

# India's Stand on Climate Change

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**India and Global Climate Change: Perspectives on Economics and Policy from a Developing Country**  
*edited by Michael A Toman, Ujjayant Chakravorty and Shreekant Gupta;*  
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Climate change is a global environmental problem and although our scientific understanding of the phenomenon is improving it is far from complete. Climate change can manifest itself in gradual shifts in temperature, precipitation and a rise in sea level, resulting in changes in the frequency, intensity and duration of extreme events. It will affect different regions and sectors differently based on their sensitivity and adaptive capacity, and therefore their vulnerability to these changes. Enhancing adaptive capacity is a necessary condition for reducing the vulnerability of deprived regions. For the Indian economy, which mainly depends on natural resources, climate change could represent an additional stress on agriculture, forestry, the coastline, water resources and human health. Adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 globally, reflects the recognition of this problem in international efforts to address the issue formally. However, nations are far from 'united' on how best to respond to the climate change issue.

The book under review is organised into 17 chapters divided into four parts. It successfully attempts to develop an Indian

orientation and perspective on the problem of climate change. The introductory chapter by Toman briefly provides a bird's-eye view of the 17 chapters, besides supporting arguments for selecting India as a case study on the grounds of the vulnerability of the Indian economy to climate change, its problems of population, energy consumption, GHG emissions, negotiation on the international front, etc.

Part I deals with the economic drivers of greenhouse gas emissions. Shukla, Ghosh and Garg present an analysis spanning four decades and examine a reference scenario and a few carbon mitigation scenarios using bottom-up energy system models (MARKAL, AIM/ENDUSE and demand model) followed by the engineering paradigm. Their analysis suggests that demand sectors, particularly industrial and transport sectors, offer sizable potential for carbon mitigation in the short term. The medium- and long-term strategy includes improvements in electric supply, harnessing renewable and nuclear resources and improving transport infrastructure. The authors are quite optimistic about high carbon prices and the benefits accruing through clean development mechanism (CDM) activities.

Sengupta and Gupta provide a macro-level overview of India's economic reforms, including reforms undertaken in the energy industry and argue that they have not been able to make any significant impact on energy efficiency. One of the major factors responsible for this is the incompleteness of price reforms, due to structural rigidities attributable to the institutional system. It is suggested that economic reforms be supplemented by appropriate science and technology policies for sustainable development.

Gokarn, in his chapter on economic policy reforms, presumes that licensing and trade and foreign investment would have the most direct bearing on the usage of energy and thus on GHG emissions. But the analysis is silent on other important economic reforms undertaken, such as increasing competition through institutional, legislative and regulatory reforms, the reduction of subsidies and restructuring/privatisation, etc. Elasticities of energy consumption with respect to various macroeconomic indicators have been estimated and meaningfully analysed. The structural shift of the economy towards services and the increasing importance of exports in aggregate demand have favourable implications from the perspective of controlling GHG emissions.

Gupta identifies the activities of the informal sector, comprising of agriculture, small-scale manufacturing, cottage industries and services, in India and estimates GHG emissions from them, including that of the informal transport and rural domestic sector. The author stresses on considering the impacts of the policy on poverty, job loss and income distribution in the informal sector in India before it is implemented.

Chakravorty develops a theory of endogenous resource substitution that is driven by rising resource shadow prices in a Hotelling-type framework and examines sectoral energy use profiles for the Indian economy. The model captures the importance of resource scarcity and technological changes on the time path of emissions. In the short run, we observe a gradual transition from coal to natural gas in power generation but, in the long run, abundant coal reserves may be the only viable option for self-reliance in the energy sector. Technological change could have a significant impact on the emission profile but much will ultimately depend on government policies on globalisation, deregulation, restructuring of investment, etc.

