Programmes Related to Sustainable Development

Chapter 6

SUSTAINABLE DEVELOPMENT AND NATIONAL PLANNING

The single most important feature of our post-colonial experience is that the people of India have conclusively demonstrated their ability to forge a united nation despite its diversity, and to pursue development within the framework of a functioning, vibrant and pluralistic democracy. In this process, the democratic institutions have put down firm roots, which continue to gain strength and spread.

A planned approach to development has been the central process of the Indian democracy, as reflected in the national five-year plans, departmental annual plans, and perspective plans of various ministries of the central and state governments. For the last five and a half decades, the guiding objectives of the Indian planning process have been sustained economic growth, poverty alleviation, food, health, education and shelter for all, containing population growth, employment generation, self-reliance, people's participation in planning and programme implementation, and infrastructure development.

India is presently engaged with the Tenth Five-Year Plan, having achieved considerable progress during the previous nine five-year plans and three annual plans. The planning process in India aims to increase wealth and human welfare, while simultaneously conserving the environment. The national planning process lays emphasis on the promotion of people's participatory institutions and social mobilization, particularly through the empowerment of women, to ensure the environmental sustainability of the development process.

The growth of the Indian economy in the last two decades has led to a renewed emphasis on achieving significant reduction in poverty and providing basic minimum services like drinking water, health and education for all its citizens. Although India is still in the low-income category, with a per capita GDP of US$ 462 in comparison to US$ 911 for China, US$ 1,270 for the developing countries, US$ 22,149 for OECD countries, US$ 35,277 for the US, and US$ 5,133 for the world in the year 2001 (UNDP, 2002), India's skilled labour force, strong technical capabilities and increasing openness to economic reforms, have raised the potential for sustained faster economic growth.

India's poverty alleviation programmes over the years have focused on a variety of approaches. In the initial years of developmental planning, poverty was considered as essentially a rural problem and the strategies adopted focused on agricultural development and providing employment to the poor in rural areas. Specific programmes such as the Small Farmer's Development Agency (SFDA), the Programme for Marginal Farmers and Agricultural Labourers (MFAL), the Drought-Prone Area Programme (DPAP), the Integrated Rural Development Programme (IRDP), and the Development of Women and Children in Rural Areas (DWCRA), were launched. Based on past experiences with urban poverty alleviation programmes, an integrated programme called 'Swarna Jayanti Shahari Rozgar Yojana' (SJSRY) was launched in 1997, streamlining all the earlier efforts of employment generation and slum development in urban areas. Similarly, the different employment programmes for the rural areas have been brought under the umbrella of 'Sampoorna Gramin Rozgar Yojana' (SGRY) in 2001.

The rural population requires banking services that are accessible and flexible in terms of the bank timings, in order to minimize transaction costs. In this context, micro-finance programmes have emerged as

Women empowerment through Self Help Groups.

effective instruments of poverty alleviation in India. The Self Employed Women's Association (SEWA) and other micro-finance institutions have devised innovative credit programmes to address market failures and to deliver credit to the poor. These programmes use peer monitoring and a joint-liability structure to overcome the screening, monitoring and enforcement problems commonly encountered by formal lending institutions. They facilitate small loans to poor borrowers, often women organized into small groups, providing more accessible deposit facilities and with much greater attention to risk management.

Micro-finance could also be an advantageous way of introducing new information and communication technologies (ICT) in developing countries, contributing to reducing transaction costs and the digital gap. The Indian experience of ICT in the micro-finance sector is a unique and constant interplay between the diversity in the Indian micro-finance institutions. The benefits of the Internet to enhance micro-finance facilities, extending agricultural consultations and market information to farmers, and expert medical advice facilities to the vast rural population, are unquestionable to a country with over 600,000 villages. Self Help Groups (SHGs) provide an excellent facilitation mechanism for micro- finance in the Indian context. The process of organizing women into SHGs began in the late 1990s. The Small Industries Development Bank of India (SIDBI), the National Bank of Agriculture and Rural Development (NABARD), the Rashtriya Mahila Kosh (RMK) and many *Zilla Parishad*s have emerged as important players in the promotion of micro-finance through SHGs in India.

Information and communication technology can contribute tremendously to rural development.

Agriculture is a critical component of Indian sustainable developmental policies, since more than 650 million people depend on agriculture. The Green Revolution during the 1970s made India self-sufficient in food production through increased agricultural output based on high-yielding seeds, irrigation and fertilizers. At present, Indian agriculture is more intensive with regard to the use of inputs per hectare of land. The National Agricultural Policy (2000) seeks to achieve an output growth in excess of four per cent per year in a manner that is technologically, environmentally and economically sustainable. The five thrust areas for agriculture are to:

- Raise the cropping intensity of the existing agricultural land.
- Develop other rural infrastructure that supports not only agriculture, but also all rural economic activities.
- Develop and disseminate agricultural technologies.
- Diversify agricultural products, both geographically and over time.
- Reverse the declining trend of public investment in agriculture.

The Indian government has recently introduced a broad-based 'National Agriculture Insurance Scheme' (NAIS), which is an improvement on the existing Comprehensive Crop Insurance Scheme (CCIS). The

Modernizing agriculture is an important developmental priority.

NAIS is available all over the country, covering diverse crops (food, horticultural, oilseeds and commercial), all farmers (small and marginal, loanee and non-loanee), and all yield losses due to natural, non-preventable risks. The premium rates vary from 1.5 to 3.5 per cent on the sum insured on food grain crops and oilseed crops and on an actuarial basis for annual commercial/horticultural crops. To meet claims beyond the liability of the insurance agency, a corpus fund is created with contributions from the Government of India and the participating states on a 1:1 basis. During the Tenth Plan (2002–2007), it is proposed to set up a National Crop Insurance Corporation to take over all the crop insurance functions.

The National Conservation Strategy and Policy Statement on Environment and Development, 1992, provides the basis for the integration of environmental considerations in the policies of various sectors. It aims at the achievement of sustainable lifestyles and the proper management and conservation of resources. The Policy Statement for Abatement of Pollution, 1992, stresses the prevention of pollution at the source, based on the 'polluter pays' principle. It encourages the use of the most appropriate technical solutions, particularly for the protection of heavily polluted areas and river stretches. The Forest Policy, 1988, highlights environmental protection through preservation and restoration of the ecological balance. The policy seeks to substantially increase the forest cover in the country through afforestation programmes. This environmental framework aims to take cognizance of the longer-term environmental perspective related to industrialization, power generation, transportation, mining, agriculture, irrigation and other such economic activities, as well as to address parallel concerns related to public health and safety.

