It's a gas

Farmers are set to play a vital role in supplying local, environmentally-friendly energy in the future. **Laurence Smith** looks at the potential role of the humble anaerobic digester…

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Above Consuming 8,000 tonnes of slurry and 3,000 tonnes of maize a year, this anaerobic digester in Dorset produces enough energy for over 400 houses

The role of farms as potential providers of a wide range of so-called 'public goods' has been recognised since the reforms of the Common Agricultural Policy in 1992. This list of public goods is being extended to include energy provision and greenhouse gas reduction through the on-farm technologies, such as anaerobic digesters.

At its simplest, anaerobic digestion (AD) is a composting process without air. Wet organic material, such as slurry, food leftovers or forage, is collected and placed inside a sealed, airless container (the digester). The absence of oxygen encourages growth and activity of certain microorganisms which then break down the organic matter and produce methane and a stable, low odour material called the 'digestate'. As methane levels build up, the gas is collected in a top chamber, which is then extracted and burnt to produce electricity and heat.

Digesters can accept most forms of non-woody biodegradable matter, but on-farm units are mostly used for the digestion of slurry and energy crops, such as maize silage. The slurry provides the necessary moisture levels and bacteria for the digestion process and the added crops boost the gas yield.

The basic AD process is ancient in origin. The first recorded unit was used for heating bath water in Assyria in the 10th century BC. But AD is now used extensively in sewage management, particularly in continental Europe, where it is a major contributor to green energy production. In Germany, there are over 3,000 on-farm AD plants, while over 15 million units are in operation across China. With only 15–20 units across the country, the UK has a bit of catching up to do. The benefits of anaerobic digestion are clear. At a time of reduced energy security and with climate change an increasing

Over 3.6 million anaerobic digesters are used in India for community or domestic purposes, like this one being built in Bangalore

ASHDEN AWARDS

concern, AD presents a way of providing a local and environmentally friendly energy system. By sealing the manure in an enclosed unit, the methane (a greenhouse gas 25 times more potent than carbon dioxide) is captured and utilised instead of being released into the atmosphere. Furthermore, the digestate may be used as a stable, odour-free and easy to handle organic fertiliser and soil conditioner. The feedstock loses none of its N, P and K value during the digestion process and, if it is properly digested, it can actually have an increased N availability compared to slurry. Anaerobic digestion is therefore particularly attractive to organic farmers because it encourages a more self-sufficient system - one that makes better use of its resources.

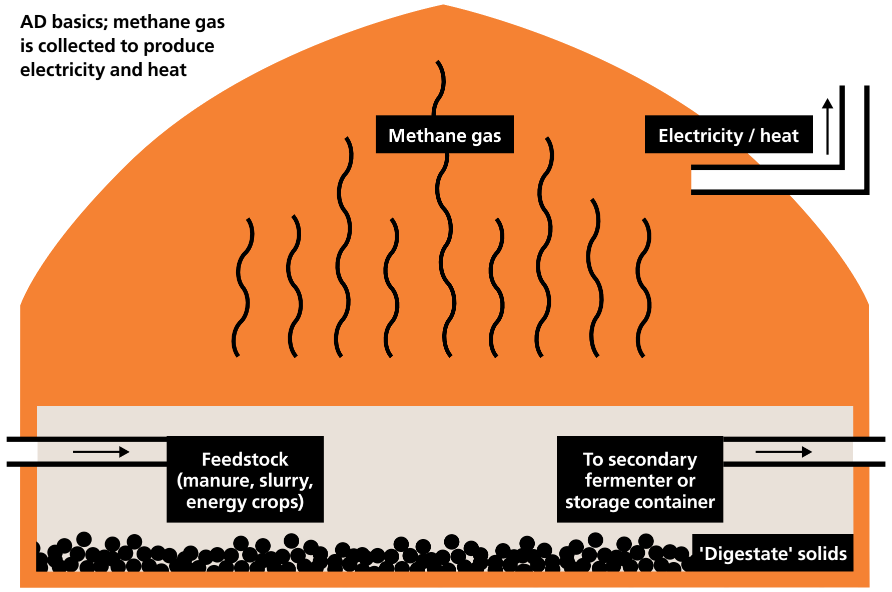
Economies of scale

So what are the downsides? Firstly, significant capital expenditure is required to set up these systems. Most currently on the market are aimed at larger herds (300+ cattle) that can provide more feedstock and, hence, more electricity and faster payback periods. Smaller systems may cost less but take longer to pay off the initial investment. Economies of scale may help and a potential vision for the future is for sharing large, farm-based AD systems between several farms to spread the cost and increase feedstock availability. There are nevertheless a number of low-cost systems coming to the market which are aimed at those who want to provide their own farm/domestic energy needs.

