An Indian Perspective of Climate Change Mitigation: Poverty Eradication

Through Sustainable Economic Growth

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Introduction

With a total geographical area of 329 million hectares, India is the seventh largest country in the world. India's population reached the one billion mark in May this year (2000) with a population density of 267 persons per km^2 and a substantial number living below the poverty line.

Out of the 500 million people in absolute poverty in South Asia, India alone has as many as 360 million people below poverty line (defined as per capita earning less than $1 a day). Even those who have some income may not have access to basic facilities. Many in India live not only without safe drinking water, sanitation, and medical care, but also without homes. **Sustainable livelihoods need to be created in millions**. Seven million jobs need to be created every year. Added to this, education facilities need to be provided to all children. In 1995, 48 percent of the adult population in the country was illiterate. Lack of education of such a large percentage of the population makes the situation still worse.

India's sustainable development goals and rapid economic growth

Against this backdrop, poverty alleviation, economic and social development and environmental protection are the overriding sustainable development goals and priorities of India. To meet these goals India needs rapid economic growth to fulfil the aspirations of the people. But this growth should not occur at the expense of India's environment as has happened in the past.

Climate Change

The earth's climate is a complex system, resulting from an aggregated interaction of many components such as the ocean, the atmosphere, human beings, and living organisms like forests and the biodiversity.

The earth's climate has changed over the millennium, but what is causing concern is the projected rapid rate of change in the earth's climate due to increased human activities like energy use, industrial processes, agriculture and land use, land use change and forestry. The Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 1995) has clearly brought out that the balance of scientific evidence suggests a discernible human influence on global climate change.

National context of the implementation of the Climate Change Convention : India's proactive role

The Climate Change Convention is not merely meant for the stabilisation of the concentrations of greenhouse gases (GHGs) in the atmosphere; **poverty eradication and economic and social development in the developing countries are also central, though implicit, in the Convention.** This is also reflected in Agenda 21.

Unless it can be demonstrated that certain policies will generate short and long term benefits for the environment (both national and global), and also address the core issue of poverty alleviation and social sustainability, developing countries like India will find it difficult to convince people to divert meagre resources to climate change programmes and policies. **While it is true that climate change is not a priority area for developing countries, India has adopted a pro-active role in all international climate change initiatives and negotiations and is a signatory to the UNFCCC. In its development strategy, it has pursued measures and options, which also address climate change mitigation.**

Common but differentiated responsibility

India's strategy to contribute to global efforts **to reduce the risk of climate change** is in accordance with its common but differentiated responsibilities, capabilities, and socio-economic conditions as enunciated in the Convention. India is aiming to (i) develop institutional capability to formulate, assess and implement economic, social and technical responses to climate change; (ii) focus on transfer and adaptation of new environmentally sound technologies and (iii) integrate sustainable development with the national development programmes.

India's Vulnerability to climate change

Vulnerability of a system to climate change is defined as the extent to which climate change may damage or harm a system. It depends not only on a system's sensitivity but also on its ability to adapt to new climatic conditions. **The vulnerability of a system increases as its adaptive capacity decreases.** India's agriculture, water resources, coasts and islands, and population health are vulnerable to climate change.

Agriculture

It has been said that Indian agriculture is a gamble with the monsoon, thereby emphasising the interrelationship and linkages between agriculture and climate change. Climate change will have adverse impacts on food production. Agricultural research in India must lead to the discovery of varieties that can withstand adverse climatic conditions and thus meet the demand for food grains in the country.

Water Resources

Water resources are already scarce in many parts of India. Global warming and climate change may add additional stress to this scarce resource. India, however, utilises only a fraction of water from rain and from the melting of the Himalayan glaciers, the rest drains down to the sea. India needs to construct many thousands of check dams with the participatory efforts of the local community to store water during the rainy season for drinking, agriculture and other industrial requirements.

Human Health

As already mentioned, a very large percentage of India's population lives below the poverty line and are already in poor health due to not only a lack of adequate food and nutrition, but also the affliction of tropical diseases. Human health will be under stress due to global warming and such a situation will exacerbate incidences of malaria, dengue fever, measles etc., and also deaths from heat stroke and scarcity of drinking water. India needs to invest a considerable part of the total plan outlay in the health sector to provide primary health facilities, particularly in rural India where about 75% of the population lives.

