Lecture #1

Environmentally Responsible Design and Manufacturing

Prof. John W. Sutherland

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Contact Details

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Course Objectives

Acquaint students with the environmental issues surrounding product and process design decisions.

Identify/develop strategies, techniques, and methods that can used to make more environmentally responsible decisions.

Understand the “systems” nature of environmental challenges.

Course Topics

Introduction

- **Environmental measures (Global -- Local)**
- **Sustainability**
- **Laws & Regulations**
- **Control vs. ?**
- **Motivators**

Product Design

- **Life Cycles**
- **Materials**
- **Assembly & Disassembly**
- **QFD**
- **DFX**

More Course Topics

Process Design

- **Types & Wastes**
- **Process Impacts and how to measure them**
- **Plant Issues**
- **Input-Output Analysis**
- **Supply Chain Issues**

System Issues & Industrial Ecology

- **System Modeling**
- **Life Cycle Analysis**
- **Risk Assessment and Management**
- **Decision Making**
- **Future Steps**

Readings

Text

Graedel, T., and B. Allenby, Design for Environment, Prentice-Hall, 1998.

Other

- **Toward a Sustainable Future: Addressing the Long-term Effects of Motor Vehicle Transportation on Climate and Ecology, Special Report by Trans Res. Board of the Natl. Res Council, 1997.**
- **Brown, L., C. Flavin, S. Postel, Saving the Planet, W. W. Norton & Co., 1991.**
- **Handbook of Environmentally Conscious Manufacturing, C. Madu ed., Kluwer Acad., 2001.**
- **Graedel, T., Streamlined Life-Cycle Assessment, Prentice Hall, 1998.**
- **Graedel, T., and B. Allenby, Industrial Ecology, Prentice-Hall, 1995.**
- **OTA - U.S. Congress, Green Products by Design, 1992.**
- **Plus handouts and website links posted on the course webpage.**

Grading

Basis (graduate student breakdown in parentheses)

- **30% Homework (20%)**
- **30% Midterm Exam (25%)**
- **40% Final (35%)**
- **Graduate Project (20%)**

Grade Breakdown

- **Class GPA: approx. 3.0**
- **Graduate students graded separately**

Web Site

- **The course web site can be accessed from: http://www.me.mtu.edu/~jwsuther**

- **At the web-site, the following materials may be retrieved:**
  - **Course notes**
  - **Homeworks**
  - **listing of assignment results for both on- and off-campus students**
  - **other**

- **For listing of assignment results we need a 3 digit codeword -- btw, because we may need to have classes at other times -- need your schedule**

