material. Whereas traditional composting takes place in the presence of oxygen (often enhanced through aeration), anaerobic digestion is a series of processes in which micro-organisms break down biodegradable material in the absence of oxygen.

Anaerobic digestion is an entirely natural phenomenon, but can be harnessed for industrial or domestic purposes to manage waste and / or to release energy. In digesting biodegradable material such as food waste and plant matter the micro-organisms produce a biogas – principally methane, carbon dioxide and small quantities of hydrogen sulphide.

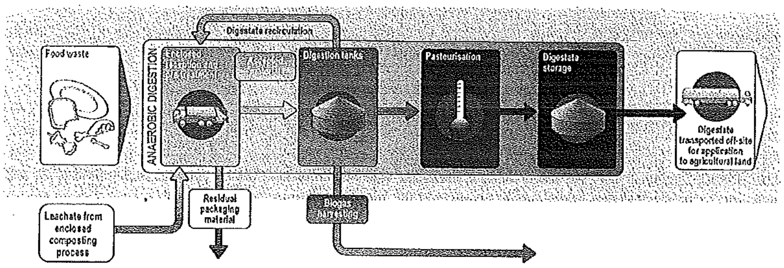
It is worth noting that anaerobic digestion often occurs within landfill sites, when the biodegradable fraction of the household and / or commercial waste begins to break down. This releases biogas, principally methane, into the atmosphere. Methane is a greenhouse gas and when entering the atmosphere, is some 23 times more harmful than carbon dioxide.

In order to reduce the environmental impact, most modern landfills incorporate gas capture systems. However, such systems are only capable of capturing some of the methane and it is estimated that significant volumes still escape to the atmosphere. In recognition of this fact, the European Union has formulated policies requiring member nations to divert biodegradable wastes away from landfill. This requires investment in new waste management infrastructure – such as composting and AD facilities.

5.3.3 Harnessing anaerobic digestion

Dedicated AD plants provide the ideal host conditions for micro-organisms to thrive, accelerating the digestion process and optimising the production of biogas. They are purposefully designed to capture the biogas within sealed tanks. Once captured, the methane can be combusted to generate electricity and/or heat using CHP gas engines or boiler based steam turbine systems. Gas engines tend to be the preferred option owing to the electrical efficiencies offered and the opportunity to recover heat.

New Earth will utilise a proven AD technology. There are subtle variations in the precise configuration of the plant that may well affect the process flow, however the diagram below and supporting text illustrates how the facility is likely to operate.



The AD plant will be capable of treating 50ktpa of waste, principally pure food waste supplemented by leachate (that would otherwise be tankered offsite) from the fully enclosed composting process. The incoming food waste will be delivered from kerbside collection in Refuse Collection Vehicles (RCVs) with a payload of circa 8t or from waste transfer stations in bulkers (HGVs) with a payload of circa 20-25t.

Incoming delivery vehicles will pass across the weighbridge and documentation checked before proceeding to the entrance door on the northern elevation of the proposed reception building. The rapid rise door will open to allow access and will shut once the vehicle is inside, providing full enclosure. The plant will be equipped with multiple tipping points to accommodate different waste streams and vehicle types, thereby minimising potential queuing. Sufficient space has been allowed within the proposed building to allow for circulation and manoeuvring. The waste will be tipped, or in the case of liquid waste, pumped directly into sealed concrete bunkers sunk into the floor. The sealed bunkers will each provide for the full containment of 60-80t of waste. Delivery vehicles will then exit the reception building via the rapid rise doors on the southern elevation of the reception building and leave the site via the weighbridge.

Air within the headspace of the reception building will be continuously ventilated creating a slight negative pressure within the buildings reducing the propensity for fugitive emissions. Extracted air will pass through an aqueous scrubber and bio-filter before being released to the atmosphere. The aqueous scrubber and bio-filter will reduce odour concentrations and mitigate potential amenity impacts.

Food waste in the bunkers will move forward continuously along a moving floor, conveying it to a screw feed conveyor. The screw feed conveyor transfers the waste to a hammer mill and screen, which separates any residual packaging within the incoming waste stream. The residual packaging waste will be temporarily stored within a skip in the waste reception building prior to being removed from site for further treatment.

