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CARBON EMISSIONS & ITS IMPACT ON CLIMATE CHANGE

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ABSTRACT

Over the last hundred years or so, the instrumental temperature record has shown a trend in climate of increased global mean temperature, i.e., global warming. The probability of warming having unforeseen consequences increases with the rate, magnitude, and duration of climate change.

Climate change is the long-term change in average weather conditions, including temperature, precipitation and wind. Climate change is already apparent as evidenced by higher temperatures, rising sea levels, increased ocean acidity and decreased snow cover in the Northern Hemisphere.

Temperature is the key factor which affects climate. In the 20th century earth surface temperature increment is around (0.6±0.2) °c due to most of anthropogenic activities as believed. Main effect of carbon increment in atmosphere is global warming, and greenhouse effect due to Radiative forcing which is the cause of other effects.

The effects, or impacts, of climate change may be physical, ecological, social or economic. The impacts of climate change across world population will not be distributed evenly. Some of the physical impacts of climate change are irreversible at continental and global scales. climate change would likely result in reduced diversity of ecosystems and the extinction of many species.

Some changes to our climate are inevitable given the historic build up of emissions in the atmosphere, but immediate action is needed to avert the worst of these impacts. Scientists have predicted some future data about climate change which is terrible. If this scenario continues then within some centuries most of the species might be eliminated from the atmosphere. Therefore, this effect cannot be minimized by regional efforts until and unless any global efforts.

INTRODUCTION

Definition of climate change

"Climate change" refers to a change in the state of the climate that can be identified by changes in the mean and/or variability of its properties, and that persists for extended periods, typically decades or longer .

Climate is not the same as weather, but rather, its meteorological elements include precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, and hail-storms, and other measures of the weather. The climate change referred to may be due to natural causes or the result of human activity.

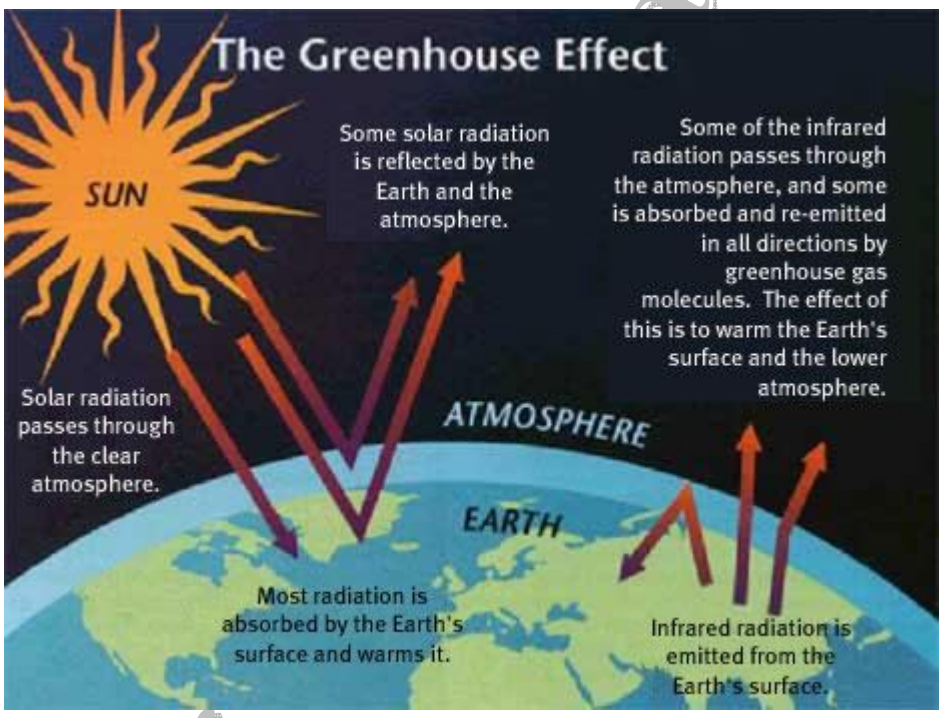
In order , atmosphere contains :

Atom-wise

- Nitrogen (78%),
- Oxygen (21%),
- Argon (0.93%) and
- Carbon (0.03%)

Temperature is the key factor which effects climate. Main effect of carbon increment in atmosphere is global warming, and greenhouse effect , due to Radiative forcing which is the cause of other effects.

