
Integrated MSW Strategy and Plan for Delhi.

Abstract: The Union Territory of Delhi, the capital of India has a population of 18 million and is one of the biggest metropolises of the world and generates 10,500 MT/D and which is expected to reach 17,000 – 25,000 MT /D by 2021.

The Five agencies responsible for Municipal Solid Waste (MSW) management in Delhi are; North, South and East Municipal Corporation, New Delhi Municipal Council (NDMC), and Delhi Cantonment Board (DCB). **After a careful assessment of the status of MSWM an** Integrated Sustainable Municipal Solid Waste Management System (ISWMS) was suggested in 2017. Cost estimates has also been worked out for setting up waste processing plants based on the recommendations of the Task Force on WtE constituted by the Planning Commission. A End to End (E t E) waste collection to elimination scheme based on modern Technological options (WTG1XG + WTG2XG) has also been suggested to Manage MSW.

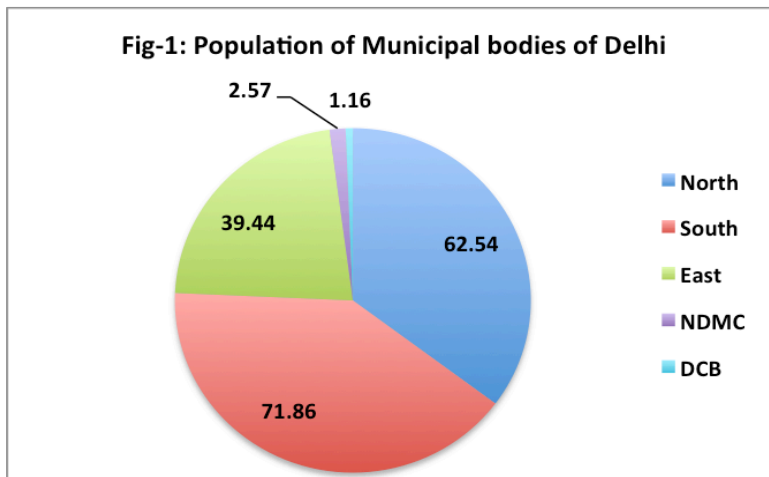
The paper details a sustainable, technical and financial MSW strategy for all the 5 Municipal Corporation of Delhi(MCD) . The Strategy suggested, has been submitted to the Delhi Government by the Delhi Finance Commission who sponsored the study.

Keywords: Integrated Sustainable Municipal Solid Waste Management System (ISWMS); Waste to Energy (WtE); End to End (EtE); de-centralised processing; Sanitary Landfill Site (SLF); WTG1XG technology; 5 R's -Reduce, Reuse, Recycle, Recover and Re-Manufacture; Decision Support System (DSS).

1.Introduction

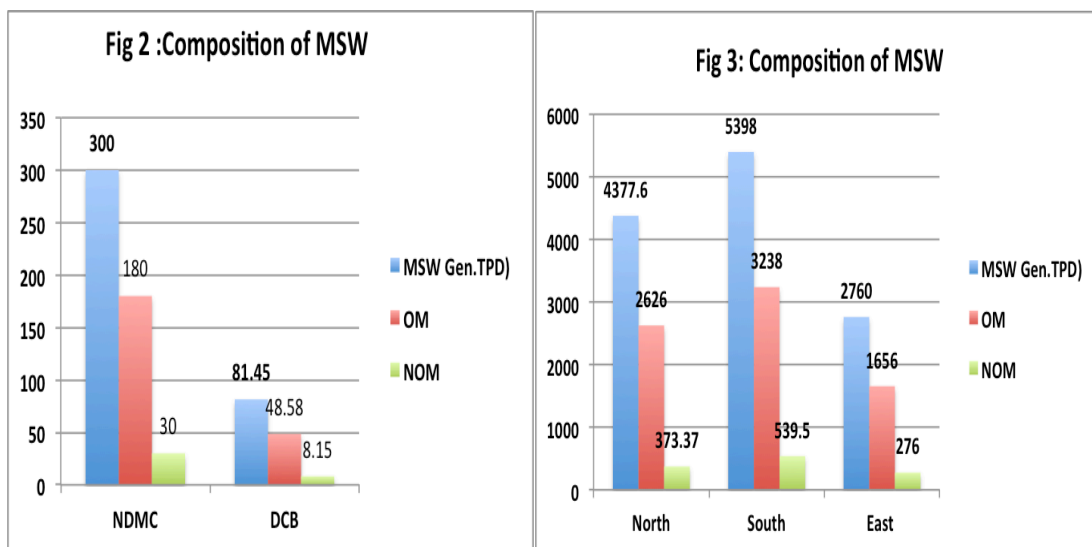
The Union Territory of Delhi is the capital of India with a population of 18 million , is one of the biggest metropolises of the world and generates 10,500 MT/D and which is expected to reach 17,000 – 25,000 MT /D by 2021. One of the major goals of the Government is to make Delhi a center of urban excellence, a well-managed, clean and hygienic city. The Five agencies responsible for Municipal Solid Waste (MSW) management in Delhi are; North, South and East Municipal Corporation, New Delhi Municipal Council (NDMC), and Delhi Cantonment Board (DCB).

The area covered by NMCD, SMCD and EMCD is approximately 1399.26 sq.km and has a population of 174 lakhs and comprises of 12 Zones and 272 wards. The North MCD , spread over 604.54 Sq Km ,consists of six zones namely; 1.City, 2.Karol Bagh, 3.Sadar Paharganj, 4.Civil Lines , 5.Narela, and 6.Rohini. South MCD consists of four zones, namely ;west, South ,Nazafgarh and Central. East MCD consists of two zones namely; Shahdara South and Shahdara North and has a population of 23.89 and 15.45 lakh respectively.



