

Chapter 1

National Development Plans and Sustainable Development

1. 1 Introduction

In the coming years India faces great challenges in development and its impact on climate. The path of development chosen by the region, upon which lies the future growth of energy and emission trajectories, would be greatly influenced by technological developments, economic cooperation between countries, and global cooperation in limiting greenhouse gas emissions. The climate change problem is basically rooted in this core aspect of the economic development process. It is influenced by anthropogenic GHG emissions related to consumption of resources and production processes and at the same time influences the productive basis of the economy and general living conditions. Among the most important anthropogenic causes for climate change is energy use. As defined in Article 2 of the UNFCCC, the need is to focus on the anthropogenic causes for climate change since climate systems have inherent variations and uncertainties. Among the most important anthropogenic causes is energy use, which is dominated by fossil fuels worldwide and India in particular.

There are several key development issues that are directly related to climate change impacts, and to adaptation and mitigation policies. These include economic growth processes including capital accumulation, investments and technological change, and the productivity of labour; natural resource consumption and environmental impacts; institutional issues; and welfare concepts, basic human needs, and equity.

A key theme in development economics is to distinguish between economic growth and development. The subject of development economics has come a long way since the Second World War days. When it emerged shortly after the Second World War it was similar to growth economics. Some influence other than growth economics was clearly involved in the origin of development economics, but it was not clear what form this influence had taken. In one respect at least it did not differ from growth economics, and that was in the overarching importance being given to the growth of real income per head.

Ian Little (Little, 1977) reflected this understanding very well in his depiction of Development Economics as a field that ‘in a broad sense comprises all work on the growth of incomes per head, including that of the classical economic theories of Smith and Mill.’ The focus of development economics was uncompromisingly on the growth of incomes.

However in recent years the field of development economics has moved increasingly in the direction of taking a more inclusive view of the nature of economic development¹. One way of seeing development is in terms of the expansion of the real freedoms required to pursue the objectives which citizens' value. In this sense the expansion of human capability can be seen as the central feature of the development process. The success of the development programs cannot be judged merely in terms of its ability to generate growth and incomes, but must focus on the quality of lives that people can lead. Importance has to be given to the factors that promote the freedom of individuals and hence their capabilities.

The common basic foundation of most economic development theories is the neoclassical paradigm that is structured around identification of the conditions for optimal resource allocation. No particular attention is here given to the identification of reasons why economies like developing countries can deviate from optimal resource allocation. The first best policy recommendation is to achieve efficiency in resource allocation through the use of the market mechanism. A key policy recommendation of the neo-classical paradigm is to remove all market distortions. Seen in a climate change policy context the neoclassical approach recommends to internalize environmental externalities like climate change into the market mechanism and to use economic instruments like taxes, emission trading, insurance markets etc.

The structuralist theory emphasizes that the object of development is the structural transformation of underdeveloped economies in such a way so as to permit a process of self-sustained economic growth. Various policy recommendations follow from that including the need for structural change and industrialization, import substitution, and for the establishment of an effective demand in the domestic economy. A number of key policy recommendations for energy sector development are in accordance with some of the basic arguments of the structuralist school. These include energy security strategies that rely on the use of domestic resources, technology transfer models, and leapfrogging strategies, where developing countries through technology promotion programmes are supported in moving to a more advanced state of technology use.

Recent development research has included studies on the role of institutions as a critical component in an economy's capacity to use resources optimally. It is also recognized

¹ See, for example, Adelman and Morris (1973), Chenery and Srinivasan (1988), Dasgupta (1993), Toye (1993).

that there is a strong linkage between government policies and organizational capacity, and social development outcomes. The provision of resources for social services and the creation of new partnerships for delivery of services are important, and must be implemented within a framework of policies and institutions that provide mechanisms for efficiency and accountability. Weak institutions in developing countries have implications on the capacity to adapt or mitigate to climate change. The next section looks at the Indian policies linking sustainable development with climate change.

1.2 Indian Policies linking Sustainable Development with Climate Change

Sustainable development, defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED 1987), has been an important issue in the minds of policy makers of India. The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in June 1992 was the milestone event that brought the world's focus on environment and development problems. This convention strengthened the importance formulating socio-economic developmental policy with a strong connection with the environmental goals.

In India, various policies and strategies have been framed to integrate economic and social objectives with the environmental objectives. The sustainable development objectives are an integral part of the various National Five-year plan documents, annual plan documents of respective departments, perspective plans of various Ministries of the Central and State governments, and the Planning Commission documents. In the following sections we try to bring out the specific sustainable development objectives embedded in various plan documents of the state and central government and specify their linkages with climate change.

1.2.1 The Energy Sector

Energy security is one of the important concerns of any country. Energy is a very important ingredient for the economic and social development of India. India ranks sixth in the world in terms of energy demand accounting for 3.5 per cent of world commercial energy demand in 2001. The Tenth Five Year Plan (2002-2007) of India (Planning Commission 2001) projects a GDP growth of 8%. The corresponding energy demand is expected to grow at 5.2% (Planning Commission 2001).