The remaining waste will be in a semi-liquid form. It will be fed by gravity into a reception tank embedded within the floor of the building, where any 'heavy' suspended solids will sink to the conicalled base. Deposited heavy material will be removed periodically. The waste will then be macerated to aid consistency and optimise the surface area of suspended material to optimise microbial activity. The liquidised waste will be pumped into one of two primary digestion tanks where it will be stirred and heated to circa 38 degrees C by a hot water system built into the tank walls. The heat helps to stimulate microbial activity optimising bio-gas production. If required an energy crop (usually maize or silage) will be added to aid and stabilise the digestion process. This is usually only required in the early start up of the facility to ensure that digestion reaches a steady state in terms of pH levels etc. Once steady state is reached it is maintained through the careful blending of waste inputs. Glycerine will also be added to give a boost to the microbes when necessary, akin to inducing a 'sugar rush'.

As the biogas is released it will be captured within the headspace of the primary and secondary digestion tanks. The gas will be kept at a low pressure by an inner moving membrane roof (situated beneath a fixed outer membrane roof) that fills and empties as methane levels rise and fall. Pressure within the tanks will be equalised by means of interconnecting pipe work and pressure valves. Approximately 60% of the overall biogas yield is extracted from the primary digestion tanks. A second stage of digestion serves to optimise biogas yields, where approximately 30% of the biogas is extracted.

Biogas is naturally high in sulphides. Sulphides can be a problem for gas engines and a number of physical and chemical reduction measures will be employed within the digestion tanks to convert it to a solid state so that it can be isolated.

The liquid waste will begin to stabilise, and microbial activity will decline. Only a small quantum of biogas will be yielded from this point on and the remaining liquid resembles the end digestate. The digestate will be pumped from the secondary tank to a bank of pasteurisation tanks, these are small tanks located within the reception hall. The digestate is heated to over 70 degrees C for a minimum of 1hr. Pasteurisation kills off any pathogens that may have been present in the incoming food waste, ensuring compliance with the Animal By-Product Regulations (ABPR).

The pasteurised digestate will then be pumped into one of two settling tanks before being pumped to one of four storage tanks where it will await dispatch. All of the tanks will be sealed to prevent localised escapes of odour and ensure that any residual biogas is captured.

The digestate will be nutrient rich and can be applied to agricultural land as a soil improver – in much the same way as compost. The digestate will be dispatched off-site by sealed tanker during the spreading windows in Spring and Autumn. Whilst loading, air from within a mobile tanker will need to be vented. The vented air has the potential to be odourous, so the whole dispatch operation will take place within a dedicated enclosed digestate off-take building. During loading air will continually be drawn from the headspace to create a slight negative pressure within the building. Extracted air will be released to atmosphere via the aqueous scrubber and bio-filter. The dispatch area will be profiled with a collection drain, so that in the event of a spill, digestate is contained.

The biogas extracted from the head space of the primary, secondary and storage tanks will be directed to the three onsite CHP gas engines. The CHP gas engines have been carefully sized to operate at optimum efficiency. Each engine will be housed within an insulated container, providing a high degree of noise attenuation. CHP gas engines are very reliable however service agreements will be in place to minimise downtime. Redundant capacity will be allowed for in specifying the engines to ensure use of the emergency flare is minimised. The CHP gas engines will therefore have an installed capacity of circa 3MWe. Electricity (including an allowance for redundant capacity) will be used to power the lighting, motors, pumps, fans and fixed plant within the AD facility with the remainder exported to the local electricity distribution grid. Heat recovered from the exhaust cooling jackets of the gas engines is used to provide low grade heat to the primary digester tanks and to the pasteuriser (as described above).

The CHP gas engines will exhaust to atmosphere via a single 26m high multi-core stack.

5.3.4 What is Advanced Thermal Conversion?

Advanced Thermal Conversion covers a multitude of technologies, the majority of which employ pyrolysis and / or gasification processes. Pyrolysis and gasification processes are not new. They have been used for centuries, with early applications including the manufacture of charcoal and in coal gas street lighting. The same basic processes are used in a wide variety of industries today.