Policy Notes for Parliamentarians

The Human Impact of Climate Change in India

Advancing political leadership

Parliamentarians' Group on MDGs
Oxfam India
Centre for Legislative Research and Advocacy

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Policy Notes for Parliamentarians: July-August 2010

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Foreword

Overwhelming, scientific evidence has demonstrated that the earth is moving towards a point of no return, where ecological catastrophe brought about by climate change will be unavoidable. The issues of climate change with its deep ramifications into almost all the aspects of human development have become a major concern for policy makers. Climate change has the potential to undermine human development across India and may even lead to a reversal of current developmental progress. With rising sea levels threatening millions of children, women and men, changing rainfall patterns affecting crops and therefore food security and a growing scarcity in clean drinking water; the social, political and economic costs of climate change, are almost immeasurable. Climate change will be a strong force influencing development policy, and policies will be shaped significantly by the implications of this impact.

Actions taken, or indeed not taken, in the coming years ahead will have a huge impact on the future course of human development in India and across the world. With the marginalised, poor and socially excluded being the most at risk by the effects of climate change, our efforts must be targeted at protecting and safeguarding their lives and rights. We should capitalise on our privileged position now where we can see the looming emergency and take action to prepare, try and minimise the actual scale of the oncoming disaster. Unless, this is recognised and the warning is heeded, millions of lives will have been lost due to our inaction.

The articles in this publication have been contributed by experts and scientists from across the climate research sector to inform and empower Parliamentarians to make interventions on climate change issues. Each article seeks to outline the extensive and catastrophic impact that the changing climate will have on India unless we act now to mitigate and adapt to the potentially devastating effects. The articles further outline the vital role that Parliamentarians have at both local and national levels to protect the Indian people from increasing famine, depravation and suffering that climate change will undoubtedly impart in the coming years, threatening the very stability and durability of the democratic nation-state based on delivery and performance for the masses.

That parliamentarians have a key role to play in ensuring climate change issues are placed high up on the political agenda. As a part of CLRA's 'Political Leadership and Accountability Initiatives', in the month of December 2009, CLRA and Oxfam India in partnership with nine Delhi Schools (100 Students participated) successfully organised the door to door advocacy programme on climate change for parliamentarians. The Students' group met 110 MPs, from different political parties at their residences, and they informed them about climate change issues, utilising brief and customised hand-outs, report cards, etc. Enhancing the awareness on climate change among the MPs and make them accountable leaders, could leverage their actions to set out policy priorities in the governance agenda. Keeping this in view, we present this publication, which includes an anthology of writings from different authors of repute, attempts to inform Hon'ble MPs about the several aspects of climate change and human development, and calls upon them to act towards an improved policy response.

Parliamentarians, with their matchless position as representatives of the people, law makers and with their overseeing capacity, can be influential advocates to promote climate change awareness among their constituents. They can bring policies and legislation, which can potentially address the climate

mishaps and to adopt various measures to meet the challenges. They can review and vote or recommend required budget and oversee the implementation of government policies and day to day action of the governments.

Together, civil society and Parliamentarians can prevent climate calamity and lead the way in global efforts to reduce carbon emissions. However, we must act now, and the science is clear: we will be judged by our children not on how much we talked but how much we changed. Climate change is not just a problem for the future but is very much an issue for the present: increased flooding and widespread drought are just some of the effects that we have all felt over the last few years due to changing monsoon patterns and rising temperatures.

This publication is intended to serve a twofold purpose: to inform and mobilise parliamentarians so that, as political leaders, they measure the importance of the issues and call for action, and to encourage them to take initiative steps. As policy makers, they can drive the policy making process forward and shape the responses to climate change which have the biggest sustainable impact on making change. All the authors who have contributed to this publication emphasise a need for urgent action and strong political leadership at the national and the local levels to tackle climate change before it is too late. The future course of human development is undeniably now in our hands, and we cannot afford to fail.

On behalf of CLRA and Oxfam India, we are pleased to present this policy notes for parliamentarians, which is the outcome of a sustained cooperation with leading climate change experts who have contributed articles here on the diverse aspects of climate change. It is with a deep sense of appreciation, we acknowledge and extend our gratitude to each author for their respective article in this publication.

We hope that this publication will inspire you to take leadership and definitive actions to tackle the challenges posed by climate change. We look forward to your valuable responses.

Vinod Bhanu
CLRA

Nisha Agrawal
Oxfam India

Contents

1 Climate Change and its Implications for India's Fragile Ecosystems

Dr. R. K. Pachauri
Intergovernmental Panel on Climate Change (IPCC) and The Energy & Resources Institute (TERI), New Delhi

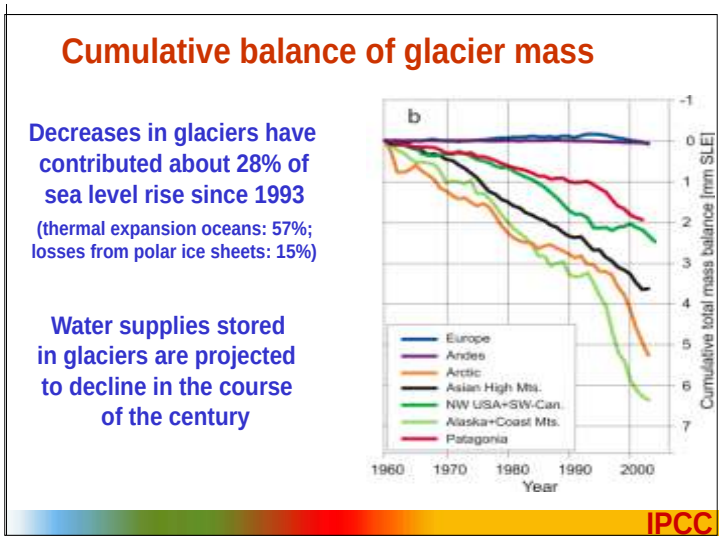
The danger of human induced climate change was highlighted by several scientists who over a century ago assessed how the emissions of carbon-dioxide from burning of fossil fuels could alter the composition of the atmosphere, thus leading to the threat of human induced climate change. Foremost among these scientists was Svante Arrhenius, a Swedish scientist who also won the Nobel Prize in Chemistry in 1903. Concerns regarding human induced climate change came to the fore globally, however, only in 1988, when a large part of North America and Europe suffered from a drought and very high temperatures. The U.S. Congress then held several expert hearings to understand the policy implications of this subject and discussions were also organised within the United Nations General Assembly (UNGA). As a result the UNGA decided to set up the Intergovernmental Panel on Climate Change (IPCC) which was established in the same year, 1988, through the joints efforts of the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP). The IPCC has now carried out four separate assessments of all aspects of climate change as well as produced a number of special reports on specific topics related to climate change. However, it is the Fourth Assessment Report (AR4) of the IPCC, completed in 2007, which has had a profound impact in forming public opinion on and creating widespread awareness of the scientific realities of climate change worldwide. It was essentially this work which led to the Nobel Peace Prize for 2007 being awarded to the IPCC and Mr. Al Gore, former Vice President of the U.S.

Climate change is likely to affect several areas in the sub-tropical and tropical regions quite seriously through a range of impacts which have been assessed by the AR4 of the IPCC. Figure 1 from the IPCC AR4 shows the rate at which melting of the glaciers across the globe has taken place in recent decades. The depiction of glacier mass for the Asian high mountains which refers essentially to the Himalaya-Hindukush range causes

considerable concern. The IPCC estimated that as a result of projections of a reduced flow of water through the river systems originating in these high mountains, around 500 million people in South Asia are likely to be adversely affected and 250 million in China. Water problems resulting in increased scarcity and stress across this entire subcontinent are likely to become acute in the coming decades not only because of reduced river flows, but also as a result of the increased intensity, frequency and duration of floods, droughts and heat waves. In addition, there is the possibility of a negative effect on the pattern of monsoon rains in this country as well as the possibility of increased occurrence of extreme precipitation events. With a growing population, India and other countries of South Asia would have to take in hand a large number of adaptation measures by which society can cope with increased water stress in several parts of this subcontinent. While agriculture, being the largest user of water in the country, would need to move to changed practices, including new cropping patterns and the use of water conserving technology, other sectors will also have to use water more efficiently. With rising incomes increases in water demand for household purposes would be inevitable as also for industrial and commercial use on a large scale.

It is estimated that every 1°C increase in temperature is likely to lead to a 5-10% reduction in yields of some crops.

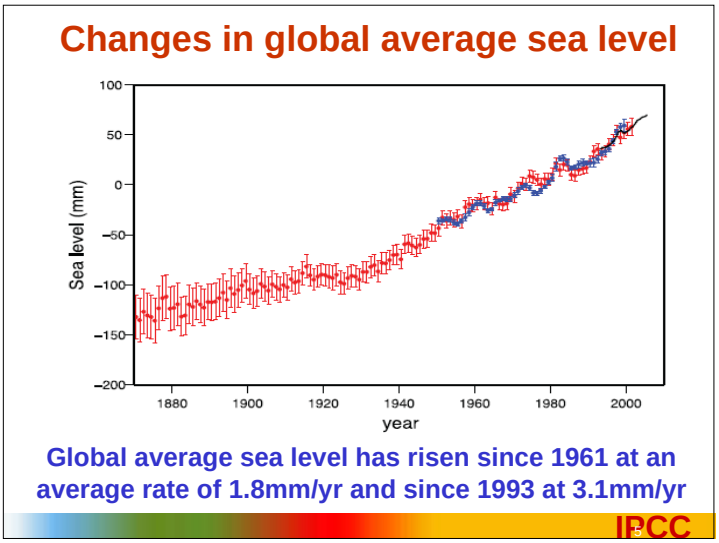
Figure 1



Another sector which is likely to be affected negatively is agriculture. It is estimated that every 1°C increase in temperature is likely to lead to a 5-10% reduction in yields of some crops. In the case of those farmers dependent entirely on rainfed agriculture, not only would water scarcity have adverse impacts on yields but also higher temperatures would bring about a downward change in productivity. Food security in this country would require the agricultural research system to take in hand a large range of research and development activities by which crops and cropping patterns can be evolved for drought resistance, salt tolerance and withstanding heat stress resulting from higher temperatures that would occur in the future.

India has a large coastline which makes a large number of people and a substantial part of the country's property vulnerable to the impacts of climate change. Figure 2 shows the increase in average sea level over the past 100 years. It would be seen that the rate of increase since 1993 has been substantially higher than in previous decades. The overall increase in sea level during the 20th century was 17 centimetres on the average and firm projections for the 21st century are difficult to arrive at, because there is the possibility of collapse of some part of the Greenland or West Antarctic ice sheets. If that were to happen the world could suffer sea level rise of several metres. However, even with

Figure 2



What is extremely important in tackling the threat of climate change is the need for effective and adequate mitigation measures worldwide by which we can reduce emissions of greenhouse gases with a sense of urgency.

present trends there would be acute danger for several parts of our coastal regions. The IPCC has in fact determined that the megadeltas of Asia and Africa are locations which are most vulnerable to sea level rise. These include cities like Shanghai, Dhaka and Kolkata. The Sundarbans which are low lying islands with very fragile ecosystems and scattered population are particularly vulnerable to the impacts of sea level rise.

All in all, the impacts of climate change worldwide and in India provide cause for deep concern and a necessity to act effectively in adapting to projected impacts that would take place in the coming decades. However, what is extremely important in tackling the threat of climate change is the need for effective and adequate mitigation measures worldwide by which we can reduce emissions of greenhouse gases with a sense of urgency. The cost of taking such action is really not high. In the global scenario that has been assessed by the IPCC, it was found that for attaining a stringent pathway of mitigation the cost to the global GDP in 2030 would be not more than 3%. In fact, if the specific number of co-benefits which are created through mitigation measures were taken into account the cost would be much lower and possibly even negative. Several mitigation measures, therefore, provide huge local benefits and means to attain sustainable development. The use, for instance, of renewable energy technologies has the potential of providing large benefits and enhancing human welfare for a vast range of people who are currently outside the supply of modern forms of energy. Hence the most effective strategy for mitigation of greenhouse gases and meeting the challenge of climate change globally is essentially the reorientation of growth policies that should attain the objectives of sustainable development. A country like India while pursuing a path of sustainable development must also immediately take in hand a range of measures for adapting to the impacts of climate change or else not only would human society in this country suffer to a significant extent from the consequences that would occur, but could also experience social disruption since the worst affected victims of climate change would be the poorest sections of society. The Government of India and several states have made a beginning in articulating climate related policies and planning a range of actions to meet this challenge, but much more is required if we have to deal with emerging developments in this area in the coming decades.

The most effective strategy for mitigation of greenhouse gases and meeting the challenge of climate change globally is essentially the reorientation of growth policies that should attain the objectives of sustainable development.

2

Dealing with Climate Change: From Panchayat to Parliament

Suresh Prabhu
Former Member of Parliament, was the Union Minister of Environment and Forests

Climate change is the biggest challenge faced by human kind in modern times. From the Industrial Revolution onwards, human action has led to dramatic changes in the climate, which have led to an almost irreversible rise in global temperatures.

Climate's natural cycle sees global temperatures increase and decrease. However, we are now witnessing climatic changes that are inextricably linked to human action. Global temperatures have risen alarmingly and yet the world continues its business as usual. If the pollution level goes beyond 450 ppm to 550 ppm, temperature may rise by another 2 degrees which will cause unthinkable consequences to human kind. If human action has caused climate change, it is logical that human action can reverse it. Here lies the main role for people representatives, which includes Members of Parliament (MPs), legislative assembly members and local self governance members; from district to village level.

The human body is a unified entity and thus when any part of the body is damaged. this naturally has implications on the body as a whole. Similarly the eco system of the world is like a human body and wherever may be the sources of climate change, the whole world will suffer adverse consequences. Therefore the response has to be at a global level, for which MPs can play a significant and effective role in advocating that national governments arrive at an agreement to succeed the landmark Kyoto protocol, which will expire in 2012. MPs can also put pressure on the Indian government to implement the National Action Plan for Climate Change (NAPCC), which has already been agreed. It is imperative that the action plan be an actual plan for action – many plans that the Indian government have prepared previously have merely been left stagnant, under lock and key.

The NAPCC has many mandates ranging from solar energy to water management. With so many sectors to address , it is absolutely crucial that there is no omission of action. MPs must

raise these issues on the floor of parliament in every session and ask the government to supply concrete reports on their actions under each mandate. There are several standing committees in the Indian Parliament, which ensure that enough funds are located to activate these various actions. There is though a further need for each government ministry to work in a carbon neutral manner.

Any action plan formulated at the national level can only be effectively implemented through the action of all 28 states and union territories. Each Indian state will be impacted by climate change in a very different way. The East and West coastlines go through the states of West Bengal, Orissa, Tamilnadu, Andhra Pradesh, Pondicherry, Kerala, Karnataka, Goa, Maharashtra and Gujarat. A sea level rise would possible destroy the traditional professions of fishermen and further have a devastating impact on the regional tourism industry. We need to prepare rehabilitation plans for the people affected by climate change. Members of Legislative Assemblies (MLAs) have the potential to work very effectively on state specific plans that focus on specific sectors, as mentioned above.

India has 35 agro-climatic zones and the changes in rainfall pattern and climate variability will have different effects on the cropping patterns. For an effective solution, a generalised solution is not possible, instead we must recognise that this is localised the problem which will need a region specific response. Again MLAs can play a very useful role in making this happen.

Climate change has a major impact on water resources. Each state must prepare an integrated water resource management plan, keeping in mind the supply side constraint and the increased demand by agriculture, households and industry. Energy and particularly the use of fossil fuel based energy is a principal cause of greenhouse gas emission, which has resulted in global warming. Another top priority for MLAs must be to focus on changing the energy basket of state electricity and utilise India's renewable energy resources.

Transportation uses huge amounts of energy and is a leading contributor to greenhouse emissions. Public transport should be the preferred public choice and be encouraged rather than

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the continual use of private cars. An estimated, 65 per cent of India's population would live in urban areas by the coming 25 years and if this happens the consequences would be detrimental especially if the majority of them use private cars. MLAs therefore must develop and implement specific policies to encourage public transport over private.

MLAs and municipal corporations from metropolitan cities like Mumbai, Chennai and Kolkata must also take special care to study the vulnerability of their coastal cities and have a contingency plan in place to respond effectively to environmental emergencies, which will increasingly occur with little warning. From district to village level, elected representatives also have a very important and big role to play in this regard. Water body restoration and water conservation must be the top priority in all the 600,000 villages in India. As rain fall patterns begin to change and there are indefinite periods without rainfall, water must be better stored wherever possible. Each of the village Panchayats needs be trained and systems need to be put in place to cope with the effects of natural disasters, the frequency and intensity of which will undoubtedly begin to rise as a result of climate change.

Biomass, solar and oceanic power can be harnessed in a very significant and effective way in all villages in India. Of course it will need huge support, financial and technological from the central and state governments to ensure implementation. However, the action of generating electricity will in practice occur at the local level. Distributed generation of electricity from renewable sources in stand alone systems is the best response to changes needed in India's energy basket to combat climate change. This can effectively be done by the Zilla Parishads and the village Panchayats. These bodies can not only generate renewable energy but also distribute it to their constituencies.

There are many areas where effective partnerships and coalitions of MPs, MLAs and local self government functionaries can realise the spirit of the Constitution of India, which has prescribed different spheres of activities to all the elected representatives. Furthermore, it is important to note that all public officers are elected by the villagers or city dwellers, and therefore they also must join hands to serve the common cause to combat climate change.

There are many areas where effective partnerships and coalitions of MPs, MLAs and local self government functionaries can realise the spirit of the Constitution of India, which has prescribed different spheres of activities to all the elected representatives.

