

Energy from Municipal Waste

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Generation

- Municipal Solid Waste – 40 Million tonnes/Year
- Municipal Liquid Waste – 5000 Milion Cubic mtr/year
- In addition large quantities of solid and liquid waste is generated from industry

Sources

- Solid Waste
 - Domestic
 - Commercial Establishments
 - Roads
 - Markets
- Liquid
 - Domestic drainage
 - Storm water drainage

Advantages of Power generation from MSW

1. Non-Hazardous Waste disposal
2. Provide Local Reliability.
3. Maintain an Economic Resource Portfolio.
4. Ensure Stable Electric Cost and Power Supply.
5. Facilitate Economic Development.
6. Meet Future Supply Needs in a Timely Fashion.

Categorisation – Solid Waste

- Non Combustible – Metals, Glass, porcelain, Debris etc
- Combustibles but not bio degradable – Plastics, Rubber, Synthetic fibres etc
- Biodegradables: Vegetable Market, Domestic, Gardens etc

Present Scenario of Disposal

- Mixed Garbage from cities is collected and dumped in low lying areas in the outskirts .
- Untreated wastewater & industrial waste discharged into rivers, water bodies & wet lands.
- Pollution control norms not strictly followed.

Result : Water, air & land pollution, emission of green house gases.

Recent Measures for Safe Disposal

- MoEF notified MSW management & handling rules 2000 according to which every Municipal Authority is responsible for implementation of any infrastructure development for collection, segregation, transportation & disposal of MSW & were to set up waste processing & disposal facilities by 31st Dec. 2003.
- A manual prepared for safe disposal of the wastes
 - *Enforcement yet to take place*
 - *Compost plants being set up by Municipal Corporations*
- Industries already under compulsion to treat wastes for adhering to acceptable discharge standards
- India ratified Kyoto Protocol for bringing about reduction in GHG emission

Waste to Energy Advantages

- The quantity of waste gets reduced by nearly 60% to over 90%, depending upon the waste composition and the adopted technology
- Demand for land, which is already scarce in cities, for land filling is reduced;
- The cost of transportation of waste to far-away landfill sites also gets reduced; and
- Net reduction in environmental pollution.

Technology Operations

- Land Fills
- Bio Methanation
- Combustion
- Pyrolysis/Gasification

Steps involved

- Segregation of waste at collection points
- Reception and Sorting
- Pre treatment
- Adoption of Process- Anaerobic
Digestion/Combustion/Gasification
- Power Generation systems
- Final products to meet the norms of PCB

