CHAPTER V

OPERATIONAL ASPECTS OF THE BIOGAS PLANTS

GENERAL REVIEW

5.1 INTRODUCTION :

The success of new technique and its devices in any line of production depends on its adaptability to the need of the product and economical use of it and also its capacity to save the consumption of raw materials. In other words, the new technical devices in the production process aim at elimination of wastage of raw materials. Accordingly, the new devices namely biogas plants recently introduced in the rural areas must aim at elimination of wastage of the sources of cooking fuel materials that have been used for cooking purposes by the rural population. As stated some where earlier the rural population..has been and still using the animal wastages and firewood from nearby forest. The purpose of new biogas plants is to avoid wastage and reduce the consumption of firewood. But the new devices can not be a perfect substitute for animal wastes and firewood which are being presently consumed by a large section of the rural population.

5.2 DIFFERENT SIZES OF THE BIOGAS PLANT :

The biogas plants may be of different sizes. The minimum size of the biogas plant is to be 2 Cubic metres, (70 Cubic feet)the maximum size 25 Cubic metres (875Cubic feet). As far as the size of the biogas plant is concerned, it seems to be quite flexible. In other words,the size of

a plant could be adjusted in accordance with the requirement of the fuel consumer and also the quantity of waste available from animals. The number of animals per family may decide the required size of plant. Therefore, an uniform size of the plant may not be feasible in respect of families having varying number of cattle population. If one takes into account the average number of cattle population per family to be 2 to 4, 2 Cubic metres capacity plant may be considered as a suitable size for the rural families. Even though, the capacity of the plant could range to 25 Cubic metres (875 Cubic feet), the plant of this size may not be worthwhile considering the capacity of the small and marginal farmers and landless agricultural labours who dominate the rural economic scene. Since the capacity of the plant is constrained by the number of cattle population and number of cattle population in turn upon the size of the land holdings. The plant with a large capacity may not be viable in cases of a large number of farmers. This could be described as a structural constraint on the spread of biogas plants in the rural areas.

Table 5.1 shows the capacitywise requirement of the number of animal population.

TABLE 5.1

THE SIZEWISE REQUIRED NUMBER OF CATTLE POPULATION

Sr.No.	Size of plant		Minimum necessary number of cattle
	Cubic meter	Cubic Feet	
1	2	3	4
1	2	70	2-4
2	3	105	5-6
3	4	140	7-8
4	6	210	9-12
5	8	280	13-15
6	10	350	16-20
7	15	525	21-30
8	20	700	31-40
9	25	875	41-45

SOURCE : 1) Gobar Gas Sanyantra
(Ajachaya Kalachi Garaj)

(Gobar Gas Plant: Present Day's Need)
Directorate of Gobar Gas Scheme,
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Even then ,for biogas generation animal and human waste such as cow dung,buffalo dung urine, poultry droppings free from litter,horse dung,free from bedding material,other live stock excreta , night soil etc.can be used for feedstock. From the technical point of view and also efficient use of the biogas plant it is desirable to use mixture of excreta in order to generate more gas because as compared to cattle dung (100%), the gas production is 60% from poultry droppings, 70 % from goat excreta, 150% from horse dung and 250% from pig dung. In order to utilise other materials like water hyacinth,crop residues, forest litter etc.research work is in progress to develop suitable designs of biogas plant. There are two tested and field worthy designs of biogas units. There are (1) Floating Gas Holder type (gobar gas plant)

This design was first developed in the year 1954 in India. KVIC,Bombay adopted it for promotion in 1962. Therefore, it is also known as KVIC type gobar gas plant. The floating as holder type gobar gas plants could be divided into two models,

i) Vertical Floating Gas Holder

ii) Horizontal Floating Gas Holder.

The other type which is in vogue is known as, (2) Fixed -Dome Type (Janata Biogas Plant)

This type of plant was first developed by the State Planning Institute,Lucknow in 1978. It is

an improved version of the Chinese Fixed Dome Biogas Plant. In India, there are number of different models. In the light of the policy guideline regarding multi-model and multi-agencies approach, many agencies including Governmental and non-Governmental have taken keen interest and developed so many models in view of the basic principles of construction of biogas plant. They have reduced the scarce materials and consequently the cost of plant. In the recent years, the large number of models have been developed.[1] Even these models have got their own merits and demerits. We need not go into the details. Our main concern is to find out the benefits to the biogas plant holders over and above the traditional methods of fuel consumption.

