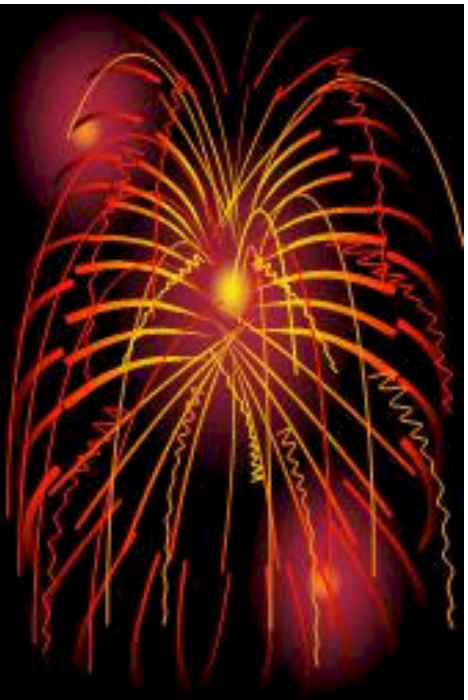

CHAPTER FOUR
Atmosphere

CHAPTER FOUR

ATMOSPHERE

Atmospheric Pollution – Main Sources

4.1 The atmosphere consists of a mixture of gases that completely surround the earth. It extends to an altitude of 800 to 1000 kms above the earth's surface, but is deeper at the equator and shallow at the poles. About 99.9% of the mass occurs below 50 Km and 0.0997% between 50 and 100 km altitude. Major polluting gases/ particles are confined to the lowermost layer of atmosphere known as Troposphere that extends between 8 and 16 Kms above the earth surface.

4.2 The **main sources of atmospheric pollution** may be summarized as follows:

a) The combustion of fuels to produce energy for heating and power generation both in the domestic sector as well as in the industrial sector.
b) The exhaust emissions from the transport vehicles that use petrol, diesel oil, etc.
c) Waste gases, dust and heat from many industrial sites including chemical manufacturers, electrical power generating stations, etc.

Environment Pollution due to Energy Use

4.3 A considerable amount of air pollution results from burning of fossil fuels. Fuels are primarily derived from fossilized plant material and consist mainly of carbon and/or its compounds. The household sector is the largest consumer of energy in India, accounting for 40-50% of the total energy consumption. As per a report of Planning Commission, the share of the household sector in the final use of energy declined although retaining its dominant share at 58.9% in 1987. The most abundantly used fossil fuel for cooking is the wood, which is almost 61% of the total fuel demand for cooking. Burning of traditional fuels introduces large quantities of CO_2 when the combustion is complete, but if there is incomplete combustion and oxidation then Carbon monoxide (CO) is produced, in addition to hydrocarbons. Incomplete combustion of coal produces smoke consisting of particles of soot or carbon, tarry droplets of unburnt hydrocarbons and CO. Fossil fuels also contain 0.5–4.0% of sulphur which is oxidized to SO_2 during combustion.

4.4 The environmental effects of various fuels, namely, coal, oil, nuclear etc. are of growing concern owing to increasing consumption levels. The combustion of these fuels in industries and vehicles has been a major source of pollution. Coal production through opencast mining, its supply to and consumption in power stations, and industrial boilers leads to particulate and gaseous pollution which can cause pneumoconiosis, bronchitis, and respiratory diseases. Another major impact of coal mining is land degradation, especially of forest areas.

4.5 The consumption of petroleum products in vehicles, industries and domestic cooking activities results in the emission of pollutants in large quantities. Radioactive emissions from nuclear power plants are of grave concern as they can cause serious impact both in terms of spatial and inter-generational concerns. In addition, two key problems are long-term waste disposal and the eventual decommissioning of plants. Due to limited reserves of petroleum, main emphasis needs to be given to non-conventional energy sources such as wind energy, solar energy and ocean energy.

Industrial Emissions

4.6 Air borne emissions emitted from various industries are a cause of major concern. These emissions are of two forms, viz. solid particles (SPM) and gaseous emissions (SO_2, NO_x, CO, etc.). Liquid effluents, generated from certain industries, containing organic and toxic pollutants are also a cause of concern. Heavily polluting industries were identified which are included under the 17 categories of highly polluting industries for the purpose of monitoring and regulating pollution from them. The Ministry of Environment and Forests has, over the last two decades, developed standards for regulating emissions from various industries and emission standards for all the polluting industries including thermal power stations, iron and steel plants, cement plants, fertilizer plants, oil refineries, pulp and paper, petrochemicals, sugar, distilleries and tanneries have been prescribed. The industrial units in India are largely located in the States of Gujarat, Maharashtra, Uttar Pradesh, Bihar, West Bengal and Madhya Pradesh. The highest concentration of sulpher dioxide and oxides of nitrogen is, therefore, often found in cities located in these states. Some other industrial estates in Delhi, Punjab, Rajasthan and Andhra Pradesh are also becoming critical.

Road Transport

4.7 Road vehicles are the second major source of pollution. They emit CO, HCs, NO_X, SO_2, and other toxic substances such as TSP and lead. Diesel engines are much less polluting than petrol engines. Both types of engines are not very efficient converters of fuel energy. However, diesel types with a conversion efficiency of around 30% must be more efficient and use less fuel than petrol types with a 15-20% conversion efficiency. Both types of engines have incomplete combustion of fuel, so the major pollutant is CO, amounting to 91% by weight of all vehicle emissions.

4.8 The primary pollutants produced in vehicle emissions undergo a series of complex interrelated chemical reactions in the troposphere and lower stratosphere to form secondary products.

4.9 Four factors make pollution from the vehicles more serious in developing countries.

(i) Poor quality of vehicles creating more particulates and burning fuels inefficiently.

(ii) Lower quality of fuel being used leads to far greater quantities of pollutants.

(iii) Concentration of motor vehicles in a few large cities.

(iv) Exposure of a larger percentage of population that lives and moves in the open.

Harmful Effects of Emissions

4.10 The high concentration of particulates in the atmosphere over large urban and industrial areas can produce a number of general effects. Smoke and fumes can increase the atmospheric turbidity and reduce the amount of solar radiation reaching the ground. The overall effect of air pollution upon the biosphere and the built environment can be broadly considered under 3 headings: The effect upon-

(i) buildings and materials,

(ii) soil, vegetation, crops and animal life,

(iii) human beings.

i) **Buildings and Materials**: The fabric of buildings that are surrounded by heavily polluted air for years undergo chemical changes. Gradual erosion takes place and this is only too evident when grimy upper surface is removed. A good example is that of the famous historical monument ‘Taj Mahal’ at

Agra, which, on account of reaction of Sulphur-di-oxide, emitted from neighbouring industries, with the limestone has slowly, started turning yellow. As a result, on Court's directives, a number of measures have been taken to protect our national heritage monument, e.g. closure of neighbouring heavy polluting industries, operation of only non-polluting vehicles like battery buses, tonga, in the vicinity of Taj Mahal.

ii) **Soil, vegetation and Animal Life:** The presence of gaseous pollutants in the air and deposition of particulates on to the soil can effect plants. It can effect the cattle and animals too as they have been found to develop breathing difficulties and suffer from low yield of milk, lameness and joint stiffness in a polluted environment.

iii) **Human beings:** Smoke and SO_2 cause the general and most widespread effects of air pollution on people. Atmospheric smoke contains potentially carcinogenic organic compounds similar to those that occur in cigarette tobacco smoke. The CO affects the cardiovascular system, NO_xs affect the respiratory system, Ozone causes increased sensitivity to infections, lung diseases, irritation in eyes, nose and throat, etc.

Steps Taken So Far and Their Impact

4.11 With the alarming increase in the atmospheric pollution, especially in the big cities, Government has taken some important initiatives in the recent years. To start with, the emphasis and implementation has been primarily in the big cities but gradually to spread throughout the country. These relate to the progressive tightening of the auto-emission norms (1991, 1996, 1998 & 2000) and fuel quality specifications (1996) as recommended by the Central Pollution Control Board (CPCB).

4.12 Till early 1994, ambient air quality standards in India were based on 8 hourly average time only. In April 1994, these standards were revised and 24 hourly standards were also prescribed. National ambient air quality standards are prescribed for three distinct areas, viz. i) industrial, ii) residential, rural and other areas and iii) sensitive areas.

Following steps have been taken so far:

i) **Unleaded Petrol**: With the gradual reduction of lead content in petrol and finally supply of unleaded petrol for all vehicles from Sept. 1998 in the capital city of Delhi, a lethal pollutant from vehicular exhaust has been removed. The lead content in the atmosphere near traffic intersections of Delhi has reduced by more than 60% with this measure.

ii) **Sulphur in diesel**: The sulphur content in the diesel supplied in Delhi has been reduced from 0.5% in 1996 to 0.25% in 1997 so as to meet the EURO-II norms.

iii) **Tightening of the Vehicular Emission Norms**: From 1995, new passenger cars were allowed to register only if they were fitted with catalytic converters. Emission norms for such cars were tightened by 50 % as compared to 1996 norms. With the recent directions of the Hon'ble Supreme Court, passenger cars (both petrol and diesel) are required to meet atleast EURO-I norms in June 1999 and from Apr. 2000 only such vehicles meeting EURO-III norms will be permitted to register in the NCR of Delhi. CNG operated vehicles are also permitted by the Supreme Court directions.

iv) **2-T Oil for Two stroke engines**: From 1.04.99, on the recommendations of CPCB, the low

smoke 2T oil became effective. To prevent the use of 2T oil in excess of the required quantity, premixed 2T oil dispensers have been installed in all the petrol filling stations of Delhi. Sale of loose 2T oil has also been banned from Dec. 1998.

v) **Phasing out of Grossly Polluting Vehicles:** On CPCB's recommendations, initially 20 yr. old vehicles were prohibited from plying from Dec.1998, followed by phasing out of 17 yr. old vehicles from Nov.98 and 15 yr. old from Dec. '98.

Impact on Pollution Load and Air Quality in Delhi

4.13 The major impacts have been observed through the implementation of emission norms and fuel quality specifications effective from 1996, as also phasing out of 15 year old commercial vehicles and leaded petrol in the year 1998 and phasing out of 8 year old commercial vehicles and 15 year old two wheelers from 2000 onwards. The ambient air quality as monitored by CPCB during 1999 shows reduction in levels of various pollutants in ambient air as compared to previous year. The reducing trend was observed with respect to Carbon Monoxide, nitrogen dioxide, and lead in residential areas.

Noise Pollution

4.14 Of late, noise has been recognized as a pollutant which until recently was considered only as a nuisance. The Central Pollution Control Board (CPCB) has notified the ambient noise standards in 1987 under section 20 of the Air (Prevention and Control of Pollution) Act, 1981. The noise standards specify limits as 55dB(A) and 45dB(A) as limits for day and night time, respectively, for residential areas, 75 dB(A) and 70 dB(A) in the day and night time for industrial areas, and 50 dB (A) and 40 dB(A) in the day and night for silence zones. Special campaign for reduction in use of fire crackers in Delhi have resulted in reduced pollution levels during Diwali.

4.2 Green House Gases and Their Effects

4.15 The greenhouse effect plays a crucial role in regulating the heat balance of the earth. It allows the incoming short-wave solar radiation to pass through the atmosphere relatively unimpeded; but the long-wave terrestrial radiation emitted by the earth's surface is partially absorbed and then re-emitted by a number of trace gases in the atmosphere. These gases known as GHGs (greenhouse gases) are: water vapor, carbon dioxide, methane, nitrous oxide and ozone in the troposphere and in the stratosphere. This natural greenhouse effect warms the lower atmosphere.

4.16 If the atmosphere were transparent to the outgoing long wave radiation emanating from the earth's surface, the equilibrium mean temperature of the earth's surface would be considerably lower and probably below the freezing point of water. Mere incidence of GHG's in the atmosphere, by itself, is no concern. What is more important is that their concentration should stay within reasonable limits so that global ecosystem is not unduly affected. However, by increasing the concentrations of natural GHG's and by adding new GHG's like chloroflouro carbons, the global average and the annual mean surface-air temperature (referred to as the global temperature) can be raised, although the rate at which it will occur is uncertain. This is the enhanced greenhouse effect, which is over and above that occurring due to natural greenhouse concentration. Such a rise in the atmospheric concentration of GHG's has led to an upward trend in global temperature.

4.17 While it is required to follow the general commitments under the Framework Convention on Climate Change, India is not required to adopt any GHG reduction targets. Irrespective of international

commitments, it seems prudent to be ready with

- Inventory of sinks and sources of GHG emission
- Predict the cumulative impact of national and international GHG emissions to plan for temperature and sea level rise
- Devise land use plans for the coastal areas likely to be affected
- Devise water and land management strategies especially agricultural sector.

TABLE 4.1.1 : AVERAGE GASEOUS COMPOSITION OF DRY AIR IN THE TROPOSPHERE

Sl. No.	Gas	Percent by Volume	Parts Per Million (ppm)
1	2	3	4
1	Nitrogen	78.080000	780840.00
2	Oxygen	20.950000	209500.00
3	Argon	0.930000	9300.00
4	Carbon dioxide	0.034500	345.00
5	Neon	0.001800	18.00
6	Helium	0.000520	5.20
7	Methane	0.000140	1.40
8	Kryton	0.000100	1.00
9	Hydrogen	0.000050	0.50
10	Xenon	0.000009	0.09
11	Ozone	Variable	Variable

Source : Ministry of Environment & Forests

TABLE 4.1.2 (a): AMBIENT AIR QUALITY LEVELS IN HIGHLY POLLUTED CITIES 1998

(µg/m ^{3})

Sl. No.	State /Union Territory	*Sulphur Dioxide*		Oxides of Nitrogen		Suspended *Paniculate* Matter	
		Industrial	Residential	*Industrial*	Residential	*Industrial*	Residential
1	**Andhra Pradesh**						
	Hyderabad	38.90	31.80	84.90	100.00	776.00	564.00
	Visakhapatnam	11.40	27.00	16.60	34.80	113.00	332.00
2	**Bihar**						
	Dhanbad	-	65.60	-	57.50	-	238.00
	Jamshedpur	74.10	-	93.90	-	365.00	-
	Jharia	76.40	-	53.70	-	454.00	-
	Patna	-	34.10	-	41.00	-	717.00
	Sindri	64.50	-	58.40	-	177.00	-
3	**Delhi**	85.80	84.80	164.10	112.60	1878.00	1531.00
4	**Goa**						
	Ponda	-	9.80	-	18.30	-	166.00
	Vasco	8.60	-	17.80	-	103.00	-
5	**Himachal Pradesh**						
	Damtal	-	5.80	-	21.50	-	301.00
	Parwanoo	-	1.40	10.30	12.90	118.00	302.00
	Shimla	-	3.60	-	13.60	-	127.00
6	**Haryana**						
	Faridabad	35.70	-	13.30	-	386.00	-
	Yamuna Nagar	32.20	-	23.10	-	232.00	-
7	**Karnataka**						
	Bangalore	40.00	21.00	44.00	31.00	259.00	199.00
	Mysore	72.00	-	64.00	-	209.00	-
8	**Kerala**						
	Kochi	34.10	22.30	21.40	27.10	804.00	183.00
	Thiruvananthapuram	25.80	14.80	19.10	44.10	179.00	299.00
	Kottayam	1.70	-	24.10	-	55.00	-
	Kozhikode	2.30	2.50	7.30	6.60	75.00	73.00
9	**Maharashtra**						
	Mumbai	21.70	32.20	24.90	59.80	226.00	475.00
	Nagpur	16.50	25.60	27.50	76.00	278.00	668.00
	Pune	100.40	48.10	119.20	56.60	748.00	247.00
10	**Madhya Pradesh**						
	Bhilai	31.40	29.60	34.90	63.20	379.00	226.00
	Bhopal	17.50	34.40	26.30	52.30	384.00	574.00
	Indore	16.30	26.20	15.30	27.30	382.00	612.00
	Jabalpur	-	-	-	12.80	-	153.00
	Korba	-	30.20	-	41.10	-	272.00
	Nagda	55.20	84.00	24.60	67.90	141.00	335.00
	Raipur	9.90	8.80	35.30	29.20	273.00	268.00
	Satna	11.70	10.80	14.50	13.00	269.00	198.00
11	**Orissa**						
	Angul	-	17.60	-	19.50	-	254.00
	Rourkela	35.50	32.00	27.60	36.10	154.00	192.00

TABLE 4.1.2 (a): AMBIENT AIR QUALITY LEVELS IN HIGHLY POLLUTED CITIES 1998 (Concld.)

(µg/m ^{3})

Sl. No.	State / Union Territory	*Sulphur Dioxide*		Oxides of Nitrogen		Suspended *Paniculate* Matter	
		Industrial	*Residential*	*Industrial*	*Residential*	*Industrial*	*Residential*
12	**Punjab**						
	Jalandhar	-	-	-	-	-	-
	Ludhiana	-	-	-	-	-	-
13	**Rajasthan**						
	Alwar	28.70	13.50	156.60	75.20	208.00	699.00
	Jaipur	26.60	33.80	45.60	83.60	495.00	837.00
	Kola	10.20	9.70	26.20	25.30	300.00	274.00
14	**Tamil Nadu**						
	Coimbatore	13.40	11.00	20.70	29.60	150.00	220.00
	Chennai	31.30	31.50	38.80	44.60	288.00	348.00
	Tuticorin	32.70	11.00	27.80	12.60	98.00	124.00
15	**UttarPradesh**						
	Agra	24.80	10.00	20.90	8.90	818.00	482.00
	Anpara	117.00	-	121.70	-	513.00	-
	Dehra Dun	17.20	15.80	14.50	14.30	301.00	307.00
	Gajroula	19.70	15.50	-	-	301.00	247.00
	Kanpur	35.40	66.00	51.70	87.10	882.00	1617.00
	Lucknow	32.50	60.00	34.40	64.20	524.00	895.00
16	**West Bengal**						
	Haldia	87.80	-	115.40	-	395.00	-
	Mowran	-	-	-	-	-	-
17	**Chandigarh**	5.80	4.80	9.80	9.00	331.00	229.00
18	**Pondicherry**	-	-	-	-	-	-

Source: TEDDY (TERI Energy Data Directory and Yearbook) 2002/03

TABLE 4.1.2 (b) : ESTIMATED VEHICULAR POLLUTION EMISSION LOAD IN METROPOLITON CITIES DURING 1994

(Tonnes/day)

Sl. No.	City	Particulates	SO_2	NOx	HC	CO	Total
1	2	3	4	5	6	7	8
1	Delhi	10.30	8.96	126.46	249.57	651.01	**1046.30**
2	Mumbai	5.59	4.03	70.82	108.21	469.92	**658.57**
3	Bangalore	2.62	1.76	26.22	78.51	195.36	**304.47**
4	Calcutta	3.25	3.65	54.69	43.88	188.24	**293.71**
5	Ahmedabad	2.95	2.89	40.00	67.75	179.14	**292.73**
6	Pune	2.39	1.28	16.20	73.20	162.24	**255.31**
7	Chennai	2.34	2.02	28.21	50.46	143.22	**226.25**
8	Hydrabad	1.94	1.56	16.84	56.33	126.17	**202.84**
9	Jaipur	1.98	1.25	15.29	20.99	51.28	**90.79**
10	Kanpur	1.06	1.08	13.37	22.24	48.42	**86.17**
11	Lucknow	1.14	0.95	9.68	22.50	49.22	**83.49**
12	Nagpur	0.55	0.41	5.10	16.32	34.99	**57.37**
Total		**35.31**	**29.84**	**422.88**	**809.96**	**2299.21**	**3597.20**

Source : State of the Environment 2001

TABLE 4.1.2 (c) : PM, NOx, HC, CO EMISSION LOAD IN METROPOLITON CITIES, 2001

(TMT, Annual)

Sl. No.	City	Paniculate Matter	NOx	HC	CO
1	Delhi	14.0	63	113	293
2	Mumbai	6.0	20	54	109
3	Kolkata	5.0	22	16	45
4	Chennai	4.0	17	44	88
5	Bangalore	7.0	27	71	118
6	Hyderabad	6.0	15	73	129
7	Ahemdabad	5.0	22	31	58
8	Kanpur	2.0	6	12	23
9	Varanasi	1.2	17	29	51

Source: Central Pollution Control Board

TABLE 4.1.3 : NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Sl. No.	Pollutant	Sulphur Dioxide (SO_2)		Oxides of Nitrogen (NO_2)		Suspended Particulate Matter (SPM)		Respirable Particulate Matter (RPM) (size less than 10 µm)		Lead		Carbon Monoxide (CO)		Ammonia #	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	**Time Weighted Average**	Annual * Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	Annual * Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	Annual * Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	Annual * Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	Annual * Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	8 hours** Average ($\mu g/m^3$)	1 hours Average ($\mu g/m^3$)	Annual * Average (mg/m^3)	24 hours** Average (mg/m^3)
2	**Industrial Area**	80	120	80	120	360	500	120	150	1.00	1.50	5.00	10.00	0.10	0.40
3	**Residential, Rural and Other Area**	60	80	60	80	140	200	60	100	0.75	1.00	2.00	4.00	0.10	0.40
4	**Sensitive Area**	15	30	15	30	70	100	50	75	0.50	0.75	1.00	2.00	0.10	0.40
5	**Methods of Measurement**	1. Improved West & Gaeke Method 2. Ultraviolet Fluorescence		1. Jacob & Hochheiser Modified (Na- 2. Gas phase Chemiluminiscence		High volume sampling (Average flow rate not less than 1.1 m^3/minute)		Respirable particulate matter sampier		AAS Method after sampling using EPM 2000 or equivalent filter paper		Non- Dispresive infra-red Spectroscopy		-------	

Source : Central Pollution Control Board

* : Annual Arithmatic Mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval.

