

WELCOME



Energy & Environmental Science

Energy and Environment L-T-P-C: 2-0-0-2

Syllabus:

Unit – 1 [4 Hours]: Present Energy resources in India and its sustainability:

Energy Demand Scenario in India, Different type of conventional Power Plant, Advantage and Disadvantage of conventional Power Plants, Conventional vs Non- conventional power generation.

Unit – 2 [4 Hours]: Basics of Solar Energy: Solar Thermal Energy; Solar Photovoltaic: Advantages and Disadvantages, Environmental impacts and safety.

Unit – 3 [4 Hours]: Wind Energy: Power and energy from wind turbines, India's wind energy potential, Types of wind turbines, Offshore Wind energy, Environmental benefits and impacts.

Unit – 4 [4 Hours]: Biomass Resources: Biomass conversion Technologies, Feedstock pre-processing and treatment methods, Bioenergy program in India, Environmental benefits and impacts; **Other energy sources: Geothermal Energy resources, Ocean Thermal Energy Conversion, Tidal Energy.**

Unit – 5 [4 Hours]: Air pollution: Sources, effects, control, air quality standards, air pollution act, air pollution measurement; **Water Pollution:** Sources and impacts; **Soil Pollution:** Sources and impacts, disposal of solid waste. **Noise pollution**

Unit – 6 [4 Hours]: Greenhouse gases effect, acid rain; Pollution aspects of various power plants; **Fossil fuels and impacts, Industrial and transport emissions impacts.**

Course Objectives

Learning Objectives



The objective of the course to teach

- ☐ the **principal renewable energy systems,**
- ☐ the **environmental impact of various energy sources** and
- ☐ the **effects of different types of pollutants**

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Unit – 1

Present Energy resources in India and its sustainability:

- ☐ **Global Energy Scenario and Global Environmental Issues**
- ☐ **Different types of Energy sources: Conventional vs Non-conventional Energy**

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Faculty



Dr. P. Dharmalingam

B.Tech (Hons), PGEM (Energy Management), M.S, Ph.D.

Accredited Energy Auditor

ENSAVE ACADEMY

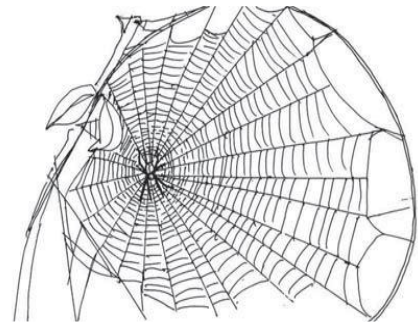
- Accredited Energy Auditor (BEE)
- Certified ISO 50001 –EnMS Auditor
- CMVP & Green Building Professionals
- 35 Years of Energy Auditing experience in India & Abroad
 - Conducted >450 +Energy Audit in Industry & buildings
 - Trained >20,000+ engineers in energy efficiency, plant utilities, green buildings etc.
 - Developed >250+ certified energy auditor in Iran, Nepal, Fiji, APO, UNEP, Egypt, Ghana
- ✓ Lead-author of BEE Energy Efficiency guide books
- ✓ Established Practical Energy efficiency Centre @NPC Chennai
- ✓ Recipient of AEE's Asia Subcontinent Region Energy Professional Development Award for 2017 ,USA.

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Energy and Environmental studies

Definition

- Energy and Environmental studies deals with **every issue that affects an organism.**
- It is essentially a **multidisciplinary approach** that brings about an appreciation of **our natural world and human impacts on its integrity.**
- It is an **applied science as its seeks practical answers** to making human civilization sustainable on the earth's finite resources.
- Its components include biology, geology, chemistry, physics, engineering, sociology, health, anthropology, economics, statistics, computers and philosophy.



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Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use , deforestation. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources


d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, waterlogging, salinity

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.

