# Energy Management & Utilization

Chapter 1

## Introduction

Prof. Dr. Uğur Atikol, cea

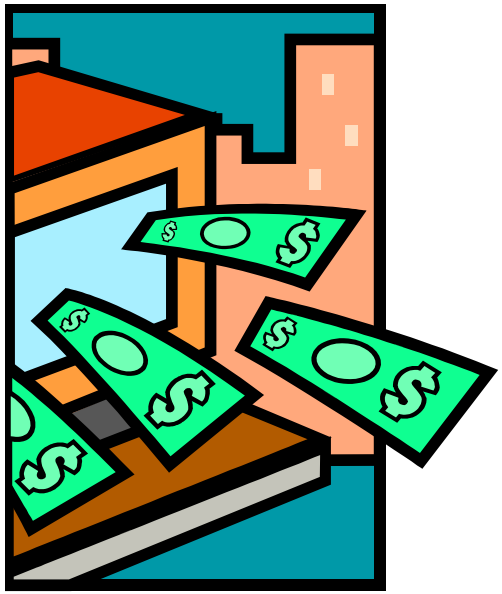
*Director of EMU Energy Research Centre*

# Primary objectives of Energy Management

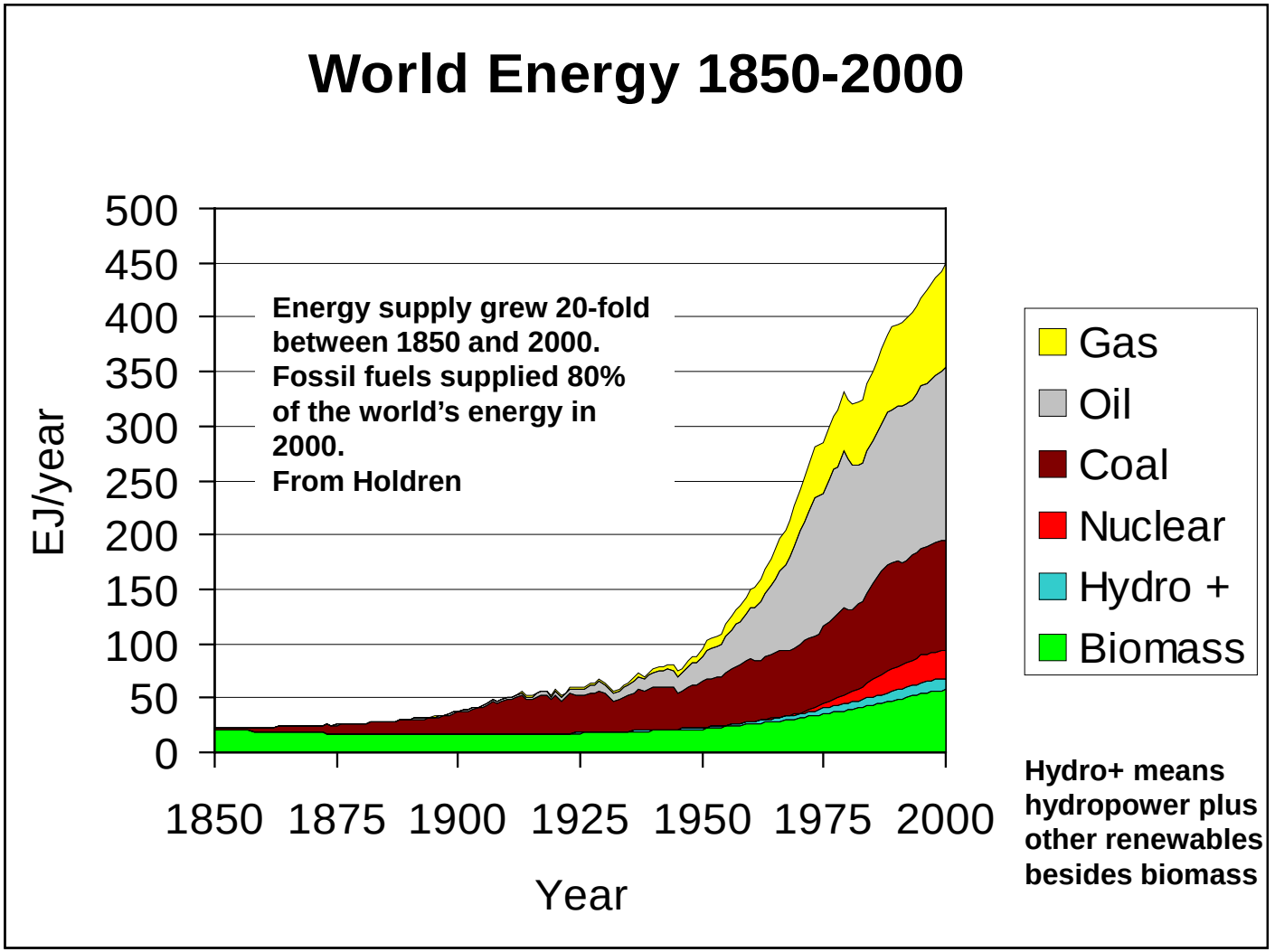
- Improving energy efficiency, reducing energy use, reducing costs, reducing impact on the environment
- Cultivating good communications on energy matters
- Effective monitoring, reporting and management strategies for wise energy usage
- Finding new and better ways to increase returns from energy investments
- Developing interest in energy programs from all emloyees
- Reducing the impacts of any interruption in energy supplies

# The Need for Energy Management

- Economics
- National interests
  - Using resources efficiently
    - Economics
    - Competitiveness
  - Increasing national security
- Reducing emissions
  - Acid rains (*caused by sulfur dioxide*)
  - Global warming (*caused by carbon dioxide*)
  - Depletion of ozone layer (*caused by CFC's and NOx*)

