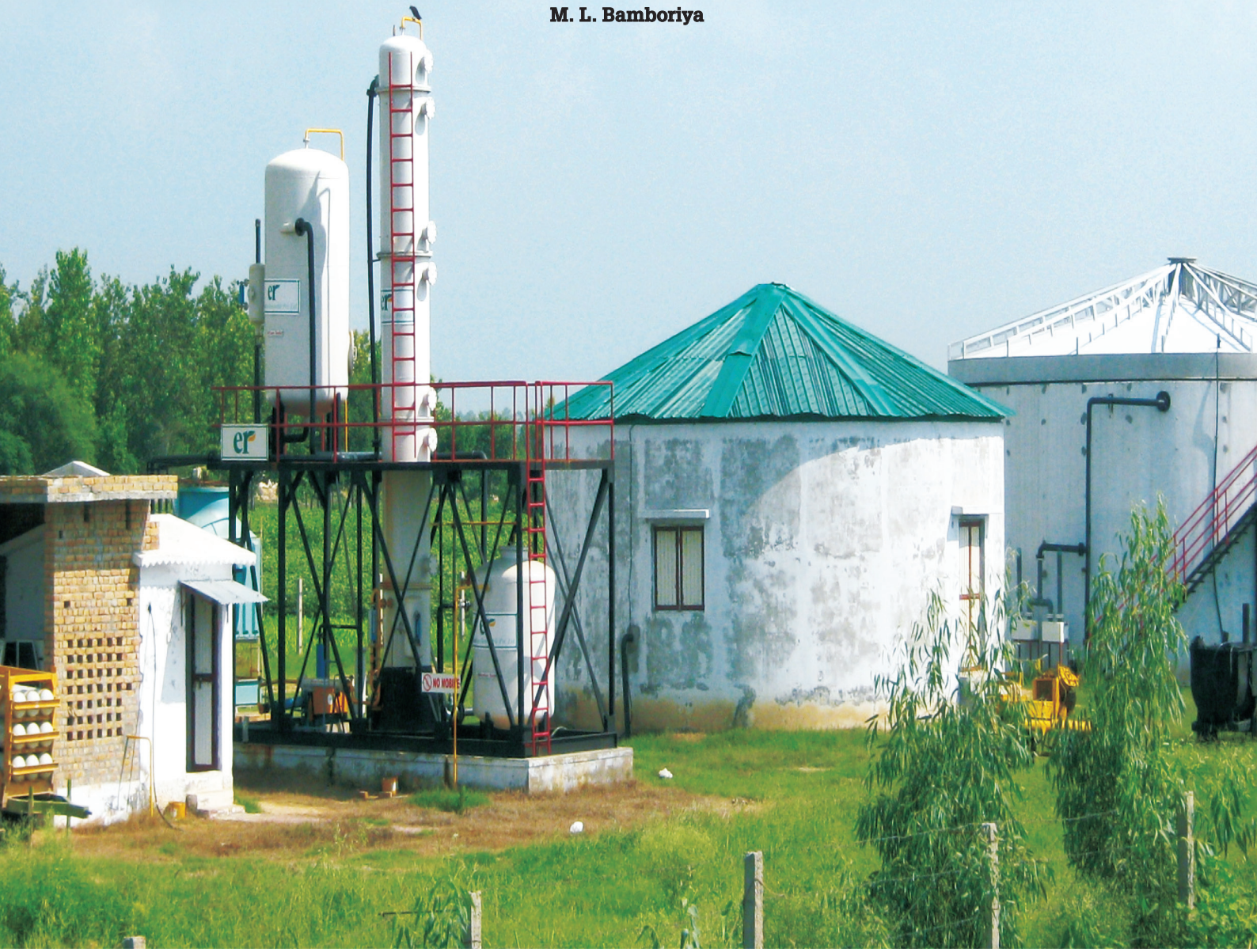
Biogas
Bottling in India

Today's fast paced world is overly dependent on energy to fulfill its various requirements related to daily life. Biogas, a clean and renewable source comes as a efficient and cost effective method to generate power. This case study of a biogas bottling plant showcases the efforts of the Ministry of New and Renewable Energy to usher in new technological breakthroughs in the arena of renewable energy.

