

Cropgen - Vienna February 2006

Reactor Design for Anaerobic Digestion of Crops and Crop Residues

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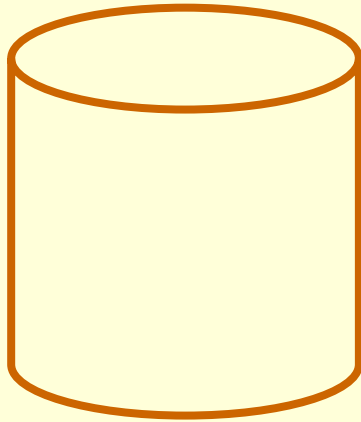
Considerations

- Feedstock - Wet or Dry?
- Budget - level of engineering required
- Project Objectives
 - waste management ?
 - energy production ?

Plant Design

- **Tank design**- shape, material
- **Mixing system**- mechanical, gas, liquid recirculation
- **Heating** - external / internal
- **Digester feeding** - pump, auger, gravity
- **Discharge** - pump, auger, gravity
- **Gas collection**
- **Biogas utilisation**

Tank Shapes



Tank Construction

Common materials of construction are:

- Reinforced Concrete;**
- Welded or Bolted Steel; and**
- Plastic, e.g. Glass Reinforced Polyester.**

Meikle Laught

Dairy Farm Digester in Scotland



Portglenone 1983

Digester on Monastery in Ireland

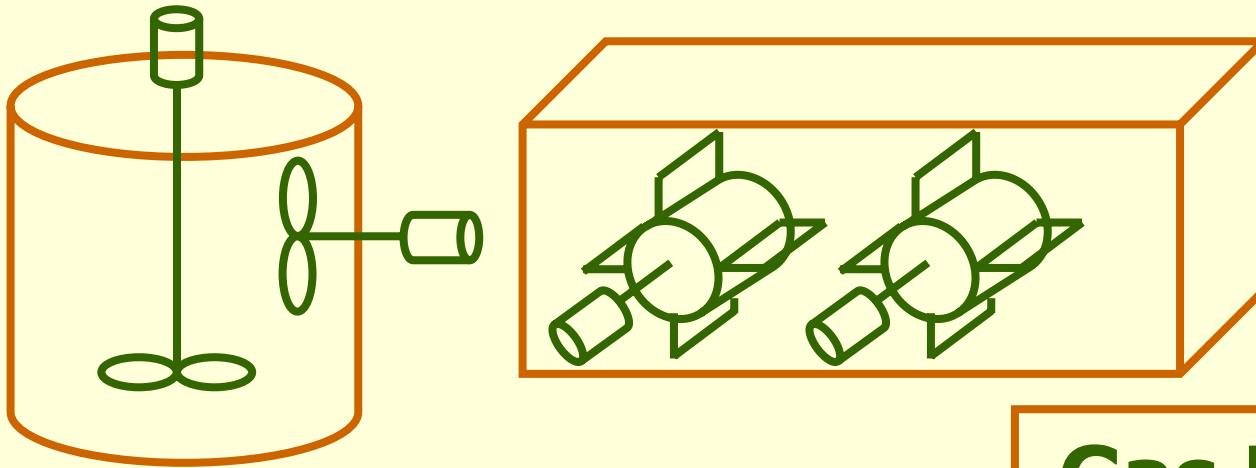


Sewage Sludge Digester in Wales



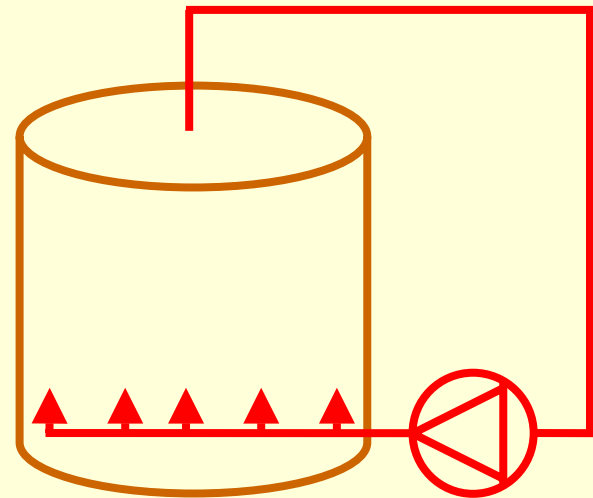
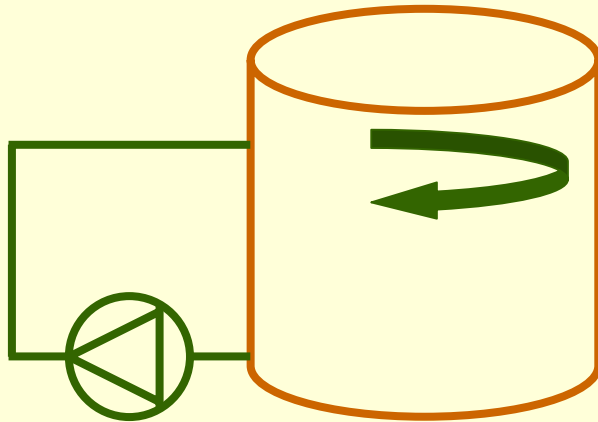
Digester Mixing

Mechanical Mixing



Gas Mixing

Liquid Circulation





Digester Heating

There are two methods of heating:

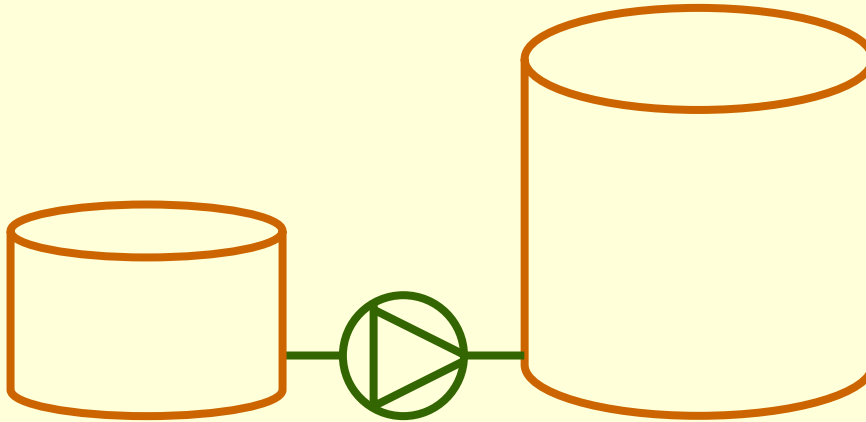
- External Heat Exchange; or**
- Internal Heat Exchange.**

External Heat Exchangers



Digester Feeding

Pump Feed

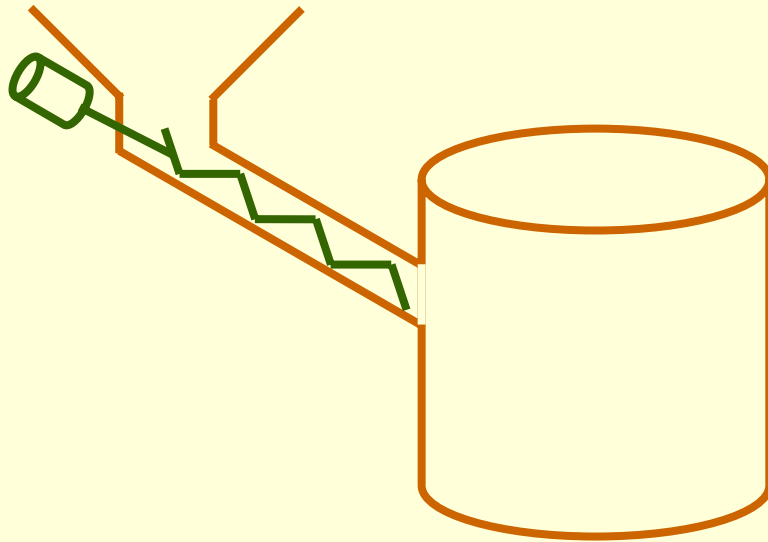


Raw feedstock is pumped from a reception tank into the digester, normally by a positive displacement pump. The pump can include a macerator to reduce particle size.

