

Global Warming and Climate Change

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Abstract

On a careful observation, we find that in recent times there has been a striking change in the average temperatures in many regions. The global average surface temperature had risen since last century. The 1990s have been the warmest decade and the year 1998 has been the warmest year recorded so far and the second warmest year 2001. The tropical and coastal areas are facing cold temperatures, rainfall is either in excess or scanty, and there is an increase in the frequency and intensity of the droughts. The human activities are primarily responsible for these and the climate change due to global warming is going to alter their lives so much that the very survival of the mankind is at stake. Globalization, development, climate change and human health are closely interconnected. These are also causing conflicts among states with regard to responsibilities of causing and reducing environmental changes. Only consistent and serious efforts to mitigate them can alter the existing conditions and prevent further deterioration. In this research paper highlights the Global warming effects, indicators of climate change and worldwide efforts to Global Warming and Climate Change.

Keywords: melting of glaciers, rise in sea levels, acid rains, ozone layer depletion and global warming

1. Global Warming and Green House Gases (GHGs)

Around 75% of the solar energy that reaches the earth is absorbed by earth's surface while the rest of it radiates back to the atmosphere without which the planet would be too cold for the humans. Some of it is trapped by the gases in the atmosphere which are called as green house gases and mostly by carbon dioxide. Also the increasing human activity is leading to further increase in the release of carbon dioxide and this is what is causing global warming. It is basically a rise in the temperatures leading to discomfort for humans and also causing changes in the weather patterns and natural climatic

changes. In short, the radiation absorbed by clouds, carbon dioxide and some other gases produce the greenhouse effect and therefore the warming of the temperature occurs. Due to this, there are variations in climatic patterns leading to floods, cyclones, storms, water scarcity and desertification. The additional changes are melting of the glaciers, erosion of the soil systems and rise in sea levels etc.

Carbon dioxide, methane, nitrous oxide and chlorofluorocarbons (CFCs) are called as greenhouse gases. CFCs that contain chlorine and bromine cause the depletion of the ozone layer and this, in turn, increases the incoming ultraviolet radiation. While some natural

weather changes contribute to gases, most of the emissions are attributed to human activities like industrial emissions, vehicular emissions, burning of forests and refrigeration. As per estimates, the global mean surface temperatures would be about 2 degrees above the pre-industrial levels by the year 2030 and about 4 degrees above preindustrial levels by 2090. Resultantly, due to the rise in global temperature and melting of glaciers, the sea level is projected to rise between 9 cm and 29 cm by 2030 and 28 cm and 96 cm by 2090.

Precisely, climate change refers to the change in distribution of weather over a period of time in a particular region or whole of the earth. Though there are several causes attributed to climate change like motion of tectonic plates, variations in solar intensity of energy output, volcanic eruptions and so on, scientists around the world firmly believe that it is the human activities that are most responsible for the climate change problem. The rise in carbon dioxide component in the air, fuel combustion, deforestation, cement manufacturing, depleting soil fertility are all an evidence to this belief.

Time and again, there have been efforts at all levels to persuade the nations of the world, especially the most polluting ones, to reduce their emission levels considerably so as to ensure a better environment for the mankind. The negotiations to this effect have not been much fruitful as there seems to be no willingness on the part of the compliant nations to achieve progress on this front. Though the per capita emission level in India is very low, it is likely that their levels of GHGs emission in future would increase manifold. Many countries had signed a convention to reduce GHGs under the United Nations Framework Convention on Climate Change (UNFCCC) but these are definitely not enough to prevent the damage resulting out of global warming and the rising sea levels. The signatories to the Convention agreed to promote and cooperate in education training and public awareness on different dimensions related to climate change and vowed to participate in mitigating the negative effects of the climate change.

2. Indicators of Climate Change

The main indicators of Climate Change are the following:

2.1 Melting of Glaciers

Glaciers are considered to be the most sensitive

indicators of global warming. From the world glacier inventory compiled since 1970, which monitors the glacier mass and melting, it has been observed that the glaciers all around the world are melting very fast. Glacier melting would lead to severe water crisis and would result in extreme water scarcity for the future generations.

