Climate Change and its Implications: Which Way Now?

Praveen Jha[1]

Centre for Economic Studies & Planning

Jawaharlal Nehru University, New Delhi – 67

India

praveen@mail.jnu.ac.in

praveenjha2005@gmail.com

The author is thankful to Seth Lartey, Vijay Krishnarayan, Mario Negre, Siba Sankar Mohanty and Pooja Parvati for their valuable assistance towards this paper.

[1] Prepared by Professor Praveen Jha for the Commonwealth Foundation

‘There is mounting scientific evidence to show that global warming is the biggest single threat to the World today – especially developing countries.’

Lord May, President of the UK’s Royal Society

‘Loss of food and water security is one of the most immediate threats by global warming.’

Dr Rajendra Pachauri, Chairman of IPCC

Introduction

'Climate change is not an environmental problem. It is a civilizational problem. Climate change is not just another issue. If it is not addressed in very short order, it will swamp every other issue facing us today' - Ross Gelbspan, author 'The Heat is on - The Climate Crisis'

There is agreement among scientists that recent extreme weather events and a rise in world average temperatures have been caused by human activity. The only present disagreement originates in a few US-based organisations like the American Enterprise Institute (AEI), an ExxonMobil-funded think tank with close links to the Bush administration, which recently offered US$ 10,000 to scientists and economists to undermine an important climate change report[i]. The increasing emission of Greenhouse gases, of which CO_2 is the main contributing one, over the last two centuries, and particularly during the last half a century, will have devastating effects unless urgent action is taken. The Greenhouse effect, produced naturally by gases present in the atmosphere and which grants the Earth the mild temperature needed for life, is being anthropogenically reinforced resulting in a greater retention of the sun's radiation thus producing global warming.

We may note right at the outset that developed countries have produced the overwhelming share of these emissions, whereas developing countries will have to bear the brunt with regard to the impact of climate change in the foreseeable future. Climate-induced natural disasters have already caused deadly floods and droughts, displaced hundreds of thousands and depleted fresh water resources.

The continued intensive use of CO2-producing fossil fuels while renewable energy alternatives and energy efficiency technologies are available, has to be overcome and a concerted effort by rich and poor countries to tackle climate change adaptation and mitigation is utterly imperative. Most developed nations have committed themselves to emission reductions targets by 2012 under the Kyoto Protocol. However, stipulated reductions are too modest and, even more importantly, the US, the world's largest polluter remains outside the agreement. The scientific community warns that a global coordinated response with participation of the major emitters and rapidly growing economies of China and India is the only way forward to avoid the worse predicted effects of global warming.

It would not be an overstatement to say that environmental concerns, to a large extent, have been brought to the public/popular domain, quite successfully, by the untiring efforts of the civil society organisations in the recent past. The path breaking initiatives such as the books titled *Limits to Growth*, written by Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W. Behrens III, (1972) and *Mankind at the Turning Point* (1974) on behalf of the 'Club of Rome' generated very important debates within several civil society organisations which was followed by the mobilisation of the public opinion; this brought to the centre stage a number of critical concerns relating to environment and sustainable development. The Club of Rome drew effective public

attention regarding sustainable use of natural resources and the limits to the availability of such resources.

Recognition to Wangari Maathai, the leader of Green Belt Movement in Africa, as a Nobel Peace winner, and a number of other well known awards to prominent activists in different regions of the world, are obvious testimonies of the fact that mass mobilisation over environmental concerns through active civil society participation has come to acquire salience in the public domain. As is well known, Wangari Maathai and her environ-political associations like Kenya's Green Party and National Council of Women of Kenya led the "Green Belt Movement' through involving common citizens and villagers in drought affected areas and planted 30 million trees to fight deforestation. Several similar examples can be cited to acclaim the civil society actions on environmental issues especially in protecting biodiversity, urban waste management and promoting sustainable agricultural practices. Even during the incidents of industrial disasters, the civil society organisations have come forward to create public awareness and called for appropriate action for the benefit of the people in peril. It is high time now that global warming and climate change are taken up on an urgent basis, locally and globally, to fight one of the major scourge afflicting the mother earth and its children today. Thus, among the most important challenges confronting civil society organisations at the current juncture is to press for the ways and means that would ensure stalling this horrendous journey towards humanity's self destruction and to persuade the governments and other relevant actors (such as powerful corporate industrial interests), at different levels (from local to global), to embark on a broadly agreed trajectory of sustainable development.

Impacts

Global warming effects have already started showing up with increasing intensity, namely change in species habitats and habits, acidification of oceans, loss of wetlands, bleaching of coral reefs and increases in allergy-inducing pollen, among others.[ii] Rapid and continued loss of biodiversity is taking place at an alarming rate, and the ecological footprint, which measures the extent of human demand on Earth's ecosystems, has tripled since 1961, showing that the planet's resources are being used at a rate 25% higher than their ability to regenerate.[iii]

These disturbing effects will worsen as climate change accelerates and are likely to deprive hundreds of millions of people from access to water within just a couple of decades, while tens of millions will be displaced by floods from rising sea levels; Dangerous pests will increase, insects will thrive and tropical cyclones as well as wildfires will intensify; Food production may initially improve in some northern regions but starvation could affect hundreds of millions by 2080.[iv]

The recently published Stern Review and the report by the Intergovernmental Panel on Climate Change (IPCC) compile current knowledge about the future, and some of their critical findings are summarised in the following:[v]

Fresh water resources and their management

- By 2050, there will be a shift of around 10-30% in rainfall from already water-stressed mid-latitudes dry tropics to high latitudes and wet tropical areas.
- Droughts will spread to cover larger areas and rain will become more concentrated, implying more floods.
- One sixth of the world population living in regions supplied by meltwater will be affected by water shortages as snow covers and glaciers decline.

Ecosystems

- The combination of climate change and associated disturbances like flooding, drought, wildfire, infestation and ocean acidification, in addition to other contributors to climate change such as land use change, pollution and overexploitation of resources, will exceed the resilience of many ecosystems.
- Beyond 2050, terrestrial ecosystems, which play an important role as carbon sinks, may reach the upper limit of the absorptive capacity or even, decrease their net carbon uptake.
- If increases in global average temperature exceed 1.5-2.5ºC, around 20-30% of plant and animal species may become extinct.
- Ecosystems goods and services, like water and food supply, will be adversely affected by projected major changes in ecosystem structure and function, species' ecological interaction and geographic ranges.
- Increasing ocean acidification due to higher CO2 atmospheric concentrations will harm corals, shelled organisms and dependant species.

