

Utilization of Biogas As Green Fuel in Alappuzha Suburbs: A Case Study

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Abstract:

Biogas is one of the most economical ways to cook or light a home in rural areas of the world when other power sources are unavailable. Biogas is one of the most economical ways to cook or light a home in rural areas of the world when other power sources are unavailable. The present study is aimed at revealing the status of awareness about biogas and actual usage thereof among the local population, as an alternative fuel for domestic cooking purpose. In the amateur survey conducted during 2012 we found that people depending on LPG as the lone source of cooking fuel (46.67%) far out numbered those using other fuels like firewood electrical equipment etc (Table 1). However, people who use both LPG and firewood users registered 43.33% which was immediately close to LPG alone users. Only a small number of people were found to use electrical equipments along with LPG (6.3%). The results of survey conducted during 2015 January onwards proved that people of urban Alappuzha are largely interested in using biogas at their households. The commendable factor that makes biogas unique is that its substrate is not only absolutely free (*kitchen waste and faeces*) but also something that we always wanted to get rid off, the bio-waste. So installing a biogas plant naturally becomes ‘two birds in one shot’ type of achievement. Future prospects of this investigation suggest a modified version of biogas usage for urban users and flat dwellers which involve cultured vials of anaerobic methanogenic bacteria developed through research.

Introduction

Biogas is unique in several aspects when compared to its alternate fuel counterparts. The commendable factor that makes biogas unique is that its substrate is not only absolutely free (*kitchen waste and faeces*) but also something that we always wanted to get rid off, the bio-waste. So installing a biogas plant naturally becomes ‘two birds in one shot’ type of achievement. Probing further we come across the positive facts that it is non-explosive, non smoky flame, regulatable just like an LPG stove, tank available at subsidized rate, almost repair free, portable, no complicated technology, flame strength equivalent to that of LPG, one hour flame guaranteed for every 3 to 4 kg biowaste per day, space requirement not more than a normal water tank, any non-fibre and non-acidic biowaste can be raw material etc. Biogas is one of the most economical ways to cook or light a home in rural areas of the world when other power sources are unavailable.

This means savings not only for them but the whole nation. Now in real quantitative terms let us see what the savings is in Indian rupee. Suppose you are a person using 8 LPG cylinders per year. By using LPG it is reduced to 6. You straightly save approx. Rs. 800/- (400×2) for yourself and 600/- (300×2 in terms of subsidy) for the nation. Just multiply with crores of citizens and we happily arrive at the magic

of biogas in bringing national level savings to the tune of multicrores which can be diverted for better infra structure across the country which as a natural byproduct of biogas usage, would have already become almost garbage free too.

Review of literature

According to studies Carried out at the central Mechanical Engineering Research Institute in Durgapur, 1kg of dry water –hyacinth can produce 4-6litres of gas following fermentation at temperature between 30-35 degree celcius. About 10 cm long chopped stem and evenly crushed material with moisture content ranging between 50-60% is appropriate for biodegradation ,chopping of lower part of stems is helpful in quick drying to the desired level of moisture content. Gas yield becomes maximum after 13-15 days of anaerobic fermentation during summer and after 18-20 days during winters.

The action for food production – Canadian Hunger foundation (AFPRO-CHF) net work, comprising a total of over 100 NGOs, has been unique experiment. It involved the governmental/ voluntary sector in dissemination of biogas technology. By installing over 97000 biogas plants in different parts of each country over a decade, this net work has enabled a wider reach of technology. This publication is an outcome of a study conducted by the Tata Energy Research Institute to assess the impact of the biogas programme implemented by the AFPRO-CHF network.

Material and methods

The present study is aimed at revealing the status of awareness about biogas and actual usage thereof among the local population, as an alternative fuel for domestic cooking purpose. In the present day the twin evils that require immediate solution are fossil fuel depletion and bio-waste disposal.

The suspected reasons of failure of implementing this noble cause are lack of follow up at the grass root level and over reliance on existing data in this aspect. We apprehend that the on hand data are unempirical and intuitive. Scientific data on the following aspects are inevitable for the successful implementation of government policies on biogas: these are, actual level of understanding, will of people and their expectations from the governing bodies regarding assistance for installation of biogas tanks and also its worth. True data on these could be obtained only by direct interview with a cross-section of the society. Therefore our investigation was carried out in the form of a survey.

Area of assessment included panchayats namely Kanjikuzhy north, Punnapra north, Mararikulam north and Kidangapparambu area of Alappuzha municipality where biogas plants were installed. We collected information using an initial questionnaire comprising of 38 questions relevant to the title of the project. Observing the response, comments and suggestions from the people at the receiving end, the questionnaire was customized for users of biogas with 18 questions (Appendix-I) and non-users of biogas with 5 questions (Appendix-II). Further information was collected using the modified feedback form. About 200 households per panchayath were quizzed.

