

# MSW Management and Best Suitable Option Virtually Waste to Energy Plant for Resource and Energy Recovery for Bhopal (M.P.) India



Varun Singh Bundela, Arun Patel

**Abstract:** While most of the focus in waste management in on municipal solid waste management, it is important to note that MSW is but a small fraction of the total amount of waste generated in the India. The municipal Solid Waste Management Rules 2016 which is the major rules that governs Solid Waste Management in India. In our Country we generated some 1,00,000 MT tons of Municipal solid waste generated daily in my country. Even though MSW is dwarfed in size (and environmental impact) by other sectors, it should be that industrial waste is created in the process of providing us with the materials things that ultimately end up in our trash. Consuming less therefore saves not only the waste that would have ended up in the municipal waste stream but it also reduces the energy, materials and waste associated with providing those items that we may be able to live without cleanly, attention needs to be directed not just at the management of consumer waste but at the completed set of processes that result in the products our society seems to demand.

**Keyword:** Plasma Gasification, Waste to Energy Plant, Reuse, Recycle, Effective Waste Management

## I. INTRODUCTION

### A. Objective of Solid Waste Management

The objective of solid waste management is to reduce the quantity of solid waste by disposed off on land by recovery of materials and converts into energy from solid waste.

### B. Problems in developing countries like India: -

The waste characteristics in developing countries are known to differ considerably from that in developed countries due to different food habits, culture, traditions and socio-economic aspects. The organic matter is found to be higher due to the use of fresh and unprocessed vegetables and has a high moisture content unpaved roads and seasonal variation in climatic conditions tend to increase the ash and soil content increasing the density of the waste. Correspondingly lower calorific value has been observed. Urban centers are mostly modern outgrowths of the cities with narrow winding streets requiring small slow moving vehicles for collection and transport.

### C. Problems Being faced by urban local bodies:-

Over the years, there has been a continuous migration of people from rural and semi-urban areas to towns and cities. The proportion of population residing in urban areas has increased from 10.84% in 1901 to 25.70% in 1991. Now it is just double of the percentage. The number of class I cities has increased from 212 to 300 during 1981 to 1991, while class II Cities have increased from 270 to 345 during the same period. Now in the 2020 figure almost double. The increase in the population in class I cities is very high as compared to that in class II cities. The uncontrolled growth in urban areas has left many Indian cities deficient infrastructural services such as water supply, sewerage and municipal solid waste management. Barring a few progressive municipal corporation in the Country all other local bodies suffer due to non-availability of adequate expertise and experience, there by the solid waste is not properly handled resulting into creation of environmental pollution and health hazards.

## II. SOLID WASTE MANAGEMENT

It involves management of activities associated with generation, storage, collection, transfer and transport processing and disposal of solid waste which is environmentally compatible adopting principles of economy, aesthetic energy and conservation. It encompasses planning, urbanization, administration, financial, legal and engineering aspect.

### A. Functional Elements of MSW Management

- Generation** Waste differ in the rate of generation, quantity and quality depending upon the area of generation. The quantity and quality from residential areas may not vary appreciable. On the other hand, waste from commercial and industrial area may vary in quality and quantity at different times of the year. This will have a marked effect on the selection of method for its collection, processing and disposal.
- Storage** The generated waste is stored within the premises in commercial and industrial areas, where as in residential areas occupants take it out and transfer to community storage basis.
- Collection** Citizens deposit the wastes by the road side from where the conservancy staff transfer it to the community bins using wheelbarrow on other equipment such primary collection is common in India and other developing countries which need a large number of workers and small number of equipments.

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- D. *Transportation* The material collected in community dustbins is transferred to transport vehicles for transport to processing on disposed site.
- E. The fleet transport vehicles should have sufficient capacity for average and peak loads and should be utilized at optimum levels. In big cities the material is conveyed to a transfer station from where another set of vehicles transport in furthers.
- F. *Processing and Recovery* A large quantity of waste has to be processed before suitable disposal to reduce its potential nuisance value, occasionally recovery of useful constituents is also carried out as an independent process.
- G. *Disposal* The waste may come for disposal either directly after its transportation or effect processing, Disposal could be on land or water logged area for reclamation. The different function are inter depended and interrelated which could be better managed by a system approach. Disposal method costing less may not always be the best, which may be effected by higher transport on processing cost.

**B. The Case Studies of Different SWM Facility in M.P.**

***Integrated Solid Waste Management Facility- Vill. Pahadiya, Distt. Rewa***

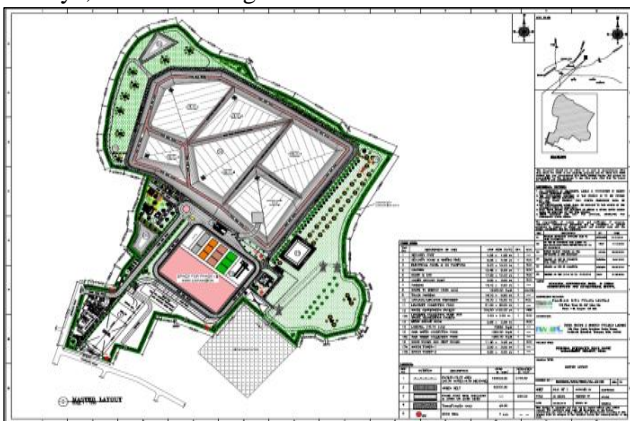
**Location:** Village Pahadiya Khasra no. 290, 292, 294, Village Sagra, Khasra no. 2201, 2202; total area 18.35 hect. , Tehsil- Raipur Karchuliyan, District- Rewa (MP).

