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Research Work on Conversion of Environmental Waste to Energy - Electrical Energy

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Abstract: **-- Waste the term which is usually creates a feeling of untidiness and unused matter in environment/ society. We know that now a day's consumption of Electric energy is majorly employed in every industry, companies, domestics, etc. and it very essential for all. We know that present resources and fossil fuels are getting extinct. So, there is a necessity to find the alternative ways for production of electricity. This project deals with great applications and management of the waste in an eco-friendly manner. The process of producing electric energy from the waste and utilization of its by-products such as fly ash bricks, manure, and gasification are discussed.**

I. INTRODUCTION

Millions of tons of solid municipal waste is created in many country across the world every day. This waste is then dumped onto landfills and left to decompose. This Waste causes a lot of environmental as well as health problems. The problem deepens further when the landfills are overfilled and there is no more space for any kind of waste. By producing electricity from solid municipal waste this problem can be solved, and it provides an alternative way to produce electricity.

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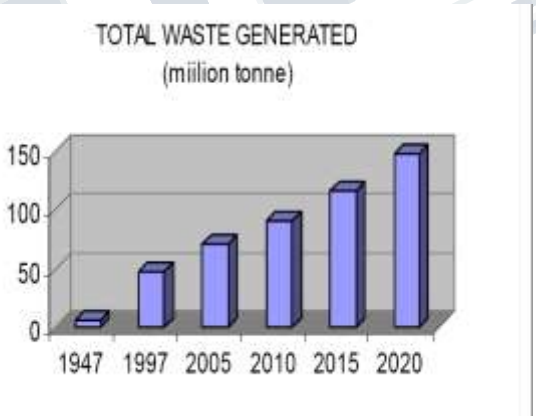
The heat emitted from industry is recognized as a form of solid municipal waste, and now it has being recognized as a means of producing electricity. Efforts are being made to generate electricity from this waste source.

In fact there is so much waste of garbage that, many developed countries are dumping their country's waste in less developed countries in exchange of money, off course. They do this because their countries are extremely populated and they are unable to resolve the waste management issues. By using the above mentioned methods they may not able to solve their waste management issues but producing electricity in abundance in other forms. Waste to energy is undoubtedly one of the most important challenging technologies to the future.



Municipal solid waste to energy, also known as electricity production from solid municipal waste, may offer one of the largest domestic opportunities for an alternative and renewable energy source that is good for the environment and the population at the same time. Millions of tons of solid municipal waste are created every day in world, and this can become a source of problems or a source of energy. The typical way that municipal solid waste management used to be done was by dumping all the waste into landfills, and letting them slowly decompose and reduce. This causes several problems, including greenhouse gases being released by the decomposing material, and the possibility of leach ate that can enter the ground water with harmful contaminants. In addition, many landfills across the country are becoming full, and cannot hold any more

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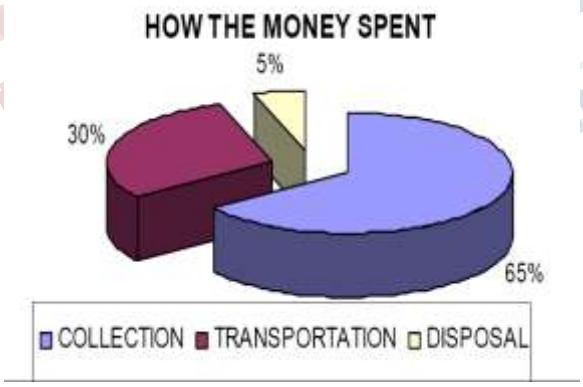
solid municipal waste. Municipal solid waste to energy programs can help eliminate landfill crowding, and the process is eco-friendly without any dangerous chemicals, toxins and pollution. The process creates steam, which then is used to power a steam driven turbine engine that generates electricity for use in your home.

Municipal solid waste to energy power plants can use one of four main types of technology such as refuse derived fuel, mass burn, pyrolysis, and modular controlled air. These plants are intended to burn municipal solid waste around the clock, and can be extremely efficient. One ton of municipal solid waste can provide five to six hundred hours of light or other electrical needs to your home. Since world makes millions of tons of the stuff, it is not hard to see the unlimited possibilities. Refuse derived fuel municipal solid waste to energy power plants, also called RDF facilities, have a processing area where recyclable products are taken out of the waste stream and used for the boiler, to create the heat. These plants can eliminate almost fourteen hundred tons of municipal solid waste each day, which takes a lot of pressure off the landfills and the environment. Municipal solid waste to energy facilities may also use the mass burn technology. In this process, mixed municipal solid waste is dumped into the boilers with no preparation or sorting.



Electricity production from municipal solid waste can be very efficient, depending on the method that is used. The level of carbon or greenhouse gas emissions and environmental friendliness will also depend on the processing method used to generate the electricity. Generating electricity from municipal solid waste, which you discard every day, can be a terrific way to get the energy the world needs, without putting any more strain or pollution on it.

A. Solid waste

The garbage that is managed by local governments is known as municipal solid waste (MSW). Specifically, MSW is waste generated by commercial and household sources that is collected and either recycled, incinerated, or disposed of in MSW landfills. The U.S. Environmental Protection Agency (EPA) separates MSW into several categories, including containers and packaging, yard wastes, durable goods, and nondurable goods. Examples of durable goods, which are designed to last longer than three years, include appliances, tires, batteries, and electronic equipment. Newspapers, clothing, disposable tableware, office paper, wood pallets, and diapers, which all have a lifetime of less than three years, are types of nondurable goods. MSW does not include domestic sewage and other municipal wastewater treatment sludges, demolition and construction debris, agricultural and mining residues, combustion ash, and wastes from industrial processes. These types of waste, known collectively as industrial solid waste, are largely excluded from hazardous waste regulation; programs addressing industrial solid waste are still in their infancy.

During the 1980s, solid waste management issues emerged in the United States due to the increasing amounts of solid waste generated, shrinking landfill capacity, rising disposal costs, and strong opposition to the sitting of new solid waste facilities. This problem was illustrated by the much-publicized Mobro garbage barge, which traveled on a six-month odyssey before the garbage was finally disposed of in New York state, where it was originally generated.

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With millions of households and businesses generating garbage in the United States, developing a national management program is challenging. Instead of federal regulations dictating how solid wastes should be managed, solid-waste programs are managed by states and municipalities on the local level according to individual community needs. With the exception of federally mandated landfill design and operating criteria to ensure the protection of groundwater and requirements for the federal purchase of products containing recovered materials, the EPA's role in implementing solid-waste management programs includes setting national goals, providing leadership and technical assistance, and developing educational materials.

b.MSW Stream

The generation of MSW has grown steadily over the past thirty years, from 88 million tons per year, or 2.7 pounds per person per day in 1960, to 229.9 million tons or 4.62 pounds per person per day in 1999. The largest component of the MSW stream is paper and paperboard products (38.1%), with yard trimmings the second most predominant component (12.1%). While the generation of waste has grown steadily, so too have its recycling and recovery. In 1960 about 7 percent of MSW was recycled, and in 1999 this figure had increased to 27.8 percent. How MSW is managed is shown in the bottom of two pie charts on the next page. Although the majority of solid waste is still sent to landfills, statistics indicate that there is a clear trend away from reliance on this method. Combustion of MSW and recovery through recycling are now a common practice in the United States.

c. MSW Management

In response to mounting solid waste problems, EPA published The Solid Waste Dilemma: An Agenda for Action in 1989, which presents goals and recommendations for action by the EPA, state and local governments, industry, and consumers to address the solid waste problems facing the United States. The EPA recommends an integrated, hierarchical approach to waste management using four components: source reduction, recycling, combustion, and landfills. This comprehensive approach addresses critical junctures in the manufacture, use, and disposal of products and materials to minimize wastefulness and maximize value. This strategy favors source reduction to decrease the volume and toxicity of waste and to increase the useful life of products. After source reduction, recycling, including composting is the preferred waste management approach to divert waste from combustors and landfills. Combustion is used to reduce the volume of waste being disposed as well as to recover energy, whereas landfills are used for the final disposal of no recyclable and noncombustible material.

The goal of the integrated management hierarchy is to use a combination of all these methods to handle the MSW stream safely and effectively with the least adverse impact on human health and the environment. The EPA encourages communities to develop community-specific assessments of potential source reduction, recycling, combustion, and landfill programs and to customize programs according to local needs, keeping in mind the strategies preferred in the national hierarchical structure. Because each community's waste profile (i.e., the amounts and types of waste generated), infrastructure, social and economic structure, and policies differ, decision makers at the local level are the most qualified to assess community needs and develop an appropriate solid waste management strategy.

d. Source Reduction

Source reduction, also known as waste prevention, is a front-end approach to addressing MSW problems by changing the way products are made and used. It represents an attempt to move away from the traditional "end-of-the-pipe" waste management approach used in the past. Source reduction at the "beginning of the pipe" is defined as the design, manufacture, and use of products in a way that reduces the quantity and toxicity of waste produced when products reach the end of their useful lives. Waste-prevention activities include product reuse (e.g., reusable

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shopping bags), product material volume reduction (e.g., eliminating unnecessary product packaging), reduced toxicity of products (e.g., use of substitutes for lead, mercury, and other toxic substances), increased product lifetime (e.g., design of products with a longer useful life), and decreased consumption (e.g., changing consumer buying practices, bulk purchasing). In 1996 the EPA reported that 23 million tons of MSW had been source-reduced, approximately 11 percent of the 209.7 million tons of MSW generated that year. Businesses, households, and state and local governments all play an active role in implementing successful source reduction programs.

e. Recycling

Recycling refers to the separation and collection of wastes and their subsequent transformation or remanufacture into usable or marketable materials. Recycling, including composting, diverts potentially large volumes of material from landfills and combustors, and prevents the unnecessary waste of natural resources and raw materials. Other environmental benefits offered by recycling include a reduction in greenhouse gas emissions, energy conservation, and the preservation of biodiversity and habitats that would otherwise be exploited for virgin materials. In addition, recycling programs create new manufacturing jobs, boost the economy, and facilitate U.S. competitiveness in the global marketplace.