The New Delhi Municipal Council (NDMC), with a population of 2.54 lakhs spread over an area of 42.74 sq km generates 250-300 TPD of MSW and Delhi Cantonment Board (DCB), with a population of 1.16 lakhs generates 60.53 TPD and both have 9 wards each. (Fig-1)

Fig 2 & 3 depicts the MSW generated TP day along with percentage of Organic and Non-organic components of the waste.



The function of the DEMS of all 5 DMC's which includes SDMC, NDMC, EDMC, New DMC and the Cantonment can broadly be divided into two parts.

- Solid Waste Management
- Management of Storm water drainage system

The jurisdiction of the 3 MCD South, East and North, includes 135 urban/191 rural villages; 567 unauthorized regularized colonies; 1639 unauthorized colonies; 45 resettlement colonies; 725 jhuggi jhopri clusters; 18 industrial estates; 9 dairy colonies; roads; streets and public conveniences. About 49% of the total population of Delhi lives in slum areas, unauthorized colonies and about 860 JJ Clusters with 4,20,000 Jhuggies. A sizeable population therefore lives in unplanned areas having no proper system of collection, transportation and disposal of Municipal Solid wastes. As a rough estimate only, about 25% of population lives in planned development areas. There is also the floating population visiting Delhi in connection with business activities Delhi being a major distribution centre of retail business in North India.

As per the Municipal Solid Waste Rules 2016, which has replaced the 2000 rules, the collection, segregation, storage, transportation, processing and disposal of MSW continues to be the

responsibility of the local bodies. It is also the obligatory function of MCD to provide receptacles, depots and places for waste disposal. MCD is helped by various agents in private sector e.g. private sweepers and garbage collectors employed by private premises; rag pickers; junk dealers and industries which use scrap to produce products.

2. Current Status and Gaps of MSWM in Delhi

The current status of management of MSW in Delhi and gaps observed in compliance and provisions of MSW Rules are briefly summarized as under and depicted in Fig-3:

Collection of waste: All the areas are not served with house- to house collection of waste resulting into littering of garbage all over the places.

Extending facilities for collection of solid waste from all the sources (Households, Markets, Offices, Slums and other areas). Organizing a system of collection through rag pickers and participation of NGO's RWA and market associations.

Segregation of waste: Practically no segregation of waste is practiced. Appropriate mass awareness programmes have been launched for motivating citizens to take part in undertaking segregation of waste.

Promoting/motivating citizens to start segregation of waste at source involving NGO's, RWA for appropriate mass awareness campaigns.

Storage facilities (Bins): Age-old practices (Dhalaos) are used for storage of waste which are posing serious problems and are not acceptable in the present scenario. However, in some selected zones private contractors are engaged for waste storage and transportation.

Provision of litter bins at all public places to discourage littering. Replace dhalao's/ existing dustbins with mechanized storage facility for deposition of segregated waste.

Transportation: Trucks used for transporting garbage are open and not compatible with storage facilities. Entire lifting is manual and at a few places front-end-loaders are used.

Private contractors are also used waste transportation in some selected zones of MCD/NDMC.

Transportation system should synchronize with storage facility thereby prohibiting manual lifting of garbage. Garbage carrying vehicles should be covered. Devising effective transportation system for congested narrow lanes and for slums.

Processing of Waste: Out of 8000 MT/day of estimated waste generated in Delhi, only about 300 MT/day of waste is processed for composting against the 800 MT/day installed capacity. Performance of all the three compost plant is not satisfactory. Main problem of associated with operation of compost plants relates to subsidy by govt. and sale of products (compost) and also its fertility value.

Setting up integrated waste processing facilities (composting/waste to energy and other appropriate methods) for processing of waste.

Disposal of Waste: Approximately 6000 MT per day of waste is transported to the three landfill sites as follows:

Bhalswa: 2700 MT/day

Ghazipur: 2100 MT/day

Okhla: 1200 MT/day

3. Sustainable and Integrated MSW Strategy for North, South and East Municipal Corporation of Delhi, NDMC and DCB.

The Sustainable and Integrated MSW strategy for North, South and East Municipal Corporation of Delhi is detailed in Table-1 along with for NDMC and DCB .

Table-1:-Sustainable and Integrated MSW Strategy for North, South and East Municipal Corporation of Delhi , NDMC and DCB

