

**CETESB**  
**Energy From Biogas**  
**April 23<sup>rd</sup> – 24<sup>th</sup> 2003**

***European Experience  
on Industrial Anaerobic  
Wastewater Treatment***



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Environmental Biotechnology Limited

# Problems



# What is Anaerobic Digestion ?



- **Microbial Activity Without Air**
- **Fermentation at 35°C or 55°C**
- **Biogas Production (65% CH<sub>4</sub> + 35% CO<sub>2</sub>)**
- **Pollution Reduction (60-97% COD RE)**
- **Stabilised By-product**

# Features of Anaerobic Digestion



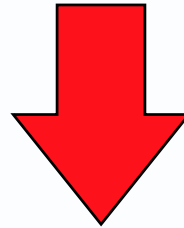
- **Sealed Reactors (no odour or fugitive emissions of CO<sub>2</sub>/CH<sub>4</sub>)**
- **Insulated in cooler climates**
- **Seeded or Inoculated**
- **Slow Start-up**
- **Continuous Feed**

# Simplified AD Process



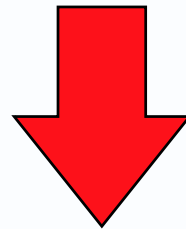
**Long Chain Organics**

Acetogens



**Volatile Fatty Acids**

Methanogens



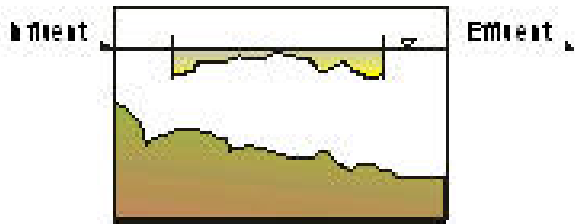
**Methane + Carbon Dioxide**

# What Wastes Can you Treat with AD?

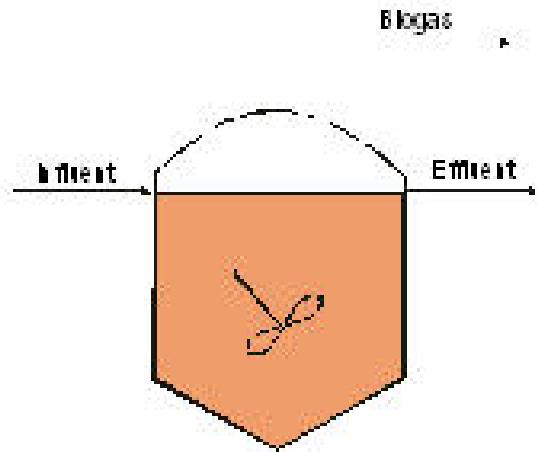


- Sewage
  - Animal Manures
  - Industrial Effluents:
  - Solid Wastes: MSW etc
- Food Industry  
Paper & Pulp Industry  
Chemical Industry  
Pharmaceutical Wastes  
Petrochemical  
Steel  
Wastewasters

