

# Greenhouse Effect: Causes and Effects

Dr. Sulabha.S. Lalsare , Prof. Jyoti V. Manekar  
Assistant Professor, Associate Professor  
Department of Botany, Department of Physics ,  
A S C College Saikheda, Nashik India

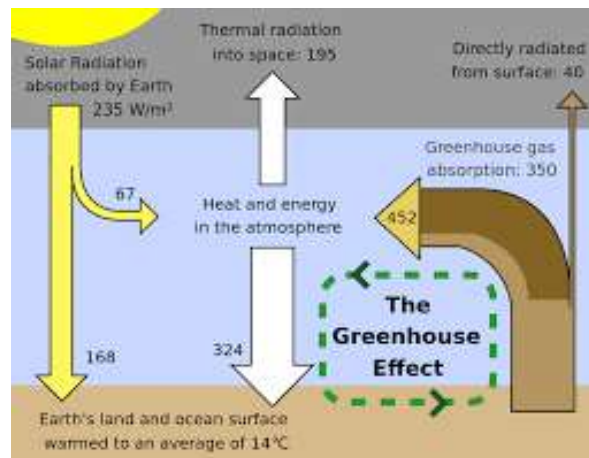
*Abstract:* Greenhouse effect is a natural process of absorbing the Sun's energy and some of the energy is reflecting back in the atmosphere. Natural Greenhouse effect keeps the Earth's atmosphere comfortable. In this paper what is greenhouse effect and why there is enhancement in greenhouse is reviewed. What are greenhouse gases and how their concentration is increasing due to human activities like burning of fossil fuel, deforestation is explained. How greenhouse gas emissions being produced daily and a large imbalance is being created which enhancing the greenhouse effect and making it stronger are discussed. How concentration of Greenhouse gases like Carbon dioxide, Methane, Nitrous oxide and fluorocarbon gases is increasing due to human activities is reviewed. Adverse Impact of enhanced greenhouse effect on the Earth's climate like global warming and effect of global warming on various issues are discussed.

*IndexTerms - Electromagnetic waves, industrialization, greenhouse gases, Fluorinated gases, global warming , Aerosols.*

## I. INTRODUCTION

The greenhouse effect is natural process that warms the Earth's surface. When the Sun energy reaches the Earth's atmosphere some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. Green gases absorb energy and warm the surface of the Earth. The earth has average surface temperature comfortable between the boiling point and freezing point of water that is suitable for our life. It is result of having right kind of atmosphere and greenhouse effect. Greenhouse effect maintains the Earth temperature at around 33 degrees allowing life on earth. But the problem now we face is that human activities i.e. burning fossil fuels due to Industrialization, agriculture and land clearing is increasing the concentration of greenhouse gases. This is the enhanced greenhouse effect which is contributing to warming of the Earth.

**The greenhouse effect:** The energy produced by the Sun as electromagnetic waves which 99% radiation have wavelength in the range of 0.2 to 0.4 micrometer. Solar radiation reaching the top of the Earth atmosphere consists of 8% ultraviolet radiation i.e. short wavelength less than 0.3 micrometer 46% visible light (390 nm to 780 nm) and 46% infrared radiation (0.78 μm to 1000 μm). Visible sunlight absorbed on ground at temperature 20 °C , it emits infrared light of higher wavelength in atmosphere. Greenhouse gases absorb this high wavelength light and radiate back to the earth. When radiation strikes a solid or liquid it is absorbed and transformed into heat and heat conducts to surrounding material i.e. air, water other solid or liquid. This hot material radiated to other materials of lower temperature. This is called green house effect.