3 Preparing to Cope with Climate Change

Prof. M.S. Swaminathan
Member of Parliament
M. S. Swaminathan Research Foundation, Chennai

Dr Paul Crutzen, one of the world's leading climate experts, has recently stated that "In order to be safe we would have to reduce our carbon emissions by 70% by 2015. Instead of achieving any reduction, we are currently adding 3% more each year". The consequences of such a situation will be multi-dimensional. First, most of the Himalayan glaciers will melt with adverse repercussions for many of the major rivers in the region. Second, both Bangladesh and South India will suffer from a rise in sea level. For example, it has been predicted that Western Antarctica's ice sheets will not survive beyond this century, leading to a sea level rise of at least 1 to 2 meters. Third, projections for India indicate a temperature rise of 0.68 degrees in the twentieth century with an increasing trend in the annual mean temperature; the Global mean is likely to go up by 4 degree centigrade before the end of this century. Some experts believe that such a disaster situation may arise even sooner, say by 2015.

Over 20 years ago, my colleague the late Prof S K Sinha and I studied the impact of a one degree rise in mean temperature on wheat yield in North India. We found that such a rise in temperature will lead to a reduction in the duration of the wheat crop and thereby result in a drop in yield. Therefore, global warming and its consequent adverse impact on temperature, precipitation and sea level will cause unprecedented hardship and loss of livelihoods. Food security will be threatened and people will try to migrate towards Northern latitudes. Such migration may also not be politically feasible.

We should therefore initiate anticipatory action to meet the challenges arising from climate change. In 1973, in my Sardar Patel Memorial Lectures over the All India Radio, I suggested that we should develop drought, flood and good weather codes in order to help local communities to minimise the adverse impact of aberrant weather and to maximize the benefits of a good monsoon. Unfortunately we are yet to develop well planned anticipatory steps to meet such challenges. Only

recently, a National Plan of Action has been developed for climate management. This Plan outlines a national strategy that aims to enable the country adapt to climate change and enhance the ecological sustainability of India's development path. It stresses that maintaining a high growth rate is essential for increasing living standards of the vast majority of people of India and reducing their vulnerability of the impacts of climate change. I hope that this plan will become operational soon.

Let me illustrate how anticipatory research can help us to face such problems with confidence and courage. Twenty years ago, at the M.S. Swaminathan Research Foundation in Chennai, we started an anticipatory research programme to meet the challenge of sea level rise along the Tamil Nadu coastline. This involved the erection of bioshields comprising both mangrove and non-mangrove species. It also involved transferring genes for sea water tolerance from mangrove species like Avicennia marina to rice, pulses and other crops. Both these steps have led to successful outcome. During the titanic tsunami of Dec 26, 2004, the coastal areas protected by a mangrove bio-shield did not suffer loss of life, while those areas without such protection suffered serious losses of life and property.

The transfer of genes for salinity tolerance from mangroves to crop plants like rice has also yielded successful results. It will be possible to test such transgenic material extensively once the necessary regulatory approvals are received. Similar material has also been developed for drought tolerance with the help of genes from Prosopis juliflora. This success has encouraged us to set up a National Resource Centre for Genes for a Warming India. This is a unique gene bank in the world designed to help in combating the problems arising from global warming.

The risks posed by climate change in respect of food security only serve to emphasise the need for the government to play a proactive role and to step up public investment in agriculture and rural development, besides taking measures to ensure both renumerative prices for farmers and affordable access to food grains for the poor. The conclusions of the FAO High Level Conference of June 2008 also remind us that sustainable efforts to increase food availability should focus on strengthening small farmers.

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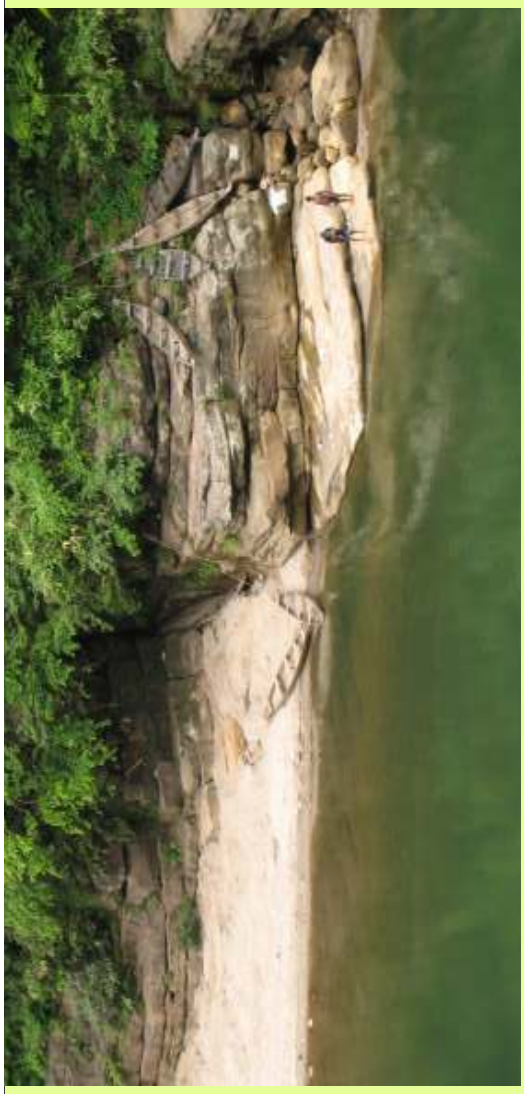
Poor nations and poor people in all nations will be the worst sufferers of the consequences of global warming, in view of their limited coping capacity. In India, if an action plan is to be formulated at the national level by the government, effective implementation will rely on the decisive actions of all individual states and union territories at a local level. Each state will be affected differently by climate change and therefore require localised response. To this end, Members of Legislative Assemblies (MLAs) and not only Members of Parliament have a vital role to play in advising on and developing state specific plans that will enable India to adapt and mitigate to the effects of climate change. MSSRF is further developing training modules for empowering women and men from every Panchayat to serve as Climate Risk Managers, thus reaching down to the most local level.

Partnership and collaboration is needed at all levels, between MPs, MLAs and Panchayat or local self government functionaries – a national and local response is needed to effectively combat climate change. While global negotiations and agreements are important, what is even more urgent is equipping local communities to face such challenges successfully. Local action must go side by side with global negotiations.

MLAs and not only Members of Parliament have a vital role to play in advising on and developing state specific plans that will enable India to adapt and mitigate to the affects of climate change.

4 Climate Change: Threat to the 'Abode of Clouds'



Thomas Sangma
Member of Parliament
&
Tanya Rana
Symbiosis Law School, Pune

The Northeast of India is a true frontier region originally comprising of seven states known as the 'Seven Sisters' (though Sikkim also joined the region later). There are about 166 tribes living in the Northeast speaking various languages which add to its beauty and diversity.

Meghalaya as a state was formed in the year 1972 with Shillong as its capital. The total area covered by the state is 22,429 sq.km. The total population of the state stands at just over 2.3 million people with the majority of people coming from three major tribes: Garo, Khasi and Jaintia.

Meghalaya's Flora and Fauna

Meghalaya has a forest cover of 8,510 sq.km. which is mostly cultivated except for patches which have been reserved for religious and cultural beliefs. The state has a unique array of vegetation as well as a large variety of fruits, vegetables, spices, medicinal plants and is best known for its orchids. Immigration and the introduction of new plants from neighbouring states and countries like China, Tibet and Burma add to rich flora of Meghalaya.

Some of the unique plants found in Meghalaya are:

Pitcher plant or the Nepenthes khasiana Hk found mostly in the Jarain area of Jaintia Hills and the Baghmara area of Garo hills. Meghalaya is the depot for 325 different species of orchids. Timber, lac and gum grown in the forest play a vital role in determining the economy of the State. Medicinal plants are grown here which help in curing and healing. The state is also known for its decorative plants and honey derived from the forests.

Some of the unique animals found in Meghalaya are:

Various mammals, birds, reptiles and insects also inhabit the state of Meghalaya like civets, mongooses, bear, deer, bats, magpie-robin, red-vented bulbul, hill myna, common green

pigeon, the blue jay, lizards, crocodiles, tortoises etc. Meghalaya also has close to 250 species of butterflies and snakes like the python, copperhead, the green tree racer, the Indian cobra, king cobra, coral snakes and vipers.

It would thus be appropriate to say that the state of Meghalaya has been bestowed in abundance by nature with vast, voluminous and extravagant flora and fauna.

Agriculture in Meghalaya

Meghalaya is predominantly an agricultural society with 81% of the population depending on it as their sole source of income. To provide market support to the farmers of Meghalaya, the State Agricultural Produce Marketing Act came into being and in 1983 the State Agricultural Marketing Board was set up. In spite of this, Meghalaya is still running short of food grains by 1.22 lakh tonnes per annum to feed a population of 2.3 million; but with only 10% of land cultivated, there is clearly space for increased agricultural output. But no 'propagandas' or 'implementations' or 'provisions' could negate the effects of transportation and communication problems, excessive rainfall, poor marketing systems or the inadequate credit support.

Meghalaya is still running short of food grains by 1.22 lakh tonnes per annum to feed a population of 2.3 million; but with only 10% of land cultivated, there is clearly space for increased agricultural output.

Issues and Impact of Climate Change on Agriculture

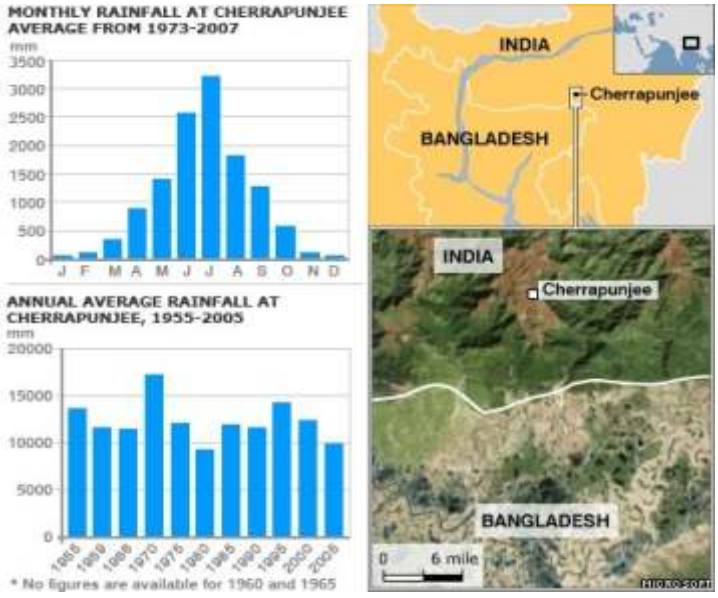
"Not without reason has Cherrapunjee achieved fame as being the place with the heaviest rainfall on earth," wrote German missionary Christopher Becker more than 100 years ago.

According to Cherrapunjee's most renowned weather-watcher, Denis Rayen, the climate of the town is changing fast. "The average rainfall at Cherrapunjee during the last 35 years has been 11,952 mm (470 inches) and there were several years when it was substantially more than this," he says. Cherrapunjee, despite being the wettest place on earth, is suffering from acute water scarcity. "Meghalaya will lose the very meaning of its name because of drastic climate change caused by global warming."

The state of Meghalaya is highly prone to the effects of climate change because of its geo-ecological tenuity, inescapable location, trans-boundary river basins and socio-economic problems. These impacts are highly dangerous for the environmental security and sustainability of the region. Natural resources have not been utilised to the fullest and as a result the state suffers from draught like situations even in monsoons and

floods which submerge vast plain areas. Precipitation patterns have changed over the last twenty years, making extreme rainfalls and floods increasingly. As a result of this, raising and reaping of crops is affected, which threatens the livelihoods of 80% of Meghalaya's population engaged in the agricultural sector.

Rightly pointed out by the environmentalists, "Rampant deforestation and global warming mean these areas are getting less rain, while the soil is not able to hold water that does arrive, environmentalists say. They say that this is not only affecting the livelihoods of hill farmers who depend on sub-soil water, but has even resulted in shortages of drinking water, particularly during winter months."



Statistical data for the average monthly rainfall at Cherrapunjee

Agricultural problems occurring due to climate change in Meghalaya:

- Due to excessive rainfall the food grains are destroyed resulting in low agricultural productivity expediting the issue of food insecurity.
- Shifting agriculture with the heavy rainfalls causes large scale soil erosions.
- Climate change and specifically floods have forced people to leave their original habitat. This internal displacement has caused a dramatic increase in environmental refugees.

Meghalaya is highly prone to the effects of climate change because of its geo-ecological tenuity, inescapable location, trans-boundary river basins and socio-economic problems.

Mehgalaya has seen a significant increase in the number of environmental refugees from Bangladesh which puts more strains on the State's resources.

Forests have been destroyed because of the drastic climatic conditions disturbing the flora/nature of the Meghalaya. It would not be appropriate to mention that a single weather event alone can attribute to climate change. There are various factors which would have to be taken into consideration while analysing the probability of a particular event affecting climate change. However, it would be apt to acknowledge that urgent attention is required for the missing policy link to control the existing situation.

Ways to combat agricultural problems:

Intergovernmental Panel on Climate Change (IPCC) predicts that due to climate change, another 40 to 170 million more people will be undernourished all over the world. If climate change is not mitigated against or adapted to, food insecurity in the state could increase and lead to increased risk of hunger and undernourishment. Possible action includes:

- Agriculture must address its contribution to the global climate change as well as try and adapt to yield reductions from floods, draughts and rising temperatures so that food security can be guaranteed.
- Conservation agriculture should be used as an alternative to shifting agriculture.
- A national authority and national legal framework upholding the rights of internally displaced persons should be created.

Furthermore the Asian Centre for Human Rights, New Delhi has appealed to the National Human Rights Commission (NHRC) to discuss and address the issue of displacement in the Northeast region.

To adapt to climate change and reduce its effects, promotion of conservation together with sustainable use of the state's endangered forests and watersheds should be a high priority. If an

It would be apt to acknowledge that urgent attention is required for the missing policy link to control the existing situation.

ambiguous legal or policy framework exists, which makes illegal logging and forest clearing easy, it must be challenged immediately.

Mining and Climate Change

Indiscriminate and sometimes illegal mining in the rich coal reserves of the Jaintia, Garo, Khasi and Mikir Hills in Meghalaya has a direct bearing on climate change. Mining has meant upsetting the ecological evolution, endangering the biodiversity, making the adjacent land unproductive, depleting the forest cover and causing air, land and water pollution – leading to serious climate change repercussions. Furthermore, these small scale mines are outside the norms related to environment and safety, laid down by the Coal Mines Act 1973.

Taking Cue from Global Experience

Climate change is causing an increased number of natural disasters and emergencies which have a dramatic affect on how people live, access sufficient food and nutrition, clean water, health and education and secure livelihoods. Especially for countries where agriculture is the main source of income for a huge percentage of population it is difficult to overcome environmental disasters quickly and effectively. However to overcome and reduce these disasters different segments of the United Nations like the International Strategy for Disaster Reduction, UNHCR (the UN Refugee Agency), and IPCC are trying to help the people at risk and those so affected by such disasters. Similar policies must be adopted by India to overcome similar disasters which are linked to the increased global warming and the climatic changes.

Climate change is causing an increased number of natural disasters and emergencies which have a dramatic affect on how people live, access sufficient food and nutrition, clean water, health and education and secure livelihoods.

Conclusion

"A combination of global warming and intensive deforestation is taking a heavy toll in this one of the most beautiful areas of India." (Denis Rayen, Weather Watcher)

In the current scenario commitment of the state government is missing. Little or no attention has been paid for the mitigation of climate changes resulting in the ignorance of people and politicians as to how to solve the problems. Therefore, to avoid

failure to value future, the first and the foremost step to be taken by the government of Meghalaya is to commit and adopt promising strategies for reducing greenhouse gas emissions. If the needed efforts are not made in time, food production will be adversely affected in Meghalaya leading to food insecurity in the state as well as resulting in the displacement of a large number of people. Considerable actions like formulation of policies, projects and programmes should be taken and timelines should be set to achieve the goals.

Ways of achieving success:

- Voluntary agreements: Agreements should be made with the target industry groups.
- Taxation: Various taxes to curb the industries draining environmental resources and polluting the natural environment should be introduced.
- Agricultural measures: The government should encourage the use of renewable energy for the purpose of carrying out agricultural activities.
- Fiscal incentives: This should be done to improve efficiency of energy and conservation.
- Afforestation and wasteland developments: There should be extensive tree plantation as well as wastelands development for productive use.

As important to achieving success in combating the problem of climate change, political will is needed at all levels so that sustainable and long term plans can be developed and implemented. Ultimately, if we all do not make the changes now, we will have to answer our children on why we did not take sufficient action in the face of overwhelming scientific evidence.

"A combination of global warming and intensive deforestation is taking a heavy toll in this one of the most beautiful areas of India."

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5 Low-Carbon Energy for All: Some Policy Imperatives

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A key question is emerging in this country as we consider the growing threat of climate change: What can be done to avert this danger within the Indian context? While the United Nations Framework Convention on Climate Change (UNFCCC) states that "the developed country Parties should take the lead in combating climate change" in these countries, the call for greenhouse gas (GHG) mitigation is still seen as a threat to their economic and social aspirations. The same view generally holds true for developing countries, but with much more justification. In fact, the UN Climate Convention gave particular emphasis, and rightly so, to the "legitimate priority needs of developing countries for the achievement of sustained economic growth and the eradication of poverty."