The statutory framework for the environment includes the Indian Forest Act, 1927, the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, The Forest (Conservation) Act, 1980, and the Environment (Protection) Act, 1986. Other enactments include the Public Liability Insurance Act, 1991, the National Environment Tribunal Act, 1995, and the National Environment Appellate Authority Act, 1997. The courts have also elaborated on the concepts relating to sustainable development, and the 'polluter pays' and 'precautionary' principles. In India, matters of public interest, particularly pertaining to the environment, are articulated effectively through a vigilant media, an active NGO community, and very importantly, through the judicial process which has recognized the citizen's right to a clean environment as a component of the right to life and liberty.

Forest conservation and enhancement are the stated objectives of national policy. Various policy initiatives have resulted in the increase of forest cover and a reduction in the per capita deforestation rate. The National Forests Policy envisages peoples' participation in the development of degraded forests to meet their fuel, fodder and timber needs, as well as to develop the forests for improving the environment through joint forest management (JFM). India has implemented a large number of progressive policies, programmes and measures to conserve and develop the forests, wildlife, mangroves and coral reefs, such as: the Forest Conservation Act (1980), the National Forest Policy (1988), the Wildlife Act, JFM, Social Forestry, banning of timber extraction in reserve forests, the improved cook-stove programme, and biogas to conserve fuelwood. Similarly, there are conservation programmes for mangroves, coral reefs and lake ecosystems. The National Wasteland Development Board is responsible for re-generating degraded non-forest and private lands. The National Afforestation and Eco-Development Board is responsible for regenerating degraded forest lands,

the land adjoining forest areas, as well as ecologically fragile areas. The Forest Survey of India monitors changes in the forest area. All these measures have led to some stabilization of the forest area, a reduction in deforestation, afforestation, significantly contributing to conservation of the forest carbon sink. All these preparations will act as a buffer for the forest-dependent communities against the challenges posed by climate change.

India is fortunate to be endowed with both exhaustible (particularly coal) and renewable energy resources. Despite the resource potential and the significant rate of growth in energy supply over the last few decades, India faces serious energy shortages. This has led to an increasing reliance on imports to meet the growing oil and coal demand. The Tenth Plan strategy for the energy sector includes increasing the production of coal and electricity, accelerated exploration for hydrocarbons, equity oil abroad, introduction of reforms through restructuring/deregulation of the energy sector to increase efficiency, demand management through the introduction of energy efficient technologies/processes and appliances. The process of producing, transporting and consuming energy has a significant impact on the environment. The pollution abatement processes will form an important part of the development of the energy sector.

India has Disaster Management Plans for natural calamities.

India often faces natural calamities like floods, cyclones and droughts, which occur fairly frequently in different parts of the country. Sometimes, the same area is subjected to both floods and droughts in successive seasons or years. About 85 per cent of the country's total area is vulnerable to one or more disasters, and about 57 per cent of the area lies in high seismic zones, including the national capital. While not all natural calamities can be predicted and prevented, a state of preparedness and the ability to respond quickly to a natural calamity can considerably mitigate loss of life and property and restore normalcy at the earliest. Therefore, the Government of India has formulated detailed plans of action to deal with contingencies that arise in the wake of natural calamities, which are periodically updated. Detailed plans are formulated up to the district level.

The last decade of the 20 century has seen a visible shift in the focus of development planning—from the mere expansion of production of goods and services, and the consequent growth of per capita income—to planning for the enhancement of human well-being, more specifically to ensure that the basic material requirements of all sections of the population are met and that they have access to basic social services, such as health and education. A specific focus on these dimensions of social development is necessary because experience shows that economic prosperity, measured in terms of per capita income alone, does not always ensure enrichment in the quality of life, as reflected, for instance, in the social indicators on health, longevity, literacy and environmental sustainability. The latter must be valued as outcomes that are socially desirable in themselves and, hence, made direct objectives of any development process. (Box 6.1 and 6.2) They are also valuable inputs to sustain the development process in the long run.

In order to ensure the balanced development of all states, the Tenth Plan includes a state-wise break-up of the broad developmental targets, including targets

Box 6.1: Indian Developmental Targets

- Reducing the poverty ratio by five percentage points by 2007 and by 15 percentage points by 2012.
- Providing gainful and high-quality employment to the labour force over the tenth plan period (2002-2007).
- All children in school by 2003; all children to complete five years of schooling by 2007.
- Reducing gender gaps in literacy and wage rates by at least 50 per cent by 2007.
- Reducing the decadal rate of population growth between 2001-2011 to 16.2 per cent.
- Increasing the literacy rates to 75 per cent within the Plan period.
- Reducing the Infant Mortality Rate (IMR) to 45 per 1000 live births by 2007 and to 28 by 2012.
- Reducing the Maternal Mortality Ratio (MMR) to two per 1000 live births by 2007 and to one by 2012.
- Increasing the forest and tree cover to 25 per cent by 2007 and 33 per cent 2012.
- All villages to have sustained access to potable drinking water by 2007.
- Cleaning of all major polluted rivers by 2007 and other notified stretches by 2012.

Source: Tenth Plan Document, Planning Commission, 2002.

for growth rates and social development, which are consistent with the above national targets. These state-specific targets take into account the potential needs and constraints present in each state and the scope for improvement in their performance, given these constraints.

At the dawn of the new millennium, the Tenth Plan provides an opportunity to build upon the gains of the past and also to address the weaknesses that have emerged. The role of the government has to be redefined to that of a facilitator and developer of specific infrastructure such as rural infrastructure and road development. In other infrastructure sectors, for example, telecommunications, power, ports, etc., the private sector can play a much greater role, supported by an appropriate policy framework.

The process of development encompasses broader societal issues than merely economic growth. The conventional paradigm of economic development, which was woven around the optimal resource allocation, is now extended to include participative processes, local initiatives and global interfaces. The new vision views welfare as the *raison d'etre* of development. Under the emergent development perspective, while efficient resource allocation is best addressed by market mechanisms, the institutions are also a key component in a nation's capacity to use resources optimally. Thus, the institutions and policies have an important role in welfare maximizing development. The strong link between government

Box 6.2: Strategy for equity and social justice

- Agricultural development must be viewed as a core element of the national planning process, since growth in this sector is likely to lead to widespread benefits, especially to the rural poor. The first generation of reforms concentrated on the industrial economy and reforms in the agricultural sector were neglected; this must change in the Tenth Plan.
- The growth strategy of the Tenth Plan must ensure rapid development of sectors most likely to create large employment opportunities and deal with the policy constraints that discourage growth of employment. These include sectors such as agriculture in its extended sense, construction, tourism, transport, small-scale industry, retailing, information technology and communication-enabled services, as well as a range of other new services.
- There will be a continuing need to augment the growth momentum with special programmes aimed at target groups that may not derive sufficient benefit from the normal growth process. Such programmes have long been part of our development strategy and they must continue in the Tenth Plan as well.