**Google map of the project site:** The project site is located in Pahadiya village on a village road which is connected to National highway NH 7 approximately 05 Kms distant passing through Raipur karchuliyan. Google map of the project site is shown below.

**Latitude and longitude**

24.595854 N, 81.386736 E

**Site layout** Site layout plan of ISWM project Villag - Pahadiya,distt. Rewa is given below.



**Fig. 1 Site layout of ISWM Project Pahadiya, Rewa**

**C. Feasibility of the project (why this technology is adopted):**

The project aims to treat/handle the municipal solid waste of 28 ULBs of Rewa, Satna and Sidhi districts in an integrated manner and cluster based approach. In this manner the cost of establishing plants at different location will be minimized and waste will be handled at single location in an integrated manner. The project proposes Waste to energy plant of 2X6 MW capacity to generate electricity from RDF produced out of solid waste thereby utilizing the waste as a resource and

minimizing the waste ultimately going to landfill. Apart from that the facility is also handling animal carcasses so as to manage the carcasses in environment friendly manner without causing public nuisance. The compost is to be made from organic fraction of solid waste which will be reused for horticulture/agriculture purposes. Thus such an integrated facility is more useful for handling large amount of solid waste in economical and environment friendly manner efficiently.

**D. Area covered by ISWM facility**

Municipal solid waste of 28 ULBs of Rewa, satna and Sidhi Districts is to be handled by this ISWM facility. Names of those ULBs are given below:

**Table 1**

Sr No.	Rewa District	Satna District	Sidhi distrcit
1	Rewa Nagar Nigam	Satna Nagar Nigam	Sidhi Municipality
2	Municipal Council, Baikunthpur, Distt. Rewa	Maihar Municipality Distt. Satna	Municipal Council Rampur Naikin, Distt. Sidhi
3	Municipal Council, Chakghat, Distt. Rewa	Municipal Council, Amarpatan, Distt. Satna	Municipal Council Churhat, Distt. Sidhi
4	Municipal Council, Teonthar, Distt. Rewa	Municipal Council, Birsinghpur, Distt. Satna	Municipal Council Majhouli, Distt. Sidhi
5	Municipal Council, Mangawan, Distt. Rewa	Municipal Council, Chitrakoot, Distt. Satna	
6	Municipal Council, Sirmour, Distt. Rewa	Municipal Council, Jaitwara, Distt. Satna	
7	Municipal Council, Semariya, Distt. Rewa	Municipal Council, Kotar, Distt. Satna	
8	Municipal Council, Hanumana, Distt. Rewa	Municipal Council, Kothi, Distt. Satna	
9	Municipal Council, Gurh, Distt. Rewa	Municipal Council, Nagod, Distt. Satna	
10	Municipal Council, Govindgarh, Distt. Rewa	Municipal Council, Ramnagar, Distt. Satna	
11	Municipal Council, Naigarhi, Distt. Rewa	Municipal Council, Rampur Baghelan, Distt. Satna	
12	Municipal Council, Mauganj, Distt. Rewa	Municipal Council Uchehra, Distt. Satna	



A map showing location/distribution of ULBs with respect to Project site is shown as follows.

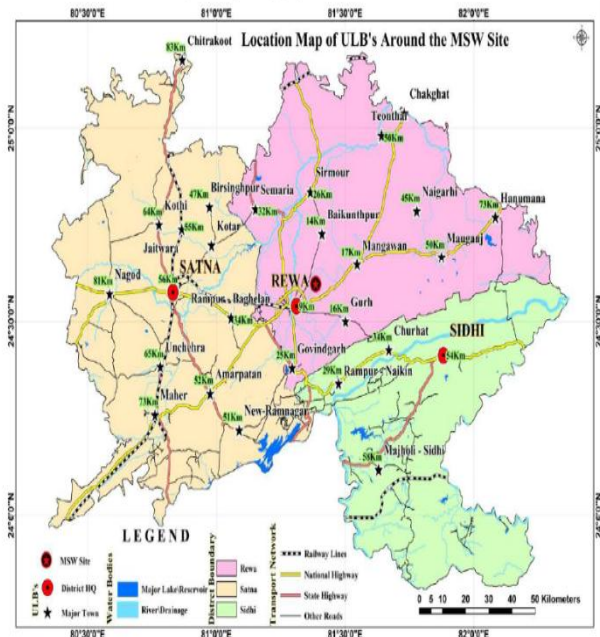


Fig.2 Map showing ULBs of Rewa, Satna and Sidhi District with distances from Rewa

**E. Quantity of solid waste**

The total capacity of plant to handle municipal solid waste is 700 TPD. However at present approximately 150 TPD MSW is being handled at the facility. The current estimated solid waste generation is 340 TPD in the region. Apart from

MSW, the facility is also handling animal carcasses in 6-8 nos. per day from nearby localities which are incinerated in controlled conditions of operation at animal carcass plant.

