

The Norfolk Farmer's Guide to Biomethane

April 2012



Anaerobic digestion of farm wastes produces biogas which can be upgraded to biomethane and used as a valuable renewable resource for fuelling Norfolk and the rest of the UK. This is a guide to the options and benefits for farmers producing biomethane.

Background to Biomethane

Anaerobic digestion is the breakdown of organic matter by bacteria to produce biogas and digestate. Biogas is a mixture of methane, carbon dioxide and other components such as hydrogen sulphide and nitrogen. Biogas can be cleaned up to remove everything except the methane; this is biomethane.



Natural gas in the UK gas grid contains around 90 per cent methane so biomethane provides a readily available renewable replacement for fossil fuel in the grid. In addition, biomethane can be used as a vehicle fuel, significantly reducing carbon emissions from the transport sector.

Benefits

Biomethane can provide an additional income stream, reduce the environmental impact of some farming practices and provide an economical use for agricultural wastes. Biomethane production generates local and regional jobs that will benefit the rural economy in the long term. Furthermore, the digestate produced as a by-product of the anaerobic digestion process makes a good replacement for chemical

fertilisers and may even enhance productivity by blending in trace elements.

Challenges

There are challenges which must be addressed when building an AD plant. These can include traffic issues, planning and noise and odor emissions. More information on these can be found in the further guidance document.

Organic Waste in Norfolk

Farms in Norfolk produce over 1.9 million tonnes of agricultural waste every year and 99 per cent of this is organic. Common types of organic waste in Norfolk are:

- Manure
- Slurry
- Unbaled straw
- Vegetable waste
- Crop residues



Different organic wastes produce different amounts of biogas when processed in an anaerobic digester. Typical biogas yields for organic waste feedstocks are shown in table 1. A number of different feedstocks may be mixed in the same anaerobic digester. For example, slurry can be mixed with break crops to increase biogas yield.

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Organic Waste Feedstock	Biogas Yield	
	m ³ biogas/tonne of waste	kWh/tonne of waste
Cattle Slurry	15-25	90 - 150
Pig Slurry	15-25	90 - 150
Poultry Manure	30-100	180 - 600
Maize Silage	180-220	1080-1320
Grass Silage	160-200	960-1200
Maize grain	500	3000
Whole crop wheat	185	1110

Table 1: Typical biogas yields for organic wastes

The Biomethane Injection to Grid Option

The UK has an extensive natural gas infrastructure and biomethane can be used to replace the natural gas in the pipelines. In order to meet the gas quality specifications in the grid, the biogas must undergo several changes:

- Clean-up** to remove unwanted components such as hydrogen sulphide.
- Upgrade** by removing the carbon dioxide and adding a small amount of propane so the energy content of the gas is the same as the gas already in the grid.
- Odourisation** to give the biomethane a recognisable 'gas' smell for safety reasons.



Incentives

The main financial benefit of injecting biomethane into the gas grid is that it is eligible for the Renewable Heat Incentive (RHI) tariff. This is worth 7.1p per kWh on top of the normal gas export rate.

First steps

There are some preliminary checks that should be undertaken to see if a biomethane injection project is viable.

1. Gas grid check

Is the farm near to a gas pipeline, and is there capacity in the pipeline to accept the biomethane produced?

2. Biomethane flow rate

The minimum amount of biomethane needed to make a grid injection project feasible is around 200m³ per hour.

