Policies and Measures for addressing Climate Change in Developing Countries with particular reference to India

Kalipada Chatterjee

Development Alternatives
B - 32, Tara Crescent
Qutab Institutional Area
New Delhi - 110 016, India

Introduction

Due to historical reason the developing countries had to start their effort of economic development after a long colonial rule with whatever technologies they could acquire from North with meager fund they had to divert for their development effort. Most of these technologies were highly polluting affecting air and water, soil, quality, human health and agricultural outputs. The main concern of these countries is early eradication of poverty and providing basic facilities to their millions for their services like safe drinking water, sanitation, basic health facilities, shelter, food & fibre, employment, education particularly of women & children. To address to this gigantic problem in the South, an all round effort for rapid economic growth, industrial development as well as social development was necessary. In South Asia alone according to the latest report there are over 500 million people survive below the absolute poverty line, where even their basic human needs are not met. South Asia is fast emerging as the poorest, the most illiterate, the most malnourished, - indeed, the most deprived region in the world. (1)

India case study

My subsequent discussion on the policies and measures to address to climate change in the developing countries will be restricted to India. By discussing and elaborating various policies and measures taken in India, I believe I shall be addressing issues which are similar in most of the developing countries in the Asia-Pacific region.

India's environment and development priority is to conserve environment - resources of land, water, forests, air, flora and fauna and enhance their quality. india's development is depended on these resources. The top most priority in India's development goals is the alleviation of poverty.

Even those who have some income may not have access to basic facilities. Many of India's poor live not only without safe drinking water, sanitary facilities, and medical care but also without homes. The housing gap in India is staggering. This gap was 24 million housing units in 1991, expected to grow to 30 million units by 2001. india's first priority must be to provide the most basic services for the poor.

Out of the 500 million people in absolute poverty in South Asia, India alone have as many as 360 million people below the poverty line. The basic needs of food, water, shelter are yet to be met. Livelihoods are required to be created. Seven million jobs are required to be added every year. All these call for a rapid yet sustainable economic growth. Many out and inside India agree that economic growth must and should accelerate as a result of the landmark economic reforms of 1991 which opened the economy up to private investment. In 1996 India targeted 7% annual GDP growth and 12% industrial growth over the next five years. The requirements for development however are staggering. The infrastructure development prepared by the Government of India is likely to cost the country $ 200 billion over the next five years at a minimum or 6% of total GDP.

(1) Human Development in South Asia, 1997; Mahbub ul Haq, Oxford, 1997

Yet this growth cannot come at the expense of **local environment**, as it has so often in the past. Issues such as industrial pollution, declining air and polluted waterways are tied directly to economic growth and must be addressed.

Environment Action Plan (EAP)

Following the Rio Summit in 1992, the Government of India laid out its over arching environmental policy in the 1993 Environmental Action Plan (EAP). The priority areas of the EAP are:

(a) conservation and sustainable utilization of biodiversity in selected ecosystem,
(b) afforestration, wasteland development and conservation of soil moisture,
(c) control of industrial and related pollution with an accent on reduction and management of wastes,
(d) improving access to clean technologies,
(e) tackling urban environment issues,
(f) strengthening scientific understanding, training and awareness of environmental issues, and
(g) developing an alternative energy plan

India's economic growth and emissions of greenhouse gases

India's greenhouse gases (GHG) emissions are intimately linked to the process of economic growth. GHG emissions are given in the Tables 1-3. Energy intensive sectors such as transport and construction are expanding and the power sector is struggling to close the gap in supply and demand for electricity. Agriculture is vital to feed the

millions, but it is also the source of methane emissions. The Indira Gandhi Institute for Development Research estimates that at 5.5% annual GDP growth, carbon emissions will more than double between 1990 and 2005 from 168 million to 375 million tonnes of carbon.

