Environment

Water & Environmental Sanitation Network (WES-Net India)

Solution Exchange for WES-Net India
Consolidated Reply

Query: Solid waste management in urban settings/ from Sanket Information & Research Agency, New Delhi/ Advice

Compiled and additional research provided by Preeti Soni
16 August 2005

Original Query: Nidhi Prabha Tewari, Sanket Information & Research Agency, New Delhi
Posted on: 6th July 2005

I am part of a professional group, which provides inputs on developmental issues to the Member of Parliament from East Delhi. This query is related to solid waste management in the constituency.

East Delhi like many urban agglomerations has pockets of congested, densely populated areas where sanitation and hygiene are major concerns. Agile noses can locate garbage strewn carelessly all over long before the eye spots them. We are toying with the idea of management of the imposing problem of solid waste collection, segregation, analysis and disposal/ recycling.

I would like community members to share **case studies or advice on two particular issues in solid waste management in urban settings**:

1. **Successes and failures with recycling** various categories of waste (aluminium, copper, paper, organic and toxic/ medical waste). For example, in some cities energy generation programmes through the solid waste route did not take off because much of the waste was wet and had high organic content and did not have significant calorific value (ref Rajghat Plant in Delhi).

2. **Revenue generation potential of solid waste** – e.g., vermi composting and energy generation among others. There are examples of organizations like SELCO in Hyderabad and Waste Concern in Bangladesh who have done some pioneering work.

Nidhi Prabha Tewari
Coordinator
"Support for Good Governance"
Sanket Information & Research Agency
New Delhi

Solution Exchange received Responses, from:

1. **Sushant Kumar Singh, Department of Environment & Water Management, A. N. College, Patna**

2. **Shubhagato Dasgupta, Water and Sanitation Program (WSP) - South Asia, New Delhi**
3. **Usha Rao, UNDP, New Delhi**
4. **Usha Rao, UNDP, New Delhi**
5. **Prabhjot Sodhi, National Coordinator, UNDP GEF Small Grants Programme (GEF-SGP), New Delhi**
6. **Siddarthan B., the Norwegian Development Agency (NORAD), New Delhi**
7. **Satish Vangal, UNDP, New York**
8. **Sunil Arora, UNDP, New Delhi**
9. **Anil Arora, UNDP, New Delhi**
10. **Suneel Pandey, The Energy and Resources Institute (TERI), New Delhi**

Further contributions are welcome

Summary of Responses

Waste management and disposal is a growing environmental concern in almost all cities in India. Proper disposal of the urban wastes is not only essential for reducing its adverse human health and environmental impacts, but also presents a large potential for resource recovery.

Waste management systems include onsite-handling, storage, collection, transportation, processing and recovery and final disposal. The municipal solid wastes (MSW) are not homogenous and vary with respect to their individual components and size, moisture content, density etc. Their composition also impacts the effectiveness of the waste management system in place. With regard to the experience in India, there are many challenges in this area including analysis of quality and quantity of wastes, as well as appropriate institutional mechanisms.

Network members offered a wide range of experiences, case studies, resources and contacts that can be followed up on. In their responses, Network Members also indicated the importance of the following: (a) awareness creation, (b) emphasis on waste reduction, (c) long run self sustainability as well as technical feasibility, (d) institutional arrangements (e.g. for ensuring market for the products), and (e) community as well as other stakeholder involvement.

Recycling of waste in India is a highly organised and profit making venture, though it is largely informal in nature. Community based and NGO led approaches have played an important role especially in collection and segregation of wastes, as well their recycling. Examples of innovative approaches, described in more detail below, were cited for **Delhi, Lucknow, Patna, Kuppam, Chennai, Surat, Patna, Goa, Puri** and **Tirupati.** The successes have generally highlighted the need for awareness creation and to foster positive relationships between formal, informal, private and municipal systems.

Waste to energy: The municipal wastes contain organic and inorganic matter. The latent energy of its organic fraction can be recovered for gainful utilization through the adoption of suitable waste processing and treatment technologies. Some of these options that convert waste to energy (and revenue) include:

- **Sanitary landfills** can be used for large scale generation of biogas from MSW, depending on composition of wastes, and age, size and operation of the landfills. However, most of the landfills in India serve as dumpsites rather than sanitary landfills where provisions for extracting the gas are made.

