



A Watery Solution

The ArrowBio process can help divert waste from landfill and deliver high quality diesel fuel

ArrowBio is a water-based mechanical biological treatment (MBT) facility that can be applied to both municipal and commercial mixed waste streams. ArrowBio can be used alone or with other technologies in sustainable energy parks and has been independently assessed by both the Environment Agency and the Juniper MBT Report. Oaktech Environmental, through multinational co-operation between the UK, Israel, Australia and the US, has a number of projects incorporating the ArrowBio process planned in the British Isles.

The aim of the ArrowBio process is to fully recover and wash the recyclable elements of the waste while extracting the maximum available gas yield, which is converted into renewable energy. Unlike some other MBT facilities, the

ArrowBio process does not produce any intermediate stage refuse derived fuels.

The process consists of two distinct yet integrated components: a “front-end” wet materials recovery facility (MRF) and a “back-end” advanced anaerobic digestion system. The wet MRF combines standard waste handling technology adapted to take advantage of the beneficial properties of water. The water facilitates passive separation and cleaning of recyclables and their transportation around the facility, while also suppressing odours and dust.

The wet MRF cleans and recovers ferrous metals, non-ferrous metals and plastics separated by type in a standard that can be sold directly into the recycling market. The wet MRF also incorporates a unique element called a hydrocrusher. This blasts the biodegradable waste with high

pressure jets of water through a series of pipes. Food and paper is torn apart, greatly increasing surface area, while simultaneously suspending the organics in a watery solution. The solution is able to produce higher gas yields than thicker sludge in water-based anaerobic digesters. It is screened for physical contaminants then pumped directly into the digesters. Any waste that is not recoverable or that is not sent to the anaerobic digesters exits ArrowBio as a residue.

ArrowBio’s anaerobic digesters are two-stage and separate out the acidogenic and methanogenic stages enabling optimisation of pH levels, temperature and residence times. The digesters produce high gas yields through the use of an upflow anaerobic sludge blanket digester. This separates out the residence times of biodegradable waste in the system in a blanket of sludge suspended in the reactor. Liquids pass through the system quickly whereas solids can remain there for up to 90 days. In this way the maximum amount of gas is generated and the digestate produced is highly stabilised with little biodegradability



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left. The biogas produced has a high concentration of methane (approximately 75 percent) and is used to power gas engines producing renewable energy. There is a relatively small output of digestate produced by the system with very low levels of biodegradability.

In Israel the digestate is sold to seed farms as a peat substitute for potting. It also produces water that is recovered from the incoming waste. This water is cleaned in the waste water treatment facility and is disposed of to sewer.

An ArrowBio facility is currently under construction at Jack's Gulley near Sydney, Australia, due to commence operations in January 2008. WSN Environmental Solutions won a contract for the surrounding Macarthur region's waste in November 2005. The total contract is for 90 000 tonnes of waste and will consist of an integrated facility including in-vessel composting, water-based MBT and a civic amenity site called "Ecolibrium". Mohan Selvaraj, general manager of WSN explains: "The [Jack's Gulley] facility features the ArrowBio technology as the key process in developing a sustainable method for the ongoing management and recovery of resources. This integrated facility, which will be a showcase, includes a materials recovery facility for kerbside recycling, garden organics processing, dry waste processing, an educational facility, a revolve shop and facilities for community projects associated with beneficial use of recovered resources."

Plastics have for a long time been regarded as expendable, often disposed of with scant regard to recycling or the depletion of the world's oil reserves. The Thermofuel process can convert the majority of waste plastics into a clean, compliant diesel fuel that can be used as a direct replacement for ordinary diesel.

There are currently nine operational Thermofuel plants, eight in Japan and one in Taiwan, producing diesel oil from waste plastic. In the UK and Ireland the technology is provided by Cynar, with the Thermofuel plant being manufactured in Australia by license holders, Ozmotech Pty, based on the original Japanese design.

A Thermofuel plant consists of a pyrolysis chamber, filled with shredded plastic and purged with nitrogen gas



Left: the ArrowBio plant in Sydney. Above: the working ArrowBio plant in Tel Aviv

while being heated to around 400°C. This releases a gas derived from the plastic that is cracked and reformed in an adjoining catalytic chamber. This gas is then condensed into oil fractions that are combined, purified and blended into diesel. The most important part of the system is the catalytic chamber that is designed to selectively break and reform the gaseous plastics into the right chain length for diesel fuel.

ArrowBio plant will provide biogas to synergistically fuel the Thermofuel process. The high-grade plastics will be sorted and cleaned then sent for recycling while low-value film plastics will be converted into high-value diesel fuel, a readily marketable output.

This holistic solution provides a minimum of 85 percent diversion from landfill, with the production of synthetic diesel and renewable energy,

The aim is to fully recover and wash the recyclable elements of the waste while extracting the maximum available gas yield

The most suitable plastics for the Thermofuel process are high/low density polyethylene, polypropylene and polystyrene. Plastics such as polyvinyl chloride, polyethylene terephthalate and nylon are tolerated by the process but in lower amounts. The process is highly flexible and suited to clean either sorted plastic waste streams or recovered plastics from municipal wastes. Operational plants accept waste agricultural film and various mixtures of waste plastics and industrial plastic waste. Recorded yields are in the region of 1 050 litres of diesel per tonne of plastic processed. The two processes, while currently operating successfully thousands of miles apart, can be joined in a unique way to promote a truly sustainable solution.

Oaktech Environmental and Cynar have joined forces in the sustainable energy parks concept where the

while promoting a low carbon solution to the Sustainable Energy Park. Once the process is running successfully the centre is self-powering, requiring only to be fuelled by the waste. The centre will help reduce carbon emissions by saving energy generation from fossil fuels. Expected outputs from a 100 000 tonne municipal solid waste stream would be:

- 3.9MW of renewable electricity
- 19 000 litres per day of synthetic diesel
- 10 000 tonnes of recyclables per annum
- 10 000 tonnes per annum of carbon savings.

ArrowBio can either be deployed as a stand-alone solution or coupled synergistically with other technologies. The system is able to recover resources from waste while producing renewable energy and helping reduce carbon emissions. **CIWM**