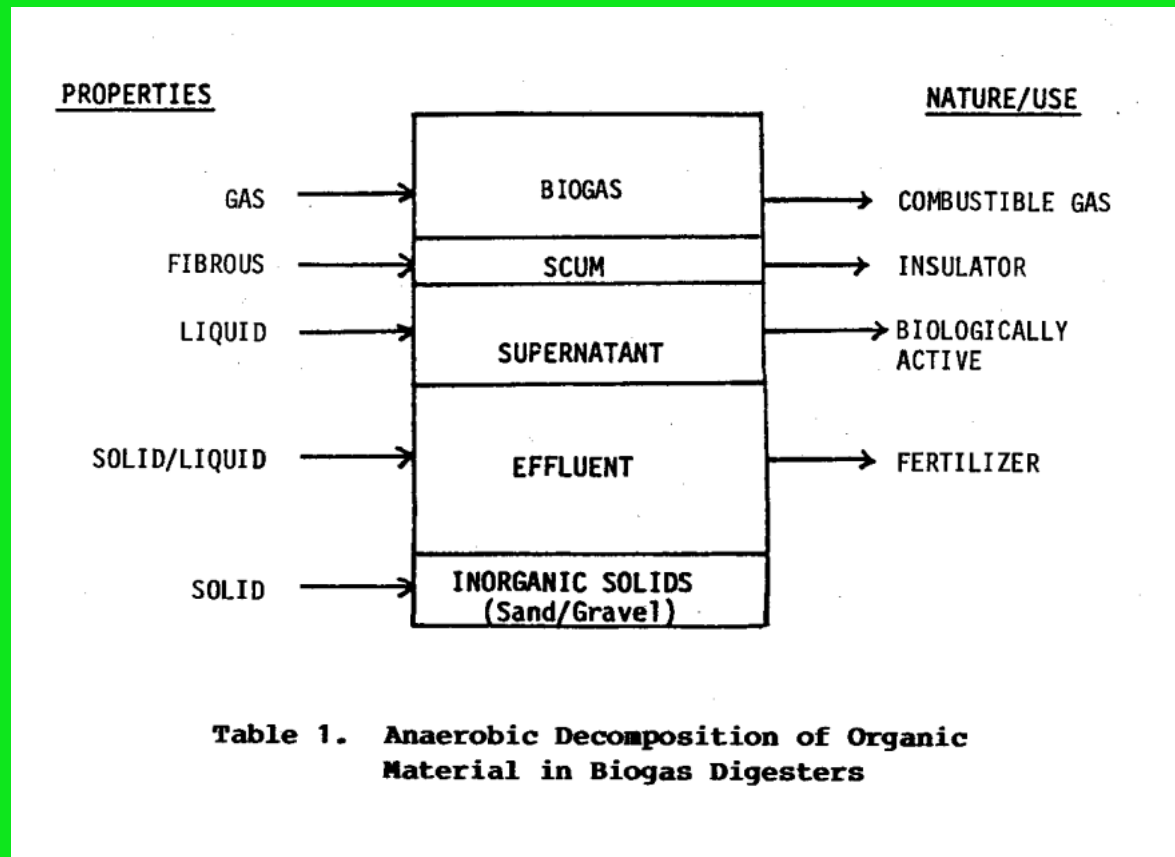


BIOGAS

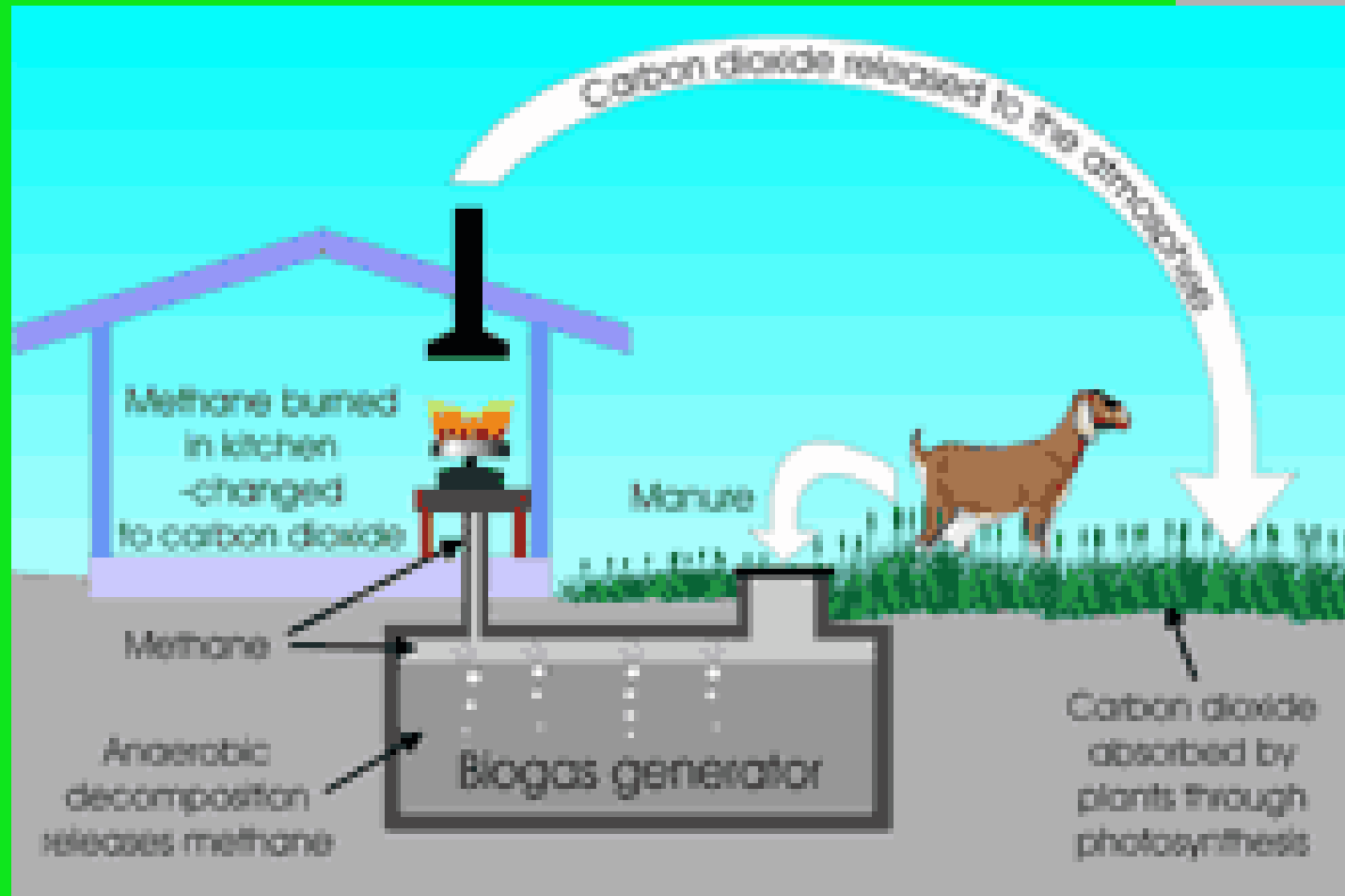
**THE PRODUCTION OF BIOGAS AS RENEWABLE AND
AN ALTERNATIVE SOURCE OF ENERGY
GENERATION**



SCHEMATIC OVERVIEW



SCHEMATIC OVERVIEW



WHAT IS BIOGAS?

- n Biogas can be generated from anything organic that contains Carbon, it is the anaerobic digestion of biological material, ranging from cooking oils and crops to manure. Its composition is generally 60% methane and 25-39% carbon dioxide and other trace elements, though this mixture varies depending on the material used.
- n Methane is the second most harmful GHG, it is produced on a daily basis and not utilised, it is a valuable source of fuel that has a wide range of applications, from heating, cooking, vehicular fuel, electricity generation