- **Incineration** requires high investment and maintenance, and the flue gas has to be treated. In addition, incinerators are suitable for wastes containing high calorific value which may not be true for wastes in several cities in India. For example, an incinerator installed at **Timparpur, New Delhi**

had to shut down because the waste with low calorific value was unfit for burning (though there is now talk of reviving the plant).

- **Composting** can be carried out in small scale in households or on a large scale depending on the quantity of wastes. Mechanized composting plants are also set up in different cities such as **Ahmedabad** and **Mumbai**. Composting of city wastes is recommended under the Municipal Solid Waste Management (MSW) Rules 2000 for all municipal bodies in India. A concern related to composting, however, is marketing of the products. **Vermi-composting**, a process by which wastes can be turned to compost by a natural action of worms, is being undertaken in several places as in projects in **Uttar Pradesh**, **Gujarat** and **Maharashtra**. Usually vermin-compost is found to be of better quality and thereby may sell at a higher price (may be between Rs. 5-9/kg compared to aerobic compost from window process that may sell at around Rs 3-4/kg depending on the region and demand).

- **Biomethanation** is normally a good option for India due to a high organic and moisture content of waste in Indian cities. Although not in place on a commercial scale, indigenous technologies and prototypes are functional – e.g. those developed by ASTRA in **Bangalore** and TERI, and another plant set up in **Lucknow**. A biomethanation process project at advanced stages of commissioning is at the Chennai Metropolitan Development Authority (CMDA). **Chennai** on vegetable market/mixed waste, which is designed and implemented by Central Leather Research Institute, Chennai with GEF funding and co-funding from the Ministry of Non-Conventional Energy Sources (MNES) and CMDA. MNES is developing other demonstration projects using this technology.

- **Others**: There are other options as well – e.g. pelletization plants are reported to be operational in **Bangalore** and **Mumbai**.

All the options have their merits and demerits and a lot depends on the volume, composition and characteristics of wastes and the local conditions including effective segregation of wastes and marketing potential. Investment also plays an important role, and many a times external financing or government subsidies are needed (e.g. in case of the plant at **Hyderabad**). Studies by NEERI and TERI have analyzed the wastes in **Delhi**, and they can be contacted for further details. It may also be useful to contact Municipal Authorities in this context. Lessons may also be drawn from similar experiences in other countries such as **Bangladesh** and **Pakistan**.

Comparative Experiences

Delhi: A waste collection and recycling project was undertaken in select colonies in East Delhi. The waste was segregated and taken to the “dhalao” from where it was picked up by the Municipal Authorities. However, this waste was not further commercially recycled. The project included awareness creation and mass sensitization through a communication strategy using FM radio.

Lucknow: Innovative NGO programmes have been developed by introduction of cost recovery waste collection and disposal systems. A uniform or a differentiated (according to income groups) subscription fee is collected for collection services. This waste is categorised and sent for recycling – organic waste is converted through vermi-composting and all by-products and recyclables are sold.

Kuppam: Field level workers and local residents in Kuppam town in Andhra Pradesh have worked out a town-wide system for waste segregation, reuse, re-sale and full disposal with full cooperation of users, who are willing to pay for the improved services

Others: Experience gained from projects in Patna shows that large scale social awareness about waste management practices and segregation and categorization of waste in different bins which then may be

collected is needed. Under the GEF Small Grants Programme, programmes are supported in **Patna Goa, Puri** and **Tirupati** for waste collection and recycling, which involve working closely through the NGOs and Municipal Corporations and others.

Related Resources

Recommended Contacts: *(recommended by Usha Rao, Anil Arora, Sunil Arora, Prabhjot Sodhi)*

For experiences in different states in India:
Dr. Ram Babu, Price Waterhouse Coopers, Mumbai (ram.babu@in.pwc.com)
Dr. Ravi Agarwal, Toxic Links, New Delhi (Phone: 24328006, 24320711; Email: info@toxicslink.org)
Mr. Rajamani, Joint Secretary, Ministry of Urban Development, Government of India (Tel: 23022199)

Specifically for the waste collection and recycling project in New Delhi:
Ms. Kiran Wadera, President, Asian Centre for Organization Research and Development (ACORD), New Delhi (Tel: 26410616, 26435993, 26238495; E-mail: accord@del2.vsnl.net.in).

