

MONOGRAPH 9/2010

**Feasibility of Incentive Based Environmental
Instruments in State and Central Taxation
Regimes**

D K Srivastava and C Bhujanga Rao



MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

December 2010

*Feasibility of Incentive Based Environmental
Instruments in State and Central Taxation Regimes*

**D.K.Srivastava
C.Bhujanga Rao**



**MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India**

December 2010

MONOGRAPH 9/2010

December 2010

Price: Rs.200

**MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India**

Phone: 2230 0304/ 2230 0307/2235 2157

Fax : 2235 4847 /2235 2155

Email : info@mse.ac.in

Website: www.mse.ac.in

Acknowledgement

We are thankful to the Ministry of Environment and Forests for entrusting this study to the Madras School of Economics. We have considerably benefited from discussions with Dr. R.J Chelliah and Professor U. Sankar at the Madras School of Economics and Dr. M. Govinda Rao and Dr. Kavita Rao at the National Institute of Public Finance and Policy, New Delhi. We also had occasion to consult the TERI library.

In the preparation of the manuscript we have been helped considerably by Ms Sudha and Ms Jothi at the Madras School of Economics.

This study was initiated by Dr. Paul Appasamy of Madras School of Economics and Dr. Rita Pandey of National Institute of Public Finance and Policy.

We are thankful to all of them for their help at various stages in the completion of this study.

**D.K.Srivastava
C.Bhujanga Rao**

CONTENTS

Executive Summary

Chapter 1	Introduction	1
Chapter 2	Incentive based Environmental Instruments: Theory and Practice	21
Chapter 3	Major Environmental/Ecological Problems of the States	39
Chapter 4	State Taxes Some Recent Reforms	67
Chapter 5	State and Local Level Eco-taxes for Pollution Abatement	83
Chapter 6	Central and State Taxes: A Coordinated Approach to Environmental Reforms	101
Chapter 7	Summary and Conclusions	125
References		145
Appendix Tables		155
Annexures		179

LIST OF TABLES

Table 1.1	World Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels, 1995-2005
Table 1.2	Carbon Dioxide Emissions and Gross Domestic Product Per Capita by Region, 2004
Table 1.3	Local, Regional, and Global Effects of Pollution
Table 1.4	Estimates of State Level CO ₂ Emissions of India
Table 1.5	Estimates of State Level Per Capita CO ₂ Emissions of India
Table 1.6	Source Wise Percentage Contribution of CO ₂ Estimation by States: 2000
Table 1.7	Descriptions of the Environmental Groups
Table 1.8	Ranks Obtained by States for Different Environment Quality Criteria: 1997-2001
Table 1.9	Growth Rates: 1993-94 to 2004-05
Table 1.10	Per Capita GSDP and Growth Rate of Per Capita GSDP
Table 1.11	Sectoral Shares in Gross State Domestic Product at Current Prices: 1993-94 to 2004-05
Table 3.1	State-wise Number of Vehicles: Major States: 2002-03
Table 3.2	State-wise Share in the Total Vehicles in the Country: 2002-03
Table 3.3	Category-wise Pollution Load of Vehicles: 2005
Table 3.4	Phased Tightening of Exhaust Emission Standards for Indian Automobiles
Table 3.5	Category-wise Ozone Potential of Vehicles under Different Scenarios -2010
Table 3.6	State-wise Information on Degraded Land of the Districts
Table 3.6	State-wise Information on Degraded Land of the Districts
Table 3.7	State-wise Consumption of Pesticides
Table 3.8	National Emission Standards for Pesticides Manufacturing Industries in India: 2004
Table 3.9	Rate of Water Cess
Table 3.10	Primary Water Quality Standards
Table 3.11	Programs implemented by the National River Conservation Directorate
Table 3.12	State-wise Water Quality Affected Habitations in India
Table 3.13	Number of Habitations Affected with Water Quality Problems
Table 3.14	Status of Wastewater Generation, Collection and Treatment in Class I Cities and Class II Towns
Table 3.15	Status of Pollution Control in 17 Categories of Highly Polluting Industries, India, 1995 and 2000
Table 3.16	Status of Defaulters under the Program of Industrial Pollution Control along the Rivers and Lakes, India, 1997 and 2000
Table 3.17	Wastewater Generation by SSIs in Selected Industrial Sectors
Table 3.18	Water Pollution Load Using Output Intensity
Table 3.19	Estimated Water Pollution Load (in tonnes) by Industry
Table 3.20	Water Pollution in Indian States
Table 3.20	Summary Status of Pollution Control in Grossly Polluting Industries Discharging their Effluents into Rivers and Lakes

Table 3.21	Summary Status of Pollution Control in Grossly Polluting Industries Discharging their Effluents into Rivers and Lakes
Table 3.22	Average Noise Levels in Various Metropolitan Cities
Table 4.1	Assignment of Taxes: Union and State Governments
Table 4.2	State-wise Growth Rates in Tax Revenues: 1993-94 to 2004-05
Table 4.3	Buoyancy of Own Tax Revenues: 1993-94 to 2004-05
Table 4.4	State-wise Relative Share of Major Taxes: 1993-94 to 2004-05
Table 4.5	Tax-wise Share of States in Total (15 States) Tax Revenue
Table 4.6	Implementation of Value Added Tax by States
Table 5.1	VAT Rates in Selected States: Selected Goods
Table 5.2	VAT Rates in Selected States: Coal and Plastics
Table 5.3	VAT Rates in Selected States: Iron and Steel and other Metals
Table 5.4	VAT Rates for Petroleum, Diesel, High Speed Diesel and Kerosene
Table 5.5	VAT Rates for Aviation Fuels and any other Motor Spirit
Table 5.6	VAT Rates: Liquor and Alcoholic Beverages
Table 6.1	Coal Royalty Rates: 1981 to 2002
Table 6.2	Rates of Eco-tax on Coal
Table 6.3	Tax as Percent of Retail Price
Table 6.4	Rate of Entry Tax on Crude Oil
Table 6.5	Expenditure on Urea Subsidy
Table 6.6	Colour Coding Based on Toxicity
Table 7.1	Rates of Eco-tax on Coal