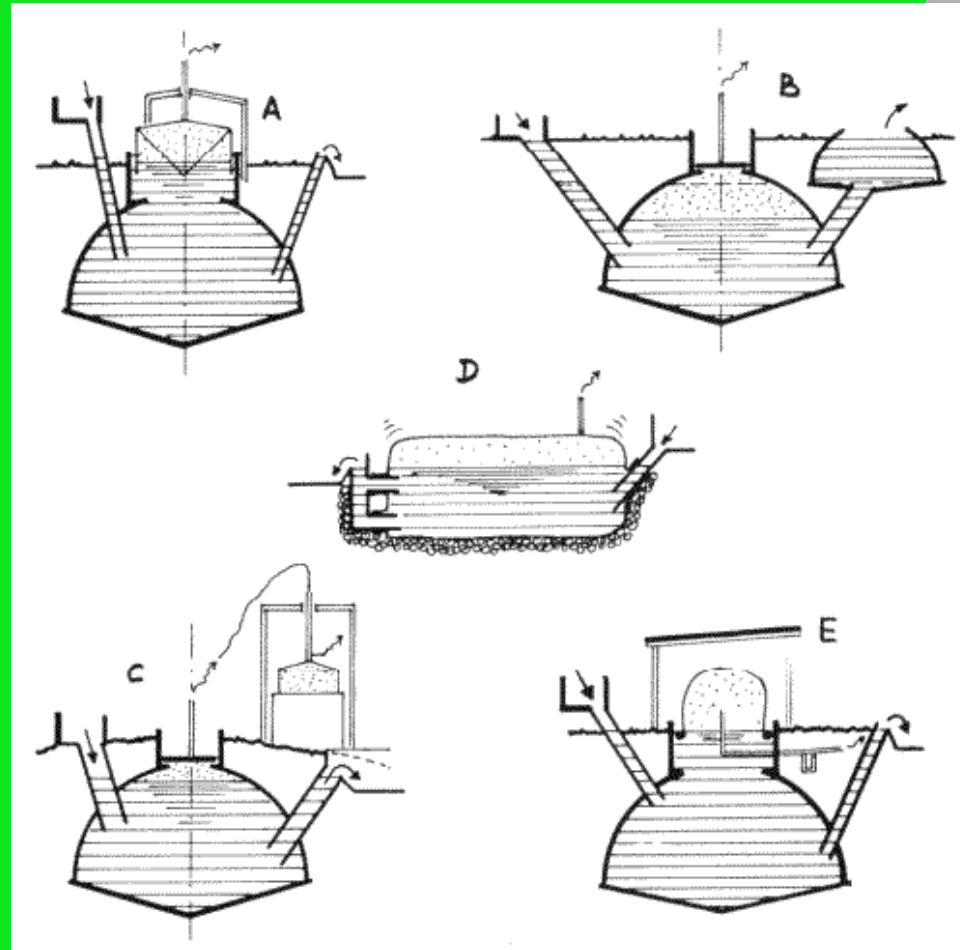
ANAEROBIC DIGESTION

- n Anaerobic Digestion is the bacterial decomposition of organic matter that occurs in the absence of oxygen.
- n **The anaerobic digestion process can be divided into three steps:**
- n 1. **Hydrolysis** occurs as complex organic molecules are broken down into their constituent parts, including fatty acids, amino acids, and simple sugars.
- n 2. **Acidogenesis** Acid producing bacteria, convert the intermediates into acetic acid, Hydrogen and Carbon Dioxide
- n 3. **Methanogenesis** is the final stage, in which methane, analogous to natural gas, is formed, along with carbon dioxide and water.

WHAT IS METHANE?

Each year some 590-880 million tons of methane are released worldwide into the atmosphere through microbial activity. About 90% of the emitted Methane derives from biogenic sources, i.e. from the decomposition of biomass. The remainder is of fossil origin (e.g. petrochemical processes). In the northern hemisphere, the present tropospheric methane concentration amounts to about 1.65 ppm.

