OPTIMIZING RESOURCE AND ENERGY RECOVERY FOR MUNICIPAL SOLID WASTE MANAGEMENT

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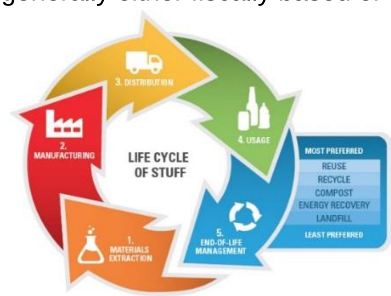
Significant reductions of carbon emissions and air quality impacts can be achieved by optimizing municipal solid waste (MSW) as a resource. Materials and discards management were found to contribute ~40% of overall U.S. greenhouse gas (GHG) emissions as a result of materials extraction, transport, collection, processing, recycling, composting, combustion, and landfilling. Decisions affecting materials management today are generally either fiscally based or based on the presumption of favorable outcomes without an understanding of the environmental tradeoffs. However, there is a growing demand to better understand and quantify the net environmental and energy trade-offs in setting waste management goals and priorities at a state and local level.



In 2012, EPA's Office of Research and Development released the MSW decision support tool (MSW-DST) to help identify strategies for more sustainable MSW management. Depending upon local infrastructure, energy grid mix, population density, and waste composition and quantity, the most sustainable strategies will vary in regards to the net life-cycle assessment (LCA) impacts and cost. Users of this tool are able to identify opportunities to reduce carbon emissions and air criteria pollutants through optimization of MSW as a resource. The MSW-DST evaluates the material and energy flows from point of collection throughout the system (as shown in the figure) to aid in materials management decision-making, planning, and policy development.

Over 400 downloads of the MSW-DST have occurred since 2012 by state and local government (21%), NGOs (10%), academia (25%), consultants (8%), federal government and military (11%), and industry (25%). Universities such as Arizona State University, University of California at Berkeley, University of Colorado at Boulder, Harvard University, University of Virginia at Charlottesville, and Yale University are using it as an education tool across multiple disciplines and curricula, including waste and materials management, industrial ecology, environmental engineering, and LCA. To date, over 150 peer-reviewed publications have resulted from use of the tool. Communities in the U.S. are using the tool to benchmark current practices and track environmental improvements (e.g. energy savings, GHG and criteria emissions reductions) achieved through optimizing MSW as a resource.

Since the development of this tool, research has been conducted by North Carolina State University to update and add process models that will more accurately reflect U.S. technology and the range of practices available to manage MSW. The second generation tool will provide estimates of metrics for cost, LCA environmental and energy tradeoffs, and societal aspects such as land usage and population density. Cost is based on full cost accounting – as was done in the first version of the tool – in addition to estimates of carbon, energy, waterborne pollutants, air criteria pollutants, and other life-cycle environmental tradeoffs. A multi-variate optimization algorithm will be embedded in the tool to facilitate dynamic analysis reflecting evolution of the MSW composition and management practices over time. Updates will be made to the user interface based on feedback from the current user group and ability to answer community-specific questions. Plans also include the use of advanced visualization and interpretation features for use in communicating results with stakeholders (e.g., the public, city officials, NGOs, businesses) to better advance more sustainable materials management.