5.3 CLASSIFICATION OF BIOGAS PLANT HOLDERS ACCORDING VARIOUS SIZES IN MURGUD TOWN

From the above general review, we notice that, there is a large number of varying sizes of the gobar gas plants which may suit different quantities of the cow dung, buffalo dung and sheep drops. In other words, the sizes are framed so as to make them suitable to small or big size family and also useful in terms of availability of raw material i.e. cow dung, buffalo dung etc. which in turn depands upon number of animals and collection of gobar. For different sizes of gobar gas plants held by the surveyed families in Murgud Town. Refer Table 5.2.

TABLE No.5.2

CATEGORIES OF BIOGAS PLANT ACCORDING TO PLANT SIZE AND TYPE OF PLANT

(Size of Plant in Cubic Feet)

Sr. No.	Model of Plant	Size of the Plant						Total
		105	140	210	240	280	500	
1	2	3	4	5	6	7	8	9
1.	KVIC	1	6	36	4	5	1	53(94.64)
2.	JANATA	1	-	-	1	-	-	2(3.58)
3.	DINBANDHU	-	1	-	-	-	-	1(1.78)
	TOTAL	2	7	36	5	5	1	56(100%)

(N.B.: Figures in the brackets show percentage of models of plant to the total number of plant).

According to Table 5.2 the sizes of the plant in use vary from 105 Cubic feet to 500 Cubic feet. A glance at the table will show the heavy concentration of the biogas plant holders in the class of 210 Cubic feet. In this class the number of the holders measured 36. Above this size class i.e. between 240 Cubic feet to 500 cubic feet there are only two household families having biogas plants. The break up of the families in this class (above 210 Cubif feet to 240 cubic feet glbar gas plant) numbers to 5 families, 280 Cubif feet by 5 families and 500 cubic feet by only 1 family. Below 210 Cubif feet size of biogas plant, there are only 7 families who possess gobar gas plant and of 140 cubic feet , there

are 2 families who have plants of 105 Cubic feet. Again the model designed by KVIC, is more popular among the biogas holders. Others like Dinbandhu model are not so popular in rural community. Very recently Dinbandhu models are (being preferred to) KVIC Model i.e. people are showing inclination to Dinbandhu model rather than to KVIC model.

5.4 PLANT SIZEWISE DISTRIBUTION OF CATTLE POPULATION AND THE REQUIRED NUMBER OF CATTLE POPULATION

TABLE Number 5.3

DISTRIBUTION OF THE ANIMAL POPULATION TO THE SIZE OF THE GOBAR GAS PLANT

(Size of plant in Cubic Feet)

Sr. No.	No.of Animals	Size of the Plant						Total number of Plant/ Families	Total number of the Animals
		105	140	210	240	280	500		
1	2	3	4	5	6	7	8	9	10
								3+4+5+6+7+8	2x9
1	1	-	1	4	1	-	-	6	6
2	2	-	4	9	3	1	-	17	34
3	3	2	1	6	-	1	-	10	30
4	4	-	-	5	-	-	-	5	20
5	5	-	1	6	-	-	-	7	35
6	6	-	-	3	-	-	-	3	18
7	7	-	-	2	-	2	-	4	28
8	8	-	-	-	1	-	-	1	8
9	10	-	-	1	-	-	-	1	10
10	12	-	-	-	-	-	1	1	12
11	19	-	-	-	-	1	-	1	19
12	TOTAL	2	7	36	5	5	1	56	220