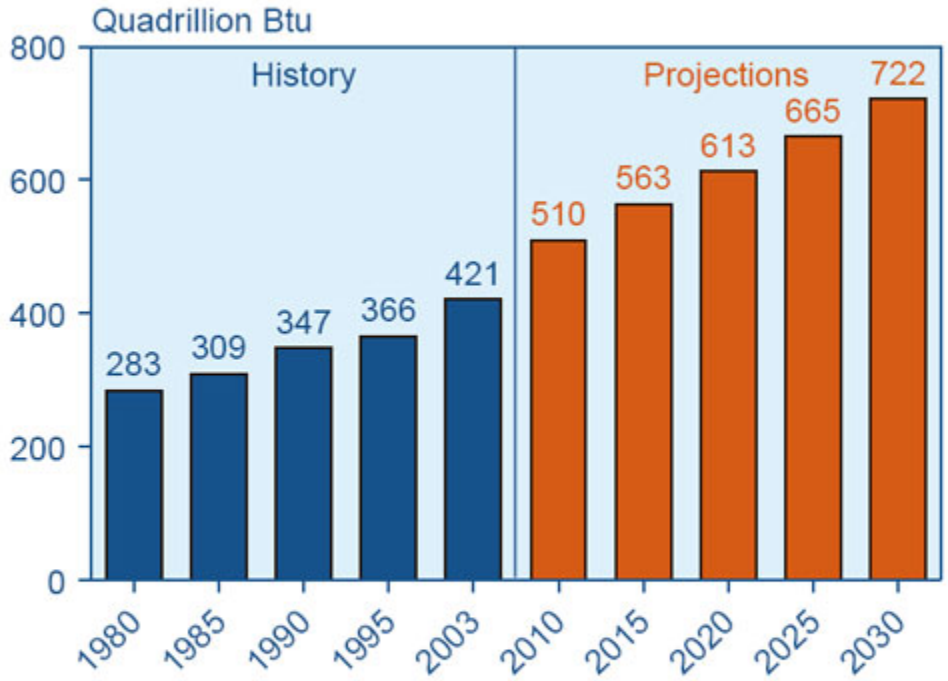


# History of world supply of primary energy: Continuous growth.



# …and that growth will continue

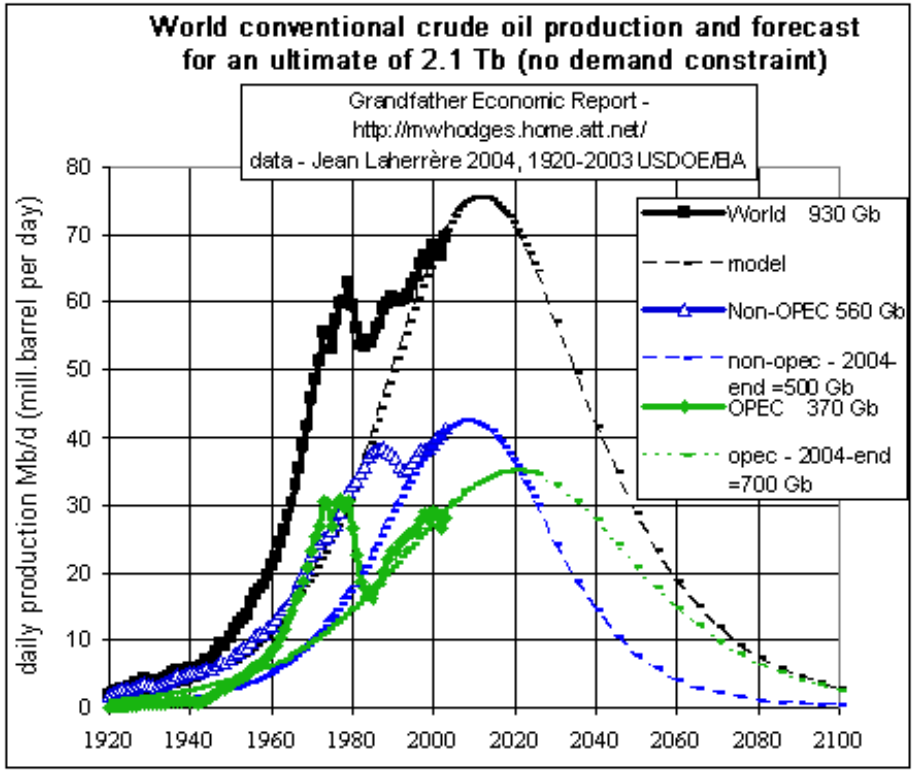
**Figure 7. World Marketed Energy Consumption, 1980-2030**

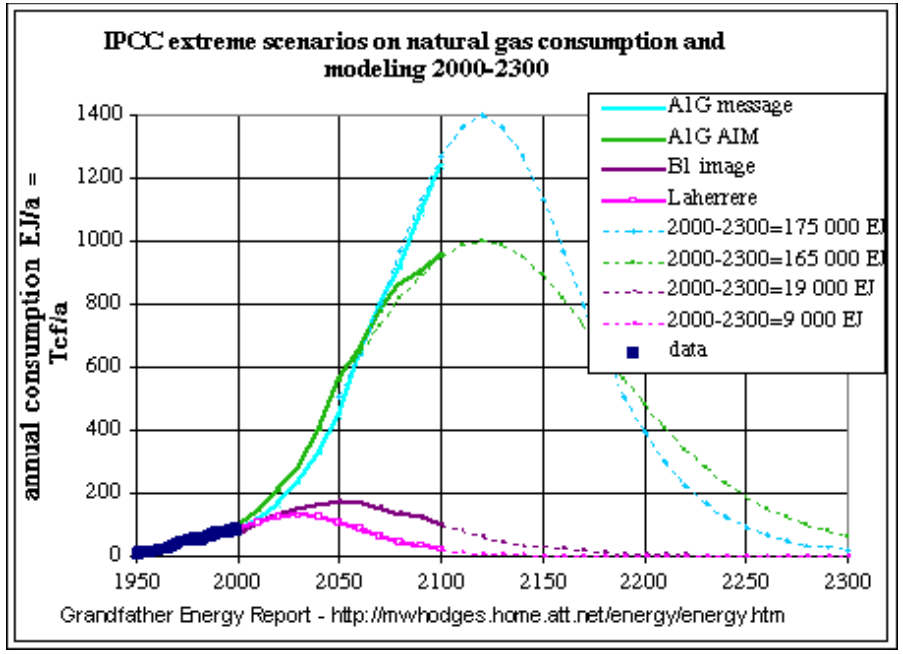



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea/. **Projections:** EIA, System for the Analysis of Global Energy Markets (2006).

# World energy reserves

## Petroleum and Natural gas



# Problems with business as usual (BAU)

- The problem with this path is not only that we won't have enough energy to meet projected demand
- The problem is the irreparable harm to the global environment that will result from current energy use patterns...
- …and the increased tensions between states as they compete for energy resources.