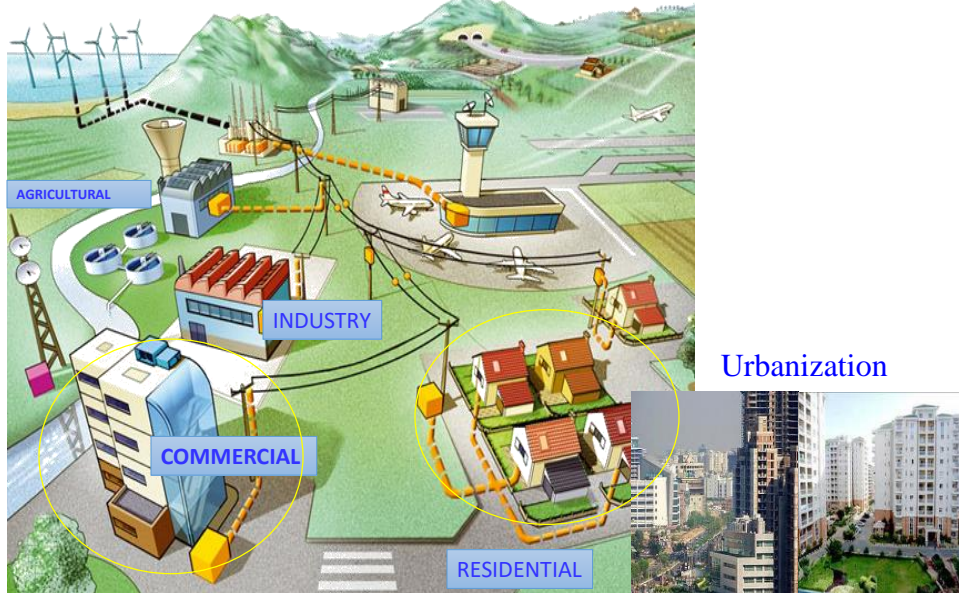
f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

What are the Role of an individual in conservation of natural resources?

Civil Society Perspective

	People need energy	<ul style="list-style-type: none"> • For domestic use • For infrastructure requirements • For entrepreneurial needs
	People need energy	<ul style="list-style-type: none"> • That is affordable • That is supplied un-interrupted
	People need energy	<ul style="list-style-type: none"> • That does not pollute environment during production and transmission • Use of which does not result in environmental degradation

Which Sectors accounts for higher Resource consumption and why?



Global Issue

Focus Issues



- Climate change
- ▶ Water pollution
- ▶ Human health
- ▶ Natural resource depletion
- ▶ Ecological degradation
- ▶ Water scarcity
- ▶ Energy security

By 2035, 75% of buildings will be new or renovated

What's the biggest problem facing humanity over the next 50 years?

Humanity's ten top problems for next 50 years

1. **ENERGY**
2. WATER
3. FOOD
4. ENVIRONMENT
5. POVERTY
6. TERRORISM & WAR
7. DISEASE
8. EDUCATION
9. DEMOCRACY
10. POPULATION