Mixing Tank



Auger Feed

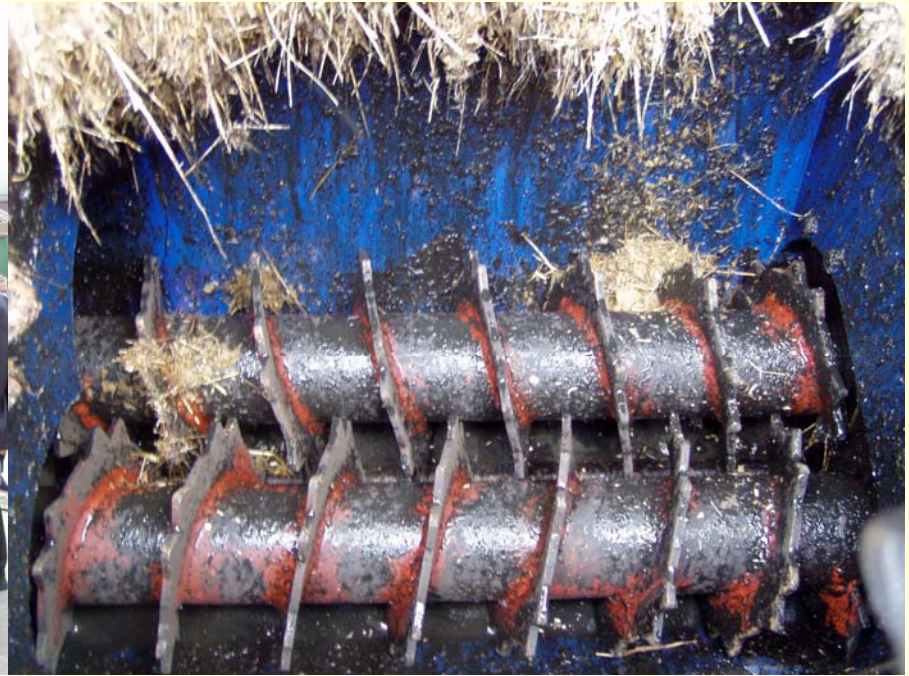


Raw feedstock is augered from a hopper into the digester, mounted either vertically or at an angle. The auger tube must include a system for preventing the release of biogas.

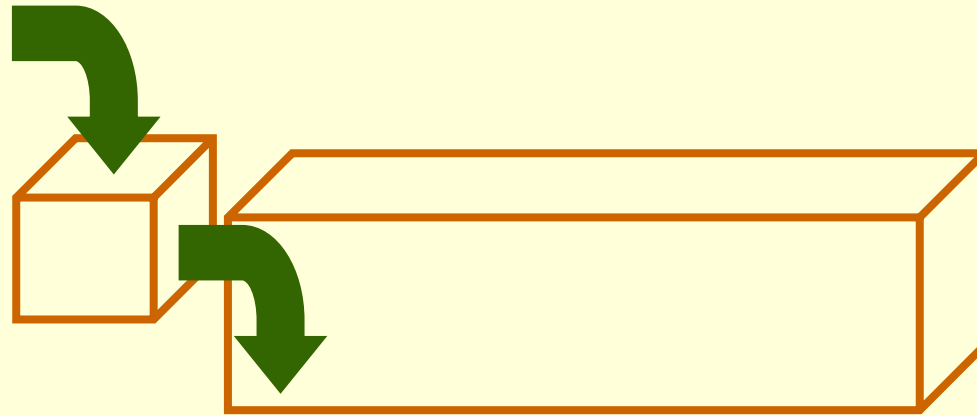
Auger Feed



Auger & Pump Feed



Gravity Feed



Raw feedstock is fed into a chamber connected to the digester, and flows by gravity until the levels are equalised. This method is normally used only for below-ground digesters.