Table 1: GHG Emission (1995) in Tg/Yr	
Methane From	Tg/yr
Livestock	6.91
Landfills	2.35
Rise cultivation	4.00
Coal mining	0.40
N_2O from	
Nitrogen Fertilizer	
(20.23 million tonnes)	0.012

Table 2: Landuse related CO_2 Emissions (Tg/yr)	
1. Forest fires (accidental)	27.23
2. Firewood burning	9.00
3. Shifting cultivation	5.35
4. Controlled burning	0.69
5. Deforestation	0.25
Total	**42.52**

Table 3
GHG Emissions from fossil fuels Emissions from all energy sources

	Coal	Petroleum	Natural Gas	Total (million tonne of C)
1986-87	80(68%)	34(29%)	9(2.6%)	117
1989-90	105 (69%)	41(27%)	7(4.6%)	153 (ADB)
				159 (TERI)

India's per capita CO_2 emissions = 0.2tc/yr or 1/6 of world average

World average = 1.2tc/yr

Although per capita emissions of GHGs in developing countries is low, their emissions per unit of GDP are quite high. Hence there is a scope for these countries to develop and in the process increase their GDP, **without necessarily having an increase in the GHG emissions.**

Climate Change is not a priority area for the developing countries

The Climate Change Convention is not merely for the stabilization of concentrations of the greenhouse gases in the atmosphere; economic and social development and poverty eradication in the developing countries are also central though implicit in the convention. This is also reflected in Agenda 21 adopted in Rio along with the UNFCCC.

Unless it can be demonstrated that certain policies and options can simultaneously generate short and long term benefits for both national and global environment, developing nations find it difficult to divert meager resources to address to climate change programmes, policies and measures.

Article 4.7 of the UNFCCC clearly states that the extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology .....

... Economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties.

While it is true that climate change is not a priority area for the developing countries, some countries have during their development paths pursued options/measures to address to their national developmental needs which in turn also address to climate change such as India.

Policies and Measures initiated in India to address to rapid economic growth for eradication of poverty as well as for the reduction of emissions of greenhouse gases from the economy.

Some of be priority sectors for development are energy, transport, building and agriculture. Policies and measures initiated in India in some of these sectors will be briefly discussed here.

Energy Sector in India

Energy is central to economic development. Energy is consumed in a variety of forms in India. Fuelwood, animal waste, agricultural residues are traditional sources of energy that continue to meet the bulk of the energy requirement in the rural areas. The 'non-commercial' fuels are gradually getting replaced by 'commercial fuels' such as coal, lignite, petroleum products, natural gas and electricity.

The energy sector has been plagued by shortages, even though investments in real terms in coal, hydrocarbon and power sectors have quadrupled since 1974-75. The energy profile of India is dominated by coal, which is indigenous resource. Coal will continue to play a major role in meeting the energy needs of the Indian economy.

A Barrier

Increase in GHG emission particularly of CO_2 from the Indian economy is therefore inevitable, till India builds up its capacity, has adequate additional funds and clean coal or economically viable environment friendly non-fossil technologies to replace fossil based technologies.

Proven energy reserves

Table: 4

	Unit	India
Coal	billion tonnes	69.9
Oil	billion tonnes	5.8
Natural gas	trillion cu.m.	0.7

Power Sector in India

The demand for electricity in the entire economy has risen at the rate of 9.73% during 1986-87.

Installed Capacity

Table : 5

	Total (MW)	Thermal	Hydro	Nuclear
1947	1400			
1994-95	81,164	58,110 (>70%)	20829 (25%)	2250 (~ 3%)

Notwithstanding this substantial capacity enhancement, the country continues to face 20.5% power shortage during peak hours. Out of the total installed capacity only 4% i.e. 3000 MW is in the private sector.