Anaerobic Digestion

Biogas

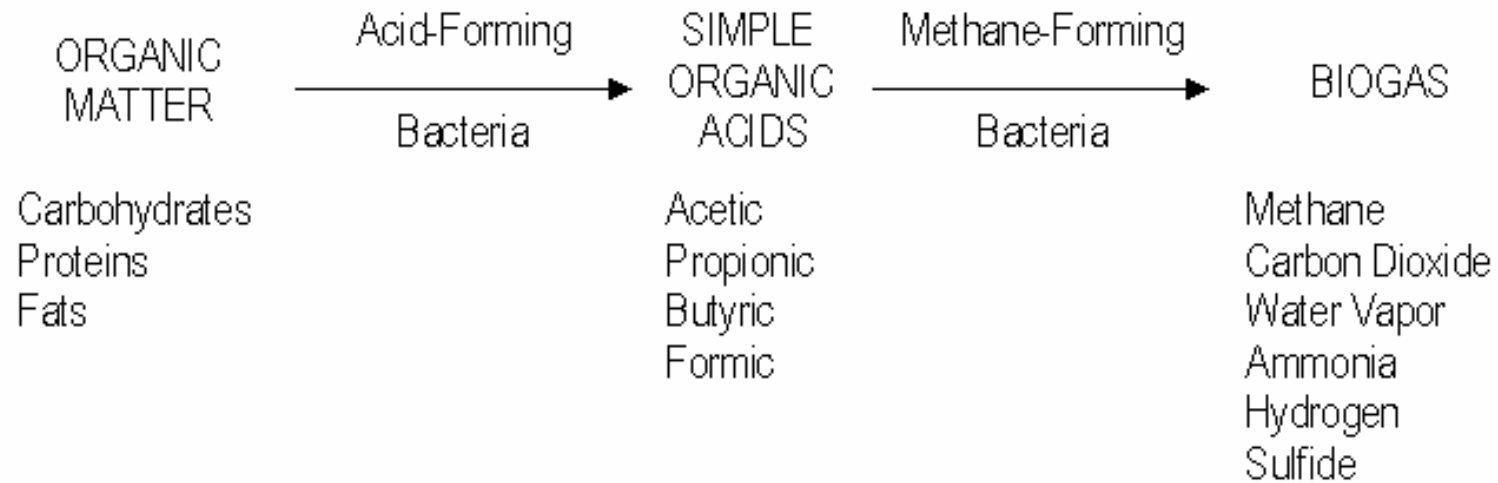
When organic matter decomposes in the absence of oxygen and in the presence of anaerobic organisms at ambient pressure and temperature of 35-70°C, a gas is evolved that is mostly methane (55-65%) and carbon dioxide (30-40%), plus smaller amounts of other constituents like H₂, H₂S & N₂.

Properties :

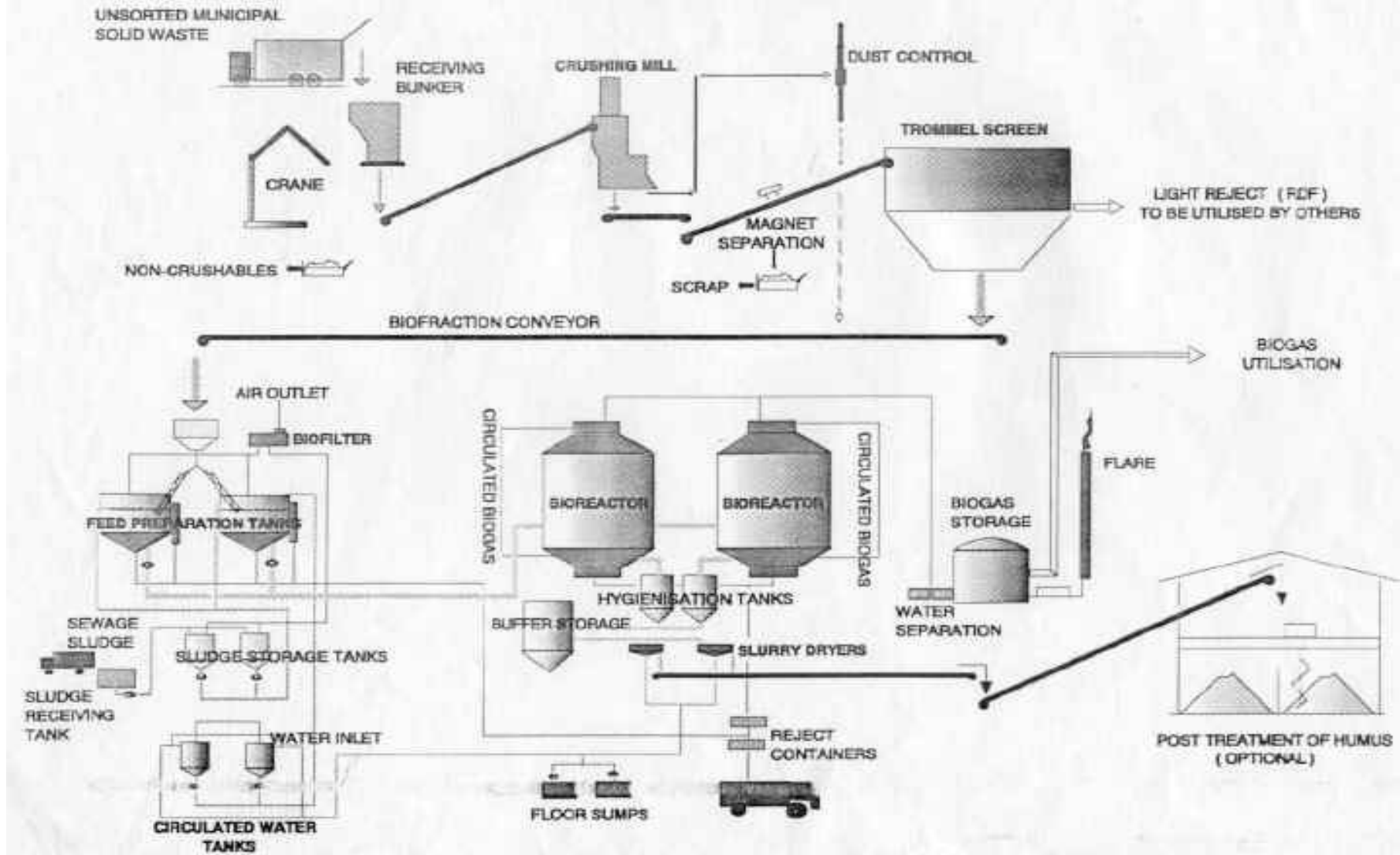
- Clean but Slow burning gas.
- Calorific Value of 5000 – 5500 kcal/Nm³.