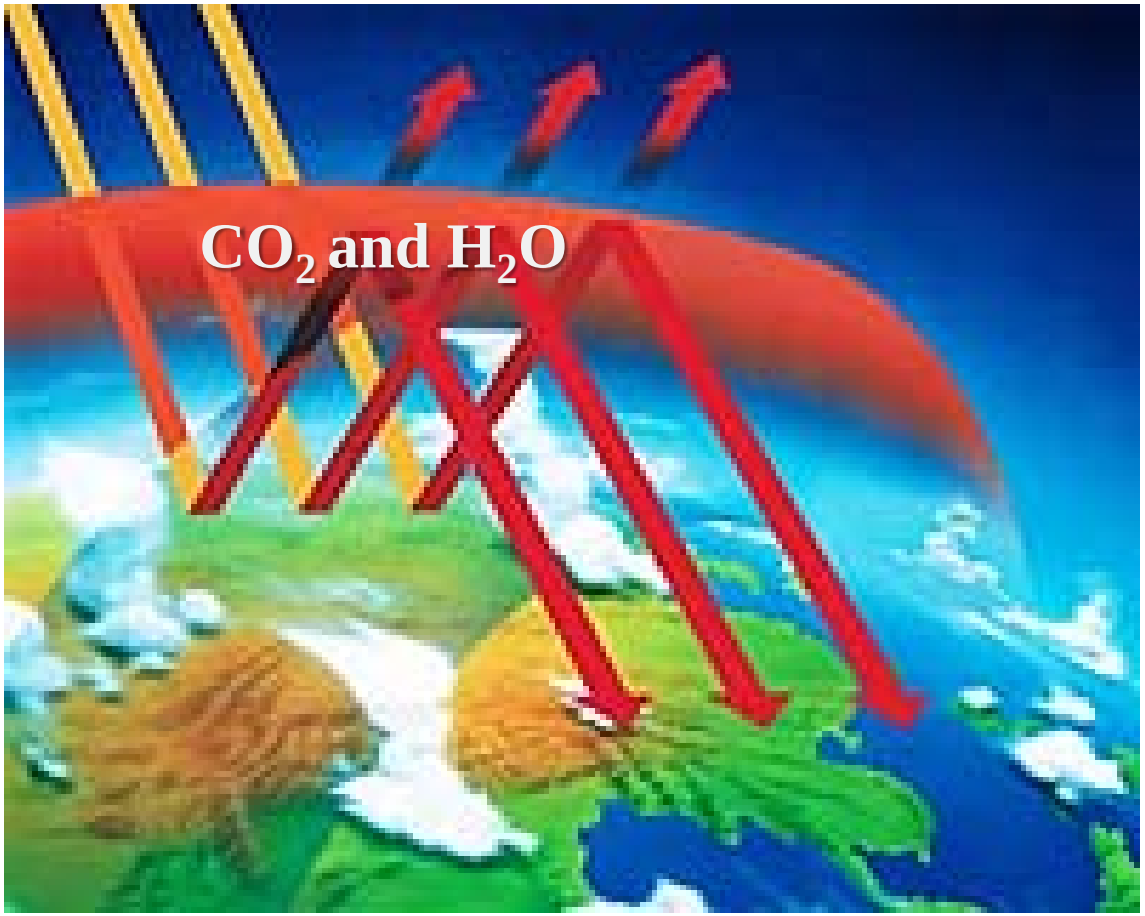
# Problems with business as usual (BAU)

- Energy use can be the source of most indoor and outdoor air pollution
- Energy use can be the source of most of the human-caused emissions of greenhouse gases that are ***altering the global climate.***
- Energy use can be the source of most radioactive waste.

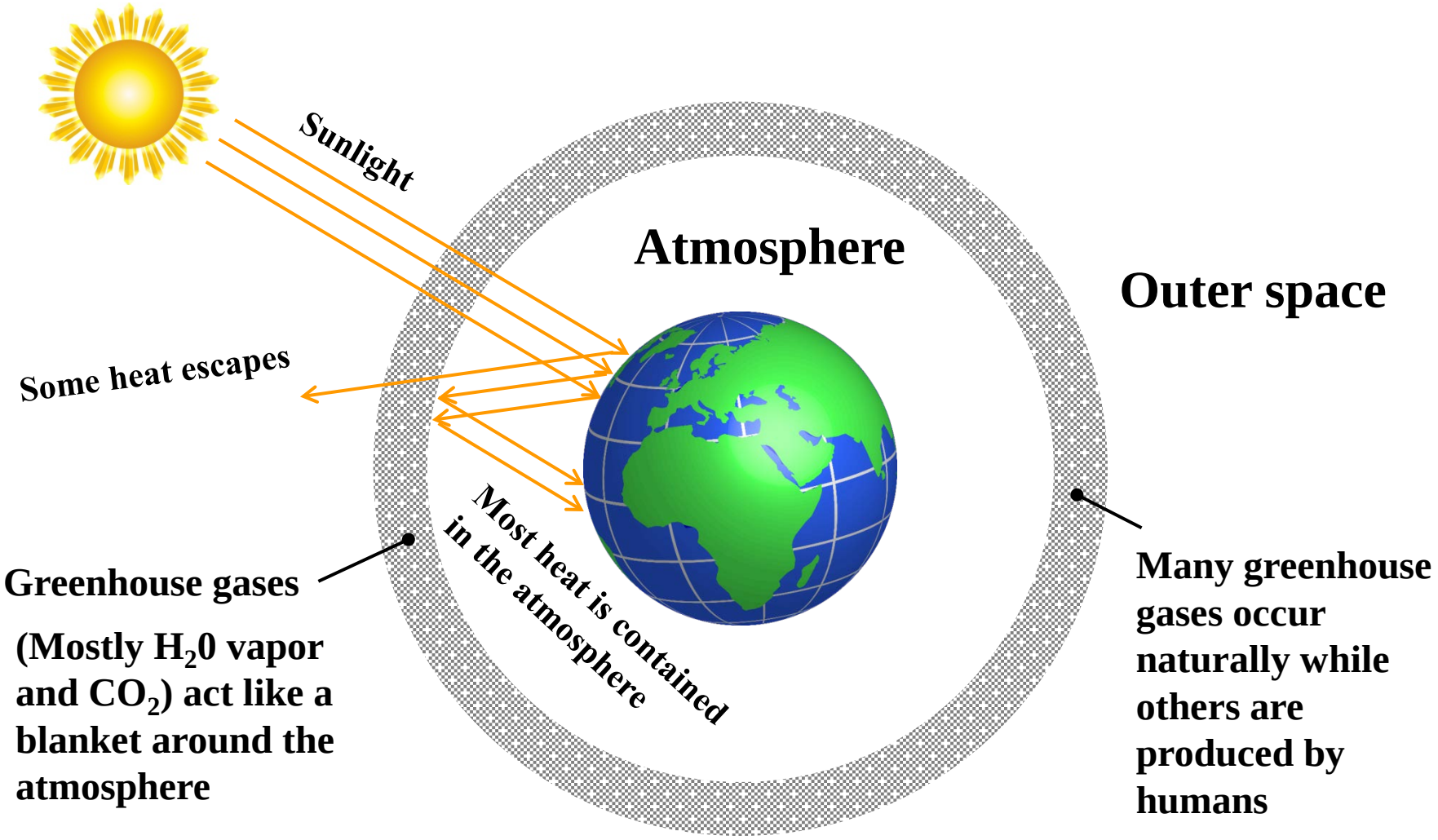
# Problems with business as usual (BAU)

