

# Biogas

**a shitty solution for a problem that stinks**

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Topic Workshop - 3/11/2010

# Observation Exercise

- Hanoi students break into 2 groups  
(new students to Khe Soong)
- Nominate a leader and spokesperson from each group
- Leader collects **question paper** and group moves to their observation area to answer questions
- 1 hour – return to **Nha So Ba** for sharing and comments at **9:30am**

# What is biogas?

- A gas that can be burned to give energy.
- Biogas is made by rotting or digesting manure, food scraps, mulch or anything that was once living (organic matter).
- The energy that was in the organic matter, is then stored in the biogas



# What is biogas?

- The digestion is done in water, without any air.
- Bacteria and other microbes in the water eat the organic matter, produce biogas and give nutrients back to the water.
- This is called **anaerobic digestion**.



# Anaerobic Digestion

- Needs:**
- One or more airtight containers to catch the gas and to hold water & manure
  - Bacteria to start the process – fresh cow/buffalo manure has this naturally



# Anaerobic Digestion

- Needs:
- Temperature is best between 15 and 40°C
  - Fairly neutral pH (not acid, not alkaline)





## Inputs:

- Organic matter
  - Manure, food scraps
  - Garden waste/ mulch
  - Hair, cotton, wool
  - Anything that was once living
- Minimal water





## Outputs:

- Biogas (energy)
  - heat / cooking
  - light
  - Electricity
- Liquid nutrients
- Pressure (energy)





- Fire / explosion
  - flames & sparks
  - electrical equipment



- Disease
  - hygiene, use of nutrients (root crops, low harvest)
- Breathing dangerous gases
  - good ventilation around system

# Use of products at HEPA

- Cooking with biogas in the kitchen – much cleaner and healthier
- Feeding the soil with liquid nutrients
- Generate electricity?
  - Power backup