Like any other part of the integrated waste management hierarchy, recycling programs should be carefully designed and implemented to address the needs of the community, including attention to their cost-effectiveness. Recycling collection and separation programs vary in degree of implementation. Some may be simple drop-off programs, whereas others may involve comprehensive curbside collection and complex source separation at a recovery facility. Successful recycling, however, requires more than the separation and collection of postconsumer materials. Recycling programs must identify and develop markets for recovered material, only when the materials are reused in the recycling loop completely.

The demand for recovered materials are constantly expanding in the markets. For example, recycling options for plastic are contingent on the type of resin used. Soft drink bottles are currently incorporated into products such as carpeting, household cleaner bottles, and fiberfill for coats and pillows, whereas polystyrene food containers and cups are being recycled into insulation, cafeteria food trays, and children's toys. Depending on their condition, tires can be used for artificial reefs, playground equipment, floor mats, and road construction materials. Recycled-content newspapers, stationery, corrugated containers, and toilet paper are some examples of how discarded paper is recycled.

Recycling activities also include centralized composting of yard and food wastes. Composting refers to the controlled decomposition of organic matter by microorganisms into a stable humus material that is used primarily on the land to improve soil quality. Many communities conduct large-scale centralized composting of yard waste in an effort to save landfill capacity. Individuals are also helping to reduce waste by

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composting yard waste in their backyards, and by not bagging grass clippings or other yard wastes—these activities are actually classified as source reduction. The composting of yard waste has seen tremendous growth in the past ten years. In 1980 the amount of yard waste recovered was negligible (less than 5,000 tons, or 0.05%). By 1999 the amount of yard waste recovered had grown to 12.6 million tons, or 45.3 percent.

f. Combustion

Burning has been a popular method of reducing the volume and odor of garbage for centuries. With the onset of the 1970s energy crisis and the Clean Air Act, a more sophisticated system of incineration was developed that could use waste as a fuel to produce energy. Modern combustion facilities no longer just destroy garbage, but instead are designed to recover energy that is used to produce steam and electricity.

Developing a successful waste-to-energy system involves numerous decisions that will dictate whether such a project is effective in a given community. Over the past two decades communities have demonstrated an increased interest in combustion as a waste management option. Between 1980 and 1999, the combustion of solid waste increased 5.8 percent, with approximately 2.6 million tons of MSW burned in 1999. In addition to the benefits of energy recovery, combustion residues consume less landfill space; combustion ash amounts to approximately 25 percent (dry weight) of the MSW input. However, citizens often oppose the building of incinerators close to communities and farmland because of the perception of health risks due to emission of pollutants including mercury and dioxin that are toxic, persistent, and bio-accumulate.

II.OBJECTIVE

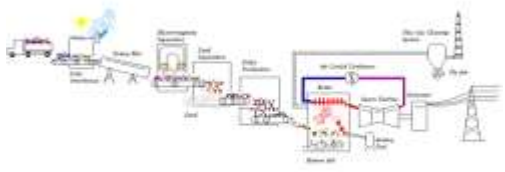
The objective of this project is to create a sustainable metropolitan municipal solid waste management system that supports GHG (green house gas) emission reduction. The main objectives of the project are:

- ♣ Reduction of MSW;
- ♣ Increase of value added refuse;
- ♣ Reduction of environmental and social problems at the disposal site;
- ♣ Utilization of MSW to generate energy; and
- ♣ Improvement of MSW management services

III.PRINCIPLE OF OPERATION

Electricity can be produced by burning "municipal solid waste" (MSW) as a fuel. MSW power plants, also called waste to energy (WTE) plants, are designed to dispose of MSW and to produce electricity as a byproduct of the incinerator operation.

The term MSW describes the stream of solid waste ("trash" or "garbage") generated by households and apartments, commercial establishments, industries and institutions. MSW consists of everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint and batteries. It does not include medical, commercial and industrial hazardous or radioactive wastes, which must be treated separately.



MSW is managed by a combination of disposal in landfill sites, recycling, and incineration. MSW incinerators often produce electricity in WTE plants. The US Environmental Protection Agency (EPA) recommends, "The most environmentally sound management of MSW is achieved when these approaches are implemented according to EPA's preferred order: source reduction first, recycling and composting second, and disposal in landfills or waste combustors last.

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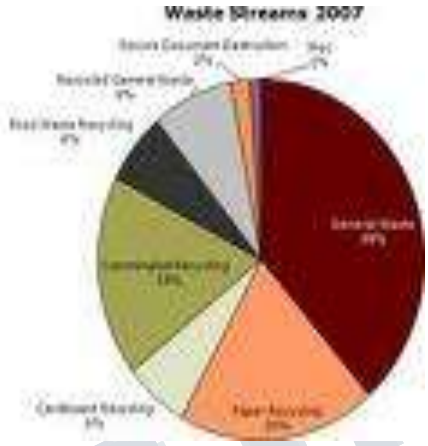
Mass Burn is the most common waste-to-energy technology, in which MSW is combusted directly in much the same way as fossil fuels are used in other direct combustion technologies. Burning MSW converts water to steam to drive a turbine connected to an electricity generator.

Refuse-derived fuel (RDF) facilities process the MSW prior to direct combustion. The level of pre-combustion processing varies among facilities, but generally involves shredding of the MSW and removal of metals and other bulky items. The shredded MSW is then used as fuel in the same manner as at mass burn plants

The Power Scorecard does not consider MSW a renewable energy source, because the waste stream includes materials made from fossil resources; the sources of the plant material based content (e.g., paper and wood) are unpredictable; and the waste stream would be greatly reduced with environmentally preferable waste reduction and management practices. The EPA and the federal government and some state governments classify MSW as a renewable energy source because MSW is abundant and contains significant amounts of biomass.

IV. TYPICAL COMPOSITION & PROPERTIES OF INDIAN MSW

Organic Fraction/Bio-mass : 35.00 %
Woody Bio-mass : 15.00 %
Paper : 05.00 %
Rags/Textiles : 05.00 %
Plastic : 00.05 %
Rubber etc. : 04.85 %
Glass : 00.05 %
Metals : 00.05 %
Stones : 20.00 %
Sand/Earth etc. : 15.00 %
Moisture Content (%) : 50.00
Bulk Density (MT/m3): 0.4-0.6
Gross Calorific Value (kcal/kg): 800



V. EQUIPMENTS

A. Major Equipment / Systems In The Power Plant
B. Boiler & Auxiliaries
C. Turbo generator & Auxiliaries
D. Fuel Preparation & Handling System
E. Ash Handling System
F. Cooling Water System
G. De-Mineralization Plant &
H. Feed Water System
I. Condensate System
J. Plant Electrical Distribution System
K. Hv & Ehv System
L. Plant Instrumentation & Control System

5. A.Boiler & Auxiliaries

1.. Fixed Grate Fired Boiler
2. Travelling Grate / Stoker Boiler
3. Afbc – Conventional And Open Bottom
4. Cfbc
5. Waste Heat Recovery

5. C.Turbine & Auxiliaries

1. Condensing Turbine
2. Back Pressure Turbine
3. Condensing Extraction
4. Extraction Back Pressure

5. I.Condenser

1. Water Cooled Condenser
2. Air Cooled Condenser
3. Combination Of Water And Air Cooled

5. j.Cooling Tower

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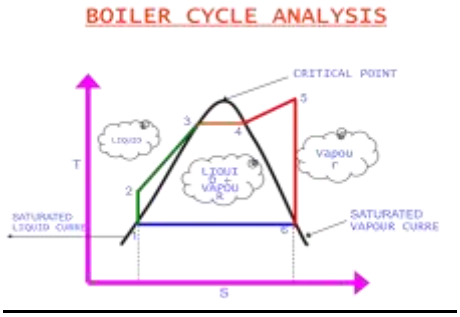
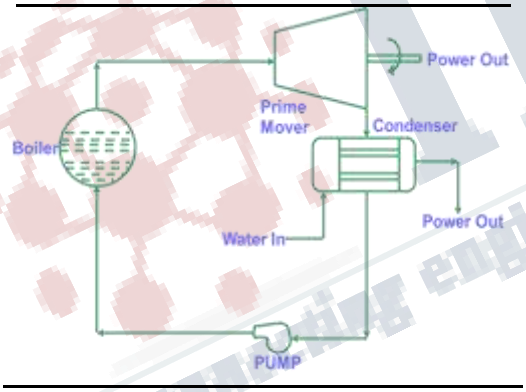
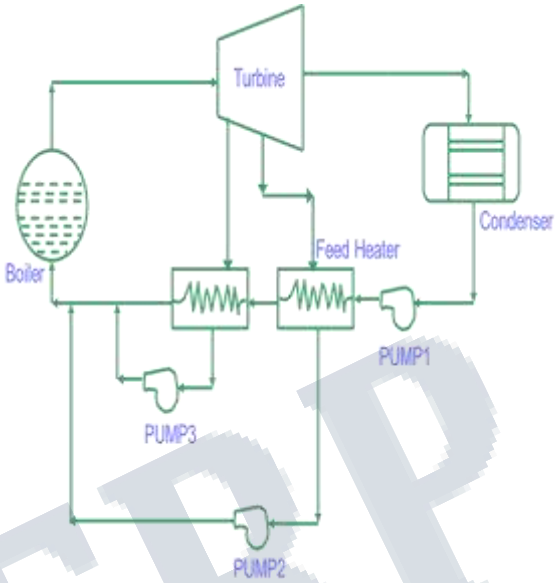
1. Induced Draft
2. Force Draft
3. Natural Draft

