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WHITE PAPER / **RENEWABLE NATURAL GAS**

MAXIMIZING BENEFITS WHILE MINIMIZING RISKS OF ADDING ALTERNATIVE FEEDSTOCK SOURCES

BY Adam Bogusch AND **Jeff Keller**

Considering adding alternative feedstocks to enhance the production of renewable biogas at your wastewater treatment plant? Understanding the basic requirements, benefits and drawbacks can help determine if feedstock addition will be viable at your facility.

Renewable natural gas (RNG) is a valuable commodity for many municipal and industrial wastewater facilities that utilize anaerobic digestion. The number of projects focused on the production of RNG continues to gain momentum due to the economic opportunities and supportive regulatory policies that create an environment for success.

Municipalities can expand upon existing digester and biogas recovery programs by incorporating the use of alternative feedstock sources — such as fats, oils and grease (FOG) — to their traditional biosolids to produce more biogas and generate larger revenue streams. But without the proper infrastructure, training and forethought, adding additional feedstock into a digester can also be a major point of failure, with costly consequences for an owner.

To fully take advantage of potential opportunities, municipalities need to understand the basic components of RNG, assess the benefits and drawbacks that adding alternative feedstock can bring to a project, and plan upfront for how this new material will be stored, handled and treated to yield the best possible results.

WHAT IS RENEWABLE NATURAL GAS?

Biogas is a form of energy that is produced from the decomposition of organic waste during the anaerobic digestion process. Wastewater treatment facilities have been utilizing biogas for decades, with varying levels of success.

Biogas becomes a form of RNG when it goes through a cleaning process to remove impurities and carbon dioxide. This creates a product that more closely resembles natural gas, with 90 to 95 percent methane, which is an energy source that can be used to heat homes, fuel vehicles or be returned to the pipeline.

Opportunities for RNG are growing due to the creation of improved technology that makes cleaning the biogas and removing the carbon dioxide a more efficient and cheaper process than it had been in years past. These advancements have helped make it easier to return RNG to the pipeline and for municipalities to reap the business advantages of producing this type of renewable energy.

POTENTIAL ECONOMIC BENEFITS COME FROM MULTIPLE SOURCES

When RNG is sold on the open market, municipalities benefit economically based on the energy content of the gas. Due to the Renewable Fuel Standards (RFS) — a federal program requiring transportation fuel to contain a minimum volume of renewable fuels — RNG is also sought by commercial gas and oil companies, who are looking for opportunities to purchase renewable fuel sources to meet the federal standards. A recent change in regulations that reclassified biogas generated from a municipal wastewater plant into a more valuable category has only intensified its demand.

SOURCES FOR RNG PRODUCTION

TRADITIONAL FEEDSTOCKS

Biogas is produced in wastewater treatment plants that have anaerobic digestion. Through the use of specialized bacteria, these microorganisms consume the pollutants in the waste stream, leaving a residual known as biosolids.

These biosolids are a byproduct of the liquid treatment process in an aerobic treatment system, but the anaerobic process also produces biogas as part of the digestion of biosolids and other available organic materials.

ALTERNATIVE FEEDSTOCKS

Wastewater treatment plants can produce more biogas — and potentially increase the economic benefit of a project — by incorporating alternative feedstocks into the process.

These alternative feedstocks are organic materials that are not part of the influent wastewater but can still be processed in an anaerobic digester to create additional biogas. This can include materials such as FOG from restaurant food waste, industrial discharge or other liquid streams that are high in organic materials.

Waste haulers and industries are often looking for opportunities to get rid of these materials and typically will pay a fee to the municipality for receiving these types of waste.

HANDLING AND INFRASTRUCTURE REQUIREMENTS FOR DIFFERENT FEEDSTOCKS

Accepting alternative feedstocks can have multiple business advantages for a municipality. It can increase the overall production of biogas, as well as provide additional revenue from tipping fees collected from businesses looking to offload the materials. However, there are handling and infrastructure requirements that need to be considered before a municipality decides to accept alternative feedstocks.

Most digesters are built to handle traditional wastewater solids, but alternative feedstocks are more complex. For instance, if a business decides to accept FOG collected from grease traps at restaurants, there may also be other materials, like forks or rocks, that are present in the grease and need to be removed before the FOG can be added to a digester.

To effectively use a digester, municipalities need a holding tank and feed pumps that can easily control the material going into the digester. In the case of alternative feedstocks, such as food waste or grease, specialized equipment is also needed to blend and grind the material into a homogeneous substance that will be better tolerated by a digester. Internal mixing, as well as recycle pumps and heating capacity, also need to be considered when adding alternative feedstocks.