**III. CHARACTERISTICS OF SOLID WASTE**

Mixed type of solid waste is being sent to the facility from different ULBs. It is containing food waste, vegetables, fruit peels, as organic content whereas plastic waste, tyres, inert waste, metals etc. are found as inorganic content in the waste. RDF is being prepared from combustible fraction of solid waste reaching in the facility which is further transported to cement industries for co-incineration in cement kiln. The approximation estimation of characteristics/ composition of solid waste is given below:

Table 2 Composting of MSW Of Rewa

Waste Component	% share
Food, vegetable & other organic waste	56.6 %
Textile	4.5
Paper, cardboard	6.6
Plastic and Polythene	18.7
Glass & Ceramic	2.9
Rubber & Leather	1.5
Wood	1.5
Stones & Bricks	7.5
Metal	0.3
Total	100%

Details of installed units Table 3

Sr. no.	Name of unit	Capacity	Purpose	Water pollution control arrangement	Air pollution control arrangement
1	Compost plant	300 TPD	To produce compost of good quality from organic fraction of municipal solid waste	The processing of waste is done under shade and leachate collection system is provided.	The processing of waste is being done under covered shade and to mitigate the odour problem Ecosorb chemical is sprayed over the waste daily.
2	Animal carcass incinerator	200 kg/hr	To handle the dead bodies of animals without causing public nuisance.	No water pollution is there from this unit as WW generation is nil.	Three stage filters are installed to curb the chances of air pollution and adequate stack ht of 30 m is provided.
3	RDF Processing unit	500 TPD	To produce RDF which may be utilized further for energy recovery	Leachate collection system is provided.	The processing /sorting is done under covered shade.
4	Recyclables	14 TPD (5110 per year)	To recycle the metal, wood, glass and other recyclable fraction of the waste.	Recyclable fraction will be given to recyclers for processing.	Recyclable fraction will be given to recyclers for processing.
5	Waste to energy Plant	2X6 MW	To generate electricity from RDF	To be installed as WTE Plant is under construction	To be installed as WTE plant is under construction
6	Sanitary landfill	175 TPD	To dispose off leftover waste in secured manner, which cannot be reused or further processed.	HDPE liners are provided on the base and daily cover is applied in secured manner. Leachate collection system is also there.	Daily cover is applied.
7	Construction and demolition waste management facility	100 TPD	To handle C&D waste being generated from ULBs in an eco friendly manner and reuse it in new projects.	Unit is Under construction.	Unit is under construction.

Photographs of above units are given below:

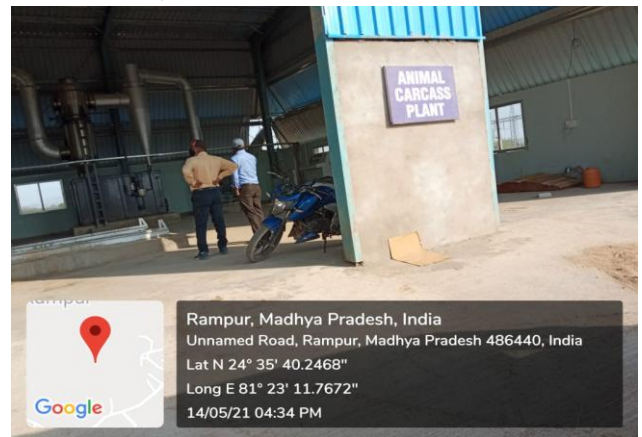
(a) Compost plant:

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**Windrows Storage & Processing under Shade**

**RDF Processing Unit Refuse Derived fuel (RDF) content  
(Animal Carcass Incinerator:**



Rampur, Madhya Pradesh, India  
 Unnamed Road, Rampur, Madhya Pradesh 486440, India  
 Lat N 24° 35' 40.2468"  
 Long E 81° 23' 11.7672"  
 14/05/21 04:34 PM



**Aerobic Compost Sorting Section Finished Compost  
(b) RDF Processing Unit:**



**Animal Carcass Plant (200 Kg/hr Capacity)  
Recyclables/MRF centre:**



**Material Recovery facility Waste to Energy Plant: the unit is under construction.**



**Sanitary Landfill Leachate collection pond**

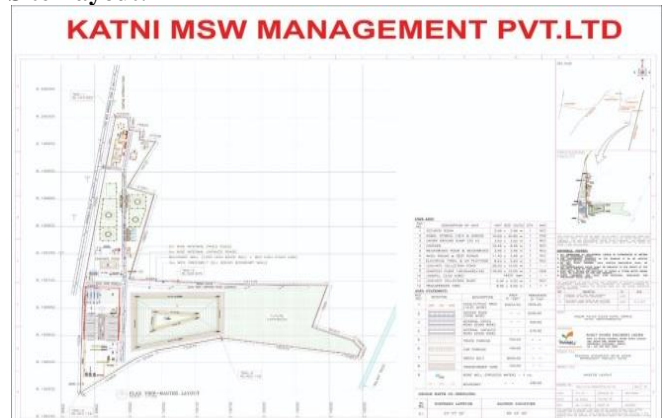
**A. Integrated solid waste management project Katni**

**Name of Project:** Development of an Integrated MSW Processing and Disposal Facility at Katni by Katni MSW Management Private Limited.