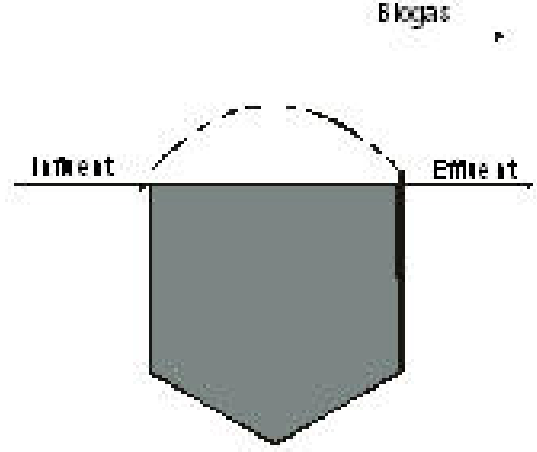
# Digester Designs



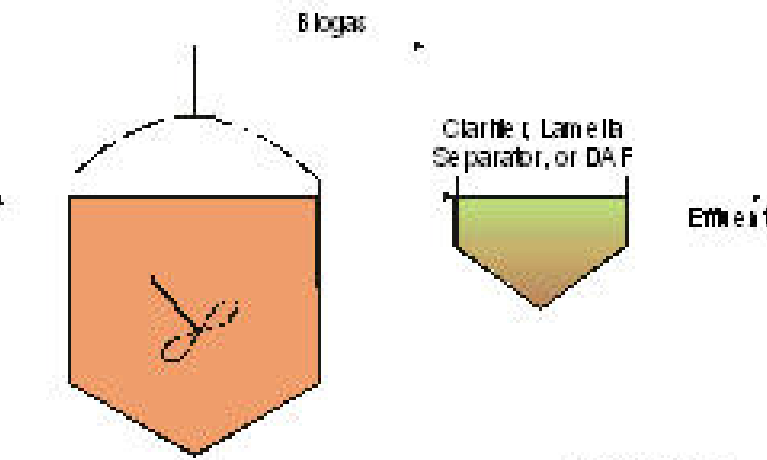
Septic Tank



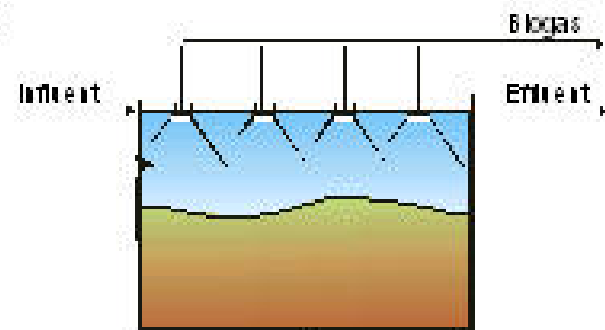
Continuously Stirred Tank Reactor (CSTR)



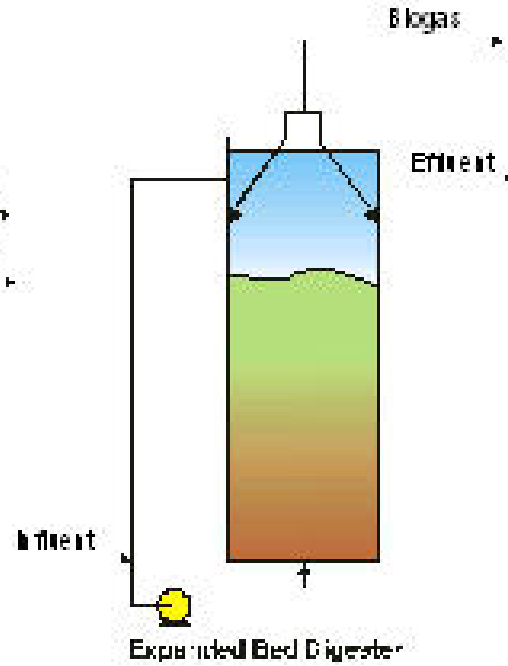
Anaerobic Filter



Contact Reactor (Anaerobic Activated Sludge)



Upflow Anaerobic Sludge Blanket (UASB)



Expanded Bed Digester

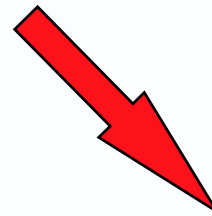
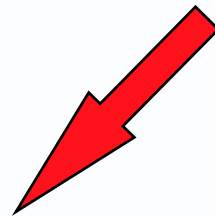
# Aerobic & Anaerobic Treatment