Specifically for the biomethanation project in Chennai:
Dr. Anil Dhussa, Director & National Project Coordinator, MNES, New Delhi (Tel. 24364188, email: anildhussa@yahoo.com)
Dr. R.A. Ramanujam, Scientist, CLRI, Chennai (Tel. 044-24916351 and 24911589, Fax: 044-24912150).

For experiences of GEF-Small Grants Programme partners involved in solid waste management projects
Mr. Kapil Shah, Jatan Trust, Vinoba Ashram, Vadodara (Tel: 0265 - 237 1429 Fax: 0265 - 237 0463; E-mail: jatan@satyam.net.in)
Mr.Kiran Kulkarni, Secretary, Institute of Rural Credit and Entrepreneurship Development (IRCED), Sangli, Maharashtra (Tel: 0233-300045, 302125, 303460 Fax: 0233-301473; E-mail: san_irced@sancharnet.in, san_irced@hotmail.com)

For experiences in Bangladesh:
Mr. Maqsood Sinha and Mr. Iftekhar Inayetullah, Waste Concern, Bangladesh (wastecon@dhaka.agni.com)

Recommended Organizations *(recommended by Usha Rao, Preeti Soni)*

Ministry of Non-Conventional Energy Sources, New Delhi (http://mnes.nic.in/u1.htm)
MNES also has in place a National Programme on Energy Recovery from Urban and Industrial Wastes.

Maharashtra Energy Development Agency, Pune (http://www.mahaurja.com/PG_Waste_Overview.html)
Has supported municipal solid waste management projects in different cities in the state

Environment Protection Training and Research Institute, Hyderabad (http://www.eptri.com/)
Providing consultancy, training, applied research services and advocacy in the field of Environment, including solid waste management, to industry, regulatory bodies, Government and NGOs.

National Environmental Engineering Research Institute, Nagpur (http://www.neeri.nic.in/WWT.html)
NEERI has undertaken research work and studies pertaining to solid waste management in different parts of India

The Energy and Resources Institute, New Delhi (http://www.teriin.org/division/eetdiv/repta/repta.htm)
The Resource Efficient Process Technology Application group at TERI undertakes research on different issues related to solid waste management.

Recommended Websites

Toxic Links [http://www.toxicslink.org/index.php]
Contains information and resources on Solid Waste Management issues in India

Small Grants Programme of the Global Environment Facility (SGP-GEF) [www.sgpindia.org/]
Provides the details of the SGP-GEF programme and its various projects including those mentioned above

Waste Management and Recycling in Bangladesh [http://www.wasteconcern.org/] (*recommended by Usha Rao*)
Provides information on waste management and recycling activities and projects in Bangladesh

Recommended Documentation

Recommended by Preeti Soni:

MOEF 2000. **Ministry of Environment and Forests. Notification New Delhi, the 25th September, 2000.** http://www.envfor.nic.in/legis/hsm/mswmhr.html
Provides the Municipal Solid Wastes (Management and Handling) Rules, 2000.

Lal, B. and M R V P Reddy (eds.). 2005. **Wealth from Waste**. New Delhi: TERI
Covers different aspects of generating resources from wastes in India.

Recommended by Shubhagato Dasgupta:

Nagari. Effective Solid Waste Management with the Participation of Waste Producers. Seventh Meeting of the Urban Think Tank, January 1999, Calcutta.
Includes several examples for different regions in India on recycling and solid waste management

Profits from Waste: An NGO-led Initiative for Solid Waste Management in Lucknow, Uttar Pradesh, India. Field Note.
Is a case study of an NGO led solid waste management initiative in Lucknow.

Community-based Action Planning for Effective Solid Waste Management: Kuppam, Andhra Pradesh. Field Note
Provides the process and findings of a situational analysis and initiative in Kuppam

Organically Managing Garbage. Field Note
Discusses a initiative for organically managing garbage in Peshawar in Pakistan

Recommended by Usha Rao:

"Trash is cash in Bangladesh" http://www.csmonitor.com/2005/0608/p07s01-wosc.html
Talks of an innovative project turns waste into fertilizer, helping clean the streets and the air.

