

analyst view

Waste to Energy: An Interview with Waste2Tricity

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Rubbish strewn beneath a pylon in Wales. (Source: Matt Cardy)

According to the Environment Agency, England and Wales produce around 300 million tonnes of waste each year, which must be disposed of in a safe and environmentally sound manner. A range of methods are available for waste disposal including landfill, anaerobic digestion and incineration, but none of these provides a universal solution to process our increasing quantities of waste.

Landfill sites are subject to stringent legislation regarding the composition of waste they can handle and how those wastes are managed in the long term, including mitigation of landfill gas (40–60% methane, remainder carbon dioxide) and leachate (a liquid formed as rainwater seeps through landfills). The Environment Agency manages more than two thousand landfill sites in England and Wales, but around 75% of them no longer accept any waste. Public opposition to new landfill sites is likely to lead to fewer operational landfills in the future.

Anaerobic digestion (AD) uses microorganisms to break down biodegradable waste producing a biogas consisting of methane, carbon dioxide and other trace gases. AD has typically been used as part of an integrated waste management scheme at landfill sites, where suitable feed materials can be sorted, and using AD can lower the production of landfill gas. AD cannot process plastics or wood-based materials containing lignin however, so feedstock purification adds cost to the system. AD also cannot extract all the available energy from sorted feeds, producing digestate for use as fertiliser.

Incineration of waste is also a controversial topic and is a process which can take many forms. At its most basic, incineration simply burns combustible material, converting it to ash and heat, with no separation of particulate matter or hazardous materials. More sophisticated methods of incineration capture and reuse the heat and also separate hazardous materials and recyclables, but still produce flue gases which need treatment to remove toxic substances and particulates.

Fuel Cell Today recently spoke to Howard White of Waste2Tricity, a company aiming to address the environmental aspects of waste management and produce useful electricity from municipal solid waste (MSW). White believes a sea change is imminent for the UK waste industry with many landfills due to close in the next few years and a shortfall in incineration capacity not able to fill the resulting void. To address this problem, Waste2Tricity brings together state of the art technologies for waste processing and electricity generation, including fuel cells, which demonstrate the environmental and commercial benefits of treating waste as a feedstock rather than a problem.

Plasma gasification is the waste processing method of choice for Waste2Tricity. This technique can process any form of carbon-containing waste (plastics, paper, cardboard, food or plant material) and generates syngas with minimal by-products (predominantly vitrified slag, used as a building material). Compared to conventional incineration, plasma gasification produces less ash, tar and pollutant gases. After clean-up, this syngas can be fed into internal combustion engines (ICE) to produce electricity, but in the future using fuel cells would greatly enhance system efficiency. White put this into the following context: a facility processing 80,000 tonnes of waste per year would generate around 16 MW of electricity using ICE. Substituting fuel cells would result in efficiency increases, allowing the site to produce around 25 MW of electricity using the same quantity of waste. Waste2Tricity has recently secured the exclusive rights to use AFC Energy's fuel cell technology in UK waste to energy sites, and has the option to extend this to include the rest of Europe and North America. Waste2Tricity believes processing between 50,000 and 100,000 tonnes of waste per year would enable a number of commercially viable sites to be located across the UK, all of which could provide distributed electricity generation using MSW.

Air Products is currently building a 350,000 tonnes per year waste treatment facility to be located in Teesside, UK, which is expected to produce 49 MW of electricity per year (enough for up to 50,000 homes) processing MSW and is planned for commercial operation from 2014. This site will initially use turbines, but fuel cells could be retrofitted at a later date.

Diverting waste away from landfill sites can help to diversify a country's energy supply while at the same time avoiding the environmental and political impact of landfill. High gate fees at landfill sites, coupled with landfill taxes in certain countries, are encouraging alternative processing methods and increasing the interest in advanced processing techniques, such as plasma gasification and fuel cells. In addition, schemes such as the Renewables Obligation in the UK and renewable portfolio standards in other countries obligate electricity suppliers to source a percentage of electricity from renewables. Earning incentive payments from these schemes can provide an additional financial incentive. Siting these facilities close to urban centres could help to manage the increasing waste problem worldwide while at the same time generating efficient distributed electricity to power our cities.

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