



Biorenewable Insights: Municipal Solid Waste

Municipal Solid Waste is one in a series of reports published as part of NexantECA's 2016 Biorenewable Insights program.

Overview

Municipal Solid Waste (MSW) is a material resource that is radically different from any other, in that it starts as fundamentally a societal and economic problem. We can choose to exploit it or dispose of it in various ways that are more or less problematic. Only undeveloped societies allow it to accumulate in open dumps, undisturbed, where it has the potential to pose a great risk to society – health problems, environmental pollution, land depletion etc. A more modern approach is to bury it in “sanitary landfills”, where it is capped with soil as it is deposited and where leachate and landfill off-gases (LFG) are managed. However, it comprises large fractions of useable materials, which if recycled or repurposed, has the potential to yield high-valued products. A recent World Bank report describes MSW as “the most visible and pernicious byproduct of a resource-intensive, consumer-based economic lifestyle”. Rapid population growth and high rates of urbanization, coupled with increasing prosperity in developing countries, necessitates a serious examination of waste management processes.

This report examines the composition and quantities of MSW generated throughout the world, as well as commonly practiced waste disposal methods. It provides a technological overview of waste management practices and examines the economic competitiveness of different configurations in the United States, Western Europe, China, and Brazil.

Technologies

MSW collection refers to the collection of waste generated by all sources, including residential, commercial, institutional, and industrial sources, by using any of the various waste collection methods and agencies. It includes not only the gathering of solid waste and recyclable materials, but also the transport of these materials, after collection, to the location where the collection vehicle is emptied. This location may be a material recovery/processing facility, a transfer station, or disposal facility (i.e. landfill, open dump, waste-to-energy or WTE, etc.).

MSW collection efficiencies vary according to national incomes. Higher income countries tend to have higher collection efficiency of greater than 90 percent, although the collection costs can represent less than 10 percent of a municipality's total solid waste management costs. Conversely, in low-income countries, collection services make up the bulk of a municipality's solid waste

management budget (as high as 80 to 90 percent in many cases), yet collection rates and efficiencies (<50 percent) tend to be much lower.

After collection, obtaining value from the sale of separated waste products requires a relatively pure stream of a given component. Systems for separating recyclables, putrescibles, etc. into desired categories, as well as the elimination of contaminants, is an on-going technological development reflecting on the economics of the entire operation.

Separation in developed countries is markedly different than in those with under-developed or emerging economies. Techniques range from hand-picking and manual segregation to sophisticated mechanical processes. The separation technique will depend upon the waste collection method that has been employed and the regions socioeconomic standing.

In developed countries and in some cases, sorting occurs at Material Recovery Facilities, or MRFs, which have varying degrees of mechanization and technical maturity. The most technically advanced processes are fully mechanized and involve such systems as laser scanners to determine polymer grades. Less advanced MRFs may be little more than conveyer belts with manual sorters on a line.

Process Economics

Cost of production models for USGC, Brazil, Western Europe and China are shown, and include breakeven tipping fee calculations for:

- MRF with Composting and Power Generation
- MRF with Power Generation
- MRF with Composting
- MRF
- Incineration
- Composting

Capacity

NexantECA has catalogued existing MSW creation and disposal by region.

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Technology@NexantECA.com or www.NexantECA.com**



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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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Americas

Tel: +1 914 609 0300
44 S Broadway,
5th Floor White Plains
NY 10601-4425
USA

Europe, Middle East & Africa

Tel: +44 20 7950 1600
110 Cannon Street
London EC4N 6EU
United Kingdom

Asia Pacific

Tel: +662 793 4600
22nd Floor, Rasa Tower I
555 Phahonyothin Road
Kwaeng Chatuchak
Khet Chatuchak
Bangkok 10900
Thailand

For more information. please contact
Technology@NexantECA.com or www.NexantECA.com