

# Climate change and sustainable development in India: A notion on its penalty

Dr. Suman vij

Assistant Professor

Shri Guru Ram Rai Institute of Management and Technology,  
Shri Guru Ram Rai University, Dehradun, India

**Abstract :** Climate change is a burning and critical issue. The Earth's climate is altering and has become a source of discussions all through the world on the subjects of global warming and climate change. We know that humans have significantly contributed to it through the emissions of GHGs and aerosols and through changes in land use, resulting in a rise in global temperatures.<sup>1</sup> Increase in global temperatures may have different global dangers such as an increase in storms, floods, droughts, and sea levels, and the decline of ice sheets, sea ice, and glaciers.

In 1970, a paper by the Club of Rome acknowledged that limited planet resources cannot sustain limitless development. Even renewable assets will be exhausted if they cannot be transformed quickly. By approx calculation, we are at present consuming 50% additional resources than the sustainable level. The 8 billion population projected by 2030 is twice the 4 billion the earth had to feed as recently as 1974. The chase of economic growth is compounding the growth in demand. Global warming is deteriorating the sustainability challenge as it might decrease agricultural production and will result in physical harm.

The rationale of this paper is to present some edification on the issue which will consist of providing some backdrop to these issues, recognizing some of the existing and future risks, the possible financial and other impacts posed by these risks.

**Key Words:** Global warming, Climate change, Aerosols, Exhausted, sustainable

## Introduction

Existence on Earth is possible as the warmth of the sun and balance of gases that create our atmosphere. Lacking this, Earth would have been merely another rock hurtling through space. But today climate change is one of the greatest challenges faced by the humanity. The prime difficulty with the issue of climate change is its vast consequence on the life on earth. Most of the scientist agrees that climate change is principally due to the human use of fossil fuels, which discharges carbon dioxide and supplementary greenhouse gases into the air. The gases trap heat within the atmosphere, which affects ecosystems, including increasing sea levels, severe weather happenings and conditions like droughts. While climate change result from activities all over the world but it may lead to very different impact in different countries depending on the local and regional environmental conditions. The nastiest impact will plunge over the emerging nations because of their weak managing capacities. The intergovernmental Panel on climate change (IPCC) projects that the global mean temperature may increase between 1.4 and 5.8 degree Celsius by 2100. This record raise increase is expected to have a severe impact on the global hydrological system, ecology, sea levels crop production and other allied practices. This impact will be mainly severe in tropical areas, which mainly comprise of developing countries including India.

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1. [http://www.wmo.int/pages/themes/climate/causes\\_of\\_climate\\_change.php](http://www.wmo.int/pages/themes/climate/causes_of_climate_change.php)

2. Research paper by Canadian Institute of actuaries Climate change and resource sustainability August 2015 pg. no. 5

Climate change is a big concern in achieving sustainable development as it impends to slog millions of people into oppressive poverty. Climate change is not just an enduring issue. It is happening today, and it brings out worries for policy makers trying to form the future. There exist a twin association between climate change and sustainable development at the one side it affects basic natural and human physical situations and thus also the basis for communal and fiscal progress, while on the other side , the social order urgencies on sustainable development influence both the GHG emissions that are affecting climate change and the vulnerability.

### **Understanding climate change:**

Climate change is the topic of exactly how climate form changes over period or over the long time. Or we can say climate change refers to the deviation of the earth's global climates over time. Climate change has been defined in numerous ways. While several define it as an outcome of Earth's natural processes, some other describe it as a result of human activities. Balancing different viewpoints, climate change may be defined as "a change which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".<sup>3</sup> In fact, the current alteration in the Earth's climate cannot be elucidated alone by the natural processes but a can be attributed to human activities.<sup>4</sup> If people are in a big part accountable for this variation, then whatever choices we make today, will have a noteworthy bearing on the climate of the future. This makes climate change a challenging concern.

