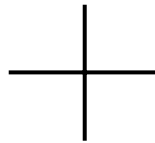


Materials Management and Greenhouse Gas Emissions

California Resources Recovery Association
2008 Annual Conference
August 5th, 2008

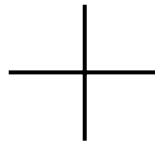
Joshuah K. Stolaroff
AAAS Science and Technology Policy Fellow
Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency

Materials management and land management
have influence over a large share of greenhouse
gas (GHG) emissions

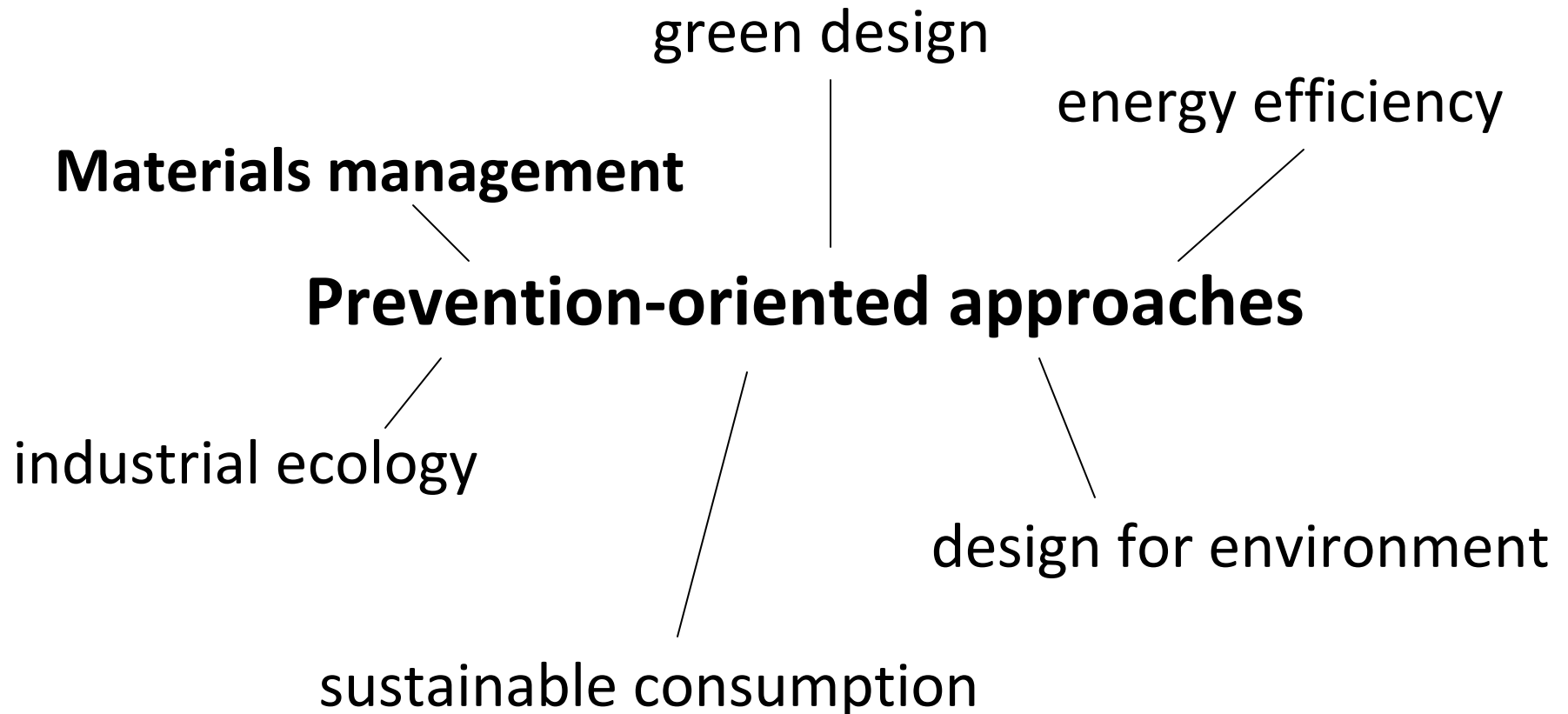


Materials and land management
approaches can make significant
GHG reductions.