** : 24-hourly /8 -hourly values should be met 98% of the time in a year. However 2% of time, it may exceed but not on two consecutive days.

: Included vide notification SO. 955 (E), Air (Prevention & Control of Pollution) Act, 1981 dated October 14, 1998.

Note :

1. National Ambient Air Quality Standards : The level of air quality necessary with an adequate margin of safety necessary to protect the public health, vegetation and property
2. Whenever and wherever two consecutive values exceed the limits specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigations.
3. The standards for H_2S and CS_2 have been notified seqerately vide GSR No. 7, dated December 22, 1998 under Rayon Industry.

continuous monitoring and further investigations.

The primary aim of the ambient air quality standards is to provide a basis for protecting public health from adverse effects of air pollution and for eliminating or reducing to a minimum, those contaminants of air that are known or likely to be hazardous to human being, animals, vegetation and historical monuments.

TABLE 4.1.4 : AMBIENT AIR QUALITY STATUS IN SOME CITIES/TOWNS

(2001)

Pollution Level	Annual Mean Concentration Range (µg/m ^{3}) (microgram per cubic meter)			
	Industrial		Residential	
	SO_2 & NO_2	SPM	SO_2 & NO_2	SPM
Low (L)	0-40	0-180	0-30	0-70
Moderate (M)	40-80	180-360	30-60	70-140
High (H)	80-120	360-540	60-90	140-210
Critical (C)	>120	>540	>90	>210

Sl. No.	State/City	Sulphur Dioxide		Nitrogen Dioxide		SPM	
	Area class	I	R	I	R	I	R
1	2	3	4	5	6	7	8
1	**Andhra Pradesh**						
	Hyderabad	L	L	M	M	M	H
	Vishakhapatnam	L	L	L	L	L	H
2	**Assam**						
	Guwahati	--	L	--	L	--	H
3	**Bihar**						
	Patna	--	L	--	L	--	C
4	**Chhattisgarh**						
	Bhilai	L	L	L	M	M	H
	Korba	--	L	--	L	--	M
	Raipur	L	L	M	M	M	H
5	**Delhi**						
	Delhi	L	L	L	H	H	C
6	**Gujarat**						
	Ahmedabad	L	L	M	M	H	C
7	**Goa**						
	Ponda	--	L	--	L	--	M
	Vasco	L	--	L	--	M	--
8	**Himachal Pradesh**						
	Damtal	--	L	--	L	--	--
	Parwanoo	L	L	L	L	--	--
	Paonta Sahib	L	--	L	--	--	--
	Shimla	--	L	--	L	--	--
9	**Haryana**						
	Yamuna Nagar	L	--	L	--	M	--
	Faridabad	L	L	L	L	M	C
10	**Jharkhand**						
	Dhanbad	--	L	--	M	'--	C
	Jharia	L	--	L	--	M	--
	Jamshedpur	L	M	M	M	M	C
	Sindri	L	--	L	--	M	--
11	**Karnataka**						
	Bangalore	L	L	L	L	L	H
	Mysore	L	--	L	--	L	--
12	**Kerala**						
	Cochin	L	L	L	L	M	C
	Kottayam	L	L	L	L	--	--
	Kozhikode	L	L	L	L	L	M
	Thiruvananthapuram	L	L	L	L	--	--
	Palakad	L	--	L	--	L	--
13	**Maharashtra**						
	Mumbai	L	L	L	L	M	C
	Chanderpur	L	L	M	M	L	H
	Nagpur	L	L	L	L	M	C
	Nashik	L	M	L	L	M	C
	Pune	L	M	M	C	L	C
	Solapur	L	L	M	M	H	C

TABLE 4.1.4 : AMBIENT AIR QUALITY STATUS IN SOME CITIES/TOWNS-- Concld.

Sl. No.	State/City	Sulphur Dioxide		Nitrogen Dioxide		SPM	
	Area class	I	R	I	R	I	R
1	2	3	4	5	6	7	8
14	**Madhya Pradesh**						
	Bhopal	L	L	L	L	--	--
	Indore	L	L	L	L	--	--
	Jabalpur	--	--	--	L	--	--
	Nagda	M	M	M	M	--	--
	Satna	L	L	L	L	--	--
15	**Meghalaya**						
	Motinagar	--	L	--	L	--	M
16	**Orissa**						
	Angul	L	L	L	L	M	M
	Rourkela	L	L	L	L	M	H
	Talcher	L	--	L	--	L	--
	Rayagada	L	L	L	L	L	M
17	**Punjab**						
	Gobingarh	L	--	L	--	M	--
	Jalandhar	L	L	L	M	M	C
	Ludhiana	L	L	L	M	--	--
18	**Rajasthan**						
	Alwar	L	L	M	H	H	C
	Jaipur	L	L	L	M	M	C
	Kota	L	L	L	L	M	C
	Udaipur	L	L	--	--	M	H
	Jodhpur	L	L	L	L	H	C
19	**Tamil Nadu**						
	Chennai	L	L	L	L	L	M
	Coimbatore	--	--	--	--	L	L
	Madurai	L	L	L	M	L	C
	Salem	--	L	--	L	--	L
20	**Uttaranchal**						
	Dehradun	L	L	L	L	M	C
21	**Uttar Pradesh**						
	Agra	--	L	--	L	--	C
	Anpara	M	--	M	--	M	--
	Gajraula	L	--	L	--	H	C
	Kanpur	L	L	L	M	H	C
	Lucknow	--	L	--	M	M	C
	Varanasi	--	L	--	L	--	C
	Ghaziabad	--	--	--	--	M	--
22	**West Bengal**						
	Haldia	L	--	M	--	L	--
	Howrah	L	L	M	M	M	H
	Kolkata	L	L	H	H	M	C
23	**Chandigarh**						
	Chandigarh	--	--	--	--	M	H
24	**Pondicherry**						
	Pondicherry	--	L	--	L	L	M

Source :Central Pollution Control Board

I : Industrial Area R : Residential Area -- : Data not available/Inadepuate

TABLE 4.1.5 : NUMBER OF MOTOR VEHICLES REGISTERED IN INDIA (TAXED AND TAX-EXEMPTED)

(As on 31st March)

(Number)

Sl. No.	Year/State/UT	Two-Wheelers	Auto-Rickshaws	Jeeps	Cars	Taxis	Buses	Goods Vehicles #	Misce-llaneous ##	Total No. of Vehicles
1	2	3	4	5	6	7	8	9	10	11
	1990-91	14199858	617365	443734	2266506	243748	331100	1512884	1759005	21374200
	1991-92	15660801	669538	480922	2461519	262338	358165	1643729	1970401	23507413
	1992-93	17183224	720364	512602	2550286	297941	363962	1752536	2124433	25505348
	1993-94	18898701	771117	552038	2654232	362622	392148	1828117	2200903	27659878
	1994-95	20831428	897383	614567	2875651	350331	423383	1938422	2769990	30294656
	1995-96	23252287	1010344	671682	3150951	381011	448415	2030728	2966042	33911460
	1996-97	25728982	1175283	727965	3527303	417013	484099	2343000	2927887	37331532
	1997-98	28642351	1360151	824525	3829209	484374	537237 (b)	2535930	3154263	41368040
	1998-99	31327607	1495200	837700	4201774	516449	539819 (b)	2553689	3403087	44875325
	1999-2000 (P)	33912954	1577463	896270	4574013	571410	558847 (b)	2680932	3621036	48392925
	1999-2000 (P)									
	State:									
1	Andhra Pradesh	2958629	118421	39948	201463	40690	46576	144992	85013	3635732
2	Arunachal Pradesh*	10605	1430	2260	2340	299	665	2878	667	21144
3	Assam	236149	16036	10238	73273	5826	8416	73337	29741	453016
4	Bihar	538337	26009	29498	50376	19067	14493	46636	146943	871359
5	Goa	223115 (&)	7839	(a)	50346	6483	3444	23730	3675	318632
6	Gujarat	3673658	241021	87087	380915	33284	42717	317151	412899	5188732
7	Haryana @	859400	19400	50097	114313	2113	5780	100737	257773	1409613
8	Himachal Pradesh**	78149	2149	7399	14411	9249	5796	24914	8058	150125
9	Jammu & Kashmir *	121227	12608	7599	27377	4586	12623	22083	8514	216617
10	Karnataka	2403683	159589	39073	310985	30577	52512	148906	248232	3393557
11	Kerala	997542	182394	55251	237748	86660	53436	148680	20598	1782309
12	Madhya Pradesh	2619332	42002	38401	131145	52817	25616	129628	417727	3456668
13	Maharashtra	4047156	388037	200955	618959	84015	64256	378873	331272	6113523
14	Manipur	53695	2226	6184	4870	316	2048	5984	1052	76375

TABLE 4.1.5 : NUMBER OF MOTOR VEHICLES REGISTERED IN INDIA (TAXED AND TAX-EXEMPTED)--Concld.

(As on 31st March)

(Number)

Sl. No.	Year/State/UT	Two-Wheelers	Auto-Rickshaw	Jeeps	Cars	Taxis	Buses	Goods Vehicles #	Misce-llaneous ##	Total No. of Vehicles
1	2	3	4	5	6	7	8	9	10	11
15	Meghalaya	17174	1447	8155	10324	4375	2208	11815	2999	58497
16	Mizoram*	7901	N.A.	5240	1668	1600	634	2921	346	20310
17	Nagaland	32481	9102	29435	28264	2501	4276	34238	4820	145117
18	Orissa	766961	11497	25977	43811	8511	13243	62353	49684	982037
19	Punjab**	1630068	22337	20028	117798	5166	13823	82579	404118	2295917
20	Rajasthan	1837146	47392	106647	128643	18806	46732	136696	389461	2711523
21	Sikkim	3994	N.A.	2205	890	3108	605	1085	14	11901
22	Tamil Nadu	3679525	100892	33544	409479	57337	35308	211629	83448	4611162
23	Tripura	24208	6568	1215	3465	1311	1714	5300	1418	45199
24	Uttar Pradesh	3351113	66695	84651	258902	31192	35655	142774	655470	4626452
25	West Bengal	1036009	N.A.	(a)	366043	41298	22336	189568	34551	1689805
	Union Territory:									
1	A. & N. Islands*	12147	20	699	672	396	317	1179	637	16067
2	Chandigarh**	315113	N.A.	(a)	61242	466	1492	5654	2059	386026
3	D. & N. Haveli *	7483	417	533	2783	159	180	1444	253	13252
4	Daman & Diu	21586	603	(a)	8765	43	246	2657	223	34123
5	Delhi	2184581	86985	(a)	869820	17762	38112	212705	13509	3423474
6	Lakshadweep	2824	217	72	9	N.A.	4	194	466	3786
7	Pondicherry	161963	4130	3879	42914	1397	3584	7612	5396	230875

Source: Transport Research Wing, Ministry of Surface Transport.

\# : Includes trucks three and four wheelers used for carrying goods.

\## : Includes tractors and trailers also.

* : Data relates to 1996-97

** : Data relates to 1997-98

& : Includes Motocycle on hire also

(b) : Includes Omini Buses

@ : Data relates to 1998-99

(P) : Provisional

TABLE 4.1.6 : TOTAL REGISTRED MOTOR VEHICLES IN METROPOLITAN CITIES OF INDIA

(as on 31st March, 2002)

(Number)

Sl. No.	Name of City	Transport					
		Multi-axied/Articulated Vehicles Trucks & Lorries	Light Motor Vehicles (Goods)	Buses	Taxies	Light Motor Vehicles (Passengers-Auto)	Total Transport
1	2	3	4	5	6	7	8
1	Ahmedabad	8786	9809	14872	4639	40944	**79050**
2	Bangalore	26482	19722	11287	14850	72210	**144551**
3	Bhopal	4152	3782	2604	5296	9377	**25311**
4	Chennai	24296	6254	5765	11122	39027	**86464**
5	Cochin **	7769	16351	3726	7247	12978	**48071**
6	Coimbatore	8457	2926	1297	2509	5371	**20560**
7	Delhi	161650	65289	47578	20628	86985	**382130**
8	Hyderabad $	20763	16479	2539	3098	45800	**88679**
9	Indore	24197	6596	4003	11146	9446	**55388**
10	Jaipur	27705	1876	15027	6148	8509	**59265**
11	Kanpur	7452	2343	875	311	2430	**13411**
12	Kolkata *	59576	N.A.	8586	32199	9747	**110108**
13	Lucknow	7222	4639	2895	5405	7936	**28097**
14	Ludhiana ***	13252	10190	1425	2095	6421	**33383**
15	Madurai	6002	2294	1801	2827	6361	**19285**
16	Mumbai	19134	36278	12768	63679	101829	**233688**
17	Nagpur	9354	8306	2589	602	10932	**31783**
18	Patna	15172	2987	3003	2914	15781	**39857**
19	Pune	19446	13718	7478	3750	44349	**88741**
20	Surat	2872	5910	785	850	27000	**37417**
21	Vadodara	6346	10875	2730	4981	25503	**50345**
22	Varanasi	2888	2262	986	493	4016	**10645**
23	Visakhapatnam $	974	456	99	288	1543	**3360**
Total(P)		**483947**	**249342**	**154718**	**207087**	**594495**	**1689589**

LE 4.1.6 : TOTAL REGISTRED MOTOR VEHICLES IN METROPOLITAN CITIES OF INDIA (Con

(as on 31st March, 2002)

(Number)

Sl. No.	Name of City	Non-Transport								
		Two Wheelers	Cars	Jeeps	Omni Buses	Tractors	Trallors	Others	Total Non-Transport	Grand Total (Transport +Non Transport)
1	2	9	10	11	12	13	14	15	16	17
1	Ahmedabad	693421	115524	9426	--	109	171	1645	**820296**	**899346**
2	Bangalore	1253408	234888	6931	12971	6847	6183	14499	**1535727**	**1680278**
3	Bhopal	268659	23104	3058	--	9278	3436	636	**308171**	**333482**
4	Chennai	1011072	234381	8450	310	1152	--	13721	**1269086**	**1355550**
5	Cochin **	136219	33028	3700	--	469	985	3713	**178114**	**226185**
6	Coimbatore	363042	52427	4039	424	5798	--	2037	**427767**	**448327**
7	Delhi	2354530	1009524	115669	379	4771	99	9305	**3494277**	**3876407**
8	Hyderabad $	757884	84187	15127	3802	204	282	659	**861945**	**950624**
9	Indore	425094	45953	4278	--	10694	7348	1633	**495000**	**550388**
10	Jaipur	518530	69284	21630	--	21393	2686	548	**634071**	**693336**
11	Kanpur	321215	39541	3887	1755	3543	422	1181	**371544**	**384955**
12	Kolkata *	298959	238560	(a)	--	4736	N.A.	11683	**553938**	**664046**
13	Lucknow	442441	59425	10803	--	11090	911	3006	**527676**	**555773**
14	Ludhiana ***	500685	63516	2589	--	44708	311	494	**612303**	**645686**
15	Madurai	203632	11769	780	97	3416	(b)	1008	**220702**	**239987**
16	Mumbai	475352	326886	22560	3971	1382	1100	4560	**835811**	**1069499**
17	Nagpur	384383	26069	8585	497	3475	3716	453	**427178**	**458961**
18	Patna	210033	33878	12500	1055	7760	6438	1280	**272944**	**312801**
19	Pune	491747	63489	11232	612	908	752	832	**569572**	**658313**
20	Surat	487013	46770	3432	--	132	206	403	**537956**	**575373**
21	Vadodara	395692	46597	6117	--	1568	3244	2451	**455669**	**506014**
22	Varanasi	283769	19045	2632	-	20371	1296	907	**328020**	**338715**
23	Visakhapatnam $	190546	12628	393	--	595	524	733	**205419**	**208779**
Total		**12467126**	**2890473**	**277818**	**25873**	**164399**	**40110**	**77437**	**15943236**	**17632825**

Source : Motor Transport Statistics of India 2001-02, Transport Research Wing, Ministry of Road Transport & Highways

* : Data relates to 1997-98 (a) : Included in cars $: Data relates to1998-99

** : Data relates to 1996-97 (b) : Included in tractors N. A . : Not Available

(--) : Nil *** : Data relates to 2000-01

With the increasing urbanization and industrialization, the transport demand has also increased consequently. The total number of vehicles in India has increased from about 11 million in 1986 to more than 48 million, in 1999-2000, of which about 31% is concentrated in the 23 metropolitan cities. This has increased the vehicular pollution. The different factors are the types of engines used, the age of the vehicles, poor road conditions and congested traffic. The principal vehicular pollutants are Carbon Monoxide, Oxides of Nitrogen, Hydrocarbons, suspended and particulate matters, a varying amount of Sulphur Dioxide depending on the Sulphur content of the fuel and lead compounds.