Method of interrogation was direct with the head of each family with the prepared questionnaire having multiple choice closed ended questions. In situations where the family members were busy, an appointment was fixed and visit was repeated. In any case ample time and mood was ensured so that data acquired was genuine. The fact that survey type research studies usually need larger samples owing to low percentage of responses was born in mind while carrying out the survey. So visiting individual houses was perceived to be quite a time consuming exercise. Therefore towards the later stage of survey, questionnaires were distributed to school and college students at their institutes and were collected back

the very next day. This was done with prior permission and involvement of principals to ensure accountability .

For the ease of survey we divided into houses and institutes. Houses were further divided into rural, urban and semi urban based on degree of crowdedness and area possessed by individual household for waste disposal. Institutions included Hospitals, Schools and Hostels. Total of about 150 houses and 30 institutions were covered per panchayat area.

Whereabouts of users of biogas were collected from various biogas agencies and they were located for interview. In the next and final stage of information collection, we mustered details of efforts from the government through panchayats and municipalities on the subject of biogas, its awareness and installation. This was done through right to information. The copy of questions drafted is displayed in Appendix-III.

Right to information: We got very valuable information through Right to Information from Kanjikuzhi, Alappuzha, and Punnapra panchayat.

Method of survey conducted:

1. Panchayat area was divided into five parts.
2. Each area was again divided into two parts.
 - a. Houses
 - b. Institutions
3. Houses are again divided into three.
 - a. Rural (More than 15 cent)
 - b. Semi urban (More than 5 cent)
 - c. Urban(Less than 5 cent)
4. Institutions
 - a. Hospitals
 - b. Hostel
 - c. School
5. Total houses=30x5=150

Total Institutions=30

Apart from survey, the project had aimed to find out some correlation if any between content of proteins and carbohydrates of vegetable and fruit inputs to biogas plant. A possible list was identified among fruits as well as vegetables the waste of latter being used raw and cooked.

The method followed was simple spectrophotometric using a visible automated spectrophotometer manufactured by 'Systronics'.

Method Summary For Total Protein In Veggies:

The pellet of vegetable tissue is treated to remove lipids (*the tissue sample is homogenized with 18 volumes of a mixture of hexane/2-propanol (3/2) for 1 minute, the suspension is filtered and the filter rinsed with 3 x 2 vol of the same solvent. The whole liquid phase is evaporated and the dried extract dissolved*) then allowed to dissolve in 0.1 N Sodium Hydroxide (NaOH) for 15 minutes to generate a crude protein extract. The solution is centrifuged, and duplicate 0.1 milliliters (mL) aliquots are pipetted into separate test tubes. The protein content is determined on these duplicates using the Bicinchoninic Acid (BCA) method. This involves mixing the sample with reagents which react to form a product with

a color intensity that is proportional to the amount of protein in the sample. The color is quantified as an absorbance reading in a spectrophotometer at a wavelength of 562 nanometers (nm). To normalize enzyme activity, the determination is made directly on a portion of the same crude extract assayed for enzyme activity. Duplicate 0.1 mL aliquots are pipetted into separate test tubes and also assayed by the BCA method. For any purpose, when protein is determined on unknown samples, solutions with known protein are used as standard.

Results

The use of biogas is still limited to few individuals in spite of enough awareness programs from the government. The answer could only be obtained through house to house survey. Initial survey was done during 2012 and later during 2015. Primary data obtained from the surveys are presented here.

In the amateur survey conducted during 2012 we found that people depending on LPG as the lone source of cooking fuel (46.67%) far out numbered those using other fuels like firewood electrical equipment etc (Table 1). However, people who use both LPG and firewood users registered 43.33% which was immediately close to LPG alone users. Only a small number of people were found to use electrical equipments along with LPG (6.3%). Urban and sub-urban population who depend upon firewood alone registered only 3 per cent. None of the households were detected using biogas as the main cooking fuel. It was revealed that even those who use biogas as a supportive of supplementary fuel source with LPG and other equipments were negligible.

In the survey area covered by us, percentage of people who are concerned about how long a single cylinder of LPG lasts was 93.67% (Table 1.3). A minority do not bother to have such a check. Table 1.4 shows that in 83.67% of households, the general duration of usage of one cylinder ranged from 1-3 months. A small number users up LPG in less than one month time (4.33%) and the percentage of those who use it for more than three months was found to be 5. It was interesting to note that although 93.33% of people were worried about the present rate of LPG, only 74.33% believe that the rate of the LPG rate may hike up to rupees 1000/- within a year. About 5% did not respond to this question.