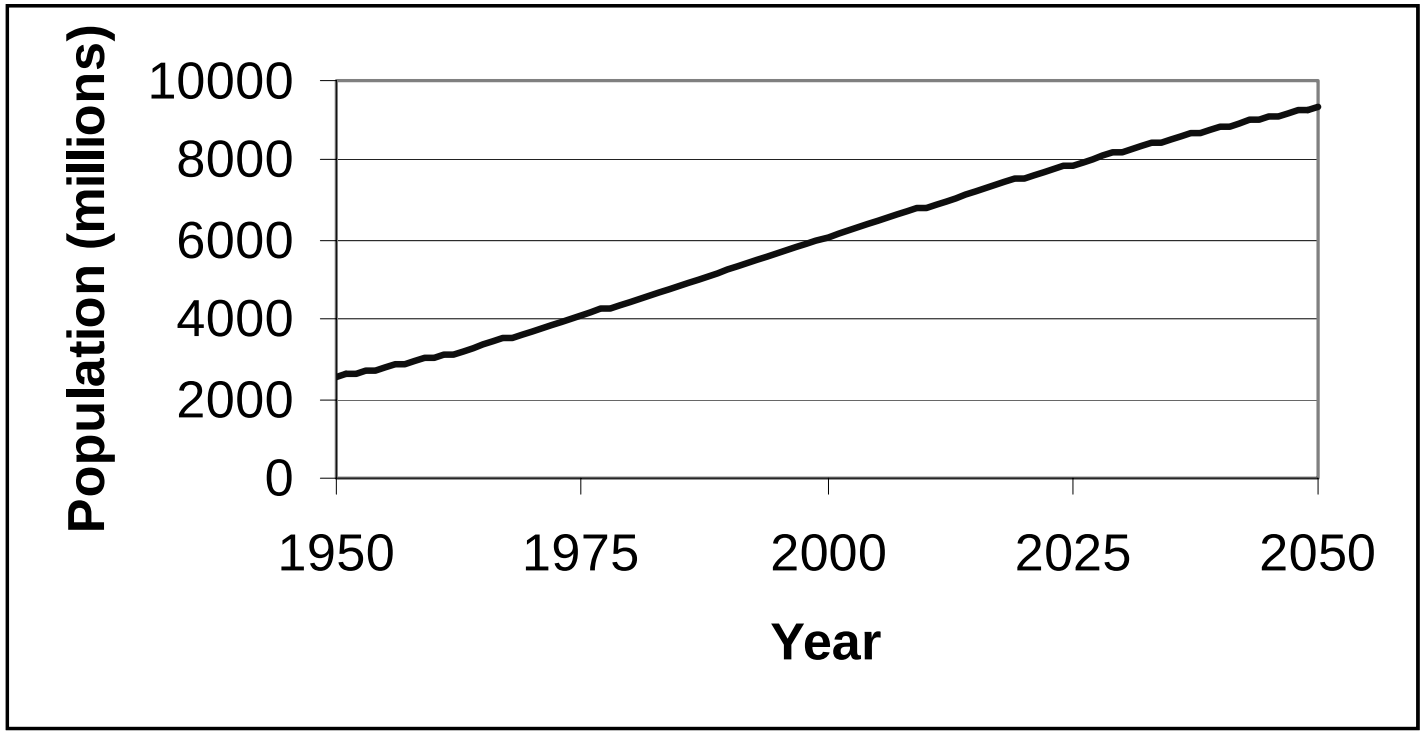
Assignment

- **Read Chapter 1 & Material Through Chap. 2 in WTEC EBM Report**

- **Problems:**

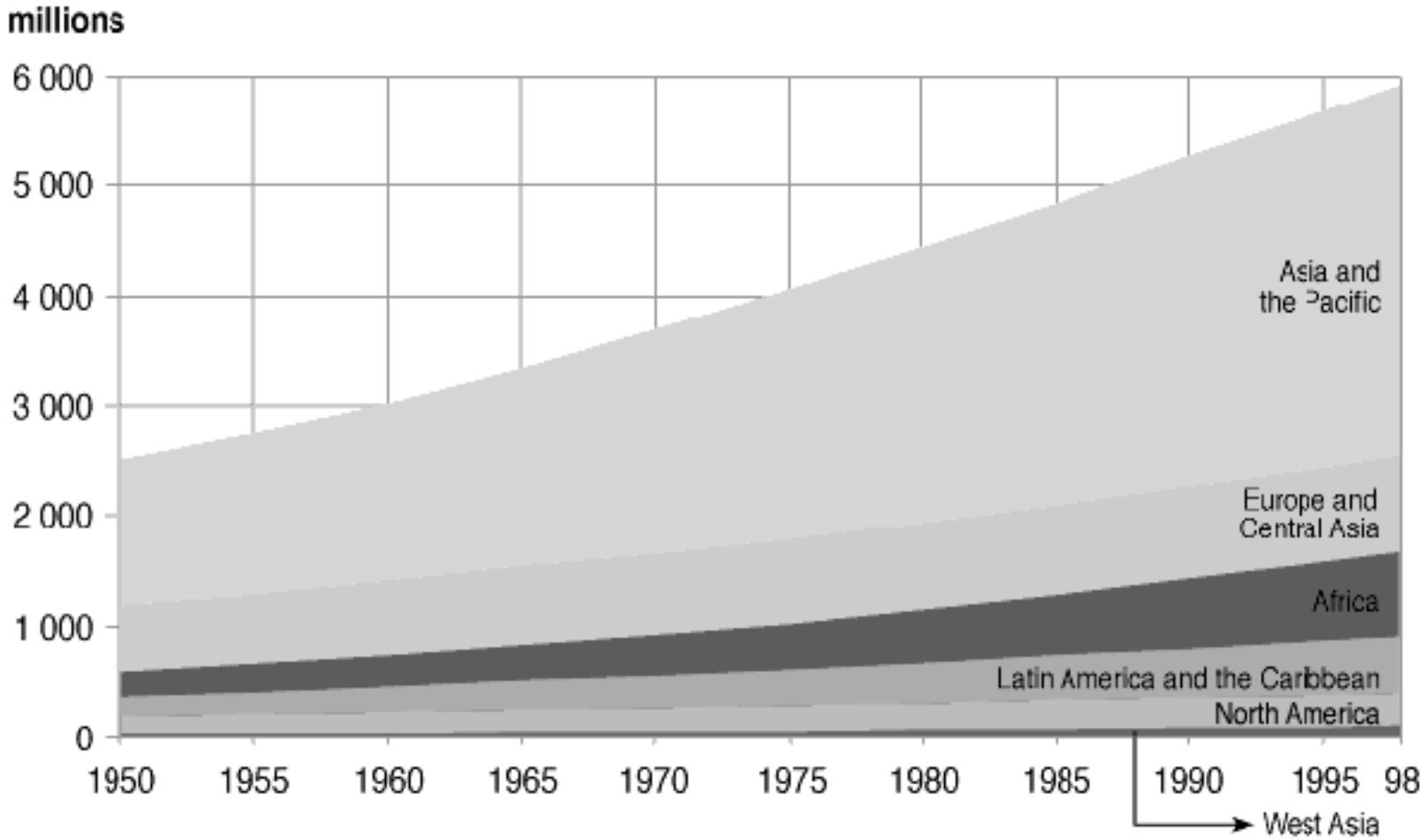
  Due next Monday (Jan. 19, 2004)