Greenhouse gases are gases in the atmosphere that act like a blanket or glass roof around the earth, trapping in heat that would otherwise escape to space – this is commonly referred to as the "greenhouse effect".



In order, Earth's most abundant greenhouse gases are:

- water vapor
- carbon dioxide
- methane
- nitrous oxide
- ozone
- chlorofluorocarbons

The contribution to the greenhouse effect by a gas is affected by both the characteristics of the gas and its abundance. For example, on a molecule-for-molecule basis methane is about eight times stronger greenhouse gas than carbon dioxide, but it is present in much smaller concentrations so that its total contribution is smaller.

When these gases are ranked by their contribution to the greenhouse effect, the most important are:

- water vapor, which contributes 36–72%
- carbon dioxide, which contributes 9–26%
- methane, which contributes 4–9%
- ozone, which contributes 3–7%

Why carbon and carbon compounds are mainly concerned?

Main effect of carbon increment in atmosphere is because any molecule made up of similar or different types of atoms having loose bonding, on absorbing radiation its atoms vibrate and eventually radiate back the same radiation. If any space is full of such molecules then radiation will be trapped and which lead to greenhouse condition.

Carbon dioxide, water vapor, methane, and nitrous oxide are loose bonded molecules and their amount in atmosphere is more. So they are main greenhouse gases of earth

SOURCES OF CARBON EMISSIONS:

The two main sources are

- Natural
- Anthropogenic

NATURAL SOURCES:

Natural sources mainly include forest fires, volcanic eruptions. Natural sources of carbon dioxide are more than 20 times greater than sources due to human activity, but over periods longer than a few years natural sources are closely balanced by natural sinks such as weathering of continental rocks and photosynthesis of carbon compounds by plants and marine plankton.

ANTHROPOGENIC SOURCES:

Since the Industrial Revolution, human activities such as the burning of oil, coal and gas, as well as deforestation have greatly increased CO_2 concentrations in the atmosphere. As we can see from figure 1, almost all CO_2 emissions (about 96.5%) come from fossil fuels use. The 3 types of fossil fuels that are used the most are coal, natural gas and petroleum. When fossil fuels are combusted, the carbon stored in them is emitted almost entirely as CO_2.[1]

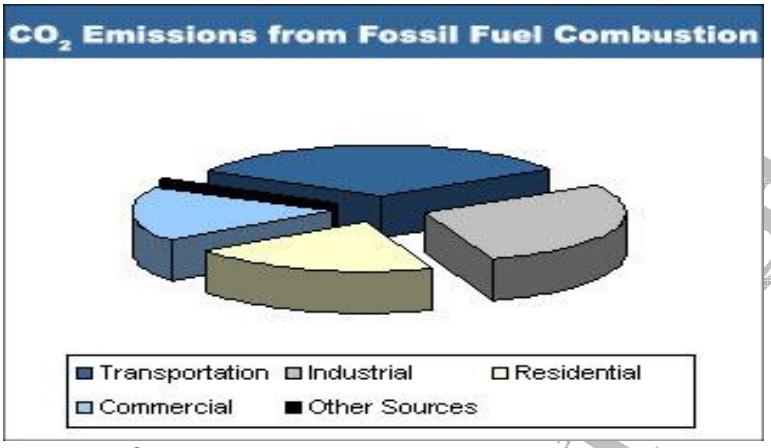
The three main sectors that use fossil fuels are:

- Transportation
- Utilities (power, gas, oil etc...)
- Industrial production

Transportation:

The most important source of CO_2 emissions worldwide is caused by the transportation of goods and people. The emissions caused by people traveling (by car, plane, train, etc...) are examples of direct emissions since people can chose where they are going and by what method.

The emissions caused by the transportation of goods are examples of indirect emissions since the consumer has no direct control of the distance between the factory and the store. Since the distance between the manufacturer and the consumer is constantly growing, more pressure is put on the transportation industry to bridge this gap and this ends up creating more indirect emissions. What's worse is that 99% of the energy used to transport people and goods all over the world comes from the combustion of fossil fuels.



(*Source:* **Inventory of U.S. Greenhouse Gas Emissions and Sinks (2008), EPA.)**

Utilities (power, gas, oil etc...):
Depending on the energy mix of your local power company you may find that the electricity that you use at home and at work has a considerable impact on greenhouse gas emissions. All industrialized nations (with the exception of Canada and France) get the majority (between 60-80%) of their electricity from the combustion of fossil fuels. Below is a chart for all G8 nations.

