International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163
Issue 6, Volume 2 (June 2015) www.ijirae.com

Importance of Waste to Energy Conversion

Reshmi Banerjee
Department of Electrical Engineering, Guru Nanak Institute of Technology, WBUT

Abstract – In a growing world, where the conventional forms of energy are fast moving towards extinction as well as are contributing generously to global concerns like the greenhouse effect and global warming, the need to innovate and employ alternate or unconventional energy sources has become crucial for the existence of a future. Waste to energy or energy from waste is the process of generating energy in the form of electricity and/or heat from the waste. Waste to energy is a form of energy recovery. Most waste to energy processes produce electricity and/or heat directly through combustion, or produce a combustible fuel commodity, such as methane, methanol, ethanol or synthetic fuels.

Keywords – ***Combustion, Gasification, Anaerobic digestion, Incineration, Mechanical biological treatment, Thermal depolymerisation, Waste to Energy***

I. INTRODUCTION

A rising quality of life, and high rates of resource consumption patterns have had a unintended and negative impact on the urban environment – generation of wastes far beyond the handling capacities of urban governments and agencies. Cities are now grappling with the problems of high volumes of waste, the costs involved, the disposal technologies and methodologies, and the impact of wastes on the local and global environment.

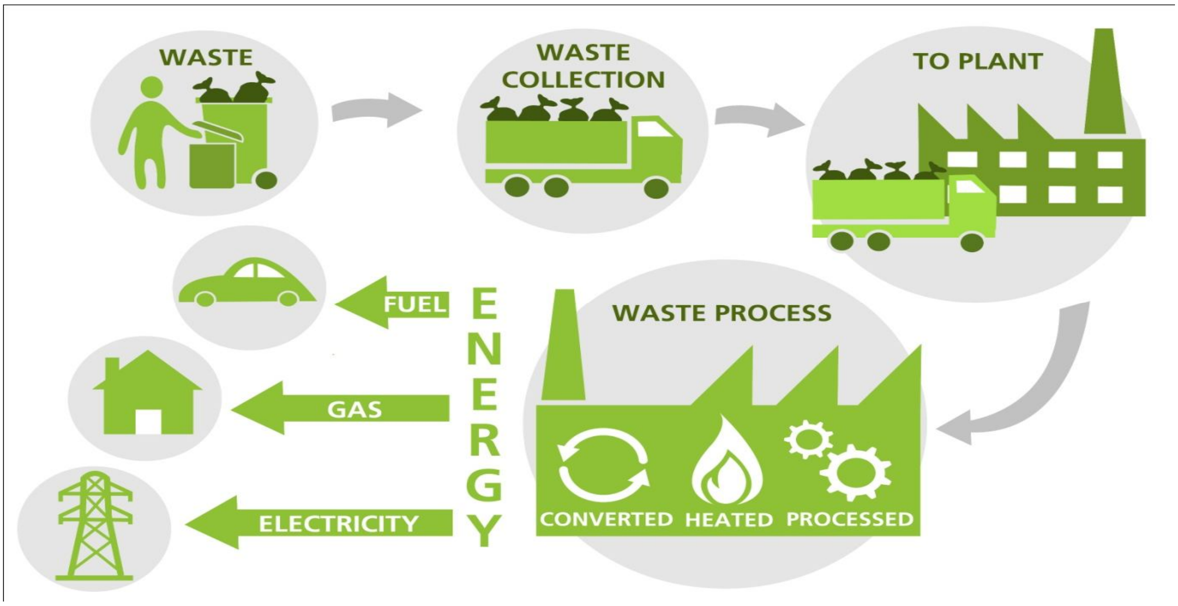

Fig. 1 : Cycle of waste to energy conversion

But these problems have also provided a window of opportunity for cities to find solutions – involving the community and private sector; involving innovative technologies and disposal methods; and involving behaviour changes and awareness raising. There is a clear need for the current approach of waste disposal that is focused on municipalities and uses high energy/high technology, to move more towards waste processing and waste recycling.

