Waste Management

Indian Scenario

Authors

Dr. Rajaram Vasudevan
Techno Engineering,
Chicago, IL, USA

Mr. George Mathew
W2ES USA Inc,
Cochin, India

Practical Issues with waste management in India

- Physical characteristics
  - Unsorted waste – Mixed waste of bio degradable and non-biodegradable
  - Low calorific value
  - High moisture content
  - Presence of hazardous waste
- Lack of awareness
- Unplanned growth and development of cities
- Land Availability

Identifying appropriate technology for waste management

At Source treatment - Bio-degradable waste & Sewage Treatment

- Bio-Methanation Plant

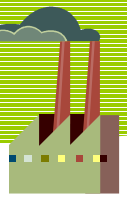
Unsorted & Non-biodegradable Waste Treatment

- W2E Gasification Plant

Solutions to Waste Management

Residential Waste

- Organic Waste
  - Food
- Inorganic Waste
  - Paper
  - Plastic
  - Wood
  - Metal
  - Discarded Furniture
- Sewage



Commercial Waste

- From Main Production
  - Sludge
  - Inorganic Waste
    - Paint, Tires Paint
  - Toxic
    - Chemical
- From Support Services
  - Organic Waste
  - Inorganic Waste
  - Sewage
  - (From Canteen, Housing)

Decentralised W2E Gasification Plant

At Source Bio-Methanation Plant

At Source Bio-Methanation Plant

‘At Source’ treatment of Biodegradable Waste & Sewage

Appropriate Technologies for sewage & wet waste

Typical Aerobic treatment systems follow the European model where :

- Low **ambient temperatures** the digesters need to be heated for proper functioning.
- The availability of oxygen is more because the solubility of oxygen is more at lower temperatures

In tropical India the situation is reversed.

- High ambient temperatures avoids need for heated digestors.
- High temperatures result in low soluble Oxygen availability.

Anaerobic Treatment of sewage is recommended for Tropical India

Biodegradable Waste

Bio-Methanation uses bio-degradable waste for biogas generation

- Canteen Waste
- Combined Sewage and Canteen Waste
- Poultry Waste
- Food Processing Waste
- Slaughterhouse Waste
- Leather Shavings Waste
- Starch Effluents
- Animal Droppings
- Fruit & Flower Market
- Sewage Sludge from STP

Problems in waste treatment by Aerobic & Vermi Composting

- Large Methane gas emissions.
- Nuisance from foul smell
- Uncovered compost bins attract stray animals & Insects

Composting is suitable for cold countries.

For countries like India, it adds to global warming.