- Energy use can be the source of much of the hydrocarbon and trace-metal pollution of soil and ground water.
- Energy use can be the source of many international and internal conflicts (Iraq war; Nigerian unrest; source of funds for terrorist activities, to name but a few)

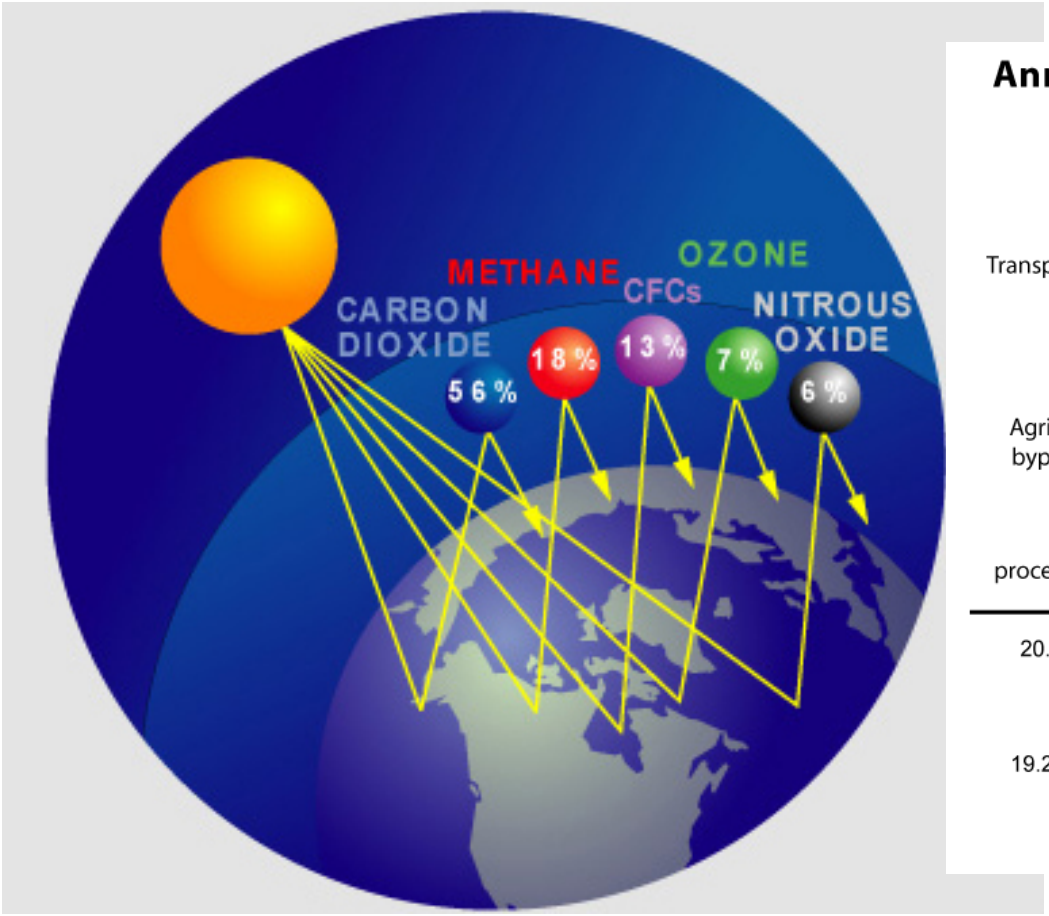