Some of the defining criteria for future waste minimization programmes will include deeper community participation, understanding economic benefits/recovery of waste, focusing on life cycles, decentralized administration of waste, minimizing environmental impacts, reconciling investment costs with long term goals.

International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163
Issue 6, Volume 2 (June 2015) www.ijirae.com

II. METHODOLOGY

- Municipal waste is delivered to some facilities and stored in a bunker.

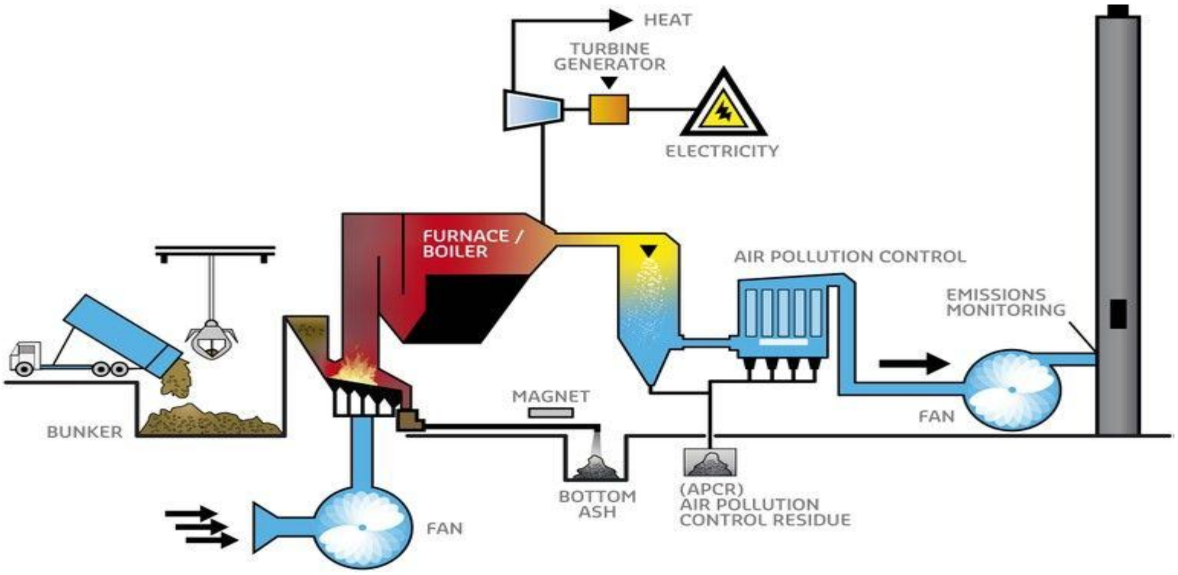

Fig. 2 : Process of producing electricity from waste

- The waste is transferred to a combustion chamber where self-sustaining combustion is maintained at extremely high temperatures.
- The heat from the combustion process boils water.
- The steam from the boiling water is used directly, or more frequently, the steam drives a turbine that generates electricity.

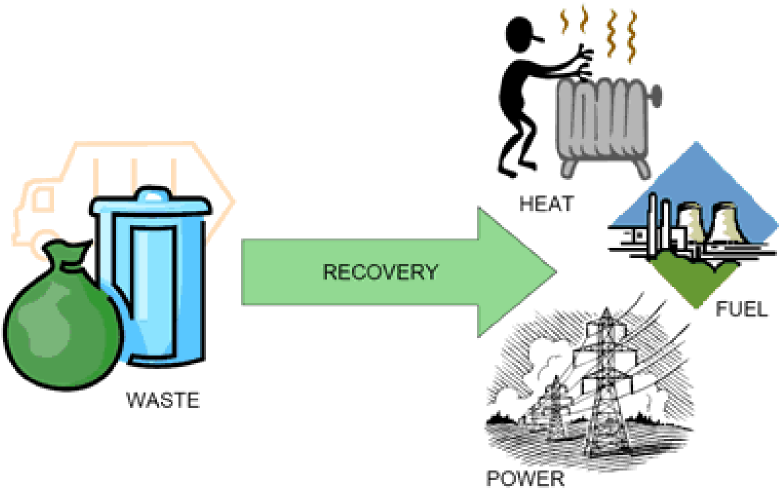

Fig. 3 : Producing heat, fuel and power from waste

- Electricity is distributed to the local grid.
- Ash from combustion is processed to extract metal for recycling. It is then combined with residue from the air pollution control process.

