United States Environmental Protection Agency

International Conference on LCA and other Assessment Tools for Waste Management and Resource Optimization

Development of a 2nd Generation Decision Support Tool to Optimize Resource and Energy Recovery for Municipal Solid Waste

Susan Thorneloe, US EPA

Office of Research and Development
National Risk Management Research Laboratory
Air Pollution Prevention and Control Division

7 June 2016
Cetraro, Italy

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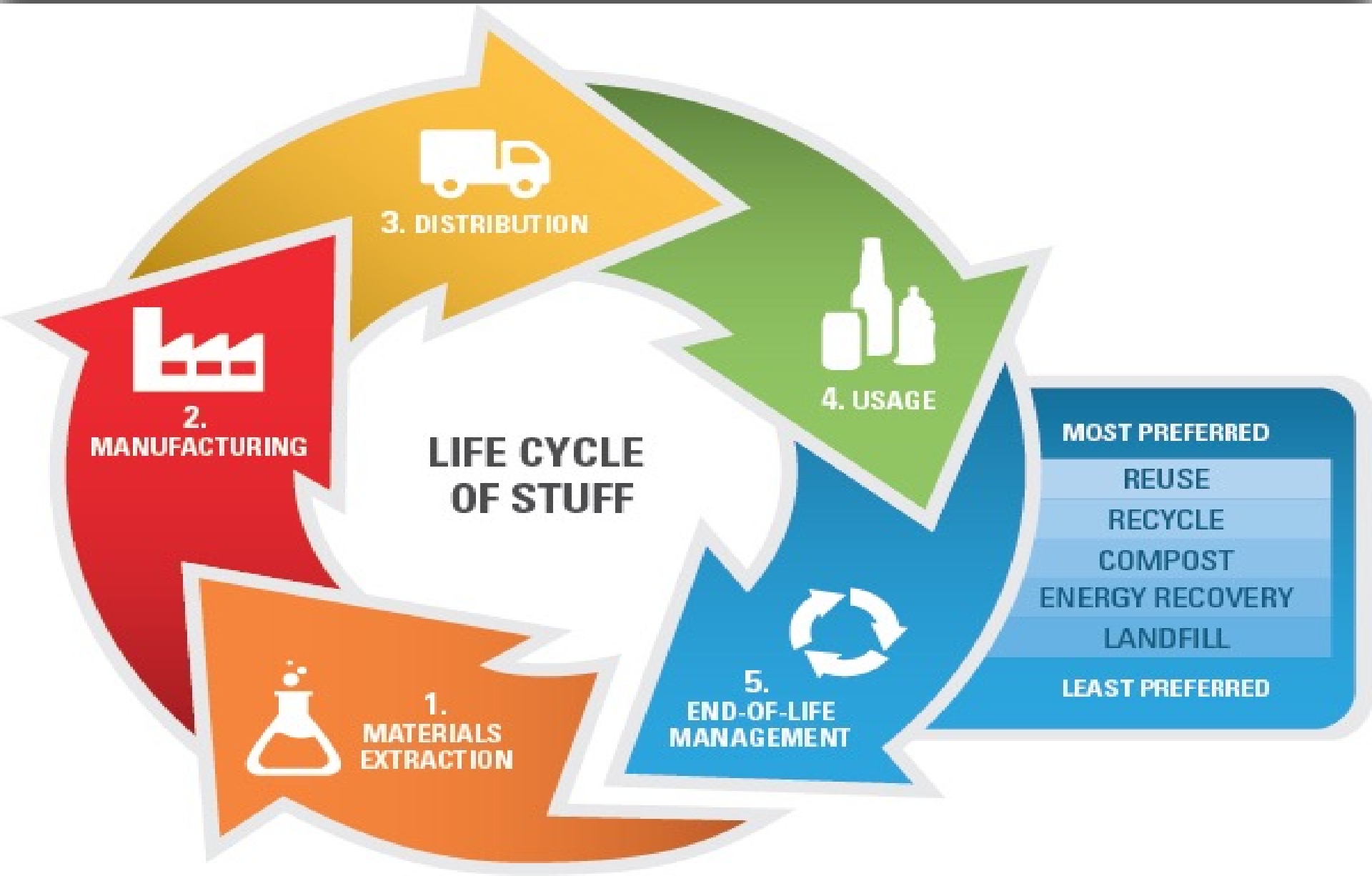
The Life-Cycle of “Stuff”