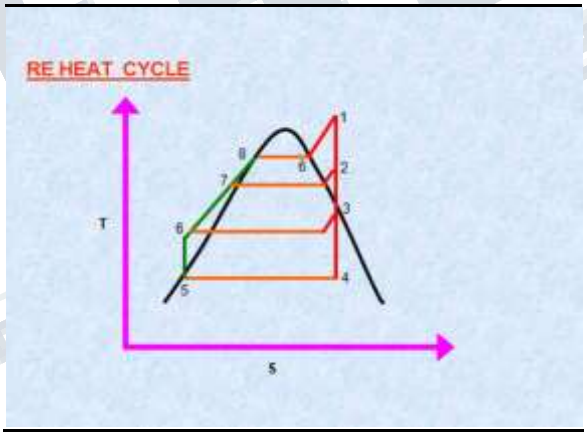


BOILER CYCLE ANALYSIS

1 – 2 ⟶ BOILER FEED PUMP WORK
2 – 3 ⟶ SENSIBLE HEAT ADDITION (ECONOMISER)
3 – 4 ⟶ LATEST HEAT ADDITION (BOILER BANK, EVAPORATIVE & FURNACE)
4 – 5 ⟶ SUPER HEAT ADDITION (SUPER HEATER)
5 – 6 ⟶ EXPANSION (TURBINE WORK)
6 – 1 ⟶ CONDENSATION (WATER COOLED / AIR COOLED CONDENSER)







VI. PROCESS FOR PRODUCTION OF ELECTRICITY FROM WASTE

6.a. Collecting of garbage from city premises
6.b. Storing under sheds for sun drying
6.c. 3-stages of inspection
6.d. Chipping
6.e. Fluff making palletization
6.f. Burning of pallets in the boiler
6.g. Steam generation
6.h. Power generation
6.i. Collecting of bottom ash
6.j. Collecting of fly ash
6.k. Collecting of gases from chimney

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6. A.Collecting of garbage from city

6. A.1.introduction

Primary collection of waste is the second essential step of Solid Waste
Management activity. Primary collection system is necessary to ensure that waste stored at source is collected regularly and it is not disposed of on the streets, drains, water bodies, etc. However, step has to synchronize well with the first step i.e. Storage of Waste at source.

6. A.2. Present Scenario

In India, the system of primary collection of waste is practically nonexistent,

As the system of storage of waste at source is yet to be developed.

Doorstep collection of waste from households, shops and establishments is insignificant and wherever it is introduced through private sweepers or departmentally, the system does not synchronize further with the facility of Waste Storage Depots and Transportation of Waste. The waste so stored is deposited on the streets or on the ground outside the dustbin. Thus streets are generally treated as receptacles of waste and the primary collection of waste is done, by and large, through street sweeping.

An appropriate system of primary collection of waste is to be so designed by the urban local bodies that it synchronizes with storage of waste at source as well as waste storage depots facility ensuring that the waste once collected reaches the processing or disposal site through a containerized system.

6. a.3. Measures necessary to improve the service

Local bodies should provide daily waste collection service to all households, shops and establishments for the collection of putrescible organic waste from the doorstep because of the hot climatic conditions in the country. This service must be regular and reliable. Recyclable material can be collected at longer regular intervals as may be convenient to the waste producer and the waste collector, as this waste does not normally decay and need not be collected daily.
Domestic hazardous waste is produced occasionally. Such waste need not be collected from the doorstep. People could be advised or directed to deposit such waste in special bins kept in the city for disposal.

6. A.4. Steps to be taken

- Urban local bodies may arrange for the collection of domestic, trade and institutional food/ biodegradable waste from the doorstep or from the community bin on a daily basis.
- Local bodies may also arrange through NGOs collection of recyclable waste material/non bio-degradable waste other than toxic and hazardous waste from the source of waste generation at the frequency and in the manner, notified by local bodies from time to time in consultation with the NGOs/Resident Associations, etc.
- Domestic hazardous/ toxic waste material deposited by the waste producers in special bins (provided by the local body at various places in the city) may be collected at regular intervals after ascertaining the quantities of such waste deposited in special bins.

6. A.5. Arrangements to be made for primary collection

Local bodies should arrange for the primary collection of waste stored at various sources of waste generation by any of the following methods or combination of more than one method:

- Doorstep collection of waste through containerized handcarts/tricycles or other similar means with active community participation as shown in the photograph in Fig.
- Doorstep collection of waste through motorized vehicles having nonconventional/sounding horns deployed for doorstep waste collection with active community participation.
- Collection through community bins from private societies multi-storied buildings, commercial complexes,

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- ♣ Doorstep or lane-wise collection of waste from authorized/unauthorized slums or collection from the community bins to be provided in the slums by local bodies.
- ♣ House-to-house collection of waste from posh residential areas on full-cost recovery basis where community participation is not to be done through NGO's efforts

6. a.6 Tools & Equipment

6. A.6.1 Hand carts

The use of traditional hand carts should be discontinued and instead, hand carts having 4 to 6 detachable containers of capacity ranging from 30-40 litres i.e. 0.03 to 0.04 cu.m each should be used The containers should be of sturdy material preferably strong polyethylene/plastic with a handle on the top and rim at the bottom for easy handling of the container. The handcarts should have preferably three wheels and sealed ball bearing. There should be locking arrangement with a chain and a lock.

6.a.6.2 Tricycles

Local bodies can use tri-cycles instead of handcarts in the areas which are spread out, and distances are long. The tricycles could have eight containers of 0.04 cu.m. (40 litres) capacity each as shown in Fig. 10.4 These containers should also be detachable from the tricycle and should have a locking arrangement.

6.a.6.3 Community Bin Carrier

A community bin carrier having a capacity to carry 40 containers (bins) in a two tier arrangement may be used to pick up community bins from residential areas and slums in the cities and towns where direct transfer of waste into the hand carts or tricycles is not found suitable. These vehicles with two member crew should pick up filled community bins and replace empty ones and take the vehicle, when 40 filled containers are picked up, to the nearest temporary waste storage depot (large container for transfer of waste)

USE OF COMMUNITY BIN CARRIER

6.a.7. Methods of primary collection of waste

6.a.7.1 Door step collection through containerized handcarts

A bell may be affixed to the handcart given to the sweeper or a whistle may be provided to the sweeper in lieu of a bell. Each sweeper may be given a fixed area or beat for sweeping plus a fixed number or stretch of houses for collection of waste. The local bodies may, based on local conditions, fix the work norms as they deem appropriate. It is suggested that in congested or thickly populated areas, 250 to 350 running metres (RMT) of road length and the adjoining houses may be given to each sweeper, whereas in less congested areas 400 to 600 running metres of the road length with adjoining houses may be allotted to a sweeper depending upon the density of population in the given area and local conditions. In low193 density areas even 650 to 750 running metres of road length and houses can be given. Normally 150 to 250 houses coupled with the above road length may be taken as a yardstick for allotment of work to an individual sweeper.

6.a.7.2 Role of Sweeper

The sweeper should ring the bell or blow the whistle indicating his arrival at the place of his work and start sweeping the street. The people may be directed through adequate publicity campaign that on hearing the

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bell or whistle they should deposit their domestic biodegradable waste into the handcart of the sweeper or hand over the waste to him/her.

At places where it is not convenient for the householder to deposit the waste in the handcart/tricycle, on account of their non-availability at home when sweeper arrives in their areas, they may leave the domestic waste in domestic bins or bags just outside their houses on the street in the morning so as to enable the sweepers to pick up the waste and put it into the handcart.

No sweeper may be expected or directed to do house-to-house collection by asking for waste at the doorsteps, as this will affect his energy and productivity.

6.a.7.3 Collection through Motorized Vehicles

Local bodies as an alternative to doorstep collection through containerized handcarts may deploy motorized vehicles having unconventional/sounding horn for doorstep collection of waste. Driver of the vehicle should intermittently blow the horn announcing his arrival in different residential localities and on hearing this; the householders should deposit their domestic waste directly into such vehicle without loss of time.

6.a.7.4 Primary Collection of Waste from Societies/Complexes

In private societies, complexes and multi storied buildings, normally no sweepers are provided by local bodies; hence private sweepers are generally engaged. It may therefore be made compulsory for the management of the societies, complexes and multi storied builders, to keep community bins or containers in which dry and wet waste may be separately stored by their residents Such bins may be placed at easily approachable locations to facilitate convenient collection by the municipal staff or the contractors engaged by the local body. The local body should arrange to collect waste from these community bins/containers through handcarts, tricycles, pick-up vans, or other waste collection vehicles as may be convenient, on a daily basis.

