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Climate Change: A Global Challenge (Indian Perspective)

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ABSTRACT:
Climate change is one among the most challenging issues faced by the world today. United National Framework Convention on Climate Change (UNFCC) defines Climate change as "The change of climate 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 over comparable time periods". The changing climate impacts society and ecosystems in a broad variety of ways. Climate change can increase or decrease rainfall, influence agricultural crop yields, affect human health, cause changes to forests and other ecosystems or even impact our energy supply. Climate related impacts are occurring across countries and across many sectors of their economies.

INTRODUCTION:
Climate change is not mare a regional climatic issue but it has taken place as a Global Economic Challenge as well as Global Environmental Challenge. Developing countries like India have to face "Dual Challenge" of balancing between the two major challenges. First one is to achieve desirable development goals and second one is to maintain the minimum emission levels. This situational perplexity of developing countries can be asserted as **"Prisoner's Dilemma"** or "**Tragedy of Commons"**.
The intricacy of this "Dual challenge" turns severe due to the fact that climate change is truly a Global Phenomenon. Once emitted, the Green House Gas Emissions can have climate effects anywhere on the planet regardless of their source. It will not be overstating the problem if, it is opined that climate change is a global challenge with a nature of dual perplexity. And when it comes to the developing countries like India the challenge is more intricate. This piece of study talks about the emerging global challenge: Climate change in the light of Indian perspective to cope with this major challenge.

1. What is the problem?
Over the past century, human activities have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere. The majority of greenhouse gases come from burning fossil fuels to produce energy, although deforestation, industrial processes, and some agricultural practices also emit gases into the atmosphere. Greenhouse gases act like a blanket around Earth, trapping energy in the atmosphere and causing it to warm. This phenomenon is called the greenhouse effect and is natural and necessary to support life on Earth. However, the buildup of greenhouse gases can change Earth's climate and result in dangerous effects to human health and welfare and to ecosystems.
Global Warming refers to the recent and ongoing rise in global average temperature near Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere. Global warming is causing climate patterns to change. However, global warming itself represents only one aspect of climate change.

Climate change refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer.

The Earth is warming. "Warming of the earth's climate system is unequivocal.CO2 atmospheric concentration--280 ppm in the year 1750 rose to 379 ppm in 2005. Direct observations of changes in temperature, sea level, and snow cover in the northern hemisphere during 1961–90 indicate increased temperatures, rise in the mean sea levels, and decreasing snow cover. Global average sea levels rose by 1.8 mm/year over 1961–2003. Eleven of the twelve years—1995-2006 rank among the twelve warmest years since 1850. Both the hemispheres have observed a decline in the mass of mountain glaciers and snow cover. Precipitation has been found to be more variable, with increased frequency of heat waves, droughts, heavy precipitation events, and floods. Projected changes in the climate indicate an increase in global temperatures in the range of 1.8°C to 4.0°C over the twenty-first century and sea level rise is projected between 0.18 m and 0.59 m by 2100." (IPCC AR4 2007)

Small changes in the average temperature of the planet can translate to large and potentially dangerous shifts in climate and weather. The evidence is clear. Rising global temperatures have been accompanied by changes in weather and climate. Many places have seen changes in rainfall, resulting in more floods, droughts, or intense rain, as well as more frequent and severe heat waves. The planet's oceans and glaciers have also experienced some big changes - oceans are warming and becoming more acidic, ice caps are melting, and sea levels are rising. As these and other changes become more pronounced in the coming decades, they will likely present challenges to our society and our environment
.

2. Review of Literature on Climate Change:

As per UNDP's Human Development Report (HDR), 2007/2008, "Climate Change is the defining human development issue of our generation". This problem is not one which a single nation or community is facing in isolation. Rather, the issue is global in nature which is a consequence of the fact that the atmosphere is common to the entire mankind. Moreover, the problem needs to be viewed in the context of growth and development in the developing countries and how the presently poor in different parts of the world will be able to break the shackles of deprivation and have adequate access to health, nutrition, education and other basic services needed for their well-being.

The Fourth Assessment Report of 2007 of the Working Group III of the Intergovernmental Panel on Climate Change (IPCC) states that GHG emissions have grown since pre- industrial times, with an increase of 70 percent between 1970 and 2004. The largest growth in global GHG emissions during this period has come from the energy supply sector (an increase of 145 percent). The growth in direct emissions from transport had been 120 percent, industry 65 percent and land use land use change, and forestry (LULUCF) 40 percent.

