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Climate Change and Green Energy in India - A Micro Study

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Abstract

Because of the sector's susceptibility, ongoing methodological advancements, and data availability, research on how climate change affects renewable energy is becoming more and more pertinent. Particular research is required for both public and private decision-making. Resources for renewable energy are crucial in the fight against climate change. However, their production, usage, and collection have an influence on the environment, and they are also impacted by climate change. One of the major concerns of the twenty-first century is climate change. It has had profound effects all around the world due to its quick escalation and steadily rising intensity. India's urban, socioeconomic, and natural landscapes have seen significant change as a result of climate change. India came in at number seven on the list of nations most impacted by extreme weather events brought on by climate change in 2019. Both the human toll—2,267 lives lost—and the economic damage—66,182 million US dollars in purchasing power parities (PPPs)—were clear indicators of this impact. Extreme weather occurrences have been much more frequent and frequent in India in recent years, putting vulnerable communities at risk. The nation was listed among the most polluted cities in the world and faced serious air pollution issues in a number of its major cities. India is now the most populated country in the world, with 1.4 billion people, or about 18% of the world's total population, and a rising rate of natural resource consumption. The current state of affairs in the nation necessitates the implementation of a number of climate mitigation techniques, including nature-based solutions, in order to lessen these effects and help India reach its goal of attaining the Sustainable Development Goals (SDGs). In this article we will discuss the impact of climate change in India and how green energy to be effective.

Keywords – Climate change, Green energy, Temprature, GHG,

Introduction

Human actions, especially the burning of fossil fuels, deforestation, and industrial processes, are the cause of climate change (CC), which over time causes notable and permanent changes in the patterns of the world's climate. Rising temperatures, increasing sea levels, more frequent and powerful storms, altered precipitation patterns, and altered ocean currents are just a few of the numerous consequences of climate change. A wide range of industries, including agriculture, public health, water use, energy generation, and biodiversity, are significantly impacted by these changes. Crop yields, for instance, are impacted by temperature and shifting precipitation patterns, whereas fisheries and marine biodiversity are impacted by changes in ocean chemistry. By making natural disasters like floods, droughts, and storms more common and severe, CC is also having an impact on the lives and means of subsistence of millions of people worldwide. Furthermore, CC exacerbates already-existing social and economic disparities by negatively affecting low-income individuals, indigenous peoples, and marginalized communities. As a result, CC is one of the most pressing global issues, and immediate action is required to cut greenhouse gas (GHG) emissions, prepare for their effects, and guarantee that everyone lives a long and healthy life.[1]

Climate Change - In 2019, India came in at number seven on the list of nations most impacted by climate change. Compared to the global average, India emits less greenhouse gases annually—roughly 3 gigatonnes (Gt) CO2eq, or 2.5 tons per person. Despite having 17% of the world's population, the nation contributes 7%

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of global emissions. Of the 63 countries that accounted for 92% of all greenhouse gas emissions in 2021, India ranks eighth on the climate change performance index. The Ganges, Brahmaputra, Yamuna, and other important rivers' flow rates are in danger due to the retreat of Himalayan glaciers brought on by temperature increases on the Tibetan Plateau. The Indus River might dry up for the same reason, according to a 2007 World Wide Fund for Nature (WWF) assessment.States like Assam are expected to see an increase in the frequency of severe landslides and floods.Climate change is causing heat waves to occur more frequently and with greater intensity in India. Between 1901 and 2018, India's temperatures increased by 0.7 °C (1.3 °F).[2]

(Source- Satpura coal-fired power station by https://en.wikipedia.org>...)

A US-based study group recently released papers that emphasized the concerning effects of climate change in India. The nation saw its second-hottest season since 1970 from June to August of 2024, with more than 70 days of high temperatures in places like Thane, Mumbai, and Thiruvananthapuram. Long-term changes in temperature, precipitation, wind, and other elements of the Earth's climate system are referred to as climate change. These changes may be caused by human activity or by nature. It presents serious problems for human society as well as natural ecosystems. Health, food production, housing, safety, and employment are all impacted by climate change, and certain populations—such as those in developing and tiny island nations—are more vulnerable than others.[3]

Causes of Climate Change –[4]

1 – Natural Causes - Earth's climate is mostly determined by the energy from the Sun, and variations in solar radiation can have a big effect on world temperatures. Numerous causes, such as sunspot cycles—periodic increases and declines in solar activity—cause these oscillations. More energy reaches Earth during times of high solar activity, which could cause warming. On the other hand, the earth may experience colder temperatures during times of minimal activity, such the Maunder Minimum in the 17th century. Climate patterns are also significantly influenced by tectonic movements. Ocean currents and atmospheric circulation can be impacted by the shifting of tectonic plates, which can change the geography of continents and oceans.