To facilitate collection of waste from societies or commercial complexes, the local bodies should by a rule, make it obligatory for them to identify an appropriate site within their premises for keeping such bin/container for the storage of waste.

6. A.7.5 Collection of Waste from Slums

Local bodies should collect waste from slums by bell ringing/whistle system along their main access-lanes. Residents should bring their wastes from their

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houses to hand carts. Where slum residents prefer community bins, they should bring their biodegradable waste to these bins only an hour or two before the time of clearance The local body may, if so desired, engage a private contractor for collection of such waste. Performance certification by a "Mohalla (local level) Committee" may be insisted upon in such cases.

6. A.7.6 Collection-at-the Doorstep in Posh Residential Areas

In posh residential areas where the residents as a whole might not be willing to bring their waste to the municipal handcart/ tricycle, system of collection from the-door step on full cost recovery basis may be introduced. This service can be contracted out by the local body or NGOs or contractors registered with the local body may be encouraged to provide such service in the areas where it is found economically viable to introduce door to door waste collection service. This service may not be provided to isolated houses, shops and establishments. Penal provisions may be introduced for failure of service where contracts are proposed to be awarded.

6.a.7.7 Collection of Duly Segregated Recyclable/Non io-degradable Waste from Households

Recyclable waste has a value. Several rag pickers in the urban areas, therefore, move from street to street, bin to bin and go to the dump yard to pick up recyclable waste. These rag pickers are exposed to health risks as they put their bare hands in contaminated waste. They sell contaminated waste to the waste purchasers stored in slums creating unhygienic conditions. Quite often they spread the waste at the dust bin site to pick up recyclable. This system can be improved by introducing a system of collecting recyclable waste from the doorsteps changing the roll of rag pickers to that of waste collectors. This informal sector could thus be organized through NGOs, upgraded and given an opportunity to earn their living through doorstep collection of unsoiled recyclable waste. NGOs may be activated to organize the rag pickers and convert them into door-step waste-collectors to improve their quality of life and to reduce their health risk. This will also increase their income levels. NGOs may allot to such waste collectors specified lanes and by-lanes comprising of 150 to 250 houses and some shops for doorstep collection of recyclable. They may also be given identity cards by the NGOs for increasing their acceptability in society. NGOs and/or the corporation may support such waste collectors by giving them bags and tools required for collection of recyclable waste from the doorsteps. The local body may also inform the community of the arrangements made by the NGO and advise them to avail of the services.

6. A.8 Encouragement to ngo's / private sector

Local bodies may also encourage NGO/private sector to collect both Food/biodegradable waste as well as recyclable waste from the door steps on their own by making direct contractual arrangement with the residents' associations/commercial complexes to reduce their financial burden.

6. A.9 Collection of waste from shops and Establishments

- Shops and establishments normally open after 9 am. These timings do not synchronize with the usual work schedule of sweepers. Under such a situation one of the following alternatives may be adopted.

- Sweepers may first carry out the work of street sweeping in the morning hours as usual and soon thereafter take up the work of door-step collection of waste, after most of the shops have opened.

- Waste collectors (rag pickers) may be organized to collect the recyclable waste from shops and establishments as soon as they open, as most of such waste is recyclable. Working arrangements may be made with the shops and establishments accordingly. The shops & establishments may be asked to store waste in two bins if they produce waste other than recyclable waste also. This arrangement may be made on 'No payment' basis on either side.

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- The recyclable material received by the waste collectors directly from shops and establishments would give them a better return. The waste would be dry and not soiled and would fetch a good price in the market. This will work as an incentive for them to continue door to door collection.

- The associations of markets, shops and establishments may be persuaded to organize this service with the help of NGOs and waste collectors in their market.

- Doorstep collection service from shops and establishment may be provided or may be contracted out on 'full cost-recovery' basis. Large commercial complexes could use 3.0 cu.m to 7.0 cu.m containers, which are commonly used by the local bodies for community storage of waste so that its transportation could be synchronized by local bodies along with other containers, kept in the city

6. A.10. Collection of bio-medical waste

Collection of bio-medical waste should be done in accordance with the rules/directions contained in the Ministry of Environment & Forests, Govt. of India Notification dated 20th July 1998 as the liability for safe disposal of biomedical waste is on such waste producer and the local body as such is not directly responsible to provide any service. The recommendations given in the chapter on biomedical waste in the manual may be followed.

6. A.11. Collection of hotel and restaurant waste

Hotels and restaurants may make their own arrangements for collection of waste through their own association, or local bodies may extend help in primary collection of such waste by deploying their own manpower and machinery for door step collection of such waste on full-cost-recovery basis. The cost could be recovered on pro-rata basis. Doorstep service may be contracted out by local bodies if so desired. Charges for the collection of hotel waste may depend upon the quantity of waste to be picked up from the hotels and restaurants and frequency of collection required. The cost recovery may be planned according to the classification of hotels/ restaurants made on the above basis and decided in consultation with them. Thorough survey of the waste generation by hotels/ restaurants may be made before the collection rates are introduced and notified.

6. a.12 vegetable, fruit, meat and fish markets waste

Such wastes should be removed on a daily basis either departmentally or through contractors on full or part-cost-recovery basis as may be deemed appropriate by local bodies. Large containers kept in the fruit and vegetable markets should be removed during night time or non-peak hours and the waste from meat and fish markets should be collected through closed pick-up vans service by engaging a contractor, or departmentally as deemed expedient by the local body.

6. A.13 collection of garden waste

The waste stored in public and private parks, gardens, lawn plots etc. should be collected on a weekly basis by arranging a rotation for collecting such waste from different areas, on different days to be notified to the people to enable them to trim the trees and lawns accordingly and keep the waste ready. This waste may be got collected through a contractor or departmentally as deemed appropriate by the urban local authorities. Cost recovery may be insisted upon, based on the volume of waste collected.

6. a.14 collection of waste from marriage halls, kalyanmandaps, community halls, etc

The special arrangement should be made for collection of waste from marriage halls, kalyan mandaps, community halls, etc. daily on a full costrecovery basis. The cost of such collection could be built into the charges for utilizing such halls. This service may be provided preferably through a contractor or departmentally as the local bodies deem fit. On-site, processing of food wastes by bio-methanation and composting may be encouraged.

6. a.15. Collection of construction and demolition waste

- Local bodies should prescribe the rate per tonne for the collection, transportation and disposal of construction waste and debris and notify the same to the people.

- Every person who is likely to produce construction waste may be required to deposit

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with the concerned local body an approximate amount in advance at the rates as may be prescribed by the local body from time to time, for the removal and disposal of construction waste from his premises by the local body. Such amount may be deposited at the time when the building permission is being sought and in cases where such permission is not required, at any time before such waste is produced.

- The charges for removal of construction waste to be doubled for those who fail to deposit the amount in advance.

- Large local bodies may provide skips (large containers) to the waste producers on rent for the storage of construction waste so that double handling of the waste can be avoided or use front end loader & trucks to pick up such waste. In small towns this may be done manually using trucks, tractors and manpower.

- To facilitate disposal of small quantities of construction /demolition waste, large containers may be placed in various parts of the city where waste producers may deposit small quantities through private laborers, cart pullers, donkeys, etc. and such waste may be collected by ULBs from time to time before such containers start over flowing.

6. a.16. Dairy and cattle-shed waste

The dairies and cattle breeders having sheds within the city limits should be asked to move the cattle sheds outside the city limits and until this is implemented they should be directed not to stack the cow dung, grass or other stable wastes within their premises or on the roadside. They must transfer the waste produced by them daily into the specified municipal storage containers nearby, which should be collected at regular intervals by local bodies.

6. A.17 collection of domestic hazardous & toxic waste

Collection of Domestic Hazardous & Toxic Waste such as used batteries, paints, broken tube lights, expired medicines and others shown in chapter of Storage of Waste kept separately in the bins placed in various parts of the city should be collected periodically by the urban local bodies and got segregated and disposed of as per the hazardous waste management rules of the Government of India.

6. B.Drying

The effect of air flow rate on the change of biomass (organic waste material) temperature and moisture content during an auto thermal drying process was discussed in this paper. The laboratory-scale experiments were performed using a 240 dm3 capacity, horizontal composting reactor (insulated with polyurethane foam), equipped with an air-supply system, compost temperature measuring system, and air humidity and temperature sensors. An organic fraction of municipal solid waste with the addition of structural material was used as a substrate in this process. As a result of the auto thermal bodying process, moisture content decreased by 50% at the initial moisture content of organic waste ranging from 800 to 900 gH2O/kg wet weight. Water balances were calculated before and after the composting and drying process. Very good agreement of the calculated water balances was obtained. The heat of combustion of dried waste and its calorific value were 12.28 kJ/g and 10.98 kJ/g, respectively.

To solve problems connected with waste management, technologies for biological waste treatment such as composting, biostabilization and biodrying have become of general interest. After composting or biostabilization, the final product can be used for agricultural purposes, or the biostabilized material can be stored safely in a landfill. In the case of biodrying, the refuse can be used as a source of energy (Sugni et al., 2005). Thus, the technologies of biological degradation of municipal solid waste or its fractions are of special importance since they can influence the preservation of natural resources, a decrease of greenhouse gas emissions and other environmental advantages. Reduction of gas emissions not only improves the natural state of ecosystems but also contributes to the rise of living standards of their inhabitants and has a beneficial effect on their health.