EPA's Beneficial Use Definition

- Virtually all industrial sectors generate by-products that are typically discarded but may be used to replace natural resources and conserve energy
- EPA has defined beneficial use as the incorporation of an industrial material into a commercial product that:
  1) provides functional benefit
  2) meets relevant design specifications and performance standards for the proposed use
  3) replaces virgin, raw materials in a product already on the market and
  4) is implemented in a environmentally acceptable manner

Objective

- Status of current Decision Support Tool (DST) and its usage
- Ongoing work to develop 2nd generation tool
  - Updated process models and addition of anaerobic digestion and other process models of interest
  - Better visualization of results to track performance and communicate potential benefits of more sustainable strategies to community leaders.
  - Importance of reflecting changes in energy grids over time
- Benefits from using tools that optimize MSW as a resource

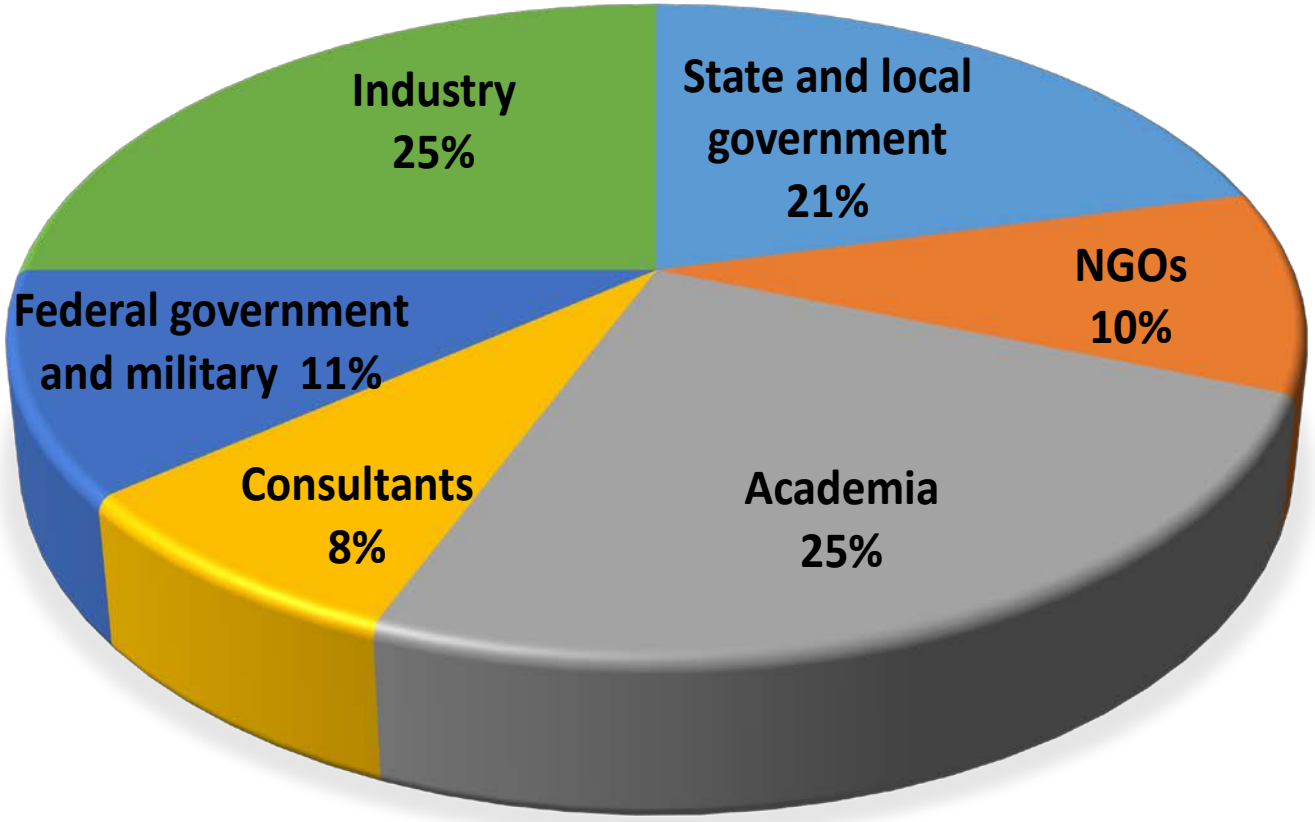
1st Generation tool for identifying more sustainable strategies for managing MSW materials and discards