The Intergovernmental Panel on Climate Change (IPCC) has reported that the Himalayan glaciers are fast melting and by the year 2035, they would disappear. Though the figure has been distorted due to a printing mistake, the environmentalists are warning that the melting of glaciers in the Himalayan region could spell a disaster for the population living in these areas. The swelling glacial lakes severely impact the regions with catastrophic flooding leading to sweeping away of people, houses, roads and bridges. It is a fact that adequate monitoring is not being taken up to address this problem. In India, the Gomukh glacier is one of the largest and the source of the river Ganga. It is spread over an area of 260 square kilometers. But the frequent mountaineering activities and travels by the enthusiasts have resulted in the increased human activity in the area. Scientists have warned that the melting rate has doubled since 1970s and that the number of tributaries to the glacier which were nine in number has come down to five. This does not augur well for our environment as the river Ganges could become, in future, a monsoon-fed river with its source melting away completely. The other regions in the world that are facing threat from climate change include Arctic region (wherein the snow would melt considerably losing its snow in summer time) and Siberia (where GHGs are trapped most, leading to serious emission levels).

2.2 Rise in Sea Levels

One of the most serious factors resulting out of climate change effect is the rise in sea levels. The melting of the ice caps will result in 10-25 meter rise in sea levels which means that the low lying nations and areas are at severe risk. The Indian Ocean region, Bangladesh, Mauritius, The Netherlands, Egypt are all under serious risk emanating from rising sea levels. The land area of the Netherlands is almost 60% below the sea level. In India, the coastal regions face the maximum risk with the low lying areas mostly existing in Tamil Nadu, Gujarat and Maharashtra. The coastal regions also face the

risk of severe natural calamities like the ones that happened in 2004 tsunami and the Hudhud cyclone in Andhra Pradesh in 2014. Further, the supply of fresh water to the areas would seriously be affected as there would be an intrusion of salt water into the regular supply. Deforestation is also greatly contributing to the global warming as the much needed forest areas and reserves are being cut to pave way for concrete structures and building up of new cities and other infrastructure projects. Of all the risks associated with global warming, the rise in sea levels is the most dangerous so far.

2.3 Acid Rains

The burning of fossil fuels such as coal, oil and natural gas results in the production of chemicals like sulfur dioxide and nitrogen oxides. In combination with water or other chemicals in the air, they become harmful pollutants and spread upwards in the atmosphere. These get back to the ground in the form of acid rain, fog or snow. Some of the countries that are at risk include Europe, Japan, North America and China to name a few. Acid rains wash away the nutrients from the soil, resulting in water pollution and poisoning of plain soil. They also affect the trees and the photosynthesis of plants, increase the insect infestation and drought. The water sources become acidic and affects aquatic ecosystem. Acid rains and deposition damage the buildings, automobile, and other stone and metal structures. They ruin the structures to great extent. Though the acid rain does not directly harm people, the toxic substances reach the water sources and pollute them; the fish fed on these water sources is harmful for human consumption. The smog, resulting out of the combination of these pollutants and fog, has serious effect on human health, especially the respiratory system. One of the effective ways to contain the damage is to use less energy from fossil fuels and switch to cleaner burning fuels. For example, using natural gas is cleaner than gas produced out of coal. The acidity in the soil may be minimized through using powdered limestone that neutralizes the acidity contaminating it.

2.4 Ozone Layer Depletion

Ozone is formed by the action of sunlight on oxygen. It forms a layer 20 to 50 kms above the surface of the earth. It is a highly polluted and poisonous gas and often results in human health

hazards by causing respiratory problems. It also severely affects the natural vegetation and leads to the deterioration of plastic products. It is vital in protecting the Earth from ultraviolet rays and radiation. The ozone layer absorbs the harmful ultraviolet radiation from the sun and protects the surface of the earth. The thinning of the ozone layer is a result of the CFC emissions which are indestructible until they reach stratosphere where the ultraviolet radiation breaks them down into releasing chlorine atoms. The ozone and chlorine molecule break down into oxygen but it does not absorb the radiation. The ozone layer destruction poses great health risks like skin cancer and cataracts. It decreases vegetation as well.

The Montreal Protocol of 1987 that aims at protecting the ozone layer came out with different proposals to ensure the recovery of the ozone layer. It proposed the ban of the use of CFCs by the year 2000 so that the ozone layer can slowly recover. But other chemicals and compounds of the industries like bromine and nitrous oxides continue to damage the ozone layer.