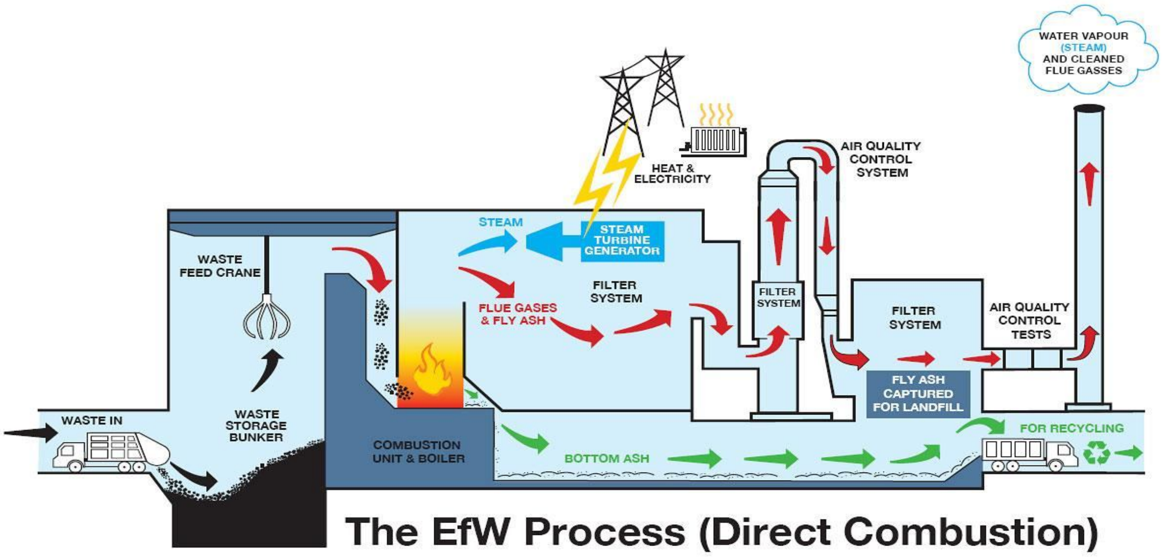

Fig. 4 : Direct combustion process

- The combined ash is either disposed of in a monofill (where only ash is stored) that receives only that waste, used as cover material at a conventional landfill, or landfilled with other waste.
- All gases are collected, filtered and cleaned before being emitted into the atmosphere.
- We can control emissions of particulate matter primarily through a fabric filter.
- We can monitor criteria and other pollutants and operating parameters to ensure compliance with the conditions.

