ACCO Climate Change Leadership Series
Overview of the Materials/Waste/Climate Connection

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Prepared for the ACCO Managing Waste Workshop

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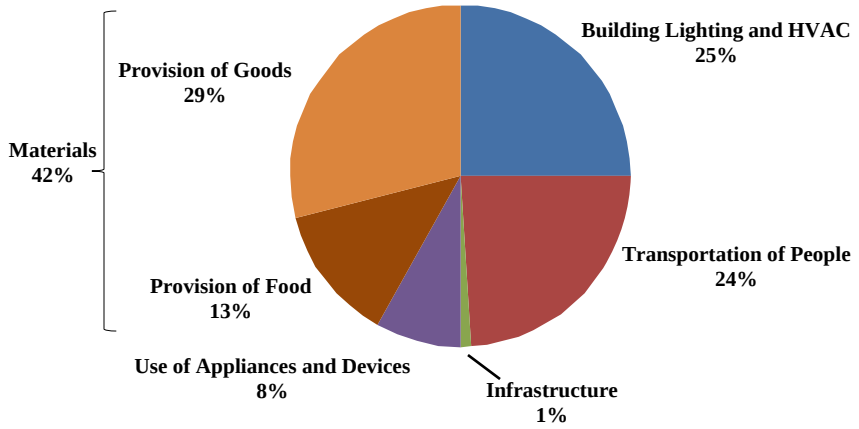
Materials Matter: Systems-Based Geographic Emissions Inventory (2006)



Source: US EPA (2009)

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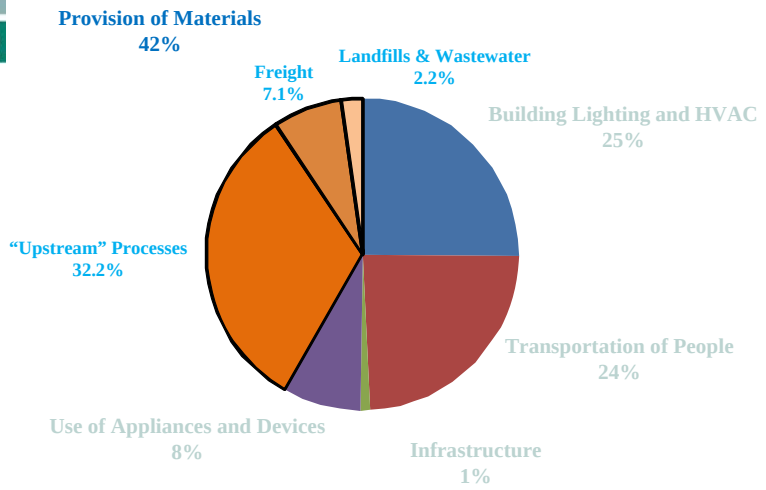
For Materials, "Upstream" Emissions Dominate



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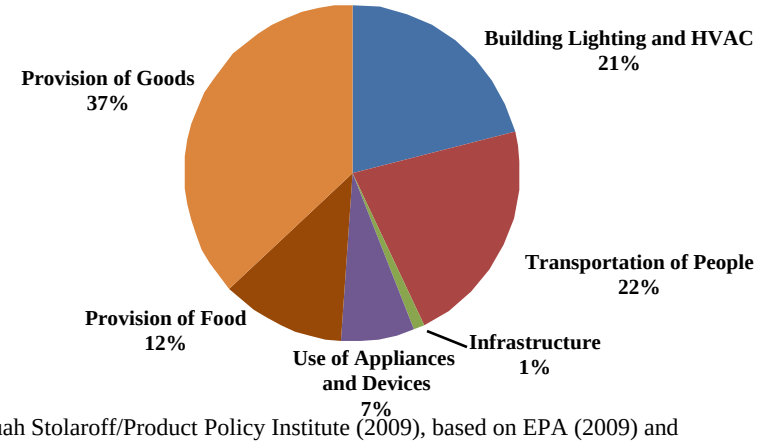
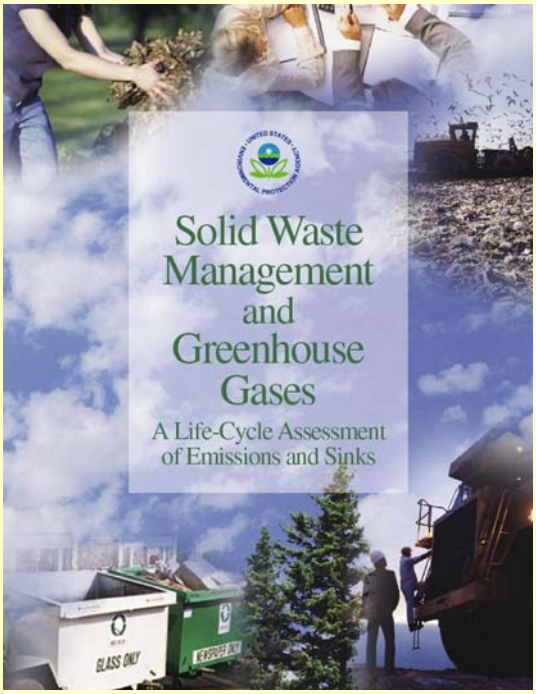
Systems-Based Emissions Inventory, Geographic Emissions *Adjusted for Imports and Exports* (2006)