While India currently is the fourth largest emitter of CO_2 emissions worldwide, its total emissions in 2005 were still about 4.8 and 4.6 times smaller than U.S. and Chinese emissions, respectively. Additionally, India's per capita carbon emissions in 2005 were less than one sixteenth that of United States and about a quarter of the global average. Furthermore, India's per capita GDP (on a purchasing-power parity basis) was about one-nineteenth that of the US and a quarter of the global average. Consequently, although India is a major current emitter of greenhouse gases in the aggregate, it stands much lower than the global average and other major countries in per capita terms, – as well as in financial capabilities.

Even as the Indian government participates in global climate negotiations, and launches a National Action Plan on Climate Change, economic indicators suggest that it is premature to start considering low-carbon energy for *all* Indians at this point. While this is a goal that we should strive for in the long-term, currently technologies are not available to achieve such a goal under reasonable economic and technical performance criteria. However, I do believe that it is crucial to focus specifically on the

potential for convergence of climate mitigation and sustainable development (SD) strategies. The energy sector provides a natural arena for such a convergence. It is abundantly clear that the provision of clean and adequate energy services to all citizens, while minimizing the health and other environmental risks from energy extraction, conversion, and utilization, is a central part of the SD agenda. The interactions between the climate change mitigation agenda and the need for sustainable development, while sometimes portrayed as a possible conflict, could be positive and beneficial to the latter.

Therefore I believe that our response to climate change in terms of low-carbon energy needs to have a nuanced approach, focusing both on immediate and future objectives:

- In the short-term, we should particularly focus on areas that promote SD with climate co-benefits. Most importantly, we should focus on cleaner energy services for poorer households and rural areas. An estimated 80% of the residential energy in India still comes from solid fuels (wood, crops wastes and dung), much of it burnt in traditional chulhas. The health and social implications of this form of energy supply are enormous: the World Health Organization estimated that in the year 2000, household biomass fuel air pollution was responsible for about 400,000 premature deaths in women and young children in India alone. This health impact ranked third in India only after malnutrition and poor sanitation.

  In addition, inefficient or incomplete combustion of biomass has significant climate implications through the emissions of Kyoto GHGs and other shorter-lived pollutants that contribute to regional atmospheric heating (e.g. carbon monoxide, volatile hydrocarbons and black carbon). . Potential regional effects in South Asia include alterations in lower atmospheric heating, monsoon patterns and Himalayan glacier melting. Therefore, success in improving household combustion will have a tangible national benefit on regional climate effects. Similarly, delivery of power using decentralized renewable generation for rural areas will provide significant SD benefits as well as climate co-benefits.

While India currently is the fourth largest emitter of CO_2 emissions worldwide, its total emissions in 2005 were still about 4.8 and 4.6 times smaller than U.S. and Chinese emissions, respectively.

- For the medium to long-term, it is crucial to take advantage of low-carbon technologies emerging as a result of global research and development efforts. Rather than full advance commitment to new advances, it would be advisable to establish a strategic technology policy encompassing assessment and deployment programmes , alongside the provision for the promotion of industry around new technologies. Such an approach would be designed to link with, and leverage, global energy research and development.

It is becoming increasingly clear that avoiding dangerous climate change will require major reductions in GHG emissions, and that action on this front must begin soon. Through the use of cleaner, sustainable energy, we in India can play our part in this drive.

The interactions between the climate change mitigation agenda and the need for sustainable development, while sometimes portrayed as a possible conflict, could be positive and beneficial to the latter.

6 India's Institutional Framework for Climate Change Adaptation

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As one of the fastest growing economies of the world, India's modernisation, industrialisation and urbanisation trends in the recent years have been accompanied by increasing greenhouse gas emissions, high consumption lifestyles and increasing use of fuel for transportation, industrial and domestic purposes. The adverse effects of climate change include: weather related loss of lives, an increasing trend in infectious diseases like dengue fever, leptospirosis and chikunguniya, worsening air quality especially in urban areas, increasing incidence of respiratory illnesses and an increasing incidence of coastal and river erosion, storm surge inundation of coastal areas, and increasing coastal protection related costs.

As envisaged by the United Nations Framework Convention on Climate Change (UNFCCC), a National Action Plan on Climate Change (NAPCC) has been drawn up by the Government of India to address the concerns of climate change mitigation and adaptation during the Eleventh Five Year Plan and the Twelfth FiveYear Plan period. This National Action Plan hinges on the development and use of new technologies, with a special focus on promoting the understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation.

The strategies available for reducing green house gas emissions include:

- Increasing the efficiency of energy usage and an increase in the efficiency of energy production.
- Widespread adoption of low carbon technologies for power, heating and transportation.
- Further reduction in the demand for emission-intensive goods and services.
- Reducing deforestation.

- Instigating changes in cropping patterns in favour of less water-intensive crops increasing carbon sinks through afforestation, bio-diversity conservation, wet land management.
- Introducing coastal protection through bio-shields like mangrove plantations and shelter-belt plantations

More than 400 million people living in the coastal areas and in the catchment areas of major rivers are vulnerable to extreme weather changes and hydro-meteorological disasters. Mitigation and adaptation to climate change will have to factor in the adverse implications of climate change on the lives and livelihoods of these vulnerable communities. Furthermore, the climate change concerns related to mitigation and adaptation in the context of countries like India have to move away from technology-driven solutions to process-driven transformations which empower the marginalised and weaker sections. The quality of life of people at the margins will improve when the generation of power moves away from emission-intensive sources like coal to much less restrictive natural gas and nuclear sources.

Inter-ministerial and inter-agency coordination

Climate change mitigation and adaptation strategies must be addressed at many levels, from the Ministries and Departments of the Government of India to the public sector undertakings and State Governments, as well as other stakeholders including the corporate sector, non-governmental organisations and the community at large. The various Missions envisaged through the National Action Plan on Climate Change (NAPCC) are expected to be anchored by the respective nodal agencies mandated with the specific tasks of each of these Missions. For instance, the Ministry of Non-Conventional Energy Sources will have the prime responsibility for the Mission on Solar Power, while the Ministry of Urban Development will play the nodal agency role for the Mission on Solid Waste Management.

The National Disaster Management Authority (NDMA) set up through the Disaster Management Act 2005 as the apex body for disaster management in India, chaired by the Hon'ble Prime Minister of India, is mandated, inter alia to:

National Action Plan hinges on the development and use of new technologies, with a special focus on promoting the understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation.

- Instigate policies for disaster management.
- Establish guidelines to be followed by the State Authorities in drawing up the State Plan.
- Establish guidelines to be followed by the different Ministries and Departments of the Government of India for the purpose of integrating the measures for prevention of disaster or the mitigation of potential effects in their development plans and projects.
- Coordinate the enforcement and implementation of the policy and plan for disaster management.
- Recommend provision of funds for the purpose of mitigation.
- Take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with the threatening disaster situation or experienced disaster as it may consider necessary.

The word “disaster' is defined in the Disaster Management Act 2005 to mean a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature and magnitude as to be beyond the coping capacity of the community of the affected area.

Besides institutional mechanisms like NDMA chaired by the Hon'ble Prime Minister of India, State Disaster Management Authorities headed by the respective State Chief Ministers and District Disaster Management Authorities headed by the respective District Collectors and co-chaired by the elected representatives from the districts set up through the Disaster Management Act 2005, there are institutions like the National Coastal Zone Management Authority and State Coastal Zone Management Authorities that have been established to address the specific concerns of the coastal areas. For addressing the concerns of drought-prone states, the Government of India has also established institutions like the National Rainfed Area Authority (NRAA) under the Ministry of Agriculture.

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Institutions like the Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad, the Central Arid Zone Research Institute (CAZRI), Jodhpur, the Karnataka State Natural Disaster Monitoring Centre (KSNDMC), Bangalore in the field of agriculture and similar institutions in the field of energy like the Bureau of Energy Efficiency in the Ministry of Power and in the field of environment and forests like the Compensatory Afforestation Management and Planning Authority (CAMPA), have a role to play in monitoring the impact of climate change and in introducing mitigation and adaptation strategies in their respective domain areas.

Institutional framework for adaptation

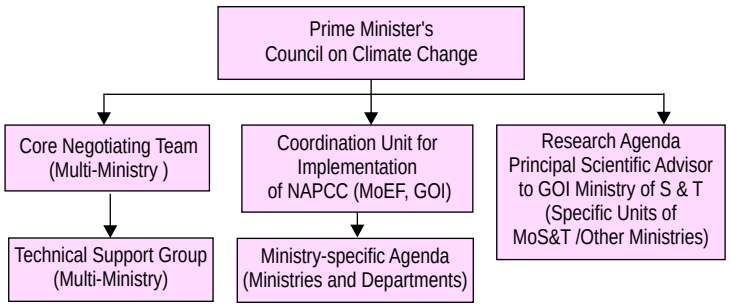
The Government of India has appointed Shri Shyam Saran, former Secretary in the Ministry of External Affairs, as the Prime Minister's Special Envoy on Climate Change (Though he has recently resigned from his position). A Council on Climate Change chaired by the Hon'ble Prime Minister of India, has been established to formulate policies on climate change mitigation and adaptation in India. The Council on Climate Change lays down broad directions for mitigation and adaptation approaches in the area of addressing the impact of climate change and provides guidance on matters relating to the coordinated action on the domestic agenda and reviews the implementation of the National Action Plan. This Council also provides guidance on bilateral and multilateral programmes for collaboration, research and development and international negotiations.

At the global consultations at Bali, Copenhagen and Poznan both Members of the Council on Climate Change and a Core Negotiating Team representing senior officials of key Ministries of the Government of India participated in the negotiations. This Multi-Ministry Core Negotiating Team is assisted by a Multi-Ministry Technical Support Group. The National Action Plan for Climate Change is coordinated by a Coordination Unit in the Ministry of Environment and Forests, which is the nodal Ministry for monitoring the Climate Change concerns in India. The Ministry-specific agenda of the concerned Ministries will be shared with the Coordination Unit for the implementation of NAPCC in the Ministry of Environment and Forests. The

The quality of life of people at the margins will improve when the generation of power moves away from emission-intensive sources like coal to much less restrictive natural gas and nuclear sources.

Research and Development Agenda is coordinated and monitored by the Principal Scientific Advisor to the Government of India in the Ministry of Science and Technology, assisted by specific units responsible for climate change concerns from other Ministries, Departments and public sector undertakings. The institutional framework for monitoring climate change mitigation and adaptation is shown in Diagram 1.

Diagram I
Institutional Framework for Monitoring Climate Change in India



A Council on Climate Change chaired by the Hon'ble Prime Minister of India, has been established to formulate policies on climate change mitigation and adaptation in India.

7 Climate Change: A Threat to National Security

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Climate change is an unambiguous security threat. That was the view expressed by US Secretary of State Hillary Clinton in her confirmation hearing in early 2009. Her testimony reflects a growing consensus that climate change will not only have ecological and economic impacts, but also poses a serious threat to global stability and security. The defence and foreign policy community in the US and Europe now sees climate change as a mainstream problem that can only be managed through climate resilient planning and a rapid shift to a low carbon global economy. This view is slowly beginning to gain traction in India too.

Climate change poses a real and significant threat to India's security. Projections show that the Indian subcontinent will be disproportionately affected by unchecked climate change, with retreat of the Himalayan glaciers, changes in the monsoon pattern and sea level rise just some of the anticipated consequences. It will turn things that have been taken for granted – such as reliable river flows, stable coastlines or fertile land – into scarce resources and therefore potential sources of conflict. Climate change will affect the security of both states and people alike, undermining efforts to meet the Millennium Development Goals, and acting as a 'threat multiplier' exacerbating existing weaknesses and tensions around the world. We ignore it at our peril.

Increased competition in a resource stressed world

Competition for scarce and unevenly distributed resources will increase as the world population rises by 2.5 billion people by 2050. Climate change will further compound this scarcity problem.

In India, water is likely to be one of the resources most under pressure. Himalayan glacial melt and intensification of the monsoon rainfall are expected to increase seasonal flooding and

droughts, and reduce summer melt-flow, severely increasing water insecurity for the hundreds of millions of people that depend on the Ganges, Brahmaputra and Indus rivers. India's major rivers are shared with less stable neighbours, including Pakistan, Bangladesh and Nepal. Possible responses to water stress, such as upstream dams and water storage, are only likely to exacerbate both internal and cross-border tensions, and put additional pressure on water sharing treaties between India and its neighbours. The significance of water in regional politics should not be underestimated: President Zardari of Pakistan recently warned that failure to resolve current water disputes between India and Pakistan "could fuel the fires of discontent that leads to extremism and terrorism". Although the existing water sharing treaties in the region have been remarkably resilient to date, climate change threatens to make water disputes even more divisive as each state seeks to ensure water security for its own people.

Access to energy resources will also be affected by climate change. As the planet warms, existing energy infrastructure will become more vulnerable, increasing the risk of disruption of supply and global volatility in energy markets. A changing climate also raises questions around ownership of oil and gas. The melting of the north polar sea ice has already started to shift the geo-politics of that region. The Russian's planting a flag on the seabed in the Arctic and the Canadian Navy commissioning six new icebreakers demonstrate that even before the significant impacts of climate change are felt countries are taking action to protect their interests. For India, climate change may also generate new international legal disputes over energy resource rights, particularly in the Bay of Bengal where changing coastlines may engender maritime boundary disputes.

Climate refugees

Climate change will result in widespread food insecurity in India. Increased temperatures will reduce agricultural yields, and reduce fish stocks, stretching India's capacity to feed her own population, increasing the already significant numbers living in hunger and reversing efforts to lift millions out of poverty. Food insecurity, along with sea level rise, extreme weather events, and human insecurity will lead to climate induced migration both

> The defence and foreign policy community in the US and Europe now sees climate change as a mainstream problem that can only be managed through climate resilient planning and a rapid shift to a low carbon global economy.

internally, and across international boundaries. The greatest cross-border flows of migrants into India are likely to come from Bangladesh where sea level rise will push millions from their homes, and from Pakistan, where reduced rainfall and river flows are expected to result in drought and hunger. Growing flows of migrants into and within India threaten to change the social fabric of many receiving cities and states, exacerbate existing ethnic and religious tensions, and increase the risk of terrorism and extremism.

The case of the Maldives, the very existence of which is threatened by climate change, also throws up complex questions for India and her neighbours. President Nashid of the Maldives has said "We can do nothing to stop climate change on our own and so we have to buy land elsewhere. We do not want to leave the Maldives, but we also do not want to be climate refugees living in tents for decades". The notion of the Maldives purchasing land to create a new homeland in another sovereign state – most likely India or Sri Lanka – raises new questions and challenges about territoriality and nationhood that the international system has yet to come to terms with.

Losing control

The global picture will be uneven, but many countries will be hit by multiple chronic conditions. Crucially it is the poorest citizens in the most vulnerable countries that will be worst affected, as their governments struggle to cope the impacts of climate change. Climate resilient development and adaptive strategies may be able to limit some of the worst human security impacts; however, these strategies alone will not be sufficient to ensure stability. In fragile states, repeated shocks and chronic changes to fundamental resources will weaken the grip of consensually elected governments on power, foster the conditions for internal conflict and extremism – and lead to breakdown in the rule of law. While India may be able to maintain internal stability, increased insecurity in the fragile states on her borders poses a major security threat. Furthermore, even countries which are stable, with strong governance and civil societies do not always cope very well with shock events. The recent extreme weather events in developed countries (such as hurricane Katrina, flooding in Europe and fires in Australia) illustrate the strain that such events place on civil response mechanisms.

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Policy response

India's security is predicated upon regional and international stability. Climate change should therefore be recognised as a serious national security threat. The past few years have witnessed a mainstreaming of climate change into defence and foreign policy debates in Europe and the US, as illustrated by Hillary Clinton's remarks at her confirmation hearing, and the 2008 US National Intelligence Assessment on the Security Implications of Climate Change. There is now a strong consensus among this community that the only viable way to manage the climate threat is to stabilise and reduce greenhouse gas emissions.

Hard security solutions will not solve the underlying causes of climate change, nor ultimately be successful in protecting states from its impacts. No country has the defence or security capacity to contain the magnitude of the threat. Failure to prepare for the worst case scenarios is as dangerous as failing to prepare for the risks of nuclear proliferation and terrorism. The only realistic means of limiting the security implications of climate change will be to work with our international partners to undertake an urgent transition to a low carbon economy. Although we cannot stop climate change entirely, a global shift to a low carbon development path offers the best chance of stabilising global emissions and preventing the worst impacts of climate change in India, South Asia and globally.

"We can do nothing to stop climate change on our own and so we have to buy land elsewhere. We do not want to leave the Maldives, but we also do not want to be climate refugees living in tents for decades."

8 Climate Change and Millennium Development Goals*

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The critical threat to human existence on Earth is climate change. To mitigate the risk of climate change and adapt to the consequences of floods, changing rainfall patterns and glacier melt, global cooperation and sustained action must take place at an unparalleled scale and pace. Climate change is intrinsically linked to the issues of poverty reduction and the Millennium Development Goals (MDGs). Achievement of MDGs on one hand will effectively facilitate interventions to reduce impact of climate change, while it may be undermined if climate change is not addressed effectively on the other.

When developing global agreements on climate change, the MDGs and poverty reduction must be central to all policy decisions. Inequalities in the levels of development across and within nations and the requirement for growth to realize the rights of the poor remain important to both developing and developed nations. Unless these commitments are met, a global agreement on climate change will remain obscure. There would be a significant erosion of trust between developing and developed nations.

Historically, having emitted more carbon dioxide into the atmosphere, the industrialized nations have a greater responsibility for climate change in comparison to the poorer countries. The degree of responsibility and commitment that the rich countries shoulder should be commensurate with this legacy. It is imperative that they take immediate steps to implement deep emission cuts, fulfil their aid commitments to achieve the MDGs, provide additional aid for adaptation measures, facilitate and transfer sustainable technology and create incentives for poor countries to limit their emissions while safeguarding their right to development. In a similar vein,

*The article is based on Seal a Just Deal – The MDG Path to Climate Change Solution, (Published by UN Millennium Campaign) www.endpoverty2015.org

the poorer countries must integrate climate change initiatives into national MDG-based sustainable development plans and prioritize renewable energy resources while ensuring the rights to land, forests, water, food, energy and livelihood for the most marginalized and socially excluded people.

