Solar C³ITIES 3 IBC Biogas System: Simple and Effective Solution for Organic Waste

Solar C³ITIES e.V. / Solar C³ITIES Inc
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Motivation and Background

Biogas – a product of anaerobic digestion – is THE regenerative energy resource that should be considered the core of sustainable development concepts since it uses common input sources found worldwide : food and toilet wastes! Because of this, biogas technologies are not only seen as industrial and commercial solutions for health and sanitation problems in many parts of the world, but stand out as effective simple and comprehensible renewable energy and soil regeneration systems that can be built at low cost by anyone anywhere .

One of these systems is the Solar C³ITIES 3 International Bulk Container based biodigester! First developed by Dr. Thomas H. Culhane, the system has been continuously improved ever since through ideas from the small scale biogas community and is now not just applied in households and communities around the globe, but will also be implemented in refugee camps.

Dimensioning of the Biodigester

Three 1 m³ IBC tanks are the base for the reliable and cost-effective Solar C³ITIES biodigester system. Both fermenter and gas storage are included and are dimensioned to cover the daily needs of gas for a small household.

One IBC tank functions as **fermenter (1)**. The ground up and liquefied biomass is inserted into the fermenter through the **feeding pipe (2)**. Inside the tank anaerobic digestion takes place in the absence of air and light. The arising biogas, mainly consisting of methane (~60%) and carbon dioxide (~40%), leaves the fermenter through a **gas outlet pipe (3)** and flows via a simple garden hose into the gas storage (5). Another pipe **(4)** serves as outlet for the **liquefied fertilizer** (fermented biomass) that is leaving the filled fermenter with every feeding event.

The **gas storage (5)** consists of two IBC tanks and works according the floating drum principle: The upper tank, rotated by 90°, is inserted into the lower tank whose lid has been cut off and which is filled with water. The inserted IBC tank has a hole on one of its side's sidewalls close to the bottom through which it is filled with water. The gas that flows via the hose in to the top of the tank through the rotated drain valve presses out the water and causes the rise of the floating tank. It generally pressurizes the gas sufficiently for cooking by gravity, but can be assisted by the placement of a pallete, a wooden board or bricks or sandbags.

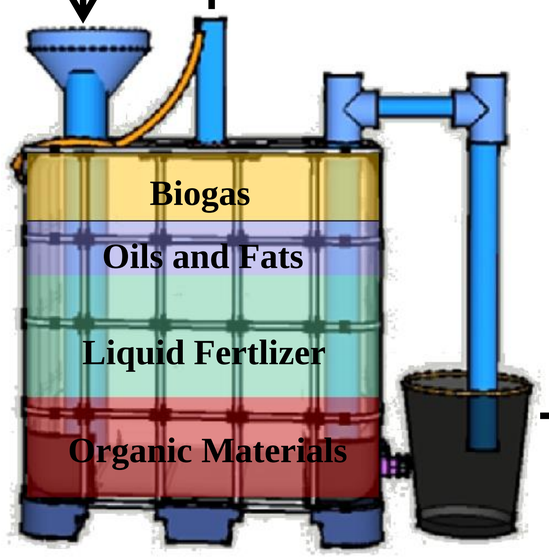
Main part list for the Build

- Three 1 m² IBC tanks
- 3 to 4 pipes for the fermenter
  - Feeding pipe with greater diameter, e.g. ~ 110 mm
  - Gas and fertilizer pipe with smaller diameter, e.g. 50 ~ 75 mm
  - AND: PVC T and 90° elbow connection for fertilizer outlet pipe
- Fittings for the pipes (e.g. threaded tank connectors or uniseals)
- Valves to coordinate and control gas flow
- Connectors between pipes and hoses
- Hose (fermenter – gas storage, gas storage – stove)

Functioning of the Biodigester

About 25 liters of ground leftovers and bio wastes mixed with warm/hot water (50:50) produces in 24 hours under idealistic conditions (relatively neutral pH-value and temperatures around 30°C) 1000 liters of biogas that can be used for cooking, heating or other appliances! With every feeding event valuable organic liquid fertilizer is released that ensures the growing and flourishing of plants!

Leftovers and Bio Wastes



Biogas Generator

Biogas Car

Biogas Stove

Organic Liquid Fertilizer

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