EPA Efforts to Reduce GHG Emissions from Solid Waste Management

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EPA's activities in Climate Change Mitigation from the Solid Waste Management perspective:

- Background
- EPA's Waste Management Hierarchy
- OSWER's Climate Change strategy will focus on:
  - Materials management and
  - Land management
- Implementation of EISA
  - Effects on managing waste materials
- Case studies:
  - 6 community waste management analysis

“The State of the Union”

In October, 2008 is change:

– Change in administration
– Change in economic conditions
– Change in environmental priorities

EPA is anticipating significant new direction

Change in Environmental Priorities for the Solid Waste Program?

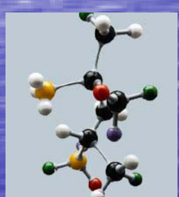
- No major new legislation in solid waste management since 1985 RCRA amendments
- Priorities locked in from that time
- Focus was on cradle-to-grave waste management
- RCRA purposefully restricted combustion of wastes by imposing stringent conditions on units combusting waste materials

Advance to 2008:

– Expansion of energy and materials consumption (particularly from emerging economies)
– Recognition of the potential for severe climate change
– Completion of most mandated regulations
– Studies of waste management suggests changing to “cradle-to-cradle” materials management strategy to promote energy efficiency and GHG reduction

Safe Management: Cradle to **Grave**

Material Inputs

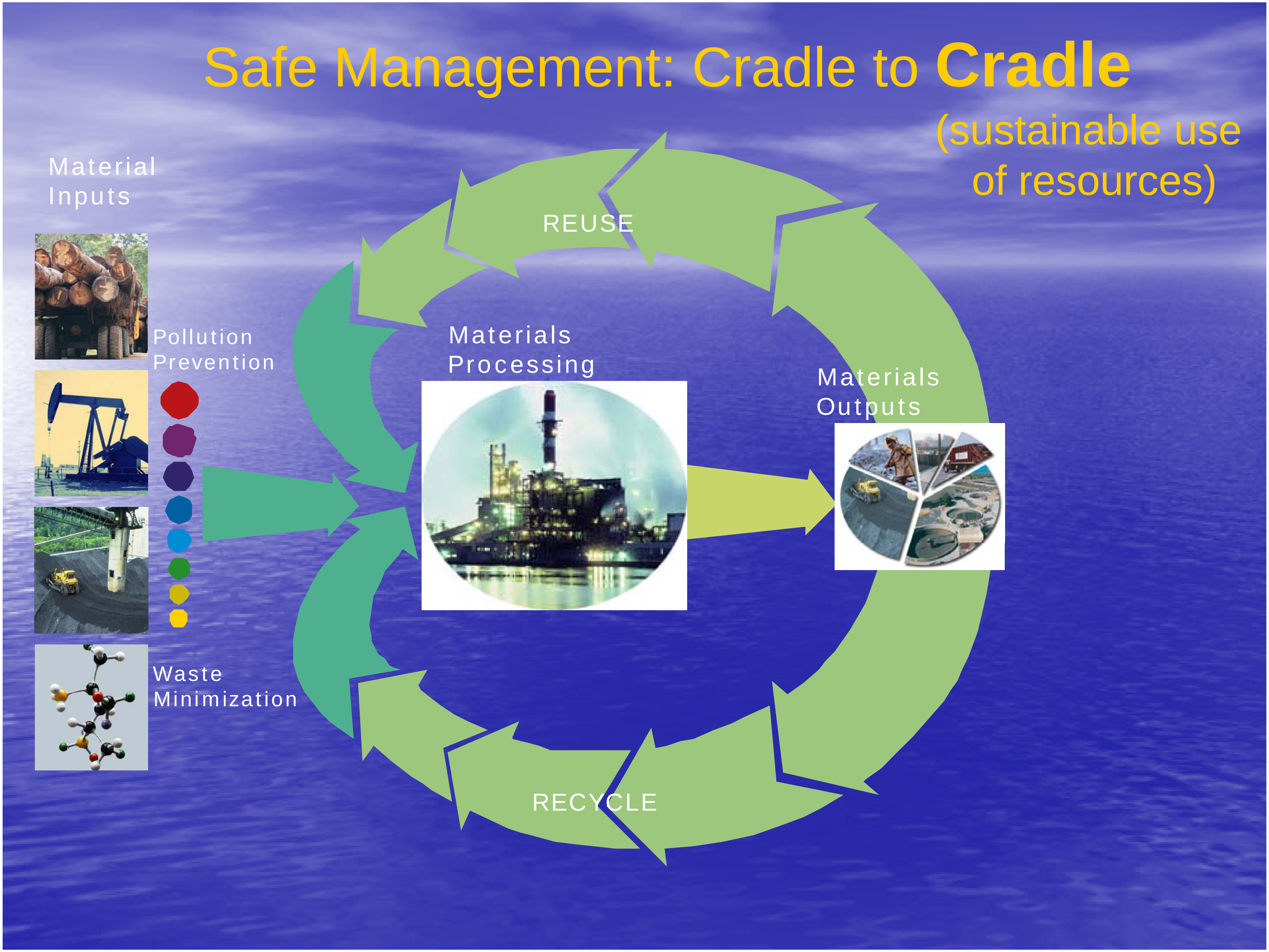


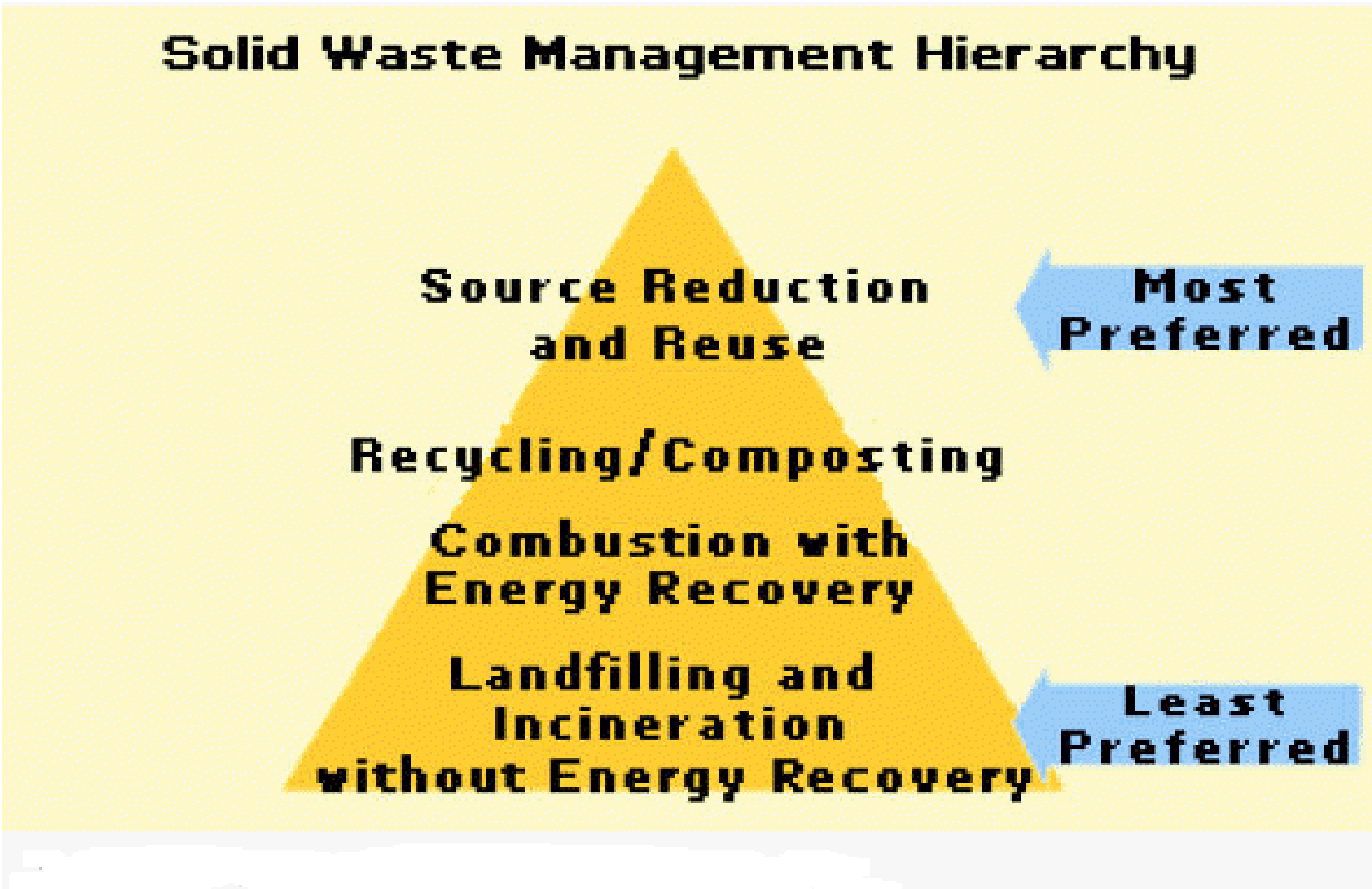
Materials Processing

Materials Outputs

Safe Management and Disposal

- Largely complete set of protective regulations
  - Filling in gaps – responses to law suits
  - Tweaking to improve certain “catch all” aspects of regulations


Safe Management: Cradle to **Cradle**
(sustainable use of resources)
Material Inputs
Pollution Prevention
Waste Minimization
REUSE
