

# Management of climate change through Geoengineering in India

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**ABSTRACT:** Climate change is having a significant impact on India, which was ranked fourth among countries most affected by climate change in 2015. According to a 2007 research by the World Wide Fund for Nature (WWF), the Indus River may run dry for the same reason. Heat waves are becoming more frequent and powerful in India as a result of climate change. There is possibility that large section of Indian society may face shortage of drinkable water and cities like Bombay may be affected by rising sea level. The present paper tries to explore ways to manage climate change.

**Key words:** Carbon sequestration, Silvopasture, Hydropower

## I. INTRODUCTION

There is a lot of news these days about rising global temperatures. It's all about how drought is impacting one part of the India while flooding is affecting other part of India. Oceans are hotter than they have ever been, their levels are steadily increasing, and ice sheets are melting at unprecedented rates. According to some current projections, the number and severity of droughts in India will have markedly increased by the end of the present century (1) There have been increased incidents of serve heat waves in India year after year . Temperatures in India have risen by 0.7 °C (1.3 °F) between 1901 and 2018 (2)

Unfortunately, despite the negative impacts of human activity on the environment, there is currently no absolute viable solution to the climate change problem. Experts also claim that even if humans reduce greenhouse gas emissions to zero, global warming could persist for several decades longer.

The problem with climate change is that carbon dioxide, the primary source of global warming, can remain in the atmosphere for hundreds of years. Without serious action to curb greenhouse gas emissions, the temperature might

climb by an average of 6 degrees Celsius, according to the experts. Nonetheless, researchers believe it is still possible to reverse climate change. Although the effects of climate change cannot be avoided at this time, they can be mitigated or avoided. Mitigation and adaptation should be included in any good plan to counteract climate change. The mitigation phase should focus on reducing greenhouse gas emissions, while the adaptation phase should educate people on how to cope with climate change (3). Governments must adopt better and more effective strategies to manage greenhouse gases and other harmful human activities, while communities must change their behavior. People have already begun to adjust to the changes by engaging in more beneficial activities such as driving electric automobiles and using solar-powered electricity.

People must avoid making climate change worse while simultaneously investing in technologies that can help reverse the warming trend to assure a rapid recovery. Nonetheless, researchers believe it is still possible to reverse climate change. A solid plan to combat climate change should have two components: mitigation and adaptation.

Geoengineering is a concept that refers to technologies that can shift the planet's natural cycle to cool it and thereby reverse climate change. Following measures may be adopted for the effective management of effect of climate change in India.

Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. It is one method of reducing the amount of carbon dioxide in the atmosphere with the goal of reducing global climate change.

Carbon capture and storage is becoming more popular as a safe solution to combat climate change. Although the technology is still in its infancy, power facilities in the United States and Canada are already using it to reduce pollution.

India's Intended Nationally Determined Contribution (INDC) of creating an additional carbon sink of 2.5-3 billion tons of carbon dioxide equivalent through additional forest and tree cover by 2030, is unlikely to materialize.(4) The Forest Festival or Van Mahotsav is an annual celebration of the plantation of trees in India. It is celebrated in the first week of July and denotes the right time of plantation as it coincides with the monsoons.

Rooftop Solar has emerged as one of the important tools to manage climate change by using natural resources like sun instead of conventional source of energy. In 2017, India's Ministry of New and Renewable Energy (MNRE) decided to install 40GW of rooftop solar (RTS) power by 2022.(5) However, how much India is going to achieve ,only future will tell. Over the last few years, solar photovoltaic(gets its name from the process of converting light-photons to electricity (voltage), which is called the photovoltaic effect.) has undergone exponential growth. As per industry sources ,it is estimated systems of less than 100 kilowatts accounts for about 30-percent of solar PV capacity installed globally. Experts also claim that, although the industry is still in its early stages, it is already producing about 2-percent of global energy.

