

# FACT SHEET

## Anaerobic Digestion

*Capturing green energy from putrescible wastes*

### Key Points

- Proven, financially viable technology.
- Converts putrescible organic materials into useful biogas and digestate.
- Biogas used for heat & power generation or gas-grid injection, both with sales opportunities.
- Digestate used as an organic fertiliser/soil conditioner.
- Reduces emissions of the greenhouse gas methane.
- Can generate a regular income (ca. 8 year payback) through sales, guaranteed incentives and gate fees.
- Integrates well into existing farming activities.

### What is anaerobic digestion?

Anaerobic digestion (AD) is a process which converts organic waste materials into **biogas** and **digestate**. Biogas, which primarily consists of **methane** (60%) and **carbon dioxide** (40%) is **captured** and can be used to generate heat and power. Alternatively it can be purified and injected directly into the **gas network**. Digestate can be used as an **organic fertiliser** and **soil conditioner**.

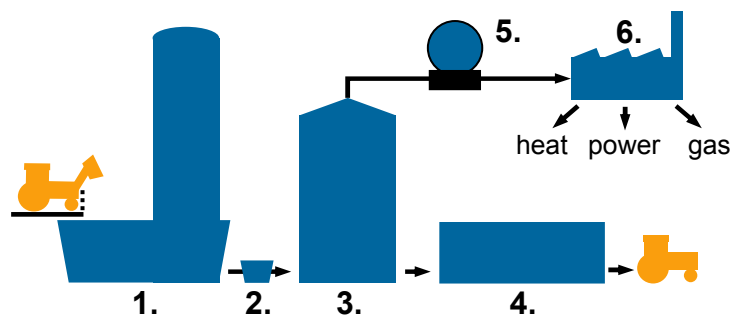
The process of AD is entirely natural and is carried out by **micro-organisms** which are already present in the waste streams. These micro-organisms thrive in an **oxygen-free environment** - consequently, the process takes place in large, **air-tight** vessels which are designed to maximise biogas generation and recovery.



*A recently commissioned anaerobic digestion facility*

### How does it differ from composting?

AD and composting both involve the microbial degradation of organic materials. However unlike AD, **composting** is carried out by oxygen-loving micro-organisms in aerated vessels or wind-rows. Under these conditions, organic waste materials are converted to carbon dioxide, heat and compost. **Useful methane is not produced** and the heat and carbon dioxide are lost to the atmosphere.



*Schematic of an AD plant*

### What's involved?

AD technology is very simple and consists of the following components:

1. A waste **reception/storage** facility
2. A **blending unit** for macerating and mixing the various waste components
3. One or more stirred **digestion tanks**
4. A **digestate storage tank**
5. **Gas buffer/collection** and clean-up apparatus
6. **Energy centre** (heat/power generation or gas-grid injection facility)

In addition, local access to the electricity and gas grids is desirable. A typical farm based system occupies **less than one hectare** - most of this space is required for vehicular movements. The AD process is usually automated and computer controlled with the plant requiring around one-hour or less of inter-vention per day.

### Reception & pre-treatment

Organic waste materials arrive at a **reception facility** - typically slurries are pumped into a storage tank whilst solid materials are delivered by trailer/dumper truck. The materials are transferred to a **macerator** which homogenises and mixes the waste materials into a uniform slurry.



*AD reception, maceration and blending facilities*

The blended wastes are automatically fed into the digester tanks. Typically, this occurs on a **semi-continuous basis** (i.e. a fixed amount is introduced once every hour). Some AD plants feature a **pasteurising** pre-treatment stage in order to comply with animal by-products regulations (**ABPR**) - for catering waste the requirement is **70°C for 1 hour** and a maximum **particle size of 60mm**.

## Digestion processes

The digestion tanks are **agitated** in order to maintain a good mix and to prevent stratification or settlement. Agitation is achieved either through **mechanical stirring** or by **recirculating biogas bubbles** through the tank. As fresh material is fed into the digestion tank, a similar volume of spent material exits the tanks as **digestate** - average residence time within the digester is around **30 days** but varies from system to system.

