

Preface

In 1992, leaders of government, international agencies and non-governmental organisations, from around the world met at Rio de Janeiro. This conference resulted, amongst other things, in the adoption of Agenda 21 — a global plan of action to confront the pressing needs of the world and prepare for the challenges of the next century in order to attain the long-term goal of sustainable development. The objectives of Agenda 21 were sought to be achieved with the active involvement of all stakeholders — national and local governments, international organizations, business, non- government organisations and citizen groups.

Ten years later, the international community comes together once again at the World Summit on Sustainable Development in Johannesburg. The objective of the summit is to review the developments of the past decade and to forge a cohesive set of global partnerships to achieve a comprehensive implementation of Agenda 21.

This report is an attempt to document India's experience in implementing Agenda 21. The report begins with an overview of India's resources and its economic, governance and social profile. A broad picture of India's approach to Agenda 21 is also provided. Thereafter, individual chapters deal with the different facets of Agenda 21 – environmental, economic and social – and analyze initiatives, achievements, concerns and future directions for each sector vis-à-vis sustainable development concerns drawn from Agenda 21.

This study was commissioned and coordinated by the Government of India in the Ministry of Environment and Forests and supported by the UNDP. The draft document was prepared by TERI based on a consultative process involving all the relevant Ministries of the Government of India. The draft was finalized after several discussions at two forums — the Working Group, chaired by the Joint Secretary (International Cooperation) MoEF, and the Monitoring Committee, chaired by Secretary, MoEF. Concerned Ministries, the Planning Commission and UNDP were represented at these forums.

It is hoped that this document will provide a comprehensive assessment of India's experience in integrating Agenda 21 objectives. This assessment demonstrates India's commitment to Agenda 21 and brings out the possible initiatives that need to be taken in the future to sustain and implement this commitment.

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Towards sustainable development: an overview

Introduction

During the last few decades, it has become evident that we can no longer think of socio-economic development in isolation from the environment. The nature of issues confronting us along with an increasing interdependence among nations necessitates that countries come together to chart a sustainable course of development. The United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in June 1992, was a milestone event, effectively focussing the world's attention on environmental and development problems we face as a global community. The Summit brought together governments from around the globe, representatives from international agencies and non-governmental organizations with the objective of preparing the world for attaining the long-term goals of sustainable development.

Agenda 21 adopted at the conference, represents a *global consensus and political commitment at the highest level* on socio-economic development and environmental cooperation^a. The foremost responsibility for leading this change was placed on national governments. Each government was expected to design national strategies, plans, and policies for sustainable development — a national Agenda 21 — in consonance with the country's particular situation, capacity and priorities. This was to be done in partnership with international organizations, business, regional, state and local governments, non-government organizations and citizens groups. The Agenda also recognized the need for new assistance for developing countries to support the incremental cost of actions to deal with global environmental problems, and to accelerate sustainable development.

Since UNCED, extensive efforts have been made by governments and international organizations to integrate environmental, economic and social objectives into decision-making through new policies and strategies for sustainable development or by adapting existing policies and plans. As a nation

^a In addition to Agenda 21, the assembled leaders signed the Framework Convention on Climate Change and the Convention on Biological Diversity; and endorsed the Rio Declaration and the Forest Principles.

deeply committed to enhancing the quality of life of its people, and actively involved with the international coalition towards sustainable development, the Summit provided India an opportunity to recommit itself to the developmental principles that have long guided the nation. These principles are embedded in the planning process of the country and therefore the need for a distinct national strategy for sustainable development was not felt. As we approach Rio +10 and set new milestones based on an evaluation of past performance, this exercise attempts a critical appraisal of national and sectoral planning in India and how it has sought to address sustainability concerns since and even prior to Rio. The objective of this review is to evolve strategies for the sustainable development for the country.

To put the analysis that follows in perspective, it will be in order to sketch a brief profile of the country.

India: a profile

India is the seventh largest country in the world and Asia's second largest nation with an area of 3.29 million square kilometres. The Indian mainland stretches from 8° 4' to 37° 6' N and 68° 7' to 97° 25' E. The country is set apart from the rest of Asia by the Himalayas to the north, and is flanked by the Bay of Bengal to the east, the Arabian Sea to the west, and the Indian Ocean to the south. India is characterized by variable terrain, starting from the Himalayas to flat rolling plains along the Ganges deserts in the west and an upland plain (the Deccan Plateau) in the country's south. India has numerous perennial and seasonal rivers, a rich variety of soils and a great diversity of natural ecosystems. There are also diverse climatic zones varying from tropical monsoon in the south to temperate in the north.

Natural resource endowment

Minerals and energy resources

India is richly endowed with mineral resources, which include fossil fuels, ferrous and non-ferrous ores, and industrial minerals. There are about 20 000 known mineral deposits in the country and as many as 87 minerals (4 fuels, 11 metallic, 50 non-metallic, 22 minor minerals) are being exploited (TERI, 2001b). The country has abundant reserves of bauxite, coal, dolomite, iron ore, manganese, limestone, magnesite and adequate reserves of chromite, graphite, lignite, and rock salt. The production of some important minerals over the years is given in Table 1.1.

Table 1.1 Mineral production (in million tonnes)

Mineral	1970	1990	1998-99
Iron ore	16.6	55.6	70.7
Bauxite	1.4	5.0	6.4
Limestone	23.8	70.1	106.8

Source. Ghosh and Dhar (2000) cited in TERI (2001b)

Coal remains the single most important source of energy in India with a reserve-production ratio of over 200 years (Table 1.2). The Geological Survey of India has estimated India's proven coal reserves to be approximately 8% of the world's total proven reserves (TERI, 2001a).

Besides conventional sources, the country is richly endowed with non-conventional energy resources such as solar, hydro and wind. The country stands out as being the only one in the world with a separate Ministry of Non-conventional Energy Sources. India's renewable energy programme is one of the largest and most extensive in the world. Currently, almost 3% of India's installed power capacity comes from non-conventional energy sources.

Table 1.2 Proven reserves of fossil fuels and reserve-production ratios

Fuel	End 1991				End 2000			
	Reserves		R/P		Reserves		R/P	
	India	World	India	World	India	World	India	World
Coal (billion tonnes)	62.54	1040.5	195.0	239.0	74.73	984.21	223	227
Crude oil (billion tonnes)	0.80	135.40	25.60	43.40	0.6	142.1	17.3	39.9
Natural gas (trillion cubic metres)	0.70	124.00	48.80	58.70	0.65	150.19	24.8	61.0

Source. BPSR (2001), TERI (2001a)

Forests and biodiversity

A large variety of forests is found in India ranging from evergreen tropical rain forests in the Andaman and Nicobar Islands, the Western Ghats and the North-Eastern states to dry alpine scrub in the Himalayan region. Between the two extremes the country has semi-evergreen rain forests, deciduous monsoon forests, thorn forests, subtropical pine forests and temperate forests. The forests of India have been divided into 16 major groups comprising 221 types. The forest cover of the country, as per the assessment by Forest Survey of India, is 63.73 million ha constituting 19.39% of the geographic area of the country out of

which 37.74 million ha (11.48%) is dense forest (crown density more than 40%), 25.50 million ha (7.76%) open forest (crown density 10%-40%) and 0.49 million ha (0.15%), mangroves (FSI, 2000). Over 45,000 plant species are found in the country. Several thousand of them are unique to the country. Two international biodiversity hotspots have been identified in the Eastern Himalayan region and the Western Ghats.

Fresh water

India is considered rich in terms of annual rainfall and total water resources available at the national level. The average annual rainfall, equivalent to about 4000 billion cubic metres (BCM), however, is very unevenly distributed both spatially as well as temporally. This causes severe regional and temporal shortages. Utilizable resource availability in the country varies considerably from 18,417 cubic metres in the Brahmaputra valley to as low as 180 cu m in the Sabarmati basin (Chitale, 1992). Precipitation varies from 100 mm a year in western Rajasthan to over 9000 mm a year in the north-eastern state of Meghalaya (Engleman and Roy, 1993). With 75% of the rain falling in the four monsoon months and the other 1 000 BCM spread over the remaining eight months, Indian rivers carry 90% of the water between June and November, making only 10% of the river flow available during the other six months.

Governance structures

India, at the time of its Independence faced many challenges. The partition of the country produced severe communal stress. There were a large number of small states ruled by dynastic monarchies. Assimilating these into the mainstream of the Indian Union was an uphill task. The country required a strong governance structure to ensure peace and rapid socio economic development. The fundamental principles of governance that were enunciated then were democracy, equality and the rule of law. These principles have, over the last fifty years and more, taken deep roots and the country has had an unbroken democratic continuum.

The basic democratic character of the Indian state has, since Independence, become stronger, wider and deeper. The country has a strong and vibrant legislature with an independent judiciary, that have acted as a balance to the executive. The planning process in the country is so structured as to ensure a iterative mechanism of planning based on the interaction between the centre, states and local bodies. At the national level, the Planning Commission draws up Five-Year Plans in consultation with various ministries and state

governments, reflecting the nation's priorities. The Five-Year Plans are divided into annual plans, which set the prioritized and short-term developmental goals. The performance of programmes is regularly monitored, by a mid-term review of the Plan. The implementation of developmental programmes in the country is carried out through a decentralised and broad-based governance machinery. The country has a fairly uniform pattern of devolution of responsibility between the centre and the states and between the states and the local bodies. There is an active and independent press and since the 90's an equally effective electronic media. A large number of NGO's are active and help to support the formal governance structure. Increasingly, information technology is playing an important role in bringing about greater awareness, peoples' participation and transparency. These features of the Indian system of governance are elaborated upon in the following sections.

Legislature and Judiciary

The Indian state is characterised by the classical division of powers between the executive, legislature and judiciary. The principles governing this division are laid out in the Constitution. Amendments have been made in the Constitution from time to time to meet the changing needs and to cope with unforeseen situations. The state is federal with 28 states while seven smaller administrative units are directly controlled by the centre (Union Territories). Elections to the legislature, both at the centre and the states, are supervised by an independent Election Commission, whose independence is safeguarded by constitutional provisions. Elections in India are the largest in the world and have been accepted as being fair with provisions for correction in case of any aberrations. The legislatures have the powers to approve/reject/modify all legislation, review financial allocations, expenditures, revenue collection and the overall performance of government. Proceedings of the legislatures are open. Important proceedings of the Parliament are also televised live to a national audience.

The Judiciary also has a federal character with the Supreme Court at the apex, High Courts in the states and other courts below the high courts in the states. The Judiciary is independent and has acted as an effective check on both the executive and the legislatures. In the recent past the Judiciary has also played a pro-active role in upholding the rights of the citizens particularly through the route of Public Interest Litigation. In the area of environment, in particular, the courts have been active in achieving a greater degree of compliance with the laws and in upholding the right of the citizens to acceptable quality of water and air.

The other positive feature of the State is that it has been continuously ruled by elected civilians. The large armed force of the country has protected the country borders from external aggression and plays an important role in countering terrorism in some of the border states as also assisting the civilian administration to cope with internal disturbances and natural calamities.

Devolution to states

The Constitution lays down the division of powers and responsibilities between the centre and the states. These have provided the basis for an enduring federal structure. Broadly, issues requiring a national perspective like defence, external affairs are with the centre. In the areas of social and economic issues there is shared responsibility. Often the centre takes the initiative on important issues and involves the states in the implementation. Thus the “green revolution” in agriculture was a central initiative implemented by the states. Financial flows to the states are guaranteed by leaving certain taxation powers with the states. This is supplemented by the awards of the Finance Commissions, set up every five years under the Constitution – these lay down the principles of revenue sharing of central revenues between the centre and states.

Devolution to local bodies

India has had a long history of local self government, starting well before Independence. After Independence greater use was sought to be made of these bodies in socio-economic development of the country. In 1993 the Constitution was amended to provide constitutional protection to these bodies. This was done in three ways. First there were constitutional safeguards for regular elections and the establishment of State Election Commissions to ensure free and fair elections. Second the powers and functions of these bodies were laid down in the Constitution and it was expected that states would follow this national pattern by amending the state legislation where required. Finally there was a provision for State Finance Commissions (on the lines of the National Finance Commission) that would ensure an adequate level of revenue sharing between the state and the local bodies. This move has provided the basis for greater devolution to elected local bodies and thus to the local communities. The amendment was also an important step towards the empowerment of women and increasing their participation in decision-making since it reserved 33% seats in urban municipalities and the panchayat raj institutions for women.

Education, awareness and the role of media

The rise in the literacy level along with efforts to mainstream the less privileged in the society have strengthened the decentralised governance system in the country. The media has played an important role in awareness generation. The country has an active press that has guarded its freedom zealously. Given the large diversity of the country, regional papers in the local language far outnumber the national press that is dominated by the English press. Of late there has been a veritable explosion of television channels, once again with a very large number of regional channels in the local languages. The media has played an effective role in upholding the basic rights of the people. It has thus acted as yet another forum where people can seek redress of their grievances, where the other forums are not effective. It is also an instantaneous barometer of public opinion on issues that are contentious. With growing literacy, the effectiveness of this medium in moulding public opinion has been growing. It has thus proved to be a valuable instrument to strengthen the basic democratic character of the Indian governance structure.

Transparency and peoples' participation

There has been a growing trend to provide for greater transparency in the functioning of Government. The natural complement of this process has been the parallel trend of allowing people to participate in decision making at all levels. Important issues are debated and discussed before a decision is taken. Consultations are held, both by Government and by Parliament, with important stakeholders. The Five-Year Plans are also finalised only after consulting experts from various fields and disciplines. Similarly, in the case of environmental clearance all major projects have to go through the process of a public hearing. Again in the case of forests a new style of governance has been introduced in the form of Joint Forest Management where both, the government and the local community, participate in managing the forest resources. Use of independent regulatory commissions is yet another administrative innovation to impart greater transparency and peoples' participation to the governance structure. The Indian system of governance has thus shown remarkable resilience in adapting to changing situations and learning from the experience of other countries. Throughout this process, the fundamental principles of democracy and openness have not only been retained but also strengthened.

Information technology and e-governance

In this process the new opportunities thrown up by information technology have been made full use of. There is now a mass of information available on the

Internet on the performance of the government, important new initiatives and plans for the future. The Internet is also being used for wider consultations – important documents, like the Convergence Bill (which seeks to provide a uniform regulatory structure for the converging telecommunications, entertainment and information technology sectors) are placed on the Internet for comments and feedback. The electronic media is also fostering efficient governance through speedier communications, uniform databases that can be used for multiple departments like ration cards, voter identity cards etc and public services such as tracking the status of rail reservations and passport applications.

Challenges and administrative reforms

Governance is an ongoing process that has to continually adapt to new challenges, situations and the opportunities provided by new technologies. The Indian system, rooted as it is in the fundamental principles of democracy, respect for the rights of individual citizens and openness, has shown ample evidence of its robustness in continuous adaptation to these changes. Administrative reforms have to be seen not as a one time effort but an ongoing process of change, adaptation and improvement. At every level of governance, both within the various organs of the state and the other agencies like the media, NGO's and local communities, there has been a continuous process of change. This change has led to a progressive improvement in the openness of the system and a greater degree of responsiveness. Given the vast size of the country, the wide differences in traditions and cultures, this is an unmistakable sign of the basic health of the governance structure and its capacity for continuous correction and self improvement.

Economic progress

The country has witnessed sustained growth since Independence; the per capita net national product in constant 1993-94 prices has grown from Rs 3687 (1950-51) to Rs 10 254Q^a (2000-01). GDP at factor cost has grown from Rs 1404.8 billion (1950-51) to Rs 11939.2 billion (2000-2001)^b. The sectoral composition of GDP has changed overtime — the share of agriculture has declined, while that of industry and services has increased (Table 1.3).

^a Q: quick estimates

^b Per capita net national product and GDP for 2000-01 are quick estimates by the GoI Economic Survey 2001/02.

Table 1.3 Gross Domestic Product at factor cost by the industry of origin (at 1993-94 prices)

Year	GDP at factor cost Rs billion	Percentage share				
		Agriculture, forestry, logging, fishing, mining and quarrying	Manufacturing, construction, electricity, gas and water supply	Trade transport and storage and communication	Banking and insurance, real estate and ownership of dwellings	Public administration and defence and other services
1950-51	1404.8	59.19	13.29	11.95	6.69	9.41
1970-71	2963.0	48.12	19.91	13.73	5.94	10.69
1990-91	6930.5	34.92	24.49	18.73	9.69	12.18
2000-01*	11939.2	26.55	24.99	22.34	12.56	13.53

*quick estimates

Source. MoF (2002)

The share of agriculture in GDP has come down to 27% from as high as 60% at Independence; however, about two third of India's workforce still depends on agriculture for its livelihood. The Green Revolution which worked through introduction of high-yielding varieties and large and assured quantities of fertilizers, pesticides, and irrigation water helped transform the economy from one deficient in food grains to one that is self-sufficient. The area under food grains accounts for 65% of the total gross cropped area and commercial crops (such as oilseeds) make up 25% (2001). Wheat and rice are grown on nearly two thirds of the area on which food grains are cultivated. About 38% of the total gross cropped area was irrigated in 1997/98. Though around 84% of the country's total water consumption for irrigation 62% of the cropped area is still dependent on the monsoons for water.

The Ninth (1997-2002) and Tenth (2002-2007) Five-Year Plans perceive accelerated agricultural growth as a means of reducing the incidence of poverty and enhancing employment. It is believed that supply side factors — technology, fertilizers, irrigation, infrastructure and credit would be the prime

movers for an accelerated and sustainable growth of Indian agriculture (Rao and Gulati, 1999).

The decade of nineties witnessed fundamental reforms that led to the removal of entry barriers, reduction of areas reserved for the public sector, liberalization of the foreign investment policy and import policy for intermediates and capital goods, all contributing to an upsurge in industrial growth. Overall growth in the last decade was marked by cyclical fluctuations with the peak level of industrial growth at 13% in 1995-96. It has slackened thereafter to around 6.5% annually. The EXIM (export-import) Policy for 1992-97 aimed at bringing about major reforms in the trade policy for accelerating India's transition towards a globally integrated economy. The phasing out of import restrictions, abolition of import quotas, quantitative restrictions, have all played an important role in enhancing trade opportunities. Exports (including re-exports) from the country have increased from US \$ 18.2 billion in 1992-93 to US \$ 44.5 billion in 2000-01 while imports have gone up from US \$ 21.8 billion to US \$ 50.53 billion in the period (MoF, 2002).

The service sector grew in the 1990s with its share in GDP rising from 28% in the early 1950s to 41% in 1990-91 and around 49% in 2000-01. Sectors such as software services and IT-enabled services have emerged as new sources of strength, creating confidence in India's competitiveness in the world economy. The Tenth Plan aims at providing further impetus to the rapid growth of these sectors, which are likely to create high quality employment opportunities.

Social development

India's population was estimated at 1 billion as on 11 May, 2000 i.e. 16% of the world population on 2.4% of the globe's land area. Half a century after formulating the national family welfare programme, India has been successful in reducing the crude birth and total fertility rates, halving the infant mortality rate (IMR), and reducing the crude death rate. The average life expectancy in the country has also increased (Table 1.4).

Table 1.4 Selected health indicators for India

Indicators	1951	1998
Crude Birth Rate (per 1000), (SRS) ^a	40.8	26.4
Crude Death Rate (per 1000), (SRS)	25.0	9.0

^a SRS-Sample Registration System

Infant Mortality Rate (per 1000 live births), (SRS)	146.0	72.0
Total Fertility Rate, (SRS)	6.0	3.3*
Life Expectancy (years)	37.0	62.0

* 1997

Source. MoF (2002), National Population Policy, 2000 Government of India^a

The country has also made significant progress in reducing poverty (Table 1.5). Between the mid-1970s and 1993/94 the proportion of the people living below the poverty line (the head count ratio) ^b declined steadily from 55% to 36% and further to 26% in 1999-2000. The incidence of poverty, defined as the percentage of population below a specified poverty line is highest in Orissa (55%), West Bengal (51%), and Himachal Pradesh (45%) and low in Andhra Pradesh, Punjab, Haryana, and Kerela (Shariff, 1999).

Table 1.5 Estimates of poverty (%)

Year	All India	Rural	Urban
1973-74	54.9	56.4	49.0
1977-78	51.3	53.1	45.2
1983	44.5	45.7	40.8
1987-98	38.9	39.1	38.2
1993-94	36	37.3	32.4
1999-2000	26.1	27.1	23.6

Source. MoF (2002)

Access to reliable and affordable energy services is an important indicator of social development. Despite an increase in the per capita consumption of commercial fuels like electricity, traditional fuels still dominate the household energy profile. Moreover, there is a marked disparity in the levels of energy consumption in the rural and urban areas of the country (Table 1.6).

Table 1.6 Monthly per capita consumption — All India

All India	Rural	Urban
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^a <http://mohfw.nic.in>

^b Head Count Ratio represents the percentage of population that earns/spends below a certain level of income. This level is identified as the poverty line. Poverty line (monthly per capita) for the rural India is Rs 205.84 (93-94), for urban India is Rs 281.35 (93-94); Planning Commission.

	1987- 1988	1999- 2000	1987- 1988	1999- 2000
Fuel wood and chips (kg)	16.24	17.70	7.40	5.34
Electricity (kWh)	1.30	4.54	7.18	20.89
Kerosene (lt)	0.57	0.57	1.29	.71
Liquefied petroleum gas (kg)	0.01	0.14	0.39	1.31

Source. TERI (2001a), NSSO (2001)

Drinking water and sanitation facilities are basic requirements for healthy living. There has been significant progress in improving these services (Table 1.7), but there are marked rural-urban and regional inequalities in the country. While in some states such as Uttar Pradesh, Delhi, Pondicherry and Chandigarh, 100% access to water supply services in rural areas has been achieved, in others such as Assam, Punjab and Kerela the percentage habitation fully covered is only 57.4%, 33.3% and 22.2% respectively (MoRD, 1999). Coupled with this are inadequate resources for treating wastewater. Improvement of water supply and sanitation facilities are both priorities of the government.

Table 1.7 Population covered with drinking water and sanitation facilities (%)

Area	1985	1990	1999
Drinking water			
Rural	56.3	73.9	98.0*
Urban	72.9	83.8	90.2@
Sanitation			
Rural	0.7	2.4	9.0*
Urban	28.4	45.9	49.3@

*With Government initiative only under CRSP, MNP, JRJ, and IAY, coverage through private initiative is not known

@As on 31-3-1997

Note:

Percentage coverage in respect of rural water supply and sanitation are based on population covered in current year to corresponding 1991 census population

Percentage coverage in respect of urban water supply and sanitation are based on population covered in current year to corresponding current population

Source. MoF (2001)

Improvement in the health status of the population has been one of the major thrust areas in the social development programmes of the country. Over the years there has been a significant improvement in health standards particularly among the poor. Access to basic health facilities has improved and many dangerous diseases have been eradicated. This has been achieved through technological breakthroughs and improvements in the access to health, family welfare and nutrition services with special focus on the under-served and the under-privileged segments of the population. There has been steep fall in mortality and in specific diseases such as polio, neonatal tetanus and other vaccine-preventable diseases; the incidence of leprosy too, has declined. The disease burden due to communicable, non-communicable diseases and nutritional problems, however, continues to be high in the country.

The last decade witnessed an improvement in literacy rates from 52% in 1991 to 65% in 2001 (Table 1.8). At the same time, there are many without access to education — out of approximately 200 million children in the age group 6-14 years, only 120 million are in schools and the net attendance in the primary level is only 66% of the enrolment (Planning Commission, 2001).

Table 1.8 Literacy rates (percent of population)

Year	Total		Female		Male		
		Rural	Urban	Total	Rural	Urban	Total
1971	29.5	13.2	42.1	18.7	33.7	61.3	39.5
1981	43.7	21.8	56.4	29.9	49.7	76.8	56.5
1991	52.2	30.6	64.1	39.3	57.9	81.1	64.1
2001	65.4	46.70	73.20	54.16	71.40	86.70	75.85

Source. MoF (2002)

As the foregoing section indicates, there has been improvement in the various facets of human development; though there is still a long way to go. That poverty goes beyond lack of adequate income, and should be viewed more as a state of deprivation spanning the social, economic, and political context of the people that prevents their equal participation in the development process, is now well appreciated. Recognising the need for this holistic view of welfare, the government has recently come out with a well-researched and contextually relevant approach to mapping the state of human development in the country in its many facets through a range of indicators that will be useful in formulating and monitoring public policy.

As the Human Development Report brings out, the HDI (human development indicator) for the country has improved significantly between 1980 and 2001, improving by nearly 26% in the eighties and another 24% in the nineties (Planning Commission, 2002). There has been an improvement both in rural as well as in urban areas. Further, though the rural-urban gap in the level of human development continues to be significant, it has declined during the period. Inequalities across states on the HDI are less than the income inequality as reflected in per capita State Domestic Product. The index of gender inequality measuring the attainments in human development indicators for females as a proportion of that of males has also improved, though marginally, in the 1980s. At the national level, the GEI increased from 62% in the early eighties to 67.6% in the early nineties. This implies that on an average, the attainments of women on human development indicators were only two-thirds of those of men. At the state level, those that have done well in improving female literacy are also the ones that have substantially improved their gender equality. On the whole, gender disparities across the states have declined over the period.

The HPI (human poverty index) conceptualised in terms of various aspects of deprivation, covering accessibility to minimum services, has considerably declined during the eighties, in line with the head count measure discussed earlier. However, there are considerable variations in terms of the rural -urban

incidence as well as at the state level. The rural-urban ratio for the proportion of the HPI is nearly twice as high as that on the head count ratio of poverty, possibly reflecting the lower levels of basic amenities in rural areas. At the state level, while the HDI declined in all states, interstate differences have persisted.

Harnessing science and technology

Technology is a fundamental input into sustained growth and welfare. The role of science and technology in decoupling economic growth with environmental degradation has also become important. The promotion of science and technology for the cause of development has been one of the guiding principles of planned development in Independent India. There has been significant growth in capabilities and achievements in several areas, namely, space sciences, astronomy, meteorology, disaster warning, electronics, defence, nuclear, material and medicine. Industry interface, community involvement and international co-operation in development of science and technology have been strengthened over time. Increasingly the government has sought to support socially oriented S&T interventions for rural areas and weaker sections. The role of remote sensing satellite system for natural resource monitoring and management has also gained importance. Since 1990's in particular, sustained efforts have been made for developing newly emerging areas such as information and communication services, biotechnology and new and renewable sources of sources.

The government recognizes the enormous potential of information and communication technology as a catalyst towards sustainable development through access to information thus facilitating market access, education, and participative and transparent governance. India enjoys a competitive advantage in software and related services in the form of abundant qualified manpower and expertise in state-of- the-art hardware and software platforms. The Department of Information Technology in the Government of India is guided by the vision of making India an IT super power by the year 2008. Independent estimates suggest that by 2008, the IT industry will be the single largest contributor to the GDP of the country and large employment generator.

In the area of biotechnology, the government strives for "attaining new heights in biotechnology research, shaping biotechnology into a premier precision tool of the future for creation of wealth and ensuring social justice - specially for the welfare of the poor". Significant advances have already been made in the growth and application of biotechnology in the broad areas of agriculture, health care, animal sciences, environment, and industry.

Specifically, several initiatives have been taken to promote transgenic research in plants with emphasis on pest and disease resistance, nutritional quality, molecular biology of human genetic disorders, brain research, plant genome research, development validation and commercialisation of diagnostic kits and vaccines for communicable diseases, food biotechnology, biodiversity conservation and bioprospecting, setting up of micropropagation parks and biotechnology based development for weaker sections, rural areas and women.

Sustainable energy development is a key element of a sustainable growth outlook. India has made rapid advances in harnessing clean energy and boasts of one of the world's largest renewable energy programmes covering the whole spectrum of renewable energy technologies for a variety of grid and off grid applications. The country has the largest decentralised solar energy programme, the second largest biogas and improved cookstoves programme, and the fifth largest wind power programme in the world. A substantial manufacturing base has been created in a variety of new and renewable sources of energy, placing India not only in a position to export technologies but also to offer technical expertise to other countries. Renewable energy technologies are an important means of social development in the country, being an attractive, and sometimes only option to provide energy to non-electrified areas that are too remote for grid electrification.

Environmental sustainability

Environmental sustainability considerations have been an integral part of the Indian culture. The need for conservation and sustainable use of natural resources has been expressed in Indian scriptures more than three thousand years old and is reflected in our constitutional, legislative and policy framework as also international commitments. Apart from concerns about increasing air and water pollution, degradation of land and forests along with loss of biodiversity have also come into focus. Specific measures were initiated way back in 1972 after the Stockholm Declaration. Since then a full-fledged Ministry of Environment and Forests has evolved and an extensive legislative network now exists to address environmental issues. There have also been several policy initiatives to safeguard the environment. These are discussed in detail in later chapters.

Sustainability concerns have become an intrinsic component of the planning process (Annexure 1.1). The Ninth Five-Year Plan (1997-2002) explicitly recognized the synergy between environment, health and development and identified as one of its core objectives the need for ensuring *environmental*

sustainability of the development process through social mobilization and participation of people at all levels. Environmental awareness programmes supported by the government and NGOs have also gained momentum in recent times. The country has signed and ratified several international conventions and agreements on the environment and related issues and has been effectively implementing these. The efforts made so far need to be carried forward by strengthening the existing attempts at the domestic level and reinforcing international cooperation in dealing with issues related to social development and the environment.

Towards sustainable development

The Earth Summit 21 awakened countries to the need for integrating sustainable development concerns in the planning process. Agenda 21, adopted at the Summit put forward a road map directing this change, spanning a wide spectrum of social, economic and environmental issues from combating poverty and improving access to basic services to increasing the role of the private sector and international cooperation, to conservation and management of natural resources.

The principles underlying Agenda 21 objectives have been central to development planning in India. Since Independence, the country has paved the way towards social development through multi-faceted development planning, guided by the objectives of poverty eradication and provision of basic needs.

The governance structure of the country is founded on the principles of democracy, equality and the rule of law. The basic democratic character of the Indian State has, since Independence, become stronger, wider and deeper, even as the structure has itself evolved to accommodate new challenges. In order to strengthen the basic character of democracy i.e. the flow of power upward from the people- there has been emphasis on strengthening local self-governance in villages and urban areas alike. Education, awareness, a vibrant print and electronic media and the rapid spread of information technology have led to an ever-widening participation of the civil society in the development process of the country.

The government has, over the years, developed a number of programmes that aim at eradicating poverty either through directly targeted programmes such as employment generation, training and building-up assets of the poor or indirectly through human development with an emphasis on health, education, and minimum needs including protection of human rights and raising the social status of the weak and the poor. As a result of these initiatives the percentage of

population under poverty has continuously declined. Population growth has decelerated below 2% for the first time in four decades and literacy has increased from 52% in 1991 to 65% in 2001, the performance being even more impressive in some states.

The government recognizes the role of economic growth in improving the quality of life of the people. Growth enables expansion of productive employment and provides the necessary financial and technological resources for development programmes. As discussed earlier, since 1991, the country has initiated economic reforms including trade, financial and structural reforms allowing the private sector into hitherto restricted areas. These measures have ushered in a new age of productivity and competitiveness. GDP growth in the post-reforms period has accelerated from an average of about 5.7% in the 1980s to an average of about 6.5% in the Eighth and Ninth Plan periods, making India one of the ten fastest-growing developing economies.

Environmental considerations have been an integral part of the Indian culture and have increasingly integrated in the planning process. This is reflected in our constitutional, legislative and policy framework as also international commitments.

The government recognizes that these laudable objectives are clouded by concerns. The economy is currently in a decelerating phase, which is compounded by the general slow-down in the world economy. On the social front, too, there remains much to be done. Despite the significant progress in areas of poverty eradication, literacy and health standards, there still remains a gulf between the standards prevailing in India and the rest of the world. According to the Human Development Report (HDR) 2001, India ranks 115th in the world as judged by the Human Development Indicator, an index incorporating various measures of GNP, longevity, health, nutritional standards, literacy, water supply and the like. India's HDI was estimated at 52.9 compared to the average of 64.5 for all developing countries. Growth in the 1990s has generated less employment than was expected. The infant mortality rate has stagnated at 72 per 1000 for the last several years. There remain perceptible rural-urban and regional differences in access to basic services. Per capita electricity consumption in the country is only one-sixth the world average and one-twentieth that in high-income countries and, as many as 60% of rural households and 20% of urban households do not have an electricity connection (Planning Commission, 2001). Land and forest degradation in rural areas and over-exploitation of groundwater is seriously threatening the sustainability of food production and pollution in cities is on the rise.

The Government of India is cognisant of these challenges as the country sets out to prepare the first development plan of this millennium. While seeking to achieve a high and sustained economic growth, it realizes that economic growth standing on an unsteady social and environmental foundation cannot be sustained. The Tenth Five-Year Plan assigns primacy to enhancement of human well-being which includes not only adequate level of food consumption and other consumer goods but also access to basic social services especially education, health, drinking water and basic sanitation. It also assigns primacy to the expansion of economic and social opportunities for all individuals and groups and wider participation in decision-making. Conservation and management of natural resources is an important focus of the plan.

As a nation that has been actively associated with the global pursuit of sustainable development, India's commitment to Agenda 21 re-emphasises the principles that have long guided development planning in the country. In order that the country build upon the gains of the past and address the weaknesses that have persisted within it, it is necessary that the international community, especially the developed world, recommit itself to the global partnership forged at Rio. This partnership was based on the principle of common but differentiated responsibility as the developed world acknowledged the burden their societies had placed on the global environment and the distinct advantage they commanded with respect to technologies and financial resources. The commitments made by the developed world towards enhanced and stable concessional financing to the developing world have largely gone unfulfilled. As developing countries struggle with their limited financial resources to meet the immediate and more basic requirements of their people, it is imperative that the North plays its role in order to operationalize the long term mandate of Agenda 21.

Structure of the report

This study undertakes a sectoral analysis of achievements and concerns in the backdrop of Agenda 21 objectives with the aim of evolving directions and strategies for sustainable development at the sectoral level. The scope and structure of the report are illustrated in Figure 1.1.

The analysis for each sector (in the case of economic and social sectors and natural resources) begins with a brief overview of the sector followed by a discussion of Agenda 21 concerns relevant to the sector in the Indian context. Major policy and other development are highlighted and analyzed to bring out

achievements and concerns vis-à-vis the objectives set out in Agenda 21. Each chapter concludes with directions and strategies for sustainable development.

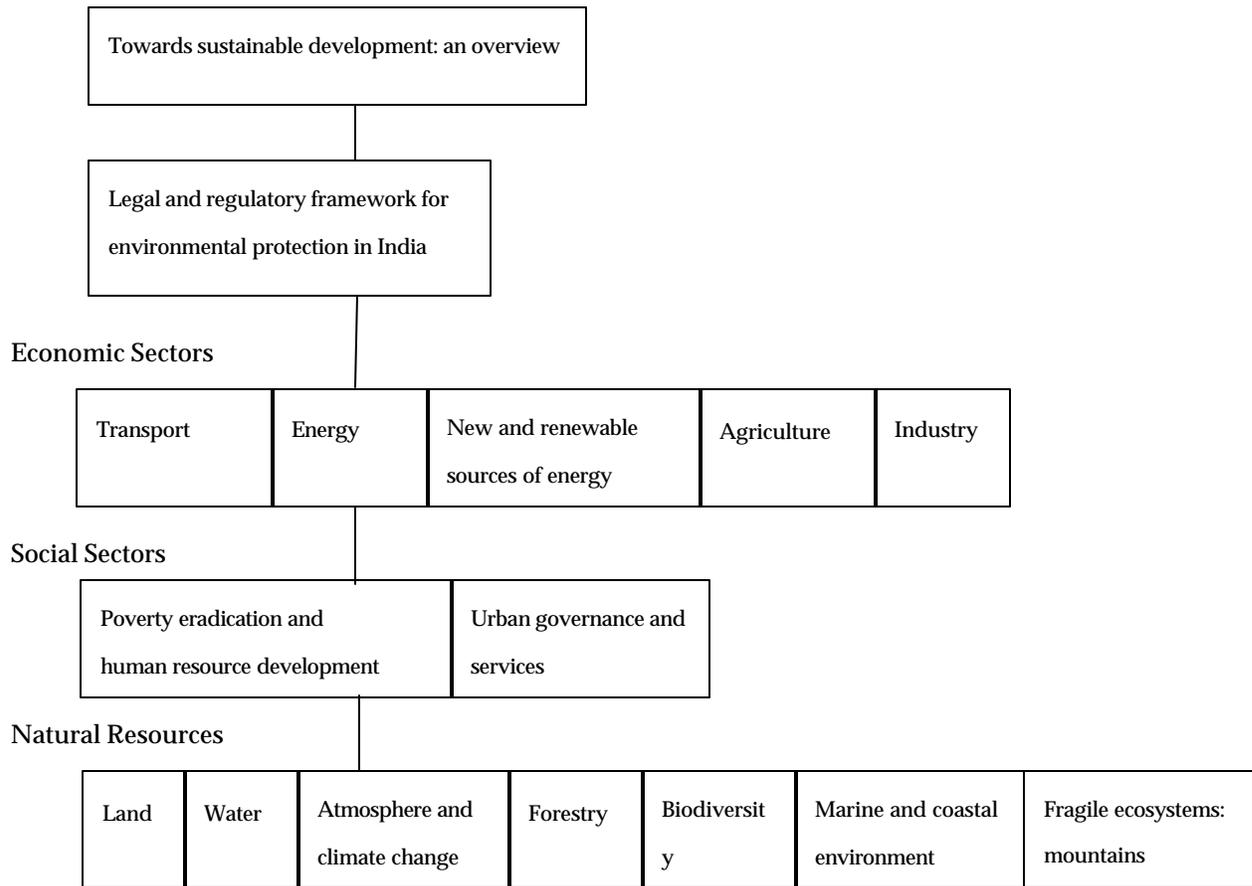


Figure 1.1 Structure of the report

Annexure 1.1

Highlights of environmental initiatives in Five-Year Plans**Sixth Plan (1980-85)**

- New Department of Environment set up
- Major activities in the areas of water and air pollution control, EIA, natural living resource conservation, ecological studies by the Botanical Survey of India (BSI) and Zoological Surveys of India (ZSI), environmental information, education, training and awareness
- A ten year review in respect of appendices on flora for CITES prepared
- An integrated study of the Ganga basin completed and integrated River Basin Studies for the Brahmaputra, Indus and Narmada proposed to be taken up.
- The Wildlife Institute set up in 1982-83 for building up of scientific knowledge on wildlife research.

Seventh Plan (1985-1990)

- Significant progress under the Ganga Action Plan, forestry and wildlife, wasteland development, and island development sectors
- Programmes on waste recycling and prevention of coastal pollution initiated
- EIA of major river valleys and hydro electric, mining, industrial and thermal power projects carried out through Environmental Appraisal Committees
- National Forest Policy formulated in 1988 with the principal aim of ensuring environmental stability and maintenance of the ecological balance
- Implementation of the 10 point National Wildlife Action Plan initiated.
- Considerable increase in the total area brought under afforestation programme and the National Development Board set up in 1985

Eighth Plan (1992-97)

- activities for abatement of pollution undertaken, which included management and operation of national air and water quality network, controlling pollution at sources, river basin studies, hazardous waste management; development of criteria for eco-labeling of consumer products, remedial measures for vehicular pollution; training of personnel engaged in controlling pollution and organizing nation-wide awareness programmes for prevention and control of pollution, promoted adoption of Clean Technologies in Small Scale Industries
- incentives to adopt efficiency enhancing and waste minimization practices promoted like, enhancement of cess rates on water consumption, duty concessions on import of certain pollution control equipment, accelerated depreciation on pollution abatement equipment.
- Various carrying capacity studies (Doon Valley, National Capital Region), on improving methodology and techniques of EIA carried out
- BSI and ZSI surveys conducted
- Scheme on Bio diversity Conservation was initiated in 1991-92
- Programmes such as Man and Biosphere Program, the Environmental Research Programme, research climate change were undertaken
- more than 5000 clubs launched for providing environmental education amongst children
- National River Conservation Plan approved in 1995
- Several steps for afforestation and eco-development undertaken

Ninth Plan (1997-2002)

- Programmes under the above Plan included attempts to phase out lead in motor spirit, improvement in quality of high speed diesel
- Focussed on integration of environmental concerns with decision making
- Area specific programmes also stressed upon like National River Conservation Program that started National Lake Conservation Program, Taj Trapezium, schemes to protect Himalayan eco system and bio diversity, programmes for sustainable development of islands, Islands Development Authority (IDA) was constituted in 1998
- Initiatives towards strengthening, environmental statistics and mapping, management of biosphere reserves, biodiversity conservation, environmental education and training
- Schemes similar to 8th Plan for Afforestation, wetland development also envisaged by the Plan

Approach paper to Tenth Plan (2002-2007)

- Reconciliation of population and economic growth with environmental conservation perceived as an urgent necessity
- Action plans to be initiated for reducing pollution levels
- Management of hazardous wastes through collection, processing, and disposal to be given priority
- Emphasis on environmental education amongst masses through the involvement of NGOs, Youth Educational institutions

Source. Five-Year Plans, Planning Commission (various years)

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The legal and regulatory framework for environmental protection in India

Introduction

Over the years, together with a spreading of environmental consciousness, there has been a change in the traditionally-held perception that there is a trade-off between environmental quality and economic growth as people have come to believe that the two are necessarily complementary. The current focus on environment is not new—environmental considerations have been an integral part of the Indian culture. The need for conservation and sustainable use of natural resources has been expressed in Indian scriptures, more than three thousand years old and is reflected in the constitutional, legislative and policy framework as also in the international commitments of the country.

Even before India's independence in 1947, several environmental legislation existed but the real impetus for bringing about a well-developed framework came only after the UN Conference on the Human Environment (Stockholm, 1972). Under the influence of this declaration, the National Council for Environmental Policy and Planning within the Department of Science and Technology was set up in 1972. This Council later evolved into a full-fledged Ministry of Environment and Forests (MoEF) in 1985 which today is the apex administrative body in the country for regulating and ensuring environmental protection. After the Stockholm Conference, in 1976, constitutional sanction was given to environmental concerns through the 42nd Amendment, which incorporated them into the Directive Principles of State Policy and Fundamental Rights and Duties.

Since the 1970s an extensive network of environmental legislation has grown in the country. The MoEF and the pollution control boards (CPCB i.e. Central Pollution Control Board and SPCBs i.e. State Pollution Control Boards) together form the regulatory and administrative core of the sector.

A policy framework has also been developed to complement the legislative provisions. The Policy Statement for Abatement of Pollution and the National Conservation Strategy and Policy Statement on Environment and Development were brought out by the MoEF in 1992, to develop and promote initiatives for the protection and improvement of the environment. The EAP (Environmental

Action Programme) was formulated in 1993 with the objective of improving environmental services and integrating environmental considerations in to development programmes.

Other measures have also been taken by the government to protect and preserve the environment. Several sector-specific policies have evolved, which are discussed at length in the concerned chapters.

This chapter attempts to highlight only legislative initiatives towards the protection of the environment.

Legislation for environmental protection in India

Water

Water quality standards especially those for drinking water are set by the Indian Council of Medical Research. These bear close resemblance to WHO standards. The discharge of industrial effluents is regulated by the Indian Standard Codes and recently, water quality standards for coastal water marine outfalls have also been specified. In addition to the general standards, certain specific standards have been developed for effluent discharges from industries such as, iron and steel, aluminium, pulp and paper, oil refineries, petrochemicals and thermal power plants. Legislation to control water pollution are listed below.

Water (Prevention and Control of Pollution) Act, 1974

This Act represented India's first attempts to comprehensively deal with environmental issues. The Act prohibits the discharge of pollutants into water bodies beyond a given standard, and lays down penalties for non-compliance. The Act was amended in 1988 to conform closely to the provisions of the EPA, 1986. It set up the CPCB (Central Pollution Control Board) which lays down standards for the prevention and control of water pollution. At the State level, the SPCBs (State Pollution Control Board) function under the direction of the CPCB and the state government.

Water (Prevention and Control of Pollution) Cess Act, 1977

This Act provides for a levy and collection of a cess on water consumed by industries and local authorities. It aims at augmenting the resources of the central and state boards for prevention and control of water pollution.

Following this Act, *The Water (Prevention and Control of Pollution) Cess Rules* were

formulated in 1978 for defining standards and indications for the kind of and location of meters that every consumer of water is required to install.

Air

Air (Prevention and Control of Pollution) Act, 1981

To counter the problems associated with air pollution, ambient air quality standards were established, under the 1981 Act. The Act provides means for the control and abatement of air pollution. The Act seeks to combat air pollution by prohibiting the use of polluting fuels and substances, as well as by regulating appliances that give rise to air pollution. Under the Act establishing or operating of any industrial plant in the pollution control area requires consent from state boards. The boards are also expected to test the air in air pollution control areas, inspect pollution control equipment, and manufacturing processes.

National Ambient Air Quality Standards (NAAQS) for major pollutants were notified by the CPCB in April 1994. These are deemed to be levels of air quality necessary with an adequate margin of safety, to protect public health, vegetation and property (CPCB 1995 cited in Gupta, 1999). The NAAQS prescribe specific standards for industrial, residential, rural and other sensitive areas. Industry-specific emission standards have also been developed for iron and steel plants, cement plants, fertilizer plants, oil refineries and the aluminium industry. The ambient quality standards prescribed in India are similar to those prevailing in many developed and developing countries.

To empower the central and state pollution boards to meet grave emergencies, the *Air (Prevention and Control of Pollution) Amendment Act, 1987*, was enacted. The boards were authorized to take immediate measures to tackle such emergencies and recover the expenses incurred from the offenders. The power to cancel consent for non-fulfilment of the conditions prescribed has also been emphasized in the Air Act Amendment.

The Air (Prevention and Control of Pollution) Rules formulated in 1982, defined the procedures for conducting meetings of the boards, the powers of the presiding officers, decision-making, the quorum; manner in which the records of the meeting were to be set etc. They also prescribed the manner and the purpose of seeking assistance from specialists and the fee to be paid to them.

Complementing the above Acts is the *Atomic Energy Act* of 1982, which was introduced to deal with radioactive waste. In 1988, the *Motor Vehicles Act*, was enacted to regulate vehicular traffic, besides ensuring proper packaging, labelling and transportation of the hazardous wastes. Various aspects of

vehicular pollution have also been notified under the EPA of 1986. Mass emission standards were notified in 1990, which were made more stringent in 1996. In 2000 these standards were revised yet again and for the first time separate obligations for vehicle owners, manufacturers and enforcing agencies were stipulated. In addition, fairly stringent Euro I and II emission norms were notified by the Supreme Court on April 29, 1999 for the city of Delhi. The notification made it mandatory for car manufacturers to conform to the Euro I and Euro II norms by May 1999 and April 2000, respectively, for new non-commercial vehicle sold in Delhi.

Forests and wildlife

The Wildlife (Protection) Act, 1972, Amendment 1991

The WPA (Wildlife Protection Act), 1972, provides for protection to listed species of flora and fauna and establishes a network of ecologically-important protected areas. The WPA empowers the central and state governments to declare any area a wildlife sanctuary, national park or closed area. There is a blanket ban on carrying out any industrial activity inside these protected areas. It provides for authorities to administer and implement the Act; regulate the hunting of wild animals; protect specified plants, sanctuaries, national parks and closed areas; restrict trade or commerce in wild animals or animal articles; and miscellaneous matters. The Act prohibits hunting of animals except with permission of authorized officer when an animal has become dangerous to human life or property or so disabled or diseased as to be beyond recovery (WWF-India, 1999). The near-total prohibition on hunting was made more effective by the Amendment Act of 1991.

The Forest (Conservation) Act, 1980

This Act was adopted to protect and conserve forests. The Act restricts the powers of the state in respect of de-reservation of forests and use of forestland for non-forest purposes (the term 'non-forest purpose' includes clearing any forestland for cultivation of cash crops, plantation crops, horticulture or any purpose other than re-afforestation).

General

Environment (Protection) Act, 1986 (EPA)

This Act is an umbrella legislation designed to provide a framework for the co-ordination of central and state authorities established under the Water (Prevention and Control) Act, 1974 and Air (Prevention and Control) Act, 1981.

Under this Act, the central government is empowered to take measures necessary to protect and improve the quality of the environment by setting standards for emissions and discharges; regulating the location of industries; management of hazardous wastes, and protection of public health and welfare.

From time to time the central government issues notifications under the EPA for the protection of ecologically-sensitive areas or issues guidelines for matters under the EPA.

Some notifications issued under this Act are:

- *Doon Valley Notification (1989)*, which prohibits the setting up of an industry in which the daily consumption of coal/fuel is more than 24 MT (million tonnes) per day in the Doon Valley.
- *Coastal Regulation Zone Notification (1991)*, which regulates activities along coastal stretches. As per this notification, dumping ash or any other waste in the CRZ is prohibited. The thermal power plants (only foreshore facilities for transport of raw materials, facilities for intake of cooling water and outfall for discharge of treated waste water/cooling water) require clearance from the MoEF.
- *Dhanu Taluka Notification (1991)*, under which the district of Dhanu Taluka has been declared an ecologically fragile region and setting up power plants in its vicinity is prohibited.
- *Revdanda Creek Notification (1989)*, which prohibits setting up industries in the belt around the Revdanda Creek as per the rules laid down in the notification.
- *The Environmental Impact Assessment of Development Projects Notification, (1994 and as amended in 1997)*. As per this notification:
 - All projects listed under Schedule I require environmental clearance from the MoEF.
 - Projects under the delicensed category of the New Industrial Policy also require clearance from the MoEF.
 - All developmental projects whether or not under the Schedule I, if located in fragile regions must obtain MoEF clearance.
 - Industrial projects with investments above Rs 500 million must obtain MoEF clearance and are further required to obtain a LOI (Letter Of Intent) from the Ministry of Industry, and an NOC (No Objection Certificate) from the SPCB and the State Forest Department if the location involves forestland. Once the NOC is obtained, the LOI is converted into an industrial licence by the state authority.

- The notification also stipulated procedural requirements for the establishment and operation of new power plants. As per this notification, two-stage clearance for site-specific projects such as pithead thermal power plants and valley projects is required. Site clearance is given in the first stage and final environmental clearance in the second. A public hearing has been made mandatory for projects covered by this notification. This is an important step in providing transparency and a greater role to local communities.
- *Ash Content Notification (1997)*, required the use of beneficiated coal with ash content not exceeding 34% with effect from June 2001, (the date later was extended to June 2002). This applies to all thermal plants located beyond one thousand kilometres from the pithead and any thermal plant located in an urban area or, sensitive area irrespective of the distance from the pithead except any pithead power plant.
- *Taj Trapezium Notification (1998)*, provided that no power plant could be set up within the geographical limit of the Taj Trapezium assigned by the Taj Trapezium Zone Pollution (Prevention and Control) Authority.
- *Disposal of Fly Ash Notification (1999)* the main objective of which is to conserve the topsoil, protect the environment and prevent the dumping and disposal of fly ash discharged from lignite-based power plants. The salient feature of this notification is that no person within a radius of 50 km from a coal-or lignite-based power plant shall manufacture clay bricks or tiles without mixing at least 25% of ash with soil on a weight-to-weight basis. For the thermal power plants the utilisation of the flyash would be as follows:
 - Every coal-or lignite-based power plant shall make available ash for at least ten years from the date of publication of the above notification without any payment or any other consideration, for the purpose of manufacturing ash-based products such as cement, concrete blocks, bricks, panels or any other material or for construction of roads, embankments, dams, dykes or for any other construction activity.
 - Every coal or lignite based thermal power plant commissioned subject to environmental clearance conditions stipulating the submission of an action plan for full utilisation of fly ash shall, within a period of nine years from the publication of this notification, phase out the dumping and disposal of fly ash on land in accordance with the plan.^a

^a Details of the notification available on <http://envfor.nic.in/legis/hsm/flyash.html>

Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Micro-organisms/Genetically Engineered Organisms or Cell were introduced in 1989 with the view to protect the environment, nature and health in connection with gene technology and micro-organisms, under the Environmental Protection Act, 1986. The government in 1991, further decided to institute a national label scheme for environmentally-friendly products called the 'ECOMARK'. The scheme attempts to provide incentives to manufactures and importers to reduce adverse environmental impacts, reward genuine initiatives by companies, and improve the quality of the environment and sustainability of available resources. Besides the above attempts, notifications pertaining to *Recycled Plastics Manufacture and Usage Rules, 1999* were also incorporated under the Environment (Protection) Act of 1986.

The Environment (Protection) Rules, 1986

These rules lay down the procedures for setting standards of emission or discharge of environmental pollutants. The Rules prescribe the parameters for the Central Government, under which it can issue orders of prohibition and restrictions on the location and operation of industries in different areas. The Rules lay down the procedure for taking samples, serving notice, submitting samples for analysis and laboratory reports. The functions of the laboratories are also described under the Rules along with the qualifications of the concerned analysts.

The National Environment Appellate Authority Act, 1997

This Act provided for the establishment of a National Environment Appellate Authority to hear appeals with respect to restriction of areas in which any industry operation or process or class of industries, operations or processes could not carry out or would be allowed to carry out subject to certain safeguards under the Environment (Protection) Act, 1986.

In addition to these, various Acts specific to the coal sector have been enacted. The first attempts in this direction can be traced back to the *Mines Act, 1952*, which promoted health and safety standards in coal mines. Later the *Coal Mines (Conservation and Development) Act (1974)* came up for conservation of coal during mining operations. For conservation and development of oil and natural gas resources a similar legislation was enacted in 1959.

Hazardous wastes

There are several legislation that directly or indirectly deal with hazardous waste. The relevant legislation are the Factories Act, 1948, the Public Liability Insurance Act, 1991, the National Environment Tribunal Act, 1995 and some notifications under the Environmental Protection Act of 1986. A brief description of each of these is given below.

Under the EPA 1986, the MoEF has issued several notifications to tackle the problem of hazardous waste management. These include:

- *Hazardous Wastes (Management and Handling) Rules, 1989*, which brought out a guide for manufacture, storage and import of hazardous chemicals and for management of hazardous wastes.
- *Biomedical Waste (Management and Handling) Rules, 1998*, were formulated along parallel lines, for proper disposal, segregation, transport etc. of infectious wastes.
- *Municipal Wastes (Management and Handling) Rules, 2000*, whose aim was to enable municipalities to dispose municipal solid waste in a scientific manner.
- *Hazardous Wastes (Management and Handling) Amendment Rules, 2000*, a recent notification issued with the view to providing guidelines for the import and export of hazardous waste in the country.

Factories Act, 1948 and its Amendment in 1987

The Factories Act, 1948 was a post-independence statute that explicitly showed concern for the environment. The primary aim of the 1948 Act has been to ensure the welfare of workers not only in their working conditions in the factories but also their employment benefits. While ensuring the safety and health of the workers, the Act contributes to environmental protection. The Act contains a comprehensive list of 29 categories of industries involving hazardous processes, which are defined as a process or activity where unless special care is taken, raw materials used therein or the intermediate or the finished products, by-products, wastes or effluents would:

- Cause material impairment to health of the persons engaged
- Result in the pollution of the general environment

Public Liability Insurance Act (PLIA), 1991

The Act covers accidents involving hazardous substances and insurance coverage for these. Where death or injury results from an accident, this Act makes the owner liable to provide relief as is specified in the Schedule of the Act. The PLIA was amended in 1992, and the Central Government was

authorized to establish the Environmental Relief Fund, for making relief payments.

National Environment Tribunal Act, 1995

The Act provided strict liability for damages arising out of any accident occurring while handling any hazardous substance and for the establishment of a National Environment Tribunal for effective and expeditious disposal of cases arising from such accident, with a view to give relief and compensation for damages to persons, property and the environment and for the matters connected therewith or incidental thereto.^a

International agreements on environmental issues

India is signatory to a number of multilateral environment agreements (MEA) and conventions. An overview of some of the major MEAs and India's obligations under these is presented below. These are discussed at length in the respective chapters.

Convention on International Trade in Endangered Species of wild fauna and flora (CITES), 1973

The aim of CITES is to control or prevent international commercial trade in endangered species or products derived from them. CITES does not seek to directly protect endangered species or curtail development practices that destroy their habitats. Rather, it seeks to reduce the economic incentive to poach endangered species and destroy their habitat by closing off the international market. India became a party to the CITES in 1976. International trade in all wild flora and fauna in general and species covered under CITES is regulated jointly through the provisions of The Wildlife (Protection) Act 1972, the Import/Export policy of Government of India and the Customs Act 1962 (Bajaj, 1996).

Montreal Protocol on Substances that deplete the Ozone Layer (to the Vienna Convention for the Protection of the Ozone Layer), 1987

The Montreal Protocol to the Vienna Convention on Substances that deplete the Ozone Layer, came into force in 1989. The protocol set targets for reducing the

^a For details refer to <http://envfor.nic.in>

consumption and production of a range of ozone depleting substances (ODS). In a major innovation the Protocol recognized that all nations should not be treated equally. The agreement acknowledges that certain countries have contributed to ozone depletion more than others. It also recognizes that a nation's obligation to reduce current emissions should reflect its technological and financial ability to do so. Because of this, the agreement sets more stringent standards and accelerated phase-out timetables to countries that have contributed most to ozone depletion (Divan and Rosencranz, 2001).

India acceded to the Montreal Protocol along with its London Amendment in September 1992. The MoEF has established an Ozone Cell and a steering committee on the Montreal Protocol to facilitate implementation of the India Country Program, for phasing out ODS production by 2010.

To meet India's commitments under the Montreal Protocol, the Government of India has also taken certain policy decisions.

- Goods required to implement ODS phase-out projects funded by the Multilateral Fund are fully exempt from duties. This benefit has been also extended to new investments with non-ODS technologies.
- Commercial banks are prohibited from financing or refinancing investments with ODS technologies.

The Gazette of India on 19 July 2000 notified rules for regulation of ODS phase-out called the *Ozone Depleting Substances (Regulation and Control) Rules, 2000*. They were notified under the Environment (Protection) Act, 1986. These rules were drafted by the MoEF following consultations with industries and related government departments.

Basel Convention on Transboundary Movement of Hazardous Wastes, 1989

Basel Convention, which entered into force in 1992, has three key objectives:

- To reduce transboundary movements of hazardous wastes;
- To minimize the creation of such wastes; and
- To prohibit their shipment to countries lacking the capacity to dispose hazardous wastes in an environmentally sound manner.

India ratified the Basel Convention in 1992, shortly after it came into force. The Indian Hazardous Wastes Management Rules Act 1989, encompasses some of the Basel provisions related to the notification of import and export of hazardous waste, illegal traffic, and liability.

UN Framework Convention on Climate Change (UNFCCC), 1992

The primary goals of the UNFCCC were to stabilize greenhouse gas emissions at levels that would prevent dangerous anthropogenic interference with the global climate. The convention embraced the principle of common but differentiated responsibilities which has guided the adoption of a regulatory structure.

India signed the agreement in June 1992, which was ratified in November 1993. As per the convention the reduction/limitation requirements apply only to developed countries. The only reporting obligation for developing countries relates to the construction of a GHG inventory. India has initiated the preparation of its First National Communication (base year 1994) that includes an inventory of GHG sources and sinks, potential vulnerability to climate change, adaptation measures and other steps being taken in the country to address climate change. The further details on UNFCCC and the Kyoto Protocol are provided in Atmosphere and climate chapter.

Convention on Biological Diversity, 1992

The Convention on Biological Diversity (CBD) is a legally binding, framework treaty that has been ratified until now by 180 countries. The CBD has three main thrust areas: conservation of biodiversity, sustainable use of biological resources and equitable sharing of benefits arising from their sustainable use.

The Convention on Biological Diversity came into force in 1993. Many biodiversity issues are addressed in the convention, including habitat preservation, intellectual property rights, biosafety, and indigenous peoples' rights.

India's initiatives under the Convention are detailed in the chapter on Biodiversity. These include the promulgation of the Wildlife (Protection) Act of 1972, amended in 1991; and participation in several international conventions such as CITES.

UN Convention on Desertification, 1994

Delegates to the 1992 UN Conference on Environment and Development (UNCED) recommended establishment of an intergovernmental negotiating committee for the elaboration of an international convention to combat desertification in countries experiencing serious drought and/or desertification.

The UN General Assembly established such a committee in 1992 that later helped formulation of Convention on Desertification in 1994.

The convention is distinctive as it endorses and employs a bottom-up approach to international environmental cooperation. Under the terms of the convention, activities related to the control and alleviation of desertification and its effects are to be closely linked to the needs and participation of local land-users and non-governmental organizations. Seven countries in the South Asian region are signatories to the Convention, which aims at tackling desertification through national, regional and sub-regional action programmes. The Regional Action Programme has six Thematic Programme Networks (TPN's) for the Asian region, each headed by a country task manager. India hosts the network on agroforestry and soil conservation. For details refer to the land resource chapter.

International Tropical Timber Agreement and The International Tropical Timber Organisation (ITTO), 1983, 1994

The ITTO established by the International Tropical Timber Agreement (ITTA), 1983, came into force in 1985 and became operational in 1987^a. The ITTO facilitates discussion, consultation and international cooperation on issues relating to the international trade and utilization of tropical timber and the sustainable management of its resource base. The successor agreement to the ITTA (1983) was negotiated in 1994, and came into force on 1 January 1997. The organization has 57 member countries. India ratified the ITTA in 1996.

An assessment of the legal and regulatory framework for environmental protection in India

The extent of the environmental legislation network is evident from the above discussion but the enforcement of the laws has been a matter of concern. One commonly cited reason is the prevailing command and control nature of the environmental regime. Coupled with this is the prevalence of the all-or-nothing approach of the law; they do not consider the extent of violation. Fines are levied on a flat basis and in addition, there are no incentives to lower the discharges below prescribed levels.

^a For details refer to the web site: www.itto.or.jp/Index.html

Some initiatives have addressed these issues in the recent past. The Government of India came out with a Policy Statement for Abatement of Pollution in 1992, before the Rio conference, which declared that market-based approaches would be considered in controlling pollution. It stated that economic instruments will be investigated to encourage the shift from curative to preventive measures, internalise the costs of pollution and conserve resources, particularly water. In 1995, the Ministry of Environment and Forest (MoEF) constituted a task force to evaluate market-based instruments, which strongly advocated their use for the abatement of industrial pollution. Various economic incentives have been used to supplement the command-and-control policies. Depreciation allowances, exemptions from excise or customs duty payment, and arrangement of soft loans for the adoption of clean technologies are instances of such incentives. Another aspect that is evident is the shift in the focus from end-of-pipe treatment of pollution to treatment at source. The role of remote sensing and geographical information systems in natural resource management and environmental protection has also gained importance over time (Box 2.1).

An important recent development is the rise of judicial activism in the enforcement of environmental legislation. This is reflected in the growth of environment-related public litigation cases that have led the courts to take major steps such as ordering the shut-down of polluting factories.

Agenda 21 highlights the need for integration of environmental concerns at all stages of policy, planning and decision-making processes including the use of an effective legal and regulatory framework, economic instruments and other incentives. These very principles were fundamental to guiding environmental protection in the country well before Rio and will be reinforced, drawing on India's own experiences and those of other countries.

Box 2.1 Natural resource management and environmental protection: use of remote sensing

India has made commendable advances in the use of remote sensing for natural resource management. The major achievements can be classified as follows:

Use of remote sensing in integrating environment and development at the policy planning and management levels: The country has an extensive and integrated institutional infrastructure and focussed programme elements to enable integration of environmental concerns in decision making. The main initiatives include:

National Natural Resource Management Systems: An integrated resource management system aimed at optimal utilisation of the country's natural resources through a systematic inventory of resource availability using remote sensing in conjunction with other techniques

Remote sensing for sound environmental management: Remote sensing is playing an important role in providing information on physical environmental parameters, such as land and climate, vegetation, soils, water, terrain and slope, land use, air and water pollution etc. Through the use of Geographical Information Systems, this information is integrated with relevant collateral information to evolve solutions to many environment issues. Notable achievements have been made in the area of regular forest cover mapping and monitoring as well as detection and monitoring of natural disasters along with assessment of the associated damages.

Role of remote sensing in strengthening the legal and regulatory framework for environmental protection

Remote sensing has established itself as an operational means to provide reliable information and benchmark survey mechanisms in the context of (i) making laws and regulations more effective (ii) establishing judicial and administrative procedures, (iii) providing legal reference and support services, (iv) developing effective national programmes for reviewing and enforcing compliance with national, state and local laws on environment and development. A number of case studies in the country demonstrate the application of remote sensing in this context- these cover forest encroachment studies, mapping of coastal regulation zones, enforcement of environmental legislation, environmental impact assessments, vegetation change detection studies and land use planning studies

Generation of natural resources information towards strengthening the national accounting system: Endeavors include the setting up of a National Spatial Data Infrastructure (to build a repository of natural resource information), National (Natural) Resources Information System (to provide integrated information on natural resources, socio-economic factors etc), Groundwater Prospects Zone Mapping, Bio-resource Data Base, Wasteland Mapping, and the Integrated Mission for Sustainable Development. The IMSD project aimed at generating action plans to enhance the productivity and quality of natural resources. The project covered 85 million ha of problem lands falling in 175 districts in the country and has been successful in evolving action plans with community participation to address several issues including enriching groundwater potential and increasing cropping intensity.

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Introduction

Energy is a basic requirement for economic growth and social development and essential for all life-sustaining activities. While energy security has always been a key concern in all countries, nations have become increasingly conscious of the challenge of ensuring the growth of the sector in an environmentally-benign manner.

Energy and sustainable development are intimately related and the sector occupied an important place at the Earth Summit. Agenda 21 urges countries to enhance the *contribution of environmentally sound and cost-effective energy systems, particularly new and renewable ones, through less polluting and more efficient energy production, transmission, distribution and use*. More specifically, the key issues highlighted in Agenda 21 and reiterated at the IX session of the Commission on Sustainable Development relate to the following.

- Improving access to energy;
- Addressing environmental and social concerns in the energy sector;
- Enhancing energy efficiency and the use of environmentally sound energy systems (including advanced fossil fuel technologies);
- Mobilizing financial resources including participation of the private sector;
- Promoting renewable sources of energy;
- Addressing issues related to energy use in transportation; and
- Fostering international and regional co-operation.

This chapter examines the developments in the energy sector in India in the light of these key Agenda 21 concerns. Following a brief overview of the sector in India and a discussion of relevant Agenda 21 issues, the chapter analyses developments in the coal, oil and gas and power sectors to highlight achievements and concerns vis-à-vis the corresponding Agenda 21 objectives. New and renewable sources of energy and the linkage between transport and energy are dealt with in separate chapters.

Overview of the energy sector

Organization

Coal sector

Under the Constitution of India, the power to regulate mines and mineral development lies both with the central and state governments. The Parliament enacted the Mines and Minerals (Regulation and Development) Act in 1957, which provided for the administration of Schedule I minerals by the central government and the other minor minerals by the states. Coal is listed in Schedule I and so the development of coal resources is controlled by the central government.

Apart from the two government owned companies – Singareni Collieries Company Limited (SCCL) and the National Coal Development Corporation, the coal industry remained largely in the private sector until 1970. Subsequently, coking coal and non-coking coal mines were nationalized in two phases – coking coal mines in 1971-72 and non-coking coal mines in 1973 – reserving coal mining for the public sector. Nationalization was a response to the urgent need to make large capital investment in the coal mines to meet the burgeoning demand; to prevent unscientific mining and to ameliorate the working conditions of labour in the industry.

In 1975, the industry was reorganized with Coal India Limited (CIL) as the holding company. At present, CIL has seven coal-producing subsidiary companies and one planning and design institute.

The Ministry of Coal is the primary agency in the Government of India for formulating and implementing policy for the exploration and development of coal and lignite resources in the country. This includes all matters regarding production, supply, distribution and pricing of coal. It is also responsible for the administration of legislation in the sector discussed later. The Ministry has under its administrative control subordinate offices such as the Coal Controllers Organization and Coalmines Provident Fund Organization. The Coal Controllers' Organization is responsible for enforcing the Colliery Control Order 2000. The Ministry also exercises control over the public sector companies, CIL and Neyveli Lignite Corporation Ltd. In addition, it has a 49% share in SCCL, a state government enterprise for development of coal resources in the state of Andhra Pradesh.

Oil and Gas Sector

The Ministry of Petroleum and Natural Gas (MoPNG) oversees the entire chain of activities in the oil industry: exploration and production of crude oil and

natural gas; refining; distribution and marketing of petroleum products and natural gas, etc. While there are no statutory regulatory bodies, the Directorate General Hydrocarbons (DGH) acts as the de facto upstream regulator. The Oil Co-ordination Committee (OCC) was overseeing downstream activities until the deregulation of the sector in 2002. Post-deregulation, the role of the government in pricing and distribution is likely to be minimal and the OCC is to be replaced by the Petroleum Planning and Analysis Cell (PPAC) whose role will be restricted to analyzing domestic and international sectoral trends, maintaining a database and communication systems to deal with emergencies and the administration of limited subsidies on LPG (liquefied petroleum gas) and SKO (superior kerosene oil) as well as the freight subsidy to far-flung areas.

Exploration and production (E&P) in the country is primarily undertaken by the Oil and Natural Gas Corporation Ltd (ONGC) and Oil India Ltd (OIL). Private parties and joint ventures account for about 10% of the total oil and gas production. Refining/marketing operations are largely in the hands of public sector companies – Indian Oil Corporation Ltd (IOCL), Hindustan Petroleum Corporation Ltd (HPCL), Bharat Petroleum Corporation Ltd (BPCL) and IBP Co Ltd. In addition there are two private/joint venture refineries: the HPCL/A V Birla Group JV at Mangalore, Karnataka and Reliance Petroleum Ltd at Jamnagar, Gujarat.

The Gas Authority of India Ltd (GAIL) is the largest organization in India to handle post-exploration activities relating to transmission, processing, distribution and marketing of natural gas, its fractions and by-products. Gas is also marketed by smaller regional companies – by Mahanagar Gas Ltd (MGL), Maharashtra; by Gujarat Gas Company in Gujarat; and by Indraprastha Gas Limited (IGL), in Delhi.

Other prominent institutions in the sector include the Oil Industry Development Board set up to provide financial and other assistance for the development of the oil industry; the Petroleum Conservation Research Association, which coordinates energy conservation efforts; and the Oil Industry Safety Directorate which develops safety standards and codes for the industry.

Power Sector

Under the Indian Constitution, electricity is a concurrent subject, i.e. the Union and State governments have concurrent authority to make laws in the area though laws made by the Parliament and the Union override those made by the state legislatures.

Box 3.1 summarizes the organizational structure of the power sector. The structure has evolved considerably after independence as private participation progressively diminished and the sector assumed its current form – that of vertically integrated state-wide public sector utilities (State Electricity Boards, or SEBs). The role of the Government of India, initially limited to national planning and policy, extended over time to generation, transmission and financing. The share of the Centre in installed capacity progressively increased from 9.7% in 1979/80 to 30% as in March 2001. Distribution has remained with the states. In the nineties, however, changes have been effected, allowing the private sector a greater role. There has been a trend towards breaking up the SEBs along functional lines (Karnataka, Andhra Pradesh, Rajasthan, Uttar Pradesh, Orissa and Haryana) and inducting the private sector in distribution (Orissa).

Box 3.1 Institutional structure of the power sector

MoP (Ministry of Power): The nodal agency for planning, policy formulation, processing investment needs of public sector projects, monitoring of implementation of power projects, training and manpower development etc. The MoP is assisted by the following agencies in the execution of policies and programmes:

CEA (Central Electricity Authority): Advises the Ministry on technical, financial and economic matters and also regulates certain aspects of the sector.

REC (Rural Electrification Corporation): Provides financial assistance for rural electrification programmes.

NHPC (National Hydro Power Corporation): Plans, promotes and integrates the development of hydroelectric power in the country.

NTPC (National Thermal Power Corporation): Premier central sector thermal power generator with a share of more than 20% in generation capacity.

PFC (Power Finance Corporation): Provides term finance for power sector projects.

NPC (Nuclear Power Corporation): Under the administrative control of the Department of Atomic Energy is responsible for nuclear power plants.

PGCIL (Power Grid Corporation of India Limited): Responsible for transmission projects in the central sector and for the formation of the National Power Grid.

CPRI (Central Power Research Institute): Undertakes applied research in electric power engineering and functions as an independent testing and certification authority for ensuring the reliability of electrical equipment.

NPTI (National Power Training Institute): Responsible for training sector personnel in India. Other Organizations that come under the MoP include the North Eastern Power Corporation, the Nathpa Jhakri Power Corporation, the Tehri Hydro Power Corporation and two statutory bodies, the Damodar Valley Corporation and the Bhakra Beas Management Board.

SEBs (State Electricity Boards): Constituted by the state governments, are responsible for generation, transmission and distribution in the most economical and efficient manner.

CERC (Central Electricity Regulatory Commission): Independent statutory body with quasi-judicial powers; regulates tariff-related matters and inter-state bulk sale of power, aids and advises the central government on tariff policy and promotes competition and efficiency in the sector.

SERCs (State Electricity Regulatory Commissions): set up in some states; engaged in regulating purchase, distribution, supply and utilization of electricity, quality of service and tariffs, responsible for promoting competition, efficiency and economy within the sector.

Energy reserves and production

India is the fourth largest producer of coal in the world, with nearly 8% of the world's reserves. India's total coal reserves are estimated at 213,905 MT (upto a depth of 1200 metres), of which nearly 86% are non-coking coal reserves (Table 3.1). Coal is the dominant energy source in the country, accounting for 70% of the total primary energy production in 2000-01. Coal production has increased from 214 MT in 1990/91 to 309 MT in 2000/2001. Indian coal has a low calorific value and high ash content. The production from open cast mines, which contributed only about 20% in 1970/71, had increased to 81% in 2000/2001.

Table 3.1. Energy supply indicators -2000/2001

Reserves/ Production	Coal (million tonnes)	Oil (million tonnes)	Gas (billion cubic metres)	Power
Reserves/Installe d capacity	213905.5 ^a	645	647	101630 MW ^d
Production/ generation	309	31.95 ^b	28.45 ^c	499.45 billion units

^a Coal reserves upto depth of 1200 metres, 1 January, 2001

^b Figures are for 1999/2000 and include crude oil production only. Petroleum products production during the year was 79.4 million tonnes.

^c Figures are 1999/2000. Gross production including flaring

^d As on 31 March, 2001

Source. MoPNG (2000)

In the oil and gas sector, India continues to be one of the least explored regions with just 30% of its estimated reserves having been (Table 3.1) explored so far. The annual production of crude oil in the last decade hovered around 32 MT while that of gas increased from around 18 BCM in 1990/91 to 28.45 BCM in 2000-01. At current production rates, India's existing proven oil reserves would last another 18 years, while gas reserves would be depleted in the next 25 years. The production of petroleum products in the country has increased from 48.5 MT to 74.42 MT between 1990/91 and 1999/2000.