Digester Discharge

Types of digestate discharge are:

- pump;**
- auger; or**
- gravity.**

Barrett's Mill Digester

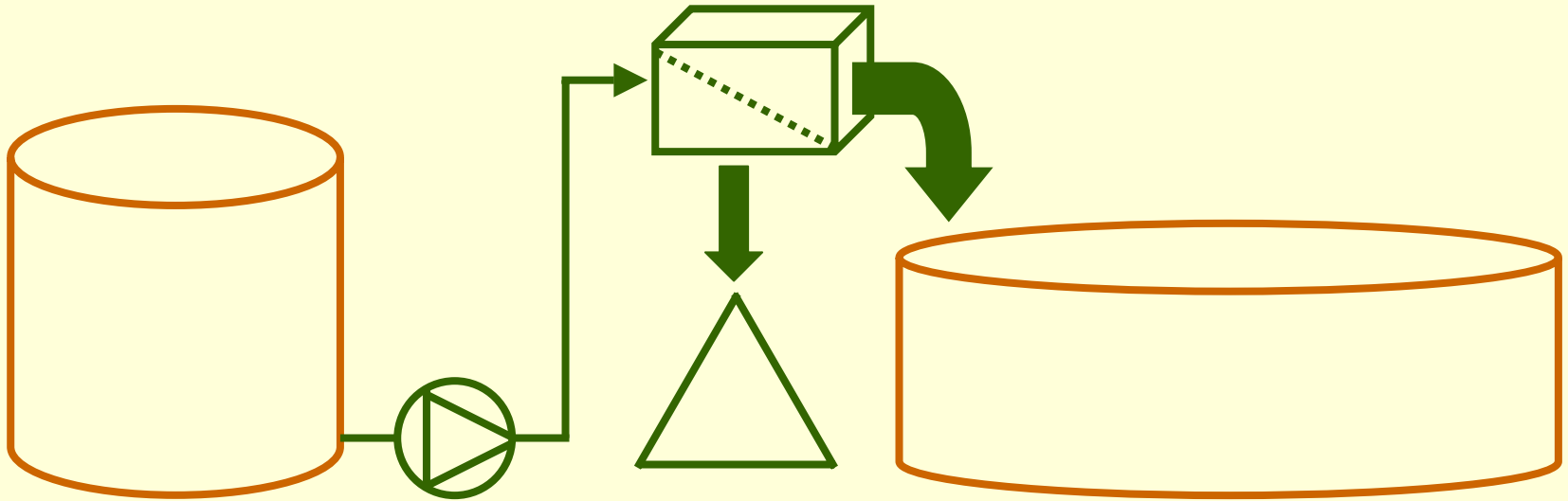


Digestate Treatment

The digestate will normally be transferred from the digester to a sealed storage tank, from which additional biogas will be collected.

For certain applications it may be useful to install a mechanical separator to divide the digestate into a fibre and a liquid.

Digestate Separation



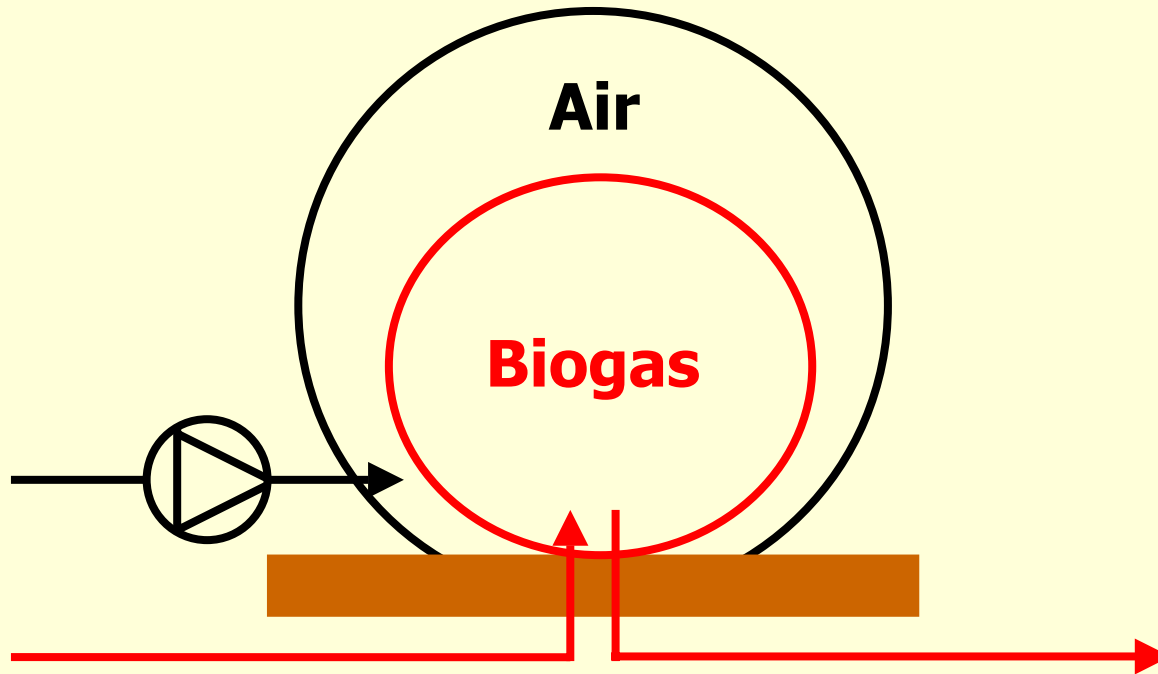
Digestate is pumped from the digester into a mechanical separator. The fibre can be used as a soil enricher and the liquid can be irrigated.