India's energy use is mostly based on fossil fuels. For this reason Energy sector is one of the greatest contributors for environmental concerns. The policy makers of India have

recognized this and have tried to address various environmental issues through the various policies to ensure sustainable development. The Tenth Five Year Plan for the energy sector visualizes the importance of reforms for the sustainable development of the sector. It specifies

...introduction of reforms through restructuring/deregulation of the energy sector to increase efficiency, demand management through introduction of energy efficient technologies/processes and appliances...

The plan also points out the importance of environment along with the overall development of the sector.

...the process of producing, transporting and consuming energy has a significant impact on the environment. Pollution abatement processes would form an important part of the development of energy sector...

For sustainable development of the energy sector, the Tenth Five Year Plan has given great emphasis on the environmental policies and energy conservation. Appendix 1 and 2 lists down the thrust areas and key issues of energy sector which has to be addressed by the various central and state departments in the Tenth Five-Year Plan. The key issues (Appendix 2) mention the importance of environmental management and research and development.

1.2.2 Petroleum and Natural Gas

The Oil and Gas sector falls under the Minister of Petroleum and Natural Gas. For sustainable development of the Petroleum and Natural gas sector, during the Ninth plan various steps have been taken. Environmental Management was identified as one of the important thrust area and for achieving a cleaner environment and assuring sustainable growth various policies was taken. Some of the steps taken are as following:

- Lead has been removed from petrol in phases and from 1st February 2000, only unleaded petrol is being supplied in the entire country.
- Petrol octane number has been increased and sulphur content reduced from 0.20 per cent maximum to 0.10 per cent maximum in the entire country from 1 April 2000.
- The four metro towns and the National Capital Region (NCR) are being supplied petrol of 0.05 per cent maximum sulphur content.
- The sulphur content in diesel has been reduced from 1.0 per cent maximum to 0.25 per cent max. in the entire country during the period 1 April 1996 to 1 January 2000.
- In the four metro towns, sulphur content in diesel has been reduced to 0.05 per cent max. Diesel Cetane number has been increased from 45 to 48 from 1 April 2000.

Improvements have been done in the distillation specifications of diesel from 1 April 2000.

- The improvements in petrol and diesel quality have facilitated adoption of India 2000 (Euro-I equivalent) emission norms in the entire country and Bharat Stage-II (Euro-II equivalent) emission norms in the 4 metros. For this purpose, an amount of Rs. 10000 crore was spent over the Plan period.

The other important step towards sustainable development that was taken during the Ninth Five Year Plan (1997-2002) period was in the direction of Energy Conservation (Planning Commission 1997). For a long time for establishing an apex institution to effectively implement energy conservation programs, need for an Energy Conservation Act was felt. In this context, the Energy Conservation Act, 2001 was passed which mandates the setting up of a Bureau of Energy Efficiency (BEE) that will introduce stringent energy conservation norms for energy generation, supply and consumption. BEE will also be responsible for benchmarking the efficiency parameters of the energy sub-sectors with the International Standards. This step allows India to develop institutes that will ensure energy conservation.

The government has also framed various policy measures for conserving petroleum products. Some of them are:

- Reduction in gas flaring by re-injection of gas to underground reservoirs,
- Installation of waste heat recovery system
- Use of dual fuel/ natural gas engines to achieve substitution of diesel by low pressure associated natural gas,
- Use of solar powered cathodic protection systems for pipelines and use of self loading types of skids for mounting rig equipment.

Energy conservation is another important step towards sustainable development. India mainly depends on the fossil fuels as its primary source of energy. This makes energy conservation all the more important for India. Energy conservation not only will lead to less consumption of energy but will also lead to less burning of fossil fuels. This in turn will lead to less emissions of global and local pollutants.

1.2.3 Coal

Geological estimates place India's coal estimates in 1999 at over 208 billion tones. Of these only about 79 billion tones are proved reserves. The rest are indicative or inferred. Only

about 80% of the proved coal reserves are recoverable (CMIE 2000). Coal is expected to remain one of the dominant energy sources. This means higher environmental protection measures are to be followed for mining of coal for sustainable development. Various government policies acknowledge this fact. For this reason the Ninth Five Year Plan has proposed

...renewed thrust on improving the environmental conditions in coal mining areas...

Policies proposed in successive Five-Year Plans for environmental protection in mining areas are as following:²

- Environmental guidelines to be prepared for coal mining.
- Environmental impact assessments to be conducted for mining projects.
- Environmental management plans to be made an integral part of the mining feasibility project reports for new projects.
- Monitoring and implementing environmental protection measures such as land reclamation after mining to be undertaken.
- Improving environmental ecology through scientific land management.
- Preparing a comprehensive rehabilitation policy.
- Concurrent restoration of land in ongoing and new projects. Restoration of land and implementation of environmental safeguards in old worked out areas.
- Establishing an independent agency to formulate and implement environment preservation schemes for the coal (and associated) sectors.
- Integrated approach to the development of coal mining blocks with specific regard to environmental and forestry issues.
- Streamlining forestry and environmental clearance procedures.