India's power sector draws upon coal and petroleum products as well as the country's resources of uranium, renewable sources and hydropower. Installed capacity has increased from 66 GW in 1990 to 101.63 GW in 2001. Thermal capacity dominates the fuel mix with a share of 71%. The share of hydro stands at 25% and nuclear 3% while wind energy constitutes 1% of the total installed capacity. Coal is the dominant fuel used in the power sector, contributing 60% of the total installed capacity. Generation of electricity has

increased from around 264 billion kWh in 1990/91 to 499 billion kWh in 2000/2001. About 86.3% of the villages in the country have access to grid electricity.

Energy movement

Coal is transported mainly by rail. The other major mode of coal movement is the MGR (merry-go-round) system, which is preferred by the pithead power stations and comprises unit trains owned and operated by power stations. The total movement of coal and coal products in 2000/2001 was about 318 MT and the share of different modes as follows: rail (56%), MGR (22%), road (17%) and others (5%). Coastal movement has emerged as an important mode of coal transport to southern India.

Bulk transportation of petroleum products is primarily by rail tank-wagons and pipelines. In 1998/99, 38% of petroleum products were moved by rail while 26% were transported by pipelines, the remaining by road and coastal tankers. The share of pipelines in product movement has increased considerably over the last five years while that of rail has declined marginally.

The development of new pipeline infrastructure for petroleum products is being primarily undertaken by PIL (Petronet India Ltd). Natural gas is transported through pipelines. The largest of these is from Hazira in Gujarat to Delhi. It is proposed to import natural gas through LNG terminals and construction on two terminals, one at Dabhol for the power plant and the other at Hazira to feed the HBJ natural gas pipeline, has begun.

In the power sector, the transmission and distribution network has been strengthened and extended significantly. The length of T&D lines has increased from 1.1 million km in 1970 to 5.5 million km in 1998. The sector is characterized by relatively high T & D losses, over 25% in some states in 2000/01, resulting in sub-optimum utilization of existing assets.

Energy consumption

India's commercial energy consumption, though only one-fourth of the world's average, has grown significantly over time. The final commercial energy consumption has grown from 125 MTOE in 1990/91 to around 202 MTOE in 1999/2000. Coal continues to be the major energy source for the country- with a share of 55% of primary energy consumption. The share of oil stood at 36% of total energy consumption in 1999/2000.

The industrial sector is the largest consumer of energy, consuming about half of the total commercial energy in 1999/2000 followed by the transport sector (Figure 3.1).

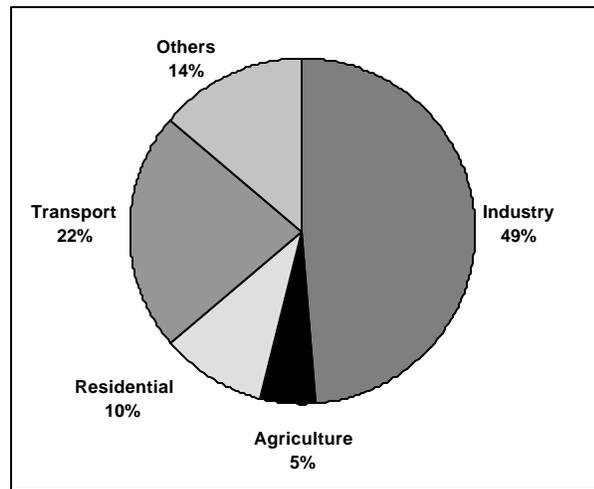


Figure 3.1 Sectoral composition of commercial energy consumption: 1999/2000

Source. TERI (2002)

The fuel composition of commercial energy varies significantly across sectors (Table 3.2). Over 70% of the industry's energy needs are met by coal. Due to the limited availability of indigenous coking coal and its deteriorating quality, low-ash coking coal is imported for blending with indigenous coal and used in integrated steel plants. Imports of coking coal have been rising continuously over the last 15 years and are about 12 million tonnes a year at present, while those of non-coking coal are around 9 million tonnes annually.

Table 3.2 Sectoral energy consumption by fuel: 1999/2000 (%)

	Coal	Natural Gas	Total		Total
			Petroleum	Power	
Agriculture	0.00	1.27	9.51	89.22	100
Industry	73.10	2.36	13.61	10.93	100
Transport	0.00	0.00	98.49	1.48	100
Residential	0.00	1.12	71.32	27.56	100
Others	0.00	33.90	60.88	5.22	100

Source. TERI (2002)

The use of coal in the transport sector has become negligible following the substitution of steam traction with diesel and electric traction. Commercial energy consumption in the transport sector, about 98% of which is in the form of high-speed diesel and gasoline, grew at the rate of 3.1% per annum in the 1970s and at 5.6% per annum in the 1990s. The higher rates of energy consumption in the latter period are because of two structural shifts – one from the railways to roads for both passenger and freight movement, and second, a decline in the share of public transport in meeting urban travel demand.

The rising demand for petroleum products from transport and other sectors together with stagnating domestic production have led to an increased dependence on petroleum imports. Net imports of crude oil and petroleum products have more than doubled in the last nine years, from 27 MT in 1990 to 57 MT in 1999 (MoPNG, 2000).

Gas demand in the country has been increasing rapidly, with sales registering a 7% growth rate over the last decade. While there are no natural gas imports at present, long-term forecasts indicate that domestic gas production will decline, necessitating imports. In fact with demand outstripping supply, the government has had to resort to a system of gas allocations. Supplies to power and fertiliser plants have been given a priority and together these account for about 80% of the total sale.

The use of electricity in the agriculture and the domestic sectors has also increased over time. While about 86.3% of the villages in the country have been electrified, only 37% of the households actually use electricity for lighting. The result is that at least 70-80 million rural households still depend on kerosene lamps for meeting their basic lighting needs^a. The household sector continues to meet a large part of its energy requirement – as much as 40% – especially for cooking through the use of traditional fuels (NSSO, 1997 as cited in TERI, 2001). About 78% of the rural populace continues to rely on fuelwood as a primary energy source for cooking.

Energy and Agenda 21

Agenda 21 and the subsequent CSD sessions recognized the need to accelerate energy production to foster development and raise the living standards of people in developing countries. *Energy for sustainable development can be achieved by providing universal access to a cost-effective mix of energy resources compatible with different needs and requirements of various countries and regions. This should include giving a greater share of the energy mix to renewable energies, improving energy*

^a According to Draft Tenth Five Year Plan (2002-2007) of the MNES, Government of India.

efficiency and greater reliance on advanced energy technologies, including fossil fuel technologies (IX CSD Session). To implement these objectives, financial and technological assistance from developed countries and allocation of resources by national governments was emphasised. The international community should support national efforts by promoting capacity-building, technology transfer, investments and other forms of financial resources for developing countries. The specific Agenda 21 concerns for the energy sector, reiterated at the IX CSD session are elaborated below.

Improving access to energy

One of the guiding principles and priority areas of Agenda 21 is eliminating poverty and reducing disparities between and within nations with respect to the access to basic necessities. Access to energy is crucial to economic and social development and the eradication of poverty. *Improving accessibility of energy implies finding ways and means by which energy services can be delivered reliably, affordably and in an economically viable, socially acceptable and environmentally sound manner.*

Addressing environmental and social concerns in the energy sector

The underlying theme in Agenda 21 is the prevention and control of environmental degradation, and the integration of environmental concerns in the development process. Activities in the energy sector may cause severe impacts on the environment right from the mining stage through the processing stage to the final use of fuels in power generation or for transport. One of the mechanisms for integrating environmental consideration in development planning, is *to develop and implement integrated enforceable and effective laws and regulations that are based on sound social and ecological principles.* Another mechanism is the use of economic and market-based instruments that incorporate environmental costs in the decisions of producers and consumers.

An important dimension of sustainable energy systems is the direct social impact of energy development such as resettlement and rehabilitation of people displaced by clearing of land for mining or setting up large hydropower plants. Those losing land and other productive assets on which their livelihood depend, such as land owners, tenants and labourers could experience a decline in living standards and need to be adequately compensated. Addressing the social impacts of energy projects is an important component of sustainable energy development.

Mobilizing resources including participation of the private sector

The need to augment financial resources, both domestic and international, particularly for developing countries, as a means of implementing programmes for achieving sustainable development has been highlighted in Agenda 21. The financial performance of the sector is critical to its sustainability and the allocation of resources for undertaking environmental protection.

Business and industry can play an important role by providing financial resources and technological know-how. Agenda 21 underscores the need for a conducive and stable policy regime that enables the active participation of the private sector. The action plan goes on to urge the private sector to accord a high priority to environmental management.

Energy efficiency and environmentally-sound energy systems

Agenda 21 gives primacy to the role of efficiency in energy production, transmission, distribution and consumption, and on the use of environmentally-sound energy systems, such as advanced fossil fuel technologies and new and renewable sources of energy for controlling environmental damage. It advocates strengthening R&D and institutional capacities, and formulating appropriate policies and programmes towards the development and use of efficient and less polluting forms of energy. The need for favourable access to and transfer of environmentally sound technologies to developing countries has been emphasized.

International and regional cooperation

As Agenda 21 points out, *an open, equitable, secure, non-discriminatory and predictable multilateral trading system that is consistent with the goals of sustainable development and leads to the optimal distribution of global production in accordance with comparative advantage is of benefit to all trading partners.* This holds equally well in the context of energy resources. The other ways in which international cooperation, both in the private sector and through multilateral and bilateral organizations, can play an important role in the implementation of Agenda 21, is through cooperation in the development and transfer of technology and capacity-building.

In what follows, major policy and other developments in the coal, oil and gas and power sectors are discussed and analyzed to highlight achievements and concerns in the light of Agenda 21's objectives discussed above. Strategies and directions are proposed that will address the emerging concerns and go towards ensuring sustainable energy development envisioned in Agenda 21.

Review and analysis of policy and other developments in the energy sector

This section reviews legislation and policy developments in the energy sector to identify areas where energy sector policies have incorporated Agenda 21 issues and areas which remain a cause for concern.

Highlights of legislation, policy and other developments in the energy sector

Tables 3.3, 3.4 and 3.5 below provides an overview of the legislative framework and policies for the development of the energy sub-sectors in the country.

Table 3.3 Legislation and policy developments in the coal sector

Year	Law/Act/Policy	Main provisions
1952	Mines Act	Promoted the adoption of health and safety standards in coal mines.
1957	Mines and Minerals Regulation and Development Act	Vested in the Central government control over prospecting and mining of coal reserves.
1957	Coal Bearing Areas (Acquisition and Development) Act	Increased public control over coal production by empowering the Central government to acquire unworked land containing or likely to contain coal deposits.
1960	Mineral Concession Rules	Provided for procedures for the grant of prospecting licences, mining leases, payment of royalty for 'other minor minerals'.
1971	Coking Coal Mines (Emergency Provisions) Act	Provided for the take over of the management of coking coal mines and coke oven plants.
1972	Coking Coal Mines (Nationalisation Act)	Provided for nationalization of 214 coking coal mines
1973	Coal Mines (Taking over of Management) Act	Extended management control of the Central government to 738 coking and non-coking coal mines including the coking coal mines taken over earlier.
1973	Coal Mines	Nationalization of all coking and

	(Nationalisation) Act	non-coking coal mines and reserved coal mining for the public sector, with a few exceptions.
1974	Coal Mines (Conservation and Development) Act	Provided for the conservation of coal during mining operations.
1993	Coal Mines (Nationalisation) Amendment Act	Allowed private participation in captive coal mining and setting up of washeries.
1996	Committee on Integrated Coal Policy (Chari Committee)	Recommendations included deregulating prices, allocation of blocks on the basis of a competitive bidding process in which Indian companies including national coal companies could participate and establishment of a regulatory body.
2000	Colliery Control Order	Deregulated the prices of all grades of coal.

Source. TERI and IMC (2000)

Table 3.4 Highlights of policies and other initiatives in the oil and gas sector

Year	Policy/programme	Main provisions/Objectives
1975	Institution of the Oil Industry Development Board	Mobilize financial resources for the oil sector
1976	Institution of Administered Pricing Mechanism (APM)	Insulate domestic markets from volatility in international markets Assured availability of products throughout the country at uniform prices Framework to administer subsidies
1976	Establishment of Petroleum Conservation Research Association	Nodal agency to coordinate conservation efforts of the oil industry
1979	Exploration blocks put on bidding to attract private participation	Attract private sector in upstream area
1987	Allowing private participation in JV refineries	Attract private sector in refining area
1993	Allowing parallel marketing for LPG and SKO	Attract private sector in downstream area Increase availability of LPG and SKO

		Induce switch from traditional to commercial fuels
1993	Establishment of Directorate General Hydrocarbons	Attract private participation in upstream area Provide a de facto regulatory framework
1995	Introduction of unleaded petrol	Improve environmental quality
1997	Reduction in sulphur content of petrol	Improve environmental quality
1998	Initiation of phased dismantling of the Administered Pricing Mechanism (APM)	Phased reduction in tariffs Shift to market determined pricing mechanism
1998	Delicensing of refining sector	Strengthening role of private sector in refining sector
1999	Exploration blocks put on bidding under New Exploration Licensing Policy	Strengthening role of private sector in upstream sector
2000	Introduction of low benzene petrol	Improve environmental quality
2000	Introduction of low sulphur diesel	Improve environmental quality
2002	Administered Price Mechanism dismantled	Market determined pricing mechanism

Table 3.5 Highlights of major policies and other initiatives in the power sector

Year	Policy/Programme/ Act Notification etc.	Highlights
1969	The REC (Rural Electrification Corporation) set up	Set up under the Ministry of Power to fund programmes for rural electrification.
1975	The, National Thermal Power Corporation (NTPC) and the National Hydro Power Corporation (NHPC) set up.	The central sector begins to play an important role in power generation
1983	Amendment of the Electricity Supply S Act (1948)	Sought to ensure a minimum 3% return on the fixed assets of State Electricity Boards. Effected in 1985
1991	Electricity Laws (Amendment) Act	Permitted private investors to set up stand-alone generation capacities and to invest in captive and co-generation plants and renovation and modernization
1996	Common Minimum Action Plan for Power	National consensus on reforms - restructuring SEBs, rationalization of retail tariff, participation of the private sector and setting up of independent regulatory bodies at the central and state level as important to ensuring efficient growth of the sector.
1997	Notification for use of beneficiated coal	Mandated the use of beneficiated/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 manufacturers within a radius of 50 km from coal- or lignite-based power plants to use at least 25 per cent 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	Electricity Regulatory Commissions Act	Enabled the setting up of independent and autonomous regulatory commissions at central and state levels. The Commissions were expected to promote competition, efficiency, and economy. Among other functions were to develop appropriate policies and procedures for environmental regulation of the power sector.
1998	Electricity Laws (Amendment) Act	1910 and 1948 Acts amended to give legal status to CTU/STU/RLDC and REB and provide for stand alone transmission companies, thus paving the way for the participation of the private sector in transmission
1998	National Hydro Policy	<p>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 hydropower by suitable evacuation of power and encourage greater private investment for faster hydro development. These include measures such as:</p> <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 hydropower during peak period - Recommendations to address rehabilitation and resettlement of project affected persons
Year	Policy/Programme/ Act Notification etc.	Highlights
2000/01	Accelerated Power Development Programme (now called Accelerated Power Development and Reform Programmes)	<p>Centrally sponsored scheme initiated with the objective of providing systematic financing for:</p> <ul style="list-style-type: none"> ▪ Renovation and modernization ▪ Upgradation of sub-transmission and distribution network in the country for financial turn-around of the SEBs
2001	Energy Conservation Act	Enables the creation of the Bureau of Energy Efficiency which would recommend energy consumption norms and standards,

create awareness and disseminate information for efficient use of energy and its conservation, promote R&D in the field of energy conservation, provide financial assistance to institutions to promote energy efficiency, implement international cooperation programmes relating to energy-efficiency etc.

The following section discusses how these and other initiatives have addressed Agenda 21 concerns relevant to the sector.

Achievements

Improving access to energy

Providing energy at affordable prices has been a key component of the Indian planning process. The emphasis has been to increase production, expand the network for distribution and to ensure that the final consumer price is affordable, specially for the poorer segments of society. This is reflected in policies in the oil and gas sectors as well as the electricity sector.

Pricing policies in the oil and gas sector have aimed at ensuring affordable energy to households. The Oil Prices Committee (OPC), constituted in 1975, recommended the Administered Pricing Mechanism (APM) for the industry. At the core of the APM was the Oil Pool Account, an extra budgetary account, which reconciled the interests of the consumers and producers. The APM ensured:

- Achievement of socio-economic objectives of the government such as availability of petroleum products at subsidized prices
- Stable domestic prices insulated from volatility in international markets
- Assured availability of petroleum products throughout the country at uniform prices.

Even with the dismantling of the APM in 2002 (which is discussed in greater detail below) the government intends to continue with subsidies on LPG and kerosene to ensure that commercial fuels are affordable.

Similarly access to electricity has improved considerably since Independence (Table 3.6). Installed capacity grew from about 1,700 MW in 1950 to about 1,01,630 MW in March 2001. Commensurate with this, per capita consumption per annum increased from around 16 kWh at the time of Independence to about 360kWh at present. The pricing policies of power are also sensitive to the income levels of consumers.

Rural electrification has received a high priority in the country- about 86.3 % of the villages in the country and thirteen states in the country have been electrified. As per the latest estimates, out of the agricultural pumpset potential of 19.5 million, 12.2 million had been electrified by March 1999 (Planning Commission, 2000). The GoI has schemes to electrify the remaining villages. The 2001/02 Union Budget announced a package of initiatives for electrification of 80,000 villages that have no access to electricity over the next 6 years. Recognizing the difficulties of the SEBs in servicing debt, the 2002/03 budget introduced a new interest subsidy scheme called the Accelerated Rural Electrification Programme. The Budget also announced notable initiatives for the electrification of villages using renewable sources of energy. In particular, 500 villages situated in far-flung areas are to be electrified through small hydropower.

Table 3.6 Growth of Indian power sector

Indicator	1950	1992/93	2000/01
Installed capacity (GW)	1.70	63.6 ^a	101.63
Electricity generation	5.10	245	499.45
Per capita consumption (kWh)	15.00	283	360 ^b
Villages with access to grid	0.00	84.8 ^c	86.3

^a 1990 data

^b 1998/99 data

^c as on 31 March 1993

Source. MoP (2001), Planning Commission (2001a); TERI Energy Data Directory and Yearbook (various years)

Addressing environmental and social concerns

The energy sector seeks to achieve environmental protection by implementing provisions under environmental legislation and policy statements (Chapter 2). The aim of these has been to ensure that the environment is adequately protected through project-specific safeguards and minimum effluent/emission discharge standards. Major initiatives taken in the 90's have been the introduction of mandatory EIA's (1994); public hearings for consideration of these EIA's (1997) and certain other specific steps discussed below.

In the coal sector, the central government has taken a number of measures for the control of fire and subsidence in some coalfields and the protection of the environment in all coal mining areas. Environmental Monitoring and Subsidence Control (EMSC) schemes have been taken up in Raniganj and Jharia coalfields for controlling fires, thereby enabling coal conservation and stabilization of old abandoned workings lying under habited areas. Box 3.2

outlines the policies proposed in successive Five-Year Plans for environmental protection in mining areas.

Box 3.2 Policies proposed in successive Five-Year Plans for environmental protection in mining areas

- 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 environment and 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.

CIL has spelt out its policy on land reclamation in mining areas. The Resettlement and Rehabilitation (R&R) policy of CIL has been designed to ensure that affected people improve or at least regain their former standard of living and earning capacity after a reasonable transition period. Coal India Limited is implementing the Environmental and Social Mitigation Project (ESMP) in 24 coal projects with World Bank funding. However, such programmes are not limited to these projects. CIL, out of its own resources is implementing this programme in almost all opencast projects.

In the oil sector the major achievements are compliance with sulphur emission norms and improvements in fuel quality.

All Indian refineries comply with the applicable minimum national standards prescribed for SO₂. Measures adopted include:

- Use of low-sulphur fuel oil
- Desulphurization of refinery fuel gas in sulphur recovery unit
- Taller stacks for better dispersion

Improvement of fuel quality to reduce vehicular air pollution has also been a priority. Unleaded petrol was introduced in phases in April 1995, and the entire country has been supplied unleaded petrol since February 2000. In addition, the sulphur content in petrol was reduced from 0.2% to 0.15% in March 1997, and further to 0.1% from April 2000. Ultra low sulphur petrol with

sulphur content of 0.05% has also been introduced in the four metropolitan cities.

The benzene content in petrol has been limited to 3% in the metros and 5% for the rest of the country w.e.f. April 2000. In addition, low benzene petrol (1% vol. max.) has been introduced in the National Capital Territory (NCT) of Delhi and Mumbai. In order to improve the quality of HSD, nine diesel hydrodesulphurization units have been commissioned in different refineries. The sulphur content in diesel was brought down to 0.25% throughout the country w.e.f. January 2000. In addition, ultra low sulphur diesel (sulphur content less than 0.05%) was introduced in selected retail outlets in the National Capital Region for newly registered vehicles in April 2000. Since March 2001, all outlets in the NCT sell diesel with less than 0.05% sulphur. Compressed natural gas (CNG) has also been introduced in Delhi and a few other states in the country urged also by the judicial system.

In the power sector, apart from prescription of emission standards for power plants, the problem of disposing large quantities of fly ash generated during power generation has received increasing attention, particularly in the Ninth Plan period. This is a problem common to the power and coal sectors. In 1997, a notification issued by the MoEF required the use of beneficiated/blended coal (with ash content not exceeding 34%) from June 2001 in power plants located beyond 1000 km. from pit heads and those located in critically polluted areas, urban areas and ecologically sensitive areas. The deadline for the use of beneficiated/blended coal with ash content not exceeding 34% has since been extended to June 2002. In addition the use of fly ash in the manufacture of bricks and roads is being promoted. To address the issue of submergence of biodiversity due to the construction of large hydropower projects, compensatory forestry has become an essential and integral part of all new water resources projects. In several large projects like Narmada Sagar and Sardar Sarovar, lands for compensatory afforestation have been allocated and related costs included as part of project costs. In addition, a lot of soil conservation, catchment area treatment and afforestation work is initiated along with such projects, which reduces the siltation rate and increase the life of the reservoirs apart from the environmental benefits.

Promoting energy efficiency and environmentally sound energy systems (including advanced fossil fuel technologies)

Efficiency enhancement and energy conservation have received considerable attention right from the first oil shock in 1973. Improving energy efficiency has

been attempted by a mix of market mechanisms as well as traditional command and control measures. The R&D efforts include international co-operation and promotion of pilot projects for new technologies. Energy efficiency standards and energy audits have also gained importance over time. The Energy Conservation Act 2001 provides for the setting up of a Bureau of Energy Efficiency to facilitate and enforce efficient use of energy – its functions include laying down standards, making energy audits mandatory, and imposition of penalties for non-compliance. The annual Union budget also makes allocations for energy conservation activities such as energy audits, demonstration projects studies, and awareness-building. Specific steps taken in the three sub- sectors are detailed as follows.

The introduction of new mining technologies to improve efficiency and productivity have been emphasized in the research and development programmes developed in the coal sector. Foreign collaboration for technological and financial assistance has been promoted through the establishment of joint working groups with France, Germany, Russia, Canada, Australia, United Kingdom, Poland and China.

Some areas of research and development that have been given priority in the coal sector are:

- Improved mining techniques
- Promoting the use of new technologies such as fluidized bed combustion
- Land reclamation systems for areas degraded by opencast mining
- Environmental protection, through improvement in ventilation and environmental conditions in underground mines
- New methods for coal beneficiation
- Clean coal technologies
- Alternative modes for coal transportation
- Environmentally friendly sources of energy such as coal bed methane (CBM)

For harnessing CBM, one pilot-scale demonstration project has been undertaken by the Ministry of Coal with funding from the GEF (Global Environment Facility) and the UNDP (United Nations Development Programme). A few blocks are also under exploration. In addition, seven blocks have been offered for development through competitive bidding by the Ministry of Petroleum and Natural Gas.

The oil industry has a strong research and development base to promote energy efficiency and technology upgradation. The IOC established a full-fledged Research & Development (R&D) centre in 1972. The centre has carried

out extensive work in upgrading and optimizing existing technologies and developing new process technologies. Likewise, the ONGC has set up seven different R&D centres to carry out research in various aspects of the upstream sector. The Centre for High Technology (CHT), a registered society under the Ministry of Petroleum & Natural Gas, acts as a focal point for co-ordinating and funding research work.

The oil industry's conservation efforts are coordinated by the Petroleum Conservation Research Association (PCRA), a society funded by the oil companies. Programmes undertaken by the PCRA include adoption of efficient engines and spreading awareness about fuel-efficient driving habits; energy audits and oil diagnostic studies in industries; standardization of fuel efficient irrigation pump sets; development of fuel-efficient domestic appliances, etc.

In the electricity sector, it is attempted to address the issue of energy conservation by reducing T & D losses, and integrated and long term planning that facilitates optimum use of the country's resources. In particular establishing pithead coal based power stations and coastal power stations would help in reducing the burden of coal transportation. The need to increase the share of hydropower and construct regional grids that will ultimately be welded into the national grid has been often felt.

The Renovation and Modernization programmes for power plants in the Seventh and Eighth Plans have been successfully implemented. Phase I of the programme covered 163 thermal units aggregating to 13570.50 MW in 34 selected power stations and achieved an additional generation of more than 10,000 MU/year against the targeted benefits of 7000 MU/year.

The Accelerated Power Development and Reform Programme is a notable initiative of the central government that promotes energy efficiency through assistance to states for renovation and modernization of old stations and upgradation of sub-transmission and distribution network in the country (Table 3.5). The APDRP is being used as a tool to engineer reforms in the distribution sector, which is central to bringing about commercial viability of the power sector, given that over 75% of the T&D losses and almost entire commercial losses take place at the distribution stage apart from maximum consumer interface. The progress of the various schemes under the programme is monitored by a committee headed by the Ministry of Power.

On the demand side the reform process is expected to improve energy efficiency through a rational tariff regime and some success has already been achieved. The states of Uttar Pradesh, Gujarat, Maharashtra and Himachal Pradesh have instituted time-of-the-day tariffs for industry and other states are

moving in this direction too. Agricultural tariffs have been increased in many states and there is a conscious move to meter energy consumption by agricultural consumers.

The rectification of pumpsets has the potential to save about 30% energy. The Ministry of Power has been sponsoring rectification of agricultural pumpsets since 1987 through programmes including subsidies.

In the area of environmentally sound energy systems, an important development is the increase in the share of natural gas – the share of gas-based power in the thermal mix increased from 2% in 1970 to 14.5% in 2001. In addition, advanced fossil fuel technologies, especially coal-based ones that will play an important role in the power scenario of the country include FBC (fluidized bed combustion), IGCC (integrated gasification combined cycle), CFBC (circulating fluidized bed combustion) are receiving attention from the government. The GOI is undertaking a project with USAID for conducting a feasibility study for a 100 MW IGCC unit. The NTPC which is the implementing arm of this project also established a Centre for Power Efficiency and Environmental Protection in 1994, with the objective of assisting utilities in reducing carbon dioxide emissions. Reforms in the power sector and market forces will also encourage the development of advanced and cleaner technologies.

Mobilizing financial resources including participation of the private sector

The mobilization of financial resources has been a major concern for the sector and has received attention with respect to the need for ensuring adequate returns on public investment and increasingly, by encouraging the participation of the private sector. When international oil prices rose in the 1970s, increasing the production of coal and substituting coal for oil became a priority. The primary objective of the energy pricing policy of the country was to minimize the cost of supplying energy, protect against fluctuations in international oil prices and encourage inter-fuel substitution. Prices of energy were closely controlled by the government, with a view to balance the interests of the consumers and the producers. The achievement has been mixed with the oil sector being the most healthy and the electricity sector the weakest. Increasingly the trend has been to use market mechanisms and the private sector to raise resources. These are discussed in detail below.

Correcting policy distortions

The coal industry was closely regulated by the government until recently. Coal prices were controlled under the provisions of the CCO (Colliery Control Order) 1945. Prices did not include a provision for depreciation and a reasonable return on investment. This resulted in substantial losses being incurred by the coal industry. Since the 1980s, the administered pricing system for coal has provided for a reasonable rate of return on capital employed in the coal industry with an additional provision for escalation linked to increase in input costs.

With the introduction of economic reforms in 1991, the problem of inadequate financial resources in the coal industry and the need to increase financial viability was given attention. This was to be achieved primarily through increases in efficiency and productivity, along with increases in prices. Accordingly, the coal industry initiated the rationalization of manpower and closure of uneconomic mines. The prices of all coking coal and superior grades of non-coking coal were decontrolled.

The Planning Commission constituted the Committee on Integrated Coal Policy in 1996, to evolve a policy for the coal sector for adoption in the Ninth and Tenth Plan periods. The main recommendations of the Committee included deregulating the prices of some grades of coal and the establishment of a regulatory body to resolve price disputes. The administered price mechanism for coal has been dismantled in phases. The prices of all grades of coal have been deregulated with effect from 1 January, 2000. It is expected that this will help in improving the financial position of the coal industry.

Funding requirements in the oil and gas sector are met through a combination of sources – the Oil Industry Development Board (OIDB), plan outlays from the Union Budget, internal accruals of companies, etc. The OIDB was constituted in 1975 to mobilize resources for the sector. The Board was set up with the objective of providing financial and other assistance for the development of the oil industry.

Though the Administered Pricing Mechanism (APM) ensured an orderly growth of the oil industry for years, it insulated oil pricing from the underlying economic realities. The prices of politically-sensitive products did not reflect their economic costs. Subsidies and cross-subsidies resulted in a wide distortion of consumer prices and led to wasteful use of energy. The APM provided little incentive for improving productivity or efficiency as returns were guaranteed on the capital employed. Competition was stifled with marketing companies acting merely as distributors.

The Ninth Five-Year Plan pegged the resource requirements for the industry during the plan period at Rs 1,240 billion. It was recognized that this

scale of investment was not possible by the government or the public sector oil companies. Participation of private capital from both domestic and international sources was considered imperative. The APM was considered inappropriate for attracting private capital. After extensive consultation the government initiated the phased dismantling of the APM in 1998, with the complete deregulation of the sector in 2002. Post-deregulation the role of the government in pricing and distribution has become minimal.

In the electricity sector a number of states in the country have initiated the process of reform. This includes transferring the powers of fixing tariff from government to an independent regulator, both at the centre and in the states that have initiated the reform process. These developments have led to a more rational tariff system, specially on the crucial issue of reducing cross subsidies. The trend is to reduce the under-recoveries for the agricultural and domestic sectors. This would help in restoring the financial health of the sector. The government also continues to give budgetary support to the sector. In the states this takes the form of subsidising losses as well to fund capital works. At the centre the funds are mainly for hydro projects.

Role of private sector

In 1993, limited private participation was permitted in the coal sector, essentially captive mining for self use. In 1996, the Chari Committee recommended a greater role for the private sector, along with its deregulation. These recommendations have been reflected in policy statements of the government. The Ninth Plan proposed reforms for deregulating the coal industry and increasing the role of the private sector. The main proposals were: restructuring the industry, greater autonomy to the subsidiaries of CIL, private sector participation in commercial coal mining through allocation of coal mining blocks and setting up coal washeries. The Approach Paper to the Tenth Five-Year Plan points out that a major policy constraint is the fact that the coal sector is the only one not open to private investment (except for captive mining). Private participation in the oil and gas sector was initiated in the upstream sector, followed by the refining sector and finally downstream marketing. Exploration bidding rounds to attract private investment in the upstream sector started as early as 1979. On the upstream front, exploration blocks were put on offer under the New Exploration Licensing Policy (NELP) in 1999, under radically different terms and conditions to attract private investment. NELP was fairly successful in attracting investments to the upstream sector – 25 blocks were awarded under the first round, while another 23 blocks were awarded

under the second. Private and joint venture companies already account for about 12% of the total domestic production of oil and gas (Table 3.7). The government plans to come out with the third round under the NELP soon.

In 1987, the Government allowed private participation in refining through joint ventures, which was eventually delicensed in 1998. The country's largest refinery, a 27 MMTPA facility at Jamnagar, Gujarat is run by a private sector company.

Parallel marketing of LPG and kerosene was permitted in 1993. Under the scheme, imports of these products were decanalized and private parties were allowed to import and market these at market-determined prices. Over the years parallel marketeers have developed facilities for imports, tankages for storage, and LPG bottling plants and have set up their own distribution and marketing networks.

Table 3.7 Oil and gas production by national oil companies (NOCs) and private and joint venture companies

Year	Oil (MMT)			Gas (BCM)		
	NOCs	Pvt/JV	Total	NOCs	Pvt/JV	Total
1995/9	34.5	0.7	35.2	22.3	0.3	22.6
1996/9	31.6	1.3	32.9	22.7	0.5	23.3
1997/9	31.3	2.5	33.9	24.7	1.7	26.4
1998/9	29.7	3.0	32.7	24.6	2.9	27.4
1999/0	27.9	4.0	31.9	25.0	3.5	28.4

Source. MoPNG (2000)

In the power sector, private sector participation and competition will improve the sector's financial viability and also serve the overall objective of sustainable development by arresting the inefficient generation and use of power, promoting technological innovations and encouraging the use of non-conventional energy by correcting the under-pricing of conventional sources of electricity. Institutional changes introduced over the past few years (Table 3.6) have removed the legal barriers to a greater role of the private sector and have also sought to create a commercial environment that would allow the private sector to effectively participate. As a result of these measures, the contribution of the private sector to installed capacity in the first four years of the Ninth Plan (97-01) was 4174 MW - 26.5% of the total as against 1262 MW (7.7%) in the eighth plan period (92-97). Simultaneously executive action has been taken to allow foreign investment into the sector – in 1998, foreign investment was made automatic upto 100% of equity in almost all activities of the power sector.

International and regional cooperation

International and regional cooperation in the energy sector has been strengthened over time to further the objectives of Agenda 21. As has been seen in the section on energy efficiency the coal sector has been co-operating with a number of countries, for technological and financial assistance.

With the large dependence on oil imports, the country has been actively pursuing options to secure acreage abroad to enhance oil security. The OVL (ONGC Videsh Limited), a wholly-owned subsidiary of the Oil and Natural Gas Corporation, is involved exclusively in foreign ventures, including acquisition of acreage and exploration and production operations. In addition to the projects in the Sakhalin area of Russia and the Caspian Basin, the company is involved in projects in Iran, Iraq, Myanmar and Vietnam.

The country has also been actively exploring the possibilities of strengthening international cooperation for the import of gas both via pipeline and in the form of liquefied natural gas (LNG). Amongst the pipeline projects, gas imports are being proposed from the South Pars field in Iran, via Pakistan. On the east coast, Unocal has proposed a pipeline from the Bibiyana gas field in Bangladesh to India. With uncertainty about assessments on reserves and future demand, Bangladesh is reluctant to commit to gas exports.

There is enormous potential for regional trade in hydropower. There is a huge untapped hydro-potential in Nepal and Bhutan – under 2% of the respective potentials of 83,000 MW and 21000 MW has been exploited in both countries. In the recent years a number of developments have taken place that will facilitate trade in hydropower in the region, notable among them being the signing of Power Trade Agreement between India and Nepal. India has been assisting Nepal in the utilization of its hydro power potential and four hydroelectric schemes, Pokhara, Trisuli, Western Gandak and Devighat have been implemented with financial and technical assistance from the government of India. Three major water resources projects in Nepal, Karnali, Pancheshwar and Saptakoshi are presently under discussion at various levels as mutual benefit projects. In Bhutan, the Chukha Project (336 MW) implemented with Indian financial and technical assistance is a shining example of cooperation between the two countries for mutual benefits. The Kurichu Project (45 MW) in Eastern Bhutan is being implemented on a turnkey basis with Indian financial and technical assistance. Another project, the Tala hydroelectric project (1020 MW) is being executed with Indian financial and technical assistance and a major portion of the power generated will be made available to India.

The Power Grid Corporation also has plans to develop a regional grid connection among Bangladesh, Bhutan, and Nepal. This will facilitate smooth electricity trade in the region.

Concerns

Environmental concerns

Although there is a comprehensive legal and regulatory framework for addressing and mitigating the environmental effects of energy production and use, its implementation and monitoring needs strengthening. Typically, environmental performance has not met prescribed norms. Enforcement mechanisms for the implementation of provisions made in the EIA report, standards, legislation etc, need to be strengthened by effective post-project monitoring and through the use of effective regulatory or economic instruments.

The use of economic instruments for the control of pollution has been negligible. Market-based instruments such as sulphur permits and pollution charges that have proved effective in other countries need to be encouraged. Within the country too, there are some examples of the use of economic instruments for pollution control, such as sales tax concessions on fly ash products such as bricks and cement in some states. Regulatory bodies will play an important role in ensuring environmentally correct decisions through the use of such economic instruments.

Financial constraints

The coal industry has been characterized by lack of financial resources, both in terms of inadequate returns and small shares of budgetary support, relative to other energy sectors. Reform measures undertaken periodically have led to some improvement in internal resource generation but delays in revision of prices have diluted the benefits of these measures. As a result of the deregulation of coal prices through the Colliery Control Order 2000, regional differentials in the price of coal have emerged and so has pricing on a cost-plus basis in some areas. However the effectiveness of this order in decontrolling prices is limited as the coal industry remains highly centralized.

Recommendations for a greater private sector role in the coal industry have not been realized, as the industry remains centralized. Private sector participation is limited to captive mining^a and contributes only about 4%-5% to

^a These are the captive mines of TISCO, IISCO, the Damodar Valley Corporation (DVC), the Bengal Emta Coal Mines Limited (BECML) and Jindal Steel and Power Limited (JSPL).

the total production. This situation will be addressed if the Coal Mines (Nationalisation) Amendment Bill, 2000, currently before Parliament, is passed. This Bill provides for private mining of coal for non-captive use.

In the oil sector, as per the estimates of the Group on India Hydrocarbon Vision 2025, investment requirements for refining and marketing alone are estimated at about Rs 3,850 billion. In addition to this, massive investments are also required for exploration and production. It is evident that such a scale of investment would require funds from both the state and the private sector. While there has been substantial progress in encouraging private investment, private players are increasingly voicing concerns about provision of a level playing field. They have expressed the need for access to existing distribution infrastructure such as pipelines, storage installations, depots, hydrant systems at airfield installations, etc.

The issue of subsidies also remains an area of concern. Over time, with political reluctance to adjust prices of sensitive fuels, huge deficits have accumulated in the oil pool account. The current deficit in the oil pool account is substantial, estimated to be at Rs 231.3 billion. However, the intended subsidies on LPG and kerosene add up to Rs 140 billion only. The remaining deficit is on account of subsidies on diesel, despite the government's decision to put diesel prices on import parity in 1997. While no official estimates are available, it is generally believed that a substantial amount of the subsidised kerosene is used for to adulterate diesel. The government has taken a number of steps, such as the introduction of tracer dyes to check adulteration.

The financial performance of the power sector is still a matter of concern, owing largely to the subsidies being accorded to agricultural and domestic consumers and the high level of T&D losses. Subsidies to the agricultural sector have also led to over consumption of electricity, specially since most of the agricultural connections are unmetered and flat rates are charged on the basis of the connected load. This over consumption of electricity in turn has meant overuse of groundwater reserves, falling water tables and also inefficient use of pumpsets. The poor financial health of the SEBs has constrained adding new capacity, improving the T&D system, carrying out renovations and modernizing and investing in new technology. This has resulted in persistent shortages of electricity – there was a peak deficit of 13% and energy deficit of 7.8% at the all India level as on March 2001 (Planning Commission, 2001b)- there are significant regional variations, with the Eastern region having surpluses. Poor performance has also affected the sectoral composition of sales,

with industry moving out of the grid (Figure 3.2). This trend needs to be corrected urgently.

The poor financial performance of the industry has also had a serious impact on private investment and introducing competition. In addition, its financial insolvency has implications for the environment because investments in cleaner technology and the import of cleaner options such as gas or hydropower are adversely affected. Minimizing subsidies and effectively targeting these would also provide a level playing ground to non-conventional energy sources. While regulatory commissions have made some progress in rationalizing the tariff structure for electricity in some states, it needs to be extended to other states.

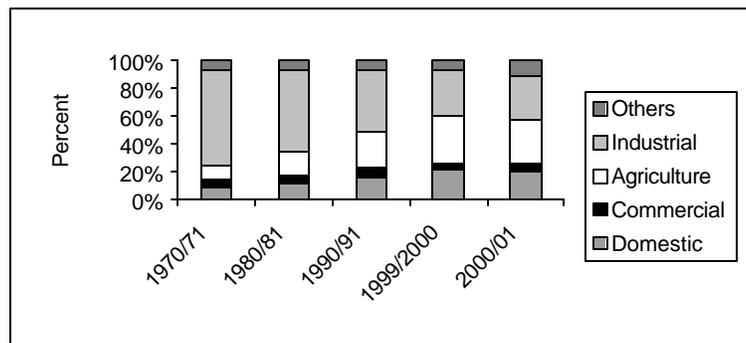


Figure 3.2 Sectoral share of electricity consumption
Source. Planning Commission (various years)

Clean energy sources

Almost all committees and plans have expressed concern over the declining share of hydro and emphasized the need to accelerate hydro development in the country. In spite of this, the share of hydropower has progressively fallen from 43% in 1970 to 34% at the end of the Sixth Plan (1980-1985), to 29% at the end of the Seventh Plan (1985-90) and further to 25% at the end of the Eighth Plan (1992-97). Not only is hydropower a cleaner source of power, it also is essential for grid stability since it provides valuable peak time support to the power system. The National Hydro Policy of 1998 has identified the hurdles to the development of hydro projects and has attempted to deal with them. CEA has completed a countrywide basin wise ranking study for hydro projects. This prioritizes the potential projects and would thus facilitate setting up of new hydro projects. Renewable sources of energy are viable options for grid and off-grid energy applications. The share of renewable energy sources needs to be augmented. This is discussed in more detail in Chapter 4.

Energy security

One of the key areas of concerns is related to security of energy supplies. With a high dependence on imports, the vulnerability to external shocks is high. The high level of imports also results in a continuous strain on the country's foreign exchange reserves. This dependence needs to be brought down by greater use of domestic resources especially non-conventional energy sources that have enormous potential. Currently, these sources contribute only about 3% to the total capacity. Strategies to augment the share of non-conventional energy sources are discussed in the chapter on 'Renewable Energy Sources'. Among other issues, it is necessary to take an integrated view of the energy problems in rural areas so that the initiatives taken by agencies in this regard can be coordinated.

Integrating Agenda 21 concerns - directions

As the energy sector grows, new challenges have emerged requiring different policies and directions. Action has been taken in many of these areas and what is required is a deepening and widening of these reforms to accelerate the process of change. The directions in which further action needs to be taken are discussed for each sub-sector below.

An analysis of policy developments in the coal industry indicates the priority areas for further action 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.

In order to achieve sustainable coal development and meet the above commitments, several initiatives will be necessary. Private sector investment needs to be promoted for the growth of the industry. The Approach Paper prepared for the Tenth Five-Year Plan has highlighted that early passage of the Coal Mines (Nationalisation) Amendment Bill 2000 is necessary for attracting private investment.

The reclamation and use of land degraded or converted to wasteland due to mining needs to be planned. Some form of reclamation trust fund or performance guarantee bond, as developed in some countries, could be established as a pre-requisite to the grant of a mining lease. Alternatively, an

effective programme to monitor compliance with land reclamation works envisaged in the Environmental Management Plans of mines needs to be formulated.

Coal gasification and liquefaction technologies have to be promoted in view of the rising prices of oil in the international market. This is essential from the point of view of adding value to domestic coal and also from considerations of energy security. Coal beneficiation has to be promoted by clearly specifying the agency that will be responsible for implementing the ash content norms.

Substantial progress has already been made in the oil and gas sector in addressing Agenda 21 issues. Subsidized prices for petroleum products have ensured affordable access to commercial energy for the economically-weak sections of society. In addition, a lot has been done to strengthen the role of the private sector in industry. Key concerns that remain are those related to energy security, mobilization of resources, and improving the subsidy mechanisms.

Enhancing energy security would require a host of measures, foremost among which is the issue of a strategic petroleum reserve for the country. This is particularly significant in the light of spiralling oil prices. In addition, strategic reserves provide a cushion against temporary disruptions. The long-term security of the country can also be enhanced by introducing specific measures to augment domestic oil and gas production. Such measures include complete analysis for sedimentary basins, institution of a regulatory framework for the upstream sector to attract investors, offering exploration bids on attractive fiscal terms, sustaining current production levels through Enhanced Oil Recovery Schemes, etc.

Over the long-term, the trend towards other sources such as coal and renewables which are domestically available, will be strengthened. Natural gas, which is also a cleaner fuel, would need to be promoted with greater vigour. With limited gas reserves, gas requirements would also have to be met by imports. However, a review of gas markets indicates that gas prices display a lesser degree of volatility compared to oil prices. In addition, gas sales are generally backed by long-term take-or-pay commitments offering greater security to both suppliers and consumers. A number of LNG projects have already been proposed along the country's coastline. Investor confidence in the sector can be further boosted by instituting a regulatory authority for the sector to address issues such as open access in transmission.

Institution of a regulatory authority for the sector would go a long way in mobilizing private capital for it. Though the sector has been deregulated, there

are still a number of issues, in particular those related to assuring a level playing field for new entrants which a regulatory framework would help resolve.

Universal subsidies, especially in the case of kerosene, have led to a large-scale diversion of subsidized kerosene for adulteration. Clearly, as long as the price difference between petroleum products is substantial, the economic incentive to divert supplies will remain. It is thus imperative that prices throughout the trade channel be uniform. Measures are required to introduce alternative mechanisms that provide subsidies directly to the intended beneficiaries.

An analysis of policy developments in the Indian power industry indicates that while the regulatory and legislative groundwork to encourage the private sector has been effected, the core problem afflicting the industry – that of financial insolvency, remains. This can be addressed by phasing in organizational changes that gradually dismantle the existing public monopoly structure and introduce competition in the generation and distribution of electricity. Market forces will also help to promote new and superior technologies and minimize inefficiency in supply as well as demand, bringing out the synergies between the reform process and sustainable development. Till markets develop, the regulatory structure would be used to reduce cross subsidy especially for agriculture. This would help in more rational use of energy and groundwater. The APDRP will be used to incentivise states and accelerate reforms.

In areas, where the public sector is bound to play a major role in the foreseeable future – such as in the case of large hydro and nuclear power – and where the interests of the weakest sections have to be ensured, the role of the government and public sector management need to be strengthened. The government also needs to proactively engage in economic diplomacy to ensure regional co-operation in energy, especially the import of hydropower and gas.

The government both at the centre and in the states has recently resolved to reform the sector – this was done in a conference of the Chief Ministers/Power Ministers in March 2001. The Approach Paper to the Tenth Five-Year Plan also recognizes the above concerns and reiterates the government's commitment to reforms in the sector, including augmenting the share of cleaner fuels such as renewable sources and hydro. It is expected that as policy reform gains momentum, the power industry will achieve not only financial sustainability but also resource efficiency, along with socially and environmentally-accountable growth.

Integrated energy policy

A comprehensive analysis of energy developments and articulation of policies for the future is critical to the pursuit of sustainable development. Typically, energy decisions are seen only in their application to the supply of specific forms of energy, but considerations of sustainability require that an integrated energy framework be woven not only into energy sector decisions, but into the structure of the economy as a whole. Energy-related decisions can be constrained if the structure of the economy is such that large quantities of energy would be required to ensure that the structure functions in keeping with the overall economic objectives. The constraint in such cases would allow very limited improvements in overall energy efficiency and only some degree of inter-fuel substitution, if at all. In other words, if the structure of an economic system is characterized by high intensity of energy use, considerations of sustainable development would be compromised by severe limitations as they would apply to the supply and consumption of energy. Perhaps the most relevant sectoral example is that of transport. In India, a continuing shift has taken place over the past five decades in the share of rail to road transport. This has led to a much higher energy intensity of transportation services with severe pollution problems and the exploitation of natural resources for expansion of roads and highways, production of construction material, and soil erosion including landslides, etc. particularly in hilly areas. Intensive use of railway facilities and a preference for rail transportation is a far more sustainable option in several areas of the country than the expansion of road transportation. Conscious policies for a greater share for rail transportation through technological improvements, appropriate pricing measures (including the internalization of environmental and social externalities) and greater investments for creating larger railway capacity are clearly preferable to the expansion of road transport.

Energy considerations should also play a part in the choice of industry and the production of all goods and services. In an era of freer international trade, it is not necessary for every country to produce the majority of goods and services that it consumes. An economic system that has abundance of energy resources, for instance, could justify large-scale production of aluminium, but this may not be desirable in a country that has no such comparative advantage. However, if choices are made to set up industrial and other activities that consume large quantities of energy then such a structure is locked into an energy-intensive path of growth which does not allow major shifts or variations. Overall energy intensity, therefore, largely determined by the choice, for

instance, between a mineral-processing or heavy-engineering oriented economic system versus one that emphasises professional services, software production and such activities with low energy intensity.

Within the energy sector an integrated policy would support sustainability objectives if environmental factors and energy security considerations determine the type and form of energy to be used. Trade-offs often become important in the choice of energy mix. Thus, for instance, coal used with traditional technologies would generally have undesirable environmental implications, but for a country such as ours, security of supply, which is as much an issue of sustainable development as any other, would favour greater use of coal. In such cases, government policy could, however, provide incentives for the development and use of clean coal technologies, which would minimize the environmental impact and promote energy security.

The choice of an appropriate mix of energy sources does not have to be the result of a planning exercise with quantities and magnitudes clearly defined. Essentially, it requires proper signals being designed and structured into a fiscal policy, so that a mix of energy sources evolves to support the objectives of sustainable development. If, for instance, the total cost of power supply from centralized sources were to be considered in supplying power to a remote rural habitation, it may emerge that some decentralized renewable technology would be far more acceptable as an option. If to this assessment of conventional costs were added the costs to the environment, the choice in favour of decentralized sources may become overwhelming. Pricing policies are therefore critical to the internalization of externalities and are perhaps the most important tool for ensuring movement towards sustainability.

Similarly, the problems of rural energy require an integrated view to be taken. Although there is an Integrated Rural Energy Programme this is essentially a programme for renewables and energy efficiency for use of traditional fuels. A policy that takes into account the possibilities of substitution between the various forms of energy will be more effective. Among other things it can make the best use of resources currently used for subsidising various forms of energy. Thus it may be more effective to divert the money used in cross-subsidising kerosene to subsidies for renewables. There is therefore need for a rural energy policy that makes the best use of the limited resources across the different energy sub-sectors.

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4

New and renewable sources of energy

Introduction

From times immemorial, non-conventional energy sources have been used for various applications such as for drying farm produce using solar energy and pumping out water using windmills. The general interest in non-conventional energy sources in India received an impetus following the oil shock of the 1970s, backed by political commitment on the government's part. Today, India boasts perhaps the only Ministry of Non Conventional Energy Sources in the world. The Ministry manages one of the world's largest renewable energy programmes covering the whole spectrum of renewable energy technologies for a variety of grid and off-grid applications. The country has the largest decentralized solar energy programme, the second largest biogas and improved cookstoves programme, and the fifth largest wind power programme in the world. A substantial manufacturing base has been created in a variety of new and renewable sources of energy (NRSE), placing India not only in a position to export technology but also to offer technical expertise to other countries. These sources have begun to emerge as an attractive option sometimes the only one, to provide light and power to areas too remote for grid electrification. Promotion of renewable energy sources is an integral component of the country's strategy for sustainable development.

NRSE are central to Agenda 21. This chapter examines the convergence between initiatives taken in India and the objectives set out in Agenda 21 towards the promotion of NRSE. The chapter begins with a brief overview of the sector in India highlighting the organizational structure of the sector. This is followed by a discussion of the various strategies proposed in Agenda 21, (and including the report of the IX session of the CSD) to promote the growth of NRSE. The next section evaluates policies, programmes and other initiatives taken by the government to highlight achievements and concerns in the sector, vis-a vis the goals set out in Agenda 21. Finally, directions and strategies are proposed that will go towards realizing the goals set out at the Earth Summit.

Overview of the sector in India

Organizational structure

Interest in RETs started from the early years of Independence. The first step towards a dedicated organizational framework was taken in 1981 when the Commission for Additional Sources of Energy (CASE) was set up in the Department of Science and Technology. A year later, an independent Department of Non-conventional Energy Sources (DNES) was created in the Ministry of Energy, to focus attention on this sector. This indicated that the stage of commercialization of NRSE devices had been reached, requiring a range of conducive policy measures. To facilitate commercialization and market development, the Indian Renewable Energy Development Agency Limited (IREDA) was established in 1987. The IREDA functions as the promotional and financing arm of the Ministry and has been able to tie up funds from domestic and international institutions for lending to end-users, manufacturers, financial intermediaries and entrepreneurs, predominantly in the private sector. In 1992, the DNES was elevated into a separate Ministry of Non-conventional Energy Sources (MNES), reflecting the political commitment towards the promotion of NRSE. The Ministry is broadly organized into six groups dealing with rural energy, solar energy, power from renewables, energy from urban and industrial wastes, new technologies and administration and coordination.

The Ministry is implementing several programmes in these areas and has at the same time sought to promote the participation of the private sector through an encouraging policy environment. Programmes for dissemination of renewable energy technologies (RETs), are implemented through state nodal agencies (SNAs) and NGOs. The MNES has nine regional offices in different state capitals, besides a network of autonomous research organizations, NGOs, R&D and financial institutions and private entrepreneurs. These regional offices monitor, supervise and create awareness, liaise with state agencies, NGOs and project promoters, and provide feedback from the field. The programmes of the Ministry have a strong R&D component. A number of research institutions are assigned specific R&D projects not only to develop new technologies but also to improve the cost-effectiveness of existing systems. Besides farming out R&D projects, the Ministry has also set up three specialized institutions, the Solar Energy Centre (SEC), Centre for Wind Energy Technology (C-WET) and the Sardar Swaran Singh National Institute of Renewable Energy (SSSNIRE) to provide a range of services for testing upgradation and standardization of devices and their components. The Ministry is also actively involved in

generating awareness and building capacity in the development and use of NRSE.

A women's cell was been set up in 1997 to review progress and schemes with a view to ensuring, that empowerment of women is fostered through the Ministry's programmes. Promotion of international co-operation remains high on the Ministry's priorities.

The MNES with increasing involvement of the private sector and NGOs has been successful in creating one of the most broad-based renewable energy programmes in the world today.

Renewable sources of energy and Agenda 21

Agenda 21 is founded on the principle that integration of environmental and developmental concerns and greater attention to them will lead to the fulfilment of basic needs, and improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. To promote the growth of NRSE several strategies — to be jointly undertaken by governments, local institutions, NGOs, the private sector and the international community — were proposed in Agenda 21 and reiterated at the IX session of the CSD. These strategies include the following.

- Identify NRSE suited to the particular circumstances in individual developing countries, develop and implement policies and address existing constraints to increasing their growth. Develop and implement measures to make renewable technologies more affordable.
- Create conditions for the participation of the private sector in the development of NRSE.
- Promote and strengthen research, development, demonstration and institutional capacities.
- Encourage education and awareness raising programmes at the local national, sub-regional and regional levels and strengthen information networks, compilation and dissemination systems concerning NRSE.
- Strengthen financial support to developing countries for the promotion of renewable energy as well as transfer of advanced NRSE technologies and practices. Coordinate energy plans regionally and sub-regionally, where applicable and study the feasibility of efficient distribution of environmentally-sound energy from NRSE.

The following section reviews how policies and other initiatives in the country have sought to address Agenda 21 concerns, in most cases even prior to 1992.

Review and analysis of policies and programmes

Since the emergence of a formal institutional set-up for the promotion of NRSE in the early 1980s, there have been concerted efforts towards identifying NRSE suitable for the country, intensifying R&D efforts to make RETs more user-responsive and affordable, setting up demonstration and pilot projects to establish the usefulness and commercial viability of RETs and improving support infrastructure for the financing and maintenance of applications based on these technologies. A large number of national programmes have evolved covering the entire spectrum of NRSE to meet a variety of energy requirements. In what follows, the major programmes and policies for the promotion of NRSE are discussed and analyzed to assess achievements and concerns vis-a-vis the objectives set out in Agenda 21.

Achievements

National programmes and policies

Agenda 21 emphasizes the need for a set of national programmes and policies to promote the use of NRSE. The growth of renewable energy in India has been possible due to a conscious and proactive government commitment towards its promotion that existed even prior to the adoption of Agenda 21.

The organizational structure for NRSE was significantly strengthened in the 1990s. At the apex level, the Department of Non-Conventional Energy Sources was upgraded to the level of a Ministry. At the same time, new institutions were created to cater to the new and growing challenges faced in expanding the role of this sector. These organizational changes have been simultaneously matched with a widening and deepening of programmes aimed at specific technologies.

The major programmes supported by the government include the following.

1. Rural energy

- National Programme on Biogas Development
- National Programme on Improved Cookstoves
- Integrated Rural Energy Programme
- Rural Energy Entrepreneurship and Institutional Development
- Women and Renewable Energy Development

2. Solar energy

- Solar thermal energy Programme
 - Solar water heating
 - Solar cooking
 - Solar air heating

- Solar buildings
- Solar Photovoltaic Programme

The programme envisages direct conversion of sunlight into electricity for such decentralized applications as fixed and portable lighting units, water pumping, small power plants, power for telecommunications, railway signalling, offshore oil platforms, and TV transmission. Noteworthy progress has been made in the following areas.

- Solar lanterns
- Solar home lighting systems
- Solar street lighting systems
- SPV power plants
- SPV water pumping units

3. Power from renewables

The following technologies are making substantial contributions to the share of renewable sources, which makes up about 3% of the total grid capacity.

- Wind
- Small hydro
- Biomass (including bagasse-based cogeneration)
- Solar

4. Energy from urban and industrial wastes

5. New technologies

Since its inception, the MNES has been promoting RD&D to tap the potential of other forms of energy namely:

- Chemical (fuel cells)
- Hydrogen energy
- Alternative fuel for surface transport (electric/battery-operated)
- Geothermal energy
- Ocean energy (tidal power, wave power and ocean thermal energy)

The details of these programmes and their achievements are discussed in Annexure 4.1. A snapshot picture of achievement under these programmes since 1992 is shown in Table 4.1.

Table 4.1 Renewable energy technologies: estimated potential and achievements

Technology	Potential	Cumulative installation up	
		March 1993	December 2001
Family-size biogas	12	1.76	3.27
Improved cookstoves	120	14.50	33.8
Solar			
Solar thermal			
Solar hot water systems	140	0.25	0.60
Solar cookers (million)		0.29	0.48*
Solar photovoltaics	20		82.0 MWp**
Biomass			
Biomass gasifier (MW)	17000 MW		
Biomass power/Co-		-	42.8
Windfarms (MW)	19,500	-	358.00
Small hydro (MW)	45000	53.00	1507.00
Waste to energy (MW)	15000	93.00***	1423.00
	1700	-	17.10

* As in April 2000

** Of this, 29 MWp SPV Products have been exported

*** The MNES was handling projects up to 3 MW capacity initially, but recently projects up to 25 MW capacity have been transferred to its charge from the Ministry of Power.

Source. MNES (2002)

While initially technologies were promoted through design and development support, and through establishment of large-scale demonstration projects, the government has placed much greater emphasis on developing market linkages and promoting commercialization since the 1990's by involving the private sector and providing fiscal and tax incentives, rather than public investment. The main elements of the government policy include:

- Budgetary support such as for financial assistance or demonstration projects
- Institutional finance through IREDA and other financial institutions for commercially viable projects;
- Promoting private investment through fiscal incentives, soft loans, capital subsidies, facilities for wheeling and banking of power for the grid and remunerative returns for power provided to the grid. These incentives differ across technologies, applications and regions
- Institutional capacity building for a range of services ranging from research to marketing
- Education and information dissemination

These incentives have led to a phenomenal growth of the private sector and have sought to make NRSE more affordable to the final consumer.

Private sector

The role of the private sector, as an agent of technological innovation and financial resources, has been stressed in Agenda 21. As discussed above, the MNES has catalyzed the creation of a policy regime conducive to private investment in development, manufacture, ownership and operation of NRSE projects. Another favourable feature has been the interest evinced by financial institutions to provide the required funds for such projects. As a result, a number of known domestic and international names are manufacturing and marketing NRSE systems on their own and with foreign collaboration. While the manufacture of solar cells, photovoltaic modules, wind and hydel turbines etc. is by and large in the large sector, there is a significant presence of units in the small and medium sectors, particularly catering to the requirements of rural energy devices such as biogas plants, biomass briquettes, solar cookers, etc. The country also exports several NRSE devices, such as gasifiers and wind turbine equipment to developing and developed countries. There has also been a growth of private foreign investment in the country, especially in the areas of solar photovoltaics, cogeneration, wind energy, waste-to-energy projects and battery-operated vehicles, encouraged by the liberalized policies of the government. Foreign investors are permitted to enter into a joint venture not only for the manufacture of renewable energy devices but also for setting up power generation projects based on RETs. For the entire non-conventional energy sector, 100% foreign direct investment is allowed under the automatic route without the prior approval of the government. The growth of the private sector is reflected in the fact that over 95% of the installed wind capacity is in the private sector.

Institutional finance

The IREDA is the promotional and financing arm of the Ministry and has emerged as one of the main instruments for promoting developing and financing technologies and projects related to NRSE. It has been able to tie up funds from leading multilateral agencies such as the UN organizations, the Asian Development Bank and the European Commission, bilateral organizations and domestic financial institutions for lending to end-users, manufacturers, financial intermediaries and entrepreneurs, predominantly in the private sector. Cumulative loan disbursements by IREDA have risen from

around Rs 16 million in its first year (87-88) to Rs 25478 million in December 2001, while cumulative sanctions touched Rs 50447 million (Table 4.2). In addition, major national financial institutions such as the IDBI, ICICI, IFCI, and PFC have also been financing wind power projects.

Table 4. 2 Cumulative sectorwise loan sanctions by IREDA till December 31, 2001

Sectors	Rs
Biomass briquetting	194.7
Biomass cogeneration	8736.1
Biomass gasification	104.2
Biomethanation from	724.7
Biomass power generation	4430.0
Energy efficiency &	1693.7
Solar thermal	753.7
Solar photovoltaic	5497.6
Small hydro	10276.7
Waste to energy	449.2
Wind energy	17562.5
Miscellaneous	23.5
Total	50446.6

Source. MNES (2002)

Research and development

Promotional policies and programmes of the government are backed by a strong research and development base aimed at reducing costs and enhancing efficiency. This includes upgradation of existing NRSE and the development, demonstration and commercialization of new and emerging technologies. The Ministry engages leading research organizations in the country to undertake R&D projects. In addition, three specialized technical institutes — SDC, C-WET and the SSSNIRE have been set up. These provide a range of services for testing and standardization of devices, upgradation of production technology, improving operational efficiency of systems and organizing programmes for skill upgradation and human resource development. In recent years, the Ministry has provided a market-oriented thrust to R&D efforts and has evolved a policy of supporting R&D with the involvement of the industry. The Ministry proposes to take up goal-oriented, industry driven R&D activities with large-scale private sector participation in order to expedite the commercialization of NRSE. The Ministry has also established an R&D Advisory Committee consisting of eminent scholars drawn from industry, academia, national laboratories and so on. The Committee considers specific proposals for research

and also recommends research priorities and strategies. Individual research efforts are promoted through scholarships for advanced education at leading institutes in the country. The MNES also facilitates the acquisition of patents in the area of renewable technology.

Information dissemination and publicity

The Ministry's programme of dissemination of information and generation of public awareness plays an important role in popularizing the use of NRSE systems in the country. Under the programme, mass awareness is created of the multiple benefits, design features, product availability etc. of renewable energy products and devices. Target groups in all sections of the society are influenced through electronic (radio and television) and print media, postal stationary, outdoor media including static and mobile exhibitions and folk arts, song and drama. A recent initiative by the government is the concept of energy parks usually organized in educational institutions, consumer fora and large public places to demonstrate the benefits of renewable energy systems and devices amongst students and teachers, rural and urban people.

Information on technological development and the promotional efforts of the government is also widely disseminated to attract investors. Much of this information has also been made available on the Internet. A Renewable Energy Network has been set up to facilitate electronic flow of information between the Ministry and the SNAs, state governments, R&D and technology institutions, consultants, NGOs etc. The MNES also organizes regular seminars and symposia to bring together stakeholders perception on the aspects of NRSE development.

International cooperation

India realizes the vital need for international cooperation and interaction with other countries and international agencies at bilateral and multilateral levels for sharing experience and technical expertise. The country has strengthened international cooperation by:

- Mobilizing financial resources from multilateral and bilateral agencies
- Facilitating foreign direct investment and acquisition of state-of-the-art technologies.
- Promoting export of renewable energy products and technologies.
- Offering technical assistance to other countries and assisting in human resource development. India has provided technical assistance and consultancy services to many countries such as Cuba, Morocco, Tunisia,

Philippines, Sri Lanka, Bangladesh, Bhutan, Mali, Nepal, Myanmar, Senegal, Namibia and Uganda.

The country has actively sought to strengthen South-South cooperation. A recent initiative to promote cooperation in the region is the BIMST-EC (Bhutan, India, Myanmar, Sri Lanka and Thailand Economic Cooperation).

Concerns

Despite the impressive growth of the renewables sector, there are concerns and barriers to further growth. Some of the major ones are:

- High initial costs
- Low product responsiveness to user needs
- Weak markets and market-support infrastructure including networks of suppliers, dealers, credit facilitators, maintenance and spares supply organizations etc.
- Weak linkage between R&D on the one hand and market requirements for product development, deployment and technological upgradation on the other
- Absence of attractive and consistent policies in certain states with respect to grid-based renewable energy, inadequate evacuation networks in some resource-rich regions and the current power tariff structure that subsidizes the use of conventional fuels
- Lack of confidence amongst developers and final users in the merits of NRSE due to biased perceptions

NRSE already occupy an important role in the energy sector of the country especially in rural areas. Their future growth would depend on how effectively such concerns are addressed.

Strategies for promoting new and renewable sources of energy

Agenda 21 recognizes the great potential in renewable sources of energy in meeting the energy needs of people in a socially and environmentally sound manner. It calls for concerted efforts by governments, local institutions, NGOs, the private sector and the international community towards the promotion of NRSE. The Government of India was taking a conscious and keen interest in harnessing the country's abundant potential of NRSE in partnership with stakeholders, long before the conceptualization of Agenda 21. Significant

growth has taken place in the 1990's because of policy initiatives by the Ministry of Non-conventional Energy Sources.

The relevance of NRSE as decentralized sources of energy for the poor has received special attention in the country. The Approach Paper to the Tenth Plan (2002-07) explicitly recognizes the role of NRSE in meeting the energy needs of people in remote areas, using local resources and cutting out expensive delivery mechanisms associated with conventional energy sources. The GOI has recently announced a scheme for using NRSE in energizing villages that have no access to electricity. It is necessary that such villages be identified and energy options — NRSE as well as conventional sources — evaluated so that cost effective options are selected and scarce resources available for NRSE are judiciously used.

The high relative cost of RETs remains the single largest problem. This needs to be tackled from both the demand and supply ends. On the one hand, R&D and market development will help in bringing down costs as technologies mature and gain acceptance; this phenomenon needs to be accelerated. Rural co-operative banks, micro-credit schemes and ESCOs (energy service companies) will play an important role in strengthening market support infrastructure and building confidence in NRSE. On the other hand, NRSE would need to be provided a level playing-ground either by bringing down subsidies on conventional energy or by giving preferential treatment to NRSE. The new electricity regulatory structure that is slowly spreading throughout the country can be used to further the growth of renewables. In giving preferential treatment, incentives should be linked with performance so that there are built-in incentives for improving efficiency and bringing down costs.

The GOI has proposed to come out with a new policy statement on NRSE. It is expected that the above challenges and concerns will be effectively addressed in this new initiative. In addressing these concerns, the state governments, regulators and other stakeholders will have to be taken along so that efforts at the national level are effectively implemented.

Finally, the international community will need to play its role by providing greater financial and technical support to complement domestic efforts and to make up for the limited resources available to developing countries often subject to competing and more pressing claims. The responsibility of the international community comes into focus in the light of grave inequities in energy consumption patterns worldwide that have also affected the global environment adversely. Only an international partnership can help ensure that

the energy needs of all are met in an economically efficient, socially equitable and environmentally accountable manner.

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Annexure 4.1**Programmes supported by the Ministry of Non-conventional Energy Sources for the promotion of NRSE in India**

Renewable Energy Technologies are increasingly being viewed as an equitable and environmentally sound way of addressing the energy concerns in the country- low per capita energy consumption, inequalities in access, supply constraints, growing dependence on imports, and high environmental costs. Rural energy demand still to a large extent is met by non-commercial energy sources such as firewood, cattle dung and crop residues. The real cost of using these fuels- in terms of the time spent in collection, storage and preparation; the health implications of indoor air pollution caused by the use of these fuels; and potential environmental damage caused by deforestation and desertification- is extremely high.

Over the last few years, the technical, operational and economic viability of RETs (renewable energy technologies) has led to a surge of interest in their applications. RETs can contribute substantively towards meeting grid and off-grid energy needs. Several technologies for grid connected power generation such as using wind, small hydro and biomass are proven technologies which are in large scale application in the country. In addition, RETs offer possibilities of distributed generation in sparsely populated or far-flung areas where extension of the grid may be unviable. A niche area for RETs is a range of thermal applications both in rural and urban centres. Applications such as solar air and water heating systems, solar cookers, solar buildings, as well as energy recovery from urban, industrial and agricultural wastes are becoming popular in urban, semi-urban and rural centres. Perhaps the most wide spread application potential of RETs is in rural areas for purposes of cooking, lighting, water pumping, agro and rural industries, where the growth of RETs also creates significant employment opportunities. This section discusses the objectives and achievements of various programmes launched by the Ministry of Non-conventional Energy Sources^a.

*Rural Energy***National Programme on Biogas Development (NPBD)**

^a The section draws largely from Ministry of Non-conventional Energy Sources, Annual Report 2000/2001

The NPBD, one of the earliest programmes to be taken up by the Ministry, was especially designed in view of the large-scale dependence on traditional fuels in rural areas.

It aims to:

- Provide clean and affordable source of energy in rural areas
- Improve sanitation and hygiene by linking toilets with biogas plants
- Reduce the drudgery of women and girl children in walking long distances to collect fuel wood
- Provide enriched manure for supplementing the use of chemical fertilisers
- Conserve on the use of fuelwood

A multi-agency approach has been followed in implementing the programme involving SNAs, various village organisations and NGOs, which provide construction, maintenance, and training services and also a number of promotional and awareness generation campaigns. Over 25% of the total potential of family size biogas plants has been achieved. Such households have been meeting their cooking fuel requirements largely and lighting fuel needs partially with biogas. With the current level of achievement, the programme is estimated to have resulted in a saving of 3.9 million tonnes of firewood and 0.9 million tonnes of urea per year as well as providing 5 million person-days of employment.

National programme on Improved Cookstoves

Started in 1986, the NPIC aims at propagating the use of more efficient cookstoves that consume less fuel and emit less smoke thereby reducing the incidence of lung and eye ailments amongst rural women. The programme is being implemented through a multi-agency approach with the help of a number of grass roots institutions to ensure extensive coverage. It is estimated that around 32.9 million improved cookstoves are in use in the country resulting in a saving of 12 million tonnes of bio-fuels and 98 million litres of kerosene per year during the five year life span of the cookstoves.

Integrated Rural Energy Programme

The IREP aims at developing planning and institutional capabilities to formulate and implement micro level energy plans and projects for promoting the most cost-effective mix of energy options for use in rural areas. The objectives of the programme are to

- Provide for minimum domestic energy needs

- Provide the most cost effective mix of energy sources for meeting the requirements of sustainable agriculture and rural development with due environmental considerations
- Ensure people's participation in the planning and implementation of IREP plans and projects through various micro-level institutions
- Develop and strengthen mechanisms and co-ordination arrangements for linking micro-level planning for rural energy with state and national level for energy and economic development

The centre and state provide financial, technical and training support for the IREP programme, which is being implemented in 724 blocks in the country against the 860 blocks sanctioned.

Rural Energy Entrepreneurship and Institutional Development

This programme was initiated in 2000-01 for building capacity for installation and maintenance servicing of energy systems. The programme seeks to create and strengthen entrepreneurship in the rural energy sector at the local level to promote micro-enterprises for manufacturing, marketing, and servicing. The programme also aims to strengthen entrepreneurship development centres in various states for providing training, management skills, support for project formulation, maintenance services and export management and consultancy. The programme would be implemented through the involvement of NGOs, and educational institutions and by strengthening linkages amongst rural energy entrepreneur, renewable energy industries, financing institution including IREDA and SNAs.

Women and Renewable Energy Development

This programme, introduced in 2000-01, aims at empowering women by involving them in the promotion and management of renewable energy systems and devices and through encouraging the widespread use of renewable energy technologies in rural areas. The SNA along with educational institutions, NGOs and other village institutions are implementing the scheme in select areas.

Solar Energy

Solar thermal energy Programme

The programme seeks to tap solar energy for thermal applications such as water heating, cooking, drying, space heating, distillation, power generation and solar passive architecture. The solar water heating, cooking and air heating concepts are being used extensively in the country while the concept of solar buildings is becoming increasingly

popular. The measures initiated by the Ministry towards the promotion of solar thermal energy programme include technology development, standardisation and quality control, financing, special area demonstration, publicity and awareness generation, training, amendments to the building bye-laws, establishment of sales and service networks etc. In terms of policy initiatives, there has been a general shift away from central subsidy towards soft loans, tax incentives and promotional support. The technology that is available in the country today is largely indigenously developed. The achievements under some of the solar thermal programmes are highlighted below.

Solar water heating: Can be used to meet the energy needs for heating water in homes, factories, and other commercial and institutional establishments. The collector area installed so far in India for water heating is around 5, 50, 000 sq. m. Solar water heaters are now being manufactured on a commercial scale with an annual production of over 50,000 sq. m. of collector area.

Solar Cooking: One of the oldest programmes of the Ministry being promoted in homes, commercial establishments, religious places, schools etc. Around 0.5 million solar cookers have been sold in the country since the inception of the programme.

Solar air heating: Can be used to meet energy requirements for space heating during winter months and to meet process heat requirements in industries and agriculture. So far, around 4500 sq. m collector area has been installed in the country for space heating

Solar buildings: The objective of this programme is to promote energy efficient-building designs with optimum use of available solar energy and other forms of ambient energy in the management of energy needs of buildings. The Ministry has provided partial financial assistance to several government and semi-government organisations for designing and constructing solar-efficient buildings. In addition, there are ongoing efforts to develop a detailed climatic database for the country to evolve suitable design guidelines for energy efficient and environmentally friendly buildings in different parts of the country.

