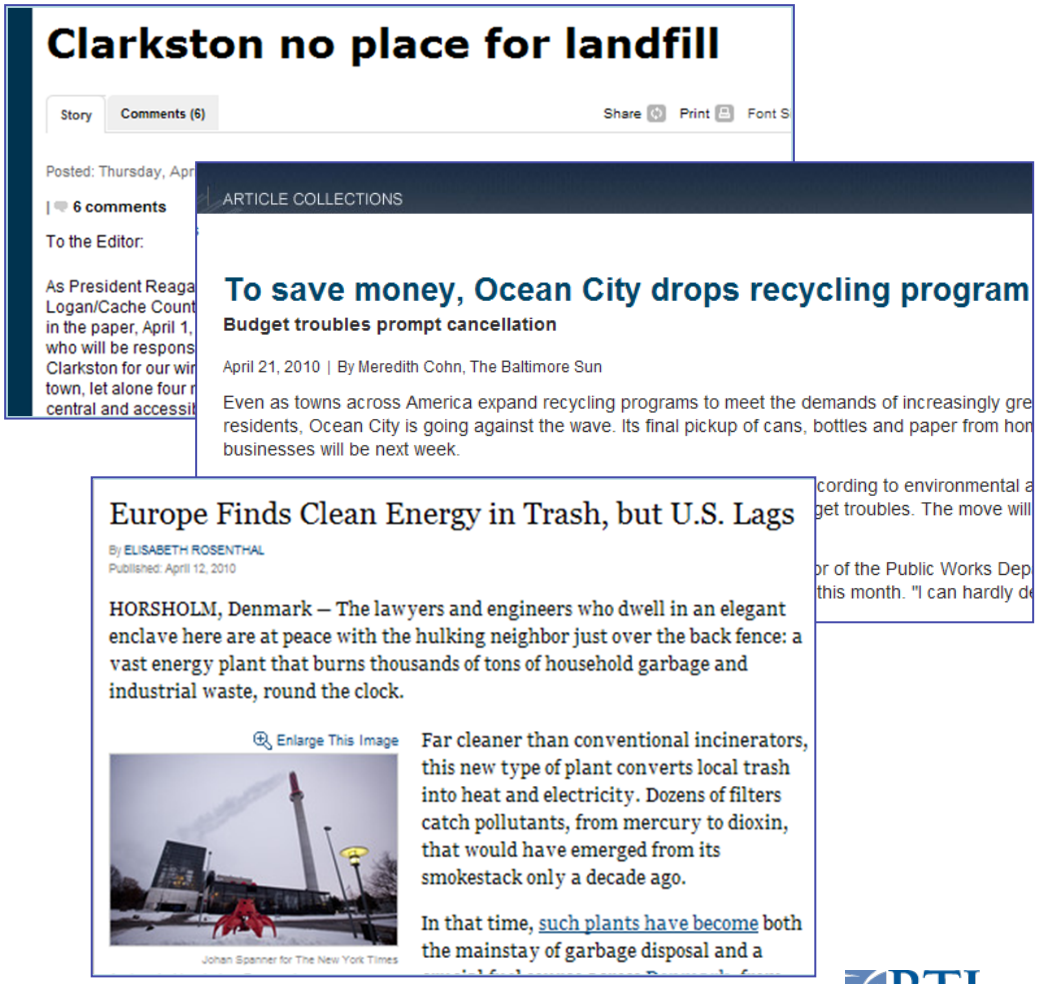
Magnitude of the Challenge

- Millions of dollars are spent each year by cities and communities to manage solid waste
- There is limited and often conflicting information on which planners and officials can base waste management decisions
- Solutions vary by region depending upon population density, infrastructure, waste characteristics, proximity to facilities, facility design and operating aspects, materials markets, etc.