Financial Barrier

Even though the capacity addition target for the present plan period is fixed at 30538 MW, it is felt the targets will not be achieved due to lack of funds

Policies and Measures in the Power Sector to improve power generation

Various short term and long term measures are being taken to improve power generation. They are:

- commissioning of new generation capacity
- renovation and modernization of old units
- formation of new institutions like the Power Grid Corporation of India
- improvement in the T&D System to bring down TD losses
- training of maintenance personal
- opening up the sector for private investment.

Power Generation in 1995-96 was 377 billion units, out of which

- 297 billion: Thermal
- 72.3 billion: Hydro
- 7.85 billion: Nuclear

At present 70-72% of commercial energy is generated by using fossil fuels, and this scenario is expected to continue in the coming decades.

This poses environmental problems at the local, national and global levels.

Other measures

- enforcement of mandatory standard for limiting GHG emissions
- adopting new clean technologies
- bringing down TD losses by 1% every year
- energy conservation
- efficiency improvement
- research for waste minimisation and utilisation (e.g. flyash)

Policy and Measures in the Renewable Energy Sector

India is one of the few countries in the world who have initiated very bold and progressive policies and measures in the renewable energy sector particularly for providing power to remote and rural areas as well as for feeding to national power grid, and for wheeling and banking. Some of these measures are laudable and promising. They are:

- Wind energy
- Mini Hydels
- Solar
- Co-generation
- Energy from biomass/Biomass gasification

The renewable energy being clean and sustainable also address to local, national and global environment. Non-fossil development path is one of the surest measures for sustainable development and mitigation of climate change.

As long as developing countries are not fully capable of developing these climate friendly technologies for harvesting the potential of the renewable energy sources to due to lack of economically viable technologies, adequate funds and capacity building, the developing countries urge the Annex-I countries to shift their economy from fossil fuels to non-fossil fuels and provide adequate ecological space for the developing countries to develop. such a step will also address to the goals and objective of the UNFCCC of stabilization of atmospheric concentrations of greenhouse gases to a level that would prevent dangerous anthropogenic interference with the Climate system.

Renewable Energy

Indian Scenarios

Wind Energy

Potential in India: 20,000 MW

Tamil Nadu Tamil Nadu is the Asia's highest wind farm cluster.
Installed capacity: 144.6 MW (125.3 MW by private sector)
Assessed Potential for wind energy: 2000 MW
Sites are around: Kanyakumari, Tirunelveli, Kattabomman
Sites are in rural areas in dry and barren lands, away from residential location of the villages.

Resource Conservation Wind energy has saved consumption of
Coal: 252216 metric tonnes
Furance oil: 7,90,300 litres
Avoided emissions of GHGs to the atmosphere

Wind mapping: A comprehensive wind mapping programme to identify prospective sides has been undertaken in the country.

Benefits

Global level benefit: Reduction in CO_2 and other GHGs emissions, stablising climate

National level

Conservation of resources addressing to the Environmental Action Plan of the Government of India.

State/Local level

Use of environmentally clean and pollution free technologies for power generation for feeding to national gird, abatement of local air, water and land pollution, achieving better health for all, and furthering sustainable development.

Incentives to private sector: **Tax holidays for five years**
- 100% depreciation
- Below market rate loan

In energy intensive sectors like paper & cement, use of captive wind power provides added advantage to investors.

Small/Mini Hydels (up to 3 MW capacity)

Potential : 600 MW
Installed capacity : 370 MW
It is anticipated that the potential of small hydro up to 15 megawatt per site in the country may exceed 10,000 megawatt.

Biomass based Co-generation

Sugar industries in India has a very big potential for co-generation of power. Bagasse from sugar industries is used as fuel for power generation and can feed additional power. But co-generation in sugar mills is not popular yet, because of low price they got for power sold by them to the grid and due to other procedures involved.

Project launched in 1994

Potential: 300 Megawatt in 420 existing and 90 new projected sugar mills in the country.

Solar Photovolatic Systems

This programme is to provide lighting and pumping water in remote/rural areas. 10,000 solar lanterns have already been distributed. A socially oriented programme specially meant for designated areas and provide a subsidy of 50% of the cost.