3. Climate Change Convention 1992

According to the United Nations, climate change is 'a change of climate that is attributed to human activity that alters the composition of the global atmosphere and which is in addition to natural climatic variability observed over comparable time periods'. The Climate Change Convention was aimed at stabilizing the GHG emissions. The convention laid down general commitments applicable to all state parties (annexed and non-annexed). They are to limit GHG emissions, gather relevant information, develop plans to mitigate and adapt to climate change and cooperate in research and development. Under the convention, the state parties divided into two categories, annexed and non-annexed, are subdivided into Annex I consisting of industrial states, OECD States and economies in transition and annex II states consisting only of OECD states. While the former have specific commitments to bring down their GHG to 1990 levels, the latter also have to bring down the GHG emissions but are not bound by the baseline limit of 1990 and can be voluntarily fixed them.

The beginning of the international cooperation on climate change dates back to the Stockholm Conference 1972. In 1979, the first World Climate

Conference in Geneva expressed concerns about the atmospheric conditions. Though this conference saw the participation by the scientists from all around the world, it drew little attention from the policy makers. In the 1980s, a series of meetings from were held in Austria to consider the fixing up the limits for gas emissions. In 1985, an international group of scientists highlighted the impending dangers of the climate change. Growing public awareness and pressure and the implications of the Brundtland Commission (WCED 1987) brought the issue to the forefront of many governments. In the 1988 Toronto Conference on the Changing Atmosphere a recommendation emerged calling on the developed countries to reduce carbon dioxide levels by 20% by the year 2005. A few months later, the Intergovernmental Panel on Climate Change was jointly established by World Meteorological Organisation and United Nations Environmental Programme. The IPCC has been reporting ever since on the climate change issues and coming up with new recommendations in order to counter the negative effects. It is a scientific body without any political orientation and its main objective is to assess different aspects of climate change and make them available to the public and policy makers. Though initially, it was taken as the most authentic source of climate change information, the IPCC was marred by controversies necessitating the establishment of a panel of scientists and experts to review its contents.

4. The Kyoto Protocol and Other Meetings

During the United Nations Framework Convention on Climate Change, an international environment treaty was finalised by the participating nations for reducing green house gases in 1997 in Kyoto, Japan. This is famously known as Kyoto Protocol. Around 187 countries had signed and ratified the protocol. The protocol had three primary objectives:

- 1) There needs to be commitment to reduce the GHGs on the part of Annex I countries and these are legally binding on them. Other member countries also need to reduce the GHGs with realistic targets.
- 2) An array of flexible market based approaches is to be included to reduce emissions.
- 3) It was also suggested that active participation of various developing countries and an adaptation fund for climate change are needed

for expediting the process.

As the Kyoto meeting came to an end, the parties to the UNFCCC agreed to bind forces of global market place to reduce GHGs emissions that reflected the first two of the objectives and also proposed to stabilize emissions at 1990 level by 2008-2012 and reduce the net emissions of all GHGs below 1990 levels by 2013-2018 and work for further reduction in the coming years. It was decided that a committee would be established to oversee the commitment and compliance to the protocol. A few interesting facts regarding the compliance of the members and their efforts to reduce emissions is given as below:

Around 38 countries were included in the agreement (Annex I parties). 37 countries agreed to reduce the emissions.

Iceland, Australia and Norway were allowed to increase their emission levels.

The United States has signed the protocol but has neither ratified nor withdrew from the Treaty. It had insisted that even the developing countries must be taken on board to reduce emissions through binding obligations.

China ratified the protocol but was not required to reduce or limit its emissions.

China has become the biggest emitter of carbon dioxide in the world by 2008 and surpassed the US. China's power plants operate mostly on the coal and therefore its emission levels are quite high. But its per capita emission is still low, almost one fourth of that of the US.

India signed and ratified the protocol but is exempted from the framework of the treaty.

The European Union countries have been steadfast in their commitment to reduce emissions and can be termed as the most compliant nations. They had unilaterally agreed to reduce emissions by 20% by the year 2020.

Denmark committed to reducing its emissions by 21%.

Germany reduced its emissions by 22.4% during 1990-2008.

France has low carbon emissions as it has shut down its coal mines and 80% of its power is generated from nuclear power plants.

The United Kingdom was successful in reducing the overall emission levels and has introduced a mandatory law to reduce emissions by 32% in 2020 and 60% by 2050. It aims at 80% reduction in emissions.

In 2002, the EU countries introduced quota for 6 important industries — steel, glass, cement, paper, bricks and energy and fines for non-commitment. By 2008, the EU has achieved 4.7% reduction below 1990 level against 8% as agreed in the Kyoto Protocol by 2012.