**Location of Project:** Padarwara, Katni, Madhya Pradesh.

**Latitude and Longitude:** (23°46'50.18" N, 80°23'20.95" E) or (23.780606° N, 80.389153° E)

**Site Layout:**



**Fig.3 Site map showing location of Project site in India**

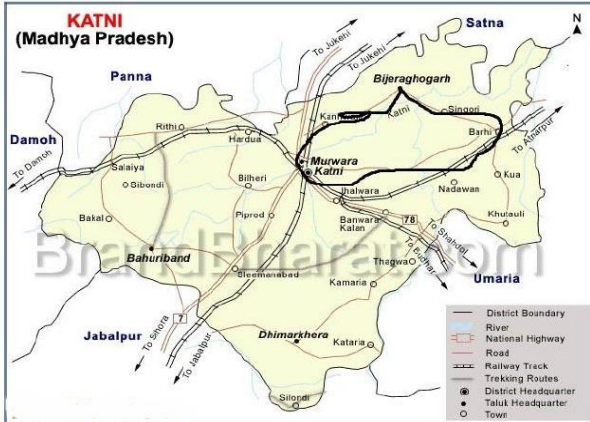
**B. Feasibility of Project (why this technology is adopted)**

Safe disposal of municipal solid waste being generated in the ULBs is necessary as per SWM rules 2016. The project aims to manage the solid waste of 5 ULBs in integrated manner so as to minimize the likely environmental impact and efficiently utilize the waste as a resource wherever it may be possible. The project helps in generating RDF (Refuse Derived Fuel) which is to be used for energy recovery and organic fraction is being converted into compost by windrow composting which is further utilized /sold to farmers for horticulture / agriculture purposes. Apart from it the facility is having animal carcass incinerator plant to handle the dead bodies of animals in an environment friendly and safe manner. Thus such a facility is beneficial for handling MSW and carcasses in efficient manner and solving the need of establishing separate plant in each ULB and hence it is cost effective/economical as well.



**C. Area Covered By Iswm Facility**

The ISWM facility Katni is covering 5 ULBs of Katni and Jabalpur districts namely Katni Nagar nigam, Kaymore Nagar Parishad, Vijayragavgarh Nagar Parishad, Sehora Nagar Parishad (Distt Jabalpur) and Barhi nagar Parishad. A map showing relative distances of participating ULBs from Katni is given below:



**Fig. 4 Relative locations of 5 ULBs with respect to Katni**

**IV. QUANTITY OF SOLID WASTE**

At present the daily amount of MSW being collected is approximately 100 TPD however the plant capacity for projected population is about 150 TPD. Out of this collected MSW from 5 ULBs the daily amount of RDF being generated is about 50 TPD and finished compost of good/desirable quality is about 10 TPD. ULBs with approximate generation of MSW is given in following table:

**Table 4**

Sr no.	Katni District		Jabalpur District	
	Name of ULB	Approximate quantity of MSW	Name of ULB	Approximate quantity of MSW
1	Katni Nagar Nigam	65 TPD	Sehora Municipality	13.4 TPD
2	Kymore Municipality	5.43 TPD		
3	Barhi Municipality	4.05 TPD		
4	Vijayragavgarh Municipality	2.75 PD		

**A. Characteristics of solid waste**

Mixed type of waste is being sent to the facility which contains food waste, vegetable waste, fruit peels, plastic waste, metals and inert waste etc. Approximate physical composition of waste is given below:

**Table 5**

Waste Component	% share
Food, vegetable & other organic waste	60.0
RDF	12.1
Textile	0.3
Paper, cardboard	0.5
Plastic and Polythene (recyclable)	0.3
Glass & Ceramic	0.1
Rubber & Leather	0.3
Stones & Bricks	0.4
Metal	0.3
Inert and non recyclables	10.6
Moisture reduction and others	15.1
Total	100%