Clarkston no place for landfill

Story | Comments (6) | Share | Print | Font S

Posted: Thursday, Apr

| 6 comments

To the Editor:

As President Reaga
Logan/Cache Count
in the paper, April 1,
who will be respons
Clarkston for our wir
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ARTICLE COLLECTIONS

To save money, Ocean City drops recycling program

Budget troubles prompt cancellation

April 21, 2010 | By Meredith Cohn, The Baltimore Sun

Even as towns across America expand recycling programs to meet the demands of increasingly gre
residents, Ocean City is going against the wave. Its final pickup of cans, bottles and paper from hon
businesses will be next week.

cording to environmental a
get troubles. The move will

r of the Public Works Dep
this month. "I can hardly d

Europe Finds Clean Energy in Trash, but U.S. Lags

By ELISABETH ROSENTHAL
Published: April 12, 2010

HORSHOLM, Denmark — The lawyers and engineers who dwell in an elegant enclave here are at peace with the hulking neighbor just over the back fence: a vast energy plant that burns thousands of tons of household garbage and industrial waste, round the clock.

Enlarge This Image

Johan Spanner for The New York Times

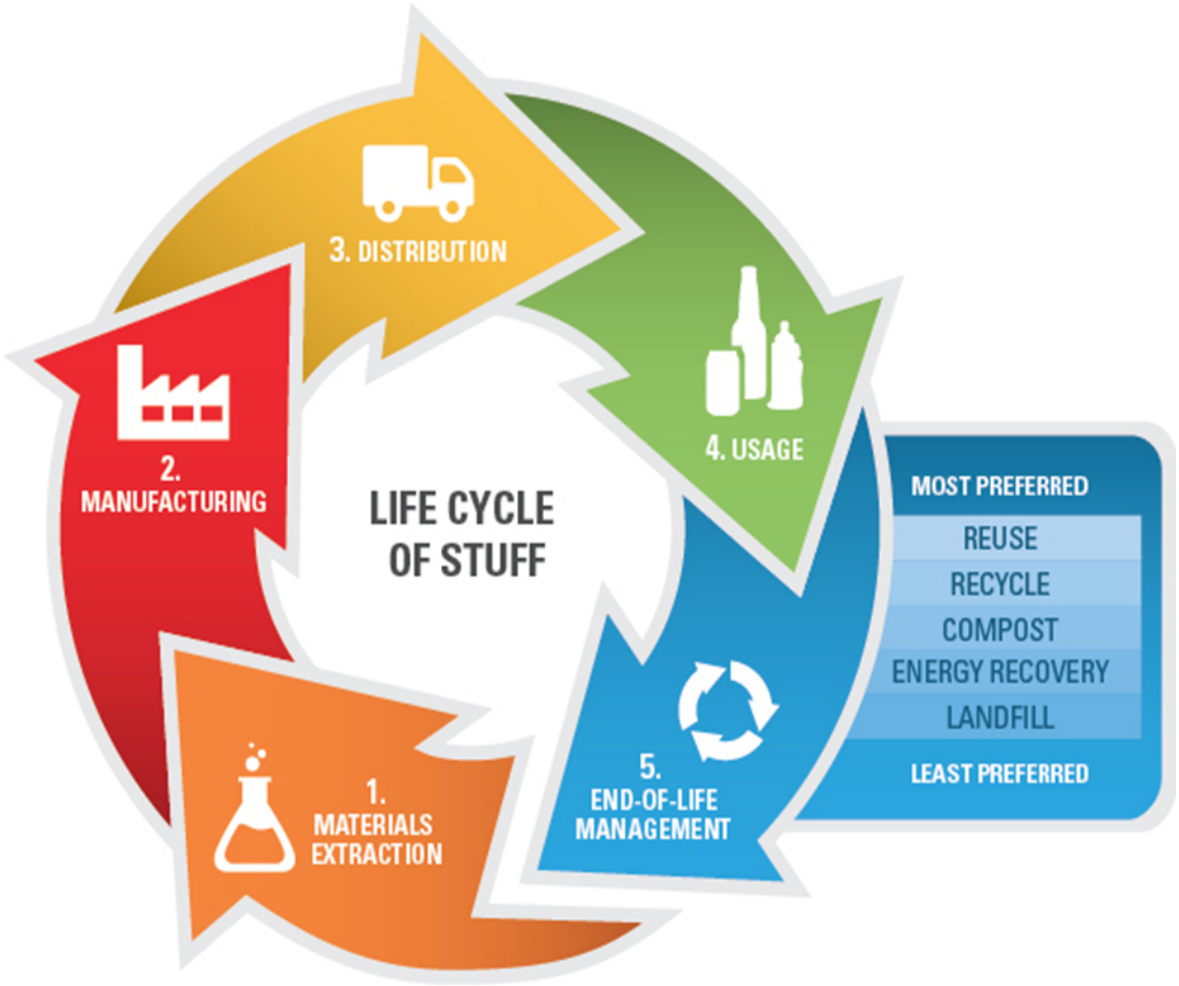
Far cleaner than conventional incinerators, this new type of plant converts local trash into heat and electricity. Dozens of filters catch pollutants, from mercury to dioxin, that would have emerged from its smokestack only a decade ago.