Rural energy Programme

Family type biogass plants installed so far: 21 lakh (1 lakh = 10^5)
Improved Chullas installed: 196 lakh

Biomass Programme: Fuelwood

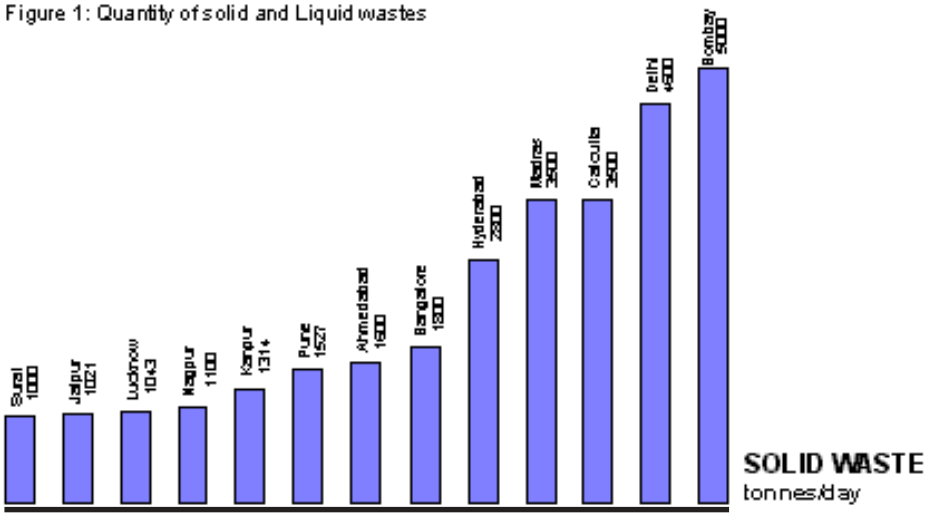
Out of about 94 million ha of wasteland, 20 million ha is productive non-forest land able to produce 400 million tonnes of fuelwood. Biomass yield ranging from 12 tonnes to 36.8 tonnes per ha has been achieved.

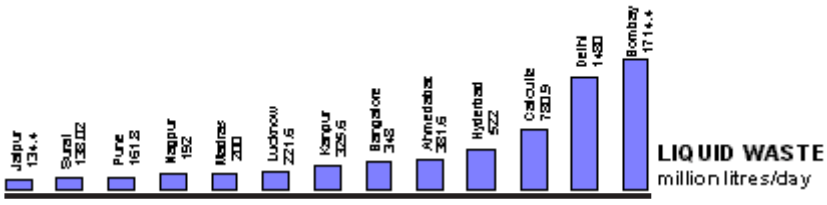
Energy from Urban (Municipal) and industrial wastes

Management of urban wastes is one of the most neglected and challenging areas of urban development in India. Municipal authorities do not have the resource and technical capacity to deal with this gigantic problem. This is a clear barrier to achieve results. The urban population which is presently 220 million, is expected to grow to 470 million by the year 2015. Indian cities will be among the most densely populated cities of the world.

Fig 1 gives quantity of solid and liquid wastes generated in some major Indian cities, and Table 6 gives estimated quantify of wastes generated in India.

Figure 1: Quantity of solid and Liquid wastes





Waste	Quantity
Municipal solid waste	27.4 million tonnes/year
Municipal liquid waste (121 class I & II cities)	12145 million litters/day
Distillery (243 nos.)	8057 kilo liters/day
Pressmud	9 million tonnes/year
Food & fruit processing waste	4.5 million tonnes/year
Willow dust	30,000 tonnes/year
Dairy industry waste (COD level 2 kg/m^3)	50-60 million litters/day
Paper & pulp industry waste (300 mills)	1600 m^3 waste water/day
Tannery (2000 nos.)	52500 m^3 waste water/day

Source: Background Information for Conference of Mayors and Municipal Commissioners, Urban & Industrial Energy Group, Ministry of Non Conventional Energy Sources, New Delhi, 1996, p.2.