Wastewater treatment plants will need a way to receive the material, which often is delivered by big tanker trucks. Creating a receiving station where the material can be stored and processed to remove any unwanted materials before it enters into a digester is essential for a successful process.

DIGESTION OF FEEDSTOCKS

OVERALL PROCESS CONSIDERATIONS

Digesters are sensitive and often temperamental processes, particularly if a community's or utility's wastewater treatment plant doesn't control how and when feedstock is being added to the digester. If materials are misfed into a digester, it can cause significant problems including excessive foaming or grinding the biology within a digester to a halt.

Municipalities will also need to consider whether they have the staff available to handle these additional activities and create training programs to teach employees how to operate and maintain the systems.

MAXIMIZING GAS YIELD

One of the biggest advantages of adding alternative feedstocks into the process is that it can yield more biogas. However, there are several critical factors that will need to be taken into account to maximize the gas yield at a facility.

First, digesters don't like change and don't operate as efficiently if conditions are altered too suddenly. Municipalities will need to communicate with feedstock suppliers to find out what kind of material will be delivered so that they are able to schedule how much and how often to introduce the new feedstock into the digesters.

A digester will operate best when it receives the same type of feedstock consistently, so municipalities will see the best results by establishing relationships with their suppliers and working out agreements to receive the same type of materials on a regular basis.

Having open and regular communication — including telling suppliers what kinds of materials they can't send — improves the receiving process and promotes better results.

TECHNOLOGIES TO IMPROVE GAS YIELD

A consistent, regular source of feedstock isn't the only way to improve gas yield. Technology, like hydrolysis, can also provide improved treatment.

Hydrolysis, which breaks open cells in the sludge that's produced so it's more easily and thoroughly digested, can be done in multiple ways. One method to promote hydrolysis is to increase the temperature and pressure in the units, while the other method utilizes a biological approach. Each strategy carries its own set of business advantages and challenges.

Thermal hydrolysis has historically been an expensive and difficult process to operate. The high temperature required can also produce an unpleasant odor, making it a public

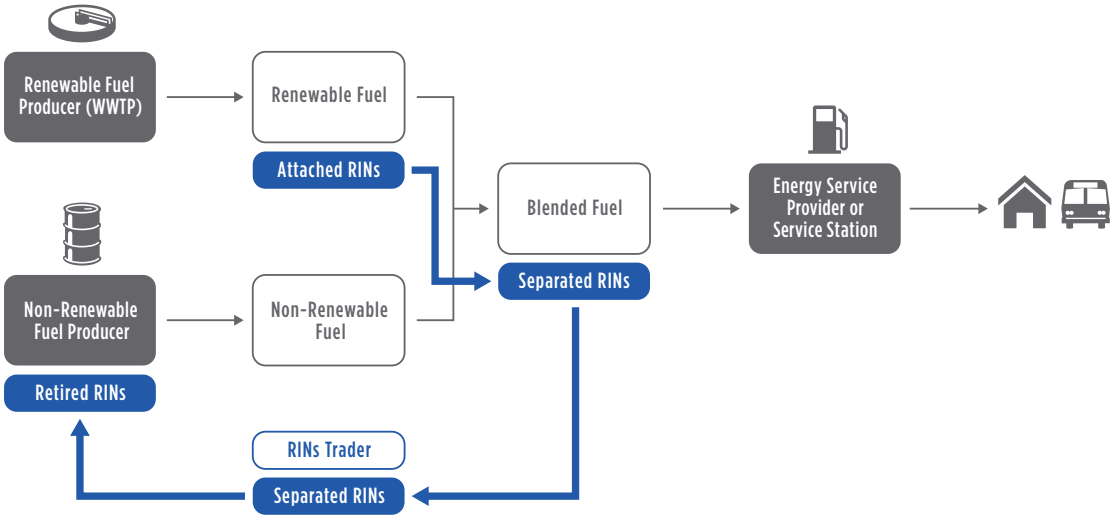

FIGURE 1: *General process of how RINs are generated. RINs are produced when RNG is utilized as a vehicle fuel and are purchased by refiners or fuel importers to satisfy their regulatory renewable fuel obligations.*

relations challenge for some facilities. Newer technology has helped mitigate some of those concerns, but these are the types of issues that owners should consider.

