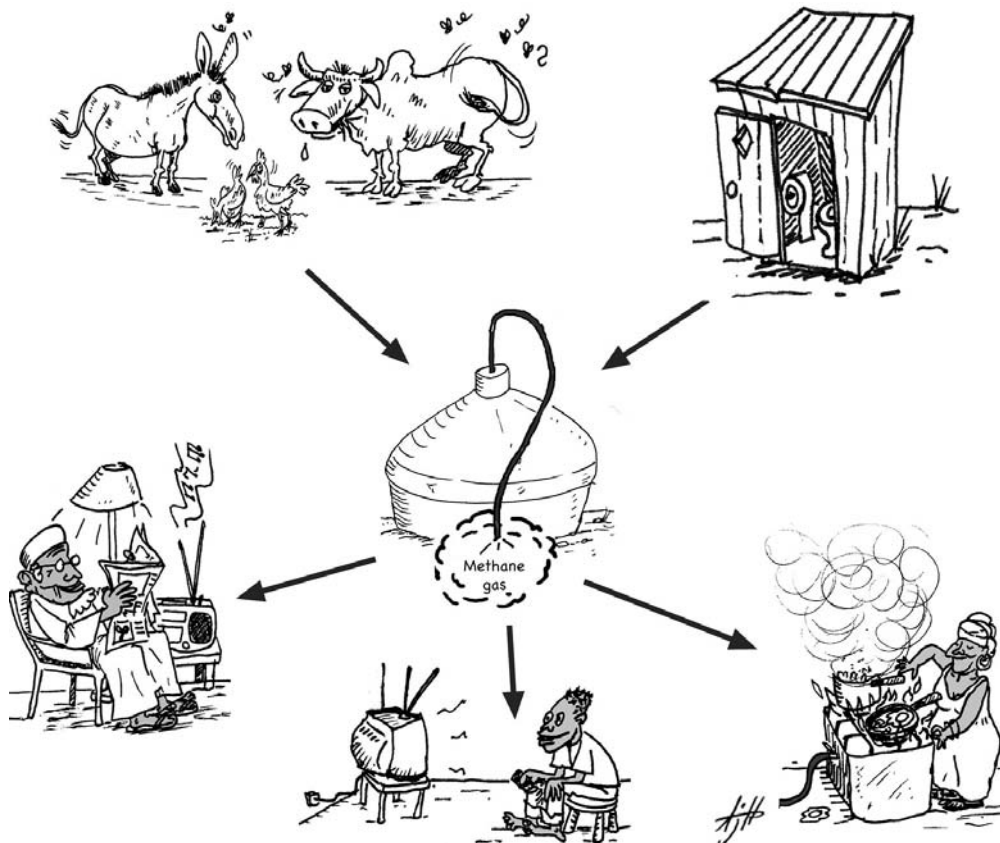


# BIOGAS

## What is this Action Sheet about?

This Action Sheet is about biogas. If you live in an area where livestock are kept, and there is sufficient water supply, then a household biogas system - which takes waste and makes energy - could help meet your household's needs.



## What are the benefits of biogas?

- Biogas systems make clean energy for household use. After an initial investment in the system, there is no need to spend money on fuel and no more smoke from wood or charcoal
- Cooking on biogas is quicker and easier than cooking with firewood
- Biogas systems kill the bacteria in livestock manure. A farm with a biogas system is a cleaner and safer place.
- Biogas systems produce excellent safe fertilizers for use on the farm
- Biogas systems can help in the fight against global warming by allowing us to burn methane from organic waste, instead of letting it escape into the atmosphere where it adds to the greenhouse effect. It also helps by letting us leave more trees standing!

## What is biogas and what is it used for?

Biogas is a mixture of methane and carbon dioxide, produced by the breakdown of organic waste by bacteria without oxygen (anaerobic digestion). If you've ever seen bubbles rising from a swampy marshy area, that's naturally produced methane. Like the gas in liquid petroleum gas canisters, methane can be burnt for cooking or lighting the house. It can also be used to power combustion engines to drive a motor or generate electricity.