### **Climate change: the debate: Is Anthropological Action Principally Accountable for Global Climate Change?**

While agreement among almost all scientists, technical organizations and governments is that climate change is instigated by human activity, a small marginal voices questions on the strength of such declarations and favors to cast disbelief on the majority of evidence. The 2010 Anderegg study establish that 97-98% of climate researchers agreed that human activity is chiefly blamable for global climate change. The study also establish that the expertise of researchers disbelieving of human-caused climate change is "substantially below" to that of investigators who come to an agreement that human activity is principally responsible for climate change.<sup>5</sup> The 2013 Cook review of 11,944 peer-reviewed studies on climate change established that only 78 studies (0.7%) explicitly rejected the position that humans are accountable for global warming.<sup>6</sup> A distinct review of 13,950 peer-reviewed studies on climate change found only 24 that rejected human-caused global warming.<sup>7</sup> A survey by German Scientists Bray and Von Storch found that 83.5% of climate scientists believe human activity is producing "most of recent" global climate change.<sup>8</sup> A distinct survey in 2011 also reported that 84% of earth, space, atmospheric, oceanic, and hydrological scientists believed that human-induced global warming is occurring.<sup>9</sup>

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3 Article 1, United Nations Framework Convention on Climate Change

4 inter-Governmental Panel on Climate Change (IPCC), Third Assessment Report, 200

5 William R.L. Anderegg, James W. Prall, Jacob Harold, and Stephen H. Schneider, "Expert Credibility in Climate Change," Proceedings of the National Academy of Sciences, July 6, 2010

6. John Cook, Dana Nuccitelli, Sarah A. Green, Mark Richardson, Barbel Winkler, Rob Painting, Robert Way, Peter Jacobs, and Andrew Skuce "Quantifying the Consensus on Anthropogenic Global Warming in the Scientific Literature," Environmental Research Letters, May 15, 2013

7. James L. Powell, "Science and Global warming," jamespowell.org (accessed Feb. 19, 2015)

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In 2010 Climate Depot published a report covering more than 1,000 scientists, who disagreed that humans are primarily responsible for global climate change.<sup>10</sup> The Cook review<sup>6</sup> of 11,944 peer-reviewed studies found 66.4% of the studies had no stated position on anthropogenic global warming, and while 32.6% of the studies implied or stated that humans are contributing to climate change, only 65 papers (0.5%) explicitly stated "that humans are the primary cause of recent global warming."<sup>11</sup> A 2012 Purdue University survey found that 47% of climatologists challenge the idea that humans are primarily responsible for climate change and instead believe that climate change is caused by an equal combination of humans and the environment (37%), mostly by the environment (5%), or that there's not enough information to say (5%).<sup>12</sup> In 2014 a group of 15 scientists dismissed the US National Climate Assessment as a "masterpiece of marketing," that was "grossly flawed," and called the NCA's assertion of human-caused climate change "NOT true."<sup>13</sup> In any case, economists agree that acting to reduce fossil fuel emissions would be far less expensive than dealing with the consequences of not doing so.

### **Dialogue on Climate change and sustainable development.**

The best acknowledged definition of sustainable development is the definition given by Bruntland Commission that is "development that meets the needs of the present without compromising the ability of the future generation to meet their own needs" Sustainable development does not exclude the use of exhaustible natural resources but necessitates a suitable balance in use of the resources.

There exists a double association amid sustainable development and climate change. On the one side, climate change effects crucial natural and human living environment and thus the basis for social and economic development too, while on the other side of it, humanity's main concern is towards sustainable development influences both the GHG discharges that are resulting into climate change and the vulnerability. Climate change influences the growth prospects and its adversative powers will be maximum prominent in the developing nations for the simple reason that they depend on natural resources and because of its restricted capability to adapt to a fluctuating climate. Combined in these nations, the poorest, with the minimum resources and the minimum volume to acclimate, are the most vulnerable' (African Development Bank 2003).

