Anaerobic Digestion cuts dairy’s waste and energy costs

BV Dairy was looking to cut waste disposal costs, but quickly discovered that with anaerobic digestion it could also make savings to its significant energy bills.

Background

When BV Dairy began to explore alternative methods of disposal for its factory process waste, it had no idea that the solution would not only provide a cheaper method of dealing with the waste, but would also produce energy to power the plant and factory, and even allow the company to inject electricity back into the National Grid.

BV Dairy manufactures a range of fresh and cultured dairy products for sale to the UK’s food manufacturers and food service operators. Established in 1958, it is a well-known employer in the town of Shaftesbury, in rural Dorset, and processes around 30 million litres of milk per year, supplied by 35 neighbouring farms.

The company’s factory generates three distinct waste streams: wash water or rinsings, the first rinses from the in-place cleaning system; trade effluent, or spillages; and permeate – a by-product of soft cheese production similar to whey. Historically, BV Dairy paid for permeate and rinsings to be collected for animal feed, so it was keen to find a more economic, but equally sustainable method of disposal.

Technical and operations director Alan McInnes said:

“We’d been looking at a number of options for the permeate, such as extracting lactose as lactose powder, or fermenting the lactose to produce alcohol; then in 2007 we were approached by an effluent treatment company called Clearfleau. It specialises in the anaerobic digestion (AD) of liquid waste. We started out looking for a waste disposal solution, but it quickly became obvious that this was an ideal opportunity to combine the ability to dispose of our permeate with an energy production system.”

Alan McInnes

Feedstock

How did WRAP help?

The financial benefit

Case Study
Feedstock
The resulting plant has an annual capacity of 70,000 tonnes and currently processes around 27,000 tonnes of liquid feedstock generated from the dairy manufacturing process. The dry matter content of feedstock is just four per cent – unlike the input into a typical AD system treating food waste, where dry matter could make up as much as 20 per cent. McInnes describes the benefits of a liquid waste input, saying: “Because there are only three waste streams, we have a stable mix all the time. The permeate goes into one tank; rinsings and trade effluent go into a second, then we blend them together.”

Previously, the trade effluent was discharged straight to the sewer, an activity which cost the company in the region of £180,000 per year due to the high Chemical Oxygen Demand (COD) of the liquid. The COD is a measure of the potential for materials to use oxygen in water, and is often employed in water treatment plants to determine how much to charge for treating the material. With the ability to mix and treat the materials, what goes in to the digester at nearly 25,000 milligrams per litre COD comes out at 250 mg/l, reducing the discharge costs to £75,000 per year.

Once the plant is full, it expects that the combined heat and power (CHP) engine will produce up to 60 per cent of the required electricity for the factory.

This will significantly reduce energy costs across the business, and any excess will be fed back into the National Grid to provide an additional source of income. Future plans include the possibility of using excess heat for the heating of milk before processing.
BV Dairy has been assisted throughout by its technology partner Clearfleau, which has developed an innovative technology designed specifically for the treatment of high strength fluids such as dairy waste. The system allows solids to re-circulate through the process, giving them a much longer retention time in the tanks than the liquid fraction, maximising biogas generation. When digestion is complete, flocculant is added to the digester liquor as it passes to the next stage of the plant. This causes the solids to clump together and rise to the top of the containment vessel for ease of removal.

This sludge is de-watered using a screw press and the resulting 'cake' is sent to a nearby turf growing and composting business which makes use of the nutrient value remaining in the material. The liquid fraction is sent direct to sewer.

McInnes says: “In principle, we split the liquid retention time from the solid retention time. Our liquid retention is only five days, but the solids remain in the system for up to 40 days. We achieve that by separating out the solids and liquids and feeding the solids back into the system while the liquid goes forward and out. This allows us to operate from quite a small footprint; otherwise we'd need a substantially larger digester.”

How did WRAP help?
Total capital costs on the project came to £2.2 million, with £1.74 million funding from the Environmental Transformation Fund, delivered by WRAP through the Anaerobic Digestion Demonstration Programme. Although the construction of the actual digester and liquid handling were managed through a turn-key project, BV Dairy took ownership of the electrical generation implementation and managed to reduce build costs by leasing its CHP engine rather than purchasing one outright. This will allow the company to expand at a later date when it starts to generate increased levels of biogas.

At the time of commissioning, the Clearfleau technology was alone in its field and McInnes stresses that without the support from WRAP, BV Dairy would have been unable to take the financial risk on such a novel solution. The plant became operational in January 2011, with the aim of breaking even within six months; a projection which incorporates all aspects of running the business, such as insurance and rent levels, as opposed to measuring solely on waste disposal and energy costs.
As the plant has become operational, so staff have had to undergo extensive training. In order to meet Environment Agency standards, AD operators are required to hold a certificate of competence and undertake an NVQ (National Vocational Qualification). Since AD is such a new technology, the anaerobic digestion module will not be available until later in 2011, but in the meantime BV Dairy’s AD staff have undertaken an NVQ in waste management in order to meet permitting requirements.

The benefits of anaerobic digestion are being closely watched by Dairy UK, which represents the interests of dairy farmers, producer co-operatives, manufacturers of dairy products, and processors and distributors of milk throughout the United Kingdom. McInnes, who sits on the Dairy UK Environment Committee, says that anaerobic digestion has been flagged up due to its potential to generate energy, which constitutes a major cost to the dairy industry. He says: “AD with CHP generates energy in two forms: one is electricity, but the other big driver is that it also generates heat. Any dairy company can use that – we’re obviously big energy users for pasteurisation so with AD there’s a double benefit.”

For BV Dairy, the development has had a direct effect on the output of the business. McInnes adds: “Now that we are able to dispose of our permeate in a more cost-effective and environmental beneficial way, we can look at expanding the operation quite significantly. We’re designing a large factory extension that will double our production in the next five years and we will be incorporating the AD and CHP in an energy centre which will combine our boilers, refrigeration and heat pumps.

“The whole enterprise will become more of an energy centre than a waste disposal operation and the benefits are widespread – it has helped us to cut costs, and at the same time has improved our environmental performance, significantly raising the company profile, both within the dairy industry and within the local community.”

Alan McInnes
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