In that time, such plants have become both the mainstay of garbage disposal and a

Magnitude of the Challenge

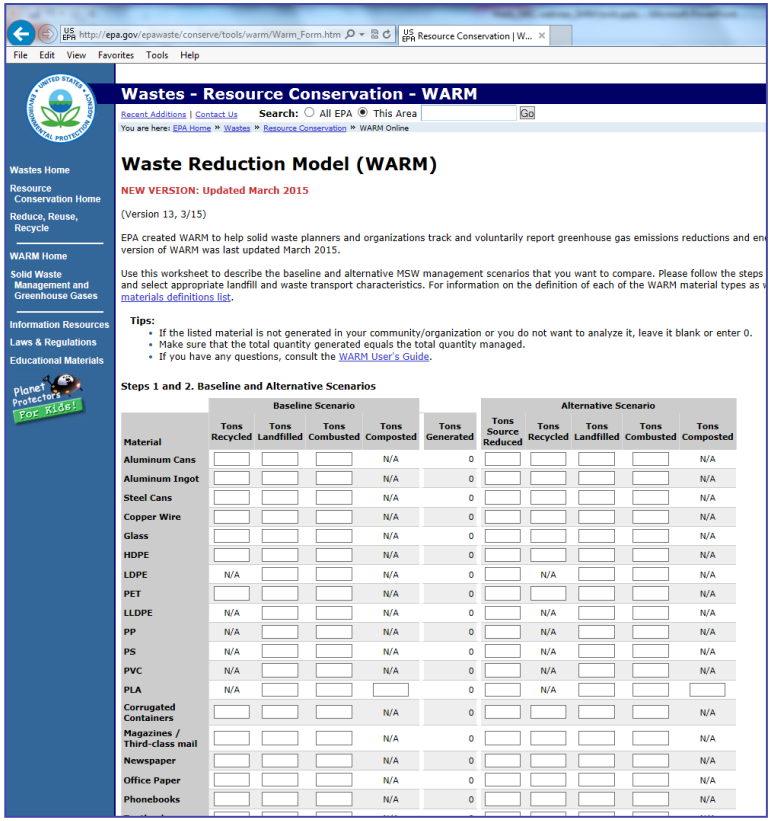
- Different materials (glass, paper, plastics, metals, organics, etc.) have different cost and environmental tradeoffs
- There is a need for credible, science-based, objective information for evaluating waste management strategies
- Decisions need to be more informed and defensible given the high level of scrutiny and large economic impact