2. History of Energy Usage

I-Fire



II-Animals, Wind & water usage



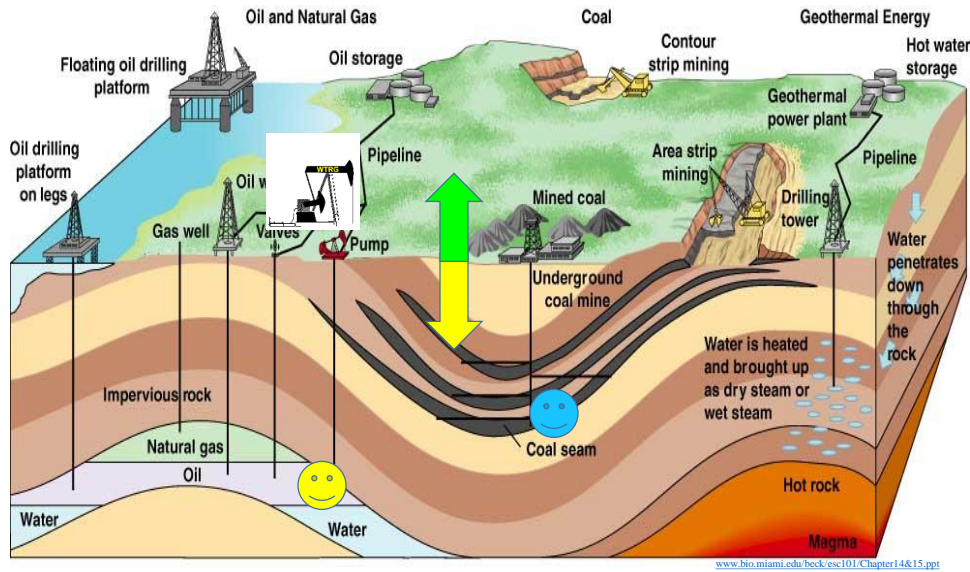
III -Steam engines powered by coal. Then use of oil & Gas more (1800 AD)



Renewable energy(1979)

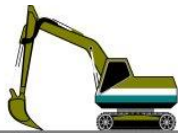


Energy resources removed from the earth's crust include: oil, natural gas, coal, and uranium



Environmental impact of coal mining

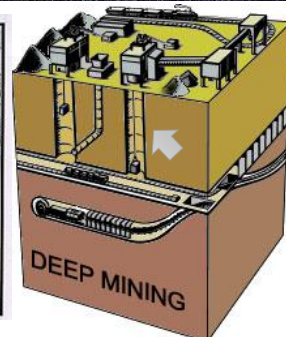
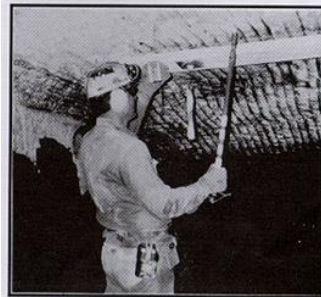
SURFACE MINING