The Ministry of Environment and Forests, Government of India also indicates priority areas similar to those mentioned in the five-year plans. They are:

- Adoption of best practices to improve coal quality, productivity and safety and to protect the environment;
- Adoption of environment-friendly technologies including coal gasification, beneficiation, and liquefaction for value addition to domestic coal;
- Environmental protection including rehabilitation of affected land and preservation of biological diversity; and
- An acceptable rehabilitation and resettlement policy for project-affected persons.

² Various Five Year Plan documents, Government of India

1.2.4 The Power Sector

The Tenth Five Year Plan envisages an increase in generation capacity to cope up with the rising demand of electricity. The projected demand of power in 2007 for India is around 719097 GWh, the peak load demand being 115705 MW (16th Electric Power Survey of India). Power sector plays a crucial role in the overall development of the economy. Electricity being a crucial input not only for industrial development but also for the socioeconomic progress has become an important tool for sustainable development. Table 1.1 gives some important government policies pertaining to power sector, aimed at achieving socioeconomic progress and sustainable development.

Apart from the policies listed in the table, initiatives on the part of the government include Special Purpose Vehicle being set up jointly by National Thermal Power Corporation (NTPC) and other Central Power Sector Undertakings as a Registered Society to take up afforestation, and making use of fly ash products mandatory in road and bridge construction, and construction of government buildings.

Table 1.1: Important policies pertaining to the power sector

Year	Policy/Program/Act Notification etc.	Highlights
1997	Notification for use of beneficial coal	Mandated the use of beneficial/blended coal with ash not of not more than 34% from June 2001 in power plants located beyond 1000 km from pitheads and those located in critically polluted areas, urban areas and ecologically sensitive areas
1999	Notification for use of ash	To discourage the dumping of ash and promote its utilization. Power plants required to prepare an action plan for full utilization of fly ash, and provide ash free of cost (for at least ten years) for the purpose of manufacturing ash-based products. Brick manufacturing within a radius of 50 km from coal or lignite based power plants to use at least 25 percent of ash with soil on weight-to-weight basis. Local authorities required to specify in their respective building bylaws and regulations the use of ash and ash-based products.
1998	National Hydro Policy	Outlined various strategies required to exploit the vast hydro potential faster, maintain a reasonable minimum level of hydro in the power system, enable inter-state and inter-regional transfer of hydro power by suitable evacuation of power and encourage greater private investment for faster hydro development. These include measures as: <ul style="list-style-type: none"> • Survey and investigations of potential hydro sites • Basin-wise development of hydro potential • Premium on the sale rate of hydro power during peak period • Recommendations to address rehabilitation and resettlement of project affected persons
2001	Energy Conservation Act	Enables the creation of the Bureau of Energy Efficiency which would recommend energy consumption norms and standards, create awareness, disseminate information for efficient use of energy and its conservation, promote R&D in energy conservation, provide financial assistance to institutions to promote energy efficiency, implement international cooperation programs relating to energy-efficiency etc.

Also services of various educational institutes have been engaged for providing consultancy services to the Ministry of Power on CDM. The terms of reference include project formulation, base line surveys for each project, negotiations with the CDM parties, identification of the counterpart CDM parties from the developed countries, cost of CO₂ monitoring and verification of CO₂ emission reduction and supervision of project implementation.

1.2.5 Energy conservation

It is essential to strive for efficient use of energy and energy conservation. According to the Blue Print for Power Sector Development (Ministry of Power 2001).

...the energy efficiency/conservation measures encourage consumers to use energy more efficiently, which will result in reduced energy consumption thereby reducing cost of production and increasing productivity...

The Central and the State Government can be provided with statutory power to achieve energy efficiency through proper acts or laws. The enactment of the proposed Energy Conservation Bill can provide this necessary power to both Central and State Governments. The scope of the proposed Energy Conservation Bill includes all forms of energy viz. coal, oil, nuclear, renewable sources etc. For implementing the provisions of the proposed Bill, a Bureau of Energy Efficiency is to be set up. The salient features of the Bill are:

- Setting up of energy conservation standards for any equipment or appliance consuming, generating, transmitting or supplying energy.
- Certain industries, establishments and users of energy to be notified as designated consumers keeping in view the intensity and quantity of energy consumed.
- Mandatory energy audit for all designated consumers, as and when required by the designated authority.
- Promotion of mass awareness at both the Central and the State levels for energy conservation, consumer education and guidance.
- Government to take steps to encourage preferential use of energy efficient equipment and appliances.
- Constitution of an Energy Conservation Fund at the Centre and the States for utilizing any grant or loans made available for promoting energy conservation.

1.2.6 Development of Hydel projects

Increased importance is being accorded to the development of Hydel projects in the country. Hydel power represented about 25% of the total installed capacity in 2002. The tenth five-year plan projects that 35% of the additional installed capacity will be hydro plants. According to the Tenth Five Year Plan one of the important reasons why the hydropower should be given more importance in India is environment friendliness. It says that

...greater emphasis on hydro-electricity is important, particularly to meet the peak loads...Hydro-electricity is also a clean and renewable source of energy...