An estimated 600 million or more people in Africa stand to face malnutrition as agricultural systems break down.

An additional 1.8 billion people could face water shortage, especially in Asia.

A person living in a developing country is 79 times more likely to be hit by a climate disaster than someone from a developed country.(Ref)

Climate Change – Relation to MDGs

Climate change can be seen both as a threat and opportunity in relation to the MDGs. We will be judged by our children on how we did or how we did not collectively heed to the warning signs of nature and make lasting changes which mitigated climate change and adapted to its consequences.

The physical impacts of climate change, the decline in availability of water and, agricultural productivity, increased drought and extreme weather conditions will have major social, economic, political and cultural consequences. This in turn will bring about migration and displacement of populations and lead to problems of unemployment and conflict over scarce resources like water, fuel and food, which inevitably lead to political instability.

However, if climate change is to be tackled thoughtfully, sustainably and thoroughly, the actions designed to tackle climate change should facilitate the achievement of MDGs. Execution of well designed policies can help alleviate poverty, provide employment opportunities, and increase time for productive engagement by reducing the time consumed for energy provision.

If climate change is to be tackled thoughtfully, sustainably and thoroughly, the actions designed to tackle climate change should facilitate the achievement of MDGs.

Developing countries are already taking substantial actions to reduce emissions growth:

- In Argentina, 10 percent of the automobile fleet runs on compressed natural gas.
- India has implemented natural gas use for heavy vehicles in its major cities and for most of New Delhi's public transport system.
- China reduced its emissions in absolute terms by 19 percent between 1997 and 2000. (EIA 1999).

MDG 1 – Eradicate Poverty and Extreme Hunger

The successful eradication of poverty and extreme hunger is threatened by climate change because changes in the natural systems can lead to increased water scarcity and decreased crop yield and therefore to food insecurity and hunger. Adverse effects on resources, infrastructure, and labour productivity may lead to reduced economic growth.

The challenges posed by climate change encourage governments to focus on the economic needs of the poor. Access to clean and abundant water resources and secure employment that underpin the solution to extreme poverty and hunger are crucial to face climate change. Steps taken to prevent the negative consequences of climate change such as clean energy projects and forest enhancement could result in employment opportunities.

The challenges posed by climate change encourage governments to focus on the economic needs of the poor.

MDG 2 – Achieve Universal Primary Education

Climate change can hamper the achievement of achieving universal primary education. Children may not be able to participate in full time education as decline in means of livelihood require children to engage in income generating activities. Displacement and migration of families and extreme weather conditions would mean lack of access to schools. Limited income may lead to discrimination whereby only the boy child might be favoured against the girl child.

However efforts to mitigate climate change could facilitate the ability of children to participate in full time education by reducing the time children spend on energy provision (e.g. collecting firewood) and also by providing solar lighting for

educational activities. As primary education may seem costly in the face of loss of livelihood due to climate change, the state could be encouraged to run government schools efficiently and at minimal cost. Furthermore, through child centred disaster risk education, schools can be designed and developed to adapt to climate change and floods so that even when disaster strikes, interruption to education is minimal.

MDG 3 – Promote Gender Equality and Empower Women

Climate change would also slow down the achievement of gender equality and empowerment of women. Women are the ones put most at risk by climate change since they are the primary users and managers of natural resources, primary caregivers, and unpaid labourers. Depletion of natural resources would place additional burden on women's health, increase their work load, limit their participation in decision making and income-generating activities and exclude them from access to scare resources in favour of men.

Depletion of resources → loss of income → poverty→ lack of education and awareness→ preference to male child→ gender inequality in education→ gender inequality in gainful employment→ male child preference →discrimination against the female child in all spheres.

Efforts to promote the use of cleaner fuels could promote gender equality by reducing the time spent by women on energy provision (e.g. collecting firewood) thereby giving them time to participate in full time education and creating gainful employment for them.

Measures for enhancement of natural resources → opportunity for income generation → poverty alleviation → improvement in education and awareness → reduction in gender bias → gender equality in education→ gender equality in gainful employment

Depletion of natural resources would place additional burden on women's health, increase their work load, limit their participation in decision making and income-generating activities and exclude them from access to scare resources in favour of men.

MDG 4 – Reduce Child Mortality; MDG 5 – Improve Maternal Health; and MDG 6 – Combat HIV/AIDS, Malaria and other diseases.

Climate change also results in increased child mortality, poor maternal health, spread of malaria, deterioration of nutritional health, and increase in the number of people infected with HIV/AIDS. The causes are interconnected. When gender inequality increases as a result of and poor education access and lack of empowerment, male child preference escalates leading to higher frequency of pregnancy which affects maternal, infant and child health.

Climate change related disasters are also on the rise and this has a direct effect on access to health services. For example, in a flood situation or other crises related to natural disaster, institutional delivery reduces as there may not be easy access to hospitals. In such cases it is crucial that community health workers are trained in home based techniques so that they can deliver the baby safely and risks to both mother and child are identified and treated. Training community health workers dramatically reduces child and maternal mortality and is especially important to deal with the consequences of climate change.

Depletion of rural natural resources (agricultural land, water) → migration → overcrowded urban slums → pressure on urban resources → problems of housing, sanitation, drainage, healthcare → various air and water borne diseases

MDG 7 – Ensure Environmental Sustainability

Climate change threatens to alter ecosystem relationships and change the quality and quantity of available natural resources. The poor in developing countries are highly dependent on natural resources for their survival.

Efforts to mitigate climate change could be geared towards promoting environmental sustainability, by maintaining and enhancing forests, protecting the biodiversity found in forests and substituting non-renewable fuel sources with renewable ones (e.g. solar energy).

Climate change threatens to alter ecosystem relationships and change the quality and quantity of available natural resources. The poor in developing countries are highly dependent on natural resources for their survival.

MDG 8 – Global Partnerships for Development

Increased conflicts over resources lead to a break down in global cooperation in trade and assistance, and high adaptation and mitigation costs expand the debt burden of developing countries.

Measures against climate change should improve global partnerships through the funding of climate change objectives, deepened cooperation on research, and development and transfer of clean energy technologies cooperation.

Potential Solutions

Adaptation and mitigation

Adaptation is defined by the United Nations Framework Convention on Climate Change as any adjustments in behaviours or economic structures that reduce the vulnerability of society to changes in the climate system. Adaptation has the potential to reduce adverse impacts of climate change and enhance the beneficial impacts. As such, adaptation measures will require as a foundation the achievement of basic standards of development, and at minimum the achievement of the MDGs.

Adaptation measures will require as a foundation the achievement of basic standards of development, and at minimum the achievement of the MDGs.

Climate change mitigation constitutes measures or actions to decrease the intensity of radiative forcing in order to reduce global warming. Mitigation involves acting to minimize the effects of global warming. Solution for climate change and the MDGs and the policies for mitigation will need to be designed with development aims and objectives at their centre.

First, for purposes of adaptation, both developed and developing nations must make the achievement of MDGs their priority. This will only be possible if the developed nations meet aid commitments.

Second, developed countries must realize their historical responsibility towards greenhouse gas emissions and make significant cuts in their emission targets.

Third, mitigation policies for development of clean fuels and the maintenance and enhancements of forests must be designed to support the achievement of MDGs in developing countries.

Fourth, agreements on climate change must be based on certain principles, i.e., funding for climate change should not draw on funds set aside for MDGs; financing must be predictable and sustainable; adaptation decisions, actions and funding must be made transparent and accountable.

Fifth, UNFCCC Adaptation Fund should be viewed as the primary source for adaptation expenditure.

Conclusion: It is important that this year (2010) being the MDG Summit where review of last 10 years will be undertaken by world leaders and a resolution to accelerate achievement of MDGs in remaining five years will be pronounced, Parliamentarians all over the world hold their respective governments accountable to develop coherent policy frame works based on MDGs and to address issues emerging from the quad crises of Climate Change – Finance, Food and Fuel.

Solution for climate change and the MDGs and the policies for mitigation will need to be designed with development aims and objectives at their centre.

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9 Climate change and the importance of the 'last' woman

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Is climate change a science? Or, is it about political responsibility? Climate change is actually about people. Because human beings cause rapid climate change, they find ways to adapt to it and they are responsible for reducing their carbon emissions. Perhaps this is why, concerned over the rapidly changing climate in the world and in the Indian sub-continent, all major political parties in India included climate change in their 2009 Parliamentary election manifestos. These political parties argued over many issues but were united on the need to tackle climate change.

There is little doubt today about the science of climate change. The 2007 United Nations Intergovernmental Panel on Climate Change (IPCC) data shows that disasters in India, already the world's second-most disaster-prone country, will become more unpredictable, frequent and intense. Cyclones, for instance, will become less frequent but more intense. There will be extreme weather events, erratic rainfall patterns and varying temperatures, all of which will adversely affect the country's predominantly rain-fed agriculture. India's National Action Plan on Climate Change (NAPCC) lists the observed changes in climate and weather events in India and also gives projections of climate change over India for the 21st century. Already, for instance, due to the rising temperatures in the Himalayas, the apple growing belt in the mountainous state of Himachal Pradesh has shifted higher up, which has left people in lower villages with no means to earn for themselves and their families.

Inequalities and climate change

India is an 'emerging economy,' predicted to become a middle income country within 5 years. Yet, it is still home to the world's largest number of poor, malnourished and illiterate people. With a young population to sustain, India's elected leaders face the challenge of either closing this widening gap, or ruling over a country of two classes – the few 'haves' and the large number of 'have-nots.'

Our legislators are well aware that economic inequalities reflect inequalities in access to adequate food, drinking water, decent housing, education, proper healthcare, etc. Climate change will make matters worse, especially for the vast number of our poor and socially marginalised women and men who do not have the wherewithal to cope with changes. The NAPCC notes how climate change will adversely impact all of the above – losses in the Rabi crop, a decline in total run-off for all except two river basins, sea level rise, increasing spread of vector-borne diseases, loss of forests and biodiversity and vulnerabilities to increased climate-induced recurring disasters and weather extremities. India will not achieve its Millennium Development Goals in this scenario unless Parliamentarians strive to make a difference.

Climate woes and simple solutions

"After Jaisalmer in Rajasthan, Anantapur district in Andhra Pradesh gets the least rainfall in India. We are used to living with droughts which, 20 years back, came every two years or so. But now the changing climate has allowed farmers to take only two crops in the last 15 years. Ground water levels have depleted, we now dig 300-500 feet deep to get to the water table. Desertification has eaten up our farm lands. Government records show that about 50 farmers commit suicide every year during the last 12 years. One-tenth of these are women but the government does not recognize women as farmers and so their families have never got any compensation. Worse, the last 15 years have given rise to trafficking of women and girls as a means to survive the persistent droughts."

"With the help of an NGO, we recently started using local seeds and bio-fertilisers and bio-pesticides. This has returned some nutrients to the soil. Our people's organisation has signed an agreement with the authorities to use NREGA to build farm bunds and water trenches to harvest rainwater. In several villages this has helped re-green village forests, increase the rainwater catchment area and raised the water table. Families now have more incomes and more food in their homes. Tribal and the dalits living off forest incomes by collecting forest produce have also benefited and now have usufruct, or usage, rights over these forests. All this has, in turn, brought down distress migration and reduced school drop-out rates."

C. Bhanuja, *40, a small woman farmer in village Kadri.*

Equity and political responsibility

Political responsibility is a double-edged sword. Politicians need to ensure both inter-country and intra-country equity. India has justifiably 'turned the heat' on the rich of industrialised nations to take deep carbon emission cuts in line with the accepted 'polluter pays principle.' Politicians now need to apply the same principle across India. The NAPCC is a good starting point for the interface

India will not achieve its Millennium Development Goals in this scenario unless Parliamentarians strive to make a difference. Political responsibility is a double-edged sword. Politicians need to ensure both inter-country and intra-country equity.

of political responsibility and people. Politicians must ensure that the NAPCC delivers bahujan hitay, bahujan sukhay, (rights and welfare of the masses), the cornerstone of all democracies.

The NAPCC recognises the need to adopt a low-carbon development pathway that will help mitigate India's own emissions in the medium to long term. Yet, the eight national missions within the NAPCC fall short of addressing the rights and concerns of one-third of our population – the faceless, voiceless poor and socially marginalised people who are affected the most by climate change and yet are not responsible for the accumulated emissions.

For example, the energy efficiency mission of the NAPCC focuses on the industry sector and market-based solutions. There is no focus on the needs of a significant number of the poorest and most marginal women and men who primarily use fuel-wood and crop waste in a most inefficient manner to cook barely two meals a day. The 'polluter pays principle' is turned on its head with the polluting industry being offered financial support and incentives to pollute less while the mission offers no support and incentives to non-polluters to adopt better and more efficient energy sources.

Again, the sustainable habitat mission is primarily urban-focused when 6 out of 10 people still live in villages. The sustainable agriculture mission promotes GM crops which cannot promote sustainability of our natural resources – GM crops fail to return nutrients to the soil to keep it fertile, do not reduce water usage and demand chemical inputs that emit greenhouse gases when they are manufactured and transported. Many of the legislators are well aware of the several on-the-ground experiments across states - and some specific state policies as in Andhra Pradesh and Himachal Pradesh – which prove that low chemical input agriculture using bio-fertilisers and bio-pesticides [1] promotes sustainability of the soil; [2] boosts yields of cash and food crops; [3] allows for mixed cropping and agro-forestry thereby reducing the risks of weather shocks; [4] increases farm incomes; [5] and conserves water and biodiversity. All these help small and marginal farmers, who constitute 80% of India's farmers, adapt more easily to the varying temperatures and erratic rainfall patterns.

It is time our elected leaders change the paradigm of agriculture and take charge of combating climate change, poverty (including malnutrition) and environment degradation with one stroke.

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Conclusion

If every elected representative can use the poverty lens to look at climate threats and lack of development locally, then we would find it easier to tackle the 'two India' phenomenon in our country. Perhaps Parliamentarians have this opportunity to adopt the approach of 'Munnabhai' and make Mahatma Gandhi relevant to building a post-modern India. Gandhi's two dictums - address the concerns of the 'last man (or woman)' and acknowledge that 'there is enough for everyone's need but not for everyone's greed' – can form the guiding principles for framing mitigation and adaptation policies and practices, and earmarking enough additional resources to these. This could mean, for example:

- Re-orienting corporate social responsibility to also address rights of people and not just see them as beneficiaries;
- Partner with the private sector and also with NGOs and community-based organisations by redefining the Public-Private-People (PPP) principle; and
- Adopt a publically accountable manner of governance.

Ultimately, climate change will affect people and people alone can reverse it. Legislators can take the lead to ensure that:

- The low carbon growth path is inclusive,
- Enough investment is made in adaptation and
- Adaptation measures and development work complement each other.

Politicians have been big and bold in responding to the financial crisis. They need to act bigger and bolder on climate change before it's too late.

If every elected representative can use the poverty lens to look at climate threats and lack of development locally, then we would find it easier to tackle the 'two India' phenomenon in our country.

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10

Climate Change and Orissa: Issues, challenges and adaptation

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Even as the debate around the latest storm that ravaged some coastal Orissa villages is still making the rounds, Orissa's infamous title of 'Disaster Capital of India' is being confirmed by each passing year. The state has been declared disaster-affected for 95 years out of the last 105 years: floods have occurred for 50 years, droughts for 32, and cyclones have struck the state for 11 years. Since 1965, these calamities have not only become more frequent, but they are striking areas that have never experienced such conditions before. For instance, a heat wave in 1998 killed around 2,200 people, with most of the casualties from coastal Orissa, a region known for its moderate climate.

Besides the disasters that strike the state with frightening frequency, the change in the state's climate is stark. Orissa's status as living proof of the effects of global warming continues to be debated, yet there is certainly evidence of unusual changes taking place, with far-reaching consequences. The 1999 super cyclone, mother of all recent disasters, affected places like Bhubaneswar and Nayagarh, which were never traditionally cyclone-prone. While the 2001 drought parched fields in coastal districts, the floods of 2001 submerged 25 of the state's 30 districts, many of which had never witnessed floods before.

A conservative study of the effects of natural disasters reveals that between 1963 and 1999, Orissa experienced 13 major disasters, killing 22,228 people) and rendering 34,21,000 people homeless. During the Ninth Plan period (1997-2002), Orissa was hit by a series of disasters, and on the eve of the Tenth Plan (2002-03), the entire state was going through a severe drought. The Government of Orissa's Tenth Five Year Plan document sets the total loss of livelihood and damage to capital stock due to calamities between 1998-99 and 2001-02 at Rs 13,230.47 crore. This accounts for almost 60% of the state's total plan outlay of Rs 19,000 crore.

The impact of disasters on Orissa's economy is evident. in the state A significant fallouthas been the serious setback suffered by the capital formation process. Consequently, the state's Gross Domestic Product (GDP) has been substantially depressed, says the State Human Development Report of 2003. What is more, during the second half of the 1990s, the most severe period of disasters, the state's per capita income declined rapidly, and is now half the national average. Every year, an average of 900,000 ha of agricultural production are lost due to disasters, with agriculture's contribution to the state GDP falling by 16% between 1980 and 2000.

