Landfill

Modern landfills are lined and managed to prevent the escape of undesirable materials, such as wind-blown debris, liquid leachate and landfill gas. Landfills can be used for disposal of any non-hazardous material. Gas generated at most landfills is collected and used to produce electricity.

Direct Combustion

Direct combustion is burning the garbage to generate heat. The heat that is generated, usually between 1,500 and 3,000 degrees Fahrenheit, is used to boil water, which generates steam. The steam is used to drive turbine generators that produce electricity. In addition, the steam can also be used for heating local or nearby buildings or providing steam energy to an industrial process.

Gasification

Gasification is a process that cooks garbage that is first extensively processed. Garbage is screened, sorted, ground up and mixed to make a uniform feedstock. Often, non-burnable items (glass, metal, etc.) are removed during this pre-processing operation because they reduce the heat potential of the feedstock. The cooking process takes place at temperatures above 1,800 degrees Fahrenheit, with controlled amounts of oxygen to prevent combustion. Without true combustion, a gas is produced containing mostly carbon monoxide, hydrogen, and methane, which can be further "cleaned" or "scrubbed" to a suitable grade for use in an engine to generate electricity or as a feedstock to produce chemicals.

Plasma Arc Gasification

In Plasma arc gasification garbage (after extensive processing) is heated to about 4,500 degrees Fahrenheit and then exposed to a very-high-temperature (5,000 to 12,000 degrees Fahrenheit) electric arc that is generated between carbon electrodes. This process breaks the garbage down into simpler compounds forming a mixture of gases and a liquid slag. The gases can be processed/purified for uses in chemical manufacturing or could be used on site to generate steam or electricity. The slag could be used for daily cover and aggregate at a landfill.

Pyrolysis

Pyrolysis is a process whereby material such as wood, carpet, and plastic are converted to gases, liquids, and solid fuels (e.g. charcoal from wood) under high temperatures (700° to 1500°F) and pressure, with no (or nearly no) oxygen. Pyrolysis is similar to the Gasification process, but requires even more preprocessing to separate out specific materials, such as film plastics, and then create a uniformly sized and mixed feedstock from that separated material. This process does not work with a mixture of varying materials such as is found in garbage.

Aerobic Composting

Aerobic composting is generally an open-air operation where green material (yard debris, wood and food waste) is placed in elongated piles called windrows that are kept aerated by physically turning the piles with a machine or by ensuring that air flows through the piles. Generally, within 30-60 days the green material breaks down, leaving a rich soil amendment that can be used in farms and gardens. Composted garbage could not be used as soil amendment, it would likely be sent to a landfill.

Anaerobic Digestion (AD)

Anaerobic Digestion (AD) is a series of processes in which bacteria act to break down biodegradable material in the absence of oxygen to produce a biogas (primarily methane and carbon dioxide). The biogas can be cleaned for use in a direct combustion engine to produce electricity, cleaned and compressed for vehicle fuel or cleaned for sale into a local natural gas pipeline.

Dry systems, often referred to as Dry Fermentation, have a higher tolerance for contamination and do not require pre-processing of the feedstock. Instead, garbage is piled in closed "bunkers" (sealed air tight) and sprinkled with bacteria-rich liquid to initiate digestion, which will produce a methane rich gas. The gas used in an engine to produce electricity. After digestion the garbage is typically sent to landfill due to contamination. (The entire process takes about 30 days at the ZWED facility in San Jose.)

Mechanical Biological Treatment (MBT)
Mechanical Biological Treatment (MBT) is a type of process that combines a sorting facility (e.g. Advanced Materials Recovery described below) with composting or anaerobic digestion. Typical products of this process are electricity generation and landfill.

Hydrolysis
The Hydrolysis process involves the reaction of water and fiber-based substances (e.g., paper, yard waste, etc.) in garbage with a strong acid (e.g., sulfuric acid) to produce sugars. These sugars are fermented to produce an alcohol that is then distilled to produce a liquid fuel.

Catalytic and Thermal Depolymerization
Depolymerization targets plastics, waste oils, grease, fats and animal parts and converts them into a crude oil-like substance, which can be further processed into fuels such as gasoline or diesel. There are two depolymerization methods, thermal and catalytic.

- Thermal Depolymerization utilizes relatively high temperatures (1,000° to 1,400° Fairenheit) and pressure to produce crude oil.
- Catalytic Depolymerization uses lower temperatures (500° to 700°F) and pressures but adds a chemical catalyst to aid in the process of breaking down the feedstock into crude. Zeolite, silica-alumina, and bauxite are common types of catalysts used in the process. The plastics, synthetic-fiber components and water in the feedstock react with the catalyst under pressure and heat to produce a crude oil.

Waste-to-Fuel Technology
The generation of liquid fuels from garbage is an evolving technology and reportedly involves the use of a thermal conversion process to generate a synthetic gas ("syngas"), followed by the use of a chemical process to convert the syngas into a fuel.

Autoclave/Steam Classification
Autoclaves are large rotating vessels that have steam injected and are kept at a high temperature and pressure over a 2 to 3 hour period. Autoclaving is classified as a "mechanical" process that is used to separate paper like material from other portions of the garbage to be recovered for further processing for pulp, digestion to fuel, or drying for combustion. The remaining garbage is landfilled

Advanced Materials Recovery
An Advanced Materials Recovery Facility (AMRF) is a specialized plant that receives, separates and prepares materials for marketing to end-user manufacturers. The function of advanced materials recovery is to extract recyclables and reusable materials from garbage and not to process curbside recyclables. The by-product or residual will be what is left after removing what are typically smaller or harder-to-recover pieces of marketable materials. The residual can be used as a feedstock for other processes (thermal, chemical or biological). These types of advanced facilities usually recover about 10 to 25 percent of incoming garbage, depending on the facility design, performance, and the nature of what is being processed.

Refuse Derived Fuel (RDF) Production
An RDF processing system prepares garbage by using shredding, screening, air classifying and other equipment to produce a fuel product for combustion, either on-site or off or for use in another conversion technology that requires a prepared feedstock. RDF consists largely of combustible components of garbage such as plastics, textiles, paper and wood waste. RDF facilities may be developed to supply coal-equivalent fuel for coal burning power plants or other industrial processes.