Reversing the greenhouse effect through renewable power generation

Generating power through the use of fossil fuels is both unsustainable and environmentally damaging. A project led by Hennock Industries Ltd is currently developing a prototype power plant that fuels an existing combined heat and power (CHP) installation with organic landfill waste. The team believes it's proving the benefits of using a truly organic, 'growing' fuel and the value of the process's by-products in the food production industry.

Key benefits

- Developing a means of releasing the energy in organic waste for power generation, reducing reliance on damaging and expensive fossil fuels
- Using a process that generates heat, carbon dioxide, water and fertiliser as its by-products, all vital in growing crops of any kind
- Creating a sustainable power source for areas of the world where fuels like natural gas are in limited supply

As the world's fossil fuels resources continue to reduce through use, with a commensurate growth in environmental damage, for many years the hunt has been on for alternative means of releasing the latent energy in other potential power sources.

In the food production industry, waste is inevitable. Food may be damaged in transit or simply go off before it can be sold and consumed. Until now, landfill has been the most common means of disposal, itself a potentially damaging and financially inefficient activity. Using organic food waste as a fuel is therefore a potentially productive area of investigation, particularly in the food industries where its by-products may also be used as a means of nourishment for growing plants.

It was to develop a working commercial prototype of a power generation system using organic waste as a fuel that greenhouse services company Hennock Industries Ltd created a consortium to run a 12-month, £400,000 project that is part-funded by the DTI under the Technology Programme. Launched in late 2005, it is designed to create a large-scale anaerobic digestor for landfill waste that's linked to an existing CHP powering a commercial glasshouse.

The three partner companies, Hennock Industries Ltd, NewEnCo Ltd and Guy and Wright Ltd, worked with each other on initial development of the micro-turbine installation, and have a long term relationship.

Objectives

In an important investment in its site, a family-owned British tomato-growing growing business, Guy & Right Ltd, Hertfordshire, decided in 2003 to install an advanced and highly efficient 0.6MW micro-gas turbine CHP system designed by

Hennock Industries and using the Turbec CHP unit. This has especially low emissions, and the gases are so clean that they meet the toughest standards in the world.

Once this had successfully proved its value, the business decided alongside Hennock to take an important step further by moving away from fossil fuels.

According to Hennock Industries' Dr Andrew Marchant, "Critically, this adds to the great efficiency already achieved by making the power source totally renewable, with all by-products in turn returning to the land to help grow more food. It's a truly virtuous circle."

The project involves the creation of an airtight 'bunker' into which the waste food is placed where it rots in an oxygen-free environment to produce the gas by which the turbine is powered. This will include a multiple-cell digestor, with associated pipes and storage facilities for the liquids and gas produced, and a sophisticated artificial intelligence-based control system.

Solution

Construction of the bunker is close to completion, and attention will shortly turn to the CHP units for conversion to the new fuel. Work has also progressed strongly on developing and testing and new gas compressor, which will be necessary when production of the gas itself begins.

The team's attention will shortly turn to building the pipe work and transport system to connect and integrate the system, and the installation is on target to be up and running by the autumn of 2006. At that time, the primary focus will be on ensuring the quality of exhaust gases from the system is maximised for the best possible plant growth.

Results

According to Dr Marchant, "Anaerobic, or oxygen-free digestion has been used before although not in a commercial greenhouse environment. By integrating the system in the way we have, we are showing how waste may be used to produce heat, light and electricity for the grid, as well as the CO_2, water and highly nutritious sludge that in turn may be used for growing more food.

"There has been much interest from UK sites as well as from overseas. In New Zealand, for example, there is very little natural gas and a large fruit industry, making it a perfect market for our system. Altogether, though, we believe there will be a major domestic and export market for all the partners in the project."

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