### Green house effect

**Greenhouse Gases:** Gases that trap heat in the atmosphere are called greenhouse gases. These gases, mainly water vapor ( $H_2O$ ), carbon dioxide ( $CO_2$ ), methane ( $CH_4$ ), and nitrous oxide ( $N_2O$ ), Fluorinated gases all act as effective global insulators. Some sources of greenhouse gases are natural and some are man made. Greenhouse gases make about 1% of the earth's atmosphere. Without the greenhouse gases the Earth's temperature could be  $-18^\circ C$  [1]. Human activities enhanced the emission of large amount of green house gases into the atmosphere. Percentage of Greenhouse Gases is [2]

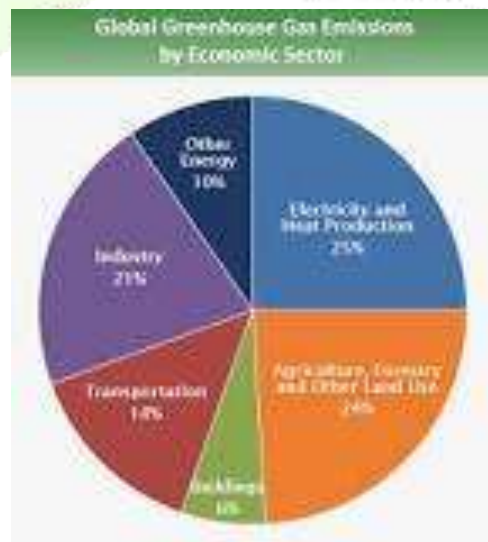
Water Vapor 36-72%

Carbon dioxide -9-26%

Methane 4-9%

Fluorinated gases -9-11%

Emission of greenhouse gases started rising after industrial revolution. Industrialization is essential for global economy and it is essential for modern life. But industrialization has enhanced the greenhouse effect which is contributing the warming of the Earth's atmosphere. The world's business collectively emits over 5 Giga tones of  $CO_2$ . [3] Greenhouse gas emission has increased by 1% from 2011 to 2016 [4] The Industries which are major sources of greenhouse gas emissions are Electricity. 67% percent of our electricity comes from burning fossil fuel like coal and natural gas. 27% of greenhouse emission comes from transportation [4]. Maximum percent of our electricity comes from burning fossil fuels, mostly coal and natural gas. [3] Agricultural activities are also responsible for enhancement of greenhouse gases. The nitrogen contained in many fertilizers enhances the natural processes of nitrification and denitrification that are carried out by bacteria and other microbes in the soil. These processes convert some nitrogen into nitrous oxide. The amount of  $N_2O$  emitted for each unit of nitrogen applied to the soil depends on the type and amount of fertilizer, soil conditions, and climate - a complex equation that is not fully understood.



### Greenhouse Gases Percentage

**Carbon dioxide CO<sub>2</sub>:** Human activities release Carbon dioxide into the atmosphere. This emission much smaller than natural emissions but as this emission upset the balance in carbon cycle . Carbon dioxide is created by many human activities i.e by burning fuel, coal, natural gas, oils, solids biomass like trees, wood products, bio-west etc.24.9% CO<sub>2</sub> released by electricity producing Industries. Other industries release 14.7% CO<sub>2</sub>. [3]

Many Industries release large amount of CO<sub>2</sub> in atmosphere due to fossil fuel combustion or indirectly using electricity. Cement production produces large amount of CO<sub>2</sub> . CO<sub>2</sub> is byproduct of chemical reaction. Making 100 tones of cement produces 900kgs of CO<sub>2</sub>. [3]. Still industries are another source of CO<sub>2</sub> emission. To manufacture steel iron is melted and refined, this process uses oxygen to combine with carbon in iron which creates CO<sub>2</sub>. 1.9 tones of CO<sub>2</sub> is emitted to every tone of steel produced [5] .Transportation contribute 14.3% Carbon dioxide. Agricultural activities like using pesticide ,fertilizers burning corp release 13.8% Carbon dioxide in the atmosphere[4].Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g., manufacture of cement). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.

**Total emission of CO<sub>2</sub> in 2016 = 7,20 Million Metric Tones[5]**

**Methane (CH<sub>4</sub>):** Both natural and human sources emit methane into the atmosphere. Wetlands , termites and the ocean are natural sources of methane emission. Before human interference methane levels were steady because of natural balance Human activities cause increase in emission of methane. Methane level has doubled in last 150 years.

Natural sources create 36% methane human related activities create 64% methane emission. Methane is emitted during the production and transport of coal, natural gas, and oil. Burning of fossil fuel is most important sources of methane emission which create 110million tones of methane per year. Oil wells also release methane. Methane gas is emitted by the decomposition of solid waste in landfills. This generate 16% methane emission. Waste water from domestic municipal and industry sources produce methane emission.