TABLE 4.1.7 : WORKING OF STATE TRANSPORT UNDERTAKINGS

(As on 31st March)

Sl. No.	Year/State/UT	Fleet Strength (Buses) (no.)	Vehicles in Bus Scheduled Service (No.)	Kilometers Performed (Lakh km.)	Gross Revenue Receipts (Rs. Lakh)	Current Expenditure (Total Operating Cost) (Rs. Lakh)	Net Revenue (Rs. Lakh)
1	2	3	4	5	6	7	8
	1990-91	100182	85481	3766032	509351	571019	-61668
	1991-92	96909	85099	3956416	608679	669574	-60895
	1992-93	105214	92089	4152713	691882	763124	-71242
	1993-94	102913	91835	4111659	777344	842947	-65603
	1994-95	90566	80213	3713205	613420	688359	-74939
	1995-96	91144	80572	3916078	657591	759655	-102064
	1996-97	88479	78896	3816364	632465	735700	-103234
	1997-98	101514	91916	4067927	831140	941947	-110807
	1998-99	105336	95092	4243137	902597	1080743	-178147
	1999-2000	115034	103392	4608822	1102700	1303904	-201204
	2000-2001	**104773**	**65211**	**--**	**1563541**	**1692108**	**-130071**
	State:						
1	Andhra Pradesh	18764	17811	--	254021	275016	-20995
2	Arunachal Pradesh	--	--	--	--	--	--
3	Assam	--	--	--	--	--	--
4	Bihar	--	--	--	--	--	--
5	Goa	--	--	--	--	--	--
6	Gujarat (1)	9402	747	--	133396	170403	-37007
7	Haryana	3358	--	--	49534	56755	-7221
8	Himachal Pradesh	1700	2485	--	20383	23859	-3476
9	Jammu & Kashmir	--	--	--	--	--	--
10	Karnataka (7)	11288	9291	--	144508	144391	118
11	Kerala	3502	4126	--	56725	68345	-11620
12	Madhya Pradesh	--	--	--	--	--	--
13	Maharashtra (2)	20172	4502	--	399162	368276	29441
14	Manipur	--	--	--	--	--	--
15	Mizoram	39	--	--	194	1062	-868
16	Meghalaya	44	--	--	594	778	-184
17	Nagaland	86	--	--	516	1421	-905
18	Orissa	254	173	--	2999	4167	-1168
19	Punjab (3)	3100	1738	--	35163	47844	-12745
20	Rajasthan	4401	4281	--	58807	67145	-8338
21	Sikkim	88	--	--	1191	1870	-679
22	Tamil Nadu (4)	15662	14523	--	285241	307865	-22622
23	Tripura	38	116	--	224	1049	-825
24	Uttar Pradesh	7001	--	--	73852	83637	-9785
25	West Bengal (5)	1149	971	--	10379	19587	-9206
26	**Union Territory:**						
27	A.& N. Islands	--	--	--	--	--	--
28	Chandigarh (6)	395	--	--	5486	5634	-148
29	Delhi	4330	4447		31166	43004	-11838

Source: Transport Research Wing, Ministry of Surface Transport

(1) Relates to Gujarat SRTC, Ahmedabad MTS.

(2) Relates to Maharastra SRTC, BEST Undertaking, Kolhapur MTU, Pune MT, Pimpri-Chin.MT, Solapur MT.

(3) Relates to Pepsu RTC and Punjab Roadways.

(4) Relates to Metro.TC (Chennai Dvn-I) Ltd, Metro.TC (Chennai Dvn-II) Ltd, State Exp.TC (TN Dvn-I) Ltd, State Exp.TC (TN Dvn-II) Ltd, TN STC (Coimbatore Dvn-I) Ltd, TN STC (Coimbatore Dvn-II) Ltd, TN STC (Coimbatore Dvn-III) Ltd, TN STC (Kumakonam Dvn-I) Ltd, TN STC (Kumakonam Dvn-II) Ltd, TN STC (Kumakonam Dvn-III) Ltd, TN STC (Kumakonam Dvn-IV) Ltd, TN STC (Madurai Dvn-I) Ltd, TN STC (Madurai Dvn-II) Ltd, TN STC (Madurai Dvn-III) Ltd, TN STC (Madurai Dvn-IV) Ltd, TN STC (Salem Dvn-I) Ltd,TN STC (Salem Dvn-II) Ltd,TN STC(Villupuram Dvn-I) Ltd, TN STC (Villupuram Dvn-II) Ltd, TN STC (Villupuram-III) Ltd, Kadamba TCL.

(5) Relates to Calcutta STC, North Bengal STC. (6) Relates to Chandigarh TU only.

(7) Relates to KSRTC, North West Karnataka RTC & Bangalore Metropolitan TC.

BLE 4.1.8 : DIFFERENT CATEGORIES OF PETROL DRIVEN VEHICLES MONITORE AND PERCENTAGE MEETING CARBON MONOXIDE STANDARDS

Sl. No.	Categories of Vehicles	No. of Vehicles Monitored	No. of Vehicles Meeting CO Standards	% age of Vehicles Meeting CO Standards
1	2	3	4	5
1	Two Wheelers	400	358	89.5
2	Three Wheelers	66	63	95.45
3	Four Wheelers	246	213	86.58
Total		**712**	**634**	**89.05**

Source : Ministry of Environment & Forests, Annual Report 1999-2000

Automobile exhausts accounts for a sizable part of pollution. Their effect on human health is particularly of concern. There is a strong correlation between average blood lead levels and the lead content in gasoline. Hydrocarbons present in the exhaust, particularly, in vehicles with poor combustion cause respiratory problems. In the urban areas with tall buildings, which act as concrete canyons, and in street crossings, the pollutants from vehicles stay for a much larger period. Pollution also causes photochemical smog.

The National Environmental Engineering Research Institute (NEERI) has been involved in R&D for developing indigenous, lead-resistant, cost-effective catalytic converter for Indian conditions, under three-phased programme. Under the first phase, which has been completed, the test results indicate that the use of a catalytic converter reduces the Carbon-mono-oxide and hydrocarbons concentrations in petrol-driven vehicles to the tune of 50-60%.

Lead additions are added to petrol to enhance its anti-knock properties. It is estimated that only 30% of the lead is deposited in the engine and the balance 70% is exhausted out of the tail pipe into the atmosphere as inorganic salt which can be readily absorbed by people. While the permissible limit for lead is 2 micro gram per 100 ml of blood, an average citizen in a metropolis in India has a lead level between 3 to 82 micro gram per 100 ml of blood. The first phase of introducing petrol with a maximum lead content of 0.15 gms per litre (which was 0.56 gm/litre) in the four metropolitan cities of Delhi, Mumbai, Chennai and Kolkata has already been implemented by the Ministry of Petroleum and Natural Gas since December 15, 1994.

TABLE 4.1.9 (a): ESTIMATED VEHICULAR POLLUTION LOAD IN DELHI

Sl. No.	City	Emission Load of Pollutants in Thousand Tonnes in 2001					
		CO	HC	NOx	PM	Benzene	Butadiene
1	Delhi	292.51	112.57	62.69	14.30	2.97	0.3500
2	Hyderabad	128.89	72.57	15.11	5.64	2.92	0.1532
3	Bangalore	118.34	70.59	27.34	6.68	2.95	0.1533
4	Chennai	88.40	112.57	17.19	4.10	1.89	0.1100
5	Mumbai	109.35	54.17	19.96	5.81	2.15	0.1300
6	Kolkata	44.49	16.14	21.67	4.58	0.73	0.0550

Source : Central Pollution Control Board

TABLE 4.1.9 (b) : ESTIMATED VEHICULAR POLLUTION LOAD IN DELHI

Sl. No.	Pollutant	Pollution load ('000 tonne)				% Change As Compared to 1995-96
		Without Measures		With Measures		
		1995-96	1998-99	1995-96	1998-99	
1	2	3	4	5	6	7
1	Carbon monoxide	373.000	451.000	351.000	337.000	-4
2	Hydrocarbon	121.000	148.000	113.000	115.000	+2
3	Nitrogen Oxides	208.000	248.000	207.000	182.000	-12
4	Sulphur dioxide	15.000	17.000	15.000	11.000	-27
5	Lead	0.259	0.362	0.259	0.007	-97
6	Particulate matter	28.000	22.000	28.000	21.000	-25
7	Total pollution load	747.000	897.000	714.000	666.000	
8	Emission load in **t/day**	2047.000	2459.000	1957.000	1825.000	

Source : Central Pollution Control Board

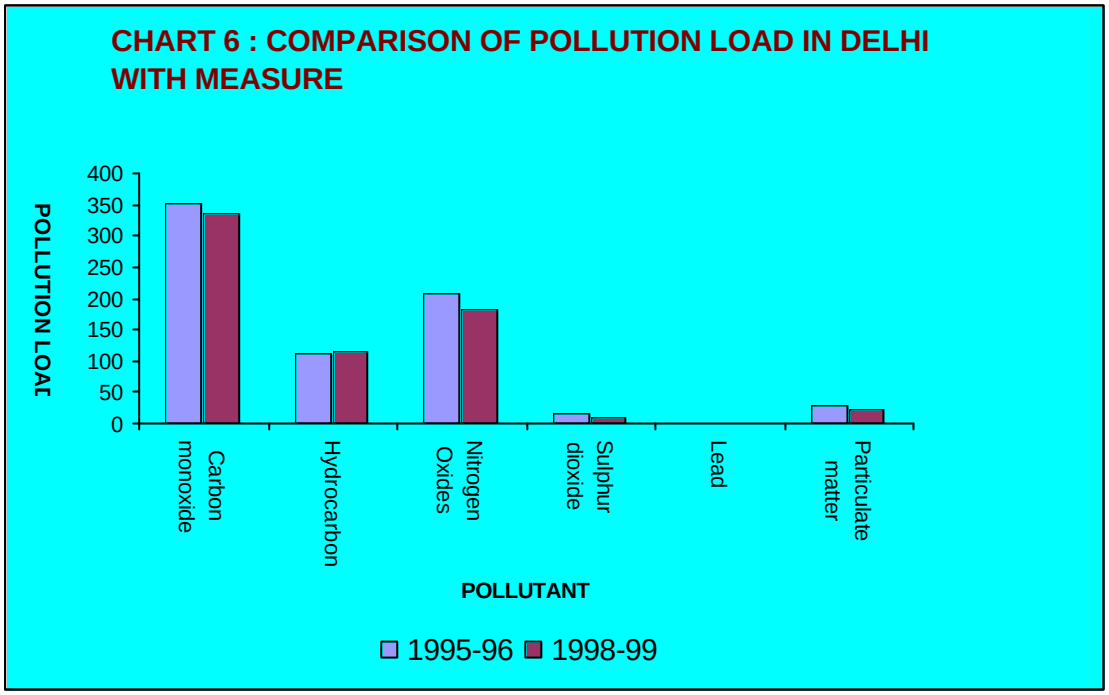
CHART 6 : COMPARISON OF POLLUTION LOAD IN DELHI WITH MEASURE
POLLUTION LOAD
400
350
300
250
200
150
100
50
0
Carbon monoxide
Hydrocarbon
Nitrogen Oxides
Sulphur dioxide
Lead
Particulate matter
POLLUTANT
1995-96
1998-99

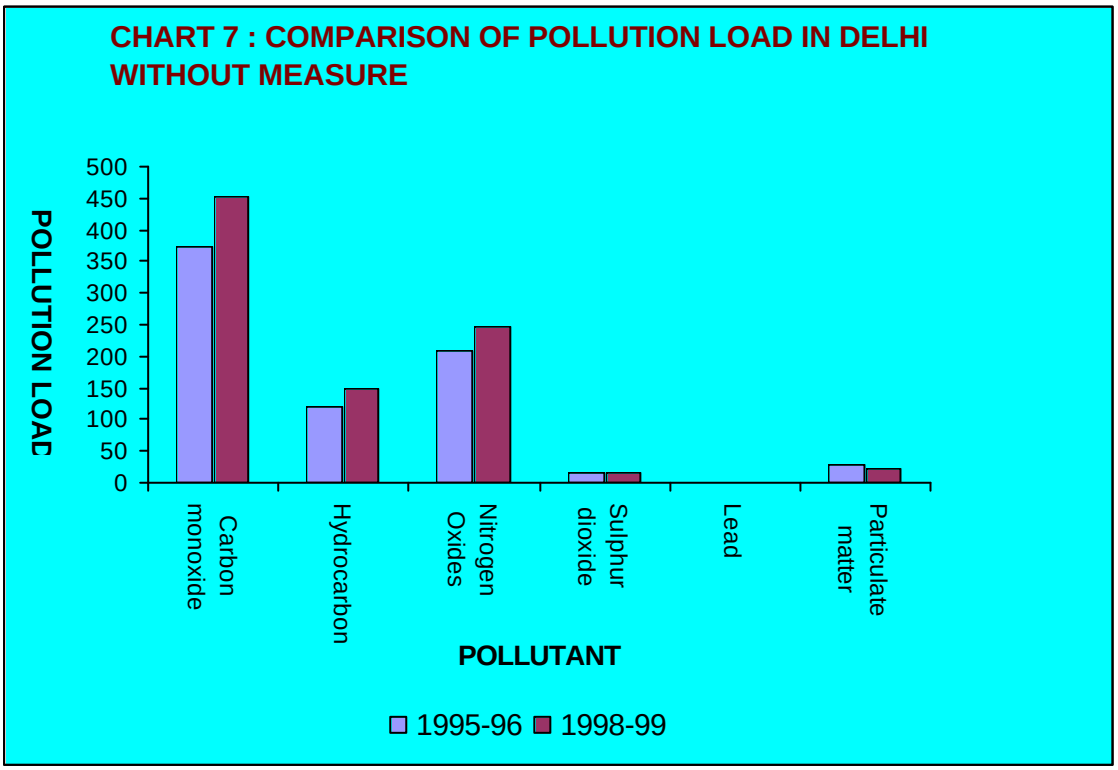
CHART 7 : COMPARISON OF POLLUTION LOAD IN DELHI WITHOUT MEASURE
POLLUTION LOAD
500
450
400
350
300
250
200
150
100
50
0
Carbon monoxide
Hydrocarbon
Nitrogen Oxides
Sulphur dioxide
Lead
Particulate matter
POLLUTANT
1995-96
1998-99

TABLE 4.1.10 : AMBIENT AIR QUALITY IN DELHI

Sl. No.	Parameters/Area	Year				
		1995	1998	1999	2000	2001
1	2	3	4	5	6	7
1	**Sulphur Dioxide (µg/m^3)**					
	Industrial Area	24.1	20.2	19.5	19.0	13.0
	Residential Area	16.5	15.8	17.0	17.0	14.0
	Traffic Intersection	42.0	25.0	20.0	18.0	15.0
2	**Nitrogen Dioxide (µg/m^3)**					
	Industrial Area	37.0	34.7	33.5	36.0	29.0
	Residential Area	32.5	28.6	26.5	31.0	29.0
	Traffic Intersection	66.0	63.0	60.0	59.0	67.0
3	**Suspended Particulate**					
	Industrial Area	403.0	363.0	361.0	433.0	358.0
	Residential Area	409.0	345.0	349.0	370.0	311.0
	Traffic Intersection	452.0	426.0	418.0	490.0	476.0
4	**Lead (µg/m^3)**					
	Residential Area	155.0	95.0	46.0	40.0	47.0
	Traffic Intersection	335.0	136.0	70.0	102.0	103.0
5	**Carbon Mono-oxide (µg/m^3)**					
	Traffic Intersection	3916.0	5450.0	4241.0	4686.0	4183.0

Source : Central Pollution Control Board

TABLE 4.1.11: EMISSION LIMITS FOR DIESEL DRIVEN VEHICLES

Sl. No.	Test	Light absorption Coefficient (Millilitre)	Maximum Smoke Density	
			Bosch Units	HartridgeUnit
1	2	3	4	5
1	Full load at a speed of 60 to 70 per cent of maximum engine rated speed specified by the manufacturer	3.1	5.2	75.0
2	Free acceleration	2.3	---	65.0

Source : TERI Energy Data Directory and Yearbook, 2002-03

TABLE 4.1.12 : PHASED TIGHTENING OF EXHAUST EMISSION STANDARDS FOR INDIAN AUTOMOBILES

Sl. No.	Category	1991	1996	2000 (Euro II)	2005 (Euro III)
1	2	3	4	5	6
1	**Petrol Vehicles : (in grams/km)**				
I.	**Two wheelers**				
	(a) CO	12-30	4.5	2.0	-
	(b) HC	8-12	-	-	-
	(c) ($HC+NO_X$)	-	3.6	2.0	-
II.	**Three Wheelers**				
	(a) CO	12-30	6.75	4.0	-
	(b) HC	8-12	-	-	-
	(c) ($HC+NO_X$)	-	5.40	2.0	-
III.	**Cars with CC :**				
	(a) CO	-	4.34-6.20	2.72	2.2
	(b) HC	-	-	-	-
	(c) ($HC+NO_X$)	-	1.5-2.18	0.97	0.5
IV.	**Cars without CC :**				
	(a) CO	14.3-27.1	8.68-12.4	2.72	2.2
	(b) HC	2.0-2.9	-	-	-
	(c) ($HC+NO_X$)	-	3.00-4.36	0.97	0.5
2	**Diesel Vehicles :**				
	A : Gross Vehicles Weight > 3.5 ton (Heavy Duty Vehicles)-in grams/kWh				
	(a) CO	14.0	11.2	4.5	4
	(b) HC	3.5	2.4	1.1	1.1
	(c) NO_X	18.0	14.4	8.0	7
	(d) PM > 85 KW/g/KWh	-	-	0.36	0.15
	(e) PM < 85 KW/g/KWh	-	-	0.61	0.15
	B : Gross Vehicles Weight < 3.5 ton (Light duty Vehicles)*-in grams/km				
	(a) CO	14.3-27.1	5.0-9.0	2.72-6.90	1.06
	(b) ($HC+NO_X$)	2.7-6.9	2.0-4.0	0.97-1.70	0.71
	(c) NO_X	-	-	-	0.566
	(d) PM	-	-	0.14-0.25	0.080

Source : The Energy Research Institute.

CO : Carbon Monoxide CC : Catalytic Converter

HC : Hydrocarbon PM : Particulate matter

NO_X : Oxides of Nitrogen

* : The test cycle is as per 13 mode cycle or a chasis dynamometer.

Euro I w.e.f. 1-6-99 and Euro II w.e.f. 1-4-2000 for private (non-commercial) vehicles in NCR.

Stricter emission norms for new vehicles effective from 1.4.2000 have been notified by the Ministry of Surface Transport and has come into force. The Progressive tightening of emission norms for vehicles at manufacturing stage has brought about significant improvement in exhaust emission of new vehicles after March, 2000.

