GUIDELINES

FOR

PREPARATION OF DETAILED

PROJECT REPORTS

AND

SELECTION OF TECHNOLOGIES

FOR

PROCESSING AND FINAL

DISPOSAL OF

MUNICIPAL SOLID WASTE

USING

12TH FINANCE COMMISSION

GRANTS

GUIDELINES FOR MUNICIPAL SOLID WASTE MANAGEMENT

. Rapid urbanization has led to over-stressing of urban infrastructure services including Municipal Solid Waste Management because of poor resources and inadequacies of the existing systems. Therefore, augmenting, operating & maintaining solid waste management system in a sustainable manner by urban local bodies would require huge capital investment, introduction of latest technologies which are cost effective, Public-Private Partnerships (PPP) in waste management and introduction of appropriate waste management practices in order to prevent urban waste from causing environmental pollution and health hazards.

2. Per capita waste generation varies between 0.2 Kg to 0.6 Kg per day in cities with population ranging from 1.0 lakh to 50 lakh. An assessment has been made that because of increasing per capita waste generation of about 1.3% per year, and growth of urban population between 3% and 3.5% per annum, yearly increase in the overall quantity of solid waste in the cities is about 5%. Waste collection efficiency ranges from 50% to 90%. Urban Local Bodies (ULBs) spend between Rs.500/- to Rs.1500/- per ton on solid waste management, of which 60% to 70% is spent on

collection alone, 20% to 30% on transportation and less than 5% on treatment and disposal which is very essential to prevent environmental pollution. Crude dumping is normally resorted to by ULBs without adopting scientific and hygienic approach of sanitary landfilling.

3. Problem of urban waste management is notable not only because of large quantities involved, but also its spatial spread across 5161 cities and towns and enormity and variety of problems involved in setting up and managing systems for collection, transportation and disposal of waste.

4. Quantity & Characteristics of Indian Municipal Waste

Urban India produces about 42.0 million tons of municipal solid waste annually i.e. 1.15 lakh metric tons per day(TPD), out of which 83,378 TPD is generated in 423 Class-I cities. Waste generated in 423 Class-I cities works out to 72.5% of the total waste generated each day and this needs to be tackled on priority.

Municipal solid waste comprises 30% to 55% of bio-degradable (organic) matter, 40% to 55% inert matter and 5% to 15% recyclables. Composition of waste varies with size of city, season and income group. **Details are at Appendix- A.**

5. 9

Possible Waste Management Options

At least 50% to 55% of municipal solid waste is also a valuable resource which can be recovered profitably using different technologies through following processing options:

I. Wealth from Waste

Organic fraction of municipal solid waste contains bio-degradable matter ranging from 30% to 55% which can be profitably converted into useful products like compost (organic manure), methane gas (used for cooking, heating, lighting, production of energy) etc. through the following processes:-

(a) Waste to Compost

(i) Aerobic / Anaerobic Composting

(ii) Vermi-Composting

(b) Waste to Energy

(i) Refuse Derived Fuel (RDF) / Pelletization

(ii) Bio-methanation

(iii) Incineration

(iv) Pyrolysis / Plasma Gasification

II. Recycling of Waste (Plastics, paper, glass, metal etc.)

Recyclable materials like paper, cardboards, plastics, polythene bags, pieces of metals and glass are recycled to recover useful resource.

III. Sanitary Landfilling

Rejects from compost plants, recycling and other inorganic materials like construction debris in Municipal Solid Waste are sent to scientifically engineered landfills**.**

It is emphasized that success of above mentioned options largely depends on segregation of waste at source. Details of processing options are given at Appendix-B.

6. Technology Options for Waste Processing

The quantity and quality of garbage generation varies from city to city keeping in view the standard of living of citizens, industrial or non-industrial city and commercial & economic activity therein. Therefore, various technology options are available for processing the municipal garbage.

Towns generating garbage :

Upto 50 Metric tons/ Day (MT / Day)	=	Vermi-composting
Between 50 MT and 500 MT / Day	=	Vermi Composting + Mechanical Composting
More than 500 MT / Day	=	Mechanical Composting and Waste-to-Energy through Refuse Derived Fuel (RDF) keeping in view the type of city (industrial or non-industrial) and suitability of quality and quantity of garbage available.

(Rejects from all the above processing options have to go to the scientifically reengineered landfills to prevent environmental pollution)

Bio-methanation technology can also be used for treatment of garbage as decentralized plants for treating limited quantity of municipal garbage. Till date, there is no success story of treating

large quantities of municipal garbage through bio-methanation route.

While selecting waste-to-energy technologies, suitability / success of each technology vis-à-vis quality and quantity of garbage in a particular city should be got verified and ULBs should ensure that the selected technology has successfully treated the municipal garbage in large quantities before adopting any technology.

7. Preparation of Detailed Project Report (DPRs)

DPRs should be prepared as per the guidelines laid down in the Manual on Solid Waste Management published by this Ministry, which should include:

(i) Existing status of SWM in the towns including mechanism and infrastructure for collection, transportation, treatment & disposal. The details should include existing equipment/machinery and other infrastructure available with ULB and its age. The mechanism & O/M of the equipment available, present establishment expenditure, technical and non-technical manpower available.

(ii) Field study be carried out in commercial / institutional and residential areas to assess the quantity of garbage generated in the city before planning the system and report of the field study be included in the DPR.

(iii) Complete physical characterization of waste, including moisture content, density and etc. as well as weight & volume of quantity of bio-degradable, non bio-degradable & recyclables available in the waste produced in the town everyday and test report for quality of garbage from a standard test laboratory .