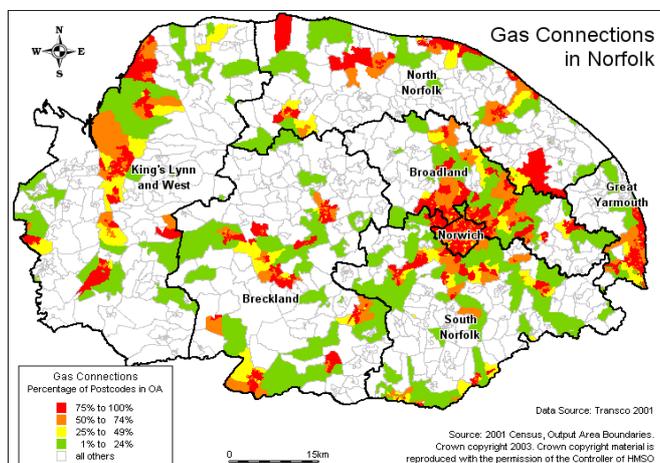


If one farm produces too little biogas or is not located near to a grid connection point, there is the option of forming a cooperative. This would involve biogas being collected from a number of smaller farms in Norfolk and transported to a central grid entry facility near a connection point by pipeline, or the feedstock from each farmer being taken to a central anaerobic digester which is located near a gas line.

In Norfolk, the gas grid tends to be clustered in more populated areas; so many farms are likely to be some distance from a connection point. Therefore the cooperative approach could present a better option for Norfolk farmers.

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Costs

Anaerobic Digester

Typical costs for an anaerobic digester producing around 250m³ per hour of biogas are approximately £2 million.

Electricity Generation (500kWh CHP)

Additional Capital costs £0.5 to £0.7 million
Additional Operational costs.... £50,000
Annual income£0.75 million

Biomethane to Grid

Additional Capital costs £1.7 - £2 million
Additional Operational costs.... £200,000
Annual income£1.1 million

Biomethane for Vehicle

Additional Capital costs £0.5 million
Additional Operational costs ... £60,000
Annual Income£0.4 million

Biomethane as a Vehicle Fuel

The use of biomethane as vehicle fuel could be a valid solution for an innovative Eco-friendly Public transport sector and has numerous benefits in terms of economics, local air pollutants, greenhouse gases and safety.

A gas-fuelled vehicle can reduce carbon monoxide emissions by 97 per cent, hydrocarbons by 81 per cent, nitrous oxides (NO_x) by 86 per cent and particulate matter by 94 per cent. It can also be beneficial if the producer is not near the gas grid so injection is not

possible, as biomethane can be used directly in vehicles.

A container-based biogas to compressed biomethane unit can be installed which cleans the biogas as described before and pressurises it to around 250 Bar for storage. This gas can be used to refuel vehicles through a conventional compressed natural gas (CNG) refuelling system.

There are a number of vehicles coming to market which are suitable for compressed biomethane with the market launch of a dedicated natural gas tractor expected in 2015.

Incentives

A Renewable Transport Certificate (RTFC) is awarded for every kg of biomethane produced for vehicles and two RTFCs are awarded if the feedstock to the anaerobic digester is waste. The average price of a RTFC is around 20p/Kg

Currently the high capital costs for the upgrading equipment and the relatively low financial incentives mean that it is not financially viable to follow this route. However, as these come down and more vehicles come to market, it may be an option to explore in the future.



