WASTE TO ENERGY

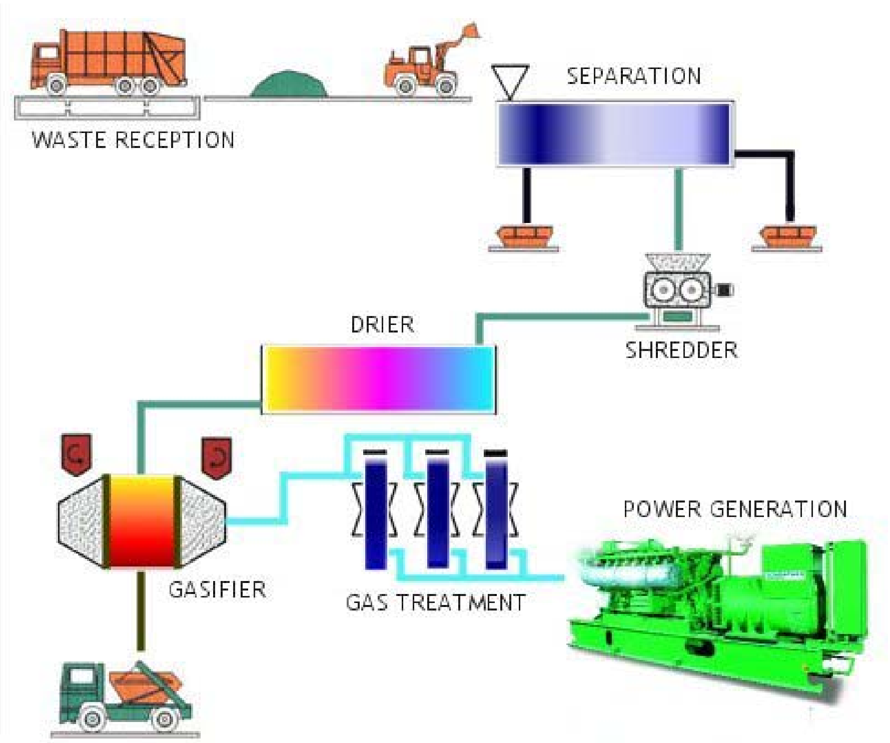
Municipal Solid Waste to electricty through gasification

The system offered here for the commercial implementation of a waste-to-energy strategy is based upon the following process stages:

- Waste sorting
- Waste pre-treatment
- Gasification
- Gas treatment
- Energy generation

Waste is taken in at the reception centre and rough-sorted with a front-end loader. Large objects are removed for disposal separately. The remainder of the waste passes to a sorting facility, the extent of which is very much a site-specific design decision. The feedstock waste for the gasifier is then shredded and dried, ready for loading into the gasifier. Dust and tars are removed as part of the system design, prior to the passage of syngas to an internal combustion engine.

The process is kept deliberately simple in order to ensure its viability.



ISO 9001 REGISTERED FIRM

DATA SHEET ODSR03

KEY FEATURES

FROM THE RECEPTION HALL TO ELECTRICITY - A TURNKEY SOLUTION

REDUCE FEEDSTOCK WASTE TO FIFTEEN PERCENT OF THE FEEDSTOCK VOLUME

ENSURE INTERT WASTE ONLY PASSES TO LANDFILL

CONVERTS A LIABILITY INTO AN ASSET

SIMPLE AND RELIBALE

WASTE MANAGEMENT

The management of domestic waste streams is currently undergoing fundamental change in many countries around the world.

Amongst one of the prime options for consideration is that of recovering energy from municipal solid waste at the point of receipt, prior to disposal, whilst at the same time reducing waste stream volumes.

Technologies that can achieve these objectives include recycling followed by anaerobic digestion, direct combustion, pyrolysis or gasification. The process presented in this datasheet addresses the opportunity afforded by the use of gasification.

In the design of this system, particular emphasis has been given to factors relating to its application, such as waste composition and emissions. The economics of gasification demonstrate that, where the technical issues relating to its application have been effectively addressed, it is a viable and attractive option.

The Organics gasification system ihas been designed with a view to the mimimum of complexity. This approach means that systems are robust and can be operated without a need for highly-skilled technicians.