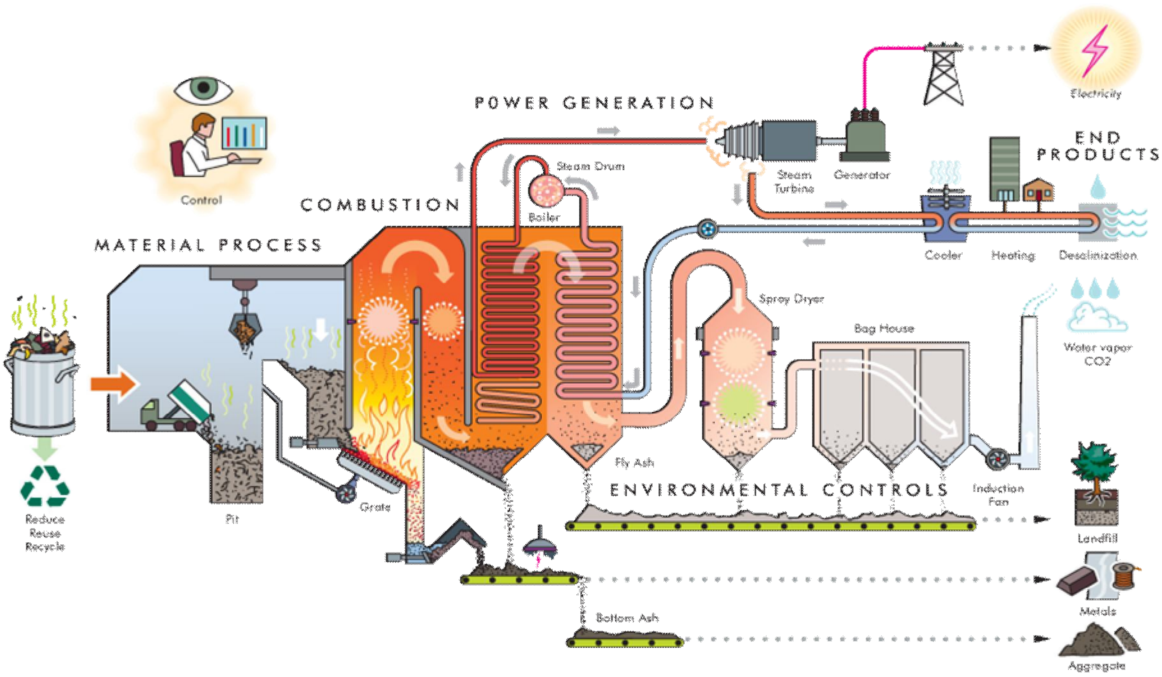

Fig. 5 : End products from reduce, reuse and recycle

- Incineration, the combustion of organic material such as waste with energy recovery, is the most common waste to energy implementation.

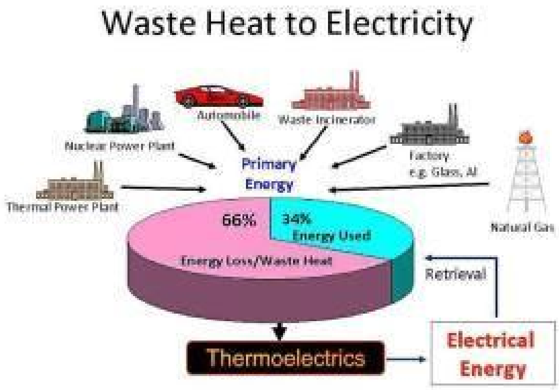

Fig. 6 : Waste heat to electricity

- Incinerators may emit fine particulate, heavy metals, trace dioxin and acid gas, even though these emissions are relatively low from modern incinerators.