(iv) Existing system of collection, storage, transportation, processing, treatment and disposal of waste and proposed system of collection, transportation and process of treatment & disposal, fully justifying the process adopted including in-house facility of maintenance and repair if available in ULB.

(v) Justification for equipment & machinery required, if any, for collection and transportation based on the time and motion study in order to ensure optimum utilization of the same.

(vi) Detailed designs & drawing of proposed Solid Waste Management System including sanitary landfill / waste processing plants should be included in the DPR. Details

of the survey and geo-hydrological investigation carried out for development of sanitary land fill.

(vii) Mechanism of operation & maintenance of equipment & machinery and its upkeep, preventive maintenance on regular basis for existing and proposed equipment & machinery.

(viii) Mechanism of operation and maintenance of sanitary land fill / waste processing plant on self sustaining basis including details of engagement of private sector, if any.

(ix) A routing plan for storage and collection of garbage, marked out on the city's layout plan, to facilitate easy operations in SWM services.

(x) Proposed institutional and financial reform after completion of scheme.

(xi) An action plan for effective O/M through imposition of user charges.

(xii) Details of suitable land for setting up of integrated waste management facility in possession including land for sanitary landfill

While preparing the detailed project report for any city / town, the guidelines laid down in the Manual on Municipal Solid Waste Management published by this Ministry in May, 2000

should be considered and each component of the project prepared as per the norms laid down therein.

APPENDIX-A

Quantity of waste generation

Total quantity of municipal solid waste generated - 1.15 lakh tonne / day (TPD)

		% of total garbage
Waste generated in 6 mega cities	21,100 tpd	18.35%
Waste generated in metro cities (Population 10 lakhs +)	19,643 tpd	17.08%
Waste generated in other Class-I towns (1.0 lakh plus population)	42,635.28 tpd	37.07%
	83,378.28 tpd	**72.50%**

If waste produced in all 423 class-I cities is tackled, percentage of solid waste managed scientifically would be 72.5% of total waste generated each day.

Characteristics of typical Indian Solid Waste

Municipal solid waste comprises organic and inorganic wastes including recyclables which could be sorted out and reused as raw materials. The organic fraction of municipal solid waste can be converted into useful product like organic manure or Methane gas etc. which could be used for cooking, heating and production of energy.

Bio-degradable (organic matter)	-	30-55%
Inert matter	-	40-55%
Recyclable matter	-	5-15%

Composition of waste varies with size of city, season and income group

APPENDIX-B

POSSIBLE WASTE MANAGEMENT OPTIONS

At least 50% to 55% of municipal solid waste is also a valuable resource which can be recovered profitably using different technologies through following options.

1. Wealth from Waste

The organic fraction of municipal solid waste contains bio-degradable matter ranging from 30% to 55% depending upon the size of the city, income levels of citizens, eating habits of the population and ongoing economic activity. This organic matter can be profitably converted into useful products like compost (organic

manure), methane gas (used for cooking, heating, lighting, production of energy) etc. through the following processes:-

(a) Waste to Compost

(i) Aerobic / Anerobic Composting

Composting is a process of conversion of bio-degradable waste into stable mass by aerobic / anerobic decomposition producing Carbon-di-oxide, Nitrogen, Phosphorous, Potassium etc. useful for soil fertility.

(ii) Vermi-Composting

Organic waste is stabilized through consumption by earthworms into worm castings which is known as vermi-compost and which is used as organic manure in agriculture.

(b) Waste to Energy

(i) Refuse Derived Fuel (RDF) / Pelletization

Pelletization involves segregation of incoming waste into high and low calorific value materials, shredding them separately to uniform size, reducing its moisture content, mixing them together and making

into pellets / briquettes which are used for producing thermal energy.

(ii) Bio-methanation

Segregated garbage undergoes anaerobic digestion producing methane gas and effluent sludge. Bio-gas production ranges from 50 M^3 – 100 M^3 / MT of wastes. The gas is utilized for heating applications / dual fuel engines / steam turbines for generation of power. Sludge after stabilization can be used as soil conditioner.

(iii) Incineration

Process of direct burning of wastes in the presence of excess air at temperature of about 800^0C to 870^0C, liberating heat energy, inert gases and ash. The process is power intensive and used for bio-medical waste management.

(iv) Pyrolysis / Plasma Gasification

The process of thermal decomposition of organic waste for energy recovery using plasma arc torch producing temperatures between 5000^0C and 14000^0C

for heating of waste and converting into gaseous form. The process is cost-intensive and can be used for hazardous waste / bio-medical waste only.

2. Sanitary Landfilling

Municipal waste contains 40% to 55% of the inert matter depending upon the type of city and ongoing infrastructure development activity. This inert material cannot be converted into any useful product and needs to be managed in the scientific and hygienic manner in order to prevent pollution of underground water reservoirs or surface sources in the vicinity of the town. Therefore, the residuals / unutilized / inerts from the waste processing facilities like compost / waste-to-energy plants are put into the scientifically engineered landfills to prevent environmental pollution.

3. Recycling of Waste (Plastics, paper, glass, metal etc.)

The municipal solid waste contains 5 to 15% recyclable matter like plastics, glass, paper, metals etc. which can be easily recycled and reused by the community. The

recyclables are collected by *kabadis* at household level and by informal sector from compost plants and dump yards and sent to recycling industries for conversion into useful products.

However, segregation of waste at source is key to the success of all the options and technologies available within the country and abroad.