MCD	Population In Lac*/**	Waste Gen. TPD (0.700 Kg PD)	OM (60%) / NOM (10%)in TPD	Technology Options	Minimum Requirement	Value Added products a Generation Zone wise in
North MCD Zone						
1.Civil Lines	17.298* 18.61	1210.99 1302.7	781.6 / 130.2	1.Renewable CNG gen. @ 10% of OM. 2.Bio-fertilizer generation @ 40% of OM 3.Green Diesel generation @ 30% of NOM. 4.Renewable bitumen gen. PD @40% of NOM.	Segregate OM and NOM wastes at Source/ collection Center.	1. R CNG ----78.2, 62.9 , 40. 2.Bio-Fert-----312.48, 25 153.6 . 3.G.Diesel-----39.06, 31.5, 2 1. R-Bitumen.-----52.08, 4 25.63
2. Rohini	13.67 14.98	956.90 1048.6	629.16 / 104.86			
3. Narela	8.305 9.617	581.39 673.19	403.91 / 67.32			
4.Karol Bagh	7.842 9.154	548.94 640.78	384.47 / 64.08			
5.City	3.589 4.90	251.27 343.0	205.6 34.3	As above	Segregate OM and NOM wastes at Source/ collection Center	1. R CNG --20.6 and 22.2 TP 2. Bio-Fert-----82.24 & 88.8 3.G.Diesel-----10.2 & 11.1 4. R-Bitumen.-----13.6 & 1
6.Sadar Pahar ganj	3.964 5.276	277.48 369.32	221.59 36.93			
TOTAL	54.668* 62.540**	3826.96 4377.6	2626 / 373.37	* Population as per 2011 census, ** Population as on 2016 Dec. Calc		
South MCD Zone	Population In Lac*/**	Waste Gen. TPD (0.700 Kg PD)	OM (60%) / NOM (10%)in TPD	Technology Options	Minimum Requirement	Value Added products a Generation Zone wise in
7.West	25.43	1780	1068 /178	As Above	Segregate OM and NOM wastes at Source/ collection Center	1. R.CNG--100/115/55 2. Bio-fert---400 /450/2 3. G-Diesel --53/55/45 4. Bitumen--70/75/65
8.South	27	1913	1147/191			
9. Najafgarh	13.65	955	573 /95.5			
10.Central	5.78	405*/ 750**	243 / 40.5 450/ 75	As above	Segregate OM and NOM wastes at Source/ collection Center	1. R-CNG --24 2. Bio-Fert-160 - 3. 12 TPD G-Diesel 4. 16 TPD Bitumen
Total	71.86	5398	3238 /539.50			

EAST MCD Zone	Population in Lac*/**	Waste Gen. TPD (0.700 Kg PD)	OM (60%) / NOM (10%)in TPD	Technology Options	Minimum Requirement	Value Added Generation TPD
11. Shahdara. South	23.98	1679	1008 /168 503 (C & D & Silt)	1.Renewable CNG gen. @ 10% of OM. 2.Bio-fertilizer generation @ 40% of OM 3.Green Diesel generation @ 30% of NOM. 4.R. bitumen gen. PD @40% of NOM	Segregate OM and NOM wastes at Source/ collection Center	1. R-CNG --1 2. Bio-Fert-4 3. G-Diesel - 4 Bitumen--
12. Shahdara North	15.45	1081	648 /108 325(C&D & Silt)	As above	Segregate OM and NOM wastes at Source/ collection Center	1. R-CNG --6 2. Bio-Fert-2 3. G-Diesel - 4 Bitumen--
Total	39.43	2760	1656 / 276			

NDMC & Cantonment	Population in Lac*/**	Waste Gen. TPD (0.700 Kg PD)	OM (60%) / NOM (10%)in TPD	Technology Options	Minimum Requirement	Value Add and Gener wise in TP

NDMC	2.54	300	180 /30	1.Renewable CNG gen. @ 10% of OM. 2.Bio-fertilizer generation @ 40% of OM 3.Green Diesel generation @ 30% of NOM. 4.R. bitumen gen. PD @40% of NOM	Segregate OM and NOM wastes at Source/ collection Center	1. R- 2. Bi- 3. G-l 4 Bit
Total						
Cantonment	1.16	81.45	48.87 /8.15	As above	Segregate OM and NOM wastes at Source/ collection Center	1. R- 2. Bi- 3. G-l 4 Bit
Total						

4. Integrated Municipal Solid Waste (IMSW) Management Systems

The Integrated Municipal Solid Waste (IMSW) Management Systems recommended for Zones indicated of North MCD, South MCD and East MCD is set out in Fig-4 and for specified Zones in North MCD, South MCD and East MCD is in Fig-5 below. Fig-6 depicts IMSW system for DCB.

Fig-4:- Integrated MSW Management System for Population above 2 million & 1-2 million , North MCD (Zones -City, Civil Lines, Sadar pahar Ganj and Karol Bagh Zones) ,South MCD (Zones -West, South and Nazafgarh) and East MCD (Zone-Shahdara South)

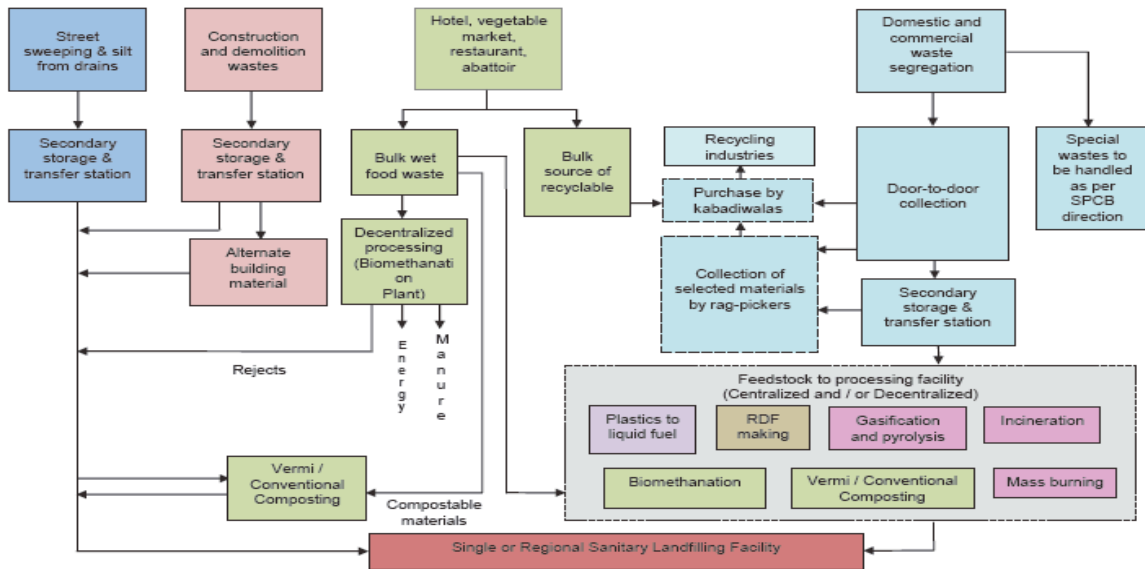


Fig-5 Integrated MSW Management System for Population range 1-10 lakhs North MCD (zones-Narela and Rohini Zone) , South MCD (Zones-Central) and East MCD (Zones-Shahdara North)

