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Adaptive and mitigative strategies on issue of climate change in India

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Abstract
Climate change is a serious issue throughout the world but India being a developing country has to bear more adverse effects which in turn affect its goal of development. Adaptation and mitigation are two important strategies in combating the problem of climate change. Adaptation is short term effective while mitigation for long term. In era of development with mitigative strategies adaptive measures become important. India is adopting both of these strategies but climate change being a complex and technical issue therefore selection of the strategy should be best suited to situation. India has formulated various schemes, policies and action plans working in this direction. The National Action Plan focuses attention on 8 priority National Missions.

Keywords: climate change, adaptation, mitigation, strategies

Introduction

India, as a developing country has reasons to be concerned about the adverse impact of climate change on its economy. A large part of its population depends on climate sensitive sectors for livelihoods which makes it highly vulnerable to climate change. Climate change can have serious impact on its crops, forests, coastal regions, etc. which can in turn affect the achievement of its important national development goals. The issue of climate change cannot however be taken up without linking it to developmental needs such as poverty, health, energy access and education. Traditionally climate change experts have focused on mitigation measures, adaptation measures have also been acknowledged of late as effective and equitable means to deal with climate change impacts. Most of the mitigation measures are high in terms of technology and capital. Therefore, while developed economies choose to mitigate climate change by making heavy investments, developing economies choose to adapt. However allocating responsibilities for mitigation is a complex task and involves international negotiations. It has been increasingly recognized that a joint approach addressing the issues of adaptation and mitigation together is the most appropriate one for countries like India [1]. There is increasing recognition that the world's current progress on reducing greenhouse gas emissions is not occurring rapidly enough to avoid impacts from climate change in the coming century. Because of this, the world is "committed" to a certain level of global warming and therefore, subject to a degree of impacts that will require adaptive responses by nations and communities [2].

Adaptive and mitigative strategies

The present national policies for environmental management are contained in the National Forest Policy,1988, National Conservation Strategy and Policy Statement on Environment and Development, 1992, Policy Statement on Abatement of Pollution,1992, Some sector policies such as the National Agriculture Policy, 2000, National Population Policy, 2000 National Water Policy, 2002 have also contributed towards environmental management. All of these policies have recognized the need for sustainable development in their specific contexts and formulated necessary strategies to give effect to such recognition. The National Environment Policy 2006 seeks to extend the coverage, and fill in gaps that still exist, in light of present knowledge and accumulated experience. It does not displace, but builds on the earlier policies.

The principal objectives of the National Environment Policy are as following:

1. Conservation of Critical Environmental Resources
2. Intra-generational Equity: Livelihood Security for the Poor
3. Inter-generational Equity
4. Integration of Environmental Concerns in Economic and Social Development
5. Efficiency in Environmental Resource Use
6. Environmental Governance
7. Enhancement of Resources for Environmental Conservation

Our energy sector is taking various initiatives in mitigation and adaptation of climate change keeping in view the concept of sustainable development these are as follows:

- Introduction of CNG for public and private transport in metropolitan areas;
- Improving quality of transportation fuels;
- Raising share of public transport, building Delhi Metro and Metro in other cities like Bangalore.
- A major bio-diesel programme. Five per cent blending of ethanol in petrol– to increase in the next phase;
- Increasing forest and tree cover to 25 per cent by 2007 and 33 per cent by 2012;
- Electricity for all by 2012– decentralized power based on local resources;
- Cleaner fuels for power generation. Raising thermal

efficiency of coal plants;
- National programme on coal washing, in-situ coal gasification, Integrated Gasification Combined Cycle (IGCC), Coal bed and Mine-mouth methane and Hydrogen energy;
- 50,000 MW hydropower initiatives including over 50 per cent from Run of River Operation (ROR) projects to be accomplished by 2012.

India has historically been vulnerable to the vagaries of natural climate variability. India has, for many years, large nationally funded programs for reducing the adverse impacts due to the natural climate variability. These programs need to be extended and enhanced to cover the additional risks of climate change, through provision of financial resources and relevant technologies.

India is strongly and honestly committed to the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, which represent the international consensus on the way to deal with climate change. India believes that uncompensated climate change mitigation by developing countries may hamper the speed of their economic growth. It has a very comprehensive framework of legal and institutional mechanisms in the region to respond to the tremendous challenges to the environment it is facing, owing to population growth, poverty and illiteracy augmented by urbanization and industrial development and has initiated several climate-friendly measures, particularly in the area of renewable energy. India had adopted the National Environment Policy 2006, and has also taken many other measures and policy initiatives [3]. India has a number of policies that contribute to climate mitigation by reducing or avoiding GHG emissions. In June 2008, the Prime Minister released India's first National Action Plan on Climate Change, which identified eight core "national missions" running through 2017 [4]. India's Five-Year Plan (2012-2017) [5], which guides overall economic policy, includes goals to:

- Achieve average 8% annual GDP growth;
- Reduce emissions intensity in line with India's Copenhagen pledge; and
- Add 300,000 MW of renewable energy capacity.

