SYNERGIE ENVIRON
Decarbonisation & Energy Efficiency Specialists
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Delivering on Scotland's circular economy – what does it mean?

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Foreword

In a bid to help move Scotland towards a circular economy the Waste (Scotland) Regulations 2012 (the Waste Regulations) set out a number of provisions for objectives and targets as part of Scotland's Zero Waste Plan. One such measure is the forthcoming landfill ban on biodegradable municipal waste (BMW), due to come into effect after 31 December 2025. But what is BMW and what does this mean for businesses?

What is BMW and Why the Landfill Ban?

BMW is defined as waste from households, or that similar to households such as from offices and staff canteens, that contains organic matter. When BMW is landfilled, it generates carbon dioxide and methane, two gases that for decades have been known to be potent greenhouse gases. In addition, methane is a major contributor to the formation of ground-level ozone which is a hazardous air pollutant responsible for around 1 million premature deaths every year[1].

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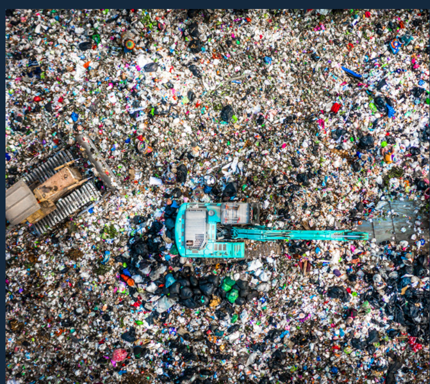
As a result, the Waste Regulations originally set out to ban BMW from landfill disposal in Scotland from the start of 2021[2]. Due to a lack of alternative processing capacity in Scotland, implementation and enforcement of the ban has been delayed until after 31 December 2025[3].

With food waste volumes remaining high[4], the Waste Regulations



also ban from landfill separately-collected fractions of municipal and commercial waste, including food waste and garden waste.

The Ban

This means that biodegradable wastes from non-public sources, such as animal/plant material waste from food manufacturing or agricultural slurry, will not be subject to the ban. However, the reality is that in the face of lost revenue that would normally be received from the high volumes of BMW post-ban, together with the escalating costs of landfill tax, most landfill sites licensed to receive this waste in Scotland have either closed or are in the process of closing. This means that landfill will also likely cease to be an option for the disposal of wastes not within the scope of the ban[5]. In any event though, there are still clear environmental and social drivers for moving away from landfill as a method of bio-waste disposal.

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In recent years, the Scottish waste industry as well as some local authorities have invested heavily in infrastructure to meet the requirements of the ban by processing it in such a way as to render it non-biodegradable. However, the majority of new processing capacity in Scotland is based around thermal treatment (primarily incineration)[6], which still generates a substantial carbon impact and deters pre-segregation of recyclable material.