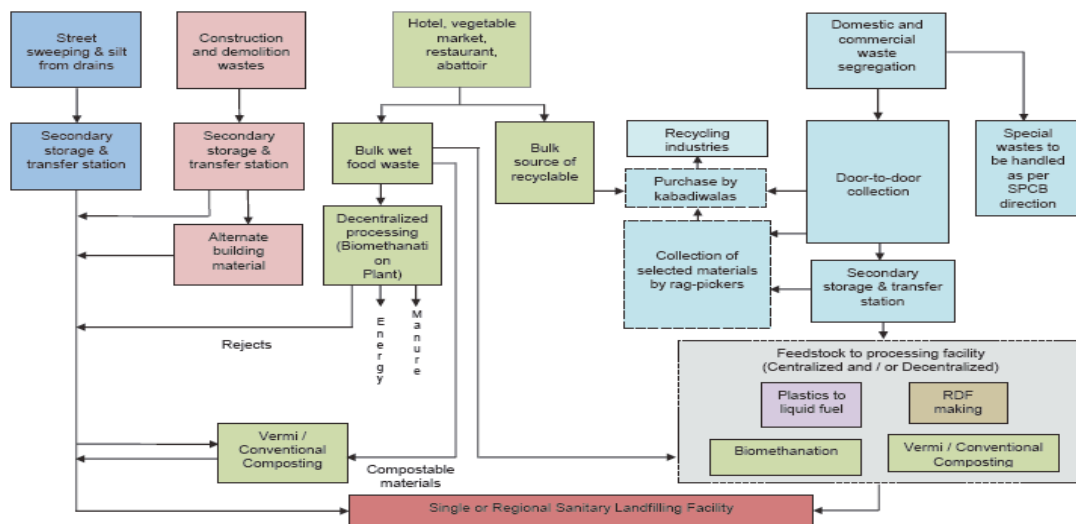
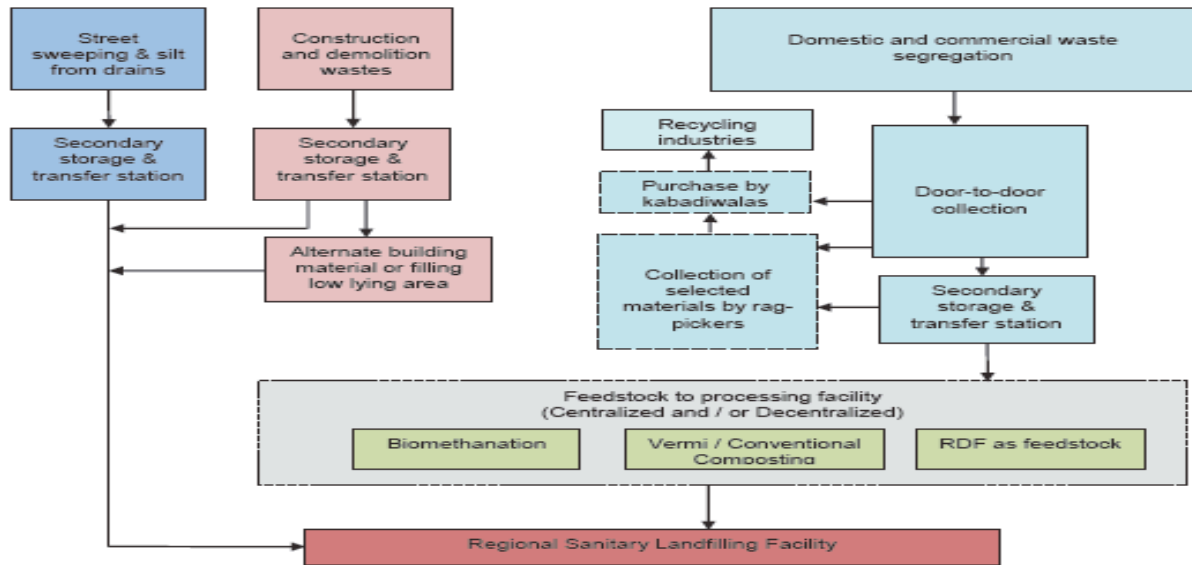


Fig-6 Integrated MSW Management System for Population range 1-2 lakhs DCB



5. Technological Options for Delhi ULB's

Selection of appropriate technology is one of the key considerations for success of a waste management system for a particular Zone /town/city besides taking consideration of other aspects like resource recovery, environmental soundness, financial support, involvement of stakeholders/ public and institutional capability. The following technologies were identified for processing of MSW in the TF report of the Planning Commission:-

- Biomethanation for wet biodegradable wastes
- Conventional microbial windrow/mechanized/ vermi composting for wet biodegradable wastes
- Preparation of briquette/ pellets/ fluff as Refuse Derived Fuel (RDF) from dry high-calorific value combustible wastes
- Incineration / Gasification / Pyrolysis for dry high-calorific value combustible wastes and
- Plastic wastes to fuel oil.

6. E t E waste Collection to Elimination scheme

The E t E waste collection to elimination scheme recommended is based on modern Technological Options (WTG1XG +WTG2XG) to Manage MSW and is detailed below.

