

## Effects of change in the climate of India

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### SUMMARY

Climate change is one of the most important global environmental challenges, with implications for food production, water supply, health, energy, etc. Addressing climate change requires a good scientific understanding as well as coordinated action at national and global level. Historically, the responsibility for greenhouse gas emissions' increase lies largely with the industrialized world, though the developing countries are likely to be the source of an increasing proportion of future emissions. The projected climate change under various scenarios is likely to have implications on food production, water supply, coastal settlements, forest ecosystems, health, energy security, etc. The adaptive capacity of communities likely to be impacted by climate change is low in developing countries. Indians should be concerned about climate change since this phenomenon might have substantial adverse impacts on them. Like other developing countries, several sections of the Indian populace will not be able to buffer themselves from impacts 2,8 of global warming. With close economic ties to natural resources and climate-sensitive sectors such as agriculture, water and forestry, India may face a major threat, and require serious adaptive capacity to combat climate change. As a developing country, India can afford little risks and economic backlashes than industrialized nations can. With 27.5 per cent of the population still below the poverty line, reducing vulnerability to the impacts of climate change is essential. It is in India's interest to ensure that the world moves towards a low carbon future. Therefore this paper makes attempt to study the effects of climate change in India.

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Climate change is one of the most important global environmental challenge, with implications for food production, water supply, health, energy, etc. Addressing climate change requires a good scientific understanding as well as coordinated action at national and global level. Historically, the responsibility for greenhouse gas emissions' increase lies largely with the industrialized world, though the developing countries are likely to be the source of an increasing proportion of future emissions. The projected climate change under various scenarios is likely to have implications on food production, water supply, coastal settlements, forest ecosystems, health, energy security, etc. The adaptive capacity of communities likely to be impacted by climate change is low in developing countries. The efforts made by the UNFCCC and the Kyoto Protocol provisions are clearly inadequate to address the climate

change challenge. The most effective way to address climate change is to adopt a sustainable development pathway by shifting to environmentally sustainable technologies and promotion of energy efficiency, renewable energy, forest conservation, reforestation, water conservation, etc. The issue of highest importance to developing countries is reducing the vulnerability of their natural and socio-economic systems to the projected climate change. India and other developing countries will face the challenge of promoting mitigation and adaptation strategies, bearing the cost of such an effort, and its implications for economic development.

Climate change is one of the most important global environmental challenges facing humanity with implications for food production, natural ecosystems, freshwater supply, health, etc. According to the latest

scientific assessment, the earth's climate system has demonstrably changed on both global and regional scales since the pre-industrial era. Further evidence shows that most of the warming (of 0.1°C per decade) observed over the last 50 years, is attributable to human activities. The Intergovernmental Panel on Climate Change (IPCC) projects that the global mean temperature may increase between 1.4 and 5.8°C by 2100. This unprecedented increase is expected to have severe impacts on the global hydrological system, ecosystems, sea level, crop production and related processes. The impact would be particularly severe in the tropical areas, which mainly consists of developing countries, including India.

The climate change issue is part of the larger challenge of sustainable development. As a result, climate policies can be more effective when consistently embedded within broader strategies designed to make national and regional development paths more sustainable. The impact of climate variability and change, climate policy responses, and associated socio-economic development will affect the ability of countries to achieve sustainable development goals. The pursuit of these goals will in turn affect the opportunities for, and success of, climate policies. In particular, the socio-economic and technological characteristics of different development paths will strongly affect emissions, the rate and magnitude of climate change, climate change impacts, the capability to adapt, and the capacity to mitigate.

The UN conference on environment and development (UNCED) in 1992 at Rio de Janeiro led to FCCC (Framework convention on climate change), which laid the framework for the eventual stabilization of greenhouse gases in the atmosphere, recognizing the common but differentiated responsibilities and respective capabilities, and social and economic conditions. The convention came into force in 1994. Subsequently, the 1997 Kyoto protocol, which came into force in 2005, reasserted the importance of stabilizing greenhouse gas concentrations in the atmosphere and adhering to sustainable development principles. The protocol laid out guidelines and rules regarding the extent to which a participating industrialized country should reduce its emissions of six greenhouse gases – carbon dioxide, methane, nitrous oxide, chlorofluorocarbon, hydrofluorocarbons and perfluorocarbons. It requires industrialized countries to reduce their greenhouse gas emissions by a weighted average of 5.2 per cent, based on the 1990 greenhouse gas emissions. The reduction is to be achieved by the end of the five-year period, 2008 to 2012. The Kyoto protocol does not require the developing

countries to reduce their greenhouse gas emissions.

