

BIOGAS

THE ENERGY OF THE FUTURE?

British on-farm biogas plants may be few and far between now, but their impeccably green credentials mean they soon could be much more widespread. **Kevin Lindegaard** explains why

Let's face it: Biogas isn't exactly sexy. It brings to mind images of dark, bubbling pits, swirling micro-organisms and earthy smells.

But now, at least in farming terms, it's been pushed centre-stage in the search for carbon-friendly sources of renewable energy.

The problem for biogas (and the anaerobic digestion (AD) process that produces it) is that it's been kept in the shadows by wind farms and has struggled to find a home in either the biomass or biofuels camp. But now it's sprung into the limelight and even got an enthusiastic mention by David Miliband in a recent speech.

So what's changed? Well, a lot of it has to do with ever-tougher regulations forcing local authorities to cut methane emissions from their landfill sites. But there are diversification opportunities for farmers to convert slurry and crops into methane that can then be used to produce heat, power or fuel.

In fact, a number of companies have sprung up to offer various ways to help put a biogas plant on your farm. Michael Chesshire of Shropshire-based pioneers Greenfinch, which has built seven on-farm plants, even goes as far as saying that "2007 will be the year of AD on farm".

What is AD?

Anaerobic digestion, like composting, is a way of converting organic matter into an inert soil conditioner. Both processes are carried out by micro-organisms but there are key differences. Unlike composting, AD requires air to be excluded and can be used with wastes of more than 75% moisture content



Greenfinch has seven plants.

(most food waste is 80% water). And while composting requires energy, AD releases energy in the form of biogas (a mixture of 60% methane, 39% carbon dioxide and 1% ammonia).

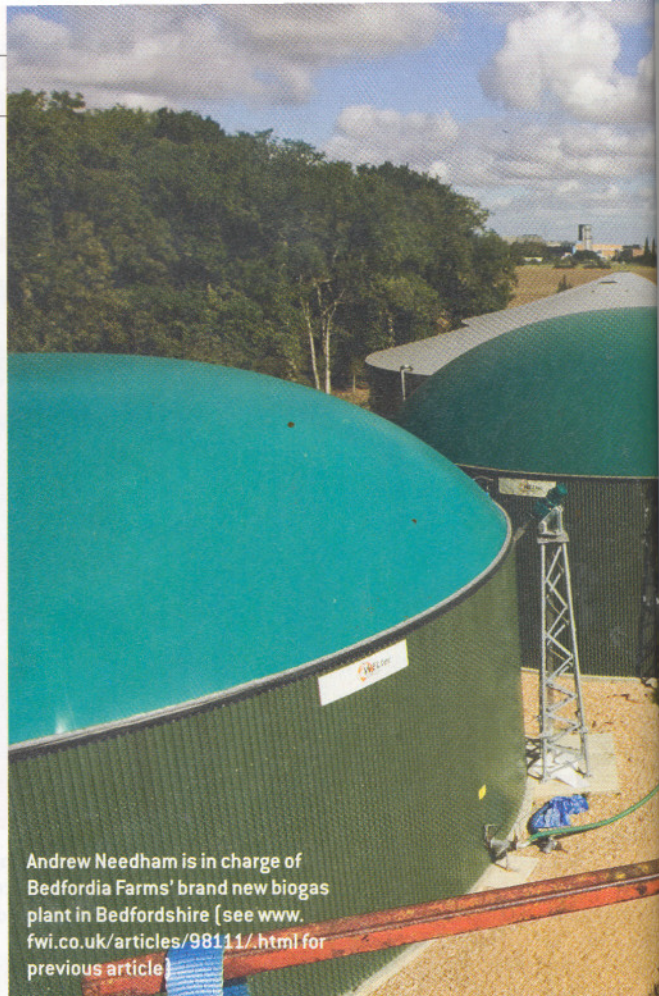
Why is the future bright for biogas?

A lot of the 30m tonnes of UK food waste produced each year currently gets tipped into landfill sites. But the EU has said that biodegradable waste sent to landfill has to be reduced sharply.

Most councils are countering this by investing in composting schemes, but a few are beginning to look at biogas, which can effectively turn the huge waste headache into a massive local energy resource. Farmers are ideally placed to take advantage of this demand.

What can biogas be used for?

Biogas is a versatile fuel that can power a generator as it is, or be cleaned up to produce biomethane. That can then be pumped into the gas supply grid or used as a road fuel. In Denmark biogas is used for community heating and power, while in Sweden it is used as a vehicle fuel for buses and waste collection vehicles.



Andrew Needham is in charge of Bedfordia Farms' brand new biogas plant in Bedfordshire (see www.fwi.co.uk/articles/98111/html for previous article)

CASE STUDY

Josef Hockner

SALZBURG, AUSTRIA

* Josef Hockner (right) and three neighbouring farmers from north of Salzburg in Austria set up their biogas plant three years ago. Over 200ha (500 acres) of maize, sunflowers, whole-crop cereal and grass silage supplies the plant each year, most of it from within a one-mile radius.