Generation of Power from Wastes

It is estimated that urban municipal wastes (solid & liquid) have a potential to generate up to 1000 MW. Industrial wastes coming from diaries, distilleries, pulps paper, good processing industries have a potential to generate nearly 700 MW power.

Other policy measures in the energy sector

Energy Pricing

At present there is considerable subsidies in the electricity tariff and energy pricing in India. The present policy of the government is to gradually withdraw the subsidies so that the economic impact to common man is minimum. However electricity tariff in the agriculture sector is still not touched may be it need considerable political will to do so.

As regards pricing, recently there was a small increase in the price of diesel oil which was not touched for years.

Co-generation is not popular with the sugar mills because of low price they get for power sold by them to the grid and other procedures.

Building Sector in India

The building sector uses various energy intensive materials such as steel, aluminum, glass, cement, lime and bricks. 80% of the energy input leading to CO_2 emission from the construction sector is from cement, steel, bricks and lime. For each of the four building materials, cement, steel, brick, and lime, there exists a technology spread within each sector characterised by widely varying levels of energy and material consumptions (Table 7)

Table - 7

	Technology as Usual	Best Practice	New Technology
Cement	Dry process (70%) Semi dry retrofit of Wet process phase out	Dry process with 5 stage pre-heater	Improved dry (Japanese Technology level)
Energy Emission	5.79GJ/tonnes Emission:0.92tCO_2/t	5.34 GJ/tonne 0.894 tCO_2/t	4.5GJ/tonne 0.835tCO_2/t
Steel	Integrated Steel Plants (ISP) (Blast furnace - Open Hearth)	Mini: mixco feed 70% scrap 30% sponge iron ISP: with some improvement	Mini: Mixed -- (some as best practice) natural gas based fuel also ISD. Corex process using non-coking --
Energy Emission	31.6 GJ/t 2.4 t CO_2/t	24.75 GJ/t 1.8 2t Co_2/t	21.7 GJ/t 1.2 t CO_2/t
Brick	B.T.K. Mobile Chimney: 90% Fixed Chimney: 10%	B.T.K. Fixed chimney	High Draught Kiln Vertical Shaft Kiln (VSBK)
Energy Emission	4.2 GJ/'000 0.29 tCO_2/'000	3.2GJ/'000 0.23tCO_2/'000	2.6 GJ/'000 0.18tCo_2/'000

Energy Consumption for the four building materials for 1989-90 (Table 8).

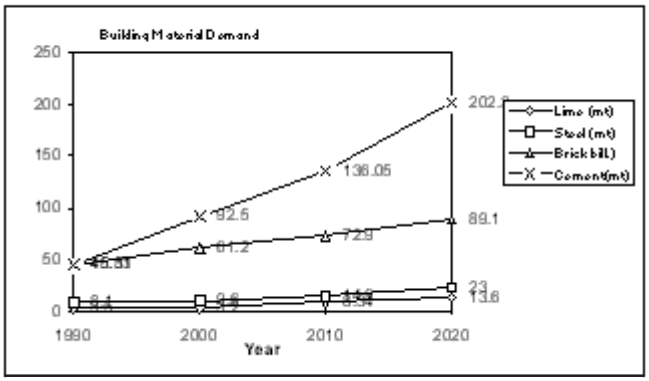
Housing demand in India

Development Alternatives (DA) study projected 41 million household to be provided in the decade 1991-2000. 32.43 million household were provided in the previous decade (1981-1990). For the subsequent decades, a stable rate of 4.1 million households per annum would be able to close the housing gap by 2010. The probable demand for cement,steel, bricks and lime from DA's study is shown in Fig 2.

