DEENBANDHU MODEL 2000 BIOGAS PLANT

developed by

AFPRO
Action For Food Production

25/1A, Institutional Area, D-Block,
Pankha Road, Janakpuri,
New Delhi – 110 058
Tel: +91 1128525412, 28525452
Fax: +91 11 28520343
Email: afprodel@afpro.org
Web Site: www.afpro.org

INTRODUCTION

Non-polluting, renewable, with a residue that is immensely usable biogas is all this and more. It is the most resourceful way of making use of biomass generated from Indian livestock, the largest livestock population of the world.

Then why are more and more families with livestock not opting for biogas ? The reasons, predictably, are non-awareness and the cost factor. A lump sum one investment, even with long-term benefits, is not easily available to the majority of rural India.

AFPRO's involvement in research and development and training for better and cheaper biogas technology is over two decades old. The first important milestone was the developing of a new model, called the Deenbandhu, in 1984. The Deenbandhu 2000 is an improved version of this. Among the technical changes made, the shape of the outlet tank of the approved Deenbandhu Biogas model has been changed to a dome.
The thickness of the wall of the outlet tank, diameter of the inlet pipe and wall thickness of the mixing tank have al been reduced, thus reducing the materials required for construction. The result is a plant that is more efficient, and costs 16 per cent lesser than the approved model. A 2 cubic meter plant will cost Rs. 7,603, while the 3 cubic meter one will cost Rs. 9,305. This excludes the cost of peripherals like pipes to carry the gas from the plant to the kitchen, gas burners etc.

DIFFERENT MODELS OF BIOGAS PLANT

Before installing a biogas plant it should be decided, which model should be installed. The following models of biogas plants are available in India.

1. Floating Dome

a. KVIC

b. Pragati

c. Ganesh

2. Fixed Dome

a. Janata Biogas Plant

b. Deenbandhu Biogas plant

c. Ferrocement biogas plant

DEENBANDHU 2000 BIOGAS PLANT

The digester of Deenbandhu 2000 is same as that of Deenbandhu. The outlet tank of Deenbandhu 2000 is dome shaped. Due to the spherical surface, which has smaller surface area as compared to rectangle surface, the quantity of construction

material and mandays for of labour and mason are reduced. The structural strength of spherical structure is more than a rectangular structure, therefore the width of the wall has been reduced.

Construction of Deenbandhu 2000 requires lesser days as compared to Deenbandhu model. With little bit of information about Deenbandhu 2000 model, the mason trained in Construction of Deenbandhu plant can easily construct Deenbandhu 2000 plant.

MAIN COMPONENTS OF DEENBANDHU 2000

1. Foundation
2. Dome — Digester / Gas storage
3. Gas Outlet Pipe
4. Inlet
5. Outlet

1. Foundation

The foundation of the plant is bowl shaped with a collar around the circumference. The construction of the digester dome is done on this collar.

2. Dome

Digester: The dome of the digester is divided in 2 parts. The bottom part is called digester. The mixture of dung and water decomposes in this part and produces gas due to bacterial activity.

Gas storage : The upper part of the digester dome is called gas storage. The gas produced by the bacterial activity is stored in this place.

