

Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices

<http://www.epa.gov/oswer/ocpa/>

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Purpose of the EPA's Paper

Explain the systems and
life cycle paradigm

Estimate percent of US
greenhouse gas (GHG)
emissions related to
materials management and
land management.

Estimate the technical
potential of GHG reductions
through materials and land
management activities.

**Improve understanding of the relationship
between materials and land management and
greenhouse gas emissions**

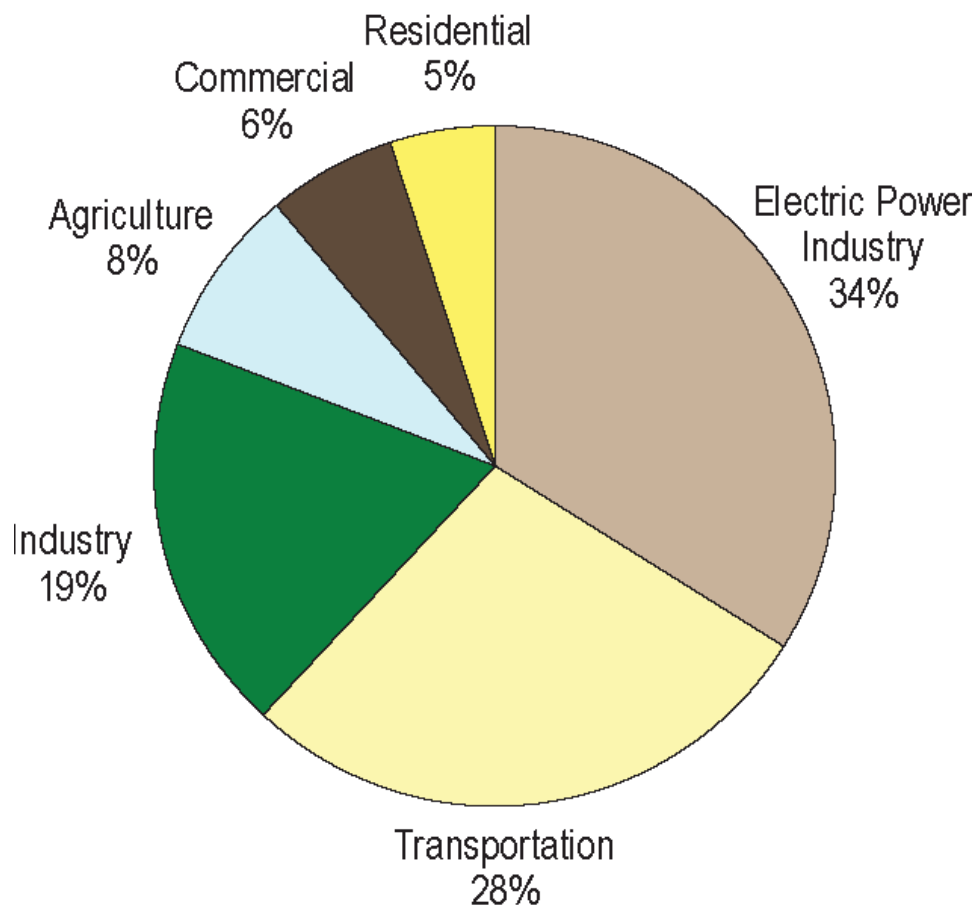
Make materials and land management part of the
response to climate change.

Audiences

- **OSWER:** to help understand the value of our programs, to identify opportunities for improvements, to guide future analysis and policy.
- **EPA:** to make the case for including OSWER in climate change activities and considering the climate benefits of OSWER programs
- **Climate policymakers:** to include materials management and land management in federal, state, and local responses to climate change.
- **Waste managers and policymakers:** to consider and promote the GHG benefits of materials management
- **Land use policymakers:** to consider and promote the GHG benefits of land reuse.