- *In 2012, EPA released a decision support tool to simulate existing MSW management practices and conduct scenario analyses of new strategies based on cost and environmental objectives.*

- *The tool is freely available including multiple design options for MSW collection, transport, transfer, materials recovery, composting, waste-to-energy, and landfill disposal.*

- *Has been used in over 200 studies by industry, academia, World Bank, NGOs, and state and local government.*

Distribution of Usage of 1st Generation Tool*



*Over 400 downloads since 2012

Second generation tool for optimizing MSW as a resource

Anticipate work to be completed by 2018. New tool will include

- Updates to life-cycle based process models and addition of new process models (i.e., anaerobic digestion) based on research conducted by North Carolina State University
- Mixed-integer optimization to allow for analysis of MSW system evolution over a period of time
- Estimate 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
  - Environmental metrics include greenhouse gas emissions, energy and land usage, waterborne pollutants, air criteria pollutants, and other life-cycle environmental tradeoffs

Example of a Community Dashboard

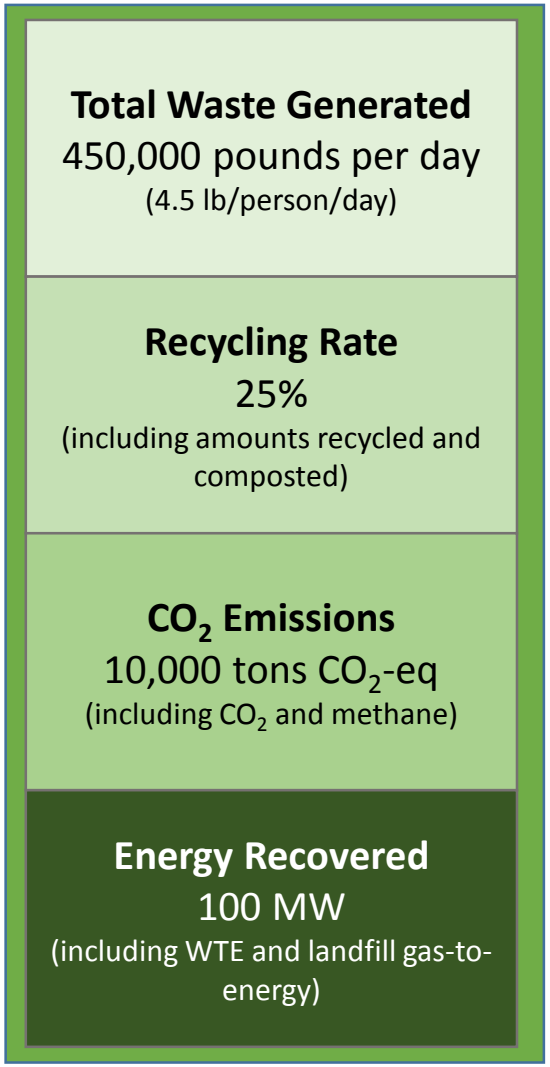
Source: http://environmentaldashboard.org/brd/