Solar Photovoltaic Programme

The programme envisages direct conversion of sunlight into electricity for such decentralised applications as fixed and portable lighting units, water pumping, small power plants, power for telecommunications, railway signalling, offshore oil platforms, and TV transmission. These are being increasingly used for meeting the electrical energy needs in remote villages, hamlets, hospitals and households in the hilly areas, forest

region, deserts and islands. The programme is supported through intensive R&D, standardisation and testing, demonstration programmes, and various financing incentives. The programme has resulted in significant technology developments, besides widespread field demonstrations and utilisation of SPV technology for various applications. A strong research base, as well as indigenous production capability has been created in the entire SPV area starting from silicon material to solar cells, photovoltaic modules, complete systems and power plants. So far a total of 65 MWp aggregate capacity SPV systems have been deployed for various applications, including export of about 18MWp capacity of SPV products. The sector wise deployment of PV modules is shown in Figure 1.

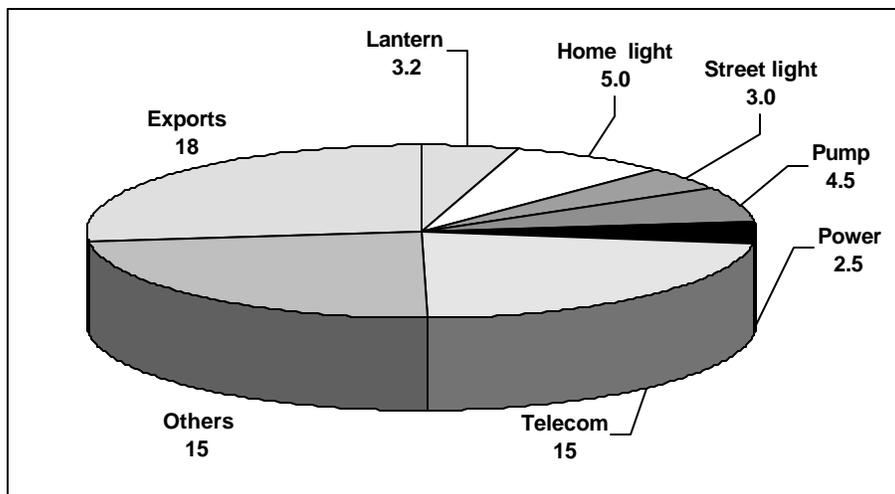


Figure 1 Sector-wise use of PV modules
(Aggregate capacity: 65MW; 800,000 Systems)

Power from renewables

The government has actively sought to increase the share of renewable sources of energy in the grid capacity. By the end of December 2000, about 3000 MW, representing around 3% of the total grid capacity in the country was based on renewable energy sources, mainly wind, small hydro, biomass (including bagasse-based cogeneration) and solar as indicated in Table 7.1. This has been possible through intensive R&D, survey and assessment of the potential of various sources, demonstration projects, development of capacity for manufacture, installation, operation and maintenance, institutional and infrastructural development, training programmes, awareness creation etc. In the 1990s, there has been a general policy shift towards large-scale commercialisation of RETs for

power generation and participation of the private sector through various financial and fiscal incentives.

Energy from wastes

The national programme on energy recovery from wastes offers the multiple benefits of reduction of urban and industrial waste, abatement of environmental pollution and production of energy. The Ministry is currently implementing two programmes in this area. One is the national programme on recovery of energy from urban and industrial wastes and the other, with UNDP/GEF assistance, on development of high rate biomethanation processes to reduce the emission of greenhouse gases. The national programme on energy recovery aims at promoting efficient and proven technologies for treatment, processing and disposal of wastes, as means of improving the waste management practices in the country, besides augmenting decentralised power generation. Various fiscal and financial incentives are being provided under this programme to Municipal Corporations, State Nodal Agencies, promoters, entrepreneurs and financial institutions for setting up waste-energy projects. More than 26 MWe of capacity has been installed through such projects since 1996-97. The project on the development of high rate biomethanation processes, assisted by UNDP/GEF, seeks to build expertise and capabilities in national and state level institutes, R&D organisations and universities to assimilate develop and adapt technologies; to generate awareness; to set up demonstration projects; and to develop a master plan at the national level and a shelf of investment proposals.

New technologies

Since its inception, the MNES has been promoting the development of other forms of energy namely chemical, geothermal, ocean and hydrogen. The Ministry has been supporting a number of RD&D projects sanctioned to various scientific institutions, universities, CSIR (Council for Scientific and Industrial Research) laboratories, and industries. In particular, progress has been made in the promotion of the following technologies.

- Fuel cells
- Hydrogen energy
- Alternative fuel for surface transport (electric/battery operated)
- Geothermal energy
- Ocean energy (tidal power, wave power and ocean thermal energy)

Introduction

Transport plays a significant role in the overall development of a nation's economy. However, this sector also accounts for a substantial and growing proportion of air pollution in cities. In addition, the sector contributes significantly to greenhouse gases emissions and is a major consumer of petroleum fuels. This is a concern that has been reflected in the Agenda 21 as well. This chapter identifies the degree of convergence between the concerns raised in Agenda 21 and India's transport policy.

The chapter is organized as follows. The following section highlights the role of the transport sector in India in terms of energy consumption and environmental impact. Subsequently, Agenda 21 concerns in the transport sector are discussed. The third section reviews transport sector policies – pre- and post-Rio in light of the concerns raised in Agenda 21. Section four evaluates these policies with the criterion laid down in Agenda 21 as the backdrop and section five identifies the gaps that need to be addressed. Subsequently, directions for changes in policy are suggested.

Overview of the transport sector in India

In India, the share of the transport sector in GDP (gross domestic product) in 1997/98 was 7.3% (1993/94 prices). Road transport and the railways account for the majority of this contribution. The transport sector is also the second largest consumer of energy, next only to industry and commercial energy consumption about 98% of which is in the form of HSD and gasoline, grew at the rate of 3.1% per annum in the 1970s and at 5.6% per annum in the 1990s^a.

The relationship between transport and emissions in India is established via the use of fossil fuels. The linkage between transport and the environment is particularly visible in the urban transport sector due to the dominance of road transport. In addition, the transport sector accounts for a large and growing proportion of Greenhouse Gas (GHG) emissions.

^a The demand for HSD has been volatile since 1999/2000 with a decline in 2000/01 and an upswing in 2001/02. However, the trend over the entire 1990s has been upward.

The organizations and institutions in the transport sector, their roles and functions, and the relevant Acts are given in the Table 5.1.

Table 5.1 Organizations in transport sector at the national level

Organizations	Functions	Relevant acts
Roads		
Ministry of Road Transport and Highways	Development of road transport infrastructure and national highways, and overall regulation of freight road transport in the country	Motor Vehicles Act 1988 , Central Motor Vehicle Rules 1989
National Highway Authority of India	Development and maintenance of national highways in the country	National Highways Act 1995
Roads department, state government	Development and maintenance of state highways in the country	VII Schedule of the Indian Constitution (Article 246), List II (State List), Item 13
Ports, shipping and inland water transport		
Ministry of Shipping	Coordination of various activities related to ports, shipping and inland water transport	
National Shipping Board	Advisory body to the Ministry	Merchant Shipping Act, 1958
Director General, Shipping	Implementation of various provisions of the Merchant Shipping Act, 1958, of various international conventions relating to safety, and mandatory requirements under the International Maritime Organization	Merchant Shipping Act, 1958
Port Trusts	Managing daily activities of the individual major ports in the country	Major Ports Trust Act, 1963
Inland Water Way Authority of India	Regulation and development of national water ways for the purposes of shipping and navigation	Inland Waterways Authority of India Act, 1985
Transport Department, state government	Regulation and development of water ways other than national waterways for the purposes of shipping and navigation	VII Schedule of the Indian Constitution (Article 246), List II (State List), Item 13
Tariff Authority for Major Ports	Independent regulation of tariff setting in Major Ports	Major Ports Trust Act, 1963
Civil aviation		
Ministry of Civil Aviation	Planning and development of infrastructure for regulating air traffic. Responsible for Airport Authority of India, Director General of	Air Corporation Act, 1953

	Civil Aviation and Bureau of Civil Aviation Security	
Airport Authority of India (AAI)	Infrastructure and facility for Air traffic is provided by AAI. It is also responsible for maintaining domestic and international airports and civil enclaves at defence airports in country.	Airport Authority of India Act, 1995
Director General of Civil Aviation/Bureau of Civil Aviation Security	Perform regulatory functions.	
Railways		
Ministry of Railways	Planning and development of railway infrastructure.	Railway Act, 1989

The allocation of responsibilities between the Central and State government agencies in this sector is based on the principle of federalism. Similar is the case in the urban transport sector. The management of the urban areas in India is essentially a responsibility of the state government, even though the 74th Constitutional Amendments devolves urban development to local bodies. Urban transport as a subset of urban development is primarily a responsibility of the state governments though some agencies such as the Indian Railways which play an important role in urban transport planning work under the Central Government with no accountability to the state government. Table 5.2 lists some of the agencies involved with urban transport and their specific responsibilities.

Table 5.2 Institutions involved with urban transport in India

Organizations	Functions	Relevant Acts
Urban transport planning		
Ministry of Urban Development	Overall responsibility for urban transport policy and planning	
Land Development Authority, State government	Land-use allocation and planning	State Development Acts
Roads		
Transport Department, State government	Licences and controls all road vehicles, inspection of vehicles, fixing motor vehicle tax rates	Motor Vehicles Act, 1988
Ministry of Surface Transport	Administer the Motor Vehicles Act and notify vehicle specifications as well as emission norms	Motor Vehicles Act, 1988
State Transport Undertaking,	Operation of bus services	Road Transport Corporations Act

State government		1950
Public Works Department, State government	Construction and repair of state roads	VII Schedule of the Indian Constitution (Article 246), List II (State List), Item 13
Local municipality	Construction and repair of smaller roads, road signage, traffic lights, licencing and control of non-motorized vehicles, clearing of encroachments and land-use planning.	Constitution (Seventy-Fourth Amendment) Act, 1992
Police	Enforcement of traffic laws and prosecuting violators	State Police Acts
Railways Ministry of Railways	Own and operate urban rail transit systems wherever they exist	Railway Act, 1989
Others Ministry of Petroleum and Natural Gas	Regulation of prices and quality of transportation fuels	Essential Commodities Act, 1955 The Petroleum Rules, 1976
Department of Environment, State government	Monitoring air quality	

The transport sector and Agenda 21^a

The concerns related to the impact of the transport sector on environment and energy highlighted earlier are reflected in Agenda 21 as well. The overall objective outlined in the document is to reduce the local and global emissions from all modes of the transport sector. To achieve this objective, the document seeks to integrate environmental concerns with the development of the transport network and specially urban transport. Chapters 7 and 9 of Agenda 21 have identified the following key issues in the transport sector.

- Promoting integrated transport policies that consider alternative approaches to meeting commercial and private mobility needs.
- Integrating land-use and urban and rural transport planning, taking into account the need to protect ecosystems.
- Improving efficiency of transportation and related sectors.
- Accelerating phasing-out of the use of leaded gasoline.
- Promoting voluntary guidelines for environmentally-friendly transport and action for reducing vehicle emissions.
- Fostering partnerships at the national level for strengthening transport infrastructure and developing innovative mass transport schemes.

The issues that reflect the concerns in Agenda 21 are listed below.

Mitigating the impact on the environment

The relationship between transport and the environment forms the bulk of the transport sector's concerns in Agenda 21. It calls for a review of the national laws, rules and regulations to reflect upon such issues as protection of the atmosphere and energy efficiency. Apart from this, there is also mention of developing alternative and sustainable modes of transport and upgrading vehicles for curbing emissions. Where fuel quality is concerned, phasing out leaded gasoline is particularly important. In addition to strategies and actions for mitigating vehicular emissions, there is also an emphasis on spreading information related to air pollution and in general promoting public awareness of the impact of transport on the environment through the media.

^a Based on the guidelines for National Reporting to CSD IX on transport.

Social and poverty concerns

Agenda 21 stresses the need for an integrated strategy of urban planning, rural development, and transport infrastructure. It recognizes the import of the mobility needs of commercial, private, and public activities. Specifically for the poorer sections of society, public transport is the only option, and thus vital to their integration with the economic and social mainstream. Strategies to mitigate the effect of air pollution, arising from ill-managed transport and traffic systems, on vulnerable sections of the population are important. Reducing traffic-related accidents and damages is another area highlighted.

Decentralization in decision-making

Agenda 21 emphasizes the need for complete decentralization of decision-making to the lowest level of public authority, or local governments. Participation of groups or individuals other than government officials in the decision-making process is also highlighted. It points out the need to incorporate public opinion into transport policy development.

Private sector participation

Special prominence is given to the role of the private sector in the decision-making, planning, management, and operation of transportation systems. Private sector involvement is considered necessary to augment public resources for infrastructure investment and for improving operational and managerial efficiency.

International cooperation

Agenda 21 also emphasizes international cooperation in bilateral, regional and international transportation schemes by land, air or water.

Review and analysis of policies and other developments in the transport sector

Highlights of major developments

A brief review of the policy developments in this sector is presented in Table 5.3. As is clear, even before Rio, a number of concerns regarding the transport sector in Agenda 21 were reflected in government policy.

Table 5.3 Review of policies in the transport sector

Pre -1992 transport policy status	
Reducing the energy intensity of the transport sector	<p>Railways</p> <ul style="list-style-type: none"> ▪ Initiatives identified in numerous policy documents to increase the share of railways. NTPC (1980) suggested a modal share of road to be 28% for freight and 60% for passenger ▪ Reduced energy intensity of transport systems by increasing the share of electric traction in railways and public transport in urban areas <p>Alternative transport modes</p> <ul style="list-style-type: none"> ▪ Energy-efficient modes like coastal shipping and IWT to be promoted <p>Urban transport</p> <ul style="list-style-type: none"> ▪ Increased share of public transport in urban areas along with efficient vehicle technology to reduce the energy and environmental implications ▪ An efficient mass transport system to reduce the energy intensity of the sector ▪ Given the rapid increase in city size, the need for rail-based urban transport systems should be explored ▪ Pricing of mass transport services should be based on commercial principles so as to ensure viability of public transport ventures ▪ Private sector involvement in the operation and management of urban transport systems would have the twin benefits of efficiency gains and thus cost reductions, and additional resource mobilization. <p>Land use transport implications</p> <ul style="list-style-type: none"> ▪ Optimization of transport effort by policy measures such as dispersal of industries and rational land-use planning ▪ Land-use and transport planning in the urban context should be parallel processes. Develop multi-nucleated metropolitan centres
Increasing the productivity of transport sector	<ul style="list-style-type: none"> ▪ Transport user costs to include external costs ▪ Least-cost principle to be followed in deciding modal shares - policy to be implemented by integrated transport

infrastructure planning

- Predominant role for government in providing transport infrastructure
- Pricing of transport services to be on marginal cost basis

Transport policy post

-1992

Economic liberalization
Improvement in vehicle emission norms

- Introduction of a number of small and fuel - efficient cars
- Certificate of fitness for in use vehicles introduced - it is now mandatory for every motor vehicle to obtain a certificate of pollution under control (PUC) every three months
- Vehicular emissions standards progressively tightened
- A CNG pilot programme launched in 1993 in Delhi, Mumbai, Surat and Vadodara aimed at conversion of petrol vehicles into vehicles using CNG as a fuel
- LPG is now permitted as a transport fuel
- Use of battery operated vehicles/electric vehicles for IPT and buses on a trial basis

Transport policy post

-1992

Improvements in fuel quality

- Pre-mixed fuel (petrol and lubricating oil) for use in two-stroke engines of two- and three-wheelers has been introduced at filling stations in Delhi to optimize the oil-fuel mix.

Judicial interventions in Delhi

- Unleaded petrol introduced into the entire country
 - Diesel sulphur content was reduced from 1% to 0.05% in the four metros and to 0.25% in the rest of the country
 - 1995 - convert all Government of India vehicles into CNG
 - Restrict plying of commercial vehicles older than 15 years from 15 October 1998
 - No eight -year old bus to ply except on clean fuels by 31 March, 2000
 - Replacement of all pre-1990 taxis with new vehicles on CNG or other clean fuels (like CNG) by 31 March 2000
 - Gradual transformation of the entire city's
-

	bus fleet into a single mode on CNG by 30 September 2001
	<ul style="list-style-type: none">▪ Financial incentives for the replacement of all post-1990 autos and taxis with new vehicles on clean fuels by 31 March 2001▪ Augment public transport by increasing the number of public buses to 10000 by the 1 April 2001
Port sector restructuring	<ul style="list-style-type: none">▪ Areas for private sector investment identified▪ Procedure for inviting private participation laid down▪ Setting up of TAMP▪ Policy guidelines to enable major ports to set up joint ventures
Road sector liberalization	<ul style="list-style-type: none">▪ The National Highways Act was amended in 1995 to allow private sector participation▪ The NHAI (National Highways Authority of India) has been mandated to implement the National Highways Development Project comprising strengthening and upgrading to a four-lane status about 13 000 km of high-density corridors▪ Norms for foreign investment in the road sector liberalized and approval for foreign equity participation under certain conditions▪ Funds have been made available to the NHAI for its capital base through a tax on motor spirit and a cess on diesel
Liberalization of the civil aviation sector	<ul style="list-style-type: none">▪ Corporatization of Delhi, Mumbai and Bangalore airports proposed▪ Automatic approval for foreign equity participation in airports▪ Private air-taxi operations permitted▪ 100% NRI investment permitted in air-taxi operation

Regional cooperation	<ul style="list-style-type: none"> ▪ Proposals for linking Indian railways with Bangladesh railways ▪ Proposals for upgradation as the Bangladesh railways may require in order to carry the additional Indian traffic ▪ Offer to assist Myanmar to extend its railway to the main Yangon-Mandalay rail system and form part of the Trans-Asian Railway in the future. ▪ A need for a revised regional perspective plan for road development in the North East with international linkages, especially Bangladesh-recognized
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Based on the above review, this section evaluates policies with respect to sustainable development concerns identified in Agenda 21.

Achievements

Improving the energy efficiency of transport systems

Nearly every policy in the transport sector emphasises the link between transport and energy. The three key strategies highlighted in every policy document are checking the decline in the modal share of railways in traffic, augmenting the capacity of other modes such as inland waterways and coastal shipping, increasing the share of public transport in meeting urban travel demand, and introducing modern and energy-efficient technologies. Thus it is clear that the policy makers in the transport sector in India are seized of issues that have received substantial attention in Agenda 21.

To further promote energy efficiency in transport systems, efforts have been made to arrest the decline in the share of railways. The share of both passenger and freight movement has been constantly declining. This can be in part attributed to declining budgetary allocations that have declined to 23% of the Railways Plan in 1997/98 from 75% in the Fifth Five-Year Plan (MoF, 1999). In the face of a declining budgetary support to the Railways, they have increasingly taken recourse to market borrowing—Rs 29.71 billion in 1997/98, about 35% of the Railways Plan outlay (MoF, 1999). This has put a constraint on the ability of the Railways to raise resources internally due to a rising interest burden delaying development projects. Moreover, funding has become easier for road infrastructure after its liberalization resulting in a further pressure on the railways share in freight transport. Nevertheless, the government has recognized the importance of ensuring the commercial viability of the railways

and has taken steps to increase its revenue generation (Planning Commission, 2001).

Similarly, efforts are on to check to the decline in the share of public transport in urban areas. This decline can be attributed to a gradual withdrawal of state funding for public transport and increasing emphasis on commercial viability as also the deteriorating service and inability of the infrastructure to keep pace with the increasing demand. The Government of India and various state governments are attempting to address this issue by permitting greater private participation in the sector and restructuring the operations of public transit providers (TERI, 2000).

Insofar as introduction of modern technologies in the transport sector goes, liberalization of the licencing regime in the early 1990s resulted in the introduction of a number of fuel efficient vehicles in the cars and two wheelers segment.

Reducing the impact on environment

There have been substantial improvements in the emission characteristics of vehicles in India. Lead has been gradually phased out of gasoline and the target now is to reduce the benzene and sulphur content of diesel. There has been a gradual reduction in the sulphur content of diesel. Dramatic improvements in emission norms for all types of vehicles have taken place since these were introduced in 1991—additional pollutants such as particulate matter are now considered during the type approval tests for vehicles. Fuel and vehicle emission standards in Delhi are stricter than those in the rest of the country owing to the severity of the problem. To address the issue of the slow turnover rate of vehicles in India, vehicles of a certain vintage are not permitted which have high utilization rates to operate on city roads unless retrofitted for use with cleaner fuels. Since the government recognises the need to lay down a roadmap for emission norms and fuel quality specifications, it has initiated a dialogue with the automobile and oil industry to prepare a roadmap for emission reduction from vehicles under the aegis of the Working Group to Formulate Fuel Standards for Automobiles (CPCB, 2000).

In September 2001, the Government of India constituted the Mashelkar Committee to recommend an auto fuel policy for the major cities of the country, to devise a road map for its implementation and recommend suitable auto fuels, automobile technologies and fiscal and institutional measures. The Committee presented its report in January 2002 and has recommended that the Bharat Stage II norms, which are in place in Delhi, Mumbai, Kolkata and Chennai be

introduced into the entire country from 1 April 2005. Euro III equivalent emission norms for all categories of vehicles (excluding two- and three-wheelers) are recommended to be introduced in the seven mega cities from 1 April, 2005 and extended to other parts of the country from 2010. The necessity and the feasibility of extending the Euro III norms would be reviewed in the light of the experience gained after the introduction of Bharat Stage II norms in the entire country.

Social and poverty concerns

The underprivileged sections of society find mention in nearly all policy statements of the transport sector. The emphasis is on improving access to public transport and infrastructure for non motorized modes such as bicycles and pedestrians. Another policy that reflects the state's social concerns is the continued support provided to the Indian Railways in ensuring rural connectivity. The Ninth Five-Year Plan document states that 'budgetary support is necessary for a public utility like the railways which has to take up developmental projects for social and strategic reasons'. Also, rural connectivity is one of the key objectives of policy-making in India's transport sector in India. Another objective of the Ninth Five-Year Plan is to achieve connectivity by road for at least 85% of the villages in India.

Decentralization in decision-making

As the earlier section on the Organizational structure of the transport sector in India highlighted, the institutions in the transport sector derive from the principle of federalism. At the national level, there is very little policy provision for participation at the local or even the state level – most transport sector activities are carried out by agencies of the Central Government. At the local level, urban development is a local government subject under the 74th Constitutional Amendment. The local governments are assisted in administering the sector by a number of state government agencies.

As far as participation by non governmental organizations, community pressure groups, and civil society is concerned, while there are no policy guidelines requiring their formal participation in decision-making at any level, the Government consults such stakeholders at a number of fora during policy making. One such instance is the deliberations of the Working Group to Formulate Fuel Standards for Automobiles (CPCB, 2000) where a number of research interests and stakeholders were consulted.

Market orientation and commercialization

All policy statements in the transport sector recognize the importance of using market signals in transport planning. However, before the liberalization of the licencing regime in the early 1990s, the emphasis was on planning independent of market signals. Post-liberalization, there has been increasing emphasis on commercial orientation of the service providers as has been highlighted earlier for the state transport corporations. Private investment can now provide transport infrastructure for roads, civil aviation, and ports. Access to capital markets was made easier for government agencies such as the NHAI to permit greater public-private partnerships.

Regional cooperation

Indian initiatives on regional cooperation in the transport sector have been limited to the north east border of India given the problems with Pakistan on the western front and China to the north. The region borders Myanmar on its south and east, Bangladesh on its west and China (Tibet) and Bhutan on its north. Rapidly developing economies such as Thailand, Malaysia and Singapore are not far, being closer to the region than many important cities of India. Thus, policy initiatives have focussed on regional cooperation using the north east as the hub for the entire south east Asian region.

Concerns

Most policy documents in the transport sector recognize the concerns raised by Agenda 21, and suggest strategies to address them. However, the impact of these policy documents has been limited. This section analyses some of Agenda 21's concerns in the Indian transport sector.

Improving the energy efficiency of transport systems

While every policy in the transport sector emphasizes the nexus between the transport and energy sectors, the implementation of these policies has been inadequate. The share of the railways has constantly been declining. Of greater concern is the dichotomy in policies for the road and rail sectors. While the import of arresting the decline in rail shares has been universally recognized, liberalisation of the road transport sector has put further pressures on railways share in freight transport.

A similar trend has been seen in urban transport where the share of public modes is declining because of fiscal discipline leading to a gradual withdrawal of state funding leading to increased usage of personal modes and therefore energy. For instance, in Delhi, the penetration of public transport has declined from 62% in 1985 (GNCTD, 1997) to 57.25% in 1990, to 49.54% in 2000 (TERI, 2000a) resulting in personal modes meeting an increasing proportion of travel demand. Another problem has been the limited concern for consumer satisfaction because government-owned agencies operate and manage public transport services in most cities. The virtual monopoly that public sector service providers enjoy has meant that service planning is largely dominated by operating convenience than consumer convenience.

Finally, the integration of land use and transport planning, essential to optimization of transport demand, has not been realized due to a lack of coordination between agencies in the transport and land development sectors.

This can be partially attributed to these activities not being devolved to the local bodies despite the 74th Constitutional Amendment.

Reducing the impact on environment

While there has been substantial progress in improving emission characteristics of vehicles in India it is well recognized that current vehicle technology in India is inferior to that in the developed world, especially for heavy-duty diesel vehicles. Diesel vehicles do not have particle traps to reduce the emissions of particulate matter. Buses are built on a truck chassis and designed for speeds that are possible only on highways and not within the city. The largest segment of the vehicular fleet, namely two-wheelers, mostly uses the highly polluting two-stroke engine.

Petroleum fuels sold in India have less stringent specifications compared to those sold in other parts of the world. For example, the sulphur content in diesel here is higher than that sold elsewhere in the developed world. Some recent developments have seen a tightening of the fuel quality standards, particularly for Delhi. However, other cities in the country are yet to follow suit and policy directions would be necessary if the same standards as those applicable to Delhi are also to apply to other urban centres. Here again, the constraint in the financial resources to build the required capability in the refineries.

The turnover rate of vehicles in India is low and the progressively stricter mass emission norms for new vehicles will have only a limited impact. It is, therefore, necessary that policy initiatives apply to 'in-use' vehicles as well. So far, these initiatives have been directed largely at commercial vehicles, by not allowing those of a certain vintage to operate in the city roads or requiring them for use with cleaner alternative fuels. The strategies for making 'in-use' vehicles less polluting would revolve around mandating stricter emission standards coupled with a requirement for periodic certification.

Social and poverty concerns

The emphasis on efficiency and commercial orientation often leads to undermining the social and poverty concerns. For instance, the Ninth Five-Year Plan says that funds for fleet replacement would be made available only if the State government is able to commit a similar amount for this purpose and the state transport corporations are financially viable. The result of this policy has been the withdrawal of capital contribution to the public transport sector in urban areas. Consequently, fleet replacement and augmentation has suffered leading to a decrease in the penetration of public transport. Similarly, an

emphasis on the efficiency on transport networks has resulted in an increase in expenditure on improving the road infrastructure for motorized transport at the expense of non-motorized modes.

Market orientation and commercialization

While there have been initiatives to introduce private sector participation into transport infrastructure, these initiatives have not resulted in the desired outcomes. In the road sector, private investment has been limited to building overbridges and bypasses owing to uncertainties and risks in funding road projects. In the ports sector, India has not gone the whole hog towards making the major ports commercially-oriented. New investments by way of some berths or container handling facilities have been made by the private sector in the existing major ports, with the Port Trusts themselves continuing to handle the other berths and facilities. Even where the private sector has been allowed to invest, there has been no attempt to encourage competition by introducing two or more service providers. The Tariff Authority for Major Ports has not been given the power to function as a quasi-judicial body and ensure compliance of its orders.

Despite the well-documented and obvious advantages of using the market for environmental regulation in the transport sector, very little has actually been done. Nevertheless, there are a number of fiscal policies that impact the emissions loading from the transport sector such as pricing of transportation fuels. Some correction in fuel prices has resulted after the APM was dismantled in April 2002.

Integrating Agenda 21 concerns - directions

A transport policy must develop and promote cost-effective policies, reduce emissions into the atmosphere and also take account of development priorities as well as social and poverty-related concerns. An integrated approach is called for over the entire transport sector to ensure that the developed modes complement one another.

The increasing share of road transport is a cause for concern, reflected in the Approach Paper to the Tenth Five-Year Plan. As mentioned earlier, the impact on the economy, particularly energy consumption, would be severe. Being an intermediate service for all economic activity, restraining transport demand could be counterproductive. Thus efforts would be directed towards meeting the demand in more sustainable ways. Attempts will be made to check the decline in the share of the railways by actively pursuing strategies identified in

the Approach Paper to the Tenth Five-Year Plan such as adjusting fares to reflect actual costs, especially for passenger transport, and promoting multimodal transport. A step in this regard has been taken in the railway budget this year. Also development of infrastructure for other modes of transport such as inland waterways, coastal shipping and pipelines is necessary to check the growth in road transport.

The development of cost-effective and safer transport, specially for integrated rural and urban mass transit needs to be addressed. Apart from the policies, cost effective programmes will be undertaken to encourage the use of modes transport which have the minimum impact on the environment. Mechanisms for integrated transport planning strategies and urban and regional settlement strategies to reduce environmental impacts of transport need to be put in place. To promote cleaner technologies, especially zero-emission technologies in the urban Indian context, and to promote R&D leading to their commercialisation, available technology options will be evaluated with a view to identifying vehicle technologies and fuels for the future. Also, the use of market-based instruments in mitigating the environmental concerns in the transport sector will be encouraged.

Agenda 21 calls for greater regional cooperation. One potential location for this is the North Eastern part of India, which can become the hub for virtually the entire Asian continent, and as a gateway for south east Asia. Hence, a good way of rethinking the economic development strategy for the region is to look at it as a transit route for the movement of goods between east and south east Asia, and south Asia.

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Introduction

The path of industrialization adopted by India after Independence emphasized building heavy industries, the role of the public sector and a high degree of protection. In 1991, economic reforms were introduced, the role of the public sector was reduced and measures for increasing efficiency and integration with international markets were taken. The last decade has also witnessed an increased awareness of the environmental impacts associated with economic and industrial activity, as reflected in the concerns voiced at the Earth Summit in 1992.

This chapter begins with an overview of the industrial sector in India, highlighting trends in production and the environmental impacts and social issues associated with industrial growth. Next the areas of concern in Agenda 21 with regard to the industrial sector are set out, followed by a brief overview of Indian industrial policies and legislation. To what extent industrial policy planning, in the 1990s in particular, has addressed Agenda 21 concerns for the sector is then discussed. Finally, strategies for incorporating these concerns in future industrial policies are presented as a possible course of action.

Overview of the sector

Industrial production grew at an average rate of 6.46% per annum in the period 1992/93 to 2000/01 (MoF, 2002). This growth was mainly on account of the manufacturing and electricity sectors, while the mining and quarrying sector witnessed much lower growth rates in production. This relative picture is reflected in the trend in the Index of Industrial Production for these sectors (Figure 6.1).

The overall industrial growth path in the 1990s has been marked by cyclical fluctuations with the industrial growth rate increasing to a high of 11.6% in 1995/96 before falling to 3.4% in 1998/99. There was a significant improvement in overall growth in industrial value added to 6.4% in 1999/2000 due to acceleration in growth rate of the manufacturing and construction sectors, which declined to 5% in 2000-01 (MoF, 2002). The targeted growth rate for the industrial sector in the Tenth Plan period is over 10%, in line with a targeted

GDP (Gross Domestic Product) growth rate of 8% (Planning Commission, 2001a).

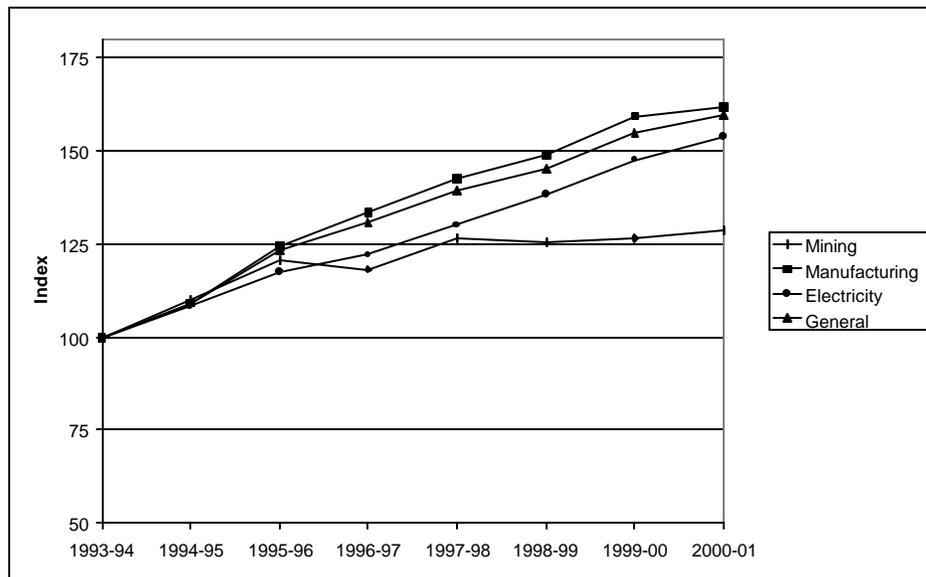


Figure 6.1 Index of industrial production (base year 1993/94=100)

Source. Data from MoF (2001)

Production trends and compound annual growth rates (CAGR) in selected industries in the last decade are shown in Table 6.1.

Table 6.1 Production of selected industries (**million tonnes**): 1990-99

Industry	1990-91	2000-01	CAGR (%)
Cement	48.4	99.5	7.4
Finished steel	13.5	29.3	8.0
Sugar	12.1	15.5 ^a	2.4
Fertilizers	9.0	14.7	5.0
Paper and paper board	2.1	3.1	3.9
Caustic soda	1.0	1.6	4.8
Aluminium	0.45	0.6	1.1

^a Figure is for 1998-99

Source. MoF (2002)

Environmental impact

The energy and resource intensity of industrial production has been associated with adverse environmental impacts. These can be categorized under four

heads: emissions, effluent discharges, generation of wastes including hazardous wastes and the production of ozone-depleting substances (ODS). The quantum of industrial solid wastes (non-hazardous) generated has nearly doubled in the last decade, from 77 MTPA (million tonnes per annum) in 1990 to 147.05 MTPA in 1999. In addition, about 7.2 million tonnes of industrial hazardous wastes are generated in the country (MoEF, 2000). A discussion of the extent of industrial emissions and effluent discharge is presented in the chapters on Atmosphere and Water.

Employment generation and labour welfare

The industrial sector is an important source of employment in the country. The estimate of employment in organised public and private sector stood at 27.9 million (MoF, 2002). In addition, large numbers are employed in the unorganized sector. In the context of economic reforms and restructuring of the industrial sector, changes in the labour market involving redeployment and retrenchment of labour would be associated with social costs. These costs would have to be minimized by providing for social security mechanisms. Most importantly, productive employment generation and labour welfare in the unorganized sector, where it will have the greatest poverty-reducing impact, will have to be ensured (ILO, 2001).

Industry and Agenda 21

The areas for action in the industrial sector as articulated in Agenda 21 emphasize the integration of environmental concerns in industrial planning, ensuring full participation in industrial activity, enhancing international trade and minimizing social costs. Four main issues can thus be identified for the industrial sector: environmental management, strengthening the role of the private sector, trade liberalization and environmental regulation and employment generation and labour welfare. These issues are discussed in the following sections.

Environmental management

Governments were urged to promote policies or programmes, including administrative, social or economic measures to encourage industrial development in a manner that would minimize adverse environmental impacts. Six key mechanisms were visualized in Agenda 21 for improved environmental management in the industrial sector:

- Incorporating environmental considerations in industrial development through proper siting policies and mandatory environmental impact assessments.
- Increasing efficiency in the production and use of materials, resources and energy.
- Improving existing pollution abatement technologies and developing new clean technologies, products and processes.
- Developing and implementing emission and effluent controls and standards.
- Ratifying multilateral environment agreements (MEA) such as the Montreal Protocol and the Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal.
- Corporate environmental responsibility: The role of business in improving the efficiency of resource use, reducing risks and hazards, minimizing wastes and safeguarding the environment.

Strengthening the role of the private sector

Agenda 21 charts a path of full participation of business and industry in the implementation and evaluation of policies for promoting sustainable development. It calls upon them to recognize environmental management as among the highest corporate priorities and a key determinant of sustainable development. For industry to participate fully in the implementation of sustainable development activities, the role of the private sector has to be strengthened.

Trade liberalization and environmental regulation: implications for industry

The contribution of an open, equitable and secure multilateral trading system to achieving sustainable development by increasing financial resources and efficiency in allocation of resources was highlighted in Agenda 21. All countries were urged to implement commitments to halt and reverse protectionism and increase market access, particularly for products from developing countries. Developing countries for their part were to continue or initiate trade policy reforms and structural adjustment programmes.

Agenda 21 recognized the concerns of developing countries such as India, of environmental standards being used as a protectionist device. It therefore called for steps to be taken to ensure that environment-related regulations or standards including health and safety standards, did not constitute a means of

arbitrary or unjustifiable discrimination or a disguised restriction on trade. It also emphasized that environmental standards developed in advanced countries may not be applicable in developing countries.

Employment generation and labour welfare

The industrial sector is indispensable in achieving the overall objective of poverty alleviation by providing 'full and sustainable' employment opportunities. In addition, by ensuring a safe, clean and healthy working environment, the sector can contribute to improving the surrounding natural environment. Agenda 21 asked governments to establish arrangements with workers and employers to deal with industrial safety, health and environment at the workplace.

Review and analysis of policies and other developments in the industrial sector

Highlights of legislation, policies and programmes

Recent initiatives relevant to the industrial sector are set out below:

Table 6.2 Policy highlights

Year	Highlights of legislation policies and programmes
1989	Hazardous Wastes (Management and Handling) Rules <ul style="list-style-type: none"> ▪ Lists 18 types of waste categories and their levels, which if exceeded by an industry, compliance with the specified rules is required
1989	Manufacture, Storage and Import of Hazardous Chemical Rules <ul style="list-style-type: none"> ▪ Lists 434 toxic flammable and explosive chemicals and specifies guidelines for manufacture, storage and import of hazardous chemicals
1991	New Industrial Policy <ul style="list-style-type: none"> ▪ Reduction in scope of industrial licencing ▪ Reduction of number of areas reserved for the public sector ▪ Disinvestment of selected public sector enterprises ▪ Enhancing limits for foreign equity participation in domestic industrial undertakings ▪ Liberalization of trade and exchange rate policies
1991	Public Liability Insurance Act <ul style="list-style-type: none"> ▪ Required industries dealing with hazardous wastes to get liability insurance cover up to stipulated amounts ▪ Provided for relief to persons affected by accidents while handling hazardous wastes
1992	Ratification of the Basel Convention on the Transboundary Movement of Hazardous Wastes <ul style="list-style-type: none"> ▪ Restrictions on trade in hazardous wastes
1992	Environment Audit Notification <ul style="list-style-type: none"> ▪ Required all polluting units to submit an annual environmental

	statement to the State Pollution Control Board
1992	Accession to the Montreal Protocol <ul style="list-style-type: none"> ▪ Various projects in ODS consuming sectors submitted to the Multilateral Fund for assistance to change over to ozone friendly substitutes.
1993	National Minerals Policy <ul style="list-style-type: none"> ▪ Mines and Minerals (Regulation and Development) Act 1957 amended and the mining industry opened to the private sector for 13 non-fuel and non-atomic minerals, including foreign direct investment upto 50% equity participation.

<u>Year</u>	<u>Highlights of legislation, policies and programmes</u>
1994	Environmental Impact Assessment (EIA) Notification <ul style="list-style-type: none"> ▪ Environmental clearances mandatory for undertaking expansion, modernization or new projects in industries such as chemical fertilizers, pesticides, petrochemical complexes, bulk drugs and pharmaceuticals, distilleries, pulp, paper and newsprint, dyes and the cement industry.
1999	Environment (Siting for Industrial Projects) Rules <ul style="list-style-type: none"> ▪ Restricted or prohibited the setting up of specific new industries in sensitive areas such as national parks, sanctuaries, wetlands and archaeological monuments. ▪ Industries covered by this notification included chemical fertilisers, primary metallurgical industries, distilleries, tanneries, pesticides, bulk drugs and pharmaceuticals, pulp and paper and cement.

Based on the concerns for the industry sector highlighted in Agenda 21 and the policy highlights presented above, it is analysed below, to what extent these concerns have been addressed or incorporated in industrial policies. The analysis is segregated into achievements and areas that remain of concern.

Achievements

Environmental management

Over the past two decades, the government has developed and set standards for regulating emissions and effluents from polluting industries. These are discussed in detail in the chapter on Environmental regulation.

Programmes to monitor the status of pollution control in industry have been implemented and have yielded results measured by an increase in the number of units installing pollution control equipment. In 1996, 17 categories of industries covering 1551 large and medium industrial units were identified as highly polluting, of which 79% had adequate pollution control equipment

installed to be able to comply with environmental standards. In December 2000, 85% of the identified industrial units had adequate pollution control facilities in place (Figure 6.2).

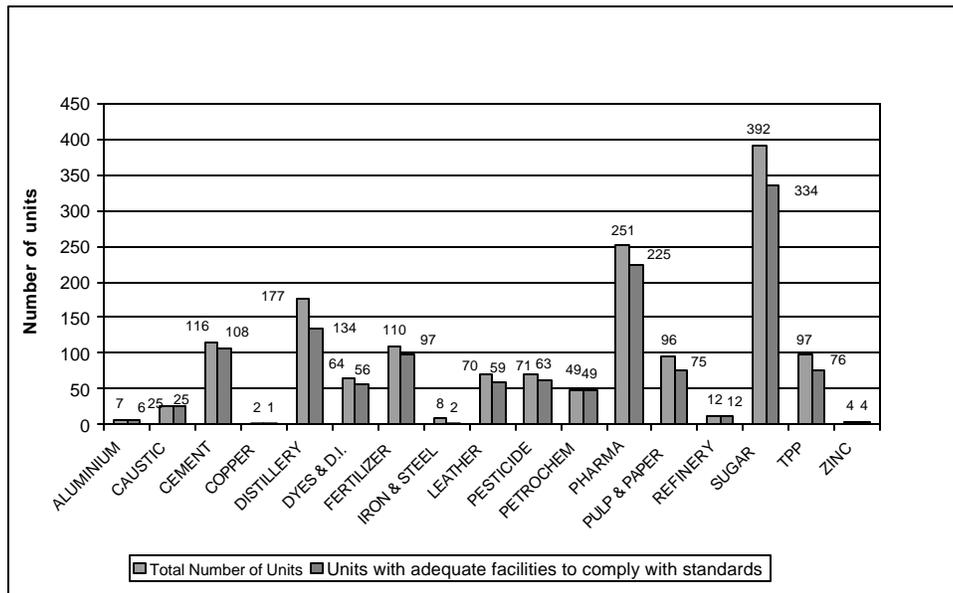


Figure 6.2 Status of pollution control in 17 industries

Source. Data from CPCB (2001)

To control the discharge of industrial effluents into water bodies, 851 industries located along rivers were identified in 1997 as 'grossly polluting industries'^a and directions were issued to them to install effluent treatment systems or face closure. Since the initiation of the programme, the number of industries that had not provided for effluent treatment or disposal after directions had been issued, had reduced to 22 from 851.

These programmes are complementary with other initiatives such as the setting up of Common Effluent Treatment Plants (CETP) for Small Scale Industry (SSI) clusters and the preparation of a zoning atlas for the environmentally-sound location of industries.

India has ratified both the Montreal Protocol and the Basel convention and various programmes and policies for implementing provisions under these MEAs have been developed. Details of these have been discussed in the chapters on Atmosphere and Environmental regulation.

Corporate environmental responsibility in India has taken the form of adoption of environmental management frameworks such as the ISO 14001.

^a Industries discharging 100 kg or more of BOD (Biological Oxygen demand) per day

Launched in India in 1996, it has become a well-recognized standard increasingly adopted by companies for increasing their competitive edge in domestic and international markets.

Strengthening the role of the private sector

Before 1991, a series of industrial policy resolutions beginning in 1948 gave primacy to the public sector. The recognition of the need to increase competitiveness and efficiency in Indian industry led to industrial reforms being introduced as part of the New Economic Policy in 1991. A highlight of these reforms was a reduction in the role of the public sector in industrial activities and opening them to the private sector.

The public sector reform process has focused on increasing viability, competitiveness and efficiency through restructuring, modernization, rationalization of capacity, product-mix changes, selective exit and privatization (Eighth Five-Year Plan, 1992-97). The role of the public sector has been redefined to focus on strategic, high technology and essential infrastructure and accordingly the number of industries reserved for it reduced to 4 from 17. The scope of industrial licencing has also been reduced, with the number of industries requiring licences limited to six (Ninth Five-Year Plan, 1997-2002). States have also initiated reforms of PSEs and programmes for privatization of these units have been drawn up in 12 states^a (Ninth Five-Year Plan, 1997-2002).

The strategy for disinvestment of PSEs adopted has involved the strengthening of strategic units, privatization of non-strategic units through gradual disinvestment or strategic sale and rehabilitation of weak units (MoF, 1999). The public sector industries classified as strategic are arms and ammunition^b, atomic energy and railway transport. For all other non-strategic public sector units, government equity is to be brought down to 26% or less, and the receipts from disinvestment and privatization to be used in meeting expenditure in the social sector, retiring public debt and restructuring of PSEs (MoF, 2000).

In 1999, a separate Department of Disinvestment was created to give a thrust to the disinvestment process and to establish a systematic policy approach to privatization. The government has completed strategic sales in 7 public sector companies and some hotel properties of Hotel Corporation of India and the Indian Tourism Development Corporation (ITDC). Disinvestment in another 6

^a Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Orissa, Tamil Nadu, Rajasthan, Punjab, Uttar Pradesh, West Bengal and Assam

^b Including defence equipment, defence aircraft and warships

companies is expected to be undertaken this year, with estimated receipts as Rs 5000 crore (MoF, 2002a).

Trade liberalization and environmental regulation

The adoption of a New Industrial Policy in 1991 was accompanied by a series of complementary reforms in fiscal, trade and foreign investment policies, which gradually opened up the industrial sector to international competition. There was a shift in focus from import substitution to competitiveness in international markets, with trade liberalization contributing to reducing effective protection for industry.

The Foreign Direct Investment (FDI) policy was further liberalized and limits for foreign equity participation in domestic industrial undertakings were enhanced. In 1996, a list of nine industries, which included infrastructure, electronics and software, for which joint ventures upto 74% foreign equity would be automatically cleared, was approved. The number of industries eligible for automatic approval upto 51% foreign equity was also expanded from 35 to 48.

Domestic industry is increasingly open to competition from international markets, with quantitative restrictions on imports removed with effect from April 1, 2001 (Planning Commission, 2001a). Tariff levels have also been decreased drastically since the initiation of reforms. It is estimated that India's weighted import tariff has declined from around 90% at the start of reforms to around 34% in 2001/02 (Planning Commission, 2001a).

Employment generation and labour welfare

In India the poverty-alleviating role of employment generation is most apparent in the Village and Small Scale Industries (VSI) sector which is more labour intensive per unit of capital employed than large-scale industries. The sector comprises small scale industries, khadi and village industries, coir industries, handloom units, sericulture activities and small handicraft businesses. Khadi and village industries have an important role to play in promoting non-farm employment in rural areas and thus providing supplementary income.

The SSI sector contributes about 40% of industrial production in terms of value added, 7% of GNP (Gross National Product), one-third of total exports and employs the largest number of people, next only to agriculture (Gulati, 1997). In 1990/91, 43 million people were employed in the VSI sector, which increased to 58 million people in 1996/97 (Planning Commission, 2001b).

The growth of the VSI sector has been encouraged by an increase in plan outlays, both by the Centre and the state governments/union territories. Total outlays (central and state sector) for this sector increased from Rs 6800 crore in the Eighth Plan period (1992-97) to Rs 10,700 crore in the Ninth Plan (1997-2002) (Planning Commission, 2001b). This represents about 14% of total outlays for the industry and minerals sector.

Government policy towards employment generation has also emphasized self-employment, and several programmes promoting self-employment have been implemented, significant among these being the Prime Minister's Rozgar Yojana started in 1993.

Institutional mechanisms and legislation for ensuring adequate remuneration and protecting the rights of workers exist for the organized industrial sector. Government programmes for improving labour welfare in the unorganized sector have targeted the prevention of exploitation of child labour.

There has been recognition of the need to reassess and give greater attention to industrial safety, since an increasing proportion of the industrial workforce is exposed to occupational hazards, dangerous chemical substances and environmental pollution. Programmes for improving working conditions in factories, establishment of a system of chemical safety, strengthening the system of monitoring occupational health status and certification of protective equipment were envisaged in the Eighth Plan.

To provide training and develop skills of workers entering the industrial labour force, a National Vocational Training System comprising a network of over 2000 Industrial Training Institutes (ITI) has been established. The Central Board of Workers Education (CBWE) has developed schemes keeping in view the need to educate workers on industrial health, safety and environment (Eighth Five-Year Plan, 1992-97). In addition, to provide training to women participants in the workforce, a National Vocational Training Institute, Regional Vocational Training Institutes and ITI's specifically for women have also been set up.

Concerns

Environmental management

The implementation of environmental regulation in industry has had mixed results. While large-and medium-scale enterprises in the industrial sector have mostly been able to comply with environmental requirements, as shown by the status of pollution control in 1551 highly polluting large and medium industrial units, small-scale industries have faced difficulties complying. This has been

due to a lack of financial resources and technical expertise for installing pollution control equipment. The dispersed nature of these units has also made monitoring of their environmental performance difficult for the authorities.

The approach to environmental protection in industry has been predominantly in the form of regulatory or command-and-control measures rather than using economic instruments. Fiscal and budgetary instruments to promote the adoption of pollution control equipment have been used but these have focussed more on providing incentives (tax concessions, subsidies, soft financing, accelerated depreciation allowance), with a corresponding lack of taxes/charges/levies on polluting industrial activities (TERI, 2000). The concept of making the polluter pay has not been adequately incorporated into the development of instruments. Further, the provision of incentives has not been linked to environmental performance. As a result, the efficacy of the fiscal instruments in actually reducing industrial pollution can be questioned. Finally, there has been a focus on promoting the adoption of end-of-pipeline pollution control technology in industries rather than assessing potential for pollution reduction in the life cycle of the product.

Indian industry is characterized by low resource-use efficiency, particularly in energy use, where there is a wide gap between most industrial operations and their counterparts in the developed world (TERI, 2001b). The industrial sector consumes as fuel and feedstock over half of the total commercial energy consumption in the country. Energy consumption is concentrated in seven industries: fertilizers, aluminium, textiles, cement, iron and steel, pulp and paper, and chlor alkali which together account for 80% of total industrial energy consumption. High-energy use coupled with low-resource use efficiency implies not only increased costs but also adverse environmental impacts.

Suboptimal R&D (Research and Development) efforts has also been a problem area for Indian industry (TERI, 2001b). Large process industries mostly rely on overseas technology suppliers and there is a lack of indigenous capability. The R&D programmes of larger industries have been mainly in the form of technology adaptation or upgrading or removing constraints. Lack of local capacity results in the transferred technology seldom reaching the designed operational efficiency (TERI, 2001b).

Strengthening the role of the private sector

Progress on disinvestment of government equity in PSEs has been very slow; disinvestment has been undertaken for only a third of the 46 PSEs for which disinvestment or closure was recommended (Planning Commission, 2000).

Privatization has picked up in the latter half of 2001-02 and this momentum needs to be maintained.

Trade liberalization and environmental regulation

In addition to tariff barriers in certain sectors, a concern for Indian industry is the impact of international environmental regulation on competitiveness and the potential for a rise in 'green protectionism'. Many developed countries have set physical requirements for imported products such as standards and technical regulations, packaging, eco-labelling and recycling requirements. Indian exports from the textiles, machinery equipment, leather and chemicals industries have faced such environmental regulation.

The imposition of environmental regulation has significant trade implications for India, as the costs of compliance with these standards could be very large, particularly for the small-and medium-scale enterprises that form a sizeable proportion of the export sector. The technical and financial capacity of these firms to conform to environmental regulations set by developed countries is limited. The resulting loss of competitiveness, market access and export revenues could further limit ability to implement improved environmental standards.

Employment generation and labour welfare

Employment generation alone does not ensure poverty reduction, as a low recorded unemployment (less than 3% of labour force) coexists with a high incidence of poverty (more than 30% of households) (Ninth Five-Year Plan, 1997-2002). This is on account of the predominantly unorganized nature of the workforce, low productivity employment and very low wages.

Adequate levels of earnings, safe and humane conditions of work and access to minimum social security benefits are the major qualitative dimensions of employment which enhance quality of life of workers and their productivity (Eighth Five-Year Plan, 1992-97). While institutional mechanisms and legislation exist for ensuring these to workers in the organized sector, similar benefits are not ensured for workers in the unorganized sector.

Integrating Agenda 21 concerns – directions

From the foregoing discussion it may be seen that the concerns of Agenda 21 have been substantially incorporated in the decision making process in India. The directions in which future action needs to be taken are briefly indicated in the following section.

Environmental management

There exists a wide-ranging legal framework for environmental management. Along with strengthening the implementation, it is necessary that IT be complemented by the introduction of economic and market-based instruments such as charges on industrial emissions, effluents and wastes. This becomes all the more important in the context of liberalisation of the Indian economy. Incentives for the adoption of clean technologies and processes should be given and these should be linked to environmental performance.

There exists considerable scope for improving resource efficiency in Indian industry, with various studies estimating energy saving potential alone to be about 25%. To increase resource efficiency, measures such as recycling and use of secondary materials, development of mandatory energy efficiency norms for new process industries and energy labelling for equipment should be promoted (TERI, 2001b). A beginning in this direction has been provided by the Energy Conservation Act, 2001. In addition, voluntary agreements by industry associations on behalf of their members could be a means for improving energy efficiency. Some of these concerns can be addressed by the ongoing reforms which aim at greater use of markets and competition. Efficient pricing induced by these reforms will also promote more efficient use of resources.

Strengthening the role of the private sector

In the last decade the role of the private sector has been considerably strengthened. Disinvestment of the public sector will continue at an accelerated pace. Accordingly the Approach to the Tenth Five Year Plan calls for the creation of an industrial policy environment in which private sector companies and the erstwhile public sector units can become efficient and competitive. It also emphasises that industrial liberalization should be extended to the state level.

Trade liberalization and environmental regulation

The Approach to the Tenth Five Year Plan recognizes that although removal of quantitative restrictions on imports is an important step in opening the economy to foreign competition, import protection is still very high. Tariff levels of around 34% are still much higher than those prevalent in East Asian nations, which are about 10%. The need to bring down tariff levels further has been emphasized by successive governments and a lowering of India's tariffs to East Asian levels in a three year period has been announced (Planning Commission, 2000; Planning Commission, 2001a).

The increasing awareness of environmental issues in the international market can be turned into a competitive edge rather than a threat for Indian industry, with the adoption of environmental management systems and improved implementation of environmental legislation. There is a need for increased technology transfer on a non-commercial basis from developed countries. This transfer would be supplemented with local capacity building so that technologies can be effectively absorbed and used to bring down resource intensity.

Employment-generation and labour welfare

Strengthening of existing legislation and introduction of new legislation for the protection of interests of workers in the unorganized sector is required. Steps have been taken in this direction with the introduction of the Building & Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and Other Construction Workers' Welfare Cess Act, 1996. These laws aim to regulate employment and conditions of service as also safety, health and welfare measures for a vulnerable section of workers in the unorganized sector.

In the organized sector also there is a need to balance the immediate interests of the workers and the long-term interests. The Approach Paper to the Tenth Plan calls for a more flexible labour policy that would encourage employment. This must be complemented by a social security system that would protect workers from the adverse consequences of a more flexible labour law.

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Introduction

Over last few decades, there has been a paradigm shift in water management as the perception that freshwater is a free and abundant resource has changed to that of water being an economic good in scarce supply, threatened by pollution and warranting efficient use. The challenge of sustainable water use is particularly daunting for developing countries grappling with burgeoning populations and the need to enhance standards of living and economic growth.

Agenda 21 recognizes that a key component of sustainable development is the efficient management of fresh water. This chapter discusses India's initiatives in the water sector and evaluates these in the light of Agenda 21's objectives set out for the sector^a.

The chapter begins with a brief overview highlighting the institutional arrangements within the sector, resource endowment and demand pressures. The chapter goes on to discuss the relevance of Agenda 21 concerns for the freshwater resources sector. Major policy and other developments in the sector are reviewed in order to analyze the extent to which Agenda 21 objectives have been achieved and the concerns that remain. Finally, directions and strategies are proposed that will go towards ensuring adequate clean water equitably and efficiently.

Overview of the sector

Institutional set-up and legal framework

As per the Constitution of India, water and sanitation are state subjects, empowering the states to enact laws, frame policies or fix prices of related services. Planning and implementation of water development projects is currently handled both at the centre and state levels. Annexure 7.1 illustrates the institutional framework for water management in the country and the responsibilities handled by different institutions.

^a This chapter deals with fresh water resources; marine and coastal environment is dealt with in Chapter 11

Resource availability

India is considered rich in terms of annual rainfall and total water resources available at the national level, however the uneven distribution of the resource causes regional and temporal shortages. India's average annual rainfall equivalent of about 4000 billion cubic metres (BCM) is unevenly distributed both spatially as well as temporally. The annual per capita utilizable resource availability varies from 18,417 cubic metres in the Brahmaputra valley to as low as 180 cum in the Sabarmati basin (Chitale, 1992). Even in the Ganga basin, the annual per capita availability of water varies from 740 cubic metres (cu m) in the Yamuna to 3,379 cu m in the Gandak. Levels of precipitation vary from 100 mm annually in western Rajasthan to over 9 000 mm in the northeastern state of Meghalaya (Engleman and Roy, 1993). With 75% of the rainfall occurring over the four monsoon months and the other 1000 BCM spread over the remaining eight months, our rivers carry 90% of the water between June and November. Thus, only 10% of the river flow is available during the other six months.

Resource demand

The rapid increase in the country's population, from about 343 million at the time of Independence to over 1 000 million in 2000, accompanied by growth of agriculture, rapid urbanization, economic growth and improved access to basic services has resulted in an increase in the demand for water. A requirement of 629 BCM against the availability of 1122 BCM indicates surplus at the national level; however spatial and temporal variations give rise to shortages in some regions. The Western plains, the Kachchh region, and some pockets in the Northern plains face acute water shortages. The country's total water requirement is projected to grow to 1180 BCM by the year 2050 as against 629 BCM in 1997-98. The widening gap between demand and supply has led to a substantial increase in the share of groundwater consumption by the urban, agricultural and domestic sectors. The quality of water sources is threatened because of inadequate provisions for the treatment of wastewater.

Water and Agenda 21

Agenda 21 recognizes that the objective of water management is to maintain adequate supplies of water of a good quality for the entire population, while preserving the hydrological, biological and chemical functions of ecosystems, adapting human activities within the capacity limits of nature and combating vectors of water-related diseases.

The Agenda has identified the following key action areas for the freshwater sector. Each of these objectives requires the active involvement of local communities, authorities and the private sector in water management, creation of awareness amongst the people and promotion of international scientific research cooperation.

Drinking water supply and sanitation for urban and rural development

Access to safe water supplies and sanitation is vital for improving health, alleviating poverty, protecting the environment and ensuring sustainable growth. This would include:

- Expansion of infrastructure for urban and rural water supplies and sanitation.
- Efficient and equitable allocation of water resources, which includes reconciliation of development planning with the availability and sustainability of water resources, and introducing water tariffs, to the extent possible, to reflect the economic and opportunity cost of water especially for productive uses.
- Protection of water resources from depletion, pollution and degradation by promoting low-cost upgradable technologies for sanitary waste; recycling and reuse of industrial and domestic waste water and solid waste; protection of existing watersheds.
- Control of water-associated diseases^a.

Water for sustainable food production^b

Sustainability of food production depends on sound and efficient water use and conservation practices, which include irrigation development and management, including water management in rain-fed areas, livestock water supply, inland fisheries and agro-forestry. In addition to improving the water supply for irrigation, this would require:

- Enhancing agricultural water use efficiency and productivity through better soil management and improved agricultural practices to prevent waterlogging.
- Water quality management in agriculture through the optimal use of on-farm inputs, minimization of soil run-off and sedimentation.

^a This is dealt with in Chapter 16 on Poverty eradication and human resource development

^b Some of these issues are dealt with in Chapter 14 on Agriculture

- Developing efficient and environmentally sound aquaculture technologies.
- Capacity-building of local water users groups for better agricultural water use in conditions of scarcity with competing demands for water.
- Water resource development programmes to develop both small and large scale multipurpose irrigation projects, while minimizing the negative environmental impacts of large projects.

Protection of water resources, water quality and aquatic ecosystems

Recognizing the pollution of water by - untreated or partially treated domestic sewage and industrial wastewater, ill-considered siting of industrial units, poor agricultural practices, deforestation etc., Agenda 21 highlights the need to integrate water quality into water resource management to ensure the integrity of the ecosystem and protection of public health. Protection of water resources would include:

- Programmes for the protection, conservation and rational use of all sources of water on a sustainable basis. This would include identification of potential sources of water supply, preparation of water quality profiles, development of approaches that check degradation of water sources and replication of best practices.
- Programme for effective prevention and control of water pollution based on an appropriate blend of pollution reduction-at-source, environmental impact assessments and enforcement of standards for major point source discharges and high-risk non point sources. This would include establishing biological, physical and chemical quality criteria for all water bodies commensurate with their socio-economic development.
- Establishment of networks for continuous surveillance of water bodies and participation, as far as appropriate, in international water-quality monitoring and management programmes such as the Global Water Quality Monitoring Programme (GEMS/WATER) etc.
- Adopting an integrated approach to environmentally sustainable management of water resources and related coastal ecosystems, including consideration of fisheries, aquaculture, animal grazing, agricultural activities and biodiversity.

Water resource assessment including evaluation of impacts of climate change on water resources

The objective of water resource assessment, is to determine the sources, extent, dependability and quality of water resources, along with the demand for water so as to build a scientific data basis for rational water resource management. This would involve strengthening systems for collection, collation, analysis and dissemination of data relating to water availability and its quality, including flood and drought forecasting, impact of climate change on freshwater and relevant data on resources such as land and forests. An efficient data system would in turn require availability of assessment technologies, financial resources, an appropriate institutional framework and capacity-building.

Agenda 21 emphasizes the need to invest resources and enhance co-operation to understand and quantify the threat of climate change on freshwater resources, in areas prone to floods and droughts, and to facilitate the implementation of effective national counter measures.

Integrated water resources development and management

Integrated water management is based on a multisectoral approach to water management which seeks to optimize the use of all sources of water for the following uses; supply and sanitation, agriculture, industry, urban development, hydropower generation, inland fisheries, transportation, recreation, etc. It advocates the integration of water management efforts with that of other natural resources such as land and forests within the framework of the national economic and social policy. Integrated water management should be carried out at the catchment or sub-basin level and would involve optimal water allocation for competing uses; promotion of efficiency in use; integration of environmental and resource quality considerations; and flood and drought management. These would be effected through pricing mechanisms, regulatory measures, development of databases, forecasting models, environmental impact assessment methods, public awareness, involvement of local communities and authorities in water management and promotion of international scientific research cooperation.

Having discussed Agenda 21's main concerns for the freshwater sector, the following sections seek to evaluate policy and other developments relating to the water sector in India in the light of key Agenda 21 objectives. The analysis begins with a snapshot of major developments in the water sector since Independence.

Review and analysis of legislation, policies and other initiatives in water sector

Highlights of legislation, policies, programmes and other initiatives

Several activities have been undertaken in India, in line with the objectives of Agenda 21. Table 7.1 below gives the highlights of policies, acts and programmes in India, relevant to freshwater resources.

Table 7.1 Highlights of legislation, policies, acts and programmes

Year	Policy/Act/Programme	Salient features
1956	River Boards Act	<ul style="list-style-type: none"> ▪ Empowering the Central Government to establish, on request from the state governments, a River Board for advising the governments on matters concerning the regulation or development of an inter-state river or river valley. ▪ Central Government has not constituted any River Board under this Act so far.
1956	Inter-State Water Disputes Act	<ul style="list-style-type: none"> ▪ Enabling the creation of a Water Disputes Tribunal for the adjudication of water disputes that cannot be settled by negotiations with powers as are vested in a civil court under the Code of Civil Procedure, 1908. ▪ The Tribunal has the powers to carry out, or permit to be carried out, necessary surveys and investigation. ▪ Any matter referred for arbitration under the River Boards Act, however, does not qualify to be referred to the Interstate Water Disputes Tribunal. Similarly, neither the Supreme Court nor any other court shall have or exercise jurisdiction in respect of any water dispute which may be referred to a Tribunal under this Act.
1901, 1972	Irrigation Commissions (<i>First Irrigation Commission 1901,; Second Irrigation Commission, 1972</i>)	<ul style="list-style-type: none"> ▪ To review and examine: <ul style="list-style-type: none"> ▪ Irrigation facilities available in the country and adequacy of water supply in major irrigation projects ▪ The administrative and organizational set up for planning, execution and operation of irrigation works ▪ Criteria for sanctioning irrigation projects and develop matters related

Year	Policy/Act/Programme	Salient features
		<p>to irrigation development in the country</p> <ul style="list-style-type: none"> ▪ Recommended: <ul style="list-style-type: none"> ▪ River basin and sub-river basin approach for water resource planning and management ▪ High priority to irrigation works in drought-prone areas and efforts at resource conservation
1972-73	Accelerated Rural Water Supply Programme (ARWSP)	<p>Introduced by the Government of India to assist the states and union territories to accelerate the pace of coverage of drinking water supply in rural areas. The entire programme was given a <i>mission approach</i> with the launch of the technology mission called the Rajiv Gandhi National Drinking Water Mission aimed at covering the rural inhabitations of Not Covered (NC), Partially Covered (PC) and quality affected categories.</p>
1973	Drought Prone Areas Programme (DPAP)	<p>Aims to minimize the adverse effects of drought on the production of crops and livestock and productivity of land, water and human resources in areas that are constantly affected by severe drought conditions. Since 1995-96, the programme's approach has been redesigned and based on river watershed development.</p>
1974	The Water (Prevention and Control of Pollution) Act	<ul style="list-style-type: none"> ▪ Established the Central Pollution Control Board (CPCB) and the State Pollution Control Boards (SPCBs). ▪ Empowers the SPCBs to lay down and maintain location and source specific standards for discharge of wastewater. ▪ The actual provisions for enforcement such as penalties, imprisonment etc. are confined to source-specific standards for individual polluters.
1974-75	Command Area Development Programme (CADP)	<p>This centrally-sponsored command area development programme aims at increased utilization of the available irrigation potential by provisions such as better micro systems for water distribution; provision of inputs like seeds, fertilizers, pesticides and other infrastructural facilities and; dissemination of advanced technology amongst farmers.</p>

Year	Policy/Act/Programme	Salient features
1977	The Water Cess Act	<ul style="list-style-type: none"> ▪ Empowers the SPCBs to levy a cess on local authorities supplying water to consumers and on consumption of water for certain specified activities. ▪ Acts as a supplementary market-based instrument for pollution abatement ▪ Provides for a rebate on the cess payable if the local authority or industry concerned installs a plant to treat sewage or trade effluent.
1983	National Water Resources Council	Headed by the Prime Minister, the Council's scope includes preparing and reviewing the National Water Policy; reviewing water development plans and giving directions for related studies; advising practices and procedures for fair distribution and utilization of water resources in different regions and by different beneficiaries.
1986	Centrally Sponsored Rural Sanitation Programme (CSRSP)	The programme supplements the state's efforts by providing financial and technical assistance to include sanitation issues and other issues like personal hygiene, home sanitation, garbage and excreta disposal.
1986	Environment Protection Act	<ul style="list-style-type: none"> ▪ An umbrella Act providing for the protection and improvement of environment and for matters connected therewith. ▪ Authorises the central government to intervene directly in order to protect the environment and also allows public interest litigation for the same purpose. ▪ The nature of penalties under this Act is similar to those authorized under the Water Act.
1993	National Lake Conservation Plan (NLCP)	Focuses on urban lakes subjected to anthropogenic pressures and aims at prevention of pollution from point and non-point sources, treatment of the catchment area etc. 21 urban lakes have been identified for conservation of which 11 have been recognized for study during the first phase of the programme.
1995	National River Conservation Directorate (NRCD)	The Central Ganga Authority established in 1985 under the chairmanship of the Prime Minister was redesignated the National River Conservation Directorate in July 1995. It coordinates the implementation of schemes under the Ganga and other river action plans. These include works to intercept,

Year	Policy/Act/Programme	Salient features
		<p>divert and treat wastewater from all sources</p> <p>a) <i>Ganga Action Plan Phase-I</i> aiming at restoring the river water quality to the 'Bathing Class' standard.</p> <p>b) The <i>National River Conservation Plan</i> launched in 1995 covers 18 major rivers in 10 states of the country. Under this action plan pollution abatement works are being taken up in 46 towns in the states of Andhra Pradesh, Bihar, Gujarat, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Punjab, Rajasthan and Tamil Nadu.</p> <p>c) <i>Ganga Action Plan Phase-II</i> includes:</p> <ul style="list-style-type: none"> ▪ <i>Yamuna Action Plan</i> under which pollution abatement work is ongoing in 6 towns of Haryana, 8 towns of UP and in Delhi. ▪ Under the <i>Gomti River Action Plan</i> pollution abatement works are being taken up in Lucknow, Sultanpur and Jaunpur in Uttar Pradesh. ▪ <i>Damodar Action Plan</i> under which pollution abatement works are being taken up in 12 towns including 8 in Bihar and 4 in West Bengal.
1996	Accelerated Irrigation Benefits Programme (AIBP)	<p>Under the Ganga Action Plan (Main stem and Supreme Court Cases) pollution abatement works are being taken up in 59 towns in Uttar Pradesh, Bihar and West Bengal</p> <p>Launched by the Government of India, the programme aims to accelerate the implementation of the on-going irrigation/multipurpose projects on which substantial progress has already been made but targets have slipped from plan to plan due to the financial constraints faced by the state governments.</p>
1992, 1993	73 rd and 74 th Amendments to the Constitution	<p>The 73rd and 74th Constitutional Amendments entrusted local bodies with functions relating to water supply. The amendments also seek to ensure a better relationship between the state governments and urban local bodies.</p>
2002	National Water Policy,	<ul style="list-style-type: none"> ▪ Accords top priority to drinking water supply in the allocation of water resources for various beneficial uses. ▪ Also addresses issues like need for well-developed information system for better resource planning, maximizing water

Year	Policy/Act/Programme	Salient features
		availability, planning of water resource development projects, financial and physical sustainability of projects, participatory approach, private sector participation, water quality, water zoning, water conservation, flood and drought management, performance improvement. The Policy also calls for intensifying research in areas like assessment of water resources, hydrometeorology, water quality, water harvesting, water losses etc

Achievements

Drinking water supply and sanitation for urban and rural development

High investments have been made over successive Five-Year Plans with a view to achieving 100% domestic water supply coverage in consonance with the National Water Policy (NWP), which assigns the highest priority to drinking water supply needs. Provisions for drinking water supply have been made in all water resource development projects as per the guidelines in the NWP and the drinking water requirements of most cities is being met by multipurpose irrigation schemes located nearby or by long distance transfer. Guidelines on the conjunctive usage of surface water and groundwater are being implemented for different end uses. Water resource consolidation projects are being implemented and planned in different states aiming to bring sustainability in water resource management.

Table 7.2 highlights the estimated figures of population covered with drinking water and sanitation facilities. The progress made by the country, compared to 1985 levels, reflects the achievements made under different programmes such as the Rajiv Gandhi National Drinking Water Mission and Centrally Sponsored Rural Sanitation Programme. Various sub missions launched in rural areas with the objective of providing safe drinking water by controlling brackishness, eradicating guineaworm, and controlling iron, arsenic and fluorosis have also been successful.

Sanitary facilities for individual households below the poverty line, setting of sanitary marts and adopting locally suitable and acceptable models of latrines have led to improvements in the quality of life in rural areas and urban slums.

Table 7.2 Estimated figures on percent population coverage with drinking water and sanitation facilities

	1985	1990	1999*
Drinking water supply			
Rural	56.3	73.9	98.0
Urban	72.9	83.8	90.2 [@]
Sanitation			
Rural	0.7	2.4	9.0
Urban	28.4	45.9	49.3 [@]

* Provisional As on 31.3.1997

Source. MoF (2001)

Water for sustainable food production^a

The initial phase of water resource development, post independence, encouraged the state governments to expeditiously formulate and develop projects for specific purposes such as irrigation, flood control, hydropower generation, drinking water supply and industrial and other miscellaneous purposes. Because of the storage works created the country today has a designed live storage capacity of 177 thousand million cubic metres at full reservoir levels. An irrigation potential of 94 million hectares has been created as against the created irrigation potential of 22.6 million hectares in 1951. The Central Government also provides active financial support under the Accelerated Irrigation Benefits Programme for multipurpose and irrigation projects that have spilled over because of the financial constraints being faced by the state governments. Considerable achievements have also been recorded in programmes such as Command Area Development Programme (CADP) to ensure efficient utilization of the created irrigation potential and increasing agricultural productivity with 234 projects covering 22.76 million hectares spread over 28 states and 2 union territories. Initiatives such as the Participatory Irrigation Management (PIM) to promote efficient allocation of water through the water users association are also being taken. This water resource development drive together with the Green Revolution in the agricultural sector has enabled the country's transition from an economy deficit in food grains to one that is marginally surplus.

^a Aquaculture and inland fisheries will be covered in the chapter on Agriculture since these subjects are dealt with the Ministry of Agriculture.

Water resource assessment including evaluation of impacts of climate change on water resources

The Ministry of Water resources (MoWR) constituted the National Commission for Water Resources Development in 1996 to prepare an integrated plan for development of water resources based on resource availability and demand patterns and to suggest modalities for transfer of surplus water to water deficit basins. Assessment of groundwater resources and irrigation potential of the country is carried out on a regular basis for different basins. A network of 157 flood forecasting stations covering most of the interstate river systems under the Central Water Commission forecasts the occurrence of floods and inflows. Of the identified 40 million hectares of area susceptible to floods, flood management measures undertaken so far have provided a reasonable degree of protection to about 16.4 million hectares (upto the end of Ninth Five-Year Plan) through measures such as flood embankments and drainage channels. Similarly extensive measures have been taken for the identified drought-prone area comprising 1/6th of the country's geographical area. A thrust has been given to watershed development, dry farming and the construction of simple, low-cost structures under the Drought Prone Area Programme. Flood and drought management, and environmental and social impact assessments are an integral part of project formulation and implementation for all water resource planning processes.

Recently, the Government of India has launched a research programme in partnership with the UK Department of the Environment, Transport and the Regions, on the impacts of climate change in India. The study seeks to build on India's expertise to assess the sectoral impacts of climate change, reduce uncertainties in the current climate change prediction models and make a valuable contribution to international climate science. The impact on water resources will be studied by the Indian Institute of Tropical Meteorology, Pune.

