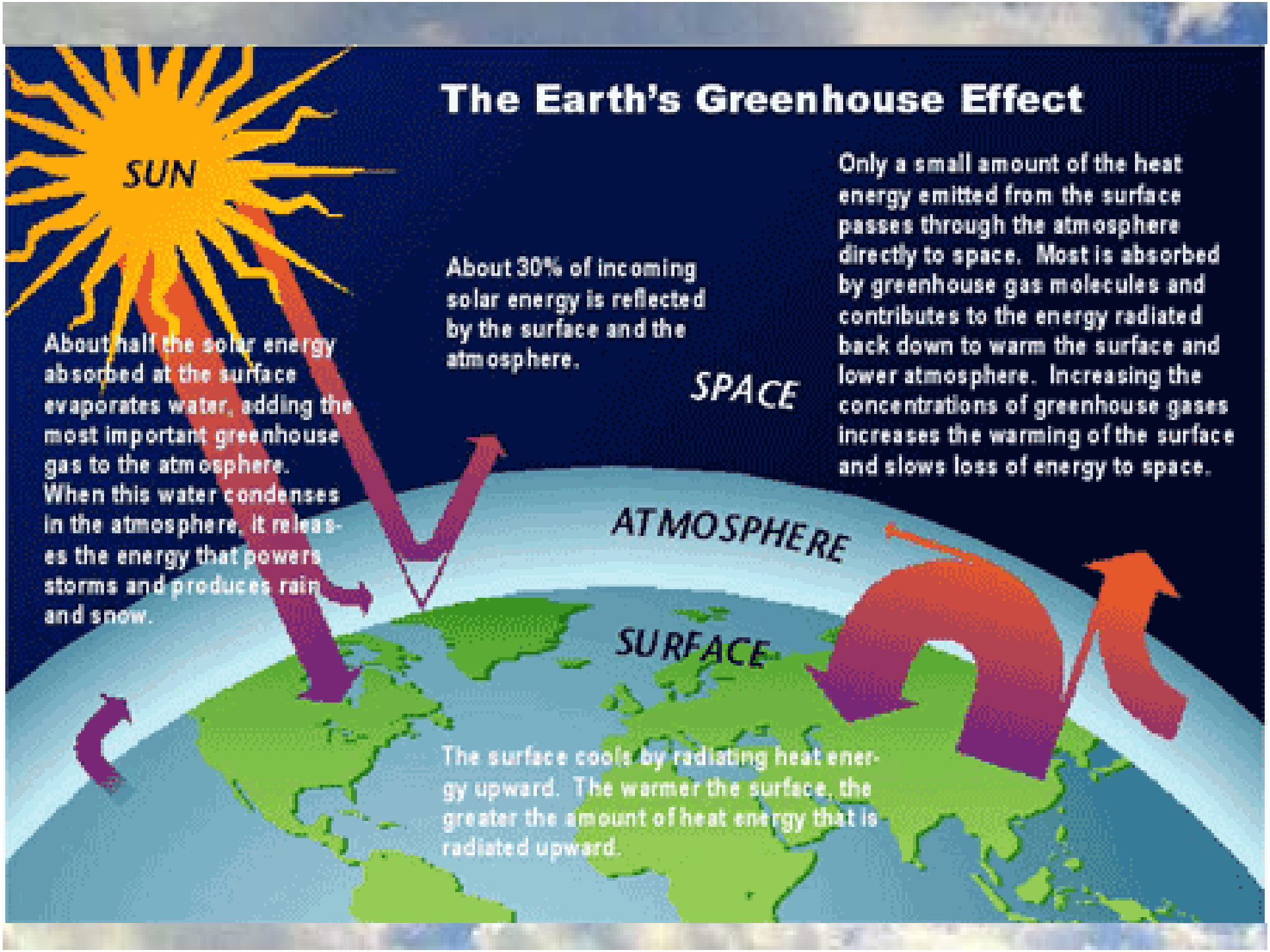
Master Recycler Class #20

Solid Waste Hierarchy and Climate Change: Why are the 3 R's in that order?

Thursday, September 17, 2009

So, what am I here to talk about?

... and how it relates to climate change.

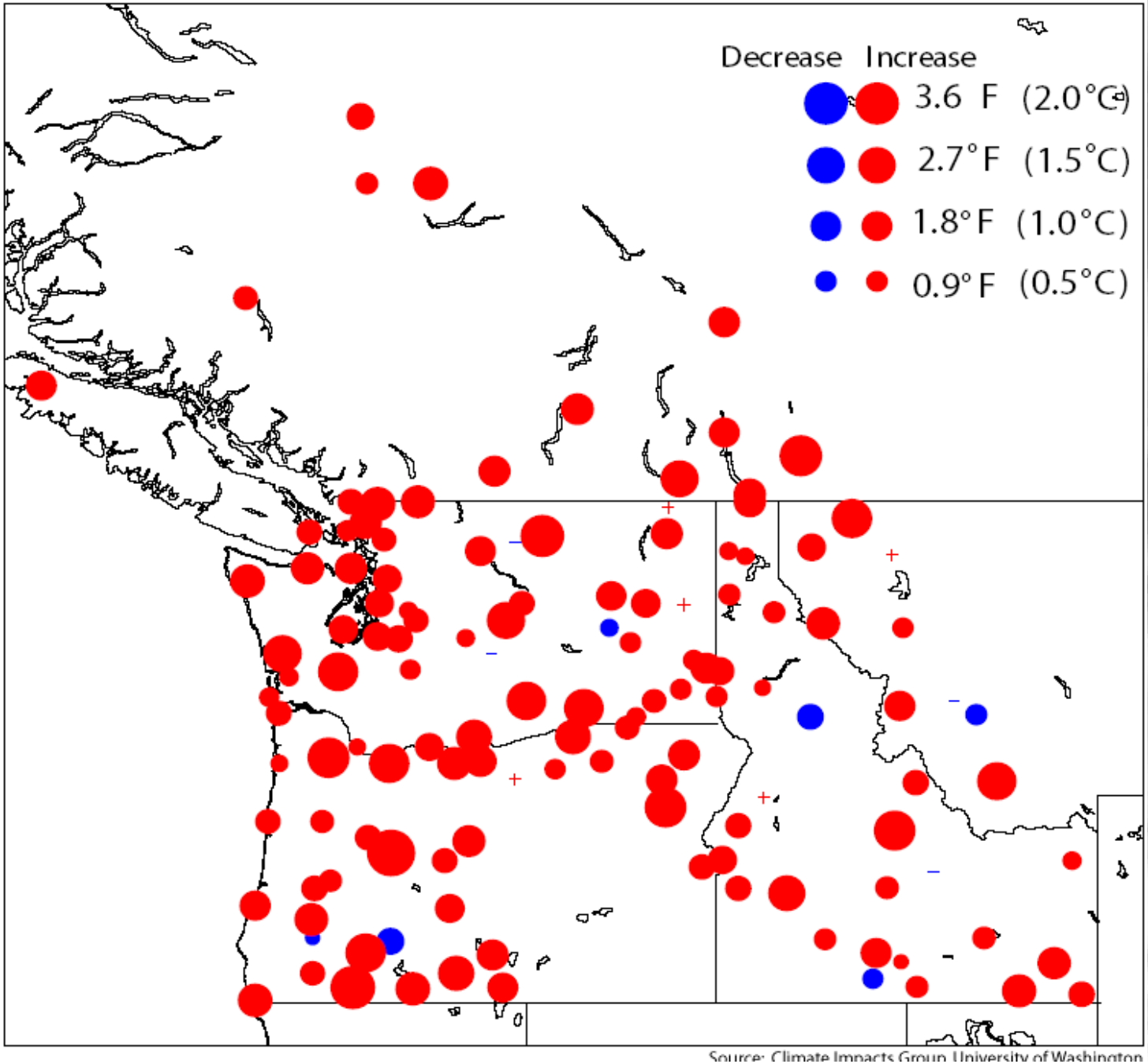

The Earth's Greenhouse Effect
SUN
About 30% of incoming solar energy is reflected by the surface and the atmosphere.
SPACE
Only a small amount of the heat energy emitted from the surface passes through the atmosphere directly to space. Most is absorbed by greenhouse gas molecules and contributes to the energy radiated back down to warm the surface and lower atmosphere. Increasing the concentrations of greenhouse gases increases the warming of the surface and slows loss of energy to space.
About half the solar energy absorbed at the surface evaporates water, adding the most important greenhouse gas to the atmosphere. When this water condenses in the atmosphere, it releases the energy that powers storms and produces rain and snow.
ATMOSPHERE
SURFACE
The surface cools by radiating heat energy upward. The warmer the surface, the greater the amount of heat energy that is radiated upward.

"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."

"Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations."

- Intergovernmental Panel on Climate Change (IPCC) 2007, 4th Assessment Report (AR4)

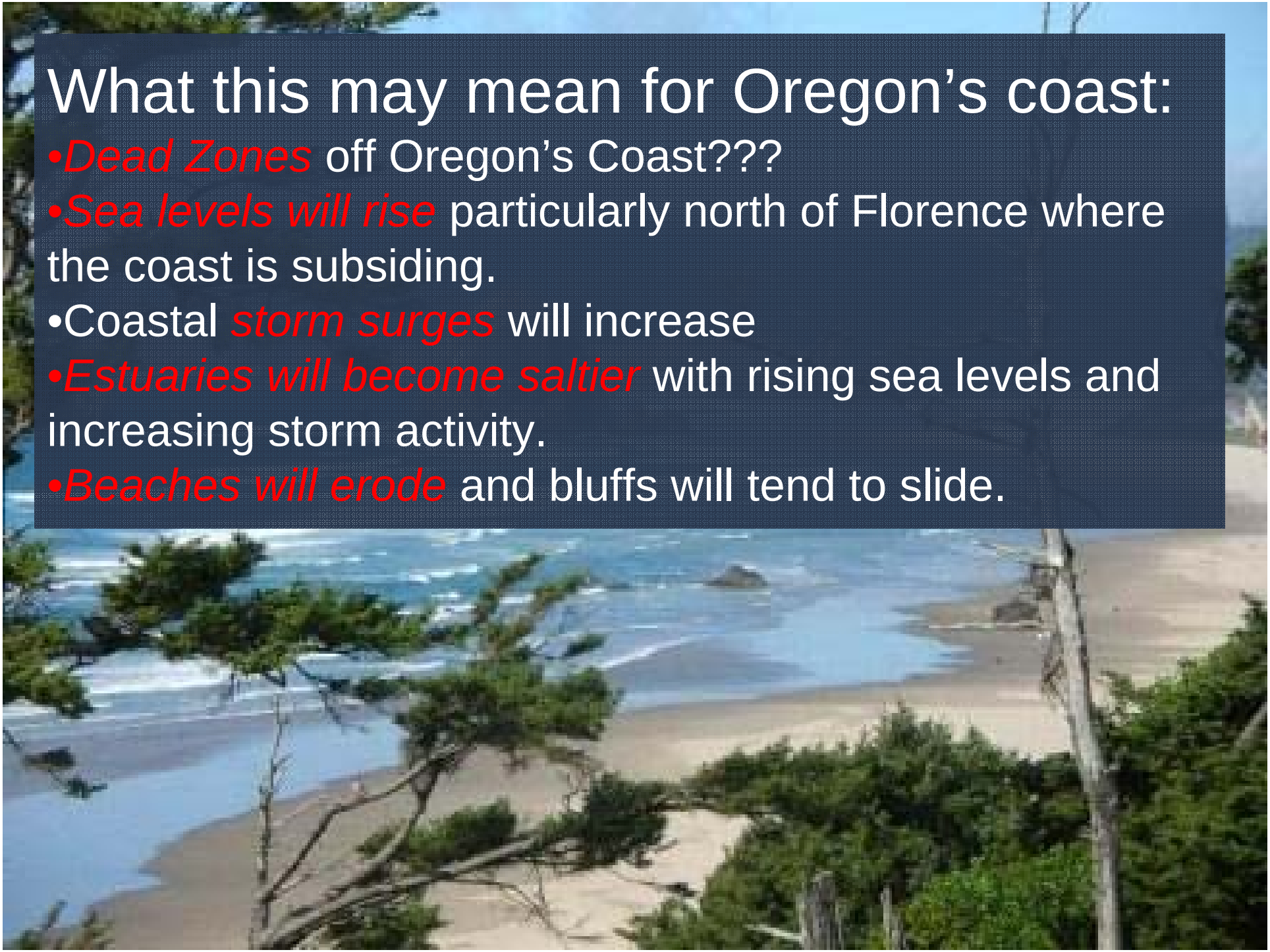
(a) Temperature trends (1920-2000)



Source:

Climate Impacts Group

University of Washington



What this may mean for Oregon's coast:

- *Dead Zones* off Oregon's Coast???
- *Sea levels will rise* particularly north of Florence where the coast is subsiding.
- Coastal *storm surges* will increase
- *Estuaries will become saltier* with rising sea levels and increasing storm activity.
- *Beaches will erode* and bluffs will tend to slide.

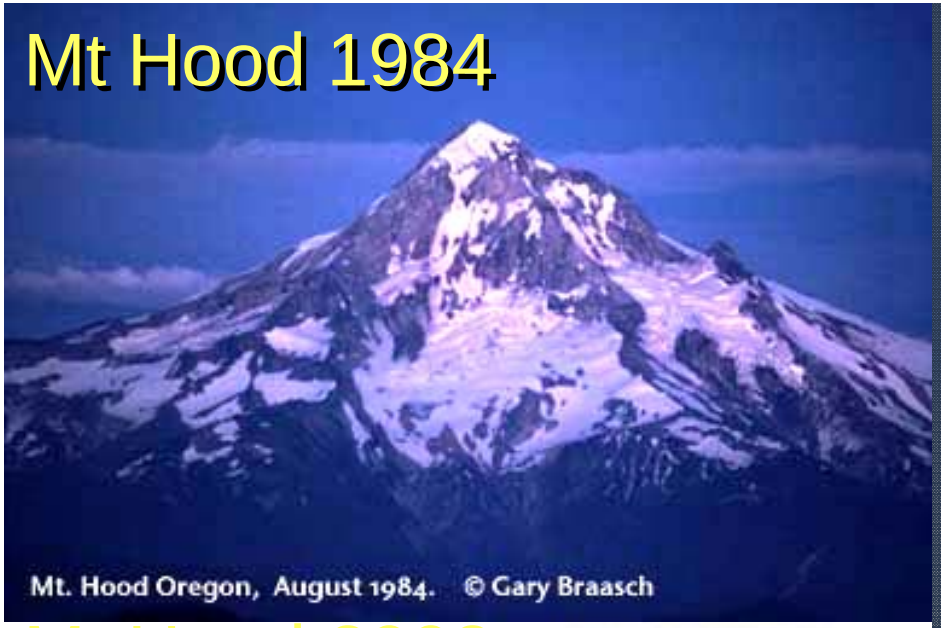
What this may mean for Oregon's forests:

- *Wildfires* projected to increase dramatically by 2040's
- Greater CO2 fertilization leads to *increased biomass/fuel levels*
- *Decreased soil moisture* w/ increased evaporative demand
- *Loss of property and life* will increase for people living in forested areas.
- Mountain pine beetle infestations will increase with warmer temperatures. Increased *insect infestation* leads to tree deaths which increases fuel levels in forests
- Ponderosa pine and Douglas-fir *tree compositions will shift* as their productivity declines with warmer temperatures

What this may mean for Oregon's rivers:

- *Water temperatures will increase* (> 70° F is harmful to salmon), affecting migrating adults and juvenile rearing statewide.
- Increased fall and winter *flooding* in western Oregon will likely reduce egg-to-fry and winter survival rates.
- Fall and winter *storm intensity* and stream flooding will increase on the west side of the Cascades.
- Decreasing summer and early fall *stream flows* and *diminished municipal water, irrigation, and hydroelectric power* supply in many areas. These demands may further compete with set-asides for endangered fish and wildlife.
- Heating demands will decrease, but *electric power demands will increase* more dramatically for cooling.
- *Increased precipitation* on average will concentrate primarily in winter months and will not be distributed evenly across state.
- The *concentration of pollutants* in the water could increase during summer and fall.