Why Focus on the Environment??



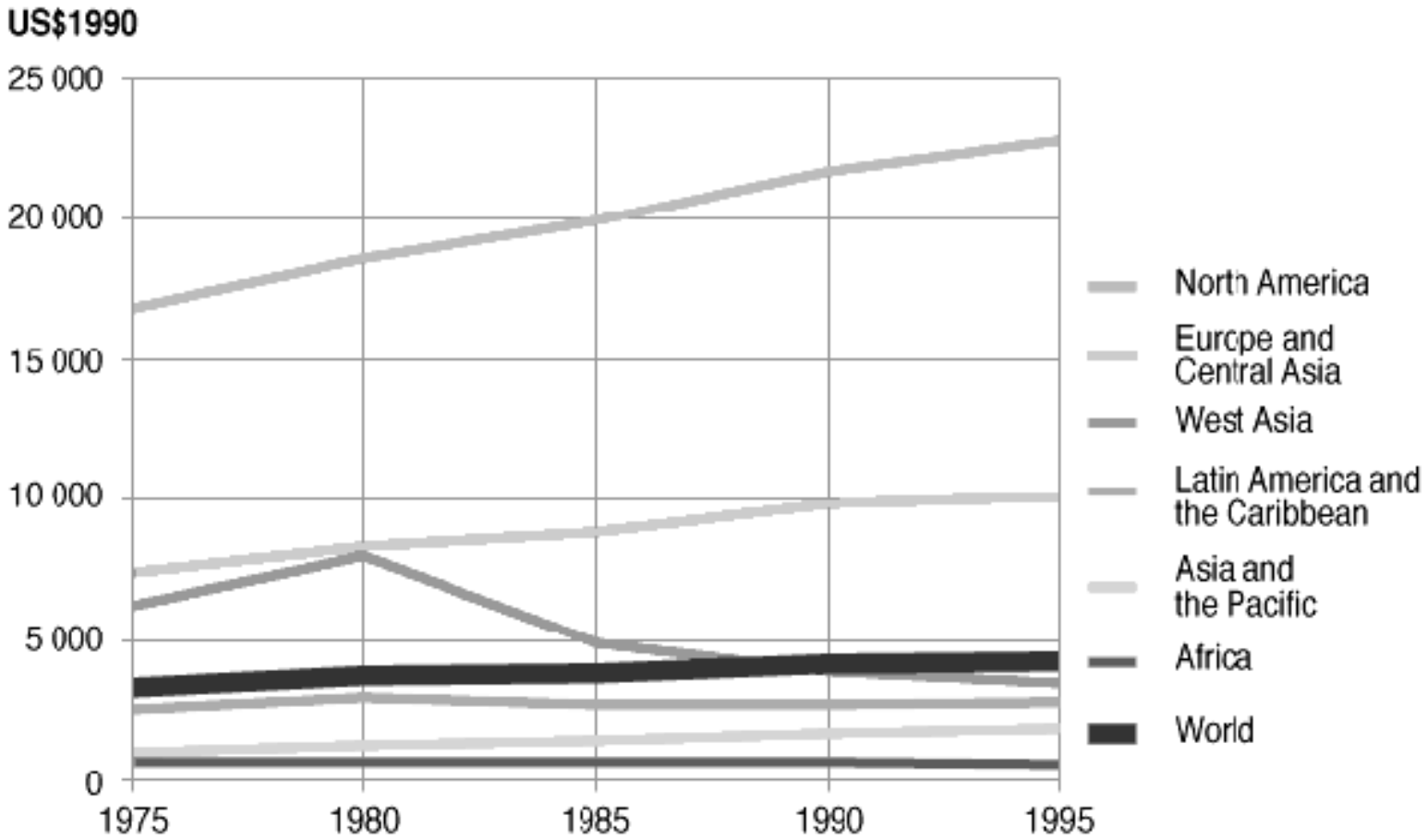
Can the earth continue to support an ever-increasing population??