Source: Tenth Plan Document, Planning Commission, 2002.

policies, organizational capacity, and social development is duly recognized. The provision of resources for social services and the creation of new partnerships for the delivery of services are important, and must be implemented within a framework that provides mechanisms for efficiency and accountability. The establishment of appropriate institutional frameworks to implement various development programmes has been an important component of development policies throughout India's planning effort since independence. These provide platforms to implement adaptation strategies for dispersed and informal sectors like watershed management, agriculture, rural health and forestry.

The three-tier *Panchayati Raj* institutions for local governance are the most fundamental system, transferring decision-making power to the grassroots level. The agricultural *cooperatives* have emerged as powerful institutions for rural development. Their organizational structures provide for the active participation of individuals at the local level. At present, there are large numbers of product or commodity-oriented co-operatives, such as in sugar, weaving, dairy, banking, and fisheries. In the mid-1990s, there were a total of 0.47 million co-operatives operating in different sectors, with more than 220 million members. However, the success of *Panchayati Raj* and co-operatives in a setting where literacy is low and the society is often fragmented into social and gender-based inequalities, requires substantial government interventions.

The development of institutions to elicit the community's participation in natural resource management has been a challenge for programme implementation. The social forestry programme was implemented through different plantation models, like farm forestry, community forestry, strip plantations, and rehabilitation of degraded forests and development of recreation forests. However, there were limitations to this approach. The National Forest Policy (1988) outlined the scope for people's participation in forest management. JFM, which followed, is a concept of developing partnerships between the forest-dependent communities and the forest departments on the basis of mutual trust and jointly defined roles and responsibilities with regard to forest protection and development. About 62,890 JFM committees covering an area of 14.25 Mha of forest land (about 21 per cent of the total recorded forest area in India), have since been established.

Community participation in natural resources management was extended to water resources as well, since it has emerged as a major challenge to public policy in recent years. Both irrigation systems and drinking-water supply systems were beset with several management problems. The irrigation sector has been facing the twin issues of sub-optimal sector planning and financial management on the one hand, and inadequate water management and maintenance on the other. Drawing lessons from the failure of supply-driven approaches in irrigation and drinking water projects, the recent initiatives have involved the users in the management of water resources. The *Water Users Associations* (WUAs) are central to the implementation of participatory irrigation management. The functions of WUAs include acting as an interface between the farmers and the main system management of the irrigation project as well as other concerned government agencies, water distribution, operation and maintenance of the irrigation and drainage system, collection of water charges and other user charges, land conflict resolution. There is a great deal of variability in the approaches to devolution and participation.

A beginning has also been made to involve users in both rural and urban drinking-water supply projects. It is based on the expectation that the implementation of a participatory demand-driven approach will ensure that the public obtains the level of service they desire and can afford to pay for. The recovery of operation, maintenance and replacement costs is expected to ensure the financial viability and sustainability of the schemes. The necessary reforms have been introduced in 1999 to the Accelerated Rural Water Supply Programme (ARWSP) implemented through the Rajiv Gandhi National Drinking Water Mission. In November 2002, the Government of India issued a notification on the implementation of participatory and community-led Swjaldhara Rural Drinking Water Projects.

Constitutional provisions and legal requirements have been used to achieve various standards and norms needed for development programmes. A variety of

environmental regulations have been enacted to achieve goals of environment protection and preservation. Some of the major legislations for environmental protection include the Water (Prevention and Control of Pollution) Act (1974), the Forest Conservation Act (1980), the Air (Prevention and Control of Pollution) Act (1981), and the comprehensive Environment Protection Act (1986), the Energy Conservation Act (2001), and the Electricity Act (2003). Constitutional amendments were also made to incorporate environmental concerns into development programmes. The forty-second Amendment of the Constitution (1977) enjoined both the state and the citizens to protect and improve the environment and safeguard forests and wildlife. The seventy-third Amendment (1992) made the *Panchayats* responsible for soil conservation, watershed development, social and farm forestry, drinking water, fuel and fodder, non-conventional energy sources and maintenance of community assets. Various national policies, such as the National Forest Policy (1988) and the National Water Policy (1987 and 2002), are all important moves towards ensuring the sustainability of natural resources.

India is also a signatory to many of the international multilateral treaties in matters relating to environment, health, investment, trade and finance. The government has also incorporated the spirit of Agenda 21 in the form of two policy statements: the Abatement of Pollution and the National Conservation Strategy. The Abatement of Pollution conforms to the 'polluter pays' principle, involving the public in decision making, and giving industries and consumers clear signals through market mechanisms about the cost of using environmental and natural resources. The National Conservation Strategy and Policy Statement on Environment and Development have made environmental impact assessment mandatory for all development projects, right from the planning stage.

NATIONAL PLANNING AND CLIMATE CHANGE

The Tenth Five-Year Plan also reflects the Government of India's commitment to the United Nations Millennium Development Goals (2002). The UN goals include halving extreme poverty, halving the proportion of people without sustainable access to safe drinking water, halting the spread of HIV/AIDS and enrolling all boys and girls everywhere in primary schools by 2015. Many of the Indian national targets are more ambitious than the UN millennium development goals, like: doubling the national per capita income by 2012, all villages to have sustained access to potable drinking water by 2007, halting HIV/AIDS spread by 2007, and all children in schools by 2003 (Table 6.1). They reflect the commitment of the Government of India to the UNFCCC, the Rio Declaration (1992) on Agenda 21 at the UN Conference on Environment and Development, the Millennium Declaration at the UN Millennium Summit, the Johannesburg Declaration at the World Summit on Sustainable Development (2002), and the Delhi Declaration (2002) at the Eighth Conference of Parties (COP) to the UNFCCC.

These specific planning targets address many climate change concerns. For example, reduced poverty and hunger would enhance the adaptive capacity of the population. Reduced decadal population growth rates would lower GHG emissions, reduce pressure on land, resources, and ecosystems and provide higher access to social infrastructure. Increased reliance on hydro and renewable energy resources would reduce GHG and local pollutant emissions, enhance energy security and consequent economic benefits from lower fossil fuel imports, and provide access to water resources from additional hydro projects. The cleaning of major polluted rivers would result in enhanced adaptive capacity due to improved water, health and food security.

