



National Operational Guidance



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Contents

Waste-to-energy facilities 3



Waste-to-energy facilities

Information

The nature of these technologies means that they will be large industrial-size complexes with on-site personnel who will be able to offer advice and guidance should access to the site be required to attend an operational incident.

Also refer to anaerobic digestion and biogas, another type of waste-to-energy process.

Incinerator

Incinerators combust a wide a variety of waste materials to produce heat and electricity. These are typically large-scale facilities with grid-scale connections.

Such sites have sophisticated municipal waste systems, working with the local authority to collect, sort and deliver material to the incinerator sites. Different sites may be designed to combust alternative forms of waste, which has implications for the design of the combustion equipment and processes required for cleaning the resulting gas emissions.

Waste collection vehicles discharge the waste into bunkers, where it is mechanically mixed to encourage an even burn in the furnace. Water sprays and induction fans may also be used to reduce the levels of dust and odour from the waste. From the bunker, a crane or automated feed system is used to load a hopper, which feeds the waste into the furnace in a controlled manner.

In the incinerator furnace, waste is first dried and then combusted producing high temperatures of around 1000°C, a 'hot flue gas'. This heat is transferred to a boiler, where water is turned to steam to drive a turbine for electricity generation.

Waste-to-energy sites must also meet strict emission criteria; as such, the flue gas goes through an extensive chemical cleaning system. This includes passing the smoke through lime scrubbers to neutralise acids, and through carbon scrubbers to remove dioxins and heavy metals. The gas then passes through a fine fabric filter to capture any remaining particles before being released through a chimney. Collected particles from the fabric filter are stored in a silo before going to a special waste disposal.

A by-product, called 'incinerator bottom ash' (IBA), is processed and recycled for use in construction, once all ferrous metals have been removed.

Gasification and pyrolysis

Gasification and pyrolysis turns biomass and residual waste into an energy resource by heating them to a high temperature in the presence of little or no oxygen. This produces a synthesis gas (syngas), which can be cleaned and upgraded to biomethane.

Sites may be designed to use different feedstocks from refuse-derived fuel, municipal waste or waste wood. The nature of the feedstock will have a bearing on the design of the site and associated fire risks.

In a typical process, the waste is loaded into an automated feeding system, which delivers the waste into a gasification or pyrolysis chamber in a controlled manner.

The waste is heated to high temperatures in the chamber, with little or no oxygen present, to cause thermochemical decomposition. The temperature required depends on the feedstock used; however, gasification can require temperatures in excess of 700°C.

The syngas released is predominantly made up of carbon monoxide, hydrogen and carbon dioxide. These gases are transferred to a processing site and taken through multiple refining stages to separate and clean the gas, producing a number of by-products. This process also includes upgrading the syngas to biomethane.

It is possible that the syngas from the gasification or pyrolysis process will be compressed and stored before further refining.

Some products from the syngas include:

- Biomethane - the primary product for gasification or pyrolysis processes, as it can be used to generate electricity in a generator, injected into the national gas grid or compressed and transported for use as a gaseous transport fuel
- Pure hydrogen - collected for use as vehicle fuel or in fuel cells for electric power
- Carbon dioxide - removed from the syngas and used for industrial processes
- Heat given off from the process, which may be connected to a heat network

A secondary by-product of the gasification and pyrolysis stage is char, a solid waste product that may be stored on site. Char can be recovered from the residue and used as a fuel, or the residue passed to a gasifier and the char gasified.

Hazards (for further information refer to National Operational Guidance: Utilities and fuel)

- Hazards consistent with working at any large commercial processing site

References and further reading

www.r-e-a.net/renewable-technologies/energy-from-waste



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<http://www.recycleforwales.org.uk/sites/files/recyclenow/9.2.3%20EfW%20Process%20Diagram%20-%20English.pdf>