LIST OF CHARTS

Chart 1.1	Share of High, Middle, and Low Income States in Tax Devolution
-----------	--

APPENDIX TABLES

Appendix Table A1	Carbon Dioxide Intensity by Region and Country, 1980-2030
Appendix Table A2	Year-wise Nutrients-wise Consumption, Production and Imports of Fertilisers
Appendix Table A3	Estimates of State Level CO ₂ Emissions of India
Appendix Table A4	Estimated CO ₂ Emission of India
Appendix Table A5	Source-wise Percentage Contribution of CO ₂ Estimation by States
Appendix Table A6	Estimates of State Level Per Capita CO ₂ Emissions of India
Appendix Table A7	Percentage Contribution of CO ₂ Emission by Major States of India
Appendix Table A8	National Ambient Air Quality Standards
Appendix Table A9	Number of Motor Vehicles Registered in India (Taxed and Tax-exempted): 2002-03
Appendix Table A10	Summary Status of Pollution Control in 17 Categories of Industries

Appendix Table A11	State-wise Consumption of Pesticides
Appendix Table A12	Centre's Gross Tax Revenues: 1993-94 to 2006-07
Appendix Table A13	Sectoral Shares in Gross State Domestic Product at Current Prices: 1993-94 to 2005-06
Appendix Table A14	Inter-state Share of Taxes
Appendix Table A15	Share of Each State in Total Collections of 15 Major States

ANNEXURES

Annexures 1	Measures Taken for Control of Air Pollution from Vehicles
Annexures 2	<i>Quantities and Emission Relations</i>
Annexures 3	Major Environmental Initiative by Important Cities in India
Annexures 4	Specific Grants for Protection of Ecology and Environment

ANNEXURES TABLE

Annexures Table 1	Maintenance of Forests; State-wise Grants Recommended by the Twelfth Finance Commission
-------------------	--

EXECUTIVE SUMMARY

Taxation policies in India have historically not been environmentally oriented. We need a tax system that is environmentally more rational. It is argued in this study that India is currently going through a major reform of indirect taxes aimed at ushering in a comprehensive regime of taxation of goods and services by April 1, 2010 and this is the appropriate time to make the entire tax regime environmentally rational.

1. Role of Environmental Taxes

Environmental taxes or eco-taxes have the potential to induce appropriate environmental decisions through instituting an incentive structure by raising the relative costs of polluting inputs and outputs. Also called 'green taxes', these are not necessarily meant as a revenue-augmenting device. Instead, the idea is to change the structure of taxation rather than putting additional burden on the tax payers. While eco-taxes are levied or increased, a corresponding reduction in other conventional taxes also needs to be planned. Many economists have argued that environmental taxes may yield benefits over and above a cleaner environment. In particular, governments can use the revenues from pollution taxes to decrease other distortionary taxes, thereby providing a 'double dividend'.

Eco-taxes are a price-instrument. For an effective use of a price-instrument, it is important that prices are allowed to be determined by the market forces. It may be noted that for some of the major polluting inputs and outputs like coal, petroleum products, and fertilizers, prices are regulated by the central government. In the case of electricity, prices are regulated by the Tariff Regulatory Authority of the state but prices reflect state government's considerations.

Some notable general points may be noted first:

1. India's contribution to global carbon emissions is much less than major developed countries and China, but the impact of adverse climate change will be disproportionately higher because of our proximity to the Himalayas where already there is evidence that many glaciers have started receding.
2. India has certain long term advantages that will make the cost of adjustment minimal and may actually lead to a 'double dividend' where not only pollution is

reduced but growth is strengthened. One major advantage is that the structure of the GDP is more service sector-oriented rather manufacturing oriented.

3. The strategy for environmentally oriented tax reforms should cover all the levels of government covering the central and the state governments as well as the local governments. Interventions at the central level provide a better policy thrust and greater overall impact while interventions at the state and local levels provide better targeting of environmentally detrimental economic activities.
4. The strategy needs to discourage excessive use of polluting inputs and outputs, while encouraging the use of non-polluting inputs and outputs and facilitating the development of environmentally friendly technologies suitable for local conditions.
5. India has to take full advantage of the clean development mechanism.
6. Apart from taxation, the regime of subsidies will also have to be reformed; many environmentally perverse subsidies will have to be weeded out and subsidies have to be strengthened for promoting the use of environmentally beneficial inputs and their production.

2. Carbon Emissions in India: Pattern and Sources

In 1990, China and India combined accounted for 13 percent of world carbon emissions, but by 2004 that share had risen to 22 percent, largely because of a strong increase in coal use in these two countries. This trend is projected to continue; and by 2030, carbon dioxide emissions from China and India combined are projected to account for 31 percent of total world carbon emissions, with China alone responsible for 26 percent of the world total. Effects on India will be disproportionately larger as compared to its contribution to global carbon emissions. According to the Geological Survey of India, it is estimated that nearly 46000 glaciers (one-third of world's glaciers) in the Himalayas between 2000 and 5000 metres altitude have started receding by 10-15 metres every year.

Historical experience demonstrates that the relationship between economic growth and energy use is strong but not unique. Countries experiencing similar paths of economic expansion may exhibit significant differences in the growth rate of energy use. Moreover, countries with similar levels of economic output per capita vary widely in per capita energy consumption. Additionally, countries with similar levels of energy

consumption may have significantly different rates of carbon emissions. Effects of pollution are different for local, regional, and national/global perspectives, as summarized below.

