Fuel and Energy

Renewable Fuels and Energy Factsheet

Anaerobic Digestion

The Anaerobic Digestion (AD) industry has grown from a nascent energy sector to an established industry in the UK over the past ten years. There are now over 316 AD plants in the UK, outside the water industry. NNFCC have produced this factsheet to help you understand the AD sector; the technology, policy, feedstocks, and economics. We collate data on AD projects to produce a comprehensive market report on 'AD Deployment in the UK' (nnfcc.co.uk) and run the official AD Information Portal (biogas-info.co.uk). We also offer business support and sustainability analysis, through AD Business Support Package and our Biogas & Biomethane Carbon Calculator.

AD is the process where plant and animal material (biomass) is converted into useful products by micro-organisms in the absence of air. This biomass can be unwanted 'wastes', such as slurry or leftover food, or crops grown specifically for feeding the digester. The outputs from the digestion process are;

- **Biogas**: A mixture of 60% methane, 40% carbon dioxide and traces of other 'contaminant' gases. This biogas is combusted to generate heat, power or both via CHP. Alternatively, biogas is upgraded to biomethane that can be injected into the gas grid or made into a transport fuel.
- **Digestate**: The left over substance is nutrient rich and is used as a bio-fertiliser. This product can be separated into 'liquor' and fibre for application to land or secondary processing for higher value.

AD Benefits & Drivers

- **Farmers and entrepreneurs:** Offers returns from otherwise low-value waste materials, as well as legislative and agronomic benefits.
- **Food processing industry:** Offers an environmentally sensitive waste treatment option and avoids increasing landfill fees.
- **Local community:** Provides a local energy supply, creates employment opportunities and reduces farm odour levels.
- **Environment:** Reduces volumes of waste going to landfill and greenhouse gas emissions, as well as providing an organic fertiliser.
- **Government:** Helps local and national government meet policy objectives and legislative targets.

AD benefits from a number of UK policies aimed at a range of environmental initiatives. The **policies** that have directly incentivised growth of the AD industry are;

- Renewables Obligation (RO), support for large-scale (>50kWe capacity) renewable electricity projects (closing 31st March 2017)
- Feed-in Tariffs (FiTs), support for small scale renewable electricity generators (<5MW capacity)
- Renewable Heat Incentive (RHI) for heat and biomethane

Support is typically secured for 20 years; however tariffs are subject to regular degression so support rates are in decline to new applicants.

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Technical Data

Although the process of AD is relatively simple there are several system options available depending on feedstock type, output requirements, space and infrastructure. System options are as follows (the most common for the UK shown in bold);

- **Mesophilic** (25–45°C) or thermophilic (50–60°C)
- **Wet** (5–15% dry matter) or dry systems (over 15% dry matter)
- **Continuous** or batch flow
- **Single, double** or multiple digesters
- **Vertical tank** or horizontal plug flow

Economics

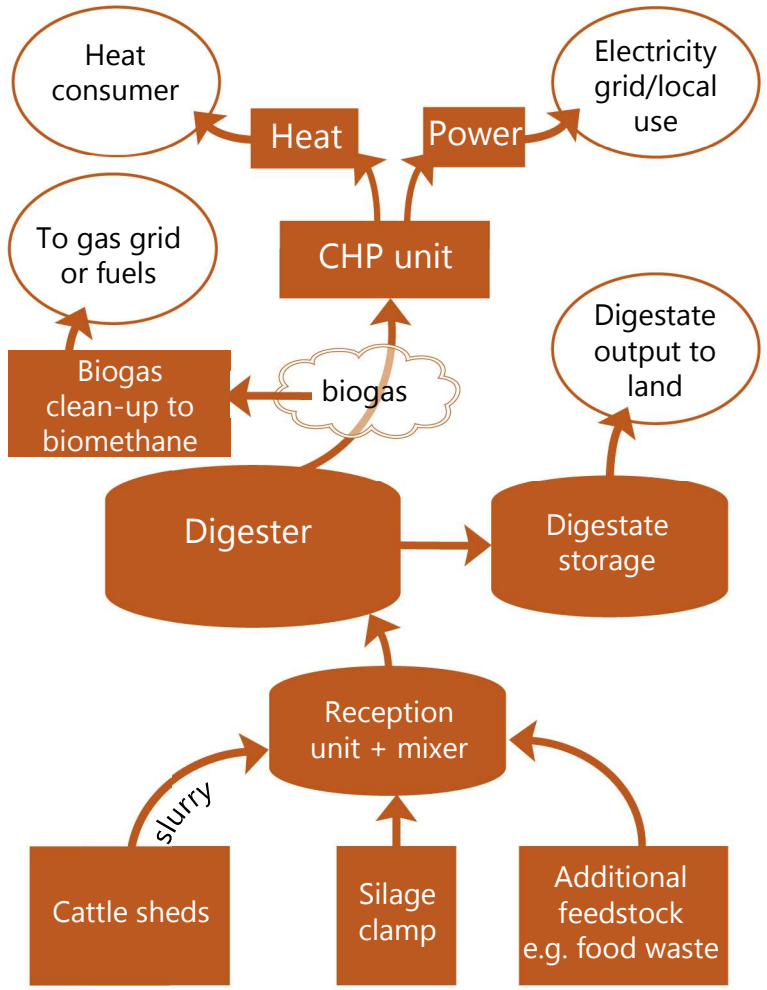
Economics of AD depends on feedstock mix, scale and technology. High capital costs are often quoted, but generally these assume no infrastructure already exists. If, for example, a site already has good access and good slurry storage & handling facilities the costs can be significantly lower. Given the right mix of feedstock, scale and technology, payback can be achieved in 7-10 years.

Sustainability Criteria

The RO, RHI (and likely FIT in the future) require biomass fuelled renewable energy, including non-waste AD, to meet sustainability criteria. Bioenergy supply chains must demonstrate:

- A minimum **greenhouse gas (GHG) saving** of 60% against an EU fossil comparator.
- Compliance with a range of '**land criteria**', restricting biomass sourced from land with high biodiversity or carbon stock value eg. primary forest, peatland or wetland.

A Simplified AD Process Diagram Example



Renewable energy incentive rates for AD (May 2016)

Renewable Heat Incentive (p/kWh)		*Feed-in Tariff (p/kWe)*	
Small biogas <200 kWth	6.94	AD <250kWe	8.21
Med biogas 200kWth-600kWth	5.45	AD 250kWe - 500kWe	7.58
Large biogas 600kWth	2.04	AD >500kWe	7.81
Biomethane first 40,000 MWh	5.35	***Renewable Obligation Certificates***	
- next 40,000 MWh	3.14	1 MWe produced by AD =	1.8 ROCs
- remaining 40,000 MWh	2.42	2015-16 average ROC price	£42.52

Summary

- Plant economics depends on scale and feedstock mix. Income will come via various streams, each requiring careful management to maximise returns.
- Although energy generation is the main driver for AD systems in the UK, the waste handling potential is also of significant interest to the food processing and retail sectors.
- Economies of scale and collaboration are important in AD; working with local 'waste' suppliers and heat / power users can improve the economics significantly.
- In light of the declining tariffs, optimising AD performance to maximise gas yields is crucial; feedstock mix and equipment configuration can be adapted accordingly.

Useful Links

Access to the **AD Deployment report** and **Biogas & Biomethane Carbon Calculator** can be found on the NNFCC website at **www.nnfcc.co.uk**.

Further information on all aspects of AD, including a map of current digesters and a list of technology suppliers, can be found on The Official Information Portal on Anaerobic Digestion **www.biogas-info.co.uk.**

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