Priorities for Adopting Technologies
Scope, Current System, Definitions, Principles

Scope

1. The Technology Sub Group is to recommend technologies to be used in Pune Municipal Corporation, the priorities to be adopted while selecting technologies and to define the principles to be used in the process of selecting the technologies and adopting them for use.

Current System in PMC

1. Currently PMC has adopted the following technologies:

Ser	Technology	Product	Rated/Actual Tonnes/day	₹. Tipping Fee/tonne	Remarks
1	Pyrolysis/ Gasification (Rochem)	Electricity	700/180-200	300	No electricity production. * @
2	Composting/RDF (Hanjer)	City Compost RDF*	1000/200	300	Partially functional*
3	Mechanical Composting (Excel/Save Environment)	Compost	4 tonnes (2 tonnes each)	300	Functional
4	Vermicomposting (Disha)	Compost	100	300	Under High Court lens for polluting
5.	Vermicomposting (Ajinkya)	Compost	200	300	Functional
6	Biomethanation.	Electricity	100 (20 plants 5 Tonnes)	6 Lakhs	Not fully functional **
7.	Biomethanation (Nobel)	Not mentioned	300	360 + add 8 % yearly	Projected
8.	Biomethanation (Organic)	Electricity	500	360 + add 8 % yearly	Projected
	Total		2904/800 ***		

Table
Technical Details of PMC's
SWM Processing Plants

Notes:

***** Although MPCB authorisation is only for composting/RDF, PMC has allowed Hanjer to manufacture pallets (?) and bio-diesel. Similarly, MPCB has authorised Rochem to generate only electricity. However, PMC has allowed Rochem to manufacture RDF.

@ Rochem is using Concord Blue Pyrolysis technology to heat ceramic beads used to decompose waste material. The waste gas is again re-used to heat the ceramic beads. During our visit to the plant on 3 June 2014, Rochem's Consulting Engineer told us that Rochem has decided to use a coal-fired furnace for heating waste material directly in the dryer because Concord Blue Technology is not working, which is borne out by the fact that Rochem has removed all references to this technology from its website at http://www.rochemindia.com/. The coal-fired furnace is not part of the approved technology. Coal contains traces of heavy metals (including radioactive) that when burnt, are emitted in the atmosphere in the form of small particles. Filters cannot eliminate all the particles that are produced, especially the very small ones. Coal is the most damaging in terms of climate change; that is, it is the fuel that generates the largest amounts of CO2 for the same quantity of energy generated.

****** See enclosure for "Biogas Production Analysis" dated September 2014.

******* If the projected capacity indeed comes through, PMC will have rated processing capacity that is almost double the actual requirement. This clearly shows ad-hoc planning, haphazard implementation of MSW processing plants and waste of public funds.

2. Presently the PMC does not have an established system or chalked out priorities for selecting technologies for MSW processing. The only constant is the use of 'mixed' garbage as raw material for all projects including for biogas generation. Thus there is no source segregation of MSW contrary to the legal framework. Hence, private companies are given 'mixed' MSW to segregate and to use the segregated MSW for processing or for recycling. In other words, PMC is paying a fee to the private operators for segregation and for operation & maintenance of their plants; a so-called 'tipping' fee as mentioned in Paragraph 1 above while bearing the transportation costs and the cost for preparing the landfill. Additionally, the PMC allows the private operators to dispose of the products or the recyclable material. PMC thus loses both the biodegradable and recyclable wastes with nothing in return.

Preparation of Report for Future Management of MSW

3. PMC has appointed M/s Tandon Urban Solutions Pvt Ltd to prepare a project report for future management of MSW proportionately with the population increase for funding through JnNURM funds vide work order no. 947 dated 31/07/2014. The Company is to prepare a report as per tender conditions within the parameters of the MSW Act, Environment Protection Act, other Acts, JnNURM toolkit and Urban MSW Handling & Management Rules. PMC should arrange a presentation by Tandon Urban Solutions to the MSW Group to ensure that all points are considered and information shared.

Definitions of Technologies to be Used

4. **Composting**, often described as nature's way of recycling, is the biological process of breaking up of organic waste such as food waste, manure, leaves, grass trimmings, paper, worms, and coffee grounds, etc., into an extremely useful humus-like substance by various micro-organisms including bacteria, fungi and actinomycetes in the presence of oxygen. Actinomycetes are similar to fungus in the way they grow and spread, but its distinguishing elements are that the types of materials they are efficient at decomposing. The active nature in this microscopic bacteria and the sheer number present (about 10 million per 1 gram of soil), make them highly effective at breaking down materials like tree bark, newspaper, and other hard organic material. Reference:
http://www.benefits-of-recycling.com/definitionofcomposting/

5. **Vermicomposting** is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end product. Vermicomposting differs from composting in several ways. It is a mesophilic process, utilizing microorganisms and earthworms that are active at 10–32°C. The process is faster than composting; because the material passes through the earthworm gut, a significant but not yet fully understood transformation takes place, whereby the resulting earthworm castings (worm manure) are rich in microbial activity and plant growth regulators, and fortified with pest repellence attributes as well.
http://www.icrisat.org/journal/agroecosystem/v2i1/v2i1vermi.pdf

