Greenhouse Effect & Its Influence On Environment - A Review

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Abstract- *This paper presents various aspects of greenhouse effect with the focus on its impacts on environment. In the "most favorable" (although not necessarily "likely") case (of slow-paced climate change), however, it seems likely that the impacts are within the "affordable" range, at least in the industrialized countries of the world. In the "third world" the notion of affordability is of doubtful relevance, making the Problem of quantitative evaluation almost impossible.*

Keywords- Absorbents, habitable, infrared radiation, radioactive property, reradiating, symmetry.

I. INTRODUCTION

Climatologist believe that increasing atmospheric concentration of carbon dioxide and other "greenhouse gasses" released by human activities, such as burning of fossil fuels and deforestation, are warming the Earth. The mechanism is commonly known as the "greenhouse effect" is what makes the Earth habitable. These gasses in the atmosphere act like the glass of a greenhouse, letting the sunlight in and preventing heat from escaping. But the human activities have altered the chemical composition of the atmosphere through the buildup of greenhouse gases- primarily carbon dioxide, methane, and nitrous oxide.[1]

Rise in environmental temperature and changes in related processes are directly connected to increasing anthropogenic greenhouse gas (GHG) emissions in the atmosphere .This rise in temperature was vehemently argued to be generally triggered by the emission of carbon based compound from fossil fuels consumption for power generation. The concentrations of carbon dioxide, methane, and nitrous oxide are all known to be increasing and in recent year, so their greenhouse gases, principally chlorofluorocarbons (CFCs), have been added in significant quantifies to the atmosphere.

SOURCES OF GREENHOUSE GASES:-

The most abundant greenhouse gases in Earth's atmosphere are:-

1. Water vapor (H20),
2. Carbon dioxide (CO2),
3. Methane (CH4),
4. Nitrous oxide (N20),
5. Ozone (O3),
6. Chlorofluorocarbons (CFCs).

Atmospheric concentrations of greenhouse gases are determined by the balance between sources (emissions of the gas from human activities and natural systems) and sinks (the removal of the gas from the atmosphere by conversion to a different chemical compound).The proportion of an emission Remaining in the atmosphere after a specified time is the "airborne fraction" (AF). More precisely, the annual AF is the ratio of the atmospheric increase in a given year to that year's total emissions. For CO2 the AF over the last 50 years (1956–2006) has been increasing at 0.25 ± 0.21%/year [5]. By their percentage contribution to the greenhouse effect on Earth the four major gases are: water vapor, 36–70% carbon dioxide, 9–26% methane, 4–9%ozone, 3–7% .It is not physically realistic to assign a specific percentage to each gas because the absorption and emission bands of the gases overlap (hence the ranges given above). The major nonages contributors to the Earth's greenhouse effect, clouds, also absorbs and emit infrared radiation and thus have an effect on radioactive properties of the atmosphere.[2]

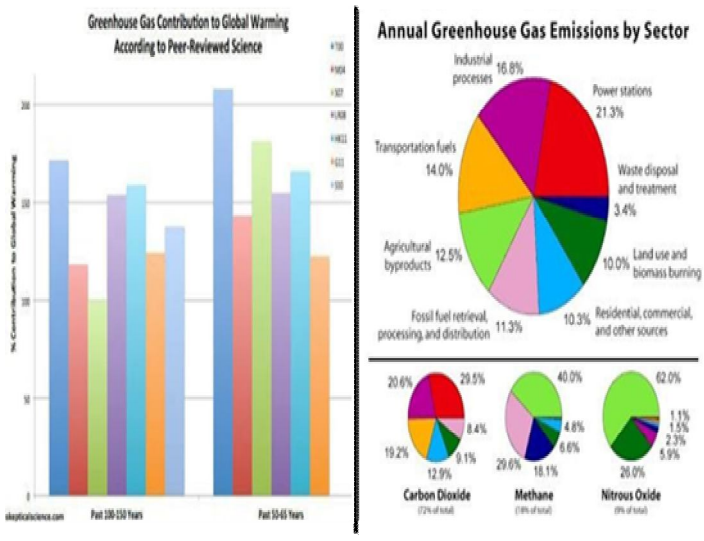

Figure 1. Annual Greenhouse Gas Emission by Sector

II. IMPACT ON ENVIRONMENT OF GREENHOUSE EFFECT

A. Global Warming

Increase of greenhouse gases concentration causes a reduction in outgoing infrared radiation, thus the Earth's climate must change somehow to restore the balance between incoming and outgoing radiation. This “climatic change” will include a “global warming” of the Earth's surface and the lower atmosphere as warming up is the simplest way for the climate to get rid of the extra energy.