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

Indians should be concerned about climate change since this phenomenon might have substantial adverse impacts on them. Not all possible consequences of climate change are yet fully understood, but the three Climate Change: India's perceptions, positions policies and possibilities main 'categories' of impacts are those on agriculture, sea level rise leading to submergence of coastal areas, as well as increased frequency of extreme events. Each of these pose serious threats to India, however, these are long term issues. The overriding immediate concern for India should be the fast pace at which negotiations are taking place on the climate front. India's main energy resource is coal. With the threat of climate change, India is called upon to change its energy strategy based on coal, its most abundant resource, and to use other energy sources (e.g. oil, gas, renewable and nuclear energy) instead, which may turn out to be expensive. Thus, an immediate issue is to come up with a better negotiation strategy such that we have more freedom to decide which type of energy we use, how we generate power, how to reduce methane emissions by agricultural practices or forestry and so on. Negotiations are important for us as a means to reduce or postpone future vulnerability by getting the developed countries to reduce their emissions.

### **How change in the climate affects India?**

Precisely at a time when India is confronted with development imperatives, we will also be severely affected by climate change. Like other developing countries, several sections of the Indian populace will not be able to buffer themselves from impacts of global warming. With close economic ties to natural resources and climate-sensitive sectors such as agriculture, water and forestry, India may face a major threat, and require serious adaptive capacity to combat climate change. As a developing country, India can afford little risks and economic backlashes than industrialized nations can. With 27.5 per cent of the population still below the poverty line, reducing vulnerability to the impacts of climate change is essential. It is in India's interest to ensure that the world moves towards a low carbon future. Many studies have underscored the nation's vulnerability to climate change. With changes in key climate variables namely, temperature, precipitation and humidity, crucial sectors like agriculture and rural development are likely to be

affected in a major way. Impacts are already being seen in unprecedented heat waves, cyclones, floods, stalinisation of the coastline and effects on agriculture, fisheries and health. India is home to a third of the world's poor population and climate change will hit this section of society the hardest. Set to be the most populous nation in the world by 2045, the economic, social and ecological price of climate change will be massive.

**The future impact of climate change, identified by the government of India's national communications (NATCOM) says that :**

Decreased snow cover, affecting snow-fed and glacial systems such as the Ganges and Bramhaputra. 70 per cent of the summer flow of the Ganges comes from meltwater. Erratic monsoon with serious effects on rain-fed agriculture, peninsular rivers, water and power supply. Drop in wheat production by 4-5 million tones, with even a  $^{\circ}\text{C}$  rise in temperature. Rising sea levels causing displacement along one of the most densely populated coastlines in the world, threatened freshwater sources and mangrove ecosystems. Increased frequency and intensity of floods. Increased vulnerability of people in coastal, arid and semi-arid zones of the country. Studies indicate that over 50 per cent of India's forests are likely to experience shift in forest types, adversely impacting associated biodiversity, regional climate dynamics as well as livelihoods based on forest products.

**Contribution of India to global GHG emissions and build up – past, current and future:**

In recent years, the development planning in India has increasingly incorporated measurable goals for enhancement of human well being, beyond mere expansion of production of goods and services and the consequent growth of per capita income. Many developmental targets are even more ambitious than the UN Millennium Development Goals<sup>16</sup>; several of which are directly or indirectly linked to energy and therefore to GHG emissions. India holds over 1 billion people, *i.e.* over 16 per cent of global population. Endowed with coal, India's energy system has evolved around coal. India's share in global CO<sub>2</sub> emissions is still very small. Thus, historically and at present India's share in the carbon stock in the atmosphere is relatively very small when compared to the population. India's carbon emissions per person are twentieth of those of the US and a tenth of most Western Europe and Japan.