Local Effects: Heavy metals in air, soil, water and plants, e.g. from industrial emissions and discharges, noise, smell, air pollution.

Regional Effects: Eutrophication, contaminants in the soil and water, landscape changes due to mining or agriculture.

Global Effects: Changes in the climate due to ozone depletion and the green house effect.

3. Major Environmental/Ecological Problems of the States

State level CO₂ emissions figures for 2000 indicate that Uttar Pradesh has the highest level of pollution followed by Madhya Pradesh, Maharashtra, Andhra Pradesh, West Bengal, Gujarat, and Tamil Nadu. Looking at the 2000 figures for per capita CO₂ emissions, Madhya Pradesh has the highest emission at 660 metric tonnes followed by 440 metric tonnes for Delhi, Orissa and Goa. Punjab has a per capita CO₂ emission of 450 metric tonnes. High per capita emissions may be due either to the state undertaking production of polluting material like Madhya Pradesh, Chhattisgarh, and Bihar or it may be due to per capita consumption as in Delhi, Goa, Gujarat and Maharashtra. States like Bihar, Orissa, Madhya Pradesh, and Andhra Pradesh have India's major steel plants that consume a lot of coal. This makes their emission levels disproportionately high compared to their incomes. Looking at the all India figures, nearly 77 percent of the CO₂ emissions are from coal.

The main forms of pollution are atmospheric pollution, land degradation and soil pollution, water pollution, and noise pollution. The main sources of atmospheric pollution are: (a) combustion of fuels to produce energy for heating and power generation in the household and industrial sectors; (b) exhaust emissions from the transport vehicles that use petrol, diesel oil, etc., and (c) waste gases, dust and heat from many industrial sites including chemical manufacturers, electrical power generating stations, etc. Three main pollutants of ambient air quality are Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂) and Particulate Matter.

Vehicles are a major source of atmospheric pollution. In terms of the relative share of the major states in the all India total number of vehicles, Maharashtra had the highest share of 12.1 percent, followed by Tamil Nadu, which had a share of 11.9

percent. Gujarat was the next with a share of 9.7 percent, followed by Uttar Pradesh with a share of 8.8 percent. In terms of two wheelers, Tami Nadu had the highest share of 13.2 percent followed by Maharashtra at 11.8 percent. In terms of cars, Maharashtra had the largest share but in terms of goods vehicles, Tamil Nadu has a higher share.

In India, about 130 million hectares of land (45 percent of total geographical area) is affected by serious soil erosion through ravine and gully, shifting cultivation, cultivated wastelands, sandy areas, deserts, and water logging. The average degradation percentage is estimated at 18.8 considering all the districts. Some of the relatively higher percentages compared to the average are Mizoram, Maharashtra, Uttar Pradesh, West Bengal, Madhya Pradesh, Himachal Pradesh and Bihar.

The activity of mining and quarrying covers underground and surface mines, quarries and wells, and includes extraction of minerals as also activities such as dressing and benefaction of ores, crushing, screening, washing, cleaning, grading, milling floatation, melting floatation and other preparations carried out at the mine site. In India, coal is the most important energy source but Indian coal contains 30-40 percent ash and moisture content. About 70 percent of the coal in India is consumed in the power sector.

Water is polluted by the effluents of industries. Some of the important industries in this context are ferrous metallurgical industry, non-ferrous metallurgical industry, mining industry, ore processing industry, petroleum industry, petrochemical industry, chemical industry, ceramic industry, cement industry, textile industry, paper industry, fertiliser industry, coal (including coke) industry, power (thermal and diesel) generating industry, and processing of animal or vegetable products industry. All of these are subjected to a water cess now. Small scale industries (SSIs) are a major source of industrial pollution. The number of SSIs is estimated to be over 0.32 million units, of which many are highly polluting. The share of the SSIs in term of wastewater generation among several of the major polluting industries was reported to be about 40 percent.

4. State Taxes: Some Recent Reforms

India has a federal fiscal structure with taxation powers divided between the central and the state governments. State governments can, under constitutional provisions, assign some of their taxes to the local governments. Sales taxes account for the largest share in total own tax revenues of the states. However, there are considerable inter-state variations.

As part of fiscal reforms, the value added principle has progressively been introduced in the system of indirect taxation in India with CENVAT replacing the union excise duties. At present all the states have moved to State VAT (Value Added Tax), which has replaced the conventional sales taxes. Under the guidance of the Empowered Committee of State Finance Ministers, states have agreed to a broadly common structure of state VAT. With the basic design of VAT formulated by the Empowered Committee, states can introduce suitable variations consistent with the basic design. The main features of the basic scheme are as follows:

- a. uniform schedule of rates of VAT for all states, making the system simple and uniform to prevent unhealthy tax competition among states;
- b. the provision of input tax credit meant for preventing cascading effect of tax;
- c. the provision of self assessment by dealers aimed at reducing harassment; and
- d. the zero rating of exports aimed at increasing the competitiveness of Indian exports

Under the basic VAT design, there are only two basic VAT rates of 4 and 12.5 percent. In addition, there is provision for a specific category of tax-exempted goods and a special VAT rate of 1 percent only for gold and silver ornaments. Under the exempted category, a small list of commodities were placed comprising natural and unprocessed products in the un-organized sector, items that are legally barred from taxation and items which have social implications. Some flexibility to the states has been given to select a set of maximum of 10 commodities for exemption from the list of goods specified by the Empowered Committee, which are of local social importance for the individual States without having any inter-state implications.

Reforms are continuing and there is a possibility of developing a comprehensive goods and services tax (GST), which may be levied on a concurrent basis by the central and the state governments. This will provide a common treatment for goods and services and fully eliminate problems of cascading. Three options are currently being considered: a central GST, a system of concurrent GST, and a system of State GST. All indications are that India will move towards a system of concurrent GST.