Indian coasts and islands

Emissions of Greenhouse gases from the Indian Economic and other activities like landuse and landuse change and forestry

For improving the quality of life of 1 billion people, the country must plan and implement rapid economic growth in all sectors of the economy. In doing so, the availability of a reliable, efficient and adequate power infrastructure in the country is very crucial. The power sector in India relies primarily on the thermal generation of power using coal, an indigenous source. Therefore in the business-as-usual scenario, emissions of carbon dioxide (CO_2) and other greenhouse gases from fossil fuel uses in India is bound to increase.

Estimates of CO_2 emissions (million tonnes of carbon) from India from the burning of fossil fuels (Table 1) show that India's total CO_2 emissions will grow considerably in the coming decades.

Table 1 : Estimates of total CO_2 emissions in million tonnes of CO_2 as carbon (from fossil fuels)

Source	1990	2000	2010	2020
Asia Climate Change Study - ADB (July 1994)	153	289	450	-
ALGAS study (Oct 1998)	139	258	448	780
Others ORNL	184.3			
Wiltite (1990)**	-	330		

Most of the studies indicate a growth rate 5.7% of GHG emissions in India from fossil fuels use in the next 20 years. India however emits a mere 2.4% of the world total. When measured on a per capita basis, its energy related CO_2 emissions are a much lower 0.2 metric tonnes of carbon against a world average of 1.15 metric tonnes of carbon.

Priority Economic Sectors For Development

India, during the past fifty years of independence, has pursued technological and policy options and measures to address its national development needs which directly or indirectly also address climate change mitigation. Some of the priority sectors for India's development are :

- energy
- agriculture
- forestry
- building (construction sector)

Energy Sector

Energy is central to economic development. Its expansion and modernisation are critical to India's rapid economic growth. The installed generation capacity has grown from approximately 1300 megawatt (MW) in 1947 to 83,288 MW in April 1996. Total electricity generation in 1995-96 was 380 billion Kwh, a 7.5% annual growth rate over 1947.

Despite the increased generation of power over the years, India's per capita annual electricity consumption is about 315 Kwh compared to more than 5000 Kwh in Europe and 17000 Kwh in North America. The demand for power is rising in the country and requires more and more capacity addition. At present 70-72% of commercial energy is generated by using fossil fuels, mainly coal, and this scenario is expected to continue in the coming decades, posing environmental problems at the local, national, and global levels.

The Government has initiated various short-term and long-term measures for the reduction of GHG emissions from the energy sector. Broadly two types of options have been identified :
improvement in energy efficiency through upgrading currently employed technologies
introduction of advanced technologies that are more efficient or are based on renewable energy sources

The renewable energy sector in the country has made very laudable progress during the last decade. There is significant potential for generation of power from non-conventional energy sources, and a number of technologies which have been successfully harnessed are solar energy, wind power, mini / micro hydel power, biomass gasification and bagasse cogeneration.

Next to electricity generation, transportation is the other major sector utilising oil and natural gas and contributing to GHG emission reduction. In India the government of Delhi has taken measures by weeding out commercial vehicles more than 8 year old, introducing lead free petrol for vehicles and CNG vehicles, and introducing EURO II standard norms for cars to bring down vehicular emissions.

Forestry Sector

Out of the total geographical area of the country about 19.31 percent is under forests (> 10 percent tree cover). The total growing stock in Indian forests is estimated to be 4.741 mt with a mean annual growth rate of 1.37m^3/ha. Net CO_2 emissions from LU & LUCF was 1.5 Tg CO_2 in 1990, projected to increase to 29.3 Tg CO_2 in 2000 and 77.3 Tg CO_2 in 2010.

Mitigation Options in the forestry sector are : natural regeneration (NR), entrance NR, private land using partially degraded forest area / degraded land.