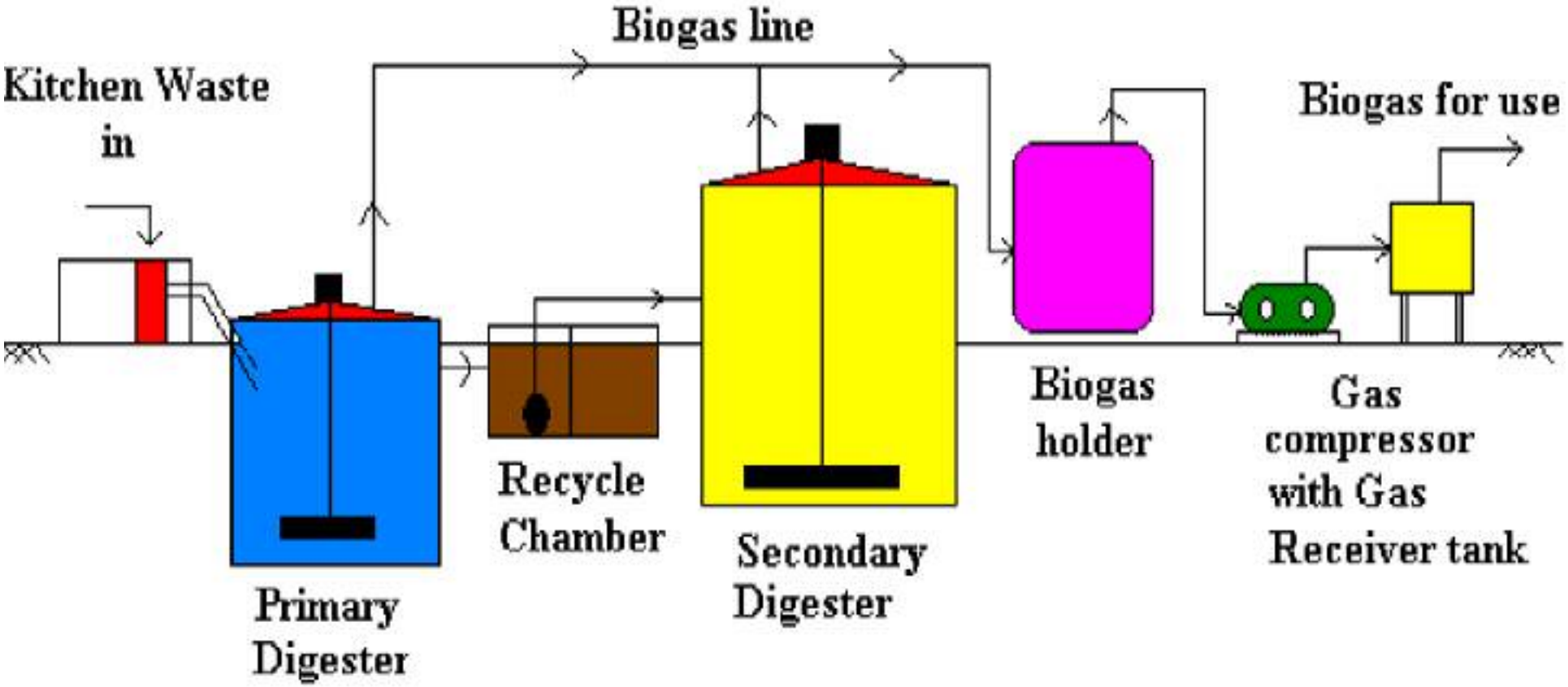
The Integrated Approach

'At Source' Integrated Treatment Plant can handle Kitchen waste and Sewage for biogas generation.

- Sewage & garbage flows from population centers to **designated** 'At source' treatment sites.
- Cost Savings by Reduction in digestor size from combined treatment
- Very low loading rates for sewage treatment.
- Efficient Energy Mangement by combined Energy recovery & utilization