5. A Coordinated Approach

Goods bear a variety of taxes including customs duties, central excise duty (CENVAT), state sales taxes (State VAT), and motor vehicle tax. Customs duties include, apart from the basic duty, additional duty of customs, additional duty of customs to countervail state taxes/VAT, special duty, additional duty on light speed diesel oil, additional duty on motor spirit, National Calamity Contingency Duty, Education Cess, and Secondary and Higher Education Cess. In designing eco-taxes, it is important to examine the overall incidence of taxes at all levels, a suitable point of levy for the eco-tax, distribution of the eco-tax components between the centre and the states, if levied at both levels, and relevance of inter-state differentials in the tax rates. In bringing about environmental considerations, both in the central and the state taxation, some of the main recommendations of this study are:

6. Main Recommendations

a. Eco-taxation of Coal and Related Issues

Under the Customs Duty Act, for all varieties of coal except Bituminous coal, the tariff rate is 10 percent. For Bituminous coal, the tariff rate is 55 percent. Under the Central Excise Act, the tariff rate is zero percent for all varieties of coal. Under a special notification, under the Coal Mines (conservation and development) Act, 1974 a Stowing Excise Duty has been levied at rate of Rs. 10 per tonne of coal irrespective of its grade with effect from 26.03.2003. This excise duty is collected by the Coal Controller on all raw coal produced and dispatched from all the collieries in India. It is realized from the consumers alongwith the coal sale bills raised by the coal companies. The net proceeds from the stowing excise duties during the preceding year or years is disbursed to the owners, agent or the managers for execution of stowing and other operations for the safety in coal mines or conservation of coal or any other purpose connected with development of coal mines or transportation, distribution or utilization of coal.

Coal beneficiation reduces the ash content in the coal and improves its thermal efficiency and reduces the operation and transport costs of thermal power plants. The MSE (2007) study recommended the levy of an eco-cess to provide suitable incentives for reducing the ash-content. We recommend a similar but somewhat simplified structure of the eco-cess as given below:

Type of Coal	Rate (Rs. per tonne)
All varieties of coking coal where ash content is 18 percent or less	nil
All varieties of coking coal where ash content is between 19 to 28 percent	20
All varieties of coking coal where ash content is higher than 28 percent	40
All varieties of non-coking coal where ash content is 28 percent or less	nil
All varieties of coking coal where ash content is higher than 28 percent	50

A cess is already being collected by the Coal Commissioner, since 2003, of an amount of Rs.10 per tonne, without any distinction in respect of the variety of coal, and the cess is fully passed on to users or consumers. It should be possible to levy an environmentally rational cess under the same provision, and pass it on to the users, while allowing prices to reflect the benefit of prior treatment of coal. It will reduce pollution as well as improve efficiency of production without causing loss either to consumers (who need less of a better quality of coal) or producers of coal since they do not bear the cess. The receipts from the cess must be allocated for setting up facilities for washing and treating coal and related research and development.

There are additional considerations for taxation of coal at the state level. This arises, particularly in the case of producing states where the coal mines are located. They suffer pollution damage both in the atmosphere and on land. They suffer a double damage if the thermal power plants or other coal-using industries are also located in the state. The producing states like Bihar, Assam, Orissa, Jharkhand, Madhya Pradesh, and Chhattisgarh are therefore entitled to levy a special cess. Further, on export of coal, the tax should not be zero-rated because although good is consumed outside the state, considerable pollution remains within the producing state. This should also apply to the Special Economic Zones (SEZs).

b. Environmental Tax Reforms in Respect of Petroleum Products

The Central excise levy on petrol and diesel has been a combination of ad-valorem and specific rates. The contribution of the petroleum sector to the total net excise revenues of the Government is of the order of 40 percent. Moreover, taxes (including sales tax/VAT) and duties constitute a significant proportion of the retail prices. State level taxes are also high for petroleum products. Almost all state governments in India are levying non-Vatable taxes on crude oil and petroleum products at special rates. Since states suffer different levels of pollution, related to vehicular and other uses of petroleum products, they are entitled to use different rates, reflecting their own environmental considerations.

As part of the overall tax reforms, we suggest that

- a. In the case of petroleum products, states may levy differential special rates but agree on floor and ceiling rates. The existing floor rate may be increased from 20 to 25 percent;
- b. Considering the revenue-importance of this tax, in order not to have detrimental effects either on growth or on prices, the core (floor) State VAT rate on all other goods may be reduced from 12.5 to 10 percent.

This would also facilitate introducing a comprehensive GST regime where both the core rates of CENVAT and State VAT will need to be reduced from the present levels of 14 and 12.5 percent respectively.

c. Environmental Reforms and Taxation/Subsidisation of Fertilisers

The recommended strategy is as follows:

- i. The overall volume of subsidy for chemical fertilizers should be reduced in stages and eventually eliminated.
- ii. A more balanced use of fertilizers should be encouraged by following a nutrient-based subsidy regime.
- iii. The overall cost should be reduced by fully shifting away from Naphtha as feedstock.
- iv. States should keep chemical fertilizers in the 12.5 percent category and bio-fertilizers in the exempted category.

d. Eco-tax on Chemical Pesticides

In the context, the recommendations, following the MSE (2007) study, are:

- a. Chemical fertilizers should be placed at 14 percent under CENVAT and at 12.5 percent under State VAT.
- b. CENVAT on bio-pesticides be reduced from 14 to 8 percent and it should be put under the exempted category in State VAT.

e. Plastics and Eco-taxes

We recommend, following the MSE study (2007) and adding the state level components, the following:

1. *Biodegradable Plastics*: The 14 percent CENVAT on biodegradable plastics to be removed. In State VAT also these should invariably be placed under the exempted category.
2. *Deposit Refused on PET bottles*: A deposit of Re.1 per bottle should be levied on

PET bottles at the time of sale which can be refunded when the bottle is returned. Manufacturers would have to set up a network of collection centers which will collect the bottles and send them for recycling.