Table 1: Electrical Energy Produced By Fossil Fuel Combustion
(Billion Kilowatt hours)

G8 Nation	Fossil Fuel Combustion	Total	%
Canada	154.55	569.41	27.1%
France	52.23	535.45	9.8%
Germany	354.78	561.57	63.2%
Italy	223.16	268.18	83.2%
Japan	640.17	982.76	65.1%
Russia	569.72	869.07	65.6%
United Kingdom	278.21	373.26	74.5%
United States	2,758.65	3,891.72	70.9%

(*Source:* **International Energy Database (2008), Energy Information Administration)**

Industrial production:

Manufacturing and industrial processes all combine to produce large amounts of each type of greenhouse gas but specifically large amounts of CO_2 because of two reasons. First , many manufacturing facilities directly use fossil fuels to create heat and steam needed at various stages of production. Second, their energy intensive activities use more electricity than any other sector so unless they are using renewable sources the energy that they use is responsible for vast amounts of emissions.

By industrial production we are mainly talking about manufacturing, construction, mining, and agriculture. Manufacturing is the largest of the 4 and can be broken down into 5 main categories: paper, food, petroleum refineries, chemicals, and metal/mineral products. These categories account for the vast majority of the energy use and CO_2 emissions by the sector.

EFECTS DUE TO CARBON EMISSIONS

Effect on Climate :

In the 20th century earth surface temperature increment is around (0.6±0.2) °c due to most of anthropogenic activities as believed. This slight increment in temperature changed climate of earth dramatically. Greenhouse gases are main reason for temperature increment, so we take a look on main carbon-emissions.

Physical Effects :

- Main physical effects are temperature, precipitation, humidity, sunshine, wind velocity, fog, frost, and hail- storms, tornado, and other measures of the weather.
- Due to temperature increase power generation efficiency decreases, water vapor increases, microbial growth increases, ice caps melt, ocean circulation pattern slows, equator warms, temperature differential between regions increases, wind increases, more salt swept from ocean to atmosphere, more lightening takes place, atmospheric reaction spontaneity increases, humidity increases, corrosion increases. More damage to plastic.
- Computer simulation shows that carbon soot particles concentration in polar ice is increasing, and energy absorption increasing so ice melting also increase.
- Due to carbon particles layer on leaves, photosynthesis decreases.

Chemical Effects:

- Due to temperature increment, activation activation energy of molecules decrease so spontaneity of reaction increases, all biological activity go up, this enhances microbial growth and increases atmospheric carbon emission.

Health Effects:

- Due to increment in temperature and humid conditions pathogens and vector increases so diseases due to these also increases.
- Complications with asthma, bronchitis, emphysema, pneumonia and other lung diseases; irritations to the nose, throat and ear canal.
- Breathing difficulties, chest pain and headaches;
- Increased sensitivity to allergens;
- Reduced alertness;
- Diminished lung function;
- Weakened immune system; and increased risk of heart disease.
- CO can cause dizziness, slowed reaction times, headaches, an increased risk of heart disease and may promote the development of arteriosclerosis.

UV causes-

- Skin cancer;
- Eye cataracts;
- Weakened immune system;
- Reduced plant yield;
- Damage to ocean eco-system;
- DNA damage;

Preventive Measures for Control of Carbon Emission

- Use of high efficiency equipments to reduce power consumption;
- Pot vegetation in houses;
- Minimum use of allotropic medicines;
- Development of non carbon emitting equipments;
- Use of environmental friendly material which can be recycled;
- Plantation in barrel land;
- Minimize deforestation;
- Less use of manmade organic cosmetics;
- Use bio-fuel for domestic cooking;
- Shifting cultivation should be stopped;
- Production of compounds which can recycled;
- Balancing unequal distribution of urbanization and industrialization;

Conclusion

Nature has a buffer capacity to counter act the change in climate either by naturally or anthropogenically to some extent. If climate changes occur beyond this limiting capacity, than nature will become pseudo. Today climate change is main issue which globally affect over temperature, precipitation, wind pattern, biodiversity lose and economic pressure etc. Scientists have predicted some future data about climate change which is terrible. So all are aware of these reports and many organizations in world are coming forward to implement some rules and regulations to control anthropogenic carbon emission. If this scenario continues than within some centauries most of species might be eliminated from biosphere of earth. This effect cannot be minimize by regional efforts until unless any global efforts.