

MODULE 3

GLOBAL WARMING



Global warming is a gradual increase in the earth's temperature generally due to the greenhouse effect caused by increased levels of carbon dioxide, chlorofluorocarbons and other pollutants.

- Since the Industrial Revolution, the global annual temperature has increased in total by a little more than 1 degree Celsius, or about 2 degrees Fahrenheit.
- Between 1880—the year that accurate recordkeeping began—and 1980, it rose on average by 0.07 degrees Celsius (0.13 degrees Fahrenheit) every 10 years.
- Since 1981, however, the rate of increase has more than doubled: For the last 40 years, we've seen the global annual temperature rise by 0.18 degrees Celsius, or 0.32 degrees Fahrenheit, per decade.

Causes of Global warming:-

1) Man-made causes

- a) Deforestation
- b) Use of vehicles
- c) Chlorofluorocarbon
- d) Industrial development
- e) Overpopulation

2) Natural causes

- a) Volcanoes

b) Water vapour

c) Forest blazes

1) Man-made causes

a) Deforestation: Plants are the main source of oxygen. They take in carbon dioxide and release oxygen thereby maintaining environmental balance. Forests are being depleted for many domestic and commercial purposes. This has led to an environmental imbalance, thereby giving rise to global warming.



b) Use of Vehicles: The use of vehicles, even for a very short distance results in various gaseous emissions. Vehicles burn fossil fuels which emit a large amount of carbon dioxide and other toxins into the atmosphere resulting in a temperature increase.



c) Chlorofluorocarbon: With the excessive use of air conditioners and refrigerators, humans have been adding CFCs into the environment which affects the atmospheric ozone layer. The ozone layer protects the earth surface from the harmful ultraviolet rays emitted by the sun. The CFCs have led to ozone layer depletion making way for the ultraviolet rays, thereby increasing the temperature of the earth.



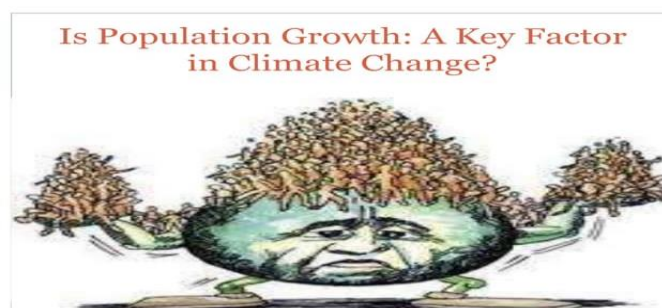
d) Industrial Development: With the advent of industrialization, the temperature of the earth has been increasing rapidly. The harmful emissions from the factories add to the increasing temperature of the earth.

In 2013, the Intergovernmental Panel for Climate Change reported that the increase in the global temperature between 1880 and 2012 was 0.9 degrees Celsius. The increase is 1.1 degrees Celsius when compared to the pre-industrial mean temperature.

- Agriculture: Various farming activities produce carbon dioxide and methane gas. These add to the greenhouse gases in the atmosphere and increase the temperature of the earth.



e) Overpopulation: An increase in population means more people breathing. This leads to an increase in the level of carbon dioxide, the primary gas causing global warming, in the atmosphere.



2) Natural causes

a) Volcanoes: Volcanoes are one of the largest natural contributors to global warming. The ash and smoke emitted during volcanic eruptions goes out into the atmosphere and affects the climate.



b) Water Vapour: Water vapour is a kind of greenhouse gas. Due to the increase in the earth's temperature, more water gets evaporated from the water bodies and stays in the atmosphere adding to global warming.



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c) Melting Permafrost: Permafrost is frozen soil that has environmental gases trapped in it for several years and is present below Earth's surface. It is present in glaciers. As the permafrost melts, it releases the gases back into the atmosphere, increasing Earth's temperature.



d) Forest Blazes: Forest blazes or forest fires emit a large amount of carbon-containing smoke. These gases are released into the atmosphere and increase the earth's temperature resulting in global warming.