Protection of water resources, water quality and aquatic ecosystems

The Central Pollution Control Board (CPCB) has been monitoring water quality of national aquatic resources in collaboration with the concerned state pollution control boards (SPCBs) since 1977. The monitoring programme started with merely 17 stations on the river Yamuna and has extended steadily over the years to 507 locations currently. The Central Water Commission also has a network to measure flow and monitor water quality at about 369 field stations. The Central Ground Water Board (CGWB) monitors groundwater quality at 15355 locations. In an effort to assess the health of a water body, the CPCB has

also initiated a bio-monitoring project under the Indo-Dutch Collaboration Programme on Environment and selected 215 locations for the introduction of bio-monitoring based on the interpretation of physico-chemical data at different locations. Limited water quality monitoring of wells is also being undertaken in different states to estimate violations of pH, dissolved oxygen, BOD and total coliform over desired levels. Source-specific standards for discharge of wastewater have been laid down by the CPCB under the Water Act. The Act also empowers the SPCBs to lay down and maintain standards more stringent than those specified by CPCB depending on local conditions. The actual provisions for enforcement such as penalties, imprisonment etc. are confined to source-specific standards for individual polluters.

Under the National River Action Plan (NRAP), a holistic and integrated approach is adopted by addressing not only river pollution but related factors like internal sewage, solid waste disposal, and low cost toilets. Sewage collection and treatment works are being constructed to reduce the pollution load in rivers. These include schemes for better sewage interception and diversion, construction of sewage treatment plants, provision for low cost sanitation and other schemes. In the first phase, under the GAP (Ganga Action Plan), 29 towns were selected along the river and 261 schemes of pollution abatement sanctioned. At present 156 towns are being considered under the NRAP, out of which about 74 towns are located on the river Ganga, 21 on the river Yamuna, 12 on the Damodar, 6 on the Godavari, 9 on the Cauvery, 4 each on the Tungbhadra and Satlej, 3 each on the Subarnrekha, Betwa, Wainganga, Brahmini, Chambal, Gomti, 2 on the Krishna and one each on the Sabarmati, Khan, Kshipra, Narmada, and Mahanadi. The National Lake Conservation Plan is also being given the same priority as the rivers. The Bhoj Lake of Madhya Pradesh is already getting assistance under funds provided by OECF, Japan for betterment of its water quality. Coastal towns are being given special attention due to the high possibility of sewage, solid waste, bio-medical waste and the like being dumped into the sea.

A 'Water Quality Assessment Authority' has also been established recently under the Environment Protection Act, 1986. The Central Ground Water Board constituted the Central Ground Water Authority for regulating the development and management of groundwater resources. To this end it has notified and banned fresh bores in areas affected by groundwater depletion. The Authority is also promoting rainwater harvesting and artificial recharge and has circulated guidelines for implementing artificial recharge projects.

Under the 1994 EIA notification, an Environmental Impact Assessment has already been made mandatory for 30 categories of development activities involving investments of Rs 500 million and above. Environmental clearance for activities is given by the Ministry of Environment and Forests. Construction of common effluent treatment plants (CETP) for treatment of effluents from a cluster of industries particularly of small scale is also getting encouraging support. Under the World Bank-aided Industrial Pollution Control project there is a provision of loan and grant assistance for construction of CETPs in an industrial estate or a cluster of SSIs. The CWC also undertakes the environmental evaluation of completed water projects. The Environmental Monitoring Committee of the CWC is monitoring 85 projects at present according to the guidelines of the Environmental Management Plans for water resources projects.

Integrated water resources development and management

Water resource management and development efforts in the country recognize the interrelationships between water and land use. Various schemes are being implemented on an integrated watershed basis with agencies such as the Damodar Valley Corporation, Krishna Godavari Commission, Sone River Commission, Ganga Flood Control Board and Ganga Flood Control Commission, Brahmaputra Board, Narmada Control Authority, Bhakra-Beas Management Board, Upper Yamuna River Board. The mandate of these agencies includes development and allocation of water resources at river basin and local levels for all identified end uses. Preliminary studies have been carried out to explore the possibilities of inter-basin transfer to making more water available in water-stressed basins. The National Water Development Authority (NWDA) under the National Perspective Plan has carried out water balance and feasibility studies for interlinking of rivers under specific programmes- Himalayan Rivers Development and Peninsular River Development.

The National Water Policy identified multi-stakeholder involvement as an integral part of all water resource development programmes. Stakeholders including women are encouraged to play an active role in water distribution and conservation, collection of water charges etc. through participatory irrigation management systems such as water users associations. Human resource development is being implemented through water and land management institutes and other organizations and agencies. Various research institutes and organizations undertake R&D and capacity-building programmes

on different subjects ranging from resource assessment and conservation to better operational technology.

Concerns

Despite the above achievements, there are issues of concern that require immediate action. These concern the significant sections of population still without access to safe water and sanitation, low per capita consumption of water in the country compared to minimum requirements, inequitable access within the country and the high levels of water pollution.

Inequitable access to basic services

Huge disparities exist in the provision of basic services.

- Only 77 of the 299 Class-I cities have 100% piped water supply coverage
- 203 of the 345 Class-II towns have low per capita supply of less than 100 lpcd
- Per capita water supply ranges from as low as 9 lpcd in Tuticorin to as high as 584 lpcd in Triuvannamalai
- Access available to slums in urban areas is poor
- 100% access to water supply services in the rural areas has been achieved only in Uttar Pradesh, Delhi, Pondicherry and Chandigarh. Percentage habitations fully covered in Assam, Punjab and Kerala are only 57.4%, 33.3% and 22.2%, respectively.

Besides the inequitable distribution of water in a given city, the supplies are erratic and levels of access to adequate sanitation services vary considerably.

Ground water depletion

Shortages in water supply for domestic and industrial consumption, is resulting in over-exploitation of groundwater beyond its recharge capacity. The share of groundwater in net irrigated areas has also increased considerably from a third in 1965/66 to over half at present to either supplement surface deliveries of water or to provide irrigation water when limited or no surface supplies are available. Groundwater overdraft beyond recharge capacity is posing serious threats, in the form of a long term decline in water levels, with associated adverse consequences such as land subsidence, deterioration of water quality in aquifers, and ingress of saline water in coastal aquifers.

Resource quality

Water quality of Indian rivers has degraded considerably, not only because domestic wastewater is collected inadequately and treated inefficiently in Class-I cities but also because highly complex waste from industries is discharged into water bodies. Indicators of this deterioration include depletion of oxygen, excessive presence of pathogens, settling of suspended material when the flow is lean, and bad odour. Some of the polluted river stretches and their critical parameters and possible sources of pollution are given in Annexure 7.2. Groundwater sources too, are undergoing severe degradation due to chemical contamination, mainly from fertilizers, industrial waste, municipal solid waste as well as biological contamination, particularly in the form of human waste in dug wells.

The following sections briefly discuss the causes underlying these concerns.

Inefficiency in resource use/management

Water has conventionally been considered a free commodity and government policies have provided little incentive to encourage its efficient use. The following highlight poor resource-usage practices.

- High percentage of evapotranspiration losses
- Excessive distribution losses of treated water in municipal water supply systems
- High seepage losses in irrigation and water losses in agriculture due to water overapplication
- Industrial output per unit of water withdrawal in India at about \$5 per cubic metre as compared to an output of \$25 and \$32 for equal quantity of water in developed countries as Japan and Sweden respectively

Besides, other inefficiencies also persist at the supply end –in the form of overstaffing, high administrative costs, and time and cost overruns in the execution of projects.

Pricing policies

Water is a state subject, and the price for its use in different sectors is fixed by the state government and varies from state to state. Typically, water rates for agriculture and domestic consumption, do not cover even the working expenses of providing the service, let alone capital costs. In the irrigation and urban sectors, the percentage recovery of working expenses through gross receipts in recent years is only about 10% and 30%, respectively. The subsidy regime has on the one hand encouraged inefficient use of the resource and on the other, led

to poor financial health of the sector, resulting in poor services and user dissatisfaction.

Institutional set-up and legal framework

Planning and implementation of water development projects is currently cumbersome with a number of organizations involved both at the centre and state resulting in duplication and ambiguity of functions. Few states have defined water policies and organizations for planning and allocating water. While there is an extensive legislative framework to address water pollution, there are no regulations on water abstraction. Groundwater authorities attempt to regulate groundwater withdrawals through licensing but do not define any limits for withdrawals, thereby not addressing inequitable and unsustainable groundwater withdrawals. Implementation of environmental laws in general remains weak, mainly on account of inadequate financial resources and capacity of the pollution control boards.

Clearly, steps need to be taken to improve resource management and solve disputes between states, sectors and communities. The following section concludes with proposed strategies for sustainable water management.

Strategies for sustainable water management

The country has come a long way since Independence in improving access to basic services especially to the poor and those in far-flung remote areas, and becoming self-sufficient in food grain requirements. At the same time, as discussed in the previous section, there still remain issues of concern. Recent initiatives clearly indicate that the government is cognisant of the policy, institutional and legal changes that are required to achieve the national goal of universal and equitable access to water and sanitation.

On the policy front, it is recognized that long-overdue price reforms be undertaken such that the price of water and related inputs (such as fertilizers and power in the case of agriculture) reflect the cost of providing these services and to the extent possible the environmental externalities, while satisfying the national social obligations. Price reforms will encourage resource conservation on one hand and provide additional financial support for the fund-starved municipal service providers on the other. It needs to be added that any attempts at rationalizing water tariffs must go hand in hand with improvements in supply efficiency and service quality. It is also necessary to introduce market-based instruments to arrest water misuse and quality degradation. Economic instruments should be supported by environmental management tools such as

performance benchmarking, ISO 14000 standards and environmental rating to improve not only environmental performance but also the international image and competitiveness of Indian industry.

Institutional reform can be implemented if the service sector be it irrigation projects or municipal services is allowed adequate autonomy. This would involve devolution of administrative and financial responsibilities and involving the community and the private sector as much as possible in the provision of these services. This would not only improve efficiency but also facilitate the use of cost-effective domain-specific technological options including the use of traditional knowledge. The need to involve the community in the management and maintenance of water projects has been re-emphasized in the Approach Paper to the Tenth Plan (Planning Commission, 2001). Necessary legislation also needs to be enacted for preservation of existing water bodies by preventing encroachment.

The move towards a river-basin approach to water management must be strengthened since issues related to an adequate and sustainable supply of quality water usually transcend local boundaries and need to be addressed in consonance with other resources such as land. Appropriate legislation will be required to set up planning units such as river-basin authorities, which will act as autonomous institutions with policy formulation, planning, financial, and regulatory powers.

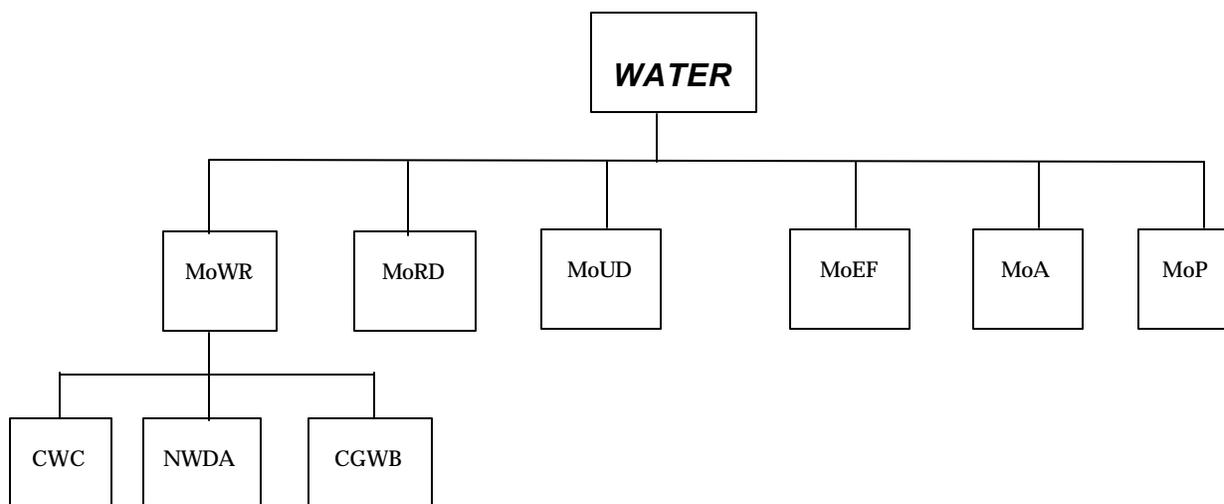
With the supplies of utilizable surface water at about 35% of the total available run-off, it is necessary to augment the available resources to the maximum possible extent. The need is to develop surface-irrigation sources, harvest rainwater, and prevent run-off. The run-off can be tapped by building appropriate water-harvesting structures in the lower reaches especially during June–November when the rivers generally carry water in excess of 90%. The concept of watershed development which effectively contributes to the revival of local traditional water control works has also to be adopted more rigorously. The possibilities of inter-basin transfers of water also need to be explored to make optimal use of the country's water resources. The National Water Development Agency envisages the utilization of 200–250 billion cubic metres of water by such transfers. Preliminary studies also highlight the possibility of using about 160 billion cubic metres through artificial recharge (MoWR, 1999). Detailed feasibility studies need to be carried out to study the potential for increasing utilizable water resources.

Demand management has to form an integral part of water management. It is necessary that water conservation practices in the day-to-day use of water be

encouraged through appropriate policies; promotion of low-cost and water-efficient technological options, R&D efforts and awareness-building. Reuse options for domestic wastewater also need to be explored.

Since Independence, developmental planning in the water sector has sought to address the central issues raised in Agenda 21—improving access and addressing resource degradation. Overtime as the pressures on the resource have grown, other issues—enhancing efficiency in provision and use of services through the promotion of appropriate practices and technologies, involving local communities and the private sector and following an integrated water management approach— have become increasingly important considerations. These efforts would need to be redoubled in partnership with the international community to realize the global vision of efficient resources management and universal access envisaged at the Earth Summit.

Annexure 7.1

The institutional set-up for water management in India

MoWR - Ministry of Water Resources

MoRD- Ministry of Rural Development

MoUD- Ministry of Urban Development

MoEF - Ministry of Environment & Forests

MoA- Ministry of Agriculture

MoP - Ministry of Power

CWC - Central Water Commission

NWDA - National Water Development Agency

CGWB - Central Ground Water Board

Table 7.3 Institutional responsibilities for collecting water related data

Organisa tion	Water quantity	Surface water quality monitoring	Ground water quality monitoring	Drinking water quality monitoring	Sanitat ion	Drinking water supply
CPCB		X	X			
CWC	X	X				
SPCB		X	X			
CGWB	X		X			
MoUD					X	X
MoRA&E				X	X	X
MoEF		X			X	
MA				X	X	X

Source. World Bank. (1998)

Note: CPCB - Central Pollution Control Board; CWC - Central Water Commission; SPCB - State Pollution Control Boards; CGWB - Central Ground Water Board; MoUD - Ministry of Urban Development; MoRD - Ministry of Rural Development; MoEF - Ministry of Environment and Forests; MA - Municipal Authorities

Annexure 7.2

List of polluted river stretches ^a

River	Polluted stretch	Desi red clas s	Exis ting clas s	Critical parameters	Possible source of pollution
Sabarmati	Immediate upstream of Ahmedabad upto Sabarmati Ashram	B	E	DO, BOD, Coliform	Domestic and industrial waste from Ahmedabad
	Sabarmati Ashram to Vautha	D	E	DO, BOD, Coliform	Domestic and industrial waste from Ahmedabad
Subarnare kha	Hatia dam to Bharagora	C	D/E	-do-	Domestic and industrial waste from Ranchi and Jamshedpur
Godavari	Downstream of Nasik and Nanded	C	D/E	BOD	Wastes from sugar industries, distilleries and food processing industries
Krishna	Karad to Sangli	C	D/E	BOD	Wastes from sugar industries and distilleries
Sutlej	Downstream of Ludhiana to Haike	C	D/E	DO, BOD	Industrial wastes from hosieries, tanneries, electro-plating and engineering industries and domestic waste from Ludhiana and Jalandhar
	Downstream of Nangal	C	D/E	Ammonia	Wastes from fertilizer and chloralkali mills from Nangal
Yamuna	Delhi to confluence with Chambal	C	D/E	DO, BOD, Coliform	Domestic and industrial wastes from Delhi, Mathura and Agra
	In the city limits of Delhi, Mathura	B	D/E	DO, BOD, Coliform	Domestic and industrial wastes from

River	Polluted stretch	Desired classes	Existing classes	Critical parameters	Possible source of pollution
	and Agra				Delhi, Mathura and Agra
Hindon	Saharanpur to confluence with Yamuna	C	D	DO, BOD, Toxicity	Industrial and domestic wastes from Saharanpur and Ghaziabad
Chambal	Downstream of Nagda and downstream of Kota	C	D/E	BOD, DO	Domestic and industrial waste from Nagda and Kota
Damodar	Downstream of Dhanbad	C	D/E	BOD, Toxicity	Industrial wastes from Dhanbad, Durgapur, Asansol, Haldia and Burnpur
Gomti	Lucknow to confluence with Ganges	C	D/E	DO, BOD, Coliform	Industrial wastes from distilleries and domestic wastes from Lucknow
Kali	Downstream of Modinagar to confluence with Ganges	C	D/E	BOD, Coliform	Industrial and domestic wastes from Modinagar

Source. CPCB (1999)

^a Water quality and the desired water quality is expressed in classes A, B, C, D, and E, which reflect the best use of that water. Class A indicates that water is fit for drinking without conventional treatment but after disinfection; Class B that it is suitable for outdoor bathing; and Class C, that it is suitable for drinking after conventional treatment. Class D water is suitable for propagation of wildlife and fisheries and Class E water can be used for irrigation, industrial cooling, and controlled waste disposal.

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Introduction

The atmosphere is a common global resource, adversely affected by the by-products of anthropogenic activity. Its preservation is imperative for present and future generations. Agenda 21 proposes directions to achieve the dual objectives of economic progress and atmospheric protection.

This chapter studies policies which have an impact on atmospheric quality to examine the extent to which Agenda 21 concerns for the protection of the atmosphere have been addressed. The chapter begins with an assessment of the pressures on the global atmosphere, followed by a discussion of Agenda 21 concerns for its protection. The institutional set-up and legislative framework for addressing global atmospheric problems is examined next. Finally, a review and analysis of the existing policies for atmospheric protection is undertaken to study the convergence with Agenda 21.

This chapter focuses on the global atmospheric problems of climate change and ozone depletion. It must be noted that India is a developing country with a very small contribution to greenhouse gas concentration, and does not have emission reduction commitments at present. However, initiatives that address immediate national and developmental priorities will contribute significantly to the global effort towards atmospheric protection. Local air quality issues are dealt with in chapters on energy, transport, and industry.

Overview

Greenhouse gases

There is worldwide concerns about rising emissions of greenhouse gases from human activities such as power generation, industrialization, and deforestation. The main naturally occurring greenhouse gases are CO₂, CH₄, and N₂O, which trap radiation emitted by the earth, leading to higher temperatures, changed precipitation patterns, and rises in sea level.

The Third Assessment Report, 2001 of the Intergovernmental Panel on Climate Change (IPCC) predicts that global average temperatures could rise by 1.4-5.8°C over the period 1990-2100. This would have wide-ranging impacts including a decline in crop yields, inundation of land in coastal areas, increased frequency and intensity of extreme events, spread of vector-borne diseases, etc.

Climate change is primarily determined by the total stock of GHGs in the atmosphere and not by annual GHG emissions. Developed countries have been responsible for more than 60% of the total global stock of GHGs (Figure 8.1).

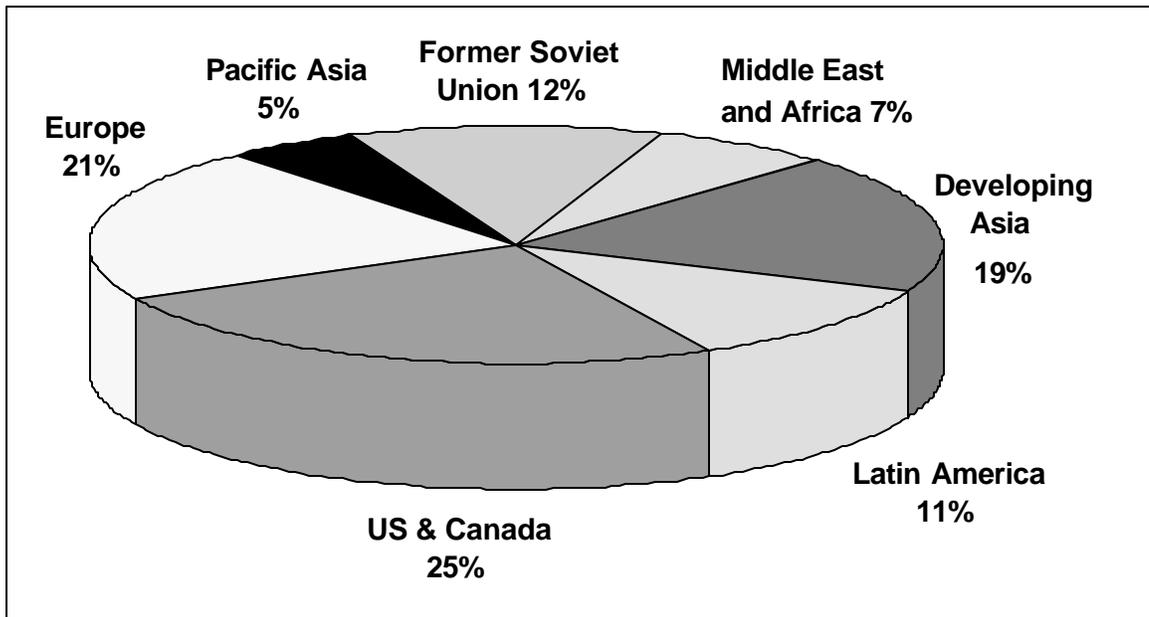


Figure 8.1 Regional contributions to cumulative CO₂ emissions from industrial sources and land-use change (1900-99)

Source. WRI (2001)

In 1990, total CO₂-equivalent^a emissions from India were 1 001 352 Gg, which was approximately 3% of global emissions (Table 8.1).

^aThis takes into consideration the fact that greenhouse gases have different global warming potentials.

Table 8.1 India's national greenhouse gas inventory for 1990 (in Gg)

GHG sources and sinks	CO ₂ emissions	CO ₂ removals	CH ₄	N ₂ O	NO _x	CO	CO ₂ -equivalent (CO ₂ +CH ₄ +N ₂ O) ^a
I. Energy							
A. Fuel combustion	508600						
Energy and transformation industries					2684 ^b	3493 ^b	508600
Biomass burning	300460 ^c		1579	11	400	1147 ²	36569
B. Fugitive emissions from fuels							
Solid fuels			330				6930
Oil and natural gas			626				13146
Total emissions from energy sector (fuel combustion + fugitive emissions)	508600		2535	11	3084	1496 ⁵	565245
II. Industrial processes	24200			1			24510
III. Solvents and other products							
IV. Agriculture							
Enteric fermentation			7563				158823
Manure management			905				19005
Rice cultivation			4070 ^d				85470
Agricultural soils				240			74400
Prescribed burning of savannas							
Field burning of agricultural residues			116	3	109	3038	3366
Total emissions from agricultural sources			1265 ⁴	243	109	3038	341064
V. Land-use change and forestry							
Change in forests and other woody biomass stock		-6171					-6171
Forests and grassland	52385						52385

^a CO₂-equivalents are based on global warming potentials (GWPs) of 21 for CH₄ and 310 for N₂O. NO_x and CO are not included since GWPs have not been developed for these gases.

Bunker fuel emissions are not included in the national total.

^b NO_x and CO emissions are computed for the transport sector.

^c CO₂ emissions from biomass burning are not included in the national totals.

^d CH₄ emissions according to IPCC 1996 methodology.

conversion							
Abandonment of managed lands		-44729					-44729
Total emissions from land-use change and forestry sector	52385	-50900					1485
VI. Waste							
Solid waste disposal on land			334				7014
Domestic and commercial waste water			49				1029
Industrial waste water			2905				61005
Other waste							
Total emissions from waste			3288				69048
Total national emissions and removals	585185	-50900	1847	255	3193	1800	1001352
			7			3	

Source. ADB-GEF-UNDP (1998)

In 1990, in per capita terms, India emitted 1.19 tonnes of CO₂-equivalent, compared with 8.8 tonnes by Japan, and 19.8 tonnes by the United States. The energy sector was the largest emitter of CO₂ contributing to 55% of national emissions. These also include emissions from road transport, coal mining, and fugitive emissions from oil and natural gas. Agriculture is the second largest source of GHGs in India; methane emissions from enteric fermentation in domestic animals, manure management, rice cultivation, and burning of agricultural residues constitute 34% of national GHG emissions. The net uptake and emissions from the land use change and forestry sector were almost equal, resulting in negligible emissions (ADB-GEF-UNDP, 1998).

Table 8.2 shows the change in CO₂ equivalent emissions from fuel combustion over the period 1990-99 in India and other countries.

Table 8.2 CO₂ emissions from fossil fuel combustion

	Total million tonnes CO ₂	
	1990	1999
World	21279.4	23172.2
	(100)	(100)
USA	4845.9	5584.8
	(23)	(24)
EU	3133.7	3106.1
	(15)	(13)
Japan	1048.5 (5)	1158.5 (5)
India	591.12 (3)	903.82 (4)

a		
Chin		3051.11(13
a	2428.9(11))
Braz		
il	201.01 (1)	305.55 (1)

Note: Figures in brackets denote % of world total

Source. IEA (2001)

Figure 8.2 shows that in 1999 per capita emissions from fuel combustion from India were much lower than for the US, EU and Japan, and one-fourth of the world average.

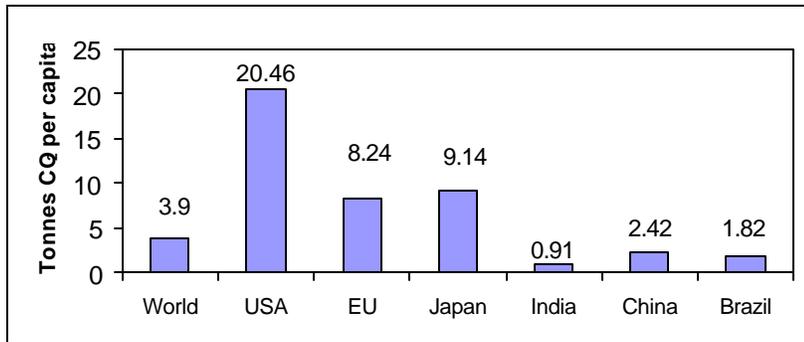


Figure 8.2 Per capita CO₂ emissions from fuel combustion (1999)

Source. IEA (2001)

Ozone-depleting substances

The ozone layer in the stratosphere is at risk from compounds containing different combinations of chlorine, fluorine, bromine, carbon, and hydrogen. These compounds (e.g. chlorofluorocarbons, hydrofluorocarbons, carbon tetrachloride, etc.) are collectively known as ozone-depleting substances (ODS) and are used in refrigeration, aerosol propellants such as body sprays, foam-blowing, and industrial solvents. They react with and deplete stratospheric ozone, allowing harmful UV radiation to reach the earth. This increased radiation can change genetic structure, affect immune systems, inhibit plant growth, and increase the incidence of eye cataract and skin cancer.

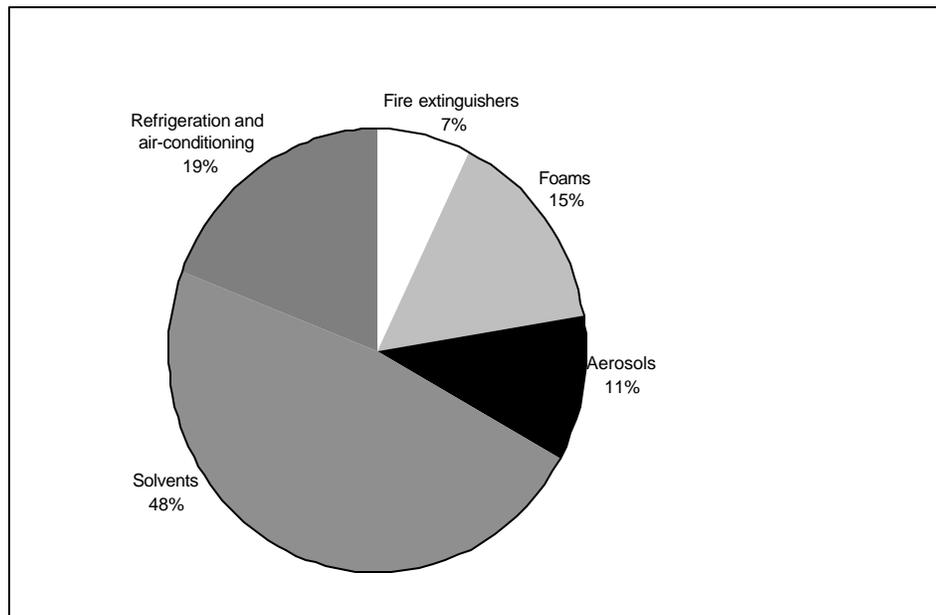


Figure 8.3 Sector-wise consumption of ODS in India (1991)

Source. GOI (1993)

In 1991, India's consumption of ODS was 10370 tonnes; of this, about 85% was produced domestically and 15% was imported. India's consumption amounted to about 1.2% of the global consumption of ODS, and less than 10g in per capita terms. The industry-wise consumption of ODS in 1991 is shown in Figure 8.3. Table 8.3 compares the change in consumption over the period 1991-1999, by type of ODS.

Table 8.3 ODS consumption in India

Name of ODS	Quantity in 1991 (metric tonnes)	Quantity in 1999 (metric tonnes)
CFC-11	1898	6167
CFC-12	2852	2050
CFC-13	321.5	-
Halon-1211	550	106
Halon-1301	197	47
Carbon tetrachloride	4003	14635
Methyl chloroform	550	1415 ^a
Methyl bromide	-	6.64
HCFC-22	-	8000 ^b

Source. UNEP-CUTS-SAWTEE (2001)

Atmosphere and Agenda21

Agenda21 states that the objective of protecting the atmosphere should be coordinated with social and economic development. It recognizes that this objective needs to be addressed in cooperation with national stakeholders – government, industry, the scientific community, and civil society – and with the aid of international financial and technological resources.

The main issues for protection of the atmosphere that are highlighted in Agenda21 are discussed below.

Addressing uncertainties

It is very important to enhance our understanding of the processes and consequences of atmospheric change, and of responses to address such changes. Agenda21 calls for improving the scientific basis for decision-making through measures including:

- Promotion of research on atmospheric processes and the crucial linkage between sustainable development and atmospheric change
- Extension of the scope of operation of systematic observation stations, and development and improved utilization of databases

^a 1996 data

^b 1998 data

- Cooperation in the development of early-detection systems concerning changes in the atmosphere
- International cooperation for building scientific capacity, scientific data exchange, and training

Promoting sustainable development

Integrating economic growth with atmospheric protection requires policies and programmes that promote greater efficiency in energy production and consumption, environmentally sound transportation and industrial development. The directions for future development are:

- Development of economically viable, environmentally sound energy sources, and increased availability of energy supplies for sustainable development, particularly in developing countries
- Research, development, transfer, and use of more efficient technologies and practices in energy, transport, and industrial systems
- Enhancement of institutional, scientific, and management capacity for energy planning, transport and urban planning strategies, and efficient use of materials and resources

Preventing stratospheric ozone depletion

Agenda21 emphasizes the need for continued efforts under the Montreal Protocol to phase out ODS through such measures as:

- Transfer of technologies to help developing nations comply with the obligations of the Protocol
- Active participation in the continuous assessment of scientific information, health and environmental effects, and technological/economic implications of stratospheric ozone depletion
- Consideration of measures to remedy the impact of ultraviolet radiation on health, agriculture, and the marine environment
- Replacement of CFC s and other ozone-depleting substances, with a holistic view of the suitability of substitutes

Review and analysis of policies and programmes related to global atmospheric issues

Highlights of legislation, policies and programmes

Relevant policies and legislation related to global atmospheric issues are briefly reviewed in Table 8.4.

Table 8.4 Review of policies and legislation in India governing global atmospheric issues

Year	Policies/ legislation	Salient features
1991	Vienna Convention for the protection of the ozone layer	<ul style="list-style-type: none"> ▪ India became a party in June 1991
1992	Montreal Protocol on substances that deplete the ozone layer	<ul style="list-style-type: none"> ▪ India acceded to the Protocol and its London Amendment in September 1992 ▪ Phase out of ODS production in India by 2010 in accordance with India Country Programme
1992	United Nations Framework Convention on Climate Change	<ul style="list-style-type: none"> ▪ Signed by India in June 1992 and ratified in November 1993 ▪ Stabilization of GHG concentrations at a level that would prevent dangerous anthropogenic interference with the climate system ▪ No emissions reduction targets for developing countries ▪ Periodic reporting through National Communication to UNFCCC
1997	Male' Declaration of the SAARC Environment Ministers Meeting on the Environment Action Plan	<ul style="list-style-type: none"> ▪ Development, updating, and implementation of national environment action plans to address environmental concerns in SAARC region ▪ Development of legal instruments for cooperative efforts to protect the environment ▪ Increase in people's involvement to find solutions for environmental problems ▪ Organization of finance and institutional mechanisms for implementation
2000	Ozone Depleting Substances (Regulation and Control) Rules	<ul style="list-style-type: none"> ▪ Quantitative restrictions on production, consumption, sale, purchase and use of ODS ▪ Ban on export and import of ozone-depleting substances, except with countries specified in Schedule VI of the notification. ▪ Prohibition on new investments with ODS

Policy analysis

This section analyses the achievements of policies and the lacunae that remain in meeting Agenda 21 concerns regarding global atmospheric problems as described in section 3 (the atmosphere and Agenda21) above.

India has a detailed institutional and legislative framework for pollution abatement. Apart from policies, legislation and programmes there is also a strong institutional structure designed for the protection of the atmosphere. All these reflect an intention to integrate environmental considerations into decision-making at every level, with an emphasis on preventing pollution. It also brings to the fore, the government's strong intention to encourage increased interaction, move away from a strictly regulatory framework, and create an enabling environment for the adoption of cleaner technologies. This is further emphasized by the Ninth Plan statement that India's strategies for environmental protection are guided by Agenda21 principles.

Addressing uncertainties

Agenda 21 highlights the need to improve scientific understanding about processes that impact our atmosphere. Given its tropical location and its significant dependence on climate-sensitive sectors such as agriculture and forestry, India is vulnerable to climate change. It is, therefore, important to develop a better understanding of climate processes in the Indian subcontinent, assess potential socio-economic impacts, and build the capacity to adapt to climate change.

Current initiatives in this section include:

- A number of governmental and independent agencies are involved in climate change research in India. The India Meteorological Department (IMD) observes climatic parameters at surface and upper air observatories throughout the country. IMD's network includes 559 surface observatories, more than 8000 rainfall monitoring stations, 100 satellite-based data collection platforms in remote areas, 203 voluntary observing ships, 10 cyclone detection radars, and 17 storm detection radars (IMD, 2001). Since 1983, IMD has maintained a meteorological observatory at the Indian Antarctic station. This data is scrutinized and archived at the National Data Centre, Pune, and used to study, predict, and determine the effects of climate change.
- The existing cyclone detection radars all being replaced with state-of-art Doppler Weather Radars in a phased manner. The cities of Calcutta and Chennai have been the first ones to witness their use. An indigenous Doppler weather radar is being developed under a collaborative

programme of the IMD with the Indian Space Research Organisation (IMD, 2001).

- Satellite data received from INSAT provides cloud imageries in the visible and infrared channels, which are used to derive cloud motion vectors, sea surface temperatures, and outgoing longwave radiation.
- Indian scientists have played a key role in international climate research efforts such as the IIOE (International Indian Ocean Expedition), MONEX (Monsoon Experiment), INDOEX (Indian Ocean Experiment), World Climate Programme, Global Observing System, and International Geosphere-Biosphere Programme.
- IMD has also been undertaking ozone measurements since 1928. The Department has a network of ozone monitoring stations in the country, as well as one observatory at the Indian Antarctic station. IMD's National Ozone Centre at New Delhi is designated as Regional Ozone Centre for the Regional Association II (Asia) of the World Meteorological Organisation.
- The Government of India has supported the Asian Least-cost Greenhouse Gas Abatement Strategy (ALGAS) study, which developed a national inventory of GHG sources and sinks, and identified potential mitigation options. Country-specific emission factors have been developed for methane emissions from paddy cultivation, carbon dioxide emissions from Indian coal, etc.
- Much-needed information about the vulnerability to climate change is being generated under the ongoing Indo-UK Climate Change Impacts programme supported by the Ministry of Environment and Forests, Government of India. Several research organizations and academic institutions in the country are also engaged in research on climate change impacts. The Indian Institute of Tropical Meteorology, Pune, and the Indian Institute of Technology, Delhi are engaged in developing climate change scenarios for India.

There is need for detailed information about sectoral GHG emissions, country-specific emission factors, and monitoring methods. Further work in these areas is being undertaken as part of the preparation of the country's first National Communication to the UNFCCC. The greenhouse gas inventory for the country is being prepared for the base year 1994, and will cover five sectors: energy, industrial processes, agriculture, forestry, and

waste. Vulnerability and adaptation assessment is also part of the National Communication project.

Promotion of sustainable development

The energy sector is the main source of greenhouse gases (Table 8.1). India is pursuing energy conservation, promotion of cleaner fuels, renewable energy technologies. The Energy Conservation Act is a noteworthy initiative in this regard. Other significant initiatives include the unbundling and privatization of the electricity sector, introduction of Bharat I and II norms in the transport sector^a, etc. Other significant measures in the transport sector include conversion of two- to four-stroke engines in two-wheelers, and demonstration of the use of electric- and battery-operated vehicles.

The Government of India has been consistently promoting power generation from renewable sources. Today, India has one of the largest renewable energy programmes in the world, and is the world's fifth-largest producer of wind energy, with an installed capacity of 1507 MW. The government offers several fiscal and financial incentives to encourage the adoption of such technologies as bagasse-based cogeneration, biomass consumption, grid connected solar photo-voltaic (PV) application, wind battery chargers, wind pumps etc. These are described in the chapter on Renewables.

The Technology Information, Forecasting and Assessment Council established under the Department of Science and Technology facilitates the transfer of environmentally sound technology. It has conducted a study on clean coal technologies, which are critically important given the large share (nearly 70%) of coal-based power generation in India, and the high ash content of the Indian coal.

In addition to these measures, India also pursues policies promoting afforestation and wasteland development. Under the UNFCCC, developing countries such as India do not have GHG mitigation commitments in recognition of their small contribution to the greenhouse problem as well as low financial and technical capacities. The Ministry of Environment and Forests is the nodal agency for climate change issues in India. It has constituted a Working Group on the UNFCCC and Kyoto Protocol to deliberate upon issues emerging from the climate change negotiations. It has

^a Bharat I norms have been implemented from April 1st 2000. These are applicable to the two- and three-wheeler segment and are stricter than Euro II norms. Bharat II norms will be applicable from April, 2005.

also established a task group on Activities Implemented Jointly (AIJ) to consider and recommend bilateral and multilateral projects aimed at GHG reduction. India is also going to host the eighth session of the Conference of Parties (COP-8) to the UNFCCC during October 23-November 1, 2002.

The Kyoto Protocol to the UNFCCC was adopted in 1997 and requires developed countries listed in Annex B of the Protocol to reduce their GHG emissions to 5.2% below 1990 levels on average. Under the Clean Development Mechanism (CDM) introduced in the Protocol, developing countries such as India can participate in joint GHG mitigation projects. India has not yet signed the Protocol. The Government of India has, however, indicated its support of the CDM in a decision made prior to the sixth Conference of Parties to the UNFCCC (COP-6) in 2000. Priority projects are being identified for CDM investment in sectors such as power generation and renewable energy. At the resumed session of the seventh Conference of Parties (COP-7), it was agreed to adopt fast-track procedures for the approval of small-scale CDM projects in renewable energy and energy efficiency, which also matches India's interests.

The country's experience with Activities Implemented Jointly (AIJ), (Table 8.5) and Global Environment Facility (GEF) projects is also valuable in this regard.

Table 8.5 Pilot phase AIJ projects underway in India (as of December 2001)

Project	Location	Investor	Host
Integrated agricultural demand-side management	Andhra Pradesh	World Bank/Norway	Andhra Pradesh State Electricity Board
DESI power: biomass gasification	20 sites	The Netherlands	DESI Power, Development Alternatives
Hybrid Renewable Energy Project	Rajasthan	Australia	Brahmakumaris Academy for a better world

Source. TERI (2001)

India has GEF projects in the following areas.

- Coal-bed methane recovery and commercial utilization
- Development of high-rate biomethanation processes as a means of reducing GHG emissions
- Optimizing development of small hydel resources in hilly areas
- Alternative sources of energy
- Biomass energy for rural India

- Selected options for stabilizing GHG emissions for sustainable development
- Solar thermal-electric
- Energy efficiency
- Fuel cell bus development in India

COP-7 also agreed upon increased replenishment of GEF, the establishment of an adaptation fund, and a special climate change fund. This last fund will finance activities that are complementary to those funded by the GEF, including:

- Adaptation
- Technology transfer
- Mitigation in energy, transport, industry, agriculture, forestry and waste management
- Economic diversification in countries adversely affected by climate change response measures

Despite the above initiatives, India requires substantial new and additional resources to implement a less-polluting and carbon-intensive path. In the long run, stabilization of GHG emissions requires the convergence of per capita emissions from developed and developing countries towards a common range. Adequate institutional capacity-building is critical to meeting the requirements of mitigation, adaptation, and CDM operationalization.

Preventing stratospheric ozone depletion

India acceded to the Montreal Protocol along with its London Amendment on 19 June 1992. The India Programme for the phase-out of ODS under the Montreal Protocol was approved in November 1993. The MoEF has established the Ozone Cell and the Steering Committee on the Montreal Protocol to facilitate implementation of the objectives of the India Country Programme. India's efforts to protect the ozone layer are guided by the need to minimize economic dislocation, encourage indigenous production of substitutes, and address the special requirements of small and medium enterprises.

To meet India's commitments under the Montreal Protocol, the Government of India has also taken some major policy decisions.

- Goods required to implement ODS phase-out projects funded by the Multilateral Fund are fully exempt from payment of duties. This benefit has been also extended to new investments with non-ODS technologies.
- Commercial banks are prohibited from financing or refinancing investments with ODS technologies.
- Indian industry is considering different substitutes for ODS. For instance, in the refrigeration and air-conditioning (RAC) sector, HFC-134a and hydrocarbons are being looked at as alternative refrigerants, and cyclopentane as an alternative foam-blowing agent for insulation. In the aerosols sector, HAP (hydrocarbon aerosol propellant) has been the preferred choice, in the foams sector, HCFC-141b, and other CFC-free technological options have been adopted. The choices available in the solvents and halons sector vary widely depending on the specific application.
- Various projects in the five ODS-consuming sectors, aerosols, foams, halons, RAC, and solvents, have been submitted to the Multilateral Fund seeking assistance for a changeover to ozone-friendly substitutes. To date, 276 projects worth approximately 93 million dollars have been approved, also including a project on the phase-out of the domestic production of CFCs. The largest number of projects is in the foams sector, followed by RAC and aerosols. During 2000, the Multilateral Fund approved 35 investment and 11 non-investment projects for India worth about 10.8 million dollars which will phase-out 9158 ODP tonnes when completed.

Strategies for sustainable development

Agenda21 brings to the fore key concerns for the preservation of the atmosphere – both, regarding global problems such as climate change and stratospheric ozone depletion, and the pressing issues of local air quality, a priority for developing countries. By exploiting the synergies that exist between local and global environmental priorities, India can optimize the use of international resources for national development.

There exists a detailed policy framework in India to address these concerns, with appropriate legislation being formulated in the pre-Rio as well as post-Rio periods. The Approach Paper to Tenth Five-Year Plan, like its predecessor, recognizes the need for a cleaner atmosphere and states that efforts should be made to reduce air pollution in each of the sectors that creates pressures on the atmosphere.

The challenge, however, is to improve the enforcement of these policies by institutional strengthening and capacity-building, improved monitoring and reporting systems, and adoption of appropriate market-based instruments. International cooperation should be promoted for the transfer of financial resources and cleaner technologies. In keeping with the suggestion of CSD-IX, attempts will be made to explore ways of increasing financial resources and create innovative financing solutions also by debt relief. Where possible, efforts should be made to facilitate foreign investment, reverse the downward trend in ODA, and fulfil the commitments undertaken to reach the accepted United Nations target of 0.7 per cent of gross national product (GNP) as soon as possible.

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Introduction

Forests are a key element of our terrestrial ecological systems. They comprise tree-dominated vegetative associations with an innate complexity, inherent diversity, and serve as a renewable resource base as well as a habitat for a myriad of life forms. Forests render numerous goods and services, and maintain life-support systems so essential for life on earth. Some of these life support systems of major economic and environmental importance are: i) supply of timber, fuelwood, fodder, and a wide range of non-wood forest products, ii) natural habitat for biodiversity and repository of genetic wealth, iii) provision of recreation and opportunity for ecotourism, iv) playing an integral part of the watershed to regulate the water regime, conserve soil, and control floods, and v) carbon sequestration and functions as a carbon sink.

The increase in human and livestock population in recent times and rural poverty have both exerted tremendous pressure on the forest resources of the country, leading to a deterioration in their quality, stocks and productivity.

This chapter deals with Agenda 21, as it addresses issues related to the forestry sector in India. The chapter is divided into sections providing an overview of the sector; a discussion of relevant Agenda 21 concerns; highlights of important policies, acts, programmes and other initiatives; analysis highlighting achievements and concerns under Agenda 21 objectives; and finally strategies for sustainable development in the forestry sector.

Overview of the sector

India supports approximately 16% of the world's human and 18% of the livestock population on 2.5% of its geographical area, which also includes 1.8% of forest area according to the Forest Survey of India (2000). The recorded forest area is 76.52 million ha or 23.28% of the country's total geographical area of 328.73 million ha, most of which (over 90 %) is under public/government ownership and managed by the state forest departments.

The growing stock of the country (including natural forest, forest plantations, and areas other than natural forests) is 4740.8 million cubic metres with an annual increment of 87.62 million cubic metres. Of this, about 60%

(52.62 million cubic metres) is estimated to be timber and 40% (35 million cubic metres) fuelwood. This represents an average volume of 74.42 m³/ha with an incremental annual growth of 1.36 m³/ha/year.

The main pressures on forests in India are on account of factors such as deforestation, over-cutting beyond silviculturally permissible limits, unsustainable fuel and fodder extraction, practice of shifting cultivation, forest fires, over-grazing and diversion of forest land for non-forestry uses. The total forest area diverted to non-forestry purposes between 1950 and 1980 was 4.5 million ha at an average annual rate of about 0.15 million ha. However, after the promulgation of the Forest (Conservation) Act in 1980, the rate of diversion has come down to about 0.02 million ha annually.

Forests contribute 1.7% (MoEF, 1999) to the gross domestic product of the country. However, this figure does not take into account its numerous non-market and external benefits. Collection of non-wood forest products by villagers is also not recorded fully. Studies are underway to provide more accurate estimates of the contribution of forests to the GDP.

Forestry and Agenda 21

Agenda 21 recognizes the need for specific actions to combat deforestation. Chapter 11 of the document identifies four programme areas for action.

Sustaining the multiple roles and functions of all types of forests, forest lands and woodlands

The objective of this programme is to strengthen forest-related institutions in order to enhance the scope and effectiveness of policies, programmes and legislation related to management, conservation and sustainable development of forests. This would involve development of technical and multidisciplinary skills, research capability and support, administrative structures and mechanisms including inter-sectoral coordination, decentralization of responsibility, incentive systems and dissemination of information. This would also require the participation of the public, including the private sector, NGOs, local organizations and women.

Enhancing protection, sustainable management and conservation of all forests, and greening of degraded areas through forest rehabilitation, afforestation, reforestation and other rehabilitative measures

The objective of this programme area is to maintain or restore ecological balance and expand the contribution of forests to human needs and welfare. This can be achieved by the conservation and management of existing forests and expansion of areas under forests and tree cover through the conservation of natural forests, forest protection, rehabilitation, regeneration, afforestation, reforestation and tree planting. This will require the preparation and implementation of national forestry action plans and other related programmes for the management of forests. These programmes should be integrated with other types of land use, and evolved in partnership with private sector and local communities.

Promoting efficient utilization and assessment to recover the full valuation of the goods and services provided by forests, forest lands and woodlands

The objective of this programme is to promote efficient, rational and sustainable utilization of all types of forests and vegetation through the development of efficient forest-based processing industries, value-adding secondary processing and trade in forest products; to promote more efficient and sustainable use of forests and trees for fuelwood and energy supplies; to enhance the economic contribution of forests by incorporating eco-tourism into forest management and planning; and to improve the recognition of the ecological, economic and social values of forests by integrating these functions in national income accounts.

Establishing and/or strengthening capacities for planning, assessment and systematic observation of forests and related programmes, projects and activities, including commercial trade and processes

This programme seeks to strengthen or establish systematic observation and assessment of forests and forestland with a view to assessing the impacts of policies, programmes and activities and to provide planners, economists, and local communities with sound and adequate updated information on forests and forestland resources.

Each of these programme areas would require, apart from institutional capacity-building and management-related activities, the strengthening of data and information systems in the country. In addition, these would also require the active involvement of all stakeholders including local communities, women

and youth, local organizations and the private sector, and active cooperation of the regional and international community.

Review and analysis of legislation, policies, programmes and other initiatives

Highlights of legislation, policies, programmes and other initiatives

Forestry is a concurrent subject in the Indian Constitution, being under the purview of both the central and state government. Systematic management of forests, began in the mid-nineteenth century. The first forest policy of India enunciated in 1894 focused on commercial exploitation of timber and gave importance to permanent cultivation. The 1952 revision of the policy recognized the protective role of forests and proposed that one-third of the land area of the country be retained under forest and tree cover. The New Forest policy of 1988 focused on environmental stability and maintenance of ecological balance. The initiatives and developments that have addressed the concerns of the forestry sector are summarized in Table 9.1 below:

Table 9.1 Highlights of major developments in the forestry sector

Year	Action taken	Scope
1972 and amended in 1991	Wildlife (Protection) Act 42 nd amendment of the Constitution of India	To protect wild animals, birds and plants including their habitat. Article 48a under the Directive Principles of State Policy and Article 51A (g) of the fundamental duties in the Constitution mention that the 'State shall endeavour to protect and improve the environment and safeguard forests and wildlife in the country and protect and improve the natural environment including forests, lakes, rivers, wildlife and have compassion for living creatures'
1980	Forest Conservation Act	Control diversion of forest land for non-forestry use
1981	The Forest Survey of India	To assess forest cover for planning and monitoring purposes
1985	Ministry of Environment and Forests	Nodal agency for planning, coordination and implementation of environmental and forestry programmes
1988	National Forest Policy	Objectives summarized in Box 9.1

1990	Joint Forest Management	To protect and regenerate degraded forests through peoples' participation
1991	Coastal Regulation Zones	Notification issued under the Environment (Protection) Act, 1986 for the protection of coastal areas
1992	National Afforestation and Ecodevelopment Board (NAEB)	To promote afforestation and ecodevelopment
1994	Environmental Impact Assessment notification	Issued under the Environment (Protection) Act 1986 making EIAs mandatory for 30 sectors
1996	Convention to Combat Desertification	To combat desertification
1999	National Forestry Action Programme	A comprehensive strategy and long-term work plan for the next 20 years formulated to address the issues underlying the major problems of the forestry sector in line with the National Forest Policy, 1988
2000	National Forestry Research Plan	Prioritise and carry out research on various aspects of forestry required for sustainable development

Box 9.1 National Forest Policy 1988

The main objectives of the NFP are:

- Maintenance of environmental stability through preservation and, where necessary, restoration of the ecological balance that has been disturbed by the serious depletion of forests of the country.
- Conserving the natural heritage of the country by preserving the remaining natural forests with the vast variety of flora and fauna, which represents the remarkable biological diversity and genetic resources of the country.
- Checking soil erosion and denudation in the catchment areas of rivers, lakes, reservoirs in the interest of soil and water conservation, for mitigating floods and droughts and for the retardation of siltation of reservoirs. Also checking the extension of sand-dunes.
- Increasing substantially the forest/tree cover in the country through massive afforestation and social forestry programmes, especially on all denuded and degraded, and unproductive lands.
- Meeting the requirements of fuelwood, fodder, minor forest produce and small timber of the rural and tribal population.
- Increasing the productivity of forests to meet the essential national needs.
- Encouraging efficient utilization of forest produce and maximizing substitution of wood.
- Creating a massive people's movement involving women, for achieving these objectives and to minimize pressure on existing forests.

The evolving priorities of the National Forestry Policy have also found reflection in the Five-Year Plans of the Government of India as outlined below.

- **First and Second Five-Year Plans:** Rehabilitation of degraded forests, introduction of economic species, survey and demarcation;
- **Third and Fourth Five-Year Plans:** Enhancing productivity of forests through plantation of fast-growing species, scientific assessments and modern logging;
- **Fifth Five-Year Plan:** Large-scale plantation, social forestry and forest conservation;
- **Sixth Five-Year Plan:** Social forestry and fuelwood reserves to save natural forests;
- **Seventh Five-Year Plan:** Forest conservation, massive afforestation and wasteland development;
- **Eighth and Ninth Five-Year Plans:** Preservation of biological and genetic diversity (both flora and fauna), protection of forest against biotic interference, utilisation of wastelands, and promotion of people's participation through Joint Forest Management (JFM).

The following section analyses the government's initiatives and other stakeholders to bring out achievements and concerns vis-à-vis Agenda 21 objectives.

Achievements

Sustaining the multiple roles and functions of all types of forests, forest lands and woodlands

Institutional set-up

The country has a strong institutional set-up for the conservation and management of forests. The Ministry of Environment and Forests (MoEF) is the nodal agency for planning, promotion, coordination and overseeing the implementation of various environment and forestry programmes.

The Ministry's mandate includes conservation and survey of flora, fauna, forests and wildlife, prevention and control of pollution, afforestation and regeneration of degraded areas and protection of environment. These objectives are being achieved through programmes such as environmental impact assessments, eco-regeneration, assistance to organizations implementing environmental and forestry programmes, promotion of environmental and forestry research, extension, education and training, dissemination of environmental information, international cooperation, and creation of environmental awareness in the country. These functions are supported technically by an extensive institutional set-up. This comprises institutions such

as Indian Institute of Forest Management (Bhopal), Indira Gandhi National Forest Academy (Dehra Dun), Wildlife Institute of India (Dehra Dun), the Indian Council of Forestry Research and Education (Dehra Dun) with its constituent institutes in different parts of the country, and the State Forest Service Colleges at Dehra Dun, Burnihat and Coimbatore, Botanical Survey of India (Kolkatta), Zoological Survey of India, and Forest Survey of India (Dehra Dun), and other affiliated institutes such as the National Museum of Natural History, New Delhi, GB Pant Institute of Himalayan Environment and Development, Almora, Salim Ali Centre for Ornithology and Natural History, Coimbatore, Central Zoo Authority, Delhi, Centre for Ecological Research and Training, Bangalore, and Central Pollution Control Board, New Delhi. At the state level, public sector forests are governed by the state forest departments and managed by well-trained and experienced forest service personnel.

In order to strengthen the system of forestry research in India, the Indian Council of Forestry Research and Education (ICFRE) an autonomous umbrella organization, was established in 1986, financially supported by MoEF and donors. ICFRE has the mandate to undertake, aid, promote and coordinate forestry research and its application; function as a clearing house for research results and information; and disseminate technology. ICFRE works through its network of ten institutes and centres. Outside the ICFRE network there are a number of research facilities under auspices of different agencies such as the Kerala Forest Research Institute (Peechi), Madhya Pradesh Forest Research Institute (Jabalpur), Indian Plywood Industries Research and Training Institute (Bangalore), and forestry faculties of the state agricultural universities. In addition, the state forest departments have research divisions to address their practical problems.

An increasing number of private companies and NGOs are funding their own research in areas such as tree breeding, medicinal plants and NWFPs.

People's participation

The growing depletion of forest resources and increasing deforestation, led to the realization that active and willing participation of the forest fringe communities is necessary for any forest regeneration programme to succeed. It was also realized that village communities will have little incentive to participate unless they benefit directly and have sufficient authority. Therefore a new strategy, called Joint Forest management (JFM) was adopted to protect and regenerate degraded forests.

Participatory forest management as an effective means of protecting and regenerating degraded forests has been gaining ground in India. In 1990, the Government of India issued guidelines to state governments highlighting the need and the procedure for the involvement of village communities and voluntary agencies in the management, planning and implementation of programmes for the protection and development of degraded forests provision of fuelwood, fodder, NWFP and timber to people living in and around forests. In response, 27 states have issued orders enabling mechanisms for public participation in the management of degraded forests promoting active participation and involvement of the people in forest conservation and development, including the development of micro-level plans and their implementation. One of the important elements of the Participatory Forest Management System relates to the use of indigenous capacity and local knowledge about different aspects of conservation, development and use of forests. Rural people, particularly women and the tribal community, have an intimate knowledge of species, their growth characteristics, utility, medicinal value, etc. They are also well informed about the species to be planted in a given locality to satisfy specific requirements of fuel, fodder, timber, and other non-wood forest products. This knowledge is utilized under the JFM for the benefit of the community.

The JFM programme has led to several positive impacts the major ones being, i) change in attitude and relationships of local communities and forest officials towards each other and forests, ii) improvement in the condition of forests, iii) reduction in encroachment, iv) increase in income of the local people and v) involvement of NGOs.

However, there are a number of issues that need attention before the JFM programme can be institutionalized in the country. At present 14.25 million hectares of forest area are being maintained through 62890 JFM groups in 27 states.

There is a symbiotic relationship between tribal people and forests. In 1991, several issues related to forest-tribal interface were examined and detailed guidelines issued by the Government of India to the state governments in order to ameliorate the socio-economic conditions of tribal people. These guidelines cover a number of subjects that include encroachments of forest lands, disputed claims over forest land, elimination of intermediaries to stop exploitation, conversion of forest villages to revenue villages, and payment of compensation for loss of life and property due to depredation by wild animals. Problems and conflicts arising from the tribal-forest interface are resolved through

administrative measures including the creation of village-based Forest Protection Committees, an experiment which has met with remarkable success in some parts of the country.

Private forestry initiatives

The private sector comprising individuals/farmers, cooperatives, and industry has a large role to play in management of forests. Though responsibility for conservation and expansion of forest area is mainly with the government, rural people have been practising tree-planting in their farms, homesteads and village woodlots to meet household requirements of fuel, poles, timber and medicinal plants. After the emphasis given to social forestry by the National Commission of Agriculture (1976), plantations were raised in wastelands, degraded forests, private forests, private marginal lands and agricultural farms. Currently, the area of private tree planting (under agroforestry, farm forestry in block and line plantations) covers over six million ha (MoEF, 1999). Other non-forest sources of wood are rubber, coconut, cashew, and mango plantations. Non-forest private sources contribute 30 to 90% of the total wood supply in different states with an all-India average of about 50%. Non-forest sources together provide about 50% of the total wood supply in the country; and probably an equal or larger share of NWFPs. There are also a large number of small private nurseries meeting the local demand of seedlings (MoEF, 1999). Apart from its contribution to wood supply, the private sector has also demonstrated its ability to enhance the productivity of forests. In addition, the private sector is dominant in the areas of wood-harvesting and processing. However, these private initiatives require more support from the government.

Enhancing protection, sustainable management and conservation of all forests, and greening of degraded areas through forest rehabilitations, afforestation, reforestation and other rehabilitative measures

The policies and programmes in forestry, particularly over the last fifteen years, have been largely in consonance with the Forest Principles adopted during the United Nations Conference on Environment and Development (UNCED).

The Forest (Conservation) Act of 1980 initiated a process by which India's forests were treated as an environmental and social resource rather than as a revenue or commercial resource. Strict controls have been placed on the diversion of forestland to other uses. In the rare cases when this is permitted for developmental purposes, compensatory afforestation is a prior requirement.

This is reflected in the sharp fall in the area diverted to non-forestry purposes after the promulgation of the Forest (Conservation) Act in 1980.

India's achievement in raising forest plantations in terms of area has been impressive. Upto 1997/98, the total area of tree plantations, under different schemes, was 28.38 million ha. Of this, some 3.54 million ha were raised before 1980, 13.51 million ha during 1980s and the rest during the 1990s. The current rate of tree planting is about 1.2 million ha per annum (MoEF, 1999). In terms of the area declared as national parks, sanctuaries and other reserves, India's achievement in protected area development is significant. India has an extensive protected area encompassing at present 88 national parks and 490 wildlife sanctuaries covering an area of 15.3 million ha. This accounts for about 5 per cent of the country's total geographical area (MoEF, 2001). Further details have been provided in the chapter on Biodiversity.

Concern has been expressed over the productivity of plantations due to several factors such as inadequacies in site selection and site-species matching, poor planting stock, lack of proper maintenance and protection, financial and capacity constraints, etc. In addition, the deficiency in regeneration of natural forests is also a matter of serious concern. Such issues are being addressed through policy initiatives of the government. The National Forest Policy (1988), formulated four years before the Earth Summit, embodies the direction emphasized in the Rio Principles. The National Forestry Action Programme (MoEF, 1999) prepared with support from the United Nations Development Programme (UNDP) and the Food and Agricultural Organization (FAO) is a comprehensive work plan for sustainable development of forests in India for the next 20 years, that has been evolved in consultation with the state governments. The objective of the NFAP is to evolve issue-based programmes in line with the provisions of the National Forest Policy (1988) by integrating the forestry development programmes in India within the framework of National Five-Year Plans. The programme areas of the NFAP are summed up in Box 9.2.

Box 9.2 National Forestry Action Programme

The NFAP identified five interrelated basic issues confronting forestry development in India which form the basis of the following programme structure.

- **Protect Existing Forests Resources**

It has three main sub-programmes of (i) forest protection, (ii) soil and water conservation, and (iii) protected areas and biodiversity conservation. These include the works of forest survey, demarcation and mapping, inventory, biodiversity conservation, protected area management, protection against poaching, encroachment and fire etc., and other related issues.

- **Improve Forest Productivity**

It has four main sub-programmes of (i) rehabilitation of degraded forests, (ii) research and technology development, (iii) development of NWFPs, and (iv) assisting private initiatives with

community participation. These involve mainly research, improvement in technology, enrichment planting, soil and water conservation, regeneration, rehabilitation and afforestation mainly in existing forests.

- Reduce Total Demand

It has three main sub-programmes for the efficient uses of (i) fuelwood and fodder, (ii) timber, and (iii) NWFPs. This includes the programmes for reduction of demand placed on forests through the technology of preservation, seasoning, substitutions, and other measures for the efficient utilization of forest products and also through biomass plantations.

- Strengthen Policy and Institutional Framework

It has three main sub-programmes of strengthening of (i) central forestry administration, (ii) central forestry institutions, and (iii) state forestry administration and institutions. These include the development of infrastructures such as buildings, communications etc. and strengthening of staff including HRD. This issue also covers all aspects of capacity-building, forest policy and legislation, public forest administration and organizational structure, research, planning and budgeting etc.

- Expand Forest Area

It has two main sub-programmes of (i) tree plantation on forest and non-forest lands, and (ii) people's participation in plantations and its protection. This issue includes the extension of forestry programmes in all kind of wastelands and marginal farm lands. It also includes the programmes of certain of plantation forests through wasteland reclamation, afforestation and promotion of agroforestry.

A National Afforestation and Eco-development Board (NAEB) was created for promoting afforestation, tree planting, ecological restoration, and ecodevelopment. The NAEB pays special attention to the regeneration of degraded forests and serves as a vital interface between external agencies and the state governments. Tree planting is the main focus, particularly through the Area-Orientated Fuelwood and Fodder Scheme, and the Integrated Afforestation and Ecodevelopment Programme. Efforts are being made to ensure that weaker sections of society and women emerge as the major beneficiaries of the activities of NAEB.

The introduction of the Eco-Development Programme has been one of the recent developments in the field of wildlife management. The objective is economic development for the people living in and around sanctuaries and national parks, in order to reduce their dependence on forest products and improve the ecological health of the protected areas. The scheme aims to increase land and forest resource productivity so that alternative avenues of employment and income are made in the immediate neighbourhood of people.

In addition to state-supported programmes, there is an array of management practices outside the formally declared forest areas that are followed in different parts of the country with different models involving agricultural crops, shrubs or non-wood vegetation. These include agro-forestry, community forestry, farm forestry, interface forestry, village woodlots, block plantations, strip plantations, improved fallow, alley cropping, road/canal/railway track-side plantations, etc.

However, accurate information on the land area covered by different models or on its economic performance is not available. There is a great scope for farm forestry in India which was initiated in the early seventies and is the largest segment of the national afforestation programme. More than 30 per cent of seedlings planted under afforestation programmes go to farm forestry.

However, sound research and counselling on potential species, improved planting materials, spacing and species combination, multiple uses, short rotation high value mixtures and market information needs to be promoted.

In addition to these conservation efforts, there are several sacred groves retained in the original undisturbed state due to their sanctity in different forest areas of the country. However, estimates of their area and details of the status of vegetation are not available.

India is working with several international organizations and other nations, bilaterally as well as multilaterally to achieve the aforesaid objectives. The Ministry of Environment and Forests is the nodal environmental agency in the country. It coordinates participation in international agreements relating to environment and handles bilateral cooperation, matters relating to regional bodies such as UNEP, ESCAP, SAARC, SACEP, the National Environmental Council and the India-Canada Environment Facility.

India has been pursuing its commitments under various conventions vigorously by initiating several measures nationally and by taking several important initiatives in the region. India is a party to the United Nations Framework Conventions on Climate Change, the objective of which is stabilization of the greenhouse gas concentrations in the atmosphere at levels that would prevent dangerous anthropogenic interference with the climate system. The convention enjoins upon the parties to implement commitments contained in its various provisions. India has actively participated in the deliberations of the Intergovernmental Panel on Forests, established by the Commission on Sustainable Development.

The MoEF is the technical nodal point for GEF facilities in India and, so far, nine projects related to the theme areas of GEF are being implemented while one has been completed. In addition, eleven projects have been approved in principle by GEF and are in the preparatory phase. The Small Grants Programme started in 1992 and managed by the UNDP on behalf of the GEF, is providing support to small scale, community-based activities which can contribute to the four GEF thematic areas.

India has participated in all the IPF/IFF meetings and agrees with the overall action relating to National Forest Programme, forest assessment, criteria

and indicators, traditional forest-related causes and underlying causes of deforestation. However, India has taken the view that there has to be an instrument to coordinate the efforts of international instruments and institutions. Accordingly, India has moved for the creation of a permanent forum such as the Global Forest Facility on the lines of the Global Environmental Facility (GEF), to continue the dialogue and discussions on contentious and unresolved issues. India has also taken the view that financial resources/funding is one a major problem area and therefore, it is necessary to assign this exclusive function to one of the International Arrangements and Mechanisms (IAMS). In consonance with the recommendations of the IPF, India prepared the National Forestry Action Programme in the year 1999 in consultation with the FAO, which incorporates the agreed commitments by India.

India's economic and trade policies which have a bearing on forest and forest products are being progressively fine-tuned to facilitate the conservation and sustainable use of forests. This is reflected in liberal imports of forest products to relieve pressures on forests, nationalization of the trade of certain forest products, incentives for wood substitution, subsidies for the use of fuel-saving devices and alternative sources of energy such as biogas and solar energy, and financial incentives to supply seedlings free of cost or at subsidized rates.

Several bilateral cooperation programmes and follow up of MoU/Joint Statements of Intent have been signed with Brazil, China, Germany, Iran, Russia, Tajikistan, Turkmenistan, USA and Vietnam in connection with the above-mentioned objectives.

External assistance for the Forestry Sector started in a meaningful manner in 1979 and since then 15 forestry projects implemented with external assistance have been completed in 14 states as on March 31, 1998 (MoEF, 1999). Approximately 2.57 mha have been covered under afforestation and 1679 million seedlings distributed through these projects at a cost of Rs 1700 crore. The thrust of external assistance is now on implementing projects geared towards overall development of the forest sector. The main donors for forestry projects are the World Bank, JBIC (Japan), DFID-UK, SIDA, EEC, UNDP Germany, etc.

Between 1981-1982 and 1991-1992, the percentage share of donor assistance in total plan outlay was around 30%. The provision for external assistance has shown an upward trend since 1994-1995. The combined outlay for these projects

was Rs 230 crore during 1994-1995 and has gone up to Rs 830 crore during 1998-1999.

Promoting efficient utilization and assessment to recover the full valuation of the goods and services provided by forests, forest lands and woodlands

India's economic and trade policies, which have a bearing on forest, and forest products are being progressively evolved to facilitate the conservation and sustainable use of forests. These policies are also in tune with Agenda 21's call for greater use of international trade. Average tariff rates in India have gone down as can be seen from the Figure 9.1 below. This has resulted in liberal imports of forest products, which have gone up over time (Table 9.2). In addition, there are incentives for wood substitution, subsidies for the use of fuel-saving devices and alternative sources of energy such as biogas and solar energy, and financial incentives to supply seedlings free of cost or at subsidized rates.

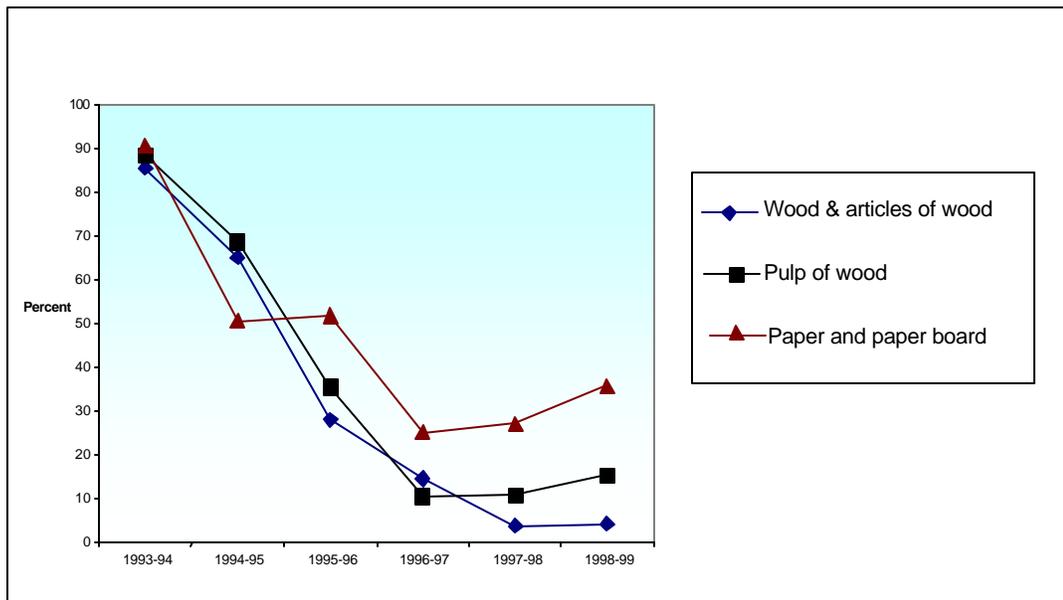


Figure 9.1 India's average tariff rates on select forest products 1993-1999 (%)

Table 9.2 Production and trade in industrial round wood and forest products

Year	Export		Import		Production	Forest Products	
	Industrial	Industrial	Industrial	Industrial		Imports	Exports
	(Quantity cum)	(value \$1000)	(Quantity cum)	(value \$1000)	(Quantity cum)	(Value 1000\$)	(Value 1000\$)
1993	2,314	663	272,463	30,570	24,691,00	291,381	16,799
1994	5,757	973	284,651	38,099	24,785,00	301,699	35,396
1995	5,867	977	355,580	48,754	24,879,00	478,735	37,466
1996	17,700	1,907	893,600	108,069	24,971,00	753,888	25,001
1997	16,700	1,810	1,052,400	130,231	25,064,00	785,514	36,062
1998	400	131	1,761,300	186,360	23,948,00	778,176	37,607
1999	400	131	2,099,000	198,640	24,038,00	789,321	54,971
2000	400	131	2,099,000	198,640	24,038,00	789,321	54,971

Source. FAO

Another way of exploiting the economic potential of forests efficiently is through 'eco tourism', as has also been recognised by the NFAP. The most inaccessible tropical rainforests, the most fragile coral reef systems and the tribal people in remote areas are within the reach of the global tourists. Eco-tourism, in its accepted sense, has assumed the shape of an industry, which makes minimal adverse impact on environment as well as on the local culture and heritage while helping to generate employment and income for the locals. Several state governments have taken steps to promote eco-tourism.

The economic value of the goods and services rendered by forests are usually underestimated. Agenda 21 calls for the development and improvement of methodologies for economic and non-economic values of all types of forests. In India, attempts have been made to develop and apply methods to quantify the tangible and intangible benefits of forests. To understand the real contribution of forests to the economy, the Government of India has initiated a process for Natural Resource Accounting, to be integrated with the conventional system of income accounts.

Establishing and/or strengthening capacities for planning, assessment and systematic observation of forests and related

programmes, projects and activities, including commercial trade and processes

There is a well-developed system for assessing and collating forestry data in the country. The Forest Survey of India, under the MoEF, objectively assesses the forest resources. The main activities are an assessment of the forest cover and preparation of forest cover maps biennially using remote-sensing data, estimation of growing stock and other land uses in different parts of the country through field inventory, preparation of thematic maps using aerial photographs and imparting in-service training to the officials of the forest departments of states/union territories in the applications of remote-sensing, Geographic Information System (GIS) and preparation of inventory essential for forest resource planning and management.

Forest Survey of India assessments since 1987 reveal that the country has been maintaining a fairly stable forest cover over the period (Table 9.3). The seventh assessment of 1999 reveals an increase in forest cover by 3896 sq km over the figure of 633,397 sq km in 1997.

Table 9.3 Forest cover estimates from 1987 to 1999

Assessment Year	Forest cover (sq km)	Percentage of geographic area
1987	640819	19.49
1989	638804	19.43
1991	639364	19.45
1993	639386	19.45
1995	638879	19.43
1997	633397	19.27
1999	637293	19.39

Source. Forest Survey of India (State of Forest Report - 1987 to 1999)

Concerns and strategies for sustainable development

The most common problem confronting the forestry sector is its inability to satisfy the many conflicting and escalating demands being placed on it. It is evident that future sustainable forestry development for India will require a comprehensive balanced and targeted strategy.

It is estimated that about 270 million tonnes of fuelwood, 280 million tonnes of fodder, over 12 million cubic metres of timber and countless non-wood forest products are removed from the forests annually, which are far beyond the sustainable limits. The average volume of 74.42 m³/ha with an incremental

annual growth of 1.36 m³/ha/year of Indian forests compares poorly with the global average volume of 120 m³/ha and average annual growth of 2.1 m³/ha. In addition, although the pace of diversion of forestland has come down, the area stipulated for compensatory afforestation has not been commensurate.