3. *Incentive to Rag pickers:* Households can be encouraged by their respective municipal authorities to segregate their plastic wastes and hand over the low value wastes to the rag pickers. The plastic industry can provide a matching incentive amount (say Rs.10 per kg of plastic bags) to the rag pickers in addition to the amount that the recycler would pay.
4. *Recycling:* Municipalities can also set up a central facility/complex with assistance from the industry to recycle low value plastic wastes in an environmentally sound manner.
5. 50 percent reduction in customs duty be given to recyclers who wish to import equipment and machinery for upgradation of recycling technology for a limited period of 10 years.

f. Taxation of Alcohol

In the case of State VAT, rates on liquor and alcoholic beverages vary considerably. These are part of the special rates although they are often specified in the VAT schedules themselves. The rates vary from 12.5 percent to as high as 70 percent. In general, the tax is non-Vatable. As part of overall reforms, states may agree to a minimum rate of not less than 30 percent and in states where many manufacturing units are located, a higher rate may be charged as considerable pollution occurs around the manufacturing units. There should not be any rebate on taxes paid on goods nor should exports be zero rated because consumption may take place in other states but pollution may be more localized in the state where the manufacturing units are located. This should enable further reduction in core State VAT rate.

7. Eco-taxes as an Integral Part of the Proposed GST

There is a concerted move both by the central government and the Empowered Committee of State Finance Ministers to move towards a National Goods and Services Tax by April 1, 2010. This is the ideal time to bring environmental considerations as an integral part of tax reforms.

For implementing a comprehensive Goods and Services tax (GST) both at the centre and the states, several options are being considered ranging from a completely centralized levy of GST to a system of extensive State GSTs. However, a consensus that seems to be emerging is likely to favour a dual system consisting of a GST with two

components: a central GST and a system of state GSTs. Once the reformed system is put in practice, it will subsume the service tax, the central excise duties, state sales taxes, additional excise duties in lieu of sales tax on textiles, tobacco and sugar and a number of other state taxes. The sales tax on inter-state transactions on goods (CST) will also go.

In undertaking reforms of the taxation of goods and services where the ecological tax reforms are an integral part of the overall tax reforms, some important considerations are listed below:

1. In a value added tax regime, input taxes are fully rebated. As such, taxation of polluting inputs will be ineffective as the tax paid on the inputs will be fully rebated, unless a non-rebatable cess is levied on the inputs. This cannot be done on a large scale as it will make the tax system very complex and defeat the objective of tax reform.
2. The more appropriate method would be to tax outputs and introduce ecological considerations by taxing at a higher rate, outputs that are either polluting or use highly polluting inputs. In important cases, a non-rebatable tax or cess should be introduced.
3. Ecological taxes should not be taken as revenue augmenting measures in general. Any ecological taxes should be accompanied by a rate reduction for the non-polluting outputs/inputs so that the overall tax burden does not increase, the use of non-polluting inputs is encouraged and the development processes are not adversely affected. These should only become more environment-friendly and therefore sustainable over the longer run.
4. If ecological considerations lead to some regressivity, as has been noted in the relevant literatures, as a result of taxation at a higher rate, some polluting but mass-consumed good, this should be properly neutralized by a well designed subsidy. Weizsacker *et al* (2005) emphasize that eco-taxation should affect the end-user prices such that existing price differences between domestic and commercial uses of the polluting inputs/outputs may be continued if the difference is due to any equity considerations.
5. Only to a limited extent, eco-taxes should be designed to lead to a net revenue augmentation and these revenues should kept in a separate account

for supporting changes in technology and processes, which use less of the polluting inputs.

6. Eco-taxes should be designed in an integrated way for taxation at the central, state and local levels. These should complement each other and should not be at cross purposes. Global sources of pollution or pollution where state boundaries are generally crossed should be taxed at the national level, regional sources at the state level, and pollution with strong local characteristics should be taxed at the local level.
7. Tax rates for eco-taxes should be fixed after taking into account the full extent of negative externalities of the polluting inputs and outputs. This requires major changes in national accounting frameworks.
8. Any state level taxation should generally be revenue-neutral. New eco-taxes should be accompanied by reduction in other taxes.
9. There should be inter-state coordination so that as result of taxation of polluting inputs and outputs, industries do not attempt to relocate in other states where eco-taxes are less stringent. This may happen if some states pursue more actively pollution control while some others are more relaxed and the CST also goes. The 13th Finance Commission should ensure that inter-state coordination takes place in the state level initiatives and at any rate state that are more aggressive in pursuing pollution control do not suffer any revenue loss if industries relocate themselves.
10. As part of reforms towards GST, the system of additional excise duties in lieu of sales tax for sugar, tobacco, and textiles will also be integrated with GST. The Finance Commission determines the inter-state distribution of revenues under additional excise duties guided by the principle of returning to the states what they would have earned had a sales tax was levied on these commodities. Production processes in all these cases have significant environmental implications. When these commodities are subsumed in the overall GST, care has to be taken that environmental considerations are kept in mind.

11. The special economic zones and export oriented units are given inputs including polluting inputs on a zero-rated basis. While their products may be exported or treated as imports if sold in the domestic economy, much of the pollution that they generate is affecting the geographical area in which they are located. Polluting inputs in their case should not be zero-rated. They should also be subject to all other applicable regulatory measures for pollution control.