Tools Focus On The Life Cycle Of Materials



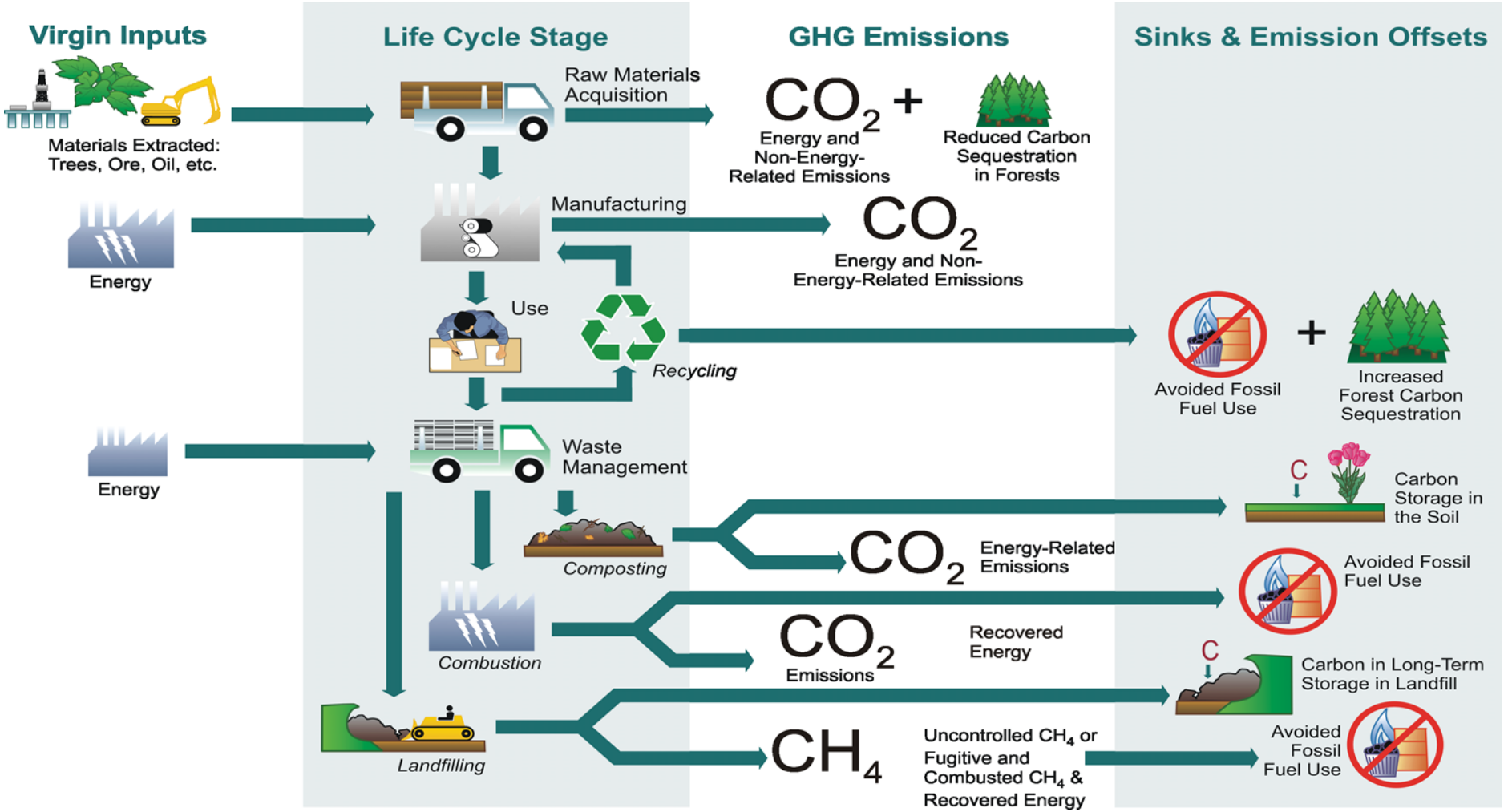
WAste Reduction Model (WARM)

- Designed as a tool for waste managers to weigh the life cycle greenhouse gas and energy impacts of waste management practices
- Includes 54 types of material types
- Captures source reduction, recycling, combustion, composting, and landfilling
- Available free of charge in both a Web-based calculator format and a Microsoft® Excel spreadsheet



