

# Chinese Experience in Bio-gas Use

## Energy Crisis

The energy crisis is creating many problems for the people all over the world. Fossil fuel reserves are getting depleted and the increase in its price all over has created many problems. It is most likely that the use of fossil fuel would have to be given up within the next three decades. Vehicles used for transportation may have to depend on solar power and these vehicles would be much lighter than the vehicles energised with fossil fuel. The users of heavy vehicles for transportation would have to re-adjust their systems to manage with solar-powered lighter vehicles.

## Bio-Gas

There is a source of energy available to mankind which could be harnessed without much expense, machinery or heavy equipment. This is bio-gas which could be harnessed by every householder. The technology involved is quite simple and does not call for expensive gadgets. All that is necessary is to put the kitchen waste, animal waste such as cow dung, and human waste into the gas chamber which could be made with cement and bricks, which could last for a long time.

The slurry that remains after the anaerobic decomposition of wastes is an excellent manure for agricultural needs. It has been found that the slurry as manure for food crops is about 10% more effective than the artificial manure that is sold in the market according to a research done by the Academy of Agricultural Science in Chendu in the Sichuan Province.<sup>1</sup>

## Bio-Gas Production and Utilisation in China

In 1984, this writer and two others representing non-government organisations (NGO) were invited by the Chinese Authorities to visit China for a study tour on transfer of appropriate technology for rural needs under the technical co-operation programme of the Food and Agriculture Organisation of the United Nations (FAO).

Historically, China gets credit for inventing gun powder, paper making, printing and the Compass. Future historians would give much credit to the Chinese ingenuity for promoting the many uses of bio-gas.

We were told that an indoor bio-gas digester set up in 1937 in Hebei Province was still functioning quite well. The secret of its success is that it had been well-maintained, and the process of producing bio-gas continues.

It was reported that there were over 7 million homes in rural areas that use bio-gas for cooking and lighting. About 30 million people in rural areas depended on bio-gas for cooking and lighting at that time. In addition to these domestic digesters in rural

areas, there were more than 36,000 large-scale digesters built for use by communes, production brigades, state farms, wineries, bakeries and confectionaries.

Sichuan Province in the South West of China has taken the lead in guiding the production and the varied uses of bio-gas. This province takes the lead in China as the region that produces the best agricultural crops. This province also has taken the lead in promoting the production of bio-gas and the conversion of the slurry into high class fertiliser. The greenery in the fields of this province is most pleasing to the eye. The following Institutes are engaged in the satisfactory promotion of the process of producing bio-gas and the associated activities.

- The Sichuan Province office of Bio Gas Development
- Chendu Institute of Chemistry
- Chendu Institute of Biology
- Sichuan Institute of Agricultural Machinery
- Quxian County office of Bio Gas Development.

These Institutes devote much time and effort to promote the development of research on bio-gas. Even in rural areas in China, people have been encouraged to live in flats in order to reserve land available for agricultural use. Large-scale bio-gas digesters have been built to provide bio-gas for cooking and lighting for the many hundreds of families in these housing flats. The gas produced in the large-scale digesters is distributed to the individual flats by tubular distribution systems fitted with meters for the control of the distribution and use of the gas. The occupants of the flats are required to make a minimum payment monthly for the use of the bio-gas supplied. In areas where there is electricity available, the flat dwellers use the gas only for cooking.

The human and animal wastes from the many flats are fed into the bio-gas digesters and the slurry is utilised to provide fertiliser for agricultural crops. In addition to meeting the domestic need for cooking, lighting, pumping water where necessary, bio-gas is utilised for providing energy for a variety of other needs of the community. Some of them are as follows:

1. Operating farm machinery with internal combustion engines.
2. Pumping water for irrigation.
3. Processing of grains.
4. Drying of agricultural products.
5. Operating fruit processing plants.
6. Generation of electricity to run machinery for lighting in urban areas, and for industrial units.
7. Pumping, cooking and distilling operations in horticultural farms.

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8. Operating rural industrial units.
9. Milling wheat and breaking
10. Operation of rice hullers.
11. Burning of kilns.
12. Curing tobacco.

A notable result of the propagation of bio-gas in the rural areas of China is the reduction in the use of firewood, which leads to the protection of the environment by reducing felling of trees and damaging the forest cover. A very impressive sight one sees in the Sichuan Province is the buses run with biogas. The buses have biogas bags mounted on top of the roof that appears like a large-sized pillow. With our gas bag mounted on the bus, it could run hundred kilometres and at that point they have stocks of other gasbags to replace the empty bag. The bags are made of flexible plastic or polythene material, and as the gas gets used up the bag gets flattened and the handling becomes easy for the bus operators. It has been found that about 70-90% of the diesel used on farm machinery could be saved by the conversion of the diesel engines into biogas-diesel dual-fuel engines. This process is utilised to save diesel on engines used for pumping, power generation, rice husking, wheat milling and breaking. By 1979, there were 514 dual-fuel engine stations with a total capacity of 5,542 h.p. in the Sichuan Province of China.