Aerobic

Anaerobic

Waste



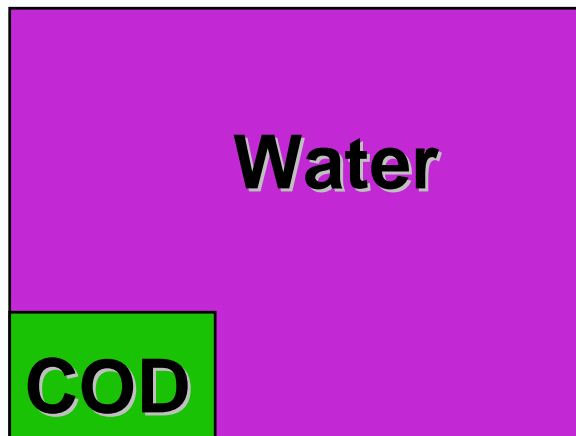
Sludge  
+  
Treated  
Effluent

Biogas  
+  
Treated  
Effluent

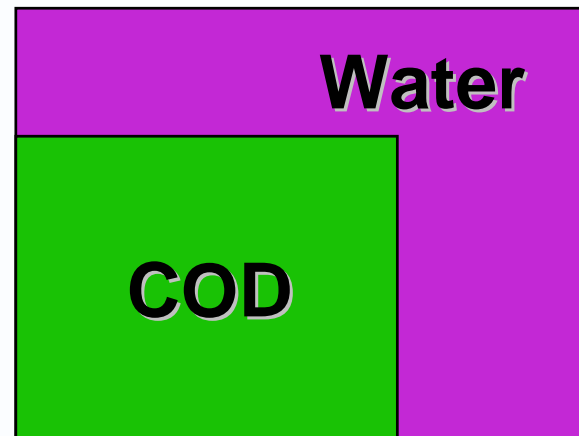




# COD Density



**Low Strength**



**High