Food production

- Although crops may increase in high and mid-latitudes, once local mean temperatures increase more than 1-3ºC, they will decrease globally.
- Increased risk of hunger in lower latitudes, especially seasonally dry and tropical regions, where crop productivity may decrease for even small changes in local average temperature of 1-2ºC.
- Subsistence sectors at low latitudes will particularly suffer increasing risks of droughts and floods.
- Adaptations through cultivation cycles may maintain cereal yields if warming remains modest.
- Regional adverse effects are predicted for aquaculture and fisheries.

Coastal systems and low-lying areas

- Coasts will increasingly suffer from erosion and rising sea levels, exacerbated by human-induced pressures.
- Corals and coastal wetlands may be seriously affected by even small increases in sea surface temperatures and rising sea levels, respectively.

- By 2080, the number of people affected by continuous floods of coastal areas due to sea-level rise may increase significantly, especially in the densely-populated and low-lying areas with low adaptive capacity and already prone to tropical storms and local coastal subsidence. Asian and African mega-deltas, as well as small islands will suffer the most in terms of numbers of people affected, particularly as developing countries present higher constraints on adaptive capacity.

Industry, settlement and society

- There is a clear correlation between climate change and negative effects on industry, settlement and society (ISSs).
- ISSs in coastal and river flood plains or in areas prone to extreme weather events, and those whose economies depend on climate-sensitive resources, are the most vulnerable.
- Due to a more limited adaptive capacity and greater dependence on food and water supplies, poor communities in high-risk areas are especially vulnerable.
- Increased economic and social costs in areas where extreme weather events will become more intense and on those with close linkages to them.

Health

Widespread effects on the health status of millions of people are projected, hitting hardest the already vulnerable groups in developing countries, through:

• Increases in malnutrition and consequent disorders, with implications for child growth and development;

• Increased deaths, disease and injury due to heat waves, floods, storms, fires and droughts;

• Increased burden of diarrhoeal disease;

• Increased frequency of cardio-respiratory diseases due to higher concentrations of ground level ozone related to climate change;

• Altered spatial distribution of some infectious disease vectors."

Although predictions are difficult and complex, some studies suggest increases in death toll figures for climate change-induced diseases to as high as 185 million lives only in sub Saharan Africa by the end of the 21st century.[vi]

On a longer timescale, the effects of global warming will have far more catastrophic consequences if present emissions trends are not curbed. Projected developments for the year 3000 show that global and regional warming could more than quadruple after 2100, reaching an average temperature increase of up to 15ºC. Sea levels could rise by 11.4m at the end of this millennium, resulting mainly from the widespread deglaciation of Greenland and West Antarctic, causing huge societal and economic disasters as relocating populations, economic activity and infrastructure would be costly and challenging.

The Atlantic currents may collapse and the Arctic sea ice could completely disappear all year round, both things aggravating abrupt regional climate changes, which, in addition, will continue to occur long after emissions cease. Also, dramatic increases in ocean acidification would threaten marine ecosystems and organisms, among them plankton, whose depletion would reduce its contribution as natural CO_2 sink, representing half the planet's total absorption capacity.[vii]

Another aspect of climate change that is becoming increasingly clear is its potential as a major source of local national and global conflicts. Disputes over water resources, food production, land use, exacerbated by changing rainfall patterns, may erupt as the effects worsen and constraints over scarce resources increase.[viii]

All of the above-mentioned current and projected global impacts lead us to an unequivocal conclusion concerning the relation between climate change and poverty: climate change is already disproportionately affecting the poor and it will be the world's most vulnerable communities who are likely to "bear the brunt of the 'future shock'".[ix]

In fact, climate change and poverty are deeply intertwined, with mutually reinforcing causalities. As Christian Aid[x] concisely puts it:

> "The potential ravages of climate change are so severe that they could nullify efforts to secure meaningful and sustainable development in poor countries. At worst, they could send the real progress that has already been achieved spinning into reverse. No other single issue presents such a clear and present danger to the future welfare of the world's poor."

A recent report[xi] warns of massive climate-induced migrations comparable to those during the world wars as climate change will undoubtedly exacerbate conflicts over scarce resources. As many as 1 billion persons are estimated to be forced to move their homes in less than half a century. Indeed, projections put Bangladesh's loss of surface due to sea-level rise at around 20 per cent [xii] by the end of the century.

Global regional impacts will differ greatly. Africa and Asia, because of their geography, their housing of the largest numbers of vulnerable people, their multiple stresses and low adaptive capacities, will by and large be most affected. The Stern Review reports the following projections: [xiii]

Africa

- Over 200 million people may be exposed to water stress within the next two decades, exacerbated by a rapidly growing population.
- Climate variability and change will severely compromise food production, decreasing yields in some areas by as much as 50% by 2020.
- Over-fishing and rising water temperatures will decrease lake fisheries resources.
- By the end of the present century, up to 5-10 per cent of GDP per annum may be absorbed for adaptation to sea level rise in highly-populated low-lying areas.

Asia

- Within the next 2-3 decades, the melting of glaciers in the Himalayas will imply more floods and less water resources, progressively decreasing river flows.
- Climate change effects, along with increasing populations and higher demands due to improving standards of living, will decrease freshwater availability, adversely affecting over 1 billion people in all but North Asia, and particularly so those living in large river basins where large populations are concentrated.
- Increased flooding from sea and rivers will affect coastal areas, greatly affecting South, East and Southeast Asia's densely-populated mega-delta regions.
- By the middle of the century, crop yields could decrease by 30% in Central and South Asia, while increasing by 20% in East and Southeast Asia. Overall, however, very high risks of hunger are projected for the developing countries in the area.

- Floods and droughts will increase endemic morbidity and mortality due to diarrhoeal diseases, as well as the spread of cholera.

The following table attempts to present a futuristic scenario of attainment of MDGs, keeping in mind the impacts of climate change.

Table 1: Climate Change and MDGs

MDG	**Situation by 2100 with Climate Change**
Goal 1: Eradicate extreme poverty and hunger	At 3^0 C, around 150-550 million additional people around the globe are under the risk of hunger and 1-3 million die of malnutrition every year. An additional 145-220 million people would be living on less than $2 a day by 2100
Goal 2: Achieve universal primary education	Climatic disasters can threaten educational infrastructure making it physically impossible for children to attend school. Schooling will become less affordable and accessible, especially for girls
Goal 3: Promote gender equality and empower women	Workloads and responsibilities of women such as collecting water, fuel and food will grow and become more time consuming in light of greater resource scarcity.
Goal 4: Reduce child mortality	An additional 165,000 to 250,000 child deaths per year in South Asia and sub-Saharan Africa by 2100
Goal 5: Improve maternal health	Severe malnutrition may increase the incidences
Goal 6: Combat HIV/AIDS, malaria and other diseases	Even at 1^0 C, 300000 people may die every year due to climate related diseases like malaria, at 2 C, up to 60 million people in Africa alone would be exposed to malaria
Goal 7: Ensure environmental sustainability	**Increasing mass migration and conflicts due to addition of another 2-3 billion people to the developing world 's population because of rising sea level and desertification in the next few decades. Add to this the growth in population in the developing world by another 2-3 billion by 2050, and the future seems catastrophic. Market monopolisation of basic needs including water and health care systems will further aggravate inequality of access to wealth and livelihood; putting further pressure on environmental sustainability.**
Goal 8: Develop a Global Partnership for Development [2]	Given the kind of problems with reference to access to resources, largely due to increasing demand on them, clearly, sustainable use will become increasingly difficult. Increased competition and conflicts over resources may lead to growing distrust among nations, a problem already rampant in parts of Africa.