It also means that the economics come closer to the goal of using waste as a resource for renewable energy production.

GASIFICATION

Gasification is the process of converting biomass into combustible gases (carbon monoxide, methane and hydrogen) that ideally contain all the energy originally present in the biomass feedstock. In practice energy conversion efficiencies lie between 60% and 90%, subject primarily to the feedtsock moisture content.

Gasification is achieved by thermally degrading organic materials in the absence of adequate air to support full combustion.

Gasification of organic materials is not a new subject. It was widely employed during the Second World War with around one million gasifiers used to operate cars, trucks, boats, trains and electricity generators in Europe. Following the end of hostilities, work on gasification ended and a great deal of the know-how involved was lost.

The possibility of using gasification for organic waste disposal is an application that has arisen as a result of both public pressures for environmental improvement coupled with a wish to derive commercial benefit from the energy content of such wastes. The use of incineration technology achieves the same objectives of energy recovery and volume reduction, but without the same inherently benign impact upon the environment.

Emissions from the Organics systems equate to those from an internal combustion engine.

Operational parameters based upon 100 dry tonnes per day of varied organic waste:

Moisture content after drying: 20%

Ash content: 14% of dry fuel = 57 kg/hour

Calorific value: 12 MJ/kg after drying

Fuel gas produced: 2.42 kg gas/kg fuel after drying

Fuel gas density: 1.137 kg/Nm3

Fuel Lower Calorific Value: 4.39 MJ/Nm3 (assuming air feed to gasifier)

Thermal energy production: 10.81 MW

Thermal efficiency: 78%

Power production: 3.5 MWe

IMPORTANT PARAMETERS

In order for gasification to proceed correctly there are a number of parameters that need to be maintained within certain limits. These include:

- Particle size distribution
- Moisture content
- Feedstock composition

Particle size distribution is important to ensure that the flow of matter through the gasifier is uniform and blockage does not occur through agglomeration. It is also necessary to ensure that particle size is not such that heat transfer to the full mass of the feedstock is prevented. The ideal situation is to have a high surface area and a low mass. As the particles get smaller, however, problems of dust formation and pass-out from the gasifier can occur.

As moisture content increases the thermal efficiency of conversion decreases. There comes a point at which the amount of heat required for drying becomes excessive and this provides an upper limit to acceptable moisture contents for gasification systems. In practice it is desirable for the moisture content to be between 10% and 20%. Moisture is actually involved in the biomass conversion process, providing the hydrogen molecules for hydrogen gas formation. The koisture content of very dry feeds may have to be increased with the injection of steam. With municipal solid waste typically having moisture contents of approximately 50% it is ususally necessary for some drying to occur.

Feedstock composition affects the make-up of the product gas and the amount and type of ash that will result. Uniform feedstock composition is preferable,although rarely achieveable in municipal solid waste systems, as this ensures that product gas composition will remain stable and provide less difficulty for subsequent usage technologies, such as combustion within an internal combustion engine.

ISSUES RELATED TO MSW FEED

A typical municipal solid waste feed will arrive at site mixed with a large percentage of non-combustible components. These will either need to be removed or passed though the gasifier. A front-end separation process, therefore, allowing recovery of recyclables is advantageous to the whole process. This allows recovery of materials of value as well as facilitates the removal of materials that will lead to difficulties within the gasifier.

One of the major difficulties in any specific system will be associated with the variability of the feedstock. Unless there is some form of pre-sorting of waste streams, the waste types will vary significantly in organic make-up. This, in turn, will lead to operational difficulties related to moisture content stability and product gas calorific value variations.

Whilst front-end buffering and mixing of the waste feed, as well as final product gas blending, may be employed to stabilise the system performance such problems are not readily assimilated by commonly available techniques. Buffering and mixing will increase operational costs as well as requiring additional operator intervention, neither of which assist with the optimal performance of the technology.

Drying of the municipal solid waste does not present a major problem as product or engine exhaust gases may be employed to dry waste in a suitably designed drier.

In general, the major problem associated with municipal solid waste as a feed to a gasification process is the variability of composition. This must be addressed, by one means or another, to produce a reliable and stable operating system.