Table: 8

Material	Unit	Energy (PJ)	Emission (10^6 t CO_2)
Cement	Million tonnes	5.79	0.09
Steel	Million tonnes	31.60	2.40
Lime	Million tonnes	6.50	1.30
Bricks	Billion no.	4.3	0.29

Figure 2



Impact of Technology Trends

The present mix of technologies will result in a three fold increase in the energy consumption and resulting emissions in the next three decades (1990-2020). The contribution to the emissions are projected to increase from 22 million tonnes of carbon to 77 million tonnes of carbon. Such a tend is not sustainable.

All the four building materials are highly energy intensive and polluting with the existing technologies and priorities.

Barrier

There is an urgent need to upgrade the technologies to bring down GHG emissions and energy intensity to address local, national and global needs, through a process of structural transformation by adopting best practices/new technologies and by imposing strict environmental standards for such industrial processes.

Small Scale Sector

The small scale sector must form the backbone of the structural transformation policy. The competitiveness of this sector will be based not on the individual plant, but on a cluster of mutually supporting industries. Widespread use of industrial wastes is also possible through economically viable small scale production systems. Policy directives are necessary to facilitate availability of credit finance to small enterprises.

Forestry Sector in India

Forests in India is important for conserving forests, wildlife habitats, and for protecting biodiversity. People in and around forests also earn their livelihoods from non-timber forest produce. In addition, it influences the earth's climate, prevent soil erosion, helps in recharging ground water sources.

India's recorded forest area (1993 estimates) stands at about 77 million ha. Of this there are 38.5 million ha of closed forests, 25.03 million ha of open forests, and 0.45 million ha of mangrove forests. The actual forest cover amounts to approximately 64 million ha. Carbon stock and flows in India is given in the Table 9.. (Kade Kodi 1994).

Carbon stock & flows in India (1986)

Table: 9

Stock	(million tonnes of carbon)
Forest Vegetation	4178.95
Soil	5389.33
Total	**9578.26**
Flows	
Cabon uptake (1986) by forests and plantation	69.00

The above estimate is based on productivity of different forests in India. Productivity of 14 different forest types in India vary form 1.28 to 2.84 tonnes per ha per year. 64 million ha of forests in India is capable of sequestering a significant amount of CO_2. Given that these forests produce about 52 million cubic meters of wood per annum, the annual CO_2 sequestration capacity, applying different methodology, falls between 31-399 million tonnes of carbon (Chatterjee, K, DA Newsletter, Vol.4, No.5, June 1994). The estimate, however is by no means even approximate to the potential carbon

sequestration capacity of Indian forests. 13 million ha (16.62% of recorded forests) are considered fully degraded (less than 10% crown cover). If these areas were afforested, the carbon sequestration capacity of Indian forests would be significantly augmented. The capital cost of planting trees in degraded forest areas is relatively low compared to the development of other renewable energy sources. If the areas to be afforested for CO_2 sequestration are not exploited as energy sources, required investment level fall somewhere between US$ 100 to 600 per ha, with an average of around US$ 250 per ha (IPCC, 1990).

Barrier

Such a level of investment would probably exceed the current funding capacity of the Indian government. Current levels of fund disbursement have only sustained a net landuse change (afforestation minus deforestation) of 92,500 ha (1993 estimate).

Activities Implemented Jointly (AIJ) under the UNFCCC and Expectations of Developing Countries such as India.

Developing countries such as India do not have any commitments to reduce their emissions of GHGs under the FCCC, nor are they likely to have any, in the near term. Their expectations from AIJ, therefore, are quite different from those of industralised countries who see it as a way to reduce the cost of fulfilling their present and future commitments under the FCCC. Developing counties expect AIJ to help them meet their national development priorities - otherwise they have no reason to divert scarce resources to develop AIJ programmes.

AIJ could help developing countries in their economic, social and institutional development, while improving the local environment. These are the areas where India and other developing countries expect some tangible benefits from AIJ.