Since Industrial revolution, manmade actions have supplemented substantial amount of CHGs into the atmosphere. Climate change is global destructive externality originated by erection of CHG emission in the atmosphere. Necessary actions are required to address climate change including moderation of CHG secretion at one side and creation of adaptive abilities to accomplish the adversative effect on the other side . These emissions levy cost equally on both the generations present and the future. This calls for coordinated actions globally for transnational climate change regime. Although The United Nations Framework Convention on Climate Change (UNFCCC) global in approach was set up in 1992 with an aim to calm greenhouse gas absorption in the atmosphere at the ratio that preclude hazardous effects on the productivity of natural and managed ecologies or on the process of socio-economic systems or on human health and wellbeing, but it sets

10. Climate Depot, "More than 1000 International Scientists Dissent over Man-Made Global Warming Claims," cfact.org, Dec. 8, 2010

11. Popular Technology, "1350+ Peer-Reviewed Papers Supporting Skeptic Arguments against ACC/AGW Alarmism,"

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12 Linda Stalker Prokopy, Lois Wright Morton, J. Gordon Arbuckle Jr., Amber Saylor Mase, and Adam K. Wilke, "Agricultural Stakeholder Views on Climate Change: Implications for Conducting Research and Outreach," Journal of the American Meteorological Society, Feb. 2015

13. US Environmental Protection Agency, "Overview of Greenhouse Gases," epa.gov (accessed Feb. 19, 2015)

no compulsory parameters on greenhouse gas releases for individual countries and contains no enforcement mechanisms. Scientists point out that the worldwide problem of climate change is not due to the existing CHG emissions but due to the store of historical CHG emissions. Maximum of the countries mostly industrial countries having big emissions today are also the greater historical emitters and supplier to climate change. The agreement therefore lays down legal obligation and commitments for developed countries to take up their historical responsibilities and provide financial resources required by evolving countries as the actions taken by these emerging countries towards climate change are dependent on the assets made offered to them

The year 2015 observed two momentous global events: the significant climate change contract under the UNFCCC in Paris in December 2015 and the recognition for the Sustainable Development targets in September 2015. The approval to an innovative climate change agreement by 195 nations in Paris in December 2015 also indicates one more milestone in the climate change front. The importance of this new agreement is that it pursues to bring about determined action by every country by establishing it on a country-driven attitude with the support of each country toward the global fight against climate change. The Millennium Development Goals (MDG) from 2000 to 2015 was substituted by the Sustainable Development Goals (SDG) with the aim of governing the international community and national governments on a path of achieving justifiable development for the following years. Recognizing the association between sustainable development and climate change a number of international study programmes, including the Development and Climate project (Halsnæs and Verhagen, 2007), and an OECD development and environment directorate programme (Beg et al., 2002) were also initiated.

### **Climate change and sustainable development in India :**

Sustainable development is a process whereby exhaustible resources should be utilized for development in such a way that it fulfills the needs of the present generation without disturbing its capacity to meet needs of future generation. It is a direction that foresees a desirable future nation for human where living settings and resource-use endure to meet social requirements. But this idea is not agreed by most of the developing countries, as this neglects their ambition for growth and development and above all sustainable development is not thinkable without noteworthy growth in developing nations. Policy framers in developing nations repeatedly observe a tradeoff between economic growth and environment sustainability. However there is growing evidence that environment conservation is a necessity when we consider the economic growth and development especially when we are concerned with the less developed nations.

The key environment trials in India have been sharper in last two decades. The state environment report by MOEF Clubs stated that the main issues that are faced by India are climate change and managing urbanization. Climate change is impacting ecosystem and is expected to have adverse effect especially on agriculture on which still 58% of the Indian population depends. It is also expected that the climate change will also cause increased frequency of extreme events such as floods and droughts. This will further result in India's food security and water security issues. As per the second national communication submitted by India to the UNFCCC. It is projected that the average annual surface air temperature rise by the end of the century ranges from 3.5 degree Celsius to 4.3 degree Celsius were as the sea level along the Indian coast has been rising at the rate about 1.3 mm per year on an average . These climate projected fluctuations in climate change are likely to have adverse effect on agriculture production, human health, water resources and natural ecosystem. In order to

achieve sustainable social and economic development, countries need to access to their resources. Their energy consumption needs to grow to achieve greater energy efficiency through the application of latest economically and socially feasible technologies.