Source: Largely drawn from the Stern Review. The author draws inferences at certain places.

Adaptation and Mitigation

Emissions Stabilization

Even if developed countries reduced their emission to nil, global warming would still go on and sea levels will rise for several decades. This means that if we are to avoid the gravest consequences of climate change, developing countries will also have to play a role in mitigation. Mitigating the impact of global warming requires that countries produce fewer greenhouse emissions than the world's sinks, can absorb – namely, forests, soils and oceans.

Key mitigation technologies and practices available now that are either already commercialized or will be in the next quarter of a century are briefly mentioned in the following by sectors:[xiv]

- *Energy supply*: shift from coal to gas; nuclear power; renewable heat and power (hydropower, solar, wind, geothermal and bioenergy); Carbon Capture and Storage (CCS). Air pollution abatement and provision of energy and employment to rural areas are some co-benefits. The table-2 below suggests that the extent of energy use from fossil soil still assumes the centre stage in total energy consumption in the world.

- *Transport*: shifts from relatively more polluting to less polluting modes of transport: such as from road to rail and public transport; widespread increase in cycling and walking. However, the positive effects of such changes may be offset by growth in the polluting segments of the transport sector.

- *Buildings*: improved passive and active solar design for heating and cooling; alternative refrigeration fluids as well as recovery and recycling of fluorinated gases.

- *Industry*: material recycling and substitution, along with a large set of process-specific technologies.

- *Agriculture*: increased soil carbon storages; soil restoration; cultivation techniques, as well as livestock and manure managements to reduce CH_4 emissions. There is a high economic potential in energy intensive industries.

- *Forestry/Forests*: Improved CO_2 natural sinks by reducing deforestation and enhancing afforestation, reforestation and use of biofuels.

- *Waste*: recovery of landfill CH_4 and energy from waste incineration; organic composting, water treatment, recycling and waste minimization.

- *Geo-engineering*: There is medium agreement that options remain largely speculative and unproven, with unknown side effects.

Table-2: World Production of Primary Energy by Source of Energy (in %)

Energy Type/Country Group	1980	1990	2000	2003	2004
Petroleum	46	39	39	38	38
Dry Natural Gas	19	22	23	23	23
Coal World Total	25	26	23	25	26
Net Hydroelectric Power	6	6	7	6	6
Net Nuclear Electric Power	3	6	6	6	6
Net Geothermal, Solar, Wind, and Wood and Waste Electric Power	0	0	1	1	1
Alcohol (Ethanol Blended into Motor Gasoline) and Geothermal,Solar, and Wood and Waste Energy Not Used for Electricity Generation	1	1	1	1	1
Total Primary Energy	**100**	**100**	**100**	**100**	**100**

Source: Energy Information Administration, International Energy Annual 2004,
< http://www.eia.doe.gov/pub/international/iealf/table29.xls >

However, the use of these technologies by developing countries is still very limited and will undoubtedly require technology transfers to occur.[xv] Nonetheless, it is apparent that the current carbon energy-based economy will need to be replaced. Arguably, the abandonment of fossil fuels altogether looks like the most plausible way forward as dependence on cleaner fossil fuels' use may represent an obstacle for a transition into zero-carbon energy.[xvi]

Mitigation over the next few decades will have a large impact on opportunities to achieve lower stabilisation levels of green house gases in the atmosphere.

> "Decision-making about the appropriate level of global mitigation over time involves an iterative risk management process that includes mitigation and adaptation, taking into account actual and avoided climate change damages, co-benefits, sustainability, equity, and attitudes to risk. Choices about the scale and timing of green house gas mitigation involve balancing the economic costs of more rapid emission reductions now against the corresponding medium-term and long-term climate risks of delay ."[xvii]

Mitigation Policies

Environmental and costs effectiveness, distributional effects – including equity – and institutional feasibility are the IPCC's criteria for the evaluation of policy instruments evaluation. Policies that can be beneficial include:[xviii]

- Integrating climate change in broader development policies;
- Regulations and standards on emission levels;
- Taxes and charges setting a price for carbon;

- Emissions tradable permits;
- Financial incentives to stimulate diffusion of new technologies;
- Voluntary agreements; and
- Research, Development and Demonstration (RD&D).

Currently, the Kyoto Protocol established by the United Nations Framework Convention on Climate Change (UNFCCC) and adopted by most developed countries, includes the stimulation of a set of national policies, the creation of an international carbon market and the establishment of the Clean Development Mechanism (CDM). The CDM allows projects in developing countries to generate emission credits if they result in emission levels lower than would be the case otherwise; these credits can be marketed and eventually counted against a developed country's emission obligation.[xix]

As regards the effectiveness of this Protocol, which does not include the world's current largest total and per capita emitter, namely the US, it has been proposed in some quarters that Border Tax Adjustments be imposed on products originating from non-signatory developed countries as a way to enforce emission curbing. However, this measure seems to be less feasible politically.[xx] Given the architecture of unequal economic relations globally, it is obviously difficult to impose sanctions on those who are in the driver's seat; the grim reality of the dependence of a very large number of developing countries for aid and other kinds of support on the developed world, in particular the powerful trio of the North America, EU and Japan, obviously puts them in extremely vulnerable situation in any global negotiation. Furthermore, even countries, which have ostensibly been relatively sensitive to the issues of global warming, the avowed intents have typically been much louder than their respective deeds. As per a very recent report of the European Environment Agency[xxi], in the 15 original members of the EU, Greenhouse Gas Emissions were slightly lower in 2005 compared to 1990, but at the same level as in 1992. Between 1990 and 2005, the drop was about 1.5 per cent, and at the current rate, it will be far below the promised 8 per cent level by 2012 as per the Kyoto protocol. (We may also note that 2005 happened to be a relatively warm year in Europe, which means that the heating requirements were way below the average norm). In any event, the reported drop was largely due to only a couple of countries such as Finland and Germany where as in Austria, Greece, Portugal, Ireland, Spain (among others) emissions rose. We may also not here that the above reported data on emissions do not include airplane emissions, which have emerged as the fastest growing source in the recent years. Add to this the reality of the revival of growth in the Eastern Europe, and consequent increases in emissions, the prospects of meeting the Kyoto Protocol target is likely to come under further pressure.