Summary of Findings

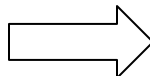
U.S. GHG Emissions (2006): Economic Sectors View



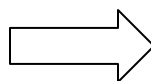
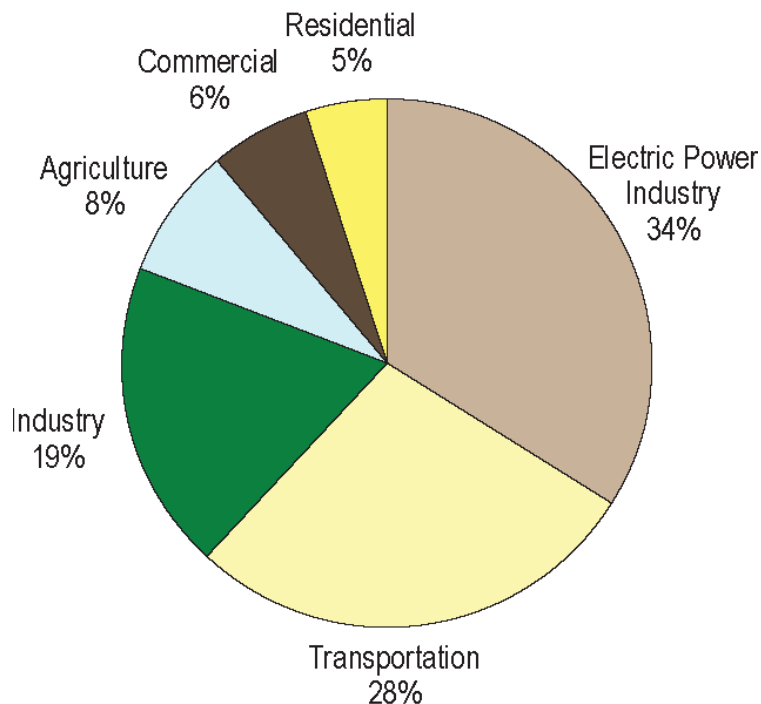
Source: *U.S. Inventory of GHG Emissions and Sinks: 1990-2006*. U.S. EPA, 2008. Excludes U.S. territories.

U.S. GHG Emissions (2006): Economic Sectors View

This view shows the point where GHGs are emitted.