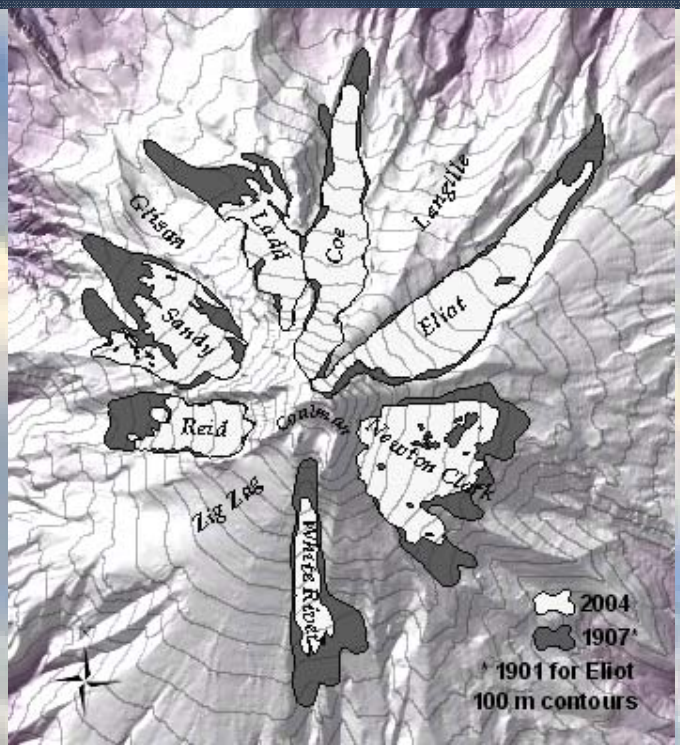
Mt Hood 1984



Mt Hood 2002

What this may mean in Oregon's mountains:

- *Melting glaciers* on Mt. Hood
- Snow pack will decrease (~30% - 50% loss by mid-century), causing earlier spring runoff and *summer drought*.



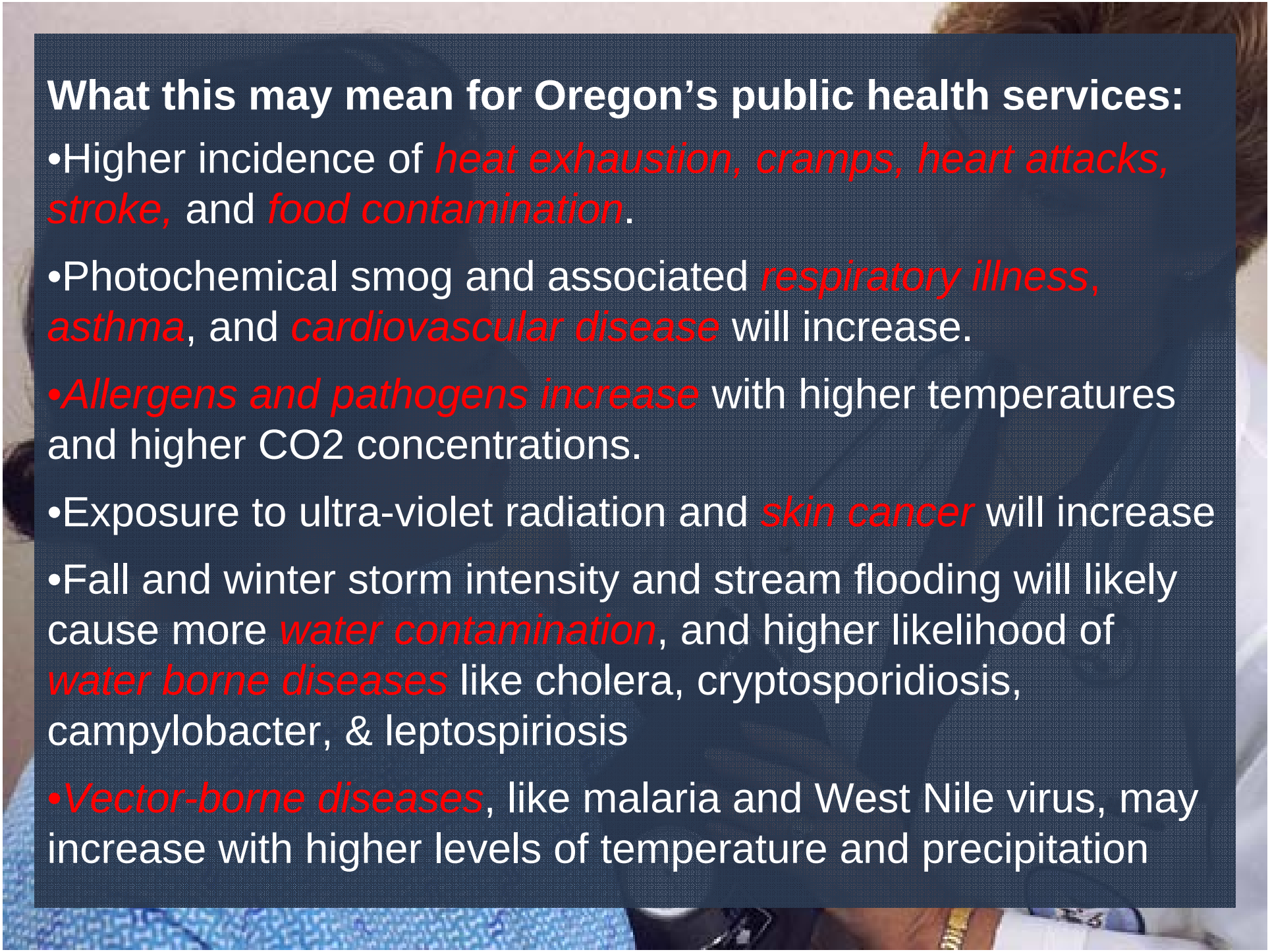
What this may mean for Oregon's farmers:

•Crop zone changes will increase *agricultural losses* and may threaten food security.

•Drier agricultural *soil conditions* will persist in the summer, especially on east side of the Cascades with increased evaporative demand and reduced precipitation.

•Less water available for *irrigation* would harm agriculture.

•*Weeds* will become more competitive and crops will have to adapt to reduced summer precipitation.



What this may mean for Oregon's public health services:

- Higher incidence of *heat exhaustion, cramps, heart attacks, stroke,* and *food contamination*.
- Photochemical smog and associated *respiratory illness*, *asthma*, and *cardiovascular disease* will increase.
- *Allergens and pathogens increase* with higher temperatures and higher CO2 concentrations.
- Exposure to ultra-violet radiation and *skin cancer* will increase
- Fall and winter storm intensity and stream flooding will likely cause more *water contamination*, and higher likelihood of *water borne diseases* like cholera, cryptosporidiosis, campylobacter, & leptospiriosis
- *Vector-borne diseases*, like malaria and West Nile virus, may increase with higher levels of temperature and precipitation

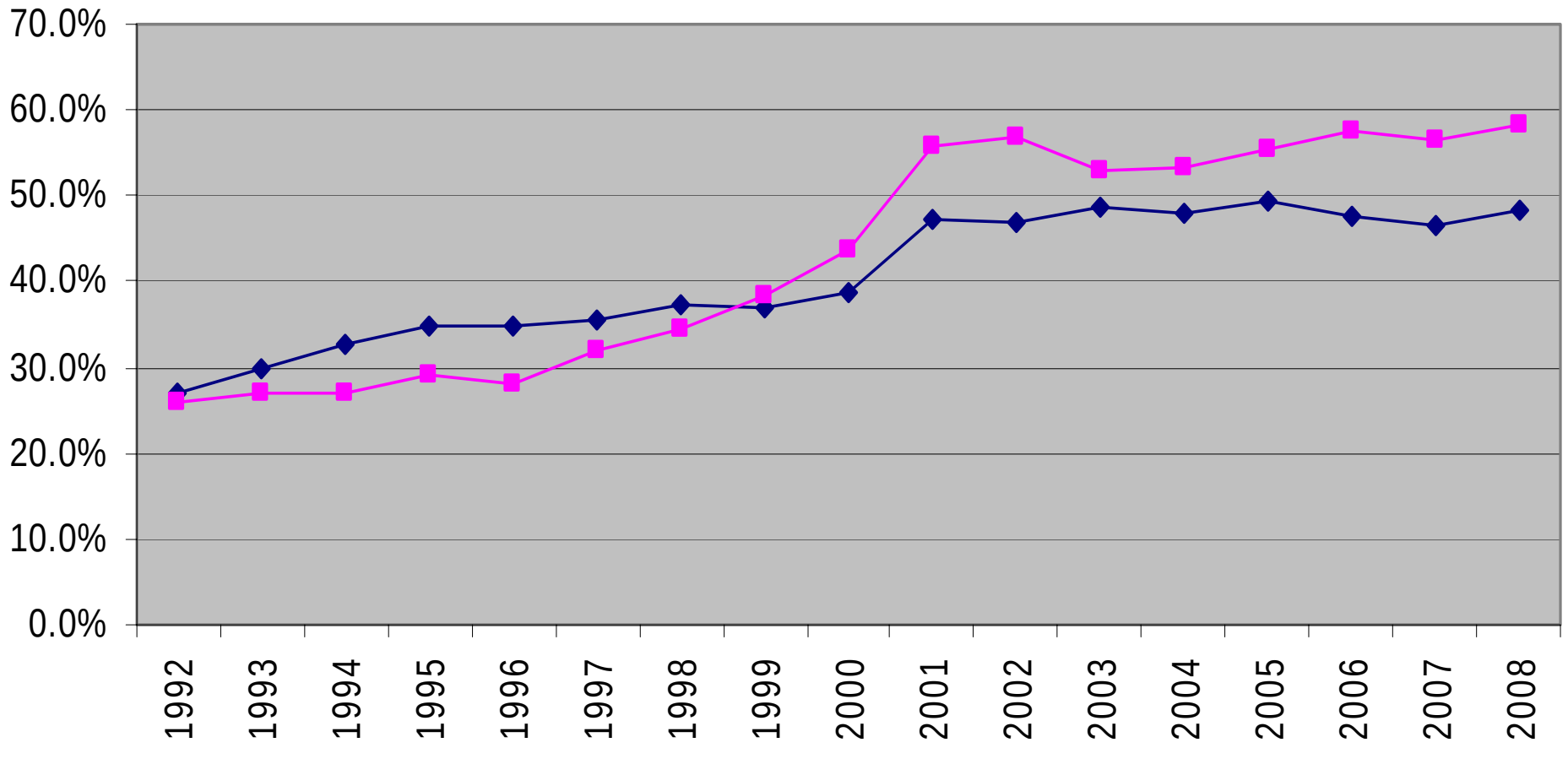

So what does this have to do with garbage & recycling?

Waste Generation Goals

(ORS 459A.010)

- By 2009 achieve a 54% recovery rate

Recovery Rates



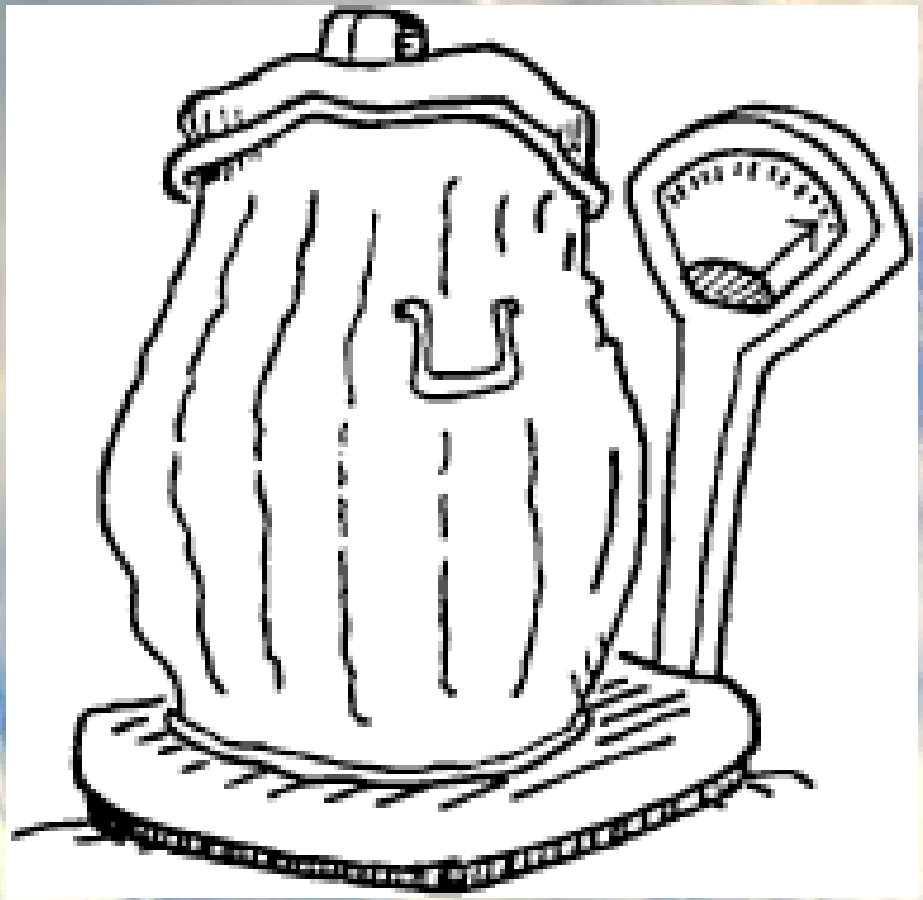
Waste Generation Goals

(ORS 459A.010)