Silvopasture is the traditional practice of combining trees, livestock and forage plants as an integrated system. The main ecological benefit of silvopasture systems is that they allow for trees to be grown in agricultural systems. Trees suck up carbon dioxide from the air and can act as carbon sinks. They also help to improve the soil through slowly adding a steady source of organic matter through leaf fall. As the soils improve, the quality of the pasture will also improve leading to healthier animals and healthier ecosystems.”(6)There has been agricultural activities causing areas that were initially under natural forests have been cleared for cultivation of palm, coffee, and tea among other cash crop plants and has been major cause of deforestation is considered a major contributor to climate change, Silvopasture helps to reverse the effect of human activities on global warming by creating inclusive lands that allow humans and plants to thrive together.Silvopasture is an integration of trees and pasture or forages to create a sustainable and symbiotic system. It is estimated that Silvio pasture is currently being practiced in over 351 million acres of land globally. (7)

Use of Solar panels to generate electricity and energy related requirements is totally environmental friendly as they do not emit any carbon products or gases into the atmosphere and are fossil free fuel unlike power generating

companies using coal and diesel among other fossils to generate power,increasing the emission of carbon to the environment. Solar energy has had a noticeable impact on the Indian energy landscape over the last few years. Millions of people in Indian communities have profited from solar energy-based decentralized and distributed applications that meet their cooking, lighting, and other energy demands in an environmentally benign manner. The social and economic benefits include a reduction in drudgery among rural women and girls who collect fuel wood from long distances and cook in smoky kitchens, a reduction in the risk of contracting lung and eye ailments, the creation of employment at the village level, and, ultimately, an improvement in the standard of living and the creation of economic opportunities at the village level. Furthermore, India's solar energy sector has emerged as a major player in the global market.

National Institute of Solar Energy has assessed the Country's solar potential of about 748 GW assuming 3% of the waste land area to be covered by Solar PV modules National Solar Mission (NSM)- considering solar energy as main source of alternate energy - was launched on 11<sup>th</sup> January, 2010, with active participation from States to promote ecological sustainable growth while addressing India's energy security challenges. The Mission's objective is to establish India as a global leader in solar energy by creating the policy conditions for solar technology diffusion across the country as quickly as possible. The National Institute of Solar Energy estimated the country's solar potential to be around 748 GW, assuming that solar PV modules cover 3% of the waste land areaand Mission's goal is to make India a global leader in solar energy by 2020.(8)

Restorations of forests is other key step to aim to reduce carbon dioxide in the environment Forest restoration is the process of returning a forest or landscape to its former state after it has been degraded or harmed by anthropogenic or natural processes. Forest restoration not only aids in the recovery of degraded forests and its varied functions, but it is also regarded as one of the most effective ways to contribute to sustainable development by restoring the forest's ecological, economic, and social functions and values. As per the National Forest Commission report In India, 41% of forests are already degraded .

In Indian forestry, the emphasis has been on growing trees for income or production forestry under various silvicultural systems, which is study of forests and woods, is termed silvology. Silviculture also focuses on making sure that the

treatment(s) of forest stands are used to conserve and improve their productivity (9)

Under silvicultural, tree planting as one of the restoration strategies. Despite the fact that much study has been done on restoration ecology, many of the findings and recommendations are not fully appropriate for India's different habitats, particularly damaged ecosystems with unique local problems. As a result, local research, particularly that relating to natural regeneration of various species, as well as ecological issues, can be used to develop area-specific restoration approaches and methodology. Humans are responsible for the majority of forest fires, which are a major source of forest destruction another stumbling block, are shareholder conflict of interest. Villagers, community leaders, government/non-government members, and people with social or political interests are all involved in the implementation of restoration interventions. For example, a villager may be more concerned with his or her own livelihood goals; a community leader may advocate for equitable produce sharing; and the government may prioritize land protection for environmental conservation. Negotiations with a wide range of parties to resolve issues are consequently a requirement and a difficult task to accomplish. Another issue in rehabilitation initiatives is adequate funding. In countries like India, where forests are heavily reliant for various purposes, adequate funds are required not only for stakeholder engagement and restoration activities, but also for the costs of foregoing livelihood activities such as grazing, unsustainable minor forest produce (MFP) collection, and so on. Failure to address these challenges may result in low public participation and possibly jeopardize the success of restoration efforts. Furthermore, high repair costs offer a significant barrier to scaling up, and may lead to indifference over time due to a loss of interest among policymakers. To supplement the efforts of the government, non-governmental organizations such as corporations and philanthropists must get involved.

