Possibilities of Generating Biogas in Urban Areas

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Conventional Sources of Energy Depend on the central system for electricity

- Hydro electricity- Motor energy and electrical energy- clean energy
- Fossil fuels- Gas, Oil, Coal for heating and electricity- non renewable polluting
- Biomass used as direct fuels- Wood, leaves, nutshells, fruits, rice husk, bagesse –renewable polluting sources
- Atomic energy-polluting

Non-Conventional Sources of Energy

- Solar energy- Heat, electricity-*intermittent*
- Wind energy- Motor energy, electricity-*intermittent*
- Tidal- generating electricity-*intermittent*
- Biomass with efficient equipment- Polluting but renewable
- Biogas as fuel-Polluting but renewable.

Problem of intermittent sources

- Supply may not be available when required
- Hence the energy is stored and used.
- The system needs batteries.
- Life of batteries finite- Hence recurring costs
- Batteries can cause lead pollution.
- Lead pollutes waterways, gets deposited in bones of humans and animals.

Energy required inside buildings for

- Light- electricity
- Ventilation- electricity
- Lifts etc- electricity
- Equipments and machines- electricity
- Air conditioning and cooling- electricity
- Cooking- fuel
- Heating water- fuel, electricity, Solar

National building code puts energy requirements for the above acts as follows

- Lighting and ventilation 20w / m^2
- Equipments 30 w / m^2 like lifts pumps etc
- Air conditioning 100 w / m^2
- Buildings like laboratories 11 w / m^2
- Heating and cooling loads are the heaviest loads
- Energy saved is energy gained

Save energy & use alternate energy

- Use energy efficient equipments
- Plan buildings for natural ventilation and cooling
- Plan A/C building with less of heat gain
- Generate or capture alternate energy
- Solar
- Wind
- Tidal
- Biomass
- Biogas

Biomass available at plot level

- Available also in urban areas
- Dry leaves, Dry tree twigs, wood, cocoanut pith, cocoanut shells, rice husk
- Burning biomass for fuel reduces load on municipal solid waste system
- The energy source is renewable
- Efficient burners for heating water are available
- These get installed at ground level
- A small pipe serves as smoke chimney
- Hot water always rises up hence these save water

Biogas can be generated in urban areas

- Biogas gets generated when biodegradable substances decompose in un-aerobic conditions
- Wet garbage & human excreta are two major sources available in cities
- These start getting foul in un aerobic conditions the moment they are generated. This causes nuisance.
- Hence handling of these substances is a problem for any municipal centralized system
- If wet garbage is taken care of by decomposition at plot level, handling dry garbage should be no problem for centralized system

Methane from bio-degradable

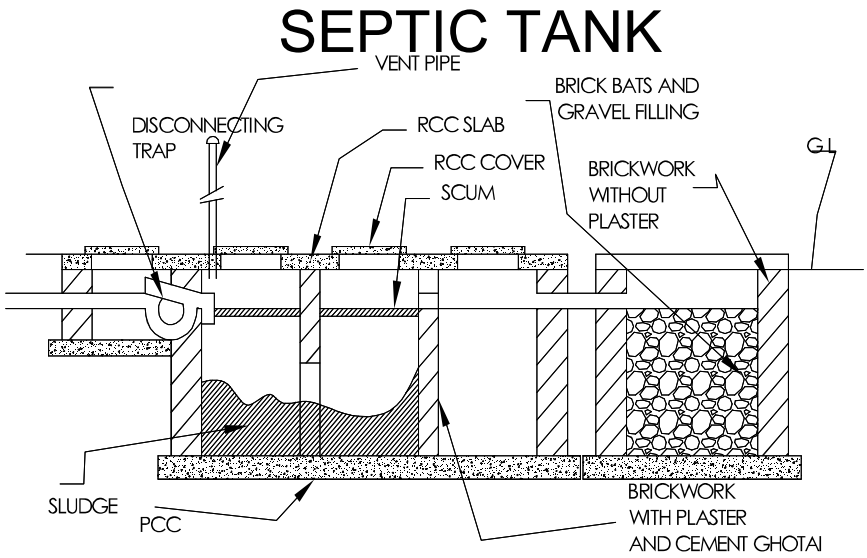
- Natural process of un-aerobic decomposition yields energy and stabilizes waste that is likely to cause nuisance.
- Available from all bio degradable that undergoes decomposition : Cow dung, any other animal excreta, human excreta, food containing sugar, starch and other types of food, fruit, leaves etc