TABLE 4.2.1 : INSTALLED CAPACITY OF POWER UTILITIES on 31st March, 2002(P)

(Megawatts)

Sl. No.	State/Union Territory	Hydro	Thermal			Wind	Nuclear	Total
			Steam	Gas	Diesel			
1	2	3	4	5	6	7	8	9
I	**Northern Region**	**8496.57**	**15469.50**	**2912.10**	**14.99**	**14.00**	**1180.00**	**28087.16**
1	Haryana	883.90	1102.50	0.00	3.92	0.00	0.00	1990.32
2	Himachal Pradesh	409.67	0.00	0.00	0.13	0.00	0.00	409.80
3	Jammu & Kashmir	311.69	0.00	175.00	8.94	0.00	0.00	495.63
4	Punjab	2398.94	2130.00	0.00	0.00	0.00	0.00	4528.94
5	Rajasthan	971.62	1975.00	38.50	0.00	14.00	0.00	2999.12
6	Uttar Pradesh & Uttranchal	1510.75	4102.00	0.00	0.00	0.00	0.00	5612.75
7	Chandigarh	0.00	0.00	0.00	2.00	0.00	0.00	2.00
8	Delhi	0.00	320.00	282.00	0.00	0.00	0.00	602.00
9	Central sector	2010.00	5840.00	2416.60	0.00	0.00	1180.00	11446.60
II	**Western region**	**4342.13**	**20691.50**	**4974.10**	**17.48**	**509.81**	**760.00**	**31295.02**
1	Goa	0.05	0.00	48.00	0.00	0.11	0.00	48.16
2	Gujarat	547.00	4819.00	1802.10	17.48	166.90	0.00	7352.48
3	Madhya Pradesh	947.91	3437.50	0.00	0.00	22.60	0.00	4408.01
4	Maharashtra	2847.17	8075.00	1832.00	0.00	320.20	0.00	13074.37
5	Daman & Diu	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Dadra & Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Central sector	0.00	4360.00	1292.00	0.00	0.00	760.00	6412.00
III	**Southern region**	**9862.84**	**12112.50**	**2378.40**	**949.29**	**981.00**	**780.00**	**27064.03**
1	Andhra Pradesh	3121.94	2952.50	1034.40	36.80	91.90	0.00	7237.54
2	Karnataka	2938.75	1520.00	220.00	234.42	54.80	0.00	4967.97
3	Kerala	1807.00	0.00	174.00	256.44	2.00	0.00	2239.44
4	Tamil Nadu	1995.15	2970.00	567.50	411.66	832.30	0.00	6776.61
5	Pondicherry	0.00	0.00	32.50	0.00	0.00	0.00	32.50
6	Lakshadweep	0.00	0.00	0.00	9.97	0.00	0.00	
7	Central sector	0.00	4670.00	350.00	0.00	0.00	780.00	5800.00
IV	**Eastern region**	**2458.76**	**13527.38**	**190.00**	**51.25**	**2.49**	**0.00**	**16229.88**
1	Bihar	174.90	2053.50	0.00	0.00	0.00	0.00	2228.40
2	Orissa	1877.00	420.00	0.00	0.00	1.49	0.00	2298.49
3	West Bengal	164.71	4506.38	100.00	12.20	1.00	0.00	4784.29
4	D.V.G.	144.00	2637.50	90.00	0.00	0.00	0.00	2871.50
5	A. & N. Islands	5.25	0.00	0.00	34.05	0.00	0.00	39.30
6	Sikkim	32.90	0.00	0.00	5.00	0.00	0.00	37.90
7	Central sector	60.00	3910.00	0.00	0.00	0.00	0.00	3970.00
V	**North-eastern region**	**1100.93**	**330.00**	**708.50**	**101.82**	**0.16**	**0.00**	**2241.41**
1	Assam	2.00	0.00	269.00	20.69	0.00	0.00	291.69
2	Manipur	3.20	0.00	0.00	27.41	0.00	0.00	30.61
3	Meghalaya	186.71	0.00	0.00	2.05	0.00	0.00	188.76
4	Nagaland ('@)	20.20	0.00	0.00	2.00	0.16	0.00	22.36
5	Tripura	16.01	0.00	64.50	4.85	0.00	0.00	85.36
6	Arunachal Pradesh	29.55	0.00	0.00	15.88	0.00	0.00	45.43
7	Mizoram	8.26	0.00	0.00	28.94	0.00	0.00	37.20
8	Central sector	835.00	330.00	375.00	0.00	0.00	0.00	1540.00
All-India		**26261.23**	**62130.88**	**11163.10**	**1134.83**	**1507.46**	**2720.00**	**104917.50**

Source : Central Electricity Authority

(@) : In case of Nagaland Wind includes .16 MW as Bio-Mass Gassifire. P : Provisional

Note : Installed capacity of jointly owned projects have been shown divided between the partner states as per their theoretical shares.

TABLE 4.2.2 : GENERATING CAPACITY AND ELECTRICITY GENERATION

Sl. No.	Parameter	1980-81	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
1	2	3	4	5	6	7	8	9	10	11	12
	Generating capacity*										
1	**All-India (Utilities + Non-Utilities)**	**33316**	**74699**	**78367**	**82375**	**87475**	**92332**	**95081**	**97874**	**102268**	**107355**
2	**Total (Utilites)**	**30214**	**66086**	**69065**	**72330**	**76753**	**81171**	**83294**	**85795**	**89102**	**93255**
	Public sector	28832	63344	66149	69426	73729	77625	79418	80783	82846	85430
	Private sector	1382	2742	2916	2904	3024	3546	3876	5012	6256	7825
	Average annual growth rate (per cent) during the decade	7.46	8.14	7.88	7.42	6.91	6.66	5.94	5.7	5.1	4.68
3	**Non-utilities(including railways)**	**3102**	**8613**	**9302**	**10045**	**10722**	**11161**	**11787**	**12079**	**13166**	**14100**
	Hydro	3	4	4	4	4	4	3	3	21	21
	Steam	2137	5010	5396	5560	5812	6029	6324	6171	6648	6950
	Gas	54	475	496	631	774	808	956	1166	1330	1950
	Diesel and wind	908	3124	3406	3850	4132	4320	4504	4739	5167	5179
4	**Electricity Generation****										
5	**All-India (Utilities + Non-Utilities)**	**119260**	**289439**	**315631**	**332713**	**356335**	**385557**	**418043**	**436729**	**465825**	**494143**
6	**Total (Utilities)**	**110844**	**264329**	**287029**	**301362**	**324050**	**350490**	**379877**	**395889**	**421747**	**448563**
	Public sector	104114	251382	273312	287536	310197	335293	361725	374126	395593	416726
	Private sector	6730	12947	13717	13826	13853	15197	18152	21763	26154	31837
	Average annual growth rate (per cent) during the decade	7.10	9.08	9.08	8.75	8.74	8.37	8.35	7.75	7.63	7.32
7	**Non-utilities(including railways)**	**8416**	**25110**	**28602**	**31351**	**32285**	**35067**	**38166**	**40840**	**44078**	**45580**
	Hydro	15	15	17	16	15	15	17	29	79	80
	Steam	7232	20017	23413	24682	25416	27390	28754	29130	30686	31900
	Gas	102	1845	1905	2803	3149	4255	4576	5039	5776	5900
	Diesel and wind	1067	3233	3267	3850	3705	3407	4819	6642	7537	7700

Source : Central Electricity Authority

* : in megawatts

** : in gigawatts-hours

TABLE 4.2.3 : ACTUAL POWER SUPPLY POSITION

(All figures in MU net)

Sl. No.	Region/ State/ System	April 2000 to March 2001				April 2001-March 2002			
		Requirement	Availability	Shortage	Shortage %	Requirement	Availability	Shortage	Shortage %
1	2	8	9	10	11	4	5	6	7
I.	**Northern Region**	**145567**	**134633**	**10934**	**7.5**	**150383**	**142410**	**7973**	**5.3**
1	Chandigarh	1072	1068	4	0.4	1110	1108	2	**0.2**
2	Delhi	18575	17667	908	4.9	19350	18741	609	**3.1**
3	Haryana	17275	16793	482	2.8	18138	17839	299	**1.6**
4	Himachal Pradesh	3190	3087	103	3.2	3293	3206	87	**2.6**
5	Jammu & Kashmir	6410	5361	1049	16.4	6635	5899	736	**11.1**
6	Punjab	27670	26923	747	2.7	28780	27577	1203	**4.2**
7	Rajasthan	25080	24178	902	3.6	24745	24495	250	**1.0**
8	Uttar Pradesh	46295	39556	6739	14.6	48332	43545	4787	**9.9**
II.	**Western Region**	**173975**	**155384**	**18591**	**10.7**	**175016**	**156793**	**18223**	**10.4**
1	Chhatisgarh					8054	7825	229	**2.8**
2	Goa	1766	1576	190	10.8	1767	1767	0	**0.0**
3	Gujarat	53038	47877	5161	9.7	53693	47530	6163	**11.5**
4	Madhya Pradesh	39644	34747	4897	12.4	31013	26233	4780	**15.4**
5	Maharashtra	79527	71184	8343	10.5	80489	73438	7051	**8.8**
III.	**Southern Region**	**134300**	**123677**	**10623**	**7.9**	**140516**	**128095**	**12421**	**8.8**
1	Andhra Pradeash	47792	44055	3737	7.8	48394	44302	4092	**8.5**
2	Karnataka	30242	27490	2752	9.1	32556	28493	4063	**12.5**
3	Kerala	13564	12670	894	6.6	13334	12349	985	**7.4**
4	Tamil Nadu	42702	39462	3240	7.6	46232	42951	3281	**7.1**
IV.	**Eastern Region**	**48073**	**48101**	**-28**	**-0.1**	**50687**	**50197**	**490**	**1.0**
1	Bihar	9208	8563	645	7.0	9370	8992	378	**4.0**
2	D.V.C.	8368	8510	-142	-1.7	8319	8312	7	**0.1**
3	Orissa	11710	12070	-360	-3.1	12328	12318	10	**0.1**
4	West Bengal	18787	18958	-171	-0.9	20670	20575	95	**0.5**
V.	**North-Eastern Region**	**5298.1**	**5606.3**	**-308.2**	**-5.8**	**5935.1**	**5854.9**	**80.2**	**1.4**
1	Arunachal Pradesh	127.7	130.1	-2.4	-1.9	136.3	134.6	1.7	**1.2**
2	Assam	3092.9	3332.8	-239.9	-7.8	3450.5	3425.2	25.3	**0.7**
3	Manipur	463.9	453.4	10.5	2.3	456.5	440.6	15.9	**3.5**
4	Meghalaya	563.9	605.2	-41.3	-7.3	700.1	705	-4.9	**-0.7**
5	Mizoram	249.7	256.5	-6.8	-2.7	284.5	278.5	6	**2.1**
6	Nagaland	226.0	231.9	-5.9	-2.6	260.1	258.4	1.7	**0.7**
7	Tripura	574.0	596.4	-22.4	-3.9	647.1	612.6	34.5	**5.3**
All India		**507213.1**	**467401.3**	**39811.8**	**7.8**	**522537**	**483350**	**39187**	**7.5**

Source : Central Electricity Authority

- : Indicates Surplus

TABLE 4.2.4(a): CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL POWER STATIONS (BY KIND OF FUELS) REGION-WISE/STATE-WISE DURING 2001-2002 (STEAM)

Sl. No.	State/Union Territory	Steam Stations								
		Coal ('000' MT)	Lignite ('000' MT)	Furnace Oil (KL)	Light Diesel Oil (KL)	LSHS/ HPS (KL)	HSD (KL)	Heat Input (K.Calx10)	Gross Gen. (GWH)	Average Heat Input (K.Cal/ Kwh)
1	2	3	4	5	6	7	8	9	10	11
1	**Northern Region**	**66207**		**139327**	**53260**	**15415**	**105**		**139928**	
	I. Haryana	4020		17003		12379	105		5082	
	II. Himachal Pradesh									
	III. Jammu & Kashmir									
	IV. Punjab	10049		19769	1606	3036			14695	
	V. Rajasthan	6471		9989					10591	
	VI. Uttar Pradesh	15420		4778	42974				59004	
	VII. Chandigarh									
	VIII. Delhi	5010			8680				6787	
	IX. Central Sector	25237		87788					43769	
2	**Western Region**	**106758**		**185342**	**27861**	**533637**	**3586**		**155090**	
	I. Gujarat	15869		43013	2637	522992	143		24991	
	II. Madhya Pradesh	20195		46587	7158		3443		28113	
	III. Chhattisgarh	17234		10680	272				24348	
	IV. Maharashtra	32515		85062	17794	10645			45457	
	V. Goa									
	VI. Daman & Diu									
	VII. Dadra & Nagar Haveli									
	VIII. Central Sector	20945							32181	
3	**Southern Region**	**56849**	**17317**	**141023**	**2288**	**24971**	**8299**		**83247**	
	I. Andhara Pradesh	26279		10784	408		1447		38119	
	II. Karnataka	5702		9469	240				8952	
	III. Kerala									
	IV. Tamil Nadu	14905	17317	104433	1404	16647	6852		20326	
	V. Pondicherry									
	VI. Central Sector	9963		16337	236	8324			15850	

TABLE 4.2.4(a): CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL POWER STATIONS (BY KIND OF FUELS) REGION-WISE/STATE-WISE DURING 2001-2002 (STEAM)-Concld.

Sl. No.	State/Union Territory	Steam Stations								
		Coal ('000' MT)	Lignite ('000' MT)	Furnace Oil (KL)	Light Diesel Oil (KL)	LSHS/ HPS (KL)	HSD (KL)	Heat Input (K.Calx10)	Gross Gen. (GWH)	Average Heat Input (K.Cal/ Kwh)
1	2	3	4	5	6	7	8	9	10	11
4	**Eastern Region**	**56986**		**147692**	**144986**		**8405**		**39678**	
	I. Bihar/Jharkhand	9238		58767	17233				3252	
	II. Orissa	8698			3946				2621	
	III. West Bengal	22741		12311	41001				12621	
	IV. Damodar Valley Corp.	2770		38307	41403		8405		7473	
	V. Sikkim									
	VI. Central Sector	13539		38307	41403				13711	
5	**North-Eastern Region**	**40**					**608**		**46**	
	I. Assam	40					608			
	II. Manipur									
	III. Meghalaya									
	IV. Nagaland									
	V. Tripura									
	VI. Arunachal Pradesh									
	VII. Mizoram									
	VIII. Central Sector									
6	**Islands**									
	I. Lakshadweep									
	II. A&N Islands									
All-India		**286840**	**17317**	**613384**	**228395**	**574023**	**21003**		**417989**	

Source : Central Electricity Authority

N.B. : Figures are not available in respect of those power stations which have not yet funished the information inspite of repeated reminders

3LE 4.2.4(b): CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL POV STATIONS (BY KIND OF FUELS) REGION-WISE/STATE-WISE DURING 1999-200

Sl. No.	State/Union Territory	Gas Stations				Diesel Stations		
		Natural Gas (Million Cu. Mts.)	HSD (Kilo Ltrs.)	Naphtha (Kilo Ltrs.)	Generation (GWH)	Diesel Oil (Kilo. Ltrs.)	Generation (GWH)	Average Oil Consumed (ltrs/Kwh)
1	2	3	4	5	6	7	8	9
1	**Northern Region**	**2830**	**122431**	**69209**	**13158.45**	**2937**	**8.46**	**0.34**
	I. Haryana	0	0	0	0.00	0	0.00	0.00
	II. Himachal Pradesh	0	0	0	0.00	0	0.00	0.00
	III. Jammu & Kashmir	0	2309	0	5.98	2937 e	8.46	0.34
	IV. Punjab	0	0	0	0.00	0	0.00	0.00
	V. Rajasthan	159	10847	0	252.92	0	0.00	0.00
	VI. Uttar Pradesh	0	0	0	0.00	0	0.00	0.00
	VII. Chandigarh	0	0	0	0.00	0	0.00	0.00
	VIII. Delhi	256	31	0	722.97	0	0.00	0.00
	IX. Central sector	2415	109244	69209	12176.58	0	0.00	0.00
2	**Western region**	**4510**	**37543**	**540320**	**21965.60**	**0**	**0.00**	**0.00**
	I. Gujarat	1916	34975	482935	8765.06	0	0.00	0.00
	II. Madhya Pradesh	0	0	0	0.00	0	0.00	0.00
	III. Maharashtra	1188	0	57385	6626.43	0	0.00	0.00
	IV. Goa	0	0	0	0.00	0	0.00	0.00
	V. Daman & Diu	0	0	0	0.00	0	0.00	0.00
	VI. Dadra & Nagar Haveli	0	0	0	0.00	0	0.00	0.00
	VII. Central sector	1406	2568	0	6574.11	0	0.00	0.00
4	**Southern region**	**547**	**26176**	**34299**	**3959.17**	**220010**	**1142.12**	**0.19**
	I. Andhra Pradesh	318	350	16295	3580.23	0	0.00	0.00
	II. Kamataka	8 e	0	0	9.10	124918	625.00	0.20
	III. Kerala	0	0	0	0.00	52761	251.28	0.21
	IV. Tamil Nadu	5	25826	18004	124.10	42331	265.84	0.16
	V. Pondicherry	2	0	0	2.44	0	0.00	0.00
	VI. Central sector	214 e	0	0	243.30	0	0.00	0.00

TABLE 4.2.4(b): CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL POWER STATIONS (BY KIND OF FUELS) REGION-WISE/STATE-WISE DURING 1999-2000 (Gas & Diesel)--Concld.

Sl. No.	State/Union Territory	Gas Stations				Diesel Stations		
		Natural Gas (Million Cu. Mts.)	HSD (Kilo Ltrs..)	Naphtha (Kilo Ltrs.)	Generation (GWH)	Diesel Oil (Kilo. Ltrs.)	Generation (GWH)	Average Oil Consumed (ltrs./Kwh)
1	2	3	4	5	6	7	8	9
5	**Eastern region**	**0**	**23145**	**5868**	**49.87**	**455**	**2.30**	**0.20**
	I. Bihar	0	0	0	0.00	0	0.00	0.00
	II. Orissa	0	0	0	0.00	0	0.00	0.00
	III. West Bengal	0	17728	0	23.72	89 e	0.45	0.20
	IV. Damodar Valley Corporation	0	5417 e	5868	26.15	0	0.00	0.00
	V. Sikkim	0	0	0	0.00	366	1.85	0.20
	VI. Central sector	0	0	0	0.00	0	0.00	0.00
6	**North-eastern region**	**1118**	**0**	**0**	**2178.54**	**10048**	**28.49**	**0.32**
	I. Assam	388	0	0	902.80	0	0.00	0.00
	II. Manipur	0	0	0	0.00	235	0.68	0.34
	III. Meghalaya	0	0	0	0.00	0	0.00	0.00
	IV. Nagaland	0	0	0	0.00	28 e	0.20	0.14
	V. Tripura	305 e	0	0	335.00	700 e	2.00	0.35
	VI. Arunachal Pradesh	0	0	0	0.00	4953	13.10	0.18
	VII. Mizoram	0	0	0	0.00	4132	12.51	0.34
	VIII. Central sector	425	0	0	940.74	0	0.00	0.00
7	**Islands**	**0**	**0**	**0**	**0.00**	**37224**	**122.29**	
	I. Lakshadweep	0	0	0	0	6602	18.84	0.35
	II. A & N Islands	0	0	0	0	30622	103.45	0.30
				0				
	All-India	**9005**	**209295**	**649696**	**41311.63**	**270674**	**1303.66**	**0.21**

Source : Central Electricity Authority

e : Estimated

TABLE 4.2.5 : ANNUAL GROSS GENERATION OF POWER BY SOURCE

(in MU units)

Sl. No.	Year	Hydro	Steam @	Diesel & Wind @	Gas	Nuclear	Thermal*	Total
1	2	3	4	5	6	7	8	9
1	1980-81	46541.8	60713.8	61.5	522.0	3001.3		110840.4
2	1985-86	51020.6	112540.1	50.6	1756.9	4981.9		170350.1
3	1990-91	71641.3	178321.7	111.3	8113.2	6141.1		264328.6
4	1991-92	72757.1	197163.2	134.0	11450.0	5524.4		287028.7
5	1992-93	69869.2	211123.5	162.3	13480.4	6726.3		301361.7
6	1993-94	70462.7	233150.7	310.9	14727.6	5397.7		324049.6
7	1994-95	82712.0	243110.2	545.2	18474.8	5648.2		350490.4
8	1995-96	72759.2	273743.5	714.4	24858.4	7981.7		380057.2
9	1996-97	68900.8	289378.3	1554.3	26984.9	9071.1		395889.4
10	1997-98	74581.7	300730.5	1929.3	34423.2	10082.6		421747.3
11	1998-99	82690.0	308056.0	2136.0	43480.0	12015.0	353662.0	448367.0
12	1999-00	80637.0	377814.0	3989.0	49773.0	13267.0	386776.0	480680.0
13	2000-01	74481.0	357006.0	3822.0	48311.0	16928.0	408139.0	499548.0
14	2001-02	73940.0	369087.0	4113.0	48787.0	19320.0	421987.0	515247.0

Source: Central Electricity Authority

* : Including Coal, Lignite, Diesel & Gas based stations

@' : We are not monitoring Captioc Power Plants Wind & Generation of small stations i.e. Mini & Micro Hydel

The power generating capacity , owned and operated by utilities, has grown at a rate of over 10% per year since 1950. The shares of hydro power and thermal power have changed substantially. The share of hydro capacity declined from 43.4% in 1970-71 to 42% in 1980-81 and further reduced to 17.7% in 1997-98 and 14% in 2001-02.