Strength**

# Flexible Liner Digestion Systems



# Flexible Liner Digestion Systems

**Digester Volume = 100,000m<sup>3</sup>**



# Upflow Anaerobic Sludge Blanket (UASB)



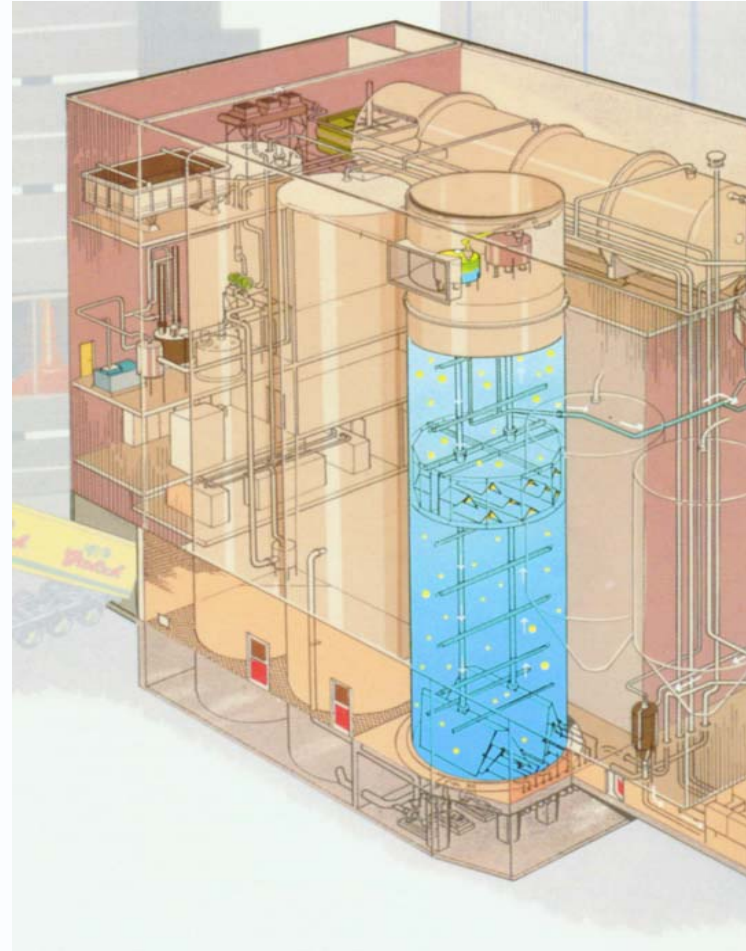