3. Gas outlet pipe

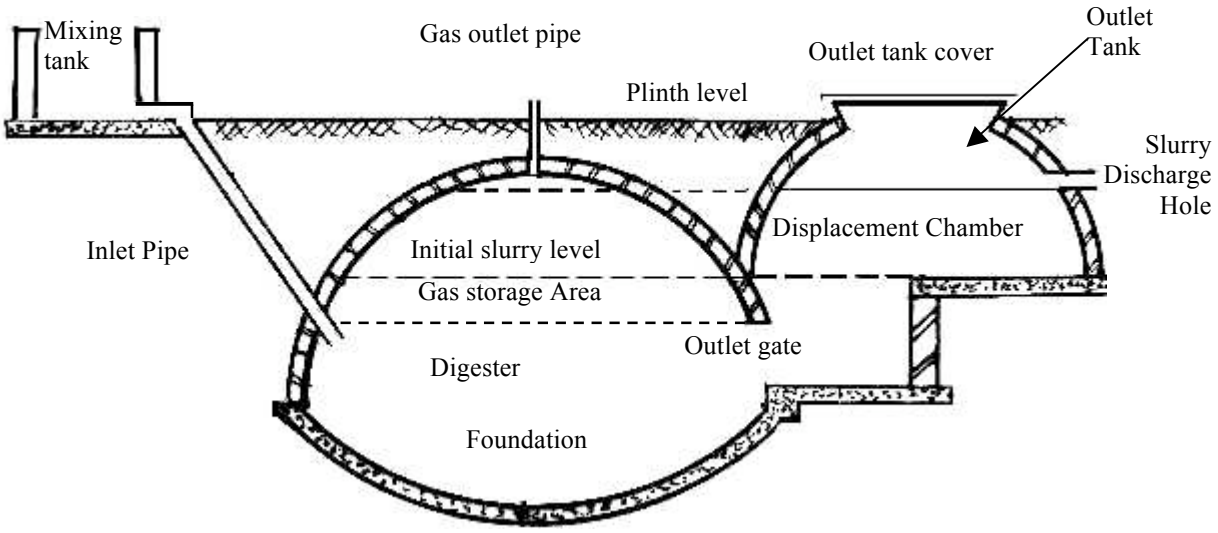
A nipple is fitted on the top of the dome, which is connected to a GI pipe. The gas reaches the kitchen through this pipe.

4. Inlet

The pipe through which fresh dung and water enters the plant is called Inlet pipe. This pipe is connected to a small tank for mixing dung and water.

5. Outlet

The portion of the plant where the slurry accumulates after coming out of the digester is called outlet tank. It is in two parts. The first bottom part is small and rectangular, which is connected to the dome opening, while the other part of outlet tank is dome shaped. A small slurry discharge hole is provided in the outlet tank. The volume of the dome upto the hole is equivalent to the gas storage volume. Only the amount of gas equivalent to this volume can be used in a burner or lamp. The main function of this part is to provide pressure for release of gas from the dome. The level of slurry rises upto the outlet hole in this tank when the plant is full with gas.



Deenbandhu 2000 Biogas plant

COST COMPARISON BETWEEN DEENBANDHU AND DEENBANDHU 2000 BIOGAS PLANTS

	Total Construction Cost				
	1 CUM	**2 CUM**	**3 CUM**	**4 CUM**	**6 CUM**
40 DAYS HRT					
DBP MODEL	7105	10115	12413	15485	21035
DBP 2000	6295	8655	10568	13140	17705
VARIATION IN COST	**810**	**1460**	**1845**	**2345**	**3330**
55 DAYS HRT					
DBP MODEL	7605	10925	13773	17415	23515
DBP 2000	6670	9465	11308	14600	19965
VARIATION IN COST	**935**	**1460**	**2465**	**2815**	**3550**

Special design features of the proposed design in contrast to Deenbandhu Biogas Plant