It is difficult to strike an optional balance between Hydro and Thermal power, as it may depend upon the system load curve, performance of various types of plants etc.

Perhaps, one of the most important reasons for the decline in the share of hydro electricity is that its gestation period is larger than that of thermal capacity. This is, because, equipment and construction procedures for thermal projects are largely independent of site conditions and can, therefore, be standardized. Hydro-development has also lagged behind due to inter-state disputes and sharing of water, inadequate funding and on account of environmental considerations with addition to installed capacity, gross utility generation also increased rapidly.

TABLE 4.2.6 (a) : PER THOUSAND DISTRIBUTION OF HOUSEHOLDS BY PRIMARY SOURCE OF ENERGY USED FOR COOKING FOR EACH MAJOR STATE

(Rural)

Sl. No.	State	55th Round						50th Round					
		No Cooking Arrangement	Firewood and Chips	Dung Cake	LPG	Others	All	No Cooking Arrangement	Firewood and Chips	Dung Cake	LPG	Others	All
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Andhra Pradesh	31	871	3	63	32	1000	6	938	6	23	27	1000
2	Assam	2	934	2	56	6	1000	0	973	5	11	11	1000
3	Bihar	2	634	242	6	116	1000	3	634	256	3	104	1000
4	Gujarat	16	776	22	102	84	1000	5	788	65	49	93	1000
5	Haryana	0	494	303	184	19	1000	1	683	247	36	33	1000
6	Karnataka	22	869	1	43	65	1000	10	940	3	17	30	1000
7	Kerala	9	847	3	116	25	1000	14	921	2	41	22	1000
8	Madhya Pradesh	5	927	26	17	25	1000	3	912	62	5	18	1000
9	Maharashtra	29	702	9	91	169	1000	9	967	13	35	176	1200
10	Orissa	13	894	55	8	30	1000	21	889	39	3	48	1000
11	Punjab	2	349	375	142	132	1000	6	507	340	51	96	1000
12	Rajasthan	5	930	18	29	18	1000	2	900	44	20	34	1000
13	Tamil Nadu	14	859	1	67	59	1000	13	913	1	31	42	1000
14	Uttar Pradesh	3	573	329	36	59	1000	4	627	329	12	28	1000
15	West Bengal	4	785	54	17	140	1000	11	613	88	3	285	1000
All India		**11**	**755**	**106**	**54**	**74**	**1000**	**7**	**782**	**115**	**19**	**77**	**1000**

Source: NSS Report 1999-2000

TABLE 4.2.6 (b): PER THOUSAND DISTRIBUTION OF HOUSEHOLDS BY PRIMARY SOURCE OF ENERGY USED FOR COOKING FOR EACH MAJOR STATE

(Urban)

Sl. No.	State	55th Round						50th Round					
		No Cooking Arrangement	Firewood and Chips	Dung Cake	LPG	Others	All	No Cooking Arrangement	Firewood and Chips	Dung Cake	LPG	Others	All
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Andhra Pradesh	3	271	216	438	72	1000	27	441	211	279	42	1000
2	Assam	1	341	111	500	47	1000	45	441	155	345	14	1000
3	Bihar	10	257	93	279	361	1000	59	218	89	172	462	1000
4	Gujarat	13	107	258	559	63	1000	78	161	310	396	55	1000
5	Haryana	0	193	167	546	97	1003	43	238	230	387	102	1000
6	Karnataka	3	232	251	438	76	1000	58	362	265	260	55	1000
7	Kerala	3	541	68	310	78	1000	73	703	52	168	4	1000
8	Madhya Pradesh	1	346	179	377	97	1000	30	414	156	308	92	1000
9	Maharashtra	11	97	304	515	73	1000	74	138	376	389	23	1000
10	Orissa	2	432	224	169	173	1000	99	424	120	180	177	1000
11	Punjab	4	113	310	480	93	1000	11	145	359	409	76	1000
12	Rajasthan	0	312	144	509	35	1000	24	391	243	285	57	1000
13	Tamil Nadu	1	233	329	372	65	1000	115	430	250	192	13	1000
14	Uttar Pradesh	4	305	141	431	119	1000	21	391	148	341	125	1026
15	West Bengal	40	121	192	347	300	1000	106	84	140	187	483	1000
	All India	**7**	**223**	**217**	**442**	**111**	**1000**	**63**	**300**	**232**	**296**	**109**	**1000**

Source: NSS Report 1999-2000

TABLE 4.2.6 (c): PER THOUSAND DISTRIBUTION OF HOUSEHOLDS BY MPCE CLASS AND AVERAGE MPCE SEPARATELY FOR EACH PRIMARY SOURCE OF ENERGY USED FOR COOKING

(All India Rural)

Sl. No.	MPCE Class	No Cooking Arrangement	Coke	Firewood and Chips	Gobar Gas	Dung Cake	Charcoal	Kerosene	LPG	Electricity	Others	All
1	2	3	4	5	6	7	8	9	10	11	12	13
1	0-225	117	64	48	0	36	48	3	1	3	51	44
2	225-255	23	32	47	6	34	35	3	1	0	70	42
3	255-300	21	81	94	7	91	76	20	5	0	131	87
4	300-340	29	112	97	7	101	82	19	8	37	134	90
5	340-380	38	83	101	14	101	164	44	14	2	115	94
6	380-420	71	87	97	24	99	43	50	21	29	111	92
7	420-470	53	118	106	70	102	92	57	36	60	109	100
8	470-525	83	93	101	59	96	118	80	49	34	80	96
9	525-615	72	102	111	158	116	2	134	99	112	92	111
10	615-775	143	110	106	151	114	161	177	191	221	69	113
11	775-950	62	56	50	186	58	64	164	183	73	26	61
12	950-More	289	63	42	318	53	115	249	390	429	11	71
13	All Classes	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
14	Av. MPCE (Rs.)	828	461	454	842	476	515	693	892	902	393	486

Source: NSS Report 1999-2000

TABLE 4.2.6 (d): PER THOUSAND DISTRIBUTION OF HOUSEHOLDS BY MPCE CLASS AND AVERAGE MPCE SEPARATELY FOR EACH PRIMARY SOURCE OF ENERGY USED FOR COOKING

(All India Urban)

Sl. No.	MPCE Class	No Cooking Arrangement	Coke	Firewood and Chips	Gobar Gas	Dung Cake	Charcoal	Kerosene	LPG	Electricity	Others	All
1	2	3	4	5	6	7	8	9	10	11	12	13
1	0-300	93	56	114	0	79	39	21	3	7	43	38
2	300-350	65	60	100	64	101	67	25	7	0	16	37
3	350-425	158	142	173	0	186	108	78	17	56	26	75
4	425-500	186	161	163	57	130	114	95	37	54	33	86
5	500-575	114	138	133	80	114	93	109	50	73	35	86
6	575-665	59	128	101	35	132	111	119	73	49	35	91
7	665-775	42	108	77	420	76	121	119	100	66	46	96
8	775-915	45	97	60	25	71	167	124	122	142	59	104
9	915-1120	53	58	41	137	54	97	120	152	136	137	113
10	1120-1500	88	40	26	112	36	47	121	190	224	230	130
11	1500-1925	54	9	6	64	7	27	43	112	107	129	67
12	1925-More	42	3	5	5	14	9	26	137	86	210	77
13	All Classes	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
14	Av. MPCE (Rs.)	588	574	502	838	542	620	729	1134	910	1426	855

Source: NSS Report 1999-2000

TABLE 4.2.7 : NUMBER OF TOWNS AND VILLAGES ELECTRIFIED IN INDIA

(As on 31.03.2002)

Sl. No.	State/Union Territory	Towns		Villages		
		Total	Electrified	Total	Electrified (provisional)	
1	2	3	4	5	6	
I.	**Northern Region**	**1342**	**1342**	**193577**	**168740**	
1	Haryana	94	94	6759	6759	
2	Himachal Pradesh	58	58	16997	16886	
3	Jammu & Kashmir	58	58	6477	6315	(a)($)
4	Punjab	120	120	12428	12428	
5	Rajasthan	222	222	37889	36488	
6	Uttar Pradesh	753	753	97122	77152	(g)
7	Uttaranchal			15681	12488	(b)
8	Chandigarh	5	5	25	25	
9	Delhi	32	32	199	199	
II.	**Western Region**	**1099**	**1099**	**130421**	**127251**	
1	Gujarat	264	264	18028	17940	(*)
2	Madhya Pradesh	465	465	51806	50306	
3	Chattisgarh			19720	18201	
4	Maharashtra	336	336	40412	40349	(*)
5	Goa	31	31	360	360	(@)
6	Daman & Diu	2	2	24	24	
7	Dadra & Nagar Haveli	1	1	71	71	
III.	**Southern Region**	**1251**	**1251**	**71128**	**70805**	
1	Andhra Pradesh	264	264	26586	26565	(*)
2	Karnataka	306	306	27066	26764	(+)
3	Kerala	197	197	1384	1384	
4	Tamil Nadu	469	469	15822	15822	
5	Pondicherry	11	11	263	263	
6	Lakshadweep	4	4	7	7	
IV.	**Eastern Region**	**786**	**786**	**153363**	**113728**	
1	Bihar	271	271	67513	47954	($$)
2	Jharkhand (++)					
3	Orissa	124	124	46989	35232	(c)
4	West Bengal	382	382	37910	29636	
5	A & N Island	1	1	504	501	
6	Sikkim	8	8	447	405	(#)
V.	**North-Eastern Region**	**195**	**195**	**38769**	**28530**	
1	Assam	93	93	24685	19019	(e)
2	Manipur	31	31	2182	2001	
3	Meghalaya	12	12	5484	2588	
4	Nagaland	9	9	1216	1212	(d)
5	Tripura	18	18	855	813	(h)
6	Arunachal Pradesh	10	10	3649	2206	(f)
7	Mizoram	22	22	698	691	(h)
Total (All India)		**4673**	**4673**	**587258**	**509054**	

Source : Central Electricity Authority
@ : Provisional, to be confirmed as per 1991 census
(*) : Fully electrified Balance not feasible for electrification.
(#) : Provisional 42 Nos. forest villages not electrified
($$) : Achievements as per 1981 census
($) : Achievements as per 1971 census. 1991 census not held
(+) : 281 villages declared non-feasible for electrification.
(++) : Separate data not available

a : as on 31.03.1998 b : as on 30.09.2001
c : as on 30.04.2001 d : as on 30-09-2001
e : as on 31.10.2001 f : as on 30.11.2001
g : as on 31.12.2001 h : as on 28.02.2002

TABLE 4.2.8 : STATEWISE PRODUCTION OF COAL AND LIGNITE

(Million tonnes)

Sl. No.	States	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02(P)
1	2	3	4	5	6	7	8
I.	**Coal**	**289.321**	**300.403**	**296.508**	**304.103**	**313.696**	**327.644**
1	Andhra Pradesh	28.734	28.941	27.326	29.556	30.274	30.811
2	Assam	0.752	0.687	0.637	0.572	0.660	0.640
3	Jharkhand	77.678	81.274	76.161	76.533	75.416	76.807
4	Jammu & Kashmir	0.021	0.005	0.010	0.028	0.033	0.035
5	Madhya Pradesh	83.283	84.753	84.937	87.901	42.503	44.156
6	Meghalaya	3.241	3.234	4.238	4.060	4.065	5.015
7	Chhatisgarh					50.227	53.621
8	Maharashtra	24.857	26.171	25.279	27.698	28.754	30.83
9	Orissa	37.365	42.162	43.512	43.554	44.803	47.805
10	Uttar Pradesh	15.397	15.781	15.646	16.220	16.863	16.533
11	West Bengal	17.993	17.395	18.762	17.981	20.098	21.391
II.	**Lignite**	**22.640**	**23.052**	**23.419**	**22.125**	**22.947**	**23.503**
1	Gujarat	5.184	4.943	5.002	4.351	4.558	4.849
2	Rajasthan			0.249	0.222	0.217	0.277
3	Tamilnadu	17.456	18.109	18.168	17.552	18.172	18.377

Source : Office of the Coal Controller
P : Provisional

Coal is the most abundant source of commercial energy in India. Coal resources are continually assessed by the Geological Survey of India through regional mapping and exploratory drilling. The total coal reserves (as on 1 January, 2001) have been assessed at about 214 billion tonnes of which 84 billion tonnes are proven resources.

Coal production increased rapidly after the nationalisation of coal mines. From about 72.9 million ton in 1970/71, it rose to 211.7 million ton in 1990/91 and to 327 million ton in 2001-2002 making India the world's fourth largest coal producer. The increase is predominantly in non-coking coal production. One of the major constraints on the profitability of the coal sector is the low productivity levels in underground mines. The underground mines employ 80% of manpower, but contribute to only 30% of the total output. Since the nationalisation of the coal industry, India's mine planners have chosen opencast mining over underground methods, to enhance productivity and meet production targets. The drawback of extracting the majority of the coal with opencast methods is that its quality is unavoidably affected by contamination of overburden mixes into the coal.

TABLE 4.2.9 : PRODUCTION OF COAL FROM OPENCAST WORKING BY MECHANISATION AND OVERBURDEN REMOVED DURING THE YEAR, 2000

(Tonne)

Sl. No.	States	Total Opencast Output	Mechanisation			Overburden Removed (in '000 Cubic metre)
			Fully Mechanised	Semi Mechanised	Manual	
1	2	3	4	5	6	7
I	**COAL**	**244586515**	**244586515**	**---**	---	**565948**
1	Andhra Pradesh	16265321	16265321	---	---	73967
2	Arunachal Pradesh	962	962	---	---	50
3	Assam	437406	437406	---	---	2100
4	Chhattisgarh	41880833	41880833	---	---	54988
5	Jharkhand	62908515	62908515			129941
6	Madhya Pradesh	27038736	27038736	---	---	80233
7	Maharashtra	24508019	24508019	---	---	85247
8	Orissa	44368500	44368500	---	---	49408
9	Uttar Pradesh	18609000	18609000	---	---	62770
10	West Bengal	8569223	8569223	---	---	27244
II	**LIGNITE**	**23505354**	**23505354**	**--**	**---**	**131756**
1	Gujarat	5653598	5653598	---	---	18154
2	Rajasthan	219665	219665	---	---	11068
3	Tamilnadu	17632091	17632091	---	---	102534

Source : Statistics of Mines in India, Vol. I (Coal), 2000

Issued by - The Directorate -General of Mines Safety, Dhanbad

TABLE 4.2.10 : PRODUCTIVITY IN COAL MINES IN THE YEAR 2000

(Tonne)

Sl. No.	State	Output Per Man Year			Output Per Manshift		
		Belowground	Opencast	Overall	Belowground	Opencast	Overall
1	2	3	4	5	6	7	8
I	**COAL**	**266**	**3765**	**692**	**0.87**	**11.67**	**2.22**
1	Andhra Pradesh	247	2872	438	0.84	9.40	1.49
2	Arunachal Pradesh	---	30	21	---	0.08	0.06
3	Assam	137	1458	217	0.45	4.09	0.68
4	Chhattisgarh	399	8815	1390	1.21	25.54	4.21
5	Jharkhand	221	2077	525	0.72	6.54	1.69
6	Jammu & Kashmir	39	---	31	0.13	---	0.11
7	Madhya Pradesh	373	4907	738	1.17	14.49	2.30
8	Maharashtra	326	4018	874	1.03	12.07	2.69
9	Orissa	259	8612	2591	0.85	27.20	8.26
10	Uttar Pradesh	---	5285	2839	---	16.24	8.63
11	West Bengal	209	2352	234	0.69	7.29	0.76
II	**LIGNITE**	**---**	**6046**	**2510**	**---**	**19.52**	**8.10**
1	Gujarat	---	6967	2672	---	23.36	8.88
2	Rajasthan	---	2197	1603	---	7.25	5.29
3	Tamil Nadu	---	5917	2479	---	18.92	7.93

Source : Statistics of Mines in India, Vol. I (Coal), 2000
Issued by - The Directorate -General of Mines Safety, Dhanbad

TABLE 4.2.11 : STATEWISE INVENTORY OF GEOLOGICAL RESERVES OF COAL

(Million tonnes)

Sl No.	State	As on	Proved	Indicated	Inferred	Total
1	2	3	4	5	6	7
1	**Andhra Pradesh (Gondawana)**	1-1-2000	7346	3312	2929	13587
		1-1-2001	7529	3364	2782	13675
		1-1-2002	7729	5459	2448	15636
2	**Arunachal Pradesh (Tartiary)**	1-1-2000	31	11	48	90
		1-1-2001	31	11	48	90
		1-1-2002	31	40	19	90
3	**Assam (Tartiary)**	1-1-2000	259	27	34	320
		1-1-2001	259	27	34	320
		1-1-2002	279	27	34	340
4	**Jharkhand & Bihar (Gondawana)**	1-1-2000	34794	28692	5642	69128
	Jharkhand & Bihar (Gondawana)	1-1-2001	35148	28444	5583	69175
	Jharkhand (Gondawana)	1-1-2002	35235	28987	6282	70503
5	**Bihar (Gondawana)**	1-1-2002	0	0	160	160
6	**M P & Chhatisgarh (Gondawana)**	1-1-2000	13010	22148	8334	43492
	M P & Chhatisgarh (Gondawana)	1-1-2001	14017	22102	8200	44319
	MP (Gondawana)	1-1-2002	6857	7866	3234	17957
7	**Chhatisgarh (Gondawana)**	1-1-2002	7627	23640	4108	35375
8	**Maharashtra (Gondawana)**	1-1-2000	4149	1323	1605	7077
		1-1-2001	4389	1302	1605	7296
		1-1-2002	4495	2050	1536	8081
9	**Meghalaya (Tartiary)**	1-1-2000	118	41	301	460
		1-1-2001	118	41	301	460
		1-1-2002	118	41	301	460
10	**Nagaland (Tartiary)**	1-1-2000	3	1	15	19
		1-1-2001	3	1	15	19
		1-1-2002	3	1	15	19
11	**Orissa (Gondawana)**	1-1-2000	11140	22755	16554	50449
		1-1-2001	11308	23728	16535	51571
		1-1-2002	13080	29809	15123	58012
12	**Uttar Pradesh (Gondawana)**	1-1-2000	766	296	0	1062
		1-1-2001	766	296	0	1062
		1-1-2002	766	296	0	1062
13	**West Bengal (Gondawana)**	1-1-2000	10779	10894	4236	25909
		1-1-2001	10846	10926	4147	25919
		1-1-2002	11099	11163	4157	26419
India (Total)		**1-1-2000**	**82395**	**89500**	**39698**	**211593**
		1-1-2001	**84414**	**90242**	**39250**	**213906**
		1-1-2002	**87320**	**109378**	**37417**	**234114**

Source : Office of Coal Controller

Note: Data may not add up to respective total due to rounding up

TABLE 4.2.12 : INVENTORY OF GEOLOGICAL RESERVES OF COAL BY TYPE

(Million tonnes)

Sl. No.	Types of Coal	As on	Proved	Indicated	Inferred	Total
1	2	3	4	5	6	7
1	**Coking**					
	I. Prime coking	1-1-2000	4614	699	0	**5313**
		1-1-2001	4614	699	0	**5313**
		1-1-2002	4614	699	0	**5313**
	II. Medium coking	1-1-2000	11267	11133	1106	**23506**
		1-1-2001	12060	11522	1106	**24688**
		1-1-2002	11294	11749	1866	**24909**
	III. Blendable/semi-coking	1-1-2000	482	904	222	**1608**
		1-1-2001	482	904	222	**1608**
		1-1-2002	482	907	222	**1610**
2	**Non-coking** (Including High Sulphur)	1-1-2000	66032	76765	38369	**181167**
		1-1-2001	67258	77118	37922	**182297**
		1-1-2002	70929	96024	35329	**202282**
Total		**1-1-2000**	**82396**	**89854**	**39250**	**211594**
		1-1-2001	**88085**	**90242**	**36657**	**213906**
		1-1-2002	**87320**	**109378**	**37417**	**234114**

Source : Office of the Coal Controller

TABLE 4.2.13 : ESTIMATED POTENTIAL FOR RENEWABLE TENERGY TECHNOLOGIES IN INDIA

Sl. No.	Source/Systems	Approximate Potential
1	Biogas Plants	120 lakh
2	Improved Chulhas	1200 lakh
3	Wind	45000 MW
4	Small Hydro	15000 MW
5	Biomas Power/Cogeneration	1 9500 MW
6	Biomass Gasifiers	--
7	Solar PV	20 MW/sq.km
8	Waste -to -Energy	2500 MW
9	Solar Water Heating	140 Million sq.m Collector Area.

