

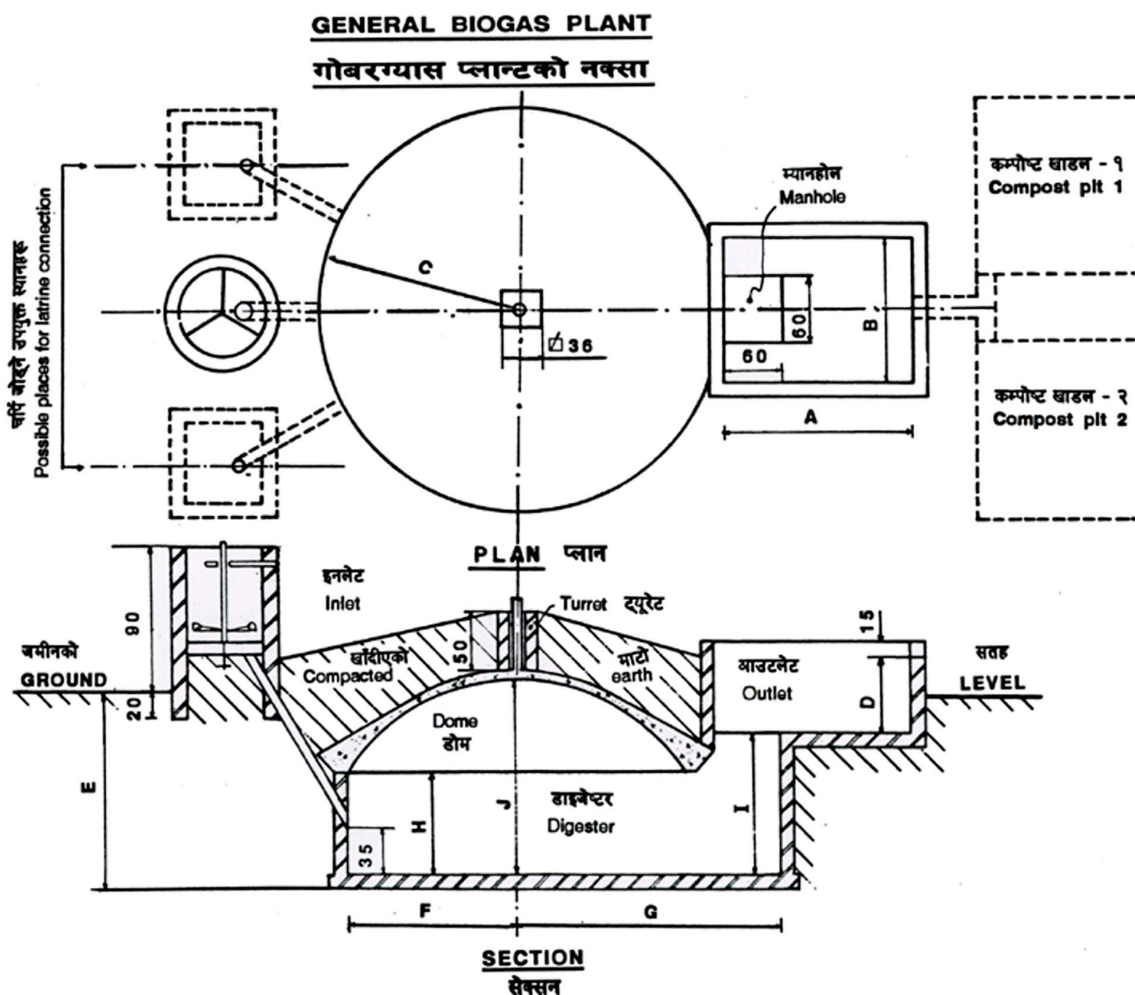
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Biogas Construction Process

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Introduction:

The success of the plant depends upon the construction. In this paper the construction process of the fixed dome design biogas plant developed by Gobar Gas Company in Nepal is presented.