Recommended by Satish Vangal:

"Resources up in Flames". The Economic Pitfalls of Incineration Versus a Zero Waste Approach in the Context of the Global South"
It includes many case studies of local approaches to waste management, including in India. It also includes economic information about the cost, job creation, etc from different approaches.

Solution Exchange Responses in Full

Sushant Kumar Singh, Dept. of Environment & Water Management, A.N.College, Patna

I have gone through your question and have following advice to offer:

1. I have worked in Patna and seen the positive results of following good solid waste management practices at the household level. If every household is made aware about sound the Solid Waste Management practices and educated about tips on how to dispose various categories of waste (the biodegradable, the non-biodegradable category) separately by using different bins- and by not putting water or any other liquid waste into the bucket, and then the garbage collectors also collect these in separate buckets, a lot of problem can be addressed. This can work only if this is done at a large/ macro scale.

2. For energy generation on very large scale you have to analyze the calorific value of garbage and calculate the per capita generation of that high calorific garbage.

3. Vermi-composting is an eco-friendly and cost-effective method and needs minor technology. My experience says that, if Vermi-composting is done in a proper manner than one can get not just the revenue from that 'vermi-compost' but also energy from the 'Vermi-compost Unit'.

Shubhagato Dasgupta, Water and Sanitation Program - South Asia, New Delhi

In response to your query, I am enclosing some documents including relevant case studies that you may find useful.

1. Nagari. Effective Solid Waste Management with the Participation of Waste Producers. Seventh Meeting of the Urban Think Tank, January 1999, Calcutta.
2. Profits from Waste: An NGO-led Initiative for Solid Waste Management in Lucknow, Uttar Pradesh, India. Field Note.
3. Community-based Action Planning for Effective Solid Waste Management: Kuppam, Andhra Pradesh. Field Note
4. Organically Managing Garbage. Field Note

Usha Rao, UNDP, New Delhi

Our direct experience in the urban solid waste management is very limited and restricted to a project on high rate biomethanation where we have looked at vegetable market wastes management in Chennai. My colleague Anil Arora (anil.arora@undp.org) will be able to give more specific details on this particular initiative.

By and large, the experience shows that there are many challenges in this area. 1) Quantity of waste; you may like to gain some experience from the Lucknow project 2) Quality of wastes; your research on Delhi is an example of this problem 3) Institutional mechanisms.

However, there are models in Hyderabad, Pune, Mumbai where some successes have been achieved. You may contact Maharashtra Energy Development Agency in Pune, Environment Protection Training and Research Institute in Hyderabad and Dr. Ram Babu in Mumbai (ram.babu@in.pwc.com). Also, a Delhi based organization Toxic Links (Dr. Ravi Agarwal) can be contacted for more first hand experience.

In this regard, you may also wish to talk to Mr. Rajamani, Joint Secretary, at the Ministry of Urban Development.

Usha Rao, UNDP, New Delhi

Further to my attached mail, you may wish to read the experience of Bangladesh "Cash for trash", provided through the link below.

http://www.csmonitor.com/2005/0608/p07s01-wosc.html

Prabhjot Sodhi, National Coordinator UNDP GEF SGP, New Delhi

We are involved in implementing projects through UNDP GEF SGP on Solid Waste. I am attaching you a brief on the flow – chart which we have developed for this rather community based, pro-active initiative. The four programes being supported through SGP are at Patna, Goa, Puri and Tirupatti. We are working closely through the NGOs and Municipal Corporations and others...We shall be happy to share, learn and exchange programs with you.

We have many examples on vermi composting and energy generation among others taken up by our partners. There are examples of organizations like "Jatan in Gujarat"; "IRCED in Maharashtra" and many more who have done some pioneering work, good links to the markets etc....

Siddarthan B., the Norwegian Development Agency (NORAD), New Delhi

Your first question needs some technical help, which I am not qualified to do. But the second one is absolutely important as in NORAD's experience, 'economics' of waste management was critical for the success/failures of the several SWM projects we supported. Same would apply to institutional issues in SWM. Narrating each case would be exhaustive and time consuming in this forum. I do not know the scale of the project you have in mind. but even if it is the constituency, the area to cover I suppose would be significant.