Source: Ministry of Non-Conventional Energy Sources

The Ministry of Non-Conventional Energy Resources was created in 1992. The main responsibilities of the ministry include the development and utilization of new and renewable sources of energy such as biogas, biomass, solar energy, wind energy, small hydro power, ocean energy, geothermal energy, hydrogen and drought animal power.

TABLE 4.2.14 : STATE-WISE WIND POWER INSTALLED CAPACITY

(AS ON 31-12-2002)

(In megawatts)

Sl No.	State	Demonstration Projects	Commercial Projects	Total
1	2	3	4	5
1	Andhra Pradesh	5.4	87.2	92.6
2	Gujarat	17.3	149.6	166.9
3	Karnataka	2.6	93.6	96.2
4	Kerala	2.0	--	2.0
5	Madhya Pradesh	0.6	22.0	22.6
6	Maharashtra	6.4	392.8	399.2
7	Orissa	6.4	18.7	25.1
8	Tamil Nadu	19.4	875.6	895.0
9	West Bengal	1.0	--	1.1
9	Others	1.6	--	1.6
Total		**62.7**	**1639.5**	**1702.3**

Source : TERI Energy Data Directory and Year Book 2002-03

TABLE 4.2.15 : STATE-WISE SMALL HYDRO STATION INSTALLED/UNDER CONSTRUCTION UPTO 3 MW CAPACITY, 1997-98

S. No.	State	SHP Station installed		SHP Projects Under Construction	
		Number	Capacity(MW)	Number	Capacity(MW)
1	2	3	4	5	6
1	Andhra Pradesh	7	7.01	36	42.10
2	Arunachal Pradesh	30	20.15	17	20.63
3	Assam	2	2.20	--	--
4	Bihar	4	0.04	5	2.46
5	Goa	--	--	2	2.90
6	Gujarat	1	2.00	--	--
7	Haryana	1	0.20	1	0.10
8	Himachal Pradesh	14	9.49	18	11.19
9	Jammu & Kashmir	15	4.37	10	11.20
10	Karnataka	12	17.20	18	23.17
11	Kerala	4	3.52	6	14.00
12	Madhya Pradesh	5	3.25	8	14.40
13	Maharashtra	5	6.82	4	6.20
14	Manipur	6	4.10	4	3.50
15	Meghalaya	1	1.51	7	0.28
16	Mizoram	9	5.36	9	8.80
17	Nagaland	5	3.17	4	5.50
18	Orissa	3	1.26	7	9.92
19	Punjab	4	3.90	8	9.50
20	Rajasthan	5	4.32	1	0.54
21	Sikkim	8	9.25	2	3.20
22	Tamil Nadu	3	4.75	4	6.40
23	Tripura	2	1.01	1	0.10
24	Uttar Pradesh	61	32.54	25	19.73
25	West Bengal	8	7.98	7	9.23
26	A. & N. Island	--	--	1	2.25
Total		**215**	**155.40**	**205**	**227.30**

Source : Annual Report, 1997-98, Ministry of Coal Govt. of India, New Delhi
As reproduced in Yearbook of Energy - Environment Statistics(YES), 1998
Bharat Information Technology Services(BIT)

In India, power generation in small scale hydro-resources is categorized as micro hydro for projects with an installed capacity of upto 100 kW, mini-hydro upto 2 MW, and small hydro upto 15 MW capacity. The categorization is fairly fluid, but here small hydro refers collectively to micro, mini, and small hydro upto 3 MW capacity.

TABLE 4.2.16 : DOMESTIC PRODUCTION OF PETROLEUM PRODUCTS IN INDIA

(000' Tonne)

Sl. No.	Year	Light Distillates			Middle Distillates			
		Liquified Petroleum Gas @	Motor Gasoline	Naphtha	Kerosene	Aviation Turbine Fuel	High Speed Diesel oil	Light diesel Oil
1	2	3	4	5	6	7	8	9
1	1970-71	169	1526	1205	2896	710	3840	986
2	1971-72	195	1615	1217*	2995	808	4356	1065
3	1972-73	227	1581	1330*	2813	801	4598	1010
4	1973-74	259	1647	1438*	2613	875	5039	1079
5	1974-75	278	1298	1720	2052	837	6034	1084
6	1975-76	331	1275	1910	2439	925	6285	946
7	1976-77	363	1340	1986	2581	1001	6399	1047
8	1977-78	383	1423	2120	2450	1077	7129	1224
9	1978-79	403	1515	2262	2514	1177	7350	1227
10	1979-80	406	1512	2415	2539	1104	7975	1230
11	1980-81	366	1519	2115	2396	1001	7371	1108
12	1981-82	410	1614	3004	2907	1009	9042	949
13	1982-83	406	1797	2986	3393	1137	9761	1121
14	1983-84	514	1937	3578	3528	1195	10862	1081
15	1984-85	596	2144	3470	3364	1297	11086	1253
16	1985-86	867	2309	4955	4030	1519	14624	1177
17	1986-87	995	2515	5437	4912	1553	15450	1172
18	1987-88	1026	2662	5462	5104	1695	16296	1259
19	1988-89	1034	2822	5378	5201	1753	16656	1468
20	1989-90	1179	3328	5227	5700	1575	17737	1540
21	1990-91	1221	3552	4859	5471	1801	17185	1509
22	1991-92	1250	3420	4546	5339	1539	17404	1482
23	1992-93	1249	3709	4586	5199	1636	18289	1453
24	1993-94	1314	3843	4666	5270	1788	18809	1474
25	1994-95	1432	4129	5662	5261	1968	19593	1364
26	1995-96	1539	4462	5975	5267	2127	20661	1351
27	1996-97	1598	4704	6123	6236	2119	22202	1286
28	1997-98	1666	4849	6103	6701	2147	23354	1246
29	1998-99	1724	5573	6081	5341	2289	26716	1336
30	1999-00	2487	6232	8170	5735	2292	34793	1624
31	2000-01	4088	8070	9908	8714	2513	39015	1481
32	2001-02 (P)	4778	9699	9180	9681	2595	39773	1703

(P) - Provisional

@ Excludes LPG production from natural gas.

* Estimated from calendar year figures.

ABLE 4.2.16 : DOMESTIC PRODUCTION OF PETROLEUM PRODUCTS IN INDIA - Concl

(000' Tonne)

Sl. No.	Year	Heavy Ends				Others**	Total
		Fuel Oil	Lubricants	Petroleum Coke	Bitumen		
1	2	10	11	12	13	14	15
1	1970-71	4090	231	151	805	501	17110
2	1971-72	4098	140*	142*	1009*	999	18639
3	1972-73	3688	304*	132*	1109*	267	17830
4	1973-74	3931	318*	131*	1093*	1072	19495
5	1974-75	4243	387	137	873	668	19603
6	1975-76	5083	342	160	697	436	20829
7	1976-77	4728	368	163	945	471	21432
8	1977-78	5332	413	155	992	521	23219
9	1978-79	5644	490	122	962	527	24193
10	1979-80	6351	487	99	1103	573	25794
11	1980-81	6120	426	86	1082	533	24123
12	1981-82	6908	407	141	1298	493	28182
13	1982-83	7964	434	149	1397	528	31073
14	1983-84	8000	470	136	1069	556	32926
15	1984-85	7886	414	181	944	601	33236
16	1985-86	7955	501	192	1107	645	39881
17	1986-87	8011	491	264	1224	737	42761
18	1987-88	8466	478	257	1370	653	44728
19	1988-89	8171	497	275	1548	896	45699
20	1989-90	8952	547	275	1671	959	48690
21	1990-91	9429	561	229	1603	1142	48562
22	1991-92	9637	390	216	1710	1416	48349
23	1992-93	10403	533	221	1862	1219	50359
24	1993-94	10304	489	233	1874	1020	51084
25	1994-95	9822	504	259	1845	1088	52927
26	1995-96	9579	633	256	2032	1199	55081
27	1996-97	10298	619	246	2283	1291	59005
28	1997-98	11080	593	282	2158	1129	61308
29	1998-99	11030	586	286	2419	1163	64544
30	1999-00	11352	728	465	2485	3048	79411
31	2000-01	11392	684	2473	2721	4555	95614
32	2001-02 (P)	12227	651	2784	2561	4372	100004

Source : Ministry of Petroleum & Natural Gas.

(P) - Provisional

* Estimated from calendar year figures

** Includes those of light distillates, middle distillates and heavy ends.

TABLE 4.2.17 : AVAILABILITY OF CRUDE OIL AND PETROLEUM PRODUCTS IN INDIA

(000' Tonne)

Sl. No.	Year	Crude Oil			Petroleum Products		
		Production	Net Imports	Gross Availability	Production	Net Imports	Gross Availability
1	2	3	4	5	6	7	8
1	1970-71	6822	11683	18505	17110	752	17862
2	1971-72	7299	12951	20250	18639	2011	20650
3	1972-73	7321	12084	19405	17830	3399	21229
4	1973-74	7189	13855	21044	19495	3387	22882
5	1974-75	7684	14016	21700	19603	2473	22076
6	1975-76	8448	13624	22072	20829	2048	22877
7	1976-77	8898	14048	22522	21432	2550	23982
8	1977-78	10763	14507	25270	23219	2832	26051
9	1978-79	11633	14657	26290	24193	3834	28027
10	1979-80	11766	16121	27887	25794	4636	30430
11	1980-81	10507	16248	26755	24123	7253	31376
12	1981-82	16194	14460	30654	28182	4829	33011
13	1982-83	21063	12397	33460	31073	4233	35306
14	1983-84	26020	10445	36465	32926	2856	35782
15	1984-85	28990	7164	36154	33236	5159	38395
16	1985-86	30168	14616	44784	39881	1902	41783
17	1986-87	30480	15476	45956	42761	556	43317
18	1987-88	30357	17734	48091	44728	739	45467
19	1988-89	32040	17815	49855	45699	4200	49899
20	1989-90	34087	19490	53577	48690	3971	52661
21	1990-91	33021	20699	53720	48562	6012	54574
22	1991-92	30346	23994	54340	48349	6509	54858
23	1992-93	26950	29247	56197	50359	7564	57923
24	1993-94	27026	30822	57848	51084	8042	59126
25	1994-95	32239	27349	59588	52927	10697	63624
26	1995-96	35167**R**	27342	62509**R**	55081	16900	71981
27	1996-97	32900	33906	66806	59005	17103	76108
28	1997-98	33858	34493**R**	68351**R**	61308	20589**R**	81897**R**
29	1998-99	32722**R**	39808	72530**R**	64544	23052**R**	87596**R**
30	1999-00	31949	57805**R**	89754**R**	79411	15862**R**	95273**R**
31	2000-01	32426	74097**R**	106523**R**	95614	902**R**	96516**R**
32	2001-2002(P)	32032	78706	110738	100004	-3504*	96500

Source : Ministry of Petroleum & Natural Gas.

P : Provisional **R** : Revised ***** Relates to exports

TABLE 4.2.18 : GROSS AND NET PRODUCTION & UTILISATION OF NATURAL GAS IN INDIA.

(Million cubic metre)

Sl. No.	Year	Gross Production	Re-injected	Flared	Net Production	Utilisation
1	2	3	4	5	6	7
1	1970-71	1445	36	762	647	647
2	1971-72	1535	49	768	718	718
3	1972-73	1565	141	653	771	771
4	1973-74	1713	115	836	762	762
5	1974-75	2041	139	951	951	951
6	1975-76	2368	162	1082	1124	1124
7	1976-77	2428	190	857	1381	1381
8	1977-78	2839	184	1191	1464	1464
9	1978-79	2812	148	953	1711	1711
10	1979-80	2767	127	964	1676	1676
11	1980-81	2358	67	769	1522	1522
12	1981-82	3851	110	1519	2222	2222
13	1982-83	4936	91	1888	2957	2957
14	1983-84	5961	45	2517	3399	3399
15	1984-85	7241	48	3052	4141	4141
16	1985-86	8134	66	3118	4950	4950
17	1986-87	9853	63	2718	7072	7072
18	1987-88	11467	54	3445	7968	7968
19	1988-89	13217	84	3883	9250	9250
20	1989-90	16988	96	5720	11172	11172
21	1990-91	17998	102	5130	12766	12766
22	1991-92	18645	132	4072	14441	14441
23	1992-93	18060	90	1854	16116	16116
24	1993-94	18335	71	1924	16340	16340
25	1994-95	19381	23	2020	17338	17338
26	1995-96	22639	17	1437	21202	21202
27	1996-97	23255**R**	-	1760	21495	21495
28	1997-98	26401	-	1879	24522	24522
29	1998-99	27428	-	1712	25716	25716
30	1999-00 **R**	28446	-	1560	26886	26886
31	2000-01 **P**	29477	-	1617**R**	27860**R**	27860**R**
32	2001-02 **P**	29714	-	1677	28037	28037

Source : Ministry of Petroleum & Natural Gas.

P : Provisional

R : Revised

TABLE 4.2.19 : INDUSTRY-WISE OFF-TAKE OF NATURAL GAS IN INDIA.

(Million Cubic Metre)

Sl No.	Year	Energy Purposes				Non-Energy Purposes		
		Power Generatio	Industrial Fuel	Tea Plantation	Others*	Fertilizer Industry	Others @	Total
1	2	3	4	5	6	7	8	9
1	1970-71	261	116	15	68	187	-	647
2	1971-72	313	129	19	61	196	-	718
3	1972-73	339	148	20	63	201	-	771
4	1973-74	323	157	22	81	179	-	762
5	1974-75	354	164	29	86	318	-	951
6	1975-76	366	143	33	117	463	2	1124
7	1976-77	344	155	38	157	663	24	1381
8	1977-78	372	165	39	184	673	31	1464
9	1978-79	560	175	43	189	721	23	1711
10	1979-80	514	156	39	187	755	25	1676
11	1980-81	492	163	45	190	611	21	1522
12	1981-82	612	166	47	379	991	27	2222
13	1982-83	1025	185	51	513	1155	28	2957
14	1983-84	1209	230	56	588	1283	33	3399
15	1984-85	1454	250	62	739	1603	33	4141
16	1985-86	1299	223	78	816	2500	34	4950
17	1986-87	2041	257	93	1320	3335	26	7072
18	1987-88	2721	281	99	1347	3490	30	7968
19	1988-89	1823	526	87	1371	5334	109	9250
20	1989-90	2140	695	78	1567	6578	114	11172
21	1990-91	3634	827	89	1825	5612	779	12766
22	1991-92	4774	766	108	2237	5509	1047	14441
23	1992-93	4967	1450	105	2103	6672	819	16116
24	1993-94	4785	1794	121	2466	6499	675	16340
25	1994-95	5229	1927	134	2420	6936	693	17339
26	1995-96 $	6836	2301	111	767	7602	474	18091
27	1996-97 $	6935	2631	130	802	7625	509	18632
28	1997-98 $	8114	3106	117	775	8752	649	21513
29	1998-99 $	8714	3005	147	1104	8869	650	22489
30	1999-2000	8829	2329	140	5126	8592	1869	26885
31	2000-2001	8801	2870	151	5377	8480	2181	27860
32	2001-2002 **P**	9215	2979	147	5894	7957	1846	28038

Source : Ministry of Petroleum & Natural Gas.

P **:** Provisional @ : Includes petro-chemicals.

***** : Includes domestic fuel, captive use & LPG shrinkage.

$: Excludes off-takes of Natural Gas by ONGC.