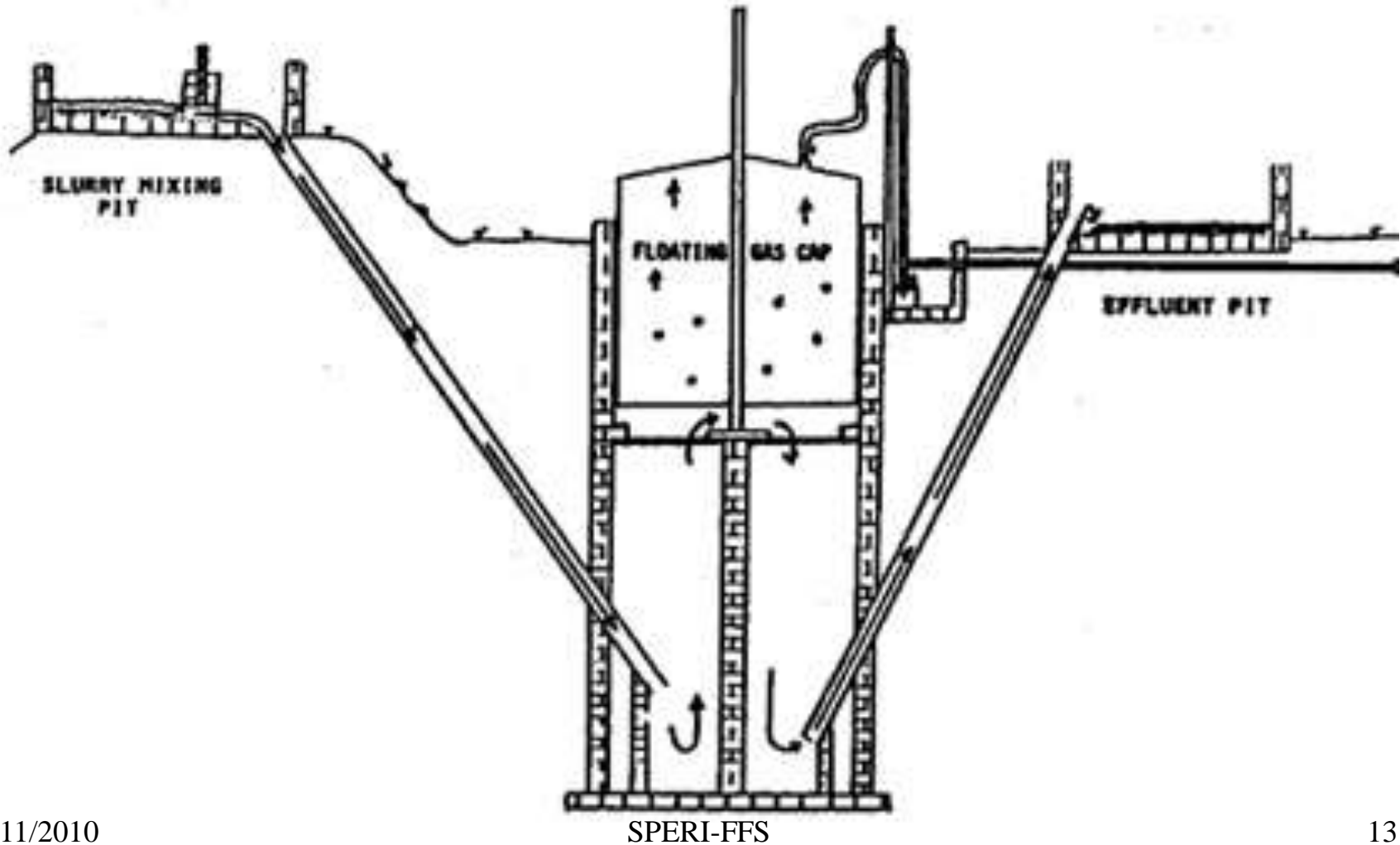
# Design examples

- The following are examples of different design ideas in many different countries
- Each idea can be built with many different materials and in various shapes; it is the function and the principles that are important to apply to our own design
- Systems thinking diagram of common design concepts in biogas examples

# Design example #1

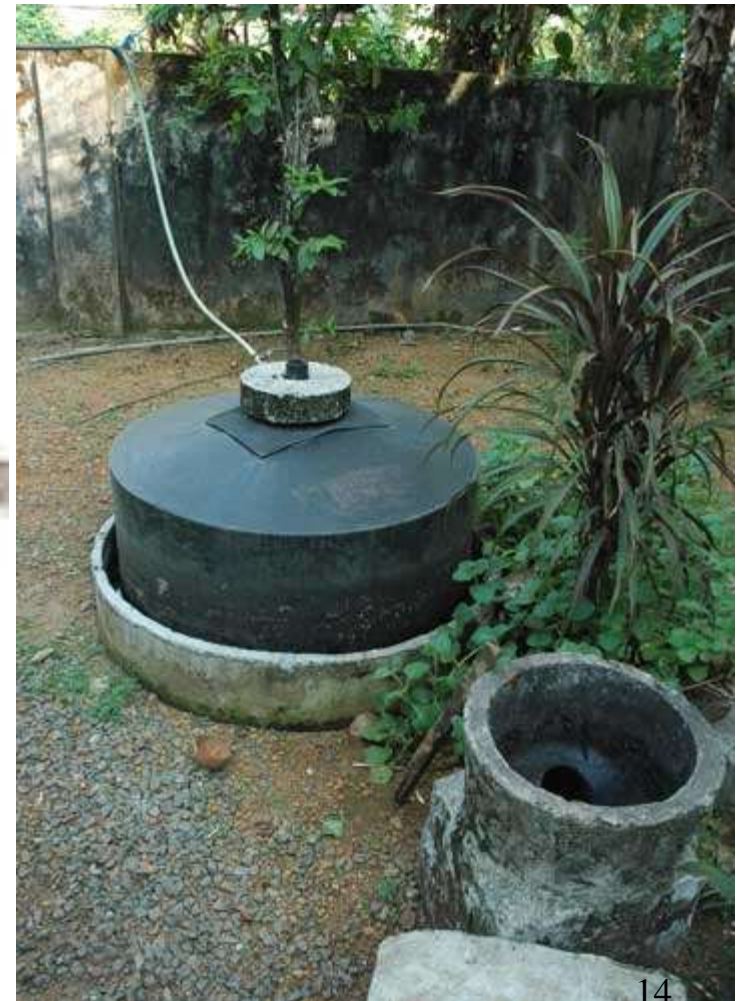
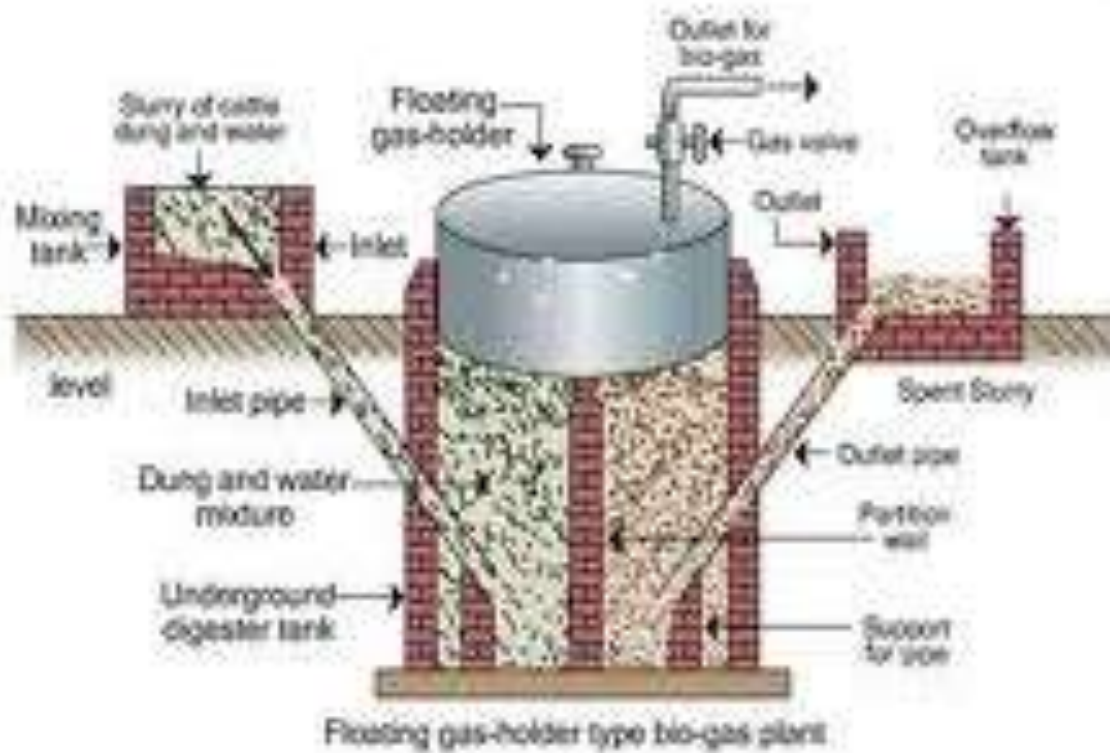
- Floating gas-holder with weight
- Digestion container has a floating gas-holder inside that rises & falls with the volume of gas inside
- Gas-holder has a weight on top to create pressure