Since taking office in May 2014, Prime Minister Narendra Modi has taken steps to scale up clean energy production and has initiated a shift in India's stance in international climate negotiations. One of his first acts was to rename the environment ministry the Ministry of Environment, Forests and Climate Change. In January, the newly reconstituted Prime Minister's Council on Climate Change launched new initiatives on wind energy, coastal zone management, health and waste-to-energy.

India has, for many years, large nationally funded programs for reducing the adverse impacts due to the natural climate variability. These programs need to be extended and enhanced to cover the additional risks of climate change, through provision of financial resources and relevant technologies. Currently, several social sector and development schemes that emphasize on livelihood security, welfare of the weaker sections, and rural infrastructure are under implementation. As a part of its international obligations under the UNFCCC, India prepares periodically the National Communication (NATCOM) that gives an inventory of the greenhouse gases (GHG) emissions in India, and assesses the vulnerability and impacts and makes appropriate recommendations regarding social, economic and technological measures for addressing climate change and first NATCOM was presented in 2004. The Government of India had also set up an expert committee on May, 2007 to study the impact of climate change on various sectors. The committee has studied the impact of anthropogenic climate change on India and has come out with its first set of findings and the research agenda that the ministries need to follow and implement in order to address India's vulnerability to anthropogenic climate change impacts [6].

There are two components to our response to the challenge posed by climate change: addressing the causes of climate change by reducing concentrations of greenhouse gases in the atmosphere i.e. mitigation; and preparing for the consequences i.e. adaptation [7]. The IPPC (2007) refers to adaptation as "the adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities" [8]. Both mitigation and adaptation are needed to significantly reduce the risks and increase the resilience of the world's most vulnerable citizens. In the near term, adaptation actions can reduce the impacts of climate change (although they cannot be reduced to zero). In the longer term, a failure to mitigate climate change will lead to such massive impacts that adaptations will be unsuccessful. Mitigation means taking action to reduce greenhouse gas emissions to avoid further climate change than has already occurred due to historic and current emissions. Possible adaptation responses include: preventing, tolerating or sharing losses, changing use or activity, changing location and restoration. For example, farmers might increase yields by changing their crops and businesses can reduce the risk of disruption by preparing for climate risks [9]. It is about transforming the way that individuals, governments and industry produce and use energy, changing activities to reduce or eliminate emissions, and developing clean and efficient infrastructure where it does not currently exist. Adaptation and mitigation should not be considered as either/or strategies, but rather as complementary ones that should be pursued together. There is difference between mitigation and adaptation, that the benefits of the mitigation are global where as that of adaptation are local and there is no single metric for measuring success in adaptation, In contrast to mitigation which can be measured by reductions in greenhouse gas emissions [10].

Currently, several social sector and development schemes that emphasize on livelihood security, welfare of the weaker sections, and rural infrastructure are under implementation. Some of the notable schemes/policies concerned with mitigation and adaptation objectives are as under:

- Mahatma Gandhi Swarnajayanti Gram Swarozgar Yojana (Rural self-employment program) Grameen Rozgar Yojana (Comprehensive rural employment scheme)
- Pradhan Mantri Gram Sadak Yojana (Prime Minister's rural roads program)
- National Rural Health Mission
- Accelerated Rural Water Supply Programme

- Desert Development Programme
- Major and Medium Irrigation
- Sustainability of Dryland/Rainfed Farming System and
- Disaster Management

Government of India has set up an 'Expert Committee on Impacts of Climate Change' to identify the measures that India may have to take in the future in relation to addressing vulnerability to anthropogenic climate change impacts. 'The National Action Plan on Climate change', prepared under the guidance and direction of Prime Minister's Council on Change reflects the importance the Government attaches to mobilizing our national energies to meet the challenge of climate change. In the absence of legislation on adaptation in most countries, adaptation strategies, sometimes called action plans, are currently the most common policy instrument for adaptation. The National Action Plan focuses attention on 8 priority National Missions.

1. Jawaharlal Nehru National Solar Mission (JNNSM) [11]

The government launched the JNNSM in January 2010 with a target of 20,000 MW grid solar power (based on solar thermal power-generating systems and solar photovoltaic [SPV] technologies), 2000 MW of off-grid capacity by 2022. The Mission will be implemented in three phases. The first phase up to March 2013), the second till March 2017, and the third till March 2022 [12].

2. Energy conservation and efficiency

Energy conservation refers to reducing energy consumption through using less of an energy service. Energy conservation differs from efficient energy use, which refers to using less energy for a constant service [13]. For example driving less is a method to conserve energy and driving the same amount with a higher mileage vehicle is a method of energy efficiency. The reduced energy intensity of the Indian economy (since 2004) has been marked by over nine per cent per annum economic growth rate.

3. National Mission on Strategic Knowledge for Climate Change (NMSKCC) [14]

The knowledge component of this mission will focus on strengthening and creating knowledge systems and their elements (e.g., people, scientific understanding, research infrastructure, etc.) while the strategic component will address the need for selection of informed actions for supporting long-term goals of the country with regard to sustainable development in this context.