With the Organics system the feed-stock undergoes minimal pre-sorting and separation. The exit gases are treated in a proprietary patented gas management system that ensures calorific value varitions are minimal.

ADVANTAGES

- Immediate conversion of biomass waste to energy
- Waste reduction to ash for landfilling
- Maximises existing landfill capacity
- Conversion of a waste-stream liability into a resource
- Integrated management options to combined wet wastes and dry wastes into a single energy park
- The absence of excess air in the thermal reduction process prevents the formation of harmful pollutant gases
- Can be located close to the source of waste, thus reducing transport distances and costs
- Plant configuration allows a wide range of waste types to be passed through the thermal reactor
- Gas management system ensures smooth operation of energy generation plant

WASTE TO ENERGY

The are many types of organic waste stream produced by both industry and society in general. Such waste is at present a public liability, causing difficulties for transfer, handling and long-term disposal.

The major repository for organic waste is presently the landfill site, although society at large is moving inexorably to minimise the use of this technology.

Such waste may be broadly categorised as both dry and wet waste. Where moisture content is high the energy required to dry the waste may be excessive. In such cases the use of gasification would be inappropriate. Organics offers anaerobic digestion systems for wet wastes. (See datasheet ODSR02)

Dry waste may be fed to a gasifier after a minimal amount of processing. Such waste will need to be classified, shredded and, where necessary, dried to an appropriate moisture content.

The Organics gasification system is designed to accept a broad range of organic waste consistencies. This is an essential pre-requisite for systems designed to gasify Municipal Solid Waste.

Disposal by means of gasification will convert waste to energy and reduce disposal requirements.

ADVANTAGES OF GASIFICATION

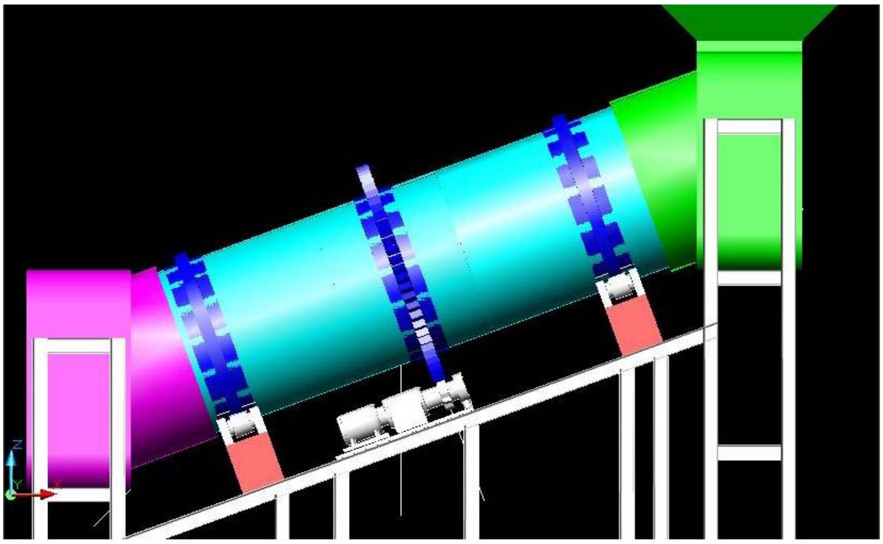
Gasifiers have a number of advantages for use in advanced biomass power systems, including reduced emissions, increased efficiencies, and flexibility for use with a variety of biomass feedstocks.

Emissions from advanced power systems, such as gas engines, gas turbines and fuel cells, are extremely low compared with conventional power systems.

Furthermore, these systems can achieve high efficiencies. Replacing less efficient conventional boilers with advanced biomass gasifiers or gas turbines can increase the amount of electricity produced from biomass by 50% or more.

Gasification can take advantage of biomass feedstocks unsuitable for direct burning. When biomass fuels are burned in conventional boilers, the inorganic materials that do not burn, stick to boiler walls and reduce efficiency. Many fast-growing, desirable energy crops and residues have high proportions of these inorganic compounds. Inorganic compounds are removed during gasification as part of the cleanup process. The filtered by-products may then recycle back to croplands.

For further information on the possible use of this technology please contact your nearest Organics office.



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