TABLE 4.2.20 : BIOMASS ENERGY IN INDUSTRY IN SELECTED ASIAN COUNTRIES

Sl. No.	Country	Year	Total Industrial Energy Use[a]	Wood Fuel		All Biomass	
				Energy[a]	Share[b]	Energy[a]	Share[b]
1	2	3	4	5	6	7	8
1	Bangladesh	1994	178000	28500	15.9	114900	64.2
2	Cambodia	1995	533	383	71.9	383	71.5
3	India	1996	4656003	375000	8.1	1094878	23.5
4	Malaysia	1993	1297	293	22.6	293	22.6
5	Nepal	1997	15951	3684	23.1	3935	24.7
6	Pakistan	1994	422280	N. A.	N. A.	92318	21.9
7	Sri Lanka	1996	51163	21773	42.6	26826	52.4
8	Philippines	1995	279211	38220	13.7	77533	27.8
9	Thailand	1997	700367	42789	6.1	194853	27.8
10	Vietnam	1995	219427	43500	19.8	87250	39.8

Source : TERI Energy Data Directory and Yearbook, 2001-2002

a : Energy measured in Terra joules ; **b** : Percentage of total industrial energy consumption

TABLE 4.2.21 : BIOMASS POWER POTENTIAL

(MW)

Sl. No.	States	Potential
1	Andhra Pradesh	200
2	Gujrat	200
3	Karnataka	300
4	Mahrashtra	1000
5	Punjab	150
6	Uttar Pradesh	1000
7	Others	300
Total		**3500**

Source : TERI Energy Data Directory and Yearbook, 2002-2003

TABLE 4.2.22 : THE STATUS OF BIOMASS PROJECTS AS ON 31 DEC. 2002

Sl. No.	Project Status	Biomass Power		Cogeneration		Total	
		MW	Nos	MW	Nos	MW	Nos
1	2	3	4	5	6	7	8
1	Commissioned	164	34	304	43	468	77
2	Under implementation	218	36	312	31	530	67

Source : TERI Energy Data Directory and Yearbook, 2002-2003

TABLE 4.2.23 : STATEWISE AND YEARWISE COMPOSITION OF COMMISSIONED BIOMASS POWER PROJECTS

(MW)

Sl. No.	State	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
1	2	3	4	5	6	7	8	9	10	11
1	Andhra Pradesh	-	-	-	1.0	-	10.0	1.0	24.2	35.4
2	Gujarat	-	-	-	-	-	0.5	-	-	-
3	Haryana	-	-	-	-	-	-	-	-	-
4	Karnataka	-	-	-	1.0	-	10.0	26.0	24.6	99.4
5	Madhya Pradesh	-	-	-	-	-	5.0	-	-	-
6	Maharashtra	-	1.5	4.5	1.5	-	-	-	-	21.0
7	Punjab	10.0	-	-	-	-	-	-	2.0	12.0
8	Tamil Nadu	3.0	-	19.0	25.5	33.5	10.0	-	-	89.5
9	Uttar Pradesh	-	4.0	6.5	-	8.0	8.0	24.0	-	46.5
Total		**13.0**	**5.5**	**30.0**	**29.0**	**41.5**	**43.5**	**51.0**	**50.8**	**308.7**

Source : TERI Energy Data Directory and Yearbook, 2002-2003

TABLE 4.2.24 : INSTALLATION OF SOLAR PHOTOVOLTAIC SYSTEM IN DIFFERENT STATES/UT's AS ON 31st DECEMBER 1996

Sl. No.	State / UT's	Lighting			Power Plants $(kW)_p$	Water Pumps
		Solar lantern	Home Lighting System	Street Lighting System		
1	2	3	4	5	6	7
	States					
1	Andhra Pradesh	5963	730	2932	18	345
2	Arunachal Pradesh	1518	52	720	8	-
3	Assam	175	700	98	1	45
4	Bihar	5800	6	619	0	86
5	Gujarat	3663	370	1564	14	16
6	Goa	-	31	38	2	14
7	Haryana	5018	6	577	24	16
8	Himachal Pradesh	6000	934	304	-	1
9	Jammu & Kashmir	2625	1051	889	-	15
10	Karnataka	300	-	441	-	93
11	Kerala	9810	965	513	5	240
12	Madhya Pradesh	1348	100	5427	9	11
13	Maharashtra	3792	72	2941	6	102
14	Manipur	767	-	351	5	1
15	Meghalaya	2055	230	588	31	-
16	Mizoram	-	-	-	-	-
17	Nagaland	-	8	271	6	-
18	Orissa	1846	252	2036	34	1
19	Punjab	682	-	60	2	77
20	Rajasthan	722	-	5545	114	121
21	Sikkim	196	31	93	-	-
22	Tamil Nadu	889	50	1940	26	424
23	Tripura	-	-	-	-	-
24	Uttar Pradesh	28250	35585	470	419	62
25	West Bengal	2102	1282	952	42	42
	UTs					
1	Andaman and Nicobar Islan	234	390	315	129	5
2	Chandigarh	-	-	-	-	7
3	Dadra and Nagar Haveli	-	-	-	-	1
4	Daman and Diu	-	-	-	-	-
5	Delhi	4508	-	371	5	33
6	Lakshadweep	442	-	514	25	-
7	Pondicherry	215	-	-	-	14
	Misc.(through agencies)	-	-	-	-	-
Total		**88920**	**42845**	**30569**	**925**	**1772**

Source : TERI Energy Data Directory and Yearbook, 2001-2002

TABLE 4.2.25 : WIND POWER INSTALLED CAPACITY AS ON 31-12-2002

(MW)

Sl. No.	State	Demonstration Projects	Private Projects	Total Capacity
1	2	3	4	5
1	Andhra Pradesh	5.4	87.2	92.6
2	Gujarat	17.3	149.6	166.9
3	Karnataka	2.6	93.6	96.2
4	Kerala	2.0	-	2.0
5	Madhya Pradesh	0.6	22.0	22.6
6	Maharashtra	6.4	392.8	399.2
7	Rajasthan	6.4	18.7	25.1
8	Tamil Nadu	19.4	875.6	895.0
9	West Bengal	1.0	-	1.1
10	Others	1.6	-	1.6
Total		**62.7**	**1639.5**	**1702.3**

Source : TERI Energy Data Directory and Yearbook, 2002-2003

TABLE 4.2.26 : ALL INDIA POTENTIAL AVAILABILITY OF AGRICULTURE BASED BIOMASS

(Million tons)

Sl. No.	Biomass	1980-81	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96
1	2	3	4	5	6	7	8	9
1	Rice husk	26.8	37.1	37.3	36.5	40.2	40.9	39.8
2	Wheat straw	48.4	73.5	74.3	76.3	79.6	87.5	83.3
3	Maize cobs	2.1	2.7	2.4	3	2.9	2.7	2.8
4	Pearl millet straw	8.9	11.4	7.8	14.8	8.3	12	9
5	Sugarcane bagasse	51.4	80.4	84.7	76	75.8	90.9	93.4
6	Coconut shell	0.8	1.3	1.4	1.5	1.6	1.8	1.9
7	Coconut fibre	0.9	1.6	1.7	1.9	2	2.2	2.3
8	Coconut pith	1.4	2.4	2.5	2.8	2.9	3.3	3.4
9	Groundnut shell	1.7	2.5	2.4	2.9	2.6	2.7	2.6
10	Cotton stalks	23.5	22.3	23	22.6	22	23.7	27.3
11	Jute sticks	3.9	3.1	3.3	2.8	2.7	2.7	2.7

Source : TERI Energy Data Directory Yearbook, 2001-2002

TABLE 4.2.27 : AVERAGE ANNUAL CONSUMPTION OF FUELS BEFORE AND AFTER ADOPTION OF AN IMPROVED CHULLAH

Sl. No.	Fuel	Annual Consumption		Quantity of Fuel Saved per Year
		Before Adoption	After Adoption	
1	2	3	4	5
1	Dung cake (kg)	860	609	251
2	Fire Wood (kg)	633	530	103
3	Twigs (kg)	543	530	13
4	Crops Wastes (kg)	276	271	5
5	Kerosene Oil (Ltr.)	8	5	3

Source : TERI Energy Data Directory Yearbook, 2001-2002

TABLE 4.2.28 : NATIONAL PROGRAMME ON IMPROVED CHULLAHS

(Number)

Sl. No.	State / UT / Agency	Annual Target		Achievements (April - December 2001)	
		No. of Villages	No. of Chulhas	Target	Achievement
1	2	3	4	5	6
	States				
1	Andhra Pradesh	800	175000	87500	34824
2	Assam	300	12500	6250	32
3	Bihar	80	6000	3000	2178
4	Chhattisgarh	150	15000	7500	-
5	Gujarat	490	105000	52500	48926
6	Goa	20	4000	2000	1510
7	Haryana	300	60000	30000	28482
8	Himachal Pradesh	6	1000	500	510
9	Jammu & Kashmir	100	30000	15000	-
10	Jharkhand	100	16000	8000	-
11	Karnataka	300	60000	30000	32179
12	Kerala	200	40000	20000	20443
13	Madhya Pradesh	10	1500	750	-
14	Maharashtra	540	86000	43000	16071
15	Manipur	100	5000	2500	1231
16	Meghalaya	100	5000	2500	-
17	Mizoram	150	5000	2500	-
18	Nagaland	150	5000	2500	1660
19	Orissa	700	200000	100000	138636
20	Punjab	250	35000	17500	-
21	Rajasthan	150	30000	15000	6234
22	Sikkim	100	5000	2500	4096
23	Tamil Nadu	300	60000	30000	45312
24	Tripura	200	18000	9000	4157
25	Uttranchal	40	2000	1000	154
26	Uttar Pradesh	800	150000	75000	52384
27	West Bengal	1300	325000	162500	191086
	Union Territories				
1	Andaman and Nicobar Islands	8	1200	600	841
2	Dadar and Nagar Haveli	5	500	250	-
3	Delhi	12	2000	1000	-
4	Lakshadweep	2	300	150	-
5	Pondicherry	15	4000	2000	1435
	Agency				
1	KVIC	1970	260000	130000	65517
2	AIWC	220	25000	12500	2448
3	Biotech	50	5000	2500	-
Total		**10018**	**1755000**	**877500**	**700346**

Source : TERI Energy Data Directory Yearbook, 2002-2003

KVIC : Khadi and Village Industries Commission AIWC : All India Women's Conference

TABLE 4.2.29 : DISTRIBUTION OF FAMILY -TYPE BIOGAS PLANTS (NUMBER OF INSTALLATIONS)

Sl. No.	State/UT	Total Estimated Potential	Cumulative Achievement as on 31-12-96 #	Cumulative Achievement 2001-02	Achievement 2002 (April-December)
1	2	3	4	5	6
	State				
1	Andhra Pradesh	1065600	172410	334054	8023
2	Arunachal Pradesh	7500	139	1514	49
3	Assam	307700	12629	51269	--
4	Bihar	939900	74499	121913	12
5	Chhattisgarh	--		3047	2215
6	Goa	8000	2212	3355	32
7	Gujarat	554000	237513	351745	3501
8	Haryana	300000	28896	44160	1095
9	Himachal Pradesh	125600	34871	43933	190
10	Jammu & Kashmir	128500	1068	1965	--
11	Jharkhand	--		400	--
12	Karnataka	680000	135428	340270	8986
13	Kerala	150500	37374	79532	618
14	Madhya Pradesh	1491200	86461	204100	3347
15	Maharashtra	897000	535279	675177	3539
16	Manipur	38700	1038	1956	16
17	Meghalaya	24000	329	2309	--
18	Mizoram	3000	1178	2818	53
19	Nagaland	6700	401	1667	75
20	Orissa	605000	106156	185690	4285
21	Punjab	411600	31235	68745	1877
22	Rajasthan	915300	55304	66552	162
23	Sikkim	7300	1622	3475	255
24	Tamil Nadu	615800	169605	201295	1210
25	Tripura	28500	3576	1719	16
26	Uttaranchal	--		1547	288
27	Uttar Pradesh	2021000	241396	370219	4600
28	West Bengal	695000	76713	203679	7983
	Union Territory				
1	Andaman and Nicobar Islands	2200	117	137	--
2	Chandigarh	1400	87	97	--
3	Dadra and Nagar Haveli	2000	157	169	--
4	Daman and Diu	100	1	--	--
5	Delhi	12900	624	676	--
6	Pondicherry	4300	517	573	
7	Others	--	104094	--	
	Agencies				
1	KVIC	--	--	--	11649
2	AIWC	--	--	--	--
3	SDA, Kanjirapally	--	--	--	5810
4	Biotech	--	--	--	525
Total		12050300	**2152929**	**3369757**	**70411**

Source : TERI Energy Data Directory Yearbook, 2001-2002 & 2002-03

: These figures are lower estimates of the actual installations.

KVIC : Khadi and Village Industries Commission **AIWC** : All India Women's Conference

SDA : Sustainable Development Agency

ABLE 4.3.1 : NUMBER OF REGISTERED FACTORIES BY MANUFACTURING INDUSTRIE

Sl. No.	Year	Manufacturing	Electricity, Gas & Water	Repair Services & Cold Storage	All Activities
1	2	3	4	5	6
1	1987-88	98379	458	3759	102596
2	1988-89	99724	481	3872	104077
3	1989-90	103373	493	4126	107992
4	1990-91	105511	518	4150	110179
5	1991-92	107454	505	4327	112286
6	1992-93	113890	961	4643	119494
7	1993-94	116227	542	4825	121594
8	1994-95	117564	554	4892	123010
9	1995-96	125281	4013	5277	134571
10	1996-97	125166	4160	5230	134556
11	1997-98	126272	3856	5423	135551
12	1998-99 *	130222	143	1341	131706
13	1999-2000 *	130035	158	1365	131558

Source : Central Statistical Organisation

* : From 1998-99, all electricity undertakings other than Captive Units have been kept outside the purview of ASI

TABLE 4.3.2 : SUMMARY STATUS OF POLLUTION CONTROL IN 17 CATEGORIES OF INDUSTRIES

(As on 30-09-2002)

Sl. No.	Category	Total No. of Units	Status (No of Units)		
			Closed	C #	Defaulter ##
1	2	3	4	5	6
1	Aluminium	7	1	6	0
2	Caustic Soda	25	0	25	0
3	Cement	116	8	108	0
4	Copper	2	0	2	0
5	Distillery	177	33	142	2
6	Dyes & Dying Industries	64	8	56	0
7	Fertilizer	110	12	97	1
8	Iron and Steel	8	0	4	4
9	Leather	70	11	59	0
10	Pesticide	71	7	64	0
11	Petrochemicals	49	0	49	0
12	Pharmaceuticals	251	26	225	0
13	Pulp & Paper	96	20	76	0
14	Refinery	12	0	12	0
15	Sugar	392	49	342	1
16	TPP	97	3	80	14
17	Zinc	4	0	4	0
Total		**1551**	**178**	**1351**	**22**

Source: Ministry of Environment & Forests, Annual Report 2002-2003

: Having adequate facilities to comply with the standards

: Not having adequate facilities to comply with the standards

Air-borne emissions emitted from various industries are a cause of major concern. These emissions are of two forms, viz., solid particles (SPM) and gaseous emission (SO_2, NOx, CO etc.). Liquid effluents, generated from various industries, containing organic and toxic pollutants are also a cause for severe concern. Heavily polluting industries were identified which are included under the 17 categories of highly polluting industries for the purpose of monitoring and regulating pollution from them.

There are 1551 industries in the country falling under the 17 categories of highly polluting industries. Thermal power and fertilizer industries are defaulting in meeting air pollution standards; sugar and pulp & paper industries are the major defaulters in complying with the norms for liquid effluents.

ABLE 4.3.3: STATE-WISE SUMMARY STATUS OF THE POLLUTION CONTRO IN 17 CATEGORIES OF INDUSTRIES

(As on 31.12.2002)

Sl. No.	State/UT	Total No. of Units	Status (No. of Units)		
			Closed	C#	Defaulters ##
1	2	3	4	5	6
1	Andhra Pradesh	173	29	144	0
2	Arunachal Pradesh	0	0	0	0
3	Assam	15	3	11	1
4	Bihar	44	19	25	0
5	Chattisgarh	16	1	14	1
6	Goa	16	0	6	0
7	Gujarat	177	7	170	0
8	Haryana	43	6	37	0
9	Himachal Pradesh	9	0	9	0
10	Jammu & Kashmir	8	3	5	0
11	Jharkhand	18	3	13	2
12	Karnataka	85	9	76	0
13	Kerala	28	6	22	0
14	Madhya Pradesh	62	11	48	3
15	Maharashtra	335	24	306	5
16	Manipur	0	0	0	0
17	Meghalaya	1	0	1	0
18	Mizoram	0	0	0	0
19	Nagaland	0	0	0	0
20	Orissa	23	3	16	4
21	Punjab	45	6	39	0
22	Raj as than	49	6	43	0
23	Sikkim	1	0	1	0
24	Tamil Nadu	119	2	117	0
25	Tripura	0	0	0	0
26	UT-Andaman & Nicobar	0	0	0	0
27	UT-Chandigarh	1	0	1	0
28	UT-Daman & Diu, Dadra & Nagar Haveli	0	0	0	0
29	UT-Delhi	5	1	4	0
30	UT-Lakshadweep	0	0	0	0
31	UT-Pondicherry	6	1	5	0
32	Uttaranchal	17	0	17	0
33	Uttar Pradesh	207	21	183	3
34	West Bengal	58	17	38	3
Total		**1551**	**178**	**1351**	**22**

Source : Ministry of Environment & Forests, Annual Report 2002-2003
: Having adequate facilities to comply with the standards
: Not having adequate facilities to comply with the standards

CHART 8 : SUMMARY STATUS OF POLLUTION CONTROL IN 17 HIGHLY POLLUTED INDUSTRIES

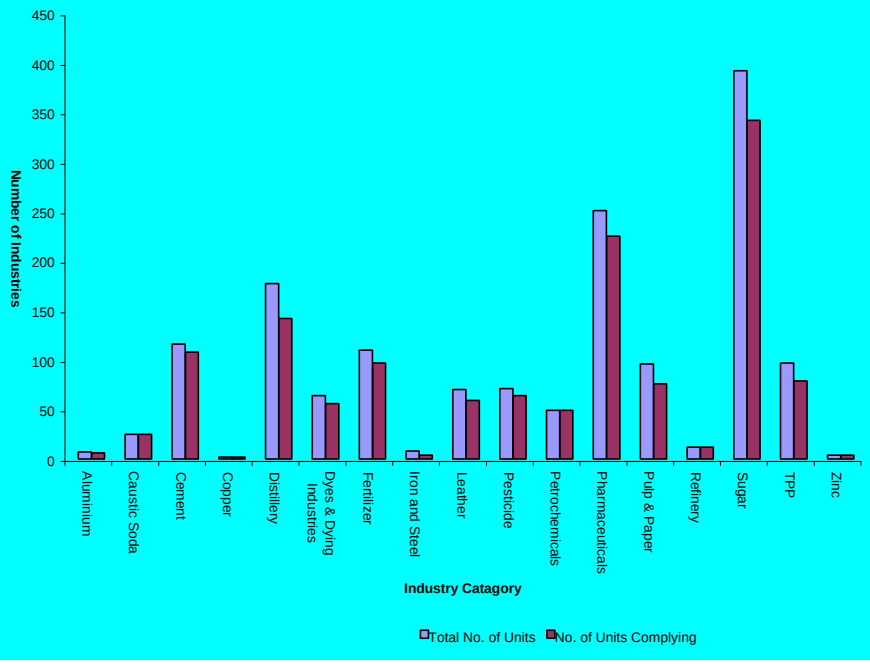

TABLE 4.3.4 : SUMMARY STATUS OF POLLUTION CONTROL IN GROSSLY POLLUTING INDUSTRIES DISCHARGING THEIR EFFLUENTS INTO RIVERS AND LAKES

(As on 30.09.2002)

Sl. No.	Name of the State/UT	No. of Defaulters as on August 1997	No. of Industries Closed	No. of industries Which Have Provided Requisite Treatment/Disposal Facilities after Issuance of Directions	No. of Defaulters
1	2	3	4	5	6
1	Andhra Pradesh	60	42	18	0
2	Arunachal Pradesh	0	0	0	0
3	Assam	7	1	6	0
4	Bihar	14	10	4	0
5	Delhi*	0	0	0	0
6	Goa	0	0	0	0
7	Gujarat	17	14	3	0
8	Haryana	21	12	9	0
9	Himachal Pradesh	0	0	0	0
10	Jammu & Kashmir	0	0	0	0
11	Karnataka	20	18	2	0
12	Kerala	36	32	4	0
13	Madhya Pradesh	2	0	1	1
14	Maharashtra	6	3	3	0
15	Manipur	0	0	0	0
16	Meghalaya	0	0	0	0
17	Mizoram	0	0	0	0
18	Nagaland	0	0	0	0
19	Orissa	9	4	3	2
20	Pondicherry	4	0	4	0
21	Punjab	18	16	1	1
22	Rajasthan	0	0	0	0
23	Sikkim	0	0	0	0
24	Tamil Nadu	366	248	118	0
25	Tripura	0	0	0	0
26	UT- Andaman & Nicobar	0	0	0	0
27	UT-Chandigarh	0	0	0	0
28	UT-Daman & Diu, Dadra & Nagar Haveli	0	0	0	0
29	UT-Lakshadweep	0	0	0	0
30	Uttar Pradesh	241	181	59	1
31	West Bengal	30	23	7	0
Total		**851**	**608**	**238**	**5**

Source : Ministry of Environment & Forests, Annual Report 2002-2003

* : Covered under the separate Plan involving shifting/relocation of the units as per the orders of Honourable Supreme Court.