Sustainable Development and Climate Change Mitigation

The way in which we generate energy is the biggest contributor to climate change. As mentioned above, reducing emissions involves substantial changes in the current model of economic development. Clearly, exploiting the synergies between climate change mitigation and sustainable development is the key to way forward. For instance, mitigation strategies can maximise poverty alleviation benefits in rural areas by

connecting communities to new energy sources such as improved grid connection biomass electricity generation, wood stoves and micro hydro- power generation.[xxii] Very positive results can be expected if resources are increasingly allocated to sustainable development strategies and these are made a focal target of general developmental efforts. In fact, not only can mitigation be directly profitable, but also it has very positive aspects in terms of improved health conditions. One should bear in mind, however, that adaptation will be necessary regardless of the degree of mitigation achieved.[xxiii]

Finally, it is important to emphasise that an effective climate policy should comprise investments directed toward eradicating poverty and hunger, providing primary education, improvements in health, promotion of gender equality, ensuring environmental sustainability and international development networking.[xxiv]

Costs, Responsibilities and the International Debate

Costs

The Stern Review[xxv], arguably the most comprehensive study so far on the effect of climate change on the world economy, concludes, "the benefits of strong and early action far outweigh the economic costs of not acting". This study calculates that conservative overall costs of climate change will represent up to "5% of global GDP each year, now and forever". Broader analysis of risks and impacts suggest damage estimates of up to 20% of GDP or more. On the other hand, in the report's considered judgement, investing around 1% of global GDP in mitigation could avoid the worst effects of climate change.

The report states that the actions undertaken now and within the next few decades will determine the degree of risk of major disruption to economic and social activity the world will face, warning that reversing changes will be difficult or impossible. Furthermore, as emphasised repeatedly in the foregoing, it points out that developing countries, and particularly vulnerable populations, will suffer earlier and most. It suggests, however, that although action is required across all countries, "it need not cap the aspirations for growth of rich or poor countries."

There are three broad elements that, together, lead to the conclusion **that the costs of strong and urgent action on climate change will be less than the cost of dealing with the impact of climate changes.** First, by reviewing the physical science base on which any economic analysis must rest. Second, by considering the risks of damage from future climate change, and the human and economic costs associated with that damage. Third, by looking at the costs of action to mitigate climate change. Economic analysis could help to identify specific goals for climate policy, and can act as a guide to policymakers or operate as a policy instrument.

The Stern Review drew attention to the risks and economic implications of increases in global average temperature up to and beyond 5 °C *relative to pre-industrial levels* over the next 200 years. It looked at the impacts of climate change in two different ways.

(i) An analysis of the physical impacts around the world -temperature, water cycle, extreme weather events;
(ii) An analysis of the way in which formal economic modelling tries to account for those impacts.

The table given as annexure-1 summarizes possible scenarios of climatic impacts on six indicators of human development.

Table 3: WHO estimates of extra deaths (per million people) from climate change in 2000

Disease / Illness	Annual Deaths	Climate change component (death / % total)
Diarrhoeal diseases	2.0 million	47,000 /2%
Malaria	1.1 million	27,000 /2%
Malnutrition	3.7 million	77,000 /2%
Cardiovascular disease	17.5 million	Total heat/cold data not provided
HIV/AIDS	2.8 million	No climate change element
Cancer	7.6 million	No climate change element

Source: WHO (2006) based on data from McMichael et al (2004). The numbers are expected to at least double to 300,000 deaths each year by 2030.

As revealed in table 3, the costs in terms of human deaths related to climate change are also a cause for concern. The other two significant aspects that can enhance costs and impact human development relate to education and gender equality. Climatic disasters can threaten educational infrastructure making it physically impossible for children to attend school[xxvi]. For example, in 1998 Hurricane Mitch destroyed 25% of Honduras' schools. Education levels may also decline through climate-induced changes in income and health conditions. Schooling will become less affordable and accessible, especially for girls, as income, assets and employment opportunities are affected by climate change.

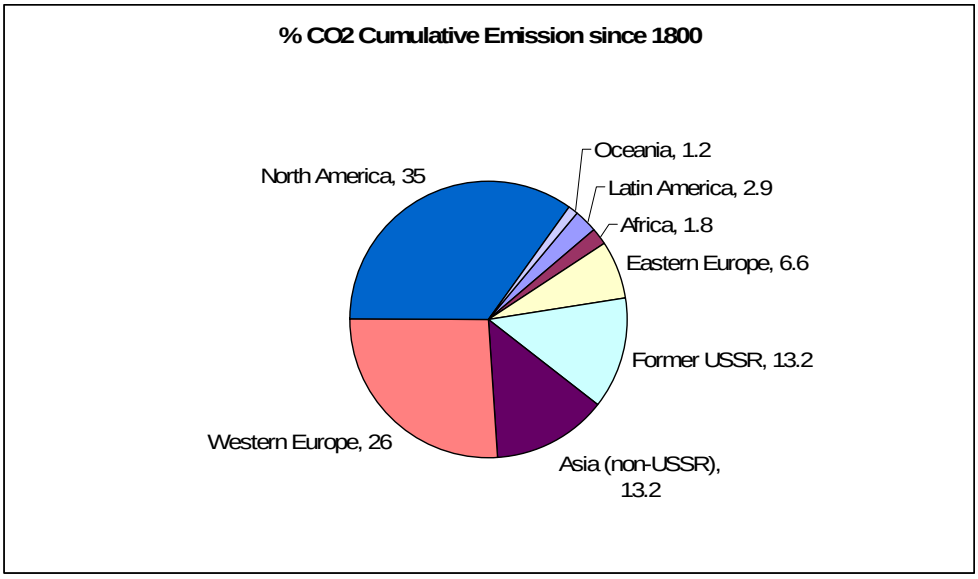
Children will need to help more with household tasks or prematurely engage in paid employment leaving less time for schooling. Deteriorating health conditions will also affect both a child's learning abilities and school attendance, and the supply of teachers. Children will be deprived of the long-term benefits of education and be more vulnerable to the effects of climate change. Better-educated farmers, for example, absorb new information quickly, use unfamiliar inputs, and are more willing to innovate. An additional year of education has been associated with an annual increase in farm output of between 2 to 5%.

Gender inequalities will, in all likelihood worsen with climate change[xxvii]. Workloads and responsibilities such as collecting water, fuel and food will grow and become more time consuming in light of greater resource scarcity. This will allow less

time for education or participation in market-based work. A particular burden will be imposed on those households that are short of labour, further exacerbated if the men migrate in times of extreme stress leaving women vulnerable to impoverishment, forced marriage, labour exploitation and trafficking. Women are 'over-represented ' in agriculture and the informal economy, these are the sectors that will be hardest hit by climate change. This exposure is coupled with a low capacity to adapt given their unequal access to resources such as credit and transport. Women are also particularly vulnerable to the effects of natural disasters with women and children accounting for more than 75% of displaced persons following natural disasters.