But to summarize:

- subsidies by local bodies or a donor will not help and will not be viable in the long run for a project. In your case, the MP may be thinking of his using his local area funds for the project. But please ensure that he does not end up paying for everything. If so, the project would last only as long as his funds last.
- economics of the project should be worked out early in the project before pumping resources for recycling, the proximity of the immediate market is critical (in Delhi, that should not be a problem)
- for marketing manure, links with individuals alone won't be sufficient; institutional arrangements will be best for long term economic viability.
- MCD Horticulture department, private nurseries, could be good targets. since your area must be a part of MCD, please examine what it does and what doesn't in waste management.

If, only if, they do good work, then do not duplicate. But in my experience, government procedures many a time make spending in some critical areas not possible. Talk to MCD, identify those important areas where they need additional resources. And if you are sure of proper utilization, then channel the funds thru MCD. I am sure a MP have better chances of ensuring resources spent properly. I know many may object this approach, but i would still suggest this.

These are immediate remarks. But you are welcome to visit our office for more information

---

Satish Vangal, UNDP, New York

Here's something to look at: "**Resources up in Flames". The Economic Pitfalls of Incineration Versus a Zero Waste Approach in the Context of the Global South**" available at www.no-burn.org It includes many case studies of local approaches to waste management, including in India. It also includes economic information about the cost, job creation, etc from different approaches.

Sunil Arora, UNDP, New Delhi

Collection of local waste: This project was undertaken in a few selected colonies in East Delhi to help the households in disposing off waste, and also improve the life of the rag-pickers (by providing them gloves, auto-rickshaw for carrying the waste, etc.). The waste was segregated and taken to the "dhalao" from where the Municipal Authorities used to pick up the waste in their trucks. However, this waste was not further commercially recycled. The idea was also to improve the quality of life of persons engaged in handling waste – it was more of a knowledge creation among the societies on the waste segregation. Many workshops were held wherein RWAs, Sanitary workers were educated on the self-sustaining, eco-friendly systems of primary collection of waste, segregation of waste. Their communication strategy was successful and also used FM radio for mass sensitization on the need to unclog the Yamuna of plastic, human and other waste.

For more info, Ms. Kiran Wadera, President, ACCORD, can be contacted (tel: 26410616, 26435993, 26238495 – e:mail: accord@del2.vsnl.net.in)

Anil Arora, UNDP, New Delhi

I understand from your message that you are interested in different types of household wastes and not the commercial/industrial wastes. The earlier response of Mr Sodhi is very relevant in this context, but I will also like to share some information that may be useful to look at in response to the query. A project at CMDA Chennai is on vegetable market/mixed waste. It involves power generation through Biomethanation process, and deals with 2,500 m^3 per day of waste. The project is at advanced stages of commissioning. It is designed and implemented by Central Leather Research Institute, Chennai with GEF funding and co-funding from MNES and CMDA. For more details, you can contact -

Dr. R.A. Ramanujam, Scientist, CLRI, Chennai, Tel. 044-24916351 and 24911589, Fax: 044-24912150; Dr. Anil Dhussa, Director & National Project Coordinator, MNES, New Delhi (email: anildhussa@yahoo.com), Tel. 24364188.

Suneel Pandey, The Energy and Resources Institute, New Delhi

In response to your query: On recycling - Recycling of metals, paper and glass takes place both in formal and informal sectors. Plastic recycling in India is happening mostly in informal sectors. It is reported that in India such recycling is up to the extent of around 70% of such material generated which is largely driven by economic reasons by enterprises working on low profit margins. This is much higher than recycling rates as reported for US, Germany and Japan.

Higher moisture content and lower calorific value in Indian MSW is problem for success of waste to energy projects. But other inherent problem in successful implementation of either waste to energy or composting projects in the country is absence of source segregation of waste which makes segregation after waste processing not only costly but also ineffective.

The plant at Hyderbad run by Selco International, basically produces fluff from MSW and has suitable designed boilers to accept this fluff (RDF) as fuel and produce around 6.5 MW of electricity. However, such plants need subsidy from government to sustain them because of power cost being higher than conventional power generation process.

On revenue generation: Both Aerobic and anaerobic waste treatment processes produce compost. Usually the compost produced from vermicomposting process is found to be better quality and hence sells at higher price of 5-9 Rs/kg depending on region where it is made and demand in that region.

Aerobic compost (from windrow process) sells at around Rs. 3-4 per kg also depending on the demand in the region.

Many thanks to all who contributed to this query!