The Ministry of Science & Technology (MoS&T) and the Ministry of Earth Sciences (MoES) have been supporting and carrying out research & development in many areas of significance to climate change and responses, including through intra- and extra-mural research and knowledge support systems. For example, the Indian Climate Research Programme (ICRP) was a decade-long effort to improve understanding of monsoon and climate-related issues [15].

4. National Mission for Sustaining Himalayan Ecosystem (NMSHE)

The broad objectives of the NMSHE include [16] understanding the complex processes affecting the Himalayan ecosystem and evolving suitable management and policy measures for sustaining and safeguarding it, creating and building capacities in different domains, networking of knowledge institutions engaged in research and development of a coherent data base on the Himalayan ecosystem, detecting and decoupling natural and anthropogenic-induced signals of global environmental changes in mountain ecosystems, studying traditional knowledge systems for community participation in adaptation, mitigation.

5. National water mission

The objectives of the National Water Mission are [17] conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources management, to prepare a comprehensive water data base in the public domain, assessment of the impact of climate change on water resources.

6. Green India Mission

The Mission's main objectives are responding to climate change through a combination of adaptation and mitigation measures [18]. These measures include enhancing carbon sinks in sustainably managed forests and other ecosystems, Adaption of vulnerable species/ecosystems to the changing climate, and adaptation of forest-dependent communities, to increase forest/tree cover on 5 million ha of forest/non-forest lands and improved quality of forest cover on another 5 million ha (a total of 10 million ha).

7. National Mission on Sustainable Habitat (NMSH)

The objectives of NMSH are [19] to promote sustainability of habitats through improvements in energy efficiency in building and urban planning, improved management of solid and liquid waste including recycling and power generation, modal shift towards public transport, and conservation, seeks to improve ability of habitats to adapt to climate change by improving resilience of infrastructure, community- based disaster management, and measures for improving advance warning systems for extreme weather events.

Prime Minister Sh. Narender Modi has launched an initiative to create 100 "smart cities" with better transport systems, utilities, and energy networks to address the challenges of urban growth [20].

8. National Mission for Sustainable Agriculture (NMSA) [21]

The NMSA has following objectives: to address issues regarding 'sustainable agriculture' in the context of risks associated with climate change by devising appropriate adaptation and mitigation strategies for ensuring food security, enhancing livelihood opportunities, and contributing to economic stability at national level, the adaptation and mitigation measures would be mainstreamed in research and development activities, absorption of improved technology and best practices, creation of physical and financial infrastructure and institutional framework, facilitating access to information and promoting capacity building.

Loopholes in various mission/policies/schemes of government [22]

- The energy efficiency and sustainable habitat missions were non-starters as they did not have clear targets.
- The urban transportation mission has been talked about for some time and it will be good if we get down to its implementation. The plan is completely silent on implementation mechanisms
- The plan targets were not as high as they should have been. For example the project envisages conservation of 10,000 MW of energy by 2012 but a mere replacement of incandescent bulbs with currently available CFL technology will save 12,000 MW.
- The NSM (national solar mission) does not have a strong due diligence mechanism for the bidding companies. There is a lack of proper monitoring mechanisms by the NTPC Vidyut Vyapar Nigam (NVVN) for the execution of the NSM projects and the validation of the commissioning certificates. As a result of irregularities, the MNRE (ministry of new and renewable energy) has sent a team to verify all the solar projects in the country. This will provide a clear and more accurate assessment of the installed solar capacity in India. Further, the NVVN has penalized three of the seven companies which produced false commissioning certificates. Such an action has sent a strong message to the market that moving ahead, the policies and regulations will be strictly implemented [23].
- Ensuring that the domestic workforce is equipped with the necessary skills is critical to the country's plans of installing a mammoth 175 Giga Watts (GW) of renewable energy by 2022. It also resonates with Prime Minister Modi's priority of creating jobs and a manufacturing base in India. Through efforts such as the Sector Skill Council for Green Jobs, Skill India, and Make in India, the central government is putting forth numerous skill development initiatives to boost clean energy development [24].
- There is an apprehension that energy efficiency and business would not go together. Energy efficiency needs its visibility in terms of bringing real value to the investment. Improving energy efficiency is a process of change as it requires changing attitudes to energy use. Complex interrelationships among multi stakeholders and an environment with several variables, shifting goals and targets make EE more challenging to implement [25].
- Building owners tend to delude EE during building design and construction due to the presence of a strong first cost bias as developers seem to believe that they don't directly gain from the initial investments towards energy efficiency. Lack of awareness regarding existing opportunities, information and techniques on the energy savings potential in buildings is also one of the causes [26].
- Lack of financial incentives for energy-efficient equipment. Energy Efficiency of buildings is not given due consideration in funding and incentives from the government. Revision of regulatory framework is required regarding duty relaxation, incentives and tax benefits [27].

Various hindrances are that will contribute to reductions in human security risks and health vulnerability among the people that is set back to our target of National Mission on Sustainable Agriculture.

Conclusions

Adaptation needs to receive the same level of attention as that given to mitigation for reasons that the adverse impacts of climate change can pose a serious risk to a sustainable economic and social development. While adopting any strategy government should take into consideration views of the expert dealing in field of climate change as climate change is a technical matter. Till now we have achieved something in this direction but still have to go a long way.

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