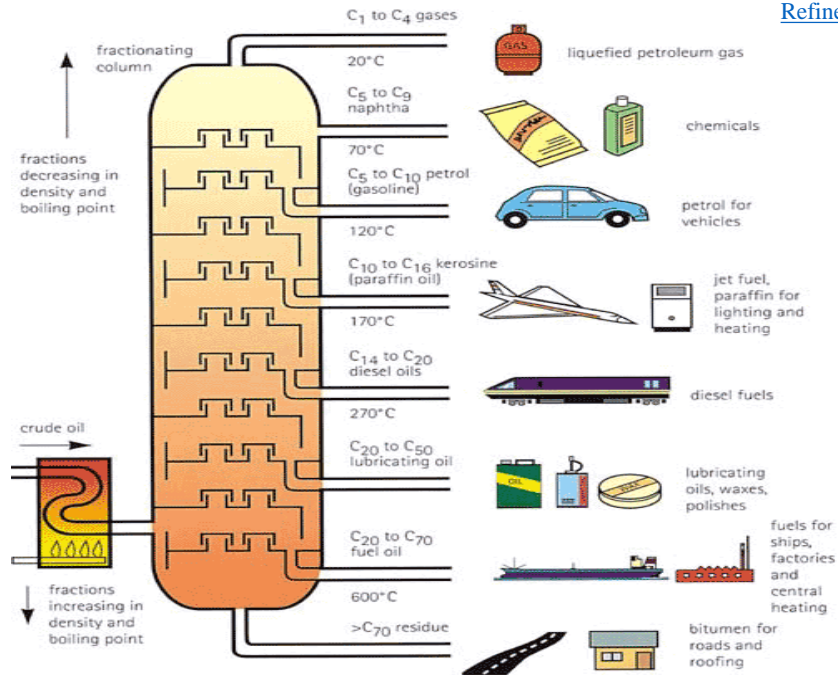
Top Soil
Overburden

Shallow Coal Seam

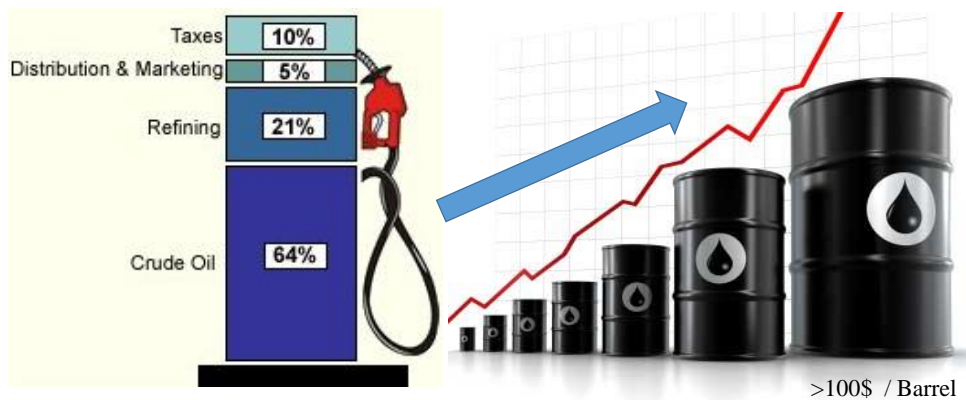
- In surface mining, removed the top-soil and layers of rock to expose large beds of coal.
- **Underground mining**, sometimes called deep mining, is used when the coal is buried several hundred feet below the surface. Some underground mines are **1,000 feet deep**.



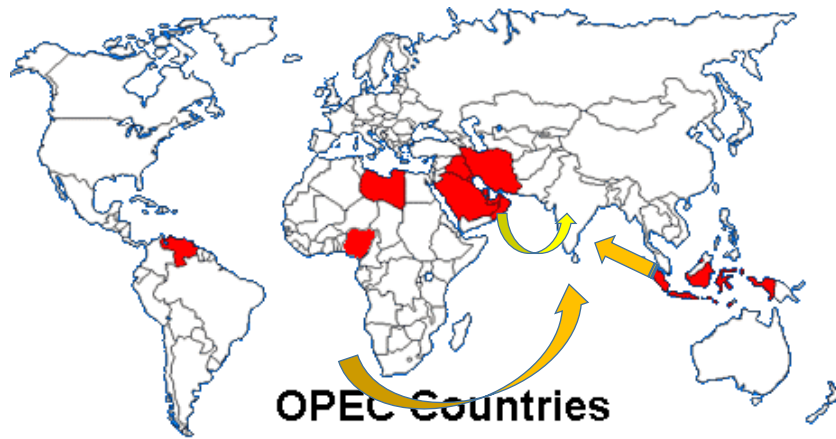
Refinery



Volatile Crude Oil Prices

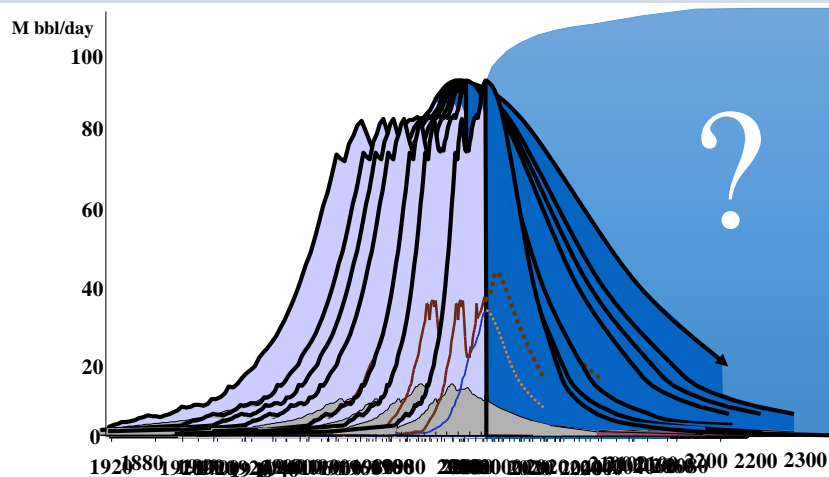


Who are Exporting Oil ?