To carry out the auto thermal drying process a horizontal tubular reactor was developed and tested. Fig.1 presents the scheme of the reactor used in the experiments. A plastic drying tunnel of 240 dm3 total capacity was insulated with polyurethane foam to prevent heat losses. The adiabatic reactor was equipped with sensors to measure the temperature of the composting biomass in the top and bottom layer of

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wastes, the temperature of the air over the composting biomass and the temperature and humidity of the outlet air. The temperature of composting biomass as well as the temperature and humidity of inlet and outlet air were continuously measured online. Fig.

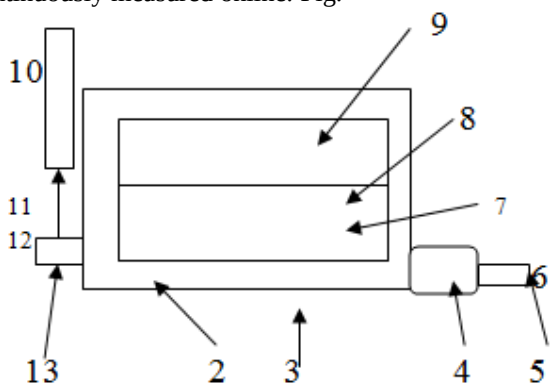

Fig. 1. Schematic diagram of the bio drying tunnel

(1. Composting biomass,
2. Biodrying tunnel,
3. Hot gases from chimney,
4. Duct heater,
5. In-line duct fan, 6. Inlet air,
7,8. Temperature sensors of composting biomass,
9. Temperature sensor of air over compost,
10. Biofilter,
11. Outlet air,
12. Exhaust fan,
13. Temperature and humidity sensors of outlet air)

The auto thermal degradation of organic matter in which stable, easily storable biofuel is produced is an interesting option of waste management. In the experiments on auto thermal drying with heat generated during waste composting, a 50% decrease of water content in the waste mass was obtained. Water balances were calculated and high agreement of initial and removal water content ranging from 90% to 99% was obtained. The highest values of heat of combustion of dried waste and its calorific value (12.28 kJ/g and 10.98 kJ/g, respectively) were obtained for the run where the air flow was equal to 11.02 m3/h and the in-line duct fan was pumping the air for 1h. The increase of the air flow at the inlet to a biodrying tunnel contributed to a higher removal of moisture from waste. Nevertheless, this did not contribute to high temperatures for composting biomass, high values of heat of combustion and high calorific values

The material solid waste are (MSW)or garbage collected is just stored under a shed just as store for raw material .it helps in sinking the moisture content

Composition of garbage
According to Indian survey
Organic fraction biomass—35%
Wood—15%
Paper—5%
Rags textiles—5%
Rubber—5%
Plastic ,glass ,metals—0.25%
Sand and stones—33%
Moisture content –55%
Colorific value—800K cal/Kg

6.c.3-stage of inspection
6.c.1 manual inspection

Layered on belts conveyer and large plastic ,glass ,metals are removed Waste is layered on belt conveyer at a layer of up to 5cm and stones, plastic ,glass, metals are removed Plastic Recycling, MSW, Wood Recycling, C & D, Paper Recycling and Document Destruction “Plastic” covers several different materials. From solid forms like purging, nylon rods, sprockets and gears to molded parts such as toters, buckets, PC printer or monitor casings; to blown molded materials like bottles. Whether you are a manufacturer interested in reclaiming your scrap waste, or a recycler of plastics, regardless of type, form or volume, Eurohansa has the size-reduction machine or turnkey system for your application. “Wood” also covers a lot of products. Maybe you just have Pallets and need a pallet grinder. Perhaps you are a furniture manufacturer or a sawmill and want to put your residual waste to use as a boiler fuel. Are you a recycler who wants to clean and reclaim, separate and sell everything you can reclaim from Construction and Demolition debris? Paper waste could also be classified under wood. Document Destruction is a vastly growing industry. Phone books, newspapers, cardboard & magazines have been recycled for years. Call us. We have the machine or system for your needs, again; regardless of material type, form or volume.

Municipal Solid Waste, commonly referred to as MSW, is fast becoming a major recycling concern as well. Eurohansa has installed complete turnkey systems

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designed to sort and shred every type of material possibly found in a landfill site. We have installed systems capable of handling from 10, 20 even 40 tons per hour with as few as 5 workers.

Our expertise, knowledge and experience in the area of size-reduction is unsurpassed. There is an infinite number of materials and combinations of materials and chances are, we have the right machine for whatever it is you have. For more information, check out our Application's web pages to the left. The list is much too extensive to have a page for every one, so if you don't see yours, or you do, and would like more information; call or contact us. We are standing by to help!

Wood Recycling is a long standing industry and a major source for landscapers across the country and the globe of mulch. Wood Recycling is also an important supply of energy for major manufacturing operations. Pallet Grinding, a form of wood recycling, is key to reducing landfill costs and tipping fees. Pallet Grinding, using pallet grinders such as our ZENO ZTLL Pallet Grinders, is a major component in such a wood recycling and grinding system. Pallet grinders are available for any volume. Furniture scrap grinders are used to size-reduce Medium Density Fiberboard (MDF) and Particleboard as well as solid woods like pine, oak, spruce or maple. MDF and Particleboard are used in a lot of wood recycling programs. Furniture scrap grinders are Vertical, Low speed/High torque Shredders, or Horizontal Wood Grinders. Sawmills will use grinders to grind up slabs and end-trim as well as Lilly Pads. Lilly Pad Grinders are used to grind up the curve that is cut out of trees often referred to as Lilly Pads. Pallet, Furniture Scrap, & Particleboard Grinders typically think of the ZENO ZTLL Model Grinders for ease of loading. Sawmill operators needed grinders for lengthy slab waste rippings,(also called rips) typically use Horizontal Grinders because this type of grinder can be installed inline with rip saws & edging saws. Some people refer to these as rips and edgings grinders.

Plastic Recycling is a huge constantly growing industry. Plastic shredding has not been around as long as wood grinding, but plastic shredding in Europe is a part of everyday life. Plastic recycling plays a huge roll in industry today and a lot of new products come from plastic recycling efforts of major manufacturers. Plastic Film shredders have become widely popular. Plastic Film shredders are used as the initial size-reduction step in a plastic recycling facility. Film shredders typically take the film type plastic and reduce it to from 1.5 - 2" particles. From there it is sent to a secondary size-reduction machine (typically a granulator) to be further reduced before going to an extruder where the plastic is heated, molded to a desired shape & cooled. Film shredders have helped pick up the pace in plastic recycling. Film shredders have become the focal point of many applications and the same is true of Fiber shredders. Fiber shredders are very important because you can batch feed endless fibers into a fiber shredder. Before fiber shredders, these endless fibers had to be cut and control-fed into granulators. The same holds true for hard plastic grinders. Purging shredders and grinders are very similar to film & fiber shredders. All of these allow plastics manufacturers & recyclers to reclaim products they couldn't have just a few short years ago. Plastic grinders and shredders have opened up a whole new avenue of reclaimable materials. These types of products will damage a knife type granulator, whereas hard plastic and purging shredders/grinders can safely reduce the size of these parts in the low speed high torque environment.

Bottle Recycling is a great market for reclaiming plastic waste. Often used in the carpet industry, the bottle recycling process usually incorporates bottle shredders. Bottle shredders as you may have guessed are not at all different than film shredders or purge shredders. Bottle recycling relies on bottle shredders because of the capacity to dump-feed bales of recovered bottles at one time. The bottle recycling process often requires much more machinery than a bottle shredder, but it is a key component.

Document Destruction is practically the law of the land in today's society. ZENO document shredders are entirely different from the crosscut shredders so commonly used today. This is about to change. Document Destruction depends on the complete destruction of documents and crosscutting tends to leave potentially important information intact. For Document Destruction, rely of the ZTLP.doc series of document shredders. Our document shredder totally destroys all information period. Document Destruction will be the norm and not the exception in coming years. Document Shredders will be a staple and the ZTLP.doc will be the leader in the industry. Paper recycling is already very big and paper shredding is a vastly growing market. Our paper shredders and paper recycling machinery play an important roll in the paper recycling and the paper

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shredding industry. Industrial paper shredders and paper recycling equipment have become a very important part of our manufacturing program. Rely on Eurohansa Inc. and ZENO for your paper recycling equipment needs.

Medical Waste is another fast growing industry. Many landfills do not allow untreated and size-reduced medical waste. Medical waste shredders are an important part of the medical waste recycling industry. Medical waste shredders are designed to handle sharps and other contaminates, while shredding the material to a manageable size for treatment and disposal. The medical waste recycling industry relies on ZENO's ZTLP-MW Medical Waste shredders for size reduction. Medical waste machinery is available to the industry for destruction and disposal applications worldwide.

Construction and Demolition also referred to as C&D, produces tons of waste. Construction debris shredders are very important to C&D companies for a variety of uses. Construction and demolition grinders need to be stout and sturdy and preferably low speed to prevent damage from the inevitable rebar or transformer box. C & D recycling grinders are built to withstand the inevitable contaminants found in construction and demolition debris. Our ZDV Pre-breakers are designed for just such materials as C&D has to offer. Construction and demolition shredders are also called construction and demolition grinders, or even debris shredders. Shredders for construction scrap can handle demolition debris which used to be good for nothing but a landfill. Now demolition debris can be salvaged and recycled into different products. Construction waste shredders and demolition grinders can pale in comparison to a ZDV Twin-Rotor Breaker which can be mounted onto trailers for mobility. Whether you call it C&D or construction and demolition debris it has to be size-reduced. We call it a ZDV Twin Rotor Breaker and we have a full line of grinders for demolition debris. C & D recycling grinders shredders for construction scrap are available from 10 tons per hour, up to 40 tons per hour. Call us for more details.