# Design example #1





# Design example #1



## Design example #2

- Elastic, expanding gas storage bag
- Digester is attached to bag / tube for greater capacity
- Elastic gas storage creates pressure when stretched



# Design example #2



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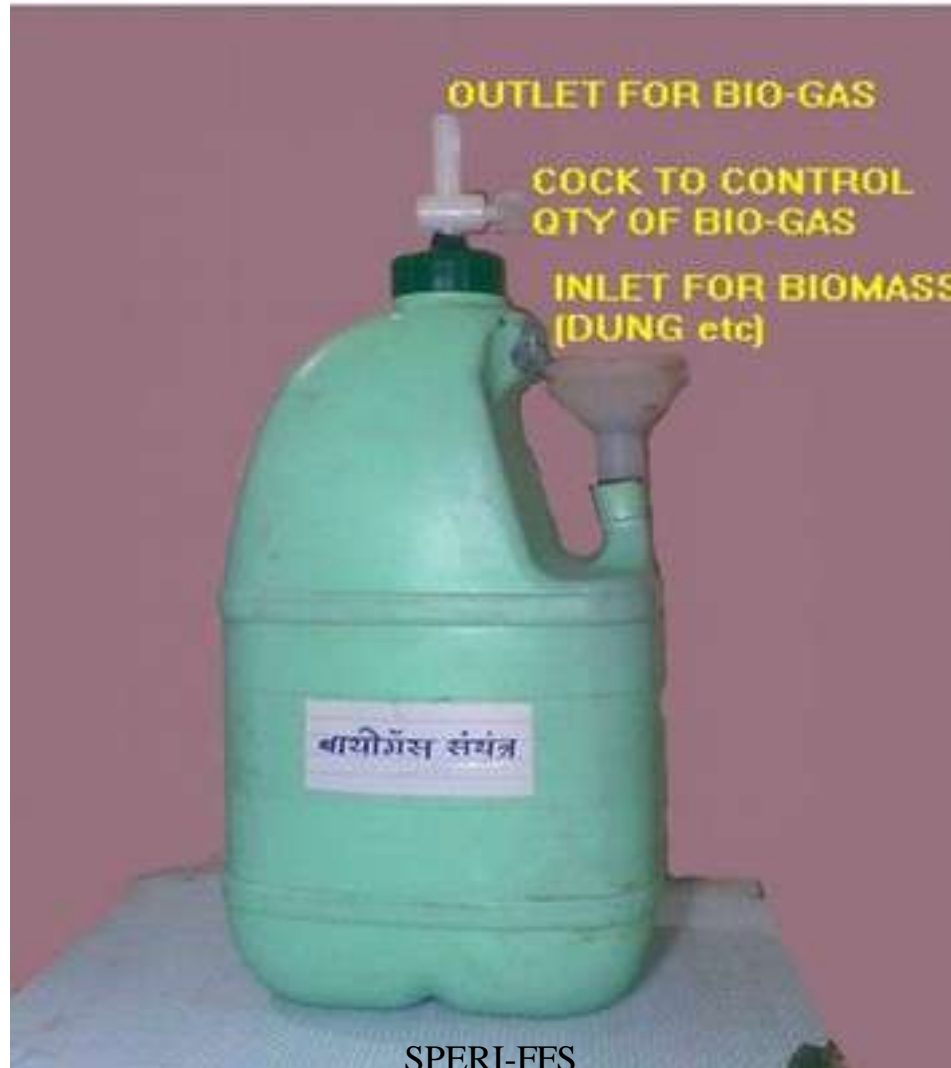


