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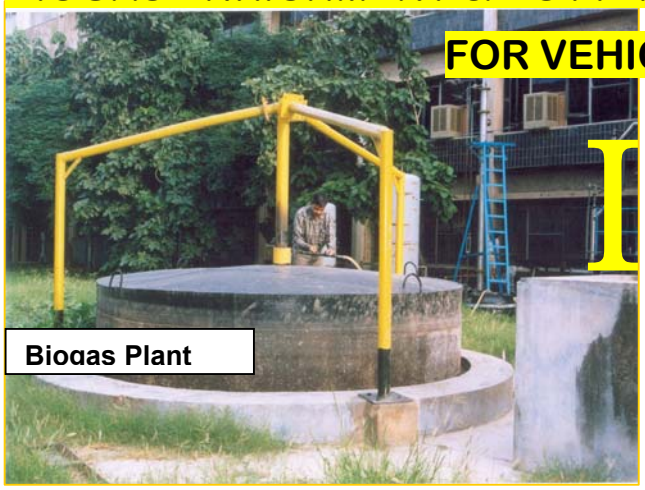
BIOGAS ENRICHMENT & BOTTLING TECHNOLOGY FOR VEHICULAR USE



Biogas Plant

In the present era of ever-increasing energy consumption and dwindling fossil fuel reserves, the importance of biomass based, decentralized fuel such as Biogas and Biomass based power generation has greatly increased. It is a well established renewable and environment friendly fuel for rural energy needs. Biogas is ideally suited for rural applications where required animal or human excreta and agricultural waste are available in plenty. Harnessing such a resource promotes rural industries, agriculture, dairy and animal farming in a sustainable way. This will also increase employment in the rural regions and discourage migration to cities.

Biogas is an environment friendly, clean, cheap and versatile fuel. It is produced by anaerobic digestion of degradable wastes such as cattle dung, vegetable wastes, sheep and poultry droppings, municipal solid waste, sewage water, land fill etc. Presently it is mainly used for cooking and lighting purposes in the rural areas. The use of biogas in stationary engines used for different agricultural operations is going on. Its utilization is also feasible in automobiles, used for transportation purposes by enriching and compressing it in cylinders. Biogas can be converted in bio CNG after enrichment and bottling. It becomes just like CNG.

Potential of the technology

So far, biogas has mostly been used as fuel for cooking and running stationary engines. However, its potential has not fully utilized, yet. There is a great enhancement in its

utilization potential particularly where bigger plants are in operation e.g. institutional biogas plants in *Goshalas*, dairy farms or community biogas plants in villages. *Goshalas* are running generally on charity basis and most of them are not in sound financial position. Enrichment and bottling of biogas will help to improve it.

India has a vast potential of 6.38 X 10^{10} cubic meter of biogas per annum from 980 million tonnes of cattle dung produced. A National Project on Biogas Development (NPBD) was launched by Government of India in 1981. A total of about 36.5 lakh family biogas plants have been installed under this programme all over the country till Dec. 2004. This is about 30 % of the total 120 lakh family type biogas plants potential. More than 3380 Community Biogas Plants (CBP), Institutional Biogas Plants (IBP) and Night-soil based Biogas Plants (NBP) have been installed all over the country with most reported satisfactory performance levels. The family biogas plants in the country are estimated to be saving 39.6 lakh tonnes of fuel-wood per year. Besides, about 9.2 lakh tonnes of enriched organic manure are being produced every year from these plants.

There are a number of *Goshalas,* dairies, village communities having large number of cattle which have potential of installing biogas enrichment and bottling system. In urban areas, large quantity of biogas can be produced in sewage treatment plants using anaerobic digestion. Okhala Sewage Treatment Plant, New Delhi, is an example where more than 10,000 cubic meter of biogas is produced every day. Due to rising cost of petroleum products and environmental concerns it has become imperative to make use of local resources as an alternate to petroleum fuels. Therefore, worldwide efforts to explore and make use of biogas as an alternate fuel in vehicles should be made.