India's development priority envisages doubling the per capita income by 2012, reducing the poverty level by 10 per cent, providing gainful employment to all and ensuring food, energy, and economic security for the country. The Indian government has targeted an 8 per cent GDP growth rate per annum for 2002–2007. To achieve these development priorities, substantial additional energy consumption will be necessary and coal, being the abundant domestic energy resource, would continue to play a dominant role. The Indian targets indicate a developmental pathway for the country, different from the present baselines. Moreover, there are considerable costs associated with achieving these targets, requiring the commitment of

Table 6.1 Millennium development goals and related Indian plan targets

Millennium development goals and global targets[1]	India's tenth Plan (2002–2007) and beyond targets[2, 3, 4]
Goal 1: Eradicate extreme poverty and hunger.	
Target 1: Halve, between 1990 and 2015, the proportion of people whose income is less than $1 a day. ***Target 2:*** Halve, between 1990 and 2015, the proportion of people who suffer from hunger.	Double the per capita income by 2012. Reduction of poverty ratio by 5 % by 2007 and by 15 % by 2012. Reduce the decadal population growth rate to 16.2% between 2001-2011 (from 21.3% during 1991-2001).
Goal 2: Achieve universal primary education .	
Target 3: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.	All children to complete five years of schooling by 2007. Increase in literacy rates to 75% by 2007 (from 65% in 2001).
Goal 3: Promote gender equality and empower women.	
Target 4: Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education, no later than 2015.	At least halve, between 2002 and 2007, gender gaps in literacy and wage rates.
Goal 4: Reduce child mortality.	
Target 5: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate.	Reduction of Infant Mortality Rate (IMR) to 45 per 1000 live births by 2007 and to 28 by 2012 (115 in 1980, 70 in 2000).
Goal 5: Improve maternal health.	
Target 6: Reduce by three-quarters, between 1990 and 2015, the Maternal Mortality Ratio (MMR)	Reduction of MMR to 2 per 1000 live births by 2007 and to 1 by 2012 (from 3 in 2001).
Goal 6: Combat HIV/AIDS, malaria and other diseases.	
Target 7: Have halted by 2015 and begun to reverse the spread of HIV/AIDS. ***Target 8:*** Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases.	Have halted by 2007; 80 to 90% coverage of high-risk groups, schools, colleges and rural areas for awareness generation by 2007. 25% reduction in morbidity and mortality due to malaria by 2007 and 50% by 2010.
Goal 7: Ensure environmental sustainability.	
Target 9: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources. ***Target 10:*** Halve by 2015 the proportion of people without sustainable access to safe drinking water. ***Target 11:*** Have achieved by 2020 a significant improvement in the lives of at least a 100 million slum dwellers.	Increase in forest and tree cover to 25% by 2007 and 33% by 2012 (from 23% in 2001). Sustained access to potable drinking water to all villages by 2007. Electrify 62,000 villages by 2007 through conventional grid expansion, the remaining 18,000 by 2012 through decentralized non-conventional sources like solar, wind, small hydro and biomass. Cleaning of all major polluted rivers by 2007 and other notified stretches by 2012. Expeditious reformulation of the fiscal management system to make it more appropriate for the changed context.

contd…

Millennium development goals and global targets[1]	India's tenth Plan (2002-2007) and beyond targets[2, 3, 4]
Goal 8: Develop a global partnership for development.	
Target 12: Develop further an open, rule-based, predictable, non-discriminatory trading and financial system (includes a commitment to good governance, development, and poverty reduction—both nationally and internationally). ***Target 16:*** In co-operation with developing countries, develop and implement strategies for decent and productive work for youth. ***Target 17:*** In co-operation with pharmaceutical companies, provide access to affordable essential drugs in developing countries. ***Target 18:*** In co-operation with the private sector, make available the benefits of new technologies, especially ICT's.	Tenth Plan includes state-wise break up of the broad developmental targets. Higher integration with the global economy. Create 50 million employment opportunities by 2007 and 100 million by 2012 (the current back-log of unemployment is around 9%, equivalent to 35 million people).

Note: Millennium Targets13 and 14 refer to special needs of least-developed, land-locked and small island countries. India is party to several international conventions and programmes assisting these countries. India is also implementing policies in line with Target 15 that exhorts amelioration of debt of developing countries, including own debt, under global cooperation.

Sources: [1] Human Development Report, UNDP, 2003.
[2] Tenth Five-Year Plan, Planning Commission, GOI, Vol. 1 (pp 6–8), Vol. 2 (pp. 108, 117, 909, 914, 927).
[3] For the most recent year between 1985–1999 (UNDP, 2002), pp. 176.
[4] India Vision 2020, SP Gupta Committee report, Planning Commission, GOI, 2002 (pp. 93).

additional resources from various sources, as well as by realigning new investments.

Market-oriented economic reforms initiated in the past decade have expanded the choice of policy instruments, technologies and resources. In the energy and electricity sectors, this has led to the amelioration of fuel quality, technology stocks, infrastructure, and operating practices. The concerns about rising energy, electricity and carbon intensity of the Indian economy inspired the Indian government to initiate targetted programmes and institutions to promote energy efficiency, energy conservation, and introduce renewable energy technologies. The thrust areas include energy efficiency improvement in all sectors of the economy, promoting hydro and renewable electricity, power sector reforms including national grid formulation and clean coal technologies for power generation, energy infrastructure development, coal washing, cleaner and less carbon-intensive transport fuel promotion, and environmental quality management.

Therefore, it is clear that the Indian planning process and global climate change concerns are intricately linked. Taking care of the national planning objectives would include addressing many of the climate change concerns.

DEVELOPMENT AND CLIMATE CHANGE

Climate change interfaces with diverse societal and natural processes and, consequently, with the development processes. Conventionally, climate change has been considered as an impediment to development and, conversely development is viewed as a threat to the climate. The development and climate paradigm, also alternatively referred to as 'development first', views development as the tool to address the challenges posed by climate change, the key to overcoming our vulnerability and enhancing our capabilities for adaptation to its adverse impacts. In this paradigm, the development itself—i.e., building capacities, institutions and human capital in developing countries—emerges

as the key factor for enhancing adaptive and mitigative capacities.

