RENEWABLES FACT SHEET
ANAEROBIC DIGESTION

JHWalter
SUSTAINABLE RESOURCE MANAGEMENT

What is Anaerobic Digestion?

Anaerobic digestion (AD) is the controlled break down of organic matter without air to produce a combustible biogas and nutrient rich organic by-product. AD systems can be located either on-farm or at a larger Centralised Anaerobic Digestion facilities (CAD plant).

How does it work?

Normally a combination of feedstocks are fed into a Digester where oxygen is excluded and bacteria breakdown the feedstock producing methane (CH_4) and carbon dioxide (CO^2). The digestion process can take place at low or high temperatures or a mixture of the two. The biogas is dried and vented into a gas engine connected to a generator to generate electricity. Heat can be taken off the engine to give combined heat and power. In addition to gas, digestate is produced which can be used as a fertiliser. It is also possible to utilise the gas as a fuel for vehicles.

Where will it work?

Ideally AD plants should be located close to the source of the feedstock, particularly when a waste product. In rural situations this is frequently possible and there is generally plenty of space to locate the plant, store the feedstock and deal with the digestate produced.

The type of feedstock used will dictate the output from the plant. Cattle and pig slurry do not have very high biogas yields and will need to be supplemented with energy crops, particularly maize. Farm manures, surplus/waste vegetables and energy crops may be seen as more straightforward systems than plants taking abattoir waste, sewage etc.

The other essential factor is an adequate grid connection. Whilst it is generally possible to establish such a connection, upgrading the grid can be extremely expensive and impact on the economics of the project. It is important to establish grid issues at an early stage.

What Feedstocks can be used?

At the Farm Level, animal manures and slurries along with energy crops such as whole-crop silage, maize or grass leys and vegetable/fruit waste. In addition to this food and catering waste (schools & commercial), food by-products; crop residues, biodegradable domestic waste and sewage can be used in the AD process. Note that the dry matter of individual feedstocks has a significant affect on the ultimate methane yield.

Feedstock	Dry Matter%	Methane Yield (m3/t FM) *Approx*	Energy Value (kWh/t FM)
Cattle Slurry	11	12	47
Pig slurry	5	12	47
Pig Slurry	9	20	75
Poultry	12	28	108
Vegetable waste	13	35	135
Maize silage	33	105	405
Grass silage	35	110	425

Centralised Anaerobic Digestion (CAD)

In order to improve economics. larger scale units are preferable and thus additional feedstocks beyond the individual farm can be considered. These may be other farm generated feedstocks or alternatively commercial and domestic wastes. The attraction of sourcing other organic wastes is that the biogas yields can be considerably greater than farm slurry. However long term security of supply for these feedstocks must be addressed.

Regulations

The scale and nature of the feedstocks dictate the extent of regulatory requirements. The following table provides a general summary.

	Veg Waste/ Energy Crops etc.	Animal Slurries	Food Waste	Animal Waste abattoirs etc.	Domestic Waste
Planning	√	√	√	√	√
Environmental Permit/Exemption	√	√	√	√	√
Animal By-Products Order			√	√	√
PAS110 (Digestate regulations)	√	√	√	√	√

√ = If Digestate Sold

Income

The principal income from AD will be from the production of electricity and the sale of Feed-in Tariffs or Renewable Obligation Certificates (FITs/ROCs). To achieve full economic benefit, a use should be sought for the heat which may also be used for cooling. Other Fact Sheets in this series deal with FITs and ROCs in more detail. For AD plants up to 499kW, the FIT is £115/MWh generated. For plants of 500kW and above the FIT is £90/MWh. AD is eligible for "Double ROCs" and these are currently trading at around £40-£50/ROC.

Example Outputs

	Feedstock 1	Feedstock 2	MWh Per Annum	FITs £'000/year	Power "Sold" £'000/year	Pay Back NO Grant
499kW	Slurry 10,000	Silage 6,800	3,900	449	195	7/8 Yrs
499kW	Pig Slurry 7000t	Silage 8,500t	3,900	449	195	7/8 Yrs
1000kW	Vegetables 20,000t	Silage 12,000t	7,800	702	390	6/7Yrs

The sale price of power assumes 25% utilisation on site. The payback calculation apportions no value to heat and the value of the digestate applied as fertiliser but these have value and will shorten the payback period. Likewise no account has been taken of enhanced capital allowances which too will significantly accelerate the payback period.

Capital Costs

Capital costs vary significantly depending on scale, technology and individual infrastructure costs. It is therefore difficult to provide guidelines in this fact sheet. However a guideline figure of £2,500 to £3,500 per kW installed may be useful. Clear specification, utilisation of existing structures and competitive tendering will help reduce capital costs. Currently there are signs of reducing capital costs due partly to exchange rate but also in real terms.

Funding and Grants

Grants have been and may still be available through the Rural Development Programme for England (RDPE). However clarification on eligibility for grant and FITs has still to be confirmed by DECC and DEFRA. High capital costs can be a barrier to some, but there are individuals and groups seeking to invest in Renewable projects, and in some cases private equity may be more attractive than bank funding.

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