Bottle Recycling requires Plastic Shredders and Granulators as well as other Polyethylene Terephthalate (PET) bottle recycling equipment. PET bottle recycling includes the PET bottle shredders and PET Bottle grinders, but also sorting equipment and probably separation equipment as well. Like in MSW or Municipal Solid Waste for municipal waste recovery, metal will often be inside the bottles themselves or bales of bottles. Successful bottle recycling requires the right plastic recycling systems. High-density Polyethylene (HDPE) bottle recycling is the same. HDPE Bottle recycling equipment is the same. The correct PET bottle grinders and PET bottle shredders should be able to house loose bottles and baled bottles but should match the volume. Just like MSW or municipal waste recovery systems, HDPE bottle recycling can include all of the same components. Bottle recycling on a grand scale includes the ZENO PET bottle Grinders and PET bottle Shredders. Just like bottle recycling on a smaller scale does. Municipal waste recovery includes some of the same components, because of the amount of bottles found in MSW

6.c .2Final inspection:

Is that the waste is placed on the belt conveyer a layer of 2cm and if any unwanted particles present they are removed The CDM EB has approved a new small-scale methodology "AMS-III AJ Recovery and recycling of materials from solid wastes" assigned to sectoral scope 13, which is now eligible to earn carbon credits. The methodology covers activities for recovery and recycling of high density polyethylene (HDPE) and low density polyethylene (LDPE) materials in muncipal solid wates (MSW) HDPE and LDPE plastics recovered from MSW in the recycling facilities are further processed in manufacturing facilities to produce intermediate and finished products e.g plastic resin, plastic bag to displace production of virgin HDPE and LDPE materials in dedicated facilities thereby resulting in energy savings and emission reduction.

HDPE is durable, resistant to chemical change and tougher than LDPE, HDPE is used in buckets, garbage bins and many other applications. LDPE is used mainly for its flexibility at the cost of durability and strength. LDPE is used in glad-wrap, shopping bags and drinking bottles. HDPE and LDPE plastics are obtained from municipal solid waste by way of separation, cleaning and compaction/packing for further processing in order to produce intermediate/finished products to substitute virgin raw materials in an industrial production chain.

The process may be accomplished manually and/or using mechanical equipment including one or more of hte following measures: washing of the separated LDPE and HDPE materials with hot water, drying, compaction, shredding and pelletizing. Among

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other requirements, the wastes containing recyclable materials are to be procured locally from sources located within 200 km of the recycling facilities. Plastics already segregated from the rest of the waste and transported over 200 km distance are not eligible

6.d.Segregation takes place in three stages
6.d.1Screening or sieving :

Screening in its simplistic form is the separation of products by size, either in a wet or dry form. When dry the nature of the recoverable product plays an important part in machine selection. Factors such as resale value, accuracy of product size, yield, and production timescales all play major roles. As such it is essential that machine selection is correct. Where larger sized granular products are required linear motion screens with large amplitude and high frequencies are usually sufficient. Woven mesh, finger or taper slot type screens are generally selected because of their robust nature and adequate capabilities within this band.

Where more accurate grades of product are required (usually sub 1.0mm) the selection of screening equipment and media is essential. The more accurate the requirement the more difficult it is to achieve high yields within specification. Flatbed screening provides an ideal platform to use mesh aperture with maximum efficiency. Large stroke and relatively low frequencies give maximum product movement and therefore allow stratification to be as effective as possible. Anti mesh blinding needs to be offered in most cases due to the problem of near size either pegging or blinding the mesh. Selection of screening media can be as important as any other factor.

Thin wire diameter may maximise screen area but can lead to a shorter life. Slotted mesh may be selected where product such a pellet needs to be sized with higher yields. Synthetic mesh such as nylon or polyester can in certain cases provide a better screening media than woven wire especially where product blinding of certain materials is prone.When recycling plastics, it is important to classify the types of plastic recovered. This process demands the following conditions: (1) instantaneous identification, (2) measurements unaffected by shape, and (3) online measurement. The Fourier Transform Infrared spectroscopy (FTIR) analysis of waste plastics using a horizontal ATR with a diamond prism is shown below. This method is relatively unaffected by the shape of the plastic and can analyze hard plastics.

6. D.2.Magnetic separation: For removing any iron particles in the inspected waste.

6.d.3 Pneumatic classifier: it is used to remove small stones and glass.
6. E.chipping: thus the waste obtained from the aboe process is made into 20 to 25mm size by passing it under a mobile chippers and drum chippers

6.f.Pellts makikg is of three stages
6.f.1.fluff making or pelletization:

Course fluff is made by adding rice husk at a

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ratio of 3:1 and mixed in the mixer for burning in the boiler Pelletization of municipal solid waste involves the processes of segregating, crushing, mixing high and low heat value organic waste material and solidifying it to produce fuel pellets or briquettes, also referred to as Refuse Derived Fuel (RDF). The process is essentially a method that condenses the waste or changes its physical form and enriches its organic content through removal of inorganic materials and moisture. The calorific value of RDF pellets can be around 4000 kcal/ kg depending upon the percentage of organic matter in the waste, additives and binder materials used in the process. ... The process starts with the delivery of MSW to the plant by the garbage pick-up trucks to the waste processing facility. The raw waste is dropped on to a tip floor, with the overhead grapple operator moving any obvious hazardous or large materials to the side for either later use or disposal. The remaining materials are then moved to the incoming material hoppers, where they are transferred to transverse conveyors, which feed onto the incline conveyors, and subsequently to the manual sorting station. The materials are then passed through a trommel, where smaller items are screened and separated. Rest of the waste is passed through separators, screens and plastic removal systems to positively select those materials that are to either be used in the pellet or sold as recyclable product. The remaining materials that require disposal is stored until sufficient amounts are retained to send via truck to the selected landfill site. ...

During the pelletization process, eddy current separation and magnets are used in several locations to select both ferrous and non-ferrous materials for delivery to the recycling markets. The materials suitable for manufacture of fuel pellets are shredded, fiber zed and stored in a silo. This stored material is then mixed with high BTU materials such as carpet waste, polyfilm etc and then pelletized and stored for sale and transportation to their final destination for use as an alternate fuel. Pellets can be stored on-site in bags or in bulk in interior bins or storage rooms, or in exterior storage silos. ...

Various qualities of fuel pellets can be produced, depending on the needs of the user or market. A high quality of RDF would possess a higher value for the heating value, and lower values for moisture and ash contents. The quality of RDF is sufficient to warrant its consideration as a preferred type of fuel when solid waste is being considered for co-firing with coal or for firing alone in a boiler designed originally for firing coal. ...Fly ash which is produced as by-product in the process is commonly used as an additive for brick manufacturing. A biological air filtration system is installed to ensure air exhaust within the MSW receiving and sorting section of the facility is cleaned prior to exhaust to atmosphere. Dust, odour and debris emissions are minimized in the process facility by maintaining a negative pressure in the tipping floor and pit area and continuously introducing fresh air. ...

6. f .2.Densification:5 to 10% of binders ,additives are added for obtaining good quality fuel

6.f .3.Size reduction unit: it is heated by the hot gases from the chimney upto moisture content 15% and made to short pieces up to 1 to 2cm These small pieces are called pellets These pellets are cooled and stored under storage room for dispatch

6.g. Supply of pellets to boilers

These pellets produced are burned in the boiler and generated heat is used for producing steam. India is the one of largest producer of MSW, it is around 1.5 Lakh ton per day. In India all the dump yards in open condition, due to this Dioxins and other air pollutants like Nitrous Oxide (N2O) are produced by the burning of Garbage in Dumping yards under uncontrolled conditions. It has 179 times more Global warming potential than CO2.Methane is formed by the decomposition of Organic matter main Sources are Landfills, It has 24 times more Global warming potential than CO2.

The only proven and time tested technology for heterogeneous Garbage is mass burning, that is widely implemented in Europe, China & Korea for the Disposal of MSW.The MSW having low heat value, high emission levels, for this we have introduced mass burning technology (Reverse Push Stoker coupled with waste heat energy system). MSW/RDF is also a good substitute to coal.

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6.g. 1.technology:

Single-segment reverses push stoker system movement process and features:

The Single Segment Reverse Push Stoker System shall be capable of combusting waste which has the minimum GCV of 1050 kcal/kg. The handling capacity is 500 tons per day. The reciprocating stoker system will consists of a refuse feeder, a reverse acting stoker with adjustable device of refuse layer, a combustion control system and a ash discharge system. This technology is developed based on the existing reverse push reciprocation grate, and its core is in view of the living MSW features of low heat value and high moisture. The MSW could be more fully burned by Single Segment Reverse Push Stoker system so as to decrease the heat reduction rate of ash slag. The primary air used for supporting burning is preheated by secondary air heater to make the temperature more than 240 ºC to 250 ºC, so as to make the MSW that enters into furnace dried, fired and burned at a quick speed. The extra air factor of boiler is designed to be over 1.6, to maintain sufficient oxygen in boiler and reduce the production of TEQ. Our boiler, high-temperature secondary air sprays into at a high speed to make sufficient disturbance of flue gas, prolong the residence in furnace, so as to improve the combustion condition to ensure the flue gas temperature not lower than 850 deg. C in furnace and residence over 2 seconds. In view of the situation that the primary air which is used for supporting burning is difficult to control, division air chambers is designed, that is in accordance with the different regional features during MSW burning, the air chamber under the grate is divided into several relatively independent air chambers, each chamber equipped with air adjust door. Under certain air pressure, by adjusting the primary air amount in one or several or all air chambers, the regional or the whole combustion condition could be improved. The open range of air door and air amount is designed to be linear ratio, and the combustion condition could be exactly controlled by auto control system.