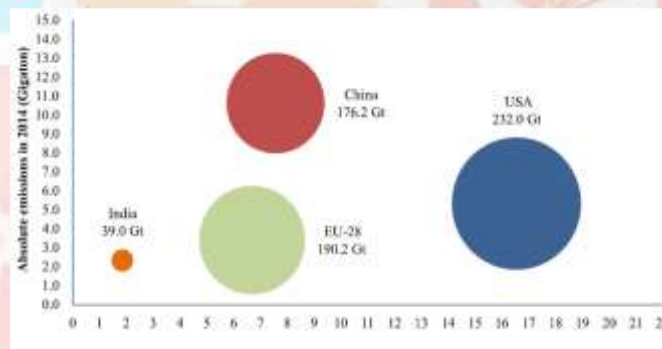
Domestically, India continued to take up ambitious goals in its movements against climate change. As its share towards the global climate change alleviation efforts, India declared its intended nationally determined contribution (INDC) which fixed aspiring targets for against climate change. Being a member of 94 multilateral environment agreement, India has volunteer to decrease its emission concentration by 20-25 percent over then level of 2005 by 2020. Indian economy is on the move towards the path of dropping carbon dioxide and achieving sustainable development in terms of declining carbon concentration and is predictable to reach, by 2031, lower than the global emission in 2005.

### **Emissions from different countries:**

Conferring to the World Meteorological organization the year 2015 was the warmest. The report of IEA that is International Energy Agency 2015 stated that the concentration of CO<sub>2</sub> in 2014 was 40% higher than in the mid 1800's The energy sector is the biggest contributor and the share of combustion of fuels have the largest share within this co<sub>2</sub> Emissions. The overall sketch display that the emissions are unevenly dispersed in different countries. If historical emissions are considered from 1970-2014 India is far behind the top three emitters i.e. USA, EU and China. In terms of Absolute emission China was on the top while in terms of per capita emission USA was on the top. India's per capita emission are among the lowest in the world (Fig 1.1)

**Fig : 1.1 Historical(1970-2014) Absolute and per capita CO<sub>2</sub> emissions of selected**

### **Per Capita CO<sub>2</sub> emissions in 2014( ton per capita)**

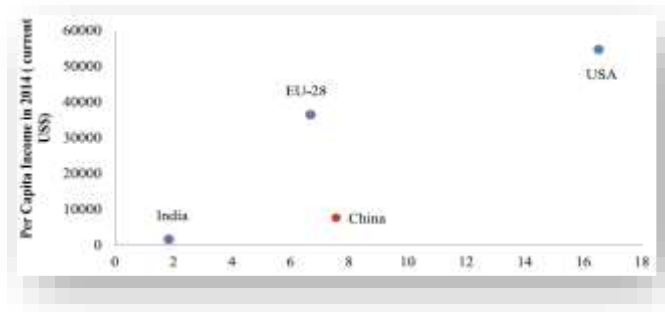


Note : Width of the bubbles indicates the total emissions between 1970 and 2014 for the respective countries.

Source : Based on PBL Netherlands Environmental assessment Agency data used in Trends in Global CO<sub>2</sub> Emissions 2015 Report