M. L. Bamboriya



Energy is the key input for the socio-economic development of any nation. Industrialisation, urbanisation and mechanised agricultural techniques have generated a high demand of energy in all forms i.e. thermal, mechanical and electrical. To meet this ever-increasing demand, fossil fuels such as coal, oil and natural gas have been exploited in an unsustainable manner. This exploitation has been posing serious environmental problems such as global warming and climate change. While we have shortage of energy and are dependent on imports in case of petroleum, we are blessed with plenty of natural sources of energy such as solar, wind, biomass and hydro. These sources are environmentally benign and non-depleting in nature and are available in most parts of the country throughout the year.

Biomass resources such as cattle dung, agriculture wastes and other organic wastes have been one of the main energy sources for mankind since the dawn of civilisation. There is a vast scope to convert these energy sources into biogas. Biogas production is a clean, low carbon technology, useful for the efficient management and conversion of organic wastes into clean renewable biogas and organic manure/fertiliser. It has the potential for leveraging sustainable livelihood development as well as tackling local and global land, air and water pollution. Biogas obtained by anaerobic digestion of cattle dung and other loose and leafy organic matter/ biomass wastes can be used as an energy source for various applications namely, cooking, heating, space cooling / refrigeration, electricity generation and gaseous fuel for vehicular application. Based on the availability of cattle dung alone from about 304 million cattle, there exists an estimated potential of about 18,240 million cubic meter (m cu m) of biogas generation annually. The increasing number of poultry farms is another source which can generate biogas of 2173 m cu m annually with 649 m birds. In addition, kitchen waste from institutions, universities, restaurants, *baraat ghars*, industries, parks and gardens in urban and semi-urban areas and even non-edible de-oiled cake from Jatropha and other plants offer a very large potential. These wastes must be treated to ensure reduction in methane emission affecting climatic change and for better environmental conditions. In addition to gaseous fuel, biogas plants provide high quality organic manure with soil nutrients which in turn improves soil fertility, a must for sustainable production and for enhancing productivity. Thus, there is a huge scope for the installation of medium size biogas plants in the country. This can be translated to an aggregated estimated capacity of 8165 MW per day power generation or 22,06,789

Fig 1. The schematic diagram of the BGFP project installed at Anand Energy, Vill.- Kalatibba, Teh.- Abohar, Dist.- Ferozepur (Punjab)

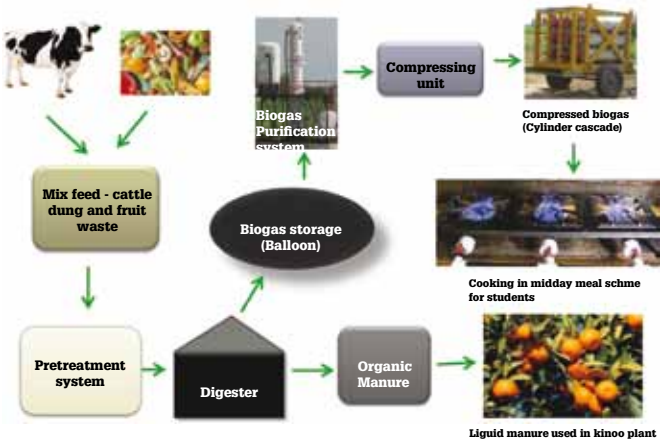


Table 1. The salient features of BGFP project installed at Anand Energy, Vill.- Kalatibba, Teh.- Abohar, Dist.- Ferozepur (Punjab).

Particulars	Description	Remarks
Quantity processed	12 MT	Cow dung, Kinoo waste etc.
Biogas generated	600 NM^3	
Purified/Upgraded Biogas	324 NM^3	
Purified Biogas	231 kg	
Purified/Upgraded Biogas Filled in Cylinders at 150 bars	27 Cylinders of 8 kg each filled.	Equivalent to Rs. 10,800 of commercial LPG
Slurry / Manure	11000 Litres/day	Used as liquid fertilizer substituting chemical fertilizer worth Rs. 5,500/-

LPG cylinders and 21304 lakh kg of urea equivalent or 3974 lakh tonnes of organic manure / fertiliser per day.