Population Breakdown

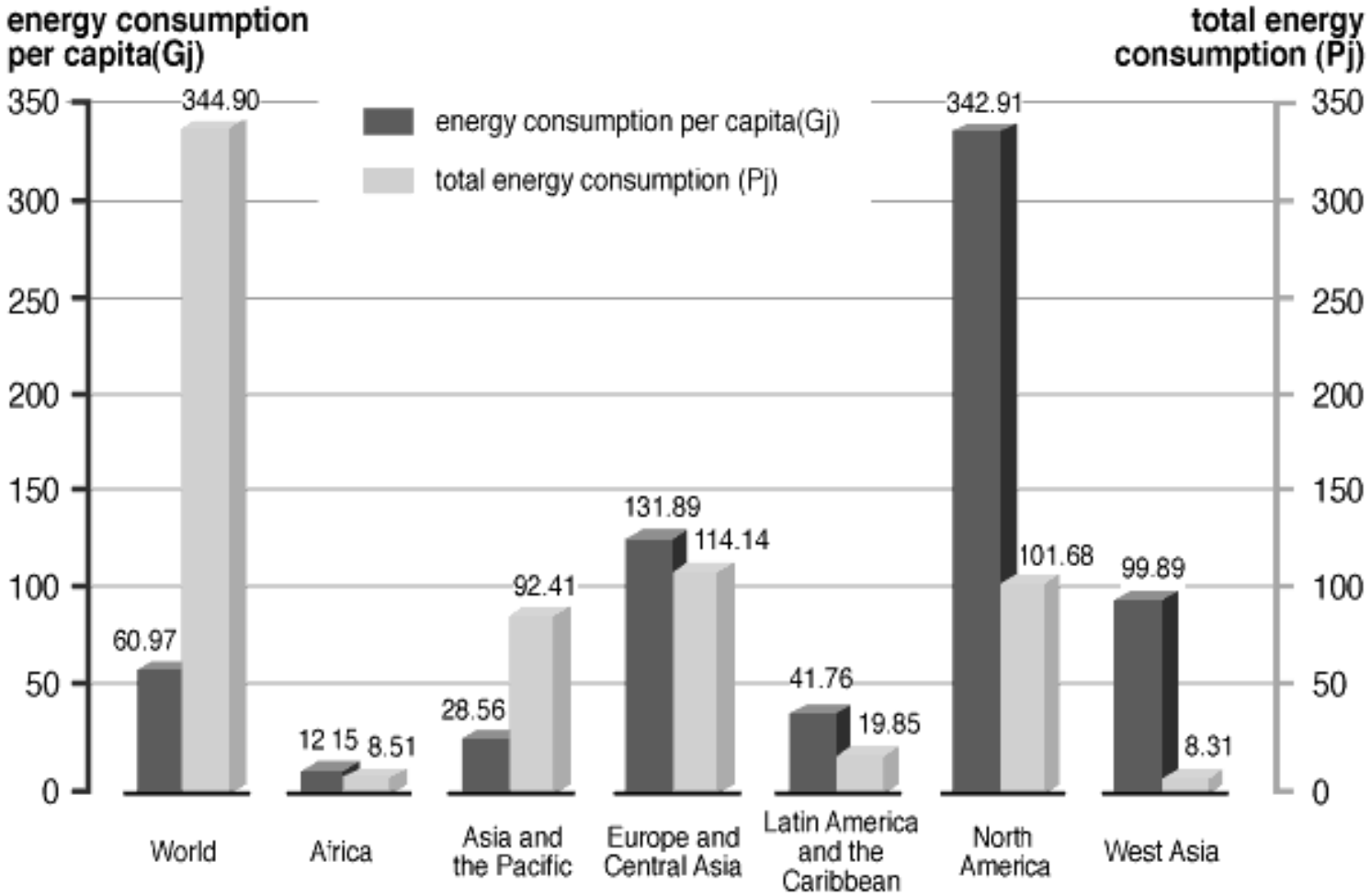


But, maybe population isn't the whole story.....

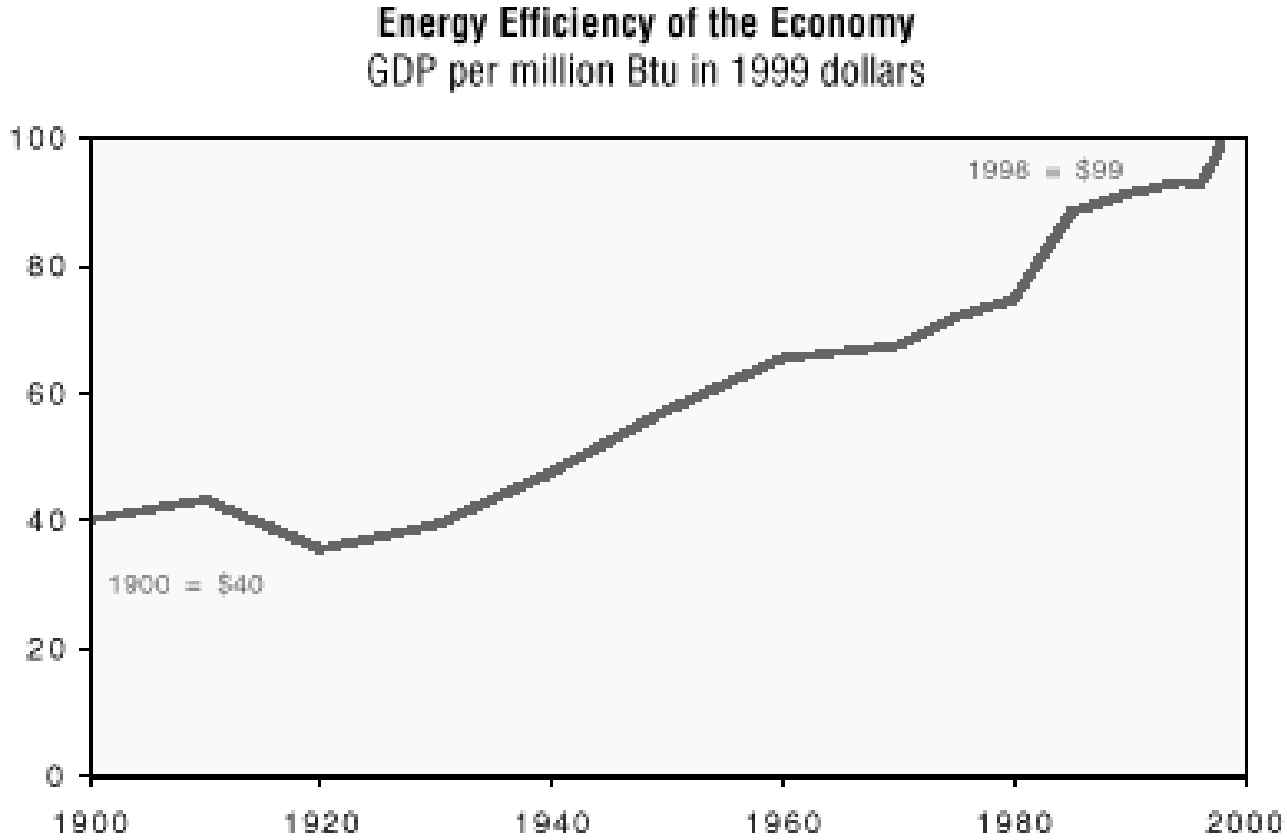
What About Spending? (GDP/Capita)



Energy Proportional to GDP/capita



Energy Efficiency of US Economy



The U.S. has become more efficient over time... Is it enough??