Biogas composition, properties and utilisation as CNG

Biogas comprises of 60-65% methane, 35-40 % carbon dioxide, 0.5-1.0 % hydrogen sulfide and water vapour. It is almost 20% lighter than air. Like Liquefied Petroleum Gas (LPG) it cannot be converted to liquid state under normal temperature. Removing carbon dioxide and compressing it into cylinders makes it easily usable for transport applications, say three wheelers, cars, pick up vans etc and also for stationary applications at

Biogas run CAR

various long distances. Already, CNG technology has become easily available and therefore, bio-methane (enriched biogas) which is nearly same as CNG, can be used for all applications for which CNG are used.

Biogas enrichment process

A variety of processes are available for enrichment i.e. removing CO_2, H_2S and water vapour. Commonly CO_2 removal processes also remove H_2S. One of the easiest and cheapest methods involved is the use of pressurized water as an absorbent liquid. In this method, biogas is pressurized and fed to the bottom of a scrubber column where water is sprayed from the top. In counter-currently operated absorption process, the carbon dioxide and hydrogen sulfide present in the biogas is absorbed in down going water and methane goes up and is collected in vessel. However, water requirement in this process is high but it is the simplest method of removing impurities from biogas.

Biogas Scrubber

Concept of alternative Bio-CNG

Biogas contains a large proportion (about 40 % by volume) of carbon dioxide, a heavier and non combustible gas and some fraction of hydrogen sulphide. Hence it is needed to enrich biogas by removing these undesirable gases to save compression energy and space in bottle and corroding effect, which can be done by scrubbing. The scrubbing system is found to enrich methane about 95 % or more depending upon biogas inlet and water injection pressure. Biogas can be used for all applications designed for natural gas, assuming sufficient purification.

Scope of the technology

Enriched biogas is made moisture free by passing it through filters, after which it is compressed up to 200 bar pressure using a three stage gas compressor. Compressed gas is stored in high pressure steel cylinders as used for CNG. There is large potential of this technology in buses, tractors, cars, auto rickshaws, irrigation pump sets and in rural industries. This will help to meet our energy demand for rural masses thus reducing

burden of petroleum demand, moving towards energy security and will improve economic status by creating employment generation in rural areas.

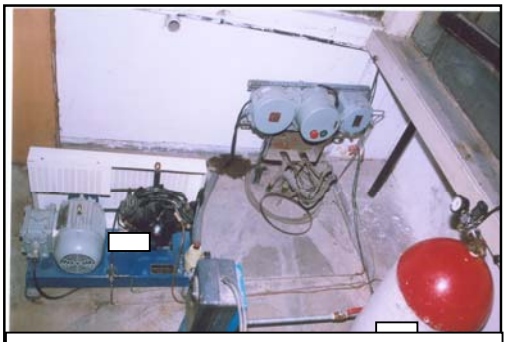
Cylinders filled from one 120 m^3 biogas bottling plant = 8 cylinders /day
(Capacity 6 kg/ cylinder)

As 6 kg CNG cylinder = 6 litre Petrol

So, gas filled in these cylinders will be equivalent to = 6 x 8
= 48 litres of Petrol/day

or Diesel/Petrol savings = 17520 litres/annum.
= 876000 Rs./annum (Approx.)

= 9 lakh Rs./annum
(from one bottling plant)


Biogas high pressure cylinder Compressor

Therefore, from only one biogas bottling plant, enriched biogas filled cylinders will be able to replace fuel worth Rs. 9 lakh annually in the country. Increasing the number of bottling plants will subsequently increase the diesel/petrol savings. The whole cost can be recovered within two-three years from the installation of the plant.

Cost estimate for the proposed technology

120 cum biogas /day plant		
1.	Biogas scrubbing/ enrichment unit	3,50,000
2.	High pressure compressor to fill CNG cylinders	7,00,000
3.	CNG conversion kit and filling into cylinders	1,50,000
Total		**Rs. 12,00,000**

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