The term 'development' refers to broader social goals, in addition to economic growth. In recent years, the national development policy perspective has taken a more inclusive view of the scope, content and the nature of national development. The conventional paradigm of economic development, which was woven around optimal resource allocation, is now extended to include participative processes, local initiatives and global interfaces. As mentioned earlier, the new vision views welfare as the *raison d'etre* of development. Under the emerging development perspective, while efficient resource allocation is best addressed by market mechanisms, the institutions are also considered as a key component for the optimal utilization of a nation's resources. Thus, the institutions and policies play a vital role in welfare development. The development vision duly recognizes the strong links between government policies, organizational capacity, and the results of social development. The vision also perceives the provision of resources for social services and the creation of new partnerships for the delivery of services as essential; it also accords primacy to the implementation of the vision within a framework of policies and institutions, which provide mechanisms for efficiency and accountability.

Many initiatives for adaptation and mitigation are likely to be integrated with and added to the already existing economic development projects. The financing for projects involves ensuring that the risks and expected returns are commensurate with the requirements of the financial markets; matching investors who have available funds with projects seeking funding is by no means easy in developing countries. The success of linking investors with projects, via appropriate sets of institutional and financial intermediaries, partly depends on the degree of development of the financial markets and the financial services sector in the country where the project will be implemented.

Therefore, the 'development first' perspective proposes to create myriad economic and social activities and orient these towards the climate-friendly pathway. Since the goals of sustainable national development are favourable to the issue of climate change, the achievement of these goals would accrue a double dividend in terms of added climate change benefits. The cascading effects of sustainable development would reduce emissions and moderate the adverse impacts of climate change, and thereby alleviate the resulting loss in welfare.

The vital relationship between sustainable development and climate change was brought into sharper focus in the Delhi Declaration made at COP-8 in November 2002. The Declaration reiterated the view of the World Summit on Sustainable Development that poverty eradication, changing unsustainable patterns of production and consumption, and protecting and managing the natural resource base of economic and social development are the overarching objectives of, and essential requirements for, sustainable development.

The WSSD emphasized the need to augment the financing of development and technology transfer to developing countries and the need for climate change policies to be aligned with national development priorities of nations. The Delhi Declaration also noted that technology transfer should be strengthened, through concrete projects and capacity building in all relevant sectors such as energy, transport, industry, health, agriculture, biodiversity, forestry and waste management. Technological advances should be promoted through research and development, economic diversification and by strengthening the relevant regional, national and local institutions for sustainable development.

CLIMATE-FRIENDLY INITIATIVES

India has the world's second largest population and fourth largest economy, with a per capita annual GDP of US $462 in 2001. India's economy grew at a rate of almost 6.6 per cent per year during the 1990s, nearly doubling over that time. The energy use grew even faster, at a rate close to 7 per cent. The demand for electric power has grown still faster, in the order of 8 % per year. Despite this growth, India's per capita electricity use averages at only one-sixth of the world average. Its per capita CO_2 emission also rank among the lowest in the world, averaging four per cent of the US per capita CO_2 emissions in 1994, eight per

Population control and family welfare policies have indirectly contributed to GHG emission abatement.

cent of Germany, nine per cent of UK, 10 per cent of Japan and 23 per cent of the global average.

To achieve the national developmental targets (Table 6.1), India endeavours to pursue a sustainable pathway with reduced population growth rates, an open market-based economy, and a sophisticated science and technology sector. It has also undertaken several response measures that contribute to the objectives of the UNFCCC.

The reduction in the decadal population growth rates of India over the last 30 years is a prominent policy initiative making a real, if indirect, contribution to controlling GHG emission growth from India. The government has many programmes that promote family planning and female literacy and advice against early marriages. However, the momentum of population growth will continue for a while, because the high Total Fertility Rates (TFR) in the past has resulted in a large proportion of the population being currently in their reproductive years. The higher fertility due to the unmet need for contraception (estimated contribution is 20 per cent) has led to 168 million eligible couples, of which just 44 per cent are currently effectively protected. The government aims to make contraception more widely accepted, available, accessible, and affordable for family planning, as well as to counter the spread of AIDS. The decadal population growth rate has steadily declined from 24.8 per cent during 1961–1971 to 21.3 per cent during 1991–2001 and is targetted to further decline to 16.2 per cent during 2001–2011. (Box 6.3).

Box 6.3: India's Demographic Achievements

Half a century after formulating the National Family Welfare Programme, India has:

- Reduced the Crude Birth Rate (CBR) from 40.8 (1951) to 24.8 (2001).
- Halved the IMR from 146 per 1000 live births (1951) to 70 per 1000 live births (2001).
- Quadrupled the Couple Protection Rate (CPR) from 10.4 % (1971) to 44 % (1999).
- Reduced the Crude Death Rate (CDR) from 25 (1951) to 8.9 (2001).
- Added 25 years to the average life expectancy from 37 years to 62 years.
- Achieved nearly universal awareness of the need for, and methods of, family planning.
- Reduced the Total Fertility Rate from 6.0 (1951) to 3.1 (2001).

Source: Census of India, 2001, Government of India.

This has resulted in reducing births by almost 40 million over the last 30 years, contributing to the reduction in emissions growth amounts to approximately 40 Mt of CO_2 per year currently, at about one tonne of CO_2 emissions per capita per year.

The wide-ranging reforms in the past decade have accelerated economic growth and lowered the barriers to efficiency. The energy and power sector reforms, for instance, have helped to enhance the technical and

National Highway Development Project is an example of climate friendly development.

economic efficiency of energy use. The last few years have witnessed the introduction of landmark environmental measures that have targetted the cleansing of rivers, enhanced forestation, installed a significant capacity of renewable energy technologies and introduced the world's largest urban fleet of CNG vehicles in Delhi.

The recent National Highway Development Project to convert the existing roads into four/six-lane highways covering around 13,146 km of road network, with another 1,000 km of port and other connectivity, is expected to cost Rs 540 billion (US$ 11.8 billion). More than 2,100 km has already been completed over the last three years and another 5,000 km are under various stages of completion. More than US$ 3.5 billion have been spent and/or committed. The project will result in substantial savings in fuel consumption and, therefore, in GHG emissions, with the total socioeconomic benefits estimated at Rs 80 billion per year for the golden quadrangle alone (http://www.nhai.org/, dated 6 April, 2004).