- Organization of Petroleum Exporting Countries-OPEC

The Big Picture – Oil Production over History



World Energy Modeling

Life of energy Resources



Oil – 40 years !



Gas – 60 years !



Coal – 100 years !

HISTORY



All will be **depleted** by the end of the 21st century

One of the scenarios with respect to an extremely “energy hungry” world

Year 1900



Year 1800
Year 2050

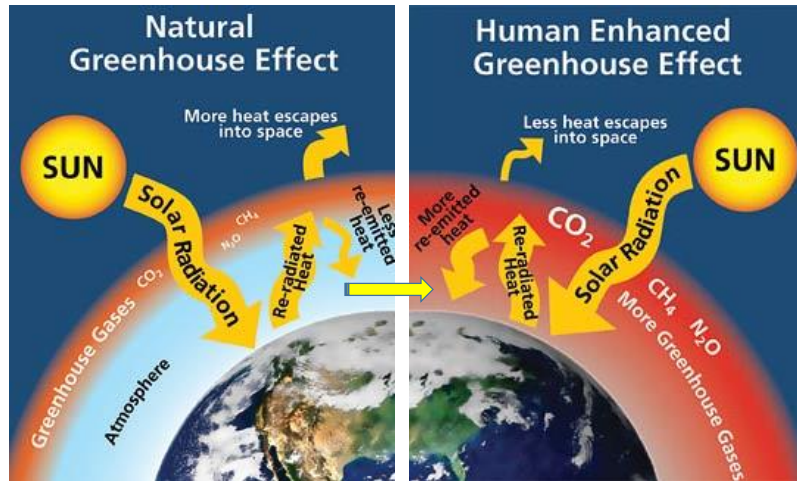


Year 2000
CFL

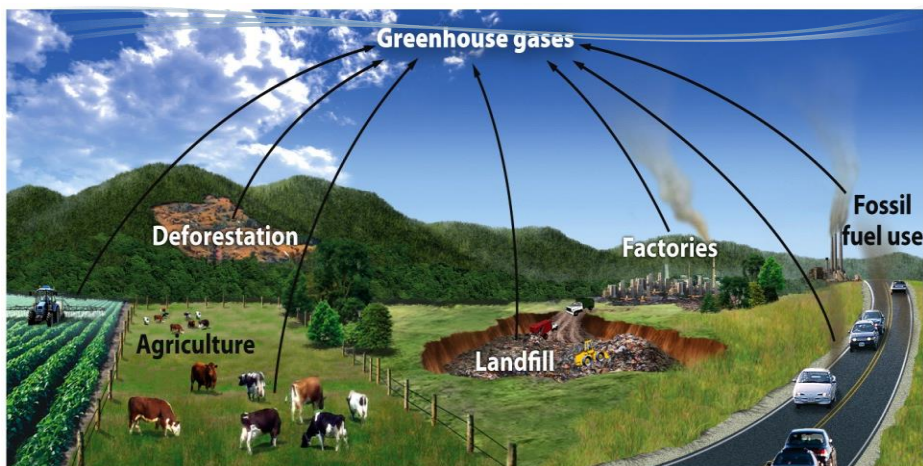


Year 2020, LED

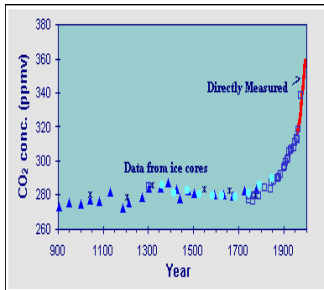
Enhanced Green house effect



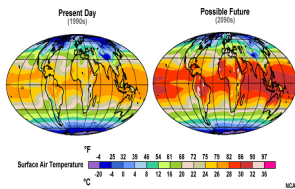
Building & Green House Gas – Major Causes



Energy sources have different impacts or effects on the environment.