It is clear that the country's forest resources are not being managed to their full potential. Some of the reasons contributing to the present status are: sustainable forest management is complex, costly and difficult; and research and technology inputs have been low and sporadic.

One major factor that has contributed to the deterioration of forest resources in the country is the lack of adequate financial resources. Although share of forestry in the plan outlay, has increased over time, it is still small—the total outlay ranging from 0.32 per cent in the First Five-Year Plan to 0.94 per cent in the Eighth Five-Year Plan. To fulfil the objective of covering 33 per cent of the country's area by forests and tree cover (NFP, 1988), an annual programme of afforestation and regeneration of 3 million ha is required against the present level of 1.2 million ha/annum. To reach this target, the NFAP estimated an annual budget requirement of Rs 39.85 billion as against Rs 16.14 billion made available for the forestry and wildlife sector in 1998/99. This resource gap needs to be bridged by proper allocation of funds and also other innovative measures, including private sector involvement.

The involvement of the private sector needs to be encouraged through research and extension support, input supplies (e.g. technology, planting stock), credit facilities, utilization and marketing facilities, and other incentives. Often, available marketing arrangements for wood come through middlemen, and farmers do not obtain remunerative prices. High-return forestry and agro-forestry models for marginal areas are yet to be developed and extended. In some cases, legal restrictions on the harvesting and transport of forest products are a disincentive for private sector participation. Despite these impediments, the experience has shown that a wide range of functions could be entrusted to the private sector. Private initiatives have also demonstrated the ability to improve the productivity of forests. It is not enough to provide resources. The people's participation has to be ensured on a sustained basis. JFM, which has shown the potential benefits from community participation needs to be reinforced.

The National Forestry Action Programme recognized these imperatives and provided the road map for future developments in the forestry sector (Box 9.2). These concerns and proposed solutions are echoed in the approach paper to the Tenth Five-Year Plan that will guide the country's planning for the next five

years (2002-2007) (Box 9.3). It is envisioned that country will achieve 25% area under forests by the end of the X plan period and 33% by the end of the XI plan period, 2012.

Box 9.3 Approach Paper for the Tenth Five-Year Plan: Forests

The Approach Paper sums up the main concerns in the forestry sector as follows. *The problems and constraints in the forestry development include lack of awareness about 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, inadequate research and extension, weak planning capability, wastage in harvesting and processing, market imperfections, overemphasis on government involvement and control, low level of people's participation and NGOs involvement, lack of private sector participation, unwanted restrictions on felling, transport and marketing of forests produce grown by people, lack of inter-sectoral coordination and weakness and conflicting roles of public forest administration.*

The following strategies are proposed to address these concerns.

- Strengthening farm forestry and tree plantation in marginal and wastelands belonging to the poor.
- Integrated land-use planning
- Measures to sustain JFM beyond the project period
- Protecting women's usufruct rights and enabling women groups to collect and market non-timber forest products
- Rationalizing policies such as subsidies on government auctions of wood and bamboo to industries, which work against farmer interests and inhibits farm forestry
- Upgradation of forest technology such as to promote more gatherable biomass
- Conservation and promoting of bamboo by inter alia classifying it as an NTFP
- Prevention and control of forest fires
- Priority to agroforestry, mountain, watershed development, river valleys, arid areas, wastelands afforestation programmes
- Conservation and development of medicinal plants
- Research and technological development to increase productivity and production of new products along with focus on value addition, improved marketing, export and productive employment generation
- Promotion of coastal shelter belt plantations for prevention of natural calamities

It is also proposed that the government gradually withdraw from some segments and tap the potential of the local communities or an efficient market such as in the areas of marketing NTFPs or retail sale of fuelwood and bamboo.

The National Afforestation and Eco-development Board (NAEB) has prepared a proposal for an ambitious National Afforestation Programme (NAP) to be implemented from the Tenth Five-Year Plan. NAP will be a central sector scheme to be implemented through the Forest Development Agencies (FDAs) that are being created in Territorial and Wildlife Divisions. All existing schemes of the NAEB are to be merged into the NAP.

With these initiatives, it is expected that the objective of the National Forestry Action Programme—to enhance the contribution of forestry and tree resources to ecological stability and people centred development through qualitative and quantitative improvement in the forest resources—would be realized.

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Introduction

This chapter examines various initiatives in the area of biodiversity conservation to analyse how the country has performed against the objectives set out in Agenda 21. After a detailed discussion of biodiversity in India, the chapter presents main Agenda 21 concerns with respect to biodiversity conservation. This is followed by highlights of policy and other initiatives in India, which are analyzed to bring out achievements and concerns vis-à-vis Agenda 21 objectives. Finally, directions and strategies are proposed that would contribute to the efficient management and conservation of biodiversity including its rich genetic, species and ecosystem diversity.

Overview of biodiversity in India

India has a rich and varied heritage of biodiversity covering ten biogeographical zones, the trans-Himalayan, the Himalayan, the Indian desert, the semi-arid zone(s), the Western Ghats, the Deccan Peninsula, the Gangetic Plain, North-East India, and the islands and coasts (Rodgers; Panwar and Mathur, 2000). Biodiversity, which is defined as the variety and variability among living organisms and the ecological complexes in which they occur, is measured at three levels — the gene, the species, and the ecosystem. India is rich at all levels of biodiversity and is one of the 12 megadiversity countries in the world.

India's wide range of climatic and topographical features has resulted in a high level of ecosystem diversity encompassing forests, wetlands, grasslands, deserts, coastal and marine ecosystems, each with a unique assemblage of species. The forests cover an actual area of 63.73 million ha (19.39%) and consist of 37.74 million ha of dense forests, 25.51 million ha of open forests and 0.487 million ha of mangroves, apart from 5.19 million ha of scrub, comprise 16 major forest groups. These range from the tropical wet evergreen forests in the northeast to the sub-alpine and alpine forests of the Himalayas through the tropical dry deciduous and tropical thorn forests of Central and Western India. India has five distinct types of grasslands, the *Sehima-Dicanthium*, *Dicanthium-Cenchrus-Lasiurus*, the *Phragmites-Saccharum-Imperata*, the *Themeda-Arundinella*

and the temperate-alpine types, and account for a species diversity of about 1256 belonging to 245 genera (MoEF, 1999).

Wetlands include a rich diversity of inland and coastal wetland habitats covering 4.1 million ha of the landmass. A number of rare and threatened species of plants and animals including *Aldrovanda vesiculosa*, *Utricularia minor*, *Cervus eldii eldii* (Manipur brow-antlered deer), *Cervus duvaucelli* (swamp deer), and *Lepidochelys olivacea* (Olive Ridley turtle) are associated with wetland habitats. The coastline of India extends over 7,500 km while the marine ecosystems cover 2.1 million sq. km (MoEF, 1999). The under-explored marine world contributes 15% of the total faunal biodiversity of the country. India has some of the most unique mangrove swamps in the world, in the alluvial deltas of the Ganga, Mahanadi, Godavari, Krishna and Cauvery rivers and the Andaman and Nicobar islands, while coral reefs, considered the most productive marine ecosystems, occur in the Andaman and Nicobar islands, Lakshwadeep, and the Gulfs of Kutch and Mannar.

Deserts cover 2% of the Indian landmass and include the sandy Thar desert of Western Rajasthan and adjoining states, the salt desert of Kutch and the high altitude cold deserts of Jammu and Kashmir and Himachal Pradesh.

Surveys conducted so far in India have inventoried over 47,000 species of plants and over 89,000 species of animals over just 70% of the country's total area (MoEF, 1999). India's biogeographical location at the junction of the Agro-tropical, Indo-Malayan and Paleo-Arctic realms has contributed to the biological richness of the country. Amongst plants, significant diversity has been recorded in Pteridophytes with 1022 species, and Orchidaceae with 1082 species. A total of 89,451 animal species has been recorded in India accounting for 7.31% of the faunal species in the world (MoEF, 1999). The endemism of Indian biodiversity is high—about 33% of the country's recorded flora is endemic to the country and is concentrated mainly in the North-East, Western Ghats, North-West Himalaya and the Andaman and Nicobar islands. About 62% of the known amphibian species and 50% of the lizards are endemic to India, the majority occurring in the Western Ghats (MoEF, 1999).

The country is bestowed with immense agro-biodiversity and a rich diversity in landraces/traditional cultivars/farmers' varieties. A number of crop plants (384) are reported to be cultivated in India. This includes 168 species earlier reported under the Hindustani centre, one of the eight Vavilovian centres of origin and diversity. India has 326 species of wild relatives of crop plants. A total of 49 indigenous major and minor crops have been reported in the 'History of Agriculture in India', which include 5 cereals and minor millets, 4 pulses, 1

oilseed crop, 9 vegetables, 5 tuber crops, 11 fruits, 5 spices, 1 sugar yielding plant and 7 fibre crops. India is the centre of origin of 30,000-50,000 varieties of cultivated plants including rice, pigeonpea, mango, okra, bamboo, etc.

The National Bureau of Plant Genetic Resources has over 1,59,080 varieties and 1,07,018 germplasm collections. Much of the country's agrobiodiversity is in the custody of farming communities/tribals who followed age-old farming systems. Genetic diversity comprising native species and landraces is concentrated in the areas of the Western Ghats, northeastern Himalayas, southern plateau, central India and northwestern Himalayas. Wild relatives of wheat and barley are located in the Western and North-eastern Himalaya while a major centre for wild rice is the Eastern-Peninsular India. Domesticated livestock and poultry include 27 breeds of cattle, 8 breeds of buffalo, over 42 breeds of sheep, 20 breeds of goats, 7 breeds of camel, 8 breeds of horses, and a few types of pigs. Of about 20,000 species comprising the fish genetic resources of the world, nearly 11 per cent (or 2118 fish species) have been reported in India, including the finfishes from the Western and Eastern Ghats (MoEF, 2001).

This immense diversity has resulted in the inclusion of two Indian regions in the 25 global biodiversity hotspots. These 2 hotspots, the Western Ghats/Sri Lanka and the Indo-Burma region (covering the Eastern Himalayas) encompassing parts of India and adjoining countries are amongst the top eight most important hotspots (Myers, Mittermeier, Mittermeier et al., 2000). As many as 14 ecoregions lying completely or in part within India figure amongst the Global 200, which are outstanding examples of the world's diverse ecosystems based on criteria such as species richness, species endemism, unique higher taxa, unusual ecological or evolutionary phenomena, and global rarity of major habitat types. The Indian ecoregions are the Chhota-Nagpur Dry Forests, Eastern Deccan Plateau Moist Forests, Eastern Himalayan Alpine Meadows, Eastern Himalayan Broadleaf and Conifer Forests, Indus river delta, Maldives, Chagos, Lakshwadeep Atolls, NagaManipuri-Chin Hills Moist Forests, Rann of Kutch Flooded Grasslands, Southwestern Ghats Moist Forests, Sunderbans Mangroves, Terai-Duar Savannas and Grasslands, Tibetan Plateau Steppe, Western Ghats Rivers and Streams, Western Himalayan Temperate Forests (Olson and Dinerstein 1998). India accounts for 6% of the total number of ecoregions.

This biological diversity is reflected in the cultural diversity of the people whose very existence is tied to the continued maintenance and sustainable use of biological resources. India has a rich ethos of biodiversity conservation and traditional knowledge systems and it is these practices that have given rise to

informal and localized in situ conservation. Traditional farming practices are directly responsible for the country's treasure trove of agro-diversity. This respect for nature continues today, and the government has institutionalized biodiversity conservation by undertaking several activities for its conservation and sustainable use.

Article 48-A and Article 51-A (G) of the Directive Principles of State Policy in the Constitution of India state that 'the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife in the country', and 'to protect and improve the national environment including forests, lakes, rivers and wildlife, and to have compassion for the living creatures'. A focussed articulation of these concerns in programmes and policies was intensified after the 1992 Rio Summit and India's becoming a party to the Convention on Biological Diversity (CBD). The CBD has three main thrust areas: conservation of biodiversity, sustainable use of biological resources, and equitable sharing of benefits arising from its sustainable use. The CBD offers opportunities to India to realise benefits from its rich biological resources and associated traditional knowledge (MoEF, 2001).

Despite the many measures taken for the protection, conservation and sustainable use of biodiversity, many species and ecosystems are seriously threatened. The 2000 IUCN Red List of Threatened Species (IUCN, 2000) is provided in Tables 10.1 and 10.2.

Table 10.1 Threatened species of India

Taxonomic group	Number of threatened species
Mammals	86
Birds	70
Reptiles	25
Amphibians	3
Fish	3
Molluscs	2
Other	21
Invertebrates	
Plants	244
Total	459

Source. IUCN (2000). Red list of threatened animals. IUCN. Gland, Switzerland

Table 10.2 Threatened plants and animals of India by status category

	Ex	EW	CR	EN	VU	LR/c d	LR/n t	DD
Plants	7	2	44	113	87	1	72	14
Animals	0	0	18	54	143	10	99	31

Legend. EX-extinct; EW-Extinct in the Wild; CR- Critically Endangered; VU-Vulnerable; LR/cd-Lower risk conservation dependent; LR/NT

Source. IUCN (2000), Red list of threatened animals. IUCN. Gland, Switzerland

Biodiversity and Agenda 21

The broad vision for biodiversity in Agenda 21 is its conservation and sustainable use accompanied by equitable benefit sharing mechanisms. This includes a focus on enhancing national biodiversity protection measures involving the development of national strategies; mainstreaming of biodiversity concerns; ensuring the fair and equitable sharing of the benefits accruing from biodiversity; country-wide studies on biodiversity; fostering traditional methods and indigenous knowledge; encouraging biotechnological innovations along with the equitable sharing of their benefits and promoting regional and international cooperation. It also called for reinforcing at the national and international level, capacities for the assessment, study, and systematic observation and evaluation of biodiversity.

The above objectives of Agenda 21 are to be achieved through 3 broad activity areas:

- Management issues dealing with the development of national level institutions, strategies, legislation, policies, plans and programmes for the conservation and sustainable use of biological diversity; measures to encourage a greater understanding and appreciation of the value of biological diversity; and environmental impact assessments;
- Data and information needs, i.e. research, data collection, inventories and the networking and sharing of information through various means, and;
- International and regional cooperation and coordination for strengthening communication, technical and scientific collaboration and promoting co-operation between parties to relevant conventions.

The means of implementation for the above activities focus on financing mechanisms, scientific and technological means, human resource development, capacity-building and partnerships with the local community.

Review and analysis of initiatives for biodiversity conservation in India

Highlights of major initiatives for biodiversity conservation

Various conservation, wise-use and resource management initiatives have been taken over millenia dating back to people's earliest associations with nature. Since the forests and other natural resources served people in a myriad ways, providing them with medicinal plants, food, fuel and fodder, a body of local taboos, practices and folklore grew up around the forest and wildlife. This led to the creation of sacred forests, trees and tanks as well as the imbuing of several species of wildlife with supernatural powers or the advent of wise-use practices and management mechanisms. The earliest codified law on wildlife protection traces back to the third century BC when King Ashoka made a law in the matter of preservation of wild life and environment where he prohibited the killing of certain species of animals such as the parakeet, rhinoceros etc.

In modern times too, India has been at the forefront of biodiversity conservation and over the years the country has set in place several institutions and measures for the conservation and sustainable use of biodiversity. Numerous actions were taken long before the Earth Summit was even envisaged. These activities are highlighted vis-a-vis the objectives of Agenda 21 in Table 10.3.

Table 10.3 Highlights of major initiatives for biodiversity conservation

Year	Initiative	Scope
1. Legislative and regulatory measures		
1927	Indian Forest Act	Colonial legislation for state ownership of forest resources and to facilitate trade and timber
1972 and amended in 1991	Wildlife (Protection) Act	To protect wild animals, birds and plants including their habitat

1976	42 nd amendment of the constitution of India	Article 48a under the Directive Principles of State Policy and Article 51A (g) of the fundamental duties in the Constitution mention that the "State shall endeavour to protect and improve the environment and safeguard forests and wildlife in the country and protect and improve the natural environment including forests, lakes, rivers, wildlife and have compassion for living creatures
1980	Forest (Conservation) Act	Control diversion of forest land for non-forest purposes
1986	Environment (Protection) Act	Legislation for environmental protection

Year	Initiative	Scope
1989	Manufacture, Use, Import, Export and Storage or Hazardous Micro organisms and Genetically Engineered Organism or Cell Rules, 1989	To regulate the storage, use, trade, transport and disposal of hazardous wastes
1991	Coastal Regulation Zones	Notification issued under the Environment (Protection) Act, 1986 for the protection of coastal areas
1994	Environmental Impact Assessment notification	Issued under the Environment (Protection) Act 1986 making EIAs mandatory for 30 sectors

1997	Amendment of the EIA notification	The notification specifies the importance of conserving certain ecologically important and sensitive areas such as National Parks, Sanctuaries, Tiger Reserves and Reserve Forests. it mandates clearance for any project located within the radius of 25 kilometres of the boundary of Reserve Forests, ecologically sensitive areas including National Parks, Sanctuaries and Biosphere Reserves.
Subsequent notifications for fragile areas	Regulatory notifications for fragile areas under the Environment (Protection) Act, e.g. Dahanu taluka, Doon valley Aravalli range, etc.	In addition to the EIA requirements, specific prohibitions and regulations operate in designated ecologically sensitive areas
1996	Panchayats (extension to the Scheduled areas) act, 1996	An Act to provide for the extension of the provisions of Part IX of the Constitution relating to the Panchayats to the Scheduled Areas and which devolved natural resource management with the Panchayats. The Panchayats are empowered to legislate on matters specified in the Eleventh Schedule. The items that relate to biodiversity include land improvement, soil conservation, watershed development, social forestry, farm forestry, minor forest produce, fuel fodder etc. The Panchayat Act regulates the right to minor forest produce, management of water bodies etc.

2000	Biodiversity bill	Proposed legislation to regulate access to biological resources, sustainable use and equitable benefit sharing
2. Policy initiatives		
1983 and updated in 2002 (Operative from 2002-2016)	National Wildlife Action Plan	Wildlife plan for the country leading to creation of protected areas and wildlife management policies
1990	JFM guidelines	Need and procedure for the involvement of village communities and voluntary agencies in the protection and development of degraded forests
Year	Initiative	Scope
1991	Initiation of Ecodevelopment programmes	In situ conservation of biological diversity involving local communities
1992	National Conservation Strategy and Policy Statement on Environment and Development	Lays down guidelines for integrating environmental concerns into developmental planning
1993	Environment Action Programme	Aims at improving environmental services and integrating these concerns in developmental programmes in order to carry forward Agenda 21
1993	National Lake Conservation Plan	Focus is in particular on urban lakes
1998	National Zoo Policy	Roles, responsibilities and strategies for captive breeding and zoo management
1999	National Policy and Macrolevel Action Strategy on Biodiversity	Biodiversity policy for the country
2000	Revised JFM guidelines	Strengthening of JFM in the country

2000	Creation of Forest Development Agencies under the Integrated Afforestation and Eco-development Projects Scheme (IAEPS) of the National Afforestation and Ecodevelopment Board (NAEB)	This is to establish convergence in flow of funds under various schemes for development of rural areas so as to establish interconnectivity between rural development in forest fringe villages, forest conservation and employment generation with smooth and timely flow of funds to the field level.
2002	Wildlife Conservation Strategy	Strategy for conserving wildlife
Development process is underway	National Biodiversity Strategy and Action Plan	To draft a strategy and action plan for the country built on several tiers of strategies, local, state, regional, thematic and cross-cutting

3. Data and Information Needs

Established in 1890	The Botanical Survey of India (BSI)	Survey and inventorization of flora
Established in 1916	The Zoological Survey of India (ZSI)	Survey and inventorization of fauna
Established in 1981	The Forest Survey of India	To assesses the forest cover, for planning and monitoring purposes
1982	All India Co-ordinated Research Project on Ethnobiology	To identify and document indigenous knowledge of biodiversity
1982	The Environmental Information System (ENVIS) which is the clearing house mechanism for the CBD in India	Collect and disseminate information on the conservation and management of biological resources
1997	All India Co-ordinated Project on Taxonomy	To enhance capacity building on taxonomy in the country

4. Management

1 st park, Hailey National Park (now Corbett NP) set up in 1935	Creation of a network of protected areas-national parks and sanctuaries	Currently (in 2001) there are 88 national parks and 490 sanctuaries
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1973	Project Tiger	Currently, 27 project tiger reserves with 6 more proposed reserves
1986	Establishment of biosphere reserves	Identify representative ecosystems for conservation that are inclusive of people's livelihood needs. Currently there are 12 reserves
Year	Initiative	Scope
Task force on elephants in 1990 led to Project Elephant in 1992	Project Elephant	To ensure long term survival of identified viable populations of elephants in their natural habitat
1 st private zoo established in 1854 by royalty. First public zoo established in Chennai.	Creation of various exsitu sites such as botanic gardens (33), zoological gardens (275), gene banks including the	Exsitu conservation of biological diversity
Indian Botanic Garden established in 1787	National Bureau of Plant Genetic Resources, the	
Indian National Gene Bank established in 1996	National Bureau of Animal Genetic Resources, the National Bureau of Fish Genetic Resources, Tropical Botanical Garden and Research Institute, etc. along with 4 gene banks	
5. Institution and capacity building		
1972	Indian Board of Wildlife	Apex wildlife advisory body of the Indian Government
1980	Department of Environment that was later upgraded into the Ministry of Environment and Forests (MoEF) in 1985	Nodal agency for planning, coordination and implementation of environmental and forestry programmes
1982	The Wildlife Institute of India (WII)	Undertakes studies of endangered species of animals and critical ecosystems
1986	National Committee on Coral Reefs,	Implementing programmes for these ecosystems

	Mangroves and Wetlands	
1986	National Committee for Biosphere Reserves	Set up a system and monitor biosphere reserves
1988	G B Pant Institute of Himalayan Environment and Development	Focal agency to advance scientific knowledge, to evolve integrated management strategies, demonstrate their efficacy for conservation of natural resources and to ensure environmentally sound development in the entire Indian Himalayan Region (IHR).
1990	Salim Ali Centre for Ornithology and Natural History (SACON)	Undertakes research and extension activities relating to all aspects of ornithology and natural history of other forms of life
1992	Central Zoo Authority	Guides and monitors functioning of zoos
1992	National Afforestation and Ecodevelopment Board (NAEB)	Promoting afforestation and ecodevelopment
2000	The Indian Institute of Biodiversity is being set up at Itanagar, Arunachal Pradesh	To conduct biodiversity research
6. International and regional cooperation and coordination		
1972	Stockholm Conference on Environment and Development	This conference lead to environmental protection and conservation of natural resources emerging as a key national priority
1972	Convention for the Protection of the World Cultural and Natural Heritage 1972	Appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection,
Year	Initiative	Scope
		conservation, presentation and rehabilitation of the world's natural heritage.

		Currently, 5 sites in the country.
1976	Ratification of CITES (Convention on the International Trade in Endangered species of wild Flora and Fauna)	International cooperation for the protection of certain species of wild fauna and flora against over-exploitation through international trade
1979 (Appendices as amended in 1985 & 1988)	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	To conserve migratory species paying special attention to 'species the conservation status of which is unfavourable
1981	Ratification of Ramsar Convention	Currently, 6 Ramsar sites in the country
Signed in 1994 into force in 1996	Desertification Convention	To combat desertification
Became a party to the CBD in early 1994	Signatory to the Convention on Biological Diversity	The conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits
Signed by India on 23January, 2001	Cartagena Protocol on Biosafety	Protect biological diversity from the potential risks posed by living modified organisms (LMOs) resulting from modern biotechnology

The country had internalized biodiversity concerns in its policies in the early 1970s, after the Stockholm Conference was held and thus had implemented the greater proportion of Agenda 21's objectives prior to 1992. In subsequent years, more such measures have been taken. The following section discusses the main achievements and concerns vis-à-vis the goals set out in Agenda 21.

Achievements

Management issues related to institutions, legislation, policies, plans and programmes for the conservation and sustainable use of biological diversity

Institutional initiatives (including those related to data and information needs)

The Ministry of Environment and Forests (MoEF) is the nodal agency in the Government of India for planning, promotion, coordination and overseeing the implementation of environmental and forestry programmes. The MoEF is also

the focal point for implementation of the Convention on Biological Diversity. The mandates of the Ministry inter-alia include survey of flora, fauna, forests and wildlife, and conservation of natural resources. These objectives are supported by legislative and regulatory measures. A number of institutions have been set up under the MoEF's umbrella. Surveys of flora and fauna are carried out by the Botanical Survey of India (BSI) established in 1890, and the Zoological Survey of India (ZSI) established in 1916. The Forest Survey of India established in 1981 assesses the forest cover, with a view to develop an accurate database for planning and monitoring purposes. The Wildlife Institute of India undertakes studies of endangered species of animals and critical ecosystems. The Salim Ali Centre for Ornithology and Natural History (SACON) conducts research on ornithology and natural history.

Over 47 000 species of plants and 89 000 animals species have been recorded by the BSI and ZSI respectively. The Surveys have also published Red Data Books on endangered species. The voucher specimens are preserved in Central National Herbarium (CNH) of BSI and National Zoological Collection (NZC) of ZSI. The Ministry has launched the All India Coordinated Project on Capacity Building in Taxonomy in 1999-2000. So far, 11 centres for research and two centres for training have been established. The project envisages establishment of centres for research in identified priority gap areas (e.g., virus, bacteria, microlepidoptera, etc.) in the field of taxonomy, education and training (fellowships, scholarships, chairs, career awards etc.) and strengthening of BSI and ZSI as the coordinating units.

The Forest Survey of India publishes every three years, a State of Forests in India report based on remote sensing and ground truth data. The government is also in the process of setting up an institute specifically for biodiversity research at Itanagar, Arunachal Pradesh (MoEF, 2001).

Many autonomous institutions such as the Bombay Natural History Society (BNHS), French Institute, etc. have also contributed extensively to the identification and documentation of biodiversity.

Programmes for conservation and management

Insitu conservation

India has an extensive system of protected areas (PA) encompassing at present 89 national parks and 496 sanctuaries (MoEF, 2001). These cover an area of 1.83 lakhs sq km in the major biogeographical zones of India. The Tura Range in the Garo Hills of Meghalaya is a gene sanctuary for preserving the rich native

diversity of wild *Citrus* and *Musa* species. Sanctuaries for rhododendrons and orchids have been established in Sikkim.

The Ministry of Environment and Forests constituted the National Afforestation and Eco-development Board (NAEB) in August 1992. NAEB has evolved specific schemes for promoting afforestation and management

Twelve biodiversity rich areas of the country have been designated as Biosphere Reserves applying the UNESCO/MAB criteria. The Nilgiri BR has been recently approved for inclusion within the International Network of Biosphere Reserves recognized by UNESCO (United Nations Educational, Scientific, and Cultural Organization). Under the World Heritage Convention, five natural sites have been declared as World Heritage Sites including Kaziranga NP, Keoladeo Ghana NP, Manas WLS, Nanda Devi NP and Sunderbans NP.

Project Tiger, initiated in 1973 to maintain viable populations of the tiger and its natural habitat, has grown over the years to 27 tiger reserves in 14 states and covers an area of 37 761 km². This exemplary conservation initiative has not only benefited the tiger, but acted as an umbrella programme that has benefited a number of other endangered species such as the swamp deer, elephant, rhino and wild buffalo, apart from protecting large swathes of habitat. The second phase of Project Tiger has expanded the programme to include the establishment of guidelines for tourism in tiger reserves, establishment of nature interpretation programmes, integration of local populations through ecodevelopment programmes and management of buffer areas.

Project Elephant is another landmark conservation initiative to protect the Asian elephant that was formally launched in 1992 on the recommendations of a taskforce set up by the MoEF in 1990 to look into the conservation of the Asian elephant. The objective of Project Elephant is to assist states having ranging populations of wild elephants to ensure the long-term survival of identified viable population of elephants in their natural habitats by providing the range states with financial as well as technical and scientific assistance. Project Elephant is aimed at the ecological restoration of existing natural habitats and migratory routes of elephants, development of scientific and planned management for conservation of elephant habitats and viable populations, measures aimed at mitigating human-elephant conflicts, anti-poaching measures as well as enhanced research and training. Other special programmes have been launched for the insitu conservation of mammals including the Indian rhino, lion, certain primates (such as the Indo-US Primate Project in Northeast India) and aquatic mammals including river dolphins.

The Indian Council of Forestry Research and Education (ICFRE) has identified 309 forest preservation plots of representative forest types for conservation of viable and representative areas of biodiversity. 187 of these plots are in natural forests and 112 in plantations, covering a total area of 8 500 hectares. Eco development programmes for the in situ conservation of biodiversity involving local communities has been initiated in recent years. The concept of eco development integrates ecological and economic parameters for sustained conservation of ecosystems by involving the local communities near protected areas.

Besides forest biodiversity, wetland conservation has been a priority for to the government since the late 1980s. In 1986/87, the Indian government initiated a programme on the conservation and management of mangroves and coral reefs and a national committee was constituted to advise the government on policy and management aspects of mangrove ecosystems. Fifteen mangroves and four coral reefs were identified for conservation and management, and state-level steering committees have been formed to coordinate the implementation of Management Action Plans for these areas. This year, another 15 mangrove areas have been added to the list. The major reef formations in India are found in the Gulf of Mannar, Palk Bay, Gulf of Kutch, Andaman and Nicobar islands, and Lakshadweep islands. Primary, fragile coral reefs that are a conservation priority include Lakshadweep, Andaman and Nicobar islands, Gulf of Mannar, Gulf of Kutch. The Indian Coral Reef Monitoring Network was set up to cover activities relating to coral reefs including research and monitoring, training and capacity-building, establishment of a database, etc.

In situ conservation of medicinal plants is a priority issue. With the collaboration of the State Forest Departments of Kerala, Karnataka and Tamil Nadu, the Foundation for Revitalisation of Local Health Traditions has established 30 Medicinal Plant Conservation Areas as well as 15 parks to store the germplasm of threatened, rare and endemic, medicinal plants. In situ conservation of agro-biodiversity has been strengthened through steps taken by the government and NGOs to protect the conservation traditions of farming communities.

Exsitu conservation

Exsitu conservation in the country has been institutionalized by setting up botanic and zoological gardens as well as a number of gene banks including the National Bureau of Plant Genetic Resources (NBPGR), the National Bureau of Fish Genetic Resources (Indian Council of Agricultural Research) and the

Tropical Botanic Garden and Research Institute. The Indian National Gene Bank was set up by the NBPGR to house collections of indigenous germplasm, seeds, propagules, safe-keep duplicate germplasm of other organizations and carry out the distribution and exchange of material.

The Central Zoo Authority has been set up to oversee the functioning of zoos, carry out planned breeding programmes and has provided detailed guidelines to zoos to monitor their activities. The National Zoo Policy, 1998, clearly identifies roles, responsibilities, objectives and strategies for ex situ conservation centres which may be broadly classified into:

- Supporting the conservation of endangered species
- Providing opportunities for scientific studies useful for conservation in general and creation of database for sharing between agencies involved in insitu and exsitu conservation
- To inspire amongst zoo visitors empathy for wild animals, an understanding and awareness of the need for conservation of natural resources and for maintaining the ecological balance

The total number of zoos, animal parks and aquaria is about 300, while there are 34 botanic gardens in the country including the National Botanical Garden in NOIDA, Uttar Pradesh (MoEF, 1998). A scheme entitled 'Assistance to Botanic Gardens' provides one-time assistance to botanic gardens to strengthen and institute measures for the exsitu conservation of threatened and endangered species in their respective regions. NGOs are also active in exsitu conservation of reptiles including for example, the Chennai Snake park, Madras Crocodile Bank, Pune Serpenterium and Calcutta Snake Park.

In situ conservation of selected species of birds and reptiles has been fortified through captive breeding programmes. The Government of India started a crocodile breeding and management project in 1976 to save the three endangered crocodilian species, the fresh water crocodile, salt water crocodile and the *gharial*. Thousands of crocodiles of these three species have been reared at 16 centres and several of these have been released into the wild. Eleven sanctuaries have been declared specially for crocodile protection including the National Chambal Sanctuary in Madhya Pradesh. The endangered white-winged wood duck was also bred in captivity and released into Protected Areas of the Northeast, in an Indo-British collaborative programme.

Policy and regulatory initiatives

The National Wildlife Action Plan, 1983 was a landmark document that laid the foundation for the establishment of a network of protected areas to cover representative samples of all major wildlife ecosystems. It also provided for a wide spectrum of wildlife activities including the setting up of botanical and zoological gardens, research and monitoring facilities and the control of wildlife trade and poaching. An updated version of the plan operative from 2002-2016 is now in place. The National Conservation Strategy and Policy Statement on Environment and Development in 1992, along with the National Forest Policy, is a major policy instrument of the government for integrating conservation considerations in the policies and programmes of other governmental sectors such as agriculture, irrigation, animal husbandry, industry, mining, tourism, etc. India now also has a Wildlife Conservation Strategy, 2002 in which wildlife and forests have been designated as priority sectors at the national level.

The Forest (Conservation) Act, 1980 controls diversion of forest land for non-forest purposes. Details of this act are given in Chapter 9. The Wildlife (Protection) Act is the single most significant statute on wildlife conservation in India. Under it, the protected areas have been created or given legal protection. Though there were several laws relating to wildlife prior to 1972, the WLPA was India's first comprehensive legislation, covering the whole country. The WLPA provides for three categories i.e. national parks, sanctuaries and closed areas. The areas that comprise national parks and sanctuaries include a broad range of biodiverse regions and can include reserve forests, protected forests, revenue land including lands that were once used as common property resources by villagers, and private (mostly agricultural and plantation) land. The WLPA prescribes both prohibitive and permissive provisions for the use of the categories of protected areas within its legal mandate (Upadhyay and Upadhyay, 2000). The highest degree of protection is accorded to national parks where no human interference is permitted except that are beneficial to conservation. In case of sanctuaries certain rights may be permitted by the Collector in consultation with the Chief Wildlife Warden (Section 24 (2) (c)) (Upadhyay and Upadhyay, 2000).

Biodiversity concerns as being integral to forest management and the advent of conservation forestry was emphasized as early as 1988, in the National Forest Policy. The Forest Policy of 1988 (NFP) spelt a complete paradigm shift from the earlier policies. Unlike the use-oriented forest policy of 1952, the present policy emphasizes the ecological role of forests, and the meeting of rights and concessions from them to be primarily for the bonafide use of communities living within and around the forest areas, especially tribals. No other policy has

made such a radical pro-people approach and this can be used as a benchmark of the basic values that any development policy must embody. The policy clearly states 'the principal aim of forest policy must be to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all life forms, human, animal and plant. The derivation of direct economic benefit must be subordinated to this principal aim.'

The 1988 Forest Policy was articulated through the Joint Forest Management (JFM) guidelines issued in 1990 and revised in 2000, that provided for village communities involvement in the protection and regeneration of forests. Details are provided in Chapter 9. This mandate has been further strengthened in the National Forestry Action Programme, 2000.

The Eco-development programme is another initiative for local communities and aims at economic development for the people near protected areas in order to reduce their dependence on the forest resources of the protected areas. This programme includes a range of interventions aimed at rural development, enhancing agriculture, minor irrigation, raising fuel and fodder plantations, etc.

The Environment Protection Act, 1986 was the response to a widely-felt need for a general legislation for environment protection (refer to Chapter 2 for details). The EPA has been used in the past to protect fragile or biodiverse regions such as the Dahanu taluka. Under the EPA as well, in 1991, the MoEF issued a notification for the protection of coastal areas known as Coastal Regulation Zones (CRZ) that led to the formulation of State-level Coastal Zone Management Plans.

The Biodiversity Bill is an important mechanism for regulating access to biological resources and in establishing benefit-sharing arrangements. It was referred to the Department Related Parliamentary Standing Committee on Science, Technology, Environment and Forests, for further examination which has approved it, making a few principal changes in the original draft. With the new set of recommendations, the Bill has been laid in both the Houses of Parliament.

The legislation primarily addresses the issue concerning access to genetic resources and associated knowledge by individuals, institutions or companies, and equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people. The legislation provides for setting up of a three-tiered structure at national, state and local level. Section 8 (i) provides for the establishment of the National Biodiversity Authority which deals with matters relating to requests for access by foreign individuals,

institutions or companies, and all matters relating to transfer of results of research to any foreigner; imposition of terms and conditions to secure equitable sharing of benefits and approval for seeking any form of Intellectual Property Rights (IPRs) in or outside India for an invention based on research or information pertaining to a biological resource obtained from India. The State Biodiversity Boards deal with matters relating to access by Indians for commercial purposes and restricts any activity that violates the objectives of conservation, sustainable use and equitable sharing of benefits. The Biodiversity Management Committees are to be set up by institutions of self-government in their respective areas for conservation, sustainable use, documentation of biodiversity and chronicling of knowledge relating to biodiversity. Biodiversity Management Committees are to be consulted by the National Biodiversity Authority and State Biodiversity Boards on matters related to use of biological resources and associated knowledge within their jurisdiction.

All foreign national/organizations require prior approval of the NBA for obtaining biological resources and/or associated knowledge for any use. Indian individuals/entities require approval of the NBA for transferring results of research with respect to any biological resources to foreign nationals/organizations. Indian citizens and organizations are required to give prior intimation to the concerned SBB about obtaining any biological resource for commercial use, and the SBB may prohibit or restrict the activity if found to violate the objectives of conservation, sustainable use and benefit-sharing.

Section 18(iv) stipulates that one of the functions of NBA is to take measures to oppose the grant of IPRs in any country outside India on any biological resource obtained from India or knowledge associated with such a biological resource. For ensuring equitable sharing of benefits arising from the use of biological resources and associated knowledge, Sections 19 and 21 of the Biodiversity Bill 2000, stipulate prior approval of the National Biodiversity Authority (NBA) before their access. While granting approval, NBA will impose terms and conditions that secure equitable sharing of benefits.

Local people and communities of the area will have free access to use biological resources within the country. Issues relating to protecting, recognizing and rewarding traditional knowledge (TK) associated with biological resources are very complex. The modalities of protecting TK are still emerging and evolving. The nature of entitlements and share in benefits is also a grey area.

Realizing the need to ensure that the holders of TK which is not still in the public domain should be able to get the benefits arising from the use of such

knowledge, an enabling provision has been made for protecting the TK in the Biodiversity Bill 2000. Section 36(iv) provides for protection of knowledge of local people relating to biodiversity through measures such as registration of such knowledge, and development of a *sui generis* system. While granting approvals for access, NBA will impose terms and conditions so as to secure equitable sharing of benefits. These benefits inter alia include:

- Grant of joint ownership of intellectual property rights to the National Biodiversity Authority, or where benefit claimers are identified, to such benefit claimers;
- Transfer of technology;
- Location of production, units in such areas;
- Association of Indian scientists, benefit claimers and the local people with research and development in biological resources and bio-survey and bio-utilization;
- Setting up of a venture capital fund;
- Payment of monetary compensation and other non-monetary benefits to the benefit claimers as the National Biodiversity Authority may deem fit; and
- The legislation provides for setting up of biodiversity funds at central, state and local levels. Benefits will be given directly to individuals or group of individuals only in cases where biological resources or knowledge are accessed directly from them. In all other cases, monetary benefits will be deposited in the Biodiversity Fund which in turn is used for the conservation and development of biological resources and socio-economic development of areas from where resources have been accessed.

Section 36(i) requires the Central Government to develop national strategies, plans, programmes for the objectives of the Act including measures for the identification and monitoring of areas rich in biodiversity, promotion of insitu and exsitu conservation, incentives for research, training, etc. Section 36(ii) calls for integration of biodiversity concerns into relevant sectoral or cross-sectoral activities. Sections 37 (I) and 38 requires the state government to notify biodiversity heritage sites and the central government to notify threatened species respectively.

In India, a well-documented example of benefit sharing with local communities already exists (Anuradha, 2000). This is the Kani-TBGRI model in Kerala State that is included in Box 10.1.

Box 10.1 Kani-TBGRI model in Kerala State

Kani is a tribal community inhabiting the Southern Western Ghat region of Kerala. In 1957, a team of scientists from the Tropical Botanic Garden and Research Institute (TBGRI) undertook an ethnobotanical field study in the tribal-inhabited Western Ghat region of Kerala. During this expedition, they came across interesting ethnomedical information on a wild plant *Trichophus zeylanicus*, locally called as 'Arogyapacha' by the Kani tribe. The scientists noticed that the Kani tribals accompanying the team frequently ate some fruits that kept them energetic and agile. When asked about the source of the fruit, the Kani men were initially reluctant to reveal the information. The team convinced the Kani men that information would not be misused and that if any marketable drugs/products got developed, the benefits accrued would be shared with the tribe. Pharmacological investigations of the fruit confirmed its anti-fatigue properties. Detailed chemical and pharmacological investigations showed that the leaves contained various glycolipids and some other non-steroidal compounds with anti-stress and anti-hepatotoxic properties. The team developed a polyherbal formulation that was named 'Jeevni'. After satisfactory clinical evaluation this herbal drug was released for commercial production. After negotiations with various interested parties, the manufacturing licence of 'Jeevni' was transferred to the Aryavaidya Pharmacy Coimbatore Ltd. for a licence fee of Rs 10 lakhs for a period of 7 years. The TBGRI in consultation with the tribal community has worked out an arrangement for benefit-sharing. According to this arrangement, the TBGRI has agreed to share 50% of the licence fee and royalty with the tribal community. In November 1997, a number of Kanis got together, and with assistance from the TBGRI, registered a trust call the Kerala Kani Samudaya Kshema Trust, comprising nine members, all of them tribals. The decision to form the trust was taken at a local meeting of around 40 Kanis. The trust deed states as its objectives; welfare and development activities for the Kanis of Kerala; preparation of a biodiversity register to document the Kanis' knowledge base; and evolving and supporting methods to promote the sustainable use and conservation of biological resources.

India has prepared a National Policy and Macrolevel Action Strategy on Biodiversity through an extensive consultative process. This document is a macro level statement of policies, gaps and further actions needed for conservation and sustainable use of biological diversity.

In a major advancement for the cause of biodiversity conservation in the country and in compliance with requirements of the Convention on Biological Diversity, the drafting of the country's National Biodiversity Strategy and Action Plan (NBSAP) with funding support from GEF, the Global Environmental Facility, is now underway. The strategy and action plan are very broad in scope and comprehensive in coverage and propose to prepare detailed action plans at sub-state, state, regional and national levels based on the framework Policy and Action Strategy on Biodiversity. NBSAP is India's biggest planning and development process aiming at conservation and sustainable use of biological diversity. A decentralized approach has been adopted for developing the NBSAP. Under the NBSAP, about 20 local micro-planning process at village to district levels, 33 state and union territory level processes, 10 planning exercises at ecological regions cutting across states, are engaged in

collecting a variety of area specific information and perspectives. In addition, national working groups are preparing action plans on 14 themes. About 75 executing agencies at various levels across the length and breadth of the country are involved in the preparation.

The process is participatory, tapping into the knowledge of diverse stakeholders and incorporating a variety of strategies for its development such as workshops and public meetings, consultations, expert inputs, etc. For implementation of the NBSAP project, an arrangement between a private company, Biotech Consortium India Ltd. (BCIL) and an NGO, Kalpavriksh has been worked out. While BCIL acts as the coordinating agency to deal with administrative financial and logistic arrangements, Kalpavriksh is the coordinator of a Technical and Policy Core Group (TPCG) which is responsible for technical execution of the project. The institutional structure for development of the Strategy and Action Plan is detailed in Table 10.4.

Table 10.4 Institutional structure of the NSBAP process

Level	Functions	Composition
<i>National</i>		
Steering Committee (SC)	Overall guidance and monitoring	Relevant GOI ministries/agencies, independent experts, NGO representatives
National Project Director and Team (NPD)	Overall execution and direction	MoEF Joint Secretary and team
Technical and Policy Core Group (TPCG)	Conceptualization, execution, monitoring, and finalization of process; integration of all SAPs	Thematic and geographically representative experts
Administrative Coordination Agency (ACA)	Administrative and financial execution of process	Biodiversity Consortium India Limited
Thematic Working Groups (TWGs)	Preparation of thematic SAPs	Relevant governmental and non-governmental experts, geographically representative (including from local communities)
Inter-state, Ecoregional Working Groups (BWGs)	Preparation of ecoregional SAPs	Relevant governmental and non-governmental experts, geographically representative (including from local communities)
<i>State</i>		
State Steering Committee (SSC)	Conceptualization, guidance and monitoring	Relevant state government agencies, NGO representatives, community/grassroots representatives
State Nodal Agency/agencies	Overall execution, substantive and administrative	Relevant state agency and/or NGOs
Thematic Working Groups (TWGs)	Preparation of thematic SAPs at state level	Relevant governmental and non-governmental experts (including from local communities)
<i>Local/sub-state</i>		
District/Local Advisory Committee (D/LAC)	Conceptualization, guidance, and monitoring	Relevant governmental and non-governmental experts, in particular local community and grassroots organization members
District/Local Nodal Agency	Execution, substantive and	Relevant district-level or local agency, in

Level	Functions	Composition
	administrative	particular people's representative agencies, grassroots organizations

The expected outcome of the NBSAP project is an implementable and realistic action plan, which can be easily translated into a number of projects at the ground level in areas of priority that would contribute significantly towards conservation and sustainable use of biodiversity in the country.

The government has also recently issued policy and guidelines for ecotourism in India (Box 10.2).

Box 10.2 Ecotourism in India

Ecotourism may be defined as nature based tourism that is educative and ensures the sustainable use of environmental resources, while producing viable economic opportunities for the host communities.

India's geographic diversity provides a wealth of ecosystems that currently or potentially could support ecotourism activities. These include biosphere reserves, wildlife sanctuaries, mangroves, coral reefs, deserts, mountains and forests, flora and fauna, seas, lakes and rivers and caves. While specific statistics on ecotourism growth in India are not available, statistics on visitation to selected parks and sanctuaries provide some indicators showing growing trends in visitor interest in nature-based activities in park settings. Recognizing the enormous potential of ecotourism in India, the government issued a policy on ecotourism in 1998 along with operational guidelines for the key players in ecotourism business-government, local authorities, developers and operators, visitors and local community while recognizing the role of NGOs and the scientific community.

International and regional cooperation and coordination

India is a party to CITES, the Convention on International Trade in Endangered Species of wild flora and fauna (CITES) which entered into force in India on 18/10/1976. The Convention explicitly recognises that 'international cooperation is essential for the protection of certain species of wild fauna and flora against over-exploitation through international trade'.

India is also a party to the Convention on Wetlands of International Importance, Ramsar 1971, that seeks to preserve the fundamental ecological functions of wetlands as regulators of water regimes and as habitats supporting a characteristic flora and fauna. Each contracting party is required to designate suitable wetlands within its territory for inclusion in a list of wetlands of international importance. Besides, information regarding pollution or other human interference-related developments in designated wetlands have to be

given to the Ramsar Convention Bureau. Further, the parties are also required to formulate and implement domestic laws to promote conservation of wetlands in consonance with obligations under this convention. Conservation initiatives included identifying wetlands of conservation value and framing policy guidelines.

India has 6 Ramsar wetlands—Keoladeo National Park, Bharatpur; Sambar, (Rajasthan); Chilka, (Orissa); Loktak, (Manipur); Wullar, (Jammu and Kashmir); and Harike (Punjab). A National Committee on Wetlands, Mangroves and Coral Reefs was created which identified 19 wetlands. The central government funded numerous conservation activities such as data collection and surveys, wetland mapping, landscape planning, wildlife development, and fisheries control. This led in 1993 to the formation of a National Lake Conservation Plan focussing in particular on urban lakes. To date, 11 lakes have been identified for conservation and management. India, however, is yet to develop a wetland policy or provide specific legal protection to wetland areas.

The Convention on Biological Diversity has been instrumental in putting the concerns for conservation of biodiversity on the international agenda. Implementation of the Convention is at the national level. For this the Convention requires that each contracting party develop (or adopt) national strategies, plans or programmes for conservation and sustainable use of biological diversity and integrate these into sectoral/cross-sectoral plans. The country has carried out national reporting including, 'Implementation of Article 6 of the CBD in India: National Report' in 1998 (MoEF, 1998) as well as submission of the second national report in 2001 (MoEF, 2001).

The COP to the Convention on Biological Diversity adopted a supplementary agreement to the Convention known as the Cartagena Protocol on Biosafety on 29 January 2000. The Protocol seeks to protect biological diversity from the potential risks posed by living modified organisms (LMOs) resulting from modern biotechnology. It establishes an advanced informed agreement procedure for ensuring that countries are provided with the information necessary to make decisions before agreeing to the import of such organisms into their territory.

Concerns and strategies for sustainable development

Despite the great strides made, there is a need for greater community awareness on issues concerning biodiversity and its permeation into all sectors of developmental planning.

As discussed in Chapter 9 on forestry, financial resources pose a severe constraint on efficient conservation of forests and biodiversity. The potential of the private sector has also not been tapped effectively. Detailed policies and strategies are required for fragile and important ecosystems such as wetlands, grasslands, seas and oceans as well as corridor and buffer areas, since the emphasis is often overly on forests. Implementation and enforcement of the excellent legislation in existence is often poor. Poaching continues to be a very major threat, even though a very detailed action plan for combating it is already in place (MoEF, 1994). Another major lacuna in our current policy environment is the lack of coordination and communication between various departments and agencies whose activities impinge on natural resources. There is a need therefore, to infuse biodiversity/forestry and land considerations in the process of development planning itself.

The NBSAP process mentioned above will provide detailed strategies for ensuring conservation, protection and management of biological resources in conjunction with their sustainable use in a fair and equitable manner. Some indicative measures for mainstreaming biodiversity vis-à-vis Agenda 21 concerns, in accordance with the a National Policy and Macrolevel Action Strategy on Biodiversity have been presented below until such time as detailed recommendations emerge from the NBSAP process.

Data and information needs

A Biodiversity Information Facility—a comprehensive database for dissemination of research data that ensures networking amongst institutions across the country needs to be established. Surveys and inventories need to be intensified with the involvement of a broader range of organizations in the process. This must include surveys of islands, marine and coastal areas, the Himalayas, listing of endangered species and their population abundance, inventories of protected areas, studies on agro-biodiversity, traditional knowledge systems, etc. There is a need to strengthen the BSI, ZSI and the three bureaus of the ICAR (NBPGR, NBAGR AND NBFGR). These institutions must play a guiding role by preparing a list of priority research issues and areas for circulation to relevant institutions, based on countrywide consultation of experts. Funding for these prioritized projects could be stepped up to ensure that research focuses on them.

Management

There is a need to expand the protected area network to the 160 National Parks and 698 sanctuaries accounting for 18.7 mha as suggested by Rodgers, Panwar and Mathur (2000). This coverage will provide a 'better distribution of protected areas with less gaps in the protection of biogeographic zones, biomes and species and fewer spatial or geographic gaps in the pattern of PA coverage' (Rodgers; Panwar and Mathur, 2000). This must be accompanied by strengthening management of PAs based on the provision of adequate humanpower, equipment, infrastructural facilities, etc. Further, management planning for protected areas must be strengthened on par with Working Plan formulation and the local communities need to be involved in conservation and management efforts. A landscape/waterscape approach for conserving ecosystems and habitats both within and outside the PA network may to be adopted. This will ensure that biodiversity concerns filter into the non-protected areas. Measures for enhancing inter-sectoral cooperation are of the essence to design strategies for preventing habitat destruction and over-exploitation. There is a need to minimize activities that are detrimental to biodiversity such as habitat destruction, over-exploitation, pollution and introduction of exotics. A wetland policy and strategy for their management must be developed.

Priority must be given to the conservation of traditional varieties of crop and to strengthen measures for conservation of crop and livestock diversity as well as on-farm and on-orchard conservation programmes. The establishment of a Central Botanic Garden Authority along the lines of the Central Zoo Authority is also required.

Policy environment and capacity-building

Biodiversity concerns need to permeate all spheres of developmental planning, since most activities have direct or indirect impacts on biodiversity. There is a need to incorporate biodiversity, forestry, and land-use considerations in development planning itself. Coordination and capacity must also be strengthened so as to ensure cross-sectoral linkages. Various economic tools also support intersectoral integration by ensuring that activities incorporate the costs to biodiversity such as taxes and cesses. Two important mechanisms for this are certification schemes and developing methods for valuing biodiversity in national accounting systems.

Another important area is genetic engineering and the related issue of genetically modified organisms. These new developments can play a positive role in increasing agricultural productivity. Given the revolutionary nature of the technology there are associated risks and uncertainties. Therefore to fully

realize the potential of this new technology proper regulatory mechanisms have to be put in place, backed by scientific inputs and testing facilities.

The capacity and involvement of local communities in biodiversity conservation, monitoring and most importantly in the decision-making process needs to be enhanced. Eco-tourism and recreation forestry for instance are income-earning options for local communities and need to be encouraged along with activities such as farming of medicinal plants and the initiation of non-wood forest produce-based enterprises. This must also include the ability to meet the subsistence needs of local people through the promotion of fodder, fuelwood plantations, non-conventional energy sources, irrigation programmes, etc. There is a need for greater documentation of traditional knowledge as well as the revival of sustainable traditional resource use practices and the application of local knowledge, scientific and medicinal systems. This must be accompanied by equitable benefit-sharing arrangements. Encouraging sustainable resource use at all levels of society is of the essence for the country.

Finally, innovative mechanisms for financing biodiversity conservation need to be devised, including tapping the potential of the private sector and earmarking at least 1% of state and central government resources for biodiversity (MoEF, 1999). Such initiatives will reinforce the initiatives taken by the government towards conserving the rich and unique biodiversity of the country.

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Introduction

The marine environment, which includes the adjacent coastal areas supports productive and protective habitats such as mangroves, coral reefs and sand dunes. The marine environment is facing a number of pressures, arising out of the needs of people, and the multiple uses that coastal and marine areas can be put to. These pressures contribute to the depletion of marine resources and degradation of the marine environment. In the absence of good management, these pressures may result in severe stress. Chapter 17 of Agenda 21^a lays out certain programmes for the sustainable development of the marine environment.

This chapter presents a brief overview of the institutional set-up of the marine sector in India. This is followed by a summary of the major programmes of Agenda 21 relevant to this sector, followed by highlights of the policies and programmes undertaken by the Government of India to meet the objectives of Agenda 21 with regard to marine resources. The government policies and programmes are analyzed in the context of Agenda 21 in the following section. The chapter concludes with recommendations for a cleaner and healthier marine environment.

Overview of India's marine sector

India has a long coastline of more than 7500 km. Its marine resources are spread over in the Indian Ocean, Arabian Sea, and Bay of Bengal. The exclusive economic zone (EEZ) of the country has an area of 2.02 million sq km comprising 0.86 million sq km on the west coast, 0.56 million sq km on the east coast and 0.6 million sq km around the Andaman and Nicobar islands. The east coast supports activities such as agriculture and aquaculture while a number of industries are supported on the west coast. Tourism has emerged as a major economic activity in coastal states such as Goa, Kerala and Orissa.

^a <http://www.un.org/esa/sustdev>

Mangrove cover in India has been estimated at approximately 3,15,000 ha confined mainly along the east (Orissa and West Bengal) coast and Andaman and Nicobar islands. The Sunderbans in West Bengal have one of the largest mangrove forests in the world. The mangrove flora of India is comprised of 50 exclusive species belonging to 20 genera. Some of the common and economically important species include *Mugil cephalus*, *Hilsa ilisha*, *Lates calcarifer*, *Scylla seratta*, *Meretrix casta* and *Crassostrea grephoides*. According to the latest evaluation (Rao, Molur and Walker, 1999) 67 % of the mangroves and associated plant species are endangered, while 97% of the plant species are threatened. Indiscriminate cutting, reclamation for agriculture and urbanization, fuel and overgrazing by domestic cattle have severely degraded mangroves in India. The threat to mangroves in recent years comes mainly from, aquaculture and urban settlements. Sand dunes which support diverse flora are categorized as ecologically sensitive areas under the Coastal Regulation Zone notification of 1991. Coral reefs are found in the Palk Bay, Gulf of Mannar, Gulf of Kutch, central west-coast of India, Lakshadweep and Andaman and Nicobar islands. A few species of corals have recently been reported from the Maharashtra coast. A total of 50 genera and 13 sub-genera of reef-building corals are known to occur in Indian reefs representing more than half of those recorded from all over the world. Fisheries in the Indian marine environment comprise 15 pelagic and the same number of demersal fisheries. India is a major seafood exporting country. The annual export of fisheries is 0.4 million tonnes (mt) worth Rs 47,000 million (Pandian, 1999). Marine fishery exports in 2000 were 421,075 metric tonnes valued at Rs 63,965 million. The Indian marine production increased from 0.534 mt in 1950-51 to 2.576 mt in 1992-93. However, the growth of Indian marine fisheries has become sluggish in recent years (Acharya and Thakur, 1999) and reached a plateau at around 2.8 million tonnes by 1995-96 (MoA, 1996). While the inland sector contributed increasingly (6.2% annually since 1980-81) to the growth of fish production in India (5.21% annually since 1980-81), the growth in marine food production decreased to 2.5 % during 1990-99 from 3.73 % during 1980-90 (Krishnan Birthal, Pounusamy et al-2000). The potential harvestable yield of marine fish stock in the Indian EEZ is estimated to be 3.9 million tonnes (Devaraj and Vivekanandan, 1999; Somvanshi, 1999). About 1 million people in 3651 villages of India situated along the coast are employed in marine capture fisheries. Indian fishery also supports several ancillary activities such as boat building, processing plants etc. All these features make this an important sector from the economic and social viewpoint.

The coastal and offshore environment of India supports rich biodiversity. Bacteria, fungi, and zooplankton species are abundant. Benthic fauna consists of polychaeta (62%), crustaceans (20%), and molluscs (18%). Over 630 species of marine algae have been reported. The annual production of seaweed is estimated at 70,000 tonnes. Sea grass flora is dominated by *Thalassia hemprichii* and *Cymodocea* species. The total standing crop is estimated at 7000–8000 tonnes. The few economically important species of algae such as *Gracilaria edulia* can be cultivated on a large scale. A sea grass called *Enhalus acroides* is now a threatened species. *Dugong dugong*, a mammal dependent on sea grass for its food is also threatened.

Economic activities such as offshore drilling, aquaculture, port activities all impact the coastal ecosystem. India's external is almost entirely dependent on surface transport through its ports, except for a small quantity of high-value international cargo in volume terms, which is carried by air. For the protection, preservation and management of coastal waters and maritime zones the Central Government has formulated exclusive jurisdiction. The state governments too, have jurisdiction over the development of fishery and other living resources in the territorial waters adjoining the states. The following institutions are responsible for decision-making in the area of oceans and seas, in India.

Table 11.1 Institutions responsible for decision-making

Organization	Responsibilities
Ministry of Environment and Forests	Management of resources in the coastal water, nodal ministry with major responsibility for protecting marine environment, includes implementation of legislative measures.
Department of Ocean Development	Scientific monitoring of the marine environment, Management of resources in the high seas
Ministry of Agriculture	Development of fisheries, aquaculture, fish processing
Ministry of Water Resources	Erosion
Ministry of Defence (Indian Coast Guard)	Pollution response measures, including oil pollution
Ministry of Surface Transport	Ports, shipping etc.
Ministry of Petroleum and Natural Gas	Offshore installations, coastal refineries, pipelines etc.
Ministry of Tourism	Tourism activities in coastal regions
Ministry of mines	Mining activities in coastal regions

Marine environment and Agenda 21

The major objectives of Agenda 21 with reference to the marine environment are the preserving of ecologically sensitive areas, developing and increasing the potential of marine living resources, ensuring effective monitoring and enforcement with respect to fishing activities, improving the living standards of coastal communities, maintaining the health of the marine environment and addressing issues of critical uncertainty and climate change. To achieve these objectives, programme areas have been identified and these are discussed below.

Integrated management and sustainable development of coastal and marine areas, including exclusive economic zones

Agenda 21 urges governments to adopt an integrated policy and decision-making process to promote a balance of uses in coastal and marine areas. It also seeks to identify existing and projected uses of coastal areas and their interactions and concentrate on well-defined issues concerning coastal management. Agenda 21 identifies the need to promote the development and application of methods, such as natural resource and environmental accounting, that reflect changes in value resulting from uses of coastal and marine areas, including pollution, marine erosion, loss of resources and habitat destruction. It seeks to provide relevant information and opportunities to concerned individuals, groups and organizations for consultation and participation in planning and decision-making.

Marine environmental protection

To address the potential for degradation of the marine environment from a wide range of activities, Agenda 21 calls for the adoption of a precautionary and anticipatory approach to development planning. It encourages the integration of marine environmental protection into relevant general environmental, social and economic development policies and the adoption of economic incentives to apply clean technologies. Agenda 21 also stresses the need to improve the living standards of the coastal population.

Sustainable use and conservation of marine living resources of (i) the high seas and (ii) those under national jurisdiction

Sustainable use of marine living resources is a concern strongly expressed in Agenda 21. Marine living resources provide food and livelihood to coastal communities. Adequate knowledge, use of new technology and good regulatory measures are necessary to manage and conserve these resources. Agenda 21 aims at developing and increasing the potential of marine living resources to meet human nutritional needs, maintaining or restoring populations of marine species at levels that can produce the maximum sustainable yield, promoting the development and uses of selective fishing gear and practices that minimize waste in the catch of target species and minimize by-catch of non-target species. It also urges governments to ensure effective monitoring and enforcement with respect to fishing activities, protecting and restoring endangered marine species, preserving habitats and other ecologically sensitive areas and promoting scientific research with respect to marine living resources in the high seas. It emphasizes the need to take into account traditional knowledge and interests of local communities, small-scale artisanal fisheries and indigenous people in development and management programmes.

Addressing critical uncertainties for the management of the marine environment and climate change

The marine and coastal environment is vulnerable to the uncertainties of climate change. These changes may cause significant damage to the coast and inhabitants of nearby areas. In order to develop a good response strategy and reduce uncertainties, it is necessary to collect data systematically on various marine environmental parameters so that future conditions can be medicated. Agenda 21 seeks to promote scientific research on and systematic observation of the marine environment; promote exchange of data and information resulting from scientific research and systematic observation as well as from traditional ecological knowledge and ensure its availability to policy-makers and the public at the national level and cooperate with a view to the development of standard inter-calibrated procedures, measuring techniques, data storage and management capabilities for scientific research on and systematic observation of the marine environment.

Strengthening international including regional, cooperation and coordination

Agenda 21 recognizes the role of international cooperation in supporting and supplementing national efforts and stresses the need to improve coordination

and strengthen links among national and international institutions. It emphasizes the need to integrate relevant sectoral activities addressing the environment and development in marine and coastal areas at the national, sub regional, regional and global levels, as appropriate; promote effective information exchange and institutional linkages between bilateral and multilateral national, regional, sub-regional and inter-regional institutions dealing with environment and development in marine and coastal areas; promote within the United Nations system, regular intergovernmental review and consideration of environment and development issues and promote the effective operation of coordinating mechanisms for the components of the United Nations system dealing with issues of environment and development in marine and coastal areas, as well as links with relevant international development bodies.

Sustainable development of small islands

Small island developing states and islands supporting small communities are considered as a special case in Agenda 21. They are ecologically fragile and vulnerable. They are rich depositories of biodiversity as they shelter some unique species of flora and fauna. Agenda 21 urges governments to adopt and implement plans and programmes to support the sustainable development and utilization of their marine and coastal resources including meeting human needs, maintaining biodiversity and improving the quality of life for island people and adopt measures, which will enable Small Island developing states to cope effectively, creatively and sustainably with environmental changes and reduce the threats posed to marine and coastal resources.

Review and analysis of initiatives for protection of marine and coastal environment in India

Highlights of major initiatives

In order to protect its marine environment, the Government of India, even before 1992, had initiated a number of programmes. These acquired a new significance post-1992. To meet the objectives of Agenda 21, continuous monitoring of ongoing projects, acquiring of new technology and implementation of already-existing policies are being actively carried out. The following section highlights the major policies and programme areas of Agenda 21 that relate to marine resources, assesses the achievements, and identifies the areas that remain of concern. Table 11.2 highlights the major policies and

programmes adopted. The developments in policies post-Rio reflect responses to the changing international scenario, where there is a recognition that development needs to be attentive not only to the environment, but also to the people who have a stake in any such development.

Table 11.2 Highlights of major policies and programmes

Year	Relevant Acts, programmes and policies	Salient features and Amendments
1897	Indian Fisheries Act	Offers protection to fisheries against explosives or dynamites
1908	Indian Ports Act	Enactment relating to ports and port charges. Provides for rules for the safety of shipping and conservation of ports
1950	Coast Guard Act	Provides levying of heavy penalties for the pollution of port waters In 1993, Coast Guard under Ministry of Defence, made directly responsible for combating marine pollution. National Oil Spill Disaster Contingency Plan, formulated in 1996, under Coast Guard Act lays down action to be taken in the event of oil spills
1958	Merchant Shipping Act	Control of pollution from ships and off-shore platforms
1972	Wildlife Protection Act	Offers protection to marine biota Creates conditions favourable for <i>in situ</i> conservation of fauna and flora. Amended in 1991 to prohibit fishing within the sanctuary area Gahirmatha, annual mass nesting place for Olive Ridley turtle, an endangered species, accorded the status of marine sanctuary in 1997. Amended in 2001 to include several species of fish, corals, sea cucumbers and sea shells in Schedule I and III Whale shark placed in schedule I
1974	Water (Prevention and Control of Pollution) Act	Control of pollution from land-based sources includes tidal waters, unlike many other countries and has jurisdiction upto 5 km in the sea

Year	Relevant Acts, programmes and policies	Salient features and Amendments
1976	Maritime Zones Act	Describes various zones such as territorial waters, EEZ, Continental shelf etc.
1978	Marine fishing Regulation Act	A model act, which provides guidelines to the maritime states to enact laws for protection to marine fisheries by regulating fishing in the territorial waters The measures include: regulation of mesh size and gear, reservation of zones for various fishing sectors and also declaration of closed seasons. Laws framed and amended from time to time by different maritime states Coastal states ban fishing during closed season Different closure period for different states
1980	Forest Conservation Act	Protection to marine biodiversity
1982	Coastal Pollution Control Series (COPOCS programme)	Started in 1982 by CPCB Aims at assessing the pollution status of coastal waters
1986	Environment Protection Act (EPA)	Under this, the Coastal Regulation Zone 1991 has been notified. Standards for discharging effluents are listed
1991 (under EPA, 1986)	Coastal Regulation Zone Notification	Regulations on various activities in coastal zone. Classifies coastal zone into four categories specifying activities permitted and prohibited in each category Offers protection to backwaters and estuaries Aquaculture was allowed as foreshore activity. The Supreme Court in 1996 banned all the aquaculture activities, except traditional and modified traditional, in the coastal zone upto 500m in most places. Aquaculture Authority was formed
1991	Deep Sea Fishing Policy	Allows foreign fishing vessels into Indian waters beyond 12 nautical miles. Protests from local fishermen Charter and leasing operations of foreign trawlers suspended in 1997 No granting of new licences to joint venture companies operating in the EEZ Deep Sea Fishing Policy, 1991 practically scrapped in 1997
1991	Coastal Ocean Monitoring and Prediction systems (COMAPS Project)	Being implemented from 1991 onwards Assesses the health of coastal waters and facilitates management of pollution-related issues Programme was restructured and modified in 2000-01 to include pollution monitoring; liaison, regulation and legislation; and consultancy services

Year	Relevant Acts, programmes and policies	Salient features and Amendments
1995	National Environmental Tribunal Act	This has been created to award compensation for damages to persons, property and the environment arising from any activity involving hazardous substances
1995	UNCLOS	A new international order established for oceans Provides a comprehensive legal framework for integrated treatment of issues relating to oceans and seas.
1995	Land Ocean Interaction in the Coastal Zone (LOICZ Project)	Aims to develop, on a scientific basis, the integrated management of coastal environments
1996	Coastal Zone Management Plans (CZMPs)	Supreme Court Intervention that all the Coastal states prepare their CZMPs by 1996
1997	National Environment Appellate Authority Act	Addresses appeals with respect to restrictions of areas in which classes of industries etc. are carried out or prescribed subject to certain safeguards under the EPA The objective is to bring in transparency and accountability and to ensure the smooth and expeditious implementation of developmental schemes and projects
1998	Turtle Exclusion Device (TED) mandatory in Orissa	Orissa High Court passed judgment in 1998 that all fishing trawlers be equipped with TED
1997-1998	Ocean Observation and Information Services (OOIS)	Generate reliable oceanographic data Various projects of DOD were restructured under this in
1998	Integrated Coastal and Marine Area Management (ICMAM Project)	Aims at integrated management of coastal and marine areas. Model plans for Chennai, Goa and Gulf of Kutch being prepared
Ninth Plan	DOD programme to assess living resources beyond 70 m depth	Major objectives were to have reliable and realistic information on the potential of marine living resources in the Indian EEZ for sustainable development and management and to augment sea food production and thereby the income of the coastal fishing community and the fishing industry. Initiated during the Ninth Five-year Plan for better understanding of the resources of the Indian EEZ, since the region upto 50-70 m depth is exploited almost to the maximum sustainable levels.
2000	The Biodiversity Bill	With an aim to protect and conserve biodiversity and sustainable use of its components the Biodiversity Bill is being placed in Parliament

Achievements

Integrated management and sustainable development of coastal and marine areas, including exclusive economic zones

Through the introduction of scientific research programmes and the legislation adopted, the GoI has been successful to a great extent in addressing the issue of sustainable development of coastal and marine areas. The Department of Ocean Development (DOD) was established in 1981, with an aim to implementing programmes for sustainable development of the Indian Ocean. DOD formulated the first Ocean Policy Statement (OPS) of the country, which sets out the basic principles through which the development of ocean resources is to be carried out. The OPS lays emphasis on sustainable exploitation of living and non-living resources and protection, preservation and conservation of coastal and marine environment. India is the first country to adopt such a policy.

The Ninth Five-Year Plan emphasizes the need for sustainable development and the strategy for natural resources management (including wild-life conservation and protection), in particular coastal resource conservation, with an emphasis on people's participation.

Projects introduced by the Department of Ocean Development such as the Integrated Coastal and Marine Area Management (ICMAM) aim at integrated management of coastal and marine areas. The concept of ICMAM has been adopted to facilitate the management of marine environment and biodiversity as well as for their monitoring. Decision support systems are being established for the management of critical habitats such as mangroves, coral reefs, areas rich in biodiversity, etc. under the ICMAM programme. The following activities are being undertaken under this programme.

- Development of GIS-based information systems for critical habitats containing all information necessary to prepare management plans.
- Determination of waste assimilation capacity at selected estuaries.
- Development of EIA guidelines for major coastal developmental activities and process.
- Determination of No Impact Zone for Pulicat and Coringa
- User classification of coastal zones for future developmental activities
- Infrastructure development for capacity building in ICMAM through training
- Development of model ICMAM plans for selected areas such as Chennai, Goa and Gulf of Kutch.

India also supports and participates in one of the core projects of the International Geosphere-Biosphere Programme (IGBP), the Land-Ocean Interactions in the Coastal Zone (LOICZ). This project was launched in India in 1995 for the integrated management of the coastal environment. The programme is aimed at determining the effects of global change on the coastal zone. LOICZ seeks to estimate fluxes of elements such as carbon, nitrogen, trace metals and major elements to the land and ocean. The primary objective is to improve predictive capability of changes in the coastal zone of India. The project also assesses economic and social impacts of development activities on the coastal population.

The Department of Ocean Development sponsors R&D projects in academic institutions, national laboratories and societies. These projects train and orient the scientists in specific fields in the ocean sector and deploy them in the R&D activities. Some of these scientists associate themselves with Universities and improve their academic qualifications also. The Department also provides research fellowship to carry out doctoral and post-doctoral work to enhance their potential, knowledge and expertise. The Department sponsors short-term training programmes in specified areas. It has plans to establish infrastructure to train coastal states on the advanced tools and techniques for planning coastal zone management systems.

The Department of Ocean Development has been sponsoring research projects in different disciplines in a large number of national laboratories and academic institutions with the guidance of a Research Advisory Committee. Special grants are given to selected academic institutions to build infrastructure. Research fellowships and Research Associateships are granted for post-graduate and post-doctoral research in Marine Science in universities and national laboratories. To promote specialization in marine sciences in different universities, the Department formulated a scheme for establishing Ocean Science and Technology Cells (OSTC) in consultation with universities engaged in Marine Science research. These cells in the academic institutions will grow into Centres of Excellence in due course. So far eight OSTCs have been established.

Marine environmental protection

India's rapid population, economic and industrial growth has created pressures on the coastal resources. Some coastal stretches in India are highly polluted with municipal waste deriving from urbanization and tourism, waste generated from industry, chemical agents from fertilizers and pesticides and silt from degraded

catchments. Untreated sewage and other non-industrial waste account more pollution than industrial effluents. Mining of sand from the sea-bed results in an increase in turbidity in the ambient water, which affects benthic organisms and primary productivity by limiting the availability of light. Aquaculture activity in some parts of India has also placed considerable pressure on coastal resources. Construction of breakwaters, which forms part of the port development, alters the sediment transport mechanisms in the coastal areas, thereby causing erosion or accretion.

A number of rules and laws regulate activities on the Indian coast. India has regulatory agencies such as the Central Pollution Control Board (CPCB) at the central level and State Pollution Control Boards (SPCB) at the state levels, constituted under Water (Prevention and Control of Pollution) Act, 1974 (for details refer to Chapter 2). The Aquaculture Authority of India has been constituted and guidelines on sustainable aquaculture development for regulating coastal aquaculture have also been developed. A National Contingency Plan has been formulated to combat oil spills in the EEZ of India with the Coastal Guard as the nodal agency.

The disposal of ship-based wastes is regulated by the Merchant Shipping Act, 1958 and by the adoption of MARPOL 73/78. Standards for discharging effluents are listed in the Environmental Protection Act, 1986. This serves as an umbrella act providing for the protection and improvement of the environment including coastal and marine areas. The effluents/discharges from various resources have to meet these standards before being discharged into marine waters.

The Coastal Zone Regulation Notification was issued in 1991 in India, under the EPA, 1986. The Notification aims at protecting and improving the quality of the coastal environment. The Notification declares the limits of the Coastal Zone and classifies it into four categories for purpose of regulation. CRZ I includes areas which are ecologically sensitive, areas of outstanding natural beauty, historical heritage or rich genetic diversity. CRZ II includes the areas that have already been developed up to or close to the shoreline. Areas that are relatively undisturbed are classified under CRZ III. CRZ IV includes the coastal stretches in the Andaman and Nicobar, Lakshadweep and other small islands except those designated as CRZ I, II and III.

The notification lays down certain prohibitions and also exceptions to prohibitions. Prohibited activities include setting up of new industries (except those which are directly related to the water front or which directly need foreshore facilities) and expansion of existing industries including fish

processing units, manufacture, handling, storage or disposal of hazardous wastes and substances, discharge of untreated wastes and effluents and dumping of municipal wastes as landfills or otherwise. Withdrawal of groundwater within 200 metres of the High Tide Line (HTL) is prohibited with some exceptions.