4.1 The Copenhagen Summit 2009

The Copenhagen Summit meeting of 2009 proposed to take forward the Kyoto Protocol beyond the target year of 2012 and come out with binding legal agreement. Prior to this summit meeting, several meetings have been held regarding the negotiations. In Bonn (June 2009) meeting, it was decided that an appropriate level of 25-40% reduction below 1990 level would be set as target. In the Bangkok (September 2009) meeting and Barcelona (November 2009) meeting, changes were proposed in absolute carbon emissions between 1990 and 2020.

The Summit meeting turned out to be a major disappointment with the nations announcing emission reduction levels in far less percentages than desired. For example, the EU agreed on 20% reduction level (as against the desired 25-40%). While the developing nations felt that the burden was shifted on them to reduce the emissions, the developed nations felt that the developing countries too should take responsibility considering the fact that climate change affects one and all equally. It is to be noted that India and China too need to reduce the emission levels so as to ensure that their economic growth is in proportion to sharing the emission burden.

4.2 Doha Meet 2012

The Doha Meet of 2012 focused on five aspects of climate change that are given below:

Adaptation — social and other changes to successfully adapt to climate change.

Finance — how countries will finance adaptation to and mitigation of climate change, whether from public or private sources.

Mitigation — steps and actions that the countries of the world can take to mitigate the effects of climate change.

Technology — the technologies that are needed to adapt or mitigate climate change and ways in which developed countries can support developing countries in adopting them.

Loss and damage — first articulated at the 2012

conference and in part based on the agreement that was signed at the 2010 United Nations Climate Change Conference in Cancun. It introduces the principle that countries vulnerable to the effects of climate change may be financially compensated in future by countries that fail to curb their carbon emissions.

The Conference produced a package of documents collectively titled **The Doha Climate Gateway** over objections from Russia and other countries at the session. An eight-year extension of the Kyoto Protocol until 2020 limited in scope to only 15% of the global carbon dioxide emissions due to the lack of participation of Canada, Japan, Russia, Belarus, Ukraine, New Zealand and the United States and due to the fact that developing countries like China, India and Brazil are not subject to any emissions reductions under the Kyoto Protocol. The conference did not make progress towards the issue of the Green Climate Fund.

5. Impact on Human Health

The human activities have compounded the problems related to the environmental issues. If climate change is a serious issue affecting all of us today, at an individual level it causes all the more problems. The change in climatic patterns not only affects us but also plants and wildlife.

1) The basic concern is about the human health wherein the weather patterns trigger extremities like droughts and floods. Natural disasters worldwide have resulted in large number of deaths about 95% of them in poor countries.

2) Public health depends on the availability of clean and safe drinking water, food, shelter and good social conditions. During floods, there is a scarcity of fresh water supply that results in harmful side effects leading to water borne diseases. Water is contaminated and often mixes up with sewage water due to breakage in pipelines. This also gives rise to infectious diseases.

3) During drought, food production is seriously affected. There is vulnerability through increase in pests/plant and animal diseases. The reduction in food production leads to malnutrition or starvation, with long-term consequences especially among women and children.

4) Climate change triggers displacement and migration of people from one region to another leading to conflicts, facing problems as

environmental victims and refugees and further health issues due to non-acclimatisation of weather conditions.

5) Climate change leads to one of the most vulnerable diseases such as vector species like mosquitoes that spread the diseases like malaria and filariasis, dengue and serious infections. Malaria transmission is especially rampant. A heavy rain can increase mosquito population leading to epidemics.

6) Heat waves claim large number of deaths due to heat strokes, respiratory diseases and dehydration. The elderly and children are most vulnerable to these conditions.

7) Tuberculosis kills approximately two million people every year. It is infectious and spreads through air. With polluted air, human lungs become vulnerable to air-borne infections resulting weakening immunity system and weight loss.

8) Globally, there have been uncertain climatic conditions resulting in extreme droughts, floods and temperature rise. The *El Nino* winds affect weather world-wide. It creates floods, droughts and triggers epidemics.

9) Motor vehicle exhausts, industrial fumes, exposure to hazardous chemicals at workplace and improper ventilation at home lead to serious health issues.

10) Environmental deterioration has a serious role in causing socio-economic disruption. The transmission of infectious diseases takes a heavy toll on the public health and poses a major risk.

11) The increase of CFCs in the atmosphere increases the risk of ultraviolet radiation affecting the immune system and leading even to cancers. It can cause skin cancer, leprosy, ringworms and ocular lesions.

12) Increase in bush fires releases large quantities of harmful chemicals leading to respiratory problems and degrading water bodies.