# Greenhouse effect and global warming

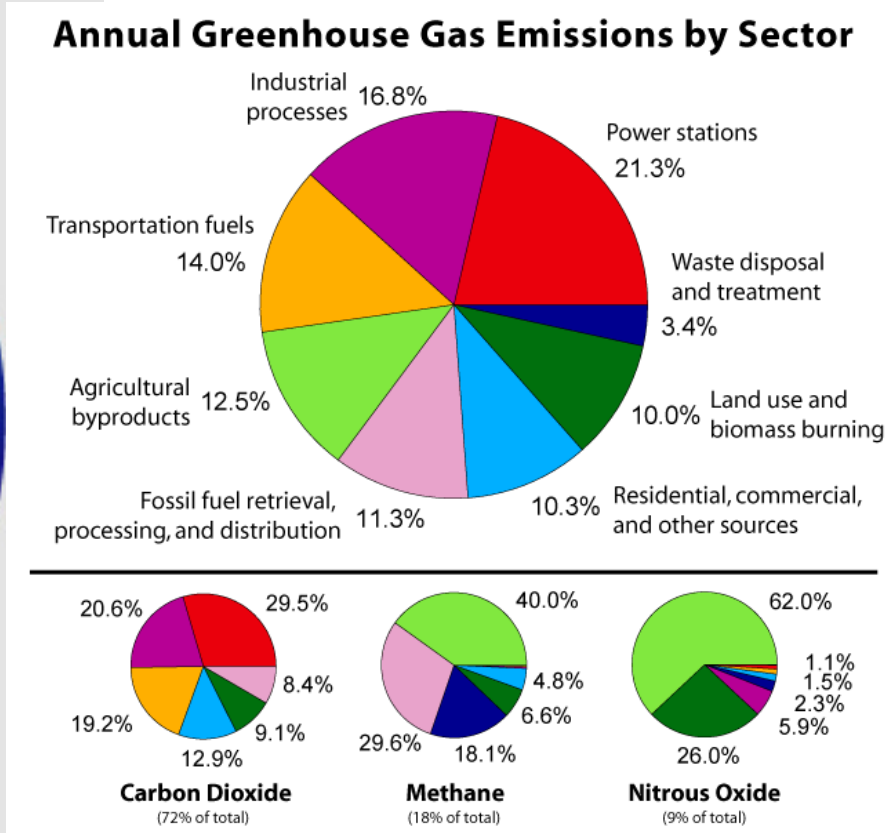


# Greenhouse Effect



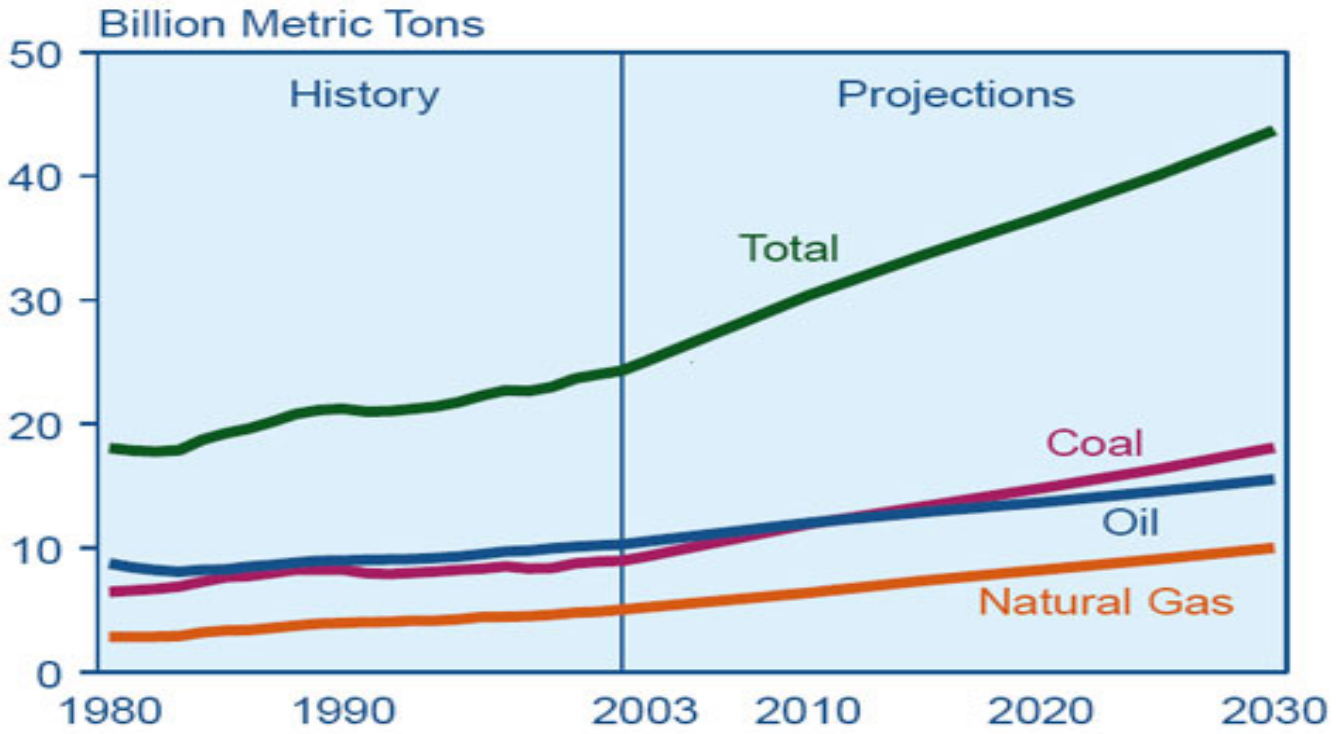
# Human-Produced Greenhouse Gases



# World $CO_2$ emissions

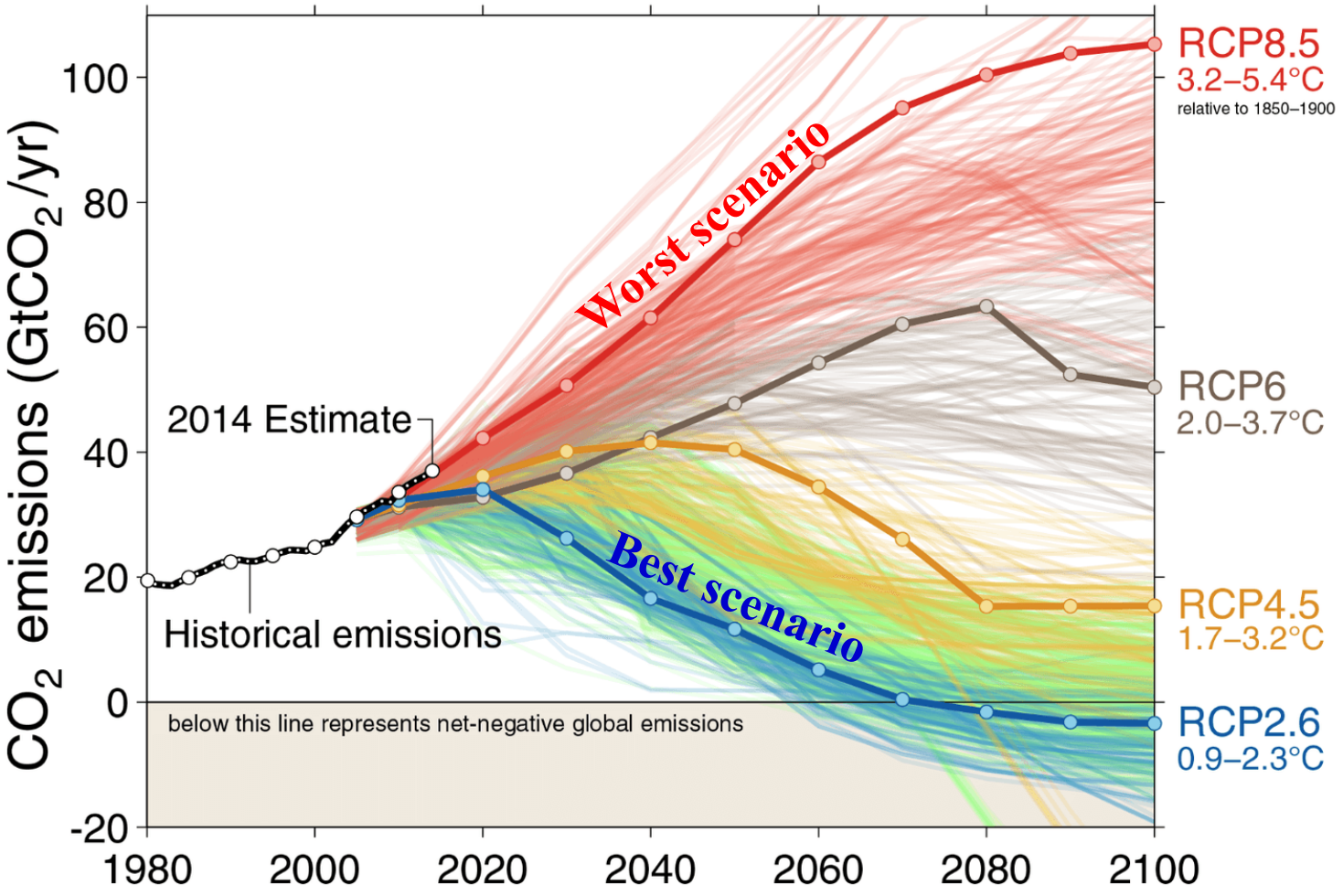
**Figure 66. World Carbon Dioxide Emissions by Fuel Type, 1980-2030**



