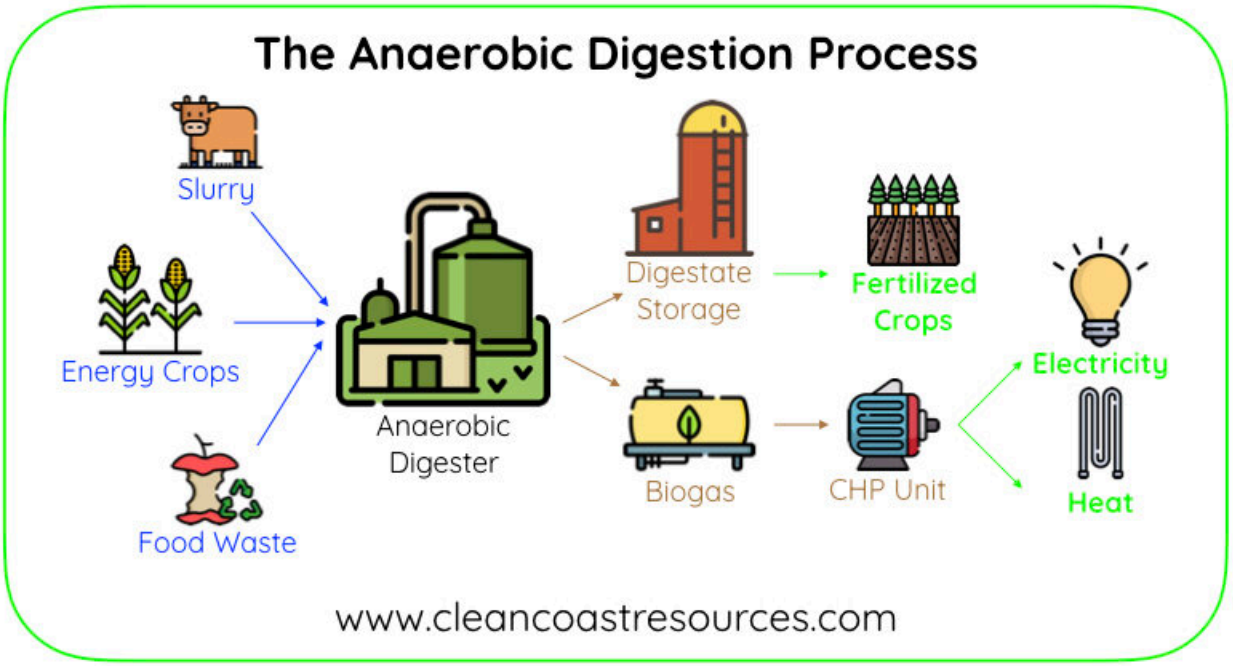
Is Anaerobic Digestion Right for your Community?

By Kieran Tay



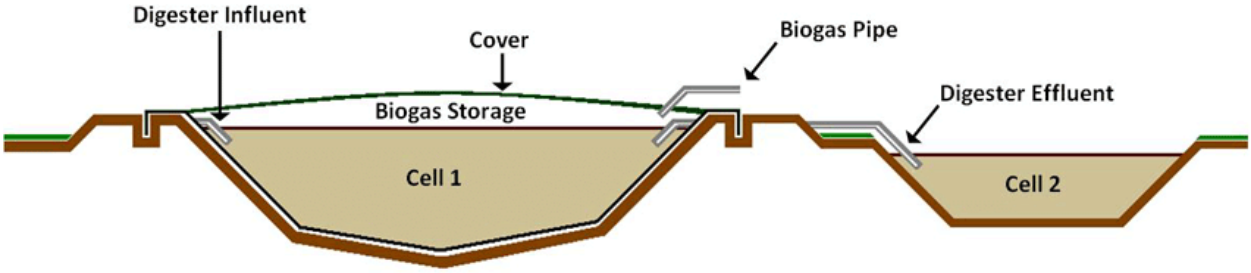
Flow Chart for the Input and Beneficial Outputs of Anaerobic Digestion

It's a long weekend, and I get the chance to go home for the holiday and spend time with my family. As a treat for my progress, my parents take me to a fancy steakhouse with small portions and big money. The food is amazing, the best steak I've had in my life, and judging by the clamoring of the customers around me, they think the same. And yet, I still see food on their plates when the bus boy comes by to collect the dishes. If the food is this good and is still being wasted, then how much of all food are we really wasting? Many people throw away their food without a second thought and it turns out that the statistic for food wastage is up to 40% of our entire food supply. It only gets worse as food that is sent to landfills ferments to produce methane, a compound with 80x more warming power than carbon dioxide when released into the atmosphere according to an article by the Environmental Defense Fund. This leaves an urgent and underexplored opportunity to both reduce food and agricultural waste and produce energy with Anaerobic Digestion.