According to the Ministry of Power Annual Report, 2002

...hydropower is a renewable, economic, nonpolluting and environmentally benign source of energy. Hydropower stations have inherent ability for instantaneous starting, stopping, load variation etc. and help in improving reliability of power

system. In the Indian context, unsatisfactory system conditions prevail especially in the Eastern and Western regions having predominance of thermal power. The off peak surplus power and inability of thermal stations to back down are reflected in the form of impermissible high frequencies and injurious low frequencies. To correct such a situation, the ideal hydrothermal mix should be in the ratio of 40: 60. At present hydro share is below 25%, which would become approximately 27% if 31,700 MW of hydropower is added by 2012...

Thus, there is scope of development of increasing the capacity of hydel power. This will also ensure sustainable development of the sector. For this reason, various government policies provide the suggestions to increase the hydro potential:

- Higher budgetary allocation for hydel power
- Identification of new projects in the Central Sector for advance action
- Promoting State projects which were languishing or could not progress due to Inter-State disputes
- Improving tariff dispensation for hydel projects
- Levy of 5% development surcharge to supplement resources for hydro electric projects by NHPC allowed by CERC
- The preliminary ranking study of the remaining hydro potential sites of all the basins in the country has been completed by the CEA, detailed ranking study and preparation of detailed feasibility report based on economic viability needs to be done.
- Adopt a national rehabilitation policy (supported by appropriate legislative changes and the apex court directives) and implement the policy uniformly.
- Streamline clearances for pursuing priority projects.
- Simplify approval procedures.
- Facilitate the early financial closure of projects through a concerted approach comprising center, states, Indian financial institutions, private sector promoters) towards multilateral agencies and other international funding sources.

1.2.7 Rural Electrification

For a balanced socio-economic development however, providing electricity to all is important. Various electricity policies have been framed to ensure rural electrification. Some of the results are encouraging also. For example, in the Ninth Plan, in the programme of electrification of remote villages, there has been success in electrifying the Sagar Island

situated in the Sundarban region of West Bengal through solar energy. About 1400 families on this island have benefited from community and individual solar photovoltaic systems. The community is totally involved in the operation and revenue collection in this programme. The Tenth Five Year Plan proposes to cover 62000 villages that can be electrified through grid extension. The balance 18000 remote villages are to be electrified by 2012 through the use of non-conventional technologies. Funding is the most important challenge for rural electrification. Government of India has designed various policies and schemes for this purpose. They include-

- Pradhan Mantri Gramodaya Yojana: According to Blue print for Power Sector Development

...rural Electrification will be treated as a Basic Minimum Service under the Prime Minister's Gramodya Yojana (PMGY)...

Thus, to facilitate the flow of funds, the Rural Electrification Programme was included as a component of the Pradhan Mantri Gramodaya Yojana (PMGY) in 2002.

- Minimum Need Program for Electrification and other policies: The funds available under Minimum Need Programme for Rural Electrification will be pooled to meet the objective of 100 per cent electrification.
- Accelerated Rural Electrification Programme: State Electricity Boards (SEBs) may receive an interest subsidy on debt raised for rural electrification through the proposed Accelerated Rural Electrification Programme. Interest subsidy would be provided for the loans to be taken by the state governments for the electrification of unelectrified villages. Rural electrification could be done through conventional as well as non-conventional sources of energy.
- World Bank Funding: Given the positive impact of programmes on poverty alleviation, the Tenth Five Year Plan states that

...it (Government) is a legitimate claimant for soft International Development Agency (IDA) funding...

This should be pursued through the Department of Economic Affairs which may indicate to the World Bank the high priority that the Government gives to rural electrification programme.

- Kutir Jyoti Programme: According to the Tenth Five Year Plan, the Kutir Jyoti programme to extend single point light connections to rural households below the

poverty line (BPL) will be revamped so that 100 per cent coverage of such households will be achieved by 2012. The norms of expenditure for rural BPL households have already been enhanced from the present Rs. 1000 to Rs. 1800 per household in special category states and Rs. 1500 in other states.

- Rural Electrification Corporation (REC): The Tenth Five Year Plan states that the REC will continue to carry out system improvement and load intensification activities in electrified villages. According to the plan

...It will finance these activities through the Rural Infrastructure Development Fund (RIDF) and issue of bonds under Section 54 EC of Income Tax Act that provides tax exemption on capital gains...

Also the action plan for rural electrification stated the importance of the role of REC to facilitate the electrification of poor citizens. The Blue Print envisaged

...setting up credit support from Rural Electrification Corporation to SEBs for speedy electrification of dalit bastis, households of scheduled tribes and other weaker sections of society...

- Development of Decentralized Power: According to the Tenth Five Year Plan, the participation of decentralized power producers will be encouraged specially for electrification of remote villages. Village level organizations like rural cooperatives and NGOs will play a crucial role in the rural electrification programme. Various policies indicate that “Community participation” will be essential for the success of the programme.
- Renewables for Rural Electrification: According to Ministry of Non Conventional Energy Sources, in the Tenth Five Year Plan period

...Electrification of remote villages will be done through the Ministry of Non-Conventional Energy Sources in association with the Indian Renewable Energy Development Agency (IREDA)...