*Mrs Agnes Saidi Shabani cooking on biogas produced on the farm in Tanzania  
(Image: PACE)*



*A biogas light on the Mr Katakwa's farm, Tanzania  
(Image: PACE)*

What biogas can do:



1m<sup>3</sup> of biogas can give as much light as a 60-100 Watt bulb for 6 hours

1m<sup>3</sup> of biogas can cook 3 meals for a family of 5 - 6

1m<sup>3</sup> of biogas can replace 0.7 kg of petrol

1m<sup>3</sup> of biogas can generate 1.25 kilowatt hours of electricity

*Biogas bubbles (Image: PACE)*

## How do you make biogas?

Biogas is made by fermenting organic waste in a **biogas digester**. The size of a digester can vary from a small household system to a large commercial plant of several thousand cubic metres. Farmers like Mr Anthony Paulo Katakwa in Tanzania use cow dung to feed their biogas digesters.



Mr Anthony Paulo Katakwa collecting dung...



...to feed his biogas digester



He adds water ...



... and gives it a stir (Images: PACE)

Two simple biogas digester designs have been developed; the Chinese fixed dome digester and the Indian floating cover biogas digester (shown in Figures 1 & 2). The digestion process is the same in both digesters but the gas collection method is different in each. In the floating cover type, the water sealed cover of the digester rises as gas is produced and acts as a storage chamber, whereas the fixed dome type has a lower gas storage capacity and requires good sealing if gas leakage is to be prevented. Both have been designed for use with animal waste or dung.

The waste is fed into the digester via the inlet pipe and undergoes digestion in the digestion chamber. The temperature of the process is quite important because methane-producing bacteria do their work best at temperatures between 30 – 40°C or 50 – 60°C. It takes from 2 to 8 weeks to digest a load of waste, depending on the temperature. The left-over slurry is removed at the outlet for use as a fertilizer.

If you are looking into building a biogas system you will need to decide on the size of the digester. This will depend on how much biogas you need to meet your daily cooking (and lighting) requirements, the availability and amount of livestock manure and water (water, number of cows, goats or other livestock), and the materials available on site (bricks, etc) for construction of the digester.

A regular supply of water is essential for operation of biogas plants. Rainwater harvesting could help with this (see Action Sheets 13–15).

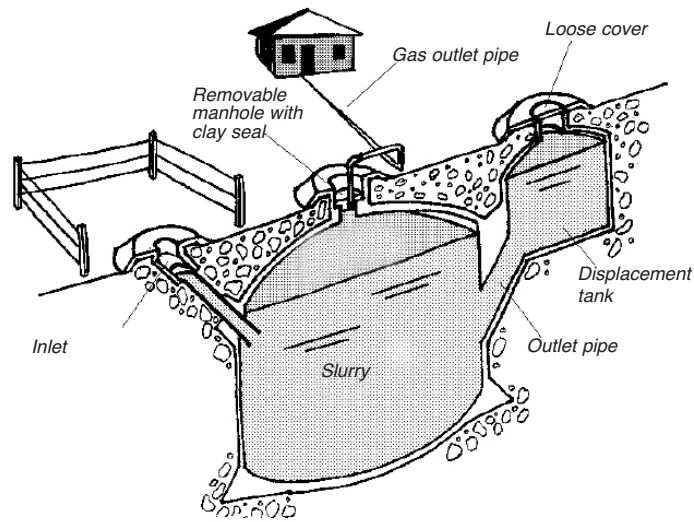


Figure 1: Fixed Dome Digester (Image: Practical Action (formerly known as ITDG))

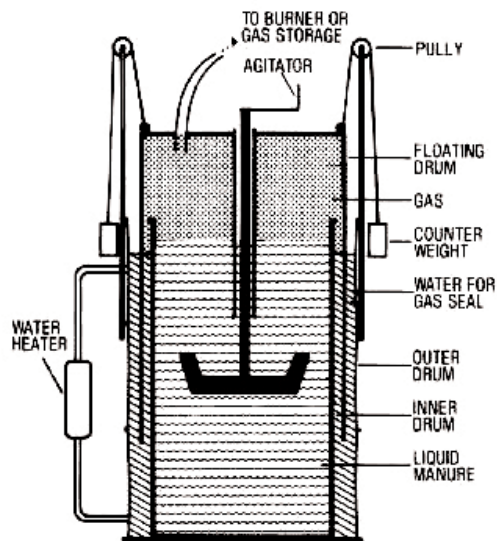


Figure 2: Floating Cover Digester (Image: Cooperative Extension Service, Purdue University)

### How much does a farm household biogas system cost?

Costs will vary depending on the availability of labour and materials. Fixed dome and floating drum digesters currently cost between US\$800 and US\$1,700) in rural areas of Tanzania. However, a simple Tubular Plastic Biogas digester is now available in Tanzania, costing only US\$100. Credit schemes and business involvement could help make biogas more affordable.