6.g. 2.brief description of the system:

Three pass thermal technology for optimum heat recovery:

6.g. 2.1.first pass consists of:

First Zone of Water Cooled Membrane walls Provides Maximum Recovery of Heat through Radiation. Fin welded membrane wall construction with special refractory protection for bottom furnace zone to protect tubes from corrosive/erosive attack.The firing system consists of Single-segment Reverse acting stoker system with water cooled Hopper with adjustable device, chute, feeders and Reverse acting stoker.

6.g. 2.2.Second Pass Consists Of:

Second Zone of water cooled membrane walls are cooled the flue gases adequately before entering super heater zone in the third pass of furnace.

6.g. 2.3.Horizontal Third Pass Consists Of Screen Tubes:

The Screen section consists of bare tubes arranged to form a tube bundle. The tubes are arranged in such a manner that they face the gas flow directly. The top and bottom ends of the tubes are welded to headers, which in turn are connected to the steam drum / water circuits respectively. The Screen section, connected to the steam drum by means of the front wall tubes of the second pass water wall casing. The bottom header is connected bottom headers of rear water wall casing. Thus individual risers & down comers are eliminated. This reduces site erection activities to a considerable extent.

6.g. 3.Superheater Section:

In the super heater section the saturated steam is heated to required final temperature. The super heater section is divided in to three parts. The first part which heats saturated steam is called Primary Super heater after primary super heater the steam enters in to Intermediate Super heater then the steam enters in to final super heater, which further heats superheated steam to the final required temperature, is called the Final Super heater. The Intermediate Super heater aiding, when the boiler is running at 60% load it will maintain the required temperature.

6.g. 4.De- Super heater Section:

Between both the primary, Intermediate and final super heaters, Two sets of de-super heater is provided. The sole purpose of the de-super heater is to control final temperature of the super heater temperature. The De-Super heater is Spray Type, Which sprays relatively cold Boiler Feed Water into the steam leaving the Primary Super heater. This causes the temperature of steam at outlet of Primary Super heater to attain to the preset valve. By varying the quantity of desuperheater spray water, the temperature of steam entering the

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secondary super heater can be controlled. Since the final temperature of steam leaving Secondary Super heater depends on the inlet temperature of steam, an attemperation at intermediate level is an efficient method of Final Superheat Temperature Control.

***6.g. 5.Evaporator Modules*:**

The Evaporator section consists of bare tubes arranged to form a tube bundle. The tubes are arranged in such a manner that they face the gas flow directly. The top and bottom ends of the tubes are duly welded to headers, which in turn are connected to the steam drum / water circuits respectively.

6.g. 6.Economiser Modules:

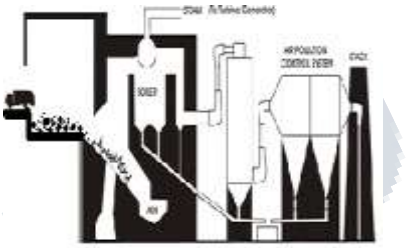
The Economizer section consists of bare tubes arranged to form a tube bundle. The tubes are arranged in such a manner that they face the gas flow directly. The top and bottom ends of the tubes are duly welded to headers, which in turn are connected to the steam drum / water circuits respectively. In this zone consists of economizer, the heat is recovered to preheat the Boiler Feed Water is preheated. The heat in flue gases after Economizer will be about 170 ºC – 180 ºC, so that bag filter operates in safe mode.

6. G.7.Steam Air Preheated Modules:

The air preheated is broadly divided into two sections namely, Low pressure and High Pressure steam air preheated section. The air is heated from ambient temperature to 240ºC - 250°C by using Steam coil air preheated for better combustion. Hot air transferred to the stoker compartments under the grate and is blown upwards through the grate in the burning refuse layer. In this arrangement Air will be outside the fin tube and steam will be inside the fin tubes. Hence steam is generated this high pressure steam is used to run the turbine .the shaft of turbine is coupled to the alternator. Thus Power generation takes place.

6. H. Ash Disposal

Another challenge is the disposal of the ash after combustion. Ash can contain high concentrations of various metals that were present in the original waste. Textile dyes, printing inks, and ceramics, for example, contain the metals lead and cadmium. Separating waste before combustion can solve part of the problem. For instance, because batteries are the largest source of lead and cadmium in the solid waste stream, they should be taken out of the mix and not burned. The ash must be disposed of carefully. Like regular garbage, it is not a good idea to place ash in an unprotected landfill because water trickling through the landfill, called leachate, will pick up the chemicals and metals in the ash and could contaminate the ground and surface waters nearby. Ash is now used in some places for building roads, making concrete stronger and as artificial reefs for marine animals.



6. H.1.process of manufacture of fly ash bricks:

Fly ash, hydrated lime, Quarry dust and gypsum are manually fed into a pan mixer where water is added in the required proportion for intimate mixing. The proportion of the raw material is generally in the ratio 62% fly ash,8% lime,5% Gypsum, 25% Quarry Dust depending upon the quality of raw materials. After mixing, the mixture is shifted to the hydraulic Brick Making machines. The bricks are carried on wooden pellets to the open area where they are dried and water cured for 14 days. The bricks are tested and sorted before dispatch.

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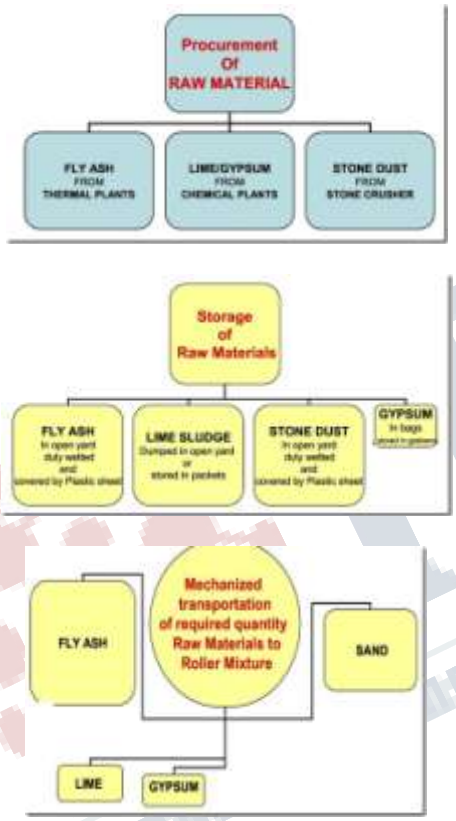
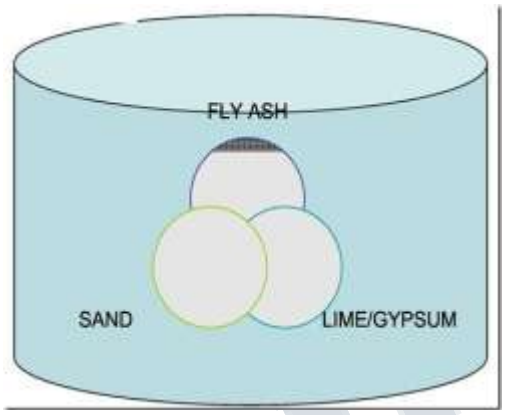
Procurement of Raw Material



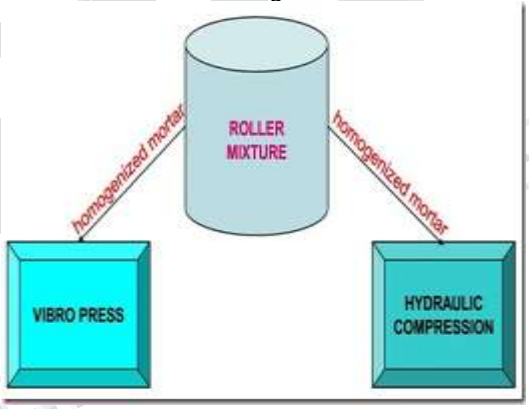
Wet mixing in Roller Mixer

Raw materials are kneaded under rollers for achieving homogenous mortar

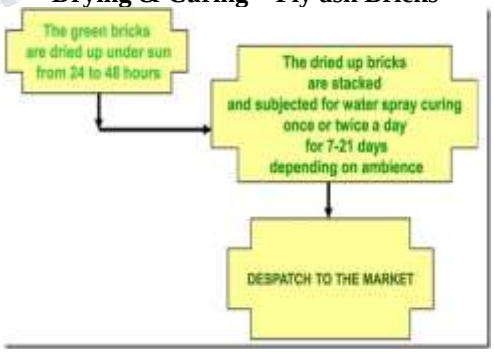
Mechanized Transfer from Pan Mixer to Automatic Brick Making Machine



