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Biogas is produced after organic materials (plant and animal products) are broken down by bacteria in an oxygen-free environment, a process called anaerobic digestion. Biogas systems use anaerobic digestion to recycle these organic materials, turning them into biogas, which contains both energy (gas), and valuable soil products (liquids and solids).

Anaerobic digestion already occurs in nature, landfills, and some livestock manure management systems, but can be optimized, controlled, and contained using an anaerobic digester. Biogas contains roughly 50-70 percent methane, 30-40 percent carbon dioxide, and trace amounts of other gases. The liquid and solid digested material, called digestate, is frequently used as a soil amendment.

Some organic wastes are more difficult to break down in a digester than others. Food waste, fats, oils, and greases are the easiest organic wastes to break down, while livestock waste tends to be the most difficult. Mixing multiple wastes in the same digester, referred to as co-digestion, can help increase biogas yields. Warmer digesters, typically kept between 30 to 38 degrees Celsius (86-100 Fahrenheit), can also help wastes break down more quickly.

After biogas is captured, it can produce heat and electricity for use in engines, microturbines, and fuel cells. Biogas can also be upgraded into biomethane, also called renewable natural gas or RNG, and injected into natural gas pipelines or used as a vehicle fuel.

New York City spends roughly $400 million each year to transport 14 million tons of waste to incinerators and landfills. Diverting that waste to anaerobic digestion would turn a cost into an opportunity, generating revenue from energy production and co-products.

With little to no processing, biogas can be burned on-site to heat buildings and power boilers or even the digester itself. Biogas can be used for combined heat and power (CHP) operations, or biogas can simply be turned into electricity using a combustion engine, fuel cell, or gas turbine, with the resulting electricity being used on-site or sold onto the electric grid.

With biogas systems, dairies, farms, and industry can reduce operational costs using their own organic wastes to power their equipment and buildings. Fair Oaks Dairy in Indiana produces 1.2 million cubic feet of biogas each day with manure from 9,000 dairy cows. Some of the biogas is upgraded to CNG and used to power trailers delivering milk to Fair Oaks processing plants, reducing their use of diesel fuel by 1.5 million gallons per year.

The Renewable Fuel Standard (RFS) was created by Congress as part of the 2005 Energy Policy Act. The RFS requires the blending of renewable fuels into the U.S. transportation fuel supply. Currently about 10 percent of

the gasoline supply is provided by renewable fuel, primarily ethanol. The RFS sets fuel volumes for a variety of fuel categories: biomass-based diesel, advanced biofuel, cellulosic biofuel, and renewable fuel as a whole. Each category has a required minimum reduction in greenhouse gases.

EPA approved biogas as a qualifying cellulosic feedstock under the RFS in 2014. Cellulosic biofuels must be 60 percent less greenhouse gas-intensive than gasoline. Currently, most of the cellulosic fuel volumes are being met through the use of RNG as a vehicle fuel. Compliance with the RFS is tracked through renewable identification numbers (RINs) that can be traded, and RINs for cellulosic biofuels can earn RNG producers $40/MMBtu (as of September 2017). According to biogas producers, the RFS has become an important driver of investment in the industry.

As part of the approval of biogas, the EPA updated the RFS to allow biogas-derived electricity used as vehicle fuel to qualify for RINs, or “e-RINs.” However, as of 2017, the EPA has not approved any producer requests to start generating e-RINs, despite biogas production already exceeding current transportation electricity demand.

Programs under the Farm Bill’s Energy Title (IX) have been crucial for growth in the biogas industry. Under the 2014 Farm Bill, the USDA’s Bioenergy Program for Advanced Biofuels provides payments to producers to promote the production of advanced biofuels refined from sources other than corn starch. The program currently receives $15 million per year in mandatory funding with $20 million available per year in discretionary funding through 2018.

With the help of over $500,000 in REAP grants and loans, Pennwood Farms was able to install an anaerobic digester in 2011. Bedding made from digestate saves the farm about $60,000 a year in bedding costs, and waste from the farm’s 600 dairy cows produces more than enough electricity to meet on-site needs.