- Impurities are **major source of pollution**
 - SO_2 travels on air currents & falls with precip. as **acid rain**



- Burning fossil fuels produces large amounts of CO_2 , which contributes **to global warming**



Effects of Global Warming

- ✓ Snow and Ice Melting
- ✓ Altered Rainfall Patterns
- ✓ Increasing ocean temperature & rising sea levels
- ✓ Extreme Weather Events
- ✓ Loss of Biodiversity
- ✓ Increased diseases
- ✓ Dwindling fresh water supply
- ✓ Food Shortages

Increased Temperature



Habitat Damage and Species Affected





Increase in Global surface temperature leads to Extreme Weather

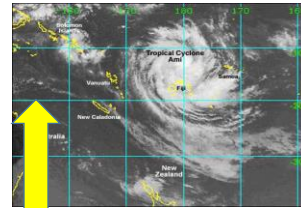


One third of the world's population is now subject to water scarcity

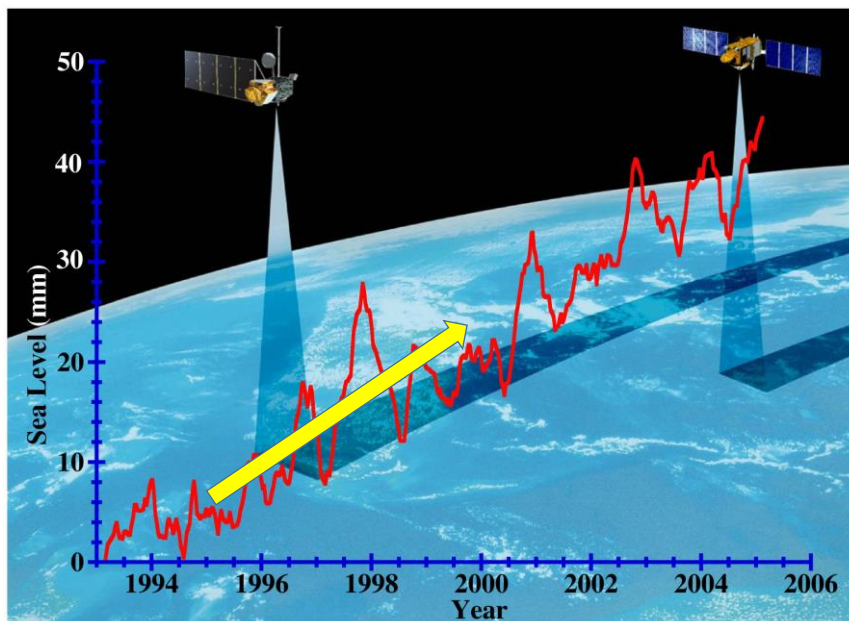


Population facing water scarcity will more than double over the next 30 years

✓ Altered Rainfall Patterns



Sea-level from satellites: 4 cm rise in last 10 years



Rising Sea Levels Threaten Low-lying Islands

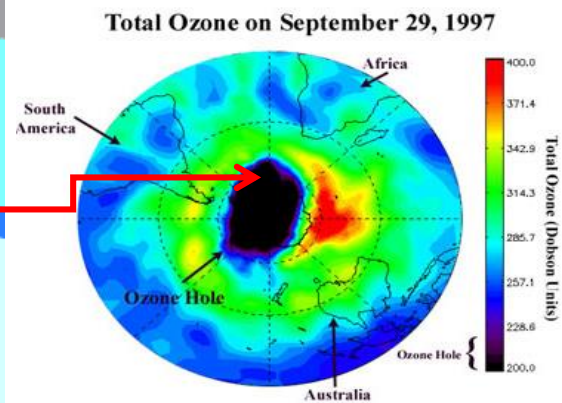
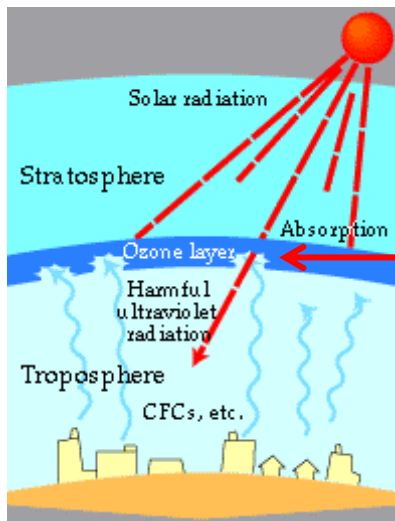
Areas of Florida, U.S., to Flood If Average Sea Level Rises by One Meter



Low-Lying Island Nation: Maldives in the Indian Ocean



Ozone layer Depletion



UV-B Effects on Human Effects

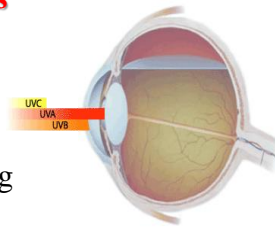