In most of these areas, an area of 200 metres from the high tide line (HTL) has been declared a no development zone. Several restrictions have been imposed for carrying out development in the area between 200 to 500 metres from the HTL. These measures have been adopted to protect fragile ecosystems which exists in the area and are vital for sustaining the ecological balance. Mangroves and coral reefs have been declared ecologically sensitive areas (CRZ I) under this notification and regular monitoring using satellite imagery is in progress. A state-wise Mangrove Committee has been formed for effective management of the mangrove ecosystem. Mining of corals and coral sands has been banned. The CRZ notification also offers protection to coastal communities such as traditional fishermen.

The Recycled Plastics Manufacture and Usage Rules, 1999; Municipal Solid Wastes (Management and Handling) Rules, 2000; Ozone Depleting Substances (Regulation) Rules, 2000; The Prevention and Control of Pollution (Uniform Consent Procedure) Rules, 1999, are some of the rules framed under EPA, 1986, with an aim to providing environmental protection and are relevant to the coastal environment.

Since 1982, the CPCB has been carrying out a rapid inventory annually to assess the pollution status of coastal waters of India. This programme known as the Coastal Pollution Control Series (COPOCS), comprises among other things, a) Identification of the uses of coastal water at different stretches and the best use among them; class designation of the sector or a portion thereof, and b) Identification of land-based pollutants and polluting activities and those that require immediate control.

The Coastal Ocean Monitoring and Prediction systems (COMAPS) programme was launched in 1991, by the Department of Ocean Development (DOD) for monitoring the health of India's coastal waters. The programme monitors the effect of anthropogenic activities on the marine environment periodically and assesses the impact on the marine flora and fauna in the coastal waters of India. Studies related to the waste assimilation capacity of coastal waters have been undertaken from 1997-98 onwards.

Efforts have been made to set up sewage treatment plants in all coastal states. Treated effluents are being discharged into deeper waters through

pipelines. The Government is also preparing an action plan for treatment of domestic wastes. Legislation has helped in the treatment of industrial wastes. In India, the Water (Prevention and Control of Pollution) Act includes tidal waters, unlike some other countries. The Act is applicable upto 5 km into the sea. Though the discharge of effluents from small-scale industries is still a problem, efforts are being made to set up common treatment plants. This will help in minimizing the load that is discharged to the sea.

Sustainable use and conservation of marine living resources of the high seas and under national jurisdiction

To address the concern for conservation of marine living resources, in some marine areas which support high biodiversity, such as the Gulf of Mannar and Wandoor (Andaman) have been declared as marine national parks, while some other coastal areas such as the Malvan coast (Maharashtra) and the Gulf of Kutch (Gujarat) have been declared marine sanctuaries. The Gahirmatha beach (Orissa) where mass nesting of the endangered Olive Ridley turtle takes place was accorded marine sanctuary status in 1997. Five species of marine turtle are found in Indian coastal waters. These are the green sea turtle (*Chelonia mydas*), Olive Ridley (*Lepidochelys olivacea*), loggerhead (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*), and hawksbill turtle (*Eretmochelys imbricata*). Except for the Loggerhead, the other four species nest in India. The Bhitarkanika Wild Life Sanctuary is another globally important site for nesting for the Olive Ridley turtle. A total of 32 critical habitats which include the Gulf of Kutch, Gulf of Khambhat, Gulf of Malvan, islands off Karwar, islands off Kochi and Lakshadweep islands have been identified in India. Such measures offer protection to the flora and fauna of the region and help prevent any damage to the marine ecosystem. The Indian Coast Guard is empowered to prevent capture of endangered marine species under the Wild Life (protection) Act, 1972. A number of threatened marine species have been placed in Schedules I and III of the Wild life (Protection) Act, 1972. Some of these are the whale shark, sea horse, sea cucumber, sea shells and different types of corals. The most important of these is the whale shark, which is placed in Schedule I.

To protect and conserve biodiversity, the Biodiversity Bill, 2000, at present with a new set of recommendations, is being placed in Parliament. The details of this Bill are discussed in the Chapter on Biodiversity.

Various studies are being carried out for the assessment of marine living resources in India. These include marine environment and productivity studies carried out in the waters of the Andaman islands and the Arabian sea, fishery

resource surveys along the continental slope, studies on the deep scattering layer, toxic algal blooms, benthic productivity and harvest technology. The Fisheries Survey of India regularly assesses fishing resources upto 50-70 m depth. The Department of Ocean Development initiated a programme to assess the marine living resources beyond 70 m depth within the Indian EEZ in 1997-98. There are plans to encourage sea ranching and mariculture in order to increase marine production. The technology for generation of Potential Fishing Zone (PFZ) information and retrieval of Sea Surface Temperature (SST) data help assessing fishing zone information.

India is a major exporter of seafood. The export of marine products from India has gone up by 28% quantitatively and 19% in terms of value during the last financial year. According to the marine Products Export Development Authority (MPEDA), India exported 440,473 tonnes of seafood valued at \$1.4 million dollars in 2000-01 as against 343 031 tonnes valued at \$1.2 million during 1999-2000. Frozen shrimp (70%), fish, cuttlefish and squid are the major export earners and account for 92.64% of the total exports. Japan is the major market (40% in terms of value and 16% in terms of quantity) followed by Europe. China is the largest single importer of Indian seafood in terms of quantity.

Aquaculture activity got a boost in the early 1990s in the coastal parts of India on account of economic liberalization policies initiated by the GoI. The increased production was both a result of increased area under expansion and increased productivity. Coastal aquaculture in India is mainly related to shrimp farming. The contribution of cultured shrimps to the total shrimp export increased from 48.78% in 1988-89 to 75.07 % in 1998-99. However, it suffered a setback with the Supreme Court declaring it contrary to the CRZ notification and banning all aquaculture activities, except traditional and improved traditional within upto 500 m of the High Tide Line (HTL) in most coastal areas.

The government has made extensive efforts to promote investments in the fisheries sector. Infrastructural facilities for handling, preservation, processing and marketing of fish have been improved. A number of ice plants and storage facilities have been created. Fishery harbours with berthing facilities and road links to fish landing centres have been set up. The Government of India has organized training programmes for people from different sectors. Financial assistance in the form of loans and subsidies is offered to small-scale farmers (aquaculture), trawler owners or for any small fishing craft. A number of programmes have been undertaken by fishermen's organizations to educate active fishers. They are encouraged to form fishery cooperatives for proper

exploitation of fishery resources. The government has also introduced a few welfare schemes for fishermen. A free Group Accident Insurance Scheme has been introduced as a measure to provide social security.

To prevent overexploitation of fish stocks and protect the interests of coastal communities, the following legislation/rules/acts are in force in the country.

- The Maritime Zones of India (Regulation of fishing by Foreign Vessels) Act, 1981 provides regulations for foreign fishing vessels operating in Indian waters. The Coast Guard and the State/UT Police has been authorized under the Act to apprehend and prosecute unauthorized foreign fishing vessels/crew for fishing/poaching in Indian waters.
- The Marine Fishing Regulation Act (MFRA), 1978. Consistent with the guidelines contained in the MFRA, 1978, which is a model act, providing guidelines to the maritime states, legislations have been enacted and enforced for regulating fishing and conservative measures in territorial waters. Such state enactments provide for regulation of mesh size to avoid catching juvenile fish, regulation of gear to avoid over-exploitation of certain species, reservation of zones for various fishing sectors to provide exclusive rights to traditional fishermen to fish unhindered in near-shore areas and also for declaration of closed seasons during the fish-breeding period to avoid catching of young juvenile fish.

These state enactments, have been provided with a view to protecting fisheries and assisting traditional fishers provide zonation within which activities such as mechanized fishing, are prohibited.

In the states on the south east coast i.e. Tamil Nadu and Andhra Pradesh the zonation is 3-6 nautical miles from the coastline. On the west-coast and the north east coast i.e. Orissa and West Bengal, an area up to 7-10 nautical miles is earmarked for traditional fishers.

The Government of India constituted a committee in March 1995 to review the Deep-Sea Fishing Policy of 1991. On the basis of the recommendations of this Committee, the policy was revoked and no new permits, extensions or renewal of fishing permits under the above policy are being given. The Government has had this matter examined and is now in the process of drafting a new policy.

The fishery survey of India has studied the availability of tuna in the EEZ. Tuna resources are estimated at between 220,000 and 250,000 tonnes per annum.

The current level of exploitation is about 10,000 tonnes per annum, most of it coming from the Lakshadweep archipelago.

The scientific community in India has also focused on deriving biologically active compounds from marine organisms. The National Institute of Oceanography has identified a marine microbial strain for bio-bleaching in the paper industry. A mangrove fungus has been successfully used in pilot studies by a paper industry and has since been patented. The research on developing potential drugs and chemicals from marine flora and fauna is ongoing.

Addressing critical uncertainties for the management of the marine environment and climate change

India has introduced some programmes for the long-term monitoring of oceanographic parameters to address the issue of critical uncertainties. These are the Sea Level Monitoring and Modelling (SELMAM) Project, National Data Buoy Programme (NDBP), Satellite And Coastal Oceanographic Research (SATCORE) Project, Experimental Ocean State Forecast (E-OSF) programme, Indian Ocean Modelling and Dynamics (INDOMOD) etc. A set of three current meter arrays at pre-selected locations along the equator in the Indian Ocean for long-term monitoring of the current structure is proposed. Various projects of the Department of Ocean Development were restructured and reoriented in 1997-98 as Ocean Observation and Information Services (OOIS) in order to generate reliable data.

Strengthening international, including regional, cooperation and coordination

India is a member of various committees of the Global Ocean Observing System (GOOS). This is a programme to collect long term systematic scientific oceanographic data at a national, regional and global level. The South Asia network of Global Coral Reef Monitoring network (GCMRN) consists of India, the Maldives and Sri Lanka. The network has commissioned four pilot reef-monitoring exercises.

During the year 1999-2000, India made contributions to international commissions and organizations such as the UNCLOS, ISBA, COMNAP/SCALOP, CCAMLR, Regional Sea Programme etc. India effectively participated in the IOC Executive Council and other meetings of IOC, IOCINDO, International Sea bed Authority, 7th UN Commission on sustainable development, XXIII Antarctic Treaty System (ATS), 2nd meeting of Environment

Protection of ATS, Commission for Conservation of Antarctic Marine Living Resources etc.

India also is actively involved in the Inter-governmental Oceanographic Commission, UN Convention on the Law of the Sea, Antarctic Treaty System, and the UNEP Regional Seas Programme. Scientific and technical bilateral cooperation with other nations, e.g. Russia, Germany, Republic of Korea, Argentina, Peru, Italy and others, has been established. India has also ratified the International Convention for the Prevention of Pollution from Ships (MARPOL Convention 73/78). Some of the other international conventions on environment ratified by India are the International Convention for the Regulation of Whaling, International Plant Protection Convention, 1951, Convention on Facilitation of International Traffic, 1965, International Convention on Loadlines, International Convention on Tonnage Measurement of Ships, International Convention on Civil Liability for Oil Pollution Damage, 1969, Special Trade Passenger Ships Agreement, 1971, International Convention on Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971, Convention on the International Regulations for Preventing Collisions at Sea, 1971, as amended (COLREG 1972), International Convention of Safe Containers, 1972, Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973, International Convention for the Safety of Life at Sea, 1974, Framework Convention on Climate Change, 1992, Convention on Biodiversity, 1992. India is also a signatory to the Convention of Wetlands of International Importance, protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, Vienna Convention for the Protection of the Ozone Layer, Convention on Migratory Species, Basel Convention on Trans-boundary Movement of Hazardous Substances, Montreal Protocol on Substances that Deplete the Ozone Layer.

Sustainable development of small islands

The Andaman and Nicobar Islands and Lakshadweep archipelago are the major islands in India. Special emphasis on island development was given in the Ninth Five-Year Plan programme proposed by the DOD. This includes a programme on lobster resource enhancement, which has been implemented from 1998 onwards. The GoI has initiated a number of steps for sustainable development of these small islands:

- Under the CRZ Notification, 1991 of EPA (1986), these islands are classified as a separate category (CRZ IV). Prohibitive activities include mining of

corals in the coral reef area along with other restricted and regulated activities.

- An Island Development Authority (IDA) has been constituted. It was directly under the chairmanship of the Prime Minister earlier but the deputy chairman of the Planning Commission is the current Chairman of the IDA. It takes up measures for ensuring sustainable development of the islands on scientific lines.
- The Andaman and Nicobar Integrated Development Corporation has been set up to undertake sustainable development in an integrated manner.
- An Island Development Programme is being implemented at the National Institute of Ocean Technology, Chennai. This programme aims at the transfer of technology in the area of marine living resources so that the island community can avail of socio-economic benefits.

Concerns

As in the other parts of the world, coastal areas in India are increasingly under pressure from anthropogenic activities. The major areas of concern are overexploitation of coastal resources and the impact of land-based activities and ship traffic. A number of issues arise in the management of India's marine environment, despite the programmes in place. These can be listed as follows.

- Sustainable use and conservation of marine living resources has been the central concern of Agenda 21. Over the last 25 years there has been a considerable influx of non-fishermen communities into the fishing sector. Entry of more people tends to encourage over exploitation though, in the Indian Ocean this is not as alarming as in some other parts of the world. Nevertheless, it is noted that though the marine production has not exceeded the maximum sustainable yield (MSY), fishery resources in India's coastal waters in the 50-70 m depth are almost fully exploited (Devaraj, 1996; Somvanshi, 1997; Biradar and Thakur, 1999; Zingde, 1999; Devaraj and Vivekanandan, 1999). Inappropriate exploitation patterns such as concentration of fishing efforts in coastal waters is having a detrimental effect on Indian fisheries (Devaraj and Vivekanandan, 1999). In addition, marine pollution has led to a degradation of the marine resource potential and marine biodiversity. Some of the species are over-exploited and endangered. The Government of India is cognizant of these and is taking measures to protect the marine environment against overexploitation of its living resources and pollution. However, strict implementation of government policies is needed.

- The following issues deserve immediate attention. Pollution from use of persistent organic pollutants (POPs) such as DDT for crop protection and the issue of adoption of a legal instrument on the control of POPs.
 - The effect of antifouling paints used on ships on marine organisms and the adoption of the ban as targeted for the year 2006 by the IMO
 - Transfer of exotic species through ship fouling and ballast water
 - A need for providing adequate and appropriate support from developed countries to ocean-related capacity-building in developing countries
 - A need for some form of international involvement in the management of the high seas fishery resources, as observed by the UN Conference on Straddling and Highly Migratory Fish Stocks.
 - The release of persistent hydrocarbons through ship traffic and their effect on global warming and climate change
 - Policies for coastal aquaculture, keeping in view socio-economic and environmental aspects, need to be framed.

Studies on these aspects have been initiated in institutions of the DOD.

- Weak enforcement of rules and laws and a fragmented approach towards the implementation of government policies is a serious concern. Difficulties in enforcement stem from conflicts between stakeholders such as the corporate class and the traditional communities, foreign operators and local fishers, between different departments or agencies of the governments and even between state governments and the central government.
- The Notification on Coastal Regulation Zone (CRZ), 1991, ensures protection to the coastal zone. However, a number of problems occur in its enforcement. A committee was appointed, headed by B B Vohra to examine certain issues related to coastal ecology and CRZ notification. Some of the recommendations were accepted while some others were modified and incorporated by an amendment in 1994 to the CRZ Notification.
- A good deep-sea fishing policy is awaited. The deep-sea fishing policy introduced by the GoI in 1991 did not work due to lack of patrolling and weak enforcement. Traditional fishers protested against the foreign vessels fishing illegally within the area reserved for traditional fishers. As a result of these protests, the deep-sea fishing policy of 1991 had to be practically scrapped in 1997. In order to relieve the pressure on coastal fisheries, deep-sea fishing has to be encouraged.
- Promotion of coastal shelterbelt plantations for prevention of natural calamities is necessary. Coastal communities need to be protected against

natural calamities and the damage caused. GoI realizes the role of ecologically protective areas, such as mangroves, as receptacles of storms and flood water and the protection they offer to coastal communities during natural calamities. This concern is addressed in the Approach Paper to the Tenth Plan (Planning Commission, 2001).

- Protection of the interests of various stakeholders can be ensured only by their involvement in the policy-making process. This aspect is central to the process of ensuring better policies as well as the equally important issue of their effective implementation and enforcement.

Towards a healthier marine environment

The Government of India has given considerable attention to commitments under Agenda 21 with regard to the marine environment. The Government has been successful in collecting scientific data in various fields of oceanography. What is required now is to recognize the linkages between the health of the environment and anthropogenic activities, through a more detailed study of the processes involved, their linkages with the social system and a greater use of inputs from the social sciences. Because of the multiple uses to which coastal areas can be put, the major challenge in coastal management is resource-use conflict in coastal areas. Such conflicts of interest arise between traditional and development cultures, between different users, between the small, medium and large fishermen and between the coastal community and the polluters (Mehta, 1999). These conflicts can be meaningfully resolved through an integrated approach that assimilates inputs from various disciplines and a greater use of multi-stakeholder consultation at all levels.

Agenda 21 highlights the need for proper exploitation and conservation of marine living resources. At present, 90% of the fish potential upto depths of 50 m is being tapped. There are no significant fishing efforts beyond this depth, especially beyond 100 m. Attempts need to be made to encourage deep-sea fishing. It is estimated that 0.5 m of the unexploited stock in the deep-sea are tunas which undergo transoceanic migration. In order to exploit these stocks, it is necessary that the neighbouring countries share information on the biological characteristics and their distribution. The deep-sea fishing policy of the GoI has to take into account the interests of traditional fishermen, whilst increasing marine production. The Murari Committee also recommended this. The new deep-sea fishing policy will address these issues.

The following issues call for international cooperation and some of these were discussed at the in the seventh session of UN Commission of Sustainable Development (CSD):

- With respect to imposing a ban on use of persistent organic pollutants (POPs) such as DDT, transfer of the expertise and technology, to developing countries such as India, to develop insecticides/pesticides which are eco-friendly is necessary. No viable and affordable alternatives to POPs, which have an effective role in the control of harmful microbes, are available as yet in India. Hence keeping in view the usefulness of the POPs in public health programmes and food security, a legal instrument banning POPs need to be reviewed.
- The effect of antifouling paints used on ships on marine organisms is being studied in India. The harmful effects of antifouling paints such as change of sex in Gastropoda, shell thickening, imbalances in growth and the reproductive stages and, on larvae in oysters and mussels and on primary productivity are well known. Regulations controlling the use of harmful paints and a proper plan for eliminating/phasing them out need to be developed. Development of such a regulatory framework under the International Maritime Organization is expected on favourable and preferential terms the developing countries.
- There is no data yet on the transfer of exotic species through ship fouling and ballast water. This issue has been addressed recently by the DOD through scientific studies.

Coastal management strategies also need to consider the socio-economic and cultural aspects of the coastal population, besides environmental issues. Such a need to improve living standards of coastal population is emphasized in Agenda 21. Adequate financial credit and banking facilities need to be provided to fishermen for upgrading their technology and improving their financial position. It is also necessary to provide alternative means of livelihood to the family members of the fisher community so that the pressure on coastal fishing does not increase further. Ecological know-how in the preservation, conservation and exploitation of marine living resources is necessary. *In situ* gene banks and more area for marine sanctuaries and parks is necessary to preserve the biodiversity of marine fauna and flora. At the same time, the interests of coastal fishermen and their employment in the fishing industry have to be protected.

A healthier marine environment needs integrated policy approaches, which involve scientific disciplines to address the complexity of the interaction between the social and natural systems in the coastal and marine environment. The need for a single administration to deal with governmental responsibilities for policy implementation is recognized and the GOI is taking steps to initiate programmes which involve inter-departmental collaboration.

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Fragile ecosystems: sustainable mountain development

Introduction

The Rio conference in 1992 recognized the crucial role played by mountain ecosystems by highlighting that the livelihood of about 10% of the world's population depended directly on mountain resources such as water, forests and agricultural products and minerals (United Nations, 2001). In addition, populations living in valleys and plains depend on the mountains for water as many major rivers originate there. This aspect was also stressed in Agenda 21 which stated that about 40% of the world's population lived in adjacent medium and lower watershed areas. The vulnerability of mountain areas to environmental degradation pressures placed by increasing population growth, tourism and economic development, was also highlighted. Notably, Agenda 21 drew attention to ecological degradation in the Himalayan region resulting from the cultivation of marginal lands due to population growth.

This chapter begins with a description of the main mountain ecosystems in India. The key issues for sustainable mountain development that were identified in Agenda 21 are then presented. This is followed by a section highlighting the policies, programmes and legislation that have been implemented specifically for the development of mountain regions in India. An analysis of these policies, their achievements and concerns with respect to Agenda 21 issues follow. The last section presents some strategies that address environmental and social concerns of mountain ecosystems in the country.

Mountain ranges in India

The major mountain ranges in India are the Himalayas and the Western Ghats. The Himalayas are among the youngest and highest mountain systems in the world. They traverse an arc of about 2500 km between the Indus and the Brahmaputra rivers, with an average width ranging from 100 to 400 km. The Himalayas pass through eight countries: Afghanistan, Pakistan, India, China, Nepal, Bhutan, Bangladesh and Myanmar. In India, this mountain ecosystem is spread over 11 states: Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and West Bengal. They are inhabited by 51 million people, covering

18% of the geographical area and 6% of India's population. The Himalayas have probably one of the highest hydropower potentials in the world, which includes the Indus, Ganga and Brahmaputra rivers. This mountain system represents one of the richest natural heritage sites in the world. One-tenth of the world's known species of higher altitude plants and animals occur in the Himalayas (IPCC, 2001).

This rich environmental heritage of the Himalayan region is under pressure from natural and human-induced stresses such as earthquakes, landslides, construction activities (roads and dams) and poaching. The impacts of these pressures is illustrated by declining forest cover in the states of Assam, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim, the loss of wildlife habitat and the loss of life and property caused due to natural disasters. Deforestation has resulted in many species of flora and fauna of the region becoming endangered.

The Western Ghats run to a length of about 1600 kms, more or less parallel to the west coast, starting from the state of Maharashtra and continuing until Kanyakumari, the southern-most tip of the country. The region covers an area of 1.6 lakh sq kms supporting a population of 442 lakh people (Census of India, 1991). The Western Ghats are the source for many major peninsular rivers such as the Godavari, Krishna, Kaveri and Periyar. About 30% of the area of the Western Ghats is forested. The region faces increasing stress from population, submergence of forests areas by river valley projects, encroachment and clearance of forest lands for raising plantations and shifting cultivation (Ninth Five-Year Plan, 1997-2002). The steep topography combined with high precipitation makes this region susceptible to soil erosion. In Kerala for instance, a total of 50 lakh tonnes of nutrient-rich soil is washed away ever year (Planning Commission, 2001a).

Sustainable mountain development and Agenda 21

Two programme areas were identified in Agenda 21 for sustainable mountain development.

- Promoting integrated watershed development and alternative livelihood opportunities
- Generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems

Specific areas for action that were identified under these broad programme areas are discussed as follows.

Promoting integrated watershed development and alternative livelihood opportunities

Agenda 21 drew attention to the problems of ecological deterioration in watershed areas adjacent to mountain ecosystems. It called for the adoption of an integrated approach to the development of natural resources of land, water, flora and fauna in these watershed areas. Concern was also expressed regarding poverty and unemployment in these regions and alternative livelihood opportunities were to be promoted in order to improve the standard of living of rural people in mountain areas. The need to improve infrastructure and social services in these areas to protect the livelihoods of local communities was highlighted.

Specific activities that were to be undertaken to address the above concerns were:

- Undertaking programmes for prevention of soil erosion
- Establishing task forces or watershed development committees to support local initiatives in animal husbandry, forestry, horticulture and rural development
- Enhancing popular participation in management of local resources
- Promoting national policies that would provide incentives to local people for the use of environment-friendly technologies, farming and conservation practices
- Establishing natural reserves and national parks for the protection of biological diversity
- Undertaking income-generating activities in cottage and agro-processing industries
- Diversifying mountain economies by creating/strengthening tourism.

Generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems

This programme area was based on the concern that knowledge on mountain ecosystems was lacking. It called for action by national governments, in coordination with relevant international and regional organizations, on the following fronts.

- Strengthening existing institutions or establishing new institutions at local, national and regional levels to generate a knowledge base on mountain ecosystems.
- Creating mechanisms for cooperation and information exchange among national, regional and international institutions for building and maintaining databases and information systems on ecological resources, evaluation of environmental risks and natural disasters in mountain areas. Identification of areas vulnerable to natural hazards and exchange of information was particularly stressed for countries sharing mountain ranges and watersheds.
- Establishing and maintaining meteorological, hydrological and climate-monitoring analysis and capabilities.
- Building an inventory of soils, forests, water use, crops, plant and animal genetic resources.

Review and analysis of policy and other initiatives for sustainable mountain development

Highlights of legislation, policies, programmes and other initiatives

There is an entire range of environmental, economic and social policy and legislative initiatives that impact mountain ecosystems in the country. The focus of this chapter is on those policy initiatives that have been specifically developed and targeted for hill regions in India and those that address particular Agenda 21 issues for sustainable mountain development. Highlights of these policies, programmes and institutional activities are presented in Table 12.1 below. It must be emphasized that these policies should be considered in addition to national policies^a and programmes developed for protection of forests, biodiversity, water and other natural resources. These national policies apply equally to mountain regions and are separately addressed in other chapters.

^a The policies and programmes for protection of forests and biodiversity have been outlined in separate chapters in the Assessment report.

Table 12.1 Highlights of policy initiatives for hill regions in the country

Year	Policy/ Legislation/ Programme/ Institutional activities	Highlights
1974	Hill Area Development Programme (HADP)	The main objectives of the programme are eco-preservation and eco-restoration with emphasis on preservation of biodiversity and rejuvenation of hill ecology.
1974	Western Ghats Development Programme (WGDP)	The programme adopts an integrated watershed development approach in the Western Ghats area, prioritising eco-development, eco-restoration and meeting the basic needs of food, fuel and fodder.
1992	National Policy for the Integrated Development of the Himalayas	<ul style="list-style-type: none"> ▪ An expert group was set up by the Planning Commission to formulate a policy for the development of the Himalayas ▪ Based on the recommendations of this group, six sector-specific sub-committees have been set up under the Chief Secretaries of the states of the Himalayan region to formulate and implement schemes in the following areas. <ul style="list-style-type: none"> ▪ Environment and Forests ▪ Agriculture and allied activities ▪ Industry and industrial infrastructure ▪ Social sectors including health and family welfare ▪ Transport, communications and tourism ▪ Energy including non-conventional energy and science and technology
1992	Ministry of Environment and Forests Notification on restriction of certain activities in specified areas of the Aravalli range	<ul style="list-style-type: none"> ▪ Issued under the Environment (Protection) Act, 1986, the notification restricts certain activities causing environmental degradation in the Aravallis ▪ The activities that were prohibited in these specified

Year	Policy/ Legislation/ Programme/ Institutional activities	Highlights
2001	Notification on protection and improvement of quality of environment in the Himalayas	<p>areas included location of any new industry, new mining operations and mining in sanctuaries and national parks and deforestation.</p> <ul style="list-style-type: none"> ▪ Environmental Impact Assessments and Environmental Management Plans are required for carrying out any of the restricted activities in this region. ▪ Issued by the Ministry of Environment and Forests under the Environment (Protection) Act 1986, specifically for environmental protection in the Himalayan states. ▪ The activities relate to location planning in urban areas, rainwater harvesting and guidelines for construction of hill roads.
	Activities undertaken by the Botanical Survey of India (BSI)	<p>The primary activities undertaken by the BSI include:</p> <ul style="list-style-type: none"> ▪ Survey of plant resources of the country ▪ Undertaking taxonomic studies of all flora of the country ▪ Enlisting endangered species ▪ Preparation of a national database of herbs
	Activities undertaken by the Zoological Survey of India (ZSI)	<p>The primary objectives of the ZSI are:</p> <ul style="list-style-type: none"> ▪ Exploration and survey of faunal resources ▪ Taxonomic studies ▪ Status survey of endangered species ▪ Publication of assessment of fauna of India
	Activities undertaken by the Forest Survey	<p>Maintenance and development of national zoological collections</p> <p>The FSI undertakes assessment of the forest resources of the country</p>

Year	Policy/ Legislation/ Programme/ Institutional activities	Highlights
	of India (FSI)	through parameters such as forest cover, growing stock, annual increment, species composition, bio-diversity, non-timber forest products etc.
	Activities undertaken by the Indian Meteorological Department (IMD)	The mandate of the IMD includes: <ul style="list-style-type: none"> ▪ Taking meteorological observations and providing meteorological statistics ▪ Warning against adverse weather phenomena such as cyclones and heavy rains ▪ Detection and location of earthquakes and evaluation of seismicity

Sources. Ninth Five-Year Plan, 1997-2002; Planning Commission (2001b); Ministry of Environment and Forests (2001)

The following section analyzes the policies highlighted in Table 12.1 above from the perspective of Agenda 21's objectives of promoting integrated watershed development, promotion of alternative livelihood opportunities, improvement of infrastructure and social services and the development of a knowledge base on mountain ecosystems.

Achievements

Promoting integrated watershed development and alternative livelihood opportunities

In India, some of the economically-weaker states are treated as Special Category States. These include Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Sikkim, Manipur, Meghalaya, Nagaland, Tripura, Arunachal Pradesh and Mizoram (Ninth Five-Year Plan, 1997-2002). Special Central Assistance is given, 90% in the form of a grant and 10% as a loan, compared with the proportion of 30% and 70% respectively, for other states (Planning Commission, 1999).

In addition to this special status accorded to hill states, specific programmes are being implemented for hill areas in other states. Since 1974, two programmes: the Hill Areas Development Programme (HADP) and the Western Ghats Development Programme (WGDP), have specially focussed on mountain

areas. The primary objectives of both these programmes are eco-regeneration and eco-preservation with emphasis on preservation of biodiversity and rejuvenation of hill ecology (Planning Commission, 2001b). Until now HADP was being implemented in designated hill areas in Uttar Pradesh, Assam, Tamil Nadu and West Bengal. With the formation of Uttaranchal as a separate state, the programme will no longer be in operation in the hill districts of erstwhile Uttar Pradesh during the Tenth Five-Year Plan. The areas covered by the WGDP include parts of Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu. Under these programmes Special Central Assistance is given to supplement efforts of the state governments in the development of these ecologically fragile regions (Planning Commission, 2001a). The assistance is apportioned between the designated hill districts and the Western Ghats areas in the ratio 84:16. The allocation of funds for these programmes is co-ordinated by the Planning Commission. Between 1974 and 2002, there has been a ten-fold increase in allocation of special central assistance under the HADP and the WGDP (Table 12.2).

Table 12.2 Allocation (Rs crore) of Special Central Assistance under the HADP and the WGDP

Programme/ State	Fifth Plan 1974-79	Sixth Plan 1980-85	Seventh Plan 1985-90	Eighth Plan 1992-97	Ninth Plan 1997-2002
Hill Areas Development					
Programme					
Assam	24	72	118	194	249
Tamil Nadu	7	22	34	55	107
Uttar Pradesh	104	350	554	910	936
West Bengal	15	30	45	97	111
Survey and studies	0	12	4	3	0
Total HADP	150	485	754	1259	1405
Western Ghats Development					
Programme					
Kerala	5	18	24	39	61
Maharashtra	6	23	38	63	97
Tamil Nadu	4	13	20	33	51
Karnataka	4	14	28	46	72
Goa	1	4	6	10	15
Survey and studies	0	3	1	1	1
Western Ghats Secretariat	0	0	0	0	1
Total WGDP	20	75	117	191	297
Total HADP and WGDP	170	560	870	1450	1702

Source. Planning Commission (2001a)

The Western Ghats Development Programme adopts an integrated approach to development of identified watersheds in the areas under its purview. This is done through the formulation, implementation and monitoring of soil conservation, agriculture, afforestation, fuel and fodder development, minor irrigation, animal husbandry and sericulture schemes in these watersheds. Some of the main activities that have been undertaken in watersheds in the Western Ghats under this scheme are discussed below.

Programmes for soil conservation on watershed basis receive maximum attention as they serve the special needs of the Western Ghats (Planning Commission, 2001a). Specific programmes that have been undertaken include land development activities such as levelling, terracing and contour bunding. Water harvesting and erosion control structures such as check dams have been built. The other area which has received attention in the WGDP is the development of horticulture. The Western Ghats region has tremendous potential for cultivation of horticultural crops, with about 3.6 lakh hectares of culturable wasteland (Planning Commission, 2001a). Under the WGDP, the cultivation of horticultural crops on wasteland will serve the twin purposes of ecological regeneration and provide complementary avenues for income for small and marginal farmers. Various horticulture programmes are being implemented depending on the needs and demands in the local areas.

Deforestation is a serious concern in the Western Ghats region and to address this, programmes for afforestation, regeneration of degraded forestlands, fuelwood and fodder development, pasture land development and social forestry schemes have been implemented under the WGDP.

The approach and strategy for the Hill Area Development Programme has evolved over the various Plans but has been confined largely to eco-preservation, eco-development and eco-restoration. Towards reducing soil erosion, the programme encourages diversifying the cropping pattern as also improving the crop productivity. Under this, subsidies have been provided to small and marginal farmers for agricultural implements, power sprayers, sprinklers, high-yielding annual vegetable crops, and perennial crops. Alternative livelihoods such as animal husbandry, dairy development, sericulture, and tourism have been encouraged through specific allocation of funds.

Generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems

As highlighted in Table 12.1, there are established scientific and research institutions such as the Botanical Survey of India (BSI), the Zoological Survey of India (ZSI) and the Forest Survey of India (FSI) that undertake comprehensive assessments of the flora, fauna and forest resources in the country.

So far, 65% of the total area of the country has been surveyed. The BSI has collected three million herbarium specimens. During 1987-97, 106 new species were discovered by the BSI. The institute has also undertaken special surveys in Alpine Himalayas. The ZSI discovered 759 new species during 1987-97 (Ninth Five-Year Plan, 1997-2002). The FSI prepares a comprehensive State Forest Report including a National Forest Vegetation Map once every two years. A National basic Forest Inventory System (NBFIS) is maintained by the FSI which contains data related to forestry for national and state level planning.

Meteorological analysis, climate monitoring and assessment of vulnerability to natural disasters in the country is done by the Indian Meteorological Department (IMD). The IMD's network includes 559 surface observatories, more than 800 rainfall monitoring stations, 100 satellite data collection platforms in remote areas, 203 observation ships, 10 cyclone detection radars, and 17 storm detection radars. The IMD has also been undertaking ozone measurements since 1928. There is thus a rich repository of information on natural resources and processes in the country.

Apart from creating an inventory of natural resources, the need for educating people on implications of environmental degradation is well recognized by the government. Steps are being taken to ensure effective use of traditional technology and development of appropriate technology required for hill areas. Environmental aspects are being included in the curriculum of primary and high school education.

Concerns

Promoting integrated watershed development and alternative livelihood opportunities

While the WGDP is implemented on a watershed basis, this is not the case with the HADP. In case of the latter, Special Central Assistance forms a sub-component of the state plan. As a result, other sectors or areas receive priority and environmental concerns do not receive adequate attention (Planning Commission, 2001a). Of particular concern is the utilization of Special Central Assistance meant for the ecological preservation of hill areas for meeting non-plan or salary requirements. Maintenance of assets created under the

programmes is a challenge which also needs to be addressed. A start has been made recently in this direction which should be made permanent.

Preservation of forests and the rich biodiversity of the mountains is a continuous challenge. The issues related to these areas have been discussed in the chapters on forests and biodiversity. The special schemes for the mountain areas have focussed more on ecology and general services like health and education. Pressure on the environment comes primarily from economic causes. It is therefore necessary to provide a greater role to interventions that will promote sustainable livelihoods for the people living in these areas.

Strategies for sustainable mountain development

Thrust areas that have been identified for promoting ecological development in hill regions under the HADP and the WGDP, in the future are as follows:

- Continuing the watershed-based approach adopted in the Western Ghats region and adopting it in the hill areas of Assam and West Bengal
- Adopting a participatory approach in the formulation and implementation of schemes under these two programmes, by encouraging the involvement of Panchayati Raj Institutions and non-governmental organizations
- Development of technologies suited to local conditions such as farm implements for small landholdings, micro-hydel projects, rain-water harvesting and water conservation schemes
- Providing incentives to farmers for conserving the traditional gene pool through promotion of traditional farming practices
- Greater role for development of income generation schemes for local communities
- Provision of funds for maintenance of assets on a continual basis in both programmes.

Out of these, the most important is the adoption of a participatory approach by involving local people, NGOs and the Panchayati Raj Institutions (PRIs) in the development process. The PRIs can facilitate the involvement of people and NGOs to ensure informed decision-making. While NGOs can play an important role in mobilizing people at the grassroots level the local community can respond to changes by breaking social, cultural and psychological barriers. Local communities possess traditional knowledge and skills which can be applied to development challenges faced by these hill areas. NGOs on the other hand can serve as the medium for knowledge exchange and facilitate the

flow of information from the government. Coupled with use of funds under these schemes for local capacity building, this strategy can help in realizing the objectives of the plan in the identified areas.

The relevance of renewable energy technologies as decentralized sources of energy for meeting needs in hill areas should be fully recognized. Such technologies are emerging as an attractive option to provide light and power to non-electrified remote areas where grid extension may be unviable. In the Approach Paper to the Tenth Five-Year Plan (Planning Commission, 2001), the government recognizes the role of non conventional energy sources in meeting the energy demands of remote and inaccessible areas^a, using local resources and cutting out the expensive delivery mechanisms associated with conventional energy sources. WGDP already has a component for promotion of renewable energy sources and initiatives have been taken in some states and the Western Ghats, encouraging the use of wind, solar and other such forms of energy. However, these efforts need to be carried forward and technologies suited to hill areas such as micro-hydel projects should be accorded priority.

^a In the budget of 2002-03, the government has announced electrification of 500 villages (through hydropower village electrification programme) and installation of 82,000 solar cookers in remote and far flung areas.

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Introduction

Land is a finite resource and put to many competing uses. It comprises soils, minerals, water and biota. In India land is a source of livelihood for 60 % of the population through agriculture and related activities. Population growth and the consequent demand for land, water and biological resources has put tremendous pressure on land.

Agenda 21 recognizes the need to allocate land for sustainable uses and promote the integrated planning and management of land resources. This chapter reviews the progress made and problems in implementing the integrated planning and management of land resources envisaged in Chapter 10 of Agenda 21. This chapter will examine trends in land use and the condition of land resources in India, along with policies, programmes and technologies adopted.

Forest and biodiversity-related land management issues are addressed in the chapters on forests and biodiversity and agricultural related land management issues are addressed in the chapter on agriculture.

Overview of the sector

Institutional set-up

Land is a subject within the legislative and administrative jurisdiction of the states as per the VIIth Schedule of the Constitution, empowering the states to develop policies and enact laws. In India, the three Ministries responsible for the conservation and management of land resources are the Ministry of Rural Development, Ministry of Agriculture, and Ministry of Environment and Forests. At the national level, the Department of Land Resources under Ministry of Rural Development is the nodal agency for coordinating different land resource development and management programmes.

Land use

Of India's reporting area for land use statistics, about 46.6% is under agriculture, 22.6% is forested, and 13.6 % is not available for cultivation (Table 13.1). Roughly 41 million hectares of land are considered totally unfit (snow cover, desert) or not available (urban use, rivers) for vegetation. The per capita

availability of land declined from 0.89 hectare in 1951 to 0.3 hectares in 2001; the per capita availability of agricultured land declined from 0.48 hectare in 1951 to 0.14 hectares in 2001. Besides the pressure of human population, there are about 500 million cattle and other livestock living off the biomass from the land (Bali, 2000).

Table 13.1 Land use classification - All-India

Classification	1990-91		1997/98 (P)	
	Million	(%)	Million	(%)
	hectares		hectares	
Geographical area	328.73		328.73	
Reporting area for land	304.86		304.92	
utilization statistics (1 to 5)				
1. Forests	67.80	22.	68.85	22.
		2		6
2. Not available for cultivation (A+B)				
(A) Area under non agricultural uses	21.09	6.9	22.53	7.4
(B) Barren and uncultivable land	19.39	6.4	19.03	6.2
3. Other uncultivated land excluding fallow land (A+B+C)				
(A) Permanent pastures and other grazing lands	11.40	3.7	10.91	3.6
(B) Land under miscellaneous tree crops and groves not included in net area sown	3.82	1.3	3.57	1.2
(C) Culturable wasteland	15.00	4.9	13.88	4.5
4. Fallow lands (A+B)				
(A) Fallow land other than current fallow	9.66	3.2	9.76	3.2
(B) Current fallows	13.70	4.5	14.36	4.7
5. Net area sown (6-7)	143.00	46.	142.02	46.
		9		6
6. Total cropped area (gross cropped area)	185.74		190.76	
7. Area sown more than once	42.74		48.74	

(P) - (Provisional)

Source. Ministry of Agriculture (2000c)

Land degradation

It is estimated that about 174 million hectares of land (53%) suffers from different types and varying degrees of degradation (Table 13.2). About 800 hectare of arable land are lost annually due to ingress of ravines (MoA, 2000a).

It is estimated that more than 5000 million tonnes of topsoil are eroded every year (Seghal and Abrol, 1994). All this has a direct bearing on food production and the livelihood of the people.

Table 13.2 Extent of soil degradation (human-induced) under the different degradation types

Degradation type	Area affected (m ha)	
	Total	Percent
Water erosion	148.9	45.3
Wind erosion	13.5	4.1
Chemical deterioration	13.8	4.2
Physical deterioration	11.6	3.5
Land not fit for agriculture	18.2	5.5
Soils with little/no degradation problem	90.5	27.5
Stable terrain (under natural condition)	32.2	9.8
Total geographical area	328.7	100.0

Source. Seghal and Abrol (1994)

Wasteland

According to the wastelands atlas published by Department of Land Resources (2000), about 20% of the reported area is categorized as wasteland in one form or the other (Table 13.3).

Table 13.3 Category-wise wastelands of India

Category	Area (sq km)	% of total geographical area covered
Gullied and/ or ravinous land	20553.35	0.65
Land with or without scrub	194014.2	6.13
Waterlogged and marshy land	16568.45	0.52
Land affected by salinity/alkalinity-coastal/inland	20477.38	0.65
Shifting cultivation area	35142.20	1.11
Under-utilized/degraded	140652.3	4.44

notified forest land	1	
Degraded pastures/grazing land	25978.91	0.82
Degraded land under plantation crop	5828.09	0.18
Sands-Inland/coastal	50021.65	1.58
Mining/industrial wasteland	1252.13	0.04
Barren rocky/stony waste/sheet rock area	64584.77	2.04
Steep sloping area	7656.29	0.24
Snow covered and/or glacial area	55788.49	1.76
Total wasteland area	638518.3	20.17
	1	

Note: 1,20,849 sq km in Jammu & Kashmir is not mapped and hence not considered for calculating the percentage.

Source. Department of Land Resources (2000)

Common property land resources

Common property land resources that are under collective management are often subject to degradation due to lack of clearly defined ownership rights. In India approximately 77 million hectares are common property land resources (Table 13.4). The per capita availability of common property land resource is 0.09 hectares (Laxmi and Parikh, 1997).

Table 13.4 Common property land resources in India (1990/91) ('000 ha)

Categories	Area
Non-forest area	
Private land with common access	16951
Permanent pasture and grazing land	11804
Cultivable wasteland	15014
Other than current fallow	9590
Total non-forest CPLR	52764
Forest area	
Protected + unclassified	24692
Total (thousand ha)	77456
Per capita (ha)	.09

Source. Laxmi and Parikh (1997)

Land resources and Agenda 21

The concerns related to the management of land resources are addressed in Chapters 10, 11, 12, 13 and 14 of Agenda 21. In the present report, these issues are covered under Chapter 9 on Forests, Chapter 12 on Mountain ecosystems and Chapter 14 on Agriculture. The following specific concerns were raised in Agenda 21 for the sustainable management of land resources.

Integrated approach to planning and management

Chapter 10 of Agenda 21 envisages an integrated approach to planning and management of land resources to facilitate allocation of land that ensures its greatest sustainable use with due consideration for social, economic and environmental issues. This integrated approach aims to:

- Review and develop policies to support the best possible use of land and sustainable management of land resources not later than 1996
- Improve and strengthen planning, management and evaluation systems and institutions for land and land resources not later than 2000

Land-use change

Land-use change through industrialization, expansion of agricultural land, urban growth, and development of transportation networks will accelerate the process of land degradation. Recognizing this problem, Agenda 21 seeks to promote appropriate environmentally-sound physical planning and land-use practices that contribute to conservation and sustainable use of natural resources. Agenda 21 also recommends the preparation of a national land resources management plan.

Combating land degradation and desertification

Agenda 21 recognizes the need to combat land degradation and desertification. It emphasizes preventive measures in vulnerable and slightly-affected areas and rehabilitation of moderate-to-severely-affected areas. This would involve introduction of:

- Improved land-use policies
- Appropriate environmentally sound and economically feasible technologies
- Improved land, water and crop management measures
- Participatory management of natural resources

Stakeholder participation and awareness creation

It is imperative to ensure active stakeholder – land users, government, executing agencies, NGO's – participation in planning and implementing land

development programmes and creating awareness about the implications of land degradation and desertification. The role of local communities and their initiatives should be recognized. This would require:

- Administrative restructuring for decentralized planning, decision-making, and implementation
- Introduction of legislative, institutional and financial measures to secure land-user involvement
- Policies for private-public participation
- Design of appropriate programmes

Strengthening knowledge base and developing information and monitoring systems

Agenda 21 stresses the need for an integrated information system on land resources for systematic observation of the dynamics of land degradation, desertification and drought processes. It also calls for strengthening of the systematic observation networks to monitor desertification and land degradation and to develop national information systems.

Review and analysis of legislation, policies, programmes and other initiatives for management of land resources

Highlights of legislation, policies, programmes and other initiatives

The Constitution of India enables the Central Government and the states to enact laws for the preservation and conservation of natural resources. Article 39(b) and (c) of the Directive Principles of State Policy lays down as the duty of the state and the Centre to develop natural resources for common good. There is a constitutional provision for the involvement and participation of the people at local level for participatory planning and decision-making. The Eleventh schedule (Article 243-G) of the constitution lists matters pertaining to land improvement, implementation of land reforms, land consolidation, soil conservation, and watershed development and management under powers, authority and responsibilities of *panchayats* (rural local bodies). The Twelfth schedule (243-W) lists urban planning and regulation of land-use under the powers, authority and responsibilities of municipalities (urban local bodies).

Besides the above constitutional provisions, there are many policies and programmes in India that promote sustainable development and management of land resources. The following table presents the important policies formulated, programmes implemented and the institutional framework adopted in India for the best possible use of land as well as sustainable and integrated management of land resources.

Table 13.5 Policies, acts, and programmes that have a bearing on land resources

Year	Initiatives	Salient features
Developments pre-1992		
	National Land Reforms Policy	<ul style="list-style-type: none"> ▪ Abolition of intermediary tenures ▪ Tenancy reforms ▪ Ceiling on agricultural holdings and redistribution of surplus land ▪ Updating and maintenance of land records ▪ Consolidation of land holdings ▪ Distribution of government wasteland
1972-73	Drought-prone Areas Programme (DPAP)	<ul style="list-style-type: none"> ▪ Minimize adverse effects of droughts on the productivity of land, water and human resources ▪ Promote overall economic development and improve the socio-economic condition of poor and disadvantaged sections inhabiting the programme areas ▪ Capacity building and empowerment of village community, ensuring participation of <i>Panchayati Raj</i> Institutions and NGOs in programme implementation at grassroots level and transfer of funds as well as decision-making power to the local people ▪ Since 1995-96, a watershed development based approach has been adopted
1977-78	Desert Development Programme (DDP)	<ul style="list-style-type: none"> ▪ Mitigate adverse effects of desertification and adverse climatic conditions on crops, human and livestock population ▪ Restoration of ecological balance by harnessing, conserving and developing natural resources, i.e. land, water, vegetative cover, and raise land productivity ▪ Capacity building and empowerment of village community, ensuring participation of <i>Panchayati Raj</i> Institutions and NGOs

Year	Initiatives	Salient features
1980-81	Integrated Watershed Management in the Catchment of Flood-prone Rivers	<ul style="list-style-type: none"> in programme implementation at grassroots level and transfer of funds as well as decision-making power to the local people ▪ Enhance the productivity of degraded lands ▪ Moderation of menace of floods
1985	National Land Use and Wastelands Development Council	<ul style="list-style-type: none"> ▪ Highest policy planning and coordinating agency for all issues concerning the health and scientific management of the country's land resources ▪ Development of wasteland
1985	National Land Use and Conservation Board	<ul style="list-style-type: none"> ▪ Formulate a national policy and perspective plan for conservation, management and development of land resources of the country ▪ Review of the progress of implementation of ongoing schemes and programmes connected with conservation and development of land resources and soils ▪ Take measures to restrict the conversion of good agricultural land to non-agricultural uses ▪ Co-ordinate the work of State Land Use Boards
1985	National Wastelands Development Board (NWDB)	<ul style="list-style-type: none"> ▪ Formulate perspective plan and programmes for the management and development of wastelands in the country ▪ Identify the wastelands in the country ▪ Review the progress of implementation of programmes and schemes for the development of wasteland ▪ Create a reliable data base and documentation centre on related aspects of wasteland development
1985-86	National Watershed Development Projects for Rainfed Areas (NWDPRAs)	<ul style="list-style-type: none"> ▪ Area approach to watershed development ▪ Improve crop productivity ▪ Restore ecological balance
1988	National Land Use Policy	<ul style="list-style-type: none"> ▪ To install an efficient and effective administrative structure for prescribing and regulating land by all concerned and revitalize the land-use boards in this

Year	Initiatives	Salient features
		<ul style="list-style-type: none"> respect ▪ Prevent further deterioration of land resources ▪ Restore the productivity of degraded lands ▪ Allocate land for different uses based upon land capability, land productivity, and national production goals ▪ Complete the inventory of land resources based on the prescribed land-use
1989-90	Integrated Wastelands Development Project (IWDP)	<ul style="list-style-type: none"> ▪ Adopt soil and moisture conservation measures such as terracing, bunding, trenching, vegetative barriers, etc ▪ Encourage natural regeneration ▪ Enhance people's participation in wasteland development programmes at all stages resulting in equitable sharing of benefits ▪ Employment generation, poverty alleviation, community empowerment and development of human and other economic resources of the village. ▪ Training, extension and creation of awareness among the participants
1992	Policy Statement of Abatement of Pollution	<ul style="list-style-type: none"> ▪ Advocate the use of a mix of instruments in the form of legislation and regulation, fiscal incentives, voluntary agreements and information campaigns for the prevention, control and abatement of environmental pollution
Developments post-1992		
1992	Constitution (Seventy Third Amendment) Act, 1992	<ul style="list-style-type: none"> ▪ Gives land related subject to the <i>Panchayat Raj</i> Institutions (local self governments) at the village, block and district levels to ensure participatory planning, decision making, and monitoring of programmes by the local self governments
1992	Constitution (Seventy Fourth Amendment) Act, 1992	<ul style="list-style-type: none"> ▪ Regulation of land use and urban planning were brought under the functional domain of urban self-governing bodies
1992	Department of	<ul style="list-style-type: none"> ▪ Promote development of non-forest

Year	Initiatives	Salient features
	Wastelands	wasteland
	Development in the Ministry of Rural Development	<ul style="list-style-type: none"> ▪ Watershed approach in area development programmes
1994-95	Investment Promotional Scheme (IPS)	<ul style="list-style-type: none"> ▪ Facilitate/attract/mobilize resources from financial institutions, banks, corporate bodies and individuals for development of wasteland in non-forest areas.
1995	Watershed approach in area development programmes	<ul style="list-style-type: none"> ▪ Integrated ridge to valley development approach ▪ Community participation
1999	Department of Land Resources	<ul style="list-style-type: none"> ▪ Coordination of land administration in India ▪ Formulation of integrated land resources management policies ▪ Implementation of land based development programmes

In addition to the above, policies, acts, and programmes adopted in other sectors also have a direct and indirect bearing on land resources management. Those programmes/acts are discussed in other chapters. A number of programmes and projects have also been initiated by bilateral donors and international funding agencies to restore productivity as well as better management of land.

International cooperation

The United Nations Convention to Combat Desertification (UNCCD) had formulated a Regional Action Programme (RAP) for the Asian countries to strengthen the existing capacity and network with other member countries to take suitable measures for combating desertification. The programme is aimed at helping the member parties strengthen their existing infrastructure for tackling desertification and identifying gaps in knowledge and existing data. Six thematic networks have been identified for regional cooperation. These are:

- Desertification monitoring and assessment
- Agro-forestry management and soil conservation in arid, semi-arid and dry subhumid areas
- Range and pasture management in arid areas with particular emphasis on controlling shifting sand dunes

- Water resources management for agriculture in arid, semi-arid and dry subhumid areas
- Drought preparedness and mitigation in the context of climate change
- Strengthening planning capacities for drought management and controlling desertification

India hosts an 'Agroforestry and Soil Conservation' network and also participates actively in the other thematic areas.

Achievements

Drawing on Table 13.5, the section below analyzes measures adopted by Government of India to achieve the objectives laid out in Agenda 21 for the sustainable management of land resources.

Integrated approach and institutional restructuring

Integrated planning and management of land resources is an integral part of the planning process in India. In the 90s, land resource management and area development programmes were restructured to allow for greater flexibility in choice of technology, decentralization of procedures, and active participation of beneficiaries in planning and execution. Several steps have been taken overtime – many before 1992 – towards institutional restructuring and better management of land resources. During the Sixth Plan (period 1980-85), a separate Department of Environment (DoEF) was constituted to focus on the environment and natural resources (including land). Subsequently, the DoEF was upgraded to a ministry- the Ministry of Environment and Forests. The National Wastelands Development Board (NWDB), under MoEF, was constituted in 1985 to develop and increase the productivity of wastelands in India. In 1992, the NWDB was bifurcated to National Afforestation and Eco-development Board (NAEB) and NWDB. NAEB, retained under the purview of MoEF, is responsible for development of degraded forestlands (refer chapter on forest). NWDB, brought under the purview of a new department –the Department of Wastelands Development (DoWD) in the Ministry of Rural Development, is responsible for management and development of wastelands. Department of Land Resources (DoLR) was formed in April, 1999, under the Ministry of Rural Development by changing the nomenclature of DoWD . The mandate of the department includes land reforms and land administration, besides implementing all the land based programmes (DPAP, DDP, IWDP etc.), earlier with different departments of the MRD. All the area development

schemes are being implemented through the watershed development approach to increase agricultural production and to improve the quality of life of the poor while arresting degradation. To integrate watershed development programmes of different departments, a single national initiative - a national movement of watershed development-was mooted through the budget speech of Union Finance Minister in 1999-2000.

The 73rd and 74th, Amendment Acts (1992) of the constitution brought the land use, conservation, management and related issues under the purview of local bodies in both rural and urban areas.

A national policy on the management of land resources is being formulated by the Department of Land Resources. There is a paradigm shift from 'use' of land to 'management' in this proposed policy (Kanda, 2000).

The initiatives taken by other Ministries also have a bearing on the prevention of degradation of lands. Some of these are:

- Improved policy framework for natural resource management
- Improved data on land resource degradation and its management
- Draft grazing and livestock management policy, 1994
- Draft national policy for common property resource lands (CPRLs) (under formulation)

Land reforms

The Ministry of Rural Development plays an advisory and coordinating role in implementing land reforms. Reforms implemented since 1950's by the Central and state governments helped to abolish intermediary tenures. Legislative provisions have been provided for conferment of ownership rights on tenants or allowing cultivating tenants to acquire ownership rights on payment of a reasonable compensation to the landlords. About 12.42 million cultivators have been conferred ownership rights on 6.33 million hectares of land. Under various ceiling laws, until September 2000, 2.97 million hectares of land had been declared as surplus of which 2.14 million hectares have been distributed to 5.51 million beneficiaries mostly belonging to the weaker sections. In addition, about 0.88 million hectare of *Bhoodar*^a land and 5.97 million hectares of government wasteland have also been distributed. Legislative provisions have been made for consolidation of holdings and 66.10 million hectares of land have been consolidated so far (MoRD, 2001).

^a Surplus land surrendered to government by landlords.

A major initiative has already been taken to ensure transparency in land records management. In the Ninth Five-Year Plan period (1997-2002) an important focus of the Ministry of Rural Development has been on land reforms including new strategies such as the promotion of women's land rights to benefit socially excluded groups and issuing *pattadar* passbooks to land owners.

Land-use change

Recognizing the need for optimal land use planning, a National Land Use and Conservation Board (NLCB) was established in 1983 (restructured in 1985) with the objective of formulating national land-use policies and preparing a perspective plan for optimum utilization of land resources. To coordinate similar activities in the states, a State Land Use Board (SLUB) was also formed in almost all states. A National Land-use Policy Outline, with a 19-Point action programme was adopted in 1988. The policy outline projected land-use for the year 2000 keeping in view the growth in population. A few states have already prepared the state-level land-use policy and a perspective plan. A scheme for strengthening the SLUB was launched in 1986 in all states and union territories with 100% Central assistance.

In addition, the Town and Country Planning Organization (TCPO) was set up by the Government of India to advise the state governments, local bodies and State Town Planning Departments in matters of urban and regional planning.

Combating land degradation and desertification

Land degradation issues received special attention with the setting up of the National Wastelands Development Board (NWDB). Conscious efforts have been made to increase the area under various programmes since the formation of the DoLR. Area development programmes are in place to arrest and reverse land degradation and desertification in India. Some of these are as under.

The Desert Development Programme (DDP)

Until 1995, this programme covered 36.2 million hectares of land. At present, the programme is under implementation in 234 blocks of 40 districts in 7 states covering an area of 45.8 million hectare (MoRD, 2002a). The MoEF has prepared a *National Action Programme to Combat Desertification* in the context of United Nations Convention to Combat Desertification (UNCCD). The report reviewed the policies and programmes adopted by India to mitigate the desertification and suggested programmes of action.

Drought Prone Areas Programme (DPAP)

Since inception in 1972-73 until 1994-95, 5.71 million hectares of land have been successfully treated at a cost of Rs 17420 million. In terms of coverage, 10% of the total geographical area, identified as drought prone, has been treated. Since 1 April 1995, this programme has been implemented on a watershed basis. At present, 971 blocks of 183 districts in 16 states are covered under this programme which covers an area of 74.6 million hectare (MoRD, 2002b).

Wasteland development

Wastelands in India were assessed in 2000 and an atlas was prepared for their management. Out of the 63.8 million hectares of wasteland identified about 50 million hectares are treatable. An integrated wasteland development project has been under implementation on a watershed basis since 1989-90. Upto March 2002, 423 IWDP projects were sanctioned in 27 states with a total outlay of Rs 18688 million to treat a total project area of 3.72 million hectare (MoRD, 2002a). Besides, about 10 million hectare of wastelands in the common property regime have been greened by NGO's and the people's efforts (Bali, 2000).

Soil conservation in the catchment of river valley projects (RVP) and flood-prone rivers (FPR)

This Centrally-sponsored scheme for enhancing the productivity of degraded lands is being implemented in 45 catchments with a treatable area of 25.58 million ha out of the total catchment area of 91.18 million ha. Since inception in the Third Five-Year Plan up to the end of the Eighth Plan an area of 4.23 million ha, at an expense of Rs 9386.2 million, was treated. In the first 3 years of the Ninth Plan an area of 0.81 million ha has been treated at a total cost of Rs 3508.9 million (MoA, 2001a).

Reclamation of alkaline soils

This scheme was launched in the Seventh Five-Year Plan (period 1985-1990) in the states of Haryana, Punjab and Utter Pradesh and extended, in the Ninth Plan (period 1997-2002), to all other states where the alkalinity problem exists. During the first 3 years of the Ninth Plan 0.06 million ha of alkaline soils were reclaimed at a cost of Rs 87.6 million.

Other programmes

Until 2000 5.9 million hectares of area were treated at a cost of Rs 15334.3 million. Under the NWDPRRA Soil and water conservation measures were implemented (until 2001) in 4.7 million hectares of land at an expense of Rs 12900.9 million.

Externally-aided projects

In addition to the above Centrally-sponsored projects, there are many externally-founded projects, such as the Indo-German bilateral project on watershed management, Uttar Pradesh Sodic Land Reclamation Project with World Bank assistance, Haryana Operational Pilot Project for Reclamation of Waterlogged and Saline land with assistance from the Netherlands government, DIFD-assisted Watershed Basis Livelihood Programme in the states of Orissa and Andhra Pradesh, and the North Bengal Terai Development Project with Dutch assistance that are in different phases of implementation.

Stakeholder participation and awareness-creation

The Environment (Protection) Act 1986, sets out the parameters within which the Ministry of Environment and Forests formulates and carries out environmental policy at the national level. Underlying the policy statements is a recognition of the principle that effective management and control of natural resources requires the support and participation of the people. To ensure stakeholder participation, public hearing is made mandatory on all projects that require environmental impact assessment (EIA) as per the EIA notification of the MoEF. The revised guidelines for watershed development assigned greater role for *panchayati raj* institutions, NGO, women, and financial institutions while implementing area development programmes.

The 73rd and 74th amendments of the Constitution ensured a definite role for local bodies in the management of natural resources including land, water and forests. Consequent upon this amendment almost all states and union territories have enacted their legislations to give local self-governing bodies these powers. Thus, *panchayats* at village, intermediate and district levels were constituted in many states ensuring stakeholder participation in planning decision-making and implementation. The provisions of the *Panchayats (Extension to the Scheduled Areas) Act, 1996* intends to enable tribal societies to effectively contribute to preservation and conservation of their traditional rights over natural resources. Since 1995, area development programmes have been implemented with the people's participation.

Strengthening knowledge base and developing information and monitoring systems

Knowledge base

The Government of India has augmented research efforts in land resource planning and management by setting up and strengthening area-specific research institutions.

Technological support is important for the success of land-based programmes. A number of technologies to combat the process of land degradation have been developed by research and academic institutions in the country. This includes technologies for the conservation of soil, water and vegetation; control, management and reclamation of degraded land; combating desertification and mitigating the effects of drought.

Realizing the importance of the above a separate Technology Development, Extension and Training Scheme was launched and implemented through the ICAR, state agricultural universities and government organizations to demonstrate cost effective and proven technologies for the development of various categories of wastelands. A national committee on watershed training was set up to build capacity among the stakeholders of watershed development programmes.

Information systems

The Centrally-sponsored scheme for computerization of land records is being implemented in 582 districts of the country. Only districts with no land records were left out (MoRD, 2002b). For preparation, maintenance and up-dating of land records, the accent has been on induction of modern technology. With this objective, the Central government is financially supporting states/UTs for purchase of equipment, strengthening of training infrastructure, etc. under the Centrally-sponsored scheme, Strengthening of Revenue Administration & Updating of Land Records (SRA & ULR).

All India Soil and Land-use survey (AISLUS) under the Department of Agriculture and Cooperation initiated land degradation mapping during the Eighth Five-Year Plan allowing for the development of district information systems for degraded lands. The AISLUS has so far covered an area of 24 million in 30 districts distributed in different agro-climatic zones (MoA, 2000). Besides, AISLUS has partially completed the development of a digital watershed atlas of India, a map library of river valley project catchments, and development of soil information system.

Concerns

The existing land-use policy failed to provide right results for lack of a cohesive approach to different components of agriculture such as land, soil and water. The proposed land resource management policy and approach to be finalized by the Ministry of Rural Development addresses some of these issues. The new integrated policy intends to have dynamic conservation, sustainable development and equitable access to the benefits of intervention as its thrust.

Integrated approach and institutional restructuring

- Many land development programmes, such as DDP, DPAP, IWDP, etc. co-exist and operate in an area. Several departments of the Government of India, often with different norms and guidelines are implementing area/watershed development programmes. The GoI recognized the need for a coordinated initiative and a separate department has been set up to coordinate the area development and income generation programme. Similar efforts are also necessary at the state level and performance should be the focus of the department (Approach Paper to Tenth Plan).
- The government had initiated steps to formulate national policies such as a draft grazing and livestock management policy, a draft national policy for common property resource lands, and an improved policy framework for natural resource management. These policies and programmes have not been given final shape so far.
- Most schemes follow a blue print and top-down approach, with little flexibility given to field staff. Any change in the scheme requires approval from the GoI which is time-consuming. There is a need to adopt a bottom-up approach. Lessons learned from *people's planning* adopted in Kerala during the Ninth Plan period could be used as guidelines.

Land-use change

- There is no long-term perspective plan for land use in India. There is a need to have a detailed perspective plan for next 20-25 years keeping in view of the increased demand for food, fodder and fuel, industrial needs etc.
- The National Land-use Policy Outline projected the land use for the year 2000. There is a considerable departure from the actual data from the projected land-use (Table 13.6). There is a need to bridge the gap.
- Even though constitutional amendments were made to empower local bodies to manage land related issues, these need to be strengthened.

Table 13.6 Actual and projected land-use

Land type	1980-81	2000 (projected)	1997-98
Net sown area	140	150	140.0
Rainfed area	101	40	87.5
Irrigated area	39	110	54.6
Forest area	67.4	115	68.8
Pasture/grass land	12	22	11
Urbanization	19.4	25.5	22.5
Others	90.1	16.5	84.7
Total geographic area	329	329	329

Source. Ministry of Agriculture (2000)

Combating land degradation and desertification

- People's role in formulation, initiation, and implementation of programmes is limited
- Monitoring of progress needs to be improved
- Programmes need to be better designed to meet the basic needs of the beneficiaries

Stakeholder participation and awareness creation

- Most of centrally-sponsored land development programmes are subsidy-driven or carried out with 100% assistance. Hence, there was only minimal involvement of the beneficiaries and a sense of ownership among them was lacking.

Strengthening knowledge base and developing information and monitoring systems

- Traditional knowledge in land resource management needs to be given requisite importance.
- There is a need of systematic scientific generation of databases for land resources (including the quality of soil etc.).

Strategies for sustainable land management

The Approach Paper to the Tenth Five-Year Plan assigns high priorities to area-specific programmes such as watersheds, river valleys, arid areas, wastelands. Even though the watershed approach has been adopted for area development

programmes, it is still essential to coordinate the activities of all line departments and adopt an integrated approach. At the institutional level, it is essential to establish the horizontal linkages between various agencies that are involved in land resource management.

It is imperative to ensure the full participation of and a sense of ownership amongst the beneficiaries of land development programmes in order to make these sustainable. There is a need to involve the stakeholders from the planning stage onwards and address other socio-economic and poverty issues in land development programmes.

The government would take the lead role in capacity building at the grassroot level by planning, implementing and monitoring integrated land resources management programmes. There is an urgent need to build and augment capacities in State soil and land use departments to develop information systems and forge linkage between the information and production systems.

Sustenance of the development programmes beyond the life of the project is an important factor contributing to the success/failure of many area development programmes. The Approach Paper to Tenth Plan also highlights the need for a paradigm shift from physical and economic targets, to sustainability in land development programmes. This shift needs to be translated into reality while planning any land development programme.

The land resource accounting is not properly incorporated in the present national income accounts. Under the present accounting system land and land resources are treated as free and the cost attached to the use of land is not accounted for, especially when land quality deteriorates or the ecosystems functions change. Natural resource accounting is yet another area, which the government intends to take forward.

From the Tenth Plan every effort would be made to bring land currently uncultivated into productive use, whether in agriculture or in forestry. For this, it will be essential to evolve a comprehensive land-use policy which will lay out the contours of ownership and institutional framework that will encourage the productive utilization of such lands.

The Tenth Plan will also focus on increasing work opportunities and the productivity of women farmers. Increasing women's access to productive land by regularizing leasing and sharecropping of uncultivated agricultural land by women's groups, encouraging collective efforts in bringing wastelands under cultivation and providing policy incentives to women in low-input subsistence

agriculture, will have immediate benefits for women's empowerment and household food security.

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Introduction

Agriculture continues to be the mainstay of the Indian economy. At around 26.8%, agriculture and allied activities continue to be the single largest contributor to the gross domestic product (GDP). The dominance of the sector is even greater, in terms of employment as it employs two-third of the country's workforce. Several major Indian industries, such as sugar, textiles, jute, food processing, and milk and milk processing depend on agriculture. On account of its backward and forward linkages with other economic sectors, changes in agricultural performance have a multiplier effect on the entire economy. It's performance is therefore crucial in the task of reduction and eventual elimination of poverty in India.

The following section gives an overview of Indian agriculture, followed by the corresponding Agenda 21 concerns. The next section reviews policies and initiatives in agriculture and thereafter, the policies are measured against the concerns in Agenda 21 and directions suggested incorporate these concerns.

Overview of the sector

The Ministry of Agriculture and Cooperation is the focal point for all issues relating to agriculture and allied activities such as Animal Husbandry and Fishing. The Ministry of Agriculture comprises three departments: Department of Agriculture and Cooperation, Department of Agricultural Research and Education, and Department of Animal Husbandry and Dairying. Other important related ministries are the Ministry of Food Processing Industries, Ministry of Chemicals and Fertilizers and Ministry of Water Resources. Under the Ministry of Food Processing Industries, the Department of Food Processing Industries is responsible for developing a strong and vibrant food processing sector. In the Ministry of Chemicals and Fertilizers, the Department of Fertilizers deals with fertilizer planning and production and its imports, movement and distribution. The Ministry of Water Resources is responsible for laying down the policy guidelines and programmes for the development and regulation of the country's water resources.

In India, agriculture is the dominant land-use type. The net sown area has stabilized at around 143 Mha since the 1970s, accounting for 47% of the reporting area. Around 34% of this area is sown more than once, amounting to a gross cropped area of 191 Mha (1997/98). The area under foodgrains accounts for 65% of the total gross cropped area and commercial crops (such as oilseeds) make up 25%. Nearly two-thirds of the area under food grain crops is under rice and wheat cultivation. About 38% of the total gross cropped area was irrigated in 1997/98 (MoA, 2001b).

Though around 84% of the country's total water consumption is consumed by agriculture, 62% of the cropped area is still dependent on the monsoons for water. Fortunately, the country has been having normal monsoons ($\pm 10\%$ of long period average) since 1992 (MoF, 2002).

The distribution of certified seeds had increased to 0.83 million tonnes by 1998/1999 (MoA, 2001b). Both private and public sectors are major players in the country's seeds industry. The availability of better seeds has brought more area under the high yielding varieties (HYVs). The area under HYVs was 78 Mha in 1998/99. Nearly 73% of the area covered by HYVs is under rice and wheat. Because HYVs are susceptible to pests and diseases, pesticides have become indispensable for modern agriculture. The consumption of technical-grade pesticides was 49 thousand tonnes during 1998/99. Modern agriculture largely depends on the use of inputs such as concentrated fertilizers and, over time, the fertilizer consumption in the country has increased. At present India is the third largest consumer of fertilizers in the world, and in 2001/02 the total consumption of nitrogenous, phosphatic and potassic fertilizers was 19.3 million tonnes (FAI, 2001).

India's food production has exceeded its requirement in the last decade. Food stocks are well above the minimum buffer stock norms, with 58 million tonnes having accumulated by January 2002. Imports were resorted to only once in the last decade. Apart from food grains, the production of other crops and activities allied to agriculture – dairying, fishing, forestry – have all been growing.

The horticulture sector has been growing more rapidly and has registered a growth rate of 6% per annum in the 90's. India accounts for 10% of the world's production of fruits and is the second largest producer of vegetables after China. Exports of fruits and vegetables increased by almost 90% in the 90's (Planning Commission, 2001b).

The average annual growth rate of agriculture and allied sectors (agriculture, forestry and fishing) during the post-Rio conference period 1992 to 2000, was 3.6% (at 1993/94 prices). The growth rate of agriculture (includes all crops,

animal husbandry and dairying) was marginally higher (3.7%) during the same period. Crop agriculture grew by 2.2% during the period 1992 to 2000. Food grains and non-food grains registered annual average growth rates of 2.0 and 2.4%, respectively. This was much higher than the population growth rate of 1.6% for the same period. Agricultural products constituted 13.5% of the total export earnings in 2000/2001 (MoF, 2002).

There is an extensive network of institutions for education, research and extension work. The most important institution is the Indian Council for Agricultural Research (ICAR) which has a wide network of research institutions.

Agriculture and Agenda 21

The major concerns in agriculture sector, as articulated in Agenda 21, are to increase food production and enhance food security in a sustainable way. To achieve this, the need for developing appropriate and new technologies, farm education initiatives, and utilizing economic incentives has been emphasized. The main issues identified in the agriculture sector relate to food security and sustainable development, people's participation and human resource development, diversification of rural employment, land resources planning, land conservation and rehabilitation, water availability, plant and animal genetic resources conservation and utilization, pests and nutrient management, rural energy, and ozone depletion and its impacts on plant and animal species (Agenda 21). Some of these issues have been dealt with at length in other chapters of the document^a.

Food security and sustainable development

This issue includes the integration of sustainable development considerations with agricultural policy, including inputs management, review of agricultural policies, especially with respect to post-harvest technologies, and review of agricultural policies in relation to foreign trade, pricing policy for inputs and output, exchange rate policies, subsidies and taxes.

People's participation and promoting human resources development

^a Specifically, rural energy is covered in Chapter 3 on Energy; irrigation and water availability in Chapter 7 on Water resources; land management and land-use planning in Chapter 13 on Land resources; and rural poverty alleviation in Chapter 16 on Poverty alleviation and human resource development.

This issue emphasizes peoples' participation in sustainable agriculture and rural development; ensuring access to natural resources, technology, financing, marketing and distribution; and strengthening people's capabilities in managing resources and decision-making.

Diversification of rural employment and infrastructure development

Agenda 21 emphasizes the need for efficiency in using local resources while minimizing environmental and economic risks in meeting food demands. It also stresses avoiding the expansion of agriculture into marginal and fragile ecosystems.

Where intensification of farming systems is not possible opportunities for diversification should be developed. There could include on-farm and off-farm employment opportunities, such as cottage industries, wildlife utilization, recreation and tourism, agro-based industries. A strong infrastructure would catalyze the development of these activities.

Conservation and utilization of plant and animal genetic resources

Plant and animal genetic resources are of paramount importance in increasing the quantity and quality of plant and animal products. Recent technological developments in biotechnology have opened up a whole new set of opportunities. The success of these new technologies depends on the availability of suitable genetic resources. Agenda 21 highlights the need to safeguard plant and animal genetic resources while preserving them for sustainable use.

Integrated pest and nutrient management

Estimates of pre-harvest and post-harvest losses due to pests range between 25-50%. Pest control is an essential part of the package of improved cultivation practices. The overuse of chemical pesticides has led to undesirable effects on human health and environment. Integrated pest management, which combines biological, host plant resistance and agronomic practices minimizes the use of chemical pesticides and contributes to the sustainability of agriculture.