Responsibilities

It is no secret that since the early stages of industrial revolution developed countries have increasingly been *leading* the world in terms of GREEN HOUSE GAS emissions. So much so that, in fact, they are responsible for more than two thirds of all historical emissions or three fourths if the former USSR is added, as shown by the diagram below[xxviii].



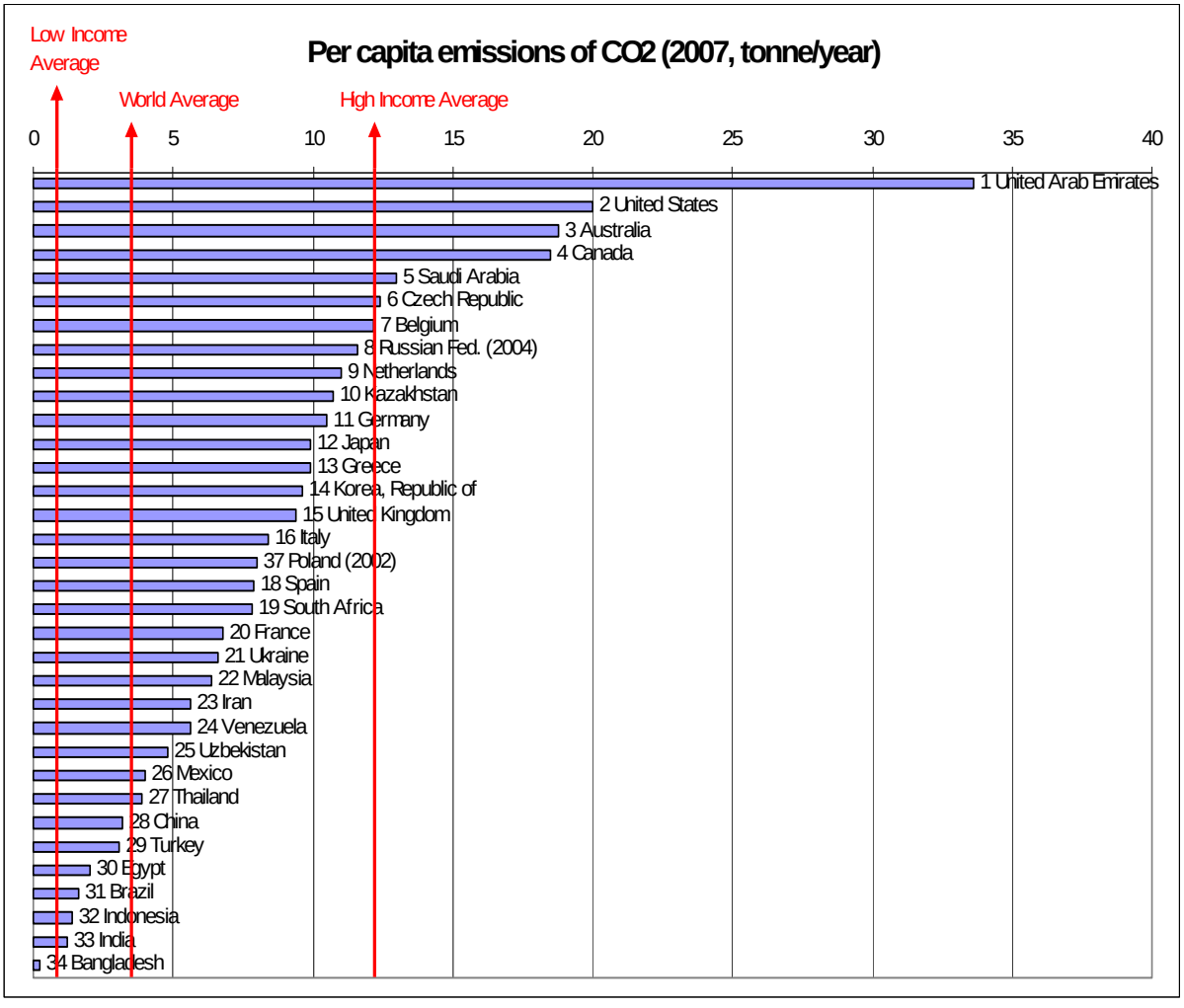
Moreover, green house gases accumulate in the atmosphere for hundreds of years, which means that historical emissions will continue to cause global warming even if their emission was completely and immediately halted.

With regard to the present major green house gas emitters, the following diagram shows the world's 33 largest emitters, and Bangladesh (though figuring at the bottom end of the emitters) will be one of the hardest hit countries. The US, in first place, with China following closely – although the latter is expected to surpass the US during 2007 account for more than triple the emission of the next countries responsible for current emissions, namely the Russian Federation, India and Japan. All other countries fell below 1000 million tonnes of total emissions in 2003.

One may also note that, regarding trends, the US, China and India show the highest climbs in emission over the 13-year period and pose, thus, major challenges for green house gas mitigation. That is why any international attempt to stabilise or even reduce emissions should include these countries if it is to have substantial success.

The picture is, nonetheless, very different if one looks at per capita emissions by country, as shown in the next diagram[xxix]. Indeed, not only do developed countries bear responsibility for most of the historical emission but also they present much higher current per capita emission figures – along with some Middle East oil producers and former so-called communist states. Four countries, however, reveal extraordinarily shocking trends in terms of per capita emission, namely the United Arab Emirates, the US, Australia and Canada, in decreasing order. The citizens of the US, Australia and Canada produce on average, over five times the world per capita average yearly emissions. With similar degrees of human development and regional climates, European countries produce almost half of what the former do.

In fact, a US citizen produces as much as 2 Germans, or 6 Chinese, or 12 Brazilians, or almost 17 Indians; all of them countries from which the US administration is seeking 'meaningful engagement' before committing itself to any significant mitigation measure.



The International Debate

Most countries – including the US under the Clinton administration – signed the UN Framework Convention on Climate Change, acknowledging that responsibility and mitigation efforts should be assumed and paid for, respectively, on a per capita emissions basis. Nevertheless, come the moment to take measures and establish emission caps for the period 2008-2012 through the Kyoto Protocol, the US backed out of the agreement challenging the equitable approach that had previously been almost unanimously agreed upon.

This is not to ignore, however, the environmental challenge posed by China's and India's rapidly growing economies, dramatically expanding middle classes and thus the need for power, which is produced by inefficient and dirty coal plants. Rapidly growing developing economies obviously need to confront their own moral responsibilities and work with the developed world to find solutions consistent with a just global socio economic order.