Economic

- Increased investment in priority sectors of the economy
- Additional investment without adding to external debt
- Transfer of clean and cost effective technologies
- Reduced impacts of fossil fuels
- Job creation from projects and industries they catalyse

Social and Infrastructure

- Improved access to power, fuel and fodder
- Community based livelihoods supported by AIJ power and agroforestry projects
- Proper structuring of AIJs can address to poverty eradication programmes as well

Institutional

- Capacity building at local, state and national level

Environmental

- Reduced air pollution caused by “dirty” power generation technologies
- Reduced water pollution and erosion caused by deforestation and unsustainable agriculture

Current government policies on AIJ in India

An AIJ Task Force in India

The Ministry of Environment and Forests (MOEF) has set up a Task Force to evaluate and recommend AIJ Projects in India during the pilot phase. An active task force, carrying out various tasks, costs money. Significant resources from government, industry and NGOs will be diverted to run India’s AIJ programme. Even though this programme should yield benefits for India in the long run, AIJ is only needed because of the high GHG emissions from the Northern countries.

India’s AIJ Task Force is exactly the kind of institutions and capacity building which industralised countries should fund. Otherwise, industrialized countries are asking developing countries, who bear almost no responsibility of climate change, to spend their own resources to set up programmes which reduce industralised countries’ cost of fulfilling their FCCC commitments.

So far not a single official AIJ project has been launched in India. This reflects a lack of communication between different AIJ programmes in the industralised countries like USA, Canada, Norway, Australia, Japan and the host country - India. This deadlock should be addressed to urgently through international efforts.

The developing countries should not loose the opportunity of ' learning lessons' from the pilot phase AIJ and for their capacity building.

North has not fulfilled their commitments in the UNFCC

Industrialized countries have not been able to slow down their carbon emissions, much less able to bring themselves to reduce energy consumption. Now they are trying to pass the onus on to others through artifices such as tradeable permits etc. Joint Implementation may well offer a sensible device to find least cost ways to improve energy efficiency, but it cannot be used to allow the developed countries to evade their responsibility to introduce more sustainable methods in their own countries.

Things won't change much until the North realises that its own interest lies in a more equitable world, where the people of all countries feel that they have a stake in the future of the planet. The Kyoto Conference (COP-3) will show how seriously governments take the imminent threats to the environment, and how much political will they bring to solving them.

Agenda 21

In Rio in 1992, South had signed the two Conventions to conserve biodiversity and to mitigate climate change in which the South had less than immediate interest. The main interest of the developing countries was the Agenda-21 which was adopted in Rio along with UNFCC mainly to address to countries in the South. The understanding of the developing countries was that a programme of action with US$ 123 billion per year would be made available. Hardly anything has happened since then. There is basically no international mony available for the implementation of Agenda 21, which reflects some of the concerns of the poor.

The present initiative by Europe in organizing this Conference is very much appreciated. I hope all the thinking people of Europe will come forward to help in implementing the Agenda 21 for the alleviation of poverty in the South.

National barriers

Three national barriers have emerged from the discussion if these barriers are removed through international efforts not only development and environment priorities and strategies of developing countries like India will be addressed, but also they would help in the mitigation of Climate Change. They are:

1. Gigantic task of alleviating poverty in the South

2. (a) Lack of availability of clean and environmentally friendly technologies particularly in the generation of power from fossil fuels like coal, and other technologies using renewable resources.
   (b) Lack of availability of technologies for upgrading the existing technologies.
3. Lack of adequate funds to address to India's development and environment priorities as stated in the Environment Act Plan (EAP).

The industrialized countries, particularly the EU should make a concerted and sincere effort to remove these major barriers in the developing countries to ensure rapid and sustainable development in these regions.

In Conclusion

As long as a large number of the world's population remain under privileged and in absolute poverty, there is very little hope of finding any real solution to global problems like the Climate Change.

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