Mechanized Transfer from Pan Mixer to Automatic Brick Making Machine



Drying & Curing – Fly ash Bricks



6. I.Vermi Compost

Vermicompost is the product of composting utilizing various species of worms, usually red wigglers, white worms, and earthworms to create a heterogeneous mixture of decomposing vegetable or food waste (not to include meat, dairy, fats or oils), bedding materials, and vertices. Vertices, also known as worm castings, worm

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humus or worm manure, is the end-product of the breakdown of organic matter by species of earthworm. This type of composting is sometimes suggested as a feasible indoor composting method



The earthworm species (or composting worms) most often used are Red Wigglers (Eisenia foetida or Eisenia Andrei), though European nightcrawlers (Eisenia hortensis) could also be used. Red wigglers are recommended by most vermiculture experts as they have some of the best appetites and breed very quickly. Users refer to European nightcrawlers by a variety of other names, including dendrobaenas, dendras, and Belgian night crawlers. Containing water-soluble nutrients, vermicompost is a nutrient-rich organic fertilizer and soil conditioner. Vermicompost tea has been shown to cause a 173.5% increase in plant growth by mass over plants grown without castings. These results were seen with only 10% addition of castings to produce these results. Waste-to-energy technologies hold the potential to create renewable energy from waste matter, including municipal solid waste, industrial waste, agricultural waste, and industrial byproducts. Besides recovery of substantial energy, these technologies can lead to a substantial reduction in the overall waste quantities requiring final disposal, which can be better managed for safe disposal in a controlled manner. Waste-to-energy systems can contribute substantially to GHG mitigation through both reductions of fossil carbon emissions and long-term storage of carbon in biomass wastes. Modern waste-to-energy systems options offer significant, cost-effective and perpetual opportunities for greenhouse gas emission reductions.

6. J.Gasification

What is Gasification?

Gasification is a flexible, reliable, and clean energy technology that can turn a variety of low-value feed stocks into high-value products, help reduce our dependence on foreign oil and natural gas, and can provide a clean alternative source of base load electricity, fertilizers, fuels, and chemicals. It is a manufacturing process that converts any material containing carbon—such as coal, petroleum coke (pet coke), or biomass—into synthesis gas (syngas). The syngas can be burned to produce electricity or further processed to manufacture chemicals, fertilizers, liquid fuels, substitute natural gas (SNG), or hydrogen.

Gasification has been reliably used on a commercial scale worldwide for more than 50 years in the refining, fertilizer, and chemical industries, and for more than 35 years in the electric power industry. There are more than 140 gasification plants operating worldwide. Nineteen of those plants are located in the United States. Worldwide gasification capacity is projected to grow 70 percent by 2015, with 80 percent of the growth occurring in Asia. Gasification can compete effectively in high-price energy environments to provide power and products.

Chemistry

In a gasifies, the carbonaceous material undergoes several different processes:

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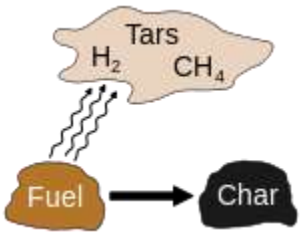
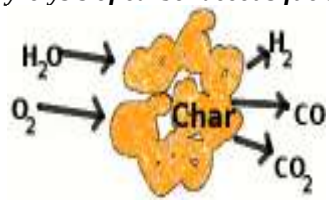


Pyrolysis of carbonaceous fuels



Gasification of cha

The pyrolysis (or devolatilization) process occurs as the carbonaceous particle heats up. Volatiles are released and char is produced, resulting in up to 70% weight loss for coal. The process is dependent on the properties of the carbonaceous material and determines the structure and composition of the char, which will then undergo gasification reactions.

The combustion process occurs as the volatile products and some of the char reacts with oxygen to form carbon dioxide and carbon monoxide, which provides heat for the subsequent gasification reactions. Letting C represent a carbon-containing organic compound, the basic reaction here is

$$C + \frac{1}{2}O_2 \rightarrow CO$$

The gasification process occurs as the char reacts with carbon dioxide and steam to produce carbon monoxide and hydrogen, via the reaction

$$C + H_2O \rightarrow H_2 + CO$$

In addition, the reversible gas phase water gas shift reaction reaches equilibrium very fast at the temperatures in a gasifier. This balances the concentrations of carbon monoxide, steam, carbon dioxide and hydrogen.

$$CO + H_2O \leftrightarrow CO_2 + H_2$$

In essence, a limited amount of oxygen or air is introduced into the reactor to allow some of the organic material to be "burned" to produce carbon monoxide and energy, which drives a second reaction that converts further organic material to hydrogen and additional carbon dioxide.

7. k. Environment impacts

The implementation of the project could possibly exert an impact to the vicinity in terms of reducing items such as air, water, noise, and vibrations. The study of this area concluded that the project would not exert an adverse environmental impact to the vicinity. The process facilities in question would be designed and constructed in accordance with the environmental standards applied in Indonesia. On the contrary, the project would act to improve the environment in the vicinity of the Cilincing disposal site if this would clearly reduce the MSW volumes. In implementing the project, the following environmental impact issues are to be considered.

7. k .1.air pollution

The air concentration in DKI Jakarta is thought to meet the country's air pollution standards, with the exception in few districts. The MSW processing facilities to be installed for this project would be designed and built to meet the standards, and it is inconceivable that their operation would exert adverse impacts to the surrounding environment. In the final disposal site at Cilincing, the concentrations of total solid particle (TSP) and hydrocarbon (HC) are much higher than the standards. A reduction of MSW disposed of by burying it from project implementation would likely to improve atmospheric environment in the site and its vicinity to some degree. The Cilincing area, which is the prospective site for the project facilities, is now a vacant lot where refuse is illegally dumped and burned (the latter being a source of dioxin emissions). The construction of a refuse processing facility at Cilincing will presumably eliminate this burning of refuse in the open, and the facilities will be in conformance with Indonesian standards for dioxin countermeasures. The atmospheric environment in the vicinity should improve as a result.

7.k .2.Water pollution

Indonesia has enacted regulatory standards for water quality, but its water environment is in worse shape than the atmospheric environment. It is clearly seen in the rivers flowing through the city that the water

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pollution standards are largely ignored. The refuse processing facilities would apply Indonesian wastewater discharge standards, which are tougher than those for common river water in Indonesia. This indicates that the facilities would not pollute the water in the vicinity. In contrast to this project, the discharge of leachate from the Cilincing site into the river has caused river water concentrations exceeding standard values, for items such as NH3, Mn, and H2S. Similarly, the study of well water found values above the standards for acidity and lead, among others. Therefore, a reduction of MSW to be disposed of along with operation of the MSW processing facilities would somewhat mitigate water pollution

VIII.ADVANTAGES

The benefits of the proposed project are:
a. Reduction of environment pollution (in rivers, sea and ground caused by waste disposal and air pollution from open burning of waste);
b. Overcome of social issues occurring from illegal waste disposal (open dumping);
c. Conversion of non reusable waste into combustible gases for electricity generation, for better economic benefits;
d. Utilization of municipal solid waste leading to reduction of the use of fossil fuel;
e. Reduction of GHG emissions;
f. Cleaner environment for better public health (odour, seeping of contaminated or polluted water, potential spreading of disease);
g. Creation of job opportunities; and
h. Dissemination of a good municipal waste treatment technology to other locations

Burning MSW can generate energy while reducing the volume of waste by up to 90 percent, an environmental benefit. Ash disposal and the air polluting emissions from plant combustion operations are the primary environmental impact control issues.

MSW contains a diverse mix of waste materials, some benign and some very toxic. Effective environmental management of MSW plants aims to exclude toxics from the MSW-fuel and to control air pollution emissions from the WTE plants.

Toxic materials include trace metals such as lead, cadmium and mercury, and trace organics, such as dioxins and furans. Such toxics pose an environmental problem if they are released into the air with plant emissions or if they are dispersed in the soil and allowed to migrate into ground water supplies and work their way into the food chain. The control of such toxics and air pollution are key features of environmental regulations governing MSW fueled electric generation.

Burning MSW in WTE plants produces comparatively high carbon dioxide emissions, a contributor to global climate change. The net climate change impact of these emissions is lessened because a major component of trash is wood, paper and food wastes that would decompose if not burned. If left to decompose in a solid waste landfill, the material produces methane — a potent greenhouse gas.

These plants produce comparatively high rates of nitrogen oxide emissions. The on-site land use impacts are generally equal to those of coal or oil fueled plants.

IX. PROBLEMS ASSOCIATED WITH BIO-MASS UTILIZATION

a. Dust and other health harzards
b. Transportation: biomass occupies a large volume due to low bulk density (30 - 180 kg/m3)
c. Seasonal availability
d. Large storage space is required due to low bulk density & seaonsal production
e. Labour intensive and dispersed in large areas
f. Specific energy content is lower
g. Localized price senstivity
h. High moisture content
i. Automatic feed control is required because of its non free-flow nature
j. Bio-mass handling & collection; large network required
k. Light ash - an atmospheric pollutant

X. CONCLUSION

1. eco-froendly project
2. Besides improving the environment, the project is financially and economically feasible.
3. Material solid waste is reduced
4. Rice husk increases the calorific value of the refused derived fuel

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5. Elctricity is generated
6. The emission of CO2 from the waste decreases so tha the green house effect decreases
7. Natural high quality manure is produced
8. Flyash bricks – equal to the strength of the general ash bricks are obtained

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