Design considerations for biogas plant

- Dark container or digester chamber without sunlight
- Water as medium
- Adequate capacity to store sludge
- Ease of removal of stabilized sludge
- Presence of un-aerobic bacteria
- Warm conditions (around 52^{o} centigrade)
- Path for methane to escape thru scum layer
- Air tight gas holder with upward thrust on gas

Septic tank generates and wastes biogas

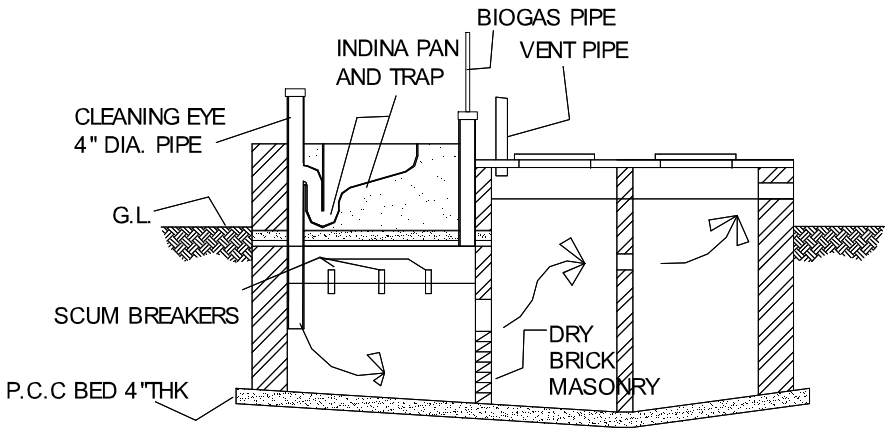
- Septic tank satisfies all above conditions except….
- It has no facility to allow biogas to escape thru scum layer
- It has no airtight chamber to store gas
- Septic tank must be modified to arrest biogas



How much biogas is available from human excreta

- It 25 persons are using toilets, 1 cubic meters of biogas will be generated daily.
- One cubic meter of biogas is equivalent to 0.43 kg of L P Gas. Hence biogas equivalent of one LPG cylinder will be available to a family of 5 in about 6 months time.
- The digested sludge is good manure
- The slurry that comes out of biogas plant contains large number of dead bodies of bacteria hence it is good manure
- Slurry should be treated with soak pit

Malaprabha toilet designed by Dr. Mapuskar works on human excreta
Advantages of converting solid waste into biogas



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- Central system of collection can not be 100% efficient collector- hence cleanliness not ensured by central system
- Load on municipal system gets reduced
- Waste gets utilized
- Energy is available
- No leaching of garbage, no flies, no stray dogs.

How much biogas from solid waste

- An average urban household is estimated to produce 200 grams of waste per capita
- One ton of wet garbage in vegetable market can produce 80 cubic meters of biogas as per Dr Mhapuskar.

- Starch, sugar etc used in households have greater capacity to generate biogas
- Use of fruits is on rise and residue of certain fruits is an excellent raw material for biogas generation

Problems of gas plant based on vegetable waste

- The waste must be ground to 3 mm size particles or smaller size to ensures speedy digestion. This will need some energy.
- The vegetable waste contains fibers that float and form a fluffy mat that can arrest flow of water and stop biogas from rising to the top.

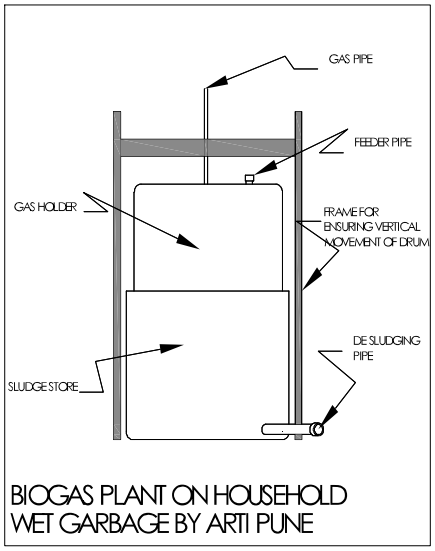
Household plant designed by Arti, Pune

- A kitchen waste based gas holder plant is available from Arti, Pune
- The waste must be ground to fine paste before adding to the gas holder plant
- Waste like atta, sugar, residue of tea, rice, cooked food particles produce good biogas
- De-sludging pipe is provided
- Rotating of drum breaks the fluff layer and allows biogas to escape