The Electricity Bill, 2001 contains an enabling provision in regard to decentralized generation so that cooperatives and NGOs can also bid for and supply electricity to dispersed communities to facilitate the same.

For sustainable development of the society, providing electricity to the rural population is must. Socioeconomic disparities between the rural and urban societies have to

be bridged for attaining sustainable development. The efforts in the rural electrification will substitute traditional/inefficient energy consumption practices with less polluting electricity thus having a beneficial effect on GHG emissions.

In India various non-conventional energy sources are used to generate power. This includes solar, biomass, small hydro, co generation etc. In the year 2002 India had an installed capacity of 3400 MW, which used non-conventional energy sources. But the potential of the power to be generated from non-conventional sources is much bigger (Appendix 3). For achieving this government has taken a number of steps. The Electricity Bill, 2001 has number of provisions to promote the use of renewable/non-conventional energy in the rural area. For example, Section 4 (clauses 4, 5, and 6 of the Electricity Bill, 2001) stipulates that the Central Government after consultation with the State Governments prepare and notify a national policy permitting stand systems (including those based on renewable sources of energy and other non conventional sources of energy) for rural areas. Also, the greater importance being attached to non-conventional sources of energy by Government of India is becoming clear from the fact that the financial allocation for them, as a percentage of the total plans allocation, increased from 0.2 % in the Eighth Year Plan to 0.44% in the Ninth Year Plan.

1.2.8 The Transportation Sector

Transport plays a very important role for the growth of the countries economy. On the other hand transport sector is one of the major contributors to air pollution. The various policies and strategies of Government of India recognize this fact. The approach paper to the Tenth Five Year Plan states that

...the growing automobile population combined with lower quality of fuels is contributing to an increase in air pollution in India. The share of the transport sector in total emissions is increasing and is a matter of concern. There are serious respiratory health problems associated with air pollution. The main causes of vehicular pollution are outdated engine technology in heavy motor vehicles, poor maintenance, large number of overage vehicles, over loading, traffic jams and absence of checks on emission standards...

The Tenth Five Year Plan of India points out the importance of the stricter environmental norms for the sector. It states that

...all major projects, including those in the transport sector require environmental clearance before they are taken up. In large cities like Delhi, initiatives have been

taken to enforce Bharat Stage II norms for vehicular emission. Stricter norms conforming to Euro III-IV are also under consideration...

The Plan suggests the nationwide development of public transport to reduce dependence on the private transport. It also suggests the greater use of cleaner fuel to reduce air pollution. India started adopting the Euro norms from the year 2000. These stricter pollution norms are for bringing down the pollution levels in the transport sector. Appendix 4 shows the road map of for vehicular emission norms for the new vehicles.

Government of India appointed Mashelkar Committee for looking at the Auto Fuel Policies (Mashelkar et al, 2002). The Committee reviewed the conventional fuel and CNG/LPG technologies and their relative benefits in terms of auto exhaust emissions for new vehicles and for converted old vehicles. The main conclusions and recommendation of the committee are:

For New Vehicles:

- New generation engine technologies for cars and three-wheelers using either liquid or gaseous fuels have resulted in reducing pollution from auto exhaust. Gaseous fuels have an advantage over liquid fuels in respect of some of the emission parameters, whereas liquid fuels have advantage in respect of others.
- Engines for buses, designed and manufactured for operation on CNG, offer benefits in terms of lower oxides of nitrogen and particulate matter. CO emissions from CNG engines are however higher as compared to the emissions from diesel engines. The particulate matter emission benefits derived from *Euro II* and higher diesel technology buses are as high as 85 per cent as compared to particulate matter emission from pre-*Euro* technology on road buses.

For conversion of old vehicles:

- In the case of older model petrol passenger cars, a change over to gaseous fuels, in most cases, results in reduction in CO emissions, however NO_x in some cases may go up.
- Particulates are low in both cases.
- In the case of old generation diesel cars and three-wheelers, conversion/retrofitment/replacement of the engine to four-stroke engine on petrol or gaseous fuel gives benefits in terms of reduced particulate matter emissions.
- In the case of diesel buses, a change over to CNG results in benefits in terms of particulate matter emissions, with a disadvantage on CO and other emissions.

- In the case of old generation two stroke petrol three-wheelers, a change over to four-stroke engine provides particulate emission benefits, both with petrol and gaseous fuels, but there may be a penalty on CO and NO_x emission.
- Road performance of alternative fuel vehicles depends on the use of standard kits of the right quality. While adulteration in liquid fuels affects emission performance, use/fitment of sub-standard conversion kits adversely affects emission performance in alternative fuel vehicles.

1.2.9 The Forestry Sector

The National Forest Policy stipulates that one-third geographic area of the country should be brought under forest/tree cover. This has been substantiated in the Approach Paper to the Tenth Five-Year Plan (Planning commission 2001), which states that the country will bring 25 per cent area under forest/tree cover by the end of the Tenth Plan period and 33 per cent by the end of the Eleventh Plan period.