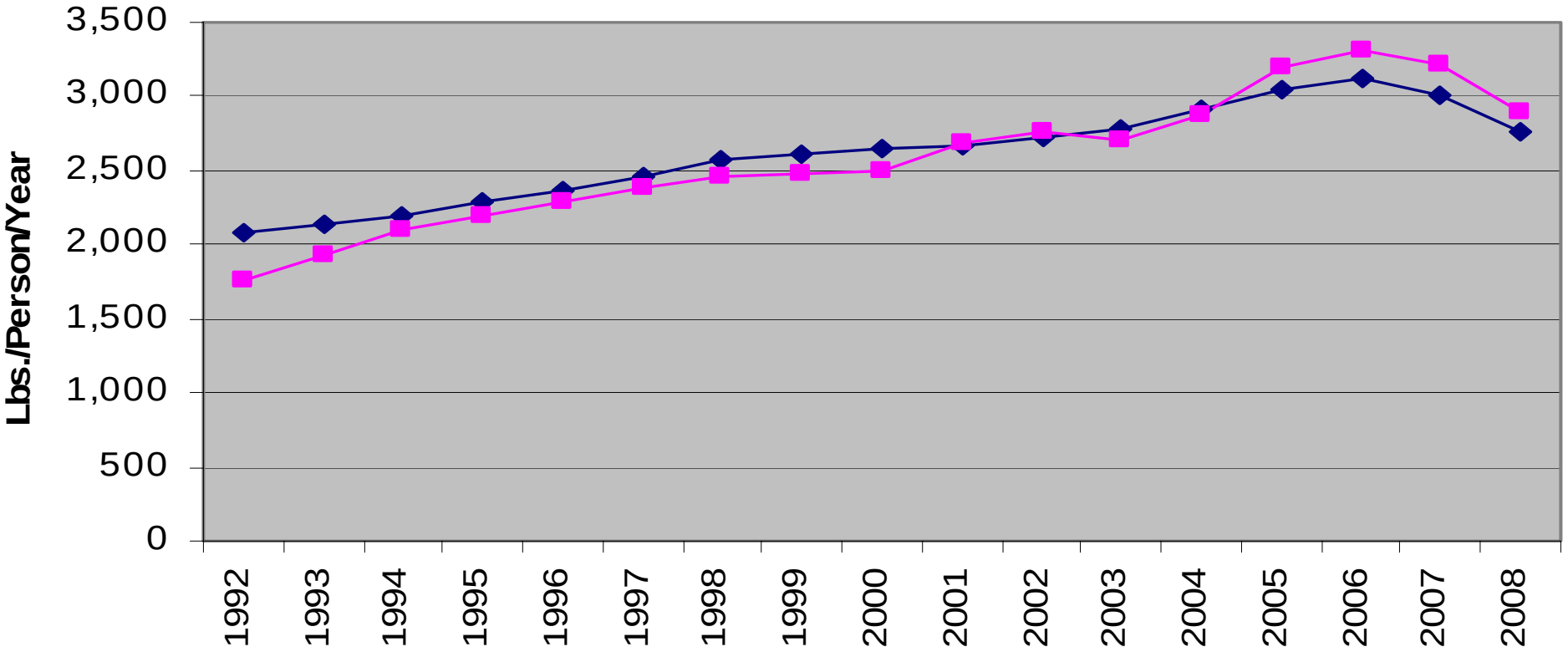
- For 2005 and subsequent years, no annual increase in per capita municipal solid waste generation

- For 2009 and subsequent years, no annual increase in total municipal solid waste generation

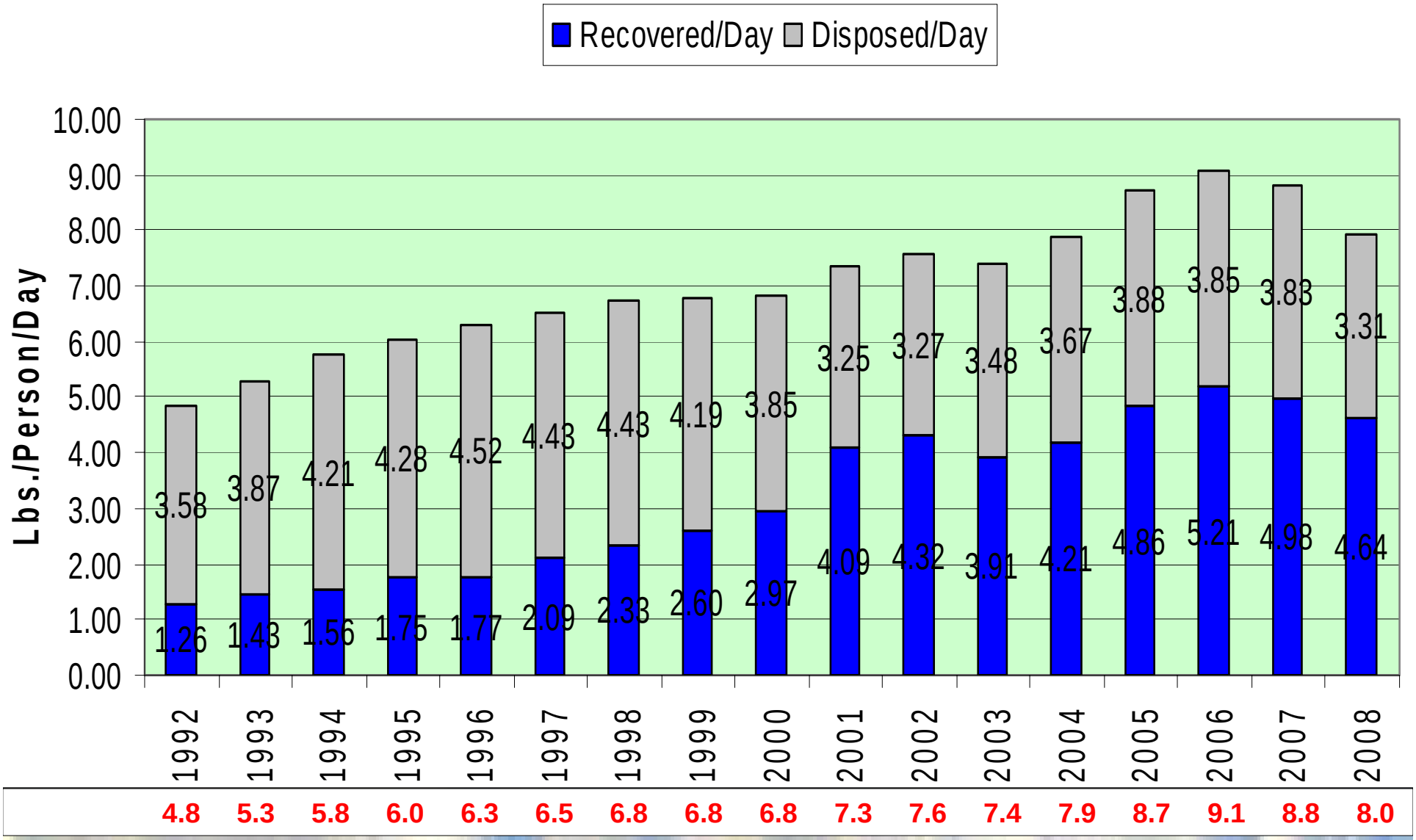
Our Weight Problem:



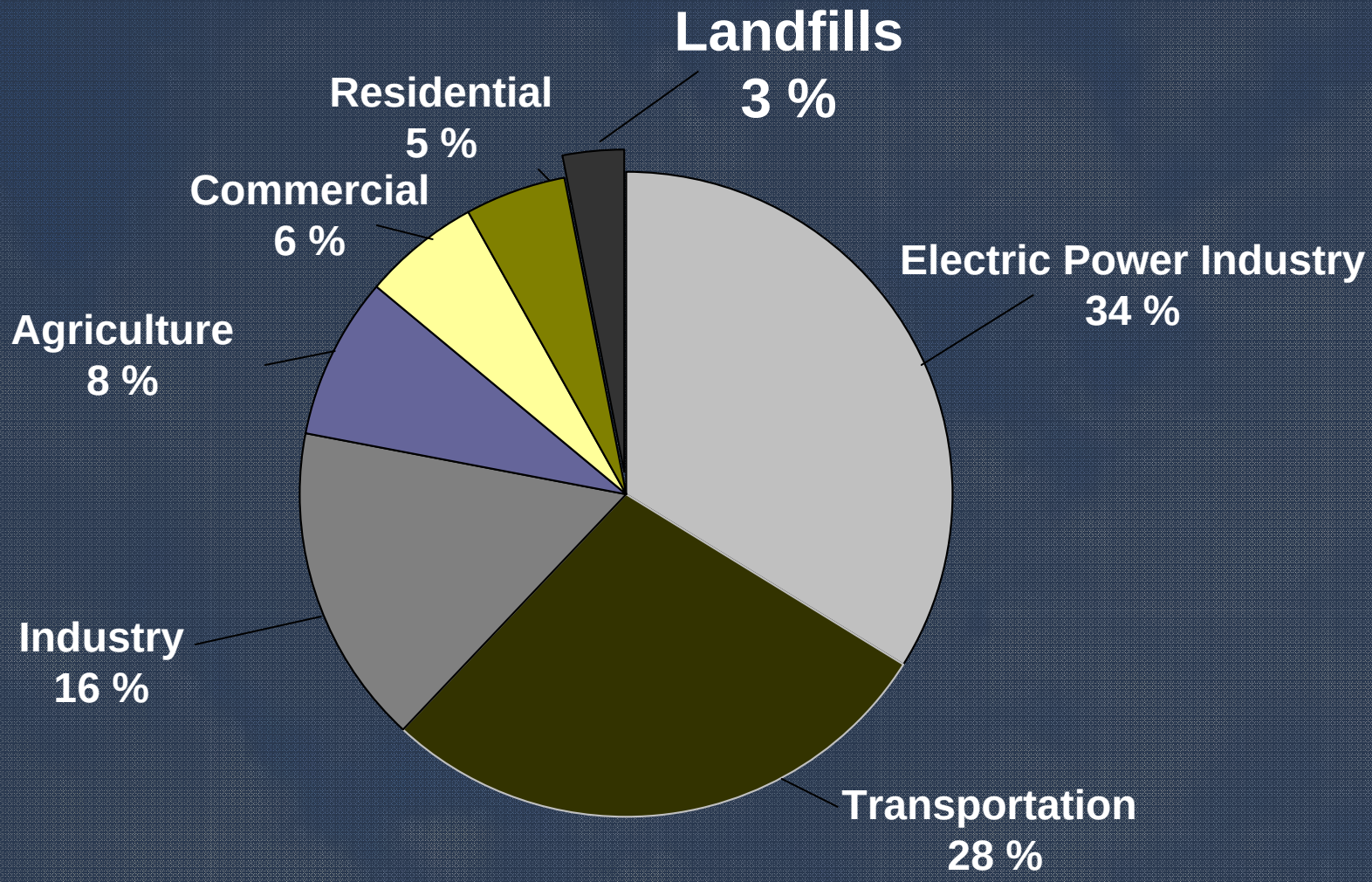
Per Capita Generation

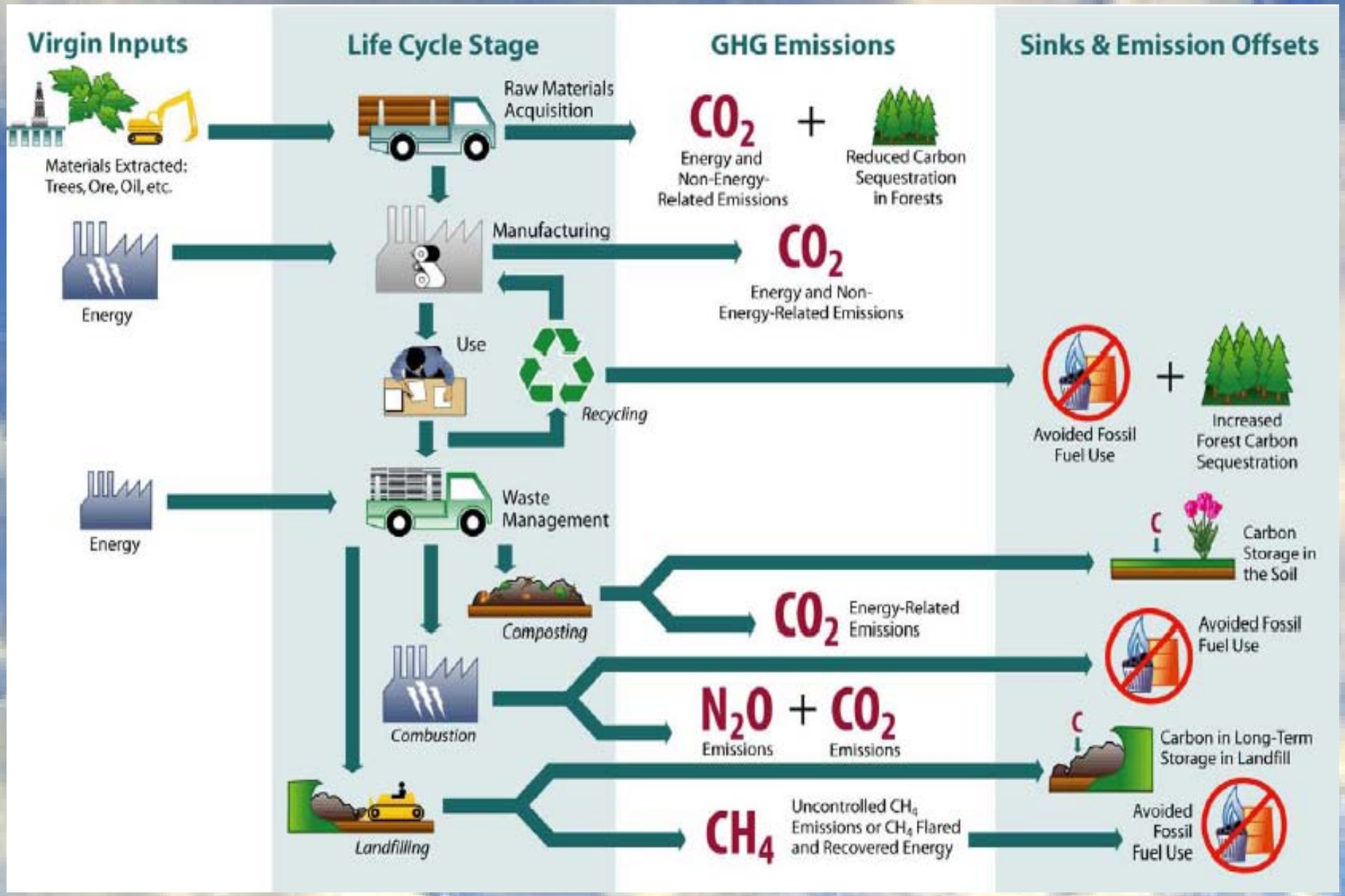


Per Capita Recycling, Disposal & Generation



Conventional Accounting:
Waste Makes Up Only 3% of GHGs




Virgin Inputs
Life Cycle Stage
GHG Emissions
Sinks & Emission Offsets
Materials Extracted: Trees, Ore, Oil, etc.
Raw Materials Acquisition
CO2
Energy and Non-Energy-Related Emissions
+
Reduced Carbon Sequestration in Forests
Energy
Manufacturing
CO2
Energy and Non-Energy-Related Emissions
Use
Recycling
Avoided Fossil Fuel Use
+
Increased Forest Carbon Sequestration
Energy
Waste Management
Carbon Storage in the Soil
Composting
CO2
Energy-Related Emissions
Avoided Fossil Fuel Use
Combustion
N2O + CO2
Emissions
Emissions
Carbon in Long-Term Storage in Landfill
Landfilling
CH4
Uncontrolled CH4 Emissions or CH4 Flared and Recovered Energy
Avoided Fossil Fuel Use

Product Life Cycle

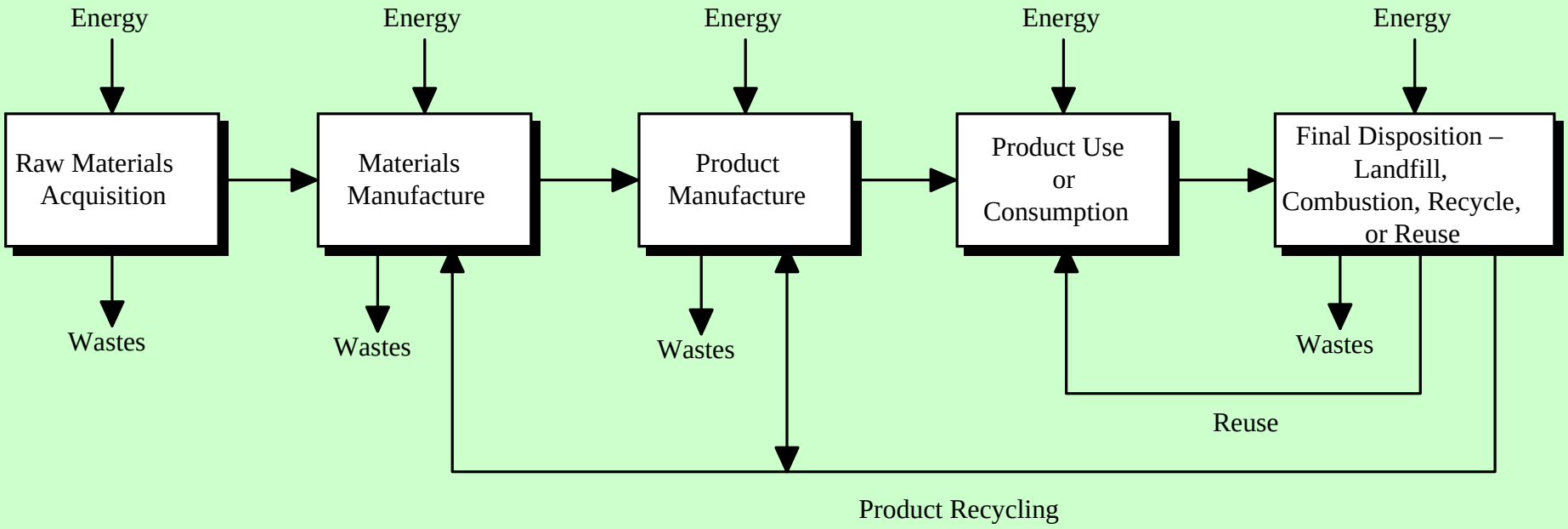


Figure 1-1. General materials flow for "cradle-to-grave" analysis of a product system.