Materials Processing
Materials Outputs
RECYCLE


Solid Waste Management Hierarchy
Source Reduction and Reuse
Recycling/Composting
Combustion with Energy Recovery
Landfilling and Incineration without Energy Recovery
Most Preferred
Least Preferred

Drivers for Converting Materials to Energy

- Increased demand on limited natural resources
  - Energy security & independence
  - Oil peaking; new sources of energy & chemical feedstock needed
  - Energy, water, and material use efficiencies are critical for a sustainable economy and environment
- Aggressive Pursuit of Renewable and Alternative Fuels
- Reduction of GHG across all societal aspects
- Economic opportunity
- Minimization of risks posed by materials not easily managed
  - Disaster debris
  - Woody biomass: wildfires, landfill

OSWER Climate Change Effort:

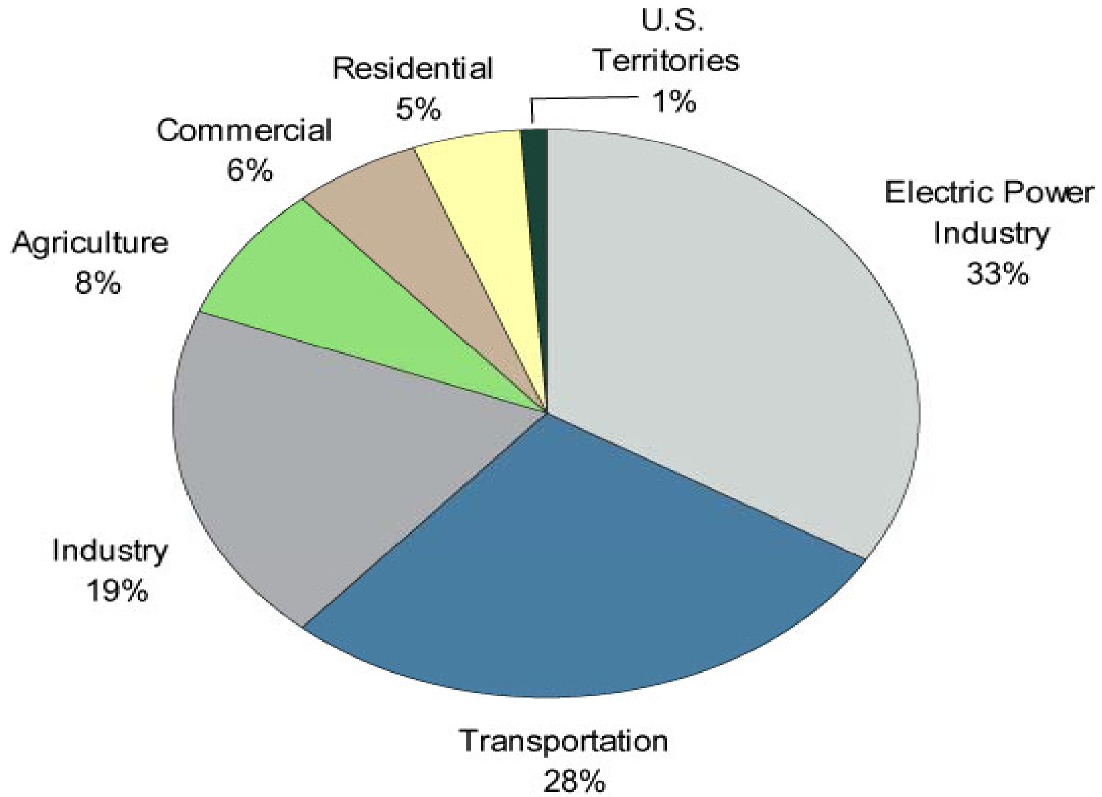
"Opportunities to Reduce or Avoid GHG Emissions Through Materials and Land Management Practices"

