Biogas is a mixture of different gases, mainly methane (CH₄) and carbon dioxide (CO₂), produced by the breakdown of organic matter in the absence of oxygen (anaerobic digestion). Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste.

Anaerobic Digestion is a series of biological processes of decomposition of organic matter in which microorganisms break down biodegradable material in the absence of oxygen. The process of biogas formation is a result of linked process steps, in which the initial material is continuously broken down into smaller units. Specific groups of microorganisms are involved in each individual step. These organisms successively decompose the products of the previous steps.

High-Solids-Stackable Digestion Systems
Materials are placed in tunnels using front-end loaders and closed by a gas-tight door. Percolating effluent water is recirculated to spray nozzles above the waste. Typical digestion time is 14+30 days. Process may be thermophilic or mesophilic, single or double stage. Biogas is collected directly from the tunnel. Biogas is being used as fuel in a combined heat and power unit, generating electricity by burning the gas and heat from engine’s cooling water. Tunnels built from materials other than concrete, are less expensive and may be cost-effective at capacities as low as 10,000 Tpy. This process is appropriate for commercial and residential food wastes.

**Advantages**

- Can process waste with contaminants (e.g., plastic, metals, and rocks)
- Handles wastes in a liquid or slurry condition upon arrival
- Produces few effluent
- More energy-efficient than wet type
- Entirely contained system (high odour control)
- Up to 250Nm³ of biogas from 1 ton of source sorted MSW
- 100 Ton/day of waste will produce a net electrical output of 1,6 MWe
PROCESS DESCRIPTION
1. Mechanical pretreatment

Waste Reception includes weighing, registration and checking (possible sampling and laboratory analysis if necessary) of received feedstock.

Pre-treatment varies according to the feedstock characteristics, it usually involves the removal of material which cannot be processed, primary crushing, with bag opener functions, primary screening, secondary screening, elimination of metal products.
2. Anaerobic fermentation digesters

Treatment of biogenic water-soluble material on a solid substrate in bio-tunnels. The control of the anaerobic digestion is realized by means of the intensive recirculation of leachate in bio-tunnels through the solid mass to be treated, combining, in a single system, the advantages of the liquid and of the dry processes.
3. Leachate collecting and gasholder

The production of biogas takes place both in bio-tunnel and in the storage tanks of the leachate; the percentage of biogas production can be estimated around 60% in bio-tunnels and about 40% in storage tanks on total produced volume.

Flare

Flare with open type burner for biogas combustion
4. Scrubber & Biofilter

The total flow of air sucked is sent to the treatment in the scrubber and bio-filter.
5. Cogeneration unit

The co-generation unit consists of a biogas powered reciprocated Otto engine with turbocharger, coupled to a synchronous alternator fixed to anti-vibration platform and complete with electrical control system and automatic adjustment of the internal combustion for the emissions control.

The cogeneration unit produce combined thermal and electrical energy. Parts of these are devoted for the auto-consumption of the biological plant. The electric energy produced, usually is fed into the grid to be sold, but in alternative case is possible to talk about “self-consumption” while it is reabsorbed to be used into production processes.

This situation usually occurs into the main energy consuming industries, as alimentary industries, which also have a lot of productions scraps.

The thermal energy produced in excess could be re-used for cooling, produced through absorbing systems (chillers), taking place by this way to the “tri-generation” alias CCHP – Combined Cooling Heating and Power.

So shortly is a system able to produce three different kind of energy (electrical – thermal – cooling). For the production of electrical energy from cogeneration of biogas, there are some feed in tariffs which establish a determinate guaranteed price for the produced energy fed into grid. Furthermore there are some capital contribution loans of government banks’ financing.