Materials management and land management
have influence over a large share of greenhouse
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Materials and land management
approaches can make significant
GHG reductions.



... tend reduce emissions at low cost and with environmental co-benefits (compared end-of-pipe controls)

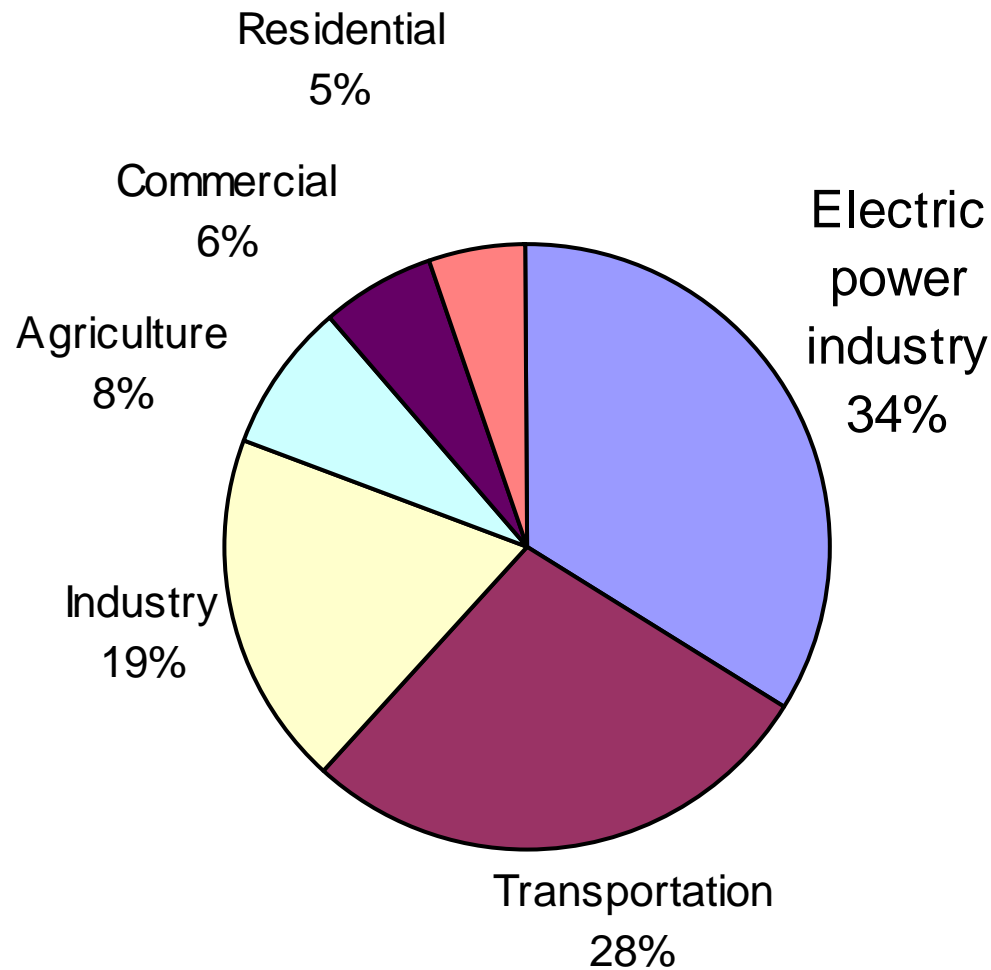