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For instance, the establishment of the monsoon system in South Asia was aided by the rise of the Himalayas millions of years ago, which also affected regional climates. These changes have the potential to cause major climatic shifts over geological timescales, such as the Earth's transition from a greenhouse to an icehouse.

2 – Anthropogenic Causes - The main causes of climate change are fossil fuels, such as coal, oil, and gas, which are responsible for around 90% of carbon dioxide emissions and more than 75% of greenhouse gas emissions. Although these sources remain account for the majority of electricity production, more than 25% now originate from cleaner, renewable energy sources like solar and wind.Because they use coal, oil, and natural gas for heating and cooling.

3 – Residential and Commercial Buildings - Residential and commercial buildings are responsible for more than half of the world's power consumption and a major source of greenhouse gas emissions. Carbon dioxide emissions from this industry have increased due to rising demand for appliances and air conditioning.

4 – Transportation – Transportation, largely powered by fossil fuels, accounts for about 20% of GHG emissions, with road transportation accounting for three-quarters of this share, while aviation and maritime transportation account for 11% each. **Fossil fuels** account for 95% of the world's transportation energy.

5 – Manufacture - Manufacturing, industry, and food production are major sources of GHG emissions, significantly contributing to climate change. Sectors like cement, steel, electronics, and plastics rely on fossil fuels for energy, while agriculture leads to deforestation, methane from livestock, and fertilizer use, all exacerbating GHG emissions.

6 – Household Activities - Household activities, including energy use, transportation, and waste, also play a crucial role, with the wealthiest 1% of the global population responsible for emitting more GHGs than the poorest 50%, highlighting the significant impact of lifestyle choices on climate change.

Green House Gases –

India's emissions have skyrocketed in recent decades due to a burgeoning population, a quickly expanding economy, and rising energy demand. The most populated nation in the world is currently the third-largest contributor to global greenhouse gas emissions, emitting about four billion metric tons of carbon dioxide equivalent ($GtCO_2e$) annually. India is now predicted to surpass the United States as the second-largest emitter by 2035, with energy consumption expected to increase even more. India must now go forward with its clean energy transition and reduce emissions while pursuing economic growth, having pledged to reaching net zero by 2070. However, there will be difficulties with this. In 2023, India's GHG emissions increased by 6.1 percent to 4.2 $GtCO_2e$, a new high. India's yearly emissions have more than doubled since the year 2000. The most polluting fossil fuel and India's main source of energy for power generation, coal, has played a major role in the South Asian nation's recent fast development. The JSW Vijayanagar Power Station and other coal-fired power stations in India produced 1.3 $GtCO_2e$ in emissions in 2023. The power sector was India's biggest source of emissions that year, accounting for one-third of all emissions in the nation. The average Indian person's carbon footprint has grown by almost 60% since 1990, reaching 2.9 tCO_2e in 2023, in line with the rise in total emissions. India's per capita GHG emissions are still less than half of the world average, notwithstanding this notable increase. The average American's carbon footprint is more than five times that of an Indian, making the disparity even more pronounced when considering the top emitters in the world.[5]

As it attempts to combat climate change, India has committed to a number of goals. These include achieving net-zero carbon emissions by 2070, meeting at least 50% of its installed power capacity through

non-fossil-fuel-based energy sources by 2030, and lowering the economy's carbon intensity by at least 45% by 2030 compared to 2005 levels. India is well on its way to reaching its renewable capacity objective, and the country's energy revolution has advanced significantly in recent years. However, India's persistent reliance on coal is undermining its ambitious climate ambitions, notwithstanding its advancements and dedication to sustainable energy. India's journey to net-zero will also face significant financial obstacles, as investments in clean energy technologies must triple by 2030 compared to 2024 levels. Due to its comparatively small historical contribution to emissions and global warming, India is advocating for more climate finance from industrialized nations, which is currently falling behind, in order to close this gap.