Source: Joshuah Stolaroff/Product Policy Institute (2009), based on EPA (2009) and Weber & Matthews (2007)



EPA Climate Change and Waste Resources:

Report:
http://epa.gov/climatechange/wycd/waste/SWMGHGreport.html

WARM (WAste Reduction Model) and other tools:
http://epa.gov/climatechange/wycd/waste/tools.html

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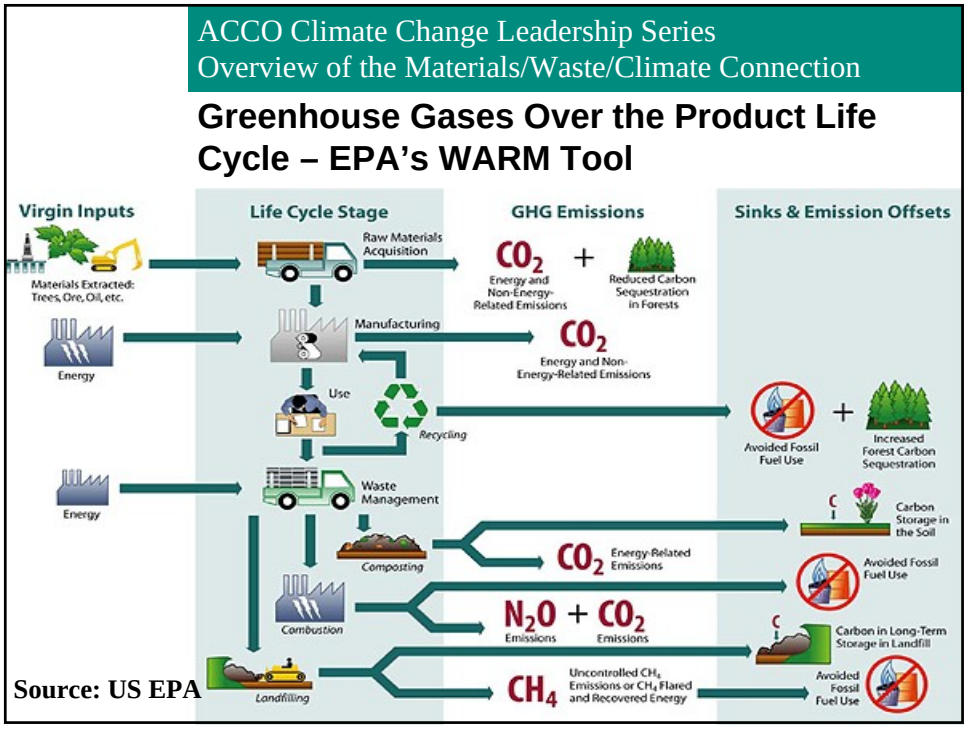

Source: US EPA

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Energy and Greenhouse Gas Benefits of Recycling

- Recycling in Oregon in 2009 saved ~27 trillion BTUs of energy
  - ~2.4% of total statewide use
  - Equivalent of ~216 million gallons of gasoline
- Recovery in Oregon in 2009 reduced greenhouse gas emissions by ~2.8 million metric tons of CO2e
  - ~3.9% of total statewide emissions
  - Equivalent of 570,000 "average" passenger cars

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Curbside Recycling (Portland, Oregon)

