

# Unit 4: Life Cycle Assessment

## Session 1: Intro - What is the Cost of Materials Usage

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## Overview

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- Context - Indirect Costs
- The role of materials in the environment
  - Direct
  - Indirect
- Is this *really* a problem?
  - How much do we consume?
- What can be done
  - Changing the rules of the game
- Overview of new methods - Life Cycle Assessment

## What is indirect cost?

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- In economics, referred to as an ... **Externality**
  - Great definition, explanation from wikipedia

The decision-maker does not bear all of the costs or reap all of the gains from his action.

<http://en.wikipedia.org/wiki/Externality>

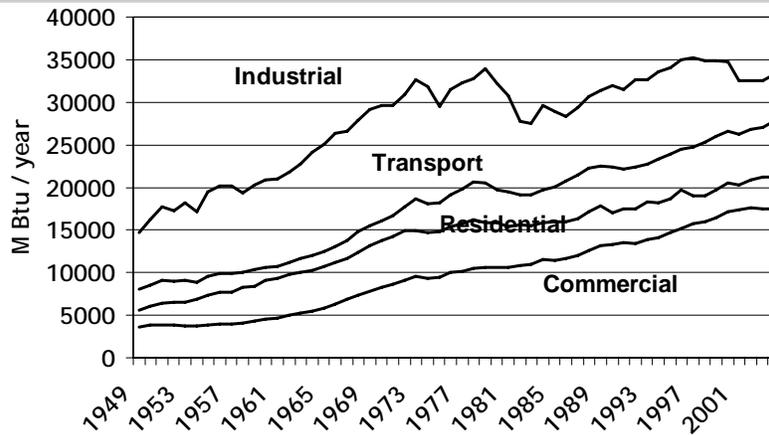
- What are examples of externalities?

## How do Materials Drive Indirect Social Cost? Environment

- **Direct**
  - **Manufacturing burden**
    - Consumption of energy
    - Emissions to the environment
  - **Concentration in the environment**
    - Most materials still eventually in up in landfills
    - Toxicity for some materials
- **Indirect**
  - **Performance of the products into which they are transformed**
    - Energy Efficiency
    - Recyclability

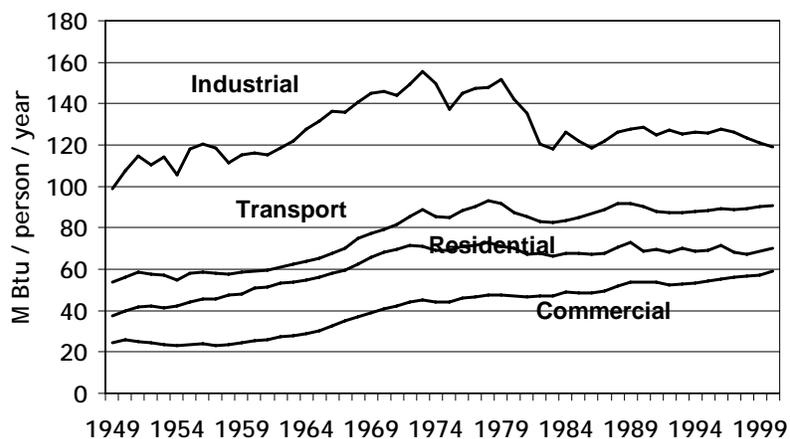
Is this something to be concerned about?

## Energy Consumption in the US



From: Energy Information Administration, Annual Energy Review 2004, Table 2.1a, 2004.

## Energy Consumption in the US



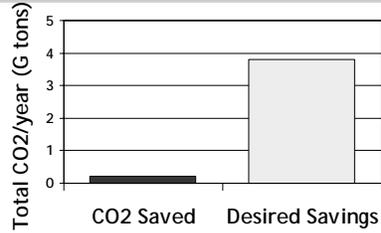
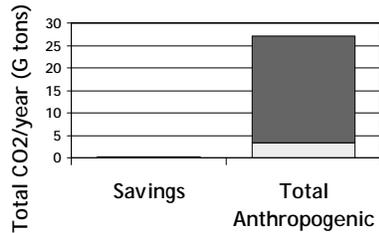
From: Energy Information Administration, Annual Energy Review 2004, Table 2.1a, 2004.