The earlier table 5.1 gives the detailed sizewise distribution of minimum (required) (Number of animals) 2 1 for full use of the plant. The minimum requirement of the number of cattle population for full use of the 105 Cubic feet size plant is 5 to 6 animals. But out of the surveyed families, 2 families having the same size plants do not possess the required number of animal population. Each of them possesses 3 animals indicating that, their plants have not been fully utilised. The next size group of plant is 140 Cubic feet.which requires the minimum number of animal 7 to 8. It is strange enough to find out that in this category of households having 140 Cubic feet gobar gas plants do not have the minimum required number of animal population. Column number 4 indicates that out of 7 families 4 families have 2 animals,and only one family has got 5 animals and remaining 2 have 1 to 3 animals. Here also the households having 140 cubic feet gobar gas plants do not fulfil the prescribed number of animal population. One may feel wonder 95% how the families falling under this category operate their respective plants with quite limited number of animal population. A large number of households is concentrated in the category of 210 Cubic Feet size plants. The required number of animal population being 9 to 10, only one household out of 36 has a minimum required number of population that is 10. The rest of the households fall

between the range of animal population varying between 1 to 7. The same observation can be made about the use of the biogas plant of this size. The next categories of gobar gas plants are 240 Cubif feet and 280 cubic feet size plants. Their minimum number of required animal population is 13 to 15. Out of the 10 families (5 belong to each category) Excepting one even not a single family fulfils the minimum required number of animals. Only one family's animals exceed the required number. The last category of surveyed housefolds belongs to those who have gobar gas plant of 5 Cubic feet.There is only one family that possesses 12 animals but the required number of animals for running the plant is 21 to 30. From the analysis of the households from the view point of the required number of animal population and the actuals,the conclusion emerges that,there is a divergence between the two and as such the gobar gas plants installed so far did not work to their full capacity. So the households do not wholly depend upon gobar gas plant for meeting their fuel requirement[1]. For details refer table 5.3. However, the household families that have been using the plant could meet fuel consumption for cooking and some other purposes not wholly but partially. The problem of under utilisation of gobar gas plant could then be solved only by the way of increasing the number of cattle population. To carry this analysis logically further, the increase in the number of cattle population per household is limited by the shortage of Fodder which in term depends upon the size of land holding

and common lands which are free to the village community for grazing their cattle. During the recent years the community lands are being used for some other purposes, forests have become debarred and the problem of supply of fodder has assumed serious dimensions. Further more the recent trends of mechanisation of Farming operation have discouraged the farming community to disown their draugh animals like bullocks and buffaloes. One could increase the number of dairy animal population but that too is restricted by the size of holding of individuals families. On the basis of this factual description of households with gobar-gas plants and without gobar gas plants one could lead to the conclusion that the universal application of gobar gas plant on the individualistic basis may not be a worthwhile proposition. The room for doubt that the households using the gobar gas plants have been induced by the capital subsidies.. granted liberally by State Government and agencies like KVIC, irrespective of the adequate supply of animal excreta which is governed by the number of animals and quantity of fodder used for feeding the animals is not totally in valid.

Still, we do not deny the advantages of gobar gas plants in meeting the requirements of the rural population and also the advantages of economy over the use of traditional sources of cooking fuel. But, we doubt

only the feasibility of gobar gas plants in respect of all the rural households. The long term solution to the problem of fuel for different purposes will be enhanced supply of natural gas through a expanded network of it distribution system in the rural sector of the economy.

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REFERENCE

1) Gobar Gas Sanyantra
(Ajachaya Kalachi Garaj)
GOBAR GAS PLANT
Present Day's Need.
Directorate of Gobar Gas Scheme, Khadi and Village Industries Corporation (KVIC). Gramodyog, Irlla Road, Vileparle (W) Bombay 400056.

2) Models of the Gobar Gas Plant.

1) KVIC Model
2) Janata Model
3) Gayatri Model.
4) Manipal Model
5) Dinbandhu Model.
6) Shivsadan Model.
7) IARI Model
8) The Keragiri Horizontal Plants.
9) Belur Math Model (Ramkrishna Mission Belur Math)
10) The NEERI Model.
11) Jyoti Top Loaded Digester Model.
12) Ganesh Model.
13) MCRC Model
14) ASTRA Model
15) TNAU MODEL.

CHEMICAL PROCESS OF METHANE GAS PRODUCTION FROM ORGANIC RESIDUES.