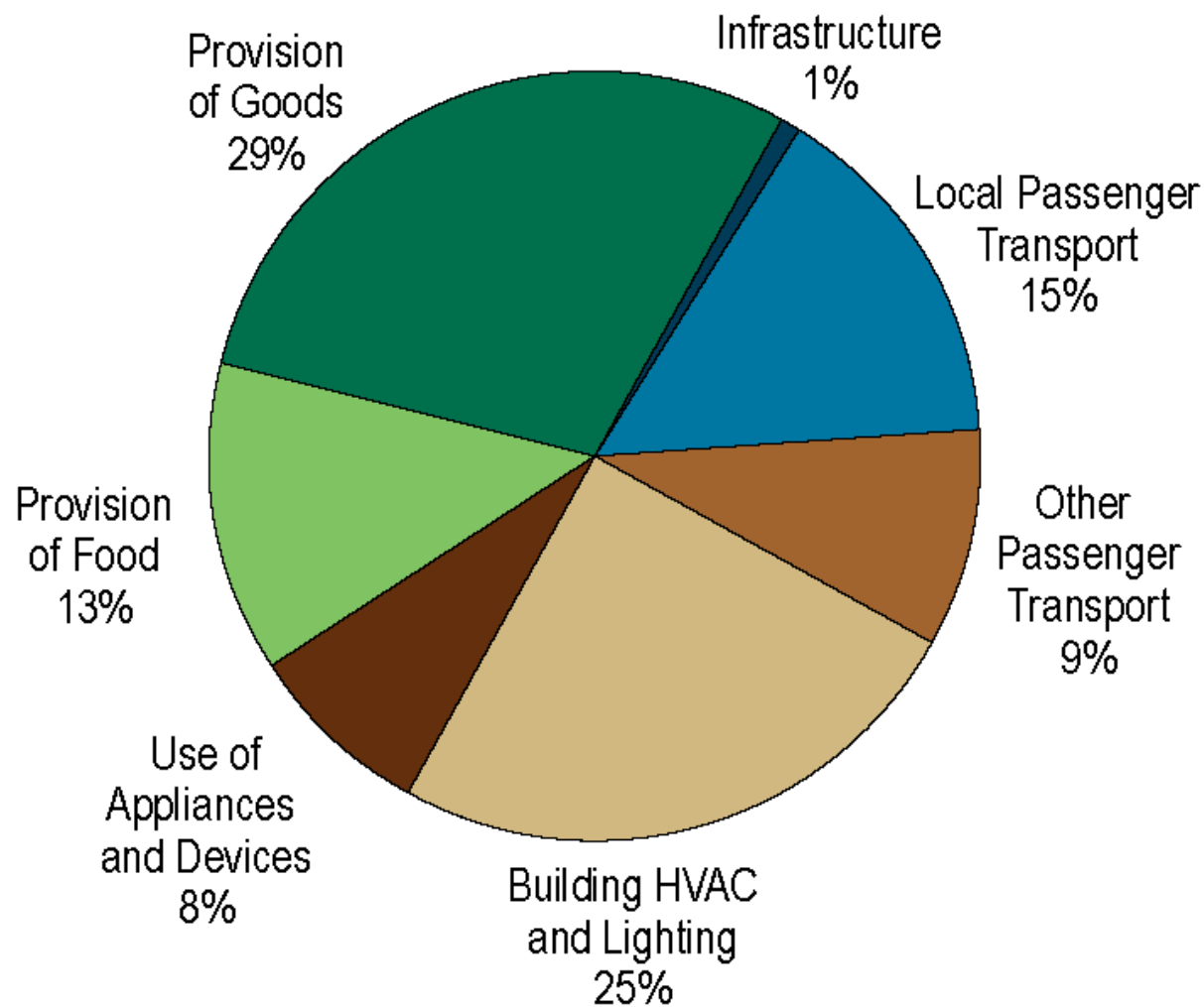


Helpful for framing end-of-pipe and technology substitutions.



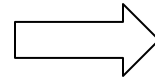
Indicates that by controlling emissions from transportation and electric power, the majority of emissions are addressed.