"About 30-32t of silage is needed each day. That is roughly four times the amount of a 250-cow dairy unit," says Mr Hockner. About 10-15cu m of slurry is added to this each day to enhance methane production.

The methane produced – about 300cu m/hour – powers a gas engine that generates 500kW/hr of electricity for sale to the national grid. "The normal price for electricity is six euro cents, but the government subsidy on green electric means we get 14.5 cents, which is guaranteed for 11 years," he says.

Nothing is wasted, as excess heat is used for drying woodchips and the waste slurry from the

fermenter. Piping this heat to the local village was considered, but a rival was already supplying heat from woodchips and the two-mile distance made it unfeasible.

Mr Hockner says the plant cost about €1.6m (£1.07m) to set up, funded mainly by a loan fixed at 0.5% above the European base rate (2.9% when they took it out), plus a €100,000 (£67,000) government grant. "We expect payback over six years."

Paul Spackman





What's so good about biogas?

Producing biogas by anaerobic digestion is a genuinely ultra-low-carbon process. For a start, using methane to produce electricity reduces fossil fuel use. It also cuts uncontrolled emissions of methane (which is 21 times more powerful than CO₂ as a greenhouse gas) to the atmosphere from slurry and landfilled food waste.

Better still, applying the digestate (what's left after the biogas has been removed) as a natural fertiliser can replace £2.50 worth of mineral fertiliser per tonne applied. Finally, biogas plants can be sited closer to urban settings and therefore reduce the transport costs of waste.

Is my farm suitable for a biogas installation?

It depends on your site and what raw materials you have available.

The main options are:

- * Using energy crops (maize and grass) and slurry. This is the option preferred by Greenfinch and chosen by Owen Yeatman and his company Farmergy (see case study).

- * Setting up a biogas plant and getting a waste management licence so that you can use slurry, energy crops, and brought-in food waste (and maybe even animal by-products). This is the option preferred by Bedfordia Biogas.

- * Setting up a centralised biogas plant using brought-in slurry and

food wastes such as the Holsworthy biogas plant in Devon.

If you are using imported food waste, the site should ideally be near a food factory or town and have good access for vehicles. A 1MW plant would need a 1ha (2.5 acre) site and be able to cope with four lorryloads a day. You would also need 7000-8000cu m of slurry annually from 300 cows or 5000 pigs plus 400-600ha (1000-1500 acres) of land on which to spread the resulting biofertiliser.

*** We're not going to wait for the market – we're going to jump first to be ahead of the game**

What sources of feedstock can I use?

- * Food waste, eg out-of-date food from supermarkets, by-products of food manufacturing and the organic fraction of our dustbin waste.

- * Catering waste

- * Slurry, which is an essential part of the mix but has a relatively low energy output.

- * Any green crops (except woody ones) like wheat, triticale, maize, fodder beet and barley.

CASE STUDY

Owen Yeatman

LOWBROOK FARM, DORSET

- * Farmer and former Dorset NFU chairman Owen Yeatman will be installing a biogas plant on his farm near Blandford Forum in 2007.

The proposed plant will have an installed capacity of 340kW, enough to power 400 households. The size of his project was limited by grid issues – he's right at the end of the line and a slightly bigger plant would have cost double.

Mr Yeatman decided that biogas was the way forward while doing a Nuffield Farming Scholarship. He saw that farmers in Germany were able to make money from feeding biogas plants with just crops and manure. His project will be the first in the UK using crops specifically grown to produce biogas.

Biogas plants are like a large version of a cow's stomach, he points out, but much more cost-effective at converting crops into cash. By feeding 1t of maize silage into his plant, he would expect to make £38 from the electricity sales but only £17 if he fed it to a cow.

His on-farm biogas plant will use 8000t of slurry from dairy cattle and 3000t of maize and grass silage. Although the slurry is the largest feedstock being used it will only produce 30% of the electricity output while the forage makes up 70%.

Owen Yeatman with an artist's impression of the new plant.



What can I use the heat for?

Surplus heat is difficult to sell unless you have a diversification that requires heat, like offices, glass-houses or indoor fish farming.

The government is still thought to be weighing up the potential for a Renewable Heat Obligation. This would potentially open the door to farmers being able to produce biogas, refine it to 99% bio-

By steering clear of the biosecurity issues associated with food waste and keeping his plant under 1MW, he avoided many of the regulations and permits required and his plant sailed through planning within eight weeks. Building is set to start this month and the unit should be fully working by July. The full cost of the plant is likely to be about £750,000 which includes £60,000 for grid connection.

He plans to use some of the heat produced for the plant itself, as well as for the farmhouse, but most will be lost. He doesn't have a market for the heat but still expects a payback in six years at current electricity and ROC prices.

He won't be getting a penny of grant funding, but instead is relying on equity backing from the German company Biogas Nord and Wessex Grain. This partnership has led to the creation of a new company called Farmergy which will promote the opportunities for similar systems across the UK.