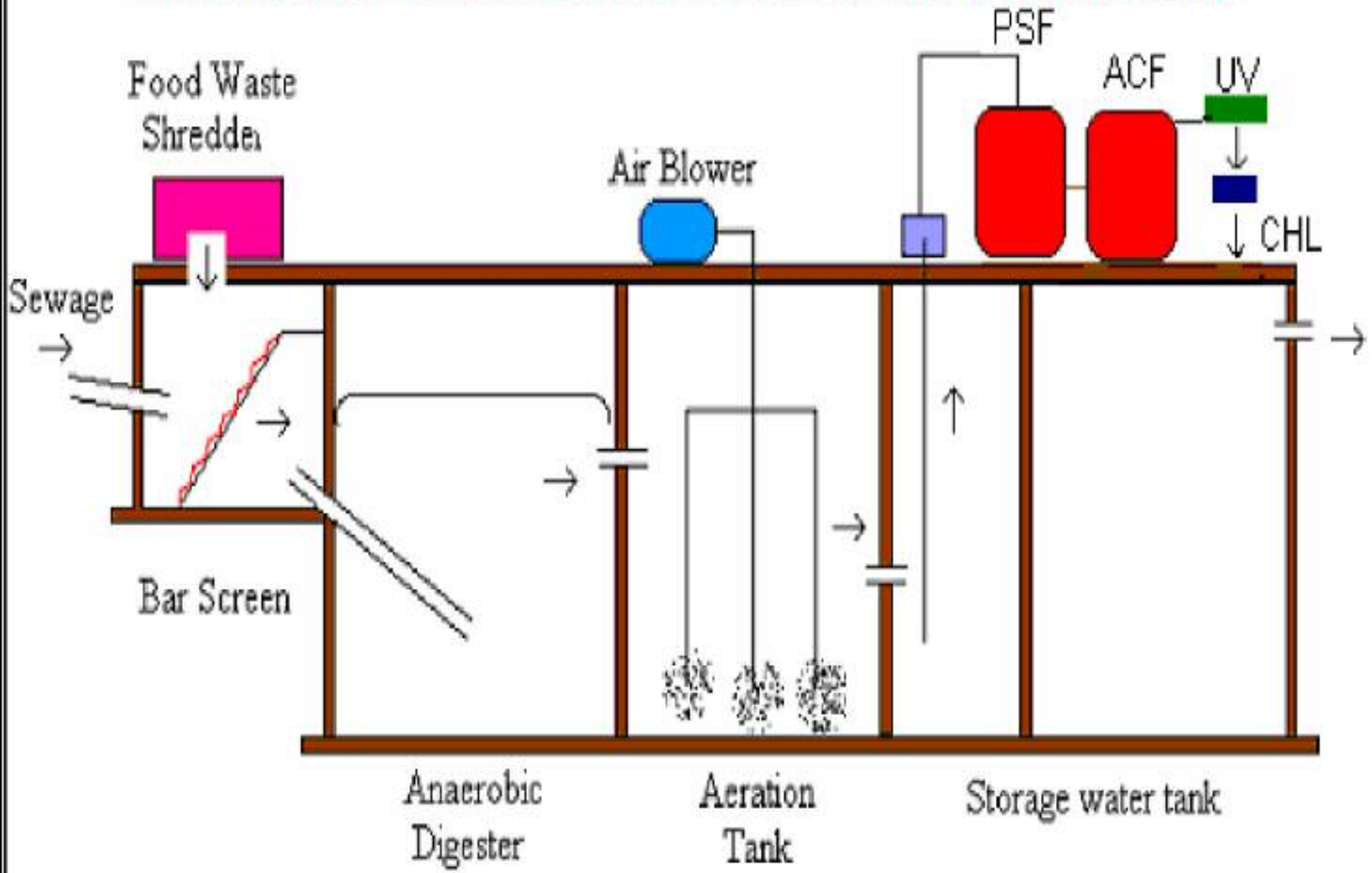
‘At Source’ Treatment- Advantages

- ‘Polluter to pay’
- Reduced transportation cost.
- Reduced cost of laying sewage line & pumping
- Less volume makes Segregation easier
- Biogas Generated can be easily utilized
- Treated Waste can be used locally as fertilized & water for gardening



Courtesy : Mailhem Engineers, Pune

TYPICAL FLOW DIAGRAM OF INTEGRATED TREATMENT PLANT



Courtesy : Mailhem Engineers, Pune

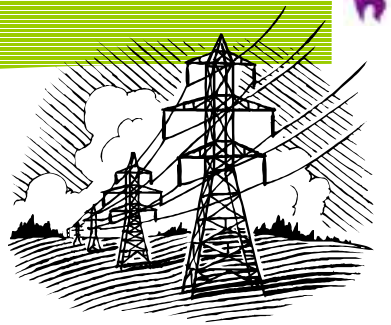
What happens to these & unsorted waste?