U.S. GHG Emissions (2006): Systems View

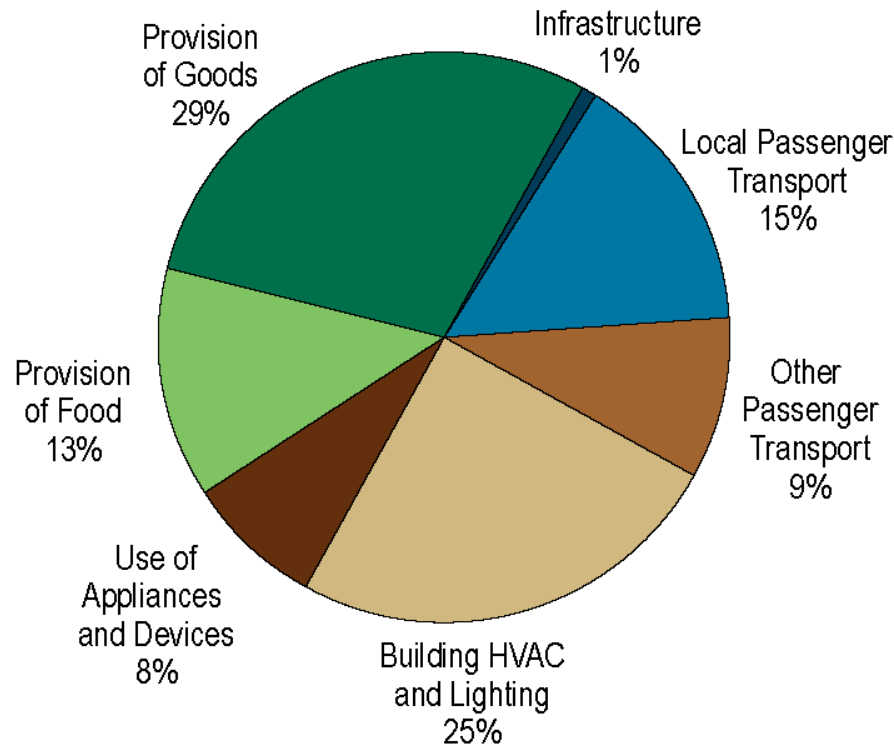


U.S. GHG Emissions (2006): Systems View

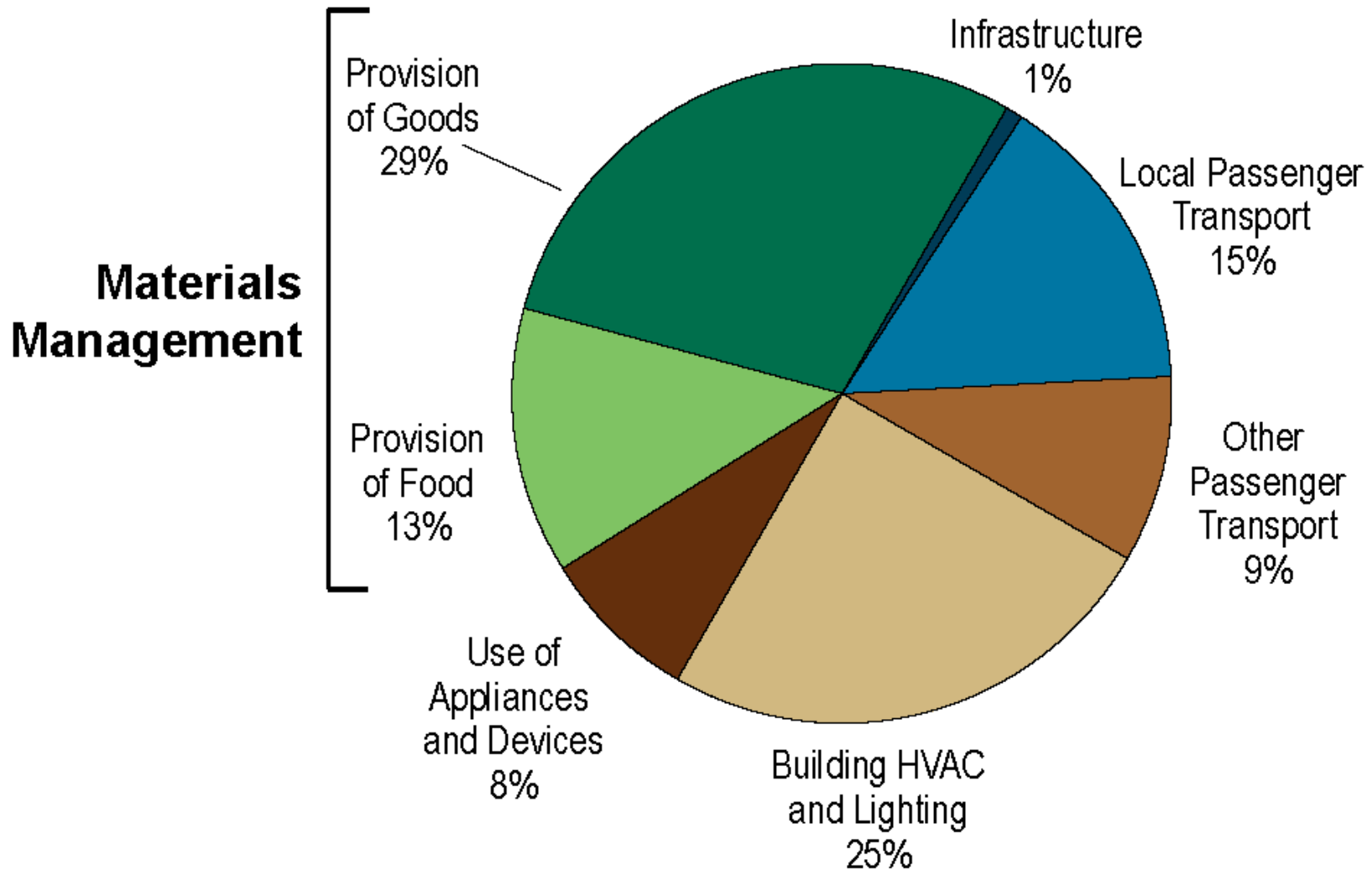
This view organizes emissions by systems, where we define a “system” as all the parts of the economy working to fulfill a particular need.