- For every 100 tons of mixed recyclables collected from households (curbside):
  - 6 $MTCO_2e$ in greenhouse gas emissions from on-route vehicles (including diesel production)
  - 232 $MTCO_2e$ greenhouse gas savings (net) when these recyclables displace virgin feedstock in production

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Long-Haul Is Not a Limiting Factor

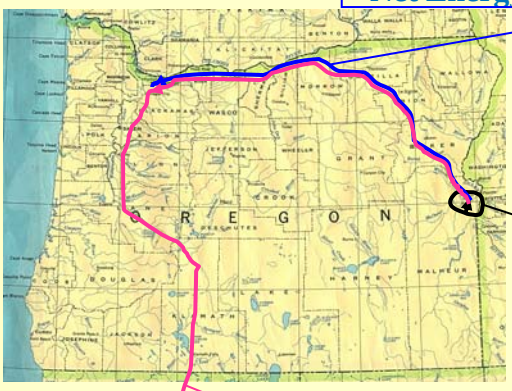
Material	"Break-Even Point" (miles) Freighter	Production & Forestry Savings (MTCE/ton collected) Truck	Rail
Aluminum	3.44	116,000	451,000	524,000
Corrugated	0.79	27,000	104,000	120,000
Newspaper	0.68	23,000	90,000	104,000
Steel	0.48	16,000	63,000	73,000
LDPE	0.36	12,000	47,000	55,000
PET	0.33	11,000	43,000	50,000
HDPE	0.30	10,000	39,000	45,000
Glass (to bottles)	0.07	2,000	9,000	11,000

"Break-Even Point" is where GHG emissions transporting the recyclables equals GHG emissions avoided when the recyclables displace virgin feedstocks.

Avoided disposal-related emissions are not included.

End Markets Matter! (sometimes)

Cullet to Bottle Recycling (Portland)
Net Energy Savings: ~2.1 MMBTU/ton



Cullet to Aggregate Recycling (Local)
Net Energy Savings: ~0.2 MMBTU/ton

Cullet to Fiberglass Recycling (California)
Net Energy Savings: ~3.2 MMBTU/ton

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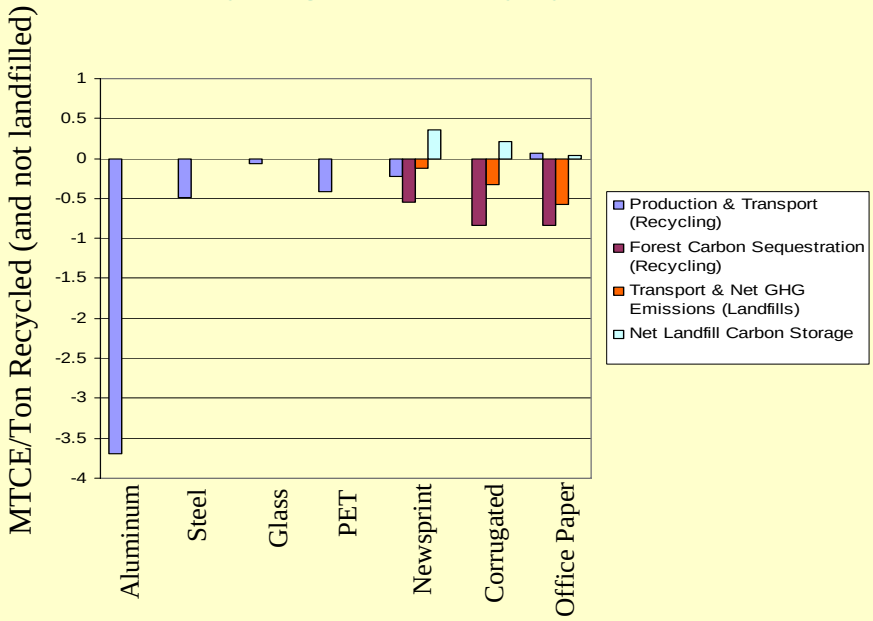
Recycling benefits vary by material



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EPA Emissions Factors (WARM): Some Caveats

- Significant uncertainty, variability:
  - Energy use/savings between individual end-markets, countries
  - Forestry-related benefits
  - Compost benefits
  - Quantity and timing of methane releases
  - Effectiveness of gas controls
  - Others