The Approach Paper also outlines the main concerns in the forestry sector. These include

- Lack of awareness about the multiple roles and benefits of forests, especially its role in drought proofing and prevention of soil and water run-off;
- No linkage between management and livelihood security of the people;
- Low level of technology; and inadequate research and extension.
- Weak planning capability;
- Wastage in harvesting and processing;
- Market imperfections;
- Over-emphasis on Government involvement and control;
- Low level of people's participation and NGO involvement;
- Lack of private sector participation;
- Lack of inter-sectoral coordination;
- Weakness and conflicting roles of forest administration.

The Tenth Five Year Plan proposes the following strategies in order to address the concerns of forestry sector and to achieve the objectives of sustainable forest management:

- The watershed approach should be universally adopted for the maintenance and development of forests.
- The future management strategy must take into account this compelling need of the community to meet their requirements.

- Out of the total 5.87-lakh villages in the country, 1.70 lakh have forests as land-use. The forest areas near population centers/villages have degraded faster due to over-exploitation and the forest resource has become impoverished. It has adversely affected the livelihood security and employment opportunity of people dependent on forests. Therefore, a special programme needs to be drawn up for development of such villages and to provide alternative source of income.
- At present, the country is dependent on bulk import of round timber and other produce for large forest industries such as paper and pulp. This must be reversed and the Government should encourage the meeting of these bulk requirements from community land, degraded forests or private farmlands.
- Agro-forestry should be encouraged by promoting technology, extension and training, credit support, marketing infrastructure, etc and providing a policy environment, which assures the farmers of a remunerative price.
- Greening programmes under the 'food for work' scheme should be extensively implemented to ensure productive employment and food security.
- The fragile eco-systems such as coastal areas, hills and mountains, wet lands, deserts, shifting cultivation areas need to be protected in order to sustain the livelihood of a large number of people, apart from the ecological benefits they bring.
- Forests can play a major role in the mitigation of greenhouse gas emission and to adapt to climate variability and long-term climate change. Afforestation is an efficient way of sequestering atmospheric carbon. Conserving and managing existing natural forests and forest soils, which are very large stores of carbon, will significantly reduce greenhouse gas emissions. This might provide new market avenues for forest protection and management.
- It has been established worldwide that Biodiesel offers unique solution to problems arising out of fossil fuel starvation and its environmental impact. Bio-diesel is a suitable alternate fuel meeting stringent specification required for implementation of Euro-III and Euro-IV norms. Promotion of bio-diesel will also encourage enhancement of livelihood opportunities and income generation for rural masses.
- Forest product research is another important area calling for attention. Value addition through primary and secondary processing, reduction in wastage and recycling, and new product development will fetch more value and provide productive employment opportunities.
- Forestry Research, Education and Training: Continuous and sustainable development of forestry would depend on research inputs in crucial areas, solving problems and expanding knowledge. The scope of forestry research covers not only biological and

technological aspects (forestry, forest products, conservation, wildlife), but also a wide spectrum of economic, environmental, sociological and policy research.

Forest being closely associated with activities of local community is crucial to any sustainable development program. Moreover, forest being a source of biodiversity and carbon sink has strong linkage with the climate change phenomenon too. Hence initiative in the 10th five-year plan with regards to forest management and development strive towards achieving sustainable development.

1.2.10 Agriculture and Land Management

Though the share of agriculture in India's GDP has consistently declined, vast majority of Indian population is dependent on agriculture for their livelihood. In the recent decades the growth rates of Indian economy has become less dependent on agricultural growth because of the dwindling share of agriculture in the overall economy. But agriculture is a crucial part of governmental planning programs and investment activities because millions of people depend on agriculture. The five-thrust areas of the Tenth plan are-

- The first, and possibly the most important, area of focus must be to raise the cropping intensity of our existing agricultural land.
- The second priority must be the development of other rural infrastructure that supports not only agriculture, but also all rural economic activities.
- The third area that needs attention is the development and dissemination of agricultural technologies.
- Fourthly, serious thought should be given to the issue of declining public investment in agriculture.
- Finally, there is a need to recognize that the true potential of Indian agriculture can be realized only when we can diversify our agricultural products, both geographically and over time. The food and nutritional requirements of our people for leading healthy lives demand a wider range of food products than are presently consumed on the average.

Since considerable investment is planned to go into improving infrastructure especially for irrigation and technology in the agriculture sector it will have a beneficial effect on the GHG emission from this sector by improving reducing energy consumption.

1.2.11 Biodiversity and Wildlife Conservation

Protecting Biodiversity is one of the basic tenets of sustainable development. Government of India has initiated and implemented several activities aimed at protecting biodiversity. Some of the recent actions in this direction are given below. In order to prepare detailed micro-level action plans at States and regional levels based on the framework document the Ministry has accessed funds from the Global Environment Facility (GEF) for the National Biodiversity Strategy and Action Plan (NBSAP). The NBSAP project envisages assessment and stocktaking of biodiversity-related information at state level including distribution of endemic and endangered species and site-specific threats and pressures. Key features of this project include an emphasis on decentralized state level planning and the use of interdisciplinary working groups to involve all sectors concerned with biodiversity conservation.