WTG1XG process converts all types of biomass and waste like household garbage, kitchen waste, agro waste, animal waste (even human waste) to very high quality clean renewable natural gas-**rNG™**, which can be further converted to renewable-PNG & CNG better known as **rPNG™& rCNG™**.

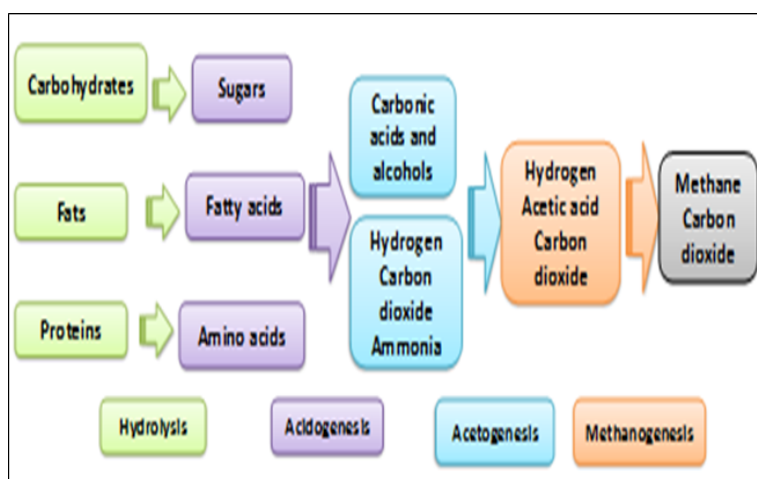
WTG1XG technology eliminates Solid and Sewage Biodegradable waste based on biological catalysts which are naturally present in nature and degrade biodegradable waste. With this technology natural bio degradation is performed in controlled manner inside a bioreactor and environment friendly.

WTG1XG process is carried out by combining **four stages** of microbial degradation of the biodegradable wastes in four independent bio-reactors each loaded with separate set of microbes functioning under different temperature and pH conditions. The four Stages involved are detailed below:-

1. WTG1XG Hydrolysis bio-reactor, uses speciality microbe that consumes sulphur so that H₂S is not produced. Hence there is zero corrosion and **no stinking smell** in WTG1XG process.
2. WTG1XG Acidogenesis bio-reactor is aided by the heating to support the efficient growth of thermophilic and thermophilic microbes of Genus *Bacillus*. The solid organic matter is converted to liquid in the form of volatile fatty acids.
3. WTG1XG Acetogenesis bio-reactor is loaded with speciality microbes that convert VFA to acetic acid and heads towards methane formation process.
4. WTG1XG Methanogenesis bio-reactor converts acetic acid to natural gas with a **low HRT of 14 days**.

The leftover from WTG1XG Methanogenesis bio-reactor is clean water with zero BOD and very high quality Bio-fertilizer. WTG1XG **bio-fertilizer is rich in nitrogen, carbon, and potassium and phosphorous** and devoid of any heavy metals. The seeds of weed are killed by heat in Acidogenesis reactor; hence WTG1XG bio-fertilizer is **weed-free**. The technology Stages and Process flow diagram are at **Fig 7 and 8**.

Fig. 7 Key Stages of Multi-Phase WTG1XG Waste to Biofuel Technology- Bio-methanation reactor

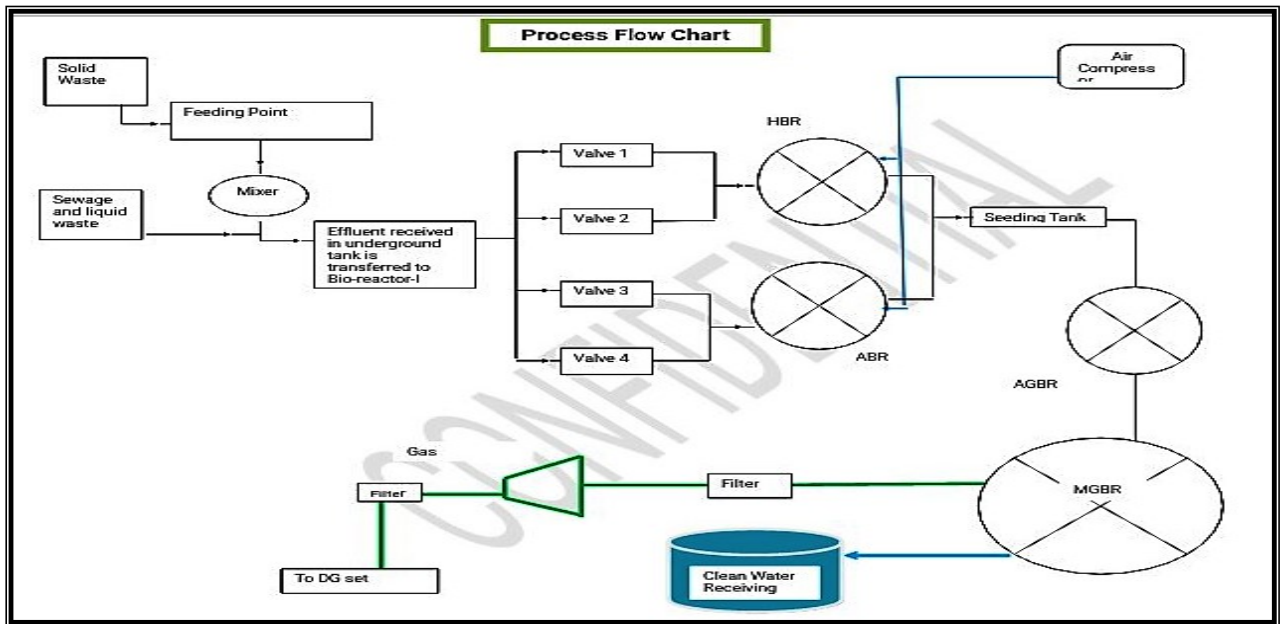


7. Estimated Capital Investments for Technologies

7.1 Estimated Capital Investments for Technologies recommended by Task Force, 2014

To start with and facilitate determining the financial requirement / support needed by the ULBs a cost estimate has been prepared for setting up waste processing plants including W to E plants,