Separator



Biogas Storage

Double-Membrane Gas Holder



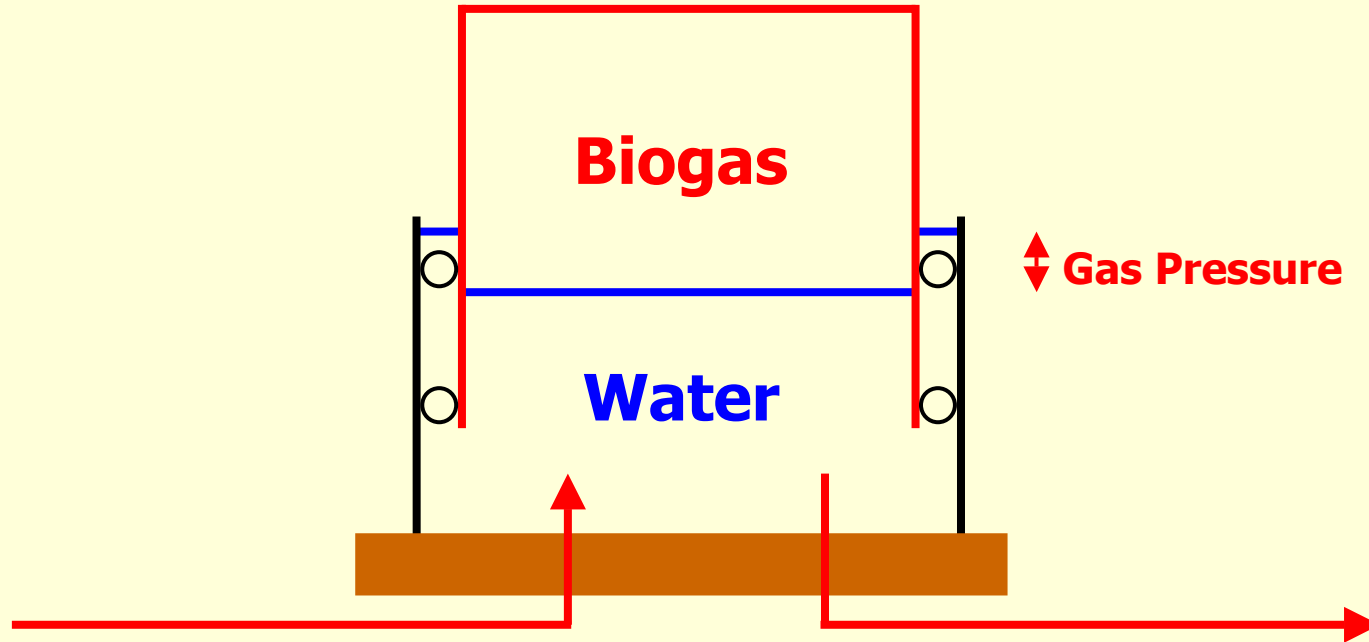
The air space between the two membranes is kept under a pressure of 100 to 200 mm water gauge by an air blower. The inner membrane expands and contracts under constant pressure to allow for variations in gas production and gas utilisation.