## Placing CO2 Savings from Lightweighting in Perspective

- Vehicle Lightweighting Saves Little vs Total Man-made Releases

- Total Man-made CO2 24 G tons / year

- CO2 Saved via Al Body 0.2 G tons / year



- BUT , Compared to Kyoto Savings Goal, Savings is Significant
- Savings Goal ~ 3.8 G ton / year
- CO2 Saved ~ 6% of Goal via Al Body

Is this *really* a problem?

How much do  
**YOU**  
consume per day?

## How much do YOU use per day (kilograms)?

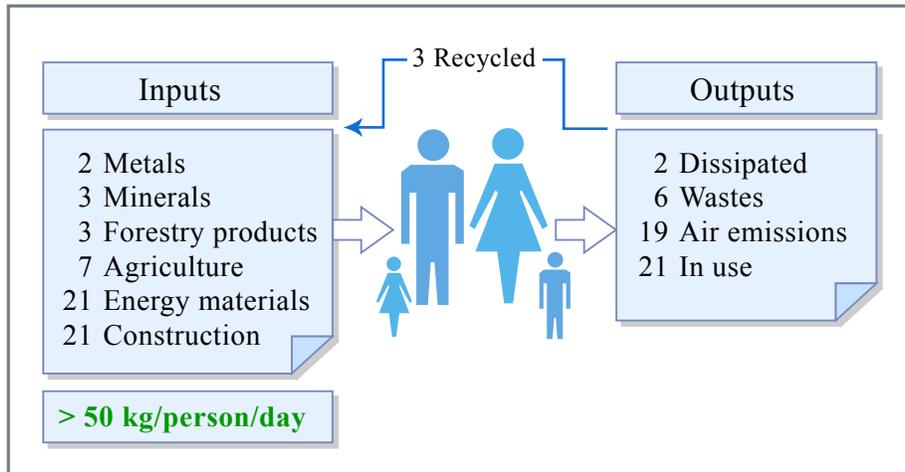


Figure by MIT OCW.

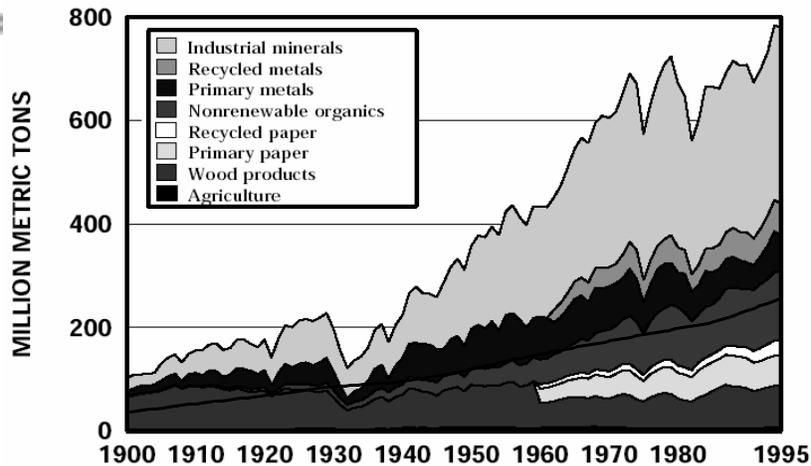


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3.080 Econ & Enviro Issues In Materials Selection  
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Life Cycle Assessment : Slide 11

## U.S. Consumption Has Skyrocketed



Courtesy of Annual Review, Inc. Used with permission.

Source: Figure 3 in Matos, G., and L. Wagner. "Consumption of Materials in the United States, 1900-1995." *Annu. Rev. Energy Environ.* 23 (1998):107-22.



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## How Can We Affect This?

- **Human Behavior**
  - Change patterns of consumption
    - Waste less
- **Change the rules**
  - Dematerialization
    - Get the same function from less material
  - Materials substitution
    - Apply less harmful materials
  - **Waste Mining - Reuse, Recycle**
    - Find ways to make use of streams currently wasted