It seems to us that the latest G-8 proposed declaration on climate change[xxx], a 50% reduction from 1990 levels by 2050 is simply 'too little too late'. Furthermore, it is still an expression of intent only. There are no legal obligations in the absence of which such declarations are worth nothing. The draft declaration examines three elements vis-à-vis dealing with climate change. The first aspect is increasing energy efficiency. The second element is diversification of the means of generating energy, focusing not on wind and solar power, but, surprisingly, on nuclear energy. The third focus is on technological innovation. In this regard, as Walden Bello taking cue from James Lovelock of Gaia fame, says '...it will take 40 years before such technologies (nuclear energy) become really feasible – and by then it will be too late.'

What is crucial is collective but differential responsibility on a global scale; this may mean reducing global economic growth rates and consumption levels, particularly in the North, and in the very near future. However, the G-8 declaration fails to address this aspect. The declaration believes that 'erecting barriers' to foreign investment flows would lead to 'loss of prosperity'. It is emphasized in the document that 'freedom of investment is a crucial pillar of economic growth, prosperity, and employment', thereby denoting that the developing countries be more hospitable to western investors. This is followed by stressing the need for innovation as key to economic growth, with this being effective only when there is 'strong protection and enforcement of property rights.' Thus, the guiding principle of the document's approach to climate change is to 'decouple economic growth from energy use.'

A Policy Perspective

'Unless we change direction, we are likely to end up where we are going'

'When the river is uncharted, one should endeavor to cross it by touching the stone'

- Chinese proverbs

It should be clear from the above that in order for the global community to address the pressing issues of climate change regarding adaptation and mitigation, mainstreaming sustainable development should be a priority on the national and global agenda. Converging synergies between sound environmental policies within the framework of the international combat to global warming and the development goals set by the MDGs must be fully exploited. A participatory approach to this strategy inclusive of an improved scientific understanding, negotiation capacities and resources, networking and broad consultation processes seems, by any reckoning, the best way forward. Clearly, the success of such endeavours hinges critically on the civil society actors.

According to the scientists, even if the current Kyoto targets are met, global temperatures will rise at least by a few degrees with the attendant devastating consequences for vulnerable communities globally. This is not only because big polluters such as the US and Australia have resolutely remained outside the Kyoto mechanism, but even the large and rapidly developing countries are adding their own considerable trail of carbon to what Australian climatologist Tim Flannery calls the 'aerial ocean'.

At the international level, developing countries must seek that developed countries abide by the widely accepted principle of per capita emissions rights, which is consistent with the principle of equity and fairness. *This is where robust alliances and partnerships between civil society organisations in the North and the South are absolutely critical.* Together they should press for the establishment of a Disaster Relief Fund to address the issues relating to mitigation and adaptation costs; such a Fund ought to be under the administration of the UN.

One important issue that requires detailed consideration is that of appropriate mechanisms to implement the management and administration of any Fund related to adaptation, mitigation or disaster relief. In particular, the developing countries, and not only donors from the advanced countries, should be able to participate in these processes. Furthermore, it is essential that they be administered in a way that can maximise their pro-poor benefits. These are obvious action domains for civil society organisations predicated on global partnerships.

It is worth emphasising that the global community should urge the developed countries to pay the bill for the effects of their actions, both in terms of mitigation of their 'past and present sins' and to facilitate funds that can be used in improving resilience in developing countries. The establishment of mechanisms securing appropriate technological transfers from developed countries that could enable the developing world's shift into clean non-carbon economies, which, ultimately, is critical to preventing dangerous climate change, is of the utmost importance. It is worth noting here that there is evidence to suggest the possibility for developing countries to mitigate their emissions without compromising their right to future growth[xxxi].

Finally, another key element could be the inclusion of a 9th Millennium Development Goal related to adaptation and mitigation of global climate change. This way, progresses could be integrated within the broader agenda of the MDGs, harmonising the mutually enhancing above-mentioned synergies between sustainable development and climate change combat.

The IPCC, focusing on carbon emissions, made several suggestions for the policy makers which civil society organisations can take up on a priority basis for appropriate mobilisation and necessary action. (For details of the IPCC suggestions, see annexure-2).

The suggested policy measures as well as the instruments, suggested by the IPCC, largely pertain to the domain of government action. However, it is worth emphasising that such measures hardly have a chance without active participation of civil society organisations. This would be particularly so in the context of several developing countries with low levels of literacy, awareness etc. Furthermore, the nature of the problems is such that the stakeholders from grassroots to the higher echelons of society and economy have to own up the challenges and the concomitant responsibilities. As we know from elementary economic analysis, the costs of imposing the appropriate measures from above are prohibitive and the mechanisms often unworkable.

The civil society organisations thus have a huge role to play in terms of increasing awareness, facilitating mobilisation etc. at different levels. For instance, in case of addressing the issue of energy supply, a policy to reduce fossil fuel subsidies may require a strong political will on the part of the government, as in many developing countries the governments might not want to encounter resistance from the corporate sector as well as large sections of consumers. Civil society organisations lobbying for the use of renewable energy sources may become major vehicles for society/economy-wide mobilisation to facilitate implementation of such policies. Obviously, this requires spreading awareness of the advantages of the use of renewable energy resources and technologies. Furthermore, the resources saved from reducing such subsidies must be used in a manner which make the adoption of alternative processes and technologies attractive for different stakeholders; again this may require substantial lobbying work, to persuade governments, on the part of the civil society organisations.

Similarly, if we take the case of policies for habitats; it is well known that the use of eco-friendly building materials may involve higher cost for individual consumers and corporate builders in the short run. Given the time horizon of most economic agents, which tends to discount future prospects of well-being at a very high rate, any public policy to impose the use of eco friendly resources typically runs into rough weather. Clearly, appropriate civil society mobilisation can cut down on what economists call *transaction as well as enforcement costs* while creating a conducive atmosphere for adoption of such resources and technologies.

The effects of globalisation needs to be factored in while discussing the ramifications and dynamics of global climate change. The currently hegemonic *neo liberal* model of globalisation has reduced the policy space for governments at different levels; although the world is becoming more and more interdependent through increases in *selective* connectedness, there is minimal global governance in a number of critical areas such as the management of natural resources. In any case with reference to most such resources (e.g. major attributes of stratosphere, lithosphere, hydrosphere

and biosphere) any reliance on simplistic localised solutions are not quite meaningful on account of the issues relating to size and scale; *neo liberal* globalisation only makes it worse.[xxxii] It is almost a truism that a global economy driven by unbridled market forces is hardly conducive to the prospects of making a quick transition to a less energy-intensive world. *This is an obvious arena where civil society organisations can play a huge role, by confronting and challenging neo liberal globalisation, as is already being done to some extent.*

Moving onto the dilemma of environment vs development, ways and means must be devised to enable transition into a clean growth paradigm for all but especially developing countries. The objectives of UNFCCC will require deep reductions in global energy-related carbon dioxide emissions, which is possible only if developing countries have unrestricted access to clean energy technologies. While on the one hand, impact of globalisation has eliminated trade barriers between nations; it has erected walls in terms of intellectual property rights and patents (as has already been detailed in the paper) effectively blocking (developing countries') access to clean energy technologies[xxxiii]. Further, in the same vein, carbon trading as a quick-fix solution would hardly go the distance in addressing the issue in a holistic manner.

