

Scaling up MSW models

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The effective management and disposal of municipal solid wastes (MSW) in India has become a major concern. Forecast rapid urbanisation, uncontrolled population growth and rising per capita income are expected to exacerbate the issue. As a result, the co-processing of MSW in cement kilns is becoming an increasingly-attractive option.

The significance of the MSW management and disposal issue is underlined by India's Prime Minister, Narendra Modi's recent launch of the Swachh Bharat Abhiyaan (Clean India Campaign) to clean more than 4000 towns and cities in the country. This initiative is India's biggest-ever such drive, which eminent people from different walks of life are being encouraged to promote. However, the challenge is huge. The total generation of MSW from urban sources alone in the country is estimated at about 68Mt (2011-12).

The responsibility for handling these wastes is with local municipal corporations, but in undertaking these operations, they face severe challenges, including a scarcity of financial resources, inherent institutional weaknesses and choice of waste disposal method/technology.

MSW co-processing in cement plants

It has therefore become imperative to look at customised, non-conventional solutions involving all stakeholders responsible for solid waste management. One such sustainable, long-term option is to turn MSW into refuse-derived fuel (RDF) for use as fuel in cement plants. RDF, which

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comprises plastics, paper, cardboard, cloth, wood, rubber and leather, is the dry organic fraction of MSW and can be recovered by the mechanical-biological treatment of MSW.

This option represents a win-win situation as it reduces coal use in cement manufacture as well as finding a long-term sustainable solution for managing urban waste effectively. As illustrated in Figure 1, states such as Maharashtra, Gujarat, Rajasthan, Andhra Pradesh, Karnataka and Tamil Nadu produce large quantities of MSW but also have a number of cement plants which can absorb the RDF.

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rate is as high as around 60 per cent while some European cement plants replace more than 80 per cent of their conventional fuel with RDF.

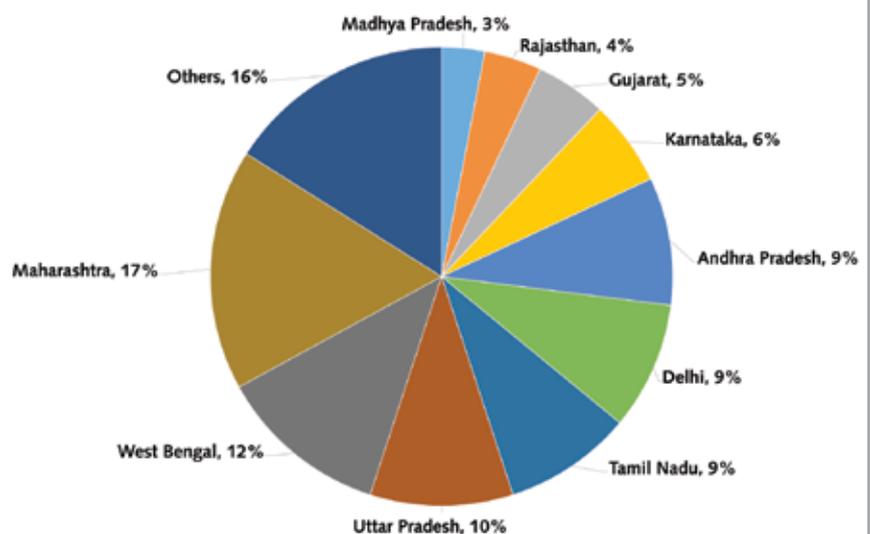
Models of MSW co-processing

The Institute for Industrial Productivity (IIP) commissioned a project to analyse the issues and challenges facing RDF projects in India. Three different models of processing MSW to RDF for usage in cement plants were studied.

To obtain a range of perspectives, understand their implementation challenges as well as reviewing comparative advantages and disadvantages, projects being managed by different types of stakeholders were chosen and the following three models carefully selected:

- municipal corporation – Panjim model
- non-governmental organisation (NGO) – Sarthak model
- private company – Jaypee Cement model

Figure 1: share of major Indian states in MSW generation



Each model involves different actors in its operations, handles a different nature of waste and has varying degrees of mechanisation in its production process.