Such disasters have resulted in a type of poverty known as 'conjectural poverty'. Vaidyananth Mishra, an Orissa-based economist, says: “Disasters have made Orissa the poorest state. What is more disheartening is that nobody cares to study this.” The State Human Development Report of 2003 confirms that in 30 years the average annual loss due to disasters has increased 27-fold. While the average cost of property lost and damaged during the 1970s was reported at 14.18 crore per year, it rose to 67.33 crore in the 1980s and to an enormous 383.5 crore per year in the 1990s.

There is now sufficient evidence to show that the state's ecology and weather conditions have undergone a dramatic change. Some scientists and climatologists believe that Orissa's frequent extreme weather conditions are a dress rehearsal for the meteorological mayhem that climate change, induced by global warming, will cause on the earth.

On the other hand, the state's ecological degradation could well be facilitating the global impact. Its people have been experiencing odd phenomena in the climate not seen by past generations. Orissa's seasons have vanished from six to two and a half, its trees have altered their flowering habits,its animals have changed their mating season and its birds have changed nesting habits. And the list goes on, whether there is a direct link in Orissa between climate change and natural disasters is still being debated, and owing to the scant amount of research being carried out, a conclusion appears no nearer. However, on a global scale it is now a widely accepted science. The severity and

Orissa's status as living proof of the effects of global warming continues to be debated, yet there is certainly evidence of unusual changes taking place, with far-reaching consequences.

increasing frequency of disasters, coupled with the contrasting weather conditions, arguably confirm that Orissa, the disaster capital of India, is becoming a climate's playground.

However, amidst the gloom there remains some hope, nurtured by its resolute communities, chiefly in poor and remote pockets. Take for example the Padiabadmal village in Jujumura Block of the Sambalpur District. The region is now synonymous with drought, despite boasting some of the most successful examples of drought proofing just a century ago. Nevertheless, this village has, through systematic ecological planning, revived some of its traditional water harvesting structures and systems to win the fight against drought. Supported by an NGO, Manav Adhikar Seva Samiti (MASS), they reversed the process of desertification with a low cost and community driven approach, in just five years. A village which had been suffering an exodus of people looking for outside jobsnow tills its own lands again and is known in the local area as the 'Maximum Village'.

We at Water Initiatives Orissa (WIO) had recently warned that if the blind path of industrialisation is not stopped, Orissa may well be a desert within 150 years! It is time the policy makers recognize the importance of such low cost people-driven systems of adaptation while preparing plans to combat climate change.

Disasters have made Orissa the poorest state. What is more disheartening is that nobody cares to study this.

11

Sustaining Agriculture and Agriculture Based Livelihoods in the Era of Climate Change

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Climate change (CC) is already a reality for the majority of Indian farmers. These farmers are being forced to adapt to several CC-related changes by themselves because they have no other choice. For no fault of theirs, Indian farmers, like the most marginalised everywhere, are paying a high price for anthropogenic climate change. The worst-hit, as usual, are small and marginal holders in marginalised locations with social disadvantages to begin with. Such farmers have meagre resources to buffer them from the new risks that climate change poses.

Although the agriculture-related Greenhouse Gas (GHG) emissions cannot be equated in any manner with lifestyle-related GHG emissions, the promotion and establishment of sustainable agriculture is vital for the mitigation of GHGs. Sustainable agriculture practices are therefore a win-win option where mitigation cannot be interpreted as an obstacle to equitable and just growth. These practices contribute to increased food security, sustainability of productive resources, and improvements in rural livelihoods.

Climate change and agriculture in India

India is a large country with 15 agro-climatic zones, and diverse seasons, crops and farming systems; for a majority of people in India agriculture is the main source of livelihood. Due to its inherent sensitivity to climate variability, agriculture is vulnerable to climate change, and impacts will be felt in a variety of direct and indirect ways, affecting the lives and livelihoods of millions of Indians.

For instance, about two-thirds of the sown area in the country is drought-prone and around 40 million hectares are flood-prone.

The poorest people are likely to be hardest hit by the impacts of climate variability and change because they rely heavily on climate-sensitive sectors such as rainfed agriculture and fisheries. They also tend to be located in more exposed or marginal areas, such as flood plains or nutrient-poor soils. Moreover, the poor are less able to respond due to limited human, institutional and financial capacity and have very limited ability to cope with climate impacts.

Impacts of CC on agriculture: Rainfall data analysis shows regional variations as well as increased rainfall during summer and reduced number of rainy days. While there has been a 0.6°C rise in the temperature over the last 100 years, there is projected to be a rise by 3.5-5° C by 2100. The carbon dioxide (CO_2) concentration is increasing by 1.9 ppm each year and is expected to reach 550 ppm by 2050 and 700 ppm by 2100. Extreme events like frequency of heat and cold waves, droughts and floods seem to be increasing in frequency over recent years. The sea level has risen by 2.5mm every year since 1950 while the Himalayan glaciers are retreating. These effects are all symptomatic of climate change.

Available research indicates that climate change-induced rises in temperature are going to affect rainfall patterns – farming in India depends on monsoons and there is a close link between climate and water resources.

Predicted surface air temperature rises will seriously impact crop yields; every 1°C increase in temperature reduces wheat production by 4-5 million tons, as per a study by Indian Agriculture Research Institute (IARI). However this loss can be reduced to 1-2 million tons if farmers change to timely planting. Exacerbated climatic extremes like droughts and floods are likely to increase production variability. Productivity of most cereals will also decrease due to increases in temperature and decreases in water availability, especially in the Indo-Gangetic plains. The loss in crop production is projected at 10-40% by 2100, depending upon the modelling technique applied.

Impacts of agriculture on Climate Change: While climate change has adverse effects on Indian farming and farmers' livelihoods, the converse is also true – Indian agriculture, even if

India is a large country with 15 agro-climatic zones, and diverse seasons, crops and farming systems; for a majority of people in India agriculture is the main source of livelihood.

not in the same degree as the developed world's agriculture, also contributes towards Climate Change.

For instance, CO_2 is released through agriculture by the burning of crop residues and fossil fuels, methane is emitted through agricultural practices like inundated paddy fields, and nitrous oxide (with a global warming potential 296 times greater than CO_2) is released during the production and use of fertilizers. In India, it is estimated that 28% of the GHG emissions are from agriculture, which accounts for about 78% of methane and nitrous oxide emissions.

Potential of sustainable agriculture as low-GHG, resilient farming systems

Sustainable Agriculture can be defined as an integrated farming system (with crops, trees, livestock etc.) which is based on locally adapted agro-diverse cropping patterns and use of local resources (natural resources and natural processes), based on local knowledge, skills and innovations. Organic farming, organic agriculture, sustainable agriculture, ecological farming interchangeably, has this holistic concept in mind while using these various terms

Food security: A question that is often posed with regard to sustainable agriculture or organic farming is whether it will be able to feed the growing population. However sustainable agriculture does not necessarily imply lowered yields. This is reinforced by a Food and Agriculture Organisation (FAO) report of 2007 which says that "conversion of global agriculture to organic management, without converting wild lands to agriculture and without using N-fertilisers would result in a global agricultural supply of 2640 to 4380 Kcal / person / day". A meta-analysis of 133 scientific papers concluded that organic agriculture was particularly competitive under lower yield environments, a feature common in developing countries.

Organic Farming Methods: Changes in farming models and practices towards sustainable agriculture offer a significant opportunity at reducing GHG emissions. Organic farms use on average 33 to 56 per cent less energy per hectare, as per FAO (2007).

While climate change has adverse effects on Indian farming and farmers' livelihoods, the converse is also true.

Organic farming reduces fossil fuel dependence in many ways. Rather than chemical fertilizers, soil productivity management, internal inputs and other practices are used to achieve optimum yields. Returning bio-mass to the soil, legume production, crop rotation, mixed cropping etc., are other ways of achieving this. Pest management can also be pursued through a variety of local resources and practices rather than chemical pesticides. Moreover, organic farming can require 30-50% less irrigation than non-organic farming - a potentially vital adaptation in drought conditions.

Another farming practice, the System of Rice Intensification, reduces flooding in rice paddies, and thereby, methane emissions, and can replace chemical fertilizers with decomposed biomass.

Sustainable agriculture also increases the Soil Organic Carbon (SOC) by incorporating organic materials into the soil. The quantity of carbon stored in the soil is about double that of the carbon in the atmosphere. Fertiliser use replaces soil organic matter, reducing potential sequestration. Crop, tree and livestock integration with a systematic recycling of organic wastes is an integral part of sustainable agriculture.

Creation of resilient systems leading to better adaptation: Increases in extreme and unpredictable weather conditions, as well as natural disasters such as floods and droughts, are attributable to global warming. Changes in rainfall, pest and disease incidence etc., will also require resilient and adaptive farming systems with the least amount of loss to the productive resources, production and the farmer.

Potential of Organic Farming beyond purely agricultural technologies: Organic farming often focuses also on consumer behaviour and encourages lower ecological footprints through localized food production and consumption and the reduction of 'food miles'.

Despite those adopting organic farming techniques being at a disadvantage due to lack of support systems in the form of extension, marketing, grassroots institutions etc., this type of sustainable farming is already being practised successfully in lakhs of hectares across the country.

Changes in farming models and practices towards sustainable agriculture offer a significant opportunity at reducing GHG emissions.

The Community Managed Sustainable Agriculture (CMSA) in Andhra Pradesh is an example of a large government-supported sustainable agriculture project, in which women farmers are taking a lead in implementing a large ecological farming project on more than ten lakh acres. This project has found that it is possible to scale up organic farming onto large areas, with sensitive support systems built along with people's institutions at the village level. The CMSA programme, being implemented since 2005, has shown that farmers do tend to adopt and spread ecological practices at a rapid pace provided they are collectivized into village-level institutions and that appropriate extension support is given. In the CMSA project, available data shows that there has been no fall in yields for farmers shifting to organic farming and that village economies stand to gain considerably due to lower expenditure on external inputs leading to increased net incomes of individual farmers.

India's national mission on sustainable agriculture

The Indian Government announced a National Action Plan on Climate Change (NAPCC) in August 2008, part of which is National Mission on Sustainable Agriculture (NMSA). The NAPCC's formulation processes have been criticised as very top-down and non-participatory by many analysts. Moreover, there are a number of more specific critiques to the NMSA:

- Creating the imperative for the paradigm shift: The NMSa should clearly specify incentives to farmers for shifting to organic and sustainable farming practices.
- Policy approach: Strategies should be evolved for a time-bound phasing out of climate change-inducing practices towards sustainable agriculture with clear targets and financial outlays.
- Biotechnology: There is a greater emphasis on Genetic Engineering to develop climate resilient crops in NMSA.
- Land to lab' programmatic interventions: Rather than a 'top-down' approach to sustainable farming, there is a need for solutions discovered from the farms, after proper assessment and validation, to be effectively disseminated. Time-tested practices and experiences of certain sustainable agriculture principles and practices from the ground can be used to build resilient farming systems.

The NAPCC's formulation processes have been criticised as very top-down and non-participatory by many analysts.

There is an overwhelming need for immediate programmatic interventions drawing on the strength of farmers' traditional knowledge, resources, experiences and innovations.

- Traditional knowledge and resources: A central component in the adaptation of agriculture to climate change must involve the promotion of traditional knowledge and resources as a cornerstone of sustainable agriculture. These traditional practices can be supported by innovations in the organic farming.

  Indigenous resources (seeds, animal breeds etc.), which have proven track record of adaptation to stress conditions, must be maintained, and where necessary, returned to. The Plan should also make seeds, as replicable resources in the hands of farmers, institutionalised the form of seed banks to form a major thrust and strategy for adaptation.

- As part of the NMSA, there should be a mechanism to track and monitor genetic erosion due to climate change.

- Centre-state relations: State governments should be involved in consultations and planning right from the beginning. For instance, seed rolling plans need to be evolved by each state, with an emphasis on the revival and restoration of open-pollinated, traditional and locally-adapted varieties.

- Public-people' partnership: Similarly, civil society and its institutions should also be involved in planning and implementation related to the NMSA. The stress should be on public-people partnership in the Plan. There is a need for renewed thrust on public research in partnership with communities.

- Risk management: There is a need for a complete recasting of the existing models and mechanisms of risk management. We need new mechanisms to assess damage and loss and better ways to deliver support, including weather insurance, livestock insurance and effective crop insurance.

- Social safety nets: As part of adaptation strategies, strong social security nets should be put in place for rural households, with a provision of minimum income, pension, insurance etc., and a special emphasis on agriculture workers.

Civil society and its institutions should also be involved in planning and implementation related to the NMSA.

12

The Great Guzzle: Energy and the Climate Challenge of Motorisation

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Mobility crisis

The International Energy Agency (IEA) has sounded the alert on India crossing the tipping point of $3000 per capita GDP. Once this threshold is crossed the IEA reveals vehicle ownership rates will begin to escalate rapidly. This increasing stock of vehicles continuously locks up huge amount of energy and carbon. However, suddenly in India, different concerns have converged around vehicles – public health, fuel splurge and the impact on climate change.

These identified concerns demand active policies to cut the carbon intensity of transport and also offset the potential growth of toxic emissions. India is in the process of building transport and energy infrastructure. If care is taken today to design policies for a low carbon and low energy trajectory, this will provide the opportunity to avoid additional emissions in the future.

This challenge must be addressed with a radical energy transition, by encouraging improvement in fuel efficiency and with strategies for fuel sufficiency. This will require a drastic reduction in energy consumption. We are already importing as much as 78 per cent of our crude oil requirement, which is expected to increase to 85 per cent by 2020. This dependence can destabilize both the economy and the environment significantly.

Reducing the demand for transport oil presents a great challenge as the scope of substitution of oil in this sector is still very limited. The transport sector uses up 40 per cent of the total consumption, and this proportion is poised to increase. The Asian Development Bank (ADB) projects that the total fuel consumption of on-road vehicles in India in 2035 may be six times over that of the 2005 level. Explosive growth in personal vehicles and a steady shift of freight transport from railways to roadways will incite ravenous appetite for energy. Delhi is adding more than 1100 vehicles each day and Bangalore nearly

1300 a day. By 2030, cars in India will consume nearly the same amount of energy consumed by the the totality of road transport today. These trends are unsustainable.

More roads are not the answer; Delhi already has more than 21 per cent of its land area dedicated to roads and total road length has increased by about 20 per cent since 1996. And yet despite just a quarter of its population owning cars, the city is still gridlocked. Traffic speed and road availability per vehicle in Delhi, as is the case in Mumbai and Bangalore, has actually dropped, despite road widening and flyovers. This story is repeated across the big and small cities of India.

Cars are becoming increasingly cheaper, but the hidden costs of using them are enormous. Conservative estimates show that congestion costs can be as high as Rs 3,000-4,000 crore per year. Yet car owners enjoy hidden subsidies. They do not pay adequately for the disproportionately high usage of road space or for parking. If parking charges are adjusted to reflect the actual costs of providing suitable parking in cities, parking charges could be as high as Rs 30-40 per hour. The government even penalises buses – a much more environmentally friendly form of transport – by taxing them higher rates than for cars. A World Bank study shows that the total tax burden on public transport is 2.6 times higher than that on personal vehicles. The government even continues to absorb colossal losses in revenues from the luxury use of low taxed diesel fuel for car users that have dangerous emissions. Fuel taxes, parking charges, road pricing and congestion pricing must reflect the true cost of owning and using a car.

The need for clean and efficient vehicles

India is aspiring to become the 'auto hub' of the world and ramp up car production to an unprecedented scale. This needs urgent policy action to link up the new investments with the most stringent emissions standards so that India can benefit from the global innovations in car technologies and avoid harmful emissions. It is unfortunate that till date India does not have fuel economy standards to prevent oil guzzling that is getting worse with more cars on the roads and shift towards bigger cars. All other major car producing countries including China have adopted fuel economy standards.

Increasing stock of vehicles continuously locks up huge amount of energy and carbon. However, suddenly in India, different concerns have converged around vehicles – public health, fuel splurge and the impact on climate change.

Reinvent mobility

Our cities need mobility, not cars. Cars cannot meet the commuting needs of the urban majority. India already has a huge strength in the usage of public transport and in the tradition of walking and cycling. If these more environmental-friendly transport modes can protected and improved, it will help in the reduction of emissions and oil consumption. A large share of daily travel trips in our cities - more than 60 per cent - are still met by buses. Increasing the use of public transport can make a significant difference; in its study on Bangalore, the ADB has estimated that the city can save 21 per cent of the fuel it consumes if it increases its share of public transport from the current 62 per cent to 80 per cent.

Some nascent policy action has begun in India to provide the National Framework for the Public Transport. These include National Urban Transport Policy, Jawaharlal Nehru Urban Renewable Mission and the Infrastructure Plan for Small and Medium Towns. The most significant policy steps have been contained in the recent stimulus package announced by the Union Ministry of Urban Development. This offers one-time financial assistance to state governments to buy buses for their respective cities. This is the first time such action has ever been taken anywhere in the world. Other governments are looking at bail outs for the car industry, but the Indian strategy innovatively links financial renewal with urban renewal and public transport. This scheme is tied to conditional reforms in the transport sector in cities. To be able to access the fund, city governments will have to give commitments to initiate institutional reforms for public transport management, create dedicated funds from revenues from higher taxes on personal vehicles and diesel cars, and implement parking policy as a car restraint measure. This principle must be looked at as a long-term approach to guide future transport policies.

The message is clear - public policy will have to recognise that car-centric growth will neither give clean air nor mobility for all. Public policies must be redesigned to scale up efficient public transport and implement effective tax policies for sustainable mobility, in line with essential measures to mitigate climate change.

The message is clear - public policy will have to recognise that car-centric growth will neither give clean air nor mobility for all.

13

Rich and Poor Divide – Energy and Climate Change

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The International Association for Energy Economics (IAEE) organizes a major international conference every year. At the 10th annual conference held in Luxembourg in June 1988, the then President of the association named energy-environment interface as one area in which their profession needed to place a stronger emphasis. Almost 20 years on, there is little evidence of progress in this field.