**Details of installed units with photos: The details of units is as follows- Table 6**

Sr. no.	Name of unit	Capacity	Purpose	Water pollution control arrangement	Air pollution control arrangement
1	Compost plant (windrow composting)	35 TPD	To produce compost of good quality from organic fraction of municipal solid waste	The processing of waste is done under shade and leachate collection system is provided. However no leachate is observed from waste.	The processing of waste is being done under covered shade and to mitigate the odour problem organic chemicals are sprayed over the waste daily.
2	Animal carcass incinerator	350 kg/hr (dual chamber)	To handle the dead bodies of animals without causing public nuisance.	No water pollution is there from this unit as WW generation is nil.	Three stage filters are installed to curb the chances of air pollution.
3	RDF Processing unit	70 TPD	To produce RDF which may utilized further for energy recovery	Leachate collection system is provided. However no leachate is observed from waste.	The processing /sorting is done under covered shade.
4	Recyclables	15 TPD	To recycle the metal, wood, glass and other recyclable fraction of the waste.	Recyclable fraction will be given to recyclers for processing.	Recyclable fraction will be given /sold to recyclers for processing and reuse.
5	Sanitary landfill	30 TPD	To dispose off leftover waste in secured manner, which cannot be reused or further processed.	HDPE liners are provided on the base and daily cover is applied in secured manner. Leachate collection system is also there.	Daily cover is applied.

**Photographs of installed units below:**

(a) Compost Plant:





(b) Animal Carcass Incinerator:

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(c) RDF Processing unit:



(d) Recyclables/ Material Recovery Facility: Sanitary Landfill:



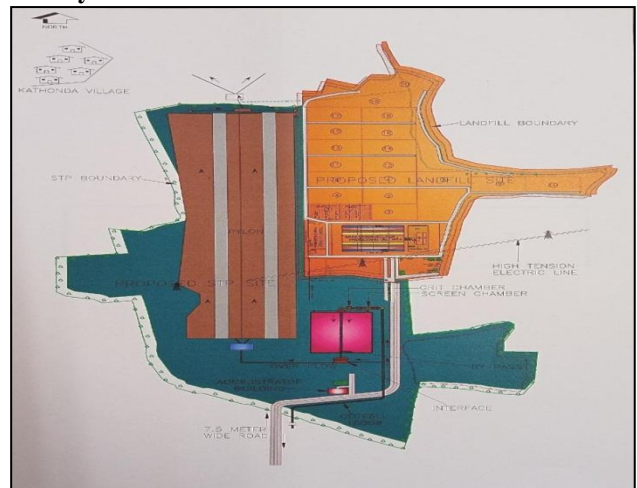
**B. Waste To Energy Plant Jabalpur (MP)**

**Name of Project:** Development of Waste to Energy Plant (11.5 MW) at Kathonda site, Jabalpur by M/s. Essel Infra Projects Pvt. Ltd.

**Location of Project:** Kathonda village, Jabalpur (M.P.)

**Latitude and Longitude:** (23°12'50.3"N 79°55'03.8"E) or (23.213971N, 79.917721E)

**Site Layout:**



**Fig. 5 Site layout plan of Kathonda site, JabalpurSite map**

**C. Feasibility of Project (why this technology is adopted)**

Safe disposal of municipal solid waste being generated in the ULBs is necessary as per SWM rules 2016. The project aims to manage the solid waste of Jabalpur Municipal Corporation in sustainable manner so as to minimize the likely environmental impact reducing the waste ultimately going to landfill and efficiently utilize the waste as a resource for energy recovery. At the same time the technology/process meets the regulatory requirements as per SWM rules 2016. The project helps in generating electrical energy from MSW by employing incineration process (mass burning technology) in controlled/scientific manner. In this process segregation of waste is not necessary hence reduces the operational cost and saves space where land is costly.



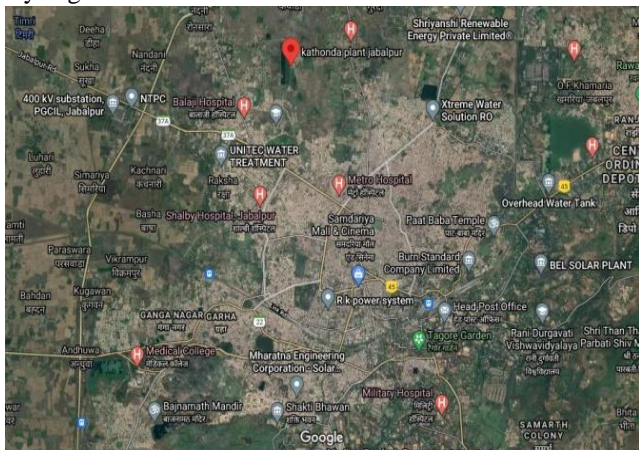
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Thus such a facility is beneficial for handling huge quantity of MSW of city like Jabalpur in efficient manner following 4R principal (Reduce, Reuse, Recycle & Recover) and hence it is cost effective/economical as well. Moreover it is helpful in creating an ecosystem of circular economy which on the other hand proving it to be one of the ambitious and innovative smart cities in the country.

**D. Area covered by ISWM Facility**

The WTE facility is handling MSW of Jabalpur Municipal Corporation only. An indicative Google map of Jabalpur city is given below:



**Fig. 7 Indicative Google map of Jabalpur City of Madhya Pradesh**

**Quantity of solid waste:** At present the daily amount of MSW being collected and processed is approximately 600 TPD. The un-segregated MSW is processed at the facility.

