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GLOBAL WARMING

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INTRODUCTION :

Global warming is the rise in the average temperature of Earth's atmosphere and oceans since the late 19th century and its projected continuation. Since the early 20th century, Earth's mean surface temperature has increased by about 0.8 °C (1.4 °F), with about two-thirds of the increase occurring since 1980. Warming of the climate system is unequivocal, and scientists are more than 90% certain that it is primarily caused by increasing concentrations of greenhouse gases produced by human activities such as the burning of fossil fuels and deforestation. These findings are recognized by the national science academies of all major industrialized nations. Understanding the hazards caused by the global warming, many measures are being taken to control it like new industrial techniques and many different policies and acts, as effects of global warming are not limited to certain landmass but are global.

WHAT IS GLOBAL WARMING :

Global Warming is the increase of Earth's average surface temperature due to effect of greenhouse gases, such as carbon dioxide emissions from burning fossil fuels or from deforestation, which trap heat that would otherwise escape from Earth. This is a type of greenhouse effect.

This primarily is caused by the greenhouse effect which can be explained as: Burning of fossil fuels have characteristic of absorbing heat energy from the atmosphere which is necessary to maintain earth temperature but due to industrialization and many more causes, amount of greenhouse gases has increased way too much and more and more heat is absorbed and remains in the atmosphere rather than get reflected back into space.

What are the Greenhouse Gases?

The most significant greenhouse gas is actually *water vapor*, not something produced directly by humankind in significant amounts. However, even slight increases in atmospheric levels of carbon dioxide (CO_2) can cause a substantial increase in temperature. In order, the

most abundant greenhouse gases in Earth's atmosphere are: Water vapor (H2O), Carbon dioxide (CO_2), Methane (CH4), Nitrous oxide (N2O), Ozone (O3), CFCs.

Why is this? There are two reasons:

First, although the concentrations of these gases are not nearly as large as that of oxygen and nitrogen (the main constituents of the atmosphere), neither oxygen or nitrogen are greenhouse gases. This is because neither has more than two atoms per molecule (i.e. their molecular forms are O_2 and N_2, respectively), and so they lack the internal vibrational mode*s* that molecules with more than two atoms have. Both water and CO_2, for example, have these "internal vibrational modes", and these vibrational modes can absorb and reradiate infrared radiation, which causes the greenhouse effect.

Secondly, CO2 tends to remain in the atmosphere for a very long time (time scales in the hundreds of years). Water vapor, on the other hand, can easily condense or evaporate, depending on local conditions. Water vapor levels therefore tend to adjust quickly to the prevailing conditions, such that the energy flows from the Sun and re-radiation from the Earth achieve a balance. CO_2 tends to remain fairly constant and therefore behave as a controlling factor, rather than a reacting factor.

GLOBAL WARMING - STATISTICS AND SOURCES:

The Earth's average surface temperature rose by 0.74±0.18 °C over the period 1906–2005. The rate of warming over the last half of that period was almost double that for the period as a whole (0.13±0.03 °C per decade, versus 0.07±0.02 °C per decade). The urban heat island effect is very small, estimated to account for less than 0.002 °Cof warming per decade since 1900. Temperatures in the lower troposphere have increased between 0.13 and 0.22 °C (0.22 and 0.4 °F) per decade since 1979, according to satellite temperature measurements. Climate proxies show the temperature to have been relatively stable over the one or two thousand years before 1850, with regionally varying fluctuations such as the Medieval Warm Period and the Little Ice Age.

More CO_2 means that the balance occurs at higher temperatures and water vapor levels. Recent estimates by NASA's Goddard Institute for Space Studies (GISS) and the National Climatic Data Center show that 2005 and 2010 tied for the planet's warmest year since reliable, widespread instrumental measurements became available in the late 19th century, exceeding 1998 by a few hundredths of a degree. Estimates by the Climatic Research Unit (CRU) show 2005 as the second warmest year, behind 1998 with 2003 and

2010 tied for third warmest year, however, "the error estimate for individual years ... is at least ten times larger than the differences between these three years." The World Meteorological Organization (WMO) statement on the status of the global climate in 2010 explains that, "The 2010 nominal value of +0.53 °C ranks just ahead of those of 2005 (+0.52 °C) and 1998 (+0.51 °C), although the differences between the three years are not statistically significant..." Every year from 1986 to the present has seen world annual mean temperatures above the 1961-1990 average.

SOURCES :

The primary sources of greenhouse gas emissions are :

- **Electricity production** - Electricity production generates the largest share of greenhouse gas emissions. Most of our electricity comes from burning fossil fuels, mostly coal and natural gas.
- **Transportation** - Greenhouse gas emissions from transportation primarily come from burning fossil fuel for our cars, trucks, ships, trains, and planes. Over 90% of the fuel used for transportation is petroleum based, which includes gasoline and diesel.
- **Industry** - Greenhouse gas emissions from industry primarily come from burning fossil fuels for energy as well as greenhouse gas emissions from certain chemical reactions necessary to produce goods from raw materials.
- **Commercial and Residential** - Greenhouse gas emissions from businesses and homes arise primarily from fossil fuels burned for heat, the use of certain products that contain greenhouse gases, and the handling of waste.
- **Agriculture** - Greenhouse gas emissions from agriculture come from livestock such as cows, agricultural soils, and rice production.
- **Land Use and Forestry** - Land areas can act as a sink (absorbing CO_2 from the atmosphere) or a source of greenhouse gas emissions. In the United States, since 1990, managed forests and other lands have absorbed more CO_2 from the atmosphere than they emit.

Effects of Global Warming :

A] On Social systems :

Food Supply :

Climate change will impact agriculture and food production around the world due to: the effects of elevated CO_2 in the atmosphere, higher temperatures, altered precipitation and transpiration regimes, increased frequency of extreme events, and modified weed, pest, and pathogen pressure. In general, low-latitude areas are at most risk of having decreased crop yields.