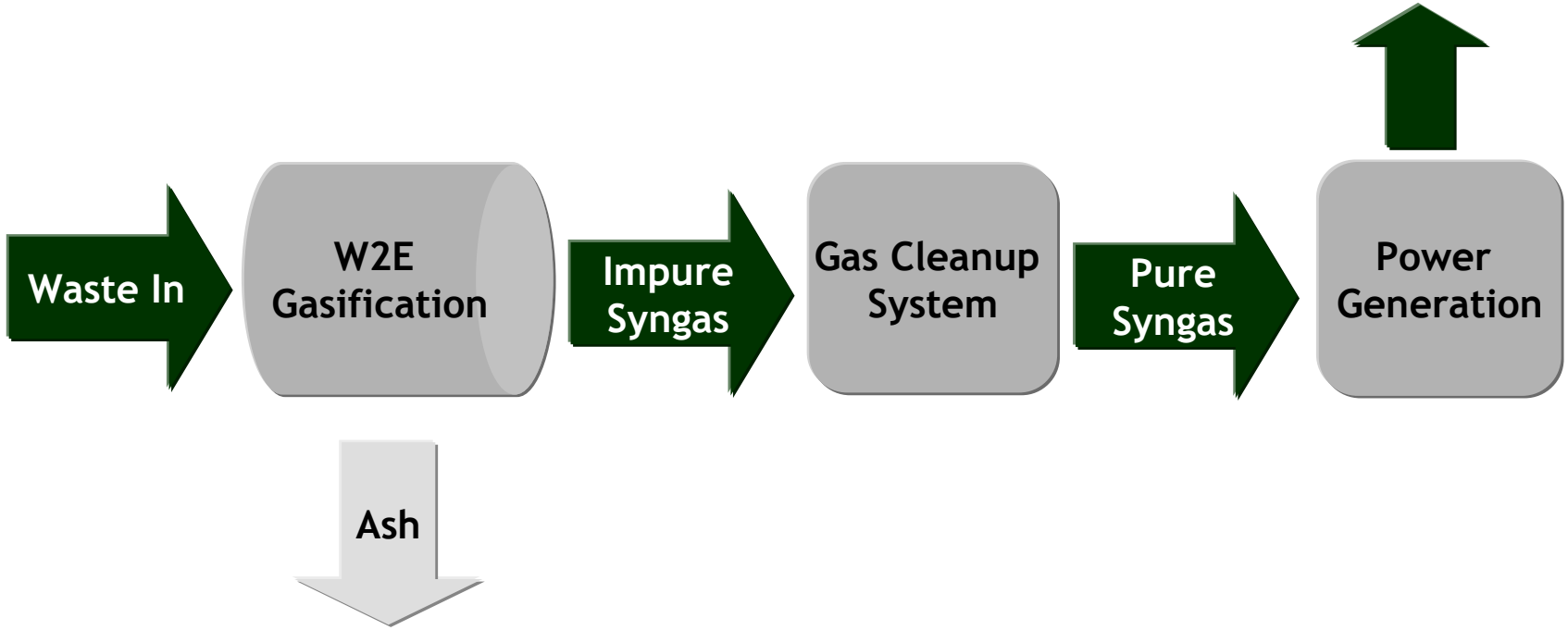
- Biomedical or Hazardous waste
- Plastic materials
- Used tires
- Electronic waste (e-Waste)
- Wood & Wet or Dry Agro waste
- Aluminum scraps
- Paints ,sludge ,oil
- Unsorted Waste .

Overview - W2E Gasification

- We go to the waste - bringing waste-to-energy plants closer to the source
- Distributed 25 to 100 Ton/day waste-to-energy plants
- The waste producer takes responsibility and sees immediate benefits in power generated or energy produced.
- Small, simple and inexpensive to manufacture, install and operate
- Low gas emissions - easy to comply with regulations
- Partners from public, private - end users or investors

W2E - The Waste to Energy Process





Waste Treatment Cycle

Garbage collection bins/bags

Garbage bags transportation

Waste Source

Waste to Energy Plant

Electricity Distribution

What is Gasification?