6. **Pyrolysis and gasification** are thermal processes: they use high temperatures to break down any waste containing carbon. Both technologies use less oxygen than traditional mass-burn incineration. The pyrolysis process degrades waste to produce char (or ash), pyrolysis oil and synthetic gas (called syngas). The gasification process then breaks down the hydrocarbons left into a syngas using a controlled amount of oxygen. Gasification and pyrolysis typically rely on carbon-based waste such as paper, petroleum-based wastes like plastics, and organic materials such as food scraps. Gasification involves using a small amount of oxygen whereas pyrolysis uses none. Both produce a synthetic gas (called syngas) made up mainly of carbon monoxide and hydrogen (85 per cent), with smaller amounts of carbon dioxide and methane. Syngas has a calorific value, so it can be used as a fuel to generate electricity or steam, or used as a basic chemical in the petrochemical and refining industries. Other by-products include liquids (mainly water used for washing the gas clean) and solid residues – ash, or char. Reference: Briefing – Pyrolysis and Gasification, Friends of the Earth, 2002.

7. **Biomethanation** is used as a technique of biofuel recovery from biomass and treatment of waste biomass. "Methane fermentation" or "anaerobic digestion" is usually used to indicate "biomethanation". Biomethanation is a complex microbial process in which organic compounds are degraded into methane and carbon dioxide by a variety of anaerobes. This biogas has a low heating value of 20-25 MJ/M^3 N and can be used as fuel after desulphurisation of hydrogen sulphide. Fermented residue can be used for liquid fertiliser and raw material of compost. http://www.jie.or.jp/biomass/AsiaBiomassHandbook/English/Part-5_E.pdf.

8. **Green manure** is not the same as raw manure. Green manure, sometimes alternatively called cover crops, is when a crop or plant is grown and then intentionally ploughed under in order to improve the soil. Green manure may also be obtained by collecting green leaf and twigs from plants grown in wastelands, forests and other areas, although in the case of organic farming, growing green manure crops is more common. (http://organic.about.com/od/organicdefinition1/g/Green-Manure.htm)

Recommended Principles for Future MSW Processing Technology

9. **Source Segregation**: All planning and implementation for management and handling of MSW should be based on the basic premise that there will be strict implementation of "source segregation". This means that there will be no processing plants that accept "mixed" MSW and that the plants get either "residual waste" or "bio-degradable" waste or "recyclable waste" but not a mixture of the three. 'Recyclable waste' should not be given to the private companies because it forms a major incentive for the rag pickers, a critical source of their earning and an incentive to pick up segregated MSW door-to-door at source.

10. **Basic Prerequisite**: Source segregation should be in three categories by painting the top of "residual waste" bin as grey, the top of the "recyclable waste" bin as red and of the "bio-degradable" waste bin as green.

11. **Holistic Approach** is a prerequisite for realistic planning. There must be a linkage of the processing plants with geographical locations and the quantity/quality of the MSW generated at these locations. PMC area should accordingly be demarcated for the purposes of MSW planning based on the quantity and the type of MSW generated in each area so that the locations of the processing plants is synchronised with the above factors.

12. **Feasibility Study**: The PMC should carry out a feasibility study to identify the locations for processing plant(s) with appropriate technology taking into account the availability of land, the reservation of the land (whether reserved for public utility-PU), proximity of and effect on residential and/or industrial areas, wind direction and whether the plant fits into the overall legal framework including obtaining of authorisation and consent from MPCB. The feasibility study should include social, economic, financial and environmental studies. The feasibility study will give a general idea of the locations of the plants, the type of technology to be adopted at the locations and the capacities of the plants. The feasibility study should be prepared by an independent agency and not by the agency executing the work.

13. **Detailed Project Report**: The detailed project report should be exhaustive to include technology details and whether proven for Indian conditions, sampling or trial runs for MSW generation and composition, justification for the tipping fee, scenario analysis, type of waste to be collected and disposal, disposal of residues and inert, methodology for erection/construction, impact on the environment (safety/pollution), commercials to include surveys for market acceptance of products, monitoring of atmospheric and ground water pollution, detailed break-down of estimated costs, financials to include returns on capital invested, results of stake holders consultations etc. Additionally, the DPR should have the following financials:

a. Summary of investment costs (construction, power supply, technology, MSW segregation);
b. Summary of operating cost;
c. Assessment of financing costs;
d. Financial appraisal;
e. Quantification of funding needs;
f. Computation of economic benefits (time savings, environmental, health, etc.) and estimation of economic benefits in terms of Economic Internal Rate of Return;

Conclusion

14. This paper is factual without any subjective judgments. It attempts to define the scope, current system in PMC, technology definitions and the principles to be followed while choosing technologies. The paper points out only gross deviations from the legal framework. This is a small input for the final report of the Technology Sub Group and a further discussion is essential to fine tune the contents, add other data and correct any errors and omissions.

18 November 2014