**Characteristics of solid waste:** Mixed type of waste is being sent to the facility which contains food waste, vegetable

waste, plastic waste, textile, metals and inert waste etc. Approximate physical composition of waste of Jabalpur city is given below:

**Table 7**

Waste Component	% share
Food, vegetable & other biodegradable organic waste	64.3
Textile	6.3
Paper, cardboard	8.8
Plastic and Polythene	8.3
Thermacol	1.4
Glass & Ceramic	3.7
Rubber & Leather	0.3
Wood	1.6
Stones & Bricks	1.5
Metal	0.2
Inerts	3.6
Total	100%

**Waste characterization in terms of calorific value from different areas of Jabalpur**

**Table 8**

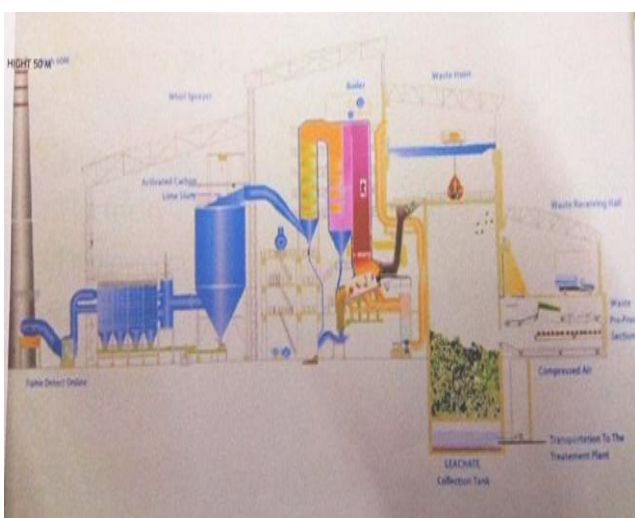
Areas	Calorific value (kcal/kg)
Commercial	2357.5
Market	1943.3
Slum	2176.8
Hotel	2286.3
High Class Society	2163.7
Middle class society	2102.2
Low class society	1877.5
Institute and College	2260.0
Community /marriage hall	2205.0
Dumping Site	2500.0
<b>Average Value</b>	<b>Greater than 1650</b>

**Details of installed units** The details of units is as follows-

**Table 9. Details of WTE Projects**

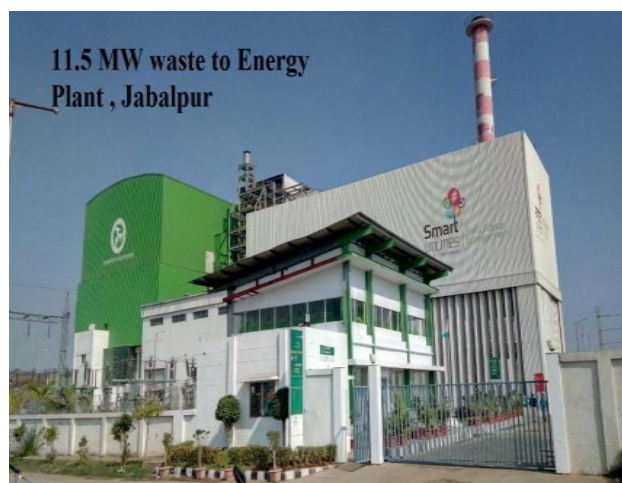
Sr. no.	Name of unit	Capacity	Purpose	Water pollution control arrangement	Air pollution control arrangement
1	Waste Incineration plant (11.5 MW)	600 TPD	To reduce the waste volume and generate electricity out of MSW.	STP of 40 KLD capacity based on UASB reactor technology has been provided.	Flue gas treatment system (FGT) and Fabric filters are provided along with providing stack height of 50 meter.

**Indicative longitudinal section of the plant**



**Fig. 8 Indicative Longitudinal Section of Waste to Energy Plant, Jabalpur**

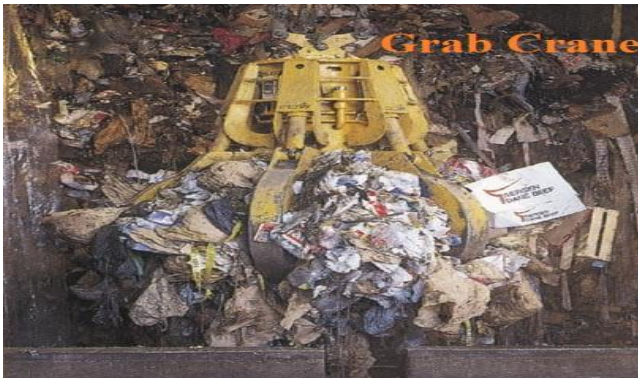
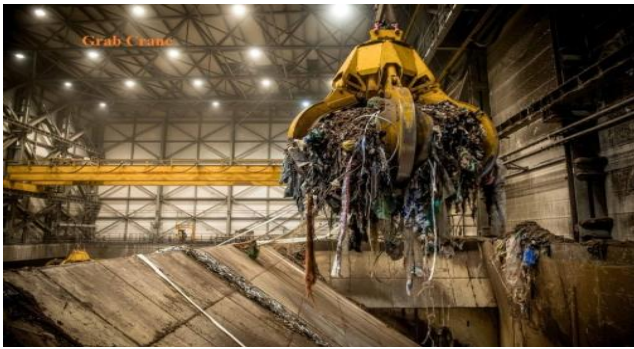
**Jabalpur Waste to Energy Plant:**



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**Photo 9**



**Photo 10**



**E. Integrated solid waste management project Bhopal**

**Name of Project:** Development of an Integrated MSW Processing and Disposal Facility at Adampur Chhavni, Bhopal by M/s. Green Resources Solid Waste Management Pvt. Ltd.