Fig. 8 :-Process Flow Diagram of Biofuel Technology



preparation of RDF, biomethanation, composting and vermi composting facilities based on the recommendations of the Task Force on WtE constituted by the Planning Commission , 2014 and as illustrated in Fig-4 & 5 above. The estimated capital investment works out to approximately Rs. 1001 crore detailed in Table 2 for Zones in North MCD, South MCD and East MCD.

Table-2: Estimated Capital Investment for Technology Options suggested by PC TF Report

MCD	Popula- tion In Lakhs	Total Waste Gen. TPD	Waste to be Treated 70%* TPD	i Waste for WtE 40%	ii Waste for Bio-Metha Nation 10%	iii Waste to Compost 50%	Cost –I @ Rs.10/12 **Cr. Per 75 TPD plant	Cost –II @Rs15Cr. per 100 TPD plant	Cost-III Rs.5 Cr. Per 100 TPD plant
North MCD	62.54	4377.8	3063.9	1225.2	306.39	1531.59	183.43	60	75
Total + 15% Cost escalation									366.19
South MCD		5053	3537	1414.8	353.7	1768.5	226.36	45	70
Total + 15% Cost escalation									392.56
East MCD	39.44	2760	1794	717	180	896	130	30	50
Total + 15% Cost escalation									243
GRAND TOTAL									869.79
GRAND TOTAL + 15% COST ESCALATION									1001.75

*This does not include 108 TPD (10%) recyclable wastes collected by rag pickers and 225 TPD (20%) of inert waste

** Rs 2 Cr extra for Segregating RDF. *** Add 15% on account of delay and likely price rise.

Note: The total cost can be reduced by about 15-20% by deducting the cost of existing operational plants.

7.2 Capital Cost Estimates for Processing Various Fractions of MSW for Tech option (E t E)

The tentative Capital Cost estimates for MSW processing indicated in Table-1 is for E t E waste collection to elimination scheme based on modern Technological Options (WTG1XG) being recommended, The

capital cost estimate for MSW processing for all the three MCD's is **Rs 9174.64 Crores (Fig-6) details , zone wise are in (Table-3,3A,3B and 3C)**, for Vehicles, equipment, etc is **(Rs 450.45 Crores, (Table-3D)** and cost sharing for MSWM is detailed in Table 3F.

The tentative Capital Cost estimates for processing of NDMC and DCB waste is **Rs 219 and 57.04 Crores (Table-3)**, Vehicles, equipment, etc **(Rs 16.97 and 137.41 lakhs,)** and **cost sharing for MSWM is detailed in Table 4 below**. Fig-12 lists the functions of Municipality and indicates the PPP Agreement Options available to EMCD. The End to End (E t E) waste collection to elimination Scheme based on modern Technological Options to Manage MSW including finances is in Table 4, 4A , 4B and 4C .

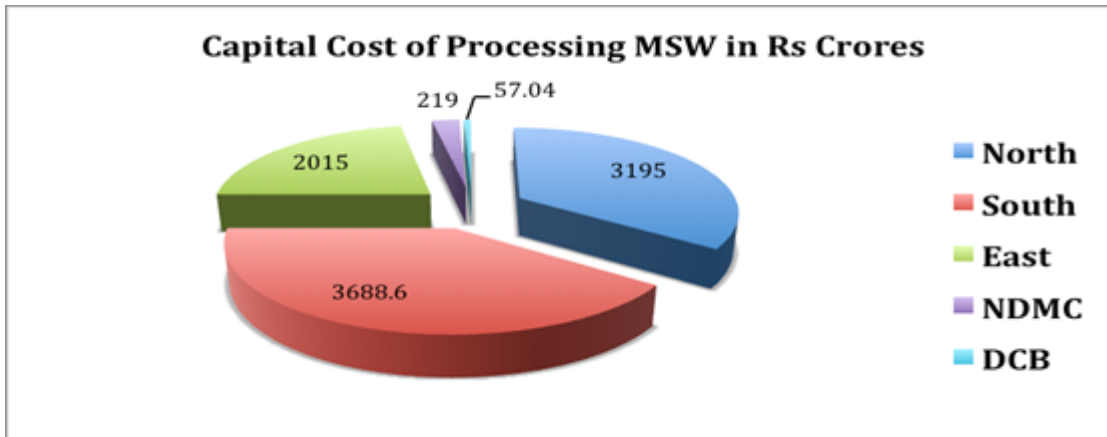


Fig-6 PPP Agreement Options for IMSWM available to Municipal Authorities.