Upstream Impacts

- Extraction and harvesting of raw materials
- Energy and consumptive water used for manufacturing of primary materials and fabrication of products/packages
- Pollution released as a consequence of off-site energy consumption
- Pollution released from manufacturing processes
- Energy and pollution associated with transportation of raw materials, products

Downstream Impacts

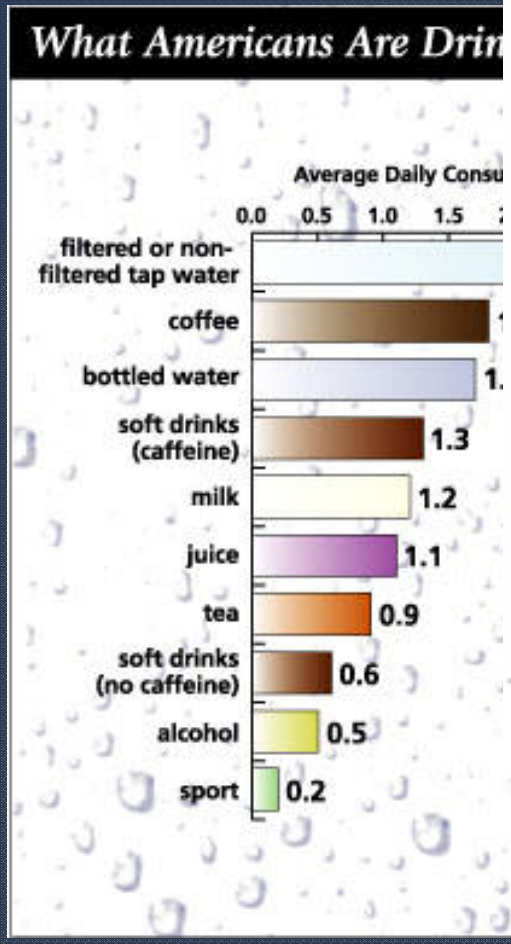
- Energy and pollution associated with collection and transportation of waste and recyclables
- Leachate from MSW and ash landfills
- Methane and other air emissions from landfills
- Air emissions from waste incinerators
- Land, air, and water quality impacts of burning, stockpiling, and illegal dumping of garbage (not well quantified)

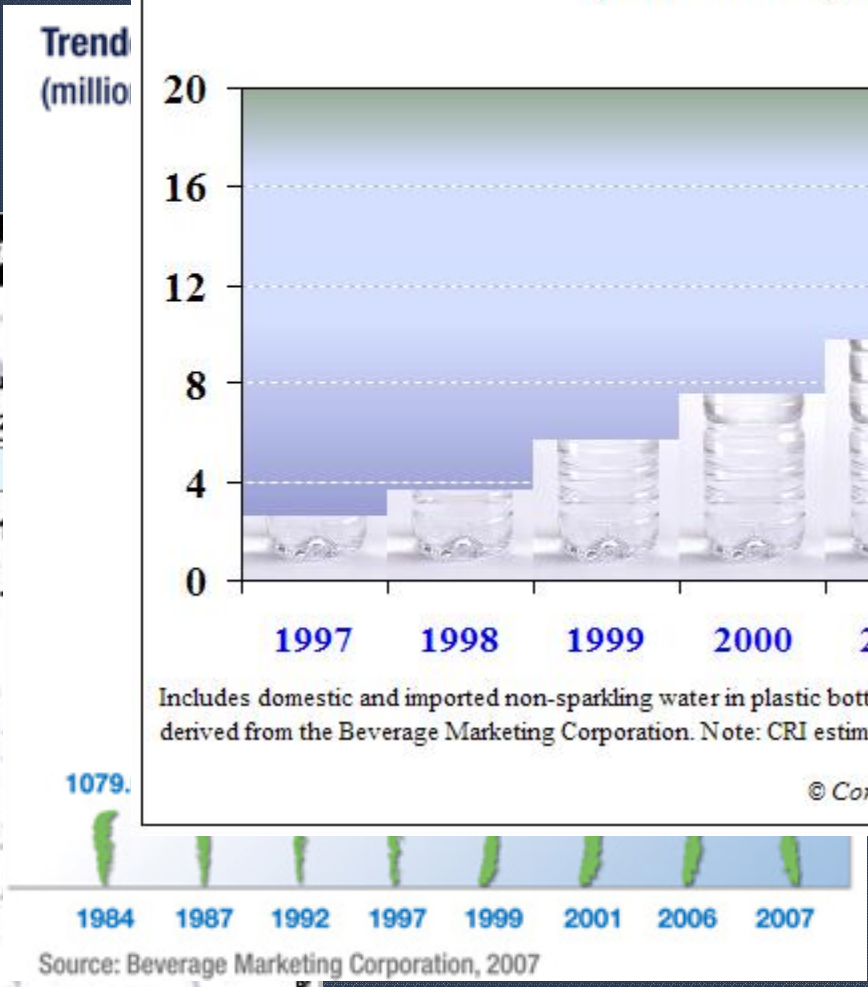
The Energy & Climate Connection:
Upstream Links

- Process energy GHGs comprise the majority of upstream emissions for the manufacture of both virgin and recycled materials – on average, approximately 80 percent*

- The transportation energy associated with manufacturing accounts for a small share of upstream emissions – on average less than 20%*

*for materials considered in EPA's Waste Reduction Model


What Americans Are Drin
Average Daily Consu
0.0
0.5
1.0
1.5
filtered or non-filtered tap water
coffee
bottled water
soft drinks (caffeine)
1.3
milk
1.2
juice
1.1
tea
0.9
soft drinks (no caffeine)
0.6
alcohol
0.5
sport
0.2

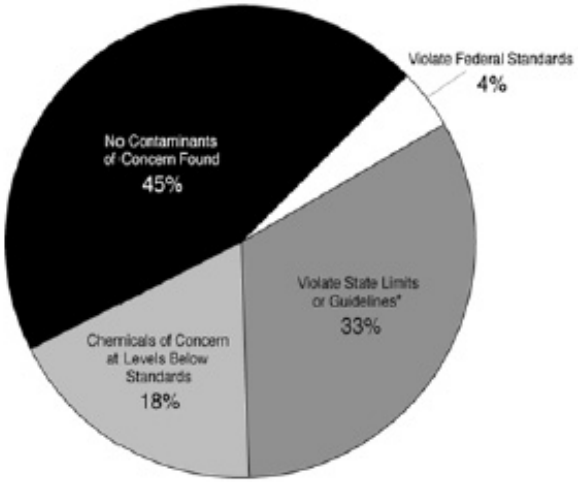

Trend
(millio
1079.
1984
1987
1992
1997
1999
2001
2006
2007
Source: Beverage Marketing Corporation, 2007

PET Water Bottles Wasted in the U.S.
(billions of units)
20
16
12
8
4
0
1997
1998
1999
2000
2001
2002
2003
Includes domestic and imported non-sparkling water in plastic bottles of 1.5 liters or less. Data derived from the Beverage Marketing Corporation. Note: CRI estimated 1997 and 1998 imports.
© Container Recycling Institute, 2005

Why are we willing to pay so much for bottled water?

- Bottled water costs between $2.66 and $12.72 per gallon
- Salem tap water on average costs on average costs $0.0032 per gallon.
- Bottled water is between 831 – 3,975 times more expensive than tap water.

Because it's Safer?



NRDC found bacterial contamination in 17% of bottled waters tested; many others contained contaminants (33% would violate enforceable standard for tap water).

An estimated 25% of all bottled water is actually bottled TAP water!

Bottled water sold in the same state it is produced is exempt from many regulations that assure water quality and safety.

Why Does it Matter?

- The SF Chronicle suggests it takes over 47 million gallons of oil per year to produce plastic water bottles.
  - This is 1 billion pounds of CO_2 and is equal to 100,000 cars.
  - This does not include fuel to transport bottled water.
- For a given bottle of bottled water, it takes five times that much water to make the bottle.

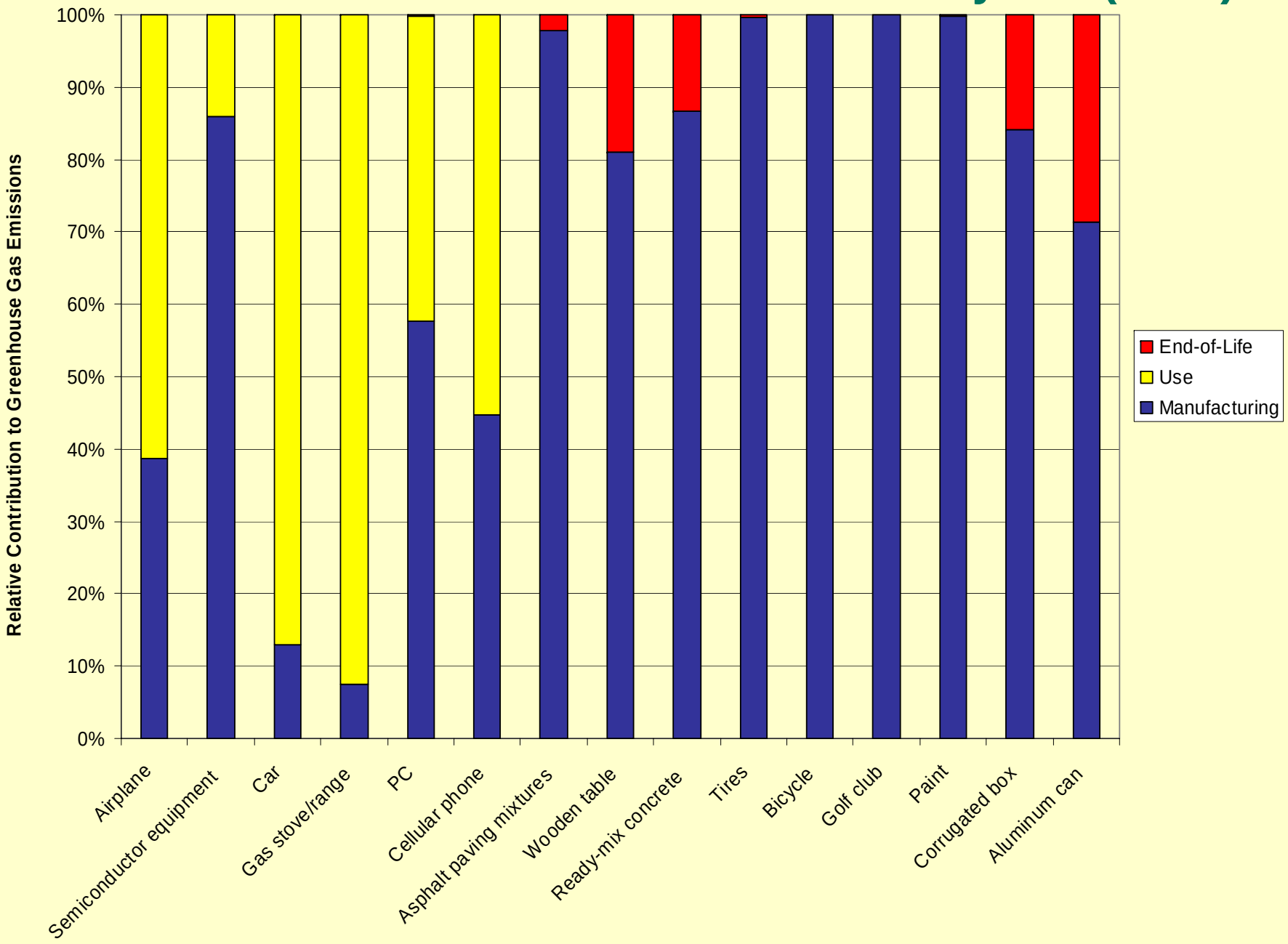
CATHY — By Cathy Guisewite

Materials Management Approach

Materials Management - considering the greenhouse gases produced during all stages of a material's life:

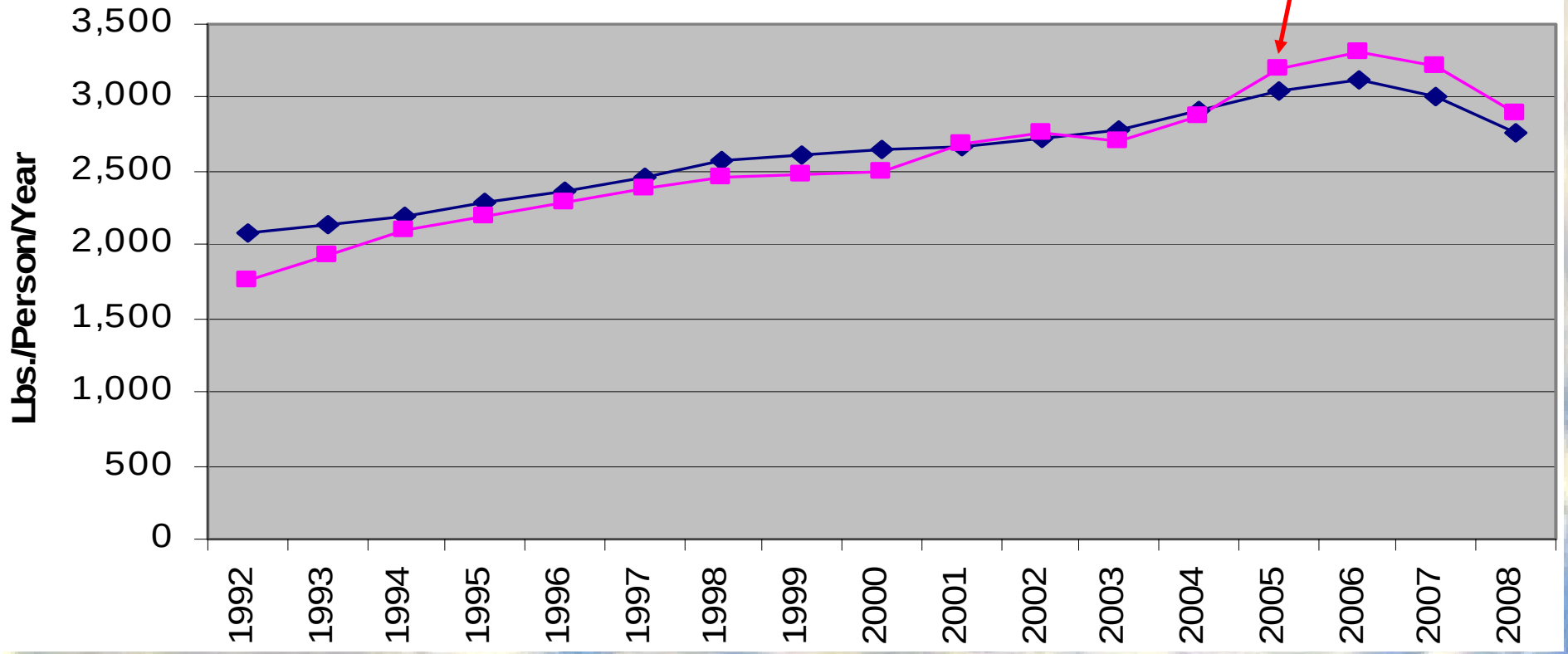
- extraction
- manufacturing
- transportation
- recycling, reuse, and disposal