Plant nutrients tend to get depleted as a result of intensive cultivation. As a result more and more marginal and fragile ecosystems have been put to agricultural use causing further land degradation and associated environmental problems. Excessive dependence on chemical fertilizers is proving to be harmful to soil health and is harming the environment. An integrated approach to plant

nutrition needs to be adopted to ensure a sustainable supply of plant nutrients so that future yields can be increased without harming soil productivity and environment.

Role of farmers

The role of farmers needs to be encouraged and special care needs to be taken of weaker groups such as the poor and women.

Review and analysis of policies, programmes and other initiatives in the agriculture sector

Review of major policies, programmes and other initiatives

Table 14.1 Important initiatives in the Agriculture sector

Year	Initiative	Objectives
(1) Agricultural productivity		
1988-89	The Special Foodgrain Production Programme (SFPP)	To maximize productivity in high and low yield areas alike.
1985-90	National Pulses Development Programme (NPDP)	To encourage pulses in irrigated areas, inter-cropping, multiplication and use of improved seeds, adoption of plant protection measures, remunerative prices and marketing support.
1989	Integrated oilseeds policy	To extend support to farmers with improved technology, inputs and remunerative prices.

Year	Initiative	Objectives
Initiated in Sixth Plan and continued thereafter	National Watershed Development Project	A holistic approach towards farming systems through micro-watershed development in each block with assured irrigation of 30%. For rainfed areas that aim at ensuring long-term food security, bridging regional disparity and providing employment opportunity. The Programme integrates components such as diverse production systems (including seasonal cropping, horticulture, forestry and animal husbandry, silvi-pasture development), crop demonstrations, organic farming, and use of vegetative barriers to prevent soil erosion and conserve moisture, land-use planning, reclamation of alkaline soils and control of shifting cultivation.
1985-90	Integrated Cotton Development Programme and Special Jute Development Programme,	Specially targeted schemes to encourage production of cotton, jute and mesta initiated during the VII
1997-2002	Establishment of Cotton Technology Mission during the Ninth Plan.	Plan from the viewpoint of enhancing export potential
2000	National Agricultural Policy	Integrated approach to enhance and optimize efficiencies of farm practices, natural resources use, rural marketing, and infrastructure.
(2) Agriculture research and education		
1929 onwards	Indian Council of Agricultural Research (ICAR) National Grid Comprising	Education, Research and Extension in agriculture and allied technologies

Year	Initiative	Objectives
	<ul style="list-style-type: none"> - Central Research Institutes (49) - Nation Bureaux (4) - National Academy of Agricultural Research Management - Central Agricultural University (1) - Agricultural universities (30) - Regional stations (158) - AICRP (80) involving 24000 agricultural scientists - Project directorates (10) 	
(3) Agricultural extension		
End of Fourth Plan onwards	Krishi Vigyan Kendras (KVKs- 261), Trainers training centre (TTC - 8), Technology assessment and refinement through Institution Village Linkage Programme (IVLP- 70), technology evaluation and Impact assessment (60), and Agriculture Technology Information Centers (ATICs - 40) and , Zonal Agricultural Research Stations (ZARS- 53)	Technical training programmes for transfer of technology in different branches of agriculture. Agriculture extension, Human resources development in agriculture, diversification of rural employment
Sixth Plan onwards 1988	Training and visit system Agro-climatic Regional Planning Approach	Re-organization and strengthening extension Integrated development plan for agriculture and allied sectors differentiated by homogenous agro-climatic regions.
Ninth Plan	National Agriculture Technology Project National grid comprising 46 institutes including 4 deemed universities, 4 national bureaux, 9 project directorates, 31 national research centres, 158 regional stations, and 80 AICRP	Research and human resources development Agricultural research and education
(4) Dry land development		

Year	Initiative	Objectives
1970/71 onwards	Dry Land Agricultural Development Scheme	Technologies for improving dry land agricultural productivity
1972-73	Drought Prone Areas Programme	Economic development of the area with focus on disadvantaged sections
(5) Crop insurance		
1985	Comprehensive Crop Insurance Scheme (CCIS)	To provide crop insurance against damage due to natural calamities for rice, wheat, millets, pulses and oilseeds
1999	National Agricultural Insurance Scheme (NAIS) or Rastriya Krishi Bima Yojana (RKBY)	To provide crop insurance to all farmers to cover all food, oilseeds and annual commercial/horticultural crops

Year	Initiative	Objectives
(6) Infrastructure		
1996-97	Accelerated Irrigation Benefit Programme (AIBP) under which the Centre provides additional central financial assistance by way of loans to the states on matching basis	Speedy and timely completion of selected large irrigation and multi-purpose projects to ensure timely benefits to farmers. Additional features of the AIBP include encouragement of improved water management practices, installation of drip and sprinkler irrigation, conjunctive use of surface and groundwater and farmers' participation in irrigation water management.
Ninth Plan	Credit Linked Capital Subsidy Scheme	Cold storage and onion storage facilities
(7) Plant genetic resources		
1976	National Bureau Of Plant Genetic Resources (NBPGR)	Exploration and collection, exchange, quarantine, evaluation/characterization, documentation and conservation of plant genetic resources

Year	Initiative	Objectives
1988	New Seed Development Policy announced.	This is a follow up to the policies initiated in the earlier years to increase the availability of quality seeds. The new policy permitted the import of superior quality seeds, germplasm and planting material after they have been verified for performance in Indian conditions.
1985-90	Third phase of National Seed Project with support from the World Bank launched.	100% foreign ownership of seeds units allowed, with focus on production of low-volume-high-value seeds. Public sector units given larger responsibility for high volume low value seeds to fulfil national objectives.
1988	New Seed Development Policy (NSDP)	Liberalize import of seeds and germplasms
2000	Draft Seeds Act	Reforms covering, seed production, distribution, quality control, legislation, import and export of seeds, quarantine, breeders and farmers rights, foreign investment in seed sector.
2001	Plant Varieties Act	Breeders right with respect to production, sale, marketing, export, import of varieties. Also farmers and researchers rights to use the improved varieties are recognized.

(8) Animal genetic resources

Year	Initiative	Objectives
1983	National Bureau of Fish Genetic Resources (NBFGR)	Collection, classification and evaluation of information on fish genetic resources of the country, cataloguing of genotypes, Maintenance and preservation of fish genetic material in coordination with other agencies and conservation of endangered fish species and monitoring the introduction of exotic fish species in Indian waters.
1984	National Bureau of Animal Genetic Resources (NBAGP, Karnal)	Identification, evaluation, characterisation, conservation and utilization of livestock and poultry genetic resources.
(9) Integrated pest management and control		
1985-90	Thrust on integrated pest management (IPM) through adoption of cultural, mechanical, biological and chemical methods of control.	To minimize the use of harmful chemicals which will affect human and ecosystem health
1989	Plant Quarantine Rules including Plant, Fruit, and seeds (Regulation of Import into India) Order 1989 (PFS order, 1989)	To prevent introduction of exotic pests, diseases and weeds etc. into India
(10) Sustainable plant nutrition to increase food production		
1990-91 & 1991-92. Continued during Eighth Plan (1992-97)	Centrally-sponsored Schemes for Balanced and Integrated Use of Fertilizers and National Project on Development of Fertilizer Use in Rainfed Areas Integrated Nutrient Management (INM)	Soil test based NPK and micro-nutrients application Setting up of compost plants for processing city waste/garbage. To promote need-based use of chemical fertilizers
1985-90	National Project on Development of Bio-Fertilizers (40 Blue-Green Algae Sub-centres established) and National Project on Quality Control.	Aim was to encourage use of bio-fertilizers and produce blue-green algae through field multiplication.
1992 & 1994	Changes in policy of fertilizer pricing	Price decontrol for P&K; increase in urea prices; flat subsidy for P&K.
(11) Animal husbandry		

Year	Initiative	Objectives
2000	National Project on Cattle and Buffalo Breeding	Improved services, greater use of private and community institutions.
2001	Aquaculture Authority	Regulation of shrimp culture specially in CRI areas.
2001	Amendment to Livestock Importation Act	Safeguarding livestock from diseases
Ongoing schemes	i) Assistance to State for Control of Animal Disease ii) Integrated Dairy Development Project iii) Assistance to Cooperatives for Dairy Development iv) Establishment of Fishing Harbours v) Development of Freshwater Aquaculture	Promoting various aspects of livestock development and fisheries.

Source. Seventh, Eighth and Ninth Five-Year Plans, Economic Survey (various issues).

Achievements

Food security and sustainable development

Food security and sustainable agriculture growth have occupied the centre-stage in formulation of policies for India's agriculture and rural sectors. Indian agriculture has made rapid strides in the past. The annual per capita production of rice and wheat rose from 152 kg in 1991 to 163 kg in 2000, and then came down to around 150-155 kg in the last two years, that is, 2001 and 2002. The achievements over the last two decades have contributed significantly to the attainment of self-sufficiency in food and in reducing food shortages and imports. Imports of cereals were resorted to only in two years, 1993 and 1994. The volume of imports was also small at less than 2% of the total production of cereals. Special efforts have been made to raise the productivity and production of crops to meet the increasing demand for food generated by unabated demographic pressures and the need for raw materials to expand agro-based industries. Several other policy interventions on the output side, such as the grain support policies executed through the Minimum Support Prices (MSP) for wheat and rice and major food grains, have contributed to it. The MSP for all the major agricultural products are announced at the start of each season after considering the suggestions of the Commission for Agricultural Costs and Prices (CACP). The MSPs have been steadily raised in the 1990s (Planning Commission, 2000).

From 1992 through 2000 the production of rice, wheat and pulses grew annually by 2.2, 3.6 and 0.8%, respectively (Eighth and Ninth Five-Year Plans). However the production of coarse cereals declined by 1.6%, indicating the producers' inclination towards high-value food grains. The production of (9 major) oilseed crops, jute, mesta and sugarcane also increased between 1992 and 2000 but cotton production fluctuated largely due to pests and diseases. The Technology Mission for Cotton has resulted in a significant improvement in production of cotton with improved export potential.

Horticulture has grown rapidly in the 90s. The production of fruits increased from 28.63 million tonnes in 1991-92 to 44.04 million tonnes in 1998-99 which represents an increase of over 50%. The production of vegetables increased from 58.53 million tonnes to 87.53 million tonnes representing an increase of about 50% over the same period (Planning Commission, 2001b).

Buffer stocks

Besides subsidies on food supplies and food procurement, buffer stock operations also constitute an important element of policy to attain food security. Given that agricultural production is subject to climatic swings, if left to the market forces, the price of food grains would tend to fluctuate, and that may be costly both for the producers/farmers as well as the consumers. To check price variability, building and maintaining buffer stocks has been the policy (GoI, 2000a; Planning Commission, 2000). However, interestingly enough the challenge faced by the policy makers now is to reduce the prevailing levels of stocks of agricultural produce to provide wider access to consumers while avoiding a reduction in product prices to the seller. The buffer stocks in the 1990s were consistently above minimum norms, except in 1997 (MoF, 2002).

Food distribution systems

For effective distribution of food procured by the agencies, there is a network of more than 400,000 fair price shops under the public distribution system (PDS). The PDS distributes Rs 15,000 crores worth of commodities to over 16 crore families each year. The PDS has been modified from time to time. In 1997 a new Targeted Public Distribution System (TPDS) was started with the objective of ensuring food and nutritional security of the poor by giving foodgrains at lower prices to those below the poverty line. This was further modified in 2000 when the Antyodaya Anna Yojana scheme was launched. Under this scheme the 10 million poorest families were identified out of the 65.2 million below poverty line families and provided foodgrains at a price even lower than the price for below-

poverty-line families (Economic Survey, 2001-02). In addition to the TPDS, two additional schemes are in operation—Integrated Child Development Scheme (ICDS) and the Mid-day Meal Programme of the Central Government—aimed at reducing household malnutrition. The government expenditure on these schemes is more than Rs 13,400 crores per annum (Planning Commission, 2000).

Inputs for agriculture development

The growth in agricultural output achieved over the nineties because of higher output support prices was combined with a range of input subsidies on water, fertilizers and power. Land is a crucial input for agriculture and several measures have been taken to ensure that its quality is maintained and optimum use is made of land resources for agriculture. (For a discussion on the policies for land resources see the Chapter on Land resources). The creation of irrigation potential and its optimum utilization have been accorded a high priority in governmental planning. The net irrigated area has increased from 22.6 Mha in 1950/51 to 94.7 Mha in 1999/2000. Most significantly, the government launched the Accelerated Irrigation Benefit Programme (AIBP) in 1996/97, under which the Centre has committed additional financial support to states for the early completion of selected large irrigation and multi-purpose projects (for more details on this aspect, see chapter on water resources) (MoF, 2002).

The consumption of fertilizers (mainly nitrogen (N), phosphorus (P) and potassium (K)) has steadily increased over the years. The overall consumption of fertilizers increased more than three-fold from 5.5 million tonnes in 1980/81 to 18.07 million tonnes in 1999/2000. The Central Government has promoted the use of fertilizers by providing a subsidy on urea, phosphatic and potassic fertilizers to encourage and move towards a more balanced use of NPK. The Retention Price-cum-Subsidy Scheme (RPS) was introduced in 1977 to help insulate the farmers from fluctuating fertilizer prices, encourage fertilizer consumption to sustain the green Revolution and provide stable mark-ups to the indigenous fertilizer industry. The level of subsidy was fixed for each plant separately. Since 1992 this has been done only for urea, while for P and K it is a flat subsidy. The total subsidy on fertilizers (including imports) was estimated at Rs 14170 crores in 2001/02 (MoF, 2002).

The private sector will also be increasingly used to provide better inputs and technology for the benefit of farmers.

Seeds development

Improved varieties of seeds together with a sound and equitable system of distributing these are another component of India's success in agriculture. The Seed Multiplication Programmes for cereals, pulses, oilseeds, fibre, fodder crops and potato have been put into operation largely by the National Seeds Corporation Limited, State Farms Corporation of India Limited, the state Seeds Corporations, state-level seed-producing agencies and private seed companies. Following the recommendations of the Seed Policy Review Group, the Draft Seeds Act proposes legislation that would establish a National Seeds Board to encourage indigenous development of newer varieties and their registration, promote research and development and regulate trade in seeds types (GoI, 2000a; Planning Commission, 2000).

Credit development

To encourage the flow of credit to the agriculture sector, a share of 18% of net bank credit is targeted for lending by commercial banks. The National Bank for Agriculture and Rural Development (NABARD) is the key institution directing flow of credit to agriculture. Some noteworthy developments in recent years have been the launch of the Rural Infrastructure Development Fund (RIDF) in 1995/96 and the Kisan Credit Card Scheme (KCCS) in 1998/99, to facilitate short-term credit to farmers. The RIDF has been set up to assist the state governments while state-owned corporations provide financial support for ongoing rural infrastructure projects. Successive Union Budgets have been raising the allocations to the RIDF. The Union Budget for 2001/02 provided for RIDF VII with a corpus of Rs 5,000 crores. Cooperative banks, the Regional Rural Banks and the commercial banks together had issued 14.4 million KCCs up to the end of March 2001, with the amount sanctioned at Rs 26,058 crores (Planning Commission, 2001c).

The Reserve Bank of India (RBI) has also evolved an annual plan of action for disbursement of credit to agriculture called the Special Agricultural Credit Plan (SACP) that targets 25% growth in disbursements each year.

Farm mechanization development

In nineties, farm mechanization grew in an unprecedented manner. Through the period 1993/94 to 1999/00, 1.47 million tractors and 85,000 power tillers were sold in the country. The employment of agricultural machinery that had earlier remained confined to a few states, such as Punjab, Haryana and Western Uttar Pradesh, now showed increasing penetration to other rice-growing states, too. The capital intensity per unit of land has been increasing for all categories of

farmers, but in relative terms this has grown much faster in the regions covered by the Green Revolution and for large farmers. The prevailing high capital intensity has been sustained by awareness campaigns, training and capacity-building programmes, subsidized power and water and other forms of subsidies (unpaid loans, cheap fertilizers) etc (Planning Commission, 2000).

Animal husbandry development

The livestock sector helps in providing essential proteins for human diet, besides providing employment opportunities to the rural people. It has also registered a notable growth. Between the period 1991/92 and 2000/2001, milk production has increased from 55.7 million tonnes to 81 million tonnes. India has become the largest producer of milk in the world. The value added from milk production is now about the same as added from rice. Fish and egg production also increased over the same period from 5 million tonnes to 5.7 million tonnes and 22 billion to 32.5 billion (numbers) respectively. All these achievements have increased the per capita availability of these products. It has also helped to diversify rural incomes (MOA, 2002).

This increase in production has been brought about by an equally impressive rise in the livestock population (Table 14.2).

Table 14.2 Livestock population, 1987-92 (in million)

Species	1987	1992
Cattle	200	205
Buffalo	76	84
Sheep	46	51
Goats	110	115
Pigs	11	13
Poultry	275	307

Source. Agricultural Statistics at a Glance (2001), Live Stock Census, Ministry of Agriculture

Exports and international trade development

India's exports of agricultural products are divided into three categories: (i) raw products, (ii) semi-raw products, and (iii) processed and ready-to-eat products. At the beginning of the nineties, the value of agricultural exports stood at US \$ 3521 million with a share of 19.4% to the total value of exports. These rose to US \$ 6828 million in 1996-97 (accounting for 20.4% of aggregate exports) and subsequently declined to US \$ 6037 million (18.2% of total exports) in 1998-99. The major commodity groups include cereals, oilmeals, plantation crops (tea,

coffee, cashew, and spices), and marine products (MoF, 2002). In 2000/01, these exports stood at US \$ 6004 million, accounting for 13.5% of total exports.

The World Trade Organisation's (WTO's) Agreement on Agriculture (AoA) offers both threats and opportunities to India's agriculture sector. The AoA requires that developed countries lower the barriers to trade in agricultural commodities faster than the developing countries by undertaking a reduction in export subsidies, production subsidies and import tariffs. Nonetheless, experience points to a lack of adequate progress in the implementation of these commitments to provide market access to developing countries such as India. While the AoA may not have an impact the entire agricultural sector, certain crop types will gain and others may lose. The analysis of the AoA on trade in select commodities points to raising of domestic wholesale and farm gate prices of rice and maize, with a magnified impact on the former. The prices of edible oils and oilseeds such as rapeseed/mustard would decline on account of freer imports of seeds (Planning Commission, 2001c).

Although quantitative restrictions were removed last year, a large-scale imports of agricultural products have not occurred thus far. Nevertheless, given the large scale support to agriculture in other parts of the world, constant monitoring would be necessary.

Peoples' participation and promoting human resources development^a

The initiatives taken by the government have improved the quality of human resources in agriculture. So far a total of 29 state agricultural universities, 1 central agricultural university and 4 deemed universities have been established in different parts of the country. The agricultural education system in the country offers degree programmes in 11 specific disciplines viz. agriculture, veterinary science, agricultural engineering, forestry, home science, dairy technology, fisheries, sericulture, marketing, banking and cooperation, horticulture and food science with a total intake of about 11,000 students. These institutions also offer post-graduate programmes in more than 55 fields of specialization with a total intake capacity of about 5,000 students. Under the human resource development programme the council offers about 1200 scholarships and fellowships from the undergraduate to post-doctoral levels. Special fellowships are also offered for socially and economically weaker groups.

^a Source: MoA 2001a

A World Bank-assisted project on Agricultural Human Resource Development (AHRD) has been launched to improve the educational system in agriculture and meet future challenges. During the project period steps will be taken to establish an accreditation board, reform the syllabus, improve faculty, upgrade and modernize laboratory facilities, farms, libraries, hostels, communication systems and other ancillary facilities. A National Agricultural Technology Project (NATP) is also contemplated to bridge gaps in technology generation, assessment, refinement and transfer and to enhance the ICAR's institutional capability to meet future challenges on the research and development fronts.

Considerable emphasis has been laid on developing a sound extension service to bring to the farmers the latest knowledge and developments. In the public sector these are categorized into three areas as follows.

- State government line departments-operated extension (Departments of Agriculture, Horticulture and Livestock development)
- State agriculture universities-based extension (Directorate of Extension, Krishi Vigyan Kendras (KVKs) and Krishi Gyan Kendras (KGKs)
- ICAR extension (Zonal Research Stations/Krishi Vigyan Kendras, Agriculture Technology Information Centres (ATICs), Institute Village Linkage Programme (IVLP) etc.)

In the private sector the types of extension are:

- Community-based organization (Farmers' organizations, farmers' cooperatives, self-help groups, farmer interest groups, etc.)
- Para-extension workers (contact farmers, link farmers, master farmers, *gopals*, *mitra kisans*, *mahila mitra kisans*, etc.)
- Agri-clinics and agribusinesses
- Input suppliers/dealers (pesticides, seeds, nutrients, farm implements, etc.)
- Corporate Sector (commercial crops – tobacco, tea, coffee, oilseeds (sunflower), vegetables, seeds, farm implements – tractors, threshers, sprinklers, drip irrigation, etc.)

Cooperatives have played a major role in ensuring the peoples' participation in agricultural development. The role of cooperatives in agriculture has been substantial covering every aspect of it – inputs, marketing, credit and distribution. These initiatives have resulted in improved quality of manpower and higher productivity in different crops ranging from 20 to 72% compared to conventional yield levels.

The participation of people has also been sought in animal husbandry. Breeders associations have been promoted to address common problems. Improvement in the maintenance of grazing/pasture lands has been sought by involving the community. The National Project for Cattle and Buffalo Breeding (NPCCB) is a recent project which was started in 2000. The project aims at streamlining the storage and supply of liquid nitrogen, providing artificial insemination at the doorstep, introduction of quality bulls, improved quality of existing services etc. NGOs, breeders associations and even private individuals are encouraged to participate in this process.

Diversification of rural employment and infrastructure development

The concerns of rural poverty are inextricably linked to low productivity of rural activities and incidence unemployment/underemployment. It has therefore been considered a policy imperative that productivity and employment levels be enhanced. While there has been a marked decline in the incidence of poverty in rural areas, any average estimates tend to hide wide variations across regions in the concentration of rural poor. A decline in poverty and rural development both follow the economic betterment of people as much as social transformations. The government has launched many programmes to this effect, that have addressed the peoples' participation in rural areas, diversification of employment opportunities, decentralization of planning (through enlargement of role of panchayati raj institutions and voluntary organizations), enforcement of land reforms and greater access to credit and inputs. The specific schemes are the Integrated Rural Development Programme, Training of Youth for Self-Employment, the Supply of Toolkits for Rural Artisans, Development of Women and Children in Rural Areas, Jawahar Rozgar Yojana etc. These have been dealt with in much greater detail in the Chapter 16 as well as Chapter 13. In addition the development of fisheries, horticulture and animal husbandry have all played an important part in diversifying rural incomes. Details of the growth of these sub sectors have been given earlier in this chapter under the section dealing with Food Security and Sustainable Development.

Steps have also been taken to encourage a greater role for private individuals to provide a range of services for the livestock sector. Apart from improving the quality of service these initiatives will also play a role in diversifying rural incomes.

Conservation and utilization of plant genetic resources for food and sustainable agriculture

The setting up of the National Bureau of Plant Genetic Resources (NBPGR) in 1976 has paid rich dividends. So far the Bureau has conducted 564 explorations in diverse agro-ecological regions and habitats representing different phyto-geographical zones of the country. This has resulted in assembling 1,07,346 accessions of agri-horticultural crops/genera. The Bureau has also established a National Herbarium of cultivated plants which has 12,599 herbarium specimens of 2,657 species belonging to 1,085 genera and 215 families. The corresponding holdings of seeds as voucher specimens are 1818. In addition to exploration of indigenous germplasms the Bureau actively promotes the introduction of exotic germplasms. So far, 13,71,814 accessions from 81 countries and 8 international agricultural research centres have been introduced and 3,95,223 accessions supplied to other countries including SAARC countries (ICAR, 2001). Realizing the need to characterize the indigenous diversity and to protect the country's genetic resources, the ICAR established a National Research Centre for DNA fingerprinting at the NBPGR. The centre will develop molecular fingerprints of released varieties and genetic stocks of crop plants of India. The All India Co-ordinated Research Project on Under-utilized and Under-exploited Plants (UU&UEP) was initiated 15 years ago, to find new plant resources for food, fodder and industrial use and to prioritize a few promising ones among these for development of improved technology. In all, 24 crop species have been identified for research under this project. Besides augmentation of over 6,700 germplasm accessions in these crops at NBPGR locations and other centres, the project has recommended/released 12 improved varieties in 7 different crops. Improved packages of cultivation practices and certain cropping systems have been standardized and recommended.

The ICAR system has so far developed and released more than 2300 high-yielding varieties and hybrids, fuelling the Green Revolution. In all, 452 high-yielding varieties and hybrids of various field crops were released for general cultivation during the period 1992 to 1996.

Conservation and utilization of animal and fish genetic resources for sustainable agriculture

The National Bureau of Animal Genetic Resources (NBAGR) has been engaged in conserving Indian animal breeds. The data on livestock and poultry genetic resources have been computerized in the form of databanks. This covers (i) district-wise livestock population for all species of domestic livestock from 1961 to 1992 for each census year and for all categories i.e. sex-wise, age-wise and function wise; (ii) germplasm repositories containing the name and addresses of

livestock farms, breeds maintained, herd strength, number of bulls, semen banks, semen doses for each breed; (iii) Breed characteristics containing complete information on the natural habitat of a breed, socio-economic status of farmers in the tract, management practices, physical characteristics and performance parameters.

The livestock census data has been integrated with the information system on animal genetic resources of India (AGRI-IS). A menu-driven information system has been developed by combining all the databases. Facilities have been provided for data entry, retrieval, display etc. This also contains colour photographs of the male, female, calf and herd for each breed. A software package has been developed for entry and analysis of data collected for evaluation of breeds under field conditions. Field surveys have been conducted on a few chosen farm animal breeds to study yield, population trends, and substitution of cattle by buffaloes. Through various initiatives, different improved breeds of cattle, buffaloes, goats, sheep, pigs, poultry and fish are being developed and released (ICAR, 2001b).

The National Bureau of Fish Genetic Resources has been working in five major programme areas related to the conservation of fish germplasm resources. The incorporation of the geographic information system (GIS) into the fish biodiversity database will help in planning macro-and micro-level location-specific conservation programmes. With a battery of genetic markers developed under its genetic characterisation programmes, definite conclusions about prioritized species have emerged. In the Bureau's programme on in situ conservation, greater stress has been given to understanding the habitat requirements of endangered species and the communities' perception of conservation issues. Under the gene banking programme, the NBFGR has added more endangered species for which sperm cryopreservation protocols have been perfected for commercial application. Under exotic and quarantine regulation, greater emphasis has been laid on the quarantine database and developing capabilities for screening exotic diseases so that the necessary research support for establishing aquatic quarantine can be given.

Integrated pest and nutrient management

Modern crop varieties require a high degree of plant protection measures. In India the consumption of technical-grade pesticides increased from 8,620 tonnes in 1960/61 to 75,000 tonnes in 1990/91. As a result several pesticide-induced pest outbreaks have been reported from the various parts of the country. Out of 166 registered pesticides in India under the Insecticide Act 1968, 34 are either banned or restricted in developed countries. The indiscriminate use of pesticides has

resulted in the loss of biodiversity of natural enemies, secondary pest outbreaks, and development of resistance to pesticides, food contamination, adverse health impacts, and ecosystem damage. Based on the recommendations of registration committee and the expert committees, 27 pesticides have been banned and 10 other pesticides have been put under restriction so far. The Government of India has been practising Integrated Pest Management since 1985. In IPM the emphasis has been on pest management through a combination of agronomic, chemical and biological methods. IPM is being promoted in the country through 26 Central Integrated Pest Management Centres located in 22 States and 1 Union Territory. Timely sowing, use of tolerant and resistant plant varieties, biocontrol agents, and need-based application of chemical pesticides have all resulted in the reduction in the consumption of technical-grade pesticides from 75,000 tonnes in 1990/91 to 49,160 tonnes in 1998/99. This trend is a positive move towards sustainable agriculture. Greater awareness creation on outbreak of pests and diseases amongst the farming community is expected to lead to a greater success (MoA, 2001a).

Integrated nutrient management

The fertilizer (NPK) consumption in India has increased from 0.5 MT in 1963/64 to 18.1 MT in 1999/2000. The fertilizer production of 14.3 MT during 1999/2000 fell short of the consumption by 27%. This gap is likely to widen for economic and environmental reasons. To meet the challenge of promoting sustainable plant nutrition to increase food production various initiatives such as centrally-sponsored schemes on the balanced and integrated use of fertilizers, and a national project on the development and use of biofertilizers have been initiated. The government had promoted the use of chemical fertilizers in the past. While this would continue, it also needs to be complemented by greater use of organic/biofertilizers. Accordingly, the Government of India has been promoting the use of organic manures and supplementary sources of plant nutrients to crop as a means of protecting the environment. A task force has been set up to go into all aspects of organic farming. It is proposed to promote the use of organic manure and organic farming in a big way during the Tenth Plan. A strategy for judicious combination of chemical and biofertilizers will be pursued to reduce dependence on chemical fertilizers alone (Ninth Five-Year Plan, 1997-2002).

Role of farmers

The Government has increasingly involved farmers in decision-making. A key concept is to decentralize decision-making to the district level through the *District*

Agriculture Technology Management Agency (ATMA) model. This model seeks to ensure a greater representation and voice for farmers in recognition of their role as the primary stakeholders. Secondly this seeks to provide a greater say to the farmers in allocation of resources and to increase their accountability to stakeholders. A third major goal is to increase programme coordination and integration between departments.

Rural women form the most important productive workforce in the economy of most developing nations including India. The agriculture sector employs 4/5th of all economically-active women; they make up 1/3rd of the agriculture labour force and 48% of self-employed farmers. There are 75 million women as against 15 million men in dairying, the number of women engaged in animal husbandry accounts for 20 million (as against 1.5 million men). Nearly 80% of approximately of all economically-active women are engaged in agriculture as compared to 63 % of men.

Despite such significant contributions by women in crop husbandry, animal husbandry, fisheries, forestry and post-harvest technology, those engaged in formulating packages of technologies, services and public policies for rural areas have often ended to neglect the productive role of women. There has been however, a significant shift in the approach towards well-being of women from 'welfare during the fifties', to 'development during the seventies' to 'empowerment during the nineties' and to 'participation during 2000s'.

The Ninth Plan had identified 'empowerment of women' as one of its objectives and had stressed the preparation of a component plan for women in every sector of development. The agriculture policy has also highlighted the incorporation of gender issues in the agricultural development agenda. The policy framework of agriculture extension has also stressed the need for mainstreaming women in the agriculture sector. Efforts are being made by different governmental/non-governmental organizations to incorporate gender issues into the developmental agenda and ensure women full and equitable participation in agriculture development programmes. The Department of Agriculture and Cooperation is implementing special schemes/projects with Central/bilateral assistance to provide training and extension support to women farmers in 21 states of the country. These projects aim to encourage and mobilize women to form groups and all agriculture support services such as technology, information, extension, credit, input and marketing interventions are channelized through these groups. At present 15,000 groups have been mobilized and approximately 3 lakh women have been directly trained under these programmes.

Concerns

Slower growth

The agricultural sector has shown high growth rates in the 80s. These growth rates have tended to slacken in the 90's (MoA, 2000). The production growth rates of rice and wheat declined on account of lower growth in productivity. This was because of saturation in the yields of rice and wheat in the established high productivity areas coupled with lower yields in the central, eastern and north-eastern parts of the country. The production of coarse cereals production grew negatively because land was diverted to other, more remunerative crops. For pulses, the lowering of production growth rates could be attributed to a sharp decline in the growth of yields in the nineties as compared to the eighties. Further, the infusion of cross-breeding programmes and Operation Flood that had boosted milk production in the eighties was not sustained through the nineties. The production of eggs which had increased sharply due to establishment of modern poultry practices in Southern India, followed the same pattern.

Amongst the key policy concerns, the relative slow down in the nineties can be attributed to a much lower accumulation in capital assets in irrigation, power, canals and roads (Planning Commission, 2000). These not only reduced the pace of technological change but also impacted total factor productivity (TFP) adversely. The continuing regulation of inter-state trade in agricultural commodities and canalization of trade have also implied that markets are not fully developed and this can hamper the sector's competitiveness, as also the industries based on it (e.g. cotton textiles and oilseeds).

Public Distribution System

The operations of the PDS also needs improvement notwithstanding the huge increases in annual food subsidy bills from Rs 2,450 crores in 1990-91 to Rs 14,700 crores in 2001/02. Diversion of PDS supplies to non-targeted groups has always been a matter of grave concern. Reportedly, 36% of wheat, 31% of rice and 23% of sugar gets diverted to wrong groups at the national level. On the other hand, the levels of grain stocks with the FCI have shot up. In January 2002, the central food grain stocks stood at 58 million tonnes against the prescribed level of 24.30 million tonnes (MoF, 2002).

Inputs

The present fertilizer pricing policy has been successful in promoting their use and increasing incomes. However there is an imbalance between nitrogen, potash and phosphorous usage with the relative use of nitrogen being excessive. Moreover, there are wide variations in fertilizer application rates across different regions of the country. In Punjab, Tamil Nadu, Haryana and Andhra Pradesh that have high adoption rates for improved technology and a better developed irrigation infrastructure, the fertilizer consumption is much higher than in the north-east or Madhya Pradesh, Rajasthan and Himachal Pradesh, where agriculture is prone to high risks. The deficiency of other forms of micro-nutrients such as zinc, iron, sulphur etc. is also being increasingly felt especially in regions where multiple cropping is practiced. Moreover, over the years the carbon content of soils has decreased in some regions, affecting soil health and productivity.

The impact of water and power pricing policies has been discussed in the chapters on energy and water resources. There is a need to review the past policies with a view to making best use of available resources. The availability of credit to agriculture from nationalized banks has not been growing at desired rates; the share of agricultural credit has been declining from the targeted 18% and is a matter of concern. While the availability of certified/quality seeds has increased substantially, the seed replacement rate (SRR) has still remained much below the desired level of 20% for self-pollinated crops. For rice and wheat it ranges between 8-9% and is much below desirable levels for other crops such as pulses and oilseeds. As a follow up to the WTO agreement on TRIPs, a new Act for the adoption of a *sui generis* system for granting of plant varieties protection has been introduced. The Act is expected to provide an effective system of protection to plant breeders' rights and would support the growth of the seeds industry as well as safeguard farmers' and researchers' rights.

Conservation of genetic resources and R&D

Where crop varieties, are concerned, although landraces and farmers' varieties have been well-explored, weedy and wild relatives of cultivated crop species, endangered species and plant species with potential uses remain under-explored. Storage and field testing of vegetatively propagated germplasm is a major problem due to inadequate facilities. Protection from pests during screening of germplasm materials is limited. In germplasm evaluation little attention is paid to the evaluation of materials for biotic and abiotic stresses. Less attention has been given to exsitu conservation of wild crop relatives and other useful plants.

Conservation of recalcitrant seeds and vegetative propagules has been done on a limited scale using *in vitro* conservation and cryopreservation.

A species catalogue is important to identify gaps and to initiate studies to fill the gap. There is a need to quantify any constriction in the genetic base of target species and to identify heterogeneous populations of endangered and commercial species whose conservation should be given a priority. *In situ* conservation has not been undertaken on a large scale because of inadequate experience in field testing procedures. The absence of infrastructural facilities has limited large-scale gene banking. *Ex situ* conservation in a live gene bank cannot be undertaken in absence of such a facility. Absence of detailed information on unauthorized introductions and spread of exotics in India, has limited the development of an action plan to control exotics (ICAR 1997 a, b & c).

Bio-pesticides

The rate of adoption of bio-pesticides has been slow largely due to inadequate knowledge reaching the farmer. A combination of traditional (organizing field days etc) and modern methods can be used to influence farmers to adopt these techniques. Reliable models to predict insect populations can be developed using the weather information and programmes available on the Internet. Use of GIS can also help better control of pests and diseases through timely adoption of plant protection measures.

Fertilizers

The fertilizer production of 14.3 million tonnes during 1999/2000 fell short of consumption by 27%. This gap is likely to widen due to economic and environmental reasons. To meet the challenge of promoting sustainable plant nutrition to increase food production, various initiatives such as centrally-sponsored schemes on the balanced and integrated use of fertilizers, and use of bio-fertilizers have been initiated. A strategy to encourage judicious combinations of chemical and bio-fertilizers is required to reduce dependence on chemical fertilizers alone.

The current demand for bio-fertilizers in India is estimated at about 1.25 million tonnes and the actual production capacity about 2610 tonnes. This huge gap between demand and supply needs to be bridged. Another concern is the slow adoption of bio-fertilizer by farmers. This is largely because bio-fertilizers do not show instant responses like chemical fertilizers do. In many cases bio-fertilizer technology faces the problems of quality control, inconsistent field performance, poor transport and storage and lack of knowledge. There is need to

put in place better quality control mechanisms and to strengthen the extension services at the grassroots levels.

Integrating Agenda 21 concerns - directions

The National Agriculture Policy (NAP) (MoA, 2000) is an effort by the Government of India to address the issues facing agriculture in India. These also cover the concerns expressed in Agenda 21. Given its comprehensive nature, the NAP is a starting point to providing directions towards a sustainable and equitable growth of agriculture in the future. The policy seeks to actualize the vast untapped growth potential of Indian agriculture, strengthen rural infrastructure to support faster agricultural development, promote value addition, accelerate the growth of agro business, create employment in rural areas, secure a fair standard of living for the farmers and agricultural workers and their families, discourage migration to urban areas and face the challenges arising out of economic liberalization and globalization and to ensure sustained food production.

The slackening of the growth of agricultural production is clearly a major concern in realizing these objectives. It calls for a multi-pronged strategy aimed at tackling the root causes for the slowdown, especially the saturation in productivity gains. The strategy must also ensure that the pattern of growth can be sustained in the long run.

A major cause for this slowdown is the reduced inflow of capital and creation of rural infrastructure. The government has already drawn upon plans for accelerated development of irrigation potential. The RIDF has also been strengthened over time and this has also been done in this year's Union Budget (MoF, 2002a). Enhanced public investment will continue to be a key component of the strategy to revive agricultural growth rates.

These measures would be coupled with policies aimed at ensuring a more sustainable use of inputs. Fertilizer applications, which are currently skewed in favour of N, need to be nudged in the proper direction. The present fertilizer policy has been reviewed by the Expenditure Committee and a decision on these recommendations will be taken shortly. The financial and environmental sustainability of the present policies will be the major factors governing the future course of direction. To supplement chemical fertilizers, greater emphasis will be placed on the use of bio-fertilizers.

The use of water has to be regulated in a similar manner to ensure equitable access today as well as for the future. Water Users' Associations have already demonstrated marked success. The management of water through its users and a

community-based approach will be strengthened. This calls for more research, spread of the success stories of such research and creation of awareness amongst users of the potential of better water management practices.

The impact of the Green Revolution has been uneven in the country. The problems in the more developed regions are different. Areas which have not had the high rates of growth that states like Punjab have experienced will need a different approach. New resource conservation technologies, such as zero-tillage, reduced tillage, surface seeding, bed-planting and the associated agronomic practices, can help in reducing costs, both financial and in terms of natural capital also.

Apart from better use of inputs, it is quite essential to provide the right signals for better crop choices to the growers. The present system, based on the support price mechanism, has yielded impressive results thus far. Food security has been achieved and imports of food grains have become a rare phenomenon. There has, however, been a sudden build-up of food grain stocks. Government has set up a high level committee to look into this issue. The Committee has given its interim report and its final report is expected soon. The Government will take a decision on these recommendations with a view to providing security to farmers and ensuring that India's agriculture is competitive and can exploit the opportunities that international markets can provide in the future. Considerable progress has been made in diversification of agriculture and these steps will be further pursued.

In the international arena, the government will continue its efforts to ensure that the developed countries open their agricultural markets. The country's tariffs will be calibrated to ensure that the agriculturists are protected from unfair competition. In the expectation that the present denial of access to the markets of developed countries will not last, steps will be taken to develop a more competitive domestic market, necessary to tap these likely opportunities. Towards this end the government has already announced its decision to have a unified national market, remove restrictions on stockholding under the EC Act and establish a futures market for all agricultural commodities.

These policies need to be complemented by steps to preserve the animal and plant genetic resources of the country. The institutional mechanisms for this already exist in the shape of the NBPGR and NBAGR. These will be supported to address the concerns identified above.

These steps will be complemented by measures for poverty removal. Greater involvement of farmers and breeders in decision-making will be promoted through measures such as the ATMA model and the NPCBB. The role of women

which has been recognized as important will be further strengthened. A combination of these measures, involving the people and the local and community-based self-help institutions at every step will provide the pathway to a sustainable rural development strategy.

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Introduction

This chapter focuses on the role of local bodies in urban governance and the provision of basic services such as water supply, sanitation, solid waste management and housing in urban areas. India's urban population has grown phenomenally over the past five decades with about 7-8 million people being added to the urban population each year. The level of urbanization increased from 17.3% in 1951 to 25.7% in 1991, and is 29% at present (Planning Commission, 2000; 2001). This has put tremendous pressure on urban services, with the major concern being the growing gap between the demand and supply of basic services, particularly for the poor and slum dwellers.

An overview of the structure of local governance and the provision of urban services in the country is first presented. This is followed by highlighting the Agenda 21 issues relevant to this chapter and a review of the main policies, legislation and programmes initiated in these areas, particularly since the 1990s. An analysis of the achievements and concerns with regard to the implementation of Agenda 21 for promoting local governance and provision of urban services is then presented. Finally, some strategies are suggested for effective participation of urban local institutions and better delivery of urban services.

Urban governance and services in India: an overview

Before 1992, local level institutions did not have a constitutional status and had only a statutory status under state law. Thus, for instance, governance of urban areas was directly within the jurisdiction of the state government. This structure underwent a major change with the enactment of the 73rd and 74th Amendments of the Constitution of India in 1992, which marked a new era in the nature of local governance in rural and urban areas respectively. The 74th Amendment Act of the Constitution of India redefined the role, powers, functions and financial authority of urban local bodies (ULBs). These bodies were given

constitutional protection for regular elections, powers and financial devolution. The urban local bodies are classified into nagar panchayats, municipal councils and municipal corporations depending on the population. The Amendment entrusts these local bodies with the responsibility of providing basic services to their cities.

Urban governance and services in the context of Agenda 21

The recommendations made in Agenda 21 for promoting the participation of local authorities in sustainable development activities and the provision of basic urban services of water supply and sanitation, solid waste management and housing, are presented below.

Role of local authorities in implementing Agenda 21

As the achievement of many Agenda 21 objectives requires action at the local level, the participation of local authorities in planning and implementing economic, environmental and social policies is critical. Agenda 21 stressed that local authorities play a vital role in raising awareness and educating people in promoting sustainable development because these were the level of governance closest to the people.

Based on the local agenda for sustainable development formulated by consultation, the progress and achievements of programmes, policies, laws and regulations to achieve Agenda 21 objectives were to be assessed. Agenda 21 also urged that all local authorities be encouraged to implement and monitor programmes which aim to ensure the representation of women and youth in the decision-making, planning and implementation processes.

Provision of environmental infrastructure: urban water supply and sanitation services

Agenda 21 recognized that the inadequacy and lack of environmental infrastructure for the provision of water supply and sanitation in developing countries was responsible for adverse health impacts. It called for an *integrated approach to the provision of environmental infrastructure in human settlements in particular for the urban and rural poor*. Agenda 21 emphasized that these basic services were an investment in sustainable development that could improve the quality of life, increase productivity, improve health and reduce the burden of investments in curative medicine and poverty alleviation.

While stressing the need for improving infrastructure and services in urban areas and ensuring *equitable access* to them, Agenda 21 stressed that these services should be provided in an economically sound manner. It called for '*adequate pricing policies*, reduction of subsidies on and recovering the full costs of environmental services such as water supply, sanitation and waste management.

Solid waste management in urban areas

With regard to the environmentally sound management of solid waste in urban areas and in particular the role of local bodies in this process, Agenda 21 called for action on two fronts. These were, the promotion of sufficient financial and technological capacity at the local level to implement waste reuse and recycling policies, and, extending waste service coverage to urban areas. By the year 2000, the necessary technical, financial and human resource capacity to provide waste collection services commensurate with needs were to be provided. By the year 2025, waste services were to be provided to the entire urban population.

Sustainable human settlement in urban areas

Agenda 21 states that 'the overall objective of promoting sustainable human settlement development is to improve the social, economic and environmental quality of human settlements and the living and working environments of all people, in particular the urban and rural poor'. Such improvements were to be based on technical cooperation, partnerships among the public, private and community groups, with special consideration for women, indigenous people, the elderly and the disabled.

Providing adequate shelter for all was one of the programme areas in Agenda 21 for promoting sustainable human settlement development. The overall objective was to achieve adequate shelter for rapidly growing populations and in particular for the urban and rural poor, through an environmentally sustainable approach to shelter development. Agenda 21 called for measures to be taken to reduce the urban shelter deficit by improving access of the urban poor to housing and finance schemes.

Review and analysis of initiatives for improving urban governance and provision of services

Highlights of legislation, policies, programmes and other initiatives

An overview of main policies, legislation and programmes for the devolution of power to local bodies and the provision of water supply, sanitation and housing services in urban areas is presented below (Table 15.1). The role of urban local bodies in the provision of these urban environmental services is also highlighted.

Table 15.1 Highlights of policy and other initiatives: urban governance and services

Year	Initiative	Highlights
1974	Environmental Improvement of Urban Slums (EIUS) Scheme	<ul style="list-style-type: none"> ▪ The scheme is applicable to notified slums in all urban areas ▪ Aims at provision of basic amenities such as water supply and sanitation ▪ The EIUS scheme was made an integral part of the Minimum Needs Programme in 1974
1979	Integrated Development of Small and Medium Towns (IDSMT)	<p>The scheme was initiated with a view to:</p> <ul style="list-style-type: none"> ▪ Augmenting civic services ▪ Strengthening municipalities through promotion of resource generating schemes ▪ Reducing migration from rural areas to larger cities by providing sufficient infrastructural facilities, including water supply.
1986, 1990/91	Urban Basic Services Scheme (UBSS) (1986)/Urban Basic Services for the poor Programme (UBSP) (1990/91)	<ul style="list-style-type: none"> ▪ The primary objective was improving the standard of living of urban low-income households, particularly women and children through the provision of sanitation and social services in slum areas. ▪ In 1990/91, the scheme was integrated with the EIUS and came to be known as the Urban Basic Services for the Poor (UBSP) programme.
1989	Scheme of Housing and	<ul style="list-style-type: none"> ▪ SHASU was one of three

Year	Initiative	Highlights
	Shelter Upgradation (SHASU)	<p>schemes implemented under the Nehru Rozgar Yojana (NRY) which targeted people living below the poverty line in urban areas</p> <ul style="list-style-type: none"> ▪ It aimed at shelter upgradation and providing homes for the urban poor and was introduced in cities with a population between 1 and 20 lakhs
1990	National Waste Management Council (NWMC)	<p>One of the NWMC objectives was municipal solid waste management. The council is engaged at present in a survey of 22 municipalities to estimate the quantity of recyclable waste and its fate during waste collection, transportation and disposal.</p>
1992	73 rd and 74 th Constitution (Amendment) Acts	<ul style="list-style-type: none"> ▪ A three-tier system of local governance, through Panchayati Raj Institutions (PRIs) in rural areas and through Urban Local Bodies (ULBs) in urban areas was established ▪ Reservation of not less than one-third of total number of seats in each PRI and ULB for women was stipulated ▪ State legislatures were empowered to entrust local bodies with necessary power and authority to enable them to function as institutions of local self-government
		<ul style="list-style-type: none"> ▪ State finance commissions were to be set up to provide for sharing of revenues between the state and local bodies
1994	Accelerated Urban Water Supply Programme (AUWSP)	<ul style="list-style-type: none"> ▪ A Centrally-sponsored scheme initiated with the objective of solving the drinking water

Year	Initiative	Highlights
1994	National Housing Policy	<p>problems in towns having a population of less than 20,000 (as per the 1991 Census)</p> <ul style="list-style-type: none"> ▪ Formulated to implement the recommendations of Agenda 21 for developing sustainable human settlements ▪ Main objective was providing access to adequate shelter for all
1995	Master Plan for Municipal Solid Waste Management	<ul style="list-style-type: none"> ▪ The Ministry of Environment and Forests and the Central Pollution Control Board organized a meeting with municipal authorities and other concerned ministers in March 1995 to evolve a strategy for the management of municipal solid wastes
1996	National Slum Development Programme (NSDP)	<ul style="list-style-type: none"> ▪ Additional central assistance being released to States/Union Territories for the development of urban slums ▪ Objectives of the programme include provision of adequate and satisfactory water supply, sanitation, shelter upgradation, garbage and solid waste management in slums. ▪ Focus areas of the NSDP include development of community infrastructure, empowerment of urban poor women and involvement of NGOs and other private institutions in slum development.
1997/ 1998	National Agenda for Governance	<ul style="list-style-type: none"> ▪ Identifies 'Housing for All' as a priority area, with particular emphasis on the needs of the vulnerable groups, economically weaker

Year	Initiative	Highlights
1998	Aseem Burman Committee	<p>sections and lower income groups.</p> <ul style="list-style-type: none"> ▪ Under this programme, 20 lakh additional units were to be created every year from 1998-2002, of which 7 lakh additional units were to be in urban areas. ▪ In January 1998, the Aseem Burman Committee was formed under the Supreme Court of India to review the solid waste management conditions in class I cities in India. ▪ The key recommendation of this committee's report was to enable private sector participation in SWM
1998	National Housing and Habitat Policy	<ul style="list-style-type: none"> ▪ Objective of the policy is to create surpluses in housing stock and facilitate implementation of the National Agenda for Governance ▪ Promotes public-private partnerships for tackling housing and infrastructure shortages
2000	The Municipal Wastes (Management and Handling) Rules	<ul style="list-style-type: none"> ▪ The rules lay down the procedure for waste collection, segregation, storage, transportation, processing, and disposal ▪ Municipalities will be required to submit annual reports about municipal waste management in their areas to the Central Pollution Control Board ▪ These rules mandate that all cities set up suitable waste treatment and disposal facilities by December 31, 2001, or earlier

Year	Initiative	Highlights
2000	Manual on Solid Waste Management for Local Bodies	In January 2000, the CPHEEO (Central Public Health Environmental Engineering Organisation) under the Ministry of Urban Development brought out a manual on solid waste management to provide guidance to local bodies.

The policies highlighted above are analyzed in the following paragraphs from the perspective of the achievements and concerns in implementing specific Agenda 21 recommendations.

Achievements

Role of urban local authorities in implementing Agenda 21

With the implementation of the 74th Constitution (Amendment) Act, all states have either enacted new municipal laws or amended existing laws to comply with the Act^a (Ministry of Urban Development, 2001). All states have conducted the election to the local bodies^b. As a result, there are 2009 nagar panchayats, 1430 municipal councils and 101 municipal corporations in the country, with an elected representative base of 68,554 people (HSMI, 2000). All States have constituted state finance commissions, which have recommended significant devolution of resources to the urban local bodies^c.

The 74th Amendment lists a whole range of functions and responsibilities as falling in the domain of ULBs. These include formulation of plans for economic development and social justice, urban planning, water supply, sanitation, solid waste management, public health, urban forestry, environmental protection, slum improvement and urban poverty alleviation, among others. State legislatures have endowed the municipalities or urban local bodies with these functions. The financial resources necessary for these functions are being generated through the State Finance Commissions.

Thus the enactment of 73rd and 74th Amendments of the Constitution have provided a framework for decentralisation of governance and local participation in the formulation and implementation of plans for environmental protection and provision of basic services like water supply, sanitation and solid waste management. For instance, Income Tax Act was amended to allow issue of tax

^a Except Jammu and Kashmir.

^b Except Bihar and Pondicherry.

^c Except Arunachal Pradesh.

free bonds by urban local bodies and guidelines were issued for tax free municipal bonds.

Urban water supply and sanitation services

The need for providing potable drinking water, expanding and improving sanitation facilities in urban areas has been reiterated in successive plans. The Basic Minimum Services Programme introduced in 1996 targeted providing safe drinking water to 100% of the urban population by 2000. Although the provision of safe drinking water and sanitation is the prime responsibility of state governments and more specifically the local bodies, the Central government has been supplementing these efforts through programmes such as the Accelerated Urban Water Supply Programme (AUWSP). Under the programme, 104 schemes in 438 small towns have been commissioned (Planning Commission, 2000). Further, schemes aimed at augmenting civic services and strengthening municipalities through promotion of resource generating schemes have been implemented. One such scheme, Integrated Development of Small and Medium Towns (IDSMT) was undertaken in 945 towns upto March 1999 (Planning Commission, 2000).

These programmes and the increasing share of urban water supply and sanitation in total public sector outlay (from 1.4% in the Eighth Plan period to 2% in the Ninth Plan) have yielded results in terms of the population covered by these services. Access to water supply is available to 90.2% of the population in urban areas and sanitation facilities to 49.3% of urban population (Ministry of Finance, 2000-2001).

Solid waste management in urban areas

Since the bubonic plague epidemic in Surat in 1994, there has been renewed focus on improving solid waste management services. The major initiative being the notification of the Municipal Solid Wastes (Management and Handling) Rules in 2000. These rules specify the guidelines and the role of local bodies as nodal agencies in solid waste collection, transportation and disposal. The Ministry of Environment and Forests has set deadlines for cities to establish suitable waste processing, disposal and landfill facilities. Municipalities across the country are in the process of privatizing different aspects of solid waste management to reduce the cost incurred in providing these services and to improve the overall efficiency. Waste-to-energy projects have been initiated with different arrangements for setting up and operating these facilities involving the private sector and local bodies.

Private sector participation (PSP) in solid waste management offers several advantages, the first of which is cost saving, closely related to improvement in efficiency and effectiveness of services. PSP also encourages new technologies and reduces establishment costs. In India, the cities of Navi Mumbai, Hyderabad, Surat and Rajkot have experimented with PSP in various aspects of SWM with encouraging results (TCGI and PADCO, 2001).

Sustainable settlements in urban areas

The need for state intervention to meet housing requirements of vulnerable sections and to create an enabling environment for achieving the goal of 'Shelter for All' was emphasized in the Eighth Plan (1992-97). Specifically targeted to implement the recommendations of Agenda 21 for developing sustainable human settlements, a National Housing Policy was formulated in 1994, with the objective of providing adequate shelter for all. The needs of adequate housing in urban areas and for vulnerable groups has been receiving increasing attention. Housing development has been accelerated for the poor, low income, urban slum dwellers and other disadvantaged groups. This has been part of the programme towards development of urban areas as economically efficient, socially equitable and environmentally sustainable entities, highlighted in the Ninth Plan (1997-2002).

Towards meeting its goal of providing housing for all, 20 lakh additional housing units were to be constructed annually over the period 1997-2002, of which 7 lakh units were to be in urban areas. This target was achieved for the year 1999/2000. In addition, about 1 lakh units of housing are constructed annually for economically weaker sections and another 27,000 units for low income groups in urban areas (Ministry of Urban Development, 2000-2001).

Several schemes have been implemented to improve living conditions in urban slums. Until November 1998, the Environmental Improvement of Urban Slums Scheme (EIUS) benefited about 375 lakh urban slum dwellers, against the targeted 330 lakh people (Ninth Plan and MoUDPA, 2001).

Concerns

Role of local authorities in implementing Agenda 21

With the implementation of the 73rd and 74th Constitution (Amendment) Acts, political decentralization has taken place in almost all states. However, the progress in fiscal and functional decentralization has been mixed, with the process of devolution at different operational levels across states (Planning Commission, 2000). Based on the recommendations of the SFCs, many state

governments have given PRIs a share in state taxes such as land revenue, land cess, royalties on mines and minerals and forest revenue. ULBs have also been empowered to levy taxes and cesses such as professional tax, property tax and entertainment tax. However, these taxes are less buoyant in nature, while proceeds from more buoyant taxes such as sales taxes and excise duties have been kept out of the purview of the local bodies (Planning Commission, 2000).

Together with inadequate fiscal devolution, internal resource generation by local bodies is poor. Resources raised by municipal authorities constitute barely 0.6% of the national GDP and, therefore still remain peripheral to the Indian economy (Planning Commission, 2000). As a result of these factors, the resource base of local bodies at the rural and urban levels is extremely limited, making them dependent on financial assistance from the state and central government. This situation persists despite the reiteration in successive plans of the need to augment civic services and strengthen municipalities by augmenting resources, devolution of funds and provision of new avenues of taxation.

Urban water supply and sanitation services

Here again, the key concern is the gap between demand and supply of basic water and sanitation services. The high population density in urban centres and the escalating per capita cost of providing urban services account for the deterioration of basic services and amenities (Eighth Plan). Moreover, the service levels of water supply in most urban areas, particularly small towns are far below the desired norm. Population coverage figures for water supply and sanitation are based on average supply levels and do not reflect regional disparities within states and even within the city itself.

The poor, particularly those living in slums and squatter settlements are deprived of these basic facilities (Planning Commission, 2000). About 40% of households living in slums are without access to safe drinking water and 90% without access to sanitation. Diarrhoea deaths account for 28% of all mortality, while acute respiratory infections account for 22%. Nearly 50% of urban child mortality results from poor sanitation and lack of access to clean drinking water in urban slums (Planning Commission, 2000).

The need for allocation of funds to the ULBs for implementation of schemes for the provision of basic services is an area of concern. The pricing of water does not cover even operational and maintenance costs and billing and collection mechanisms for water tariff remain weak. Paucity of funds, non-availability of adequate trained manpower and over centralization have

resulted in the operation and maintenance of water supply becoming an area of concern (Planning Commission, 2000).

Solid waste management in urban areas

Owing to the limited availability of finance and infrastructure none of the municipalities seem to be in a position to meet the deadlines for setting up waste processing and disposal facilities. Due to budgetary constraints, inadequate equipment and poor planning, house-to-house collection of wastes by local bodies is very rare. In spite of rules & regulations and decentralized decision-making in urban services, the collection efficiencies still range on an average from 50 to 90% of the solid waste generated, leaving the balance unattended (CPHEEO Manual, 2000). The average expenditure on solid waste collection in most class I cities is around 75% of the total expenditure on this service as per 1997-98 figures. This leaves little money for disposal activities making these services inefficient (NIUA, 2000). This percentage rises to around 85% in class II cities. The budget allocation for disposal of solid waste remains at 10-15% of the total expenditure on this service, insufficient to ensure proper disposal (NIUA, 2000).

Sustainable settlements in urban areas

Despite the introduction of policies and programmes for providing housing to disadvantaged groups and efforts to contain the proliferation of slums, the housing problem persists, resulting in pressure on urban services and infrastructure (Planning Commission, 2000). Increasing population pressure on land and infrastructure and the associated high costs have made proper housing inaccessible to the poorer segments of the population and have caused a growth of slums and squatter settlements (Eighth Plan). Thus, while there has been a steady growth in housing stock, infrastructure and services, the demand-supply gap has been rising (Ninth Plan).

Integrating Agenda 21 concerns: directions

Based on the preceding analysis, strategies for improving the effectiveness of local governance and provision of basic services in urban areas are presented below.

Role of local authorities

Greater decentralization and devolution of revenue-raising powers to PRIs and urban local bodies should be promoted, to reduce excessive dependence on the

Central and state governments. This is imperative as with the implementation of the 73rd and 74th Amendments, local bodies will become increasingly responsible for the operation and maintenance of water supply, sanitation and solid waste management. In addition, local bodies should be encouraged to raise internal resources and then receive matching grants from the government (Planning Commission, 2001).

Issuance of tax-free municipal bonds by the Ahmedabad Municipality in 1998 was an important step in this direction. Tax-free municipal bonds worth Rupees one billion were notified without a state guarantee to partially finance water supply and sewerage projects. This was an important milestone in the development of a debt market for urban environmental infrastructure in India. The Pune and Bangalore Municipal Corporations followed suit. This scheme needs to be adopted by other local bodies to enable them to raise capital for environmental infrastructure projects.

At present most local bodies have a system of single-entry accounts working on cash inflows and outflows. It is proposed to introduce a double entry accrual-based accounting system which would enable reliable financial statements subjected to check and balances, asset accounting and maintenance, rating of local bodies by credit rating agencies and facilitate inflow of private investment in urban environmental infrastructure projects.

A model Municipal Act and supporting legislation should be introduced to simplify complicated municipal bylaws, to enhance the borrowing capability of urban local bodies, to facilitate the entry of the private sector and to regulate tariff collection by local bodies.

Urban water supply and sanitation

Urban planning should be based on an integrated approach to provide and maintain basic services. This will enable addressing in a holistic manner the environmental, economic and social dimensions associated with environmental infrastructure in cities. Recommendations made in previous plans need to be implemented. These include promotion of private sector participation in construction and maintenance of water supply and sanitation schemes, involvement of communities in the management of services, strengthening of local institutions for implementing and sustaining water and sanitation programmes and raising water tariffs so as to increase resources for local bodies.

Solid waste management in urban areas

Most local bodies find it difficult to incur heavy capital expenditure in improving solid waste collection, transportation, and disposal systems. Given the resource constraints of the local bodies, the private sector should be encouraged as much as possible. Experience in India suggests that cost savings are possible by involving the private sector in solid waste management. For instance in New Bombay during the period 1992-93, the private firm's cost of service delivery at Rs 4.3 million per year was much lower than CIDCO's (City and Development Corporation) cost of Rs 9.9 million, indicating an efficiency gain as high as 56 percent. During the period 1991-92, upon privatization, Rajkot Municipality's expenditure on primary waste removal was reduced from Rs 1.7 million to Rs 1.4 million (saving of 15%) and the expenditure on secondary waste removal was reduced from Rs 260 per tonne to Rs 200 per tonne (saving of 23%). Considering the high cost involved in waste management, the first priority of the local bodies, even in the case of privatization should be waste minimization at source. To facilitate this, awareness generation programmes should be undertaken to ensure the active participation of citizens.

Sustainable settlements in urban areas

The first step in attaining sustainable settlements in urban areas is to reduce the pressure on cities resulting from migration from rural areas, by providing infrastructure and development opportunities there. Programmes such as the IDSMT that target the development of small- and medium-sized towns need to be effectively implemented to reduce the concentration of activities in metropolitan centres. The Approach Paper to the Tenth Plan highlights the need for the development of medium-sized towns which are experiencing the most rapid population growth of all segments of the country and where municipal structures and institutions are not strong enough to cope with the challenges (Planning Commission, 2001). Further, a suitable strategy needs to be developed to deal with the housing problems of socially disadvantaged groups in the informal sector. Specifically, focussed attention is needed to evolve a state-specific strategy including structured housing programmes for the urban poor to prevent the growth of slums and for the rehabilitation of existing slums (Planning Commission, 2000).

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Poverty eradication and human resource development

Introduction

The overriding objective of a country's policy and planning is to raise the standard of living and enhance the productive capabilities of its people. With over a billion people, this challenge is particularly daunting for a developing country such as India.

This chapter attempts to summarize India's initiatives towards meeting the objectives of Agenda 21 for the social sector. In most cases, the origin of these initiatives dates well before the Rio Summit, reflecting the primacy attached to social development. Given the cross-sectoral nature of issues related to poverty, government initiatives have been analyzed in several parts of this report. This chapter touches upon some issues that directly relate to poverty eradication and human resource development.

The chapter begins with a brief narration of Agenda 21 social objectives notably poverty reduction, access to education, employment opportunities and health services; and the special considerations of women and vulnerable groups in society. This is followed by a discussion of the extensive organizational structure in the country to address these concerns; highlights of the major initiatives relating to each Agenda 21 objective and progress vis-à-vis these objectives. The chapter concludes with the main concerns and strategies that need to be adopted to address these.

Social sector and Agenda 21

Agenda 21 recognizes that eradication of poverty and, greater equity in income distribution along with human resource development remain major challenges for the global community. Given the interrelationships amongst economic growth, environment and poverty, an anti-poverty strategy is one of the basic conditions for ensuring sustainable development. An effective strategy for tackling the problems of poverty, development and environment should encompass simultaneously demographic issues, enhanced health care and education, the rights of women, the role of indigenous people and local communities and democratic participation process in association with improved governance. Integral to such action is, together with international support, the promotion of

economic growth in developing countries that is both sustained and sustainable and direct action in eradication of poverty by strengthening employment and income-generating programmes.

Providing sustainable livelihood opportunities

Agenda 21 recognizes the need for direct action to eradicate poverty by strengthening employment and income-generating opportunities. It stresses on the need to generate remunerative employment compatible with the country's endowments; assign a high priority to professional training and develop an adequate facilitating infrastructure.

Demographic dynamics and sustainability

Agenda 21 underscores the need to formulate policies that address demographic issues within the holistic goal of development. Programmes would need to be evolved that promote changes in demographic trends and factors towards sustainability, in keeping with the freedom, dignity and values of individuals. Such programmes would include reproductive health programmes and services and appropriate institutional arrangements to facilitate the implementation of demographic activities.

Education

Agenda 21 identifies education, training and raising public awareness as essential for social progress and improving the capacity of people to address environment and developmental issues. The document underlines the need for:

- Ensuring universal access to basic education, access to primary education through formal or non-formal methods and reduction of adult illiteracy
- Establishing and strengthening vocational training programmes that meet developmental and environmental considerations and ensure access to training opportunities regardless of social status, age, gender, and race or religion.

Health

Meeting primary health care needs

Agenda 21 underlines the need for developing and strengthening primary health care systems that are practical, community-based, scientifically sound, socially acceptable and meet the basic needs for clean water, safe food and sanitation.

Control of communicable diseases

There is a need for organizing programmes that support the principles of the global AIDS strategy and vaccinations for preventing communicable diseases. Intrinsic to this is the development and dissemination of technology as an effective tool for controlling communicable diseases and ensuring technical assistance.

Sustainable human settlements

Agenda 21 identifies the objective of sustainable human settlement as being crucial to sustainable development. This would include improving the social economic and the environmental quality of human settlements and the living and working environment for all people in particular the urban and rural poor.

Empowerment of women

Agenda 21 emphasizes the active participation of women in decision-making as a means to fostering social development. The need to eliminate violence against women and strengthen their capacity occupies an important place in the document. It underlines the need for gender equality in education and training, health and nutrition facilities, access to credit, and employment.

Ensuring the interests of children and youth

Agenda 21 emphasises on the need to further the interests and rights of children and advance the role of youth and actively involve them in protection of the environment and promotion of economic and social development. It stresses on the need for providing the youth access to appropriate secondary education or equivalent vocational training and for establishing processes that promote dialogue between youth and Government at all levels.

Recognizing the role of vulnerable and indigenous people and ensuring their active participation.

Agenda 21 aims at establishing, where appropriate, arrangements to strengthen the participation of indigenous people in formulating national policies, laws and programmes. It also stresses on ensuring their involvement both at the local and national levels in resource management and conservation strategies.

Social sector in India: review and analysis of initiatives

Poverty reduction has been the overriding objective of development planning in India. There has been over time a conceptual broadening in the notions of well

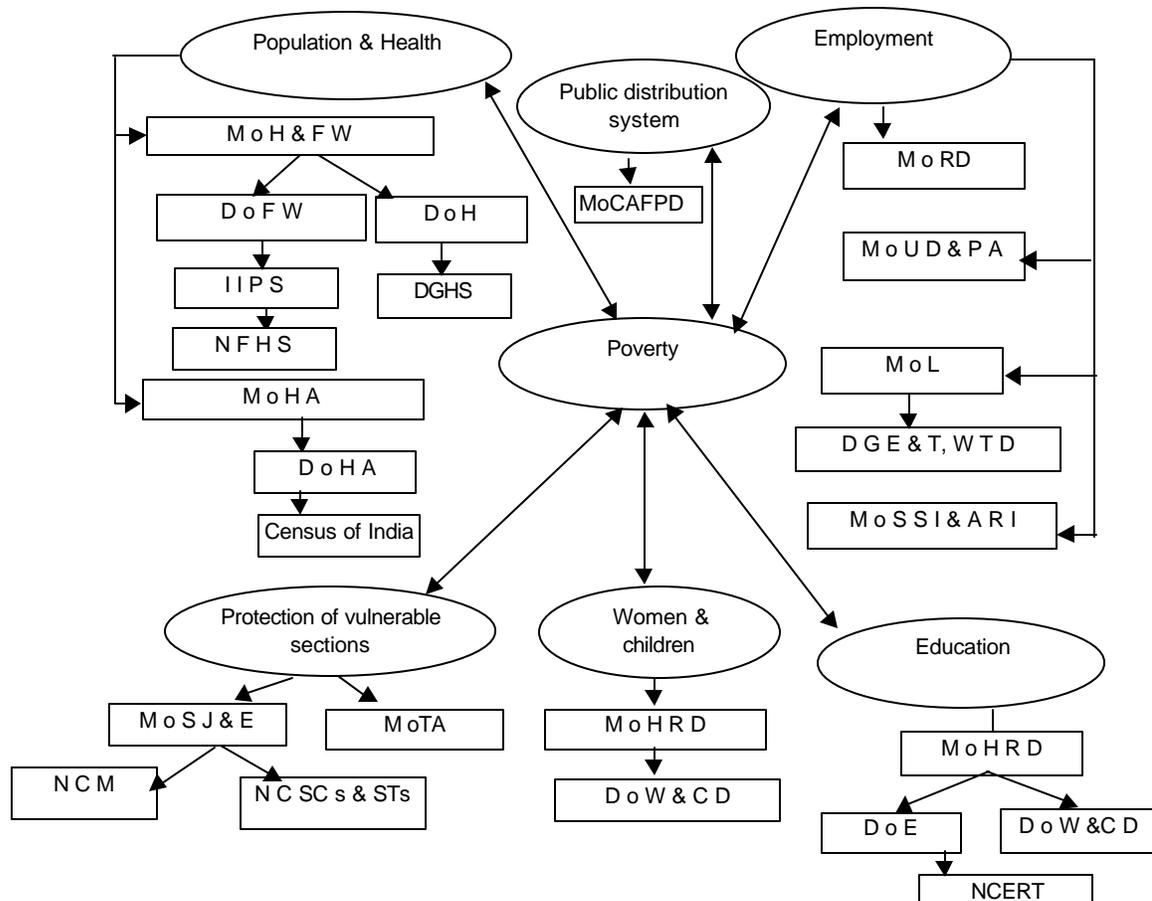
being and deprivation. The notion of well being has shifted away from just material attainments, or the means for development, to outcomes that are either desirable in themselves or desirable because of their role in supporting better opportunities for people. Similarly, it is recognised that poverty is a multi-faceted phenomenon going beyond lack of adequate income and must be viewed as a state of deprivation spanning the social, economic and political context of the people that prevents their effective participation as equals in the development process. This recognition has resulted in a renewed focus on education and health- critical for capacity building- and other social and environmental factors that have a direct bearing on the state of well being (Planning Commission, 2002). Since Independence, the government has accordingly followed a three-pronged strategy for poverty eradication, which comprises:

- Economic growth and overall development
- Human development with emphasis on health, education and minimum needs, including protection of human rights and raising the social status of the weak and poor
- Directly-targeted programmes for poverty alleviation through employment generation, training and building up asset endowment of the poor

Economic growth enables expansion of productive employment and generation of resources, which are vital to support any form of intervention for eradication of poverty. Since 1991 India has undertaken trade reforms, financial sector reforms, and removal of controls, which primarily were introduced with the objective of improving efficiency and productivity to accelerate growth. The ultimate objective of such reforms was ensuring the expeditious eradication of poverty. Adequate precaution was taken to protect the poorer sections of the society against the short-term effects of these changes. This was done mainly through increased allocation of resources for programmes for poor in the national plan and sharpening the focus of such programmes on the poor. The Central support for human resource and social development in the country has progressively increased through the 1990s. The Central Government's expenditure (plan and non-plan) on education, health, family welfare, nutrition, sanitation, rural development, social welfare etc. has increased from Rs 9608 crore in 1992-93 to Rs 40,205 crore in 2001-02 (budget estimates). As a proportion of total expenditure the combined plan and non-plan Central expenditure on these areas has increased from 8.1% in 1992-93 to 10.7% in 2001-02 (MoF, 2002). The various initiatives are discussed in detail in later sections of this chapter.

Poverty eradication and capacity enhancement programmes in the country fall under a number of ministries and departments as shown in Figure 16.1. In addition to these, there are several other ministries/departments (agriculture; sanitation, drinking water supply, etc.) that impact poverty eradication directly and a host of others that have an indirect impact on poverty reduction.

Most programmes are implemented at the block/village level, where local bodies and Panchayati Raj Institutions (PRIs) play a significant role together with NGO's. The enactment of the 73rd and 74th Amendments of the Constitution have provided a framework for decentralisation of governance and local participation in the formulation and implementation of plans for economic development and social justice including environmental protection and provision of basic services like water supply, sanitation and solid waste management.

Figure 16.1 Government organizations involved in social

sector programmes

MoHFW	Ministry of Health & Family Welfare
DoFW	Department of Family Welfare
DoH	Department of Health
MoHA	Ministry of Home Affairs
DoHA	Department of Home Affairs
MoHRD	Ministry of Human Resource Development
DoW & CD	Department of Women & Child Development
MoTA	Ministry of Tribal Affairs
MoSJE	Ministry of Social Justice & Empowerment
NCM	National Commission for Minorities
NCSCs & STs	National Commission for Scheduled Casts & Scheduled Tribes
MoL	Ministry of Labour
DGE & T, WTD	Directorate General of Employment & Training, Women Training Directorate
MoSSI & ARI	Ministry of Small Scale Industries & Agro and Rural Industries & Agro and Rural Industries
DoE	Department of Education
DoW & CD	Department of Women & Child Development
DGHS	Directorate General of Health Services
MoRD	Ministry of Rural Development
MoUD&PA	Ministry of Urban Dept. & Poverty Alleviation

IIPS	International Institute for Population Sciences
NFHS	National Family Health Survey
NCERT	National Council for Educational Research and Training
MoCAFPD	Ministry of Consumer Affairs, Food and Public Distribution

As a result of various initiatives, (elaborated in the following sections) there has been a secular decline in the poverty ratio (Table 16.1). The incidence of poverty expressed as percentage of people living below the poverty line declined steadily from 55% in 1973-74 to 36% in 1993-94 and further to 26% in 1999-2000 (MoF, 2002).

Table 16.1 Percentage of population below poverty line^a-All India

	Rural	Urban	Combine d
1983-84	45.65	40.79	44.48
1987-88	39.09	38.20	38.86
1993-94	37.27	32.36	35.97
1999- 2000	27.09	23.62	26.10

Source. Planning Commission (2001a), Ministry of Finance (2002)

The HDI (human development indicator), a composite measure reflecting health, education and economic attainment/deprivation for the country, has shown improvement by nearly 26% in eighties and another 24% in nineties (Planning Commission, 2002). The Human Poverty Index (HPI) recently formulated for the country is an attempt to capture poverty in its various dimensions, including access to minimum services, reveals that the proportion of the deprived at the national level declined from about 47.3% in the early eighties to 39.4% in early nineties in line with the head count measure of poverty (Planning Commission, 2002). However, there are considerable variations in terms of the rural -urban incidence as well as at the state level. The rural-urban ratio for the proportion of the HPI is nearly twice as high as that on the head count ratio of poverty, possibly reflecting the lower levels of basic amenities in rural areas. At the state level, while the HDI declined in all states, interstate differences have persisted.