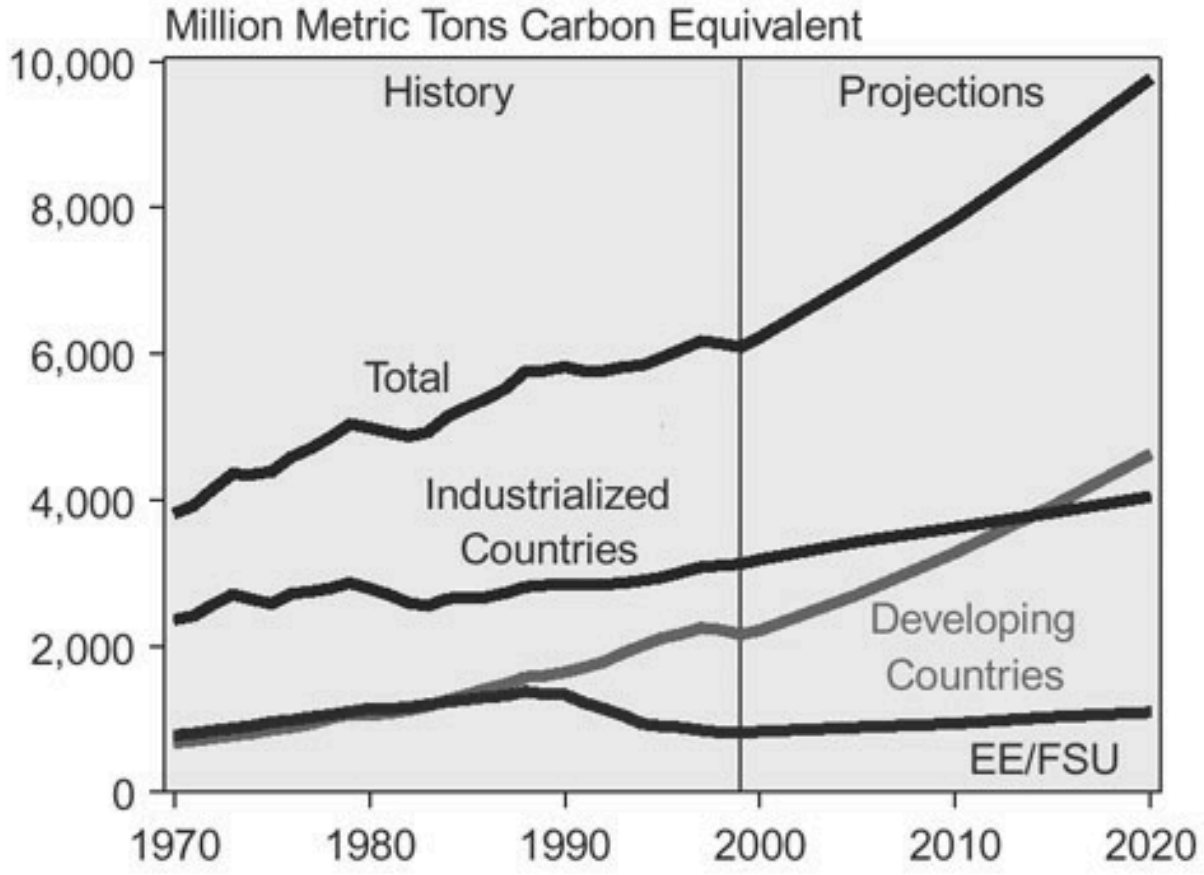
The Global Picture

Rank	GDP per capita (1999 World Factbook)	Growth Rate
1.	Luxembourg $32,700	5.7%
2.	United States $31,500	5.0%
3.	Bermuda $30,000	1.5%
4.	Switzerland$26,400	3.0%
5.	Singapore $26,300	10.10%
6.	Hong Kong $25,100	10.0%
7.	Monaco $25,000	N.A.
8.	Norway $24,700	2.7%
81.	Russia $4,000	6.3%
84.	China $3,600	6.0%
106.	India $1,720	8.0%

What are the consequences if developing countries follow same path as U.S.??

What About Emissions

As energy consumption increases, so do carbon emissions.



The Future

Maybe we can manage increased energy demands & carbon emissions?? What about energy sources??

As engineers, what should we be doing about all of this??