Energy Crop Digester in Germany



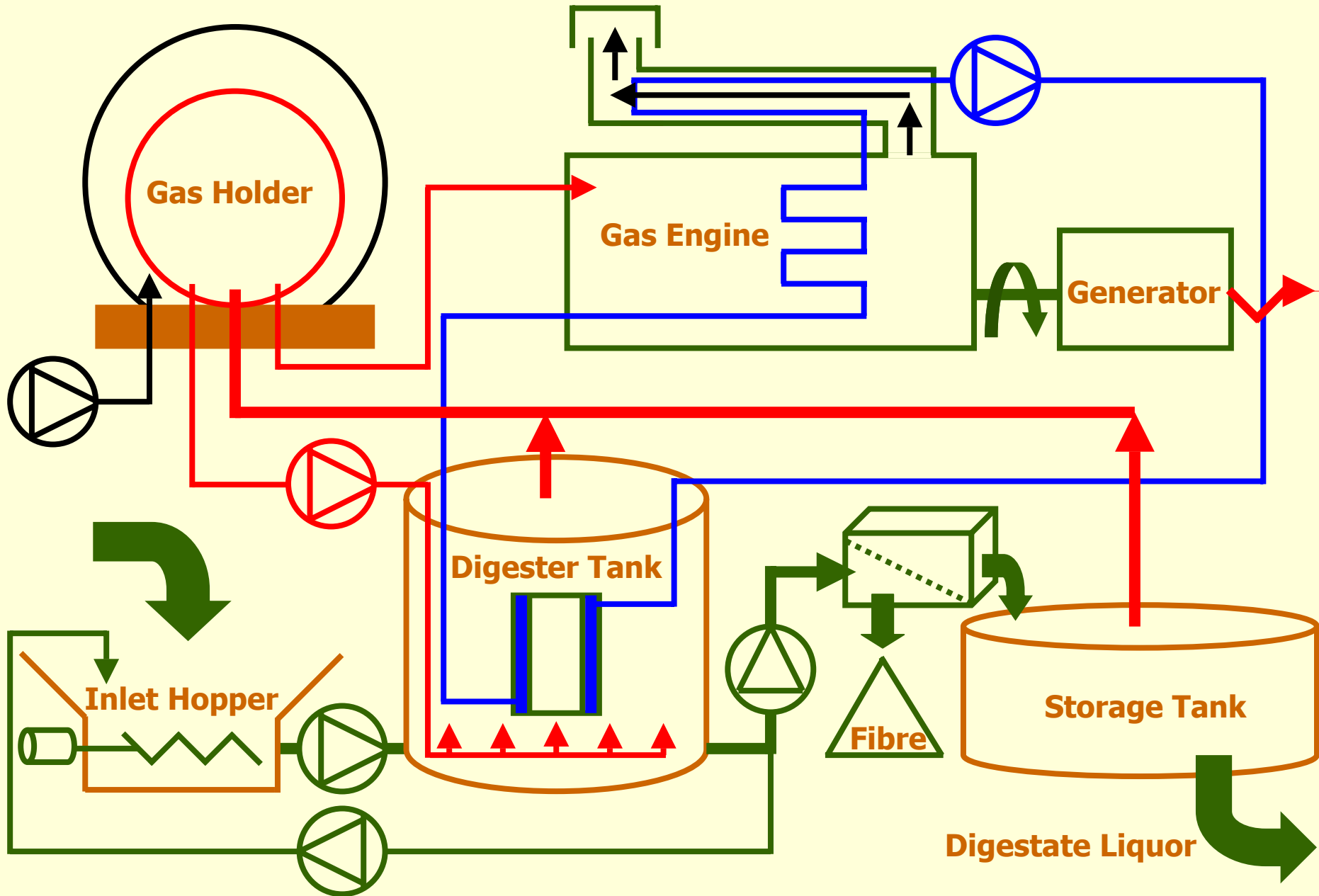
Bell-Over-Water Gas Holder



The gas bell floats on a tank of water guided by rollers. The gas pressure is determined by the weight of the bell and the internal area. Note that the water level inside the tank is lower than outside – the difference is the gas pressure (mm water gauge).



Anaerobic Digester System



Greenfinch Pilot Digesters







South Shropshire Biowaste Digester February 2006



South Shropshire
District Council

Partnership

Greenfinch

Biogas from Energy Crops & Agrowastes