Effects of Global Warming:-

The following are the major effects of global warming:

1) Rise in Temperature: Global warming has led to an incredible increase in earth's temperature. Since 1880, the earth's temperature has increased by ~1 degrees. This has resulted in an increase in the melting of glaciers, which has led to an increase in the sea level. This could have devastating effects on coastal regions.

2) Threats to the Ecosystem: Global warming has affected the coral reefs that can lead to the loss of plant and animal lives. Increase in global temperatures has made the fragility of coral reefs even worse.

3) Climate Change: Global warming has led to a change in climatic conditions. There are droughts at some places and floods at some. This climatic imbalance is the result of global warming.

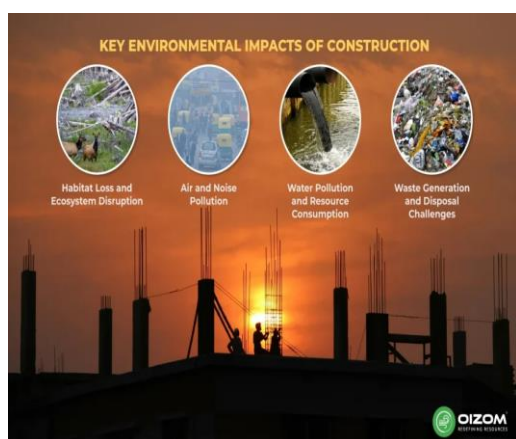
4) Spread of Diseases: Global warming leads to a change in the patterns of heat and humidity. This has led to the movement of mosquitoes that carry and spread diseases.

5) High Mortality Rates: Due to an increase in floods, tsunamis and other natural calamities, the average death toll usually increases. Also, such events can bring about the spread of diseases that can hamper human life.

6) Loss of Natural Habitat: A global shift in the climate leads to the loss of habitats of several plants and animals. In this case, the animals need to migrate from their natural habitat and many of them even become extinct. This is yet another major impact of global warming on biodiversity.

CONTRIBUTION OF BUILDING TOWARDS GLOBAL WARMING:

- 1) The built environment generates 40% of annual global CO₂ emissions. Of those total emissions, building operations are responsible for 27% annually, while building and infrastructure materials and construction are responsible for an additional 13% annually.
- 2) Poorly designed and constructed buildings use more energy, increasing the demand for energy production and contributing to global warming. Reducing energy use in buildings is one of the most important ways to reduce humans' overall environmental impact.
- 3) Structures such as buildings, roads, and other infrastructure absorb and re-emit the sun's heat more than natural landscapes such as forests and water bodies.
- 4) Boilers and furnaces used for space heating consume fuels like natural gas and heating oil.
- 5) Onsite power generation also contributes to building emissions if the energy input is a fossil fuel. For example, both diesel generators and steam micro turbines produce emissions.
- 6) Construction of road infrastructure produces huge CO₂.
- 7) Industries are also the major producers of carbon dioxide.

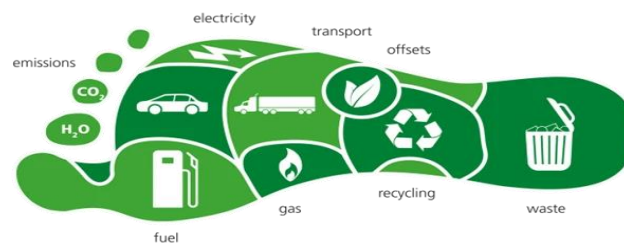


STEPS TO REDUCE CARBON EMISSION IN THE BUILDING:

- 1) Reuse buildings instead of constructing new ones.
- 2) Specify low-carbon concrete mixes.

- 3) Limit carbon – intensive materials.
- 4) Reuse materials. - Whenever possible, salvage materials like brick, metals, broken concrete, or wood.
- 5) Use high-recycled content materials.
- 6) Minimize construction waste.
- 7) Energy Star-certified appliances like water heaters, refrigerators, etc, can be used.

