

BIOGAS ENERGY

**ARIZONA PUBLIC SERVICE
COMPANY**



WHAT IS BIOGAS?

Biogas is a methane rich flammable gas that results from the decomposition of organic waste material.

Biogas Energy is the use of Biogas to produce heat or power



WHERE DOES BIOGAS COME FROM?

➤ **Vegetation** - *When vegetation decomposes, it gives off methane gas*



➤ **Farm and ranch animals** - *cattle, chickens, pigs produce manure. When manure decomposes, it also gives off methane gas*



➤ **Sewage** – *The treatment of human waste in anaerobic digesters produces methane*



➤ **Landfills**
Garbage produces methane as it decomposes



CONVERSION OF ORGANIC WASTE INTO BIOGAS

➤ ***Uncontrolled anaerobic digestion***

- ❖ ***Wetlands and Ponds***
- ❖ ***Landfills***



➤ ***Controlled anaerobic digestion***

- ❖ ***Sewage Treatment Plants***
- ❖ ***Cattle Manure Digesters***



VEGETATION - WETLANDS AND PONDS

- ***Caused by rotting vegetation***
- ***Escaping methane rich gas goes into the atmosphere.***
- ***More hazardous than CO₂ as a greenhouse gas***
- ***Can Ignite spontaneously***
- ***One common occurrence is swamp gas, also known as “Will-o-the-Wisp”***



LANDFILLS

- *There are 44 active landfills in Arizona*
- *7 Million Tons of waste material are disposed in the landfills annually*
- *To prevent methane from escaping into the atmosphere, it is collected and flared*
- *There are 29 landfills in Arizona that are flaring methane*



Escaping methane can destroy adjacent vegetation



Landfill with gas collection system and flare

SEWAGE TREATMENT PLANTS

Sewage treatment plants are designed to clean the water from the sewage and in the process can generate large amounts of methane. The methane can be either flared or used for power production.



