

**BIOGAS SYSTEM FOR SRI LANKA**

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**Abstract:-** Biogas technology, when utilized in agriculture, animal husbandry and agro-industries, regenerates and conserves Energy, controls pollution, improves the eco-system, makes the system self sufficient in food, fuel and fertilizer. Due to the multiplicity of available models, processes, raw materials and applications, this technology can be universally applied. With a few thousand units already installed, the rate of adoption in Sri Lanka is steadily increasing. One can choose an appropriate system out of several biogas systems. However there is an acute need for a promotional programme in major irrigation schemes to utilize straw to produce fuel and manure which eventually would improve the eco-system and quality of life of the people.

Conversion, co-generation, recovery, efficient management and pollution control are currently important aspects of Energy. Perhaps more important will be regeneration of Energy sources. Glancing through various Energy sources, regeneration is possible only with anaerobic digestion. Unlike other Energy systems, management of biogas Energy systems is different and has to deal with living things. Therefore, it becomes a part and parcel of life. Hence it is much more pleasant and embraces all aspects of living.

Anaerobic digestion, while generating fuel (methane), improves the productive capacity of slurry as a manure, hormone, organic compounds and a feed. It contains organic compounds required for better plant growth in addition to all micro and macro elemental nutrients. Hormone-like substances named as "Unidentified Growth Factors" (UGF) accelerates photosynthesis and nutrient

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uptake. It is an excellent medium for algae production for feed and food. Vitamin B12 and protein in the slurry makes it a good animal feed enhancing growth rate, fertility and vitality.

As in normal decomposition, no nitrogen is lost in this process. Due to improved recovery rate of nitrogen by plants and also conservation, the amount of this nutrient made available to crops is more than three times that of ordinary compost, farm yard manure and other forms. The completeness and balanced nature of plant nutrient elements in the slurry contributes to healthy, strong and vigorous growth of crops needing no pesticides or fungicides. The need for weed control becomes minimal thus preventing pollution on one hand and improving ecology due to fast growth on the other. It saves Energy used in the manufacture, transport and application of agrochemicals. More importantly it reduces the pollution and no expenditure will incur in the future for pollution control measures or on drugs, hospitals and personnel for treating victims of poisoning by agrochemicals. Anaerobic digestion produces, regenerates, conserves and saves Energy, controls pollution and improves eco-system, as a fuel, a feed and a fertilizer.

Its applicability becomes universal because of the following factors.

1. Varying sizes from very small portable to gigantic units.
2. Variety of models - mesophilic, thermophilic fixed dome type, floating gas holder type etc.
3. Technological sophistication - can vary from simple to electronically controlled systems.
4. Costs vary from very cheap to expensive models.