Agricultural Sector

Emissions of greenhouse gases particularly the non-CO_2 gases such as methane, nitrous oxide, carbon monoxide and nitrogen oxides from the agriculture sector are significant in India. The primary sources are the large agricultural areas, under paddy cultivation and high cattle population in India. Summary of methane emissions from the agricultural sector for 1990 in Tg is as follows :

Live stock [a]	~	0.3 Tg/y (largest contribution is from non dairy, followed by buffaloes
Rice paddy cultivation [b]	~	4.07 ± 1.25 Tg CH_4/yr
Animal Manure	~	0.9 Tg/yr
Field Burning of Agricultural Residues[c]	~	0.116 Tg/yr

a The Indian domestic livestock population increased 456 million in 1987 to 467 million in 1992 and is expected to increase to 625 million in 2020

*** Wiltite, Harold 1990. An analysis of India's Energy Situation and Climate Policy. A report commissioned by the Climate Division of the Norwegian Ministry of Environment.*

b The paddy cultivation area if 42.32 mha in India is the largest in Asia. The global emission of methane paddy cultivation globally is 60I40(Tg), Sundaraman, 1977

c Field Burning of Agricultural Residues also releases : CO = 2,531 Gg ; N_2O = 3 Gg and Nox = 109 Gg, Agricultural soils also release N_2O = 0.24 Tg/yr (1Tg = 10^3Gg)

Mitigation Options

Since GHG emissions from rice paddy cultivation and domestic cattle population are 'SURVIVAL EMISSIONS' from developing countries like India, there is not much scope for mitigation in the near future. However considerable research efforts and field experiments have been undertaken in India to make changes in the dietary pattern of cattle (use of MVBs etc.) and rice paddy cultivation practices to reduce emissions of GHGs particularly CH_4 (by frequent draining of paddy fields, reduction in the use of nitrogenous fertilisers and animal manure etc.)

Building Sector

The construction sector in India is estimated to contribute 22% of the total CO_2 emissions from the country. 60% of the CO_2 emissions out of the 22% are from cement, steel, bricks, and lime, which are energy intensive. A study conducted by Development Alternatives has shown that the present housing gap is over 30 million and is growing. Natural resources like clay, slate and timber are in short supply, and the CO_2 emissions from brick making, which are 17.75 mt (with technology as usual) at present (i.e. 2000) may be reduced to 13.83 mt using best current practices technology, and can be further reduced to 12.17 mt using new technology.

In 1990 the brick demand was 45.31 billion, in 2000 it is 61.20 and is projected to be 73.00 and 89.00 billion by 2010 and 2020 respectively. With this demand scenario the CO_2 emissions are estimated to be as follows :

Year	*Brick demand (in billion)*	*Tech as usual CO_2 (mt)**	*Best Current Practice CO_2 (mt)**	*New Technology CO_2 (mt)**
2000	61.20	17.75	13.83	12.17
2010	73.00	21.1	16.5	13.5
2020	89.0	26.00	20.00	15.3

*million metric tonnes

Therefore by introducing new technology like the vertical shaft brick kiln (VSBK), CO_2 emissions from brick making can be drastically brought down from 26.00 million tonnes of CO_2 to 15.3 million tonnes of CO_2 by 2020. This technological intervention reduces drastically the consumption of fossil fuels by as much as 60%.

India's Efforts at abating Climate Change

Developing countries like India do not have any binding commitments to reduce greenhouse gas emissions. Yet India has initiated several co-ordinated climate research programmes to assess and understand the implications of climate change, and to enable the country to frame regulatory measures and policies. In addition, measures have been taken to identify GHG abatement options and opportunities in the energy, forestry and agriculture sectors for implementation in 1990 - 2020.

Conclusion

In its path to achieve sustainable development and rapid economic growth, India has adopted various policies and technological measures to increase the efficiency of all economic activities in order to conserve resources. In the process India has not only addressed its prime agenda of poverty eradication / alleviation but has also indirectly addressed the issue of climate change mitigation.

However to enable India to take further positive steps, the country would need considerable finance (in the power sector alone India would need an investment of $134 billion) and transfer of technology to meet the challenge of development and climate change. The developed countries must come forward to provide funds and technology as was envisaged in the UNFCCC.

The Kyoto Protocol to the Climate Change Convention also provides an opportunity to developing countries like India to achieve sustainable development. India therefore should play a key role so that the Protocol provision comes into force at the earliest and all operational aspects are finalised during the COP- 6 at the Hague.