**Nitrous Oxide (N<sub>2</sub>O):** Before the Industrial revolution concentration of nitrous oxide was in safe level in the atmosphere because of natural sinks means forest covered land. Agriculture is the most important human source of nitrous oxide. Nitrous oxide is 300 times up which is more effective in trapping heat in the atmosphere. Agriculture is the most important source of nitrous oxide. It contribute 67% of total emission of nitrous oxide.[6]. Fissile fuel combustion and Industrial process are responsible for increase in 10 % emission of nitrous oxide into the atmosphere. Majority of N<sub>2</sub>O emission come from coal fired power plants. Deforestation is responsible to increase 12% nitrous oxide emission .[5] Use of nitrogen based fertilizer also increasing nitrous oxide in the atmosphere. Biomass burning courses increase in emission of N<sub>2</sub>O by 10%. Large fires to destroy crops contributes to increase N<sub>2</sub>O emission into the atmosphere. Biomass burning creates 70000 tones of N<sub>2</sub>O [5].

**Fluorinated gases:** Hydrocarbons (HFC), Chloroflorocarbon(CFC),Sulfur hexafluoride, and Nitrogen trifluoride are fluorinated gases. HFCs and CFCs are family of gases known as F-gases. F gases are used in refrigerators, Air-conditioning, foam Industries, Fire protection and solvents. 90% HFCs are used in refrigerator and air-conditioning. HFCs and CFCs are directly responsible for 17% of man-made global warming [9]. CFCs are ozone layer depleting substances. HFCs are not ozone layer depleting but responsible for global warming.

**Aerosols:** Aerosols are minute particles. Aerosols are formed natural by volcanic activities and Desert dust. Human made activities made aerosols by burning coal & oil. The concentration of human made aerosol has grown up rapidly since start of the industrial revolution. The concentration of aerosols is highest in northern hemisphere due to more industrial activities [7]. Presence of various aerosol in the atmosphere is increasing the earth temperature. Atmospheric Aerosols in the atmosphere scatter and absorb the solar and infrared radiation. Aerosols also change the microphysical and chemical properties of the cloud. Presence of aerosols makes droplet size of cloud smaller. Small droplet reflects more sunlight which causes increase in global temperature. [7].

**Global Warming:** Global warming means increase in temperature of the Earth's surface i.e both land and water. Average temperature of the world have risen by 0.7°C over last 50 years. 75% increase in temperature occurred since 1975 [10]. In past rise in global temperature was due to natural causes . Natural greenhouse effect maintains the Earth's temperature at safe level but due to increase in greenhouse gases due to human activities like industrialization revolution and agriculture activities have enhanced the greenhouse effect .Ozone layer protects the earth's surface by preventing the harmful rays coming on the earth. Declining ozone layer is increasing global warming. Harmful ultraviolet sun rays entering to the biosphere and get absorbed by the greenhouse gases which increase global warming.

**Hotter temperature:** If greenhouse gases keep rising it will cause global average temperature rise by 3°C to 4°C higher than previous decade[9,10].

**Higher sea level:** Sea level is rising due Global Warming .Sea level is rising due to two reasons first is due to thermal expansion of sea water and water from melting glaciers. It is predicted that average sea level will rise 0.7m to 1.2m till 2030[10,]. Higher sea level increases the risk of stream surges.

**Agriculture:** Increase heat and drought will make food production more difficult. The IPCC concluded that global warming of 1°C could start hurting crops yields for wheat,corn and rice by 2030[8,10]

**Conclusion:** Greenhouse effect is natural process but human activities have greatly increased overall greenhouse effect. Number of gases are involved are carbon dioxide, methane, nitrous oxide , florocholocarbon gases and Aerosols. Out of all gases carbon dioxide which is 55% of change in the intensity of the Earth's greenhouse effect. Enhance Greenhouse effect will rise sea levels around the Earth and will cause dramatic climate changes. So eproblem we now face is that human activities – particularly burning fossil fuels (coal, oil and natural gas), agriculture and land clearing – are increasing the concentrations of greenhouse gases. This is the enhanced greenhouse effect, which is contributing to warming of the Earth.

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