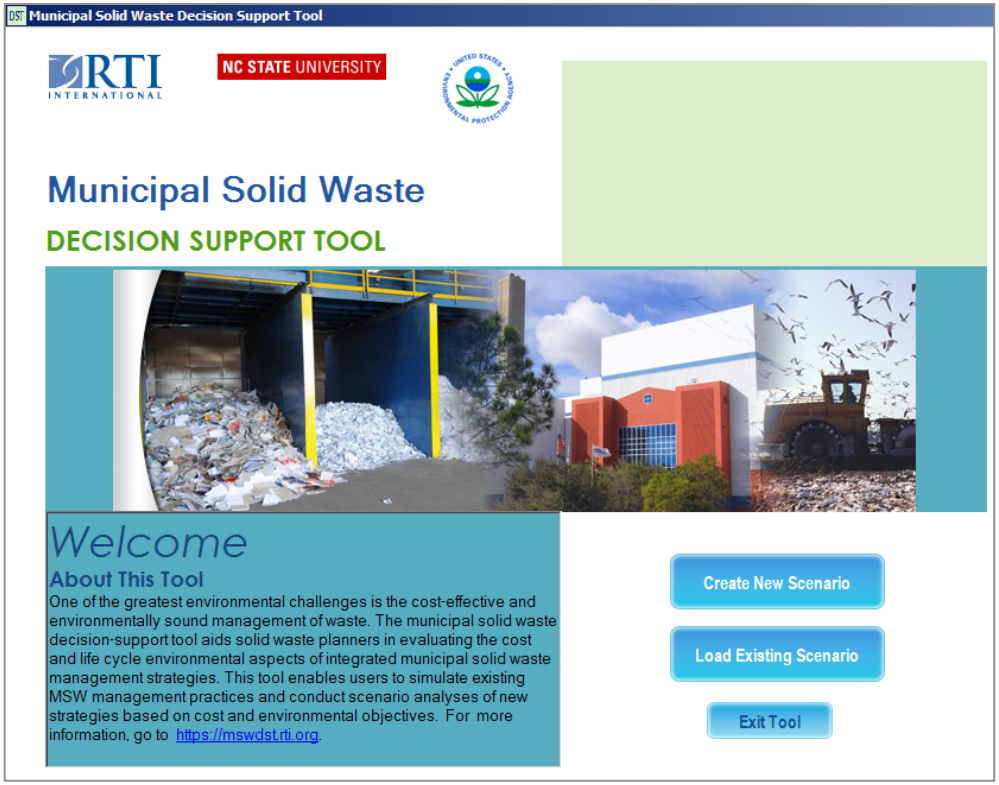
http://www.epa.gov/climatechange/waste/calculators/Warm_home.html

Life Cycle Components Included in WARM



Municipal Solid Waste Decision Support Tool (MSW DST)

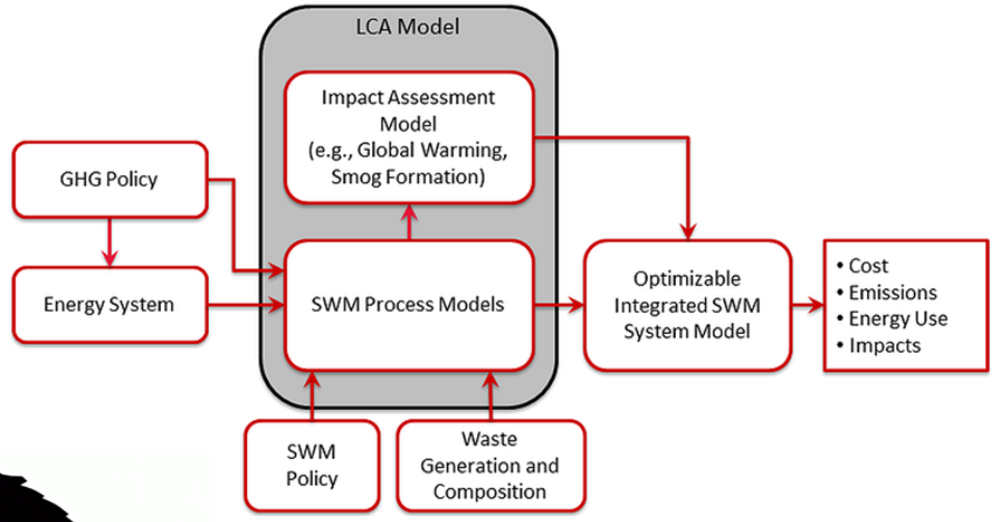
- Designed as a tool for communities to analyze the cost, energy, and environmental impacts of alternative waste management strategies
- Cost method based on full-cost accounting
- Captures multiple options for collection, recycling, combustion, composting, and landfilling
- Allows users to run simulation or optimization analyses
- Free downloadable desktop application



