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### Biogas for low income housing



#### INTRODUCTION

The petroleum price hike in the seventies created a severe economic stress in many developing countries resulting in the limited availability of funds for housing, water and sanitation projects. Such increased energy prices cause increase in the cost of living and other economic problems. The major victims are middle and low income groups both in the urban and rural areas. Also, the task of planning a new low income housing with adequate sanitation and services is becoming increasingly difficult due to the shortage of funds and acute shortage of housing. This leads to poor sanitation facilities and also restricts the availability of an affordable energy source for cooking and lighting purposes. Furthermore, the use of charcoal and wood is on the increase for household facilities and as a consequence many nations are facing severe deforestation problems. Hence with the need to look for alternative sources of energy coupled with the growing concern for environmental sanitation, resulted in the consideration of a process of digesting organic matter under anaerobic conditions which also produces a flammable gas, called Biogas. It is essentially 50-70% methane and the balance contains a substantial portion of carbon dioxide and traces of nitrogen, hydrogen, oxygen and hydrogen sulphide.

#### GENERAL CONCEPTS OF BIOGAS

The potential of biogas as a renewable source of energy has been recognised by the end of the 19th century in England where the gas was utilised for street lighting "(ref. 1)". In recent years biogas technology has received attention especially from developing countries and there are at present about seven million biogas digesters in China, while large numbers are also being used in India, Thailand, Nepal, Philippines, Fiji and Korea. Biogas plants are most commonly used to digest domestic sewage and/or animal dung. However, a wide variety of other organic materials can serve as feedstocks including agricultural plant wastes, water hyacinths, agro-industrial by-products and municipal garbage. Since biogas plant types vary in performance depending upon climate, feedstock and scale,

it would be appropriate to develop a model to match the specific feedstock and climatic conditions. Although the construction of biogas plants is mainly to obtain a source of energy, other benefits to an urban or rural environment include supplies of excellent fertiliser, sanitary waste treatment and improved public health.

#### LOW INCOME COMMUNITIES

The major problems facing the low income communities in many countries are enormous increase in the cost of living, shortage of low cost houses, rise in diseases due to poor sanitary conditions and lack of service facilities. Even where low cost housing is provided, there are no appropriate water and sanitation facilities and the roads are in a poor state with no lighting. The level of income of the people is so low that they cannot afford to pay for the conventional energy sources needed for the day to day activities. In many areas, usually public latrines are provided because of economy but the price is paid in terms of the consequences resulting in low standard of sanitary conditions by misuse of these facilities and defecating in open land. Also, cramped housing is often shared with goats, cows, pigs and other livestock and the problem of disposing animal waste remains unsolved. Disposal of excreta has to be carried out either by conventional sewerage system or with alternatives such as "vault toilets", "pour flush" latrines, septic tanks, pit latrines and aqua privies. The services connection of a low income housing scheme to the existing or extended conventional sewerage networks may not be feasible because of cost and other constraints. Improper disposal of excreta not only pollutes the environment but also spreads epidemic and parasitic diseases.

Due to the many complex aspects of environmental sanitation and protection of good health both in urban and rural setting among low income groups biogas technology appears to be the most appropriate alternative for the disposal of excreta as well as a source of providing cheap energy. India with its rural population of more than 500 million people is giving special consideration for

community-type biogas plants where the toilets are connected to the digester either in urban low cost housing schemes or in a village set up. One example is the large community type biogas plant established at Masudpur Village south of Delhi, which supplies cooking gas to about 60 houses and helps the villagers with improved sanitation and also provides manure for agricultural purposes.

#### SOCIO-ECONOMIC IMPLICATIONS

Although there are advantages, certain problems such as economic, social and lack of community participation had made the biogas systems a failure in many communities. Many of the limitations of a community or family to adopt biogas technology lie in the family traditions and cultural beliefs. For example in countries like India, Sri Lanka and Haiti, cultural superstitions among certain society prevent the successful implementation of biogas technology. In certain cases, insufficient knowledge and planning have resulted in the construction of many faulty digesters. Community education and participation are necessary to combat the lack of technical understanding at both urban and rural levels. In many low cost housing schemes it is evident that the people own television sets and radios, and newspapers are popular as in other parts of the country. The use of the media - television, radio and newspapers is therefore appropriate means of relaying information about sanitation and the advantages of biogas technology. Also, schools, markets, community centres and other public locations are ideal places to publicise the benefits of this technology.

China's success in building seven million biogas digesters is mainly due to community system and the way the government encourages biogas development. Each community has a committee of 5 to 10 people selected by the farmers, that makes decision for the entire community. People are assigned to the specific tasks of cleaning and operating the digesters. Many constraints are overcome by the fact that the biogas project is instituted at the community level and the people are cooperative with those in charge. There are also many biogas extension offices set up within different provinces to train biogas technicians.