According to the IPCC, the enhanced GHG effect will result in additional warming of the earth's surface. The Fourth Assessment Report of IPCC has projected a serious picture of the earth's future. The Report states that global warming may have a devastating impact on the climate of the earth. It is very likely that climate change can slow down the pace of progress towards sustainable development either directly through increased exposure to adverse impact or indirectly through erosion of the capacity to adapt. It also states that climate change related exposures are likely to affect the health status of millions of people, particularly those with low adaptive capacity, through increase in malnutrition and consequent disorders, with implications for child growth and development; and increased deaths, disease and injury due to heat waves, floods, storms, fires and droughts .

3. Comparative environmental performance and vulnerability of India as a developing country:

This section studies the comparative Environmental Performance Index (EPI) and Environmental vulnerability Index (EVI) of some developed and developing countries such as- Australia, US, Canada, Germany, Japan, France, UK, China, Russia, India, Pakistan, Myanmar and Nepal.

The Environmental Performance Index (EPI) is a method to quantifying and numerically making the environment performance of a nation or state's policies. This index was developed from the Pilot Environmental Programme Index, first published in 2002 and designed to supplement the environmental targets set forth in the United Nations Millennium Development Goals. The EPI was developed by Yale University and Columbia University in collaboration with World Economic Forum.

3.1 EPI performance of some selected countries:

The Environmental Performance Index (EPI) is constructed through the calculation and aggregation of 20 indicators reflecting national-level environmental data. These indicators are combined into nine issue categories, each of which fit under one of two overarching objectives. The two objectives that provide the overarching structure of the 2014 EPI are Environmental Health and Ecosystem Vitality. Environmental Health measures the protection of human health from environmental harm. Ecosystem Vitality measures ecosystem protection and resource management. These two objectives are further divided into nine issue categories that span high-priority environmental policy issues. Those are:

1 Air Quality, 2 Forest,3 Fisheries, 4 Climate and Energy, 5 Water & Sanitation, 6 Water Resources, 7 Biodiversity & Habitat, 8. Agriculture and 9 Health Impact

The issue categories are extensive but not comprehensive. The nine issues categories are 20 indicators calculated from country-level data and statistics. Table 1 below illustrates the 2014 EPI Rank, EPI Score, and percentage change in EPI of selected countries.

Table 1: EPI Scores and Ranks of Some Selected Countries:

S. No.	Country	Score	10 year change	EPI Rank
1	Australia	82.40	2.32%	3
2	Germany	80.47	1.89%	6
3	UK	77.35	3.48%	12
4	Canada	73.14	2.58%	24
5	Japan	72.35	2.17%	26
6	France	71.05	3.29%	27
7	US	67.52	2.23%	33
8	Russia	53.45	4.21	73
9	China	43	2.60%	118
10	Nepal	37	4.96%	139
11	Pakistan	34.58	6.66%	148
12	India	31.23	5.40%	155
13	Myanmar	27.44	6.11%	164

Source: epi.yale.edu

3.2 EPI country profile of India:

India is ranked 155th with 5.4% decadal change and score of 31.23 among 178 countries which reflects a deficient environmental performance. It is mentioned that the 9 indicators of EPI are further categorized into 20 sub-indictors. Indian environmental performance, for major 9 indicators are shown below in the table: 2

It's quite tragic that the sub- indicator performance of India is again unfavorable. India is ranked 128th in house hold air quality, 127th in Child Mortality, 177th in Air Pollution, 103rd in Access to Drinking Water, 144th in Access to Sanitation, 87th in Waste Water Treatment, 136th in Agricultural Subsidies, 18th in Pesticide Regulation, 57th in Change in Forest Cover, 85th in Coastal Shelf Fishing Pressure, 4th in Fishing Stocks, 49th in Critical Habitat Protection, 134th in National Biome Weights, 120th in Global Biome Weights and 82nd in Marine Protection.