Sewage Water



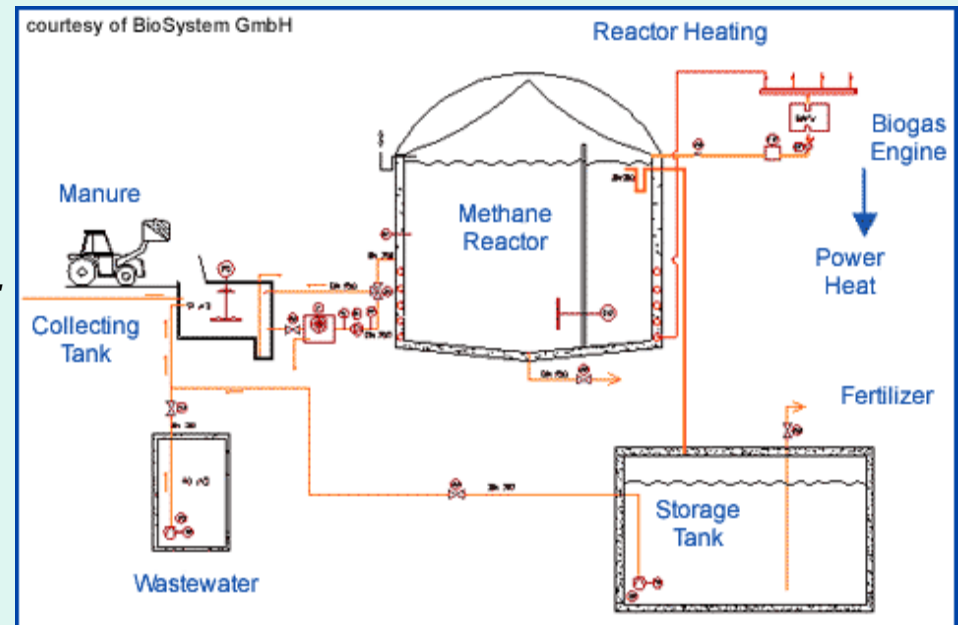
Close-up of Flares



Sewage Digester

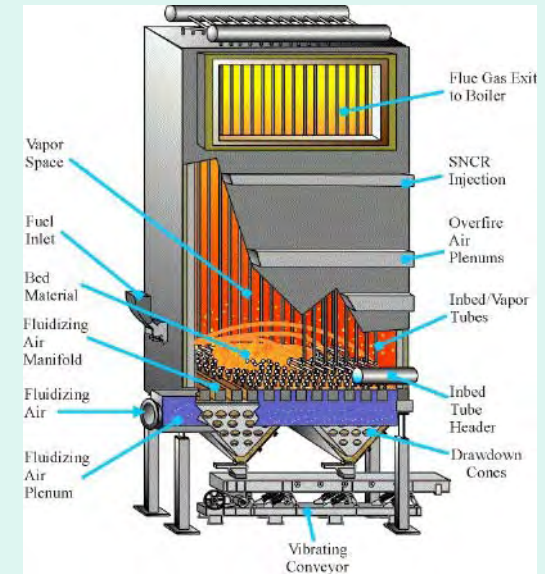
ANIMAL MANURE DIGESTER

- **The Anaerobic Digestion of animal waste creates methane.**
- **The remaining solids can be used for:**
 - ❖ **Fertilizer**
 - ❖ **Animal bedding (sterilized of all pathogens)**
 - ❖ **Gasification**
- **Recycled Water can be used for farming**



Manure Gasification

Dry Manure can be gasified to create a hydrogen-rich *Syngas*. Syngas consists of hydrogen, carbon monoxide, and small amounts of methane and can be used for power generation. A rapid gasification process can produce *BioOil*, a petroleum-like material that can be refined into adhesives, plastics, fragrances, flavorings, chemicals and fuels. The remaining ash, *Char*, is an activated carbon powder that can be used for emission filtration, fertilizer and water time-release capsules for crops



Fluidized Bed Gasifier

The bed material can either be sand or char, or some combination. The fluidizing medium is usually air; however, oxygen and/or steam are also used.

BIOGAS MAY BE USED TO PRODUCE HEAT AND POWER

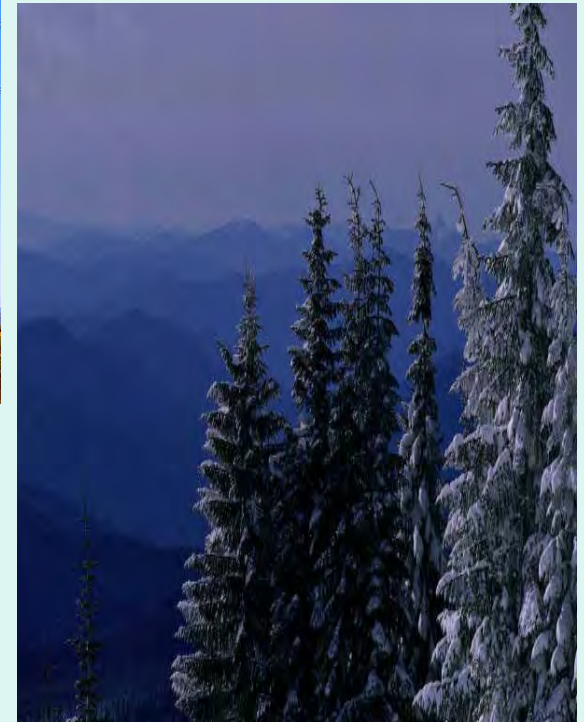
- ***The cleaned methane can be piped to an engine or turbine and generator to produce electricity or sent through the pipeline as a usable gas.***



***Butterfield Landfill Station
Maricopa, Arizona***

ADVANTAGES ASSOCIATED WITH BIOGAS POWER PRODUCTION

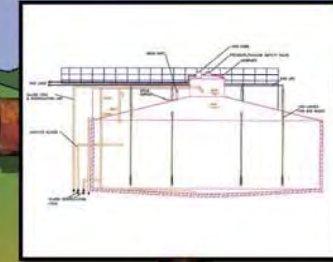
- ***Usable fuel from manure and waste water treatment plants***
- ***Useful by-products from the biogas process***
- ***Reduces Greenhouse Gas emissions***
- ***Sustainable Resource as long as we have animals and wastewater treatment plants***



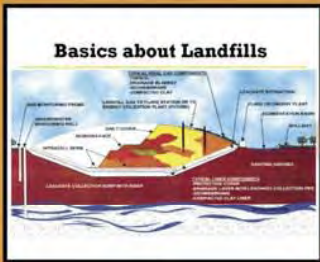
BIOGAS



Microbes in an anaerobic atmosphere (little or no oxygen) break down solid animal waste and release methane (the major constituent of natural gas) and carbon dioxide. This methane rich gas mixture can be used as a fuel in an engine/generator to produce electricity.



Methane is generated when waste material in a landfill decomposes. Collection wells can be drilled into the landfill and the methane extracted for use as fuel to make electricity.



The gas is usually cleaned of impurities and dried before being used in the engine/generator.



Additional Sources of Information

<http://www.eere.energy.gov/>

http://www.nrel.gov/clean_energy/bioenergy.html

<http://en.wikipedia.org/wiki/Biogas>

<http://www.renewableoil.com/pages/applications.html>

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