Chapter 1

INTRODUCTION

The Indian economy has been growing at an average rate of more than eight and a half percent since 2003-04. With economic growth, the rate at which pollution is increasing has also increased. The implications of growth for pollution depend largely on the changing structure of the economy and the inter-state spread of growth. Since the pace of industrialization and economic growth are different across states, the extent of pollution is also different across states. Until now pollution control measures in India have largely been regulatory in nature. Given the rapid pace of industrialization as also the international practices, regulatory measures need to be complemented by market based instruments, particularly environmental or eco-taxes. Given India's federal structure and the heterogeneous pattern of pollution in the states, it would be ideal to design interventions based on central taxes as well as state taxes.

The present study focuses largely on state taxes and complements an earlier study on eco-taxation in India undertaken by the Madras School of Economics (MSE, 2007). In that study, the feasibility of incentive based environment instruments were examined, particularly with respect to the central taxes. The following industries were studied in detail: coal, automobiles, chlorine used in pulp and paper and viscose rayon industries, phosphate based detergents, chemical pesticides and bio-pesticides, fertilisers, lead acid batteries, and plastics. However, since in India's federal system taxation powers have been divided between the central and the state governments, a more comprehensive approach to eco- taxation requires a study of state taxes also.

1.1 Global Pollution Trends and Position of India

In recent years, there has been a growing level of concern that anthropogenic (i.e., caused by human activities) emissions of carbon dioxide and other so-called "greenhouse gases" are contributing to "global warming." (Greenhouse gases also include: methane; nitrous oxide; chlorofluorocarbons and related compounds; non-methane volatile organic compounds; and water vapor). As a result of this concern, interest has risen regarding possible cost-effective options to help reduce greenhouse gas emissions without compromising the growth impulses of a developing economy like India. Interest has focused primarily on limiting the burning of fossil fuels, which releases carbon (mainly in the form of carbon dioxide) into the atmosphere.

Table 1.1 shows total carbon dioxide emissions for some of the major countries and country groups. It is seen that China's carbon emissions have increased at a very fast rate. In 2005, India's position was fifth in terms of emissions of carbon dioxide¹.

Table 1.1: World Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels, 1995-2005

(Million Metric Tons of Carbon Dioxide)

Region/Country	1995	2000	2005
United States	5,289.26	5,823.48	5,956.98
China	2,844.56	2,912.59	5,322.69
Russia	1,622.94	1,580.21	1,696.00
Japan	1,075.50	1,190.16	1,230.36
India	862.18	994.07	1,165.72
Africa	817.88	881.24	1,042.92
Canada	505.88	558.44	631.26
Australia	285.26	352.57	406.64
Mexico	318.78	380.61	398.25
Brazil	285.14	342.10	360.57
New Zealand	31.14	34.87	37.82
Europe	4,272.41	4,444.93	4,674.75
Eurasia	2,480.82	2,339.54	2,577.82
Central & South America	849.88	988.09	1,096.16
Middle East	894.41	1,081.19	1,450.81
Asia & Oceania	6,559.45	7,252.33	10,362.49
North America	6,115.03	6,763.68	6,987.78
World Total	21,989.88	23,751.01	28,192.74

Source (Basic Data): Energy Information Administration (2007).

India's per capita carbon emissions, although still much less as compared to some of the advanced industrial countries (Table 1.2) may not rise as per international projections because of the high growth of GDP. Carbon dioxide emissions per capita in the Organisation of Economic Cooperation and Development (OECD) region are significantly higher than in the non-OECD region. The International Energy Outlook of 2007 prepared by Energy Information Administration gives projections of carbon dioxide intensity per unit of gross domestic product upto 2030. Details are given Appendix Table

¹ As per a report presented at recent India Economic Summit of the World Economic Forum China may have overtaken US in terms of carbon emissions and India's position is now fourth. This report identifies six key risks that constitute potential constraints to India's growth. One of the key risks is climate change linked to carbon dioxide emissions. India's carbon dioxide emissions per capita have increased by 50 percent in the last 15 years according to this report.

A1. Significantly for all countries the annual percentage change shows a fall during the period 1990-2004 as well as the projection period, 2004 to 2030. In the OECD countries the rate of fall increased from 1.3 percent on average during 1990-2004 to 1.6 percent during 2004-2030. The corresponding rates of fall are 2.2 percent and 2.6 percent for the non-OECD countries. In India's case during the historical period the rate of fall improves from 0.9 to 2.9 percent. In China's case it decelerates from 4.2 percent to 2.9 percent. Much of India's advantage arises from its large and rising service sector whereas in China's case a very large share of the manufacturing sector leads to a higher carbon intensity per unit of GDP.

**Table 1.2: Carbon Dioxide Emissions and Gross Domestic Product
Per Capita by Region, 2004**

Region/Country	GDP Per Capita ('000 \$)	Emissions Per Capita (Metric Tons)	Emission Per '000 \$ of GDP
United States	36.4	20.1	0.552
Canada	31.5	18.3	0.581
Mexico	9.6	3.6	0.375
OECD Europe	20.9	8.2	0.392
Japan	26.3	9.9	0.376
South Korea	15.0	10.4	0.693
Australia/New Zealand	28.5	17.7	0.621
Russia	13.3	11.7	0.880
Other Non-OECD Europe and Eurasia	7.2	5.7	0.792
China	5.9	3.6	0.610
India	3.4	1.0	0.294
Other Non-OECD Asia	4.6	1.7	0.370
Middle East	7.6	6.8	0.895
Africa	2.4	1.0	0.417
Brazil	7.9	1.8	0.228
Other Central/South America	7.0	2.6	0.371

Source (Basic Data): Energy Information Administration, US Department of Energy, Report, 2007.

