

## **Anaerobic Digestion a Solution for Waste-to-Energy**

### **By Larry Cosenza and John Hays**

#### ***Introduction***

Microbial anaerobic digestion (MAD) is a process that uses bacteria in an oxygen free environment to convert organic waste into energy. Bio-gas is one product produced from the breakdown of organic matter in the anaerobic process. Anaerobic digesters come in many different styles, shapes and configurations but, they all operate in the absence of oxygen, in a sealed vessel and at elevated temperatures. Anaerobic digesters can simply be considered as mechanical cows that are fed organic waste and in the process make bio-gas and other products. Bio-gas is a mixture of methane and carbon dioxide. If carbon dioxide is removed from bio-gas the remaining material is called bio-methane and is nearly the equivalent of natural gas. The other products that result from anaerobic digestion are remaining solids and nutrient rich liquid often referred to as digestate.

#### ***Bio-gas is Energy***

The last stage of the waste to energy multi-step process is where bio-gas is produced. Bio-gas is a form of energy which is primarily a mix of both methane and carbon dioxide (CO<sub>2</sub>) gases. In a digester, easy to digest carbohydrates such as food waste from grocery stores and restaurants can digest very rapidly and convert to methane quickly much like our bodies metabolize sugars and starches quickly. Bio-gas can be burned as fuel in a generator, hot water heater or fuel cell as a means of getting the energy value out of bio-gas. Burning the bio-gas to form energy is usually referred to as combined heat and power (CHP). A rule of thumb is that ~100 cubic feet per minute of bio-gas, on a daily basis, can drive a 300 kilowatt (kW) engine which is enough power for about 300 homes in a year. High temperature fuel cells have been developed to convert bio-gas into heat and electricity. Bio-gas that has been enhanced by removing CO<sub>2</sub> and hydrogen sulfide can be injected into natural gas utility grid or compressed and burned in vehicles. For comparison, 1000 cubic feet of bio-methane has the same energy as 7.2 gallons of gasoline.

#### ***Financing & Construction***

Anaerobic digestion is a relatively old globally utilized technology that is gaining acceptance in American markets. The lack of performance of first generation dairy farm digesters, new digester technology, and capitalization costs have hindered USA market acceptance of anaerobic digestion. Securing financing for a digester project can be challenging and has been primarily based on the owner's personal or corporate equity position, credit record and projected financial payback for investors. Federal and State grants, loans and tax breaks can be an integral part of the financial backbone of a project. Public Private Partnerships are gaining in popularity whereby private companies can bring financing to a project at municipal settings in exchange for a long term partnership. Installation of an anaerobic digestion operation can follow an engineer, procurement, construction (EPC) path where the owner deals with

one single entity for all issues pertaining to system design, process performance and construction. An EPC provider will often bring in a digester process provider onto their team for a system performance guarantee. Alternatively, an owner can chose to split projects into multiple parts that contracts separately for system design, permitting, construction and the process and power generation equipment. This can put a heavier management burden on the owner but can allow for some additional financial transparency and hardware choice. Each of these models provides their own level of flexibility and accountability for all participants involved.

Rhode Island passed legislation in June of 2014 that requires large food dispensaries to divert food scraps from the landfill. For more information go to <http://www.providencejournal.com/breaking-news/content/20140620-bill-mandating-some-food-waste-recycling-in-ri-approved.ece> or contact John Hays at [john@reiteam.org](mailto:john@reiteam.org). Check the REI event calendar for programs on Anaerobic Digestion; [www.reiteam.org](http://www.reiteam.org). This article first appeared on the [www.renewablenow.biz](http://www.renewablenow.biz)

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