Prevention-oriented approaches

Systems thinking

Life cycle analysis

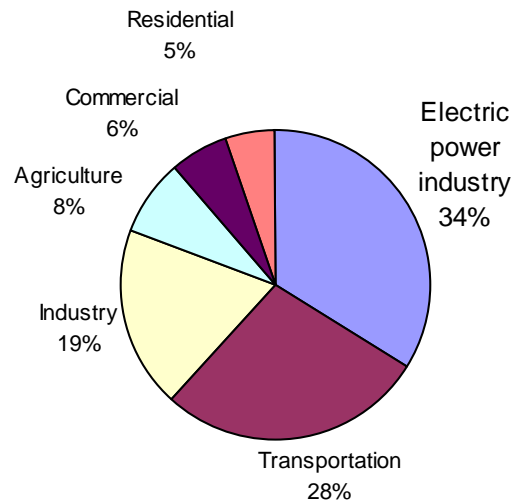
Consumption-based accounting

US GHG Emissions 2005: Sectors View



Source: EPA (2007). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005*.

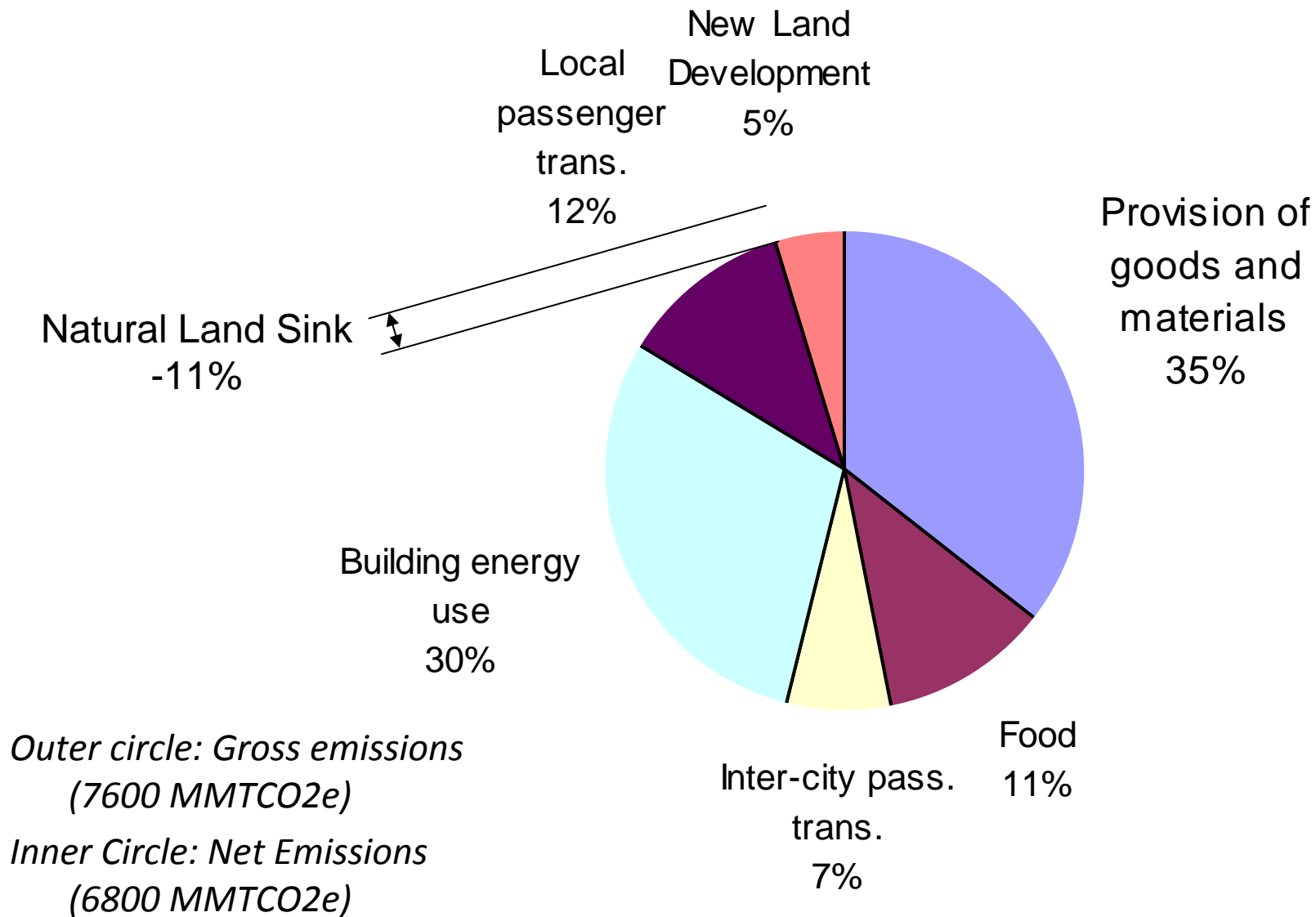
US GHG Emissions 2005: Sectors View



This view:

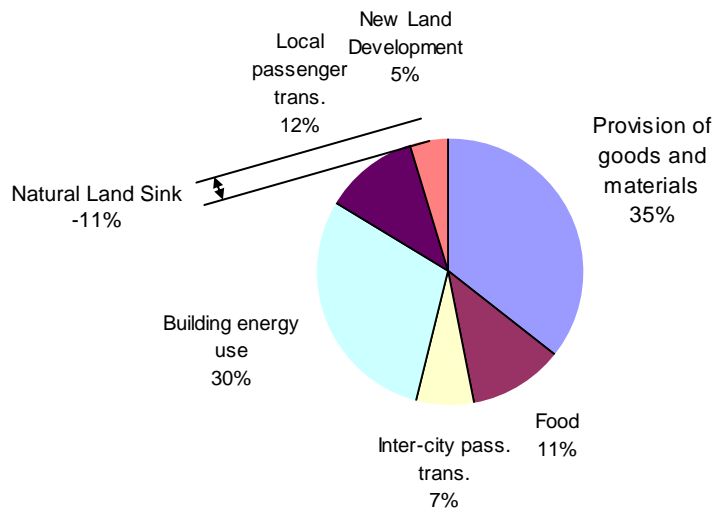
- shows share of emissions by point of emission
- is useful for targeting **end-of-pipe solutions** (e.g. carbon capture at power plants) and **technology substitution** (e.g. hybrid-electric vehicles)

US GHG Emissions 2005: Systems View



Source: Draft analysis by EPA OSWER Center for Program Analysis

US GHG Emissions 2005: Systems View

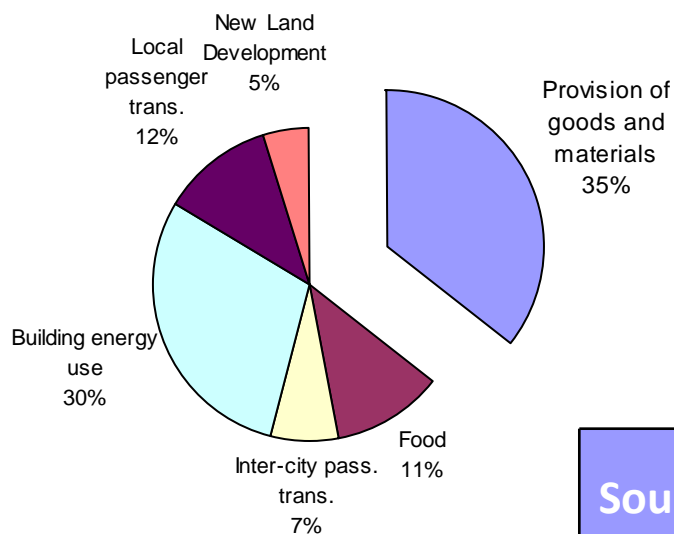


This view is:

- one perspective (among many possible) of emissions by system or **category of use**
- chosen with land and materials management in mind
- useful for targeting **prevention-oriented** mitigation solutions (e.g. materials source reduction and land reuse)