BLE 4.3.5 : MAXIMUM PERMISSIBLE LIMITS FOR INDUSTRIAL EFFLUENT DISCHARG

(Mg/Litre)

Sl. No.	Parameter	Into Inland Surface Waters Indian Standards 2490 (1974)	Into Public Sewers Indian Standards: 3306 (1974)	Onland for Irrigation Indian Standards: 3307 (1974)
1	2	3	4	5
1	pH	5.9-9	5.5-9.0	5.5-9.0
2	Biological oxygen demand (for 5 days at 20^{o}C)	30	350	100
3	Chemical oxygen demand	250	-	-
4	Suspended solids	100	600	200
5	Total dissolved solids (inorganic)	2100	2100	2100
6	Temperature (^{o}C)	40	45	-
7	Oil and grease	10	20	10
8	Phenolic Compounds	1	5	-
9	Cyanides	0.2	2	0.2
10	Sulphides	2	-	-
11	Fluorides	2	15	-
12	Total residual chlorine	1	-	-
13	Pestisides	-	-	-
14	Arsenic	0.2	0.2	0.2
15	Cadmium	2	1	-
16	Chromium (hexavalent)	0.1	2	-
17	copper	3	3	-
18	Lead	0.1	1	-
19	Mercury	0.01	0.01	-
20	Nickel	3	3	-
21	Selenium	0.05	0.05	-
22	Zinc	5	15	-
23	Chlorides	1000	1000	600
24	Boron	2	2	2
25	Sulphates	1000	1000	1000
26	Sodium (%)	-	60	60
27	Ammoniacal nitrogen	50	50	-
28	Radioactive materials			
29	Alpha emitters (milli curie/millilitre)	10^{-7}	10^{-7}	10^{-8}
30	Beta emitters (µ curie/millilitre)	10^{-6}	10^{-6}	10^{-7}

Source : TERI Energy Data Directory and Yearbook, 2002-2003

TABLE 4.3.6 : EFFLUENT STANDARDS FOR SUGAR INDUSTRY

Sl. No.	Parameter	Permissible Limits (Mg/Litres)	
		Disposal on Land	Disposal in Surface Water
1	2	3	4
1	Biological Oxygen Demand (5 days at 20^0C)	100	30
2	Suspended Solids	100	30

Source : TERI Energy Data Directory and Yearbook, 2002-2003

TABLE 4.3.7 : EFFLUENT STANDARDS FOR LARGE PULP AND PAPER INDUSTRIES

Capacity (Tonnes a year)	Parameter	Permissible Limits
1	2	3
Above 24,000	pH	7.0-8.5
	Biological Oxygen Demand at 20^0C	30 mg/litre
	Chemical Oxygen Demand	350 mg/litre
	Suspended solids	50 mg/litre
	Total organic chloride	2.0 kg/tonne of paper produced
	Flow (total waste water discharge)	--
	Large pulp and paper[a]	200 m^3/tonne of paper produced
	Large rayon grade newsprint	150 m^3/tonne of paper produced

Source : TERI Energy Data Directory and Yearbook, 2002-2003

a : the standards with respect to total waste water discharge for large pulp and paper mills established from 1992 will meet the standards of 100 m^3/tonne of paper produced

TABLE 4.3.8 : EFFLUENT STANDARDS FOR OIL REFINERIES

(Mg/Litre)

Sl. No.	Parameter	Permissible Limit	Quantum (Kg/Thousand Tonnes of Crude Processed)
1	2	3	4
1	Oil and grease	10.0	7.00
2	Phenol	1.0	0.70
3	Sulphide	0.5	0.35
4	Biological Oxygen Demand (5 days at 20^0C)	15.0	10.50
5	Suspended Solids	20.0	14.00
6	pH	--	6.00-8.50

Source : TERI Energy Data Directory and Yearbook, 2002-2003

TABLE 4.3.9 : EFFLUENT STANDARDS FOR ALUMINIUM INDUSTRY

Sl. No.	Plant	Parameters	Permissible Limits
1	2	3	4
1	**Alumina Plant**		
	Raw material handling	Primary and secondary crusher particulate matter	150 mg/m^3
	Precipitation area : calcination	Particulate matter	250 mg/m^3
		Carbon Mono-oxide	1 % maximum
		Stack Height[a]	
2	**Smelter plant**		
	Green anode shop	Particulate matter	150 mg/m^3
	Anode bake oven	Particulate matter	150 mg/m^3
		Total fluoride	0.3kg/tonne at Al
3	**Potroom**	Particulate matter	150 mg/m^3
		Total fluoride	
		Vertical stud soderberg	4.7 kg/tonne of Al produced
		Horizontal stud soderberg	6.0 kg/tonne of Al produced
		Prebacked side worked	2.5 kg/tonne of Al produced
		Prebacked centre worked	1.0 kg/tonne of Al produced
		Stack Height[a]	

Source : TERI Energy Data Directory and Yearbook, 2002-2003

a $H = 14\ Q^{0.3}$, where Q is the emission rate of sulphur dioxide in Kg/h and H is the stack height in meters.

TABLE 4.3.10 : EFFLUENT STANDARDS FOR PETRO-CHEMICAL (BASIC & INTERMEDIATES) INDUSTRY

(Mg/Litre)

Sl. No.	Parameter	Permissible Limit
1	2	3
1	pH	6.5-8.5
2	Biological Oxygen Demand (5 days at 20^0C)[a]	50.0
3	Phenol[b]	5.0
4	Sulphide (as S)	2.0
5	Chemical Oxygen Demand	250.0
6	Cyanide (as CN)	0.2
7	Fluoride (as F)[c]	15.0
8	Total Suspended Solids	1000.0
9	Hexavalent Chromium	0.1
10	Total Chromium (as Cr)[d]	2.0

Source : TERI Energy Data Directory and Yearbook, 2002-2003

a : The state board may prescribe the biological oxygen demand value of 30 mg/l if the recepient system so demands.

b : The limit for phenol shall be confirmed at the outlet of effluent treatment of phenol plant. However, at the final disposal point, the limit shall be less than 1 mg/l

c : The limit for fluoride shall be confirmed at the outlet of the chrome removal unit. However, at the disposal point, fluoride concentration shall be lower than 5 mg/l

d : The limits for total and hexavalent chromium shall be confirmed at the outlet of the chromate removal. This implies that in the final treated effluent total, and hexavalent chromium shall be lower than prescribed herein

TABLE 4.4.1 : CONTRIBUTION OF GREEN HOUSE GASES TO ATMOSPHERE

Sl. No.	Green Houses Gases	Contribution to atmosphere (%)
1	2	3
1	Carbondioxide	55
2	Methane	15
3	CFCs 11 & 12	17
4	Nitrousoxide	6
5	Others	7

Source : Central Pollution Control Board

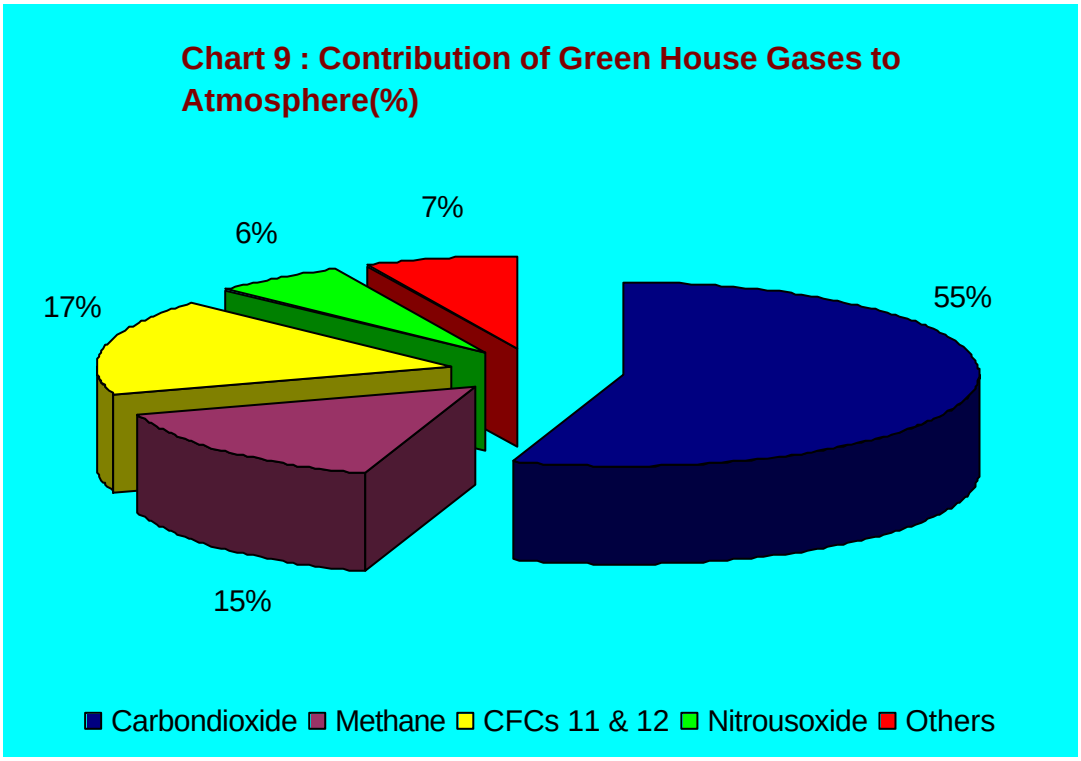

TABLE 4.4.2 : A SUMMARY OF KEY GREENHOUSE GASES

Sl. No.		CO_2	CH_4	N_2O	CFC-12	HCFC-22 (A CFC Substitute)	CF_4 (A Perfluoro-Carbon)
1	2	3	4	5	6	7	8
1	Pre-industrial concentration	280 ppmv	700 ppbv	275 ppbv	zero	zero	zero
2	Concentration in 1992	355 ppmv	1714 ppbv	311 ppbv	503 pptv	105 pptv	70 pptv
3	Concentration in 1994	358 ppmv	1720 ppbv	312 ppbv	268 pptv	110 pptv	72 pptv
4	Concentration in 1997$	366.7 ppmv	1800 ppbv	312 ppbv	264 pptv	126 pptv	
5	Concentration Change per year $	1.8 ppmv/yr	13.8 ppbv/yr	0.6 ppbv/yr	-0.6 pptv/yr	5.1 pptv/yr	1.2 pptv/yr
6	Rate of Concentration change per year$	0.5%	0.8%	0.2%	-0.2%	5%	2%
7	Atmospheric lifetime (years)	(50-200)*	12#	120	50	12	50000
8	Global warming potential (100 year time horizon)$	1	21	310	4000	1700	6500

Source : TEDDY 1999/2000, The Energy Reseach Institute

* No single lifetime for CO_2 can be defined because of the different rates of uptake by different sink processes

This has been defined as an adjustment time which takes into account the indirect effect of methane on its own lifetime

$ Compiled by TERI based on data from Carbon-di-Oxide Information Analysis Centre(website : http://cdiac.esd.ornl.gov), values of Concentration in 1997 are from the advanced global atmospheric gases experiment, Mace Head Ireland Monitoting site.

Global warming can have major physical, environmental and socio-economic consequences, which can be both positive and negative. The estimation of these impacts are complex and marked with uncertainties.

Climate change would cause changes in precipitation patterns, ocean circulation and marine systems, soil moisture, water availability, and sea-level rise. These would make an impact on agriculture, forestry and natural eco-systems like wet-lands and fisheries. Also with rising temperatures, and subsequent increasing heat stress and alteration in patterns of vector-borne diseases, the global population would be more vulnerable to health problems, causing disruptions in settlement patterns and large-scale migration. All these would have significant socio-economic consequences.

TABLE 4.4.3 : OZONE DEPLETION POTENTIAL(ODP), GLOBAL WARMING POTENTIAL (GWP) & ATMOSPHERE LIFETIME OF THE COMMON CHLORO-FLORO-CARBON(CFC)

Sl. No.	CFC/HCFC	ODP	GWP	Atmospheric Lifetime (Years)
1	2	3	4	5
1	CFC-11	1.00	1.00	65.0
2	CFC-12	1.00	2.80-3.40	120.0
3	CFC-13	1.00	2.40	400.0
4	HCFC-22	0.05	0.35	20.0
5	CFC-113	0.80	1.40	90.0
6	CFC-114	1.00	3.90	180.0
7	CFC-115	0.60	7.50	380.0
8	CFC-502	0.19	0.50-1.50	--
9	HFC-152A	0.00	<0.10	2.0
10	HCFC-142B	< 0.05	<0.20	2.1
11	HFC-134A	0.00	0.26	8.0

Source : The State of Environment 1995, Ministry of Environment and Forests

The green-house effect plays a crucial role in regulating the heat balance of the earth. It allows the incoming short-wave solar radiation to pass through the atmosphere relatively unimpeded ; but the long wave terrestrial radiation emitted by the earth's surface is partially absorbed and then re-emitted by a number of trace gases in the atmosphere. These gases, known as GHGs(Green House Gases) are: water vapour, carbon-di-oxide, Methane, Nitrous oxide and Ozone in the Troposphere (the lowest 10-15 Kms of the atmosphere) and in the Stratosphere. This natural green-house effect warms the lower temperature.

TABLE 4.4.4 : GLOBAL AVERAGE TEMPERATURE AND ATMOSPHERIC CONCENTRATIONS OF CO_2

Sl. No.	Year	Temperature (^{0}C)	Carbon Dioxide (Parts Per Million)	Emissions from Fossil Fuel Burning (Million Tonnes of Carbon)
1	2		3	4
1	1950	13.87	--	1612
2	1955	13.88	--	2013
3	1960	14.01	316.80	2535
4	1965	13.90	319.90	3087
5	1966	13.96	321.20	3222
6	1967	14.00	322.00	3334
7	1968	13.94	322.90	3501
8	1969	14.03	324.50	3715
9	1970	14.02	325.50	3997
10	1971	13.89	326.20	4143
11	1972	14.00	327.30	4305
12	1973	14.13	329.50	4538
13	1974	13.89	330.10	4545
14	1975	13.94	331.00	4518
15	1976	13.86	332.00	4776
16	1977	14.11	333.70	4910
17	1978	14.02	335.30	4962
18	1979	14.10	336.70	5249
19	1980	14.16	338.50	5177
20	1981	14.21	339.80	5004
21	1982	14.06	341.00	4959
22	1983	14.25	342.60	4942
23	1984	14.07	344.20	5113
24	1985	14.03	345.70	5274
25	1986	14.12	347.00	5436
26	1987	14.27	348.70	5558
27	1988	14.29	351.30	5774
28	1989	14.18	352.70	5879
29	1990	14.36	354.00	5939
30	1991	14.31	355.50	6025
31	1992	14.14	356.40	5922
32	1993	14.15	357.00	5914
33	1994	14.25	358.90	6050
34	1995	14.37	360.90	6182
35	1996	14.23	362.60	6327
36	1997	14.39	363.80	6419
37	1998	14.54	366.60	6401
38	1999	14.30	368.30	6366
39	2000	14.30	369.40	6480
40	2001	14.43	370.90	6553

Source: TERI Energy Data Directory and Yearbook, 2002-03

TABLE 4.4.5 : LAND AREA AND POPULATION AFFECTED BY ONE METRE SEA LEVEL RISE

Sl. No.	State	% of State Area Inundated	% of State's Population Affected
1	2	3	4
1	Goa	4.84	7.25
2	Tamil Nadu	0.52	2.91
3	Orissa	0.81	1.76
4	West Bengal	1.88	2.35
5	Andhra Pradesh	0.19	0.93
6	Gujarat	0.92	1.07
7	Maharashtra	0.18	1.75
8	Andaman & Nicobar Island	0.72	N.A.
9	Karnataka	0.15	0.56
Total		**0.41**	**1.68**

Source : The State of the Environment 1995, Ministry of Environment and Forests.

The projected global warming is expected to increase global sea-level by expanding ocean water, melting mountain glaciers, and causing the ice sheets of Greenland and Antarctica to melt or slide into the oceans. A rise in sea-level would inundate wetlands and lowlands, erode shoreline, exacerbate coastal flooding, increase the salinity of estuaries and aquifers and impair water quality.

India has coastline of about 6000 Kms. Sea-level Rise (SLR) threatens sections of all the coastal states of the country. The region most vulnerable to accelerate SLR is the low-lying coral atolls of the Lakshadweep archipelago. The east coast of India, with a larger frequency of storms and lower continental slopes, is more vulnerable than the west coast to damages from storms surges. According to a study done by Jawaharlal Nehru University (1993), a total area of 5763 Sq. Kms. is expected to be directly affected by one meter SLR. The most vulnerable area of the coast to a 1 m SLR are Gujarat, Greater Mumbai, Southern Kerala and the deltas of river Cauveri (Tamil Nadu), Krishna and Godavari (Andhra Pradesh), Mahanadi(Orissa) and the Ganga (West Bengal). Islands of the Lakshadweep archipelago would be totally lost.

TABLE 4.5.1 : AMBIENT AIR QUALITY STANDARDS IN RESPECT OF NOISE

Sl. No.	Area	Limits in dB(A)L_{eq}*	
		Day Time	Night Time
1	2	3	4
1	Industrial Area	75	70
2	Commercial Area	65	55
3	Residential Area	55	45
4	Silence Zone	50	40

Source : Central Pollution Control Board

Notes :

1 Day Time -- 06.00 hour to 22.00 hour (16 hc
2 Night time --22.00 hour to 06.00 hour (08 hours)
3 Areas upto 100 metres around certain premises like hospitals, educational institutions and courts, religious places or any other area which is declared as silence zones by the competent authority.
4 Mixed categories of areas may be declared as one of four aforesaid categories by the competent Authority.

-- * dB (A) L_{eq} denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

-- A "decibel" is a unit in which noise is measured.

-- "A", in dB (A) L_{eq} denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

-- L_{eq} : It is an energy mean of the noise level over a specified period.

According to study on occupational hazards, even short exposures to intense noise can shift upward the hearing threshold while prolonged exposure or intermittent exposure over a long period produces a damaging effect on hearing resulting in a permanent threshold shift. Accordingly, the Central Pollution Control Board(CPCB) has prescribed norms for noise levels.

TABLE 4.5.2 : AVERAGE NOISE LEVELS IN VARIOUS METROPOLITAN CITIES

(dB[A])

Sl. No.	Metropolitan Cities	Day/ Night	Industrial Area	Commercial Area	Residential Area	Silence Area
1	2	3	4	5	6	7
1	Kolkata	Day	78	82	79	79
		Night	67	75	65	65
2	Mumbai	Day	76	75	70	66
		Night	65	66	62	52
3	Chennai	Day	71	78	66	63
		Night	66	71	48	49
4	Bangalore	Day	78	76	67	67
		Night	53	57	50	--

Source : TEDDY (TERI Energy Data Directory and Yearbook) 2002/03

The noise pollution has already reached at a high level in most of the metropolitan cities in all the residential, commercial, industrial and silence zones. The increasing noise pollution may be attributed to increase in no. of vehicles, urbanization and industrialization. The increase in noise levels may cause impaired hearing ability.

TABLE 4.5.3 : EFFECTS OF NOISE POLLUTION ON HUMAN HEALTH

A. Noise Hazards	
Stage : I Threat to Survival (a) Communication interference (b) Permanent hearing loss	**Stage : II** Causing Injury (a) Neural -humoral stress response (b) Temporary hearing loss (c) Permanent hearing loss
B. Noise Nuisances	
Stage III Curbing Efficient Performance (a) Mental Stress (b) Task Interference (c) Sleep Interference	**Stage IV** Diluting Comfort and Enjoyment (a) Invasion of Privacy (b) Disruption of Social Interaction (c) Hearing Loss

Source: Sound Pollution, During Festivals in West Bengal a growing menace
West Bengal Pollution Control Board