- Convert any waste through partial oxidation with air into SynGas ,A clean-burning fuel - a mixture of combustible gases (CO, H2, CO2, H20, N2 and some HC)
- Not Incineration or mass burn
- Easier and cheaper to clean off-gas or SynGas
- Gas volumes are very low compared to incineration, makes gas cleanup easier & less capital requirement
- SynGas allows multiple use for energy - easily piped for combustion or other thermal process
- Practical and economical even at small scale of operation

Waste Utilization

- Minimum 1000 BTU/lb (555 Kcal/Kg) of Calorific Value - adjust by mixing (eg. sewage 3500 BTU/lb- tires 21018 BTU/lb)
- 60 to 70% of energy value carried with SynGas
- Energy depends on system used for power generation - typically 25 Ton per Day gives 1MW power

Environmental Benefits Derived From W2e Project

- Alternative energy produced from local waste to increase energy security
- Beneficial use of waste avoids necessity of long distance transport to landfill thereby saving cost and energy
- Significant reduction in emission of greenhouse gases and particulates per MW generated
- Generates carbon credits

Best Solution for PVC & Plastics

- All PVC react in the gasifier with steam and oxygen to produce CO, H2, CO2, and HCl.
- Unlike incineration, gasification does not produce free chorine radicals which is primary culprit in the formation of dioxins and furans.
- Gasification is the only safe way to use PVC and other plastics for generating alternative energy.

Thank You

Other Projects by W2E

- **Idaho Project**
  - Gasify swithgrass (25%moisture) to produce 1MW electricity.
  - Cost of switchgrass $40/ton, electricity $60/MW
  - 1 ton switchgrass/hour yield 1 MW power
  - Business plan based on $20 differential between cost of raw material and selling price of electricity.
- **Korea Project**
  - Waste to synfuel plant located in industrial complex
  - Plant capacity 100t/d based on industrial wastes (foam, paper, cloth,etc)
  - Synfuel delivered to ink manufacturer (25T/H)
  - Project economics based on $100/ton tipping fees for industrial wastes and $20/ton of steam
  - Project payback 1-2 year
- **Center for Neighborhood Technologies**
  - Identify host site for fuel use in Chicago industrial corridor
  - Use wood debris from construction waste as feedstok (tipping fees = $40=$50/ton)
  - Convert wood waste into sungas to replace natural gas in burners for cooking or for steam
  - Incentive is to creat new jobs and new green business in urban ssettings.
  - Projected Payback 2-3 years.

- **Chevron Ventures Hydrogen Program**
  - Wood waste to hydrogen
  - Distributed generation at hydrogen fueling stations
  - 1T/H wood gasification adequate for 200cars/day
  - Wood waste most suited for H2
- **State University of NY at Cobblerskill**
  - Gasification of agriculture and animal wastes to produce syngas.
  - Portion fo syngas used for heating and portion for power gneration.
  - Installed capacity approximately 200kw
  - Financial incentive form NY Power Authority if payback is less than 10 years.
- **Port of Detroit**
  - Install 1 MW power plant based on wood waste and used tires.
  - Port of Detroit as host site and plant operator.
  - Financed through grants or through bond issue.
- **US CAR :**
  - Convert auto shredder residue into steam and power (with syngas as intermediate step)
  - Power and steam used for on-site for auto shredding.
  - Projected paybacck less than 3 years.

PROJECT FACTS : ONGOING PROJECT IN KERALA

Name of Project	:	**Cochin Waste 2 Energy Project**
Name of Company	:	**Cochin Waste 2 Energy Pvt Ltd**
Promoted By	:	**Cochin Chamber of Commerce**
Type of Process	:	**BESI W2E Gasification Technology(Patent Pending)**
Capacity	:	**35 tons/day**
Location	:	**Willington Island, Cochin**
Land Area	:	**1 Acre**
Type of Waste	:	**e-waste,Biomedical waste,** **food waste, Wood waste, used tires** **Plastics, PVCs, Industrial effluent Sludge, Sewage Treatment sludge,** **MSW without sorting etc** Exceptions **:Radioactive Waste & Batteries**
Power Generation	:	**1 Mega Watt per hour**
Solid Waste generated from Plant		**Recovered sterilized metals for recycle. Vitrified glass. Inert Ash**
Revenue Stream	:	**Tipping fee. Sale of Power generated. Residue. Carbon Credits**
Collection Mechanism	:	**Through specially designed enclosed refuse trucks meeting international norms**
Waste Stream Analysis	:	**School of Environmental Studies, CUSAT**
Third Party monitoring	:	**PCB & School of Environmental Studies, CUSAT**