From the survey it was found that 70.33% of people felt problems in rebooking and in the availability of fresh cylinder of LPG (Table -1.7) Almost 56% (Table-1.8) feel the need of at least one more non-electrical source of fuel for domestic cooking as convenient as LPG. The survey also revealed that 31.3% do not have enough land to dispose their kitchen waste (Table-1.9). Table 1.10 shows that 90.33% of people believes kitchen waste can be useful in some or other way, but not sure exactly how. Percentage of people who had an alternative idea for LPG was found to be 55.33% (Table-1.11). A minority (1.67%) did not answer to this question. It was good information we found from this survey was that 92.33% of people have heard about biogas through media (51%), studies (7%) exhibition (11%) etc (Table-1.13). But only 2.67 % of people said they were informed through panchayats / municipalities about biogas.

As expected , majority of people (96.33%) had no clear idea about different types of biogas tanks available (Table-1.14). Only 0.33% were aware about cement tanks and 2.34% on gobar gas plants . From the table 1.15 it was clear that 87.67% people considered biogas tank in their house. The reason they showed for their unwillingness are lack of enough waste (12.33%), lack of space (13.33%) etc. People who were willing to install biogas tank exposed the reason too. It was mainly to save LPG (13.67%) and to dispose waste (19.7%) (Table-1.18).

The results of survey conducted during 2015 January onwards proved that people of urban Alappuzha are largely interested in using biogas at their households. The efforts of Municipality and special interest of Dr. Thomas Isaac, MLA has played a major role in the pro-biogas mindset of people of this town. However, the initial momentum in the installation of biogas tanks was not maintained towards later periods. Table 1 show that maximum percentage of people (37.8 %) are still in the 1 year segment regarding the duration of use of biogas.

It was seen that among fruits, Jackfruit had the second highest quantity of carbohydrates (23.5 gram per 100 gram tissue) after extreme high in Dates (64) and the least was shared by Orange and Water melon (6 gm each). Pine apple (3.8 gm) and Dates (3.6) hit the top of fruits chart for protein content and lowest protein carriers were found to be Grapes (1.09), Mango (1.06) and Papaya (0.85).

Among vegetables, beans, cauliflower and amaranths shared the least carbohydrate content (1 gm each). In the case of protein content in veggies, Soya and green gram registered the highest (11 gm).

Analysing these results, the property of jack to induce a sudden boost in the biogas generation may be attributed to its high carbohydrate content combined with high moisture content. The reason behind Dates as an average biogas performer despite its very high carbo content, may be attributed to being a dry fruit coupled with the fact that it is available in Kerala house holds as a processed one.

Discussion

The thought of a survey on usage of biogas was raised out of twin problems that we face today. First one is the fast depleting LPG source and its hiking cost as the natural consequence of depletion. The second issue is that of waste disposal which continues to be permanent head ach to society and local self governments. At this juncture, biogas could be and should be the right alternative both the concerns. First of all, biogas is highly economical as the recurring cost is almost zero. This is because, source of energy in biogas plants is the readily available domestic kitchen waste discarded from each household. For the same reason, waste disposal at public places is also taken care of automatically. However, use of biogas is still limited to few individuals in spite of enough awareness programs from the government. The answer could only be obtained through house to house survey. Primary data obtained form individual house holds were consolidated and analyzed. This was done to get and idea on lapse between government moves and the level of its actual implication or effect in the society regarding environmental issues

The fact that the urban and semi - urban population depend solely on LPG for cooking purpose is definitely a dangerous issue. This fuel is supplied by the government in a highly user friendly from through an orderly ssystem for the past so many years. Therefore the new generation families have become over dependent on it without realizing the fact that it is a vestige gas and may not last household near future owing to its fossil status. The survey results showed that people who use both LPG and firewood was also not too less. That situation is also risky for the already delicate greenery we enjoy today. No one is planting new trees these days but go on cutting down existing ones. Even educated citizens and those who advocate environment friendliness in the public also are among the culprits clandestinely. A small number of people use electrical equipments also which because regarding production of electricity we are still a poor nation. Keeping a long term goal the Government must make use of biogas in each house hold, mandatory by law.

Summary and Conclusion

Biogas is unique in several aspects when compared to its alternate fuel counterparts. The commendable factor that makes biogas unique is that its substrate is not only absolutely free (*kitchen waste and faeces*) but also something that we always wanted to get rid off, the bio-waste. So installing a biogas plant naturally becomes ‘two birds in one shot’ type of achievement. Probing further we come across the positive facts like: it is non-explosive, non smoky flame, regulatable just like an LPG stove, tank available at subsidized rate, almost repair free, portable, no complicated technology, flame strength equivalent to that of LPG, one hour flame guaranteed for every 3 to 4 kg biowaste per day, space requirement not more than a normal water tank, any non-fibre and non-acidic biowaste can be raw material.

Being a highly government dependent society we almost forgot to find out new vistas with a vision for self help. Cooking fuel is such an issue today. Therefore mere awareness programmes will not do. Keeping a long term goal the Government must make use of biogas in each house hold, mandatory by law. Future prospects of this investigation suggest a modified version of biogas usage for urban users and flat dwellers which involve cultured vials of anaerobic methanogenic bacteria developed through research.

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