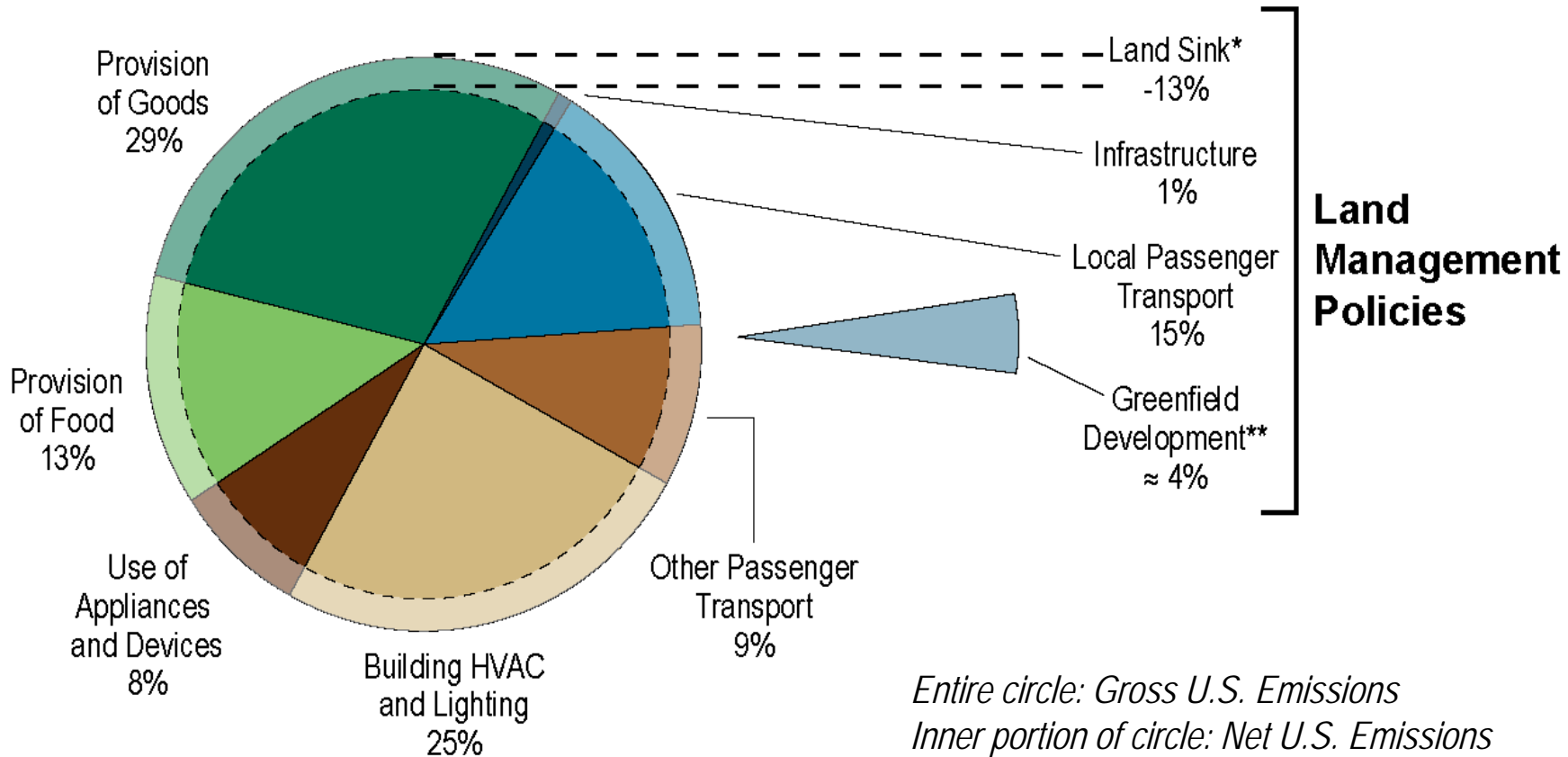
Helpful for framing prevention-oriented mitigation strategies that reduce emissions system-wide.