Process

Yields methane from controlled breakdown of organic wastes by bacteria in the absence of oxygen.



Schematic Representing Power Generation From MSW



Salient Features

- Whole process takes place in closed vessel - No odour or leakage.
- All disease causing micro organisms are eliminated.
- Quality of humus is very high with 30 - 40% organic matter - Fertiliser
- Anaerobic digestion by this process requires only 15-20 days as
- compared to a minimum of 6 months required for aerobic methods

Gasification Process

Producing electricity from MSW through thermal gasification is accomplished in three stages:

1. **MSW Handling and Processing:** Raw MSW is delivered in garbage trucks, commercial collection bins and by various other means. The material is processed into a form that can be accepted by a gasifier.
2. **Conversion of MSW into a Producer gas :** Processed MSW is heated to high temperatures in a gasifier with no oxygen, or a carefully limited amount of oxygen, to chemically convert it to a Producer gas.
3. **Electric Generation:** The Producer gas is used instead of natural gas to generate electricity.

MSW Handling & Processing

Sorting & recycling : Remove material from the MSW that cannot be burnt/gasified, such as metals, glass and other inert materials.

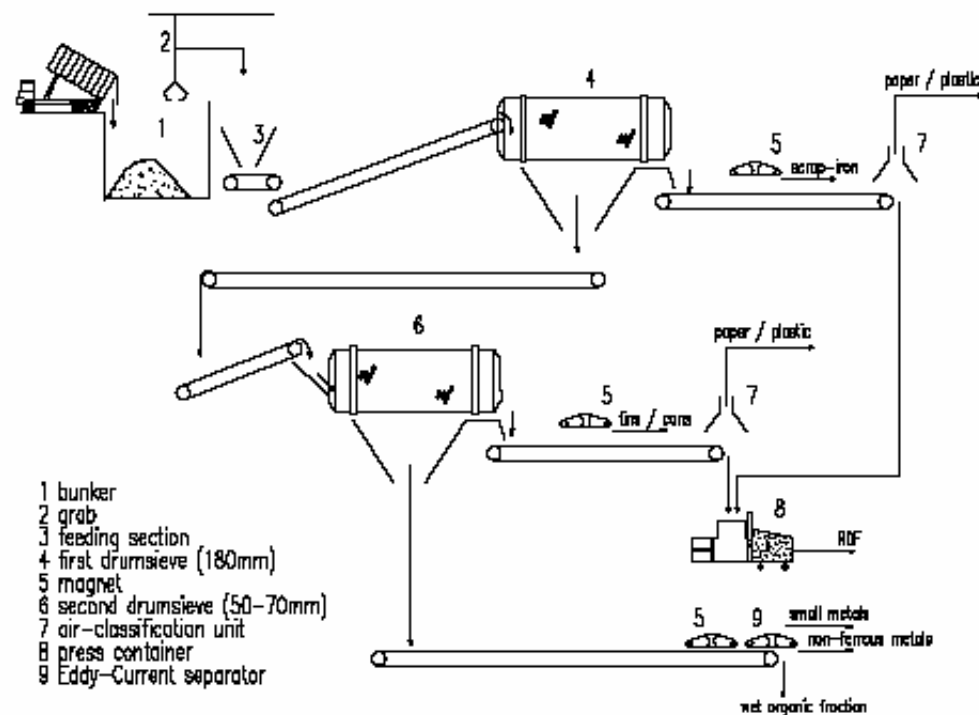
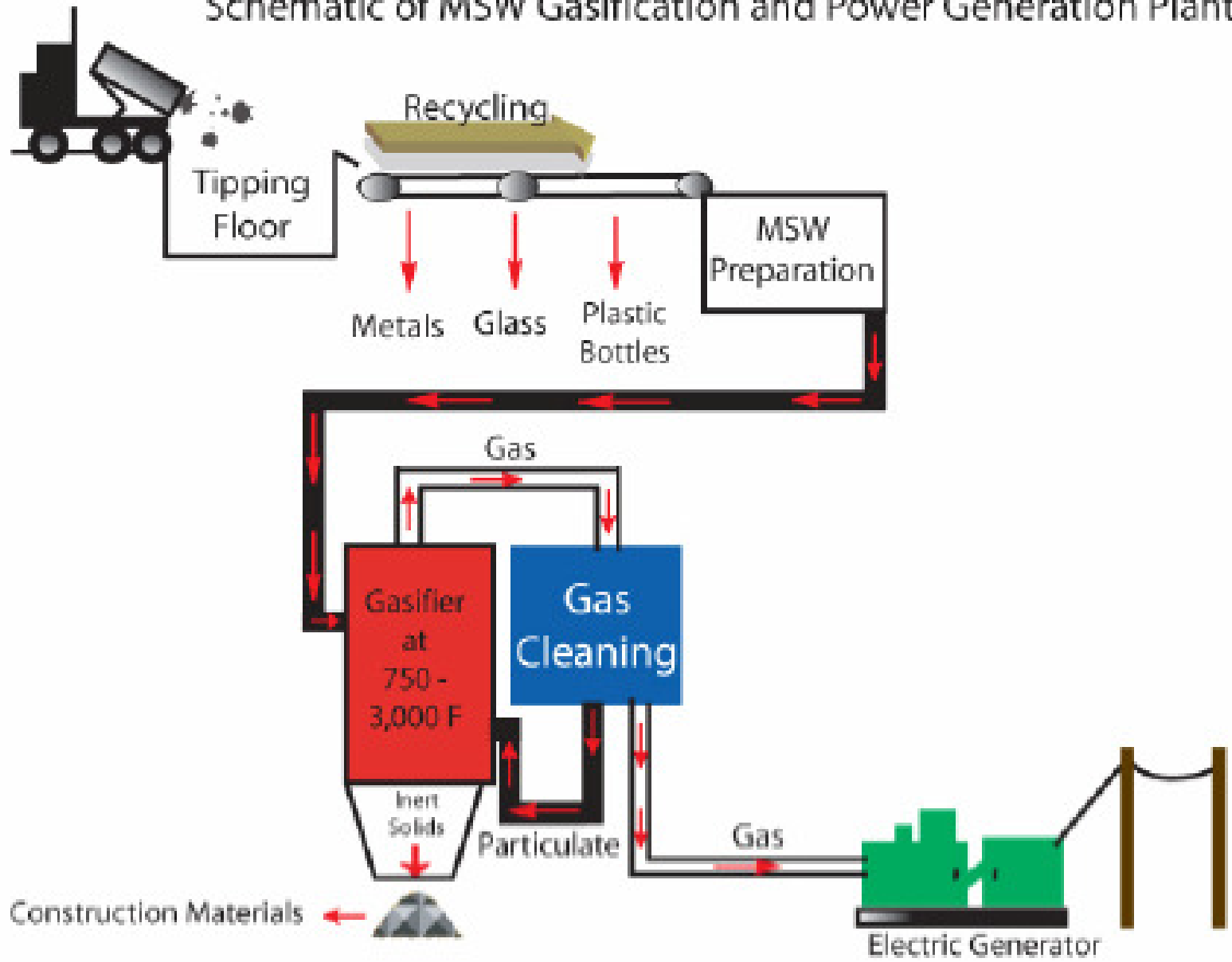