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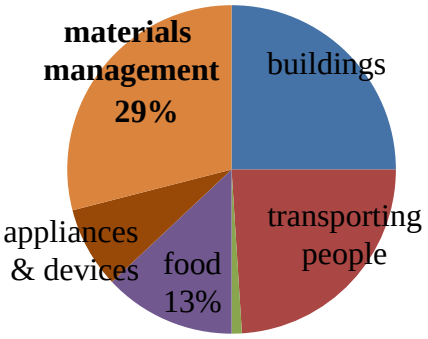
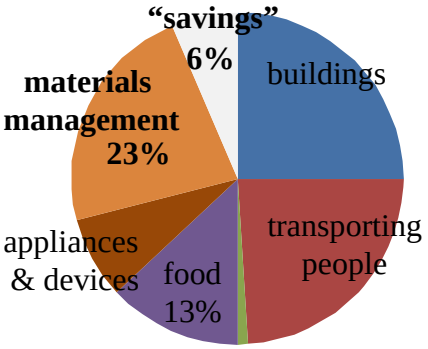
The importance . . . and limitations . . . of recovery



2006 U.S. GHG inventory with 32% recovery (MSW)



2006 U.S. GHG inventory with maximum potential recovery rate (~95% MSW + >70% C&D)

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Upstream options

- Producer responsibility
- Supply chain management (e.g., WalMart)
- Carbon footprinting, labeling
- Low-carbon purchasing
- "Sustainable consumption"
- Carbon tax and/or cap-and-trade
- Is local better?

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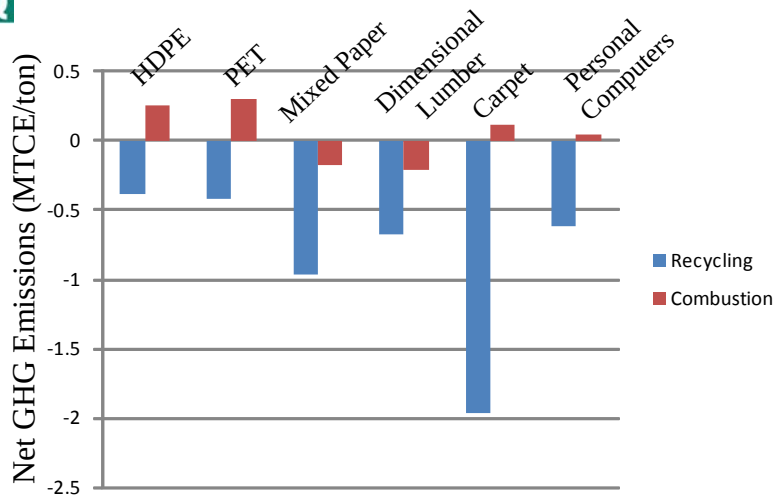
Conserving Energy (Recycling) vs. Recovering Energy (Mass Burn)



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A Few Landfill Issues

- Energy recovery benefits are of secondary importance to methane destruction
- Carbon storage is a topic of significant debate
  - Direct emissions vs. lifecycle emissions
  - Inventories vs. alternatives analysis
- Timing of emissions are highly variable

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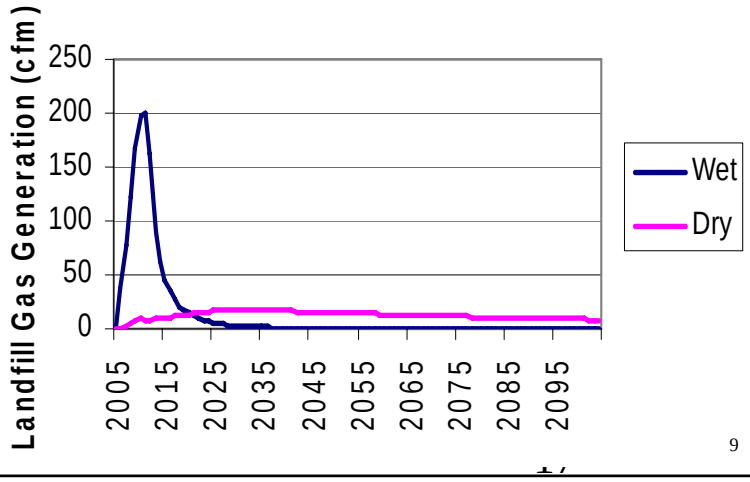
Sample Landfill Gas Generation Curves (Mixed Waste)



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