Challenges of Climate Change in Human Life –

Key Facts – [6]

- Heatwaves, wildfires, floods, tropical storms, hurricanes, and other humanitarian emergencies are becoming more frequent, severe, and of a larger scale due to climate change.
- 3.6 billion people currently reside in regions that are extremely vulnerable to climate change, according to research. An estimated 250 000 more deaths annually are predicted as a result of climate change between 2030 and 2050 due to undernutrition, malaria, diarrhea, and heat stress alone.
- By 2030, it is projected that the direct costs of health harm, excluding expenses in areas that determine health, like agriculture and water and sanitation, will range from $2 to $4 billion annually.
- Without support to plan and respond, areas with inadequate health infrastructure—mostly in pooReducing greenhouse gas emissions through improved food, energy, and transportation choices can have a significant positive impact on health, especially by lowering air pollution.
- Reducing greenhouse gas emissions through improved food, energy, and transportation choices can have a significant positive impact on health, especially by lowering air pollution.
- **Litrature Review –**
- **1 -** Leading climate scientist James Hansen of the National Aeronautics and Space Administration and three other senior researchers testified before a U.S. Congressional committee in 1988 that they were 99 percent certain that the observed warming trend in Earth's temperature was due to the buildup of carbon dioxide and other "greenhouse" gases rather than natural variation.
- **2 -** Sea level rise, particularly in the southeast U.S. state of Florida, increased precipitation, millions of environmental refugees, a higher risk of drought, and the potential that warming at higher latitudes would not entirely offset any climate change-related loss of agricultural productivity towards the equator were all concerns raised by Leaf in the New England Journal of Medicine in 1989.
- **3 -** The lengthy (41-page) 2009 article by the Lancet and University College London Institute for Global Health Commission emphasized that the health risks associated with climate change are, in fact, extremely high. The article referred to climate change as the "biggest global health threat of the 21st century."
- **4 -** Losses from catastrophe recovery and revenue loss in industries like tourism and agriculture are two examples of the economic effects of CC (IPCC 2014).
- On the basis of above litrature review articles we can say that climate change is the biggest problem for environment and lives, so environment and human life can be saved by planting trees in large numbers along with this, all pollution should be reduced.

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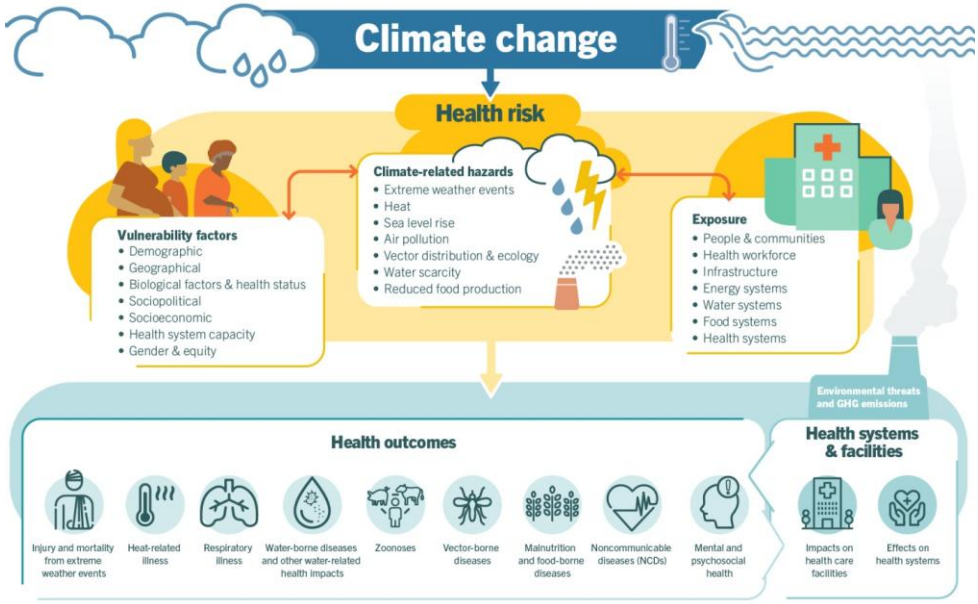
Overview –

Human health is seriously threatened by climate change. All facets of human and natural systems, including social and economic circumstances and the operation of health systems, are impacted, in addition to the physical environment. As a result, it is a threat multiplier that threatens to undo decades of advancements in health. Storms, high heat, floods, droughts, and wildfires are among the weather and climate events that are becoming more common and intense as a result of changing climatic circumstances. Both directly and indirectly, these weather and climatic risks raise the risk of noncommunicable diseases, infectious disease onset and transmission, fatalities, and medical emergencies.[7]

Our health workforce and infrastructure are also being impacted by climate change, which is decreasing our ability to offer universal health coverage (UHC). More fundamentally, the environmental and social determinants of physical and mental health are deteriorated by climate shocks and increasing stresses such rising sea levels, drought, floods, and altered temperature and precipitation patterns. Climate change impacts all facets of health, including food systems, livelihoods, and clean air, water, and soil. Delays in addressing climate change would raise health risks, jeopardize decades of progress in global health, and go against our shared commitment to guarantee everyone's right to health.