Slice: Provision of Goods and Materials

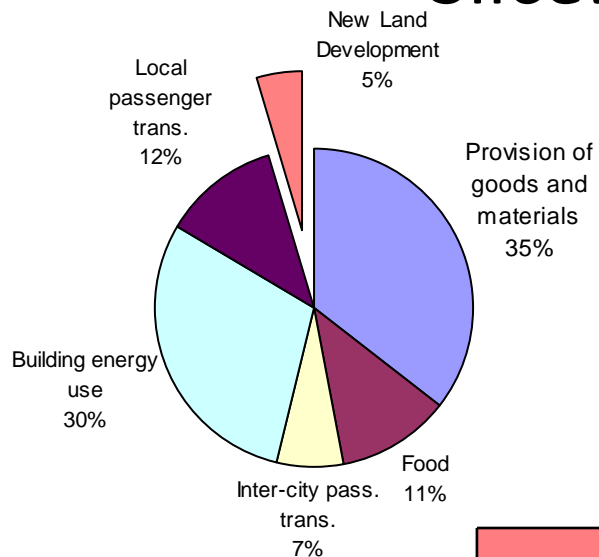
Draft analysis by EPA OSWER Center for Program Analysis



Source	Emissions [MMTCO2E]
Industrial sector fossil fuel combustion	840
Industrial sector electricity use	735
Other industrial emissions	680
Freight	514
Emissions from Waste	187
Total	2,955
Adjustments to correct for emissions counted under other slices	(285)
Revised Total	2,670

Slice: New Land Development

Draft analysis by EPA OSWER Center for Program Analysis



Source	Emissions (MMTCO ₂ E)
Lost Soil Carbon	202
Lost Biomass Carbon	81
Lost DOM Carbon	31
Highway, Street, Bridge, and Tunnel Construction	31
Water, Sewer, and Pipeline Construction	9
Total Annual Emissions Resulting from New Land Development	354

Example materials management activities

Activity	Technical Potential Reduction [MMTCO2e/yr]
Source reduce 25% of cans, glass, plastic, and consumer paper	31 – 110
Reduce packaging use by 50%	147
Extend the life of personal computers by 50%	51
Recycle all construction materials	160
Increase national MSW recycling rate to 50%	36
Capture and recover all methane at U.S. landfills	130
Compost all food scraps	21

EPA-tracked Contaminated Land in the US

Category	Area [acres]
Federally-listed brownfields	37,000
Non-Federal CERCLIS Proxy Sites	2,200,000
Federal CERCLIS Proxy Sites	2,500,000
Non-Federal RCRA Sites	1,000,000
Federal RCRA Sites	11,000,000
Total Acreage of Contaminated Sites	17,000,000

Acreage Considered Urban/Remote

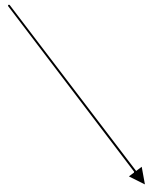
Urbanized Area	2,800,000	17%
Urban Cluster	340,000	2%
Remote	13,600,000	81%

Example land revitalization activities

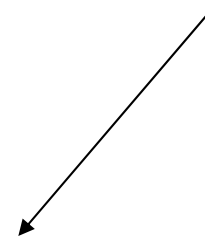
Activity	Technical Potential Reduction [MMTCO₂e/yr]
Revegetate 3.2 million acres of former mine lands	81
Develop all solar class 6 and 7 contaminated land as utility-scale solar	888
Develop 0.5 million acres of contaminated land as utility-scale wind	31
Optimize the top five NPL treatment technologies	4.6

Extending the framework

Systems-oriented accounting can help target **prevention-oriented** mitigation options.