Hydrolysis that relies on biology and enzymes to break down the material, rather than temperature and pressure, is a process that may be safer for and more familiar to wastewater treatment plants. However, this is also a more complicated process approach than simple anaerobic digestion and requires more operational effort to maintain.

ADDITIONAL CONSIDERATIONS

Municipalities can reduce the cost of necessary infrastructure additions by minimizing their existing footprint and incorporating existing tanks or buildings into the process. This can be a viable option for wastewater treatment plants with underutilized capacity considering the addition of alternative feedstocks.

However, it's important to weigh all the pros and cons of using existing infrastructure. While a municipality may save money upfront, re-tasking a building or structure could create a more convoluted layout that could have a negative effect on the efficiency or operations of a facility. Operating the technologies used in processing alternative feedstocks also requires the organization to be comfortable with a certain level of automation and have highly trained staff who can operate the equipment and maintain the conditions necessary for the health of the microorganisms.

ECONOMICS

Biogas traditionally has been viewed as a means to offset the cost of fuels or energy a municipality consumes. For example, municipalities often displace the use of natural gas with biogas to heat their digesters, reducing energy costs.

RNG is unique because it creates a clean energy source with value on the open market. This value is increased even further when it's used for vehicle fuels because the RFS require refiners to have a certain percentage of their fuels be considered renewable fuels (Figure 1). To comply with the standards, refiners who don't want to produce their own renewable fuels can purchase renewable identification number (RIN) credits from other entities, such as those created through utilizing the biogas produced at wastewater treatment plants. RIN credits have various classifications; however, a recent move to reclassify biogas that comes from municipal wastewater plants to a D3 RIN has significantly increased its value.

Not all types of alternative feedstocks are created equal in an economic sense, however. For instance, adding FOG changes the RIN classification from a D3 to a D5, significantly lowering its value. For instance, in

September 2018 a D3 RIN was valued at $26.80 per MMBtu, and a D5 RIN was worth $4.79 per MMBtu, per data obtained from the EPA.

Municipalities need to consider these factors and how different forms of alternative feedstock could alter the value of the biogas when deciding what types of alternative feedstock to accept. Adding FOG may allow a municipality to produce more biogas, but if that biogas has significantly less value owners will need to consider whether it is the best financial decision (Figure 2).

In addition to the value of biogas on the open market or to refiners, municipalities can also collect tipping fees from suppliers who are trying to offload the waste. These fees can provide an ongoing revenue stream to a municipality, potentially helping to offset the impact of any decreases in the value of biogas in the marketplace.

USING COLLABORATIVE DELIVERY TO HELP YOUR PROJECT SUCCEED

Incorporating alternative feedstocks into biogas production can have significant advantages for municipalities seeking to add revenue, but implementing this type of approach can be a complex process in which success is dictated by multiple factors.

Collaborative delivery is one strategy that fosters open communication between the designer and owner from the project's start, helping to keep the owner's end goals and limitations in mind as various project concepts are developed. While the process helps establish common goals for all project stakeholders, it also allows experienced designers and builders to work with the municipality to leverage appropriate new technology with existing infrastructure to create a custom solution. Collaborative delivery can also be used to maximize project savings by identifying project costs early, making it a more targeted and productive approach that ultimately reduces costs and risks to the owner.

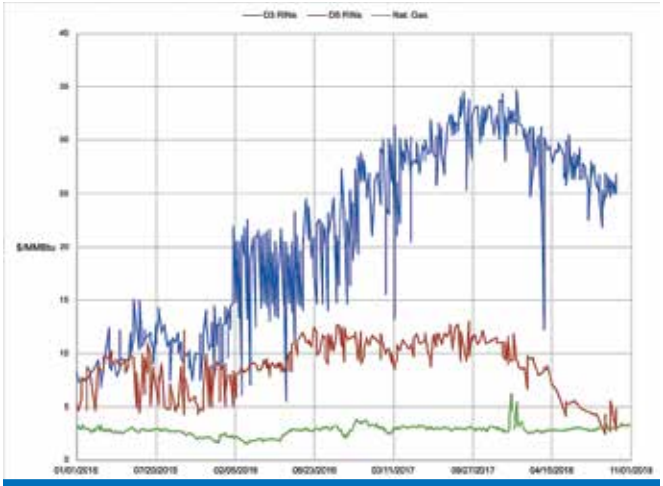

FIGURE 2: *Values of RINs relative to the energy value of natural gas on the open market over the last several years. Source: Adapted from data provided by the Environmental Protection Agency*

BIOGRAPHIES

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