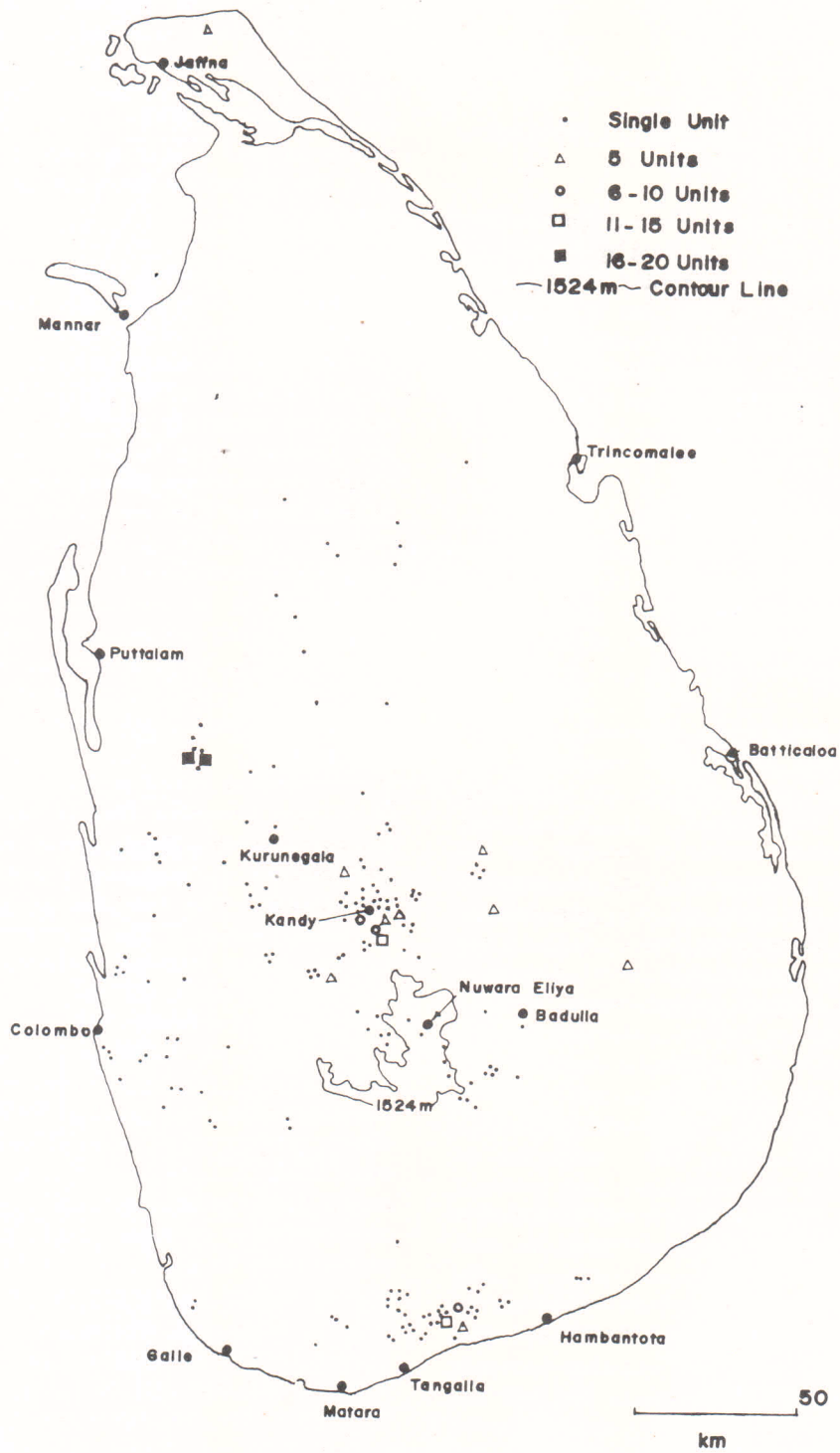


Fig.1 Locations of Biogas Plants in Sri Lanka

5. Availability of an abundance of raw materials such as night soil, animal wastes, leaves and stubble.
6. Different methods of digestion, with plenty of water, or only with soaking, with or without filters.
7. Vast potential exists in developing countries.

An uncompleted experiment indicates, 500 kg of straw, 100 kg of dung and urine, 10 kg of Urea can provide a family with cooking fuel, intermittent lighting for 4 months or more and manure for 1/2 an acre. Another experiment indicates that a small anaerobic filter made of three barrels and bamboo strips can produce lighting fuel for a small rural family.

The salient features mentioned and technological advances made during the recent past on biogas technology should draw more attention of policy makers and planners to meet Energy and environmental needs of developing countries.

Sri Lanka has a great potential for application of biogas technology because of its climate, abundant raw materials and availability of proven techniques. It is the most accepted renewable source of Energy in the country. A few thousand units of varying capacities are scattered all over the island. Figure 1 shows these locations. Still it has not reached an appreciable level though a steady rate of adoption is indicated. Increases in adoption can be an indicator of the suitability of the technology for local situation. If a promotional programme is envisaged, the country may harvest the full benefits.