B. Sea Level Rise

If global warming takes place, sea level will rise due to two different processes. Firstly, warmer temperature cause sea level to rise due to the thermal expansion of seawater. Secondly, water from melting glaciers and the ice sheets of Greenland and the Antarctica would also add water to the ocean. It is predicted that the Earth's average sea level will rise by 0.09 to 0.88 m between 1990 and 2100.

C. Potential Impact on human life

1) **Economic Impact: -** A measurable rise in sea level will have a severe economic impact on low lying coastal areas and islands, for examples, increasing the beach erosion rates along coastlines, rising sea level displacing fresh groundwater for a substantial distance inland.

2) **Agricultural Impact:-**Experiments have shown that with higher concentrations of CO2, plants can grow bigger and faster. However, the effect of global warming may affect the atmospheric general circulation and thus altering the global precipitation pattern as well as changing the soil moisture contents over various continents.

3) **Effects on Aquatic system:-**The loss of coastal wetlands could certainly reduce fish populations, especially shellfish. Increased salinity in estuaries could reduce the abundance of freshwater species but could increase the presence of marine species.

4) **Effects on Hydrological Cycle:-**Global precipitation is likely to increase. However, it is not known how regional rainfall patterns will change. Some regions may have more rainfall, while others may have less. Furthermore, higher temperatures would probably increase evaporation.

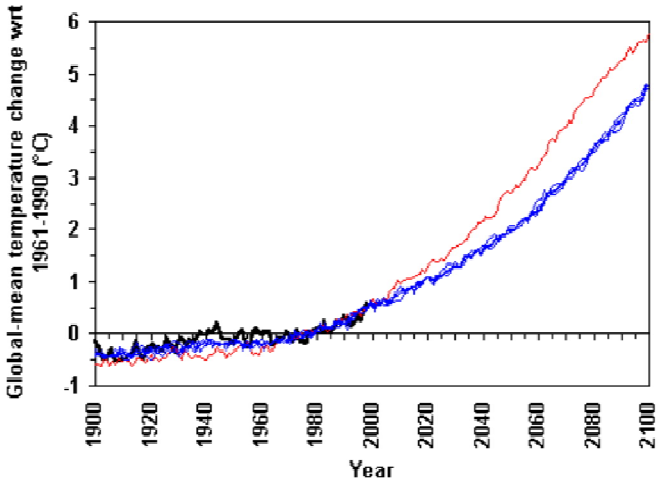

Figure 2. Global mean temp. change wrt. year

Greenhouse gases work by absorbing some of the infrared radiation that would otherwise pass directly from the earth’s surface to space and reradiating part of this energy back down toward the surface, which thus receives radiation not only from the sun but from the atmosphere and clouds as well .The most important greenhouse constituents of the atmosphere are water vapor and clouds, but water vapor cycles so quickly through the atmosphere that its concentration is usually regarded as a feedback, rather than a forcing , in the climate system.

A. NEW OPINION ON THE GREENHOUSE EFFECT

The greenhouse effect has been the subject of much discussion recently, even though it was discovered quite a long time ago [4]. In brief, the phenomenon can be summarized thus. Proceeding from Planck’s formula for thermal radiation and considering the temperature of the Sun to be equal to 6000 K, the solar radiation that passes through the Earth’s atmosphere and heats it up lies within the visible and the near-infrared (IR) regions. The wave numbers of this band are in the range of about 3000–25,000 cm −1 (the atmosphere is the transparent glass of the greenhouse). Radiation from the Earth’s heated surface at room temperature (290 K) lying within the mid- and long wave IR regions (approximately 200–2000 cm –1) is not transmitted through the atmosphere, and the heat is trapped. This leads to a temperature increase in the ‘greenhouse’ compared with the open ground. Let us examine this phenomenon more closely. It is known that nitrogen (N 2) and oxygen (O 2) are the main components of the Earth’s atmosphere (making up 78% and 21% of its volume, respectively) [5]. Ac- cording to the classification of point symmetry groups, these diatomic molecules belong to the D ∞ h group, i.e., they have a center of symmetry. The symmetry of the equilibrium configuration of the molecule is preserved under the reflection operation