The relative contributions of different fossil fuels to total energy-related carbon dioxide emissions have changed over time. In 1990, emissions from petroleum and other liquids combustion made up an estimated 42 percent of the world total. In 2004, the petroleum share was 40 percent, and in 2030 its share is projected to be 36 percent, of the world total. Carbon dioxide emissions from natural gas combustion, which accounted for 19 percent of the total in 1990, increased to 20 percent of the 2004 total. That share

is projected to rise to 21 percent in 2030. Coal's share in 2004 was the same as its share in 1990, at 39 percent; however, its share is projected to increase to 43 percent in 2030. Coal is the most carbon-intensive of the fossil fuels, and it is the fastest growing energy source in the Internal Energy Outlook 2007 reference case projection.

In 1990, China and India combined for 13 percent of world emissions, but by 2004 that share had risen to 22 percent—largely because of a strong increase in coal use in these two countries. This trend is projected to continue; and by 2030, carbon dioxide emissions from China and India combined are projected to account for 31 percent of total world emissions, with China alone responsible for 26 percent of the world total.

In the International Energy Outlook 2007 reference case, world energy-related carbon dioxide emissions are projected to grow by an average of 1.8 percent per year from 2004 to 2030. For the OECD countries, total emissions are projected to average 0.8 percent annual growth, from 13.5 billion metric tonnes in 2004 to 14.7 billion metric tonnes in 2015 and 16.7 billion metric tonnes in 2030. For the non-OECD countries, total carbon dioxide emissions are projected to average 2.6 percent annual growth. The highest growth rate in the non-OECD regions is projected for China, at 3.4 percent annually from 2004 to 2030, reflecting the country's continued heavy reliance on fossil fuels, especially coal, over the projection period. China's energy-related emissions of carbon dioxide are projected to exceed U.S. emissions by about 5 percent in 2010 and by 41 percent in 2030. Together, China and India account for 72 percent of the projected world increment in coal-related carbon dioxide emissions. For China alone, coal-related emissions are projected to grow by an average of 3.3 percent annually, from 3.8 billion metric tonnes in 2004 to 8.8 billion metric tonnes (48 percent of the world total) in 2030. India's carbon dioxide emissions from coal combustion are projected to total 1.4 billion metric tons in 2030, accounting for 8 percent of the world total.

One of the most frequently mentioned options relates to reducing the amount of energy needed to produce a given unit of economic output. This option is seen by many as offering the potential for stabilizing, if not reducing, carbon emissions without sacrificing economic growth. A similar result can be achieved by substituting low carbon fuels like natural gas for high carbon fuels (coal, for instance), or non-carbon emitting fuels (hydroelectric, nuclear, solar, etc.) for fossil fuels. Energy use and economic welfare are closely intertwined. Economically advanced societies use more energy per capita than the developing countries. The process of growth has historically entailed increasing levels of consumption of commercially-produced energy.

Many estimates of aggregate net economic costs of damages from climate change across the globe, the social cost of carbon (SCC), expressed in terms of future net benefits and costs that are discounted to the present, are now available. Peer-reviewed estimates of the SCC for 2005 have an average value of US\$43 per tonne of carbon (t C) (i.e., US\$12 per tonne of carbon dioxide) but the range around this mean is large. For example, in a survey of 100 estimates, the values ran from US\$-10 per tonne of carbon (US\$-3 per tonne of carbon dioxide) up to US\$350/tC (US\$95 per tonne of carbon dioxide.) It is useful to note that carbon comprises only 27.29 percent ($12.0107 / (12.0107 + 15.9994 \times 2)$) of the mass of carbon dioxide, that is there are only 27 tonnes of carbon in 100 tonnes of carbon dioxide.

In October, 2006, a report by Nicholas Stern referred to as the *Stern Review* states that climate change could cut growth by one-fifth unless drastic action is taken. Stern estimates that one percent of global GDP is required to be invested in order to mitigate the effects of climate change, and that failure to do so could risk a recession worth up to twenty percent of global GDP. Stern's report suggests that climate change threatens to be the greatest and widest-ranging market failure ever seen. The report has had significant political effects. Australia reported two days after the Report was released that they would allot AU\$60 million to projects to help cut greenhouse gas emissions. The *Stern Review* has been criticized by some economists, saying that Stern did not consider costs past 2200, that he used an incorrect discount rate in his calculations, and that stopping or significantly slowing climate change will require deep emission cuts everywhere.

Earlier, in 2005 Report from the Association of British Insurers, it was observed that limiting carbon emissions could avoid 80 percent of the projected additional annual cost of tropical cyclones by the 2080s. A June 2004 Report by the Association of British Insurers declared "Climate change is not a remote issue for future generations to deal with. It is, in various forms, here already, impacting on insurers' businesses now." It noted that weather risks for UK households and property were already increasing by 2–4 percent per year due to changing weather, and that claims for storm and flood damages in the UK had doubled to over £6 billion over the period 1998–2003, compared to the previous five years. As a result, insurance premia are rising. In the UK, the insurance industry normally offers insurance against natural disasters, however there is a risk that in some areas, flood insurance will become unaffordable for some, and that cover may be entirely withdrawn in some areas unless there is government backing.

In the U.S., according to Choi and Fisher (2003) each 1 percent increase in annual precipitation could enlarge loss due to catastrophe by as much as 2.8 percent. Financial institutions, including the world's two largest insurance companies, Munich Re and Swiss Re, warned in a 2002 study that "the increasing frequency of severe climatic events, coupled with social trends" could cost almost US\$150 billion each year in the next decade.

Effects on India will be disproportionately larger as compared to its contribution to global carbon emissions. According to the Geological Survey of India, it is estimated that nearly 46000 glaciers (one-third of world's glaciers) in the Himalayas between 2000 and 5000 metres altitude have started receding by 10-15 metres every year causing concerns of rivers getting dry in summer. As a result, rice production in India may come down by 10 percent by 2030 and 25 percent by 2080. Wheat production would also be considerably reduced, as projected by the Indian Agricultural Research Institute (IARI). Many of the country's coastal areas are likely to get submerged. There are already signs of inundation of Maldives and parts of Bangladesh. In this context, the former British Prime Minister Mr. Blair recently observed that "India would face the worst consequences of climate change that would involve its food security, water and energy security... " .