Presently, biogas fuel is being used for the following purposes in Sri Lanka.

1. Cooking and lighting of farm dwellings.
2. Pumping water for home consumption and irrigation.
3. Electricity generation.
4. Brooding chicks.
5. Home hot water systems.
6. Refrigerators and smoothing irons.
7. Pollution control in piggeries.

The simplest and most efficient biogas system in Sri Lanka is what is in operation in integrated farming systems. In this system, animal wastes and crop residue, sometimes with night-soil, is fed to the biogas digesters. The gas generated is used as fuel for various purposes. Depending on the farm size, the slurry is used mostly as manure for crops and in a few places as feed for pigs, ducks etc. See figure 2.

It should be noted that lighting efficiency of biogas is much less than that of heating. Therefore, wherever possible, biogas must be used for cooking and heating operations. A more versatile and a better system for rural areas, where raw materials for biogas production are not limited would be to run a generator and charge accumulators during two or three hours of peak Energy requirement and use the accumulators for the rest of the day. This system is illustrated in figure 3. Where appropriate and where capital is available, an inverter and larger capacity accumulators may be employed. A small system costs around Rs. 30,000/= inclusive of an engine, 12V generator, accumulator and other necessary instruments.

Of several users of biogas, a description of Nilamba Livestock Farm in Galaha, Sri Lanka belonging to Mr. Nimal Cooray would elaborate applications, efficiency, profitability and convenience. The farm has an adequate supply of animal wastes. The drains of the piggery and the cattle shed are connected to the inlet of the biogas unit. If the biogas generated from these materials is not sufficient, poultry litter is also added to increase the gas production. The gas generated is used for brooding chicks and broilers, lighting poultry cages, electricity generation, cooking and sometimes to cook swill. He has no power supply from the grid nor are there any appliances operating on fossil fuel. Firewood, which is available in plenty on the farm due to lush growth caused by biogas manure is used for cooking offal and swill. The farm has over 15,000 birds, 100 pigs, 6 cows and about a dozen of big dogs and many farm houses. The management does not spend any money on Energy. Similar potential exists in hundreds of farms

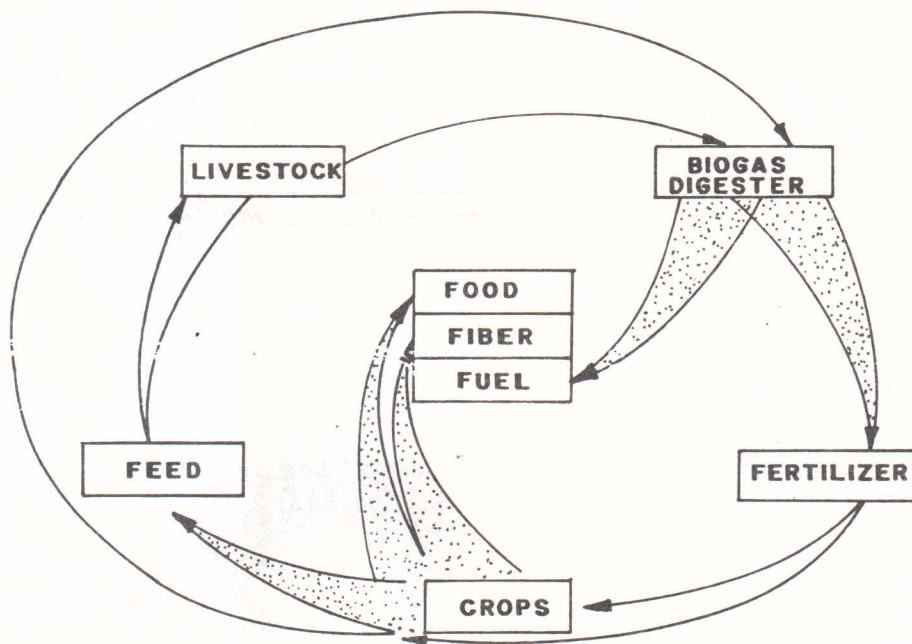


Fig 2 - Total Farm Energy Production System [2]