नोट :- प्लान्टको विभिन्न भागहरूको नाप पछ्याडि पट्टि दिइएको छ ।

Measurement of different size of biogas plants:

Part of the plant	Plants size in Cubic meter					
	4	6	8	10	15	20
A	140	150	174	180	248	264
B	120	120	130	125	125	176
C	135	151	170	183	205	233
D	50	60	65	68	84	86
E	154	155	172	168	180	203
F	102	122	135	154	175	199
G	185	211	221	240	261	288
H	86	92	105	94	115	115
I	112	116	127	124	132	137
J	151	110	175	171	193	203

Note: All the measurements are given in Centimeter.

- 1) All the measurement are given in centimeter.
- 2) Inlet, outlet and turret should be in straight line.
- 3) Toilet pipe should be placed as close as possible with the inlet pipe.
- 4) The floor of the digester should be in stable and compact ground.
- 5) The cement sand ratio for making wall should be 1:4.
- 6) The inside digester wall should be plastered with 1:3 cement sand ratio concrete.
- 7) Stone wall should be as close as the pit wall.
- 8) All the brick wall should be compacted with mud externally.
- 9) While making mud dome appropriate size of the template should be used.
- 10) For concreting dome, the ratio should be 1:3:3. Should not use concrete older than two hours.
- 11) Dome should be protected from sun and needs about 6 days for setting.
- 12) The plastering of the dome is very important.
- 13) The gobar gas is not competed unless, these is no top filling, no slab on outlet and no compost pit.

Construction materials need for different size of the plant.

No	Particulars	Plant size in cubic meter					
		4	6	8	10	15	20
1	Bricks/Stone (Pc)	1200	1400	1700	2000	2400	2800
2	Sand (bag)	60	70	80	90	110	120
3	Pebbles (bag)	30	35	40	50	60	70
4	Rod 8mm (kg)	10.5	10.5	13.5	13.5	18	44
5	Cement (bag)						
	• Terai (bricks)	11	13	16	19	27	34
	• Hills (stone)	12	14	18	21	30	37

Site selection

- Sunny place
- Water source within 20 minutes.
- Kitchen as close as possible.
- About 10m. away from the well.
- Adequate space for making compost pit.

Layout

- Fix the place for inlet, digester, outlet and compost pit.
- Use lime or ash for making layout.
- Dig pit as per the measurement and layout.

Daily feeding

No	Size (Cu.m)	Initial dung (kg)	Daily feeding (kg)		Daily water (litre)		No of cattle
			Hills	Terai	Hills	Terai	
1	4	1450	24	30	24	30	2-3
2	6	2200	36	45	36	45	3-4
3	8	2900	48	60	48	60	4-6
4	10	3500	60	75	60	75	6-9
5	15	5500	90	110	90	110	9-14
6	20	7200	120	150	120	150	14 and above

Soling

Soling of the digester floor should be in the stable and compact floor. Pour concrete on top of stone or brick layer placed properly.

Round wall

- Place ½ inch GI pipe vertically at the centre.
- Place another pipe horizontally and tie them up.
- Now start making round wall, taking measurement from the centre.

Digester construction

- Once the pit is completed the level of the digester floor should be in hard or natural soil.
- Take the radius with 1 cm. more for plastering.
- The first layer of the round wall should be from the width where as others from the length of the brick.
- There should be proper back filling by adding little water and gentle tapping.
- Stone wall should be as close as the mud wall.
- The concrete ratio should be from 1:4 to 1:6 depending on the quality of the sand.
- The inlet pipe should be placed 35cm. above from the floor of the digester.
- After completing the brick wall, it should be plastered with 1:3 concrete and should be 10 mm. thick.