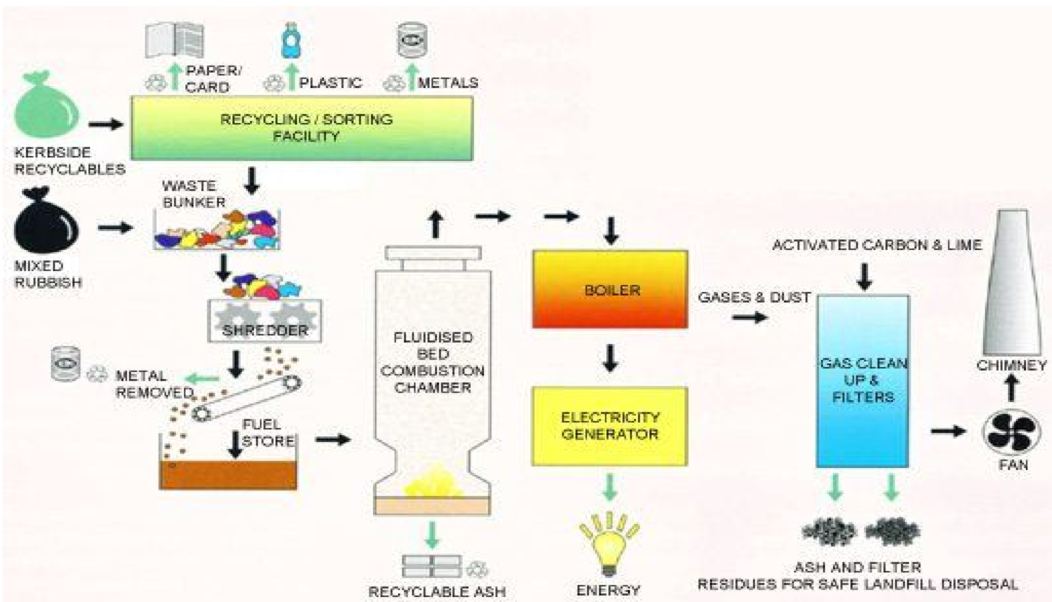

Fig. 7 : Incineration

- Incinerators have electric efficiencies of 14-28%. In order to avoid losing the rest of the energy, it can be used for e.g. district heating (cogeneration). The total efficiencies of cogeneration incinerators are typically higher than 80% (based on the lower heating value of the waste).
- The method of using incineration to convert municipal solid waste to energy is a relatively old method of waste to energy production. Incineration generally entails burning waste to boil water which powers stream generators that make electric energy and heat to be used in homes, businesses, institutions and industries.
- There are a number of other new and emerging technologies that are able to produce energy from waste and other fuels without direct combustion. Many of these technologies have the potential to produce more electric power from

the same amount of fuel than would be possible by direct combustion. This is mainly due to the separation of corrosive components from the converted fuel, thereby allowing higher combustion temperatures in e.g. boilers, gas turbines, internal combustion engines, fuel cells. Some are able to efficiently convert the energy into liquid or gaseous fuels.

- Gasification (produces combustible gas, hydrogen, synthetic fuels).

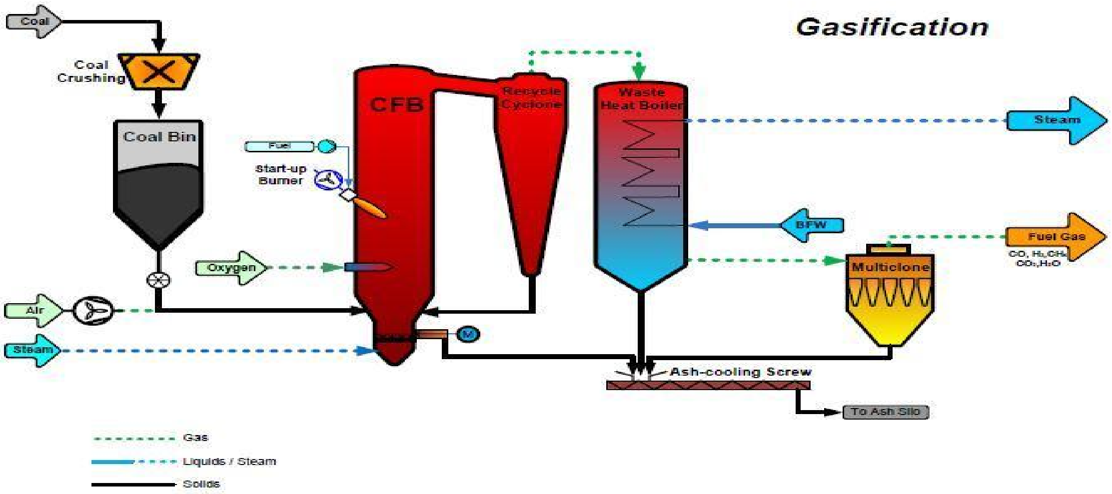

Fig. 8 : Gasification

- Thermal depolymerisation (produces synthetic crude oil, which can be further refined).

