

# **CE 213A**

# **Introduction to Environmental Science**

## **L 4 : Topic 1**

## **Conventional Energy Sources**

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***Schedule : LEC Mon Wed Fri 5: - 6pm***

# Today

- History of energy usage
- Natural resources
  - Renewable, Non-Renewable
- Energy sources, production and consumption
- Energy production and consumption
- Primary sources of energy (Fossil fuels)
  - Types, problems associated with usage
  - Advantages, disadvantages
- Sulfur in coal and associated problems, effect on ecosystem
- Natural resources and associated problems
- tragedy of the commons
- Sustainable development for Resource Preservation
- SDGs, Environmental Ethics

# **TYPE OF NATURAL RESOURCES**

# Classification of Resources

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Natural resources are categorized as :

- **Inexhaustible resources** cannot be used up.
  - Sunlight.
- **Renewable resources** can be replaced, but the process may take a long time.
  - Timber, soil.
- **Nonrenewable resources** cannot be replaced, as their formation took millions of years.
  - Coal, oil, natural gas.
- **Recyclable resources** can be used more than once.
  - Iron, aluminum, copper.

# Renewable vs. Non Renewable Resoruce

- We live in a world in which natural resources are limited. Water, air, soil, minerals, oil, the products we get from forests, grasslands, oceans and from agriculture and livestock, are all a part of our life support systems. Without them, life itself would be impossible
- Renewable resources: Natural resources which can be used but can be regenerated by natural processes provided if there is no intervention in natural regeneration cycle.
  - Ex: water, wood
- Non Renewable Resources: Those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations.
  - Example: minerals, fossil fuels.

# Renewable Resources

- Forests.
- Water.
- Energy.
  - Solar
  - Wind
  - Tidal
  - Geothermal
  - Others



# Renewable Resources

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- Sustainable yield
  - Highest rate at which a potentially renewable resource can be used without reducing its available supply throughout the world or in a particular area.
- Environmental Degradation
  - Depletion or destruction of a potentially renewable resource such as soil, grassland, forest, or wildlife that is used faster than it is naturally replenished. If such use continues, the resource becomes nonrenewable (on a human time scale) or nonexistent (extinct).

# Non-Renewable Resources

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- Resource that exists in a fixed amount (stock) in various places in the earth's crust and has the potential for renewal by geological, physical, and chemical processes taking place over hundreds of millions to billions of years.
  - Examples are copper, aluminum, iron, salt, clay, coal, and oil.
- Any potentially renewable resource can become non-renewable if used improperly
- Theoretically, never exhaust due to economic feasibility for extracting.

Non-renewable resources and natural capital degradation  
Extracting, processing and use come at an **environmental  
expense**



# **ENERGY SOURCES, PRODUCTION & CONSUMPTION**

# Energy Sources

- **Primary Energy sources-**
  - Fossil fuels (oil, natural gas, coal)
  - Nuclear energy
  - Falling water, geothermal, solar
- **Secondary Energy sources-**
  - Sources derived from a primary source like...
    - Electricity
    - Gasoline
    - Alcohol fuels (gasohol)

# **Natural Resources and associated problems**

## **Forest resources and associated problems**

1. Use and over-exploitation.
2. Deforestation.
3. Timber extraction.
4. Mining and its effects on forest.
5. Dams and their effects on forests and tribal people.

## **Water resources and associated problems**

1. Use and overutilization of water.
2. Floods, droughts etc.
3. Conflicts over water.
4. Dams and problems.

## **Food resources and associated problems**

1. World food problems.
2. Changes caused by agriculture and over grazing.
3. Effects of modern agriculture.
4. Fertilizer-pesticide problems.
5. Water logging and salinity.

## **Energy resources**

1. Growing energy needs.

## **Soil resources**

1. Land degradation.
2. Man-induced landslides.
3. Soil erosion and desertification.

## **Mineral resource and associated problems**

1. Use and exploitation.
2. Environmental effects of extracting and using minerals.

# **PRIMARY (NON-RENEWABLE) SOURCES OF ENERGY - FOSSIL FUELS**

# TYPES OF FOSSIL FUELS

1. Liquid Hydrocarbons- Petroleum (oil)
2. Coal
3. Natural Gas



Photo credit: California Energy Commission



# Efficiency in Energy conversion

- Laws of thermodynamics tell 2 things about converting heat energy from steam to work...
  - Conversion of heat to work is not 100% efficient because **a portion of the heat is wasted**
  - Efficiency of converting heat to work **increases** as the **heat temperature increases**.

# How is energy lost?

- About  $\frac{1}{2}$  of all primary energy is lost when converted to more useful forms
- **Coal**
  - 66% is lost to thermal conversion when energy in coal is converted to electricity.
  - 10% is lost when transmitted to you at home.
- **Oil**
  - 75% lost during distillation, transportation, storage, combustion in vehicles
- **Natural Gas**
  - 10% lost in shipping & processing
  - Most efficient and least polluting (has more H than C so produces less CO<sub>2</sub> when burned so contributes less to global warming.)

Concept of Calorific value