Energy is both an engine for development and a source of many problems our world faces today. Approximately 80 percent of all energy used in the world comes from fossil fuels, which are the main contributors to environmental and health problems at local, regional and global levels. For example, our continued reliance on coal is placing huge stress on such scarce resources as land and water, and causing the dislocation and destruction of the lives and livelihoods of farmers and indigenous communities.

This therefore brings us to two crucial questions: Why do countries continue to depend on coal? And what technically, ecologically and economically viable alternatives do we have at our disposal?

By 2050, the target has been set to reduce fossil fuel dependence in India by 40%. However, it is evident that this will require fundamental changes in energy policy and, more importantly, political will. Clear solutions do exist, in the form of a twin plan constituting energy efficiency and conservation measures, coupled with a massive uptake of renewable energy. These solutions will not only tackle the problem of energy scarcity, which a huge country like India faces, but will also ensure that we do not compromise on our energy requirements. For a country like India, where 60% of its population do not have access to electricity and the other 40% have limited access, efficiency measures are one sure way of providing energy for all.

The energy gained from improved energy efficiency alone can meet close to 50% of India's total energy requirement, a fact most effectively illustrated by examining the building sector. In India, the sector has been growing in excess of 10 percent per year and, in large commercial constructions alone, boasts an electricity consumption that reaches approximately 7 percent of the country's overall consumption. Increased energy efficiency has the potential to almost halve the annual energy consumption in commercial buildings of more than 200 kWh per square metre. Every kWh of electricity saved is equivalent to 0.87 kgs of CO_2 emission avoided. Therefore, every sq metre of a large building has the capacity to contribute to the improvement of the environment by avoiding CO_2 emissions of 52 kgs. From the perspective of energy production, such a reduction in energy consumption would eliminate the entire peak electricity deficit of the country and contribute to providing electricity for all Indians.

If efficiency measures can help in wiping out the energy deficit, renewable energy can help in providing the additional power India would require. India has huge potential for renewable energy, although experts are currently divided in their estimates of this potential: The Ministry for New and Renewable Energy, considers its capacity to be in the region of 80,000 MW, while the Renewable Energy Industry and other researchers believe that the potential could be as high as 150,000 MW, not accounting for the added input of solar PV and solar thermal systems. It is clear that there exists a broad range of technology for renewable energy solutions, including wind, bio-mass, solar PV and solar thermal energy. What is more, such proposed solutions are backed up by credible implementation case studies.

If efficiency measures can help in wiping out the energy deficit, renewable energy can help in providing the additional power India would require.

Renewable energy systems are best suited for a decentralised energy system, which has clear advantages for rural development and livelihood generation. Currently, India has nearly 80,000 villages without electricity, mostly in Uttar Pradesh, Bihar, Orissa, West Bengal, Meghalaya, Arunachal Pradesh, Tripura and Rajasthan. Rural electrification, including domestic connections, village street lighting and pumpset electrification, offers significant potential for growth in the use

of renewable energy. With this in mind, the advantage of round-the-clock rural electrification which this form of energy would bring, together with increased efficiency, reduced infrastructure and transmission costs, and improved quality cannot be ignored. It can be strongly argued that a move to renewable energy would lead to inclusive growth and energy-secure communities.

Currently, the one main barrier to renewable energy, particularly solar systems, is the high cost. However, policy support in the form of preferential tariffs, tax holidays for solar photovoltaic manufacturers and performance-based incentives would help address the issue of high costs. Furthermore, since renewable energy systems are best suited as a decentralised generation mode, with lower transmission and distribution costs than with a conventional electricity generation system, coupled with lesser infrastructure costs (e.g. transmission lines), the costs of renewable energy generation would be on par with the costs of generation of electricity from coal. Furthermore, if one adds to the cost of generation with the additional impact of coal-based energy on aspects such as the environment and health, renewable energy generation becomes the most economically viable option.

The importance of access to energy cannot be underestimated as a driver of development. The model of centralised energy generation and distribution has clearly not delivered energy to all, especially the poor. Decentralised and clean energy options are a crucial element of achieving inclusive and socially just growth.

It can be strongly argued that a move to renewable energy would lead to inclusive growth and energy-secure communities.

14

Bijili,* Sadak,* Paani*: Must we Sacrifice one for Another?

Greenpeace

Grace Boyle
Greenpeace India

There is a line of thought that the next wars of the world will be not wars on oil, but wars on water. The projected impact of climate change on Indian water supply is fearful: more floods and droughts in a country where one sixth of the land is already drought-prone, and 40 million hectares flood-prone;[1] an increase in intense rain events leading to high runoff; and a reduction in the recharging of groundwater tables.[2] Climate change will exacerbate the stress on water resources placed by a rapidly burgeoning population, possibly reducing India's per capita water availability to a state of water stress (less than 1000m^3 per capita) by 2025.[3]

India's growing population will battle for their domestic water requirements with the agricultural sector, which will need more water to grow food to feed them, and other sectors of a rapidly developing economy such as housing and industry. A study by the Confederation of Indian Industry and the World Bank in 2003 found that water availability was already one of the major bottlenecks to industrial growth in India.[4] The most overarching bottleneck, however, was power.

As of February 2010, 52.4% of India's total installed power capacity was generated by coal-fired thermal power plants,[5] making coal the single largest contributor to climate change on the subcontinent. The connection between coal, greenhouse gas emissions and the climatic changes already killing over 300,000 people a year is well known, but less exposed is the rampant guzzle of the country's fresh water supply by the coal cycle.

Thermal power plants use water for two main purposes: to adsorb the heat from the combusting coal, producing steam which then drives the turbines which generate electricity; and to absorb heat from the steam once it has left the turbines, condensing it back to liquid water in preparation for absorbing more heat from the combusting coal. The steam/condensate water must be extremely pure, and so only the freshest water is

* Electricity, Road, Water

used – water clean enough for drinking. The cooling water must also be fresh water, as the salts in seawater would corrode the pipes of the plant. While some coastal power plants have constructed expensive desalination units, the vast majority use water from rivers or dams, thereby consuming water that could otherwise fulfil domestic and agricultural purposes. There are two types of water cooling that can be employed by thermal power plants: once-through cooling, in which water is used only once before being returned to the local ecosystem at a much higher temperature than at which it left it; and recirculating cooling, which uses evaporation to discharge the heat of the water to the air. The former uses 30-50 times as much water as the latter. It is also the type of cooling employed by most Indian thermal power plants.

Hard data on water consumption by these plants is absent, perhaps conveniently so. However, the Central Pollution Control Board's data on wastewater discharge says that 6,670 crore (66.7 billion) litres of cooling water is discharged per day, and a further 727.5 crore (7275 million) litres excreted as boiler blow down water and overflow from the ash ponds.[6] Other figures from the National Environmental Engineering Research Institute (NEERI)[7] place usage at anywhere between 5 and 180 litres per kilowatt hour of electricity generated. That means Chandrapur Super Thermal Power Station, the biggest pit head power station in the country, could use anywhere between one and 42 crore litres of fresh water per hour, if operating at full plant load factor. This is the optimal fresh water access of millions of people daily. It is so great an amount of water, in fact, that Maharashtra cannot support it, and all units of the 2,450 MW power plants will close down by 15 May 2010.[8] The plant has all but dried the Irai Dam, and purchased water from the Chargaon Dam. Its closure will significantly worsen the deficit in the already electricity-hungry state.

Indian thermal power plants do not generate or mention data on impacts from their wastewater discharge, so a quantification of impacts to aquatic biota and further echelons of the ecosystem is not possible. What is known, however, is that fly ash from the combustion of coal contains toxic elements such as boron, which has a tendency to leach out and contaminate groundwater systems. Fly ash also contains toxic heavy metals such as mercury,[9] which in aquatic systems becomes methyl mercury, a toxicant that bio-accumulates in fish and the animals that eat fish. Coal-fired thermal power plants are one of the biggest sources of mercury pollution to the environment.

The connection between coal, greenhouse gas emissions and the climatic changes already killing over 300,000 people a year is well known, but less exposed is the rampant guzzle of the country's fresh water supply by the coal cycle.

Coal mining impacts water supply too, as water bodies surrounding mines have been found to have alarmingly high levels of acidity.[10]. Most of India's coal seams also lie beneath thick forest, meaning climate change and water shortage will be driven not only by the combustion of the coal that is extracted there, but also by the release of the carbon dioxide stored in the forest. Other areas of the coal cycle use water for washing coal, and to grind the dust created when coal is pulverised by sprinkling it with a fine but constant spray.

Despite these truths, the Indian Government's dogged commitment to the antiquated and inefficient fuel remains. The Vidharba Environment Action Group is currently fighting the decision of the Maharashtra Government to approve 49 new coal-based thermal power plants, which they say will require 160 crore (1.6 billion) tons of water per day. The potential impact of this in a region with such poor water resources that it has become known as the 'suicide belt' almost does not bear thinking about.

We must think about it. The stress placed on India's water system by climate changes and demographic factors is already becoming a matter of national concern. Violence and deaths are already occurring in parched villages and city slums as residents scramble for their meagre supply from government and private water tankers. It does not take much imagination to anticipate the effect on India's already tense cross-border relations with Pakistan and China, or to see water becoming an issue of national security to rival energy. The Indian economy must continue to develop, and must continue to expand her power industry to support this development. But in the 21st century, when renewable energy technologies are sophisticated and available, the decision to focus on building coal-fired power plants is inexcusable. We stand at a fork in our development pathway. Let us choose the energy path that does not compromise the lives and dignity of Indian citizens.

Indian thermal power plants do not generate or mention data on impacts from their wastewater discharge, so a quantification of impacts to aquatic biota and further echelons of the ecosystem is not possible.

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15

Need for a National Adaptation Policy - Experience from Flood Affected Areas -

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Change is inherent to the human context. Whether the need is catalyzed by. extreme events such as floods, droughts and economic collapse or more gradual process of change in environmental, technological or economic systems, we survive via adaptation (Moench and Dixit, 2004).

Climate Change impacts are affecting the people especially those who are directly dependent on natural resources for their livelihoods. Increasing disasters and related uncertainties are evident in different parts of the country. With varied agro climatic regions and livelihood diversity, the impacts are diverse making the situation more complex.

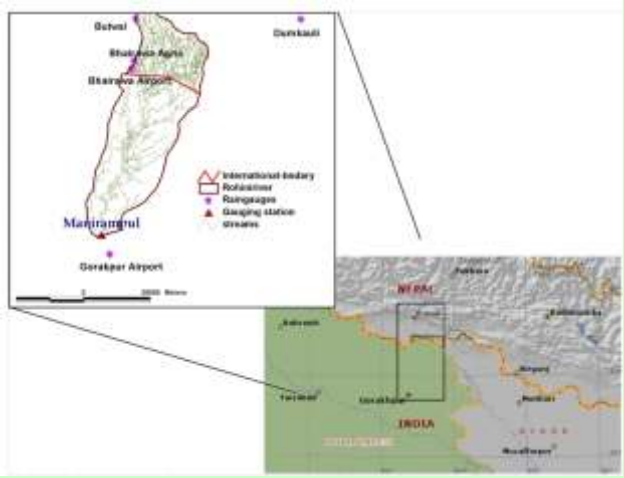
Eastern Uttar Pradesh and north Bihar have a tradition of floods. However, the recent developments have changed the nature, frequency and magnitude of floods. Floods, today, are more unpredictable. The major flood related changes observed during last two decades in the region are :

- change in time, volume and pattern of rain
- increasing frequency of flash floods resulting in fissures or collapsing of embankments.
- smaller river and streams becoming major causes of floods
- decreasing lakes and reservoirs there by reducing the local water holding capacities
- increasing duration of water logging

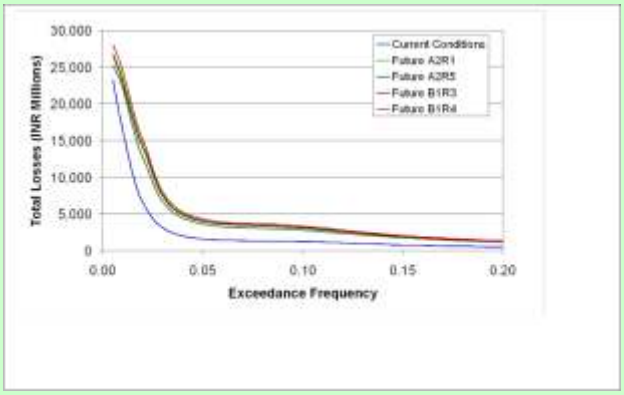
The Indo-Gangetic Plain (IGP) Comprises the floods plains formed by the Indus and Ganga rivers covering the area of about 2.5 million km 2. The IGP is home to about 900 million people and the region is largely recognized as the "bread basket" for the south Asian countries producing about 30% of the rice and 42% of wheat requirements on about 12 million hectares. Acute poverty and malnourishment persists, principally due to the low purchasing power of many (FAO, 2002). The recent disaster due to river Kosi in Bihar and increasing losses in eastern U.P. over a period of time reminds the need of measures to be

A recent study on cost and benefits of alternative strategies for flood risk management along the river Rohini basin in eastern Uttar Pradesh predicts change in rain fall patterns and exceedence frequency. Whereas, the rain fall is expected to increase in flooding months of June-September, under A2 and B1 Scenarios, the winter rains are expected to decrease significantly. Further, climate change is projected to have a greater impact on frequent smaller events-while what is now a 10 year loss will in the future be about a 5 year event, a current 100 year loss will be about a 60 year loss.

Rohini



Exceedence Frequency



Floods in Rohin Basin- Eastern U.P.

Kull, Singh, Wajih etal, 2008

Eastern Uttar Pradesh and north Bihar have a tradition of floods. However, the recent developments have changed the nature, frequency and magnitude of floods.

Adaptation Principles

It has been repeatedly established, through several researches and studies, that investment in implementing flood control measures such as embankments, flow modification structures and other such structural measures have not ameliorated the impacts of floods disasters. Many times, infact, they have exacerbated them, indicating that controlling floods is not possible. Nor is it desirable. The focus will have to be on approaches like uninterrupted drainage of flood waters, livelihood diversification and other such measures helping local communities to adapt and mitigate the impacts.

According to Moench and Dixit (2004) Adaptation is most important mechanism human society uses to respond to change and impacts that has on basic livelihood systems. It has been observed that vulnerability and the social impacts associated with floods, droughts and climate variability are heavily influenced by atleast eight factors :

1. nature of local livelihood system
2. ability of people to migrate
3. ability of information, goods and services to flow
4. differential social capital and institutional checks and balances
5. patterns of differential vulnerability (gender, social and income positions)
6. nature of physical infra-structure
7. ability to secure sources of water
8. natural resource condition

Hence, the ability of a population to adapt to or cope with floods, droughts and climatic variability depends heavily of a variety of factors that cross local, regional and national boundaries.

Adapting for Sustained Livelihoods

Climate change induced disasters and its impacts are required to be addressed on a priority for effective poverty eradication in the country as these factors are adding to the vulnerability of marginalized communities. Further, a large population is getting trapped to poverty cycles because of climate change impacts and disasters like floods and droughts.

The focus will have to be on approaches like uninterrupted drainage of flood waters, livelihood diversification and other such measures helping local communities to adapt and mitigate the impacts.

It is important that effective measures are adopted to enhance the adaptive capacities of people towards ensuring their livelihoods and well being. In developing the adaptive capacities of people for sustained livelihoods, a range of diverse areas and approaches are required to be considered. Intensification, diversification, value addition, access to markets, community level group actions are important considerations in this regard. Use of people's local and traditional knowledge has been found quite effective and meaningful in enhancing the livelihood resilience in the flood affected areas (GEAG, 2007).

Towards an Adaptation Policy

It is established that adaptive capacities of people, especially in the marginalized (vulnerable) communities, needed to be developed for mitigating the climate chnage induced disasters and checking the poverty trap. Adaptation and adaptive capacities depend on a number of hard and soft factors which also inter-linked and inter-dependent. Adaptation can not be addressed through secotral and linear interventions. Hence, an adaptation policy is quite pertinent, which can address complexity of related factors. Such a policy will provide ways, means and priorities of actions to be taken in this regard. On the basis of action researches in the flood affected areas of eastern U.P. and north Bihar and implementing pilot intervention towards adaptive capacities and livelihood resilience, following are few suggestions to be considered in developing an Adaptation Policy :

- Disaster- development linkage: A disaster sensitive development enabling better preparedness for mitigation. The development schemes like SJSY, NREGA and the available resources to be integrated for adaptation and resilience.

- Synergy : People's knowledge and technical know-how : Local people have been dealing with crisis situations and in the process evolving mechanisms to coop. Such knowledge and experiences are generally time tested and locally appropriate. The integration of modern science and technological know-how provide sustainable solutions.

- Climate Change Sensitive Extension : The conventional information and extension systems are required to address new and emerging challenges.

Climate change induced disasters and its impacts are required to be addressed on a priority for effective poverty eradication in the country as these factors are adding to the vulnerability of marginalized communities.

Research agendas (esp. agricultural universities) to address such challenges and needs of vulnerable groups (like small-marginal-women farmers).

Cost benefit Analysis : to be considered an important decision making tool for monetized aspects of disaster risk reduction.

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16

Strategies to Build a Low-Carbon Indian Economy

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Climate change is at the centre stage of global discussions. The warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level. Climate change is undoubtedly one of the greatest environmental, social and economic threats our planet faces today. It impacts all countries but is particularly severe for developing countries like India, given their vulnerabilities, inadequate means and limited capacities to adapt to its effects.