Part II of the book provides options for greenhouse gas mitigation. Khanna has argued that government interference, lack of managerial autonomy, and energy-pricing distortions have exacerbated carbon emissions generated by the electricity sector in India. Cost-effective policies have to be broader than other incentive based policies. The author analyses the institutional structure, pricing policies and policy reforms undertaken in the coal-based electricity sector in India. Neat and clearly understandable graphs have been

developed to understand the conceptual framework of the micro-level analysis of the choice of efficiency-enhancing technology and the welfare and environmental effects of policy reforms. The empirical analysis is based on data for 63 coal-based electricity-generating plants in India for 1990-91. Welfare and environmental effects have been analysed empirically for eliminating market distortions, alternative carbon abatement policies and distributional effects. The analysis shows that economic policy reforms not only achieve reductions in carbon emissions but also increase social welfare, while in the absence of such reforms, a mix of command and control instruments and market based approaches lead to reduction in electricity generation and thus loss of social welfare.

Gundimeda provides various options for carbon sequestration in Indian forests, including natural regeneration, rehabilitation of degraded lands, reforestation and afforestation of marginally degraded forestlands, agro forestry, farm forestry, strip plantations and protection from fire and grazing. Under a technically feasible scenario, forests can sequester the carbon equivalent to 1990 fossil fuel emissions in India. The estimated costs of various mitigation options are much higher than the earlier estimates due to consideration of the opportunity cost of land and growing stock, annual maintenance costs and monitoring and evaluation costs. The high cost estimates of carbon mitigation options in forestry are no longer preferable options for carbon sequestration under the CDM. The author has also provided extensive comparison of earlier studies on cost estimation for carbon sequestration in India.

Ramanathan has analysed the multi-criteria nature of GHG control strategies in the power and transport sectors in India, using data envelopment analysis (DEA) and the analytic hierarchy process (AHP). Based on CO<sub>2</sub> and SO<sub>2</sub> savings due to the use of different electricity generation technologies, combined cycle gas turbine and lighting, CNG buses, and the conversion of two-stroke engines of two-wheelers to four-stroke ones are the highest ranked strategies for power generation, demand-side management, and the transport sector, respectively. A brief discussion has also been given on the mathematical programming of the two approaches in the appendix.

Shukla and Rana applied macroeconomic models, including bottom-up and top-down energy and economy models such as Edmonds-Reilly-Barnes (ERB) and the

second-generation model (SGM) or the computable general equilibrium (CGE) model. The long-term trends of energy consumption and GHG emissions have been set until 2095 and changes have been tracked in the baseline scenarios. The main conclusions drawn from the analysis is that future CO<sub>2</sub> emissions of India would be 10 per cent of global emissions by the end of the 21st century. The authors have ignored India's failure to control population growth due to which we have low per capita emission as compared to developed countries. The three carbon mitigation scenarios assume carbon tax levels at US\$25, \$50, \$100 per tonne starting from 2000. GNP loss has been estimated at a high of 3.5 per cent, due to the severe tax regime, which will gradually even out to lower levels. Meaningful conclusions could have been drawn by the inclusion of other efficient market based instruments.

Gupta in his paper analyses short- and long-term issues of incentive-based approaches for climate change. Since international carbon trade guidelines are not clear, there is some uncertainty on the division of gains from carbon trade under the CDM between the north and south. It is therefore desirable for India to engage in carbon trading with other market based instruments (MBIs) such as carbon taxes and energy price reforms. The author also highlights issues related to the monitoring and enforcement regime in India by pointing out policy barriers, institutional and organisational impediments, and political and cultural obstacles and the solutions to overcome them.

Part III of the book deals with international climate policy and raises concerns about the emissions cap; Kyoto Protocol and equity problem, allocation of GHG emissions in the short- and the long-run and issues and options around CDM. Shah is concerned about the fact that the Kyoto Protocol is not clear on the issue of emission rights, their distribution among interested parties within the country using a regulatory mechanism and the reallocation of these rights through trade. The author proposes two frameworks of cooperative and non-cooperative games to assign emissions caps and concludes that the growth of private capital along with clean technology leads to a lower domestic cap, a higher foreign cap, a lower aggregate cap and vice versa. The growth of a nation's social capital leads to a higher domestic cap, a lower foreign cap and a higher aggregate cap. A word of caution has been

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given in a nation's social capital. If social capital is being devoted to preventing and reducing environmental damage, it should not be interpreted in absolute terms but in relation to that nation's natural vulnerability to such damages.