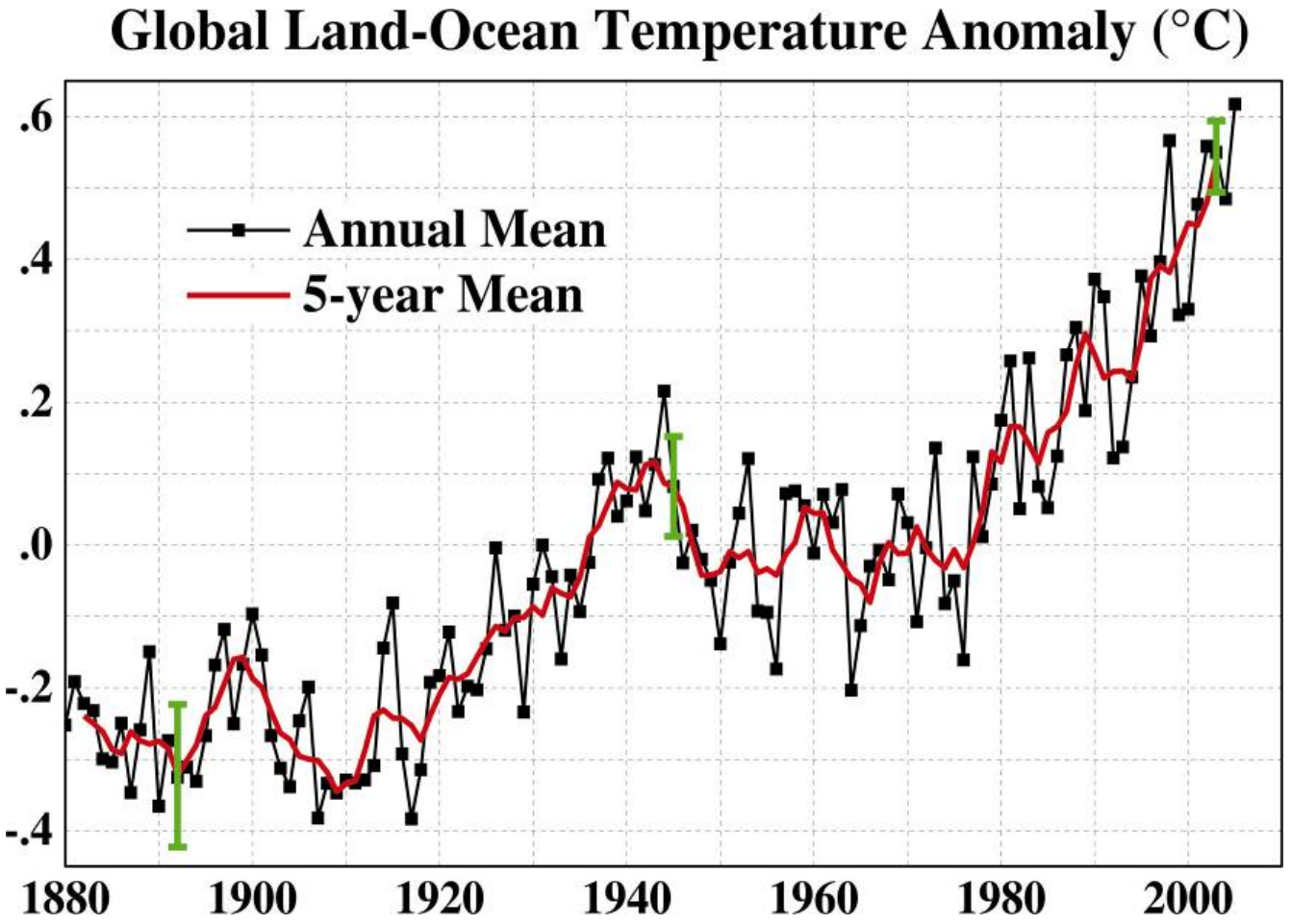

Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea/. **Projections:** EIA, System for the Analysis of Global Energy Markets (2006).

# Future $CO^2$ Scenarios

(Source: Intergovernmental Panel on Climate Change, 2014)



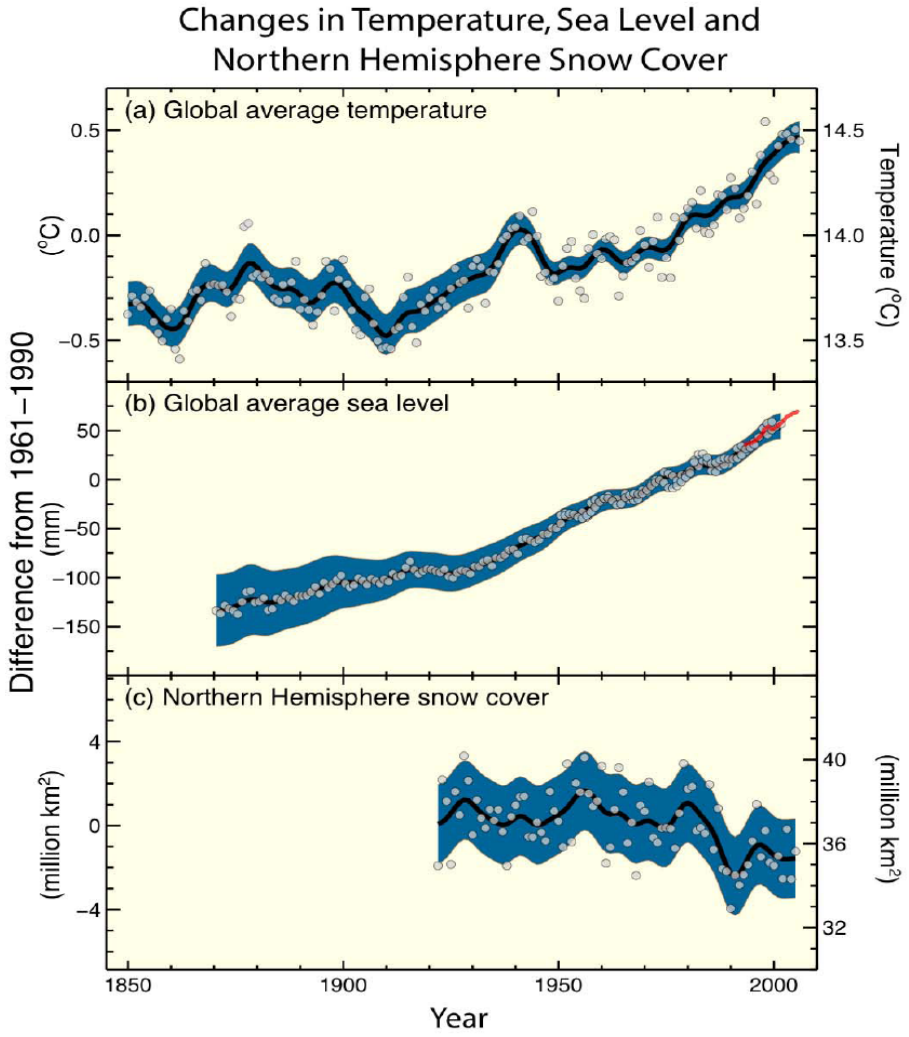
# The earth is getting warmer: Global Warming




