

GLOBAL WARMING: ITS CAUSES, EFFECTS, PREVENTION AND MITIGATION

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Abstract

Global warming is basically responsible for climate change. The global warming and changes in climate have become more intense. It is caused by increasing the amount of carbon dioxide and greenhouse gases in the atmosphere. Greenhouse gases are produced mostly from burning of fossil fuels and other human activities.

The term greenhouse effect is often associated with rising global warming. Most of the greenhouse gases are emitted by human activities. These GHSs trap and hold the heat and radiation and reside in the atmosphere.

Carbon dioxide and greenhouse gases can be reduced by decreasing the amount of energy used or by decreasing the dependence on carbon emitting fuels. The effects of GHGs can be decreased through the development of alternative projects and technology, reforestation, and better process.

Key Words: *Global warming, Climate change, Greenhouse gases, Greenhouse effect, Fossil fuels.*

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Introduction

Climate change refers to long-run fluctuations in various elements of climate system such as temperature, precipitation, wind and atmosphere. Global warming or increase in earth's temperature is basically responsible for climate change. Global temperature, weather and climate have started changing due to industrial revolution and rapid industrialisation in the world. For instance, average temperature of the Earth has increased by 0.80°C in the past century, and it is projected to increase by 1.1 to 6.40°C over the next century. Small changes in temperature of the planet may bring large and dangerous changes in climate and weather like heavy rainfall, more floods, droughts and also severe heat waves. Oceans and seas are warming and ice caps and glaciers are melting, and sea levels are, gradually but certainly, rising. These changes in climate and global warming are likely to become more intense and challengeable to the environment and the society.

Objectives of the Study

1. To study the various sources of carbon dioxide and greenhouse gases.
2. To find out the percentage contribution of greenhouse gases greenhouse effect.
3. To examine the causes of environmental pollution, global warming and climate change.
4. To suggest measures to reduce the impact and amount of greenhouse gases.

Causes of Global Warming

Global warming is caused mostly by increasing the carbon dioxide and greenhouse gases in the atmosphere. Human activities are releasing large quantity of CO_2 and GHGs in the atmosphere. Greenhouse gases are produced mostly from burning of fossil fuels which are used to produce energy. Increasing deforestation, industrial processes, changes in land use and some agricultural practices also emit GHGs into atmosphere.



Greenhouse Effect

The term greenhouse effect is generally used to show the increase in Earth's temperature. An increase in temperature of the planet due to increasing amount of carbon dioxide, water vapours, green gases, and other gases is known as greenhouse effect. The greenhouse effect is often associated with rising global warming.

Life of animals, plants and human beings on earth depends on energy/sunlight received from the sun. About 30 percent sunlight is scattered back into space or outer atmosphere, whereas the rest 70 percent reaches the surface of the planet. The upward reflected sunlight as a slow moving energy is termed as "Infrared Radiation." The heat created by infrared radiation is absorbed by greenhouses gases like CO₂ and methane. Greenhouses gases constitute only 1 percent of the atmosphere, but they regulate and change the climate and ecosystem by absorbing and holding heat which surrounds the earth.

When human activities distort the natural process by creating and emitting more greenhouse gases into the atmosphere than the required level, the problem of global warming and climate change begins. Increasing greenhouse gases means more infrared radiation held in the atmosphere, which increases the temperature of the Earth's surface.

Green House Gases

Most of the greenhouse gases are emitted by human activities. These GHSs trap and hold the heat and radiation and reside in the atmosphere. The important GHGs include CO₂, CH₄, nitrous oxide, methane and several other gases.

Carbon dioxide (CO₂)

It accounts for three-quarters of the warming impact of greenhouse gas emissions. The main source of CO₂ is the burning of fossil fuels like coal, oil and gas, solid waste, wood products, deforestation and certain chemical reactions. CO₂ is naturally present in the atmosphere due to the Earth's carbon cycle. It can be removed from the atmosphere by trees when they absorb it as a part of the biological carbon cycle.