- Resource conservation and recovery with emphasis on safe waste disposal and efficient use of materials to prevent them from becoming wastes
- Land management activities that revitalize contaminated sites
- Emergency response and preparedness

OSWER Climate Change Strategy

Traditional End Use Economic Sector View

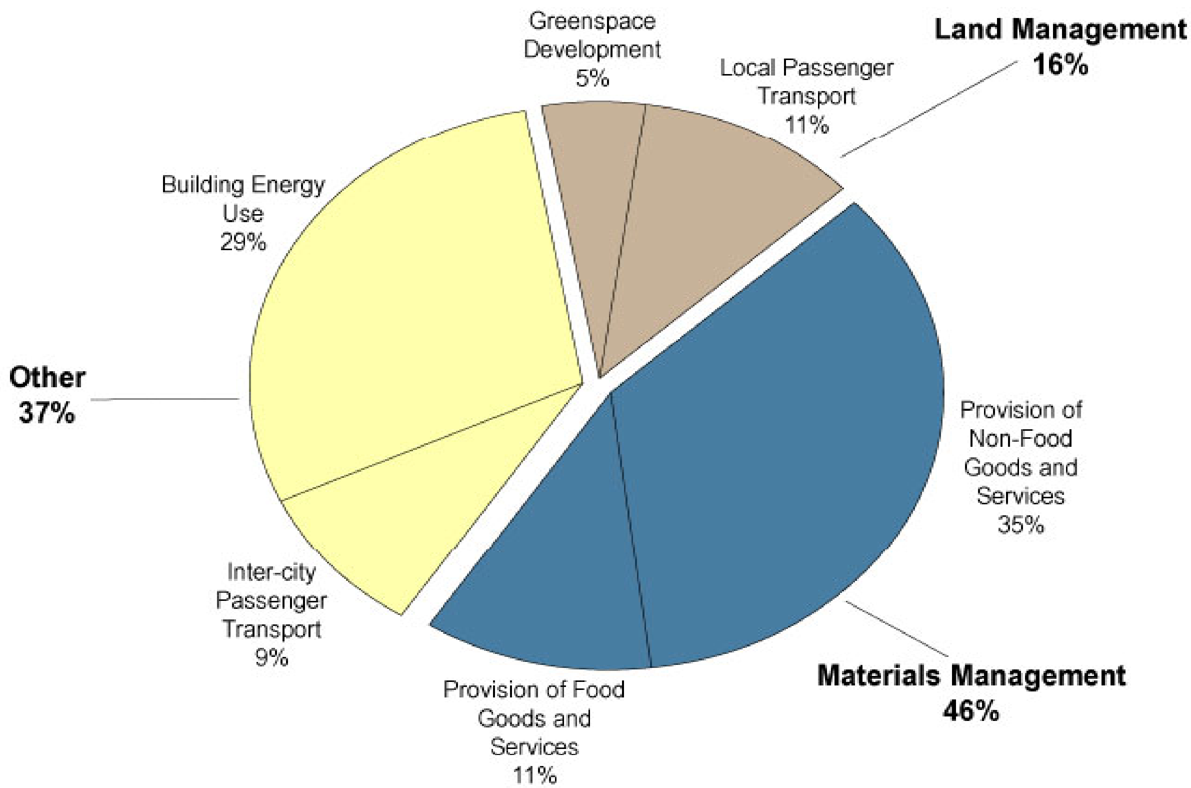
Figure 1
Conventional View of U.S. GHG Emissions



OSWER Climate Change Strategy

Non-traditional System View

Figure 2
Materials and Land View of U.S. GHG Emissions



Developing Climate Change Strategy (Materials Management)

- Minimize raw material inputs
- Extend product life spans by improving:
  - Durability
  - Adaptability
  - Reuse
- Maximize the ease and frequency of product:
  - Disassembly
  - Recycling
  - Transformation for further productive use, particularly extracting energy from suitable materials