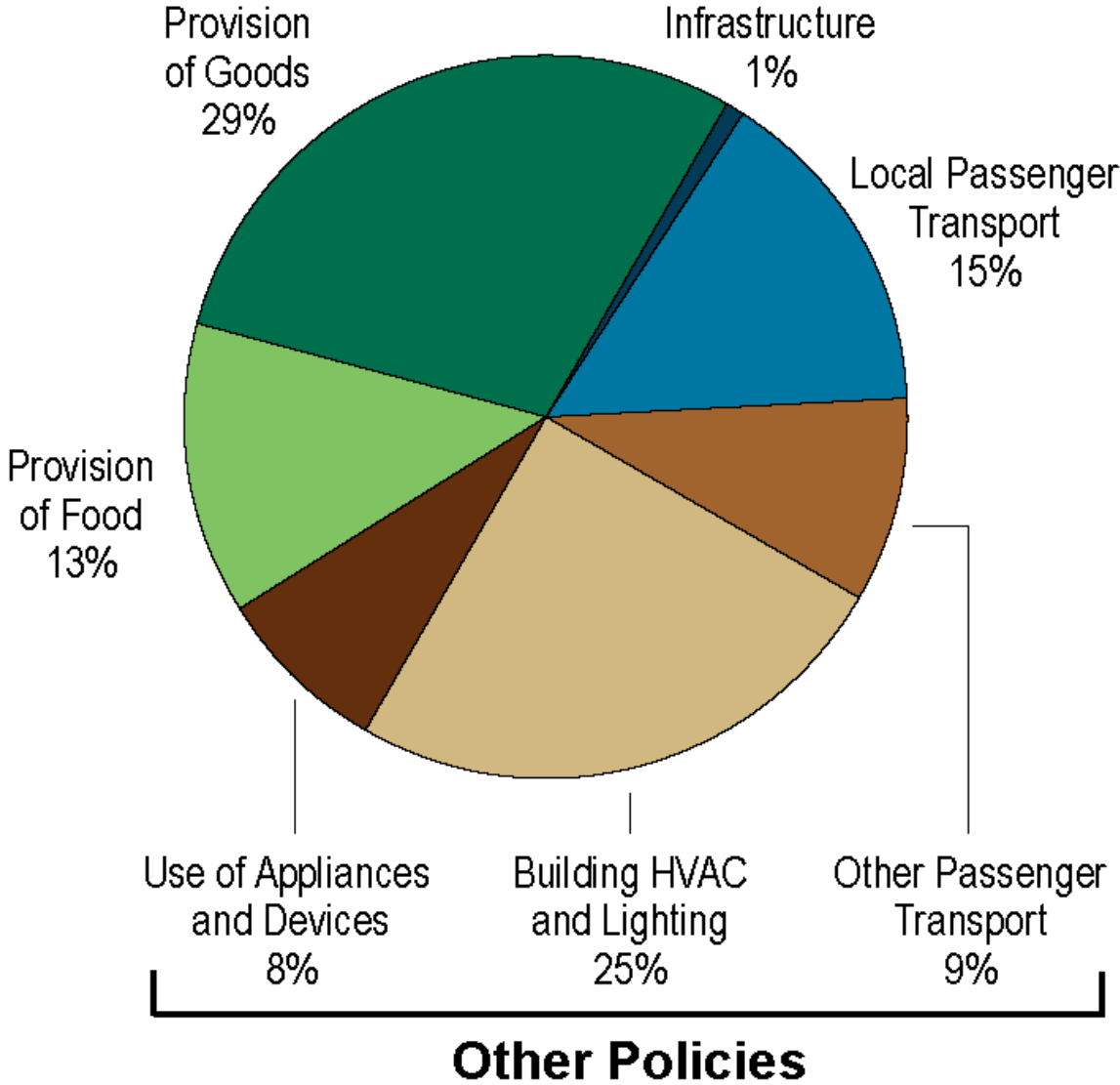
U.S. GHG Emissions (2006): Systems View



U.S. GHG Emissions (2006): Systems View



U.S. GHG Emissions (2006): Systems View



Technical potential of mitigation strategies

Total technical potential:

- is an estimate of the GHG emission reductions possible from a given strategy
- sets aside economic, institutional, or technological limitations

The numbers are meant to show:

- the scale of potential benefits from various strategies
- areas of promise for programs and future analysis

Technical Potential Reductions from Materials Management

Source Reduction		Estimated GHG Emission Benefit*	
Reduce packaging use by:	50%	40—105	MMTCO ₂ E/yr
	25%	20—50	MMTCO ₂ E/yr
Reduce use of non-packaging paper products by:	50%	20—70	MMTCO ₂ E/yr
	25%	10—35	MMTCO ₂ E/yr
Extend the life of personal computers by:	50%	25	MMTCO ₂ E/yr
	25%	15	MMTCO ₂ E/yr
Reuse/Recycling			
Increase recycling of construction and demolition debris to:	100%	150	MMTCO ₂ E/yr
	50%	75	MMTCO ₂ E/yr
	25%	40	MMTCO ₂ E/yr
Increase national MSW recycling and composting rate from 2006 rate (32.5%) to:	100%	300	MMTCO ₂ E/yr
	50%	70—80	MMTCO ₂ E/yr
Increase composting of food scraps from 2006 rate (2%) to:	100%	20	MMTCO ₂ E/yr
	50%	10	MMTCO ₂ E/yr
	25%	5	MMTCO ₂ E/yr