Table 2: Indian EPI Profile:

Indicator	Score	Rank	10 year change
Overall score	31.2	155	5.4%
1.Health impacts	50.04	127	26.68%
2.Air quality	23.24	174	29.49%
3.Water & sanitation	26.28	124	54.95%
4.Water resources	10.49	87	NA
5.Forests	35.07	57	NA
6.Fisheries	22.64	67	-0.22%
7.Biodiversity & Habitat	39.18	125	0%
8.Climate & energy	35.24	104	NA
9.Agriculture	58.4	117	16.47%

Source: epi.yale.edu

3.3 Environmental Vulnerability Index:

A vulnerability index for the natural environment, the basis of all human welfare, has been developed by the South Pacific Applied Geosciences Commission (SOPAC), the United Nations Environment Programme (UNEP) and their partners. The index was developed through consultation and collaboration with countries, institutions and experts across the globe. This index is designed to be used with economic and social vulnerability indices to provide insights into the processes that can negatively influence the sustainable development of countries.

The reason for using indices for this purpose is to provide a rapid and standardized method for characterizing vulnerability in an overall sense, and identifying issues that may need to be addressed within each of the three pillars of sustainability, namely environmental, economic and social aspects of a country's development. Development is often achieved through trade-offs between these pillars. Therefore, in order to promote sustainability, it has become increasingly important to be able to measure how vulnerable each aspect is to damage and to identify ways of building resilience. With this information to hand, the outcome for countries could be optimized for their unique situations and development goals.

The key motive to introduce this Index is to characterize the relative severity of various types of environmental Issues. The results of EVI are used to focus on planned solutions to negative pressures on environment. EVI scores and severity of vulnerability of some countries are shown below in Table 3. Higher scores of EVI indicate higher stress and vulnerability to Climate change risks. The 50 indicators been selected to measure environmental vulnerability are detailed below. Each indicator is classified into a range of sub-indices including the three aspects of hazards; resistance and damage and into policy-relevant sub-indices including:

- Climate Change = CC
- Biodiversity = CBD
- Water = W
- Agriculture and fisheries = AF
- Human health aspects = HH
- Desertification = CCD
- Exposure to Natural disasters = D

Table 3: EVI of some selected countries:

S. No.	Country	EVI	Level of stress
1	Australia	238	At risk
2	Germany	357	Highly vulnerable
3	UK	373	Extremely vulnerable
4	Canada	251	At risk
5	Japan	389	Extremely vulnerable
6	France	361	Highly vulnerable
7	US	300	Vulnerable
8	Russia	273	Vulnerable
9	China	360	Highly vulnerable
10	Nepal	305	Vulnerable
11	Pakistan	373	Extremely vulnerable
12	India	385	Extremely vulnerable
13	Myanmar	270	Vulnerable

Source: UNDP

The EVI performance of India confirms the extreme vulnerability of Indian climatic system with the index count of 385.

3.4 Comparative GHG emission of India:

Table 4: Comparisons of SIDS, LDCs and Other Countries of the World (for the year 2007)

Country name/Regions/ groups	GDP per capita, PPP (current international $)	CO2 emissions (metric tons per capita)	GDP per unit of energy use constant 2005 ppp $ per kg of oil equivalent	Electric power consumption(KWh per capita)
East Asia & Pacific	8116	4.85	4.74	2642
Europe & Central Asia	23069	7.89	6.26	5558
European Union	30710	8.01	8.02	6391

High income non OECD	32610	14.31	5.55	8450
Middle East & North Africa	9621	5.42	4.59	2292
North America	45608	18.31	5.50	13955
OECD members	32998	10.73	6.72	8397
South Asia	2618	1.21	5.10	507
Sub-Saharan Africa	2054	0.85	3.21	85 3.21
India	2854	1.43	5.06	563
Least developed countries	1271	0.24	3.91	149
SIDS average	10307	3.95	10.99	N.A
World	10276	4.74	5.42	2851

Source: World Bank Data (data.worldbank.org/indicator)

India along with SIDS and LDCs is vulnerable to climate change impacts and is likely to suffer from it, so it would be a good idea to see how these countries have performed against other regions of the world, on the basis of the indicators such as CO2 emissions, and energy consumption (Table:4). When we compare the data we find that per capita co2 emission of India is quite lower than others but there is a certain need of policy implications and environmental protection strategies for a long run sustainable development.