DEENBANDHU BIOGAS PLANT	DEENBANDHU BIOGAS PLANT 2000
Foundation: As per approved DBP design	**Foundation:** As per the approved DBP design
Digester: As per approved DBP design	**Digester:** As per approved DBP design
Outlet Tank In the existing model the shape of the outlet tank is rectangular & the wall thickness is of 4½".	**Outlet Tank** In DB2000, the shape of the outlet tank is **dome shape**. The spherical structure being stronger than the rectangular structure, the thickness of the wall has been reduced to 2½" (equivalent to wall thickness of the digester) from 4½".
Most of the plant owners leave the outlet tank covers open in order to save the cost. Uncovered outlet tank is a serious safety hazard.	In the dome shape outlet tank, the opening has been standardized to diameter of 2',3" (685 mm) for all sizes of the plants. This opening can be easily covered with local materials or a cast cover. The opening being very small, the chances of accidents is much reduced.
The large surface area of slurry in the outlet tank is subjected to effect of air & sunrays. This leads to scum formation in the outlet tank.	The opening space at the top being only 2',3", which can be kept covered, the effect of air & sunrays is reduced.
In rectangular outlet tank, slurry accumulates in the corners and adds to the scum formation. In this situation slurry starts forming a channel and flows out from the middle of the outlet tank. This adds to the solidification of slurry in the corners.	The spherical shape reduces the chances of slurry accumulation in the absence of corners.
The large opened area allows the foreign material (mud, plastic etc.) to enter into the plant through outlet tank, which reduces HRT and consequently gas formation.	In the new design, the height above outlet hole is more. This and, the open area being smaller, prevent foreign material (mud, plastic etc.) to enter the plant through outlet tank.
The outlet tank wall being straight, the slurry sticks on the walls of the outlet tank when level rises. At the time of using the gas, the slurry level goes down and the slurry, which remains stuck on the walls, dries up. Consequently layer solidifies after some time.	The outlet tank wall being spherical (curved inside), the slurry does not stick on the walls and drips down when the level goes down.
All the above factors constantly effect scum formation and thus affect the outflow of the slurry.	All the above factors add to ease of outflow of the slurry, thus maintaining the functionality of the plant. The slurry is automatically thrown out from the outlet tank when the gas in digester is full at the same time the level reaches first step of the outlet tank when all the gas of the plant is used.
Mixing Tank In the existing model the wall thickness of the mixing tank is of 4 ½"	**Mixing Tank** In this new model the wall thickness of the mixing tank has been reduced to **2½"**, which results to **less construction cost.**
Inlet Pipe In this model, the AC pipe of 6" dia is used as inlet pipe. This size is expensive and not easily available in every place.	**Inlet Pipe** In the new model 4" dia AC pipe is used as inlet pipe. This size of pipe is less expensive and easily available in every place.

Method of Emptying Deenbandhu-2000 Biogas Plant

The need for emptying a biogas plant arises when the slurry level inside the digester has increased due to leakage in the plant or due to improper daily feeding. In the case of improper feeding, the slurry is emptied upto the first step only. While in the case of leakage, the plant will require to be emptied completely. Though the method of emptying the Deenbandhu biogas plant is same as in the present Deenbandhu model, the process is explained here with line diagram for emptying Deenbandhu 2000 biogas plant. There may be several methods to empty a Deenbandhu Biogas plant, but the convenient way to empty a family size new model of Deenbandhu 2000 at the farmers level, is by using buckets and manual labour. It is much easier to empty the plant through the outlet manhole in the new model. In both the models, there are two steps in the out let tank, on which labourers can easily stand and empty the plant using a bucket. The number of labourers required to empty DB2000 is the same as in the case of currently approved Deenbandhu model.

