Zero heroes

Laura Lee and **Robert Osborne**

report on encouraging efforts to achieve zero waste in the food and drink industry

ZERO waste processing is a pressing topic in the food industry at the moment. Consumers are demanding sustainable products, both out of concern for the damage being done to the environment, and in response to increasing media pressure. Manufacturers, facing ever-increasing energy, water and raw material costs, have realised that, by developing zero-waste processes, their production costs can be reduced – in addition to allowing them to charge a premium for their now more sustainable products. On top of this, the UK government is limiting the amount of waste that can be sent to landfill and there are larger costs for choosing this disposal route.

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what is zero waste?

When a company claims to have a zero waste factory this means that none of the waste produced by the process is sent to landfill. Many of the leading food and drink manufacturing companies are claiming to have reduced their waste to zero, as illustrated throughout this article.

All of these companies are ahead of their corporate and governmental goals to reduce waste to landfill by 50% from 1995 levels by 2013 (EU Landfill Directive), with the majority of food factories aiming for zero waste by 2015. Developing a zero-waste process is not simple and there's no 'one-size-fits-all' solution. As such this article can only highlight some of the methods that companies have taken to achieve zero waste. There are a number of different approaches that can be used but the most common is to use the waste hierarchy (reduce, reuse, recycle, energy recovery, dispoal) as guidance.

Case study: Unilever

All of Unilever's 11 UK manufacturing sites have achieved zero waste; **97%** of waste is recycled, and **3%** is used as an energy source

reduce

Strategies here involve redesigning the process or the operating procedures to generate as little waste as possible. This is likely to involve a significantly larger capital investment than many of the other steps in the waste hierarchy and therefore is often one of the last steps to be considered, despite the large benefit. A good example of this is Robert Wiseman Dairies, which built a new dairy in Somerset, UK, in 2008 and made this its first zero-waste facility. The processing equipment was designed so that a 'pig' could be sent through the pipelines, forcing out a high quantity of milk that collects on the pipe surfaces. In addition, an effluent treatment plant was built on site to recycle the wastewater generated from cleaning the lines. The plant can treat up to 800,000 l/d of water.

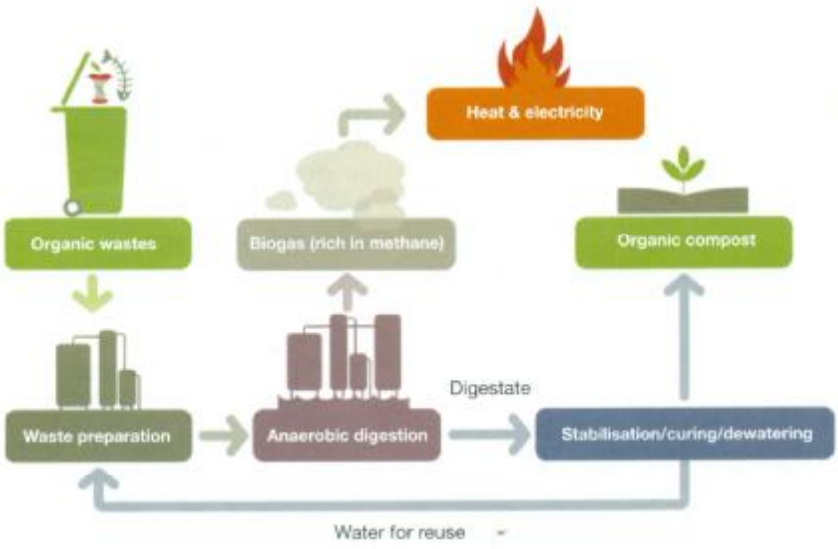
reuse

Finding a way to reincorporate waste product into a saleable one is common practice in many food factories. For example, Mondelez, whose brands include Cadbury, Oreo and Kenco, sells on the majority of its edible waste as animal feed, including corn skins and coffee beans. Many waste streams can be sold on as fertiliser to local farms and this technique is used by British Sugar and Mondelez with their pre-

Case study: Mondelez

36 factories across **13** countries send **zero waste** to landfill (24 in Europe and 12 in North America). Mondelez has cut food manufacturing waste by half in the past seven years. This is well ahead of the original target of reducing it by 15%

Figure 1: Anaerobic digestion reduces waste sent to landfill and produces biogas for heat and electricity



Since the drive for zero waste, energy recovery has seen some scientifically challenging techniques implemented and continues to attract funding to extend research in this area.

wash of sugar beet and spent coffee grounds.

Mondelez has also attempted to reduce the cardboard box waste in its supply chain by selling the boxes to local removal firms when it's not possible to recycle them.

recycle

This step involves using the waste products of one process as a raw material for another production process. In Indonesia a food packaging plant has started recycling its waste plastic into buckets and bags to sell to the local community.

Companies have acknowledged that achieving zero waste is important in factories but that the packaging materials of the products should also be more sustainable. A good example of this is with Mondelez' *Kenco* coffee and the eco refill pack launched in 2009 that claimed to have 97% less packaging waste (by weight) but also requires 81% less energy to make than the alternative jar format. This initiative looks to be working well as sales of the coffee refill packs have increased by an average of 54% each year.