Panjim municipal corp model

Panjim, the capital of the Indian state of Goa, generates around 60tpd of waste – a figure that is rising at a rate of five per cent annually. To handle this waste effectively, primary segregation is carried out at the household level by providing separate bins for the collection of biodegradable and non-biodegradable wastes. Organic biodegradable waste is then composted in pits to produce manure. Non-biodegradable waste, which constitutes about 12 per cent of total waste, is further separated into recyclable and non-recyclable waste by the municipal authority.

About 0.8tpd of non-recyclable wastes can be processed as RDF. However, the facility generates an average of 0.36-0.4tpd of RDF. Bales of RDF, which weigh about 100-110kg, are transported from the processing facility to cement companies for use as fuel.

Although the project has greatly enhanced the effectiveness of the city's waste management system, the model is not sustainable. While the total cost incurred by the municipality is INR1100 (US\$18)/t, it derives no revenues from this activity as the RDF is supplied to the cement companies free of charge. The revenues obtained through 'sanitation fees' levied by the municipality only cover 12-15 per cent of the project's total cost.

Sarthak NGO model

Bhopal is the capital of the Indian state of Madhya Pradesh. The city generates around 420-460tpd of MSW. About 5000 rag-pickers would regularly segregate the city's waste in a way that presented health hazards. Plastic waste, which constitutes around 14 per cent of the total waste, was dumped either at a centre near Bhopal or incinerated, with both practices highly detrimental to the environment and the city's inhabitants.

To improve the waste management system, as well as working conditions for the rag-pickers, Sarthak, a local NGO, initiated a MSW processing project supported by the Bhopal Municipal Corporation (BMC). BMC allocated land to Sarthak for solid waste management and the collection of plastic waste. This initiative was started in five of BMC's 70 management wards and is now being implemented in 21 wards, employing 1465 'Sarthak Karmis' (rag-pickers).

The NGO has expanded the waste collection and management capacity of the Sarthak Karmis and has also linked the rag-pickers with social security schemes. The Sarthak Karmis carry out the collection and segregation of wastes, which is then transported to a processing facility, where the waste is divided into 100kg bundles. This process generates 5-6tpd of RDF,

which is then sold to cement plants for INR5.50/kg (US\$0.09).

To date, nearly 2000t of plastic bags have been used as fuel in cement plants, saving nearly 5000t of GHG emissions from burning of plastic waste.

Furthermore, rag-pickers are employed in a job with a higher income than previously. Local cement companies have said that they are generally satisfied with the initiative, but caution that to be sustainable, cost effective and scalable this model must promote primary waste segregation at the household level.

Jaypee Cement private model

Chandigarh in northern India generates about 400tpd of solid waste. Jaypee Cement Industries has set up a highly-mechanised system for waste collection and processing that caters for the safe disposal of around 70 per cent of the waste generated in the city. The segregated waste comprises of a mixture of plastic and textiles, which is processed and converted into RDF without any primary segregation.

While this model is based on an efficient technology, it is not financially viable for Jaypee. The company incurs INR2500/t in the processing of waste but only recovers around INR1750/t when selling the product.

Furthermore, Jaypee faces an additional significant obstacle in this project: an inadequate waste supply.

Comparison of waste management models

A typical waste management process is depicted in Figure 2, where the major stages are outlined as A, B, C and D. Primary segregation (A) is an important step in the development of an efficient waste management model.