Climate change impacts on health –

The disruption of food systems, the rise in zoonoses and vector-, food-, and water-borne diseases, the increased frequency of extreme weather events like heatwaves, storms, and floods, and mental health problems are just a few of the ways that climate change is affecting health. Many of the social determinants of health, including equity, livelihoods, access to healthcare, and social support networks, are also being threatened by climate change. The most vulnerable and disadvantaged—women, children, ethnic minorities, impoverished communities, migrants or displaced people, older populations, and people with underlying medical conditions—are disproportionately affected by these climate-sensitive health concerns.



(Figure: A summary of the exposure pathways, vulnerability variables, and health hazards associated with climate change. Environmental, social, and public health variables have a significant role in mediating the direct and indirect effects of climate change on health.)

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It is undeniable that human health is impacted by climate change, yet it is still difficult to determine the exact scope and significance of many climate-sensitive health hazards. But as science progresses, we are able to more precisely assess the dangers and scope of these health hazards and link a rise in morbidity and mortality to global warming. According to WHO data, 600 million people have foodborne infections each year, and 30% of foodborne deaths occur in children under the age of five. Additionally, 2 billion people lack access to safe drinking water. Risks of foodborne and waterborne illnesses are increased by climate stresses. 770 million people went hungry in 2020, mostly in Asia and Africa. Food and nutrition problems are made worse by climate change, which has an impact on food diversity, quality, and availability.

Variations in precipitation and temperature promote the spread of diseases carried by vectors. Deaths from these diseases, which presently number over 700,000 per year, could increase if preventive measures are not taken. Both short-term mental health problems, such as anxiety and PTSD, and long-term disorders, such as social disintegration and displacement, are brought on by climate change.According to recent studies, human-induced climate change is responsible for 37% of heat-related fatalities. Over the past 20 years, there has been a 70% increase in heat-related deaths among people over 65. Compared to the 1981–2010 average, 98 million more people were food insecure in 2020. According to WHO estimates, the effects of climate change on diseases like malaria and coastal floods will cause an additional 250,000 fatalities annually by the 2030s. However, there are still issues with modeling, particularly when it comes to reflecting hazards like pressures from migration and drought.[8]

In addition to threatening to exacerbate already-existing health disparities across and within people, the climate catastrophe has the potential to reverse the last fifty years of advancements in development, global health, and poverty alleviation. It seriously jeopardizes the achievement of UHC in a number of ways, such as by increasing the burden of disease and making it more difficult to obtain health care, frequently when they are most needed. Approximately 12% of the world's population, or over 930 million individuals, spend at least 10% of their family income on health care. Around 100 million people are already living in poverty each year due to health shocks and stressors, and the effects of climate change are making this trend worse. The poorest individuals are also primarily uninsured.

Our world and our lives may be significantly impacted by how climate change affects our water supplies. As temperatures rise, patterns of where, when, and amount of precipitation change. There are more droughts in certain places and more rainy occurrences in others. The problem of flooding is growing as a result of climate change. In the majority of the United States, precipitation events are more frequent, heavier, and stronger than they were at the start of the 20th century.Additionally, drought is occurring more frequently, particularly in the Western United States. During warmer weather, we use more water, particularly for agriculture. Similar to how people perspire more in hot weather, plants transpire more water when it's hot outside. Farmers then need to irrigate their crops more.[9]

For many people, snowpack is a vital source of fresh water. Fresh water becomes usable after the snow melts. In places like the Western United States, where there is little precipitation during the summer months, snowmelt is especially significant. However, snow starts to melt earlier in the year and there is less snow as temperatures rise. Snowpack is therefore less likely to constitute a consistent supply of water.

Conclusions and Suggestion -

The conclusion is that human actions, particularly the use of fossil fuels, have increased greenhouse gasses, hence amplifying the greenhouse effect and driving rapid global warming. This is causing widespread

climate change, with serious repercussions such as rising sea levels, extreme weather, and damaged ecosystems, necessitating immediate global action to offset the severe economic and social impacts. Human activities have produced significant amounts of greenhouse gases, trapping heat and warming the globe quicker than at any other point in the last 2,000 years. This warming is not just about higher temperatures; it is causing a cascade of changes, including more frequent and intense extreme weather, rising sea levels, melting ice, and a significant threat to ecosystems and human well-being. The overwhelming scientific evidence supports the urgent necessity for a worldwide response. Acting today to minimize emissions is more cost effective than the long-term consequences of delay.

This work has substantially improved our theoretical understanding of the various effects of climate change on key sectors such as agriculture, the economy, sea level rise, water resources, human health, biodiversity, forest ecosystems, and tourism. Each of these areas is important in its own way, and this study sheds light on the intricate links between Climate Change and each industry. It provides essential theoretical contributions that help to build a thorough understanding.

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