California Greenhouse Gas/Product Life Cycles (2004)

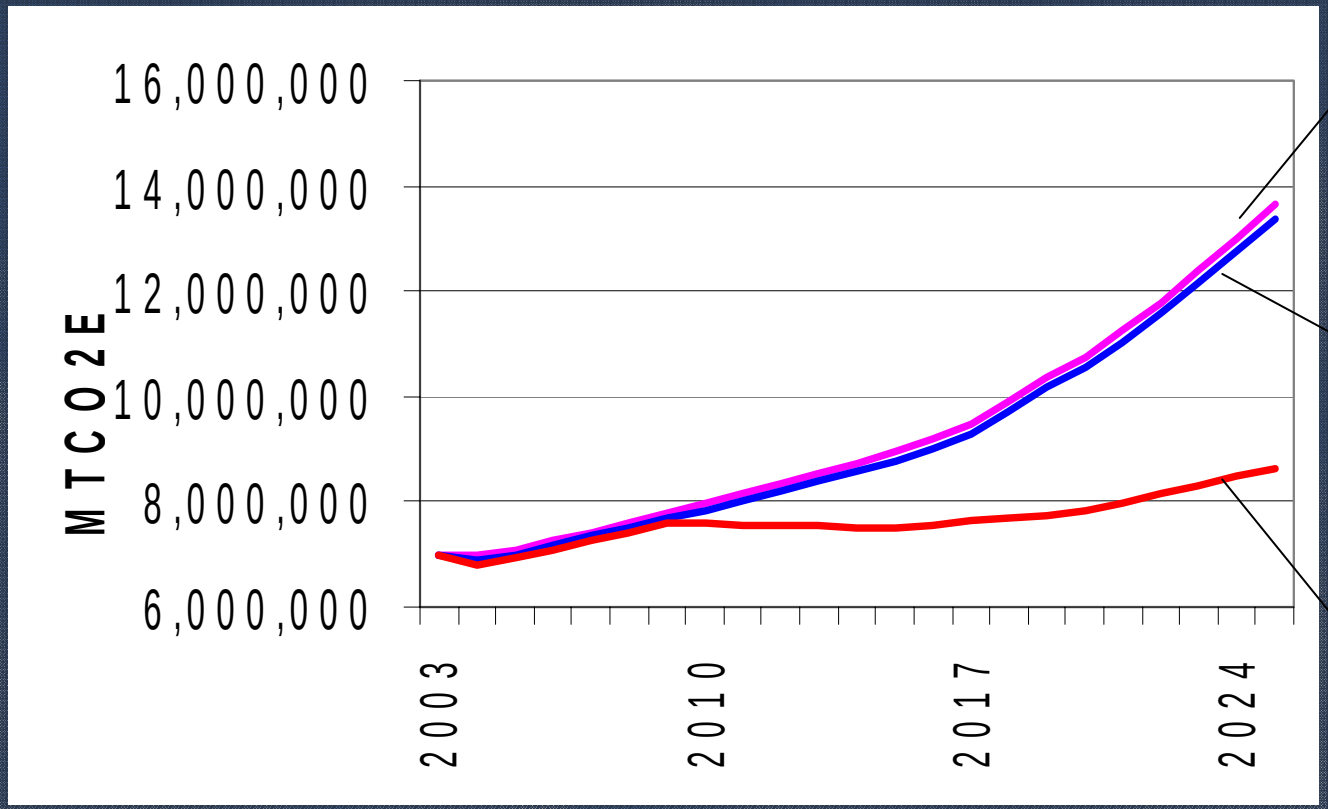


No increase in per capita from 2005 onward.

Per Capita Generation



Projected Greenhouse Gas Emissions (Materials & Waste)