Chander in his chapter 'The Kyoto Protocol and Developing Countries: Strategies and Equity Issues' interprets the protocol in terms of the game theoretic model, with special emphasis on its implications for developing countries. The role and strategy of developing countries, particularly that of India, in the implementation of the protocol and in future negotiations have been included. Against the perceived impression of the minimal role of developing countries in the initial negotiations, the author analyses and concludes that developing countries have a major role to play in the negotiations on emission trading and its implementation. India should press ahead with the Kyoto proposals regarding emission levels and leave the issue of pollution rights for future negotiations.

Gupta and Bhandari propose an approach to address the problem of GHG emissions for the longer-term with short-term, current circumstances adaptations. The long-term emissions entitlements have been analysed for select Annex I and Non Annex I countries and the percentage reduction in emissions, relative to 1990 levels, has been compared for selected Annex I countries under phasing in of per capita emissions rights. There is a direct imposition of commitments targets to reduce GHG emissions for both types of countries. Initially Non Annex I countries may have a surplus of emissions rights, which can be traded at the global market price for flexibility in adjusting their development patterns. The analysis on trade of emissions reduction between Annex I and Non Annex I countries ensures least-cost measures and provides flexibility and economic efficiency globally. However, the authors have ignored the issue of equity. The authors find synergy between the short and the long term. The short-term policies need to induce technological innovation and a change in lifestyles in the end.

Babu, Kumar and Saha talk about design issues and options related to CDM. CDM provides economically viable alternatives and transfer of technology to the host country while forcing developing countries to reduce emissions indirectly. To discuss the scope and potential of the CDM market in India, the Indian cement sector has been taken as a case study. Domestic

emissions abatement, the extent of joint implementation (JI) and emissions trading (ET) activities, adaptation fund and voluntary commitment have been identified as having a significant influence on the size of the CDM market. The authors have developed models for CDM when negotiations take place between firms, between governments, and for technology transfer on a sound theoretical understanding of environmental economics. Authors argue that the theoretically established least-cost permit trading system might not prove to be least-cost in real life because of transaction costs and political forces.

Part IV of the book provides concluding remarks by Parikh and Pachauri. Parikh argues that although India is not committed for GHG emissions now, it is still promoting energy efficiency and renewable energy, and reforming energy markets. It will be unjust to reduce emission, as India has not reached a certain level of development. Pachauri revisits his concerns for developing countries, particularly India, as the worst impacts of climate change are likely to be felt by them. Although three assessment reports of The Intergovernmental Panel on Climate Change (IPCC) provide significant knowledge on climate change, there is still a need for major dissemination efforts. IPCC has to ensure intensive work on the impact of climate change, sectorwise and region wise. Kumar briefly describes the climate change impact for different sectors in India, such as agriculture, forestry, coastal resources, water resources, etc, at the end of the book. Some more light could have been thrown on this issue, which is of primary concern. Since our economy is a natural resource based one, and will be adversely affected by climate change, the editors could have devoted one full section on the impact of climate change on the Indian economy.

All the papers in the book are backed by good research efforts and a number of references on the subject, which may prove useful for a broad spectrum of scholars. The authors and editors must be applauded for the same. The subject of climate change and India's perspective on its economic and policy aspect is of great importance as the country may play a major role in emissions reduction in the second commitment period. Even in the first commitment period, India will be a significant trading partner in CDM activities. In this context, the book under review is a valuable contribution in increasing existing knowledge and critically analysing issues of concerns. **EPW**