Box 7: Summary of Hypothetical Materials Management Approaches

Source reduction

Use 25% less source material in producing aluminum and steel cans, glass, plastics (HDPE, LDPE, PET), corrugated cardboard, magazines and third class mail, newspaper, office paper, phonebooks, textbooks, dimensional lumber

		31 – 109 MMTCO_2E per year
Reduce packaging use by 50%		147 MMTCO_2E per year
Extend the life of personal computers by 50%		51 MMTCO_2E per year
Recycle all construction materials		160 MMTCO_2E per year
Increase national MSW recycling rate to 50%		36 MMTCO_2E per year
Composting	Compost all food scraps	21 MMTCO_2E per year
Energy Recovery	Combust all landfilled MSW	73-136 MMTCO_2E per year
Disposal	Capture all methane at U.S. landfills	67 MMTCO_2E per year

These examples represent just a small portion of the total impact that materials management approaches could have on U.S. GHG emissions.

Comparative Analysis of Potential Energy Recovery Processes

Energy Recovery Opportunities	Material Volume Potential	Energy Volume Potential
MSW	133.3 million tons/year → 248.6 million tons/year	68.8 billion kWh/year → 128.3 billion kWh/year
C&D Building (Wood, Disaster Debris, and Land Clearing Debris)	110 million tons/year → 126 million tons/year	98.7 billion kWh/year → 113 billion kWh/year
Comparable Alternative Resources Rule (CAR)	42,000 metric tons/year (KO88) → 8,000 metrics tons/year (CSOS)	18.9 million kWh/year → 4.4 million kWh/year
Used Oil	200 million gallons	0.5 million kWh/year
Gasification II	170,000 metric tons/year → 1.7 million tons/year	243 million kWh/year → 2.43 billion kWh/year
Landfill Methane Gas	560 Candidate Landfills	10 billion kWh/year
Scrap Tires	600,000 tons	8.4 billion kWh/year

Energy Independence and Security Act of 2007 (EISA)

- Developed to increase:
  - Energy efficiency and
  - Availability of renewable energy.
- Renewable Fuel Standard (RFS) Mandates:
  - 2008 -- 9 billion gallons of RFS
  - 2022 -- 36 billion gallons of RFS
  - 2016 all of the increases in RFS must be met with advanced biofuels (i.e. cellulosic ethanol, etc.)
  - Are mandatory greenhouse gas emissions reductions set for renewable fuels

EISA: Waste vs. Biomass

- "Advanced Biofuels" sources:
  - Ag Biomass (switchgrass) and/or
  - Ag Waste (corn stover)
- Technical feasibility is severely limited; maybe 10 years away from practical application
- Waste materials have significant amounts of energy to address this deficit. This represents energy <u>generation</u>, not energy use <u>savings</u> as provided by recycling.
- Use of waste as a biomass source would create net GHG reductions, lower cross-media effects.

How Can Use of Waste Materials Support Alternative Fuels Production?

- Two major areas:
  - WTE supplied electricity to biorefineries. (*Improves their lifecycle GHG emission signatures*)
  - Wastes as feedstocks to biofuels production

Case Study:
"Comparative Assessment of Factors Influencing Waste Management Decisions and Environmental and Economic Impacts of those Decisions"

- Community Comparison
  - Broward County, FL and King County, WA
  - Tulsa, OK and Frederick Country, MD
  - Lancaster, PA and Wilmington, DE
- Identification of the reasons why some communities have WTE in their waste management systems, while others do not
- Analysis of community data by the WARM and DST to quantify GHG output
  - Model runs of how the communities w/o energy recovery units would look if energy recovery units were installed.

Summary

- EPA is awaiting a new administration and anticipating strategy development for renewable fuels production and greenhouse gas reductions
- One big driver: significant need for feedstocks for renewable fuels with beneficial carbon signatures
- EPA will be developing strategies on climate change and biofuels production from the waste management perspective to meet anticipated strategy directives

Where could WTE research be focused?

- Development of an cost-effective method to convert MSW to liquid fuel
  - Make MSW one source for the 21 billion gallon advanced biofuel mandate

Where could WTE research be focused?

- Development of more efficient methods to capture power from MSW and other wastes, including previously landfilled material
  - Seeking higher carbon credits for municipalities

Where could WTE research be focused?

- Carbon sequestration technologies and techniques for WTE facilities