The national capital, Delhi, has recently started its first state-of-the-art metro railway to ease traffic congestion, reduce commuting time, save fuel, reduce local pollutants and GHG emissions, and increase the share of public transport in the mega city. It is planned to construct 68.3 km of metro rail tracks in Delhi by 2005, which will cost Rs 105 billion. A unique feature of the Delhi Metro is its integration with other modes of public transport, enabling the commuters to conveniently change from one mode to another. These

The Metro Rail in New Delhi uses state-of-the-art technology.

and similar measures, affirmed by the democratic and legislative processes, have been implemented by committing additional resources, as well as by realigning new investments. These deliberate actions, by consciously factoring in India's commitment to the UNFCCC, have redirected economic development to a more climate-friendly path.

India is endowed with diverse energy resources, wherein coal has a dominant share. Therefore, the Indian energy system evolved with a large share of coal in the energy consumption. This, coupled with the rising energy consumption, led to a rising carbon emissions trajectory in the past. However, India's per capita CO_2 emission of 0.87 t-CO_2 in 1994 is still amongst the lowest in the world. It is four per cent of the US per capita CO_2 emissions in 1994, eight per cent of Germany, nine per cent of UK, 10 per cent of Japan and 23 per cent of the global average. India's energy, power, and carbon intensities of the GDP have declined after the mid-nineties, due to factors such as increased share of service sector in the GDP, and energy efficiency improvements. India has also taken some initiatives to enhance penetration of low carbon-intensive fuels like natural gas and carbon-free sources like renewable energy.

Fossil energy

The concerns about rising energy, electricity and carbon intensity of the Indian economy led the Government to initiate targetted programmes and institutions to promote energy efficiency, conservation and introduction of renewable energy technologies. The thrust areas include cleaner coal mining and use, oil security, infrastructure development, environmental and quality management, reforms, power grid integration, and energy efficiency. The clean coal initiatives include improving the quality of coal and the productivity of coal mining; adopting environment-friendly technologies including coal gasification, beneficiation, and liquefaction for value addition to domestic coal. Other initiatives such as the Electricity Act (2003); renewable energy; increasing the share of large hydro projects in the generation-mix; reducing electricity T&D losses; labelling equipment and benchmarking for energy efficiency; energy saving targets for motors, lighting and energy-intensive industries; reduction in gas flaring; waste heat recovery; and dual-fuel engines,

REVA: The indigenously built electric car.

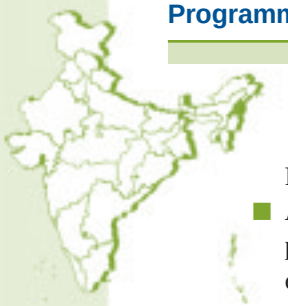
indicate the government's commitment to climate-friendly development.

Coal will continue to be the mainstay of commercial energy in India. The four-pronged strategy of more efficient and clean use of coal includes the rationalization of coal use, the participation of the private sector, price reforms, and technological up gradation. Some prominent technological interventions are in the areas of coal washing, combustion technologies and the recovery of coal-bed methane.

Energy conservation and efficiency enhancement measures in the oil sector include the reduction of gas flaring, waste heat recovery, energy audits, more efficient norms for road vehicles, and the substitution of diesel with natural gas. Institutions like the Petroleum Conservation Research Association have been promoting R&D activities for the development of fuel-efficient equipment and mass awareness.

The Ministry of Petroleum and Natural Gas has several programmes designed to mitigate the impact of activities in the oil and gas sector on the environment, which are listed below:

- It has embarked on the programme of exploiting coal-bed methane (CBM) by the oil sector, focusing on the methane trapped in the coal seams in mines that are economically unviable due to their depth, or are not safe. Under the CBM policy, 16 blocks have been awarded for exploration.
- Petrol and sulfur have been made more eco-friendly with the supply of unleaded petrol and low-sulfur petrol and diesel from 2000 onwards. The Euro-II equivalent fuel quality is available in selected urban areas and complete coverage would be achieved by 2005. The supply of Euro-III equivalent quality fuel is slated for commencement in selected major cities with effect from 1 April 2005.
- The government had also launched the programme of blending of five per cent ethanol in petrol in India. In the first phase, the major sugarcane-producing states have been selected for coverage and the remaining states are being taken up in the second phase in line with the availability of ethanol. The blending percentage would be raised to 10 per cent in subsequent phases.
- With the consumption of diesel being five times the consumption of petrol, the government had also considered blending of ethanol in diesel. However, in view of the inadequate quantity of ethanol as well as instability of the blend achieved, the blending of bio-diesel in diesel, like the developments abroad, is undergoing trials.
- To reduce the pressure on forests and the burning of biomass in rural areas, the government has introduced 5 kg LPG cylinders, available at affordable prices for the poorer sections of the population. The LPG waiting list has been liquidated and domestic LPG connections are now available across the counter.
- The laying of more gas, crude and product pipelines for transport of petroleum and gas products have been taken up, since this mode of transportation is the most eco-friendly and the least polluting. Simultaneously, the proposed national gas grid would serve to provide interconnectivity between consumers and producers in different parts of the country.
- The government has actively embarked on diplomatic initiatives with the countries of the Middle East and its immediate neighbours for the supply of natural gas, either as LNG or through pipeline transport, as the gases are environmentally cleaner than liquid petroleum fuels.
- CNG is being supplied for use as an auto fuel in Delhi and Mumbai and also as a domestic fuel. This auto fuel will be available in other cities, like Pune, Kanpur, Lucknow, Agra, Bareilly and



Faridabad, over the next two years.

- Auto LPG is also being supplied in the 10 most polluted cities of the country, with the commissioning of auto LPG dispensing stations in Agra, Ahmedabad, Bangalore, Chennai, Delhi, Hyderabad, Kanpur, Kolkata, Mumbai and Pune.
- The oil companies have also improved their housekeeping practices by systematic efforts to control gas flaring, recover waste heat, minimize handling losses, etc.
- Another environment-friendly measure proposed is the use of hydrogen for transportation purposes. Although work is still in the R&D stage, the Indian oil and gas sector has decided to step up activities in this area. The success of the move will go a long way in reducing GHG emissions, since hydrogen contains no CO_2, unlike hydrocarbons.

The government policy has included public investment to develop the natural gas infrastructure for port handling, long-distance and local distribution. One example is the HBJ 1,500-km, high-pressure gas pipeline from near Mumbai to the north of Delhi, which carries 4-5 billion cubic meters of gas from offshore production. A national gas grid is also in the planning stages. The share of gas in the power-generating capacity has risen to eight per cent from only two per cent ten years ago. LPG has almost completely replaced commercial coal and kerosene in urban households; public vehicles also have been converted to run on CNG. Box 6.4 indicates some of the major achievements in the Indian petroleum sector.