# UK Brewery

**3,300m<sup>3</sup>**

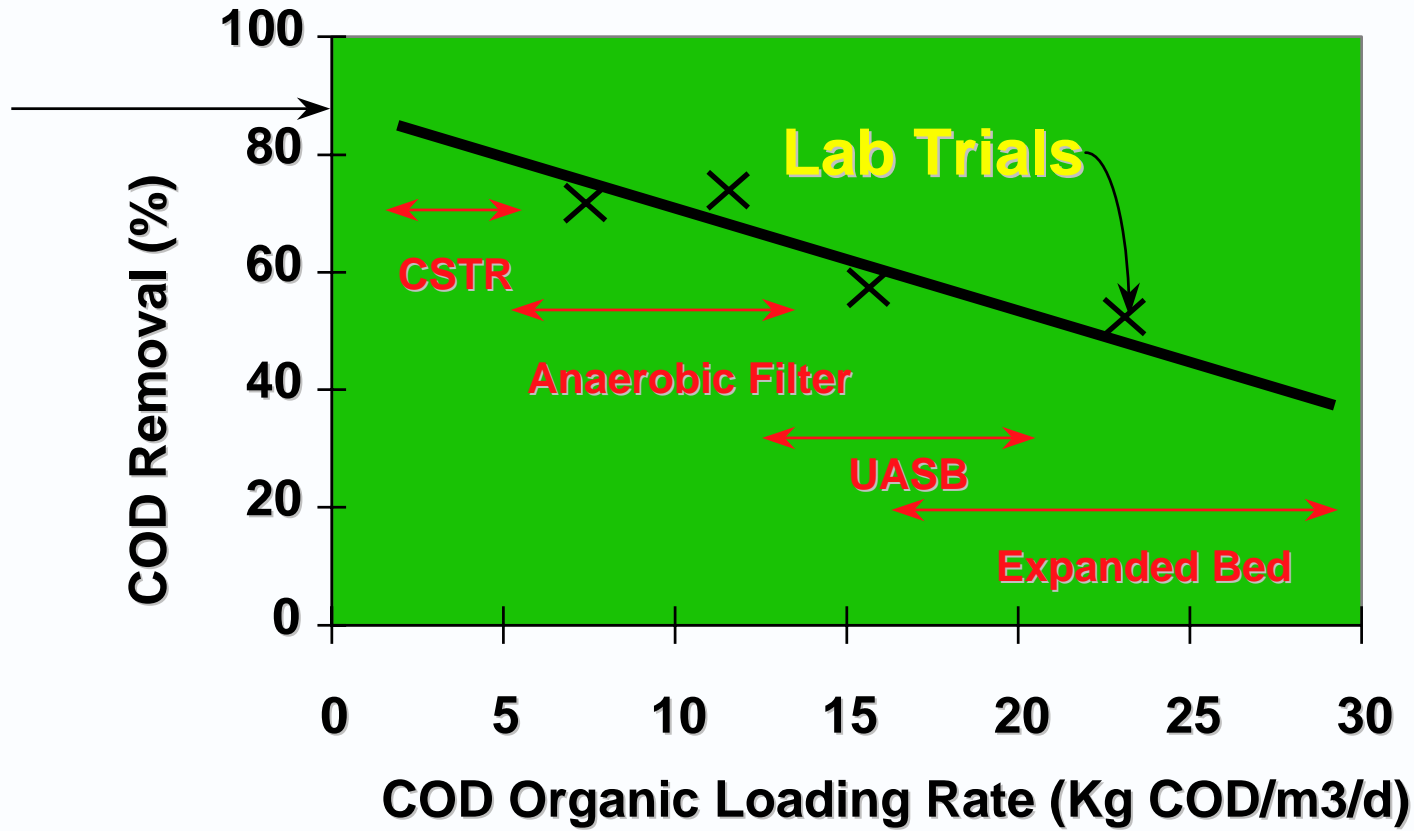


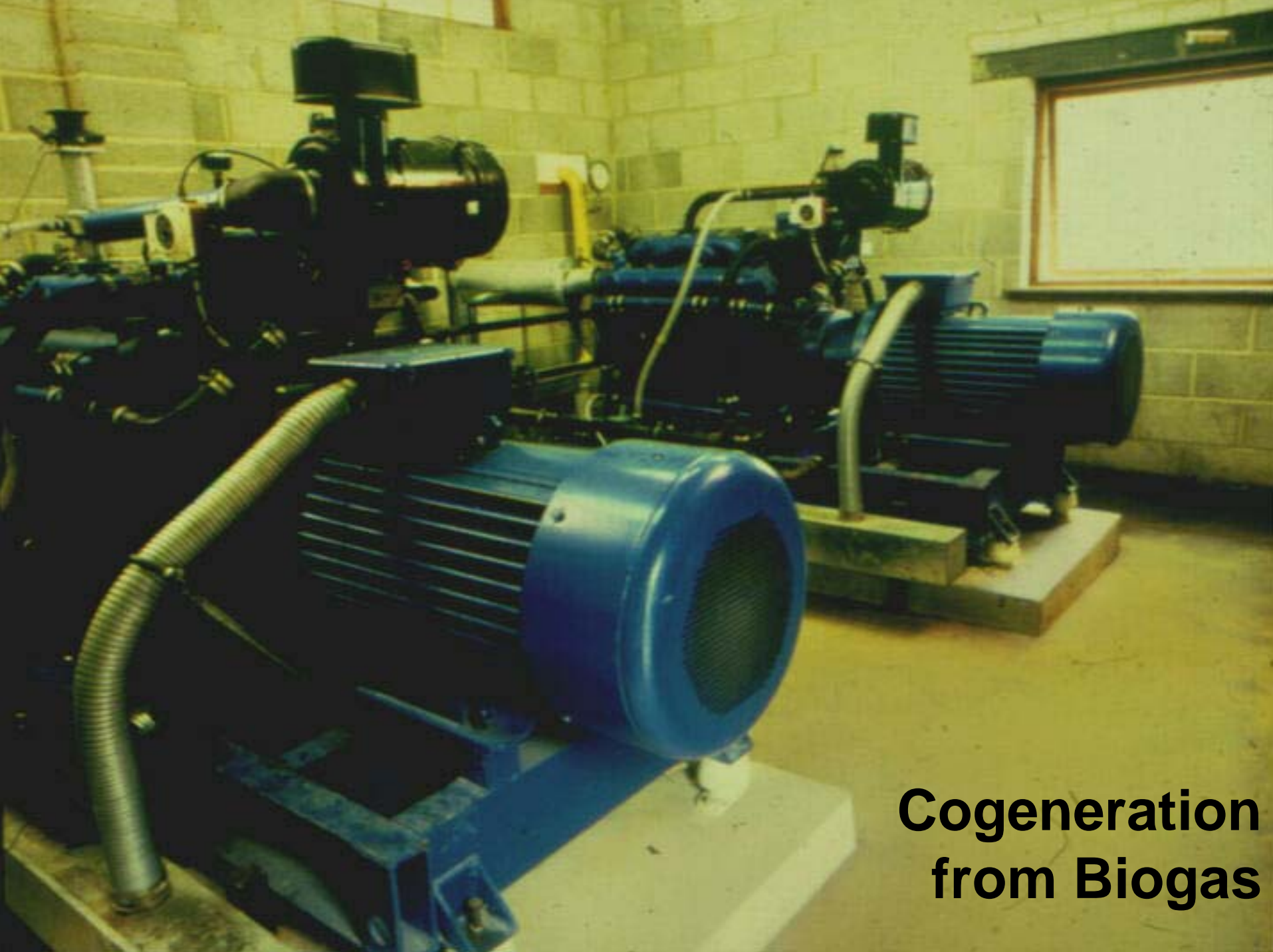


# Paques IC Reactor



# Digester Performance Curve





**Cogeneration  
from Biogas**



