

Implementation of low cost portable bio gas plant as a renewable eco friendly energy source utilizing Livestock waste and Kitchen for economic sustainability of small holder livestock

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ABSTRACT

The rural population approximately 80- 90 % dependent on the use of biomass consisting of firewood, charcoal, twigs, straw, cow dung, and crop residues to meet the energy demands for cooking and other domestic needs. The use of biomass as fuel has serious ill effects such as loss of soil fertility due to diversion of animal manure which acts as fertilizer ,degradation of environment due to deforestation, and various health hazards particularly associated with old people, children and rural women. Most of the farmers depends on agriculture and livestock farming for their livelihood security. They are getting plant residues from agriculture and farm, livestock waste from livestock yet they don't know the proper utilization of waste. Biogas is an often overlooked and neglected aspect of renewable energy in India. Anaerobic digestion has proven to be a beneficial technology in various spheres for rural development. Biogas produced is a green replacement of unprocessed fuels (like fuel wood, dung cakes, crop residues). It is a cost effective replacement for dung cakes and conventional domestic fuels like LPG or kerosene. Biogas technology has the potential to meet the energy requirements in rural areas, and also counter the effects of reckless burning of biomass resources. While solar, wind and hydropower dominate the discussion in the country, they are not the only options available. Biogas is a lesser known but highly important option to foster sustainable development in agriculture-based economies, such as India. Although biogas systems cost less than some other technologies, affording them is often still a challenge for low-income families especially in villages. Many of these families need financial and technical assistance to install them. Both government and non-governmental organizations can step in to help in this area.

Key words : Bio gas production, Portable biogas plant, eco friendly renewable energy source

Introduction

A majority of India's rural population still uses firewood for cooking purposes. With vanishing forests, there is a shortage of firewood. An integrated programme for fuel wood production to meet the total requirement of the country is an imperative need. But the implementation of such a programme would pose serious problems. It would be more useful to begin with projects covering specific locations like a village or a block, aiming at making them self-sufficient in fuel wood. The experience gained thereby could help in formulating an overall long-term strategy. rapidly increasing population; increasing costs of other fuels; depletion of forest resources; inadequate reforestation; competition between commercial and non-commercial users of woodfuel (Bruun *et al* 2014).The simple act of cooking takes on a difficult dimension due to lack of easy access to fuel and water, forcing women in rural India to walk long distances to get them, increasing drudgery and leading to health hazards that call for immediate action (Suyog VIJ (2011). Health hazards such as enormous physical burden, other than just missed opportunity for developmental activities. This strenuous and prolonged work takes a toll on the women's

health. Most often men migrate to urban areas for work and the women are forced to work hard to attend to all the needs of the family. As age advances women start suffering from various health issues, leading at times to disabling effects of these chronic illnesses. Their health related quality of life is grossly compromised. Biogas is a renewable, as well as a clean, source of energy. Gas generated through biodigestion is non-polluting; it actually reduces greenhouse emissions (i.e. reduces the greenhouse effect) (Mariara *et al.*2009). India has a rapidly expanding economy and the population to fit. This has created problems with electricity supplies to expanding areas. Like most countries, India mainly uses fossil fuels. There are significant differences between biogas and fossil fuels, but for India, one of the biggest is that you can create biogas at home. It's pretty tricky to find, dig up and transform crude oil into gas, but biogas doesn't have the same barriers. In fact, many farmers who those who have gardens or greenhouses could benefit with proper water management and temperature control so that plants can be grown year round, It still takes some learning and investment, but for many people, especially those who live in rural places, it's doable. Although the conversion of agriculture waste cattle dung and crop residues to biogas and digested slurry is an established and well-proven technology in India, it has been underused, probably because until recently, firewood was easily available and chemical fertilizer was relatively affordable to most of the farmers in India. The farmer's communities today are required to made to understand that their revenue from agriculture is decreasing year on year due to increasing deforestation, degradation of land quality, rampant use of chemical fertilizer and pesticides, lack of farm cattle, injudicious use of water for irrigation, and use heavy vehicles for ploughing. These ill-advised decisions have made the farmers poorer, impacted the health of their families and the rural environment of villages. The years ahead are crucial if this trend is not reversed.

Challenges faced in implementation of biogas technology

Firewood and chemical fertilizer were the easily available source at rural area. Bio gas technology lower the environmental degradation and prevent green house gas emission like Carbon dioxide and Methane into atmosphere. But this advantage can't motivate the farmers easily to adopt the technology. Due to poor dissemination of information and unsatisfactory communication about the plant operation and application of digested biogas slurry. The entire marketing technology of biogas failed to highlight major advantage an increased revenue from agriculture with the use of high quality and a low cost homegrown digested biogas slurry as fertilizer. Another advantage was to help farmers' understand that their land quality and output per acre will increase over the years by the use of digested biogas slurry which has been degraded from the rampant use of chemical fertilizer and pesticides. The farmer's communities today are required to made to understand that their revenue from agriculture is decreasing year on year due to increasing deforestation, degradation of land quality, rampant use of chemical fertiliser and pesticides, lack of farm cattle, injudicious use of water for irrigation, and use heavy vehicles for ploughing. These ill-advised decisions have made the farmers poorer, impacted the health of their families and the rural environment of villages. The years ahead are crucial if this trend is not reversed.