CARBON FOOTPRINT:



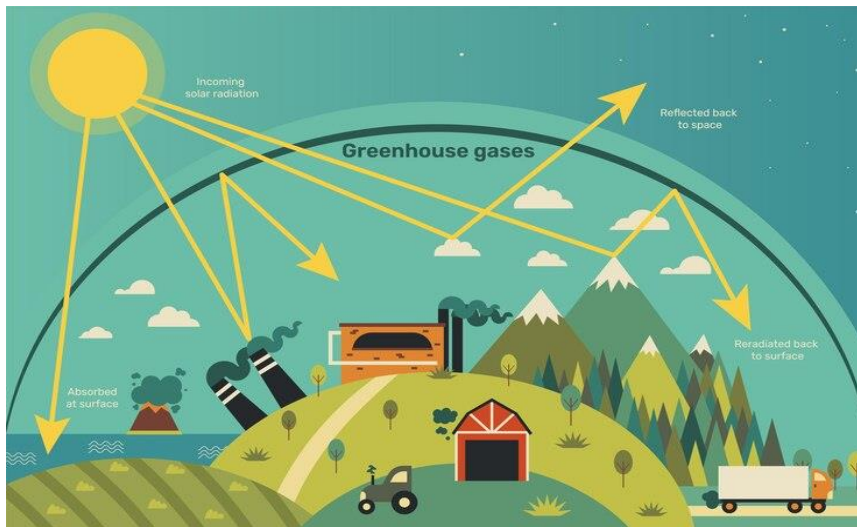
A carbon footprint is the total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our actions. Many of our daily activities cause emissions of greenhouse gases. For example, we produce greenhouse gas emissions from burning gasoline when we drive, burning oil or gas in home for heating, or using electricity generated from coal, natural gas, and oil.

According to the World Health Organization (WHO), a carbon footprint is a measure of the impact human activities have on the amount of Greenhouse Gases produced through the burning of fossil fuels and is expressed as a weight of CO2 emissions produced in tonnes.

The Six GHGs are –

- ☐ Carbon dioxide
- ☐ Methane
- ☐ Nitrous Oxide
- ☐ Hydrofluorocarbons
- ☐ Perfluorocarbon

□ Sulphur hexafluoride



Carbon footprints can be associated with an individual, an organization, or a product.

Organizational – Emissions from all the activities across the organisation such as energy use, industrial processes and company vehicles.

Product – Emissions from the extraction of raw materials and manufacturing right through to its use and final reuse, recycling or disposal i.e. over the whole life of a product or service.

GLOBAL EFFORTS TO REDUCE CARBON EMISSIONS:-

- 1) Carbon Pricing– A carbon price is a cost put on carbon pollution to nudge polluters to lower the amount of greenhouse gas they release into the atmosphere.
- 2) Carbon Tax – It is a form of Pollution Tax. It levies a fee on the production, distribution or use of fossil fuels based on how much carbon they emit. It is a cost-effective tool to reduce greenhouse gas emissions in the atmosphere.
- 3) Carbon restoration– the process of capturing waste carbon dioxide (CO₂) from large point sources, such as fossil fuel power plants, etc. and depositing it where it will not enter the atmosphere.
- 4) Paris Agreement – According to the Paris Climate agreement, the members who have to work towards the goal of achieving net-zero emissions, which is crucial to limit global warming. Its aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius.

5) Montreal Protocol – The protocol gives provisions to reduce the production and consumption of Ozone Depleting Substances to protect the ozone layer.

6) The Kyoto Protocol - It is an international treaty which extended the United Nations Framework Convention on Climate Change (UNFCCC) that commits nations to reduce greenhouse gas emissions.

7) Bharat Stage (BS) VI norms: These are emission control standards put in place by the government to keep a check on air pollution from vehicles.

8) National Wind-Solar Hybrid Policy 2018: The main objective of the policy is to provide a framework for the promotion of large grid-connected wind-solar photovoltaic (PV) hybrid

9) National Solar Mission: It is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth while addressing India's energy security challenge.

10) National Mission for Enhanced Energy Efficiency (NMEEE) – launched in 2011 NMEEE is a mission to strengthen the market for energy efficiency by creating favourable policies and regulations.