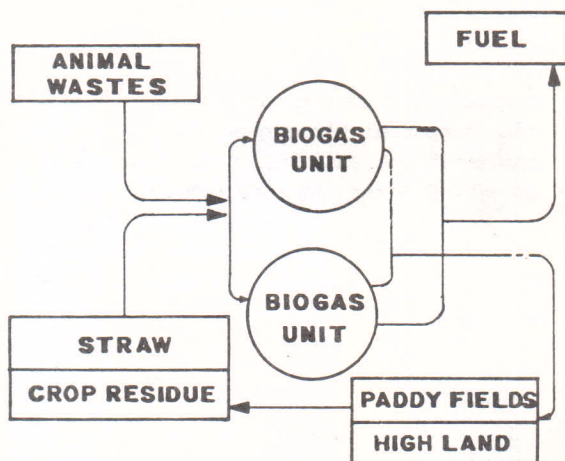


Fig 3 - Simple Biogas Production System for a Typical Farming Family

scattered in the island. Measurement of gas production with electronic equipments as well as by normal displacement method indicates that 50 pigs on an average produce 6 cubic meters of biogas which is equivalent approximately to 4 litres of liquid fuel or gasoline. With a biogas unit and a separate gas holder, a modern gas operated bakery can easily be

operated with a piggery of 300 or more pigs inclusive of piglings or even run an electric generator for farm and local use. A suitable layout is shown in figure 4.

Areas where much emphasis is required are the major paddy growing districts. Paddy straw is a very good raw material for biogas production. The experiments in Sri Lanka and also in other countries show that one kilogram of sun dried straw is capable of producing more than 250 litres of biogas. A mixture of 600 kg of straw and about 100 kg of fresh cow dung (that is roughly 10 days collection of dung of one animal) can produce daily cooking and lighting fuel requirement of a rural family for a period of about five months. This means, an acre of paddy land cultivated one season per year, provides the farmer with more than sufficient fuel and manure for his land. Figure 3 shows the system. The type of digester suitable for this straw combination are Red mud plastics [3], a modified form of normal Chinese type connected to a polythene or plastic bag, or a floating gas holder. Development work on this approach is being done at the National Engineering Research & Development Centre, Sri Lanka and is nearing completion.

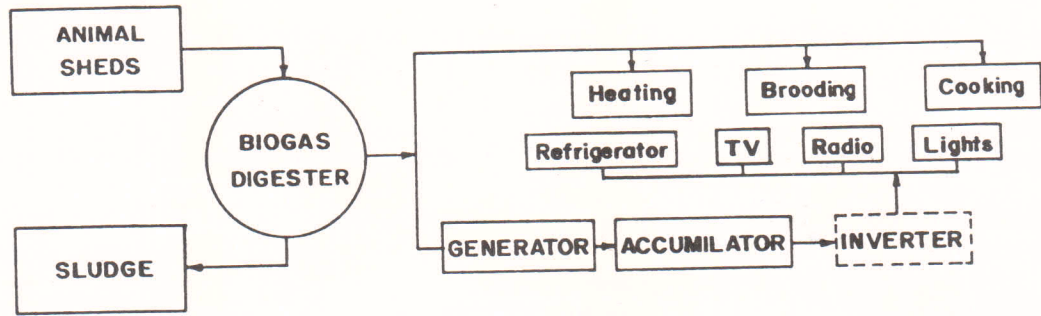


Fig 4 - Pollution Control and Energy Production System for an Animal Husbandry Farm

**REFERENCES**

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- [2] G.K. Upawansa "Small scale Integrated Farming System" Manual No. 12, FAO Soil and Fertility Division 1980.
- [3] "Biomass Energy Principle and Application" China Development Center of Red Mud Plastics for Biogas Technology.



