

Reduced GHG Emissions
When organic waste decomposes, it emits methane-rich biogas. When left untouched that biogas is released, significantly increasing the amount of greenhouse gases (GHG) in the Earth's atmosphere. Methane is a potent GHG.[15] Converting biogas into RNG not only avoids the release of methane and CO_2, it then also displaces fossil fuels. An average of 20 million gallons per month of RNG production can be estimated to reduce 835 million metric tons of CO_2 equivalent GHG emissions per year.

Cleaner Air (less smog and air pollution)
RNG use in natural gas vehicles in the place of diesel or gasoline significantly reduces the amount of air pollutants, including GHGs, released into the atmosphere. This is one of the best ways to substantially reduce the amount of health-threatening emissions from transportation. This reduction in toxic air contaminants is also a major benefit to urban communities as well as those located next to freeways and interstates where the highest concentration of diesel use occurs.

Complementary Renewable Resource
RNG is complementary to other renewable energy alternatives, including wind energy and solar energy. Because RNG provides a steady supply of fuel, it's an effective base load energy that provides stability when more intermittent forms of renewable energy are at a low point.

WHAT'S NEXT?

Now that you're convinced of the need for America to put its full weight behind the potential of renewable natural gas, what's next? How can you get involved?

One of the best ways to practically advance the cause of RNG is to join the Coalition for Renewable Natural Gas, a nonprofit organization focused squarely on promoting renewable natural gas as a clean, environmentally-friendly, renewable and domestic energy resource.

What the one cannot do alone, the many can do together. The RNG Coalition gives a platform and a voice to companies involved in the renewable natural gas industry. The Coalition's membership includes every part of the industry – waste management and recycling, engineers, environmental advocates, renewable energy developers, gas marketers and transporters, research organizations, local utilities, ratepayers and even major oil companies.

The mission of the RNG Coalition:

The RNG Coalition advocates for renewable natural gas so that present and future generations will have access to domestic, renewable, clean fuel and energy supply.

If you are part of the energy industry in any way and you are concerned about the country's future energy supply, you need to be a part of the RNG Coalition. As a member, you will have input in forming and carrying out the Coalition's priorities, which are centered around public policy advocacy and public education.

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[1] *See generally* U.S. Department of Energy, Clean Cities Program, "Turning Waste Into Vehicle Fuel: Renewable Natural Gas (RNG): A Step-By-Step Guide For Communities; Page 6. http://energy-vision.org/ev-publications/EV-RNG-Community-Guide.pdf.
[2] "Food Waste Diversion Programs & Their Impacts on MSW Systems." *SWANA Applied Research Foundation.* April, 2016.
[3] "Final 2014 Effluent Guidelines Program Plan." *United States Environmental Protection Agency*, Office of Water. EPA-821-R-15-002; July, 2015. Page 3-7. https://www.epa.gov/sites/production/files/2015-09/documents/final-2014-effluent-guidelines-program-plan_july-2015.pdf.
[4] "Biogas Opportunities Roadmap: Voluntary Actions to Reduce Methane Emissions and Increase Energy Independence." *U.S. Department of Agriculture, U.S. Environmental Protection Agency, U.S. Department of Energy.* August 2014**.** http://www.usda.gov/oce/reports/energy/Biogas_Opportunities_Roadmap_8-1-14.pdf.
[5] U.S. Environmental Protection Agency (EPA). 2010. *Landfill Gas Energy Cost Model (LFGcost), Version 2.2*. LMOP, Climate Change Division, U.S. EPA. July 2010.
[6] "RNG Pipeline Projects," *Coalition for Renewable Natural Gas*, October, 2016.
[7] "How much petroleum does the United States import and export?" *U.S. Energy Information Administration (EIA).* http://www.eia.gov/tools/faqs/faq.cfm?id=727&t=6 (last visited Apr. 18, 2018).
[8] "The Potential for Renewable Gas: Biogas Derived from Biomass Feedstocks and Upgraded to Pipeline Quality." American Gas Foundation. September 2011. http://www.gasfoundation.org/researchstudies/agf-renewable-gas-assessment-report-110901.pdf.
[9] "Advancing Sustainable Materials Management: Facts and Figures." ." United States Environmental Protection Agency. https://www.epa.gov/smm/advancing-sustainable-materials-management-facts-and-figures (last updated Nov. 21, 2017).
[10] "Food Wastage Footprint: Impacts on Natural Resources," United Nations, Food and Agriculture Organization, 2013. http://www.fao.org/docrep/018/i3347e/i3347e.pdf.
[11] "Public Transportation Industry Is a Green Industry 41.3% of U.S. Public Transit Buses Use Alternative Fuels or Hybrid Technology." American Public Transportation Association.
[12] NGVAmerica, "Vehicles." http://www.ngvamerica.org/vehicles/ (last updated Dec. 31, 2015).
[13] According to CA-GREET, version 1.8B and Argonne National Laboratory, "Waste-to-Wheel Analysis of Anaerobic-Digestion-Based Renewable Natural Gas Pathways with the GREET Model," September 2011.
[14] "RENEWABLE NATURAL GAS: The Solution to a Major Transportation Challenge." Energy Vision and CALSTART. Page 1. http://energy-vision.org/ev-publications/EV-RNG-Facts-and-Case-Studies.pdf.
[15] "Energy Analysis: Biogas Potential in the United States." *National Renewable Energy Laboratory*. October 2013. http://www.nrel.gov/docs/fy14osti/60178.pdf.