Despite the fast pace of these changes, it is still possible to avert the worst consequences of climate change while expanding our energy supplies to meet the needs of both developed and developing countries. However, the decisions made in the next five to ten years are extremely important in determining the trajectory of required technology, systems, infrastructure and resource exploitation to ensure that global green house gases (GHGs) would peak and start to decline within ten years.

Present initiatives:

India's response to climate change is broad-based, enabling the country to move consistently towards a low-emission growth trajectory. It includes changing trends in overall consumption patterns, a thrust on the use of renewable energy sources and on improved energy efficiency, a transport policy that seeks to encourage an efficient rail-road mix and developing an efficient highways network, an automobile policy that is aligned to the best international safety and emission norms and urban planning that aims to optimise living and working spaces as well as restore depleted green cover. India is emerging as the global hub for further energy efficiency in industry, buildings, residential and commercial sectors and is playing a key role in the identification, development and utilisation of new and renewable energy sources. Recently, Government of India (GOI) has announced

the National Action Plan for Climate Change under which eight specific missions have been launched. These missions cover a whole range of climate change mitigation and adaptation challenges for India: augmentation of solar energy capacity, improvement in industrial energy efficiency, inculcating sustainable habitat approaches, afforestation, water conservation and efficiency, sustainable agriculture, protection of Himalayan Ecosystem and development of strategic knowledge-base for climate change.

Strategies and approaches for India

Future climate change mitigation strategies involve a whole range of further actions across a number of sectors. Besides the focus on promoting renewable energy technologies (RETs) and energy efficiency in industries and power plants, other issues and sectors that need significant attention are the transport and aviation sectors, green buildings, greening of consumer choices by adopting appliance and equipment standards, free and open energy and carbon markets, a thrust on cleaner conventional energy technologies for the future, as well R&D for the development of new climate-friendly technologies.

Renewable Energy: India's multifaceted renewable energy programme, supported by the Ministry of New and Renewable Energy has already achieved installation of over 13,200 MW of renewables-based capacity. During the past three years, about 2,000 MW of renewable-electricity capacity has been added in India every year. India is the fourth largest country in terms of wind energy installed capacity. Hydropower capacity in India is now over 35,000 MW and the accelerated hydro development plan aims to build 50,000 MW of new capacity by 2025-26. The private sector, accounts for around 95% of the total investment in the sector. Government policy support will be necessary to keep up the momentum in this sector.

India is today in a position to play a major role in large-scale commercialisation of RETs and can partner other developing countries as a technology provider, equipment supplier and capacity builder. India's experience in harnessing RETs for rural electricity supply linked to job creation is a powerful business model for ensuring economically, socially and ecologically viable

India's response to climate change is broad-based, enabling the country to move consistently towards a low-emission growth trajectory.

development of the rural areas of the developing world and it is attracting a great deal of interest from countries in Asia, Africa and South America.

Energy Efficiency: A large number of technological measures are possible to be adopted in the short-, medium- and long-term in the aluminium, cement, ceramics, glass, pulp & paper, co-generation steam and condensate systems, sugar, textile, foundry, iron and steel, fertiliser and engineering industries and for enhancing the efficiency of power plants.[1] A special focus for energy efficiency in coal-based power plants is required that currently account for about two-thirds of the total electricity-generation installed capacity of about 1,47,000 MW. Most of the above-mentioned industries (defined as designated consumer under the Energy Conservation Act) can benefit from the energy efficiency measures taken in their establishments under the proposed 'Perform and Trade (PAT)[2] scheme of the Bureau of Energy Efficiency.

The Transport Sector: The transport sector, particularly road transport is dependent on fossil fuels and is the second largest consumer of energy after industry. Rapid economic growth, increased urbanisation, rising income levels and increased motorisation coupled with shortage of reliable public transportation systems may lead to exponential growth in number of vehicles and consequent increase in carbon emissions. Government policies, therefore, have an important role to play by providing adequate infrastructure and effective traffic management while also strongly supporting the development of public transport. Therefore, while vehicle ownership may increase, there can be a reduction in the average vehicle-kilometres driven if suitable multi-modal alternatives are available. Government policies can help moderate energy

The transport sector, particularly road transport is dependent on fossil fuels and is the second largest consumer of energy after industry.

[1] In a recent paper titled “Building a Low-Carbon Indian Economy”, Confederation of Indian Industry has identified a set of energy efficiency measures for these sectors.

[2] Perform and Trade (PAT) scheme is being launched by Bureau of Energy Efficiency under the National Mission for Enhanced Energy Efficiency. The scheme allows industrial units to exceed from their target energy efficiency norms in a given year and trade the surplus certificates

demand further by increasing energy efficiency through setting gradually tougher fuel efficiency standards for vehicles and by promoting alternatives such as freight transportation by waterways.

The Aviation Sector: Aviation contributed about 2 per cent of global fossil fuel carbon dioxide emissions in 2005, but aviation emissions could account for 5 per cent of the total warming effect (of all global CO_2 emissions) in 2050. Since the expansion of air transport in India is among the fastest in the world, India needs to take steps to set emission targets for airlines, as has been done in Europe and USA. India also need to formulate policies to encourage a shift from aviation to high-speed rail, to explore possibility of carbon credits for the Indian civil aviation sector and to pay attention to air traffic management and advances in aircraft technology.

Since the expansion of air transport in India is among the fastest in the world, India needs to take steps to set emission targets for airlines, as has been done in Europe and USA.

Cleaner Conventional Energy Technologies: According to the IEA reference scenario, by the year 2030, almost 50% (620 Mtoe out of 1299 Mtoe) of India's total primary energy demand is likely to be met by coal. Even under the alternative policy scenario share of coal would be over 37% by 2030. Thus, any climate change mitigation strategy for India is not complete without finding the cleaner and more efficient ways of exploiting fossil fuels. These technologies include supercritical coal fired power plants and ultra super-critical boilers. Other promising technologies include Integrated Gasification Combined Cycle (IGCC) and Underground Coal Gasification (UCG).

Nuclear Energy: In the medium and long term future, nuclear energy will play an important role in India's energy scenario, considering the enormous demand of electrical energy in the future, and will also be essential from the point of view of combating climate change. According to the International Energy Agency, fusion energy has the potential to be a very safe, cost-effective and environmentally attractive source of power, although it cautions that a significant amount of research is still to be accomplished and safety aspects of various fusion systems need to be developed.

Water: Water use is directly linked to energy supply, availability and price. Water pumping takes up 25-30% of electrical energy consumption in India. Low power tariffs or free supply of power, especially at unregulated times and frequency leads to wastage of water. Supply of water to urban and municipal areas at potable purity is a huge drain on the limited financing resources of urban and municipal bodies. Numerous ways of using water more efficiently need to be adopted. These include efficient water pumping systems, demand side management and community involvement in water management and in restoration of water bodies, water harvesting and conservation as shown by the numerous instances.

Agriculture: Climate change can have extreme impacts on agricultural production, slashing crop yields and forcing farmers to adopt new agricultural practices in response to altered conditions. Climate change thus has an impact on food security and can be a matter of serious concern even in the short to medium term. A number of improvements in agricultural practices are needed to make agriculture more sustainable. These include improvement and development of efficient crop varieties compatible to climate change, efficient utilisation of biotechnology for breeding, sustainable use of biological/ecological resources through organic farming and promotion of agro-forestry. A switch-over to sustainable modes of farming (e.g. reducing excessive use of nitrogenous fertilisers) and changes in paddy cultivation methods would go a long way in tackling the problem of climate change. To minimise the threat of extreme weather events and breakouts of plant diseases due to climate change, setting-up of advanced monitoring and early warning system is critical.

Afforestation: The basic components of India's forest conservation efforts include protecting existing forests, putting a check on the diversion of forest land for non-forestry purposes, encouraging farm forestry/private area plantations, expanding the protected area network and controlling forest fires.

Open Energy and CDM Markets: India needs a well-instituted market mechanism, where energy prices are based on the interaction of demand and supply. Subsidies in certain

Numerous ways of using water more efficiently need to be adopted.

energy segments, particularly in fossil fuels, have distorted the market, have perpetuated inefficient use of energy and have serious repercussions for climate change.

CDM and other types of carbon markets such as voluntary emission reduction (VER) are proving to be effective tools for India for technology transfer and capacity building to cope with climate change. However certain deficiencies have impeded the full-scale exploitation of carbon opportunities by the country.

The paper discusses the need to set-up an organised domestic carbon market in the country and the features of such a market.

Carbon Capture and Sequestration (CCS): India's current dependence on coal and existence of large coal reserves make it important that carbon capture and storage if proven and successful is made intrinsic to future coal use in India. India can take a lead in developing the roadmap towards commercialisation of CCS by adopting suitable measures such as a legal and regulatory framework and undertaking a national CO2 sequestration capacity assessment.

These approaches mentioned above should be integrated in various missions announced under the National Action Plan on Climate Change as far as possible. Industry's involvement in the operationalisation of these missions would ensure that climate change mitigation and adaptation measures are implemented swiftly and effectively. With concerted, timely and focused efforts India can take leadership in building a low-carbon economy.

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17

Building Bridges Towards an Energy Efficient India

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Energy efficiency is a developmental tool that has been least understood by the policy makers, and ineffectively applied by the practitioners. With the aim of working towards an Energy Efficient India, some of the more informed and aware energy suppliers are joining hands and coming together to create a conducive environment to enable the growth of an energy efficiency market. These are important steps as climate change resulting from an increasingly energy-intensive economic development activities, is threatening the lifestyles, livelihoods and even the survival of a significant share of India's population. Only an accelerated pace of growth of energy efficiency projects and programmes would help to tip the balance towards equitable growth.

Since the start of economic liberalisation in 1991-92, India's GDP growth rate has steadily risen to an average of 8% during 2004-2008. However, 27.5% of population is still living below poverty line and 44 % is still without access to electricity.

Even though India is a country with the second highest population in the world, the country's contribution to global warming is only about a quarter of the global average and far below that of other developed countries. India's per capita CO_2 emission is 1.02 metric tonnes (mt), whereas world average is 4.25 mt, USA 20 mt, China 3.6 mt, European Union averages 9.4 mt, Japan 9.9 mt and Russia 11.7 mt.

India needs to increase per capita energy consumption to provide minimum well-being and a decent living standard to the lowest economic segment of the population. The best way to do this is to reduce the energy intensity of the high end-users and to improve energy efficiency in all sectors.

To give a quick and simplistic illustration of India's energy consumption in the global context:

- India is 5th globally in primary energy consumption, accounting for about 3.5% of global commercial energy demand (2003)
- Per capita primary energy consumption is 439 kg of oil equivalent (kgoe) in 2005 compared to world average of 1688 kgoe
- Per capita electricity consumption is about 615 kWh (20% of world average), expected to grow to 1,000 kWh / year by 2012
- Power generation capacity in India to rise from today's 160,000* MW (inclusive of all captive plants) to 800,000 MW by 2031-32. 1,35,000 MW in the organised sector (Data: June 2007, MOP)
- Power generation projects require about Rs 4-5 cr / MW (~$ 1.0 million / MW) to set up, whereas, to save 1 MW of power EE projects require less than Rs 1 crore (~$ 0.22 mil / MW)

Networking for better business

On November 7th 2008, ten of the energy efficient companies joined hands to launch the Alliance for an Energy Efficient Economy (AEEE), an industry association and think-tank that brings together EE service providers, consultants and equipment manufacturers, to proactively support the Government's energy conservation and efficiency policy, to promote market development and accelerated implementation of EE projects in all sectors.

AEEE includes Conzerv Systems Pvt. Ltd, Schneider Electric India Pvt. Ltd and Thermax Ltd. as Charter Members. The Regular Members are: DSCL ESCO Ltd, Forbes Marshall, Alien Energy Pvt. Ltd, Grundfos Pumps India Ltd, Emerson Network Power India Ltd and CEPT University. The formation of AEEE was supported by USAID's ECO-III Programme partners: International Resources Group and Alliance to Save Energy. AEEE would be guided by an International Advisory Board, and will be modelled on similar EE associations in North America, Europe, Australia and other leading economies.

27.5% of population is still living below poverty line and 44 % is still without access to electricity.

AEEE aims to work closely with regulatory agencies. The Bureau of Energy Efficiency (BEE). Ministry of Power, has expressed strong support to strengthen the institutional systems and market forces that would put energy efficiency on the centre stage of economic development as well as climate change mitigation in India. BEE has also welcomed the launch of AEEE, as an organization which is committed to assist the government in bringing down market barriers and fast tracking technology and other creative solutions.

Market Type	Investment Potential (Billion Rs)	Energy Savings (MWH)	Energy Savings (MW)
Industrial Generic Energy Efficiency Process Energy Efficiency	121.00 42.00	49.00 mn 23.70 mn	7000 3400
Commercial	5.69	1.71 mn	553
Government Owned Offices Hospitals	 3.40 0.85	 0.76 mn 0.87 mn	 360 140
Private Owned Hotels	 1.44	 0.18 mn	 53
Municipal	13.00	3.70 mn	1688
Total MW	Rs140 bn	54.40 mn	9240

Climate change concerns have focused attention on energy efficiency, which has emerged as an integral part of Clean Development Mechanism (CDM) and green-house gas (GHG) mitigation projects. Therefore, the need for accurate baselines and adoption of Measurement & Verification (M&V) in climate change mitigation projects is gaining attention. An institutionalised system of M&V is essential for identifying base-lines and monitoring plans for CDM projects, especially in their multi-stage approval and registration process.

There is a convergence of thinking that has taken place in recent years in energy, resources, environmental and social

There is a convergence of thinking that has taken place in recent years in energy, resources, environmental and social issues.

issues. Climate change, energy scarcity and resource depletion has generated a concern and interest towards accountability in energy, water, environmental (air & water) quality, as well as social concerns of employment, quality of life and equity in resource use. An M&V system should lay the foundation that can encompass these broader concerns over time.

One of the outcomes of recent project activities in energy efficiency is that monitoring and evaluation of government programmes, including utility-driven DSM programmes, is emerging as an important consideration for funding projects. For this to succeed, the energy efficiency companies who can design and implement M&V plans should collaborate, where necessary, with the respective government organisations and regulatory agencies such as BEE and its State Designated Agencies (SDAs), as well as the Electricity Regulatory Agencies.

Need to mandate measurement and verification (M&V)

An enabling factor in achieving market transformation in energy efficiency and in replicating successful energy efficiency projects is to mandate M&V by qualified and certified practitioners. This would require strong advocacy with the government and other stakeholders, supported by authentic data and case studies documented under IPMVP guidelines. The objective would be to make M&V mandatory for all energy saving projects in public domain, and all projects funded by banks and Fis.

According to Director General of BEE, "The larger commercial environment for energy efficiency projects has changed in the recent past. The changes include availability of inexpensive metering, and increase in the metering-based monitoring capabilities. On the other hand in-terms of the demand, there are larger projects now, and project developers and investors are more conscious about the scale of savings that could be achieved, especially in view of high and increasing energy cost". In this changed scenario, there is clearly going to be a greater need for M&V and skilled professionals to implement it. Consequently, third-party verification of saving could emerge as the way to seamlessly integrate energy efficient

An enabling factor in achieving market transformation in energy efficiency and in replicating successful energy efficiency projects is to mandate M&V by qualified and certified practitioners.

projects with ESCO and as a procedure for dispute free conclusion for such projects.

Indian industry has to adapt and advocate accurate and reliable monitoring and control systems, supported by the now universally accepted M&V protocols and systems.

Way forward

Climate change, energy scarcity and resource depletion has generated a concern and interest for accountability in energy, water, environmental (air & water) quality, as well as social concerns of employment, quality of life and equity in resource use. An M&V system should lay the foundation that can encompass these broader concerns over time.

Proactive companies and organisations are setting the trend toward transforming the market for energy efficiency projects. If the battle to save the planet from drastic climate change, and resource depletion is to be won, such projects have to take centre stage, and for this only effective and reliable system of monitoring and evaluation of energy savings can assure that the reported gains are durable and sustainable.

The Alliance for an Energy Efficient Economy (AEEE) is a platform for pro-active companies and organisations, which are not satisfied with reacting and responding to government policies and lament over deficiencies of the systems. Rather, they would like to play a creative role in enabling and shaping policies that create a healthy climate for energy efficiency and sustainable development. AEEE aims to give wings to energy efficiency as a sought after business model in India.

Proactive companies and organisations are setting the trend toward transforming the market for energy efficiency projects.

18

Adapt to Upscale 'Adaptation' in India Climate Change – a threat

Sanjay Vashisht
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Climate change poses a serious challenge to social and economic development. Developing countries like India are particularly vulnerable because their economies are dependent on climate-sensitive natural resources, for example when there are any changes in seasonal weather patterns they are less able to cope with the impacts of climate change. In India, 60% of the population is still dependent on agriculture for their livelihoods and thus the effects of climate change are especially critical to the achievement of development objectives related to the most vulnerable groups and communities. Indeed, the projected impact of climate change on access to natural resources, heat-related mortality and spread of vector-borne diseases has direct implications for the achievement of several of the Millennium Development Goals.

The latest global scientific consensus from the Intergovernmental Panel on Climate Change (IPCC) indicates that all of Asia is very likely to begin warming up during this century. This warming will be accompanied by less predictable and more extreme patterns of rainfall, including droughts and more extreme inundations. Tropical cyclones are projected to increase in magnitude and frequency, while monsoons, around which farming systems are designed, are expected to become more temperamental in their strength and time of onset.