**Location of Project:** Adampur Chhavni, Raisen road - Bhopal (M.P.)

**Latitude and Longitude:** (23°15'55.6"N 77°33'33.3"E) or (23.265452 N, 77.559256 E)

**Site Layout:**



**Fig. 11 Site layout plan of Integrated Solid Waste Management Facility, Bhopal**

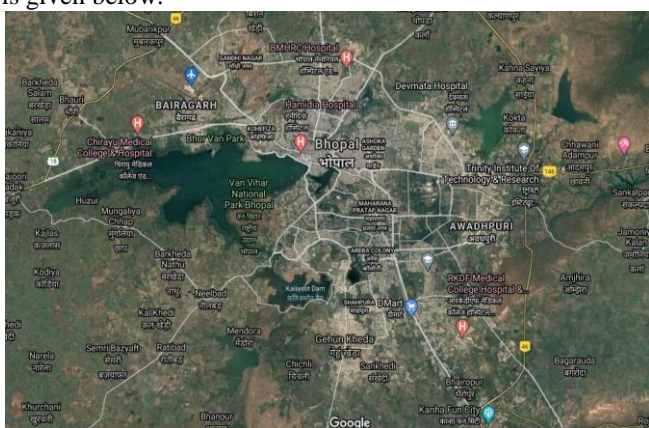


**F. Feasibility of Project (why this technology is adopted)**

Safe disposal of municipal solid waste being generated in the ULBs is necessary as per SWM rules 2016. The project aims to manage the solid waste of Bhopal Municipal Corporation in integrated manner so as to minimize the likely environmental impact and efficiently utilize the waste as a resource wherever it may be possible. The project helps in generating RDF (Refuse Derived Fuel) which is to be used for energy recovery and organic fraction is being converted into compost by windrow composting which is further utilized /sold to farmers for horticulture / agriculture purposes. Thus such a facility is beneficial for handling MSW in efficient manner following 4R principal (Reduce, Reuse, Recycle & Recover) and hence it is cost effective/economical as well.

**G. Area covered by ISWM Facility**

The ISWM facility is handling MSW of Bhopal Municipal Corporation only. An indicative Google map of Bhopal city is given below:



**Fig. 12 Indicative Google map of Bhopal City of Madhya Pradesh**

**H. Quantity of solid waste**

At present the daily amount of MSW being collected is approximately 800 TPD however the plant capacity for projected population is about 1000 TPD. Out of this collected MSW the daily amount of RDF being generated is about 200 TPD and finished compost of good/desirable quality is about 100 TPD. Apart from this recyclables obtained in the range of 7 TPD whereas inert material quantity going to landfill is approximately 50 TPD.

**I. Characteristics of solid waste**

Mixed type of waste is being sent to the facility which contains food waste, vegetable waste, fruit peels, plastic waste, metals and inert waste etc. Approximate physical composition of waste is given below:

**Table 10**

Waste Component	% share
Food, vegetable& other organic waste	54
Textile	6
Paper, cardboard	7
Plastic and Polythene	13
Glass & Ceramic	2.5
Rubber & Leather	3.5
Wood	2
Stones & Bricks	11
Metal	1
Total	100%

**Details of installed units. Table No 11**

Sr. no.	Name of unit	Capacity	Purpose	Water pollution control arrangement	Air pollution control arrangement
1	Compost plant (windrow composting)	500 TPD	To produce compost of good quality from organic fraction of municipal solid waste	The processing of waste is done under shade and leachate collection system is provided. Leachate treatment plant (LTP) will be installed soon to treat excess amount of leachate.	The processing of waste is being done under covered shade and to mitigate the odour problem organic chemicals are sprayed over the waste daily.
2	RDF Processing unit	500 TPD	To produce RDF which may utilized further for energy recovery	Leachate collection system is provided.	The processing /sorting is done under covered shade.
3	Recyclables	20 TPD	To recycle the plastic, metal, wood, glass and other recyclable fraction of the waste.	Recyclable fraction will be given to recyclers for processing.	Recyclable fraction will be given /sold to recyclers for processing and reuse.
4	Sanitary landfill	50 TPD (Area of landfill is 5 acres)	To dispose off leftover waste in secured manner, which cannot be reused or further processed.	HDPE liners are provided on the base and daily cover is applied in secured manner. Leachate collection system is also there.	Daily cover is applied.
5	Bio-mining	2000 TPD	To handle the legacy waste already dumped at the site	Leachate collection system is provided.	Covered boundary is there along with green belt.