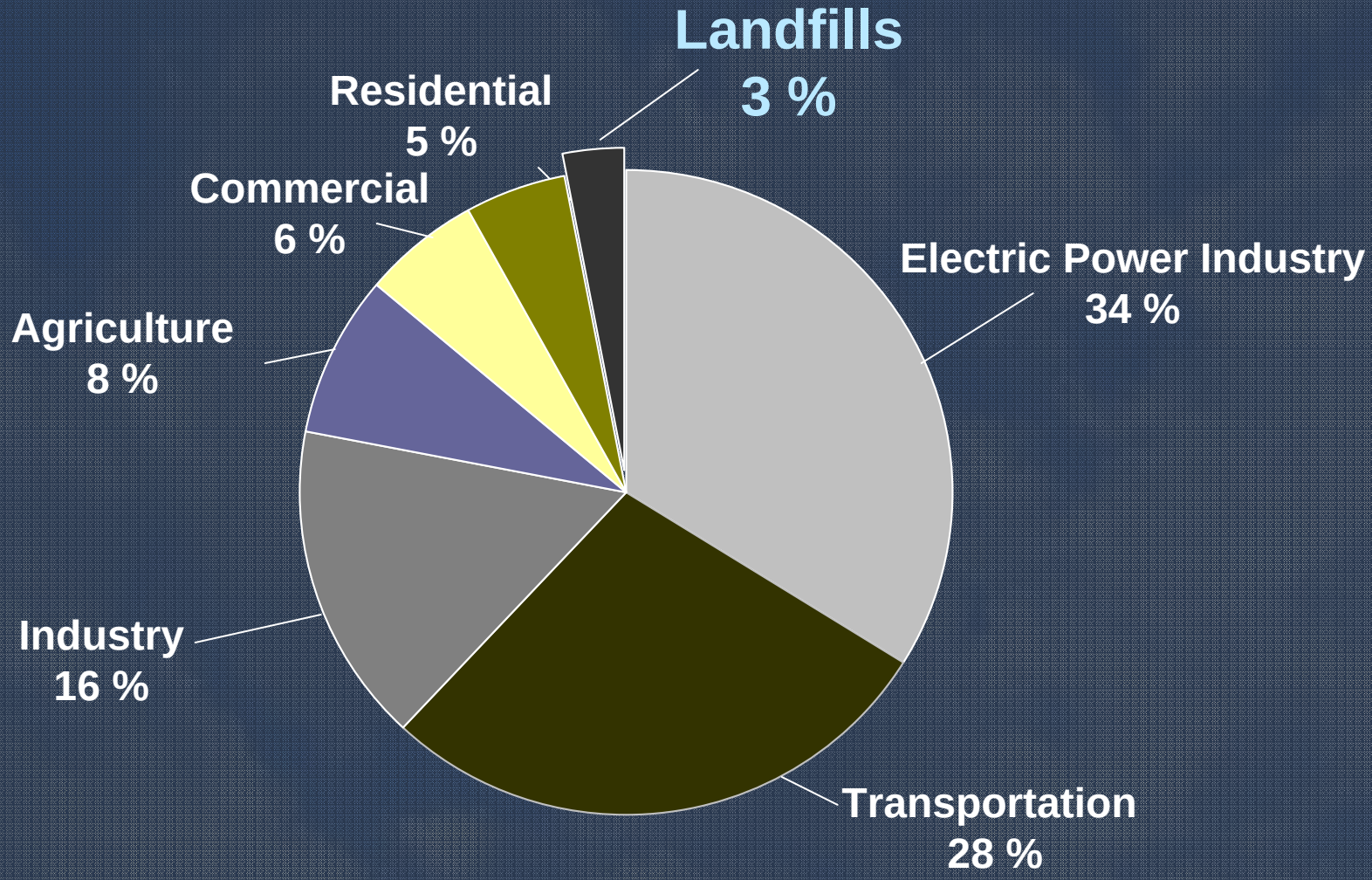
"Business as Usual"*

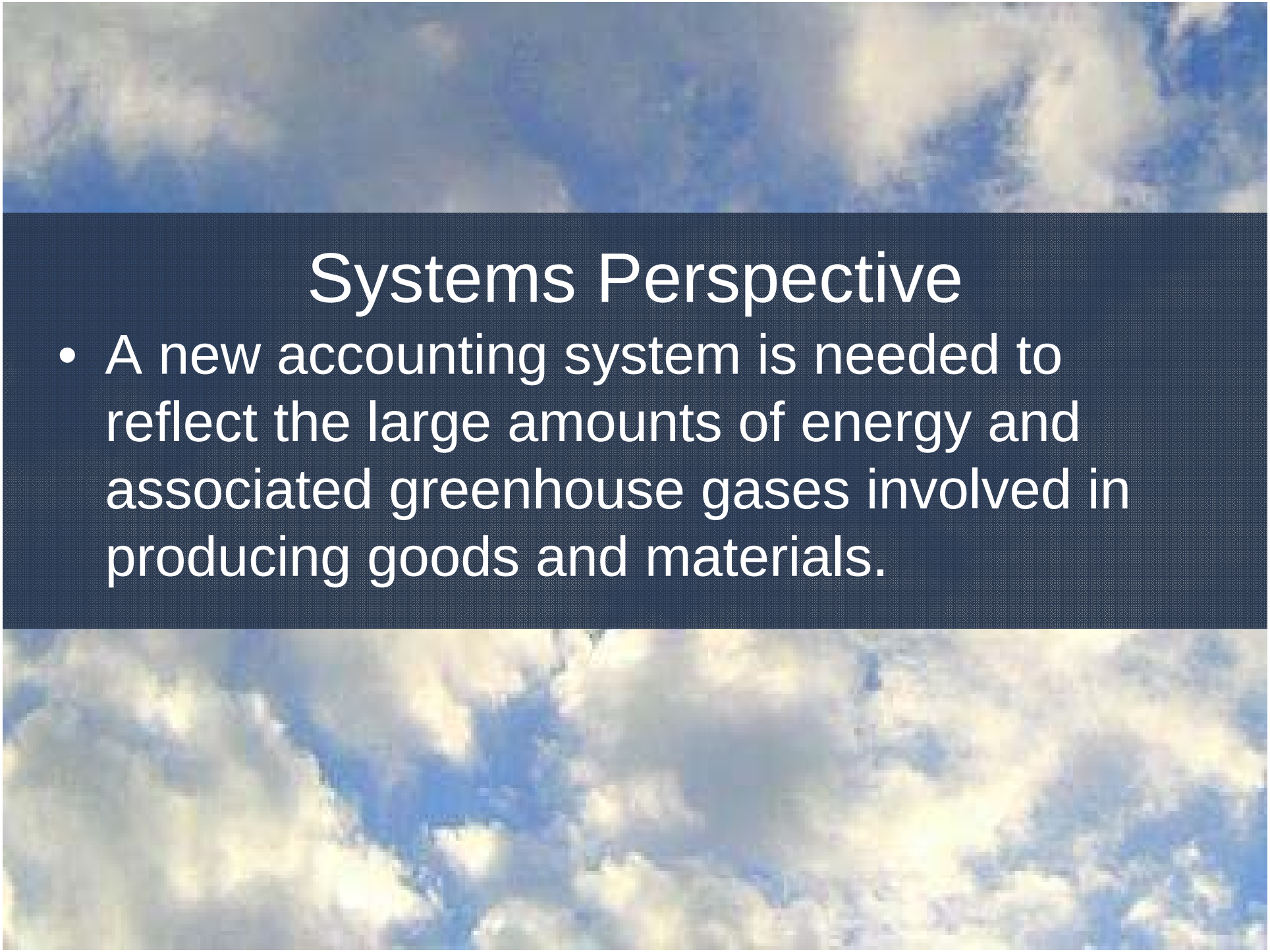
50% Recovery Goal

Waste Generation Goal

*Per-capita waste generation continues to grow, recovery rate stays at 47%

Conventional Accounting:
Waste Makes Up Only 3% of GHGs

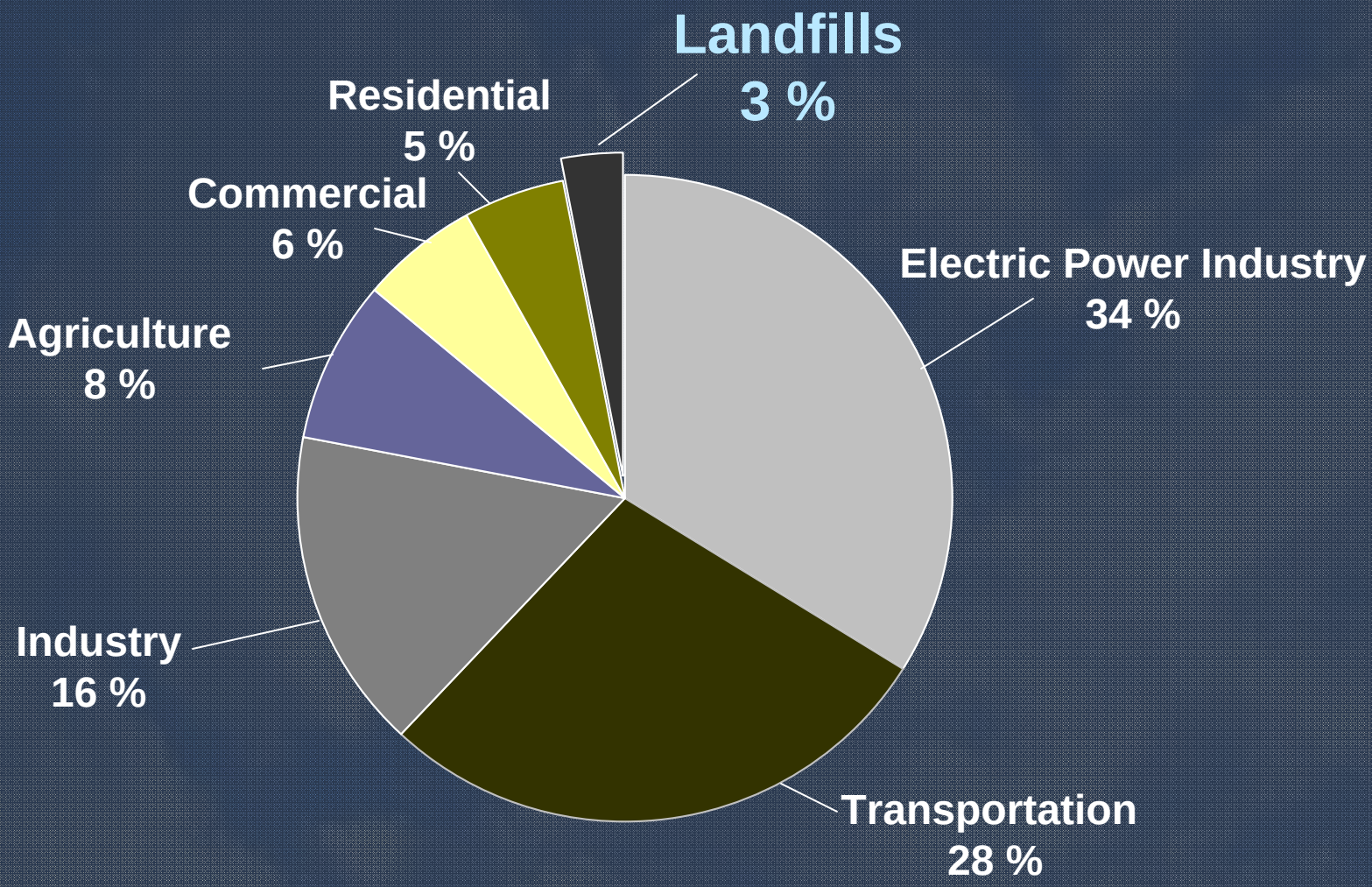




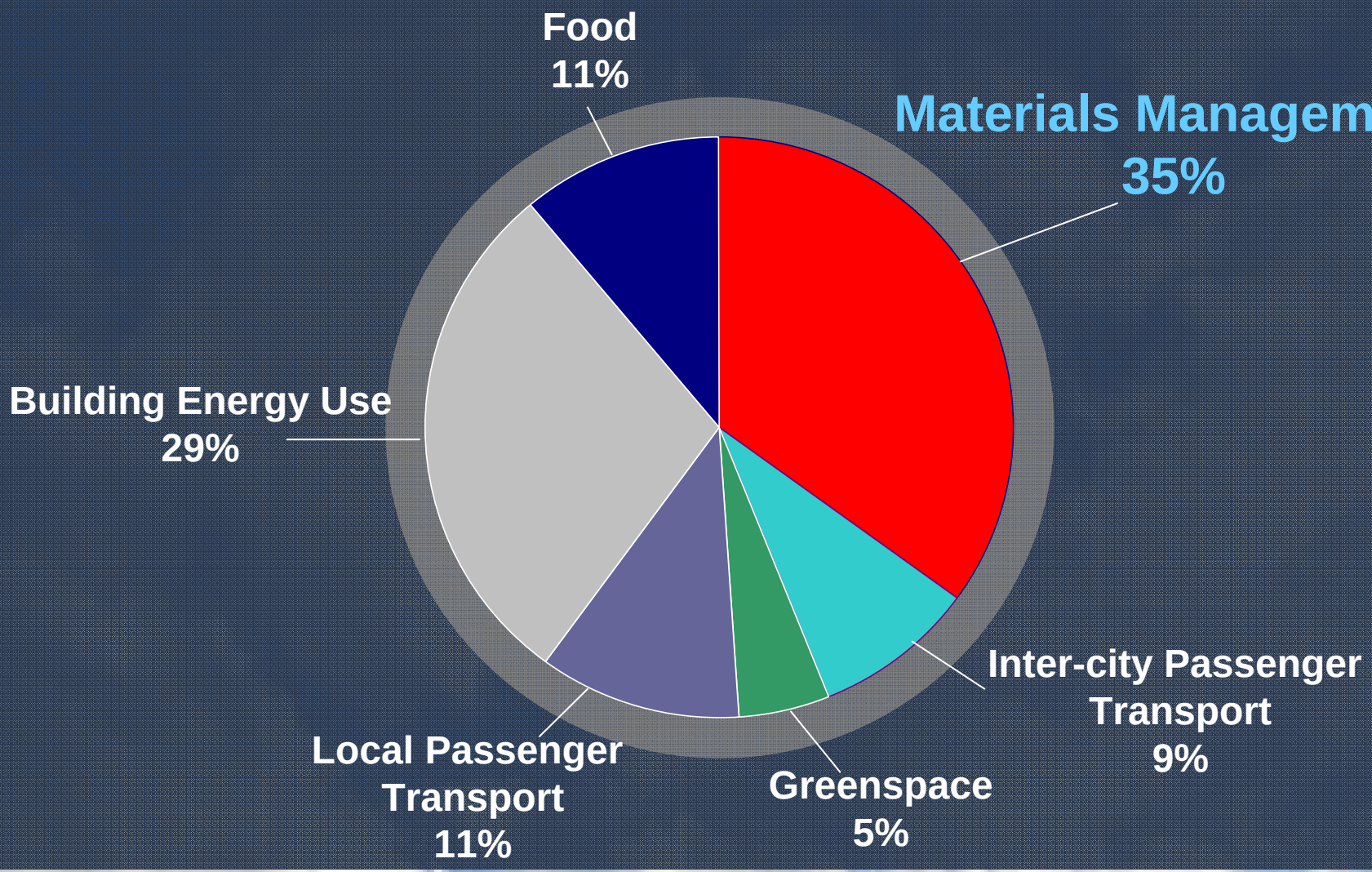
Systems Perspective

- A new accounting system is needed to reflect the large amounts of energy and associated greenhouse gases involved in producing goods and materials.

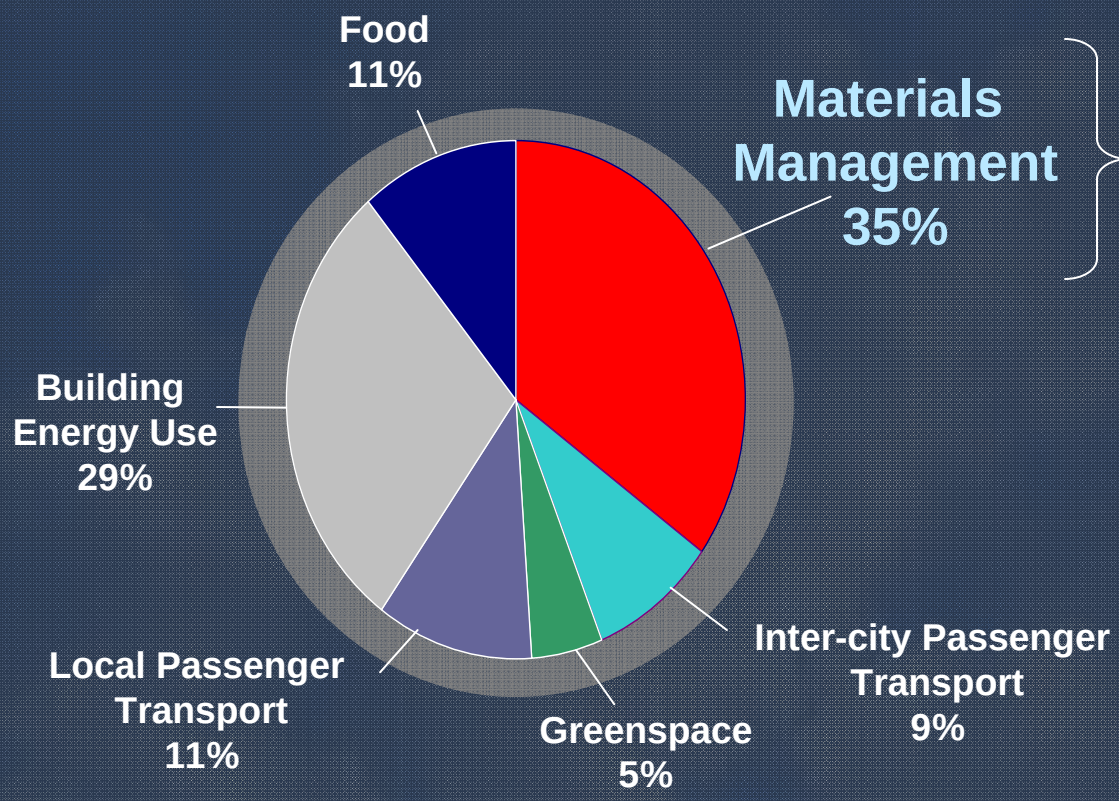
Conventional Accounting



Systems Accounting



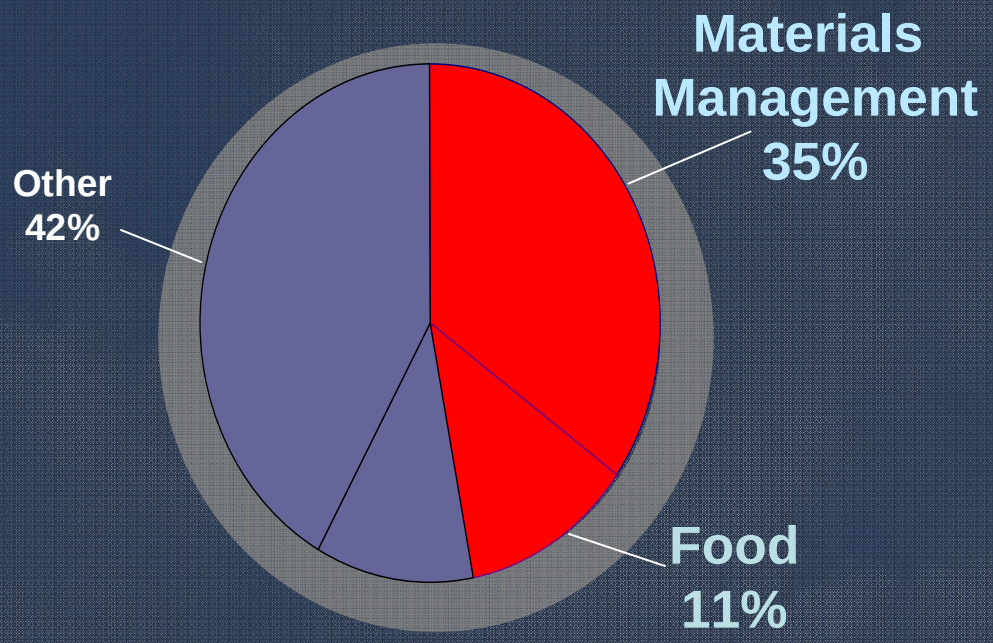
Systems Perspective



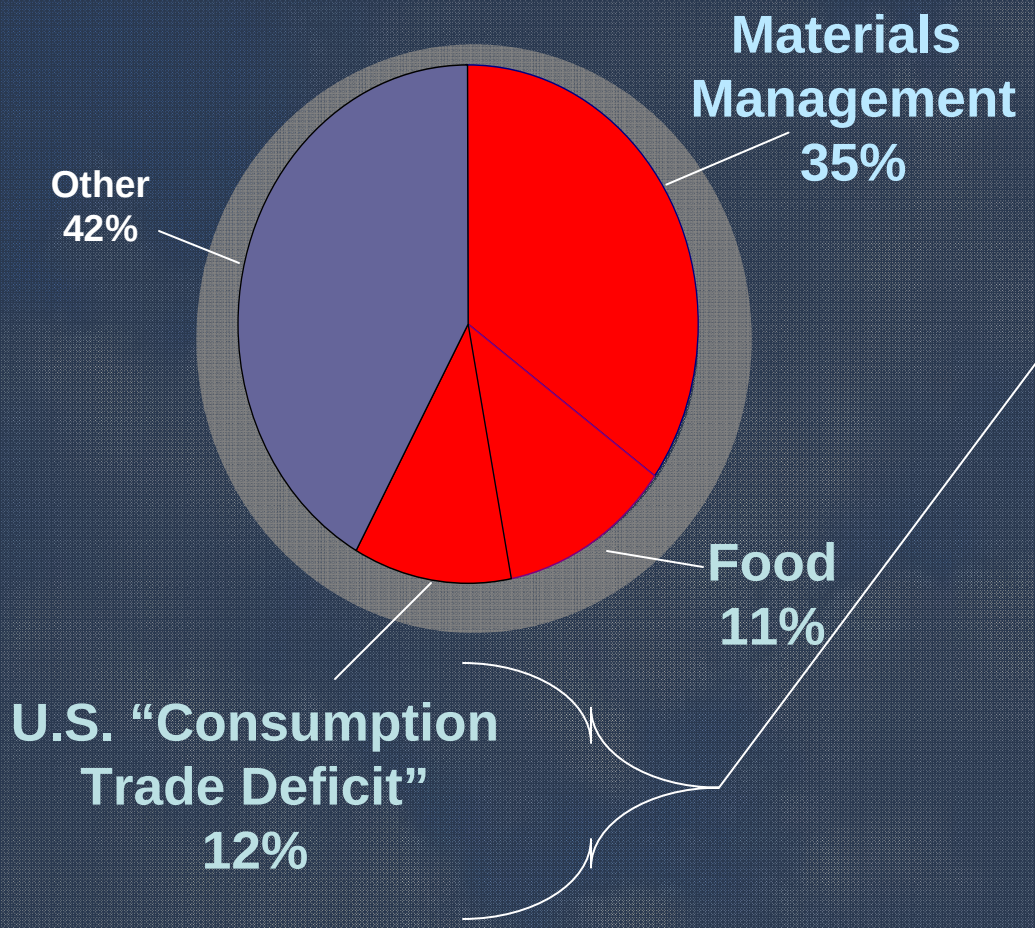
35% takes into account the electricity used and GHGs emitted from mining, manufacturing, and transporting materials and products.

These numbers represent domestic production and disposal only. The impacts of materials from a consumption perspective are larger because we live in a global economy.

Systems Perspective



Systems Perspective



The US operates a carbon "trade deficit" of sorts (emissions associated with producing imports are greater than emissions associated with producing exports). In 2004, this net carbon embedded in trade was estimated to add somewhere between 3 and 21% above and beyond the national GHG account - and almost all of this net increase was associated with materials.

Key Findings

- “Upstream” emissions from extraction and manufacturing are much more than “downstream” emissions for most materials/wastes
- Most GHG inventories do not adequately recognize the climate change impacts from goods

Comparison: Prevention and Recycling

- Recycling reduces upstream impacts.
- Prevention eliminates upstream impacts.