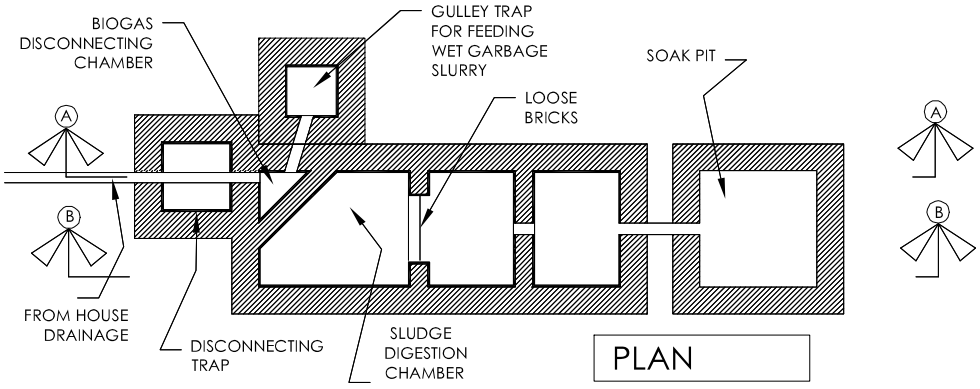
Biogas Plant of kitchen waste by Arti

Biogas calculations per person in urban areas
Biogas available from toilet @ 1000 liters per 25 persons = 40 liters
Kitchen waste available 0.2 kg per person
Biogas available if no starch or sugar is available in kitchen waste (80/1)0.2=16 liters
Minimum Biogas available 56 liters per day
=0.43x56/1000=0.024kg of LPG equivalent
Months yield=0.024x30x5 persons=3.6kg=Rs 75

Biogas Plant of kitchen waste by Arti



Design for Urban biogas plant



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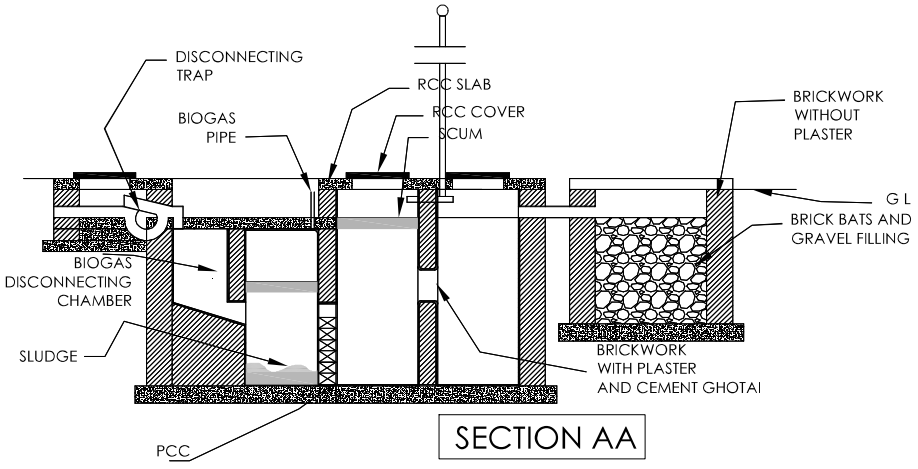

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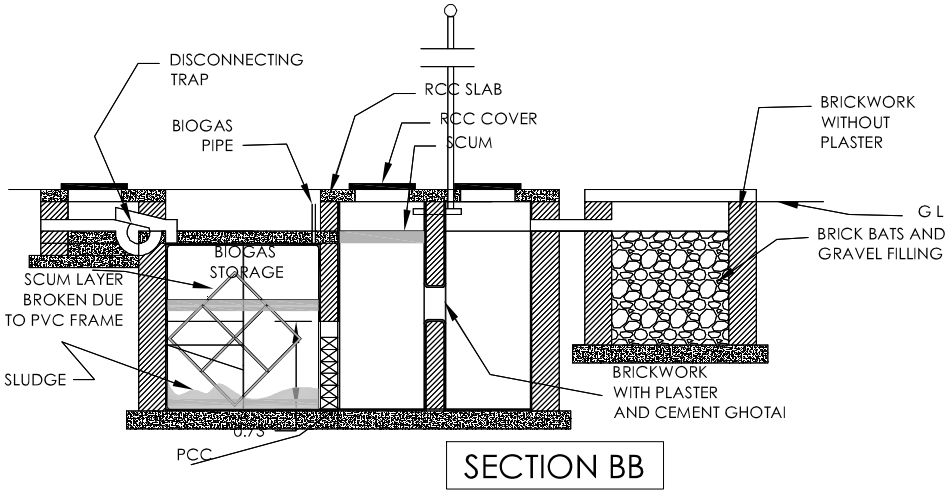

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