The global carbon cycle comprises various stocks of carbon and flow of carbon among these stocks in the earth system. Carbon stocks are stored in above and below ground and found in the form of inorganic and organic compounds. It is cycled between the atmosphere, oceans, and terrestrial biosphere. Carbon is withdrawn from the atmosphere through photosynthesis and return by plant respiration and decomposition process. Natural processes and human activities influence stocks of carbon and fits lows in the earth system.

Methane (CH₄)

Methane accounts for 14 percent of the current greenhouse gas emissions. The sources of this gas are agriculture, rice fields, livestock, fossil fuel, extraction and the decay of organic waste. Methane is also emitted during the production and transportation of fossil fuel such as coal, natural gas and oil. Although methane doesn't remain for a longer time in the atmosphere like CO₂, its warming effect is per gram of gas released is much more than CO₂.

Nitrous Oxide

Nitrous oxide accounts for 8 percent of the human generated greenhouse gas emissions. The main sources of this gas are industrial processes, fossil fuels, solid waste, and agriculture like nitrogen-fertilized soils and livestock wastes. Its warming effect is more potent than methane.

Fluorinated Gases:

These gases accounts for only 1 percent of the warming impact of human induced greenhouse gas emissions. F-gases are synthetic and powerful GHGs and even more potent than nitrous oxide. Key sources of these gases are industrial processes. Although these gases are emitted in

smaller quantity, they are known as High Global Warming Potential Gases (High GWPG) due to their much more potent for each gram of gas released.

Table 1: Lifetime and Concentration of Greenhouse Gases in the Atmosphere

Gas	Chemical Formula	Lifetime (Years)	Pre-1750 Concentration	2013 Concentration	Increased Radiative Forcing (W/m ²)
Carbon Dioxide	CO ₂	Variable	280	395	1.88
Methane	CH ₄	12+3	722	1893/1762	0.49
Nitrous Oxide	N ₂ O	120	270	326/324	0.17
Sulphur Hexafluoride	SF ₆	3200	Zero	7.8/7.4	0.004
HFC-134a	CH ₂ FCF ₃	14.6	Zero	75/64	0.011
Perfluoromethane	CF ₄	50000	-	-	-

Source: <http://www.cpcb.nic.in>

Water Vapour

Water vapour is the most abundant greenhouse gas and its contribution to the natural greenhouse effect is also important. Its atmospheric lifetime is short. The global concentration of water vapour is controlled by temperature, temperature, in turn, influences overall evaporation and precipitation.

Human Activities and Production of Greenhouse Gases

The emissions of greenhouse gases have increased dramatically due to Industrial Revolution and indiscriminate changes in land use pattern. Many GHGs generating activities are essential and have become a part of modern human life.

- 1) **Burning of Fossil Fuels:** The burning of fossil fuels is the single largest source of Carbon dioxide emissions from human activities. The use of fossil fuels account for three quarters of CO₂ emissions, one-fifth of the methane and 8 percent of nitrous oxide emissions. Even nitrogen oxides, hydrocarbons and carbon monoxide are also produced from the burning of fossil fuels.
- 2) **Other Gases:** Oil, natural gas and coal are used to generate electricity, run automobiles, heat houses and power factories. These fossil fuels emit the most carbon per unit of energy used. If fuel is burned completely, then only carbon dioxide is emitted. If fuel is not burned completely, other gases are also produced such as carbon monoxide, hydrocarbons, nitrogen oxides and sulphur oxides.
- 3) **Extracting, Processing, Transporting and Distributing Fossil Fuels:** These processes and activities also release greenhouse gases. These releases are sometimes deliberate like flaring of natural gas which emit mostly carbon dioxide and methane. GHGs can be released from accidents, poor maintenance of oil and gas distribution network and small leakages in pipe fitting and pipelines. Methane is released when coal is mined, and hydrocarbons is released in the atmosphere when oil spills from tanker ships.
- 4) **Deforestation:** It is the second largest source of creating carbon dioxide. Trees are cut and forests are cleared for agriculture or development purpose. In such a case, carbon in the burned or decomposing trees releases to the atmosphere. Deforestation occurs mainly in the tropics. As per the estimates about 600 million to 2.6 billion tones of carbon are released every year in the world. On the other hand, when new trees and forests are planted, carbon dioxide is absorbed by trees and it is removed from the atmosphere.
- 5) **Producing Lime to make Cement:** It accounts for 2.5 percent of carbon dioxide emissions from industrial sources. The CO₂ is released during the production of cement. It is derived from limestone and is fossil origin like sea shells and biomass.
- 6) **Domestic Animals emit Methane:** Methane is the second most important greenhouse gas after carbon dioxide. It is produced by cattle, dairy cows, buffalo, goats, sheep, camels, pigs and horses. Methane emissions from livestock are produced by enteric fermentation of food by bacteria and other microbes and decomposition of animal manure. About one-quarter methane emissions are released from livestock out of total 100 million tones produced every year.