13) The effects of acid rain include pollution of soil, and deposition of acids in the soil, vegetation and water reservoirs. The food grown thereof becomes unfit for human consumption. This directly affects the kidneys and liver causing internal wounds and weakening immune system.

14) A significant concern of climate change is the disappearing ice caps and water sources,

livestock and agriculture. Coastal zones are largely affected due to this. Coral reefs are damaged by warming, excess waste, over-fishing and fungal and bacterial diseases. Reefs provide safety against storms and water Stalinization and protect fish, which are a major source of food and protein.

15) Adverse climate change leads to loss of biodiversity and habitat, ozone depletion, degradation of air, water and soil. An imbalance is likely to aggravate the situation with irreversible losses to humankind. As the old adage says, health is wealth. Without health, the so-called progress and development are nothing but a waste.

6. Mitigating Global Warming in India

As per the IPCC Report of 2007, India is going to become the third largest emitter by 2015 after China and the US. Its economic growth rate of 7-8% has resulted in good economic progress but loss in terms of emission levels. India requires energy to meet its requirements and is forging agreements with various countries in energy cooperation. India depends on coal for power generation rather than oil or gas. Almost 70% of the power generation is dependent on coal. This actually is the main reason for India's higher emission levels and also its inability to commit for emission reduction levels.

1) India needs to opt for cleaner energy sources or make use of energy sources that can alternatively produce better results. Instead of depending on building new power plants based on coal, it can harness other available sources such as solar energy, wind energy, hydro energy etc. Not that India is unaware of these sources; it requires the identification of right energy source to be used at the right place and replicating it in other areas.

2) Hydro energy is a crucial source of energy and India's Indus and Brahmaputra basins offer major scope for harnessing the hydro energy. India needs to tap this source as the present hydro energy accounts for only 10% of total electricity generation.

3) In many European countries, wind energy has become a major source of generation of energy. The Netherland leads in harnessing this energy. India too needs to identify the regions from where it can generate this energy. Wind energy is clean and cost-effective.

4) Nuclear energy is the new area where India is

exploring all the possibilities and its deal with the US is an effort in this direction. Nuclear energy does not emit carbon dioxide and India's target is to achieve 25% of its power requirements from these plants by 2050. Presently, the nuclear plants account for only 2.5% of electricity generation in India.

5) Solar energy, the richest source of renewable energy, is the need of the hour in India. India can harness best out of this energy but with new innovations and technology that can be cost-effective. The Government of India has been encouraging the generation from this source so as to encourage new research and development.

6) Most importantly, there should be sustainable consumption in India which, due to its growing population, is unable to match up to its requirements. There is a heavy burden on natural resources and too much demand for finite resources that are available on this earth.

7) A heavy population naturally leads in generating too much of waste. There is a high quantity of waste generated all around. Without proper waste disposal mechanisms, methods and techniques, there would be too much garbage and sewage which pose risk to human health. The unhealthy industrial effluents and smog will be more dangerous than any other natural disease. The use of plastic is to be limited thoroughly so as to provide for better environment. Himachal Pradesh is the first state in the country to regulate the manufacturing and use of plastic. It has imposed a ban on all types of polythene usage.

8) One of the most important things India needs to do is to control air pollution in order to breathe easy and clean air. There is too much of usage of personal cars in the absence of an effective public transport system. The increase in the number of cars has added to the higher pollution levels and there seems to be no end to this. 60% of air pollution in Delhi is due to vehicular emissions. Two most important requirements are the setting of fuel efficiency standards and the improvement of public transport system.

9) India should derive benefit from the carbon credit business wherein the carbon credits are the certificates issued under emission trading norms. These are used in national and international carbon trading. The incentive of credit goes to the companies or countries that emit less carbon. The unit of credit is known as

Certified Emission Reduction (CER).

10) India should opt for Clean Development Mechanism (CDM) wherein a project on GHGs reduction is supported by a developed country to developing countries. The credit for GHG reduction goes to the developed country and the developing country would benefit by getting clean technology and capital.

7. Conclusion

Global warming and the climate change are not mere local issues that could be solved at the local level. These international issues are affecting one and all and have major health implications for the whole of mankind. It is extremely important to educate people on this issue because it is mostly a man-made phenomenon and crisis and it is the human beings who are responsible for undoing the damage at least partially. While development needs to be taken up to improve overall living standards, it also needs to be kept in mind that the development has to sustain the present and future generations too. There is a need to evolve green initiatives for development and also bring about a basic change in the production and consumption patterns. Considering the global course of action on climate change, India too needs to evolve a policy that will sustain its resources for future generations.

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