Digester Designs



Biobags



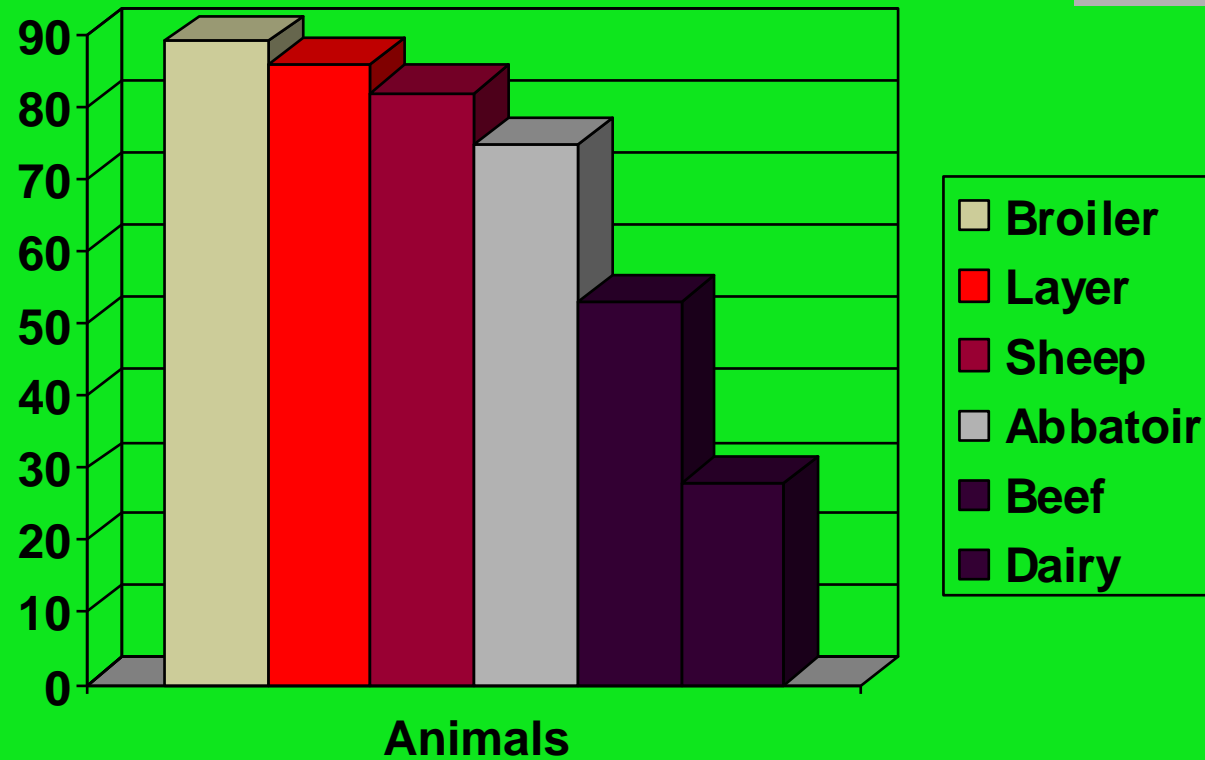
Accumulator



BIOGAS SYSTEM

- n CONSTRUCTING BIOGAS SYSTEMS INCORPORATING THE TECHNOLOGY OF DIGESTING ANIMAL MANURE AND ORGANIC WASTE ANAEROBICALLY TO PRODUCE:**
 - n 1. Combustible gas for the generation of electricity and heating**
 - n 2. To produce an excellent fertilizer**
 - n 3. To dispose of agricultural resources, aquatic weeds, animal and human excrement and other organic matter**

L /Kg substrate gas Production



TYPES OF DIGESTERS

There are three primary types of anaerobic digesters used for livestock farms.

- n *Covered Anaerobic Lagoon:*** Covered anaerobic lagoons can be used to generate and collect biogas from manure. They consist of a plastic impermeable flexible cover with manifolds designed to collect the gas produced. They are most applicable for swine or dairy operations which utilizing a flush system to transport manure to the lagoon. The manure should be dilute and contain less than 2% solids. Covered lagoons require warm climates to produce gas year round.

TYPES OF DIGESTERS

- n **Complete Mix:** A complete mix digester is an engineered tank either above or below ground typically constructed of either steel or concrete that is heated. They can treat manure with a solids concentration of 3 to 10 percent. Complete mix digesters are appropriate for all climate conditions.
- n **Plug Flow** A technology borrowed from Asia and first attempted by Cornell scientists for dairy operations. They are engineered, heated, rectangular tanks with a flexible cover for biogas collection. They are best suited for scraped dairy manure that has a solids concentration of 11-13 percent. Swine manure has not been successfully digested in plug flow digesters because of the low fiber content of swine manure. Because they are internally heated, plug flow digesters can operate in any climate.