As indicated earlier, it is important to bear in mind that the economics of climate change has the economics of risk and uncertainty at its core. The unmitigated accumulation of greenhouse gases in the atmosphere poses ever-greater risks, and the policy challenge is to find the most cost-effective, efficient and equitable way to reduce the risks. It is worth re-emphasizing that the problem is not going to be solved without international collective action: there is no laissez-faire solution. As Albert Einstein observed, 'today's problems cannot be solved if we still think the way we thought when we created them'.

Notes and References

[i] "*Scientists Offered Cash to Dispute Climate Study*", by Sample, Ian. Guardian. January 2, 2007.

[ii] "*Climate Report Warns of Drought, Disease*". Borenstein, Seth. Associated Press. 10 March, 2007.

[iii] "*Living Planet Report 2006*". WWF International, Institute of Zoology, and Global footprint Network.

[iv] "*Climate Report Warns of Drought, Disease*". Borenstein, Seth. Associated Press. 10 March, 2007.

[v] "The Stern Review: On the Economics of Climate Change" (2006) HM treasury, UK Government. The Stern Review released on October 30, 2006 by economist Nicholas Stern for the British government. Although not the first economic report on global warming, it is significant as the largest and most widely known and discussed report of its kind. The report can be accessed at < http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm >

The Intergovernmental Panel on Climate Change (IPCC) established in 1988 by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP) to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. The Fourth Assessment report by Intergovernmental Panel on Climate Change (IPCC) also highlight similar issues. Please see "*Climate Change 2007: Mitigation of Climate Change. Summary for Policy Makers*". Working Group III Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report.

[vi] "*The Climate of Poverty*". Christian Aid. May 2006. Pg 3.

[vii] "*Climate Change on the Millennial Timescale"*. Tyndall Centre Technical Report 41. Tyndall Centre for Climate Change Research and Environment Agency. UK. February 2006.
"*Ocean Plankton Absorbs less CO_2*". BBC. August 30, 2006.
"*Climate Change 2007: Impacts, Adaptation and Vulnerability. Summary for Policy Makers*". Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report. Pg 5-7.

[viii] "UN Attacks Climate Change as Threat to Peace". Associated Press. April 17, 2007.

[ix] "*The Climate of Poverty*". Christian Aid. May 2006. Pg 3.

[x] Ibid.

[xi] "*Humantide. The Real Migration Crisis*". Christian Aid. May 2007.

[xii] "*The First Refugees of Global Warming*". Goering, Laurie. Chicago Tribune. 2 May, 2007

[xiii] Opcit. Stern Review 2006

[xiv] Opcit. IPCC 2007

[xv] Ibid. Pg 13.

[xvi] "*Making the Kyoto Protocol Work. Ecological and Economic Effectiveness, and equity in the Climate Regime*". Agarwal, Anil. Centre for Sciencie and Environment. 2000.

[xvii] Opcit IPCC 2007) pg 27

[xviii] Ibid. Pg 29.

[xix] Emissions trading are a way of introducing flexibility into a system where participants have to meet emissions targets. These participants may be countries (as in the case of the Kyoto Protocol), or companies (as in the case of a domestic emissions trading scheme). Participants can buy units to cover any emissions above their targets, or sell units if they reduce their emissions below their targets. The presence of a market for these units creates a value for emissions reductions which stimulates investment in the most cost-effective areas. Emission trading leads to a reduction in compliance costs compared to meeting the same target through domestic/internal means only.

[xx] "*Time to Tax the Carbon Dodgers*". Hontelez, John (Secretary General of the European Envirnmental Bureau). BBC. 5 April, 2007.

[xxi] As reported by Elisabeth Rosenthal, International Herald Tribune, June 14, 2007

[xxii] "*Moving towards Emissions Neutral Development (MEND)*". Troni J., Agbey S., Costa P.M., Haque N., Hession M., Gunaratne L., Rodriguez H. & Sharma A.. Eco Securities Limited. Oxford, UK. 2002. Cited in: "*Poverty Reduction, Equity and Climate Change: Global Governance Synergies or Contradictions?*". Richards, Micheal. Globalisation and Poverty Programme. Oversees Development Institute. UK. 2003. Pg 8.

[xxiii] Opcit. IPCC (2007).

[xxiv] "*Climate and Development Plans Must Be Combined*". Lasco, Rodel and Yohe, Gary. Science and Development Network. 16 April 2007.

[xxv] Opcit. The Stern Review (2007)

[xxvi] Ibid

[xxvii] Ibid

[xxviii] Fred Pearce 1999, Countdown to chaos, New Scientist, New Science Publications, London, November 29, p 22. Cited in: "*Climate Change: A Challenge for Indian Economy*". Agarwal, Anil. Briefing Paper for Members of Parliament. Occasional Paper. Centre for Science and Environment. New Delhi. 2001. Pg 4.

[xxix] Ibid.

[xxx] Bello, Walden: Climate Change Flap At The G-8, Fpif.org, 6 June 2007

[xxxi] 'A low pollution future is fully consistent with higher levels of energy use in developing countries and the achievement of economic prosperity on a broad basis. A low pollution future is also consistent with high levels of energy use in industrialised countries, provided that efforts to develop the required technologies and practices continue'. "*World Energy Assessment: Energy and the Challenge of Sustainability*". UNDP. 2000. Pg 409-411.

[xxxii] Mahalingam, Sudha: Leveraging Climate Change Concerns, The Hindu, 5 June 2007

[xxxiii] Ibid

"*Climate and Development Plans Must Be Combined*". Lasco, Rodel and Yohe, Gary. Science and Development Network. 16 April 2007. In: http://www.scidev.net/ , visited on 28 may, 2007.

"*Climate Change: A Challenge for Indian Economy*". Agarwal, Anil. Briefing Paper for Members of Parliament. Occasional Paper. Centre for Science and Environment. New Delhi. 2001. In: http://www.cseindia.org/programme/geg/pdf/cse_briefing.pdf, visited on 29 May, 2007.

