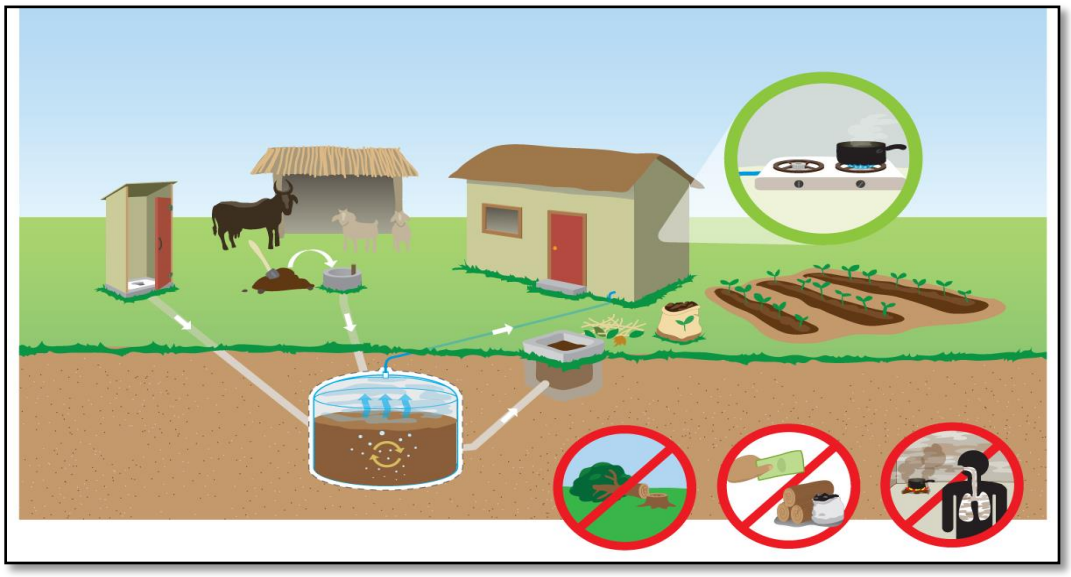
Student Sheet 1

LAB ACTIVITY:
METHANE: UP CLOSE AND PERSONAL

When garbage is buried in a landfill, bacteria grow on the organic material, digest it and give off carbon dioxide and methane gas as ***waste products.*** Things like garbage, human and animal waste, dead animals and the like can be left to rot, releasing a gas called ***biogas*** (methane gas or landfill gas). Methane is the main component of natural gas, and is relatively clean burning, colorless, and odorless. Methane combustion produces carbon dioxide, water and energy: $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$ + **energy**. Most of the methane finds its way into the atmosphere, where it is a powerful greenhouse gas.

If this gas could be captured and burned for cooking and heating it would prevent a large part of the methane from going into the atmosphere. Animal waste can also be converted into methane by a machine called ***anaerobic digester.*** An anaerobic digester is a sealed tank, deprived of oxygen, in which organic waste is broken down at an elevated temperature. This allows the waste material to decompose quickly and produce methane that can be captured and used as fuel. Even the leftover materials not used to produce methane are repurposed. The remaining solids are composted; the liquid is seasonally applied to parkland and farms as carbon-rich fertilizer.



A simple illustration of a biogas digester system

There are environmental benefits as well. Livestock manure emits methane, a greenhouse gas with 20 times the heat trapping potential as carbon dioxide. Capturing the methane to use for electricity prevents it from entering the atmosphere. A ***biogas digester*** is a great low-tech solution for the need for cooking fuel being used in developing countries. It collects waste from livestock and people, harvests the gas for cooking, lighting and/or heating, and produces organic fertilizer for crops. Using biogas instead of wood or charcoal greatly reduces smoke inhalation and related diseases (especially in women who do most of the cooking), deforestation, carbon output, time spent gathering firewood or money spent to buy wood or charcoal

In many parts of the world this is already being done on small farms and in households to provide heat. China and India have thousands of ***biogas generators*** being used to transform organic waste into fuel. In many countries, like the United States, landfills have collection systems to capture the methane generated by the decomposition of garbage.

Methane wells erected at the top of a dumpsite in the Philippines.

Large-scale ***biogas power plants*** can be built quickly, simply, and for much less money per kilowatt than coal, oil, or nuclear power plants. Farms that produce a lot of manure can use biogas generators to produce methane. Some biogas plants use manure from nearby feedlots to produce enough methane to supply electricity or heat. An added benefit is methane is a ***renewable resource***.

Student Sheet 3

OBSERVATIONS: Draw and label what you saw happening during the demonstration.

Student Sheet 4

ANALYZE AND ASSESS: Answer the questions below using the information form the reading selection and the demonstration.

1. What type of biomass was used in this demonstration?

2. What was the relationship between the level of the methane produced and what happened to the balloon?

3. When the gas was tested with the lighted match, what color was the flame it produced? What did that tell you?

4. If the setup had been located in a cool part of the room, what would have happened? Explain why.

5. How do the results and conditions of the investigation compare with the conditions that allowed for the formation of natural gas deposits millions of years ago?

6. What happened when the first test for methane was made with the match? What did that tell you about the gas that was emitted?

7. Why is the temperature important factor in the production methane?

8. What process is actually producing the methane gas? What type of organisms are involved in this process?

9. What is the chemical equation for methane combustion?

10. What are the end products of the methane combustion process?

11. Do you think different materials would produce methane at a different rate? Why?

12. What could methane biogas be used for?

13. Methane is a renewable resource, what does this mean?

14. What are the advantages of biogas as a fuel source?