# European Developments



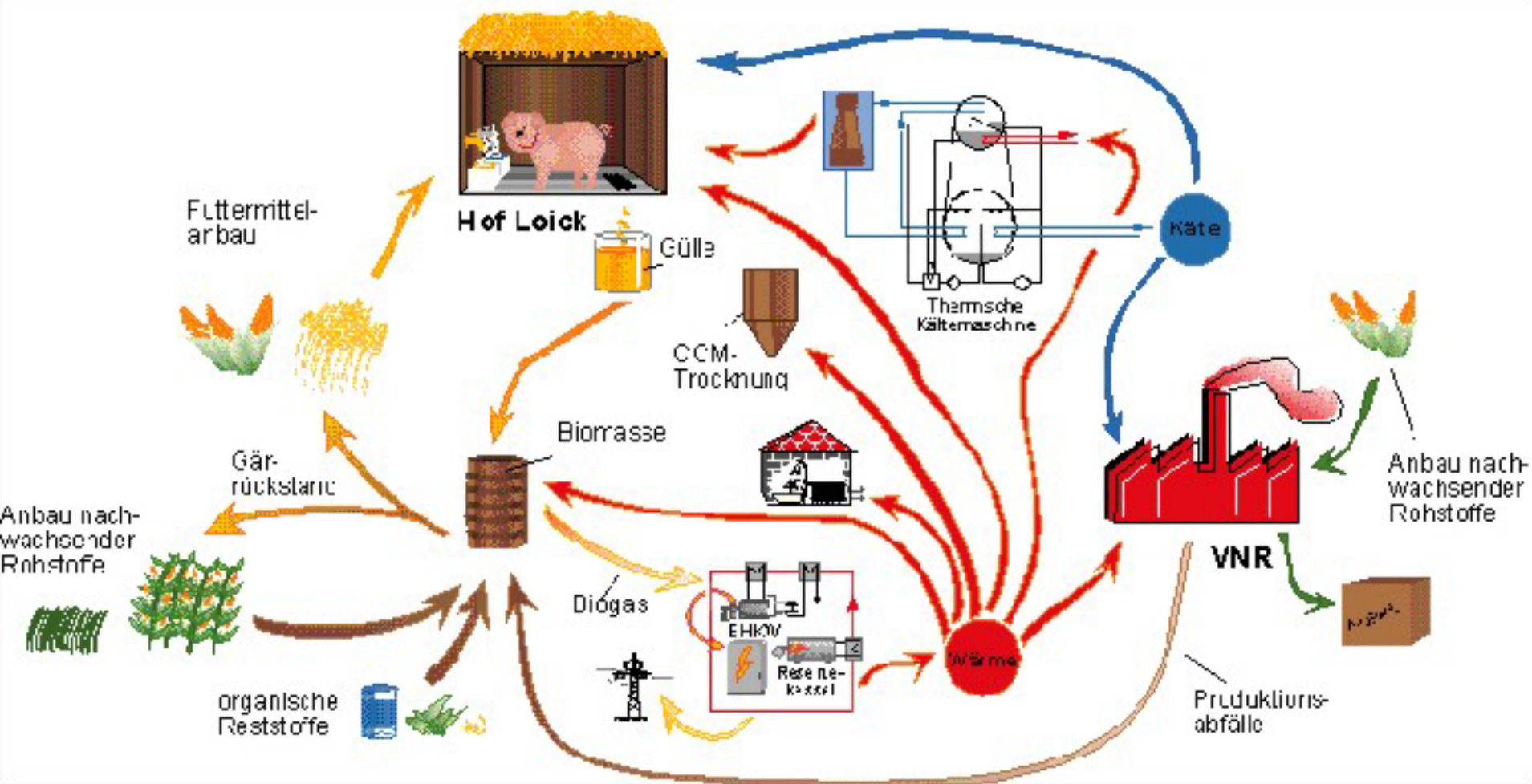
- **Incentives for Renewable Energy/AD  
(UK, Denmark, Germany)**
- **Co- Digestion**
- **Centralised Digesters**
- **Community Heating/Power etc.**
- **Integrated Effluent Treatment**