"*Countdown to Chaos*". Pearce, Fred. New Scientist. New Science Publications. London. 29, November 1999. Cited in: "*Climate Change: A Challenge for Indian Economy*". Agarwal, Anil. Briefing Paper for Members of Parliament. Occasional Paper. Centre for Science and Environment. New Delhi. 2001.

"World Energy Assessment: Energy and the Challenge of Sustainability". UNDP. 2000. In: http://www.undp.org/energy/activities/wea/drafts-frame.html , visited on 2 June, 2007.

http://www.carbontrading.com/ct/ct2.htm

ANNEXURES

Annexure-1

The Impacts of Climate Change on Growth and Development: Scenarios at Different Degrees of Global Warming

Highlights of possible climate impacts						
Temp Rise (°C)	**Water**	**Food**	**Health**	**Land**	**Environment**	**Abrupt and Large scale Impacts**
1°C	Small glaciers in the Andes disappear completely, threatening water supplies for 50 million people	Modest increases in cereal yields in temperate regions	At least 300,000 people each year die from climate-related diseases (predominantly diarrhea, malaria, and malnutrition) Reduction in winter mortality in higher latitudes (Northern Europe, USA)	Permafrost thawing damages buildings and roads in parts of Canada and Russia	At least 10% of land species facing extinction (according to one estimate) 80% bleaching of coral reefs, including great Barrier Reef	Atlantic Thermohaline Circulation starts to weaken
2°C	Potentially 20-30% decrease in water availability in some vulnerable regions, e.g. South Africa and Mediterranean	Sharp declines in crop yield in tropical regions (5-10% in Africa)	40-60 million more people exposed to malaria in Africa	Up to 10 million more people affected by coastal flooding each year	15-40% of species facing extinction (according to one estimate) High risk of extinction of Arctic species, including polar bear and caribou	Potential for Greenland ice sheet to begin melting irreversibly, accelerating sea level rise and committing world to an eventual 7 m sea level rise
3°C	In Southern Europe, serious droughts occur once every 10 years 1-4 billion more people suffer water shortages, while 1-5 billion gain water , which may increase flood risk	150-550 additional millions at risk of hunger (if carbon fertilization weak) Agricultural yields in higher latitudes likely to peak	1-3 million more people die from malnutrition (if carbon fertilization weak)	1-170 million more people affected by coastal flooding each year	20-50% of species facing extinction (according to one estimate), including 25-60% mammals, 30-40% birds and 15-70% butterflies in South Africa Onset of Amazon forest collapse (some models only)	Rising risk of abrupt changes to atmospheric circulations, e.g. the monsoon Rising risk of collapse of West Antarctic Ice Sheet Rising risk of collapse of Atlantic Thermohaline

4°C	Potentially 30-50% decrease in water availability in Southern Africa and Mediterranean	Agricultural yields decline by 15-35% in Africa, and entire regions out of production (e.g. parts of Australia)	Up to 80 million more people exposed to malaria in Africa	7-300 million more people affected by coastal flooding each year	Loss of around half Arctic tundra Around half of all the worlds nature reserves cannot fulfill objectives	
5°C	Possible disappearance of large glaciers in Himalayas, affecting one-quarter of China's population and hundreds of millions in India	Continued increase in ocean acidity seriously disrupting marine ecosystems and possibly fish stocks		Sea level rise threatens small islands, low lying coastal areas (Florida) and major worlds cities such as New York, London and Tokyo		
More than 5°C	The latest science suggests that the Earth's average temperature will rise by even more than 5 or 6 C if emissions continue to grow and positive feedbacks amplify the warming effect of greenhouse gases (e.g. release of carbon dioxide from soils or methane from permafrost). This level of global temperature rise would be equivalent to the amount of warming that occurred between the last age and today- and is likely to lead to major disruption and large-scale movement of population. Such "socially contingent" effects could be catastrophic, but are currently very hard to capture with current models as temperatures would be so far outside human experience.					
Note: This table shows illustrative impacts of different degrees of warming. Some of the uncertainty is captured in the ranges shown, but there will be additional uncertainties about the exact size of impacts. Temperatures represent increases relative to pre-industrial levels. At each temperature, the impacts of expressed for a 1°C band around the central temperature, e.g. 1°C represents the range 0.5 -1.5°C etc. Numbers of people affected at different temperatures assume population and GDP scenarios for the 2080s from the intergovernmental Panel on Climate Change (IPCC). Figures generally assume adaptation at the level of an individual or firm, but not economy-wide adaptations due to policy intervention.						

Source: Stern Review (2007)

Annexure-2

Selected sectoral policies, measures and instruments as environmentally effective in the respective sector in at least a number of national cases.

Sector	Policies, measures and instruments shown to be environmentally effective	Key constraints or opportunities
Energy supply	Reduction of fossil fuel Subsidies Taxes or carbon charges on fossil fuels Feed-in tariffs for renewable energy Technology Renewable energy obligations Producer subsidies	Resistance by vested interests may make them difficult to implement May be appropriate to create markets for low emissions technologies

Transport	Mandatory fuel economy, biofuel blending and CO2 standards for road transport Taxes on vehicle purchase, registration, use and motor fuels, road and parking pricing Influence mobility needs through land use regulations, and infrastructure planning Investment in attractive public transport facilities and non-motorised forms of transport	Partial coverage of vehicle fleet may limit effectiveness Effectiveness may drop with higher incomes Particularly appropriate for countries that are building up their transportation systems
Buildings	Appliance standards and labelling Building codes and certification Demand-side management programmes Public sector leadership programmes, including procurement Incentives for energy service companies (ESCOs)	Periodic revision of standards needed Attractive for new buildings. Enforcement can be difficult Need for regulations so that utilities may profit Government purchasing can expand demand for energy-efficient products Success factor: Access to third party financing
Industry	Provision of benchmark information Performance standards Subsidies, tax credits Tradable permits Voluntary agreements	May be appropriate to stimulate technology uptake. Stability of national policy important in view of international competitiveness Predictable allocation mechanisms and stable price signals important for investments Success factors include: clear targets, a baseline scenario, third party involvement in design and review and formal provisions of monitoring, close cooperation between government and industry.
Agriculture	Financial incentives and regulations for improved land management, maintaining soil carbon content, efficient use of fertilizers and irrigation	May encourage synergy with sustainable development and with reducing vulnerability to climate change, thereby overcoming barriers to implementation
Forestry/Forests	Financial incentives (national and international) to increase forest area, to reduce deforestation, and to maintain and manage forests Land use regulation and enforcement	Constraints include lack of investment capital and land tenure issues. Can help poverty alleviation.
Waste management	Financial incentives for improved waste and wastewater management Renewable energy incentives or obligations	May stimulate technology diffusion Local availability of low-cost fuel
	Waste management regulations	Most effectively applied at national level with enforcement strategies

Source: Intergovernmental Panel on Climate Change (2007), " Summary for Policy Makers"