Technical Potential Reductions from Materials Management (cont'd)

Energy Recovery / Disposal		Estimated GHG Emission Benefit	
Combust percentage of currently landfilled MSW:	100%	70—120	MMTCO ₂ E/yr
	50%	35—60	MMTCO ₂ E/yr
	25%	20—30	MMTCO ₂ E/yr
Combust MSW remaining if national recycling rate is increased to 50%:		65—110	MMTCO ₂ E/yr
Capture percentage of currently emitted methane at U.S. landfills for electricity generation:	100%	150	MMTCO ₂ E/yr
	50%	70	MMTCO ₂ E/yr
	25%	35	MMTCO ₂ E/yr

Technical Potential Reductions from Land Management

Land Revitalization [1]		Estimated GHG Emission Benefit	
Shift 60% of expected new development to compact development patterns:		79	MMTCO ₂ E/yr
Reuse percentage of qualifying EPA-tracked contaminated land for utility-scale solar:	100%	2,200	MMTCO ₂ E/yr
	50%	1,100	MMTCO ₂ E/yr
	25%	540	MMTCO ₂ E/yr
Reuse percentage of qualifying EPA-tracked contaminated land for community and utility-scale wind:	100%	40	MMTCO ₂ E/yr
	50%	20	MMTCO ₂ E/yr
	25%	10	MMTCO ₂ E/yr
Reduce electricity use for the most energy-intensive treatment technologies at National Priorities List sites by:	100%	0.4	MMTCO ₂ E/yr
	50%	0.2	MMTCO ₂ E/yr
	25%	0.1	MMTCO ₂ E/yr
Reforest percentage of qualifying former mine lands for carbon sequestration: [5]	100%	4	MMTCO ₂ E/yr
	50%	2	MMTCO ₂ E/yr
	25%	1	MMTCO ₂ E/yr

Key messages

- 42% of US greenhouse gas emissions are associated with materials management.
- 16-20% of US greenhouse gas emissions are influenced by land management.
- Land management impacts the existing U.S. land sink, which offsets the equivalent of 13% of U.S. emissions.
- Recycling and source reduction of waste represent opportunities to reduce GHG emissions by avoiding the impacts of extracting, processing, and disposing of new materials.
- Many materials and land management strategies have significant mitigation potential.
- Land reuse is consistent with Smart Growth principles, which can provide significant reductions in local passenger transportation emissions.
- Materials and land management should be included in the response to climate change.

Looking Forward

- ✓ Identify the portion of GHG emissions attributable to various systems.
 - ✓ Estimate technical potential reductions available from changes to those systems.
 - ➔ Estimate the average cost per ton of CO₂ reduced for those options.
 - ➔ Assess specific policy measures to achieve the reductions.

Major Data Sources

- The U.S. Inventory of Greenhouse Gas Emissions and Sinks: 1990-2006. (EPA, 2008)
- WARM model (EPA, 2008)
- Quantifying Greenhouse Gas Emissions from Key Industrial Sectors in the United States (EPA, 2008).
- Residential, Commercial Buildings, and Manufacturing Energy Consumption Surveys. (Energy Information Agency, 2005/2008/2005)
- National Household Transportation Survey (Bureau of Transportation Statistics, 2003)
- Economic Input-Output Life Cycle Assessment (EIO-LCA) model, 1997 base year (Carnegie Mellon / Green Design Institute).

Review process

- OSWER-wide review through Climate Change Coordinating Committee (C4), extensive comments incorporated.
- Agency-wide review through Climate Manager's Workgroup. Comments from many offices incorporated, including:
 - Office of Transportation and Air Quality (OAR)
 - Climate Change Division (OAR)
 - Climate Protection Partnerships Division (OAR)
 - ORD
 - National Center for Environmental Economics (OPEI)
- Review by 5 state representatives through ASTSWMO
- External peer review with 5 reviewers, including experts in:
 - Soil science
 - Climate policy
 - Life Cycle Assessment