Photographs of installed units are given below:

**Compost Plant:**

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RDF Processing unit:



Recyclables/ Material Recovery Facility:



Sanitary Landfill:



Bio-mining Facility for legacy waste treatment:



V. CONCLUSION

The study on integrated municipal solid waste management sites has given certain key outcomes related to feasibility, municipal waste management techniques, relative environmental impacts, economic considerations etc., on the basis of which it may be concluded that in order to manage the municipal solid waste in an integrated manner it is better to have integrated setup including compost plant for handling organic fraction of the waste and waste to energy plant for handling dry fraction of the waste. Wherever cement plants are situated in nearby locations (preferably within 100 km radius) at those locations RDF may be disposed off though energy recovery at cement kilns or may be transported to nearby waste to energy plant instead of setting up own WTE plant in order to maintain economic feasibility and to avoid any burden of capital investment. Further it is noteworthy to say that there are other waste to energy technologies including Plasma Arc Gasification technique which is used in many countries for handling MSW but in Indian scenario it is not that much beneficial taking into account cost considerations.

A comparative analysis of four ISWM facilities of Madhya Pradesh at different locations under study is concluded below: Table no. 12

Sr. No.	Comparison parameter	Integrated Solid Waste Management Facility Village- Pahadiya Distt. Rewa (MP)	Integrated MSW Processing and Disposal Facility, at Padarwara, Katni (MP).	Integrated MSW Processing and Disposal Facility, at Adampur Chhavni, Bhoapl (MP)	Waste to Energy Plant (11.5 MW) at Village Kathonda, Jabalpur (MP)
1	Technology for handling MSW	Windrow composting for managing organic fraction and waste to energy plant for handling combustible fraction (RDF) of MSW. Inert ultimately going to landfill.	Windrow composting for managing organic fraction of MSW and combustible fraction (RDF) is sent to other WTE Plant for Energy Recovery.	Windrow composting for managing organic fraction of MSW and combustible fraction (RDF) is sent to other WTE Plant and cement plants for Energy Recovery.	Mixed waste/un-segregated waste is handled by incineration of waste in controlled conditions and thereby energy recovery.
2	Economic Consideration	Initial capital expenditure is high due to higher cost of waste to energy plant. However cost may be recovered by selling electricity generated.	Capital expenditure is at moderate level and some recovery is done through selling compost.	Capital expenditure is at moderate level and some recovery is done through selling compost.	Capital expenditure is at high level however recovery is possible through selling generated electricity.



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3	Time requirement for handling daily waste	For composting nearly one month is required. For RDF handling on an average one day will be required.	For composting nearly one month is required. For RDF handling on an average one day is required.	For composting nearly one month is required. For RDF handling on an average two days are required.	MSW is processed within a day.
4	Capacity to Handle MSW	350 TPD wet waste/organic waste and 500 TPD dry waste (RDF)	150 TPD Wet Waste and dry waste /RDF content as may be present in MSW	1000 TPD Wet Waste and dry waste /RDF content as may be present in MSW	600 TPD Mixed waste.
4	Land/ Space Requirement	Larger area is required because of landfills.	Larger area is required per unit MSW processed because of landfills.	Larger area is required per unit MSW processed because of landfills.	Less area of land is required.
5	Transportation requirement	Collection and transportation of MSW form door to door to ISWM site Pahadiya, Rewa. After processing waste is disposed in the premises. However at present WTE plant is under construction hence RDF is sent to nearby cement plants.	Collection and transportation of MSW form door to door to MSW processing site. After processing waste is disposed in the premises and the RDF content is sent to nearby waste to energy plant in Jabalpur (MP).	Collection and transportation of MSW form door to door to MSW processing site at Adampur Chhavni After processing inert waste is disposed in the landfill and RDF content is sent to nearby cement plants.	Collection and transportation of MSW form door to door to WTE plant at Kathonda Jabalpur. After incineration no significant waste is there for transportation.
6	Leachate problem	Leachate is to be handled in Leachate treatment plant .	No Leachate is observed. Moreover, Leachate collection system is provided.	Leachate is collected in separate tank and re-circulated back to windrow to increase composting activity. Leachate treatment plant is proposed.	No Significant leachate problem.
7	Odour Problem	Odour problem is not significant however ecosorb/organic chemicals are sprayed to mitigate odour problem.	Odour problem is not significant	Mild odour problem is observed however dense plantation is being done in periphery.	Odour problem is not significant
8	Inert and Ash Handling	Inert and ash is to be disposed off in landfill.	Inert is to be disposed off in landfill, no ash generation is there.	Inert is to be disposed off in landfill, no ash generation is there.	Ash is to be disposed off in secured landfill.

Thus apart from above, it may also be concluded that in case of cluster based projects as well as for large cities further studies on route optimization to reduce the travel distance may be helpful in reducing the overall cost of waste collection and transportation.

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