

Waste-to-Energy (WtE) Technologies



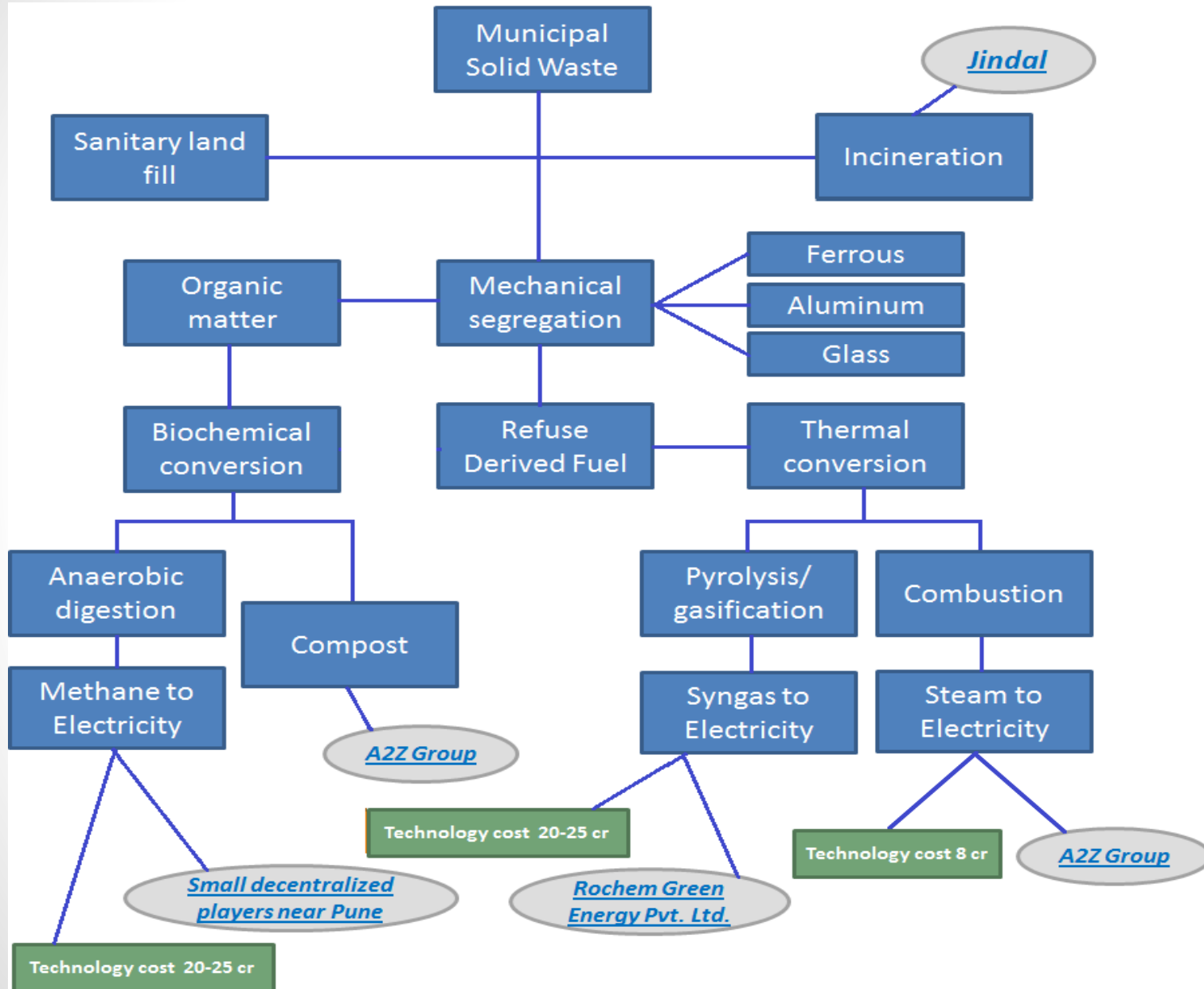
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Preamble

Selection of best available technology (BAT) at a facility depends upon a number of factors such as:

- Nature of waste
- Quantity of waste generated
- Availability of equipment for treatment on site and of site
- Regulation constraints
- Cost considerations

Technology Options



Technology Options

Sr No	Waste Treatment Method	Basic Principle	Desirable range of important waste parameters
1.	A. Combustible B. Compostable E.g. A2Z Group	Segregation of MSW in compostable and RDF part. Fuel preparation with drying and de-stoning of RDF	Moisture < 45% Organic/VM > 40% Inorganic/Combustible < 50%-55% Total inert < 05%-10%
2.	Thermo-chemical conversion	Decomposition of Combustible/ organic matter by action of heat	Moisture < 45% Organic/VM > 40% Fixed Carbon < 15% Total inert < 35% CV (Net) > 1200 Kcal/Kg
	A. Incineration eg Jindal		
	B. Pyrolysis		
	C. Gasification eg Rochem Green Energy Pvt. Ltd.		
3.	Bio-chemical conversion:	Decomposition of organic matter by microbial action	Moisture > 50% Organic/VM > 40% C/N ratio 25-30
	Anaerobic digestion/ Bio-methanation E.g. Decentralized Biomethanization plants near Pune		