https://mswdst.rti.org/

Solid Waste Optimization Life-cycle Framework (SWOLF)

- Currently under development at North Carolina State University, this tool is designed for researchers and communities to evaluate cost, energy and environmental impacts of alternative waste management strategies
- Includes multiple waste generating sectors and waste types
- Captures multiple options for collection, recycling, combustion, composting, anaerobic digestion, and landfilling
- Includes multi-stage optimization that allow waste generation and composition, facilities, and energy systems to change over time
- Free downloadable desktop application for educational, academic, and government use



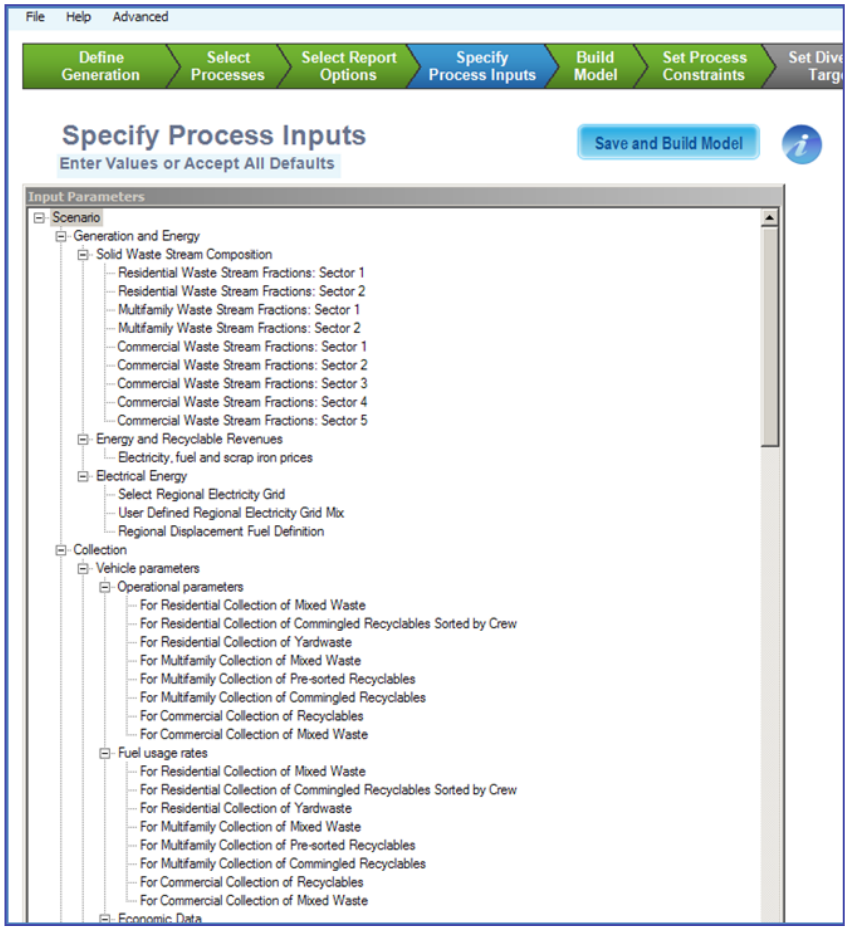
http://go.ncsu.edu/swolf

Other *Example* LCA/SMM Tools

- EaseTech
  - http://www.easetech.dk/
- Integrated Solid Waste Management Tool (IWSM)
  - http://www.iwm-model.uwaterloo.ca/english.html
- Integrated Solid Waste Management (IWM-2)
  - http://www.wiley.com/WileyCDA/WileyTitle/productCd-0632058897,descCd-description.htm
- Morris Benefits Calculator
  - http://www.zerowaste.com/pages/MEBCalc.htm
- Waste-Integrated Systems for Assessment of Recovery and Disposal (Wisard)
  - http://ecobilan.pwc.fr/

What Do I Need to Input into These Tools?

- Waste quantity and composition
- Processes to include if multiple options are available
- Collection and transportation modes and distances
- Other settings:
  - electricity grid information
  - recycling, etc. efficiencies
  - landfill gas management
  - cost factors (if included)
  - energy and recycled material prices (if included)



What Do Outputs Look Like?

- Primarily tabular results by parameter and for some tools by process
- Limited data visualization capabilities – but users can create custom charts and graphics using results

File Edit View Favorites Tools Help

GHG Emissions Analysis — Summary Report

(Version 13, 3/15)

Analysis of GHG Emissions from Waste Management

GHG Emissions from Baseline Waste Management Scenario (MTCO2E):	71,291
GHG Emissions from Alternative Waste Management Scenario (MTCO2E):	50,134
Total Change in GHG Emissions: (MTCO2E):	**-21,157**

	Baseline Scenario					Alternative Scenario						
Material	**Tons Recycled**	**Tons Landfilled**	**Tons Combusted**	**Tons Composted**	**Total MTCO2E**	**Tons Source Reduced**	**Tons Recycled**	**Tons Landfilled**	**Tons Combusted**	**Tons Composted**	**Total MTCO2E**	**Change (Alt - Base) MTCO2E**
Food Waste (non-meat)	N/A	100,000	0	0	71,291	0	N/A	75,000	15,000	10,000	50,134	**-21,157**