Over exposure may:

- Increase **risk of skin cancer**
- severe **sunburns** – especially in childhood
- **Suppress immune** system
- Accelerate **aging** of skin due high exposure



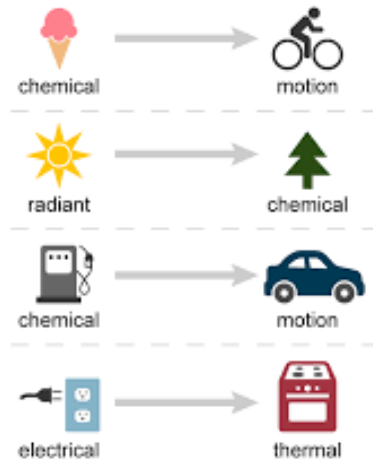
Increases the **risk of cataracts**

- Induces type of protein that provokes splitting in the lens
- Leading cause of **blindness**
- cataract after age 30 is doubling each decade



Different Energy sources and Types

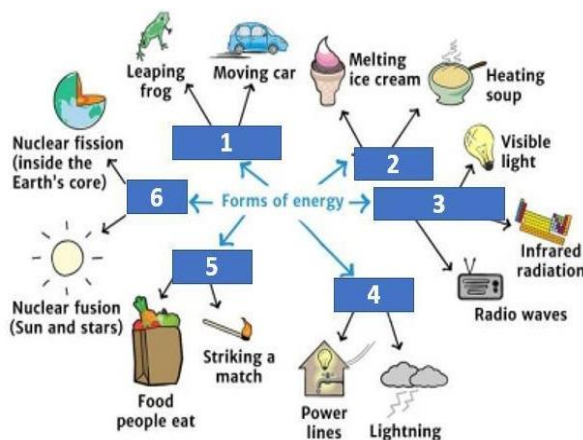
1. Application of Energy



- Lighting
- Cooking
- Transportation
- Power generation
- Melting iron
- Missile launching
- Agriculture/growing plants
- Ex: Lamp, heat engines, Automobiles, fuel cell, battery

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1. Definition of Energy



- Energy is defined as the ability to do work or as the ability to carry a heat transfer
- Energy has many different forms (gravitational, thermal, electrical, chemical, nuclear etc.)
- The SI unit of energy is joule (equals to one newton applied through one meter)
- Energy is a conserved quantity, meaning that it cannot be created or destroyed, but only converted from one form into another.
- Energy has no direction in space, and is considered a scalar quantity.
- Thus, the total energy of the universe always remains constant.