Reduce

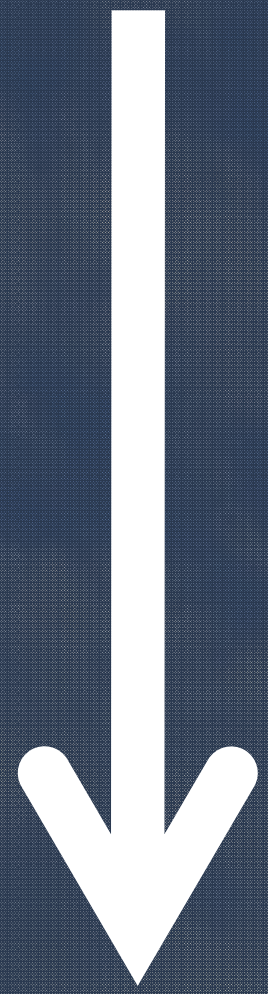
Reuse

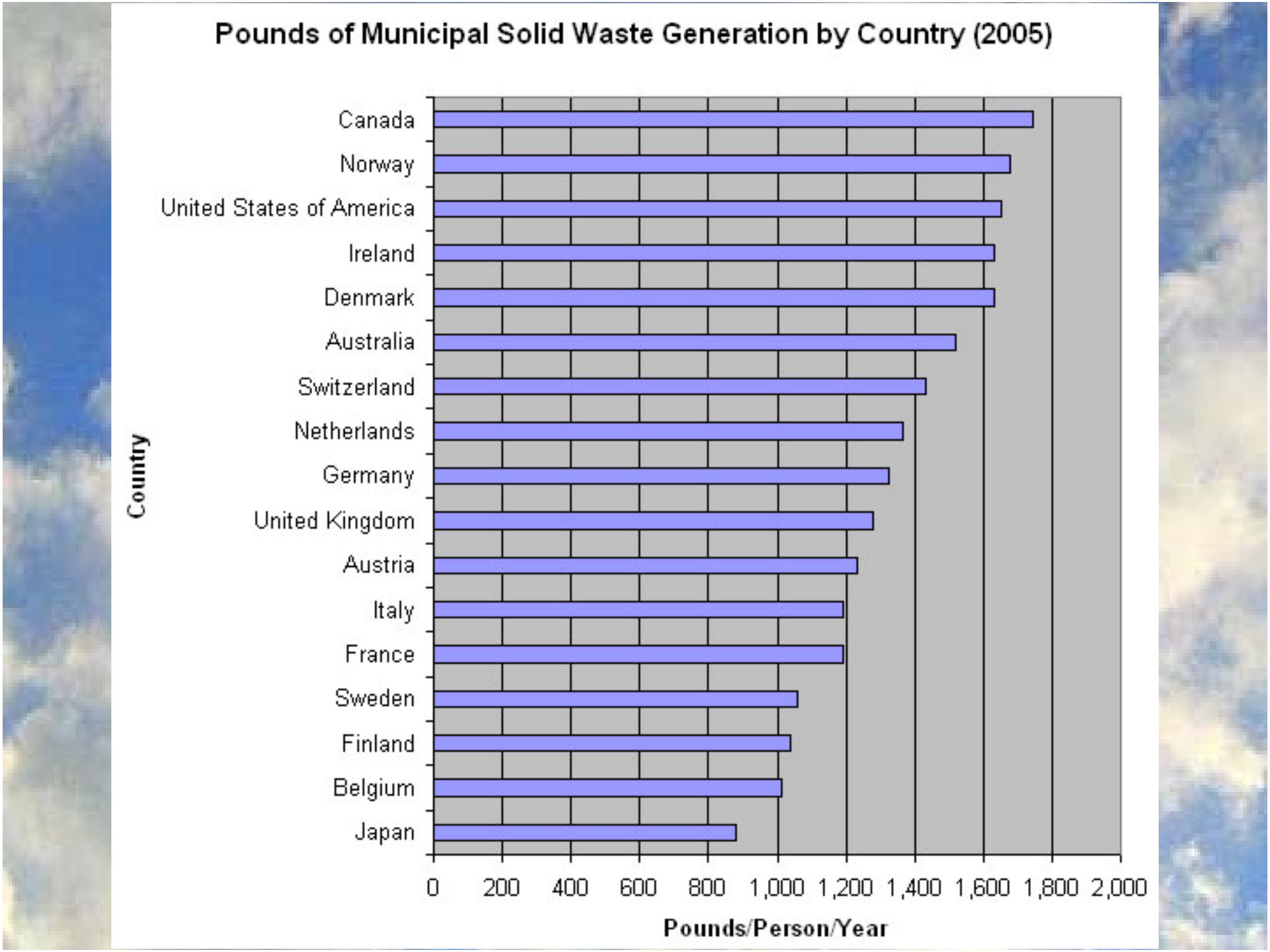
Recycle

Compost

Recover Energy

Landfill




Pounds of Municipal Solid Waste Generation by Country (2005)
Country
Canada
Norway
United States of America
Ireland
Denmark
Australia
Switzerland
Netherlands
Germany
United Kingdom
Austria
Italy
France
Sweden
Finland
Belgium
Japan
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
Pounds/Person/Year


HONDA


Lay's
Wavy
Cranberry


Vanilla Wafers
Raisin Bran
CORN DOGS


CORN
CRACKERS


外帶全家桶
此櫃暫

Bhutan’s Gross National Happiness

Is increasing waste generation *mainly* a problem because of landfill capacity? Pollution caused by landfills or waste-to-energy incineration? Something else?


If waste reduction is so much more important than recycling, is recycling worth the effort?


WASHINGTON
Astoria
Seaside
St. Helens
Hillsboro
Portland
Gresham
Beaverton
Oregon City
Tillamook
McMinnville
Woodburn
Silverton
Salem
Dallas
Monmouth
Albany
Corvallis
Lebanon
Sweet Home
Willamette
Eugene
Springfield
Cottage Grove
Umpqua
Sutherlin
Roseburg
Bend
Crater Lake N.P.
Crater Lake
Rogue
Grants Pass
Medford
Ashland
Upper Klamath Lake
Klamath Falls
Lakeview
Goose Lake
Summer Lake
Lake Abert
Steens Mtn.
Harney Basin
Harney Lake
Malheur Lake
Burns
Malheur
Jordan Valley
Owyhee
Ontario
Vale
Baker City
Powder
Snake
La Grande
Grande Ronde
Enterpr
Blue Mts.
Heppner
Pendleton
Hermiston
Milton-Freewater
Columbia
Hood River
The Dalles
▲Mt. Hood
11,239 ft.
(3,426 m)
John Day
Deschutes
Madras
Prineville
Redmond
Bend
John Day
Cascade Range
Coast Range

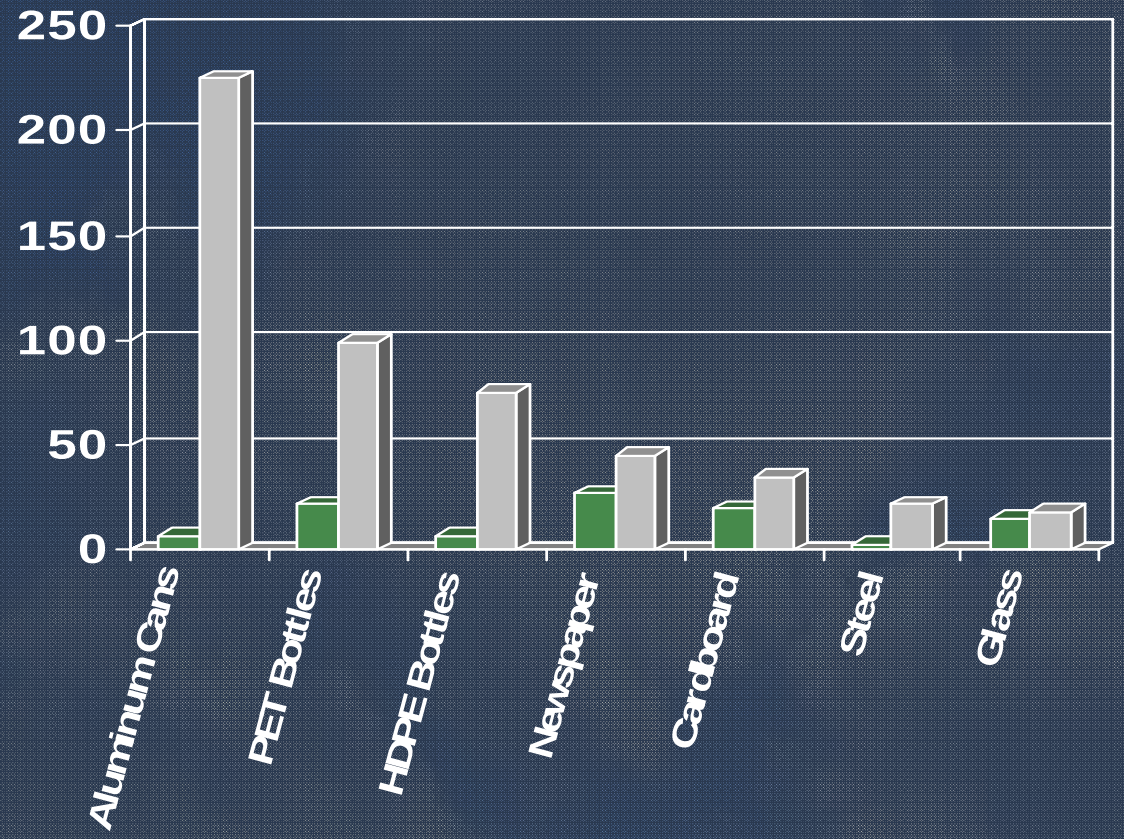
Focus: Transport to Markets

Question: When are Markets "Too Far" to Justify Long-Haul?

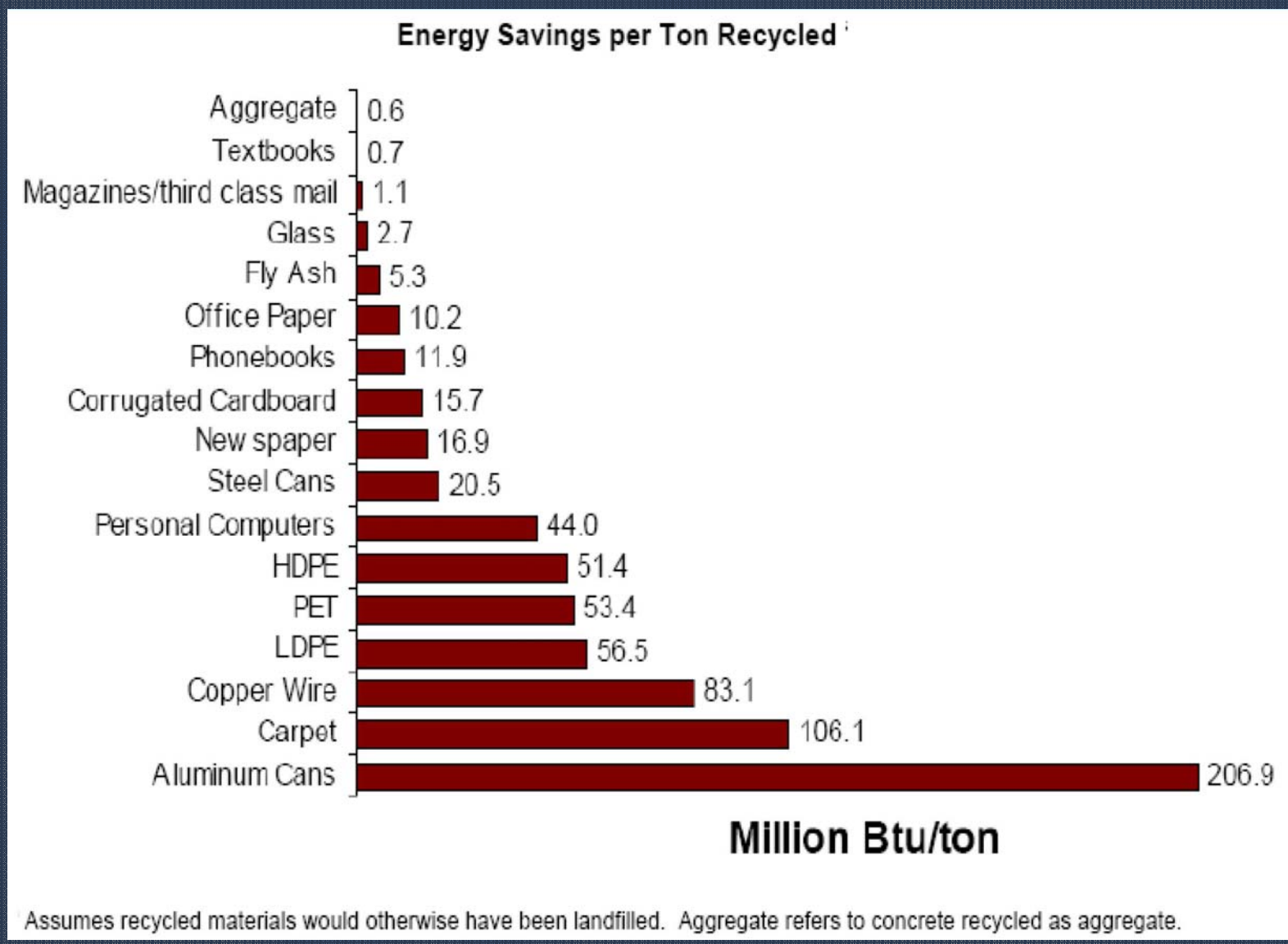
Material	Production Savings (MMBTU ton collected)	"Break-Even Point" (miles)		
		Truck	Rail	Freighter
Aluminum	177	121,000	475,000	538,000
LDPE	61	41,000	162,000	184,000
PET	59	40,000	157,000	178,000
Steel	19	13,000	52,000	59,000
Newspaper	16	11,000	43,000	49,000
Corrugated	12	9,000	33,000	38,000
Office Paper	10	7,000	27,000	31,000
Boxboard	6.5	4,400	17,400	19,800
Glass (to bottles)	1.9	1,300	5,100	5,800

Why Recycling Matters

Energy Use: Recycled vs. Virgin Content Products (million BTUs/ ton)



Using recycled materials can use up to 95% less energy than using virgin materials.


Energy Savings per Ton Recycled
Aggregate 0.6
Textbooks 0.7
Magazines/third class mail 1.1
Glass 2.7
Fly Ash 5.3
Office Paper 10.2
Phonebooks 11.9
Corrugated Cardboard 15.7
New spaper 16.9
Steel Cans 20.5
Personal Computers 44.0
HDPE 51.4
PET 53.4
LDPE 56.5
Copper Wire 83.1
Carpet 106.1
Aluminum Cans 206.9
Million Btu/ton
Assumes recycled materials would otherwise have been landfilled. Aggregate refers to concrete recycled as aggregate.