**European  
Digestion Plants**

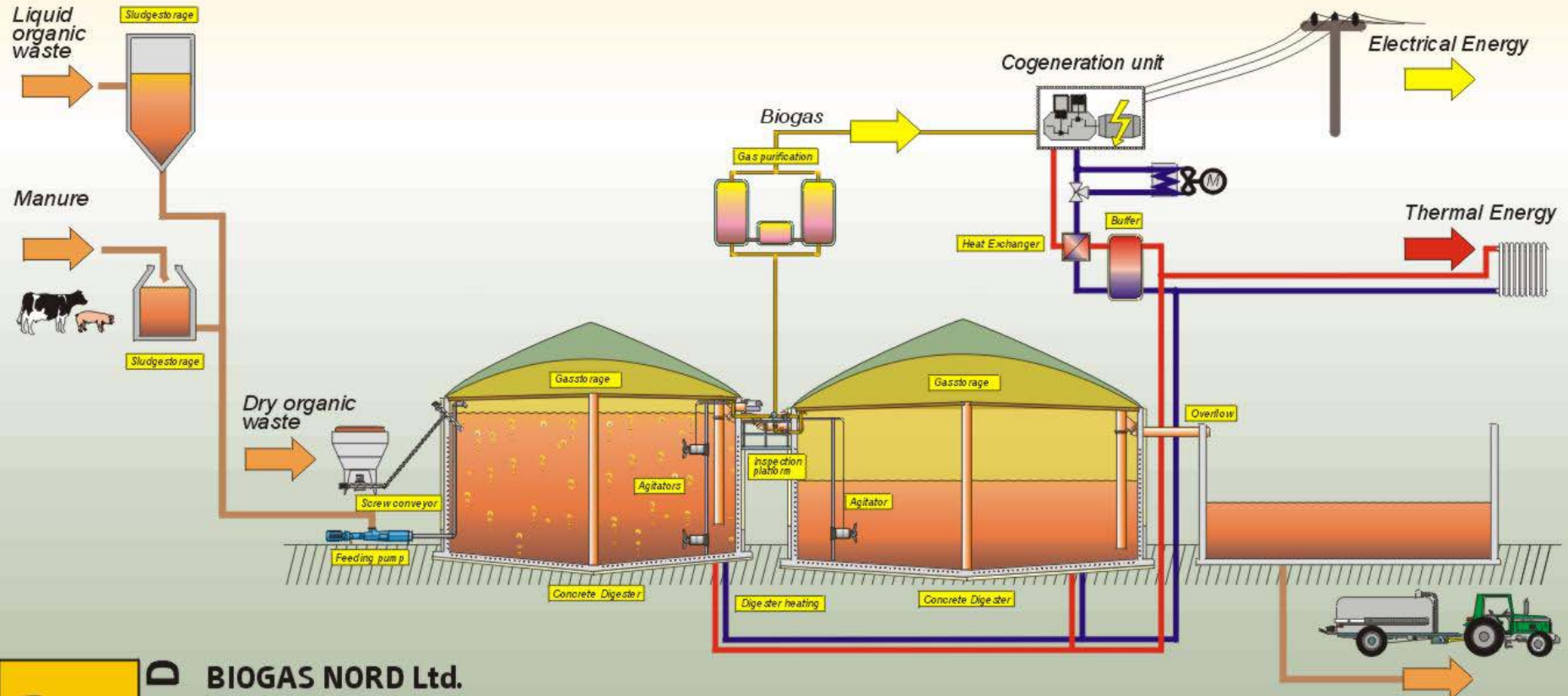
# Loick Digester







# Biogas system by Biogas Nord Ltd.



**BIOGAS NORD Ltd.**  
Kreuzstr. 12  
D-33602 Bielefeld  
Tel. 0049-521- 5215544  
Fax. 0049-521- 5215548  
info@biogas-nord.de