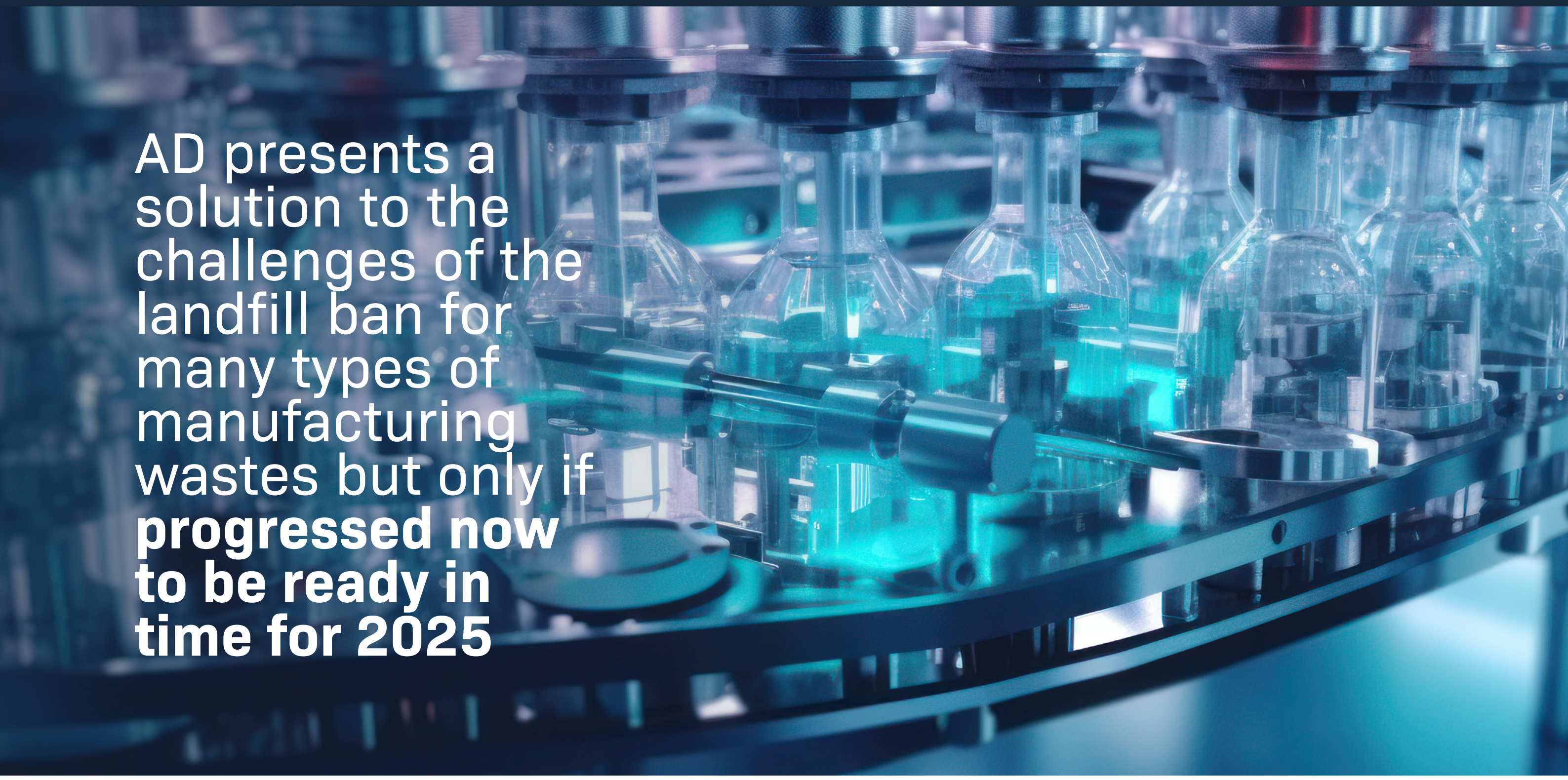
The Solution

Anaerobic digestion is a process that allows carbon-rich biodegradable wastes to be broken down into a less degradable solid or semi-solid matrix (known as "digestate") in a controlled fashion, whilst capturing and utilising the resulting greenhouse gas emissions.

This technique involves degradation of the waste by bacteria in a low-oxygen environment (similar to the process that occurs in landfill) which in turn produces heat and biogas. Biogas is a methane-rich gas that can either be cleaned and injected into the national gas grid network as a non-fossil fuel gas or used directly on-site to generate renewable electricity. When used for the latter, this allows some or all of the electricity and heat requirements for manufacturing or industrial processes that produce high organic-content wastes or byproducts (such as food manufacturing, distilling/brewing or effluent treatment) to be met, as well as significantly reducing waste disposal costs to landfill.

The resultant solid, semi-solid or liquid digestate from the process is lower in biodegradability than the original waste/by-product, as well as having a lower concentration of ecotoxic organic material. Applications for digestate vary depending on the original feedstock, but some of these include application to land for agricultural improvement as a renewable fertiliser[7]. Digestate from feedstock that has been segregated at source (e.g. organic waste from a food manufacturing process or spent lees from whisky distillation) is capable of achieving a recognised quality standard (PAS110), meaning that it is no longer considered a waste but rather a fully-recycled product, opening up its use in a much wider range of applications[8]. Some applications may require a composting stage to further treat the digestate before use[9].

AD has also been utilised for the removal of organic solvents from industrial wastewater such as that generated in the chemical manufacturing sector[10]. The technology can be utilised in these industries to process solvent wastes such as glycol, ethanol and methanol to produce energy for the manufacturing process. This provides a more economic solution to disposal for solvents that are challenging to distil back into reusable chemicals, and generates heat and electricity, both of which have seen significant increases in cost to the industrial consumer. Earlier this year, Synergie Environ successfully commissioned an AD process at Sterling Pharma Solutions' manufacturing plant in Northumberland. This facility is the first of its kind in Europe to treat waste solvents from pharmaceutical manufacturing and generates biomethane for injection into the National Gas Grid, thereby providing a significant low-carbon offset against the manufacturing plant's direct emissions and reducing the facility's overall carbon footprint. The success of this facility demonstrates that AD is a powerful tool in the decarbonisation of the pharmaceutical sector as well as the wider organic chemical manufacturing industry. Other industries such as airports that use high volumes of solvents such as antifreeze could also benefit from the use of AD technologies.



AD presents a solution to the challenges of the landfill ban for many types of manufacturing wastes but only if **progressed now to be ready in time for 2025**

AD facilities that are co-located with a manufacturing process generating a suitable feedstock not only provide a cost-effective solution to waste disposal but also align with the proximity principle of waste treatment as laid out in the European Waste Framework Directive[11], where wastes should be managed as close to the source of their generation as possible in order to minimise their overall environmental impact. This coupled with their role in producing low-carbon energy, either for the manufacturing process itself or for distribution into a national grid energy network, means that a co-located AD facility is fast becoming the responsible way in which businesses deal with their organic waste and by-products.

Like most forms of energy-from-waste, there are challenges to achieving cost-effectiveness and efficiency in terms of design and operation. Feedstock is a key element, not only in terms of its methanogenic potential but also regarding its volume and consistency (including solids content) and presence of inhibitory chemicals. Another factor is how the resultant biogas is to be utilised – whether it is to be used to generate on-site power or whether the gas is to be injected into the grid require different back-end process configurations in terms of gas clean-up and compression.

In addition, different AD technology configurations (e.g. batch feed vs continuous feed, single-stage vs multi-stage, mesophilic/mid-temperature vs thermophilic/high temperature) are better suited to different extrinsic factors such as variations in ambient temperature, differences in national regulatory requirements or available budget. It is therefore essential to select an appropriate technology and to carefully plan the design of these facilities according to the feedstock to be processed, the location of the facility and how the generated heat and power is to be used.

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