(called in- version), and therefore these molecules do not have a dipole moment. The latter does not emerge when the molecules vibrate and rotate, so, consequently, they are characterized by an absence of infrared absorption and emission. Thus, the main absorbents in the Earth's atmosphere are (in order of importance) water vapor and carbon dioxide. According to Ref. [6] , the change in relative humidity in the Earth's atmosphere lies in the range of 6%–85%. For example, the average annual relative humidity in St. Petersburg reaches 80% [7], with 67% in the summer. As for carbon dioxide, its percentage (by volume) is only 0.03% [5].

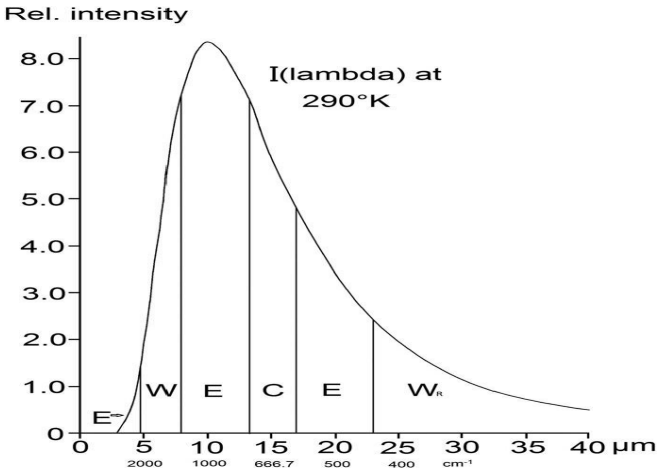

Figure 3.

Fig. A. A plot of the Plank function I(λ) for the radiation of a surface at a temperature of 290 K, plotted as a function of wavelength so that area under the curve is equivalent to total energy emitted. It is divided schematically into various regions. E shows where radiant energy can escape the surface, C is the CO2 vibration band and W is the water vibration band, WR is the water rotation band. Total reflection of radiation occurs in the vibration bands and, probably, in the rotation band too.

The above results show that the earth's surface is cooled by radiating energy and by heat exchange with the atmosphere under appropriate conditions. A part of the radiation is reflected by the greenhouse gases in a remarkably thin layer. The amount reflected amounts to about 48%, so 52% is allowed to radiate and this is far too small a proportion to account for the earth's actual equilibrium temperature, about 61% being needed. If we ignore the water rotation band then 30% is kept back and 70% radiated, now too big. Heat exchange with the atmosphere increases the proportion lost but this cannot be part of the surface radiation balance.

The overall impression is that the earth's external radiation balance is not determined by the surface temperature. The proportion of energy radiating from the surface is usually seen as leaving through the windows, E in Fig. A, and many authors seem to see it as passing straight out to space as if there is nothing to hinder it, but if it is of the incorrect magnitude, this will not give the correct radiation balance and indeed, there are measurements that show that the structured window radiation does not get very far. Bell's results for upwelling radiation detect only black body radiation at 24 m to several km from the surface [8]. Measurements from balloon borne interferometers at 16 km altitude do not detect window radiation [9]. It is suggested that this was because there was 70% cloud cover at The time, but clouds act as black body radiators too and window radiation should have welled up from them. Neither was the CO2 band evident in these spectra! Nor is window radiation evident in the spectra obtained by satellites orbiting outside the atmosphere.

These appear to be I (υ) spectra with very little overlap with the water band [10], whereas we have I(λ) spectra at the surface and at 16 km altitude. The CO2 band is very evident in these top of the atmosphere spectra, except at the Polar Regions .The bands of window radiation, seem to be processed by the atmosphere, and changed quite quickly to black body radiation which is presumably added to that produced by the atmosphere.

III. CONCLUSION

This study has shown that activities related to power generation and energy consumption has associated emissions with potential to influence greenhouse gas which is the main source of impending global warming. In reality, anthropogenic greenhouse gas emissions from energy activities are greater than the greenhouse gas emission from other human activities.

Essentially, the study also advocated the need to strategically tackle GHG reduction to prevent the sanctity of the global environmental distinction for sustainable development and biodiversity interaction. Finally, it supported the need to increase renewable energy consumption to help in dealing with Problems of energy security, energy control and health related problems.

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