Advantages & disadvantages of various technology options

Ser No	Technology	Advantages	Disadvantages
1.	Incineration	Most suitable for high Calorific Value waste, pathological wastes etc. Units with continuous feed and high through- put can be set up. Thermal Energy recovery for direct heating or power generation. Relatively noiseless and odourless. Low land area requirement.	Least suitable for aqueous/ high moisture content/ low Calorific Value and chlorinated waste. Excessive moisture and inert content affects net energy recovery; auxiliary fuel support may be required to sustain combustion Concern for toxic metals that may concentrate in ash; emission of SPM, SO_x, NO_x, chlorinated compounds, ranging from HCl to Dioxins

Advantages & disadvantages of various technology options

Ser No	Technology	Advantages	Disadvantages
2.	Pyrolysis/ Gasification	Production of fuel gas/oil, which can be used for a variety of applications Compared to incineration, control of atmospheric pollution can be dealt with in a superior way, in techno-economic sense. Syngas is easier to handle, meter and control than MSW	Net energy recovery may suffer in case of wastes with excessive moisture and inerts. If syngas is eventually combusted, dioxins, furans and NOX are still an issue syngas is highly toxic and explosive àà safety issues

Advantages & disadvantages of various technology options

Ser No	Technology	Advantages	Disadvantages
	Pyrolysis/ Gasification	Homogenous, gas-phase combustion of syngas is easier and can be better controlled Gasification at high pressure enhances the opportunities to increase energy conversion efficiency and reduce costs	Two-step conversion (gasification + syngas combustion/conversion)-> complexity, cost and reliability issues Pressurized waste gasification poses formidable challenges and has not been attempted by any technology developer

Advantages & disadvantages of various technology options

Ser No	Technology	Advantages	Disadvantages
	Pyrolysis/ Gasification	Syngas can be used, after proper treatment, in highly efficient internally- fired cycles (gas turbines, combined cycles, Otto engines)	a) Syngas treatment is complex and costly b) Due to losses in gasification and syngas clean-up, energy conversion efficiency is low c) At the small scale relevant to waste treatment, efficiency of internally-fired cycles is low

Advantages & disadvantages of various technology options

Ser No	Technology	Advantages	Disadvantages
	Pyrolysis/ Gasification	Syngas can be used, after proper treatment, to generate high-quality fuels or chemicals	a) Required syngas treatment very demanding and costly b) At the small scale typical of waste treatment plants, fuel/chemicals synthesis is extremely expensive

Advantages & disadvantages of various technology options

Ser No	Technology	Advantages	Disadvantages
3.	Anaerobic Digestion	Energy recovery with production of high grade soil conditioner. Less power requirement unlike aerobic composting, where sieving and turning of waste pile of supply of oxygen is necessary. Enclosed system enables all the gas produced to be collected for use.	Heat released is less- resulting in lower and less effective destruction of pathogenic organism than in aerobic composting. However, now thermophilic temperature systems are also available to take care of this. Unsuitable for wastes containing less organic matter

Advantages & disadvantages of various technology options

Ser No	Technology	Advantages	Disadvantages
	Anaerobic Digestion	Control green house gases emissions Free from bad odour, rodent and fly menace, visible pollution and social resistance. Modular construction of plant and closed treatment needs less land area. Net positive environmental gains. Can be done at small scale.	Requires waste segregation

Optimum technology - Optimum criterion

- Lowest life cycle cost
- Need least land area
- Cause practically no air and land pollution
- Produce more power with less waste
- Cause maximum volume reduction

Any one technology may not satisfy all of the above criterion; we need to identify best compromise.

- Optimum way of using MSW is to do the right segregation by breaking MSW into various components like Organic Matter for composting, RDF for combustion & Construction debris for brick making. The most important point is the fuel preparation
- Since of RDF after segregation has moisture percentage of 40% and construction debris. To make this RDF as a usable fuel one needs Hot Gas Generator and Dryer to reduce moisture from 40% to 12-15% and the stones are removed from Ballistic Separator to have a calorific value greater than 3000 Kcal/Kg
- It can be used very efficiently in the boilers like CFBC for Plants more than 15 MW and for Plants less than 15 MW it can be used in Reciprocating grade boilers costing Rs 8 Cr/MW.
- Inference is we shall not get ourselves confused by using other technologies which are costing not less than 20-25 Cr in International market but however focus on right fuel preparation

Thank You