4. Major International organization related to climate Change and India's response as a developing country:

4.1 International Organizations:

1. **European Union Directorate General for the Environment:** Initiates and defines EU environmental legislation and ensures that measures are put into practice in EU Member States.
2. **Global Environment Facility:** Independent financial organization that provides grants to developing countries for projects that benefit the global environment. Worldwide network of business, civil society, labour, investors and other groups are collaborating to disclose environmental sustainability performances.
3. **Intergovernmental Oceanographic Commission:** International autonomous agency of UNESCO that promotes the scientific investigation of the nature and resources of the oceans. See also the International Oceanographic Data and Information exchange.
4. **International Whaling Commission:** International organization providing for the conservation of whales and development of the whaling industry.
5. **Inter-Organization Programme for the Sound Management of Chemicals:** Pre-eminent organization coordinating action to achieve international goals for the management of chemicals.
6. **Joint Group of Experts on the Scientific Aspects of Marine Environmental Pollution (GESAMP):** Joint group of international organizations covering all scientific aspects on the prevention, reduction and control of the degradation of the marine environment.
7. **Multilateral Fund for the Implementation of the Montreal Protocol:** Multilateral funding agency providing assistance to help developing countries phase out the use of ozone-depleting substances.

8. **United Nations Convention to Combat Desertification (UNCCD):** UN convention based agency dedicated to combating desertification.
9. **United Nations Environment Programme**: Principal body of the United Nations in the field of the environment. UNEP plays an important role in developing international environmental conventions and assisting developing countries in implementing environmentally sound policies.
10. **United Nations Forum on Forests:** UN subsidiary body promoting the management, conservation and sustainable development of forests.
11. **World Conservation Union (WCU):** World's largest conservation organization, with a mission to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature.
12. **World Meteorological Organization (WMO)**: Specialized agency of the United Nations in the fields of meteorology, operational hydrology and related geophysical sciences.

4.2 Perspectives of Developed countries and India on Climate Change:

4.2.1 Developed Countries' perspective:

OECD and some other developed countries are of the view that since most of the additional carbon emissions will be taking place in the developing countries, the developing countries should also accept cut in green house gas emissions. They also are of the view that in the long run, there has to be carbon equity. The permissible carbon emission per capita has to be same for humanity across the globe and the global community should work towards it. They want developing countries to slow their emission growth. USA is thinking of establishing a Clean Development Fund to facilitate adoption of clean technologies in developing countries. Some developed countries are strongly for introduction of carbon tax. The Developed countries objective is to pass the economic burden of GHG stabilization to others and retain competitive advantage in trade. They also want to gain competitive advantage in the near-term in the energy sector. There is a feeling that developed countries aim to minimize resource transfers to developing countries for adapting to climate change, either fiscal or sourced from carbon market.

4.2.2 Indian perspective as a developing country on climate change:

India as a developing country has reasons to be concerned about the adverse impact of climate change on its economy. A large part of its population depends on climate sensitive sectors for livelihood which makes it highly vulnerable to climate change. Climate change can have serious impacts on its crops, forests, coastal regions, etc. which can in turn affect the achievement of its important national development goals. The issue of climate change cannot however be taken up without linking it to developmental needs such as poverty, health, energy access and education. Higher energy production and consumption is a major driving force of economic development and poverty reduction. Economic activities depends on energy but India's economic growth may not be associated with proportionate GHG emissions, though its emissions are bound to grow in short as well as medium term with the upsurge of the manufacturing sectors and need for industrialization to meet the growing demands of its huge population.

Climate change and energy are now a focus of local, state, and national attention around the world. India has long been a key player in international negotiations and has begun implementing a diverse portfolio of policies nationally and within individual states to improve energy efficiency, develop clean sources of energy, and prepare for the impacts of a changing climate. An effective national strategy, however, must take into account the climate change and energy-related beliefs, attitudes, policy preferences, and behaviors of the Indian people, who will play a vital role in the success or failure of this strategy through their decisions as citizens, consumers, and communities. Building public acceptance, support, and

demand for new policies to both limit the severity of global warming and prepare for the impacts of a changing climate will require education and communication strategies based upon a clear understanding of what Indians already know, believe, and support, as well as what they currently misunderstand, disbelieve, or oppose.

4.3 Steps taken by the Government of India:

India has a very comprehensive framework of legal and institutional mechanisms in the region to respond to the tremendous challenges to the environment it is facing, owing to population growth, poverty and illiteracy augmented by urbanization and industrial development. India is one of the leading developing countries in so far as having incorporated into its Constitution the specific provisions for environmental protection. Article **48A** of the Constitution of India provides that **'**the State shall endeavor to protect and improve the environment and to safeguard the forests and wild life of the country'. Similarly, Article **51A *(g)*** makes it obligatory for every citizen of India, 'to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures.' Despite the fact that India's contributions to greenhouse gas emissions are very small, the Government of India has taken many measures to improve the situation in this regard. India has initiated several climate-friendly measures.