## Design example #3

- Small scale system
- Often single-batch processing only (must empty & refill) but this can be changed
- Good for being able to change the pressure with water levels



# Design example #3





## Design example #4

- Fixed volume digester – the kind we have bought!
- Gas outlet comes directly from digester, or it can have a separate solid storage
- Height of inlet/outlet water levels will change the gas pressure



# Design example #4





# Design example #4



# Design example #4



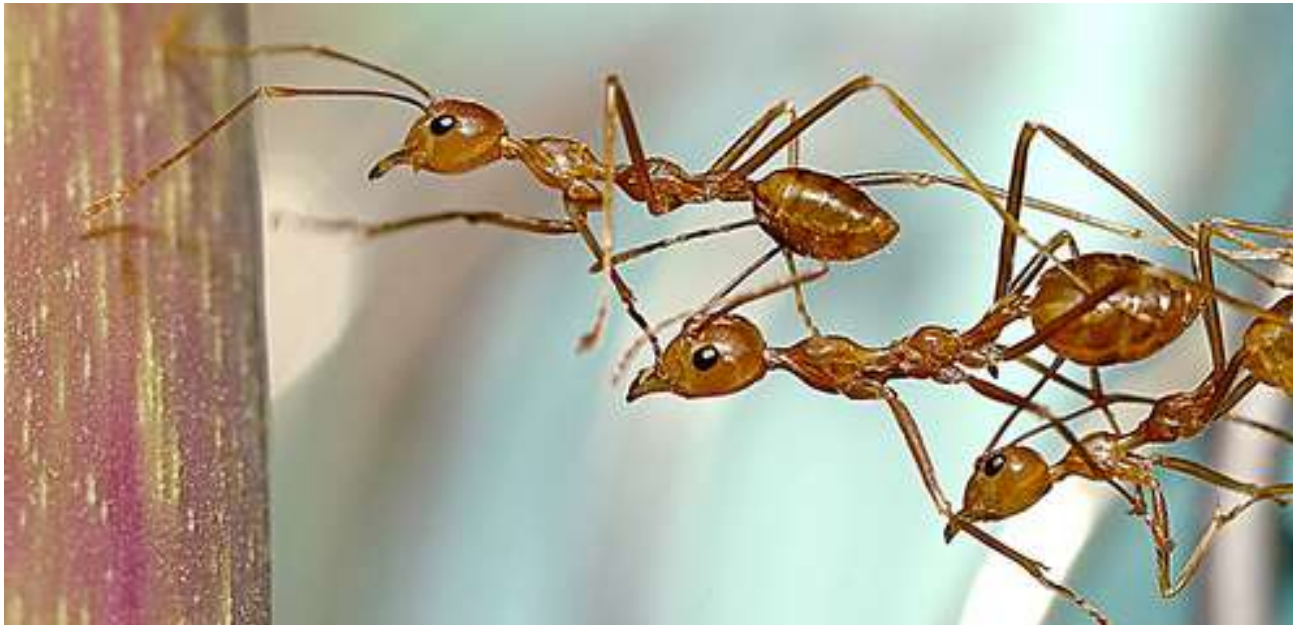
## This afternoon (chiều nay)

- In the same 2 groups as this morning, we will rotate between these jobs:
  - dig hole for biogas system & empty banana circle
  - design exercise at the pig house
- Timing – 2 sessions of 1  $\frac{3}{4}$  hours each,  
then the groups change activity
  - 1:30-3:15pm
  - 3:15-5:00pm



# Design exercise in teams

- Break into 4 groups of about 5 people [mix]
- 2 groups on exercise **A** and 2 on exercise **B**



# Always think of Design Principles

- Diversity
- Connection
- Feed the Soil
- Natural Succession
- Use the Edge
- Save Energy
- Multiple Functions
- Slow & Small Solutions
- Use Local and Biological Resources