**Global annual surface temperatures relative to 1951-1980 mean temperatures**

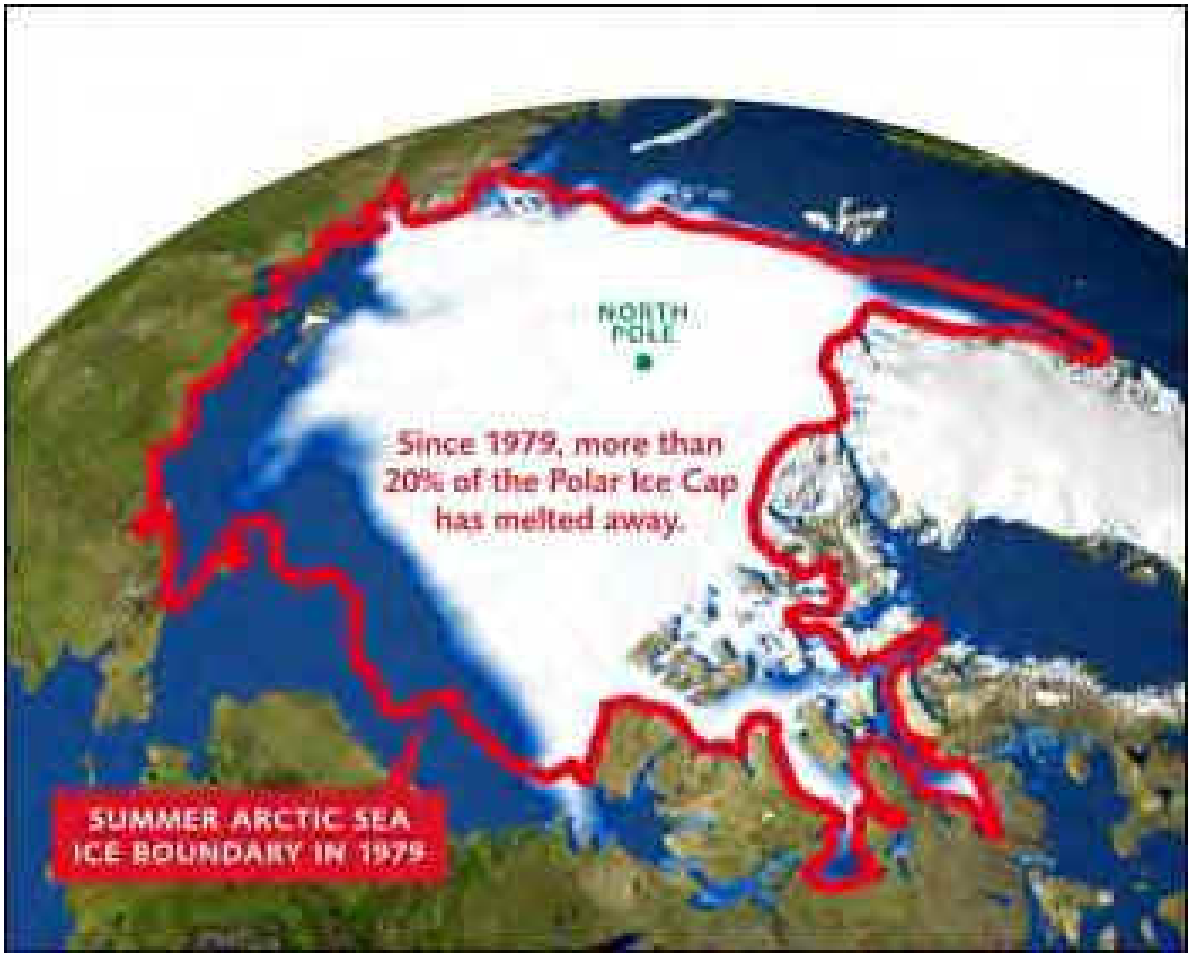
Source: J. Hansen et al., PNAS 103: 14288-293 (26 Sept 2006)

# Sea level is rising; snow cover is falling




Source: IPCC 2007

# Snow is melting in northern hemisphere



# Melting glaciers and temperature rise

- If global warming is causing ice glaciers to melt faster, the reduced ice cover over earth in turn is causing temperatures to rise further. Ice glaciers deflect almost 80% of the heat from the sun and absorb about 20% of the heat. When an ice glacier vanishes and exposes the earth below, 80% of the heat from the sun is absorbed by the earth, and only about 20% of this heat is deflected back.

Read more at Buzzle: http://www.buzzle.com/articles/global-warming-and-melting-glaciers.html

# Increase in sea level…

- Heat absorbed by the earth increases the temperature of the earth, which increases the temperature of sea water. Sea water expands with an increase in water temperature and causes sea levels to rise. Melting water from glaciers will finally empty into the sea, causing a further increase in sea levels. All low-lying areas near the sea will go under water and humans living here will be displaced. At the rate at which sea levels are rising, it is estimated that many South American and Asian countries will be the first to suffer from this effect.

  (Read more at Buzzle: http://www.buzzle.com/articles/global-warming-and-melting-glaciers.html)

# Snow is melting in northern hemisphere

There are many more effects that rapidly melting glaciers cause. While some areas will witness unprecedented floods, other areas will witness severe drought. In both cases, agriculture will be severely hit, causing scarcity of food grains. Nations depending on hydroelectricity will have to switch over to other sources to generate their electricity, in effect further polluting the atmosphere. Forest fires will happen more frequently (they already are in Australia and the US) causing great stress to humans living in the vicinity. The bad effects of rapidly melting ice glaciers are limitless.