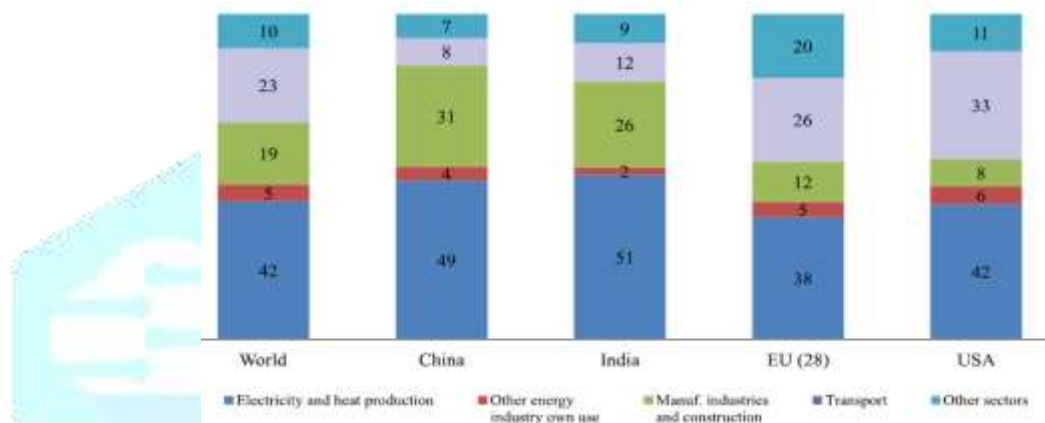
If the different levels of development and differentiated responsibilities and equity are considered the USA has the highest per capita CO<sub>2</sub> emissions and per capita income while India have lowest of both among the four countries. (Fig 1.2). If sector wise emission of co<sub>2</sub> is considered from fuel combustion ,electricity and heat production the major emitter is China and India for manufacturing industry and from transport sector is US and EU. (Fig. 1.3). These figures reflect the different priorities of these countries.

**Fig : 1.2 per capita income and per capita CO<sub>2</sub> emissions**



Source: Based on PBL Netherlands Environmental assessment Agency data used in Trends in Global CO<sub>2</sub> Emissions 2015 Report and World bank data.

**Fig: 1.3 CO<sub>2</sub> Emissions from Fuel Combustion from different sectors**



Source : Based on data from IEA CO<sub>2</sub> Emissions from Fuel Combustion, OECD/IEA, Paris 2015

### **Why India should be worried about climate change ?**

India is one of the largest developing nations with nearly 700 million rural population, directly reliant on agriculture, forest and fisheries and other natural resources for their income and living. The most recent predictions for India based on Regional climate modeling (RCM) system, known as PRECIS developed by Hadley Center display the following:

- An annual average surface temperature rise by the end of this century ranging between 3 to 5 degree Celsius with warming more noticeable in Northern parts of India.
- Apart from Punjab, Rajasthan and Tamil Nadu.
- Apart from Punjab, Rajasthan and Tamil Nadu a 20 % rise in the India monsoon rainfall is anticipated over all states.
- Extremes maximum and minimum temperatures are also expected to increase similarly extreme precipitation also shows substantial increase particularly in west coast of India and west central India.

### **Impact of climate change and its risks**

Developing countries are faced with immediate concerns related to forest, land degradation, freshwater storage, food security and air and water pollution. Climate change will adversely affect them and increase global

temperature that will result in rising sea levels. Population that inhabit small islands and low lying coastal areas are at particular risk from sea level rise as it could destroy cities and disturb large coastal livelihoods. By 2025, as much as two third of the world population much of it in the developing world may be subjected to moderate to high water stress. This will have negative effect on the crop yield predominately for tropics The consequences of climate change are projected to be more drastic o

n tropical regions for all sectors like water resource, eco system, crop production, Fisheries, human health. The population in the developing world is more vulnerable as their infrastructure does not support to resist the harmful impact. To better understand the risks of climate change to development, the World Bank Group commissioned the Potsdam Institute for Climate Impact Research and Climate Analytics to look at the likely impacts of temperature increases. Some of their findings for India include: <sup>14</sup>

### **Extreme Heat**

Uncommon and extraordinary spells of hot weather are predictable to happen far more frequently and cover much larger areas. The west coast and southern India are expected to change to new, high-temperature climatic regimes with substantial impacts on agriculture

### **Fluctuating Rainfall Patterns**

A 2°C rise in the world's average temperatures will make India's summer monsoon highly irregular. At 4°C warming, an enormously wet monsoon that currently has a chance of occurring only once in 100 years is predictable to befall every 10 years by the end of the century.

An abrupt change in the monsoon could precipitate a major crisis, triggering more frequent droughts as well as greater flooding in large parts of India. India's northwest coast to the south eastern coastal region could see higher than average rainfall.