Box 6.4: Success Story in the Petroleum Sector

- Dismantling of Administrative Price Mechanism on 31 March, 2002.
- New Exploration Licensing Policy introduced and two rounds completed in record time.
- Refining capacity targets surpassed.
- Release of around 34 million new LPG connections, thereby liquidating the entire waiting list for new cooking gas connections in India.
- Secured equity oil abroad.
- Introduction of auto LPG and setting up of Motor Spirit-Ethanol blending projects in selected States.

Source: Tenth Plan Document, Planning Commission, 2002.

The concerns about rising energy intensity, electricity intensity and carbon intensity of the Indian economy led the government to initiate specific programs and set up institutions to promote energy efficiency, energy conservation and introduction of renewable energy technologies. The thrust areas include:

- Cleaner coal mining and coal use,
- Oil security,
- Infrastructure development,
- Management of Environmental quality,
- Power grid integration, and
- Energy efficiency improvement.

The clean coal initiatives include improving the quality of coal and the productivity of coal mining; adopting environment-friendly technologies including coal gasification, beneficiation, and liquefaction for value addition to domestic coal and other initiatives such as:

- renewable energy,
- increasing the share of large hydro projects in the generation-mix,
- reducing electricity T&D losses,
- labeling equipment and benchmarking for energy efficiency,
- energy saving targets for motors, lighting and energy- intensive industries,
- reduction in gas flaring,
- waste- heat recovery,
- dual-fuel engines, etc.

indicate the government's commitment to climate-friendly development.

The Indian electricity sector has long been carbon intensive and the largest source of carbon dioxide emissions. Natural gas has penetrated this market in recent years and helped to reduce the carbon intensity of electric power generation. The improvement in the combustion efficiency of conventional coal technologies, along with strong promotion of renewable technologies, has made appreciable

contributions to reduced GHG emissions. The lower carbon emissions also have resulted from important technological advancements in coal washing. Recent government policy restricts the transportation of unwashed coal to less than a 1,000 km. The customers are motivated to reduce the ash content to improve efficiency, reduce local pollution, and cut freight costs. The capture of coal bed methane (which is a greenhouse gas) is being promoted for use as clean fuel. New combustion technologies, including super-critical coal-fired power plants, are being introduced as described below:

Introduction of Super-critical Technology: In order to achieve higher operational efficiency and minimize environmental impact, NTPC is introducing super-critical technology in the country in the forthcoming mega projects. Switching from sub-critical to super-critical technology results in enhancing the efficiency of thermal conversion, thereby reducing fuel consumption and consequently emissions.

Integrated Gasification Combined Cycle (IGCC): Lately, coal gasification-based power generation has emerged as an environmentally attractive generation alternative; i.e., high efficiency and low emissions. A detailed technical and economic feasibility study report for setting up a 100 MW IGCC Plant based on Indian coal at NTPC Dadri is in progress. Also, NTPC and BHEL are collaborating for setting up a 100 MW IGCC demonstration plant based on Indian coal at NTPC Auraiya plant.

India has one of the most active renewable energy programmes in the world.

Renewable energy

India has one of the most active renewable energy programmes in the world, which has a wide geographical reach and covers diverse economic sectors. In the rural areas, over 3.26 million biogas plants and 34.3 million improved wood-burning stoves have been installed. So far about 3,50,000 solar lanterns, 177,000 home-lighting systems, 41,400 street-lighting systems, 1.17 MW aggregate capacity of small and stand-alone power plants, and over 4,200 solar-pumping systems have also been installed.

The recent years have seen a significant increase in renewable energy applications for electricity generation. Ministry of Power has taken various steps to improve the hydropower development in India. These mainly include additional budgetary financial support, R&M and up-rating of existing hydro stations, basin wise hydropower development and comprehensive ranking studies for 399 hydro schemes. As on December 2003, hydro electric projects of 27,760 MW have been commissioned and are in operation. 41 schemes with an aggregate installed capacity of 15,300 MW (which includes capacity scheduled to be commissioned during 2007-2012) are in different stages of implementation. During 2002-2007, hydro capacity addition planned is 14,393 MW. To meet future power requirements, hydro electric schemes with a total installed capacity of about 20,000 MW are planned to be implemented.

Recently, a 50,000 MW hydro electric initiative has been launched that includes preparation of feasibility reports for 162 hydro electric schemes planned for execution during 2012-2017.

The total installed capacity of small hydro-power projects (up to 25 MW) is 1529 MW presently.

Solar Photovoltaic (SPV) power systems are being used for a variety of decentralized applications, such as rural electrification (Box 6.5), railway signaling, microwave repeaters, TV transmitters, telecommunications, and for

Solar power lights rural India.

providing power to border outposts. Biomass power-generation plants, aggregating to 537 MW have been installed in the country. In addition, biomass gasification systems totaling 55 MW capacity have also been set up for decentralized energy applications. A 140 MW Integrated Solar Combined Cycle (ISCC) Power Project is being set up, which is one of its kind in the world, based on naphtha fuel and solar power.

India's installed capacity of 1507 MW places it among the first five countries in the world in the field of wind-power generation. Wind generators of 250 kW to 600 kW capacities are being manufactured in the country.

Box 6.5: Solar Energy Lights Rural India

SELCO India, a private sector company established in 1995, has installed over 25,000 Solar Home Systems (SHS), 600 solar streetlights and 4,000 solar thermal systems, mostly in rural India. These initiatives have been successful by coupling quality products and after- sales service with doorstep customer financing at priority sector lending rates through several regional rural banking institutions. The company has also sold over US$ 50,000 worth of carbon credits to US and European firms for these clean energy initiatives.

The total installed capacity of small hydropower projects (up to 25 MW) is 1406 MW. Some projects with an aggregate capacity of about 15.21 MW have also been completed in the areas of energy recovery from urban, municipal and industrial waste.

Ministry of Power has recently launched Rural Electricity Supply Technology (REST) mission for providing affordable and reliable power supply to rural and remote areas through decentralized distributed generation based on renewable energy resources such as solar, mini- and micro-hydro, biomass, etc.

Energy efficiency and conservation

India's elasticity of energy consumption was more than unity for the 1953–2001 period. However, the elasticity for primary commercial energy consumption for the 1991–2000 period is less than unity. This could be attributed to several factors, such as the improvement in efficiency of energy use and the consequent lowering of the overall energy intensity of the economy, and the higher share of hydrocarbons in the overall energy mix.