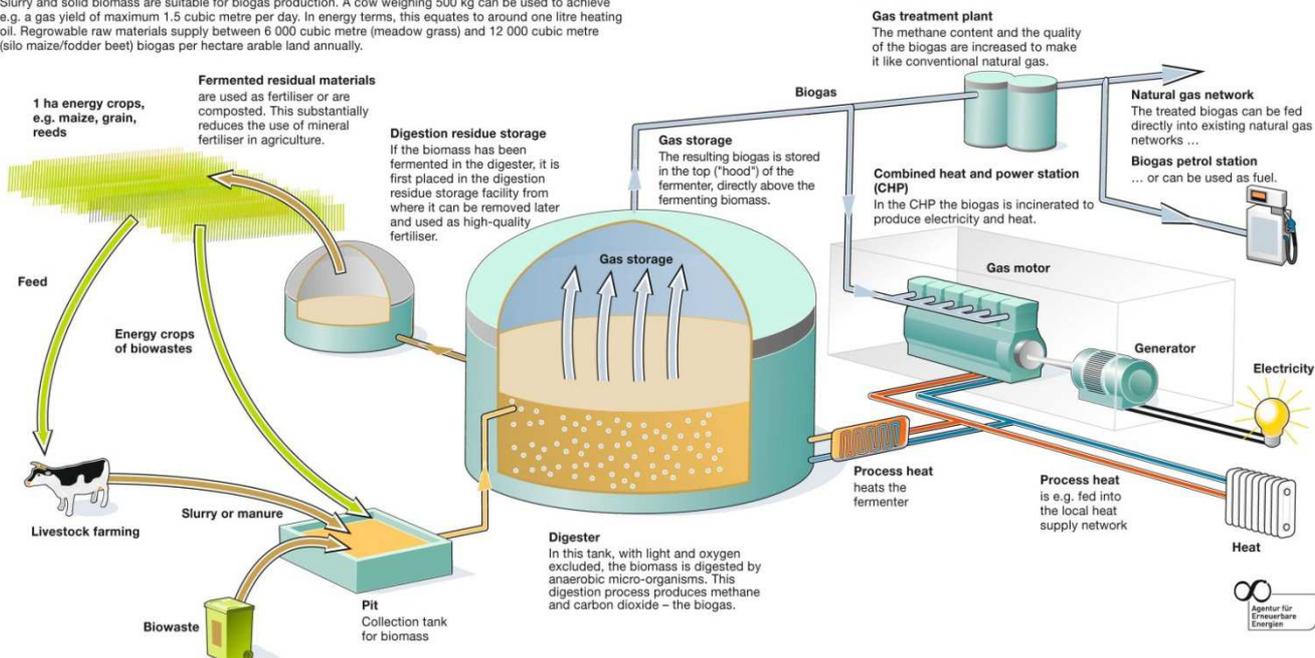
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Biogas system

Slurry and solid biomass are suitable for biogas production. A cow weighing 500 kg can be used to achieve e.g. a gas yield of maximum 1.5 cubic metre per day. In energy terms, this equates to around one litre heating oil. Regrowable raw materials supply between 6 000 cubic metre (meadow grass) and 12 000 cubic metre (silo maize/fodder beet) biogas per hectare arable land annually.



Further Information

BIOMASTER

A project co-funded by the Intelligent Energy Europe-Programme, with partners from Austria, Italy, Poland, Sweden and the UK. The aim is to exploit the potential of biomethane production and use for transport.

www.biomaster-project.eu

Norfolk County Council

Part of the BIOMASTER project. For information on Norfolk's role in this project, email the address below.

ncc@biomaster-project.eu

National Grid Gas Plc.

Gas distribution network covering Norfolk; part of the BIOMASTER project. National Grid can provide information on grid connection and capacity. For specific queries, email the address below.

ngg@biomaster-project.eu

Biogas Info

Anaerobic digestion and biogas information portal.

www.biogas-info.co.uk

NNFCC

The UK's National Centre for bio-renewable energy.

www.nnfcc.co.uk

Biogas & Biomethane Regions

Projects developing local and regional partnerships to drive the biogas and biomethane markets in Europe.

www.biogasregions.org

www.bio-methaneregions.eu

REA Biogas

The Renewable Energy Association (REA) is the trade association for the UK biogas industry. The REA will provide up-to-date information on incentives, events and market developments.

www.biogas.org.uk

ADBA

The Anaerobic Digestion and Biogas Association (ADBA) aims to represent all businesses involved in decarbonising the gas and electricity grids.

www.adbiogas.co.uk

Ofgem

The Office of the Gas and Electricity Markets will provide information on the Renewable Heat Incentive

www.ofgem.gov.uk/e-serve/RHI/Pages/RHI.aspx

Department for Transport

Information on Renewable Transport Certificates

www.dft.gov.uk/topics/sustainable/biofuels/rtfo/