Figure 2: typical waste management process

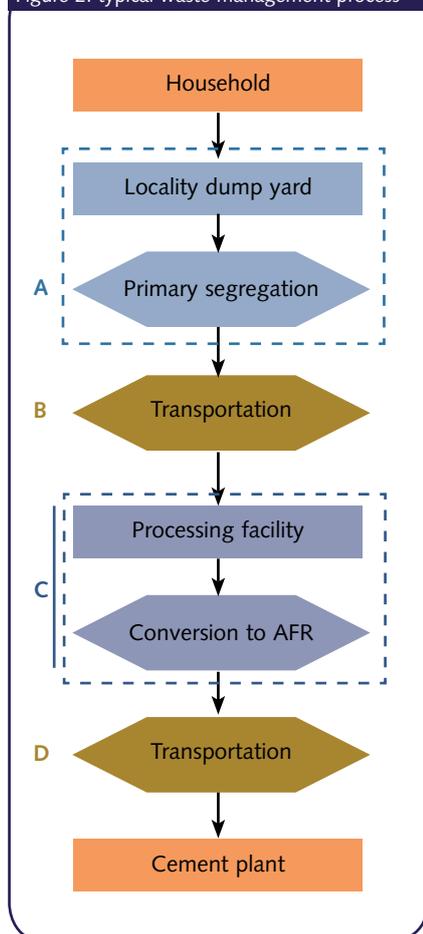


Table 1: management responsibility in different models

Process stage	Panjim (municipal corp) model	Sarthak (NGO) model	Jaypee (private company) model
A	Household-source	Trained rag-pickers	None
B	Municipal corp	Sarthak	Municipal authorities
C	Municipal corp	Sarthak	Jaypee
D	State government	State pollution control board	Jaypee

Table 2: financial performance of different models

Parameter	Municipal (Panjim) model	NGO (Sarthak) model	Jaypee (private co) model
RDF cost/t – INR	1100	5000	2500
US\$	18.33	83.33	41.67
RDF selling price/t – INR	Not estimated	5500	1750
US\$	Not estimated	91.67	29.17
Major costs	Municipal worker wages RDF transportation	Sarthak Kamis wages Waste collection & segregation	Waste processing using capital-intensive equipment

To assess the willingness of cement companies to invest CSR funds in such activities, the IIP organised a virtual roundtable discussion with CEOs of some of India's biggest producers in March 2014. Reiterating their commitment to CSR, participants also expressed much optimism regarding the creation of collaborative models.

The management arrangement and responsibility for each stage of waste management in different models is presented in Table 1.

One of the major issues impeding the rapid scale-up in all three models is the poor financial viability of these projects. The salient features of these models in terms of financial performance are shown in Table 2.

The way forward...

In August 2013, the Indian Parliament passed a landmark legislation, the Companies Act 2013. Section 135 of the act mandates companies to spend two per cent of their profits on corporate social responsibility (CSR) initiatives and to post such reports in the public domain. The act applies to all companies with a net worth of INR5bn or more, a turnover of INR10bn or more, or a net profit of INR50m. Estimates suggest that should all such companies comply with the mandate, CSR capital would generate nearly INR200bn.

Potential use of CSR funds

The effective use of these funds, to which the cement industry is a major contributor, can help deal with important social and environmental issues facing India. One such potential area is bridging the viability gap between MSW processing costs and

benefits, thereby addressing weaknesses in the existing urban waste management system in the country.

An analysis supported by IIP shows that CSR funds can be used effectively in the MSW supply chain right from supporting segregation to processing of wastes to RDF. Companies can choose to employ the production of marginalised sections of the society like rag-pickers to carry out the task of segregation. They can create employment opportunities for them either through direct recruitment or collaborations with NGOs like Sarthak that work for similar goals.

The CSR capital can also help cover the costs of transportation of collected waste to processing facilities, which proved one of the most significant costs incurred across all three models.

Furthermore, cement companies can provide the funds required for the capital-intensive activities such as operating, maintaining and upgrading the processing facility, as well as employment costs for those working at the unit.

Finally, CSR funds can be used to create awareness on the importance of segregation

at a primary, household level, as well as the promotion of using RDF alongside coal at cement plants. This would help create a steady market for RDF and thereby enhance the economic sustainability of the model.

Developing collaborative models

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The IIP is now supporting further consultation with policy makers to facilitate the inclusion of MSW processing in CSR policy of cement companies. This provision would unlock additional finance for the implementation of such projects. This will not only result in the reduction of significant levels of CO₂ but will also address the growing challenge of the management and safe handling of solid waste in India's cities.



MSW co-processing in cement kilns would enable India to reduce its waste dumps and lower their environmental impact