Wind turbines are also being adopted as an alternative to traditional electricity generation methods that lead to the releases of greenhouse gases into the atmosphere. It is Renewable energy that is not depleted when it is used. As a result, when we utilize wind energy, we do not reduce the amount of wind available, however when we use fossil fuels, we deplete resources. Surprisingly it is Low-cost energy because although wind turbines have a hefty initial investment, the energy they generate is inexpensive. According to the International Renewable Energy Agency

(IRENA) report, production of wind electricity doubled between 2009 and 2013, and in 2016 wind energy accounted for 16% of the electricity generated by renewables. To make wind energy primary source of 'power' for the people of India, the government initially had a National Wind Power Policy, but both onshore and offshore wind programmes were later developed. India's National Offshore Wind Energy Policy Framework, which was introduced in October 2015, is a very active policy for offshore wind energy. The goal is to generate offshore wind energy along the Indian coastline in the Indian Exclusive Economic Zone (EEZ). In May 2018; a Solar-Wind Hybrid policy was released. Onshore wind is an intermittent form of energy since turbines cannot create electricity on demand; instead, they can only generate electricity when the wind is blowing and strong enough. When wind strength is insufficient for turbines to operate, fossil-fuel-based power is used as a backup, which increases greenhouse gas emissions briefly. According to several studies, persons who live or work in close proximity suffer from symptoms such as annoyance, tension, sleep disturbance, headache, anxiety, depression, and cognitive impairment. Many researchers, however, hold opposing viewpoints.

Hydropower, or hydroelectric power, is one of the oldest and largest sources of renewable energy, which uses the natural flow of moving water to generate electricity. Hydroelectric power is electricity produced from generators driven by turbines that convert the potential energy of falling water into mechanical energy. Hydro power projects are classified as large and small hydro projects based on their sizes. In India, hydro power plants of 25MW or below capacity are classified as small hydro and come under purview of Ministry of New and renewable energy (MNRE). Hydropower is key to fulfill India's renewable energy ambitions for electricity generations. as Hydropower is fully renewable, meaning it will never run out unless the water supply is interrupted. Hydro plants, as a result, are built to last. Secondly as Hydroelectric power generation produces no emissions into the atmosphere. Hydropower is the most dependable renewable energy source on the planet. Water normally has a consistent and steady flow 24/7, unlike when the sun sets or the wind slows down. Hydro plants can really control the flow of water since hydropower is so reliable but it has certain disadvantages also. A running water supply must be dammed to establish a hydro plant. This hinders fish from reaching their spawning grounds, which has an impact on any species that feeds on them.

River habitats begin to disappear as the water stops flowing. Animals may be unable to reach water as a result of this. While hydropower is renewable, there are just a few areas on the planet where it can be built. Furthermore, some of these locations are not close enough to big cities to completely benefit from the energy. While no power plant is simple to construct; hydro plants do necessitate the construction of a dam to stop the flow of water. While there are no emissions from the plant's actual electricity output, there are emissions from the reservoirs it creates. At the bottom of a reservoir, plants begin to decay. Plants also release enormous amounts of carbon and methane when they die. Hydropower is the most reliable renewable energy source accessible, but it is limited by the amount of water available in any given place. A drought could thus have a substantial impact on the performance of a hydro plant. As our earth continues to warm due to climate change, this may become increasingly regular.

Dams constructed at higher elevations pose a major threat to any settlement located below them. Even if these dams are quite powerful, there are still dangers. The Banqiao Dam failure is the largest dam disaster in history, which fell due to excessive rainfall from a typhoon and resulted in to death of many people

## II. CONCLUSION

India is the world's seventh largest country and the second most populous, with a population of about 1.36 billion people. India, which lies between the Himalayas and the Indian Ocean, has a rich ecosystem and culture. Mountainous terrain, northern plains, peninsular plateau, coastal plains, island groups, and deserts make up its topography, which contains a variety of temperatures, biodiversity, and natural resources. Climate change is a significant problem for developing countries like India, increasing risks that are already high due to high levels of socioeconomic vulnerability and climate variability. India's 2016 Nationally Determined Contribution (NDC) commits the country to achieving a reduction in the emissions intensity of its GDP of 33 percent to 35 percent below 2005 levels; a 40 percent share of renewables in power generation contingent on technology transfer and finance; and an additional cumulative carbon sink of 2.5 to 3.0 GtCO<sub>2</sub>e by 2030 through increased afforestation and tree cover. by 2030 Climate change is happening, with ice melting in Antarctica and large sections of the world experiencing heat waves, droughts, and flooding. It can no longer be found in a book or on the internet.

Everyone should be working on it in order to help reverse the bad impacts. Everyone can help to reverse climate change by implementing some of the strategies outlined in this paper.

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