The Department Related Parliamentary Standing Committee completed the clause-wise discussions on the Biological Diversity Bill, introduced in the Parliament earlier and approved the Bill with certain amendments. The report of the Committee was also presented in both Rajya Sabha and Lok Sabha during the year. Further actions to move the motion for passing the Bill are being undertaken. India is also a signatory of the Bio-safety Protocol. India signed the protocol in January 2001 and actions are being initiated to ratify the same.

Wildlife conservation includes ban on export of 29 species of plant, plant-portions and their derivatives obtained from the wild. This has continued from earlier plans. The Ministry in consultation with the various scientific institutions and experts working in the field of marine sciences included several marine species under the purview of the Wildlife (Protection) Act, 1972. In order to make the provisions of Wildlife (Protection) Act, 1972 more effective, a Draft Amendment Bill has been prepared by the Ministry and was vetted by the Ministry of Law. It is proposed to introduce the Bill in the Parliament during the Budget Session, 2002.

1.2.12 Desertification, Drought plans and Disaster Management Plan

Desertification poses a great threat for sustainable development since it reduces land availability for productive activities. A two-volume, National Programme pertaining to Status Report on Desertification and National Action Programme, has been prepared and submitted to the Convention to Combat Desertification (CCD) Secretariat during the Fifth Session of the Conference of Parties (COP-5) to the UNCCD during the year.

The traditional perception regarding disaster management has been limited to the idea of “calamity relief”, which is seen essentially as a non-plan item of expenditure. However, the impact of major disasters cannot be mitigated by the provision of immediate relief alone, which is the primary focus of calamity relief efforts. Disasters can have devastating effects on the economy. Recently, expert bodies have dwelt on the role of the Planning Commission and the use of plan funds in the context of disaster management. Suggestions have been made in this regard by the Eleventh Finance Commission. The basic responsibility of undertaking rescue, relief and rehabilitation measures in the event of natural disasters, as at present, is that of the State Governments concerned. The Central Government supplements the efforts of the States by providing financial and logistic support.

1.2.13 Population Policy

The overriding objective of economic and social development is to improve the quality of lives that people lead, to enhance their well being, and to provide them with opportunities and choices to become productive assets in society. Stabilization of population would contribute towards sustainable development to a large extent by reducing the population pressure on resource utilization. The National Population Policy, 2000 affirms the commitment of government towards voluntary and informed choice and consent of citizens while availing of reproductive health care services, and continuation of the target of free approach in administering family planning services. The NPP 2000 provides a policy framework for advancing goals and prioritizing strategies during the next decade, to meet the reproductive and child health needs of the people of India, and to achieve net replacement levels by 2010. It is based upon the need to simultaneously address issues of child survival, maternal health, and contraception, while increasing outreach and coverage of a comprehensive package of reproductive and child health services by government, industry and the voluntary non-government sector, working in partnership.

1.3 Conclusion

India’s vast planning process have detailed program for almost every conceivable sector in the economy. Though the planning process has been elaborate, of late, governments have found it difficult to meet the investment requirement needed for fostering growth. Sustainable development and concern for environment are major concerns and driving force behind the Indian planning process. Integrating climate change concerns with the national planning process is important. For integrating the climate change concerns in the national

planning process it is essential to find out capacity gaps, build institutions to bridge these gaps, provide adequate finances and undertake advanced Research and Development. Scientific research and technology development will benefit greatly by international cooperation and collaboration. Common goals can be effectively addressed by pooling both material and intellectual resources. International collaborative programs should be specifically encouraged between academic institutions and national laboratories in India and their counterparts around the world.

The present study uses country case studies for establishing the link between development policies and climate change. The current chapter discussed the important government development policies in detail. Most of the analyses in the case studies that follow use an integrated modeling framework for alternate development paths or scenarios. The second chapter describes in detail the integrated modeling framework used for the analyses. The third chapter provides description of the Indian scenarios developed. Scenarios are useful tools for scientific assessments, for learning about complex systems behaviour and for policy making. Each scenario is an alternative image of how the future can unfold; they are neither predictions nor forecasts. The national emissions and impacts of the various alternate development paths (captured through scenarios) have been discussed through case studies. The case studies include:

- Projection of future Indian GHG emissions using appropriate models for the business-as-usual case and three other Indian scenarios
- Climate change impact on infrastructure and climate sensitive industry. The impact on infrastructure has been captured through a case study on Konkan railways. A village level case study in Andhra Pradesh brings out the impact of climate change on climate sensitive industry like the food industry by establishing the Food-Water-Energy-GHG nexus. Also a hundred year case study for India captures the sensitivity of energy use to climate change.
- The case study on regional energy cooperation in South Asia captures the benefits of integrating the primary energy and electricity markets in the region.
- The final study looks at urban pollution in India.