Unilever's Sustainable Living plan has led the company to invest in research that has arrived at a novel technique for recycling sachet waste. It has demonstrated a proof of principle for using pyrolysis to turn sachet laminate into fuel oil.

energy recovery

Since the drive for zero waste, this area of waste processing has seen some scientifically challenging techniques implemented and continues to attract funding to extend research in this area. The aim of this stage is to harness energy from one waste stream for use in another process. A simple recovery idea is to use waste product and burn it to generate electricity to be used elsewhere in the factory. One of Mondelez' coffee plants, which burns waste coffee grounds, has received some criticism for using this technique since it produces CO_2 as a by-product. However, this could be captured and sold as a product, whilst the process itself still reduces the amount of waste being sent to landfill and reduces the use of non-renewable energy.

Another method of energy recovery is via anaerobically digesting food waste. This process (see Figure 1) uses bacteria to produce methane (biogas) which is then burned to produce electricity in biogas power plants. When food waste is sent to landfill it produces methane which is then released to the atmosphere and contributes to global warming; therefore anaerobic digestion reduces the amount of global warming gases being released to the environment as well as reducing volumes sent to landfill.

Unilever's *Philadelphia* cream cheese factory in Wisconsin, US worked with the city to build an anaerobic digester that processes whey waste to produce biogas electricity generation for the local grid. Anaerobic digesters are becoming more common in the food industry for digesting waste. The first large-scale anaerobic digestion plant in the UK was built in 2002 in Holsworthy, Devon. Initially the company struggled to run it as a business because the plant cost £8m (US$12.5m) to build and at the time the

Case study: British Sugar

All of British Sugar's four factories in the UK have achieved **zero waste** to landfill. It produces 2.3m t/y of product with only 4,000 t of waste. Its by-products include topsoil and stones (produced after washing the beet), animal feed, lime, bioethanol, liquid CO_2, and tomatoes (grown to reduce the CO_2 waste) and electricity

Case study: SABMiller

Between 2004–2009, the company reduced its waste to landfill from **17%** to **1%**, with several sites achieving **zero waste**. 66% of waste is spent grains, waste yeast and trub which is sold as animal feed or fertiliser; remaining waste from damaged packaging is recycled into new bottles

Case study: PepsiCo

PepsiCo has **16** zero waste sites in Europe and **13** in North America with less than **1%** of waste sent to landfill; the remaining 99% of waste includes 8m kg of potato peelings and corn hulls for animal feed, with the majority of other waste recycled

Case study: Mars

Six manufacturing sites in the UK were **zero waste** at the end of 2011; it is aiming to have converted all of its **13** UK sites to zero waste by 2015

incentive to reduce food waste to landfill was low. This has changed now with a tax of £56/t of waste sent to landfill on top of the cost of disposal. On average, the plant charges £60/t of waste, so anaerobic digestion is an attractive alternative. This trend is growing worldwide, not just within the EU.

The drive for zero waste to landfill is not only found within industrial production, but also in local businesses, hospitals, residential homes and households. This is evident in London, where the first council-run anaerobic digestion plant (due to open in 2014) will digest household waste as well as industrial waste. The digester will manage 30,000 t/y of waste and provide power to the other tenants at the London Sutainable Industries Park.

Ongoing research into this area includes developing the digestion process to produce green hydrogen instead of methane from food waste in preparation for hydrogen technology, an alternative to fuel derived from petroleum. This technology was developed by the University of Birmingham in collaboration with the Hydrogen Doctoral Training Centre.

disposal

The final option in the waste hierarchy is to dispose of the waste to landfill. This is expensive in the UK, at £56/t of waste. The Food and Drink Federation (FDF) is working with many of the large food and drink manufacturers to document and reduce food waste. In 2009 there was 481,000 t of food waste of which only 9% (43,000 t) was sent to landfill.

In the future, it's expected that the landfill tax will continue to rise and eventually there will be a ban on landfilling food waste. The rising cost will continue to push through new and innovative ways of recovering energy

future developments

The drive for zero waste should not only be applied during food manufacture but also within the supply chain. Many supermarkets in the UK - including Tesco, Asda and Marks and Spencer's - have achieved zero waste in all of their stores. Therefore, the next step is to reduce the amount of waste produced. Supermarkets are under increasing pressure from the government and food manufacturers to not only eliminate waste to landfill but to consider the waste hierarchy and the most beneficial options, including the most valuable for reducing the amount of waste that is being produced initially. Sainsbury's led this initiative; it was the first supermarket to send all of its waste to anaerobic digestion. Whilst recovering energy is better than landfilling the waste, it only recovers 0.75% of the energy needed to produce the food in the first place (calculated for tomatoes). With this in mind, there is increasing research into alternatives to anaerobic digestion.

In the future, it's expected that the landfill tax will continue to rise and eventually there will be a ban on landfilling food waste. The rising cost will continue to push through new and innovative ways of recovering energy. In order to push forward the need to reduce food waste it's expected that greenfield sites will be encouraged by reducing the time required to receive planning permission.

Finally, and perhaps most importantly, our progress in reducing zero waste will continue to improve if we communicate our current methods of waste reduction. Let us know if your company has come up with some interesting zero waste strategies that are worth sharing - visit the Food and Drink Special Interest Group's LinkedIn page to join in the discussion. **tce**

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