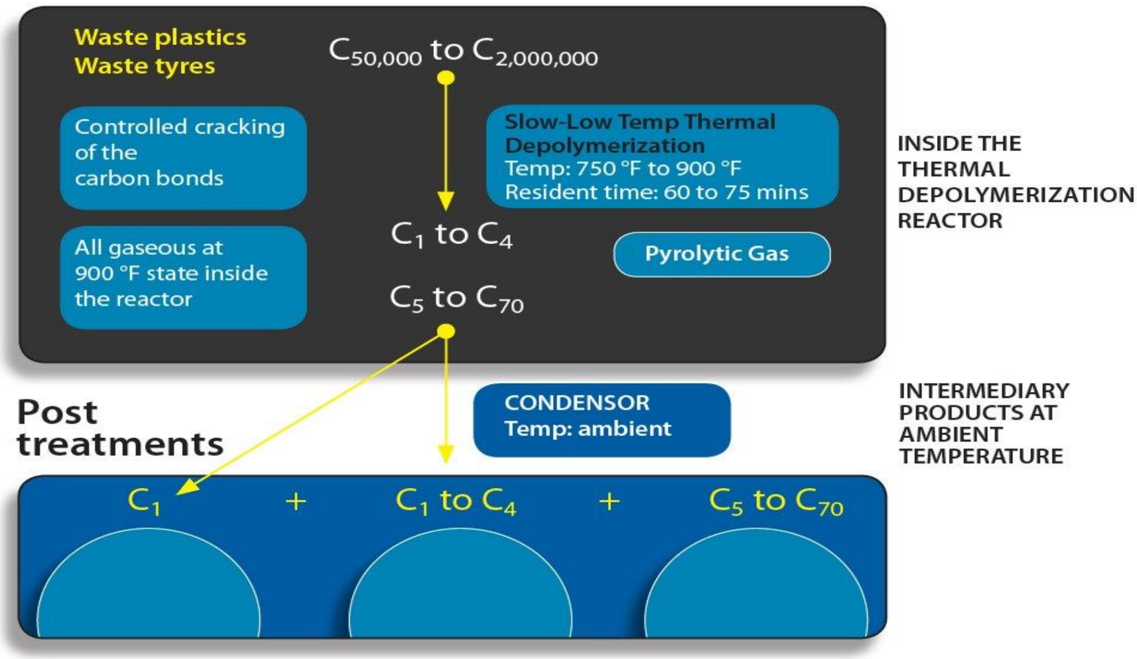

Fig. 9 : Thermal depolymerisation

International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163
Issue 6, Volume 2 (June 2015) www.ijirae.com

Fig. 10 : Different products from waste

- Pyrolysis (produces combustible tar/bio oil and chars).