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Various forms of energy

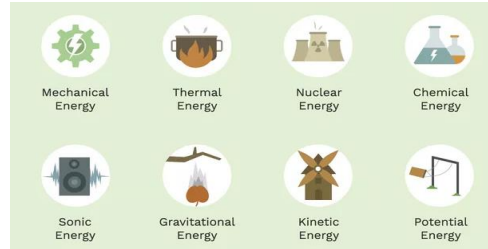
Energy is classified as potential (stored) and kinetic (velocity) energy.

Potential energy

- Chemical
- Nuclear
- Mechanical stored energy
- Gravitational

Kinetic energy

- Radiant
- Thermal
- Motion
- Sound and Electrical



Potential energy (E_p) = mass x gravitational acceleration x height = $m g h$

Chemical energy: Biomass, petroleum, N.Gas, LPG and coal are stored chemical energy.
(e.g. kJ/kg) or number of molecules ,e.g. kJ/mol

Kinetic energy (E_k) == half x mass x velocity squared = $\frac{1}{2} m v^2$

Nuclear energy (E_n) = mass x speed of light squared = $m c^2$ (where $c = 3 \times 10^8 \text{ m/s}$)

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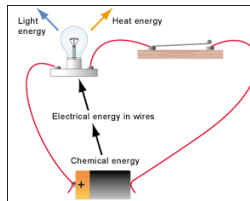
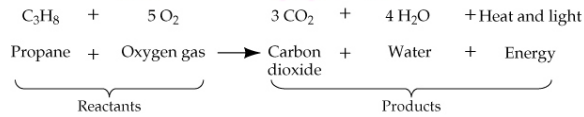
1. Importance of Energy



- All forms of life and society require Energy
- Plants use sun for energy
- Animals consume food for energy
- We also need energy for society to function and live
- Many objects around us work on electricity or heat.
- It supports quality of life and economic development
- If no energy, society would be chaotic

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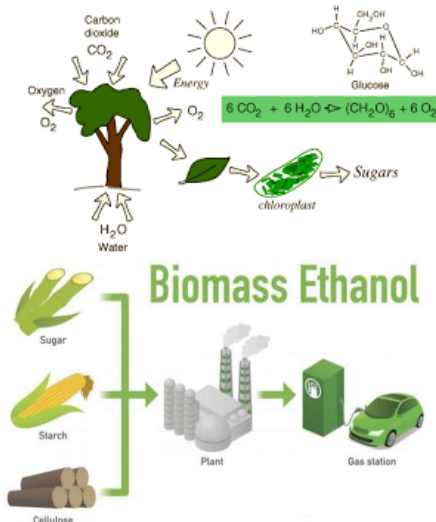
2 Different forms of energy: Chemical Energy



- Chemical energy is energy stored in atoms and molecules
- Energy released in chemical reactions.
 - Ex
 - Burning candle release light & heat
 - Petroleum, Coal, N. Gas
 - Food, wood, battery

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2. Different forms of energy: Biological energy



Biological energy is energy contained in living or recently living biological organisms

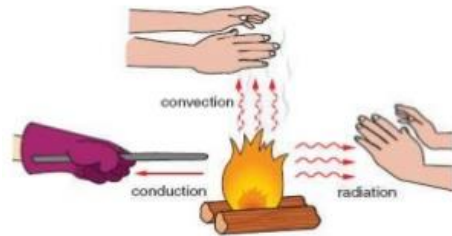
Bioenergy sources are replenished through the cultivation of fast growing trees and grasses

Ex Bio fuels

- Bioethanol
- Biodiesel
- Biogas

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2. Different forms of energy: Thermal energy



- Thermal energy is the total kinetic & potential energy of all particle in a substance
- Thermal Energy is the heat made when molecule moves.
- Faster the molecules move higher the temperature
- Heat always flows from hotter to colder objects
- Thermal energy is measured in Jules (J)

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Q & A

Thank You

Save energy and water for Sustainable Life