Energy conservation is accorded high priority by the central and state governments through multiple measures to improve the energy management of the demand and supply side. These include energy standards, labelling equipment and appliances, energy codes for building, energy audits, energy efficient bulbs, tubelights and agricultural pumpsets, mass awareness and extension efforts. In addition, affordable alternative energy sources can greatly influence the pattern of energy consumption and lead to energy efficiency. The Tenth Five-Year Plan provides energy saving potential for the country from some specific activities (Table 6.3).

The NTPC, the premier power generation company in India working under Ministry of Power, has achieved the ISO: 14001 Standard for all the stations it owns and one more that it manages. In addition, the NTPC has obtained ISO 14001 accreditation for

Table 6.3: Energy saving potential

End-use type	Potential Energy Savings (GWh)
Motors and drive systems (Industry and agriculture sector)	80000
Lighting (domestic, commercial and industrial sector)	10000
Energy intensive industries	5000
TOTAL	**95000**

Source: Tenth Plan Document, Planning Commission, 2002.

its Corporate Environment Management Group and Ash Utilization Division.

The best Operation and Maintenance (O&M) philosophy of the NTPC has yielded substantial efficiency and environmental improvement. The O&M practices of NTPC have immensely benefitted old stations taken over by NTPC, which were operating at a lower efficiency earlier. In order to increase the efficiency of ESP on a sustained basis, new technologies such as water-fogging, and sodium conditioning, are under trial to further reduce particulate emissions in some stations. The NTPC has taken a proactive step with respect to the reduction of GHGs and is in the process of preparing a road map for CO_2 sequestration.

The Indian government passed the Energy Conservation Act in 2001, 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. However, the enforcement of penalties stipulated in the Act have been kept in abeyance for five years, during which time people would be made aware of the economics and efficacy of the conservation of energy.

Industrial development has contributed significantly to economic growth in India, with indigenous coal accounting for over half of total primary energy consumption. Industrial energy intensity has declined gradually over the past decade, mainly due to the adoption of new and efficient technologies and rapid expansion of non energy-intensive industries.

Transport

There has been a sweeping change in India's vehicle stock over the past decade. Economic reforms have enlarged the vehicle market and prompted rapid penetration by Indian- collaborated foreign brands. The rising concern about air quality prompted the introduction of emissions-limiting performance standards in 2000. European-level emission norms for new cars and passenger vehicles were introduced in 2002 in Delhi, Mumbai, Chennai, and Kolkata. Apart from mitigating local pollutants, the vehicles meeting these norms are more energy efficient and emit fewer GHGs, while providing the same level of service.

In Delhi, 84,000 public vehicles—all buses, taxis, and three-wheelers—were converted from gasoline and diesel to CNG. This rapid achievement was accomplished in about one year to comply with the clean air laws. Although the compliance cost per vehicle was relatively high—up to US $300 for a three-wheeler and US $1,000 for a car—the policy has been applied uniformly and effectively. The Government of India has recently announced an Auto Fuel Policy for the country to ensure cleaner air for the citizens through efficient vehicles, cleaner fuels and other solutions that may also reduce carbon emissions.

Agriculture

Some of the climate-friendly initiatives in the agriculture sector include the standardization of fuel-efficient irrigation pump-sets, retrofitting existing pump-sets for higher energy efficiency, better water and crop management, improved cultivars, more efficient application of synthetic fertilizers, enhanced organic fertilizer use, improved animal feeds and digesters, and rationalization of power tariffs for the agriculture sector. Many of these measures would serve to reduce CO_2, methane and N_2O emissions.

Residential

The development and promotion of fuel-efficient equipment and appliances like kerosene and LPG stoves, compact fluorescent lamps, and better pumps for water lifting in high-rise buildings are endorsed in the residential sector.

Increased mechanization in Indian agriculture

Afforestation and Land Restoration

The forest and tree cover constitutes above 23 per cent of the country's geographical area according to the 2001 estimates. The per capita deforestation rate in India is amongst the lowest in the major tropical countries. The area of forests with 40 per cent crown cover has been increasing. A major afforestation plan is being implemented with the assistance of local population through JFM. The basic components of India's forest conservation efforts include putting a check on the diversion of forest land for non-forestry purposes; encouragement of farm forestry/private area plantations for meeting industrial wood requirement; expansion of the area under the protected area network; and control of forest fires. During 1990-1999, an area of over 14 Mha was brought under various afforestation programmes.

The NTPC and other central power sector undertakings of the Government of India are adopting afforestation and other environmental measures to enhance CO_2 removals by natural sinks. These include investments to increase the national forest cover, extensive afforestation and greenbelt development, and compensatory afforestation for projects that destroy forestlands.

The NTPC has already planted more than 15 million trees in and around its power stations. The scientific selection of species planted contributes to aesthetic improvement and serves as a sink for pollutants including CO_2. The NTPC has introduced medicinal and bio-diesel plants in its plantation programme. Further, the filled-in abandoned ash disposal areas are being reclaimed and restored. A Special Purpose Vehicle (SPV) for afforestation has been registered as a society for increasing the forest cover and for the natural sequestration of CO_2.

The National Forest Policy envisages peoples' participation in the development of degraded forests, to meet their requirements of fuelwood, fodder and timber, as well as to develop the forests for improving the environment through JFM. As on 1 September, 2000, 10.25 Mha of forestland has been brought under the scheme and 36,165 Village Forest Committees have been constituted. The protected area network includes 88 National Parks and 490 Wildlife Sanctuaries and is spread over 14.8 Mha. The conservation of fragile ecosystems has been accorded a high priority. There are 12 biosphere reserves that have been set up in the country with the aim of protecting the representative ecosystem. Management plans are being implemented with respect to over 20 wetlands in the country, mangroves and coral reefs. The National Wasteland Development Board has been entrusted with the responsibility of regenerating degraded and non-forest and private lands. The National Afforestation and Eco-Development Board is responsible for regenerating degraded forestlands, the land adjoining forest areas, and ecologically fragile areas. These planned measures have led to a steady increase in the rate of afforestation, significantly contributing to climate change.

Various planned responses in India have led to sizeable savings in carbon emissions during the past decade. The process has helped to integrate the national development policies with the objectives of the UNFCCC. The additional CO_2 emissions saved over the past decade by promoting renewable energy and energy conservation initiatives amount to over 330 Mt and another 40 Mt from population policies. These initiatives and additional investments have altered India's emissions trajectory, making national development more climate friendly.