At the national level, the inequality in consumption expenditure as captured by the Gini ratio has also shown a decline from 0.298 in 1983 to 0.258 in rural areas in 1999-2000 (Planning Commission, 2002). However, in urban areas, consumption

^a Poverty line is defined as the average per capita consumption expenditure which enables specified calorie requirements to be met (Planning Commission)

inequality has increased marginally from 0.33 in 1983 to 0.341 in 1999-2000 (Planning Commission, 2002).

While the details of poverty eradication programmes are discussed in the following sections, it is useful to discuss here initiatives for improving access of the poor to food, since chronic food insecurity is an important manifestation of poverty in the country. The Public Distribution System (PDS) evolved in the wake of foodgrains shortages in 1960s is a mix of producer-price support cum consumer subsidy and is seen as a safety net for protecting poorer sections who might adversely be affected by price fluctuations. To streamline the existing PDS, a targeted Public Distribution System (TPDS) was introduced in 1997 under which special cards were issued to families below the poverty line and essential goods were sold to them through the PDS at specially subsidized prices. According to the 2001-02 Economic Survey, the quantity of the foodgrains earmarked to meet below-poverty-line (BPL) requirements is 18.52 million tonnes per annum (at the rate of 25 kg/family/ month) benefiting an estimated 65.2 million poor families while for the population above the poverty line (APL), a quantity of 10.33 million tonnes of food grain per annum is earmarked for distribution under the TPDS.

Employment and labour welfare

An important objective of development planning in India has been to provide for increasing employment opportunities not only to meet the backlog of the unemployed but also to accommodate additions to the labour force. A two-pronged attack on rural and urban poverty has been launched in the country through wage employment and credit linked self-employment schemes. The Government, from time to time has undertaken several programmes and enacted legislation to reduce the incidence of unemployment and improve the welfare of labour both in the organized and unorganized sectors. Policies eliminating child labour and, enhancing employment opportunities for women and disadvantaged sections of the population are also given high priority. A brief overview of the important legislation, policies and programmes is provided in Table 16.2.

Table 16.2 Highlights of policies, laws and legislation on employment generation and poverty alleviation

Year	Initiative	Highlights
Legislation		
1923	Workmen's compensation Act	Provides for compensation to workmen or their survivors in case of industrial accidents and occupational diseases, resulting in disablement or death.
1926	Trade Unions Act	Provides for registration and operation of trade

Year	Initiative	Highlights
		unions.
1936	Payment of Wages Act	Regulates the payment of wages of certain classes of employed persons
1947	Industrial Disputes Act	Provides for conciliation and adjudication of industrial disputes
1948	Factories Act	Regulates health, safety, welfare and other working conditions of workers in factories.
1948	Employees' State Insurance Act	Provides for medical care and treatment, cash benefit during sickness, maternity, and employment injury; and pension for dependants on the death of the insured worker due to employment injury.
1948	Minimum Wages Act	Empowers Central and state governments to fix/revise the minimum rates for scheduled employment under their respective jurisdictions.
1952	Mines Act	Provides measures for health, safety, and welfare of the workers in coal, metalliferous and oil mines.
1952	Employees' Provident Fund & Miscellaneous Provisions Act	Provides for benefits such as provident fund, employees deposit linked insurance and pension to workers particularly in those classes of industry which employ 20 or more workers.
1961	Maternity Benefit Act	Regulates employment of women before and after child birth and provides 12 weeks maternity leave, medical bonus and other benefits.
1972	Payment of Gratuity Act	Provides for payment of gratuity @ 15 days wages for every completed year of service or part thereof, in excess of seven months. There is no wage ceiling for coverage under this Act.
1976	Equal Remuneration Act	Relates to equality and empowerment of women
1976	Bonded Labour System (Abolition) Act	It fulfils the Indian Constitution's directive of ending forced labour.
1986	Child Labour (Prohibition & Regulation) Act	Its purpose is to prohibit the employment of children in specified hazardous occupational and processes.
Policies and Programmes		
1969	National Commission on Labour, 1969; Second NCL, 1998	Three decades after setting up the first NCL the second commission was set up to rationalize existing labour laws in the organized sector and an umbrella legislation for ensuring the minimum level of protection to workers in the unorganized sector.
1980	Integrated Rural Development Programme	Provides central assistance to states on the basis of proportion of rural poor. Comprises several schemes including: <ul style="list-style-type: none"> ▪ Supply of Improved Toolkits to Rural Artisans (SITRA), 1992

Year	Initiative	Highlights
		<ul style="list-style-type: none"> ▪ Training for Rural Youth for Self Employment (TRYSEM), 1979
1982-83	Development of Women and Children in Rural Areas (DWCRA)	Initiated in 1982-83 on a pilot basis, covers almost all districts of the country today. Directed at improving the living conditions of women and thereby of children through opportunities for self-employment and access to basic social services.
1987	National Policy on Child and Labour	Focuses on general development programmes benefiting children wherever possible.
1987	Support to Training and Employment Programme, STEP	Seeks to train women for employment in the traditional sectors of agriculture, animal husbandry, dairy, handlooms and handicrafts was launched in 1987. Since its inception, about 448245 women have benefited from 86 projects (Planning Commission, 2001c).
1993	Employment Assurance Scheme, (EAS)	It was started in 1993, and restructured in 1999-2000 as a single-wage employment programme for creation of additional wage employment for the rural poor living BPL.
1995	National Social Assistance Programme (NSAP)	Seeks to provide social assistance to poor households affected by old age, death of primary breadwinner
1997	Swarna Jayanti Shahari Rozgar Yojana, (SJSRY)	Comprises two special schemes: Urban Self Employment Programme and the Urban Wage employment Programme
1999	Jawahar Gram Samridhi Yojana, (JGSY)	Jawahar Rozgar Yojana (JRY) was restructured as the Jawahar Gram Samridhi Yojana, (JGSY), where all works that result in the creation of durable productive community assets are taken up. The secondary objective is generation of wage employment for rural unemployed poor.
1999	Swarna Jayanti Gram Swarozgar Yojana, (SGSY)	Aims at promoting micro enterprises and helping the poor. Formulated as a result of restructuring and combination of the Integrated Rural Development Programme and allied programmes along with the Million Wells Scheme into a single self-employment programme.

Year	Initiative	Highlights
2000-01	Pradhan Mantri Gramodaya Yojana (PMGY)	Focuses on village level development in five critical areas: health, drinking water, primary education, housing, and rural roads with the objective of improving quality of life in the rural areas.
2001	Sampoorna Grameen Rozgar Yojana	Aims at providing wage employment in rural areas as also food security, along with creation of durable community, social and economic assets
2001	Food for work Program	It aims at augmenting food security through wage employment in drought-affected areas. A part of the wage can be paid in kind and rest in cash. Programme stands extended up to 31 st March 2002 in respect of notified natural calamity affected districts.

Achievements

As can be inferred from Table 16.2, Government programmes aimed at employment generation for the poor can be classified under two heads.

- Self employment programmes (e.g. the Swarna Jayanti Gram Swarozgar Yojana, TRYSEM, and the Urban Self-Employment Programme).
- Wage employment programmes (e.g. Sampoorna Grameen Rozgar Yojana, and Urban Wage Employment Programme).

In addition, elimination of the gap between skills required and available has been a major focus of human resource development in the country, with emphasis also on enhancing the skills and productivity of workers through vocational training and education (Table 16.2). One of the main sources of such training is the Industrial Training Institutes (ITIs). Other initiatives include the Ministry of Labour's National Vocational Training System, the oldest training set-up and a number of organizations in sectors such as small industry, the khadi and village industries commission (KVIC), handlooms, tourism, electronics, medical technicians, agriculture and rural development also provide sector-specific training.

Other initiatives include creation of necessary infrastructure (e.g. Pradhan Mantri Gramodaya Yojana) and setting up of employment exchanges as sources of information, counselling and guidance to employment seekers. States such as Gujarat, Maharashtra, Pondicherry, Tamil Nadu and Andhra Pradesh have been successful in setting up employment exchanges on a computer-linked network for efficient exchange of information on placement services. Various labour welfare programmes including those catering to the interests of women (e.g. Equal

Remuneration Act, 1976, National Policy on Child and Labour etc) have also been introduced by the Government.

These initiatives have been successful in ensuring higher employment levels of the organized sector (Table 16.3). There has also been an increase in the real wages for unskilled agricultural labour, an indicator of change in quality of employment, at the all-India level (Planning Commission, 2001c).

Table 16.3 Employment in the organized sector (in lakhs)

	1971	1976	1981	1986	1987	1991	1996	1998
Private	67.6	68.4	74.0	73.7	73.6	76.8	85.1	88.4
Public	107.3	133.2	154.8	176.8	180.3	190.6	194.3	195.4
Total	174.9	201.7	228.8	250.6	253.9	267.4	279.4	283.8

Source. Planning Commission (2001a)

There has been an increase in the proportion of women's employment to the total employment. The work participation rate for women has increased from 14.22% in 1971 to 22.27% in 1991 (Planning Commission, 2001a). According to the Economic Survey 2001-02, women constituted about 17.2% of the organized sector in 1999—an increase of 0.8% as compared to 1998.

Population and health

The Government of India has adopted an integrated approach to population and health, linking population policies and programmes to improving human conditions and poverty reduction. This approach simultaneously addresses concerns about rapid population growth and the need to improve individual and family welfare.

Population stabilization has been a priority area for sustaining the process of economic development in India. India was the first country to launch, in 1952, a national programme, emphasizing family planning to the extent necessary for reducing birth rates 'to stabilise the population at a level consistent with the requirement of the national economy'. The National Population Policy (NPP) 2000 outlines its long-term objective as a '...to achieve a stable population by 2045, at a level consistent with the requirements of sustainable economic growth, social development and environment protection'. Table 16.4 depicts the milestones in the evolution of the population policy of India.

Table 16.4 Evolution of National Population Policy in India

Year	Initiative	Highlights
1952	Launching of Family Planning Programme	In 1952, India became the first developing country to establish a national family planning programme to address the issues of high fertility and rapid population growth.
1983	Statement on National Health Policy	Emphasized the need for 'securing the small family norm, through voluntary efforts and moving towards the goal of population stabilisation'.
1993	Committee on Population appointed by the National Development Council	The Karunakaran Report endorsed by the NDC in 1993 proposed the formulation of a National Population Policy to take 'a long term holistic view of development, population growth and environmental protection'; to 'suggest policies and guidelines (for) formulation of programmes' and 'a monitoring mechanism with short, medium and long term perspectives and goals' (Planning Commission, 1992).
2000	National Population Policy	<p>Prepared after several rounds of deliberations and revisions to ensure political consensus, the policy takes a holistic view of population control and its links with poverty by focussing on a range of issues such as access to reproductive health care, primary and secondary education, basic amenities including sanitation, safe drinking water, housing, transport and communication besides the issue of empowering women and enhancing their employment opportunities. The objectives of the policy are:</p> <ul style="list-style-type: none"> ▪ Immediate objective: to address the needs for contraception, health care infrastructure, health personnel and integrated service delivery. ▪ Medium-term objective: to bring the fertility rate to replacement levels by 2010. ▪ Long-term objective: to achieve a stable population by 2045. <p>The policy identifies 14 national socio-demographic goals, which include providing free and compulsory school education up to 14 years of age, reducing IMR to below 30 per live births, ensuring universal immunization, achieving 80% institutional deliveries and 100% deliveries by trained persons, providing access to information, arresting AIDS, prevention and control of communicable diseases, promoting small family norms, and conducting a people-centred family welfare programme.</p>

On the health side, a number of policies and programmes have been evolved to improve the health conditions of the people of India. These policies and programmes are summarized in Table 16.5.

Table 16.5 Highlights of policies and programmes in the health sector

Year	Programme	Highlights
1953 ; 1971	National Anti-Malaria Programme (NAMP), 1953; Urban Malaria Scheme (UMS), 1971	Aimed at the control of malaria by reducing the vector population through recurrent anti-larval measures and detection and treatment of cases through existing health services;
1955 ; 1983	National Leprosy Control Programme, 1955; renamed the National Leprosy Eradication Programme, NLEP, (1983)	<ul style="list-style-type: none"> ▪ NLEP, 1983 aimed at eliminating leprosy by the end of the century ▪ In 1993-94, NLEP received boost from World Bank assistance under Phase I that ended on 30th September, 2000. Phase II under consideration ▪ Extension of MDT (multi drug therapy) services in uncovered areas, strengthening of existing services, health education and training activities.
	National Immunization Programmes	<ul style="list-style-type: none"> ▪ Expanded Programme on Immunization, 1978 ▪ Universal Immunization Programme (UIP), 1985; Accorded the status of a Technology Mission under the banner of the Technology Mission on Immunization in 1986
1975 ; 1985	National Cancer Control Programme, 1975 (revisited in 1984)	<ul style="list-style-type: none"> ▪ Pulse Polio Immunization (PPI) Programme, 1995-96 <p>Its objectives include:</p> <ul style="list-style-type: none"> ▪ Primary prevention: Health education and prevention of intake of tobacco; ▪ Secondary prevention: Early detection of common cancers ▪ Tertiary Prevention: Strengthening of existing institution for comprehensive therapy including palliative care. <p>The following steps have been taken to strengthen the National Cancer Control Programme:</p> <ul style="list-style-type: none"> ▪ Existing Regional Cancer Centres being strengthened to act as referral centres ▪ Increase in the number of cobalt therapy units ▪ Scheme for development of oncology wings in medical colleges initiated to fill up geographical gaps in detection and treatment of cancer. ▪ District Cancer Control Programme: Under the scheme for district projects for health education, early detection and pain relief measures, one time and recurring assistance provided for four years. So far, 40 districts

Year	Programme	Highlights
1987 ; 1999	National AIDS Control Programme (NACO), 1987 National AIDS Control Programme- II, 1999	<p>provided with assistance under the scheme.</p> <ul style="list-style-type: none"> ▪ Scheme of voluntary organization initiated for undertaking health education and early detection of cancer ▪ Led to the creation of National AIDS Committee, National AIDS Control Board and National AIDS Control Organisation • NACO II is a centrally sponsored programme initiated in 1999 funded by World Bank, DFID and USAID. The project has five components: <ol style="list-style-type: none"> 1. Reducing HIV transmission among poor and marginalized sections of the community at the highest risk of infection by targeted intervention, STD control and condom promotion 2. Reducing the spread of HIV among general population by reducing blood borne transmission and promotion of IEC, voluntary testing and counseling. 3. Developing capacity for community-based low cost care for people living with AIDS. 4. Strengthening implementation capacity at the National States and Municipal Corporation levels 5. Forging intersectoral linkages between public, private and voluntary sectors ▪ National Counselling Training Programme launched to train grassroot counsellors ▪ National AIDS Helpline set up in 1997 with a toll free number, 1097, for telephonic counselling ▪ School AIDS Education Programme started to provide lifestyle education and information on HIV/AIDS. Draft National AIDS-Prevention & Control Policy to control the epidemic and arrest its spread within next five years. The policy aims at improving the quality of blood transfusion services through a comprehensive and total quality management approach ▪ NACO II aims at reducing the spread of HIV infection in India and strengthening India's capacity to respond to HIV/AIDS on a long term basis
1962 ; 1992	National TB Control Programme (NTCP), 1962; Reviewed by an Expert Committee in 1992	<p>The revised NTCP (RNTCP), 1993 had the following features:</p> <ul style="list-style-type: none"> ▪ Based on Directly Observed Treatment Short course (DOTS) strategy with the objective of curing at least 85% of new sputum positive patients and detecting at least 70% of such patients; uninterrupted supply of medicines to patients assured. ▪ Possibility of covering the entire country by

Year	Programme	Highlights
		2005 under consideration
1992	National Iodine Deficiency Disorders Control Programme (NIDDCP)	<ul style="list-style-type: none"> ▪ Iodization plants donated to 40 small scale manufacturers association/cooperative societies ▪ Loans offered by the Salt Department for development of salt works to licenced manufacturers and promotion of cooperative societies in the salt industry
1995	Pilot Project on Oral Health	Launched by the Directorate General of Health Services for 3 years in one district each of five states, Himachal Pradesh, Haryana, Punjab, Delhi and Rajasthan as a collaborative project of the Government of India and WHO
1996	Yaws Eradication Programme (YEP)	Yaws is a preventable, disfiguring and debilitating non-venereal treponemal infection; YEP initiated as a central sector health scheme in one (Koraput) and gradually extended to other states; is expected to achieve eradication of Yaws by 2004-05. Programme strategy includes manpower development, detection of cases, simultaneous treatment of cases and close contacts and Information Education Communication (IEC) activities
1996	National/District Mental Health Programme	Launched in 4 districts; Includes training of health team at the identified nodal institutes within states, increasing awareness about mental health problems, providing services for early detection and treatment of mental illness, and providing data and experience at the level of community for future planning; extended to 22 districts in 20 states in 2001
1997	National Dengue Control Programme	Under the programme <ul style="list-style-type: none"> ▪ Dengue situation regularly monitored by the National Anti -Malaria Programme (NAMP) ▪ Important components include surveillance and control, health education and symptomatic treatment
1997	National Surveillance Programme for Communicable Diseases (NSPCD)	Under the programme: <ul style="list-style-type: none"> ▪ A model district surveillance plan drafted with an objective to train, modernize laboratories, strengthen linkages for disease surveillance from peripheral to central levels, networking with state/regional and national institutions etc. ▪ Pilot project implemented in 25 districts in 1998 ▪ Programme extended to 20 more districts in 1999 ▪ Programme continued to exist in 45 districts and extended to 35 more districts in 2001

Achievements

As is apparent in Tables 16.4 and 16.5 above, the achievements in the health and population sectors can be classified under four broad heads: population and demography; prevention and disease control, infrastructure; and promotion of Indian systems of medicine.

Population and demography

The intensive health care and family planning programme in the country has led to an overall decrease in the birth rates along with stabilization of death rates over time (Figure 16.2). This has resulted in a decline in the rate of growth of population in the country from 2.14% in 1981-1991 to 1.93% in the decade, 1991-2001 (Census of India, 2001) (Figure 16.3).

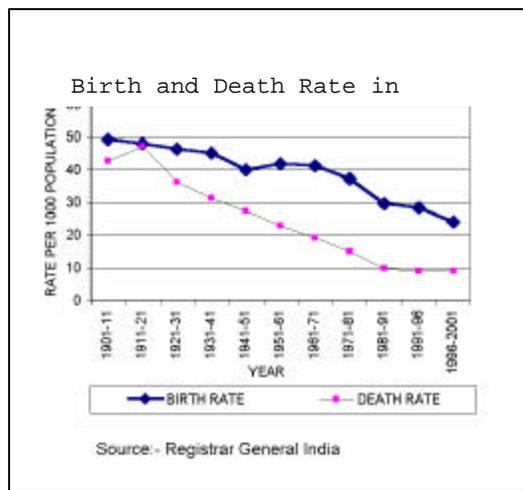


Figure 16.2 Trends in birth rate and growth rate

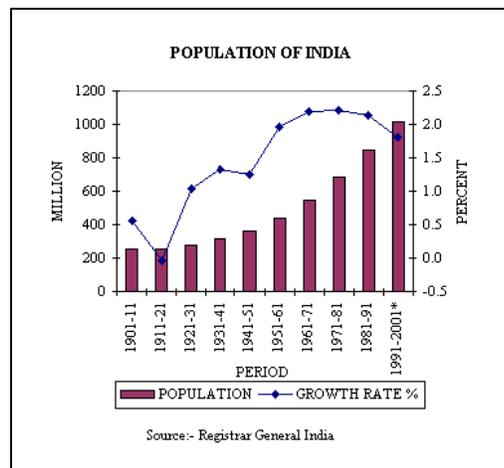


Figure 16.3 Trend in the growth of population: 1901-2001

Half a century after the formulation of the first family planning programme, the country has^a:

- Reduced crude birth rate (CBR) from 40.8 (1951) to 26.4 (1998, SRS);
- Halved the infant mortality rate (IMR) from 146 per 1000 live births in 1951 to 70 per 1000 live births in 1999 (MoHRD, 2002);
- Quadrupled couple protection rate (CPR) from 10.4 percent (1971) to 44 percent (1999);
- Reduced crude death rate (CDR) from 25 (1951) to 9.0 (1998, SRS);
- Added 25 years to life expectancy from 37 years to 62 years ;
- Achieved nearly universal awareness of the need for and methods of family planning, and
- Reduced total fertility rate from 6.0 (1951) to 3.3 (1997, SRS).

(Source: National Population Policy 2000^b and MoHRD (2000))

Disease prevention and control

As summarized in Table 16.5 above, the government has launched a number of programmes to control infectious and other diseases in the country. These programmes have led to a significant decline in their incidence. Some indicators of this performance are:

- Number of reported cases of polio has progressively decreased from 28757 in 1987 to 3265 in 1995 to 1005 reported during 1996. In 2000, only 265 cases had been detected throughout the country. Most parts of the country have become polio-free and widespread transmission is restricted only to the states of Bihar and Uttar Pradesh.
- A review of the TB programme undertaken in February 2000 by the government and WHO found that there has been a striking increase in the proportion of patients cured.
- Number of malaria cases has declined from 75 million in 1951 to 2.2 million in 2000.
- Number of leprosy cases per 10,000 people has fallen from 38.1 in 1951 to 3.74 in 2000.
- The HIV estimates for the year 2001 (based on HIV Sentinel Surveillance round-2001) reveal that while AIDS epidemic is still spreading there is a

^a There are inter-state variations in these trends. For instance, IMR varies from a figure of less than 50 per 1000 live births for Goa, Kerala, Tamilnadu and Mizoram to a figure of nearly 100 per 1000 live births for Bihar, Madhya Pradesh, Uttar Pradesh, Rajasthan and Orissa.

^b Ministry of Health and Family Welfare web site: <http://www.mohfw.nic.in>

gradual decline in new infections. The number of new infections can be put to a figure of 0.11 million compared to 0.16 million in 2000a .

- Small pox and guineaworm have been eradicated.

The following table (Table 16.6) reports the achievements of immunization programmes in the country.

Table 16.6 Immunisation programme: % of targets achieved for various diseases - All India:1989/90 to 1999/2000

Year	Coverage levels (% achievement of target)				
	DPT	OPV	BCG	MSLS	TT
1989-90	82.93	82.30	89.04	69.32	58.83
1990-91	100.72	101.54	102.99	90.85	79.70
1991-92	90.85	91.22	92.93	85.07	77.51
1992-93	90.53	91.03	96.54	85.82	79.18
1993-94	93.16	93.62	97.18	88.53	82.55
1994-95	94.51	95.21	99.75	87.23	83.82
1995-96	90.72	91.61	97.07	82.63	80.36
1996-97	91.5	92.7	98.2	83.2	81.8
1997-98*	92.9	93.9	99.5	85.8	82.6
1998-99*	93.7	95.3	97.7	88.1	83.9
1999-00*	95.3	95.9	101.6	89.6	81.7

(* Figures provisional)

Source. MOH&FW

DPT: Diphtheria Pertussis Tetanus

OPV: Oral Polio

BCG: Bacillus of Calmette and Guerin

MSLS: Measles

TT: Tetanus Toxoid

Health care infrastructure

The various programmes discussed above have reinforced the delivery of primary, secondary and tertiary health care throughout the country. As a result of the several initiatives of the government, there has been an increase in the number of health care centres/sub-centres/primary health centres/ community health centres from 725 in 1951 to 1,63,181 in the year 2000. The number of dispensaries and hospitals increased over five-fold, which indicates their accessibility by the population. Table 16.7 provides a summary of the major achievements.

Table 16.7 Major achievements in health care infrastructure:1951-2000

Indicator	1951	1981	2000
Infrastructure			
SC/PHC/CHC	725	57,36	1,63,181 (99-Rural)

^a <http://naco.nic.in/vsnaco/indiascene/esthiv.htm>

		3	Health Survey)
Dispensaries and hospitals (all)	9209	23,55	43,322 (95-96 -CBHI)
Beds (private and public)	117,1	569,4	8,70,161 (95-96-CBHI)
Doctors (allopathy)	61,80	2,68,	5,03,900 (98-99-MCI)
Nursing personnel	18,05	1,43,	7,37,000 (99-INC)
	4	887	

Source. MoH&FW

CBHI: Central Bureau of Health Intelligence

MCI: Medical Council of India

INC: Indian Nursing Council

To further enhance the health standards a New Health Policy (NHP), 2002 has been formulated (Box 16.1). The policy focuses on the need for enhanced funding and organisational restructuring of the national public health initiatives in order to facilitate more equitable access to health facilities.

Box 16.1 New Health Policy-2002

Some of the important features of the NHP are:

- Increase health sector expenditure to 6% of GDP with 2% of GDP being contributed as public health investment by the year 2010. State governments to increase the commitment to health sector,
- Increase sectoral outlay on primary health sector,
- Ensure provision of financial resources, in addition to technical support, monitoring and evaluation at the national level; gradual convergence of all health programmes under a single field administration,
- Develop capacity within State Public Health Administration for scientific designing of public health projects
- Recognize the need for more frequent in-service training of public health medical personnel; consider need for extending public health services,
- Greater emphasis on implementation of public health programmes through local self-government institutions
- Promote setting up of organized urban primary health care structure; network of decentralized mental health services; prioritise school health programmes; operationalise integrated disease control network
- Envisage identification of specific programmes targeted at women's health; periodic screening of health conditions of workers.

Indian systems of medicine and homeopathy

The Indian systems of medicine and homeopathy (ISM&H) consist of Ayurveda, Sidhha, Unani and Homeopathy, and therapies such as Yoga and Naturopathy. During the last five decades there has been a progressive increase in the number of

physicians qualifying through educational institutions in ISM&H. There are about 6 lakh ISM&H practitioners serving in remote rural and urban areas (Planning Commission, 2001c). Strengthening undergraduate and post graduate training in ISM&H, establishment of speciality clinics in major hospitals, standardisation of drugs, enhancing availability of raw materials, research and development and information, education and communication (IEC) are some of the major achievements of the Department of ISM&H. There are four Research Councils for ISM&H—Central Council for Research in Ayurveda and Siddha (CCRAS); Central Council for Research in Unani Medicine (CCRUM); Central Council for Research in Homoeopathy (CCRH); and Central Council for Research in Yoga and Naturopathy (CCRYN). These initiate, aid, guide, develop and coordinate basic and applied research, medico-botanical surveys, research on the cultivation of medicinal plants and pharmacognostical studies.

Over the last two decades the cultivation of medicinal plants and herbs has been unable to meet the increasing demands for drugs used in these systems. Some of the species of medicinal plants are reported to be endangered because of increasing pressure on the forests. A scheme has been initiated for the development and cultivation of medicinal plants with the objective of augmenting production of raw herbs of plant origin by providing central assistance for their cultivation and development.

Education

'Education for all' is one of the priority areas of the government. Programmes have been initiated by the government at various levels involving state governments and local bodies to enhance the spread of education in the country. Several of these schemes, launched by the Central government are summarized in Table 16.8 below.

Table 16.8 Highlights of policies/programmes/schemes in the education sector

Year	Initiative	Highlights
Policies and legislation		
1988	National Literacy Mission (NLM)	Aimed at <ul style="list-style-type: none"> ▪ Providing literacy and life skills to persons in the age group of 15-35 years by the year 2005 ▪ Promoting literacy among women, scheduled castes and tribes and backward classes. District-based total literacy campaign (TLC) emerged as a programme strategy for NLM.
1982	National Policy on	The 1992 Plan of Action assigned specific

Year	Initiative	Highlights
	Education, 1982; Reviewed in 1990; Revised in 1992	responsibilities for organizing, implementing and financing the proposals of NPE, 1986. The NPE emphasized elementary education, giving a thrust to: <ul style="list-style-type: none"> ▪ Universal enrolment and universal retention ▪ Improvement in quality of education
2001	Constitution (Ninety-third Amendment)	The Bill seeks to introduce a new article in the Chapter on Fundamental Right of the Constitution of India, which makes the right to elementary education a fundamental right for all children in the age group 6-14 years. The Bill is waiting approval by the Parliament.
Programmes		
1987	Operation Blackboard (OB), Later renamed 'Special Orientation of Primary Teachers (SOPT)' programme	Intended to improve school infrastructure by providing essential facilities such as teachers, classrooms, books and teaching equipment.
1987	Teacher Education	This centrally-sponsored scheme of restructuring and reorganization of teacher education taken up in 1987 envisages setting up District Institutions of Education and Training (DIETs) in each district to provide academic and resource support to elementary education teachers and non-formal and adult education instructors; establishment of Colleges of Teacher Education (CTEs) and Institutes of Advanced Study in Education (IASEs) to organize pre-service and in-service training for secondary teachers; strengthening of State Council of Educational Research and Training (SCERT) in States. Under this scheme 461 DIETs, 85 CTEs, 37 IASEs have been established so far.
1989	Mahila Samakhya, (supported by the World Bank)	Designed specifically for women's empowerment through education. focussed on the education and empowerment of women in rural areas, particularly of women from socially and economically marginalized groups. The programme goes beyond target interventions; Sanghas (Village level women's collective, the nodal points around which the programme evolves, address a wide range of issues relating to livelihood, education and health; Sanghas have played an active role in enrolling children specially girls in the village schools
1991	Bihar Education	Aims to bring about quantitative and

Year	Initiative	Highlights
	Project (collaborative venture of the UNICEF, Government of India and Government of Bihar)	<p>qualitative improvements in the primary education, especially for deprived sections of society, such as SCs, STs and women. Focuses on Minimum Levels of Learning (MLL) and training of teachers</p> <p>Highlights of MLL Programme:</p> <ul style="list-style-type: none"> ▪ Aims at competency by all primary school students in languages, mathematics and environmental studies. ▪ First phase implemented through voluntary organizations, institutions, State Councils for Educational Research and Training (SCERTs) and established District Institutes of Education and Training (DIETs)
1992	Lok Jumbish (LJ),	<p>Aims at empowerment of locally elected people, especially female representatives at village level.</p> <ul style="list-style-type: none"> ▪ LJ achieved a major breakthrough in welding government agencies, teachers, NGOs, elected representatives and the people into a group effort to promote universalization of primary education ▪ Coverage extended to 75 blocks, covering a population of approximately 12 million
1992	Shikhsa Karmi Project	<p>Led to constitution of Village Education Centres (VECs) in 2000 villages to promote community involvement in primary education and encourage village level planning. The role of the VECs includes:</p> <ul style="list-style-type: none"> ▪ Mobilizing resources for maintenance, repair and construction of school infrastructure. ▪ Determining the school calendar and school timings in consultation with the local community educational workers (shiksha karmis) <p>The programme covers over 150,000 students in 1,785 schools and 3,520 Prehar Pathshalas, involving over 4,271 Shiksha Karmis.</p>
1993	Uttar Pradesh Basic Education Programme	<p>Assisted by the World Bank aims at 'education for all'. Activities include:</p> <ul style="list-style-type: none"> ▪ Construction work of schools and Block Resource Centres ▪ Preparation of training material for teacher trainers in established District Institutes of Education and Training (DIETs) (about 40,000 teachers have been trained in the first cycle of in-service teacher training)

Year	Initiative	Highlights
1994	District Primary Education Programme	<p>The project is currently in operation in 12 districts. It is planned to expand the coverage to 15 districts under DPEP-II.</p> <p>The programme, partially funded by a World Bank loan, aims at operationalizing strategies required for achieving the goal of universal elementary education through specific planning and target-setting at the district level;</p>
1995	National Programme of Nutritional support (Mid-Day Meal Scheme) Non Formal Education	<p>Provides 3 kgs of foodgrain per month to each primary school student; being implemented in all states.</p> <ul style="list-style-type: none"> ▪ Based on the concept of decentralized management, community mobilization, contextual and research-based inputs. ▪ Designed to enhance government efforts to provide basic education to all children in the age group 6 to 11 years with a focus on girls, marginalized communities (SCs and STs), children with disabilities and working children. <p>Implemented in pursuance of the National Policy of Education, 1986; provides Central Government help for establishment of non-formal education centres</p> <ul style="list-style-type: none"> ▪ Scheme of Jan Shikshan Sansthan or Institute of People's Education, (previously known as the Scheme of Shramik Vidyapeeth) evolved as a non-formal continuing education programme to respond to the educational and vocational training needs of adults and young people living in urban and industrial areas and rural-urban migrants ▪ Institutes' activities enlarged and infrastructure strengthened to enable functioning as district level repositories of vocational and technical skills in urban and rural areas. ▪ 92 Jan Shikshan Sansthans in the India currently
1997	Education Guarantee Scheme	<p>Being implemented vigorously in Madhya Pradesh, this is a community centred initiative for Universalization of Elementary Education (UEE; more state/UTs proposing to launch this shortly</p>
1998	Schemes on Vocationalisation of Secondary Education	<p>Centrally sponsored scheme to encourage setting up of vocational courses in the country; Pandit Sundar Lal Sharma Central Institute of Vocational Education (PSSCIVE) was set up to give impetus to R&D and technical support in</p>

Year	Initiative	Highlights
1998	Schemes of Technical Education	the field of vocational education. Aims at implementing the recommendations of the National Task Force on information technology and software development through agencies such as the NCERT, IGNOU, and UGC; Indian Institute of Information Technology and Management set up in Gwalior and Indian Institute of Information Technology at Allahabad.
2000	Sarva Shiksha Abhiyan	<p>Flagship programme for UEE announced in the year 2000, made operational and launched in all the states of the country. Steps have been taken to make elementary education a fundamental right for children in the age group 6-14.</p> <p>Broadly, it aims at ensuring that the schemes of elementary education are implemented in a holistic manner. The major goals include:</p> <ul style="list-style-type: none"> ▪ All children in the age 6-14 in schools/Education Guarantee Centres/bridge course by 2003 ▪ All children of age 6-14 to complete 5 year primary education by 2007. ▪ All children of age 6-14 to complete 8 years of schooling by 2010. ▪ Focus on elementary education of satisfactory quality with emphasis on education for life. ▪ Bridge all general and social category gaps at primary stage by 2007 and at elementary education level by 2010 and ▪ Universal retention by 2010.
2000	Education Guarantee Scheme & Alternative and Innovative Education (EGS & AIE)	Launched in 2000 in the entire country to improve access to education with flexibility to cater to diverse needs of out-of-school children. It provides for guaranteed opening of EGS schools in unserved habitations where there are no school within 1 km radius.
2001	Kasturba Gandhi Swatantra Vidyalaya Scheme	<p>Provides for setting up of residential schools for girls in districts that have a particularly low female literacy rate</p> <ul style="list-style-type: none"> ▪ Sum of Rs 2500 million provided in the 2001-02 ▪ Financial incentives and scholarships for the girl child born in families living below the poverty line, also provided

Year	Initiative	Highlights
2001	Andhra Pradesh Primary Education Project	Implemented in the south central state of Andhra Pradesh, with a female literacy of just 34%, APPEP adopts a two-pronged strategy of improving classroom transaction by training teachers and giving a fillip to school construction activities. <ul style="list-style-type: none"> An estimated 80,000 teachers in 23 districts trained and more than 3,000 teaching centres operational
2001	National Programme for Women's education	Aims at providing incentives such as free textbooks, uniforms, to increase intake and retention of primary and middle school girl's enrolment

Achievements

As can be seen from the above table, a number of central and state level initiatives are in place to enhance the level of literacy in the country. As a result of these, the literacy rates for India as a whole increased from 18.33 % in 1951 to 65.38 % in 2001, with the literacy rate for males at 75.85% and that for females at 54.16% (Census of India, 2001).

The country's commitment to elementary education sector is reflected in the move to make free and compulsory education a Fundamental Right for all children in the age group six to fourteen. Necessary Constitutional Amendment Bill has been introduced in the Parliament towards this end. The government has also launched the programme Sarva Shiksha Abhiyan (Movement for Education for All) which would be the main instrument for fulfilling this Constitutional obligation. It is a holistic and convergent scheme, with an effort to universalize elementary education by community-ownership of the school system. The community is the key in the planning, implementation and monitoring of SSA. There is a special focus in the programme for girls and other disadvantaged groups. In addition, to the gender-focus in SSA, the government is implementing some gender specific programmes like Mahila Samakhya and is also launching two more programmes, viz. Kasturba Gandhi Swatantra Vidyalaya (KGSV) and the National Programme for the Education of Girls at the Elementary Level (NPEGEL), targeting key issues affecting girls' education.

Another notable initiative operating at a decentralised level through collaboration of the state government, local body/panchayat and the community is the Education Guarantee Scheme (1997) introduced in the state of Madhya Pradesh (Table 16.8). Under EGS, the Government gives a guarantee to provide a primary

schooling facility to children in a habitation where there is no such facility within a kilometer within a period of 90 days of receiving a demand for such a facility by the local community.

The achievements in access to education sector can be categorized under the following broad headings: basic education, adult education and technical and professional education.

Basic education

Major achievements in the area of primary education include:

- Three-fold increase in the number of primary schools from 210,000 in 1950-51 to 642,000 in 1999-00.
- Increase by 15 times in the number of upper primary schools from 13,596 in 1950-51 to 198,000 in 1999-00.
- 83% of the rural habitations and 94 % of the rural population with access to primary schools within a distance of 1 km; 76 % of the rural habitations and 85% of the rural population served by upper primary schools within a distance of 3 km as per the Sixth All India Educational Survey, 1993.
- Increase by 5.9 times in total enrolment at the primary stage, with the share of girls' enrolment having increased from 28.1% in 1950-51 to 43.6% in 1999-00.
- Enrolment at the upper primary levels increased by 13 times, in which, the relative share of girls' enrolment which was only 16.1% in 1950-51 rose to about 40.4% in 1999-00.
- Significant increase in the gross enrolment ratio at primary and upper primary levels (Table 16.9), with enrolment for girls rising from 24.8% to 85.18% at the primary level and the boys/girls differential declining from 35.8% in 1950-51 to 18.90% in 1999-00; GER for girls at upper primary level improved from 4.6% to 49.66%.

Table 16.9 Growth in school enrolment at the primary and upper primary level 1950/51-1999/2000

Total enrolment (in million)	1950-51	1999-00
Primary level	19.2	113.61
Upper primary level	3.1	42.06
<i>Gross enrolment ratio (%)</i>		
Primary level	42.60	94.90
Upper primary level	12.70	58.79

Source. MoHRD

Adult education

The National Literacy Mission (NLM) was set up in 1988 to impart a new sense of urgency and seriousness to adult education. The goal of this Mission is to attain total literacy i.e. a sustainable threshold literacy rate of 75% by 2005. The Mission seeks to achieve this by imparting functional literacy to non-literates in the 15-35 age group. This has been a very successful programme for promoting adult literacy in India.

The Total Literacy Campaign (TLC) has been the principal strategy of the National Literacy Mission (NLM) for eradication of illiteracy. On the conclusion of a Total Literacy Campaign (TLC), a Post-Literacy Campaign (PLC) is implemented. The NLM has emphasized the integration of a skill development programme with the PL programme to enable neo-literates to acquire skills for their economic self-reliance and as a problem-solving tool, so that learning becomes relevant to living and working. the salient features of the NLM include:

- The Scheme of Continuing Education (CE) encompasses the removal of residual illiteracy, individual interest programmes, skill development, rural libraries etc., would allow for opening of Continuing Education Centres in every major village.
- NGOs receive grants for activities relating to the organization of the functional literacy component in various developmental programmes and for imparting functional and technical education to neo-literates.
- State Resource Centres (SRC) conduct the training of literacy functionaries and preparation of reading material.
- The Jan Shikshan Sansthan (JSSs) function as district repository of vocational/technical skills in both urban and rural areas.

As of December 2001, 561 out of 588 districts in the country, were covered under Adult Education Programme—166 under Total Literacy Campaigns, 260 under the Post Literacy Programme, 30 under the Rural Functional Literacy Project (RFLP) and 105 under the continuing Education Programme. About 91.5 million people have been made literate as of 31.12.2000. Besides, 92 Jan Shikshan Sansthan have been set up and 25 State Resource Centres are functioning under NGOs. The Directorate of Adult Education and National Institute of Adult Education (NIAE) are functioning as National Resource Centres.

Higher education (including technical and professional education)

The number of secondary and senior secondary schools in the country increased from 7416 in 1950-51 to 1,16,000 in 1999-00 with a student enrolment of 28 million. The Sixth All-India Educational Survey 1993 showed that there was an increase of 51% in the enrolment of girls in classes IX to X and a 54% increase in classes XI to XII as compared to 20% in the primary and 40% in the upper primary stages during the period 1986 to 1993 (MoF, 2002).

There has been an impressive growth in the area of university and higher education. Accreditation of all universities and colleges has been made mandatory. It has also been made possible for deemed universities to open campuses abroad. All higher education institutions at all levels can now have 15% supernumerary seats for foreigners. These steps will improve the quality of education offered and make the system more globally competitive.

Technical and professional education in the country has played a significant role in economic and technical development by producing quality manpower. There are at present 1058 approved engineering colleges at the degree and 1231 colleges at diploma level. Apart from this, 797 institutes impart courses on Master of Computer Applications Courses. There are 820 approved management institutes imparting MBA courses. Strong linkages have been developed between technical institutions and industry. For strengthening technical education and improving the polytechnic pass-outs, massive efforts have been made at the state level with the assistance of international agencies such as the World Bank (MoF, 2002).

Sustainable human settlements^a

Housing and shelter

^a Also refer to Chapter 7 on Water resources and Chapter 15 on Urban governance and services

Agenda 21 stressed on the need for '*Providing adequate shelter for all*'. The various initiatives of the government in both urban and rural areas are briefly set out in Table 16.10.

Table 16.10 Highlights of policies and other initiatives for provision of shelter for all

Year	Initiative	Highlights
Legislation		
1976	Urban Land (ceiling and Regulation) Act	Enacted with a view to prevent concentration of urban land in the hands of a few persons, speculation and profiteering in urban land and to bring about an equitable distribution of urban land to subserve the common good. The Act was repealed in 1999.
1998	Land Acquisition (Amendment) Act	land acquisition in India is covered by a national law, the 1894 Land Acquisition Act (LAA) and its subsequent amendments. It allows for land acquisition in the national interest for water reservoirs, canals, plants, fly-ash ponds, transmission lines and highways to be carried out by the respective States
Policies		
Sixth Plan (1980-85)	Integrated Development of Small and Medium Towns	Aimed at improving infrastructural facilities and helping in creation of public assets in small and medium towns
1996	Urban Development Plans Formulation and Implementation (UDPFI) Guidelines	Prepared by the Ministry of Urban Development and Poverty Alleviation, these aim at adopting an urban development planning system consisting of four inter related plans viz. Perspective plan, developmental plan, annual plan and plans of projects and schemes. All these plans focus on resource mobilization and legislative support as well as taking in to account the regional approach environmental aspects and peoples' participation.
	National Capital Region Planning Board (NCRPB)	NCR Planning Board was constituted under the National Capital Region Planning Board Act, 1985 to regulate the growth and to prepare plans and policies for balanced and harmonised development of National Capital Region.
1998	National Housing	Aims at providing housing for all and

Year	Initiative	Highlights
	Habitat Policy	facilitates construction of 20 lakh additional housing units annually (13 lakh in rural areas and 7 lakh in urban) with the emphasis on extending the benefits to poor and deprived.
Programmes		
1993-94	Infrastructure Development of Mega Cities scheme	The main objective of this scheme was creating and maintaining a special fund for the development of infrastructure on a sustained basis. The scheme targeted cities having population above 4 million, excluding Delhi.
1996	National Slum Development Programme	Under this programme funds are given to the states on yearly basis to take care of housing and shelter and up gradation of slums.
1996	Indira Aawas Yojana (IAY)	Launched during 1985-86 as a sub-scheme of Rural Landless Employment Guarantee Programme (RLEGP) and continued as a sub-scheme of Jawahar Rozgar Yojana (JRY) since its launching from April, 1989. It was delinked from the JRY and has been made an independent scheme with effect from January 1, 1996. The scheme aims to provide assistance to below poverty line households belonging to Scheduled caste, scheduled tribe, and free bonded labour categories.
1999	Credit-Cum-Subsidy Scheme for rural housing	The Schemes targeted rural families having annual income upto Rs. 32,000 to enable/facilitate construction of houses for rural households who have some repaying capacity. Under this scheme, preference is also given to rural households below the poverty line.
1999-2000	Samagra Aawas Yojana	Under this scheme a block each in 25 districts of 24 states and one union territory were identified for implementation of a participatory approach under Accelerated Rural Water Supply Programme.
2000-01	Pradhan Mantri Gamodya Yojana (PMGY)	Aims at achieving the objective of sustainable human development at the village level. The PMGY envisages additional central assistance (ACA) for the basic minimum services of rural roads, primary health, primary education, shelter, drinking water and nutrition in order to focus on these

Year	Initiative	Highlights
		priority areas. To achieve the national goal of village electrification by 2007, the village electrification component has now been included under PMGY.

Achievements

The government has taken numerous measures to promote sustainable settlements over the years. Efforts have been made over the years to achieve the objective of shelter for all through a number of centrally sponsored schemes and institutional financing through HUDCO (Housing and Urban Development Corporation) and other institutions. Several enabling programmes have been initiated, such as, the establishment of a housing finance system with a National Housing Bank at the apex level.

In 1998, the National Housing Policy was revised and amended, making a conscious attempt to redefine housing from a mere physical asset to more dynamic concept that of a sustainable living habitat. The concept of adequate shelter includes adequate social and physical infrastructure, use of energy saving and cost effective building material, good clean living environment and other such parametres. The emphasis is therefore on human settlement technology rather than a civil engineering approach. In order to meet the target of achieving the objective of Agenda 21 by 2007, it was decided to create 2 million additional dwelling units predominantly for the poor in urban areas each year. A practical approach was adopted to provide housing by involving various stakeholders- corporate and co-operative sector, housing finance institutions and research institutions with government playing the role of a facilitator. The Government seeks to achieve the target of 'shelter for all' through a facilitating approach principally in three areas— legal reforms, fiscal incentives and transfer of technology. A set of laws, statues, rules, regulations which have an impact on the housing and construction activity have been undertaken including an amendment to the Urban Land (Ceiling and Regulation) Act to expand the supply of land, formulation of a model Rent Control Act and model Apartment Ownership Bill (details in Table 16.10). Some fiscal incentives for enlarging the resource base have been taken by the Government. These include increase of government equity in HUDCO to enable an increase in mobilization of funds, allowing tax concessions for rental housing, providing for external commercial borrowings, activating Housing Co-operatives etc. The shelter needs of the poor cannot solely be achieved by the legal and fiscal concessions and therefore the use of efficient construction techniques and cost effective technologies becomes imperative. In this regard the Building Material and Technology

Promotion Council (BMTPC) and Housing and Urban Development Corporation (HUDCO) and Habitat Polytechnic have played an important role.

An action plan has been prepared for the development of housing in rural areas. It comprises the following elements (for details refer to Table 16.10).

- Upgradation of unserviceable kutcha houses in the Indira Awaas Yojana in addition to new construction
- Pradhan Mantri Gramodaya Yojana
- Credit-cum-subsidy scheme for rural housing
- Samagra Awaas Yojana
- Innovative scheme for rural housing and habitat development
- Rural building centres
- Enhancement of equity contribution by Ministry of Rural Development to HUDCO
- National Mission for Rural Housing and Habitat

During the period 1991 and 1997 about 57 lakh houses have been constructed through the ongoing Indira Awaas Yojana, State Governments and HUDCO. Further a major initiative - Pradhan Mantri Gramodaya Yojana- aimed at creation of social and economic infrastructure at the village level has recently been introduced.

As per the National Human Development Report (Planning Commission, 2002), the quality of housing has improved over the years. The share of households living in *kutcha* and semi *pucca* houses has declined by around 9% between 1981 and 1991 while those living in *pucca* houses increased from 33% to nearly 42%.

Basic Amenities

Safe drinking water and sanitation

Provision of sustainable housing facilities goes in tandem with access to safe drinking water and proper sanitation facilities. The 1991 Census reported nearly 62% of households in India with access to safe drinking water compared to 38% in 1981. The NFHS II survey revealed that share of population with access to safe drinking water was nearly 78% in 1998-99 while 64% of the households in the country did not have access to sanitation facilities compared to 76% in 1991 (Planning Commission, 2002).

The government has undertaken several initiatives to ensure availability of safe drinking water. These are discussed in more detail in Chapters 7 and 15. The trend is towards greater community participation in the provision and management of basic services. One such programme, *Swajal*, the Uttar Pradesh

Rural Water Supply and Sanitation Project is implemented by the Government with World Bank assistance since 1996. Under this programme, nearly 1000 villages have been covered in 12 districts of Uttaranchal with the aim of providing not only safe drinking water in rural areas but also community empowerment by converging a range of development initiatives including Non-Formal Education (NFE); Hygiene and Environmental Sanitation Awareness (HESA); and Women's Development Initiatives (WDI). The programme has been successful in promoting self-reliance amongst the local communities.

Another successful programme is the *Sulabh* Sanitation Movement started by Sulabh International Social Service Organization, an NGO. The movement has demonstrated the use of low cost technology for providing sanitation facilities throughout the country especially to the economically weaker sections. The key to the success of the *Sulabh* movement is creation of public awareness and enhanced community participation in implementation and maintenance of the infrastructure.

Other infrastructure

Provision of basic infrastructure-road connectivity and electricity - particularly in the rural areas is often the primary means for supplementing effort directed towards providing basic health and education services as well as infrastructural support for production, trade and commerce at the local village level.

The road length per 100 square kilometres has increased from 45 kilometres in 1981 to 61 km in 1991 to about 75 km in 1997 (Planning Commission, 2002). During the same period the road length per million population has increased from 21.68 km to 25.82 km. To provide rural connectivity in rural areas the government has recently launched the Pradhan Mantri Gram Sadak Yojana. Its aim is to connect all unconnected habitations with a population of more than 500 persons through good all-weather roads by the end of Tenth Five-Year Plan period.

Access to electricity has also shown considerable improvement over time. About 86.3% of the villages have been electrified in the country and several governmental schemes have been put in place to electrify the remaining villages (for details refer to Chapter 3).

Women

The principle of gender equality and protection of women's rights have been prime concerns in Indian thinking since independence. Some of the Government's main programmes, laws, and policies in this pursuit are discussed in Table 16.11 below.

Table 16.11 Highlights of initiatives for women

Year	Initiative	Highlights
Legislation		
1956	Immoral Traffic (Prevention) Act	Prohibits illegal sexual traffic and contains provisions for corrective institutions, special police officers and advisory body.
1961	Dowry Prohibition Act	Prohibits giving and taking of dowry and makes it an offence.
1984	Family Courts Act	Provide for the establishment of Family Courts to promote conciliation in, and secure speedy settlement of disputes relating to marriage and family affairs and for matters connected therewith.
1986	Indecent Representation of Women (Prohibition) Act	Prohibits indecent representation of women through advertisements or in publications, writings, paintings, figures or in any other manner and for matters connected therewith.
2002	Protection from domestic violence bill	The draft bill envisages assistance to victims of domestic violence. The bill has been approved by the Government for introduction in the Parliament (MoHRD, 2002).
Policies		
1992	National Commission for Women Act	The Commission was set up to safeguard the interests of the women. It has been reviewing women-specific and women related legislation and advising the government to bring forth necessary amendments from time to time.
2001	National Policy of Empowerment of Women	The National Policy for the Empowerment of Women was adopted by the Government in January 2001. It aims to bring about advancement, development and empowerment of women by creating an environment through appropriate economic and social policies to enable women realize their full potential; ensure equal access to participation and decision making; strengthen legal system to reduce violence against women (See Box 16.2).
Programmes		
1973	Hostels for Working Women (HWW)	Extends support services of secured accommodation and crèche to working women with the prime objective of providing greater mobility for women in the employment market.
1982-83	Development of Women and Children in Rural Areas (DWCRA)	Directed at improving the living conditions of women and thereby of children through the provision of opportunities for self-employment and access to basic social services; initiated on a pilot basis, this scheme it covers almost all districts of the country today. The scheme has now been subsumed under the Swarna Jayanti Gramin Rojgar Yojana.

Year	Initiative	Highlights
1987	Support to Training and Employment Programme, STEP	Seeks to train women for employment in the traditional sectors of agriculture, animal husbandry, dairy, handlooms and handicrafts was launched in 1987. Since its inception, about 448245 women have benefited from 86 projects (Planning Commission, 2001c).
1992	Mahila Samakhya	Programme for women's equality and empowerment, which addresses issues such as drinking water, health services, managing non-formal education, provision of pre-school centres/crèche facilities etc.
1993	Women in Agriculture Program	Aims at training women farmers having small and marginal holdings in agriculture and allied activities like animal husbandry, dairying, horticulture, fisheries, bee-keeping etc
1995	Nutritional Support to Primary Education program	The programme focussed on low female literacy blocks.
1998	Rural Women's Development and Empowerment Project (RWDEP): Swa-Shakti Project Women's Co-operatives	A centrally sponsored scheme that aims at providing empowerment to women particularly in rural areas through the self help groups. An example of these cooperatives is Operation Flood, where rural women involved in dairy development on cooperative lines were given training in various activities relating to milk production, preservation and cooperative group formation.
2001	Swayamsidha (Integrated Women Empowerment IWEP)	Aims at holistic empowerment of women through awareness generation, economic empowerment and convergence of various schemes. Immediate objectives include establishment of Self-reliant women's self-help Groups (SHGs); creation of confidence and awareness; improving access to micro-credit; involvement in local level planning
2002	Swadhar	A new scheme launched for the benefit of women in difficult circumstances like destitute widows, women prisoners released from jail and without a family, women survivors of natural disaster who have been rendered homeless. The package of assistance under this scheme includes provisions for food clothing, health care, measures for social and economic rehabilitation through education, awareness etc.

In addition to these, India has ratified the International Convention on Elimination of All Forms of Discrimination Against Women (CEDAW) in 1993 and endorsed the Mexico Plan of Action (1975), the Nairobi Forward Looking Strategies (1985), the Beijing Declaration as well as the Platform for Action (1995) for appropriate follow up.

Achievements

The Indian Constitution and legal framework uphold the dignity and status of women and seek to create an environment where empowerment is facilitated. The 73rd and 74th Constitutional Amendment Bills for strengthening the local self governance, provides that a third of all elected offices in the local bodies are reserved for women.

As can be inferred from the Table 16.11 above, the planning strategies on women have evolved over the years from 'welfare' to 'development' to empowerment'. The Eighth Five-Year Plan adopted strategies to ensure that the developmental benefits do not bypass women and implemented special programmes—Mahila Samridhi Yojana and set up institutions like the National Credit Fund called the Rashtriya Mahila Kosh to complement the general development programmes. The RMK was established to facilitate credit support to poor women particularly those in the unorganised sector.

The Ninth Five-Year Plan further brought about changes in the planning strategy enabling women to exercise their rights both within and outside home, as equal partners with men. The empowerment of women became a primary objective in the Ninth Plan, for which the National Policy for Empowerment of women was approved in 2001, the year that was observed as 'Women Empowerment Year' (refer to Box 16.2). The centre and states were also directed to adopt a special strategy of Women Component Plan, through which 30% of funds would to be earmarked in all women sectors. The Government recently has initiated *gender budgeting* to establish the gender-differential impacts of various government programmes.

To deal with the increasing problem of violence against women and the girl child within and outside the family, concrete efforts have been undertaken such as the setting up of women cells, family courts, counselling centres. A National Commission for women has been established and the National Human Rights Commission has been mandated to look into the human rights issues involving women. Special cells for preventing crimes against them have also been established..

As a consequence of several efforts initiated by the Government of India there has been a perceptible improvement in the status of woman. The life expectancy at birth among women has steadily improved overtime and stood at 61.8 in 1997 (MoHRD, 2002). The female literacy rate has risen steadily over time from 29.76% in 1981 to 39.29% in 1991 and further to 54.16% in 2001. Higher literacy rates offer possibilities of greater exposure to new ways of thinking, which in turn results in better health, improved maternal competence and lower infant mortality. The percentage of women in the organized activity has increased from 10.9% in 1961 to 17.4% in 1998 (Planning Commission, 2001a). On March 31, 1999 women constituted about 17.2% of the organized sectors (public and private) employment (MoF, 2002).

The index of gender inequality measuring the attainments in human development indicators for females as a proportion of that of males has shown improvement, though marginally, in the 1980s. At the national level, the GEI increased from 62% in the early eighties to 67.6% in the early nineties. This implies that on an average, the attainments of women on human development indicators were only two-thirds of those of men (Planning Commission, 2002).

Box 16.2 National Policy for Empowerment of Women (2001)

The goal of the Policy is to bring about advancement, development and empowerment of women. Specific objectives of the Policy include:

- Creating an environment through positive economic and social policies for full development of women
- The de jure and de facto enjoyment of all human rights and fundamental freedom by women on equal basis with men in all spheres-political, social, cultural and civil
- Equal access to participation and decision making
- Equal access to health, education, career, vocational guidance, employment, equal remuneration, occupational health and safety, social security etc.
- Strengthening legal system aimed at elimination of all forms of discrimination against women
- Changing societal attitudes and community practices by active participation and involvement of both men and women
- Mainstreaming a gender perspective in development process
- Elimination and discrimination of all forms of violence against women and girl child
- Building and strengthening partnerships with civil society, particularly the women organisations.

Children and youth

Investment on child development is viewed not only as a desirable societal investment for the nation's future but also as fulfilment of the right of every child to 'survival, protection, and development'. The Convention on the Rights of Child ratified by India in 1992 is the guiding principle for formulation of necessary policies and programmes of child development. The highlights of some major policies, acts and others initiatives are given in Table 16.12.

Table 16.12 Highlights of initiatives for children and Youth

Year	Initiative	Highlights
Legislation		
1929;	Child Marriage	The Act restrains the solemnization of child marriages. The Child marriage restraint Act of 1976 raised the age for marriage of a girl from 15 to 18 years and that of a boy to 21 years and made offences under this Act cognisable.
1976	Restraint Act	
1986	Child Labour Prohibition Act	Prohibits the employment of children in specified hazardous occupational and processes.
Policy		
1974	National Policy on Children	The National Policy on Children was adopted with the view to provide adequate services to children, both before and after birth and through the period of growth to ensure their full physical, mental and social developemnt.
1987	National Child Labour Policy	Comprises a legislative plan focusing on general development programmes benefiting children. A major activity undertaken under NCLP is establishment of special schools to provide basic needs like non-formal education, pre-vocational training, supplementary nutrition etc. to all children withdrawn from employment.
1992	National Plan of Action on Children	Two plans of action adopted in 1992: one for children and the other specifically for the girl child; Identifies quantifiable targets in terms of major as well as supporting sectoral goals representing the needs of children in India in spheres of health, nutrition, education and related aspects of social support.
2001	National Charter for Children and a National Commission for Children	These major initiatives, are in the process of being finalized (MoF, 2002). The main objective is removal of structural causes related to issues that affect children and to awaken the conscience of the community to protect children from violation of their rights.
Programmes		
1974	Integrated Child Development Scheme (ICDS)	ICDS was conceived in early years of Fifth Five year Plan and since then it has played a major role in catering to the needs of the pre-school children below six years and expectant and nursing women with a package of services viz. Immunisation, health check ups, supplementary nutrition, pre school education etc. the scheme is now in operation in almost all the development blocks of the country (See Box 16.3)

Year	Initiative	Highlights
1982-83	Development of Women and Children in Rural Areas (DWCRA)	Directed at improving the living conditions of women and thereby of children through the provision of opportunities for self-employment and access to basic social services; initiated on a pilot basis, this scheme it covers almost all districts of the country today.
Eight h Plan	National Service Scheme	Provides for development of youth through community services. The program has successfully taken up activities which have social orientation like literacy, environment enrichment, management of resources etc.
Eight h Plan	Nehru Yuva Kendras	Aims at providing rural and non-student youth with opportunities to take part in the process of national development as also to develop their own personality and skills.
1995	Nutritional Support to Primary Education program	To focus on low female literacy blocks.
1997	Balika Samridhi Yojana	A special intervention to raise the status of the girl child. It promises financial help for families below poverty line to whom a girl child is born.

Achievements

Over the years there have been significant efforts towards child development. Integrated Child Development Services (ICDS), is one such scheme which aims to provide an integrated package of health, nutrition and educational services to children below six years, pregnant women and nursing mothers (Box 16.3). Other initiatives in this direction include, National Crèche Fund for child care services; assistance to voluntary organisations in the field of welfare of women and child development and proposed setting up of National Commission for Children to safeguard constitutional and legal rights of the children (refer to Table 16.12).

India has all along followed an active policy for tackling the problem of child labour. The present regime of laws relating to child labour has a pragmatic foundation and is consistent with the International Labour Conference Resolution of 1979. The Government has sought to ban the employment of children below 14 years of age in hazardous employment and to regulate working conditions for children in other employment. The Child Labour (Prohibition and Protection) Act, 1986 seeks to achieve this objective (Table 16.12).

Youth are a major resource in the task of nation building. Over the years there has been a major thrust towards developing the capabilities of the youth and

enabling their involvement in the development process. Major schemes undertaken during the Eighth Five-Year Plan (1992-97) include National Service Scheme (NSS) and Nehru Yuva Kendras (NYK). The NSS aims at building the social consciousness of the youth with an overall objective of personality development of students through community service. Recently NSS launched a sensitisation campaign on AIDS awareness called 'Universities Talk AIDS' (UTA) in 174 universities all over the country. Besides, 17 lifestyle education centres have also been established to orient youth towards planned parenthood and healthy lifestyle.

Another scheme called the Scheme for Training of Youth has been formulated to motivate the youth thereby helping them develop leadership qualities through training programmes so that youth can act as focal point of dissemination of knowledge in their own area of activity. It also aims at creating new skills among rural youth in order to build foster self-reliant villages.

Box 16.3: Integrated Child Development Services (ICDS)

ICDS is a visionary scheme aimed at holistic development of children. The programme has played an important role in addressing the nutritional and health needs of the children and women across the country. The scheme targets the most vulnerable groups of population including children up to 6 years of age belonging to the poorest families and those living in disadvantaged areas including backward rural areas, tribal areas and slums. In addition to children, ICDS also takes care of the essential needs of pregnant women and nursing mothers in socially and economically backward villages and slums.

Three essential components of ICDS are:

- Nutrition
- Health care
- Early childhood care and pre-school education

Using the ICDS infrastructure, a special intervention scheme was devised for adolescent girls (AG scheme). This was revised later and renamed the Kishori Shakti Yojana with a training component aimed at empowerment of women and was converged with other programmes of similar nature in education, rural development, employment and health sectors.

Source: MoHRD (2002)

Socially disadvantaged groups

The Government of India recognizes that certain under privileged sections of society require special attention in the planning process. Over the years there have been continuous efforts to grant social justice to these socially disadvantaged

classes viz. scheduled castes (SCs), scheduled tribes (STs) and other backward classes (OBCs). The following table (Table 16.13) summarizes the policies and programmes that have been effected in the country for their upliftment.

Table 16.13 Highlights of initiatives for uplifting unprivileged groups

Year	Initiative	Highlights
Legislation		
1955	Protection and Civil Rights (PCR) Act	This act prescribes punishment for the preaching and practice of 'Untouchability'
1989	SC/STs (Prevention of Atrocities) Act	Aims to control the increasing problem of social discrimination, exploitation, untouchability, and violence/atrocities against backward classes and minority groups.
Programmes		
	National Scheduled Castes and Scheduled Tribes Finance and Development Corporation (NSFDC)	Extends financial assistance at concessional rates for training for upgradation of skills and income generating activities for SCs and STs whose annual income is below double the poverty line.
1987	Tribal Cooperative Marketing Development Federation of India Ltd. (TRIFED)	Extends marketing assistance and remunerative price to STs for their minor forests produce and surplus agricultural produce to reduce exploitation of the tribals by the private traders and middlemen.
1992	National Backward Classes Finance and Development Corporation (NBCFDC)	Assists the backward classes in a wide range of income-generating activities through both wage and self-employment ventures
1994	National Minorities Development and Finance Corporation (NMDFC)	Extends concessional finance to eligible beneficiaries for employment and income-generation ventures with a special focus on those living below the poverty line

Achievements

The National Scheduled Castes/Scheduled Tribes Finance and Development Corporation (NSFDC); National Safai Karamcharis Finance and Development Corporation (NSKFDC); Tribal Co-operative Marketing Development Federation of India Ltd. (TRIFED); and State Scheduled Castes Development Corporations (SCDCs) have been catalysts in enhancing the status of disadvantaged groups. In

addition, there are explicit provisions for these groups in most education, training and income-generation programmes.

The impact of developmental plans, policies and programmes resulted in a perceptible improvement in the socio-economic status of SC/STs.

- The percentage of population belonging to SC/STs living below the poverty line has come down from 57.60 (1983-84) to 48.37 (1993-94) and from 63.14 (1983-84) to 51.14 (1993-94), respectively (Planning Commission, 2001a).
- There has been a significant improvement in their literacy levels (Table 16.14).

Table 16.14 All India literacy rate of scheduled castes and scheduled tribes (%)

Category	1971	1981	1991	% age increase of 1991 over 1971
General Population (including SC/ST)	29.4	36.5	52.21	77.28
Scheduled Castes	14.6	21.7	37.41	155.01
Scheduled Tribes	11.3	16.0	29.60	161.95

Source. Department of Education (1995) produced in Planning Commission (2001a)

- Female literacy levels for both SC/STs has shown improvement over time. The female literacy rate has risen from 6.44% in 1971 to 23.76% for SC while for STs, there has been an increase from 4.85% to 18.19% (Planning Commission, 2001a).

Concerns

Despite a perceptible improvement in basic socio-demographic indicators and a reduction in overall poverty, large numbers of our population continue to live in abject poverty and there are large gaps in our social attainments even after five decades of planning. The government recognizes that there is still a long way to go to meet its social objectives. The main concerns include:

Prevalence of poverty

Though the poverty ratio has declined, the absolute number of poor has remained stable at around 320 million for a fairly long period of two decades, (1973-1993) due to the growth in population (MoF, 2002). In addition, there are wide regional, gender and class disparities in the incidence of poverty in the country (Table 16.1).

High density of population

India accounts for 2.4% of the world surface area with 16.7% of the world's population. Though the growth rate of the population has fallen particularly in the last decade, the large numbers pose a big challenge through their impact on density (which has increased from 117 in 1951 to 324 person per sq km in 2001), rural-urban migration and demand for services and natural resources.

High incidence of malnutrition and deficiency diseases

Though the overall levels of malnutrition have declined it is still prevalent with wide inter-state variations. More than half the children in the age group 1-5 years in rural areas are under-nourished, the fraction being even higher for girl children. As per the National Family Health Survey II, 1996-98 about 47% of children under age of 3 years were undernourished.

Deceleration in employment generation

There has been a decline in the rate of growth of employment from 2.43% per annum (1987/88 to 1993/94) to about 1% per annum (1993/94–1999/2000). This decline is associated with the lower growth of population and labour force over this period. The incidence of unemployment defined as percentage of persons unemployed in the age group 15 years and above on the usual principal and subsidiary status to the total number of persons in the labour force has increased at the national level from 2% in 1983 to 2.3% in 1999-2000 (Planning Commission, 2002).

Poor implementation of poverty-alleviation programmes

Evaluations of programmes such as the Integrated Rural Development Programme (IRDP) suggest that these suffer from numerous defects including sub-critical investments, unviable projects, lack of technological and institutional capabilities in designing and executing projects utilizing local resources and expertise, indifferent delivery of credit (high transaction costs, complex procedure, poor recovery etc.), poor targeting of beneficiaries etc (Planning Commission, 2001b).

Lack of infrastructure in providing primary health care

Though a substantial infrastructure for providing primary health care has been created, the issues of inequitable distribution of existing institutions and manpower, poor functioning due to mismatch between personnel and infrastructure, requirement of skill upgradation of personnel, provision of adequate diagnostics, drugs etc., and lack of an appropriate referral system remain areas of concern as identified by the Ninth Five-Year Plan. Technological advances

that widen the spectrum of interventions have not penetrated to the poor, still being beyond the financial reach of the masses. Indigenous and alternatives forms of medicine – Homeopathy and Ayurveda- have not been effectively integrated with conventional medicine.

Low levels of primary education

There is a huge backlog of un-enrolled children in the country. As per National Family Health Survey 1998-99, 78.6% of the children in the age group 6-14 are attending school i.e. out of the 200 million children about 157 million are attending school, leaving 43 million without access to schools.

Inadequate education infrastructure

The insufficient number of primary schools remains another concern. According to the all-India 6th Educational Survey, about 17% rural habitations were not served by primary school within a distance of one kilometre. The survey revealed that about 40% of primary schools were being run in thatched huts/tents. Apart from this, the lack of basic infrastructural facilities such as drinking water, proper sanitation, teaching equipment and teachers were identified as areas that need attention.

Low levels of education amongst women and disadvantaged groups

Low levels of education and training aggravate the state of deprivation of women. The literacy levels of women are low (50% in 1997) as compared to men (73% in 1997). There are also large regional disparities in literacy rates. The literacy rate amongst scheduled castes and scheduled tribes over the years has shown a steady increase but a wide gulf remains between the SC/ST population and the rest of the country (Planning Commission, 2001b).

Poor quality of higher education

Although the number of universities has increased over time, many of these are characterized by low educational standards. The scheme of vocationalization of education has not taken off in the country, due to logistic and academic constraints, and lack of industry-institution linkages. In addition, there is a need to augment quality education in the streams of science and information technology.

Lack of adequate housing infrastructure

The shortage of the housing has increased over the decade (1981-1991). As per the 1991 census, the total rural household shortage was 13.72 million. Of these 3.41

million households were without shelter and 10.31 million households were living in 'Kutcha unserviceable' houses. National Buildings Organization (NBO) estimated the urban housing shortage at 8.23 million in 1991 from 7 million in 1980. Another fallout of the absence of structured housing schemes for the urban poor is the rapid growth of slums causing tremendous pressure on urban basic services and infrastructure.

Gender discrimination

Gender discrimination is reflected in the sex ratio 946 females per 1000 males in 1951 which fell to 927 females per 1000 males in 1991; though the sex ratio for the country as a whole has shown a marginal improvement to 933 in 2001, most states, except Kerala and Pondichery (a parity sex ratio of 1058 and 1001, respectively), have shown declining sex ratios. Gender discrimination is also manifested in the rising incidence of crimes against women (68,317 in 1990 to 121,265 in 1997 (Planning Commission, 2001b).

Strategies for the social sector

Cognisant of the above concerns, the government will seek to redress them as is indicated in the Approach Paper to the Tenth Five-Year Plan. The document explicitly recognizes that development objectives need to be defined not just in terms of increases in GDP or per capita income but in broader terms of the enhancement of human well being. This includes not just adequate level of consumption of food and other types of consumer goods but also access to basic social services especially education, health, availability of drinking water and basic sanitation. It also includes the expansion of economic and social opportunities for all individuals and groups, reduction in disparities, and greater participation in decision-making. Accordingly, the document proposes to set targets not only for economic growth but specific state-level monitorable targets for key indicators of human development. The document also recognizes the interlinkages between economic development, social progress and environmental management—economic development which destroys the environment will create more poverty, unemployment and disease—and accordingly places emphasis on environmental protection. Some of the strategies directly related to the social sector in the areas of poverty alleviation, employment, health and interests of special groups are briefly discussed below.

Growth, equity and sustainability

While growth per se has strong direct poverty reducing effects, the frictions and rigidities in parts of the economy can make this process less effective, thereby necessitating that equity is explicitly addressed. The approach paper proposes to do so through:

- Focus on agricultural development as the core element of growth to ensure the widest spread of benefits, especially to the rural poor including agricultural labour, given that agriculture still accounts for 60% of the employment in the country.
- Rapid growth of those sectors that are most likely to create high quality employment opportunities such as construction, transport, small-scale industry, tourism. Redressal of policy constraints that discourage the growth of employment. The strategy will be to emphasize skill development in order to enhance opportunities and ensure consistency between the requirement and availability of skills.
- Continue to supplement the benefits of growth with special programmes aimed at target groups—women, backward classes, tribal communities etc.—which may not benefit sufficiently from the growth process.

Population and health

The government remains committed to improving the health status of the population through better access to quality health-care (including reproductive health care) facilities. The focus will be on reorganizing and restructuring existing health care infrastructure at the primary, secondary and tertiary level, to ensure that the delivery mechanism adequately and efficiently covers the population in the defined geographical area, with appropriate referral linkages. This would also involve adequate provision of drugs, equipment and competent manpower; skill upgradation of health personnel; increasing awareness of the community through health education; and greater involvement of local bodies to facilitate local planning and monitoring and ensure local accountability of public health care providers. There will also have to be a continued commitment to provide essential primary health care and emergency life-saving services under the National Family Welfare programme and National Disease Control programmes free of cost to the poor while evolving a system for levying and collecting user charges from people above the poverty line. In addition, it will be necessary to improve centre-state and inter-sectoral coordination, and involve the private sector, voluntary institutions and civil society to support national efforts in achieving the goals of the National Population Policy, 2000. In the area of nutrition, the strategy will be to move beyond food supplementation to monitoring growth itself, including screening

pre-natal women, in order to identify onset under-nutrition and initiate appropriate health and nutritional interventions.

Education

Universal access to primary education and improvement of basic school infrastructure will receive a high priority. This would mean a school available within 1 km of every habitation with adequate staff, textbooks provided to all SCs/STs, children and girls, mid-day meals, management and repair of school buildings, opportunities for non-formal and alternative education for out-of school children in backward and inaccessible segments of the population. Integral to these objectives would be mobilization of local communities for promotion of primary education and adult literacy and greater control of local bodies and community groups over schools and teachers to ensure accountability and need-based education.

The quality of higher education will also be addressed by modernization of syllabi, examination reforms and greater attention to issues of internal generation of financial resources, governance of universities and colleges and setting up of colleges and universities outside of the public sector. These considerations would also apply to the technical educational system—technical and management education need to be managed strategically in order to provide a broad-based, multi-disciplinary education incorporating composite skills and knowledge which will meet the challenges of globalization.

Special attention to the needs of vulnerable groups including tribal communities, Scheduled Castes, and Other Backward Classes

The government will remain committed to improving the standard of living of vulnerable groups and minimize the divergence with respect to the general population through the promotion of special facilities and programmes. Attention will also be given to strengthening and expansion of safety nets for these groups especially women and the aged. The Government is committed towards holistic empowerment of women for which several programmes such as Swayamsidha (an integrated scheme for women's empowerment) have been formulated. Its long term objective is all-round empowerment by ensuring direct access to and control over resources through a sustained process of mobilisation and convergence of all on-going sectoral programmes.

In short, the strategy would be to strengthen implementation of existing programmes; converge multiple programmes to improve efficiency; diversify the rural economy; enhance the skill sets of labour to conform to the needs of the

market; rationalize the subsidy regime; empower women and the socially disadvantaged and facilitate the active involvement of local bodies and the community to promote local planning and monitoring of programmes. The focus on human development will go a long way towards the objective of growth ensuring equity and sustainability.

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