ABOUT BIOGAS

What is biogas?
When organic wastes decompose in an oxygen-free environment they release *biogas*. This process is called *anaerobic digestion* and it is common for organic wastes like food scraps and uneaten food, animal manures and sewage.

Biogas is a mixture primarily of carbon dioxide (CO_2) and methane (CH_4), with smaller amounts of nitrogen (N_2) and trace amounts of hydrogen sulfide (H_2S), ammonia (NH_3) and hydrogen (H_2). Moisture (H_2O) is also a significant component of biogas.

Because biogas includes significant amounts of methane it is important to prevent it escaping into the environment. Methane traps over 80x more heat in the atmosphere than an equivalent amount of CO_2. Since biogas often contains enough methane to be flammable, a key strategy for mitigating this potent greenhouse gas (GHG) is capturing it and using as an energy source.

Because biogas comes from materials that are the product of the current carbon cycle, the CO_2 produced when it is used as fuel is considered biogenic—meaning it comes from natural sources—and therefore carbon neutral.

Organic waste feedstocks
The main sources (feedstocks) from which biogas is typically recovered include landfills; animal manures; food waste; and wastewater (sewage). Biogas from landfills is produced by the presence of other wastes, most commonly food scraps and uneaten food.

What do you mean by an "oxygen-free environment"?
For example, landfill wastes are compacted and buried under layers of soil, gravel, clay, plastic, and high-tech materials to keep in odors and keep out water. This creates an *anaerobic* (oxygen-free) environment. Similarly, on farms animal manures are often stored in ponds or lagoons, where the environment below the surface is oxygen free. These conditions can be replicated in purpose-built, sealed vessels called *anaerobic digesters*.

How do you capture biogas?
At landfills, systems of pipes, pumps and fans capture the biogas and direct it to a central location where it is used for energy or burned off (see below).

On farms, manure ponds can be equipped with high-tech fabric covers to capture biogas; this is commonly referred to as a *covered lagoon digester*. Alternatively, manure can be put into sealed vessel anaerobic digesters, which often include mixing systems to accelerate decomposition.

Sealed-vessel anaerobic digesters are also used to capture biogas at many wastewater treatment plants (WWTPs; also called water resource recovery facilities, or WRRFs). The technology was originally introduced to wastewater systems as a way of reducing the volume of solids left over after treatment.

Tank digesters are also used to capture biogas from food waste, which is increasingly being diverted from landfills.

How can biogas be used?
Often containing 50% or more methane, biogas is generally flammable. This means that it can be used to fuel generators to produce electricity; or to run *combined heat and power* (CHP) systems, which generate electricity and capture thermal energy (heat). Such systems can be found at landfills, wastewater plants and livestock farms, where they provide energy to the facility.

Electricity that is generated but not used by the facility can be exported to the grid (sold to an electric utility). Multiple states include *electricity generated by biogas* under their Renewable Portfolio Standards and Feed-in-Tariffs. Biogas-generated electricity can also power electric vehicles. The U.S. Congress has approved tax credits for biogas facilities under the Inflation Reduction Act, and the U.S. EPA is considering a rule under its Renewable Fuel Standard to facilitate additional credits for biogas-electricity used as vehicle fuel. (Electricity from renewable natural gas, see below, would also qualify for such credits.)

How *can't* biogas be used?
As noted above, in addition to methane, biogas contains CO2 and multiple impurities, which limits its uses to those described above. Biogas must undergo an initial treatment before it can be used in a generator or CHP system. Even after this clean up, however, treated biogas is still corrosive and can't readily be stored or piped or trucked between locations; this means that it must be used on-site as it is produced. Any biogas that is surplus to facility (and grid-export) purposes is flared (burned off/wasted); facilities that don't make use of their biogas flare it all. While flaring destroys the methane, it puts CO2 into the atmosphere without benefit.

Biogas to RNG
Biogas can be upgraded to produce *renewable natural gas*, or RNG. This is done by processing biogas using one (or a combination) of various filtration technologies, which removes the CO_2, H_2S and other impurities. The remaining gas is 95% or more methane, and suitable for injection into pipelines; it can also be stored or transported by *virtual pipeline* (tanker trucks). Chemically identical to geologic natural gas, RNG can be used in all the same ways. Like biogas, RNG is biogenic and carbon neutral. Depending on the feedstock and other factors, RNG can even be significantly *carbon negative*.

The Important Role of Biogas
Capturing biogas produced by organic wastes is an important part of reducing global methane emissions, which the Intergovernmental Panel on Climate Change (IPCC) sees as key to limiting atmospheric warming and its climate impacts.

However, capturing this biogas is just the first step: converting it to electricity or into RNG avoids the deleterious climate impacts caused by unchecked methane emissions or flaring, while also creating reliable energy supplies for multiple sectors of our society. Facilitating the creation and expansion of markets for biogas-power and RNG applications is a leading priority for RNG Coalition as we strive to incentivize increased methane capture and achieve long-term emissions reductions goals.