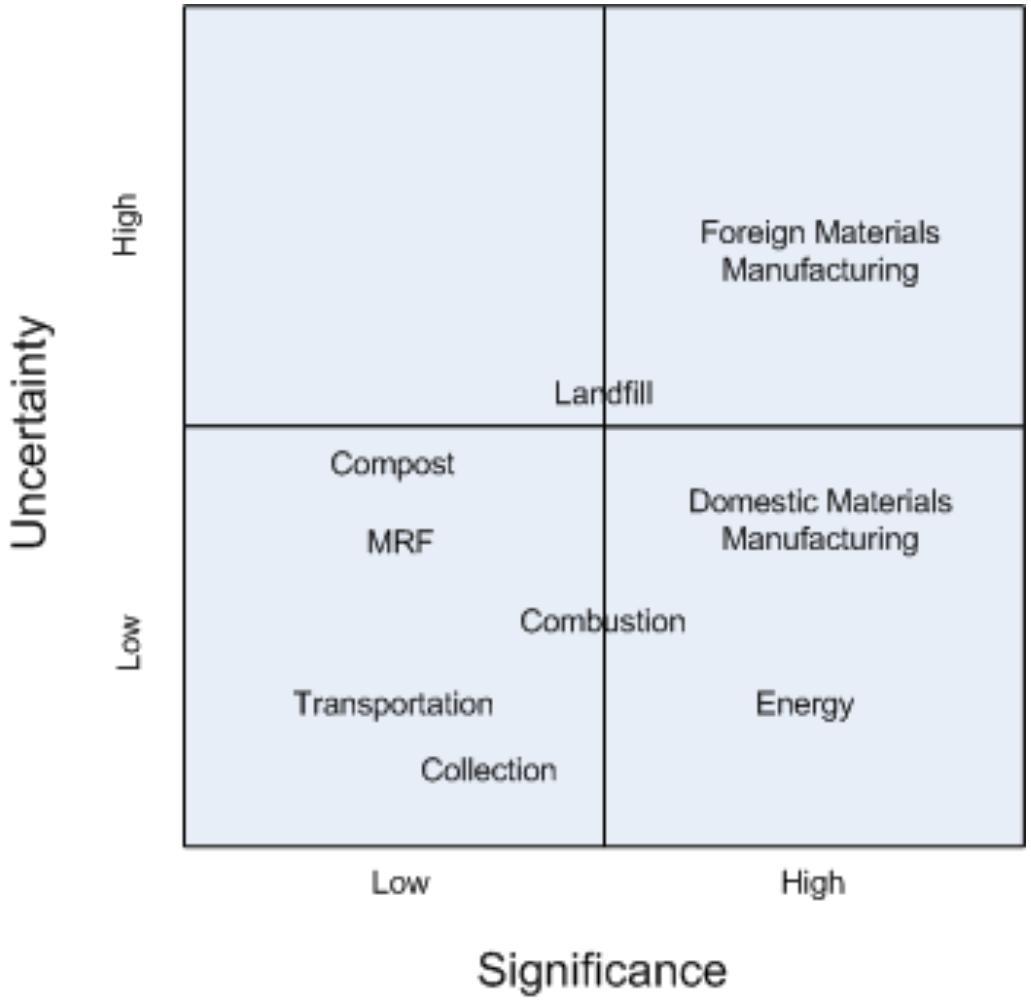
Note: A negative value indicates an emission reduction; a positive value indicates an emission increase.
a) For an explanation of the methodology used to develop emission factors, see Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM) — available on the Internet at http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html
b) Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.
c) Total emissions estimates provided by this model may not sum due to independent rounding.

- Recent application of a SMM model (MSW DST) for Chicago region communities provides a good example of how results can be used:
  - http://delta-institute.org/delta/wp-content/uploads/Delta-Institute-Waste-Management-Report-October-20141.pdf

Key SMM Tool Result Drivers

- Energy inputs
  - Electricity grid mix?
- Recycling
  - Capture rate and separation efficiency?
  - Where do recovered materials go?
  - How is residual waste managed?
- Energy recovery
  - Conversion efficiency?
  - Type of fuel/energy is being displaced?
  - Material (e.g., metals) recovery aspects?
- Landfill gas management
  - Vent, flare, gas-to-energy?
  - Gas collection efficiency?

Sources of Uncertainty In SMM Tools



Other Key Points

- Every waste management strategy and technology has benefits and costs
- SMM tools are best considered in the context of providing information about these relative tradeoffs
- Tools generally agree but can differ in data sources and methods used:
  - variation in treatment and reporting of carbon storage and sequestration
- Additional information is needed beyond existing tools to support SMM decision making:
  - technical feasibility
  - scale (pilot vs commercial)
  - marketability of products
  - economics
  - community impacts such as jobs, local economic development, environmental justice, etc.

What is the Value Proposition for SMM Tools?

- Identify counter-intuitive findings
- Provide for credible and objective analysis
- Characterize cost and/or environment impacts by material types (steel, aluminum, glass, paper, plastics, organics)
  - Effective programs would account for differences to realize the "highest and best use" by material
- Understanding impacts (and benefits) that are local versus national or global
  - Greater source separation may increase collection and transport activity and local air pollutants
  - Recycling markets are global and benefits may occur outside the immediate locale or region
- Provides a standard framework to benchmark current practices and measure and communicate improvements over time

What is the Value Proposition for SMM Tools?

- Educate solid waste managers, communities and the general public
- Identify environmental aspects for alternatives to meet waste and environmental goals and targets (e.g., carbon emission reduction, zero waste)
- Evaluate new emerging waste management technologies such as waste “conversion” technologies