The tubular plastic biogas digester promoted by SURUDE, Tanzania

- Takes 4 hours to build
- Runs on the excreta from either 1-2 cows, 5-8 pigs or 4 able-bodied people
- Needs 2 parts water for 1 part manure
- A 4m<sup>3</sup> digester produces 1m<sup>3</sup> of gas per day, enough for daily cooking and heating

Source: SURUDE (Foundation for Sustainable Rural Development) NGO, Tanzania

## Is biogas safe?

Biogas is not poisonous. The only danger is from explosion if it is mixed with air and lit by fire. However, it only explodes if mixed with air or oxygen with a lighted match or fire very close by. For example, you shouldn't ever lean into the tank with a lighted match! If you have a biogas leak in the house, and have good ventilation (windows, fresh air blowing through the house), it should not pose much danger of explosion although you would lose your stored biogas. This is why good maintenance is important.

## What about maintenance?

It's important to receive training on the use and maintenance of your biogas system when it is installed. Local biogas promotion projects will usually train a team of local technicians, so that any problems can be solved quickly.

## How can we find out more?

Find local organizations with technical biogas experience. Organizations listed in the Energy contacts directory may also be able to help.

**ACKNOWLEDGEMENTS:** This Action Sheet was prepared by Nancy Gladstone, based the following sources: Biogas pages on IGAD (Intergovernmental Authority on Development) website <http://igadrhiep.energyprojects.net/>; Practical Action (formerly known as ITDG) Technical Brief on Biogas and Liquid Biofuels; The Oil Drum Digester by E.G.Matthews, Wimborne Energy Consultancy on [www.angelfire.com/mac/egmatthews/biogas/biogas.html](http://www.angelfire.com/mac/egmatthews/biogas/biogas.html); Biogas Technology in Agricultural Regions, Tanzania (SURUDE project), Global Environment Fund Small Grants Programme report; Methane Generation From Livestock Waste by Don D. Jones, John C. Nye and Alvin C. Dale, Energy Management in Agriculture Journal, Cooperation Extension Service, Purdue University

## FOR MORE INFORMATION

### CONTACTS

GTZ - [www.probec.org/](http://www.probec.org/)  
Tunnel Technology Ltd.

Sparknet - [www.sparknet.info/home.php](http://www.sparknet.info/home.php)

SURUDE – Biogas and sustainable energy projects - <http://www.superflex.net/tools/supergas/surude.shtml>

NAFRAC - <http://www.afol-webhosting.com/nafrac2/>

### RESOURCES

#### Websites

IGAD (Intergovernmental Authority on Development Household Energy Programme) - <http://igadrhiep.energyprojects.net/>

Instructions on building a small oil-drum biogas digester can be found here.

[www.angelfire.com/mac/egmatthews/biogas/biogas.html](http://www.angelfire.com/mac/egmatthews/biogas/biogas.html)

Practical Action (formerly known as ITDG) Technical Brief on Biogas and Liquid Biofuels

[www.practicalaction.org/docs/technical\\_information\\_service/biogas\\_liquid\\_fuels.pdf](http://www.practicalaction.org/docs/technical_information_service/biogas_liquid_fuels.pdf)

[www.solarengineering.co.za/biogas\\_htm1.htm](http://www.solarengineering.co.za/biogas_htm1.htm)

KARI (Kenyan Agricultural Research Institute) Technical Note: [www.kari.org/Tech\\_Notes/tecNote10.pdf](http://www.kari.org/Tech_Notes/tecNote10.pdf)

#### Books

Running a Biogas Programme - A handbook by David Fulford, ITDG Publishing, 1988 (Available from [www.developmentbookshop.com](http://www.developmentbookshop.com))

Biogas Promotion in Kenya - A review of experiences by Stephen Gitonga, IT Kenya, 1997 (Available from [www.developmentbookshop.com](http://www.developmentbookshop.com))

Methane Digesters for Fuel Gas and Fertilizer with Complete Instructions For Two Working Models by **L. John Fry** can be accessed online at: [http://journeytoforever.org/biofuel\\_library/MethaneDigesters/MDToC.html#ToC](http://journeytoforever.org/biofuel_library/MethaneDigesters/MDToC.html#ToC)

FAO Better Farming Series 31 Biogas: what it is; how it is made; how to use it – and - 32. Biogas 2: building a better biogas unit