Dome construction

- a. There should be proper back filling before making mud dome.
- b. Measure the height from the bottom of the digester to the top of the dome, mark them and fill mud up to that level.
- c. Now replace ½ inch GI pipe 50 cm. buried in the mud dome.
- d. Use template for making proper shape of the dome.
- e. Put thin layer of sand on top of the dome.
- f. ½ inch GI pipe to be replaced with main gas pipe.
- g. The dome should be casted with 1:3:3 concrete.
- h. The thickness of the dome should be 6 – 8 cm. at the centre and 25 cm. at the edges.
- i. Protect it from the sun and pour water 4-5 times a day for about a week.
- j. Make turret on the second day of casting dome.
- k. Remove mud from the digester after about a week.

Inlet construction

- a) Place mixing machine in the inlet tank
- b) The surface of the floor of inlet should be 5 cm above from the overflow of the slurry level.
- c) The height of the inlet pit should be 50 – 100 cm.
- d) If mixing machine is placed the blade of the machine to the wall should be not more than 2 cm gap.

Outlet Construction

- a. The floor of the outlet should be stable.
- b. The size of the outlet should be as given in the drawing.
- c. It should be plastered with 1:3 cement sand ratio.
- d. The wall should be properly back filling.
- e. It should be slightly above the ground.
- f. The cover of the outlet can be made at the time of casting dome. These slabs should also be cured properly.
- g. The thickness of the slab should be 3 inch and should be casted on plain floor or on top of plastic sheets.

Gas pipe, main gas valve and turret construction

- a. ½ inch pipe placed at the centre of the dome should be replaced with main gas pipe while casting dome.
- b. Turret should be constructed next day on the top of the dome and should be 50 cm. high and 36 cm. radius.
- c. Main gas valve should be placed right after the main gas pipe.
- d. There should not be any unnecessary fittings between main gas pipe and gas valve.
- e. Main gas valve should be closed when gas is not using.

Process of plastering dome

- a. It should be cleaned with water and wire brush, once we remove mud from the dome.
- b. Apply a layer of cement water solution.
- c. Plaster 10 mm thick with 1:2 cement sand ratio.
- d. Plaster 5 mm. thick with 1:1 cement sand ratio on the next day.
- e. Mix 1.5 portion of paint with 20 portion of cement and apply inside the dome.
- f. Mix 1 portion of acrylic plastic emulsion paint with 2 portion of cement and apply inside the dome with the help of brush.

Water drain pit construction

- a. It should be placed at the lowest level of the pipe line.
- b. The wall of the drain pit should be 40 cm x 40 cm. (inside) and 50 cm. depth.
- c. The wall should be about 5 cm. above the ground level.
- d. The water drain should be placed 30 cm. below the ground level.
- e. The cover of the pit should be 66 cm. x 66 cm.

Pipe line construction

- a. All the pipe fittings should be done using taflon tape.
- b. Avoid unnecessary fitting and union.
- c. The pipe line should be 1 feet below the ground level.

Stove

- a. It should be in a convenient place.
- b. Should be cleaned every day.
- c. Air adjusting hole should be easily opened.
- d. Rubber hose pipe should be changed if it is damaged.

Compost pit

- a. There should be 2 compost pits about 1 m. far from the outlet chamber.
- b. It should not be more than 1 m. depth and the distance of two pits should be minimum of 50 cm.

Top filling of the dome

In order to protect the dome from cold and get more gas, the dome should be covered with mud (40 cm. high.)

Quality construction materials

1. Cement: -High quality portland cement
-should not be used if moist or with lumps.
2. Sand: -Should not use poor quality sand.
-If it has more than 3% impurities, it should be washed with clean water and use.
-Coarse sand is better for casting and fine sand for plastering.

3. Water: -Should not use dirty water.
 - Better to use drinkable water.
4. Aggregate: -Should be of the right size (0.5 – 2.5 cm.).
 -Should be cleaned.
5. Bricks/sand:-First class brick.
 -With proper shape.
 -Stone should not be too soft.

Quality Biogas Plant

1. Daily feeding with the right quality of dung and water.
2. Is constructed as per the drawing given.
3. There should not be any leakage through pipe line.
4. Adequate top filling on the dome.
5. Pipe line 1 feet below the ground level.
6. Adequate gas production and the user satisfied with the plant.