- 7) **Rice Cultivation:** Rice cultivation also releases methane. Paddy/rice farming produces about one-fifth to one-quarter of global methane emissions from human activities. Wetland rice is grown in flooded or irrigated fields which accounts for more than 90 percent of the rice production. Bacteria and micro-organisms present in the flooded rice paddy soil decompose organic matter and produce methane.
- 8) **Fertilizers:** Use of chemical fertilizers increases nitrous oxide emissions. Many fertilizers contain nitrogen which enhance the natural processes of nitrification carried out by bacteria and other microbes in the soil. These processes convert nitrogen into nitrous oxide. The amount of nitrous oxide emitted depends upon type and quantity of fertilizer, soil conditions, climate and others.
- 9) **Disposal and Treatment of Garbage and Human Wastes:** When garbage is buried in a landfill, there is oxygen-free decomposition which emits methane and some CO₂. If the created methane gas is not used as a fuel, it escapes to the atmosphere. The source of methane is often found in urban areas than the rural areas, where garbage is brought to a central landfill. In rural areas, garbage is either burned or often left to decompose to make manure for agriculture.

Carbon Footprint

The carbon footprint refers to the amount of carbon dioxide emitted individually in one year. It is the measure of the impact of an individual's lifestyle or organisation's operation, measured in units of carbon dioxide. CO₂ is the main gas responsible for global warming and changes in the climate. Carbon footprint is divided into two parts: Primary and Secondary footprint.

The primary footprint is the sum of the direct carbon dioxide emissions of burning of fossil fuels such as coal, gas and oils by water heaters, furnaces and transportation. The secondary footprint is the sum of indirect emissions from the manufacturing, services, breakdown of products and other human activities.

An individual's, organisation or nation's carbon footprint can be measured by conducting GHG emissions assessment known as carbon accounting. If the carbon footprint is known, a strategy can be adopted to reduce it through technological development, better process, better

product management, carbon capture, consumption strategies, and carbon offsetting. The carbon offsetting refers to reducing a carbon footprint through the development of alternative environment friendly projects like solar, wind energy and forestation.

The important factors influencing carbon footprints are increasing population, economic output, use of energy and carbon intensity of the economy. In order to decrease carbon footprints, we have to either reduce the use of energy or to decrease the dependence on carbon emitting fuels.

Ways to Reduce Carbon Footprint

The carbon footprint can be decreased by a number of ways such as:

- (1) Reduce, Reuse and Recycle is the most common practice to reduce the carbon footprint.
- (2) In manufacturing sector carbon footprint can be reduced by recycling the packing materials and by selling the obsolete inventory to other industry. No materials should be disposed off into the soil. All the oxidize and degradable materials should be sold at the earliest.
- (3) Walking or cycling to the nearby destination rather than driving can save money on fuel, burn less fuel and release fewer emissions in the atmosphere. Another option is to take share taxi or travel by public transportation system like buses and trains.
- (4) Another way for reducing carbon footprint is less use of air condition, heaters and other home appliances.
- (5) Reforestation and planting trees in deforested regions is very useful to reduce the carbon-footprint.

Conclusion

The global warming and changes in climate are likely to become more intense and challengeable to the environment and the society. Since most of the greenhouse gases are emitted by human activities, These gases can be reduced by decreasing the amount of energy and carbon emitting fuels. The effects of GHGs can be decreased through the

development of alternative projects, energy saving technology, carbon offsetting, reforestation, and better process.

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