Application of biogas technology

Most of the rural and semi-urban areas have a poor perception of the Anaerobic Digestion (or biogas or biomethanation) technology. This technology offers benefits to all spheres of society but have a particular emphasis on the needs of the farmers in rural areas. Farmers with dairy animals generally have free access to animal wastes (dung), which provide

input feed for the biogas digesters (Keri *et al* 2008). Normally, these farmers stock-pile the dung obtained from their cattle as a plant fertilizer, but this has lower nitrogen content than the digested biogas slurry created by the biogas digestion process, which is odorless and makes a better fertilizer to substitute chemical fertilizers. They can use the gas for cooking or heating, for running power generators. The biogas technology helps farmers reduce their burden to buy LPG and harmful chemical fertilizers and pesticides (Kartha *et al* 2001). In short, biogas technology is an integrated solution for sustainable agriculture, improving health and lowering environment degradation. This portable biogas plant easy to install and handle with cow dung and kitchen waste which is easy and cheap to get and produce the gas. In a short portable biogas plant is a wonderful economically feasible to poor farmers especially during these days the cost of gas cylinders becoming very high and getting wood, burning woods and their side effects making it inevitable to choose the portable biogas plant.

Portable biogas plant



Return on investment (Approximate estimate)		
1	1M ³ biogas	0.500kg LPG approx.
2	1 m ³ of biogas to kg	1 kg/m ³
3	Calorific value	20mJ/m ³ or 4713kg/m ³
4	1 Kg LPG	Rs. 73/-
5	Cost of 1 M ³ Biogas	Rs. 36.8/- approx.
6	1 Kg solid Fertilizer	Rs. 10/-
7	1 liter liquid fertilizer	Rs. 1/-
8	Income from Biogas per day	9.5*36.8 =349.6
9	Income from Biogas per year	365*349.6 = 127604

Advantages of biogas technology

- Enhance bio-security for dairy animals – being fully fermented, bio-slurry is odorless and does not attract flies, repels termites and pests that are attracted to raw dung.
- Provides high quality and low-cost homegrown fertiliser for sustainable agriculture.
- Reduce energy poverty and ensure energy security.
- Digested biogas slurry is an excellent soil conditioner with humic acid.
- Save time for women for education and livelihood activities.
- Increase forest cover as less firewood would be needed on a daily basis.
Reduce weed growth

Benefits of biogas for rural area

Anaerobic digestion systems are beneficial to developing countries because they are low-cost compared to other technologies, low-tech, low-maintenance and safe. They provide reliable fuel as well as improved public health and sanitation. Also, they save people the labor of collecting large amounts of firewood, freeing them up to do other activities. Thus, biomass-based energy systems can help in rural development.

Biogas for rural areas also has environmental benefits. It reduces the need to burn wood fires, which helps to slow deforestation and eliminates the emissions those fires would have produced. On average, a single home biogas system can replace approximately 4.5 tons of firewood annually and eliminate the associated four tons of annual greenhouse gas emissions, according to the World Wildlife Fund. Biogas is also a clean, renewable energy source and reduces the need for fossil fuels. Chemically, biogas is the same as natural gas (Kothari *et al* 2010). Biogas, however, is a renewable fuel source, while natural gas is a fossil fuel. The methane in organic wastes would release into the atmosphere through natural processes if left alone, while the greenhouse gases in natural gas would stay trapped underground. Using biogas as a fuel source reduces the amount of methane released by matter decomposing out in the open.

Conclusion

Portable biogas plant is a tool to achieve rural areas' sustainable development, giving access to clean and affordable renewable energy. The use of biogas plant in poor rural areas serves as an environmentally friendly way to reduce fossil fuels and traditional biomass and reduce indoor and outdoor air pollution. Also, the use of biogas can significantly reduce organic waste in poor rural areas. Despite the potential and the wide range of benefits that rural areas can acquire from the biogas plant, several potential problems limit the diffusion of biogas plant in rural areas. They include the lack of awareness of users, and the inadequacy of design to meet the actual biogas (energy) need. For biogas systems to succeed and be used in rural areas, government should strengthen current policies and develop new policies and regulations to motivate people in rural areas to install biogas plant. These policies should focus on the comprehensive sustainability of the biogas systems. The policies should include incentives and procedures for supplying large number of portable biogas plants.

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