Public health aspects of waste disposal include concern about the transmission of pathogenic organisms and the problems caused by improper disposal of waste water. Many types of human pathogens are largely eliminated by passing through a digester. Compared with other waste disposal methods

commonly used in low income areas of developing countries, anaerobic digestion should not create any new or additional health hazards. Despite the fact that certain pathogenic organisms can pass through the digesters, significant community health improvements have been recorded in developing countries. For instance in China, the number of people infected with hookworm disease decreased from 63.8 to 5 percent in one community and dysentery was practically eliminated in another community "(ref. 2)". Economic advantages could be identified in areas where there had been a reduction in the purchase of electricity, fossil fuel or fertiliser and also in the saving of money and time in treating dysentery, typhoid and worm diseases.

#### RADIAL DESIGN CONCEPT FOR SITES AND SERVICES

Sites and services programme envisages development of building sites with the provision of infrastructure including water supply and sanitary facilities. The cost of infrastructure in providing the utilities will depend on size and shape of the plots and the road layout. A radial layout pattern has been tried for the various sites and services schemes in Tamilnadu, India "(ref. 3)" where the individual sanitary core units of a group of plots are arranged around a central point (Fig. 1) from where a single service connection is provided. This eliminates the necessity of carrying the network of utilities along length of the plots. From this central core area, the utilities are directly made available to each of the plots in the circular group of radial flats.

The sanitary core units in each of the plots of the groups are connected to a single manhole located in the central core area and disposal is facilitated through a service passage formed between the radial sides of two of the plots in the group. This brings about reasonable savings in service connections. Similarly the distribution of water and electricity could also be facilitated through the central core area. In certain cases when a biogas digester located at the centre supplies gas for cooking and lighting thus minimising the fossil fuel energy use and pipings in the low cost housing.

#### CONCLUSION

Biogas production from human excreta especially as a community type, has a significant potential in developing countries at present, and in the future for producing a cheap source of energy and

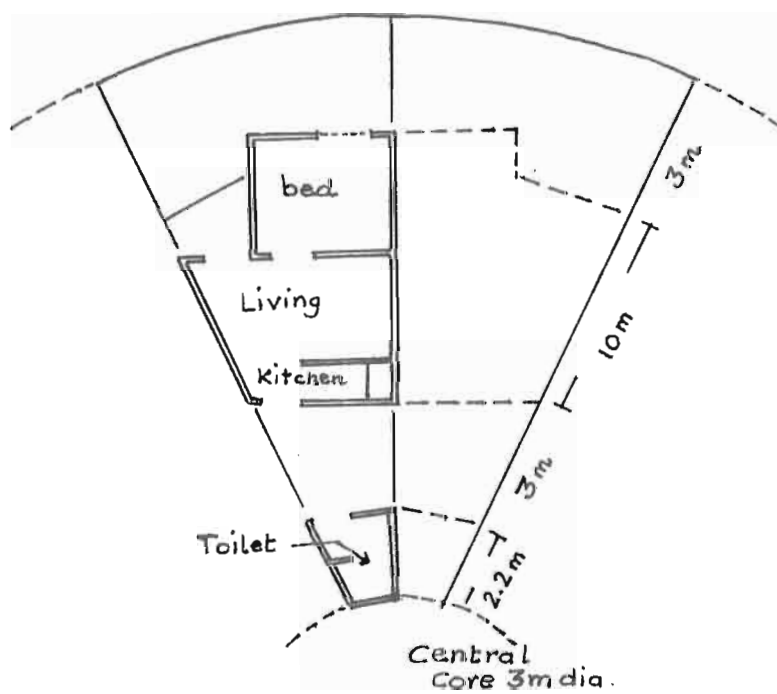
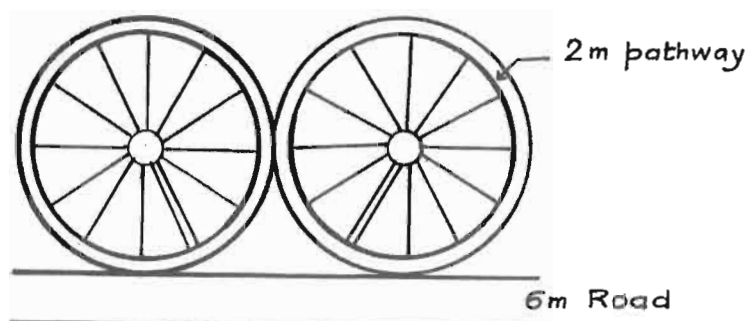


FIG. 1 RADIAL DESIGN CONCEPT FOR SITES AND SERVICES

increase in environmental sanitation. Biotechnology deserves more widespread support and to achieve this the communities need to be convinced through education by the relevant authorities about the enormous benefits of this technology.

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