> "Numerous funding sources can assist with capital investments"

Connecting to the grid is also an obstacle for many (see right) as the UK network is not really set up for receiving electricity from small scale suppliers, and some suggest budgeting 10–15% on top of the capital set-up cost for this alone. In any system the economics will improve greatly if it is possible to (a) use the heat from the electricity generation to provide hot water, (b) increase gas yields through addition of higher energy feedstock such as poultry manure and (c) ensure a year round supply of feedstock. The economics of AD systems can also be improved through charging 'gate fees' for food waste that is brought onto the farm instead of going to landfill. The strict regulatory requirements can be quite demanding on a business planning level, although WRAP, the Environment Agency and Defra are working together to make this easier. Nevertheless, the extra work and planning involved in bringing in waste from outside may be worth it in terms of increased profits.

AD basics; methane gas is collected to produce electricity and heat



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Sources of funding

Numerous funding sources can assist with capital investment, such as the Bioenergy Capital Grants Scheme and Axis 1 of the Rural Development Programme. It is also possible to claim a Renewable Obligation Certificate (ROC) from Ofgem for each MWh of electricity produced through AD. These can then be sold to electricity companies, who must purchase a sufficient number to account for their Renewable Obligation (as set out by the Government in 2002). Legislation is currently being drafted and planned for introduction in April this year which would make it possible to claim 2 ROCs for each MWh produced from AD. This would significantly increase the economic prospects for those selling their electricity to the grid.

Interest in this technology has increased dramatically in recent years due to rising oil prices, landfill taxes for biodegradable wastes and stricter manure management requirements for farmers. The Government is also pressurising electricity producers to supply from more sustainable sources, through the Renewables Obligation. So, despite the current harsh economic conditions, there are still people willing to invest in this technology. And, of course, it presents a good opportunity for farming to become part of the solution for climate change, rather than part of the problem.

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USEFUL CONTACTS

Background information:
Renewable Energy Association **www.r-e-a.net**
AD regulations **www.environment-agency.gov.uk**
AD factsheet (no.17) **www.farmingfutures.org.uk**
Bioenergy Capital Grants **www.defra.gov.uk**
Resource efficiency **www.soilassociation.org/transitionfarming**

Suppliers :
Biogas Nord UK **www.biogas-nord.de**
Biogen Greenfinch **www.greenfinch.co.uk**
Bioplex technologies **www.bioplex.co.uk**
Bedfordia Biogas **a.needham@bedfordia.co.uk**
FRE energy **www.fre-energy.co.uk**
Kingdom Bioenergy **www.kingdombio.com**
Methanogen **www.methanogen.co.uk**

Digesters can accept most forms of non-woody biodegradable matter

A load of hot air?

Owen Yeatman farms 480ha of arable land and 400 head of non-organic dairy cattle in Dorset. In 2007, he decided to invest in an anaerobic digester after completing a Nuffield Farming Scholarship, where he saw farmers in Germany making money from feeding biogas plants with just crops and manure. His on-farm biogas plant was set up in August 2008 and supplies enough power for over 400 houses. The system cost about £750,000, with a grant from the Bioenergy Capital Grants Scheme for the initial set-up costs.

A new role for agriculture

The digester uses 8,000 tonnes of slurry from dairy cattle and 3,000 tonnes of maize and grass silage. Slurry is the largest feedstock input but only produces 30% of the electricity; forage produces the remaining 70%. Annual profits are expected to be about 20% of the set up costs. Owen avoided the complications associated with regulations and permits required for bringing food waste onto the farm by only using feedstock generated on the farm. Planning permission and the expense of connecting to the grid can be big barriers. Owen was able to get through the planning issue by meeting the local community to gain their support and by selecting technology that fitted with the landscape (see page 29). With regard to the grid connection he recommends building the plant close to the electricity site to avoid the cost of laying/upgrading underground wire. His grid connection cost £70,000.

Owen's initial motivations were economic but over time his point of view has changed. Through looking at the science involved, he realises just how much carbon he is saving through his AD plant and can see a new role for agriculture in terms of greenhouse gas reduction and decentralisation of energy supplies.