## Fertiliser from Bio-Gas Plants

Agricultural production depends on high-quality fertiliser application. Many of the developing countries depend on imported fertiliser which is quite expensive. The setting up of fertiliser factories is quite expensive.

The Chinese experience has shown that recycling of organic substances through bio-bas digesters is the best way to obtain fertiliser for agricultural production. The Academy of Agricultural Science in Chendu in Sichuan Province is one of the Institutions carrying out extensive research in the application of fertiliser for agricultural development.

The compost manure produced by the traditional process of composting of organic matter is much less efficient compared to bio-gas slurry. The manure properties of the bio-gas fermentation residues exhibit a remarkable degree of efficiency. The healthy looking green fields and plants and the high crop yields in the Sichuan province speak much for the high efficiency of bio-gas slurry as a manure. When a particular type of soil lacks phosphorous or other component and soil needs special treatment, the required chemicals could be added to the soil by bio-gas slurry to produce the best results.

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### Advantages of Bio-Gas Production

Production of bio-gas from agricultural and household wastes has the following advantages:

1. Extremely cheap energy could be obtained for a variety of purposes.
2. The slurry provides an excellent fertiliser essential for agriculture.
3. This process destroys harmful bacteria, viruses and intestinal parasites that cause many diseases which in turn helps rural sanitation and public health and minimise environmental pollution.
4. Waste management ceases to be a problem. Instead it becomes a profitable venture.

### Bio-Gas Production in Western Countries

There has been considerable interest in some of the Western countries in the production of bio-gas. In 2006, the state of California (USA) and Government of Sweden signed an Agreement to jointly develop bio-methane and other renewable fuels.

Efforts have been made to produce methane gas out of certain agricultural material such as the corn seed. In Sweden, more than 8,000 vehicles are said to be powered by a combination of natural gas and bio-methane. It is said that the vehicles include transit buses, refuse trucks and more than 10 different models of passenger cars. The Swedish bio-methane industry has been growing considerably over the last five years.

### Lessons for Developing Countries

It is most encouraging to hear of interest shown in producing bio-gas in developing countries. The Chinese experience and example provide much strength and guidance to the developing countries to engage in this exercise and achieve benefits and success without much cost and sacrifice. The Chinese experience and example goes back for a period of over 70 years, and it is for the developing countries to benefit from this rare opportunity and get over the difficulties caused by the fossil fuel problem.

The provision of fuel for the different types of farm machinery with internal combustion engines is a major problem for many of the developing countries, which do not have resources. China has oil reserves but she has made all efforts to promote the production and wide use of bio-gas for operating farm machinery. Developing countries are unable to find other solutions to the challenge of the price hike in oil; China has shown a safe and promising solution to the problem. All developing countries do have resources, and with a little effort, energy could be generated for their needs without depending on any imports from outside.

The pumping of water for irrigation in some of the developing countries has become difficult due to the hike in the price of fuel and some of the cultivators had given up their cultivation operations due to the difficulties in getting fuel to generate energy. The China solution in biogas has provided a solution to these problems.

### Lessons for Sri Lanka

In the urban areas such as Colombo, our capital city, the management of waste of all types is a

major problem, and this unsatisfactory state is creating a major health problem and is also creating a hostile environment. Urban areas could benefit a great deal by introducing the use of bio-gas which could provide gas for cooking, lighting and several other energy needs. The city authorities could also generate income by the sale of the energy and also by the sale of the slurry as fertiliser for agricultural needs. The scarce foreign exchange could be saved, and this entire process would bring out a sense of satisfaction to everyone.

Some coastal towns indulge in the unsatisfactory practice of channelling night soil into the sea which does much harm to the environment by pollution in the coastal areas and lead to health hazards. This can be minimised if bio-gas is produced with sewerage. As in the Sichuan Province China, if the simple process operating buses on bio-gas is imported to Colombo, our capital city, all the buses operating in and around the city could be run without any imported fuel, and the cost would be extremely minimal while the city authorities could get an income by the sale of the slurry for use as fertiliser for agricultural activities. The passengers would be able to travel with a minimum payment as bus fare.

It has been reported that the current budget in Sri Lanka has set apart 67 Billion rupees to provide for the import of fertiliser for agriculture. We would not have to provide such large amounts of money if we had ventured to engage in the generation and use of bio-gas.

#### Footnotes

<sup>1</sup> Report of a study tour to China by a delegation of the National NGO Council of Sri Lanka