So far, the effects of regional climate change on agriculture have been relatively limited. Changes in crop phenology provide important evidence of the response to recent regional climate change. Phenology is the study of natural phenomena that recur periodically, and how these phenomena relate to climate and seasonal changes. A significant advance in phenology has been observed for agriculture and forestry in large parts of the Northern Hemisphere.

Agriculture :

Droughts have been occurring more frequently because of global warming and they are expected to become more frequent and intense in Africa, southern Europe, the Middle East, most of the Americas, Australia, and Southeast Asia. Their impacts are aggravated because of increased water demand, population growth, urban expansion, and environmental protection efforts in many areas. Droughts result in crop failures and the loss of pasture grazing land for livestock.

Health :

Human beings are exposed to climate change through changing weather patterns (temperature, precipitation, sea-level rise and more frequent extreme events) and indirectly through changes in water, air and food quality and changes in ecosystems, agriculture, industry and settlements and the economy. According to an assessment of the scientific literature by Confalonieri *et al.* (2007:393), the effects of climate change to date have been small, but are projected to progressively increase in all countries and regions.

A study by the World Health Organization (WHO, 2009) estimated the effect of climate change on human health. Not all of the effects of climate change were included in their estimates, for example, the effects of more frequent and extreme storms were excluded.

Climate change was estimated to have been responsible for 3% of diarrhea, 3% of malaria, and 3.8% of dengue fever deaths worldwide in 2004. Total attributable mortality was about 0.2% of deaths in 2004; of these, 85% were child deaths.

Migration and Conflict :

General circulation models project that the future climate change will bring wetter coasts, drier mid-continent areas, and further sea level rise. Such changes could result in the gravest effects of climate change through sudden human migration. Millions might be displaced by shoreline erosions, river and coastal flooding, or severe drought.

Migration related to climate change is likely to be predominantly from rural areas in developing countries to towns and cities. In the short term climate stress is likely to add incrementally to existing migration patterns rather than generating entirely new flows of people.

B) BIOLOGICAL SYSTEMS :

Observed Impacts on Biological Systems :

With very high confidence, Rosenzweig *et al.* (2007) concluded that recent warming had strongly affected natural biological systems. Hundreds of studies have documented responses of ecosystems, plants, and animals to the climate changes that have already occurred. For example, in the Northern Hemisphere, species are almost uniformly moving their ranges northward and up in elevation in search of cooler temperatures. Humans are very likely causing changes in regional temperatures to which plants and animals are responding.

Abrupt or Irreversible Changes :

Physical, ecological and social systems may respond in an abrupt, non-linear or irregular way to climate change. This is as opposed to a smooth or regular response. A quantitative entity behaves "irregularly" when its dynamics are (i.e., not smooth), non-differentiable, unbounded, wildly varying, or otherwise ill-defined. Such behaviour is often termed "singular". Irregular behaviour in Earth systems may give rise to certain thresholds, which, when crossed, may lead to a large change in the system.

Some singularities could potentially lead to severe impacts at regional or global scales. Examples of "large-scale" singularities are discussed in the articles on abrupt climate change, climate change feedback and runaway climate change. It is possible that human-

induced climate change could trigger large-scale singularities, but the probabilities of triggering such events are, for the most part, poorly understood.

SOLUTIONS :

The evidence that humans are causing global warming is strong, but the question of what to do about it remains controversial. Economics, sociology, and politics are all important factors in planning for the future.

Even if we stopped emitting greenhouse gases (GHGs) today, the Earth would still warm by another degree Fahrenheit or so. But what we do from today forward makes a big difference. Depending on our choices, scientists predict that the Earth could eventually warm by as little as 2.5 degrees or as much as 10 degrees Fahrenheit. A commonly cited goal is to stabilize GHG concentrations around 450-550 parts per million (ppm), or about twice pre-industrial levels. This is the point at which many believe the most damaging impacts of climate change can be avoided. Current concentrations are about 380 ppm, which means there isn't much time to lose. According to the IPCC, we'd have to reduce GHG emissions by 50% to 80% of what they're on track to be in the next century to reach this level.

- Boosting energy efficiency: The energy used to power, heat, and cool our homes, businesses, and industries is the single largest contributor to global warming. Energy efficiency technologies allow us to use less energy to get the same—or higher—level of production, service, and comfort. This approach has vast potential to save both energy and money, and can be deployed quickly.
- Revving up renewables: Renewable energy sources such as solar, wind, geothermal and bio-energy are available around the world. Multiple studies have shown that renewable energy has the technical potential to meet the vast majority of our energy needs. Renewable technologies can be deployed quickly, are increasingly cost-effective, and create jobs while reducing pollution.
- Phasing out fossil fuel electricity: Dramatically reducing our use of fossil fuels—especially carbon-intensive coal—is essential to tackle climate change. There are many ways to begin this process. Key action steps include: not building any new coal-burning power plants, initiating a phased shutdown of coal plants starting with the oldest and dirtiest, and capturing and storing carbon emissions from power plants.
- Developing and deploying new low-carbon and zero-carbon technologies: Research into and development of the next generation of low-carbon technologies will be critical to

deep mid-century reductions in global emissions. Current research on battery technology, new materials for solar cells, harnessing energy from novel sources like bacteria and algae, and other innovative areas could provide important breakthroughs.

- Ensuring sustainable development: The countries of the world—from the most to the least developed—vary dramatically in their contributions to the problem of climate change and in their responsibilities and capacities to confront it. A successful global compact on climate change must include financial assistance from richer countries to poorer countries to help make the transition to low-carbon development pathways and to help adapt to the impacts of climate change.

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