Within the anaerobic digestion tanks, a series of **chemical and biological processes** take place which break down the organic materials, releasing biogas in the process. The bacteria which carry this out are identical to those present in a cow's stomach.



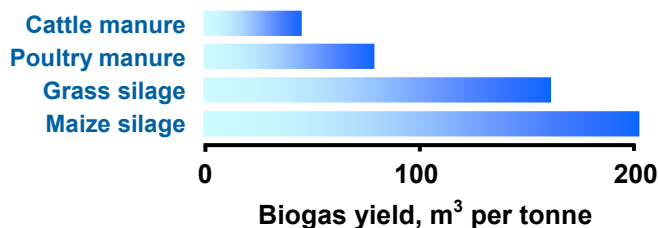
## Environmental benefits

There are many benefits to farm-scale anaerobic digestion facilities:

- **Diversion of putrescible waste** from landfill and the avoidance of harmful methane emissions;
- **The generation of clean, green heat & power** which cuts CO<sub>2</sub> emissions by offsetting fossil-fuelled energy;
- **The creation of an organic digestate** which can lead to a reduced dependence on expensive and 'carbon-intensive' agrochemicals. A new protocol for digestate quality - **PAS 110** - is now in place.

## Feedstock facts

A wide range of **putrescible materials** is suited to anaerobic digestion. However, the highest biogas yields are obtained from substances rich in undigested carbohydrates, such as maize silage. **Woody materials are not suited to AD**. Animal slurry has a relatively low biogas yield but is an excellent source of **living bacteria**.



## Finances

Capital expenditure can vary enormously but a medium scale plant with a **300 kW CHP** unit (20,000 tpa slurry from 700 dairy cows) will cost in the region of **£1.2M**. Return on investment is estimated at around **8 years or less**.

In recent years the UK Government has introduced two new **incentive schemes** aimed at encouraging the uptake of AD - **Feed in Tariffs (FITs)** and the **Renewable Heat Incentive (RHI)**. It is anticipated that the growth in AD will now mirror that seen in Germany where almost 600 MWe is currently installed (approximately 50x more than in the UK).

### Further Information

Please contact either:

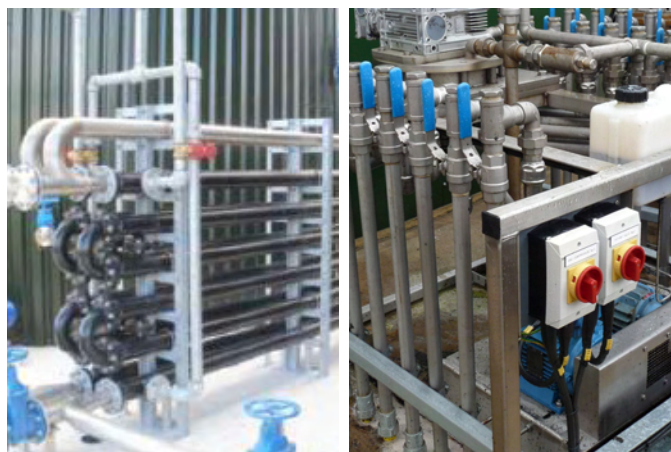


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**Heat exchanger and biogas recirculation for agitation**

To maximise biogas yield and to increase the rate at which gas is formed, the AD tanks are **insulated** and **warmed** (typically 35°C - 50°C). This is achieved using heat from on-site **biogas combustion** which avoids the need for expensive grid-sourced energy.

## Biogas collection and use

Biogas collects in the headspace at the top of the AD tanks and is passed under its own pressure to a buffer/storage tank, before being cleaned prior to final use. Traditionally, this has meant combustion in a **gas engine** to generate power, or combustion within a **boiler** to create hot water. However, there is a growing emergence of **combined heat and power (CHP) plants**. These maximise efficiency by simultaneously generating process-heat which can be used for heating the AD tanks or for space heating, and power which can be used locally or sold via the national grid. They may also qualify for **tax relief** through the ECA scheme.



**A farm-scale AD plant near Cirencester**

*We can assist you at all stages of your AD project: feasibility study, feedstock analysis, project finance, technology selection, design & engineering, site layout, safety, planning & permitting, implementation & operation.*