Figure 1. Schematic overview of separation technology.

THE SEPARATION TECHNOLOGY

- The first drum sieve, with sieve openings of 180 mm, a provision is installed for the tearing of plastic bags, so that the contents can be sieved.
- An overhead magnet is used to recover scrap iron from the overflow from this drum.
- The underflow fraction is conveyed to the second drum sieve where the sieve openings is of 50 to 70 mm. The exact size of the openings can to be chosen depending on the local waste composition and the desired separation efficiency.
- An overhead magnet removes ferrous metals from the oversize fraction of the second drum sieve (material between 50-70 mm and 180 mm). This iron fraction mainly consists of tins and cans.
- Underflow from the second drum sieve primarily consist of organic material and inert matter like sand and stones
- Non-ferrous metals, mainly copper and aluminium, are subsequently removed by an Eddy Current separator.
- Overflow from the first and second drum sieve contains a high percentage of paper and light plastics, which can be separated by air classification

Schematic of MSW Gasification and Power Generation Plant



Conversion of MSW into Producer Gas

- There are three methods used for converting MSW into Producer gas: **Pyrolysis, conventional gasification, and plasma gasification.**
- All of these methods use high temperatures and strict control of air or oxygen to drive a controlled chemical conversion of MSW into a Producer gas.
- Pyrolysis typically reaches temperatures between 400 and 900 degrees. It is the process commonly used to make charcoal from wood. Pyrolysis is accomplished in the absence of free oxygen.
- Conventional gasification takes place between 900 and 1400 degrees Fahrenheit. High temperature conventional gasification dissociate virtually all forms of organic compounds, and melt everything that is not organic.
- Plasma gasification involves temperatures of several thousand degrees. The extreme temperatures of plasma gasification insure the most complete conversion of MSW into a synthetic

Electricity Generation From MSW

Cal. Value of MSW = 1500 kCal/kg

Cal. Value sorted & dried of MSW (RDF) = 3550 kCal/kg

Refuse-derived fuel (RDF) typically consists of MSW that is the by-product of a resource recovery operation. recovery operation removes iron materials, glass, grit, and other materials that are not combustible.

Amount of raw MSW required for 1 kW = 1.67 kg/kW

(Assuming 35% Conversion Efficiency)

