Bio-digesters

The bio-systems are sewage systems built to produce biogas through a process of controlled anaerobic digestion of organic matter (human waste in this case), recycling nutrients and generating usable sub products such as organic compost for soil recovery and water.

The bio system consists of the fixed dome digester, the compensation tank, the pipelines, the anaerobic filter systems and wetland.

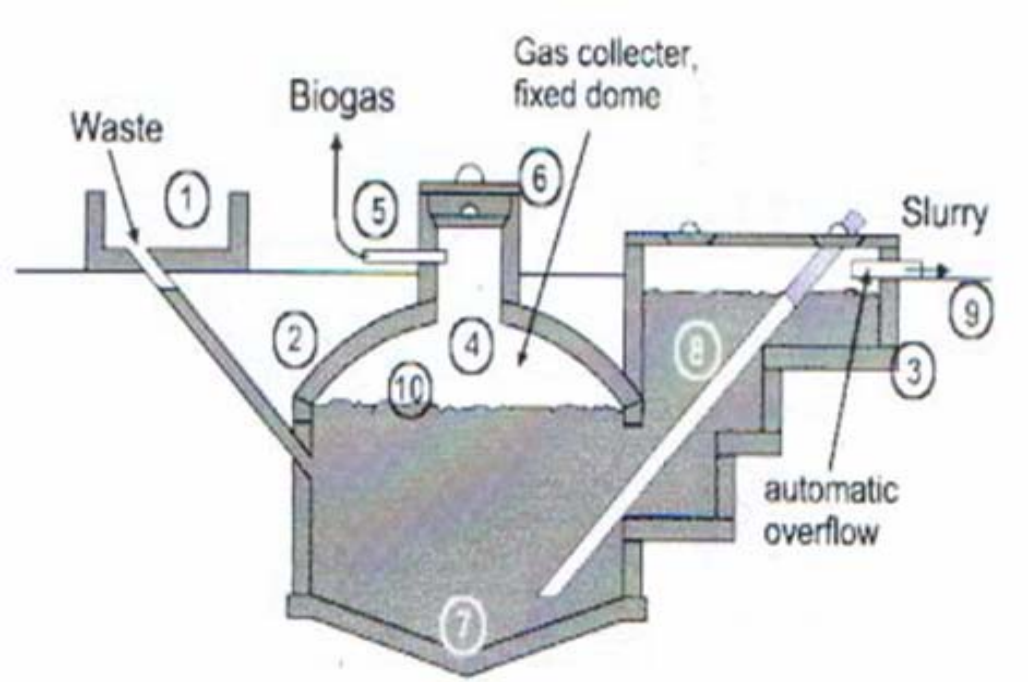

Figure 1: Fixed dome plant Nicarao design: 1. Mixing tank with inlet pipe and sand trap. 2. Digester. 3. Compensation and removal tank. 4. Gasholder. 5. Gaspipe. 6. Entry hatch, with gastight seal. 7. Accumulation of thick sludge. 8. Outlet pipe. 9. Reference level. 10. Supernatant scum, broken up by varying level.
Source: TBW

Key Considerations

- Durability of the project assured through local capacity building, initial assisted maintenance, and optimized use of infrastructure

- Environmental sustainability assured through improved sanitation, production of renewable energy, fertilization of the soil and reduction of free methane emissions.

- Sanitation: This technology leads to a drastic reduction of human waste dislodging, eliminating dependence on external logistics and avoid risks of contamination.

- Energy and pollution: the free methane which naturally is produced by human excreta is rich on CO2 which though disappears when the gas is burnt. Bio systems increase the production of this gas to use it as a clean cooking fuel.

- Environment and reforestation: the biosystem recycles nutrients to generate usable sub products such as fertilizing water and solid compost to produce a green area nearby the system where it is possible to plant fruit trees, flowers and construction trees (such as bamboo).

Important maintenance:

Biodigesters are sustainable also because they are easy to maintain.

There are 3 simple necessary activities to keep the system efficiently working:

- No plastic or other solid material must be thrown into the toilets. They may stuck the connection to the biodigester, may affect the production of gas and make difficult the dislodging operation. Hygienic paper can be thrown into the toilet without any problem

- Use of gas. Once the system starts to produce gas, it should be used often (at least 4-5 per weeks) in order to keep the anaerobic process equilibrated and to avoid that the gas goes out through the water outline pipes. However, failing in follow this rule will not lead to any danger to people.
- Dislodging of the solid waste once every 2-3 years. An excessive leaking of water is a sign that this operation is needed.

FAQs

- *Is the gas dangerous?*

  The methane produced by the biodigester is a low pressure gas. The volume it occupies inside the dome is a minimum part of the whole. Whenever the gas cannot be contained anymore inside the dome, it will up the tap (which must not be fixed to the dome) and it slowly goes out. Therefore there is no risk of explosion.

  Moreover, there is no risk of fire by throwing cigarettes or other flames inside the toilets, because the connection is to the bottom of the dome, while the gas is always on the top.

- *Are people reticent to use a cooking fuel produced by human excreta?*

  Information and training are compulsory to tackle cultural prejudice. In addition, direct users of the gas, such as cooks, recognize quickly the advantages of this fuel, such as lack of smoke.

- *Can the biogas substitute the 100% of the traditional cooking fuel?*

  Only in context such as schools or institutions where one meal per day is cooked. In a domestic context biogas can be only complementary to other cooking fuels.

- *Does the system smell?*

  The only source of smell in the system is the surface of the toilets when they are not regularly cleaned

- *Is it safe to plant edible plants on the wetland?*

  Vegetable or fruits with direct or close contact to the soil should not be planted. However, fruit trees, such as mangos, are a safe option.

- *How often does the solid part need to be dislodged?*

  For biodigester built for schools, with an average use of 50 students per toilet per day, it is necessary to dislodge the solid part once every 2-3 years. This waste, 90% clean from pathogens, can be easily dried and used as compost.