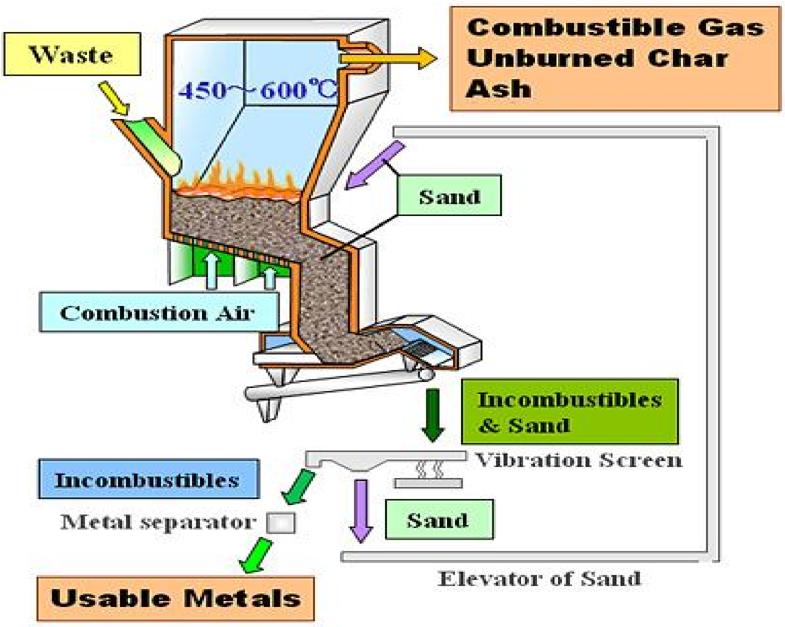

Fig. 11 : Pyrolysis

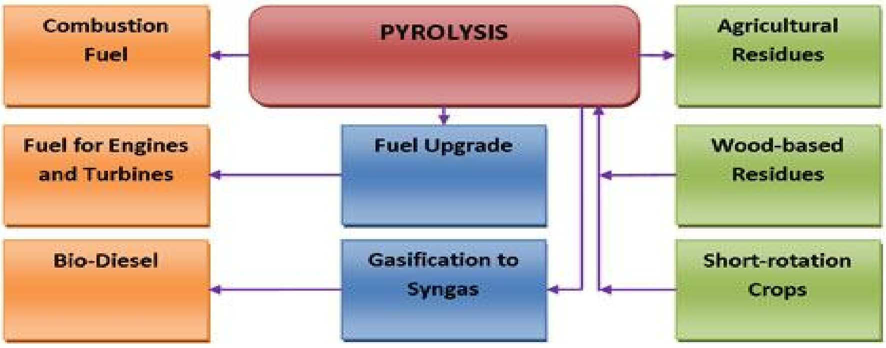

Fig. 12 : Flow chart of pyrolysis process

- Plasma arc gasification or plasma gasification process (produces rich syn gas including hydrogen and carbon monoxide usable for fuel cells or generating electricity to drive the plasma arch, usable vitrified silicate and metal ingots, salt and sulphur).

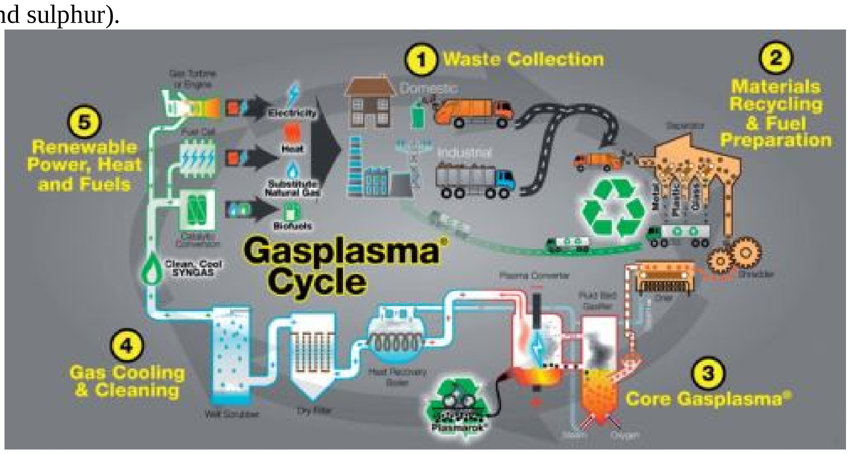

Fig. 13 : Plasma arc gasification

- Anaerobic digestion (biogas rich in methane).