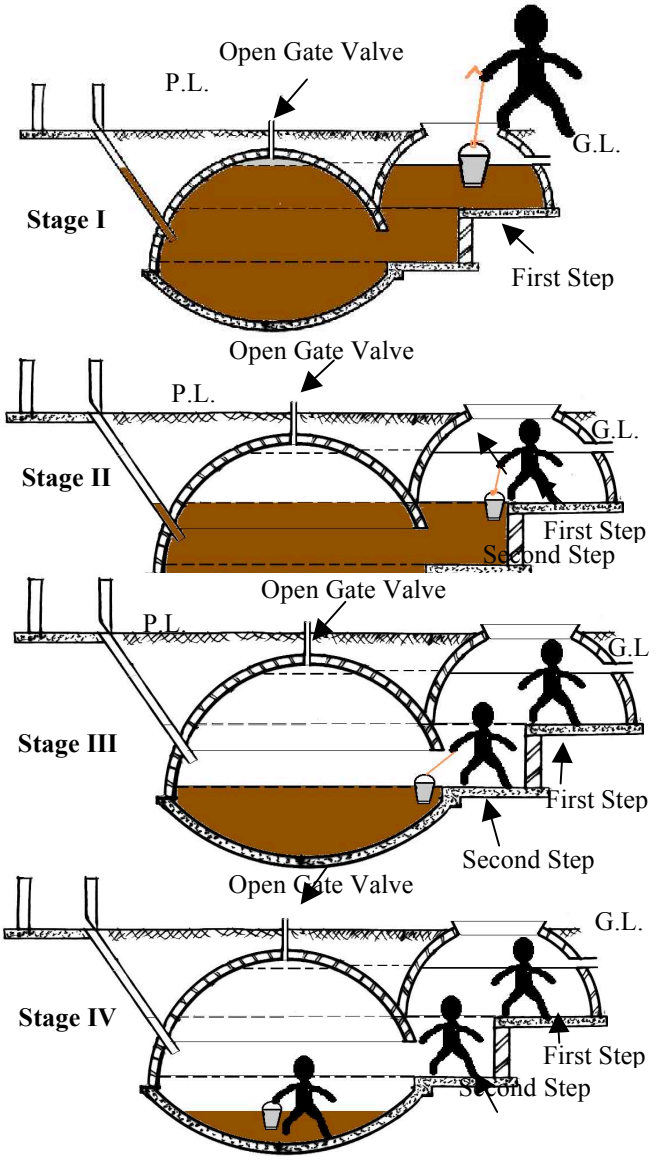
Stage I: Before emptying the plant, the first and the foremost thing is to open the main gate valve fixed on the gas outlet pipe and allow all gas to escape from the plant. This is required for safety. If the plant is working properly, the level of slurry should reach first step. If the level does not reach first step one labourer should start emptying the slurry using a bucket from the outlet manhole standing near manhole at the ground level. The slurry should be emptied up to the first step as shown in stage I.

Stage II : In the next stage, the same labourer should descend to the first step on the outlet tank and empty the slurry upto the second step as shown in stage II.

Stage III: In the next stage, two labourers will be required. The first one would stand on the second step with bucket to take out slurry from inside the digester and second would stand on the first step. The second labourer is required to assist the first one for throwing the slurry outside the plant. In this stage, slurry is emptied upto a depth to enable one man to stand in knee deep slurry in the digester for further emptying.

Stage IV: In the last stage, three labourers are required. The first one stands inside the digester (in knee depth slurry) with a bucket for emptying while second and third labourers stand on the second and first step respectively for assisting in throwing the slurry outside the plant.

In the last stage (IV stage) all the slurry including any sludge and inorganic matter etc. is emptied from the bottom of the plant.



Using the above method, 3 labourers can conveniently empty a family size Deenbandhu 2000 Biogas Plant of 1- 4 cum. capacity in 1 to 2 days duration.

FIELD EXAMPLE

Chaudhari Albel Singh, of Dhekauli village in UP, owner of a 3 cubic meter Deenbandhu 2000 plant installed by AFPRO in his backyard as part of the field testing, gives an astute account of cost benefits. Wet slurry is used a most effective manure for his vegetable plots which lie adjacent to the place where the plant is installed. With an input of 75 kilograms of dung, the plant produces gas for a maximum of 7 hours. The family uses it for cooking as well as lighting a gas lamp. "So we have light when the whole village is facing long power cuts". Points out the owner, He plans to get another plant constructed soon to power their chaff-cutter. An article on the user's experience by a biogas engineer working with the Meerut Sewa Samaj points out : "The cost of the Deenbandhu 2000 model is 42-47 per cent lesser than the Janata model and 60-65 percent lesser than the KVIC model. In the field test, families, the use of chemical fertilisers has dropped by 30 per cent. 'AFPRO assumes problems free running for 25 years. The actual lifetime of a plant is much more. Families are trained in basic maintenance to increase the life of the plant and the spare parts by the partner agencies.

CONCLUSION:

In conclusion it should be stated that continuous R and D efforts to reduce costs of biogas plants and interaction between MNES and NGO networks would result in better prospects for renewable energy development, environmental health and subsidy reduction.