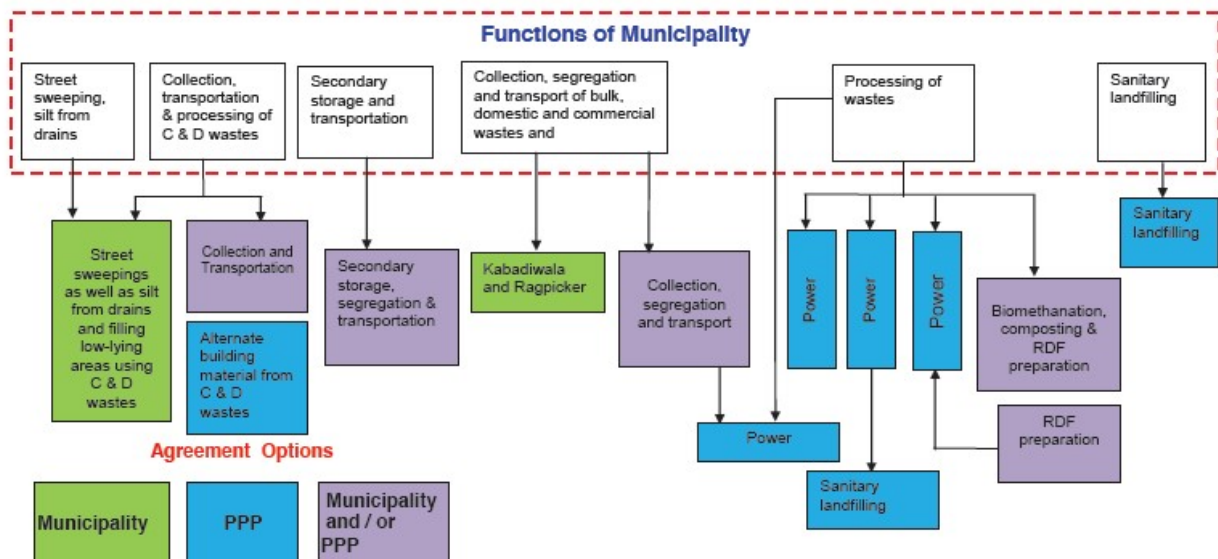


Table 10 :-Economic feasibility of the Integrated solid waste elimination Scheme.

1. Waste Elimination Capacity of the Project	3000 TPD Solid Waste per day
2. Cost of project plant and machinery, taxes, installation, commissioning-	26660 Million
3. Available organic matter in the income waste-	1600 TPD
4. Renewable CNG generation @ 10% of OM-	160 TPD
5. Available non-organic matter in the income waste-	276 TPD
6. Renewable Green Diesel generation@ 30% of NOM-	83 TPD
7. Bio-fertilizer generation @ 40% of OM	640 TPD
8. Bio-fertilizer generation per year	230400 TPY
9. Clean-fuel generation per day	243 TPD
10. Clean-fuel generation per year	87480 TPY
11. Renewable bitumen generation per day @40% of NOM-	110 TPD
12. Renewable bitumen generation per year	39600 TPY
<u>Economic Benefits from the waste to clean fuel Project</u>	
A. Revenue from sale of Clean-fuel at rate of Rs.40 per kg	Rs. 3500 Million. per year
B. Revenue from sale of Bio-fertilizer at rate of Rs. 5 per kg	Rs. 1150 Million. per year
C. Revenue from sale of rBitumen at rate of Rs. 50 per kg	Rs. 1980 Million. per year
D. Gross Revenue Generation per year	Rs. 6630 Million
E. Annual maintenance and operation costs @10% / 20% of project cost:	Rs. 2260 / 5332 Million
F. Annual profit from the project	Rs. 4370 / 1298 Million
G. ROI from the project	14%
Waste collection & logistic costs shall be covered from user fees payable	

3. Collection Centres, Transfer Stations and Dhalao's

As direct transfer of MSW primary collection from the wards to processing facilities is not feasible, MSW is collected from Dhalao's and transported. It is absolutely necessary to set up **Collection Centres, Transfer stations** and rationalize and reduce the number of dhalao's in East MCD. Currently in the 32 wards of Shahdara South there are 193 collection points of which 180 are dhalao's and 13 open sites and in 33 wards of Shahdara North there are only 129 collection points and 5 wards do not have even a single Dhalao. While the waste generation per ward in Shahdara North varies from 228 tons PD, in the south its 2-84 tons per Day.

Based on the Delhi total household numbers, the average family size is 4.88 person and the number of households in Shahdara South and Shahdara North are 4.91 lakhs and 3.16 lakhs household respectively

4. Construction & Demolition (C & D) Waste

C&D waste is one of the major components of MSW and is a major hindrance in waste processing when mixed with MSW and delivered at the processing facility. C&D waste finds a mention in Schedule III of the Municipal Solid Waste (Management and Handling) Rules, 2016 and the "Manual on Municipal Solid Waste Management" of the MoUD, 2016 has a chapter on C&D waste which lays down basic guideline on its handling.

The expert committee on C&D waste, constituted in January, 2014 by the MoEF to draft rules on C&D waste, has undertaken detailed study and prepared the draft rules encompassing segregation at source, institutional mechanisms for waste collection, reuse and reprocessing, imposing charges on C&D waste generators, formulation of standards for C&D waste etc., to address the C&D waste collection, utilization and safe disposal. The rules have been notified in 2016.

5.Smart – Waste Management and ICT in MSWM a. Smart – Waste Management

SM-WMS is an important part of waste management, as it plays a crucial role in effectively collecting and transporting waste and has a significant influence in the downstream processing costs and efficiency. SM-WMS is a combination of software and hardware which is generally outsourced to specialist IT companies or is internally applied to support company performance and integration

b. ICT in MSW Management

The transportation vehicles involved in transferring the waste from the collection points to the treatment and disposal sites would be performing multiple trips in a day. Monitoring and tracking these vehicles is a vital activity which cannot be carried out by manual methods. Therefore, a GPS(Global Positioning System) based vehicle tracking and management system is proposed for monitoring these MSW transportation vehicles

6.Decision Support System (DSS)

The DSS for Sustainable ISWM is designed to aid solid waste planners in evaluating the cost and environmental aspects of integrated municipal solid waste management strategies. The tool enables users to simulate existing MSW management practices and conduct scenario analyses of new strategies based on cost and environmental objectives.