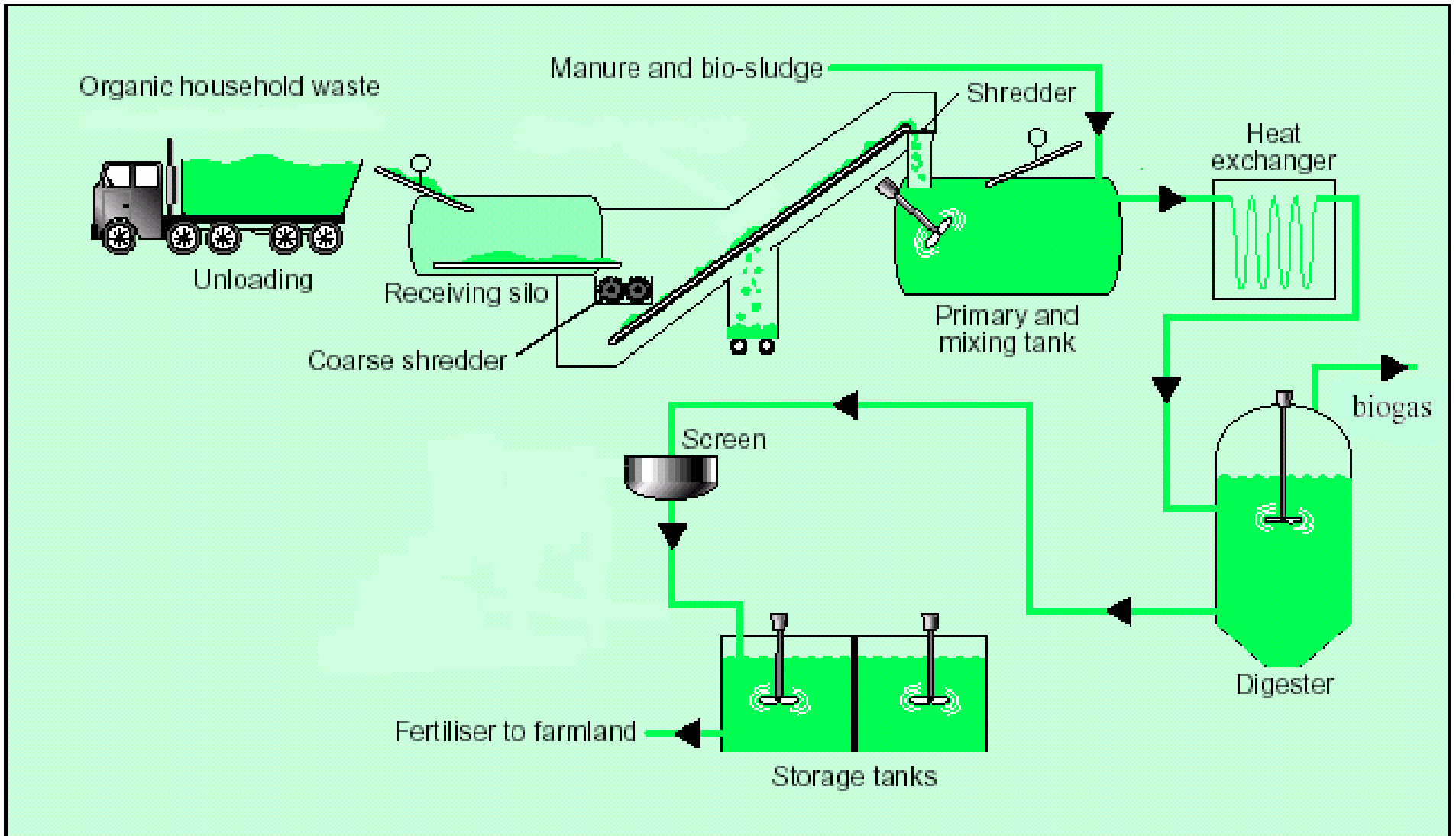
So, Amount of raw MSW required for 1 MW = 1.67 Tons

Biogas From Vegetable Waste

Process Consist of,

- Reception of vegetable waste from market and organic household waste .**
- Mechanical conditioning includes shredding and moisturising the content between 55-65 % and heating the mixture up to 75°C**
- Anaerobic digestion.**
- Power generation.**
- Dewatering of slurry to produce organic fertiliser.**

Schematic Representation of Biogas From Vegetable Waste



Source : Diagram of the process at the Kristianstad biogas plant, CADDET Centre for Renewable Energy, United Kingdom, Technical Brochure No. 118.

THANKS