He hopes to have three or four schemes ready to go by the time that ROC banding comes in. "We're not going to wait for the market – we're going to jump first to be ahead of the game," he says. "It's a little bit of risk taking, but otherwise you'd end up waiting for grants to appear, by which time you might be retired".

methane and then pump it into the gas grid.

What about the digestate?

A 1MW plant will produce about 30,000cu m of digestate a year. This has a value but is difficult to sell at the moment, especially if your plant uses imported food waste.

The Renewable Energy Association and others have just es-

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established a digestate* standard in Scotland and are hoping to get this approved in England, Wales and Northern Ireland. David Collins of the REA says that this will remove a big obstacle from the biogas industry since digestate is currently classified as a waste which makes supermarkets suspicious of buying food from farms applying it to their crops.

Of course there is no such stigma about returning the digestate from biogas plants fed with crops/slurry produced from your own farm.

Do I need planning permission?

It depends on type and scale of plant. Some of the relatively small on-farm digesters in Scotland were able to operate within their permitted development rights and for those that needed planning the process took eight weeks. The big Bedfordia plant took six months to get through planning.

* There are many ways of making electricity but it is difficult to find other ways of making fuel

How much will it cost?

A biogas plant using crops and slurry might cost around £2000 per kW installed. Projects using waste might be double this at £4000 per kW installed.

What about connecting to the grid?

Connection costs depend on the size and location of the installation and can vary enormously. The ideal site would be near a substation or close to an 11,000V line. Connection costs range between £35 and £500 for each kW installed. As a rule of thumb connection costs should not exceed 10% of the capital expense for a project to be viable.

Is it profitable?

This depends on the project – some will stack up while others won't. Michael Chesshire of Greenfinch urges farmers to look at the feedstocks available to them and the implications of bringing in waste. You might get a gate fee of £45/t for imported food waste but this must be weighed up against the extra legislation and paperwork involved.

With a good project on an appropriate farm, he suggests, you

CASE STUDY

Christopher Maltin

SOMERSET

* Christopher Maltin has been involved with environmentally-friendly vehicle technology for three decades and his Somerset-based company Organic Power is at the forefront of the development of biomethane for transport.

It employs 27 people and has sold options on licences for its digester technology to dozens of countries, mostly developing ones.

He believes that using biogas to make electricity is not the best use of an under-rated resource and can only be made lucrative by the artificial revenues provided by ROCs. "There are many ways of making electricity but it is quite difficult and expensive to find other

ways of making vehicle fuel."

He plans to install a digester on a farm owned by an organic food distribution company. The digester will be fed with organic waste on site and the biomethane produced will enable large savings in delivery vehicle fuel.

Biomethane filling stations are few and far between in the UK, as are vehicles capable of running on the fuel, so he feels that organisations with depot-based businesses are best able to benefit from it at the moment.

But this is unlikely to be the case for long. The Swedish Association of Green Motorists found that the best petrol-electric hybrid vehicle,

a Toyota Prius, produced 12 times the CO₂ of a Fiat Punto using biomethane. Even large vehicles such as a Volvo S80 produced 25% of the CO₂ emissions of a Ford Focus running on 85% bioethanol.

Moreover, German figures suggest that the biomethane produced from 1ha of wheat could deliver almost 62,000 miles of travel. The same hectare of wheat used for bioethanol would provide just over 20,000 miles while 1 ha of oilseed rape for biodiesel would produce less than 15,000 miles.

Organic Power's own vehicles are fuelled by biomethane from a digester on the farm it also owns.



should be able to achieve a pay-back on your investment in 3-3.5 years. However the price paid for renewable electricity is uncertain – currently you can get 8p/kWh for renewable electricity exported to the grid while the value of renewable electricity used on site is approximately 11p/kWh.

Where can I get funding?

Various funds tiptoe around the

edges of providing grants for biogas plants. The Bioenergy Capital Grant Scheme, for instance, doesn't even mention biogas in the guidance notes, but AEA Technology (which administers the scheme) suggests that biogas would qualify for a 30% capital grant, although the scheme must show that the heat produced can be used on site (www.aea-energy-and-environment.com). Get your skates on, though,

as the scheme closes on 9 March.

Owen Yeatman (see case study) says that DEFRA is looking at routes to encourage the technology, but thinks this will take the form of a revenue incentive by banding of Renewable Obligation Certificates (ROCs) in 2009/10. This will reduce the risk of biogas and other immature renewable technologies by guaranteeing a fixed price for every unit of electricity produced in a way that's similar to the German tariff-based system.

BIOGAS MARKET PROVIDERS AND PROJECT DEVELOPERS

Bedfordia Biogas Email: a.needham@bedfordia.co.uk 01234 827 207
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Farmergy www.farmergy.co.uk (website operational April '07) 07970 063 614
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Methanogen www.methanogen.co.uk 01588 640 902
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Where can I get more information?

Renewable Energy Association
www.r-e-a.net
Environment Agency (www.environment-agency.gov.uk)
Ofgem (www.ofgem.gov.uk)
 – Registering for ROCs
 Or see box left.