# Water levels rising


# What should we do?

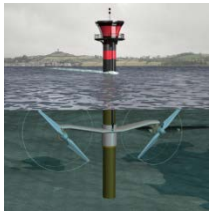
- Energy Management
  - Energy efficiency
  - Rational use of energy
  - Energy Conservation
- Energy Utilization
  - Exploration of clean energy sources
  - Utilization of innovative technologies
- New Energy Policies

**Sustainable use of energy**

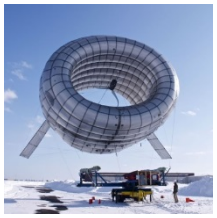
# What is Understood from Sustainable Provision of Energy

- Meeting the energy demand while at the same time avoiding or reducing the use of fossil fuels and guarding the environment in a cost-effective and healthy way
- Involves use of
  - Renewable energy systems
  - Energy efficiency

Solar photovoltaic



Wave energy



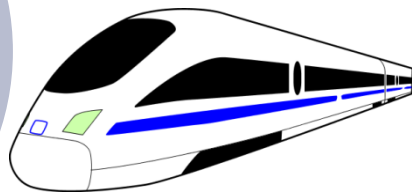
Wind energy

Bio-energy

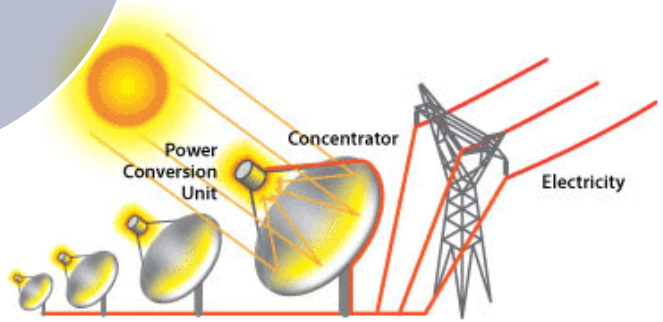
# Major sectors involved in sustainability


City planning, buildings and Industry

Mobility & transport sector

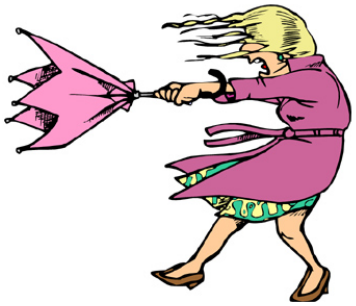


Energy & Power generation



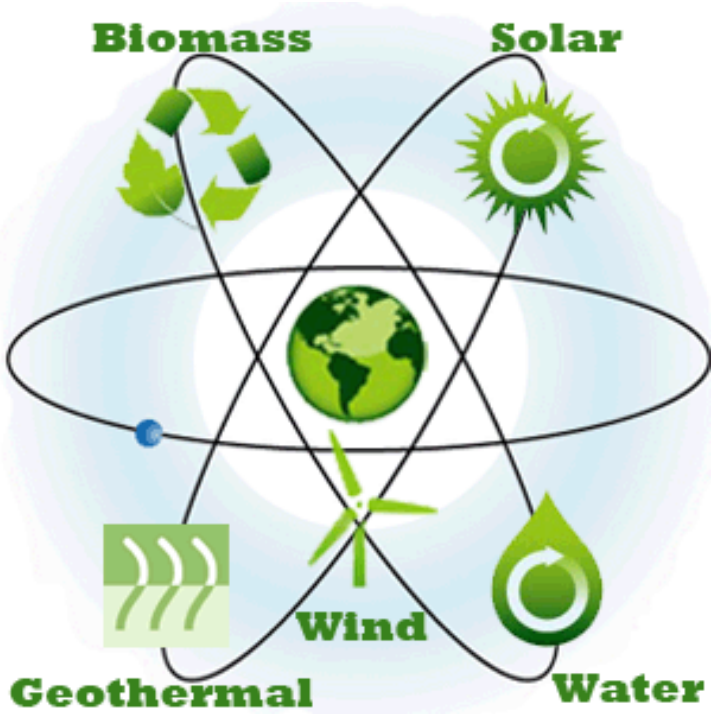
# What is Renewable Energy?

- **Renewable energy** is generally defined as the energy captured from naturally occurring and ongoing processes.
- Examples of naturally occurring events are sunlight, wind, rain, tides, waves and geothermal heat.


# Sources of Renewable Energy

- Solar
- Wind
- Hydropower
- Marine (Ocean)
- Geothermal
- Biomass
  - Wood and wood waste
  - Municipal solid waste
  - Landfill gas and biogas
  - Ethanol
  - Biodisel



# MENG 547 Grading Policy

- Mid-Term (20%)
- Assignment-I (10%)*
- Assignment-II (30%)**
- Final (40%)

*Short presention on the selected seminar topic (30 - 45 mins)

**Submission of the report on the seminar topic

(use format of Energy Conversion and Management – ISSN: 0196-8904)

# Assignment I - Presentation

**Presentation**

The presentation should have the following possible sections.

**Title of Presentation**

Student Name

1. **Brief introduction** *(with significance of the project)*
2. **Description of the technology or the system** (*Title can be different)*
    a. *Use diagrams to illustrate the general application or old system*
    b. *Explain in terms of diagram(s) how the new system works*
3. **Energy calculations** (*Show the equations used for energy calculations and explain them)*
4. **Cost** (*Indicate the investment required, operation and maintenance costs etc)*
5. **Conclusions**

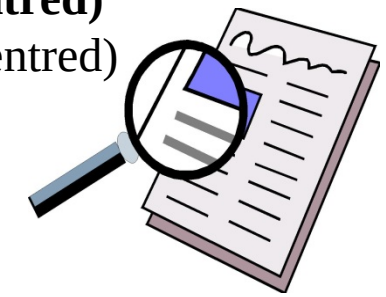
# Assignment II - Report Format

**Report Format**

The report should have the following possible sections. A suitable title should be chosen for each section. The text of the report should be 12pt Times New Roman.

**Title of Report (16 pt Times New Roman, Bold, Centred)**

Author Name (Upper Case, 12pt Times New Roman, centred)



**Abstract**

**1. Introduction** *(with a literature review)*

**2. Description of the technology or the system** (*Title can be different)*

- *a. What is it used for?*
- *b. How does it work?*

**3. Energy calculations** (*Comparison should be made with a reference case (old system) and energy savings should be calculated)in terms of energy and economics)*

**4. Economic feasibility** (*Life cycle cost analysis should be conducted and economic viability of the project should be determined)*

**5. Conclusions**

**References**

**Appendices**

# Suggestions for seminar titles for students

1. **Feasibility of solar photovoltaic (PV) system**
2. **Efficient lamps, applications and daylighting**
3. **Combined heat and power (CHP)**
4. **Feasibility of using efficient electrical machinery**
5. **Feasibility of cool (or ice) thermal storage**
6. **Feasibility of replacing chillers with VRV system**
7. **Feasibility of replacing old home airconditioner system with air-to-water heat pump system**
8. **Energy utilization technologies: Clean hydrogen energy**
9. **Solar energy utilization technplogies: Solar thermal power plants**
10. **Solar energy utilization technplogies: Solar cooling systems**
11. **Hydro-electric power**
12. **Electric cars**