PLUG FLOW DIGESTERS



PLUG FLOW DIGESTER



COVERED LAGOON DIGESTERS



RCM Covered Lagoon Digester

Biogas - December 1996
Electricity - March 1997

RCM Digesters
rcmdigesters.com

Barham Farm
Zebulon, NC
4000 sow -
farrow to wean

COVERED LAGOON DIGESTERS



RCM Cover on Lagoon Digester

Biogas for engine
and flare since
October 1993
rcmdigesters.com

Martin Farms
S. Boston, VA
600 Sows
farrow to feeder

HEATED, MIXED, COVERED LAGOON DIGESTERS



RCM Heated, Mixed,
Covered Lagoon Digester

The image shows a large, rectangular lagoon covered with a dark, flexible material. The lagoon is situated in an open field with several white, industrial-style buildings in the background. The sky is overcast. The lagoon has some lighter-colored areas, possibly where the cover is being installed or where there are leaks. A small, dark, cylindrical object is visible in the bottom right corner of the lagoon.

Biogas and Hot Water
since May 1998

RCM Digesters
rcmdigesters.com

Apex Pork, Inc.
Rio, IL

8,000 Finish Hogs
All in - All out

ANAEROBIC DIGESTERS

- n Anaerobic digesters—also known as biodigesters—are made out of concrete, steel, brick, or plastic. They are shaped like silos, troughs, basins or ponds, and may be placed underground or on the surface. All anaerobic digestion system designs incorporate the same basic components:
- n A pre-mixing area or tank
- n A digester vessel(s)
- n A system for using the biogas
- n A system for distributing or spreading the effluent (the remaining digested material).
- n There are two basic types of digesters:
- n **Batch digester**
- n Batch-type digesters are the simplest to build. Their operation consists of loading the digester with organic materials and allowing it to digest. The retention time depends on temperature and other factors. Once the digestion is complete, the effluent is removed and the process is repeated.
- n **Continuous Batch digester**
- n In a continuous batch digester, organic material is constantly or regularly fed into one of the digesters. There are more than one of these digesters to ensure constant gas production should a problem arise from one of the digesters.
- n Proper design, operation, and maintenance of continuous digesters produce a steady and predictable supply of usable biogas. They may be better suited for large-scale operations.
- n Many livestock operations store the manure they produce in waste lagoons, or ponds. A growing number of these operations are placing floating covers on their lagoons to capture the biogas. They use it to run an engine/generator to produce electricity Or heating of livestock and water.

END USE APPLICATIONS

n Biogas

- n Heating of livestock, water or refrigeration
- n Fuel for Internal Combustion Motors, Diesel, Petrol and Stirling motors.
- n Fuel for Gas turbines, Perhaps an Aeroplane in the future?
- n Electricity, Mechanical power, Irrigation pumps.
- n Vehicular Fuel, at high pressures this provides a cleaner solution to fossil fuels.
- n In Rural applications, fuel for cooking and lighting thus preventing deforestation.

Natural Gas Generator



Uses of Effluent

- n The effluent can be used as a fertiliser.
 - n N.P.K ratios can be controlled.
 - n Substitute bedding material
 - n A protein substitute for cattle feed
 - n Feed for aquaculture and fish farming.
- n Dry effluent can be reused in pyrolysis plants.

INTEGRATED APPROACH

- n As organic matter is the raw material needed for biogas plants, an integrated biogas system should be promoted and banks should provide loans for the integration of Biogas Plants. Integrated programmes with energy sector, agriculture, livestock, forestry, irrigation, health, fishery and small industries help rural communities to raise their standard of living and this has a knock on effect, healthier people, sustainable energy, less deforestation. Biogas Plants could be integrated with rower pumps, treadle pumps, poultry, piggeries, fodderplants, milks and its products, toilet attachments, etc.

CONCLUSION AND RECOMMENDATIONS

n Conclusion

- n Though there is capacity of building Biogas Plants by companies, if there is no subsidy provided by donors or the government, the system will not materialized, and will not help to prevent a serious energy crisis in the next 20 – 30 years when the world's oil resources become depleted. The use of Biogas will also ensure a cleaner environment, and will mainly contribute to minimize the “greenhouse” effect globally.