The DSS –ISWM include, multiple design options for waste collection, transfer, materials recovery, composting, waste-to-energy, and landfill disposal. The creation of knowledge-based systems to interface with individual MSW management and planning models, or assist with model selection and integration is need of the hour

7 5 R's -Reduce, Reuse, Recycle, Recover and Re-Manufacture.

Various components of MSW have an economic value and can be recovered, reused or recycled cost effectively. Currently, the informal sector picks up part of the resources from the streets and bins to earn their living. However, a sizeable portion of organic waste as well as recyclable material goes to landfills untreated. Over 81% of MSW annually is disposed at open dump sites without any treatment. With planned efforts to **Reduce, Reuse, Recover , Recycle and Remanufacture (5Rs)** and appropriate choice of technology, the MCD can profitably utilize about 65% of the waste in producing energy and/or compost and another 10 to 15% to promote recycling industry and bring down the quantity of wastes going to landfills/ dumps under 20%. As a strategy, it would be prudent to make efforts to motivate the waste generators to reduce generation in the first place and reuse the waste to the extent possible, guide and enable industry and commerce to enhance recovery of materials and intermediates during manufacturing, promote segregation of recyclables at source and re-use the material in remanufacturing of products and intermediates, transitioning towards achieving the goal of optimum utilization of recyclable material.

8. Reclamation and Remediation of MSW Dump sites.

Rehabilitation and Remediation of abandoned landfills including capping of dumpsites (Ghazipur) should be initiated on priority where water table is generally high and/ or the amount of waste being deposited is large. Scientific assessment of contamination of soil and groundwater should be undertaken and extent of damage and possibilities of remediation needs to be ascertained. Based on the outcome and cost implications, a strategic decision regarding remediation and or capping should be taken. Capping should be planned to minimize further damage and release of the part of the land by scraping and accumulating scattered waste and using it for sanitary landfills or putting it to a profitable use. Need to consider remediation to release precious land is therefore recommended. The financial support proposed to be extended is as under:

- i. 50% cost by the Central Government and,
- ii. 20% cost by the State Government may be considered
- iii. 30% cost by the private sector

9.Sanitary Landfill facility.

As per the PC TF report, 2014, Cities above one million populations generating over 100 TPD residual wastes for disposal should set-up their own Sanitary landfill and permit all cities and towns within 50km periphery of the city to use that facility for disposal of their inert waste. Shahdara South and Shahdara North have a population of 23.98 lakhs and 15.45 lakh respectively and generate 2760 tons per day of waste of which 1300 is incinerated in the waste to energy plant at Ghazipur and remaining i.e more that 50% is dumped near the plant.

East MCD has one recognised open dumping ground which has already been exhausted. The collected waste from all the wards goes directly to the dumping ground. Almost, 50% of the waste collected is dumped and these dumps pose potential threat to ground water and are likely to cause deterioration of the ambient air quality. It is therefore necessary to develop 8 sanitary landfill facility(SLF) of 680 MT capacity, adjacent to the WtE filling / planning and design process / landfill layout plan / landfill soil properties / leachate drainage, collection and removal system / liner system and final cover system of the proposed sanitary landfill facility is required to be worked out

9. Zero Waste Strategy

Zero Waste is a goal that is strategic and economical and a set of practical tools, that guides people in changing their lifestyles and practices to emulate sustainable natural cycles and guides officials in ensuring that all discarded materials become resources for everyone to use.

Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not incinerate /burn or bury or landfill them.

Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health.

Zero Waste maximizes recycling, minimizes waste, reduces consumption and ensures that products are made to be reused, repaired or recycled back into nature or the marketplace.

10. Strategy suggested.

1. Waste Prevention and segregation.
2. Separate Collection and inclusion of waste collectors(Rag pickers)
3. Minimise transportation
4. Decentralised processing of Biodegradable waste close to generation.
5. Maximise Recycling of waste
6. Centralised /Regional WtE facilities including SLF for inerts.
7. Landfills and Incinerators to be progressively phased out.
8. Reclaim and monetize MSW dump sites

11. Summary of Recommendations

1. Sustainable MSWM Strategy- 5R's –Reduce, Reuse, Recycle, Recover and Re-manufacture.
2. Financial Sustainability- Cost Sharing Pvt 50%-Center 20%-State20%- EMCD-10%(sharing of facilities available)
3. Management Strategy- PPP Model.
4. Technological Sustainability- Integrated MSW management system (IMSWM) for population range two million and above for Shahdara south and one to two million Shahdara North as detailed is recommended.

The End to End -waste collection to elimination scheme based on modern Technological options (WTG1XG + WTG2XG) is suggested to Process and Manage MSW in east MCD.

5. Social Sustainability- Inclusion of Rag Pickers , collectors/associations and recyclers.
6. Environmental Sustainability.- 100% door-door Segregated waste Collection, Establish Transfer stations, Near elimination of Dhalao's.
7. Smooth disbursement of funds:- MoUD should be designated the single point of support. The support of Ministry of Agriculture, Ministry of New and Renewable Energy, CPCB etc could be channelized through MoUD in a well-coordinated manner.
8. Automatic On-line Real Time Monitoring System based on GPS /RFID Mobile Application.
9. A decision support system (DSS) for MSWM needs to be developed.
10. In order to meet both Capex and O & M cost introduction / increase of Service fee, user charges, possible rationalization of property tax could be thought off. Revenue could also be generated through sale of by products and recyclables.

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