Learnings from these case studies can be used to further international cooperation in sustainable development and climate change policies.

Appendix 1: Thrust Areas for Tenth Five Year Plan

The following thrust areas have been identified for the Tenth Plan:

a. Oil Security:

1. Acceleration of exploration efforts, especially in deep offshore and frontier areas
2. Improved oil recovery (IOR) / Enhanced oil recovery (EOR)
3. Equity oil and gas abroad
4. Strategic storage of crude oil
5. Alternate fuels

b. Infrastructure Development:

1. Refining capacity
2. Regulatory mechanism to oversee consumer interests
3. Marketing and distribution facilities commensurate with demand

c. Efficiency Improvement:

1. Benchmarking of the hydrocarbon sector with international standards
2. Oil conservation
3. Demand side management

d. Environment and Quality Improvement

e. Reforms:

1. Dismantling of APM
2. Restructuring/disinvestment
3. Regulatory Mechanism

Appendix 2: Tenth Plan- Key issues for Energy Sector

1. Continuation of the reform process and facilitating private sector participation in commercial coal mining with a view to gaining access to latest technologies for coal exploration, production and utilization and to raise competitiveness through competition.
2. Restructuring of the coal sector by providing more autonomy to individual coal-producing companies for making them viable and enhancing their competitiveness.
3. Setting up of a regulatory authority for resolving disputes and allocation of coal blocks both for exploration and exploitation.
4. Rationalization of rail freight rates for coal movement.
5. Need for rationalizing import duty on coal for improving competitiveness of the sector.
6. Setting up a mechanism for expeditious clearance of dues from SEBs for improving the financial health of coal PSUs.
7. Augmentation of the coal production capacity to meet the projected demand of the power sector in particular and other end use sectors in general.
8. Intensification of exploration and up gradation of coal reserves to the proven and recoverable category in the context of the energy security.
9. Improvement of environmental aspects and promotion of clean coal technologies – beneficiation of non-coking coal for power generation; development of CBM; carbon dioxide sequestration; coal gasification; integrated gas combined cycle (IGCC) and fluidized bed combustion (FBC) route of power generation, development of slurry transportation, etc.
10. Promoting washed coking coal with the adoption of better technologies and making domestic products competitive for the steel sector with a view to reducing import dependence.
11. Development of port and rail infrastructure for coal movement and reducing dependence on road transportation and promoting other modes of coal transportation.
12. Rapid development and utilization of lignite resources both for power generation and industrial purposes.
13. Development of in-house research and development.
14. Need for improving productivity and capacity utilization.
15. Pricing and grading of coal on gross calorific value (GCV).

Appendix 3: Renewable Energy Potential and Achievements

Source/System Achievements	Potential	Approximate as on (31.12.2002)
Biogas plants (No.)	12 m	3.262 m
CBP/IBP/NBP plants (No.)		3520
Improved chulha (No.)	120 m	34.3 m
Biomass		
a. Biomass power	19500 MW	358 MW
b. Biomass gasifier		42 MW
Solar Photovoltaic	20 MW/sq. km.	
a. Solar street lighting systems (Nos.)		41403
b. Home lighting systems (Nos.)		176962
c. Solar lanterns (Nos.)		383929
d. SPV power plants		1172 kWp
Solar water heating system collector area	30 m sq m	0.59 m sq. km
Solar cookers (Nos.)		515000
Wind power	45000 MW	1507 MW
Small hydro power (upto 25 MW)	15000 MW	1406 MW
Urban and municipal wastes	1700 MW	17 MW
Battery Operated Vehicles (Nos.)		247

CBP=Community Biogas Plant, IBP=Institutional Biogas Plant,
 NBP=Night soil Linked Biogas Plant, SPV=Solar Photo-Voltaic, kWp=kilo Watt Peak
 * Including Biomass gasifier

Source: Planning Commission 2001

Appendix 4: Vehicular Pollution Norms for India

New Vehicles (except 2 & 3 Wheelers)

Entire Country

- *Bharat Stage II* emission norms: From 1 April, 2005
- *Euro III* equivalent emission norms: From 1 April, 2010

For Cities of Delhi / NCR, Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Ahmedabad, Pune, Surat, Kanpur and Agra

- Bharat Stage II emission norms
 - Delhi, Mumbai, Kolkata & Chennai: Already introduced in the year 2000 & 2001
 - Bangalore, Hyderabad Ahmedabad, Pune, Surat, Kanpur and Agra: From 1 April, 2003
- *Euro III* equivalent emission norms for all private vehicles, city public service vehicles and city commercial vehicles: From 1 April 2005
- *Euro IV* equivalent emission norms for all private vehicles, city public service vehicles and city commercial vehicles: From 1 April 2010

New 2 & 3 Wheelers (Emission Norms for 2 / 3 Wheelers to be the same in the Entire Country)

- *Bharat Stage II* norms: From 1 April, 2005
- *Bharat Stage III* norms: Preferably from 1 April, 2008 but not later than 1 April 2010 in any case.

Source: Mashelkar et al, 2002