1. **National Environment Policy**: The principal objectives of the National Environment Policy are to i) Conservation of Critical Environmental Resources ii) Intra-generational Equity: Livelihood Security for the Poor iii) Inter-generational Equity iv) Integration of Environmental Concerns in Economic and Social Development v) Efficiency in Environmental Resource Use vi) Environmental Governance vii) Enhancement of Resources for Environmental Conservation

2. **Abatement of Pollution:** There is a policy for abatement of pollution, which provides multi-pronged strategies in the form of regulations, agreements, fiscal incentives and other. Seventeen categories of heavily polluting industries have been identified. They are: cement, thermal power plant, distilleries, sugar, fertilizer, integrated iron and steel, oil refineries, pulp and paper, petrochemicals, pesticides, tanneries, basic drugs and pharmaceuticals, dye and dye intermediates, caustic soda, zinc smelter, copper smelter and aluminum smelter.

3. **Ozone Cell**
   As per its commitment to implement the Montreal Protocol and its Ozone Depleting Substances (ODS) phase out programme in India, the Ministry of Environment and Forests has set up the Ozone Cell as a national unit to look after and to render necessary service. The Ministry provides custom/excise duty exemption for ODS phase-out projects and grants duty exemption for new investments with non-ODS technologies. The Reserve Bank of India has issued directions to all financial institutions and commercial banks not to finance new establishments with ODS technology. Licensing system is there to regulate import and export of ODS.

4. **Environment Impact Assessment**
   India has a well-devised Environmental Impact Assessment (EIA) Programme for incorporating environmental concerns in development process and also in improved decision-making.

5. **Some specific Energy Sector initiatives:**
   These are as follows:
   1. Introduction of CNG for public and private transport in metropolitan areas 2. Improving quality of transportation fuels 3.Raising share of public transport 4.A major bio-diesel programme. 5.

Increasing forest and tree cover to 25 percent by 2007 and 33 percent by 2012 6.Electricity for all by 2012 – decentralized power based on local resources; 7.Cleaner fuels for power generation 8.National programme on coal washing

6. **National Action Plan on Climate Change (NAPCC):** Prime Minister has released NAPCC on June 30th, 2008. The National Action Plan (see GOI, 2008) has been prepared under the guidance and direction of Prime Minister's Council on Climate Change. The National Action Plan reflects the importance the Government attaches to mobilizing our national energies to meet the challenge of climate change. The National Action Plan focuses attention on 8 priority National Missions. These are:

1. Solar Energy
2. Enhanced Energy Efficiency
3. Sustainable Habitat
4. Conserving Water
5. Sustaining the Himalayan Ecosystem
6. A "Green India"
7. Sustainable agriculture
8. Strategic Knowledge Platform for climate change

CONCLUSION:

In recent years, largely due to rapid growth of both, economies and emission levels developing countries are under increasing pressure to mitigate their greenhouse gas (GHG) emissions. World wide it is argued that attempts to mitigate climate change will be futile unless the major developing countries are involved. In a developing country like India, most effective responses, policies and practices are required in the specific area of agriculture, water resources, health, coastal zones, forests and extreme weather events because these particular domains are highly vulnerable to the variability of climatic system. India is taking action on many fronts to address poverty, natural resource management and climate change mitigation. Progress has been made in the energy sector and the country is now a global leader in renewable energy. The government has been successful in encouraging the operations and policies. Although India is doing very well in terms of policy implications and taking pledges for the adaption and mitigation policies but we can't close our eyes to the fact that India's performances regarding EPI and EVI are quite unfavorable so a potential strategy is highly desirable for a sustainable environmental as well as economic growth of India.

The three approaches are summarized below reflecting the proper way to decide policies and practices. These approaches can help India to perform satisfactorily to meet the challenges of climate change. The Three Approaches in Brief:

1. We need decisive local, national and international action to prevent & minimize the worst consequences of climate change. We need strong local, national and international action to dramatically cut the production of greenhouse gasses, slow down global warming, and prevent the worst consequences of climate change.

2. We need to make sure our most vulnerable communities adapt to the inevitable changes global warming will cause. It's too late to prevent global warming, so we should make sure our communities, especially those that are the most vulnerable, prepare to adapt to the problems it will cause.

3. We should trust the free market to lead the way in the search for solutions. We should rely on the efficiency and ingenuity of businesses in the private sector to provide us with the best strategies for addressing climate change.

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