Mr. G.K. Upawansa has been a farmer from very young age and possesses rich practical experience and is probably the person responsible for introducing biogas technology as a practical proposition in Sri Lanka. He is also keen in other sources of renewable

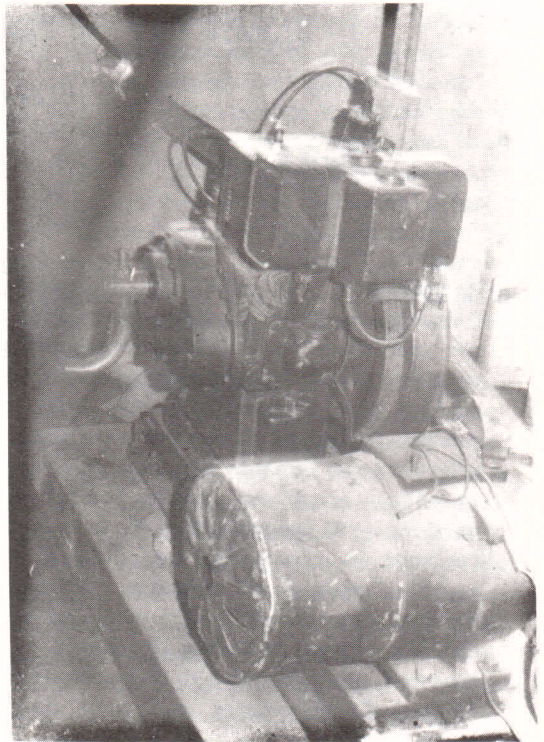
Energy that can be utilized in farming such as microhydro, wind and producer gas.

His education during childhood was badly affected due to financial difficulties. However, with farming and animal husbandry, he self supported his higher education. Having completed the Diploma in Agriculture at the School of Agriculture, Peradeniya, Sri Lanka, he joined the Govt. Dept. of Agriculture. In 1966, he entered the Peradeniya University as a private student to follow B.Sc.Ag. In 1972, he won a scholarship to Reading University in U.K. and thus became the first post graduate degree holder in Agricultural Extension in Sri Lanka.

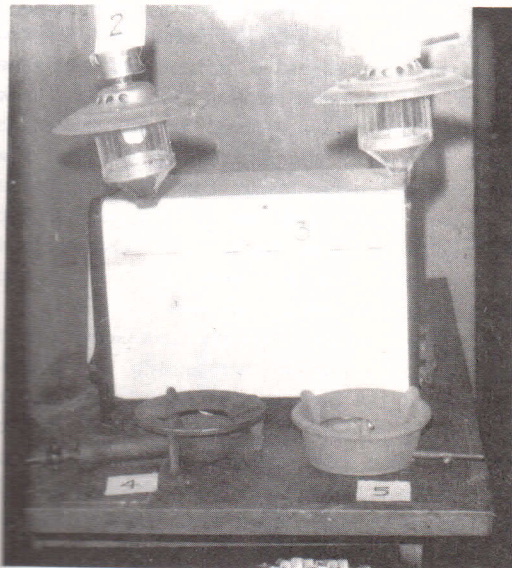
His work on Integrated farming at the In-service Training Institute, Gannoruwe and the School of Agriculture, Angunakolapelassa is well known in many parts of the world. He wishes that all readers joined him in producing their own vegetables organically in their backyard, for which all assistance is available.



Cooking with Biogas at Digana Mid country Livestock Development Center Hostel that provides meals for 40 trainees.



The power generating plant at Nillambe Livestock Farm operating on Biogas.



Biogas appliances available in Sri Lanka.

1. Standard Biogas Lamp
2. Open air " "
3. An imported oven
4. Cast iron cooker
5. Cast iron burner in clay frame



Hot water Unit operated with Biogas at Wewandon Estate Nuwara-eliya.