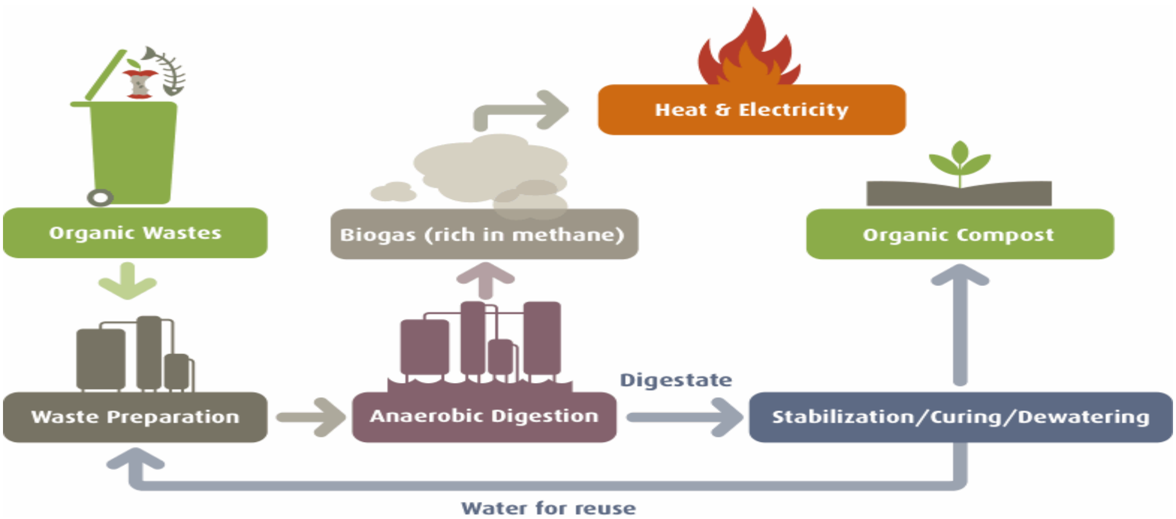

Fig. 14 : Anaerobic digestion

- Fermentation production (examples are ethanol, lactic acid, hydrogen).
- Mechanical biological treatment.

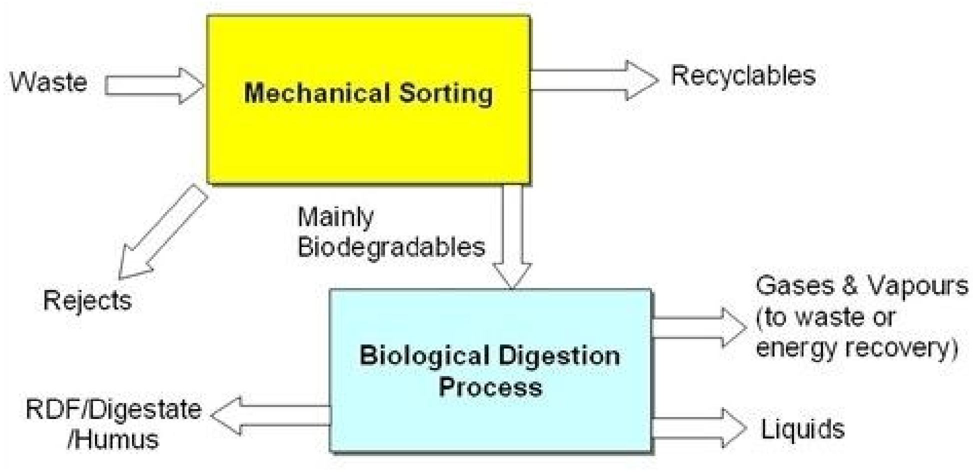

Fig. 15 : Mechanical biological treatment

- Mechanical biological treatment + Anaerobic digestion.
- Mechanical biological treatment to Refuse derived fuel.

III. RESULT

- The majority of waste that would normally go into landfill sites can be reused.
- The fuel is obtainable cheaply.
- There will always be a reliable source of fuel as people will always have waste.
- Current landfill sites can be mined out and the landfill material used as fuel.
- Reduces carbon emissions.
- Environmental impact is minimum than any other form of energy.
- Damage of ecosystem is minimum.

IV. CONCLUSION

There are some disadvantages of waste to energy conversion, i.e. the public are still unconvinced that emissions from waste to energy plants are clean and free from harmful chemicals and waste to energy facilities are expensive to construct. During the 2001-2007 period, the waste to energy capacity increased by about four Waste to Energy Plant.

REFERENCES

[1] Gary C. Young, *Municipal Solid Waste to Energy Conversion Processes: Economic, Technical and Renewable Companies,* Wiley-Blackwell.
[2] Marc J. Rogoff, Francois Screve, *Waste-to-Energy: Technologies and Project Implementation,* William Andrew.
[3] Richard C. Porter, *The Economics of Waste,* Routledge.
[4] Susan Strasser, *Waste and Want : A social history of Trash,* Holt Paperbacks.
[5] M.M.Khan, M.Rafiq Islam, *Zero Waste Engineering,* Wiley.
[6] Paul Connett, *The Zero Waste Solution,* Chelsea Green.
[7] George Tchobanoglous, Frank Kreith, *Handbook of Solid Waste Management,* Mc Graw-Hill Education.
[8] Nicky Scott, Axel Scheffler, *Reduce, Reuse, Recycle,* Green Books.
[9] Clifton Van Guilder, *Hazardous Waste Management An Introduction,* Mercury Learning & Information.