Anaerobic digestion is a method in which we can convert organic material into biogas, a methane containing fuel like natural gas that can be burned for cooking or electricity. It consists of a series of four main biochemical reactions to ferment organic material, but for a starter digester it is possible to only use the bacteria inherent in the feedstock. You can take food waste, crop waste, and sewage biosolids and place it in a reaction chamber. Then simply by waiting, the material will decompose allowing you to release biogas directly into your stove, or into a canister for sale. The digestate that is left behind isn't useless either, it can be utilized as

a fertilizer giving you full recyclability for your organic waste. This can be compared to a cow's stomach! Cows eat organic matter and produce manure, but while the food is in their stomach it ferments with their natural gut microbiome to produce biogas, making them a significant contributor to greenhouse gas emissions!

Getting into the practice is extremely accessible as well and how you want to use it can be catered to. There are three main types of anaerobic digestion processes: Passive systems, low-rate systems, and high-rate systems. Passive systems take little effort to operate and take forms such as the lagoon digester. In the lagoon digester, a lagoon is filled with biomass with one half covered with a film of water on top. As the first covered half ferments the material, the gas goes into the second uncovered half so that the water rises and can act as a gas storage unit. In the low-rate systems, there is an active feed of biomass inoculated with an anaerobic digestion microbiome. As it runs through a stirring tank it produces biogas which can be released through the top while the digestate flows out as effluent. High-rate systems are very similar to low-rate, except that some of the digestate is recycled back into the mixing tank to provide more anaerobic bacteria.



The covered lagoon Anaerobic Digestion setup above is simple and elegant, yet only one of the many possible digestions setups available to choose from.

However, the important question is how much anaerobic digestion can actually reduce our carbon footprint and prevent climate change. According to the EPA, "114.5 million metric tons of carbon dioxide equivalent" in global warming power are released into the atmosphere from our landfills in the U.S. alone. This makes up 17.4% of all U.S methane emissions! With anaerobic digestion, if we were to fully capture the methane from this organic waste and convert it into energy and CO2, we can reduce these emissions' impact by 80 times. That means cutting our landfill emissions by 98%! As a result, even though we are releasing CO2, this is a MUCH better alternative than to simply release methane into the environment. UC Davis did just that and prevents "roughly 13,500 tons of greenhouse gas emissions a year" and produces 5.6 million kWH of energy per year, according to their website. Doing some math, electricity rates in California go for 19.9 cents/kWH which means there is an annual revenue of $1,114,400 making this opportunity quite attractive.

Anaerobic Digester used in UC Davis to deal with food and agricultural waste while also producing a profit for the campus.

Are you comfortable with letting food waste be just that? Or are you going to pursue the opportunity to help the environment and create new revenue for your community? With the tools and knowledge to do it, Anaerobic Digestion is a great option to accomplish all of this and more to make your neighborhood greener.

Bibliography

Chung, Carrie. “Renewable Energy Anaerobic Digester (READ).” *Facilities Management*, 6 Dec. 2020, https://facilities.ucdavis.edu/utilities/read.

Methane: A crucial opportunity in the Climate Fight. Environmental Defense Fund. (n.d.). Retrieved December 6, 2021, from https://www.edf.org/climate/methane-crucial-opportunity-climate-fight. “FAQs about Landfill Gas.” *EPA*, Environmental Protection Agency, https://www.epa.gov/lmop/frequent-questions-about-landfill-gas.

“Food Waste FAQs.” *USDA*, https://www.usda.gov/foodwaste/faqs.

“Types of Anaerobic Digesters.” *EPA*, Environmental Protection Agency, https://www.epa.gov/anaerobic-digestion/types-anaerobic-digesters.

“Types of Anaerobic Digesters.” *Farm Energy*, 12 Apr. 2019, https://farm-energy.extension.org/types-of-anaerobic-digesters/.