### **Droughts**

Evidence shows that parts of South Asia have developed drier since the 1970s with an rise in the number of droughts. In 1987 and 2002-2003, droughts affected more than half of India's crop area and ran into an enormous fall in crop production.

Droughts are anticipated to be more recurrent in some areas, especially in north-western India, Jharkhand, Orissa and Chhattisgarh and at the same time crop yields are estimated to fall considerably as a result of extreme heat by the 2040s.

### **Groundwater**

More than 60% of India's agriculture is rain-fed, creating the country vastly reliant on on groundwater. Even without climate change, 15% of India's groundwater resources are overexploited. Though it is hard to forecast future ground water levels, falling water tables can be estimated to reduce further on account of collective

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<sup>14</sup> <http://www.worldbank.org/en/news/feature/2013/06/19/india-climate-change-impacts>

demand for water from a growing population, more prosperous life styles, as well as from the services sector and industry.

### **Agriculture and food security**

Even without climate change, world food costs are estimated to rise due to rising populations and increasing incomes, as well as a greater demand for biofuels.

Rice: Though as whole rice yields have increased, rising temperatures with lesser rainfall at the end of the growing season have affected a substantial loss in India's rice production. Without climate change, average rice yields could have been almost 6% greater (75 million tons in absolute terms).

Wheat: Current studies shows that wheat yields peaked in India and Bangladesh around 2001 and have not augmented since in spite of increasing fertilizer applications. Interpretations show that enormously high temperatures in northern India - above 34°C - have had a considerable negative outcome on wheat yields, and rising temperatures can only aggravate the situation.

### **Energy Security**

Climate-related impacts on water resources can weaken the two leading forms of power generation in India - hydropower and thermal power generation - both of which hinge on adequate water supplies to function successfully. To work at full efficiency; thermal power plants requires a continuous supply of fresh cool water to uphold their cooling systems.

The increasing variability and long-term reductions in river flows can pose a major challenge to hydropower plants and escalate the risk of physical harm from landslides, flash floods, glacial lake outbursts, and other climate-related natural disasters. Reduction in the accessibility of water and rise in temperature will place major risk factors to thermal power generation.

### **Water Safety**

Several parts of India are now facing water stress. Even without climate change, filling future demand for water will be a major challenge. Urbanization, population growth, economic development, and collective demand for water from agriculture and industry are expected to worsen the condition further.

Studies have established that the risk to water safety is very great over central India, beside the mountain ranges of the Western Ghats, and in India's northeastern states.

### **Health issues**

Climate change is anticipated to have major health impacts in India- increasing undernourishment and associated health disorders such as child stunting - with the poor is likely to be affected most harshly. Child stunting is projected to increase by 35% by 2050 if matched to a situation prevailing without climate change. Malaria and other vector-borne diseases, along with and diarrheal infections which are a main reason of child mortality, are likely to feast into areas where colder temperatures had formerly restricted spread.

### **Relocation and conflicts**

South Asia is a hotspot for the relocation of people from disaster-affected or degraded areas to other national and international regions. The Indus and the Ganges-Brahmaputra Basins are major Trans Boundary Rivers and growing demand for water is now leading to tensions among countries over water sharing. Climate change impacts on agriculture and livelihoods can further aggravate it

### **Conclusion:**

The earth has been showing rapidly warming trend which is basically caused by the increasing concentration of CHGs Particularly carbon dioxide. There is a worldwide acceptance that the largest contributor to increase CO2 concentration is the burning fossils and fuel and deforestation. The world community has accepted to need to limit the increase in the earth's temperature which will require a move away from burning fossils and fuels and reach to the stage zero carbon emission. This calls for a radical change in the way humanity lives as we move forward. For India Major investments in water storage capacity Improvements in irrigation systems, water harvesting techniques. Improvements in hydro-meteorological systems for weather forecasting and the installation of flood warning systems, better urban planning to prepare for climate-related disasters and at the same time the efficient use of ground water resources will need to be incentivized.



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