Biogas comprises of 60-65 per cent methane (CH_4), 35-40 per cent carbon dioxide (CO_2), 0.5-1.0 per cent hydrogen sulphide (H_2S), and the rest is water vapour etc. It is almost 20 per cent lighter than air. Biogas, like liquefied petroleum gas (LPG) cannot be converted into liquid under normal temperature and pressure. However, after extracting carbon dioxide, hydrogen sulphide and moisture and compressing it into cylinders, it can be made easily usable for transport applications and for stationary applications. Already, compressed natural gas (CNG) technology has become easily available and therefore, bio-methane (or enriched biogas)

which is similar to CNG, can be used for all applications for which CNG is being used. Moreover, purified/enriched biogas (bio-methane) has a high calorific value in comparison to raw biogas.

During the year 2008-09, a new initiative was taken up for the demonstration of the integrated technology-package, in entrepreneurial mode, for installation of medium size mixed feed biogas fertiliser plants (BGFP) for generation, purification/ enrichment, bottling and piped distribution of biogas under the Research, Development, Demonstration and Distribution (RDD&D) policy of the Ministry of New and Renewable Energy (MNRE). Such plants, when installed are expected to produce compressed biogas (CBG) of CNG quality standards so as to be used as vehicular fuel in addition to meeting stationary and motive power and electricity generation needs, in a decentralised manner through the establishment of a sustainable business model in this sector. These medium size biogas-fertiliser plants can be set up in various villages, agro / food processing industry zones among other areas of the country. Under the demonstration phase, the Ministry is providing financial assistance for implementation of a certain number of such projects that are following an entrepreneurial mode. So far 21 BGFP projects with an aggregate capacity of 37, 016 cu m/day have been sanctioned in ten states - Chhattisgarh, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh and Rajasthan.

The main components of BGFP are given below:

- Pre-treatment system;
- Biogas generation system;
- Biogas storage system;
- Biogas purification system
- Biogas bottling system;
- Slurry handling system.

The first biogas bottling project was sanctioned to Ashoka Biogreen Pvt. Ltd, after obtaining the license for filling and storage of compressed biogas in CNG cylinders from Petroleum and Explosives Safety Organisation (PESO), with a capacity of 500 cu m/day at village Talwade, Nashik (Maharashtra) which was commissioned on 16 March 2011. The second biogas bottling project of 600 cu m/day capacity for generation, purification/enrichment, bottling of biogas was sanctioned by the MNRE for Rs. 45.5 lakh Central Financial Assistance (CFA) during the year 2009-10, to Anand Energy at Kalatibba, Ferozepur, Punjab (Fig 1, Table 1). This was commissioned on 17 November 2011 after obtaining required license from the PESO. The biogas generation capacity of the plant is 600 cu m per day. The purity of biogas is about 98 per cent methane and this has been corroborated through tests conducted by the National Accreditation Board for Testing and Calibration Laboratories (NABL). The gas has been compressed to 150-bar pressure for filling in cylinders. This purified biogas is equivalent/similar to CNG.

The increasing number of poultry farms is another source and can generate biogas of 2173 m cu m annually with 649 m number of birds.

The upgraded biogas is being filled in CNG cylinders and supplied to support the mid-day meal scheme for cooking food for over 18000 school students in Abohar and its adjoining areas. The slurry of the biogas plant is being sold to farmers to be used as a liquid manure for *kinoo* plantations. Field trials have indicated the excellent growth in agro-production and substantial improvements in quality. Further, minimum dropping off of fruits was reported since the use of biogas slurry as manure.

This biogas bottling project is projected to replace fuel and manure worth Rs. 40 lakh annually, recovering the full cost of the project within four to five years. The separation and bottling of CO_2 and extraction of humic acid from the slurry would further improve viability of biogas bottling plants. The BGFP provides three-in-one solution of gaseous fuel generation, organic manure / fertiliser production and wet biomass waste disposal. The leftover slurry is useful as organic manure / fertiliser for improving soil-fertility. It is non-polluting because it is free from weed-seeds, foul smell and pathogens. It is rich in nutrients such as nitrogen, potassium and sodium (NPK)and micronutrients - iron and zinc. These plants prevent black carbon emissions commonly seen in biomass *chulhas*. Biogas is an easy and healthy cooking fuel since methane emissions from untreated cattle dung and biomass wastes can also be avoided. The enriched biogas can be bottled in CNG cylinders and used wherever CNG is being used. Since there is no pollution from biogas plants, these are one of the most potent tools for mitigating climatic change and being earth saviours.

The author is Scientist 'F' / Director, Ministry of New and Renewable Energy. Email: mlbamboriya@nic.in