11) The National Action Plan on Climate Change (NAPCC) – launched in June 2008 aimed to have a combined policy for tackling climate change.

GREEN BUILDING

A Green building is one which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants as compared to a conventional building.



Features of Green Building

- 1) Efficient use of water.
- 2) Renewable energy generation
- 3) Storm water management
- 4) Superior Indoor environment- ample amounts of daylight, good acoustic performance, high-quality views and excellent indoor air quality
- 5) Design innovation.
- 6) Green transportation capacity- use of bicycles, battery-powered vehicles
- 7) Sustainable materials for construction- use of green materials
- 8) Effective waste management- solid waste, liquid waste management
- 9) Site sustainability – wetland farmland should not be used for construction.

Necessity of Green building

- 1) Reduction of natural resource consumption
- 2) Reduction of operating costs
- 3) Health, comfort and safety for all residents
- 4) Energy optimization and reduction of energy consumption
- 5) Increased productivity of the occupants
- 6) Better indoor air quality (IAQ has a tremendous impact on human health)
- 7) Green Building encourages companies to benefit from the Green corporate image and to leave a very positive impression on customers, employees, business partners and shareholders.

Environmental Benefits of Green Building

- ☐ Green building positively influences our climate and overall ecosystem by reducing water use and energy sources that pollute our environment, such as coal and carbon dioxide discharged into the atmosphere.
- ☐ Green building not only decreases water waste, but may also contribute to enrich water reserves, preserves natural resources, defends biodiversity and enhances air and water quality.

☐ Green building also reduces carbon footprint by producing less waste and decreasing the amount of toxic gases set free into the air.

☐ In this way, buildings may contribute positively to saving our environment and slowing the pace of climate change.

Economical Benefits of Green Building

☐ **Reduced Operating Costs:** Savings in energy costs of 20-50% are common through integrated planning, site orientation, energy-saving technologies, on-site renewable energy-producing technologies, light-reflective materials, natural daylight and ventilation etc.,.

☐ It enhances return on assets and profits due to savings in operating costs.

☐ **Improved Employee Productivity and Satisfaction:** via better occupant comfort, improved indoor air quality, natural light, and better acoustics.

☐ Properties that are green-built, require lower maintenance costs as they are built from sustainable components which in turn adds value to the property.

Health and Social Benefits of Green Building

☐ Going green means building away bad toxins and having the ability to breathe in fresh, clean air.

☐ Having a good indoor environment protects the tenant's health and enhances their quality of life by avoiding serious illnesses induced by the inhalation of toxic substances.

☐ An improved indoor quality not only safeguards our life, but it can also strengthen employee productivity.

☐ Employees working in clean and green-built properties tend to have better concentration and focus capabilities, improving their work performance.

☐ Reduced smog and urban heat island effect, conserved resources, and lowered carbon footprint.

Major Energy-efficient areas for buildings : 1) The energy efficiency of a building is the extent to which the energy consumption per square metre of the floor area of the building measures up to established energy consumption benchmarks for that particular type of building under defined climatic conditions.

- 2) Close Proximity to Public Transit- must switch to public transport rather than usage of private cars. Also, can move with carpooling system.
- 3) New Buildings Should Take Orientation to Nature in Account: Must take better advantage of sunlight and place windows accordingly.
- 4) Take Advantage of Existing Structures: Instead of building an entirely new structure, look for an existing one, and retrofit it to our needs. Not only could this save a great deal of money, not just in the cost of construction materials, but it reduces the energy that it takes to build an entirely new building.
- 5) Design with Retrofitting In Mind
- 6) Choose the Smallest Building Possible
- 7) Keep Various Energy Efficient Standards in Mind
- 8) Have Proper Insulation
- 9) Choose the Right Windows
- 10) Use Insulated Concrete
- 11) Consider Installing Solar Panels
- 12) Select a High-Efficiency Heating, Ventilation, Air Conditioning (HVAC) System
- 13) Change Air Filters Regularly
- 14) Install LED Lights

ENERGY EFFICIENCY IN BUILDINGS

EE Measures for Buildings



Source: UNIDO, renewable energy & energy efficiency partnership