**Cost of addressing and not addressing climate change for India:**

India has potential to supply substantial mitigation at a relatively low price. Major opportunities exist both on the supply and demand side of energy, in case of carbon emissions. There are also low cost opportunities for mitigation of methane and nitrous oxide. As Table 1 shows, in the short-run, till the Kyoto protocol period, substantial potential of mitigation of carbon, methane and nitrous oxides exist at costs below \$30 per tonne of carbon equivalent

**Table 1 : Effects of change in the climate of India**

Climate change	Impacts on gender, livelihood, poverty, wellbeing and the MDGs
Forest	
Degradation of forests	<ul style="list-style-type: none"> <li>- More drudgery for women for fuel and water</li> <li>- Less time for income generating activities</li> <li>- Less time for children education</li> <li>- Reduction of income and due to non-timber forests products (NT FPs)</li> <li>- Loss of eco-tourism opportunities</li> </ul>
Food and agriculture	
- Less yield from crops	- Reduced calories intake for women and girl children
- Increased food prices	- Higher food insecurity for women
- Change in food patterns	- Less milk / nutrition for children livelihood
- Depleting livestock	
Water	
- Reduction in water availability	- Longer distances for fetching water
- More dependence on unsafe water	- Impacts on mother and child nutrition
Biodiversity	
- Loss of species (flora and fauna)	- Loss of indigenous practices
- Loss of medicinal plants/herbs	- Loss of livelihood
- Loss of mangroves and corals	- Reduced income
- Loss of gene pool	- Increased vulnerability
Health	
- Water borne diseases	- Women and children more vulnerable
- Increase of diseases like dengue, malaria, etc.	- Infant mortality
- Respiratory diseases due to indoor air pollution and other emissions	- Disease sensitivity

Table 2 : Mitigation options, potential and costs			
Greenhouse gas	Mitigation options	Mitigation potential 2002-2012 (million tonne)	Long-term marginal cost (\$/tonne of carbon equivalent)
Carbon	Demand-side energy efficiency	45	0-15
	Supply-side energy efficiency	32	0-12
	Electricity T and D	12	5-30
	Renewable electricity technologies	23	3-15
	Fuel switching – gas for coal	8	5-20
	Forestry	18	5-10
Methane	Enhanced cattle feed	0.66	5-30
	Anaerobic manure digesters	0.38	3-10
	Low methane rice varieties	Marginal	5-20
	Cultivar practices	Marginal	0-20
Nitrous oxide	Improved fertilizer application	Marginal	0-20
	Nitrification inhibitors	Marginal	20-40

(or \$8 per tonne of carbon dioxide equivalent), which is below the prevailing price of traded carbon in European market. In the long run, the results of the modelling exercises show that India, between 2005 and 2035, could supply cumulative 5 billion tonne of carbon equivalent mitigation from the energy options at price below \$10 per tonne of carbon equivalent (Fig. 1). The low mitigation cost potential is also evident from the sizable CDM projects being proposed from India in recent times.

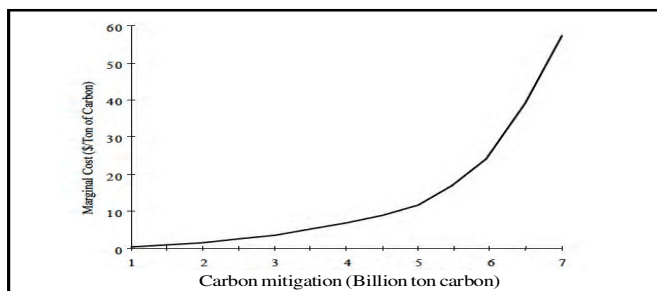


Fig. 1: Carbon mitigation supply curve for India for the period 2005-2035

### Conclusion:

Climate change strategy needs to focus on supporting design of policies and action plans, promoting early adaptation as well as long-term strategies like directing investment towards low carbon technologies and practices and finally integrating climate change broadly into development assistance at the global, regional and national levels. The nexus between climate change and gender equality needs to be intensified so that the capacity of the national and local institutions can be strengthened in terms of resilience to climate change by involving wide range of stakeholders. Prime Minister's Climate Change Council has proposed eight missions that cover areas such as

agriculture, water, forests, sustainable habitat, solar energy and energy efficiency and strategic knowledge.

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