The Indian subcontinent in particular is especially vulnerable to climate change. Globally, India is seen as a rising economic power and indeed this is true for a small segment of society, but that is a distant reality for large proportions of the population that still live in poverty. Over 250 million people live on less than US$1 per day. India is already suffering from a varied array of impacts ranging from insecure energy and food supplies, to reduced availability of fresh water and extreme weather events, such as cyclones, flooding, heat-waves, and droughts. The recent droughts in Maharashtra and floods in Chennai bear testimony to scientific findings. The worst-hit are the rural and urban poor,

who are more vulnerable and whose ability to recover from disasters is limited and inhibited. Public health, human development goals and the country's rich biodiversity will all be adversely affected. It is very likely that human development will be on reverse path in spite of all efforts to reduce poverty.

The change in climate has now reached a point where some of its effects are irreversible; whatever happens to future greenhouse gas emissions, we are already locked into inevitable changes to climate patterns. The implementation of adaptation strategies offers an opportunity to bring a fresh and more successful approach to some of the key problems of the global environment, and indeed the needs and problems faced by the world's poorest people. This opportunity must be seized and promoted in all future planning and implementation of pro-poor policies at all levels of governance in a country.

Strategising Adaptation in India

Adaptation to climate change is no longer a secondary and long-term response option that should only to be used as a last resort. Successful adaptation must be accomplished through actions that target and reduce the vulnerabilities of poor people, as they are likely to become more prevalent as the climate changes. India's National Action Plan on Climate Change (NAPCC) which identifies measures to promote our developmental objectives while also aiming for climate change co-benefits through actions on mitigation and adaptation, calculates that more than 2.6% of the GDP/year is being spent on adaptation in various vulnerable sectors like agriculture, water management, coastal development, etc… Though it raises hope that our policy makers are dedicated towards prioritising adaptation, the results in the form of increased resilience against adverse impacts are still to be witnessed.

In order to upscale efforts on adaptation, political support is essentially needed to facilitate integration and implementation of additional activities on adaptation in development plans. The sincere efforts on mitigating impacts of climate change calls for a convergence of four distinct 'communities' who have long been tackling the issue of vulnerability reduction through their respective activities—disaster risk reduction, climate and

Globally, India is seen as a rising economic power and indeed this is true for a small segment of society, but that is a distant reality for large proportions of the population that still live in poverty.

climate change, environmental management, and poverty reduction.

Further action must also be ensured through the following recommendations:

- Building a common understanding of concepts of adaptation, vulnerability, resilience, security, poverty and livelihoods, as well as an understanding of the gaps in current adaptation approaches. This may vary from region to region and thus it is essential that people's representatives in Parliament or Legislative bodies take into account climate change as a threat factor while implementing projects on local building infrastructure or other development activities.
- The goal of poverty reduction should be placed at the centre of adaptation, as the capabilities and assets that comprise people's livelihoods often shape poverty as well as the ability to move out of poverty. Local adaptation plans should compliment ongoing developmental activities.
- Learning from poverty reduction approaches- the 'bottom-up' approach plays an important role to enhance understanding of how livelihoods are conducted and sustained—that is, how resources are mobilised to earn an income, meet basic needs and generate community support.
- The ecosystem management and restoration activities such as watershed restoration, agro-ecology, reef protection and rangeland rehabilitation should form the basis of designing the adaptation plans. These activities can represent 'win-win' approaches to climate change adaptation, as they serve immediate needs and bring immediate benefits to local communities while also contributing to longer-term capacity development that will create a basis for reducing future vulnerabilities.
- Poor and vulnerable communities lack sufficient financial and technological resources for adapting successfully to climate change. This imposes major

In order to upscale efforts on adaptation, political support is essentially needed to facilitate integration and implementation of additional activities on adaptation in development plans.

constraints on their ability to build the physical infrastructure required to cope with floods or extreme weather events, or to adopt new capital intensive agricultural practices such as drip irrigation, or to switch over to new non-agricultural occupations. Government at Central and State level should introduce appropriate instruments/tools to raise financial resources for integrating and implementing adaptation activities. The rich within country should come to the rescue of poor communities and a levy or tax on carbon intensive activities holds the answer. Levy or tax on aviation, trading schemes, venture funds, etc. could hold answer to generate necessary resources.

Adaptation needs to be mainstreamed into wider development processes rather than separated into isolated measures funded and executed discretely. Institutional capacity should be strengthened in order to lessen the gaps between local and national processes, and between formal and informal patterns of economic activity and resource management. Addressing these gaps will help ensure the effective participation and empowerment of poor communities in key adaptation decisions, allowing for the inclusion of non-structural approaches rooted in community-based patterns of resource management in these decisions. While dealing with many urgent needs and many immediate problems that demand attention and investment, we must offer a process for identifying those 'win-win' options that address current realities and assist with long-term adaptation to climate change. If not addressed in time, climate change induced 'poverty' will soon be reflected in the people's agenda.

Adaptation needs to be mainstreamed into wider development processes rather than separated into isolated measures funded and executed discretely

19

Adaptation to Climate Change: On Some Issues in Framework and Finances in India

Kaushik Ganguly &
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The Union Budget 2010-11 made considerable departure from its precursors in its enunciation of some concrete and focused commitments on promotion of new and renewable energy and energy efficiency. It announced the constitution of a National Clean Energy Fund to provide financial support to research and development in clean energy technologies and proposed fiscal sops to components required for the development of new and renewable energy sectors (e.g. wind energy and solar power). These measures, to certain extent, puts into effect the inclination shown by the Government towards a lesser carbon-intensive economic growth path in its various policy statements.

However, the budget has clearly sidestepped the issue of adaptation to climate change despite significant amount of evidence on the vulnerability of overwhelmingly large section of population dependent on agriculture and other traditional livelihood practices relies on climatic factors. Moreover, a clear and holistic policy framework on adaptation is still missing from the scenario although much has been proposed and promised in the National Action Plan on Climate Change (NAPCC) in terms of a mission mode approach to adaptation. The present article seeks to discuss briefly a suggestive framework on adaptation and priorities in government financing of current adaptation in India.

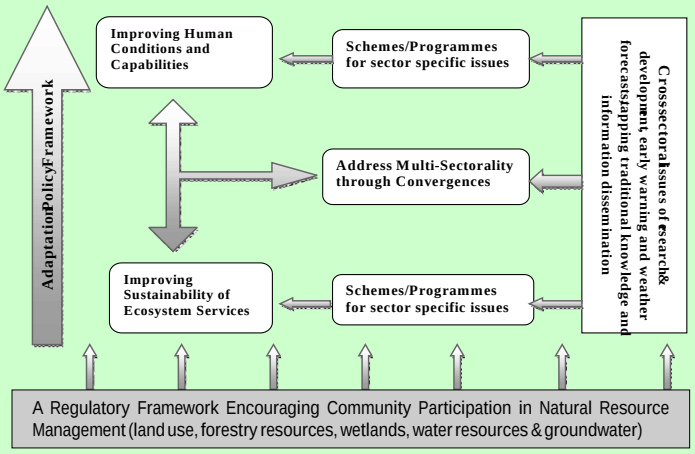
A Suggestive Framework on Adaptation in India

The response by the government on the adverse impacts of climate change needs to take into account the internal realities within the country. The country, owing to its socio-economic characteristics, faces a larger set of challenges from the adverse impact of climate change, viz. rise in temperature, unpredictable precipitation, rise in sea level, spread of vector borne diseases, and extreme weather events, which have the potential to perpetuate already existing inequalities in our society. To counter these set of challenges, the government needs to clearly articulate and initiate action on an adaptation policy framework, which should integrate strengthening of human capabilities to counter the impacts of climate change with conservation of

ecosystems. The framework on adaptation needs to be situated within a regulatory framework that sets and enforces standards on access and use of natural resources without alienating indigenous communities that depend on these natural resources for their basic sustenance.

Strengthening of human capabilities through strengthening of health and educational infrastructure, income transfer and providing livelihood and food security is essential to enable the disadvantaged sections of the society and the general populace cope with the adverse impacts of climate change. On the other hand, a large section of the population predominantly in the rural sector and involved in agricultural activities depend on climatic factors and various ecosystem services for sustainability of their livelihood. Protection of forestlands, wetlands, coastal habitats and other natural ecosystem can therefore provide social, economic, and environmental benefits, both directly through more sustainable management of biological resources, and indirectly through sustaining ecosystem services to the poor who depend on these for their livelihood.

Chart 1: A Framework for Government Interventions on Adaptation to Climate Change



The policy response on adaptation needs to delineate between the sectors that address specific issues related to improvement in human conditions and capabilities and protection of ecosystem services. In addition, there is a requirement for identification of multi-sectoral linkages between different sectors and to initiate policy measures that forge convergences across

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programmes/schemes accordingly. The response on adaptation also requires a system of building up of knowledge base involving research and development on specific issues in vulnerable sectors, constant monitoring of climatic inputs and harnessing traditional knowledge in different sectors, which may lead to better implementation of government programmes/schemes. The framework on adaptation, most of all, needs to integrate a regulatory framework on the access and use of natural resources that takes into account location specific needs of the communities that depend on these. The regulatory framework needs to encourage community participation in natural resource management and imbibe its sustainable use.

As the debates and discussions on adaptation have evolved, it has increasingly occupied a critical space within the developmental agenda of the country. Given that Government of India implements a plethora of programmes/schemes for some of the most vulnerable sectors, it is evident that some bit of investment in adaptation may already be taking place as certain government programmes/schemes address human conditions and capabilities, which may enable communities to cope with climate related adversities. In this regard, the following sections provide a parallel assessment of such spending by the Central Government with specific reference to the latest Union Budget.

The regulatory framework needs to encourage community participation in natural resource management and imbibe its sustainable use.

Government Spending on Adaptation

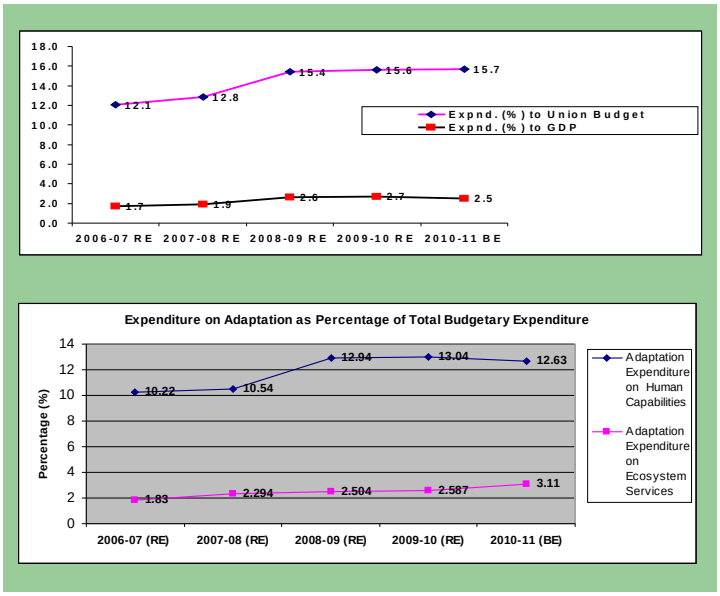
A CBGA-Oxfam study[1] assessed Central Government spending on adaptation in India, in which the expenditure has been classified into nine sectors relevant to adaptation to climate change. These sectors are a) *poverty alleviation, livelihood and food security*, b) *health improvement and prevention of diseases*, c) *risk financing*, d) *land development, drought proofing, irrigation and flood control*, e) *agriculture & allied sectors*, f) *forest, biodiversity, and wildlife conservation*, g) *water resources*, h) *disaster management*, and i) *Coastal, Marine and Ocean Management*.

Adaptation expenditure as percent of total budgetary expenditure and GDP reflects an increasing trend over the last five years. Its share to total budgetary expenditure has increased from 12.1% in 2006-07 RE to 15.7% in 2010-11 BE. The same

[1] Ganguly K. and G. R. Panda (2009), Adaptation to Climate Change in India: A Study of Union Budgets, CBGA – Oxfam.

trend is reflected in its share of GDP (in 2006-07 RE, it was 1.7% which has grown up to 2.5% in 2010-11 BE). Although the allocation on adaptation in GDP terms have shown a decline in 2010-11 budget, it does not reflect a decline in absolute allocation but rather the GDP figure used for 2010-11 is being calculated in 2004-05 base prices while the remaining years are in 1999-2000 base prices. This is also apparent from the trendline showing adaptation expenditure as percentage of total budgetary expenditure, where it shows a marginal increase from 15.6 percent in 2009-10 to 15.7 percent in 2010-11 budget estimates.

Chart 2: Trendline of Adaptation Expenditure in India



The trend of allocation for different sectors relevant to adaptation, over the last five years, shows that allocations for strengthening of ecosystem services have either remained stagnant or declined. A striking feature of the budgetary allocation is that allocation for human capabilities constitutes more than 70 percent of the adaptation related activities, which is indicative of the fact that there has not been a marked shift in adaptation policy although the NAPCC has already proposed five national missions for safeguarding ecosystems.

Less priority has signified less government intervention in ecological restoration and eco-developmental activities in the

Investment in adaptation may already be taking place as certain government programmes/schemes address human conditions and capabilities, which may enable communities to cope with climate related adversities.

country. Besides, the framework also fails to secure people's participation in planning and regeneration efforts to ensure sustainability and equitable distribution of forest products from the regenerated lands and in promoting partnerships in the management and administration of forests and common property resources.

Concluding Remarks

To compare the suggested framework on government interventions in adaptation and policy priorities of the government in terms of its budgetary allocations, it is apparent that any shift in policy priorities by the government is hardly discernible. Adaptation taking place (if any) is largely focused on sectors of poverty alleviation, livelihood and food security where business-as-usual still persists, while allocation for sectors seeking protection of ecosystem services has stagnated or declined except for the sector pertaining to *land improvement, drought proofing, irrigation and flood control*. However, simple implementation of programmes/schemes cannot be construed as adaptation as many of these interventions has been in operation over a protracted period of time and whether these have led to any tangible shift in behaviour in production or consumption decisions at ground level can only be ascertained through micro-level impact assessments of these interventions. On the other hand, behavioural changes can also come by through a regulatory framework that promotes adaptation. In this context, it is essential that an assessment of the present legal framework on environmental conservation and management be undertaken under the guiding light of evolving discourses in climate change both in the international forum and in the realm of domestic policy priorities.

The trend of allocation for different sectors relevant to adaptation, over the last five years, shows that allocations for strengthening of ecosystem services have either remained stagnant or declined.

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Abbreviations

1	ADB	Asian Development Bank
2	AEEE	Alliance for an Energy Efficient Economy
3	AR 4	Fourth Assessment Report of the IPCC
4	BEE	Bureau of Energy Efficiency
5	CAMPA	Compensatory Afforestation Management and Parliamentary Authority
6	CANSA	Climate Action Network South Asia
7	CAZRI	Central Arid Zone Research Institute
8	CBGA	Centre for Budget and Governance Accountability
9	CC	Climate Change
10	CCS	Carbon Capture and Sequestration
11	CDM	Clean Development Mechanism
12	CMSA	Community Managed Sustainable Agriculture
13	CRIDA	Central Research Institute of Dryland Agriculture
14	EE	Energy Efficiency
15	ESCO	Energy Services Corporation
16	FAO	Food and Agriculture Organisation
17	GDP	Gross Domestic Product
18	GHG	Greenhouse Gas
19	GM	Genetically Modified
20	GOI	Government of India
21	IAEE	International Association for Energy Economics
22	IARI	Indian Agriculture Research Institute
23	IEA	International Energy Agency
24	IGCC	Integrated Gasification Combined Cycle
25	IGP	Indo Gangetic Plane
26	IIT	Indian Institute Of Technology
27	IPCC	Intergovernmental Panel on Climate Change
28	IPMVP	International Performance Measurement and Verification Protocol
29	kgoe	kg of oil equivalent
30	KSNDMC	Karnataka State National Disaster Monitoring Centre
31	kWh	Kilowatt Hour
32	M & V	Measurement and Verification
33	MASS	Manav Adhikari Seva Samiti

35	MLA	Member of Legislative Assembly
36	MoEF	Ministry of Environment and Forests
37	MOP	Ministry of Power
38	MoS&T	Ministry of Science and Technology
39	MP	Member of Parliament
40	MSSRF	M.S. Swaminathan Research Foundation
41	Mtoe	Million tonnes of oil equivalent
42	MW	Mega Watt
43	NAPCC	National Action Plan for Climate Change
44	NDMA	National Disaster Management Authority
45	NEERI	National Environmental Engineering Research Institute
46	NGO	Non Governmental Organisation
47	NHRC	National Human Rights Commission
48	NMSA	National Mission on Sustainable Agriculture
49	NRAA	National Rained Area Authority
50	NREGA	National Rural Employment Guarantee Act
51	PAT scheme	Perform and Trade scheme
52	PG -MDGs	Parliamentarians Group on Millennium Development Goals
53	ppm	parts per million
54	PPP Principle	Public- Private- People
55	RETs	Renewable Energy Technologies
56	SD	Sustainable Development
57	SDA	State Designated Agencies
58	SOC	Soil Organic Carbon
59	Solar PV	Solar Photovoltaic
50	sq. km.	square kilometre
61	TERI	The Energy and Research Institute
62	UCG	Underground Coal Gasification
63	UNEP	United Nations Environment Programme
64	UNFCCC	United Nations Framework Convention on Climate Change
65	UNGA	United Nations General Assembly
66	UNHCR	United Nations High Commission for Refugees
67	USAID	United States Agency for International Development
68	VER	Voluntary Emission Reduction
69	WMO	World Meteorological Organisation

"Climate change affects us all, but it does not affect us all equally. The poorest and most vulnerable – those who have done the least to contribute to global warming – are bearing the brunt of the impact today".

Ban Ki-moon
UN Secretary General

"Climate change has become an issue of global concern in recent years. If we don't take the necessary steps in time, our glaciers will melt and our rivers will go dry. The problems of droughts and floods will grow in seriousness."

Dr. Manmohan Singh
Prime Minister of India

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