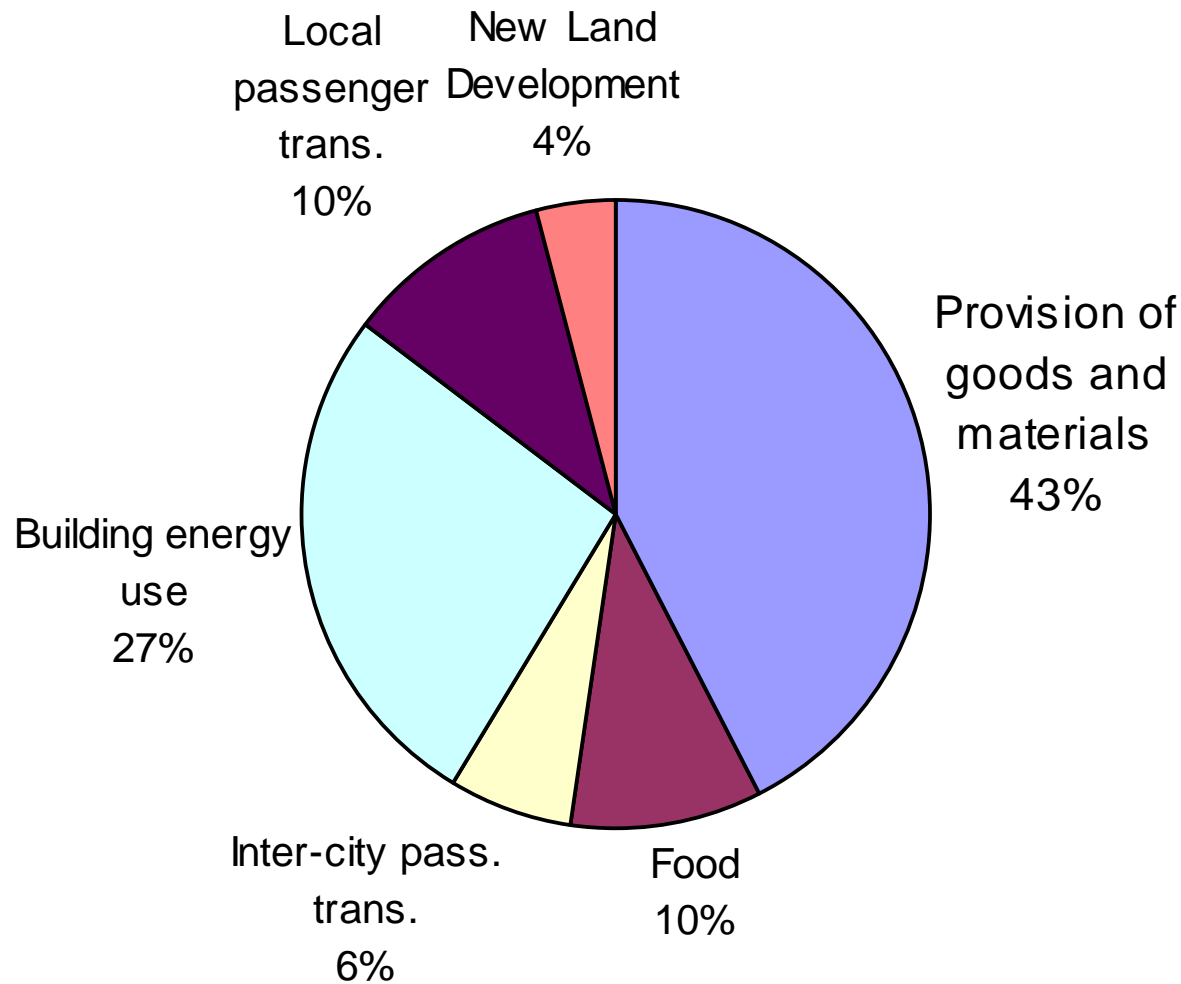


Technical potential calculations can identify **biggest opportunities** for impact.



The analysis can be done at **many levels** (local, state, individual) and for **many types** of systems.

Example: extending scope to international emissions

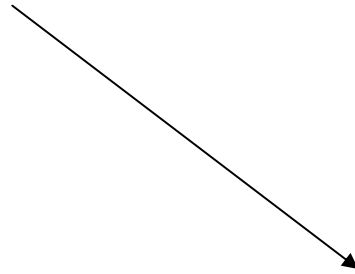


- Food emissions decrease slightly
- Goods and materials increase by 1/3
- Overall emissions increase by ~12% (4-18%)

Sources: Weber and Matthews (2007). *Environ. Sci. Technol.*, 2007, 41, 4875-4881

Draft analysis by EPA OSWER Center for Program Analysis

Systems thinking puts more emissions and more mitigation opportunities on the table.



Materials and land management opportunities are best understood within a systems framework.