National Recycling GHG Impacts

38 million

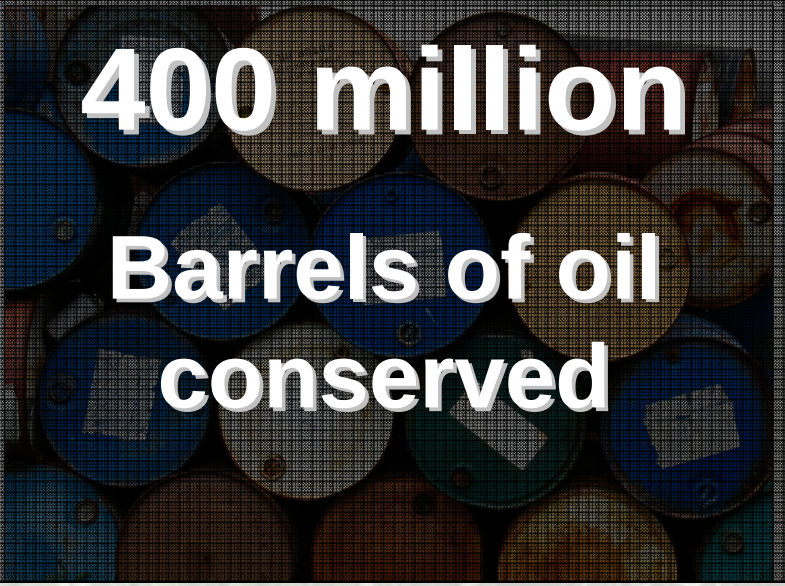
Cars off the road

22 million

Homes heated/ year

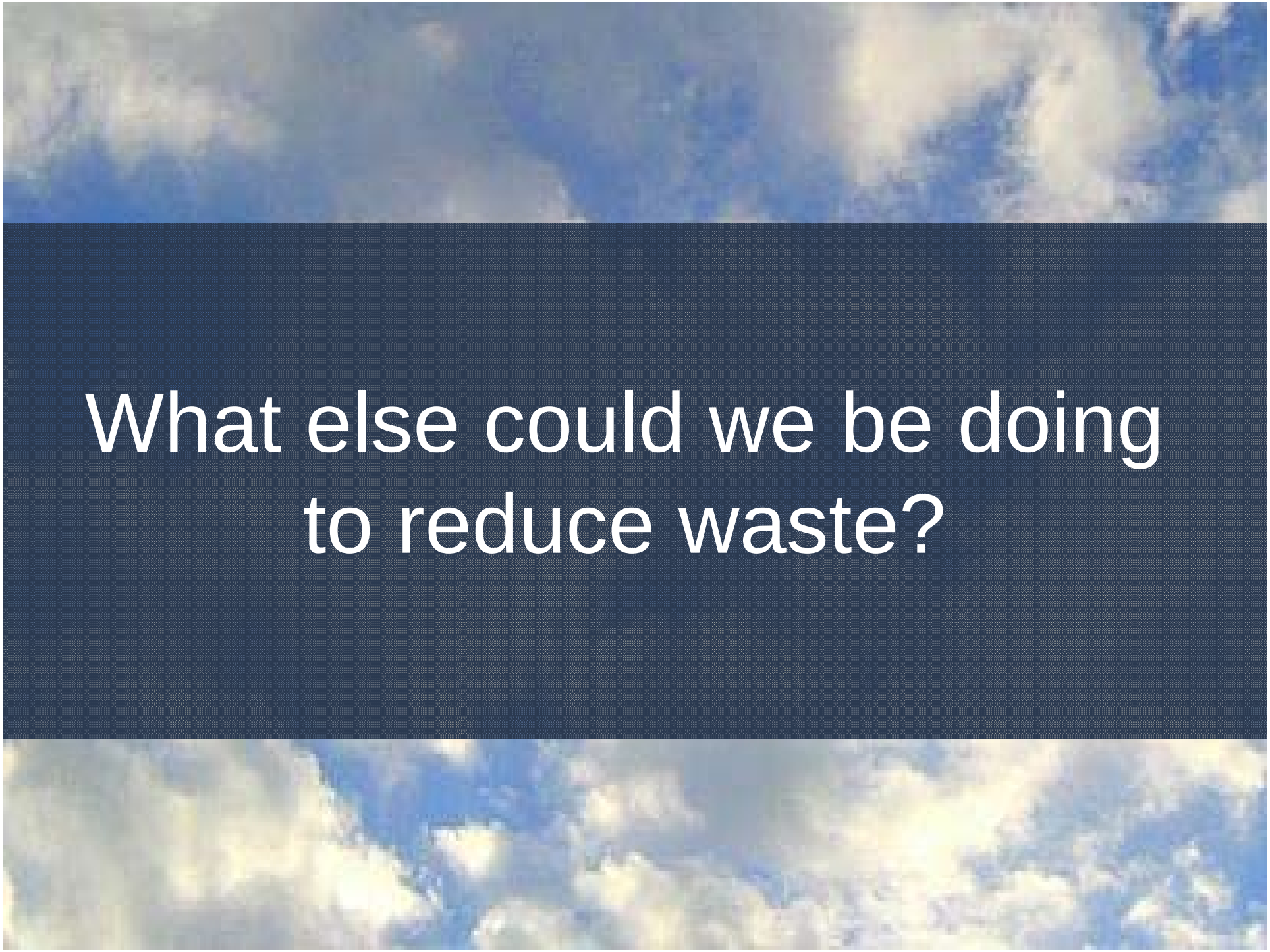
1.4 million

Acres of forest preserved



400 million

Barrels of oil conserved


What else could we be doing to reduce waste?

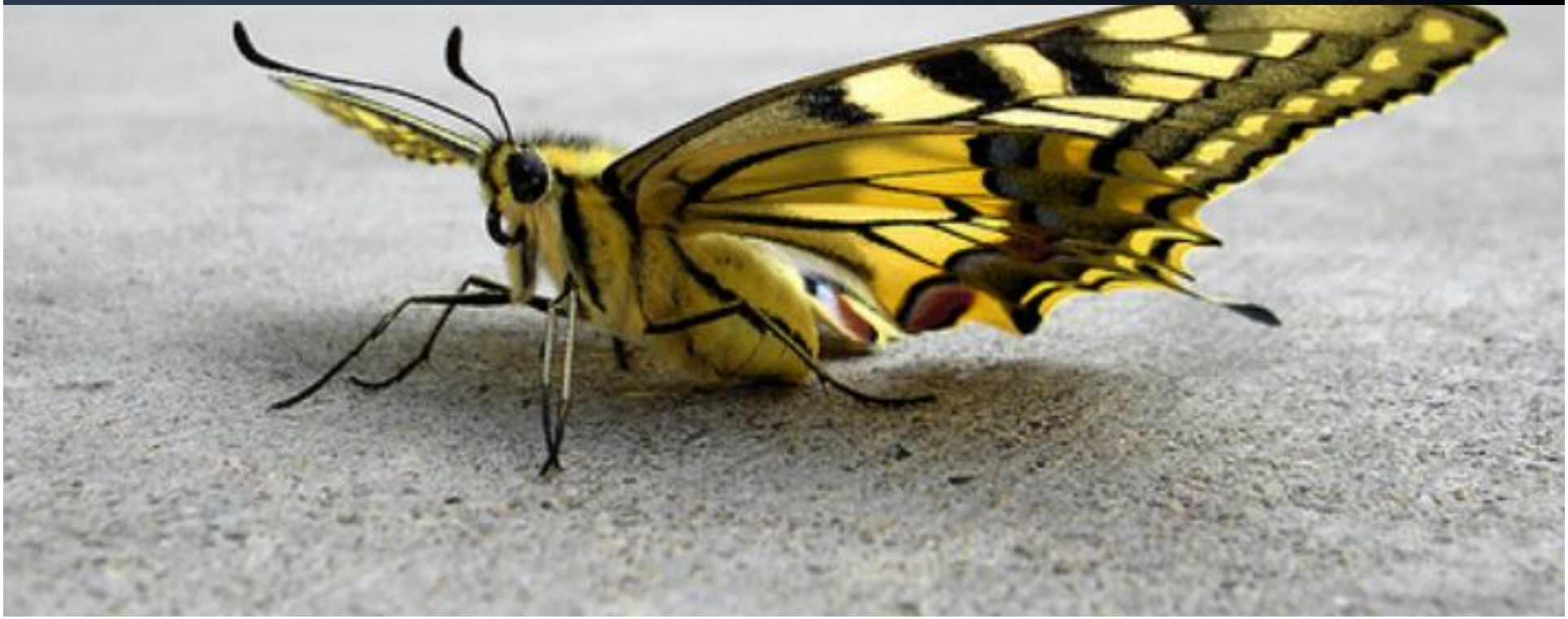
Extended Producer Responsibility

Resources: Product Policy Institute
www.productpolicy.org

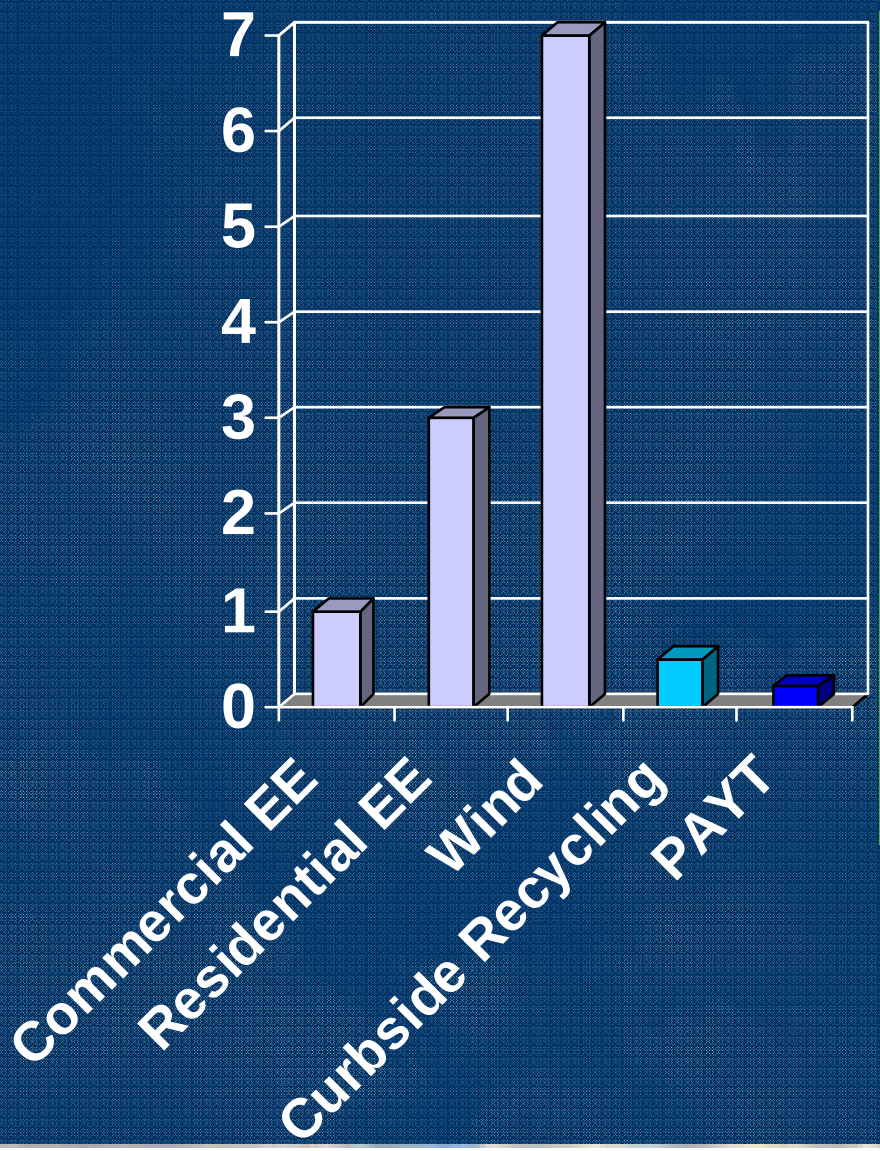
oregon E-CYCLES
oregonecycles.org

Expanding Waste Reduction, Recycling & Composting Programs

Increasing waste reduction, recycling, and composting programs is a more cost effective strategy than energy-efficiency programs in reducing greenhouse gasses



Relative Cost Per MTCO2e For Solid Waste & Energy Programs



Compared to implementing energy-efficiency programs (EE), expanded recycling and PAYT is easier and reduces more greenhouse gas emissions

Targeted Bans

Many cities have minimized the use of certain materials through ordinances:

Styrofoam reduction ordinance

http://www.sfenvironment.org/downloads/library/foodservicewaste.pdf

Plastic bag reduction ordinance

http://www.sfgov.org/site/uploadedfiles/bdsupvrs/ordinances07/o0081-07.pdf

Model Local Government Ordinances & Policies

Recycling

http://www.ciwmb.ca.gov/lglibrary/LocalDocs/default.htm

Composting (draft)

http://www.sfgov.org/site/uploadedfiles/sfenvironment/meetings/coe/supporting/2008/MandatoryOrdinance.doc

Construction & Demolition Debris / Green Building

http://www.ciwmb.ca.gov/ConDemo/SampleDocs/

Local Extended Producer Responsibility

http://www.productpolicy.org/content/local-epr-resolutions

http://www.calpsc.org/policies/local/index.html

Actions That Make a Difference

1. Expanding Composting and Recycling Programs
2. Adopting Recycling and Composting Ordinances
3. Purchasing environmentally preferable products
4. Encouraging Extended Producer Responsibility


What can an individual person do to reduce waste?

Shopping:

- Buy durable
- Buy local (farmers markets)
- Buy used (thrift stores, newspaper classifieds, Craig's List)
- Avoid packaging (shop in bulk, reuse bags and containers), disposables (paper towels, cups/utensils) & single-serving items (Lunchables, drink boxes)

- BYOB/BYOM
- Buy only what you need (Tip! Buying in bulk helps you buy only what you need)
- BYOC to restaurants
- Avoid toxic products when safer, non-toxic alternatives are available
- Avoid shopping by growing your own vegetables
- Buy concentrates (juice, laundry detergent, window cleaners, etc.)

Other ideas…

- When possible, repair before replace.
- Donate items to thrift stores or Habitat for Humanity's ReStore instead of throwing them away.
- Write a letter to manufacturers to let them know how you feel about their product &/or how it is packaged.
- When packing your lunch for the school/work day, use reusable containers.
- Use rechargeable batteries instead of alkalines.
- Rent or borrow tools rather than buying new ones.
- Keep envelopes from junkmail to be used for your personal mailings.
- Request to have your bills paid online or automatically withdrawn from your checking instead of receiving paper bills.

Opt Out of Phone Books:

118,767 homes in Marion County
+ 8,029 businesses
= 126,796 books (conservatively!)
x 5 (five directories distributed in Marion County)
= 633,980 directories distributed/year

DEX/Qwest

1. Go to **www.selectyourdex.com**. Select "Directory Options" at bottom page.
2. Enter your zipcode and click through screens until you see "Personalize Your Directory Order."
3. Fill in your address and contact information, and select "0" or the number of directories you wish to receive from the dropdown menus.

Or call 1-866-606-9339 and press 2 to speak with a representative.

Yellow Book

Call **1-800-929-3556** and press 2 to speak with a representative.

Other Phone Books

Check on the front cover or inside page for a customer service number to "order directories." Or visit **www.yellowpagesoptout.com**

Junk Mail

The U.S. Postal Service delivers more than 90 billion pieces of "direct mail" every year, weighing 4 million tons!

An average of 675 pieces of junk mail end up in every mailbox each year and it's on the rise! In addition to wasting your time, junk mail is a waste of resources.

www.newdream.org/junkmail

http://www.catalogchoice.org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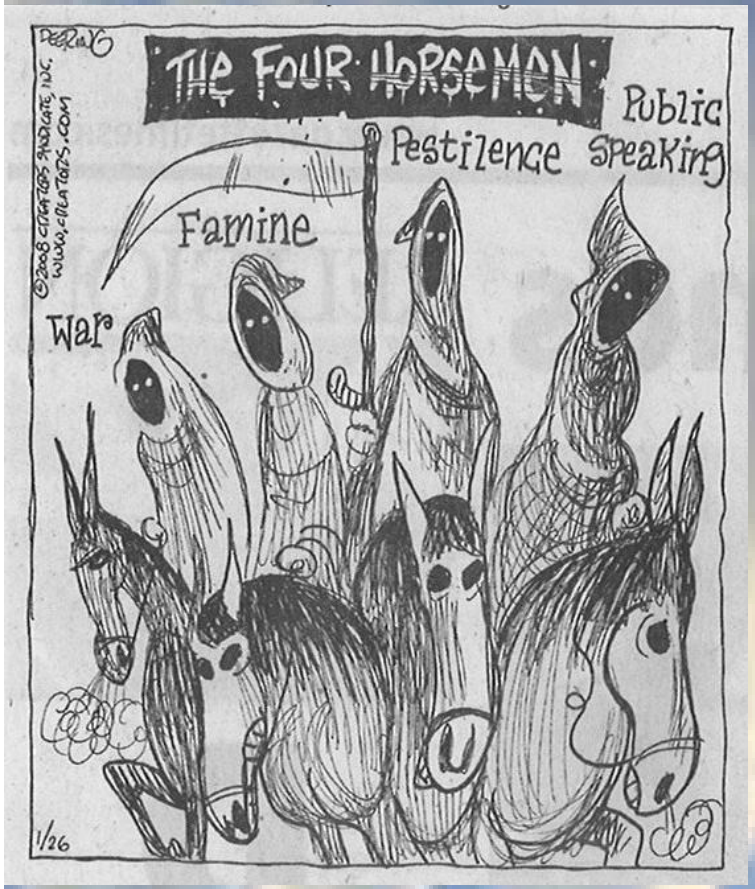
GIVE THANKS



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