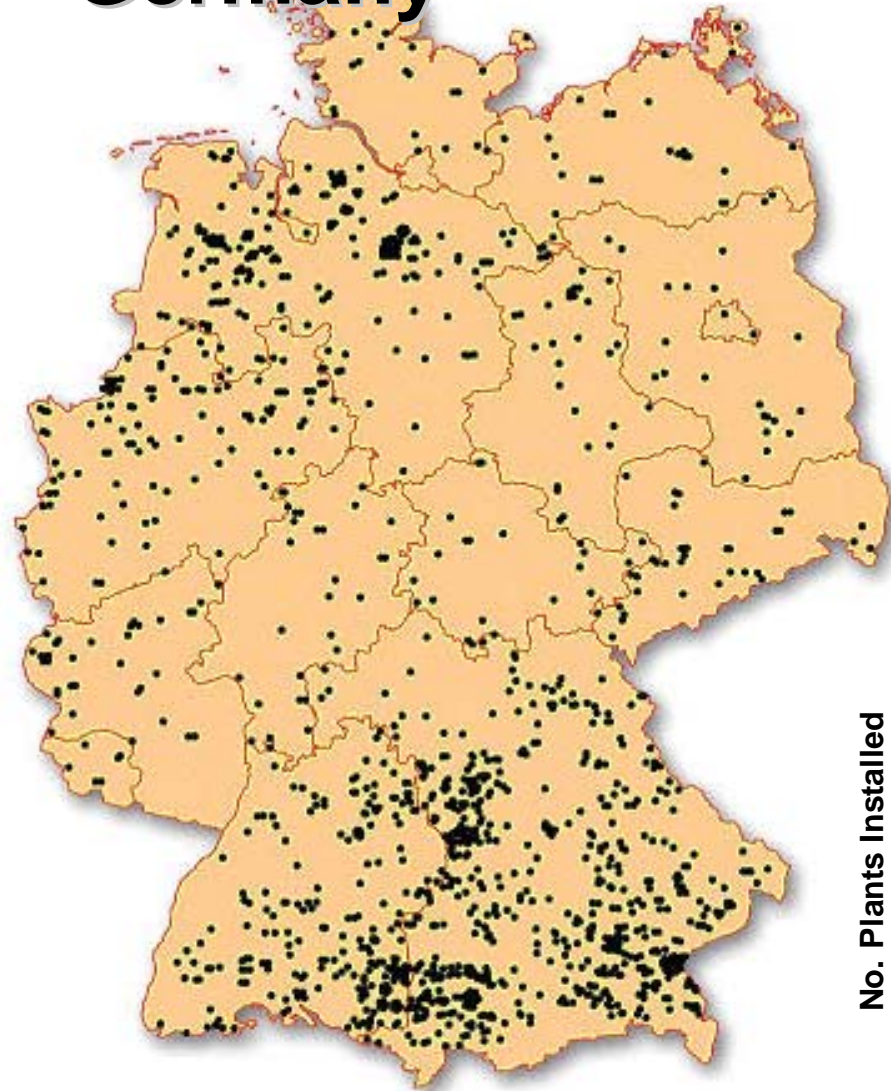
**1. Digester**

**2. Digester**

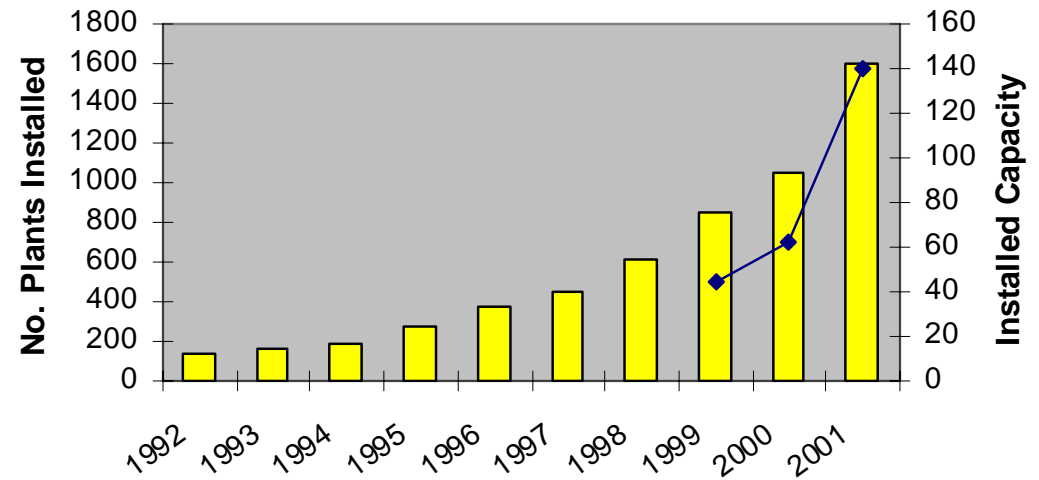
**Storage**

© BIOGAS NORD Germany

# Germany



## Biogas Development





# Centralised Digestion Plant in the UK serving 9 Farms







# Anaerobic Digestion of MSW



# Conclusions



- **Potential for Biogas Generation**
- **Mitigation of existing emissions**
- **New Systems/Approaches**
- **Incentives/Financing needed**
- **Integrated Effluent Treatment**



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**The End**