Community Waste Sector Dashboard

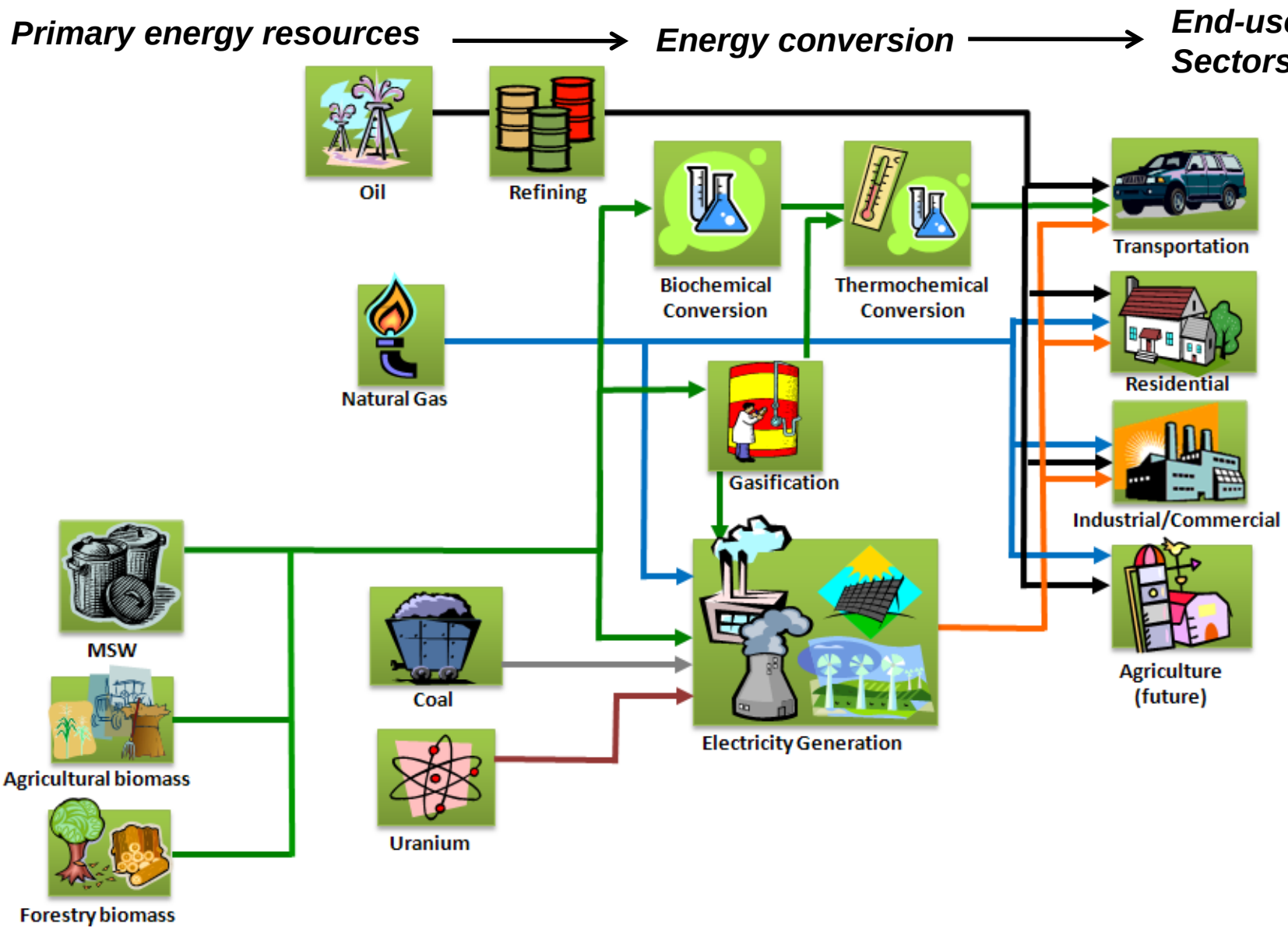
Possible dashboard parameters:

- Amount of waste generated
- Percentage of waste recycled/composted
- GHG emissions (and/or emission savings)
- Criteria pollutant emissions (and/or savings)
- Energy consumed and/or recovered
- Transportation (e.g., number of truck miles)
- Total system cost
- Revenues from sale of materials and energy

*Could also report system totals and by-process results



Importance of reflecting energy grid changes



Benefits from using these tools

- Purpose of using these tools
  - Have standardized process for evaluation that is internally consistent and can reflect the net LCA environmental tradeoffs, costs, and other societal aspects
  - Assess the potential roles of specific technologies or strategies to meet policy goals
  - Identify important system interactions and potential unintended consequences
  - Consider uncertainties in fuel prices, technologies, and policy
  - Provides information to benchmark and track environmental performance over time
- Reflecting differences in how the energy system evolves over time which will have profound impacts on our environment, including climate, air and water

Notes

- For more information, contact: Susan Thorneloe Thorneloe.Susan@epa.gov or 919-541-2709

  For further information on these tools refer to the tools section at this EPA web address:

  http://www.epa.gov/land-research/models-tools-and-databases-land-and-waste-management-research

  Or access to tools and further information can be found on the project websites

  https://mswdst.rti.org/

** This presentation has gone through the EPA clearance process but does not necessarily reflect the opinions and policies of the EPA.*