India's Commitment at Kyoto

India is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol. The Protocol provides for three mechanisms that enable the developed countries with quantified emission limitation and reduction commitments to acquire greenhouse gas reduction credits from activities outside their own boundaries at relatively lesser costs. These are Joint Implementation, Clean Development Mechanism (CDM) and Emission Trading. Only CDM is applicable to developing countries like India. Under the Clean Development Mechanism, a developed country would take up greenhouse gas reduction project activities in a developing country where the costs of greenhouse gas reduction project activities are usually much lower.

India's CDM potential represents a significant component of the global CDM market. As on 31 January 2008, 309 out of total 918 projects registered by the CDM Executive Board are from India which, so far, is the highest from any country in the world. The Indian National CDM Authority has accorded Host Country Approval to 858 projects facilitating an investment of more than Rs. 71,121 crore. These projects are in the sectors of energy efficiency, fuel switching, industrial processes, municipal solid

waste and renewable energy. If all these projects get registered by the CDM Executive Board, they have the potential to generate 448 million Certified Emission Reductions (CERs) by the year 2012.

1.2 Growth and Pattern of Energy Use

Historical experience demonstrates that the relationship between economic growth and energy use is not unique. Countries experiencing similar paths of economic expansion may exhibit significant differences in the growth rate of energy use. Moreover, countries with similar levels of economic output per capita vary widely in per capita energy consumption. Additionally, countries with similar levels of energy consumption may have significantly different rates of carbon emissions.

A report brought out by the Energy Information Administration of the US in 1994 highlighted some key issues in the context of carbon emissions, energy conservation, and development of alternate fuels. Its key conclusions included the following.

- i. **The relationship between economic development and energy use varies across country groups.** In developed countries, energy use grew slowly relative to economic growth during the 1970's and 1980's. In the developing countries, energy use overall increased as fast or faster than economic growth, even after the 1973 and 1979 oil price shocks.
- ii. **Energy consumption and carbon emissions grew fastest in the developing countries.** Most of the growth in worldwide energy consumption and carbon emissions over the past two decades took place in developing countries such as China, Brazil, India, and South Korea.
- iii. **Fuel use patterns in the developing countries were consistently more carbon-intensive than in the developed countries over the past two decades.** China and Canada represent extremes in terms of their carbon emissions per unit of energy use, with China's emissions (reflecting heavy use of coal) twice those of Canada (with its large hydro power resources).
- iv. **The world share of non-carbon emitting energy sources increased over the past two decades, particularly in the developed countries.** Most of this increase was due to growth in nuclear power generation. In the developing countries, non-carbon emitting energy sources grew from 4 percent in 1970 to 9

percent of total energy supply in 1991. Non-carbon emitting energy sources grew even more rapidly in the developed countries, increasing their share from 7 percent in 1970 to 17 percent in 1991.

- v. **Electricity use worldwide increased significantly faster than overall energy use, particularly in the developing countries.** This conclusion in turn suggests a potential course of action: namely, the widespread adoption of best-available electricity generation technologies.
- vi. **Within the developed countries, energy use patterns vary widely.** Energy use per capita, for instance, is more than twice as high in Canada and the United States than in Japan and G-7 Europe (France, Italy, Germany and United Kingdom).

1.3 India: Pollution Levels and Economic Growth: Inter-state Pattern

Pollution, of course, has larger ramifications than the carbon emissions. Differences in pollution levels across countries or states within a country with large geographic areas as the case is in India depend, among other factors, on the level and structure of demand for goods and services, which may be produced by polluting inputs and processes. Effects of pollution are different for local, regional, national, and global perspectives. Depending on the nature of pollution policies to abate pollution also need to be different. The Compendium of Environmental Statistics published by the Central Statistical Organisation (CSO), India in 2006 summarises the local, regional, and global effects of pollution as indicated in Table 1.3.

Table 1.3: Local, Regional, and Global Effects of Pollution

Local Effects	Regional	Over Marine Water and Continents	Global
Heavy metals in air, soil, water and plants, e.g. from industrial emissions and discharges, noise, smell, air pollution.	Eutrophication, contaminants in the soil and water, landscape changes due to mining or agriculture.	Eutrophication, acidification, environment contamination due to radioactivity	Changes the climate due to ozone depletion and the green house effect.

Source: CSO - Compendium of Environmental Statistics (2006).

With a view to designing a suitable strategy for pollution abatement consisting of market-based instruments, one needs to recognize the extent and local of state level pollution pattern in India and also identify differences in the relative importance of different sources of pollution across states. In India, there have been salient differences in the economic and population growth across states. This has also resulted in differential impact of the pollution levels across states. We look at the inter-state differences in two ways: (i) pattern of inter-state carbon emission, and (ii) pattern of environmental quality, as determined by a large number of factors relating to environment.

a. Inter-state Pattern of Carbon Emissions

In a recent study Ghoshal and Bhattacharyya (2007) decompose overall CO₂² emissions in India in terms of their state level contributions during 1980-00. They follow a methodology suggested by Marland and Rotty (1984) for estimating the amount of CO₂ emitted to the atmosphere from fossil fuel burning. The emissions are product of three terms: the amount of fuel consumed, fraction of the fuel oxidized, and the carbon content of the fuel. Table 1.4 provides estimates of the state level CO₂ emissions presented by Ghoshal and Bhattacharyya.

Looking at the figures for 2000 as also the mean figures (Table 1.4), Uttar Pradesh has the highest level of pollution followed by Madhya Pradesh, Maharashtra, Andhra Pradesh, West Bengal, Gujarat, and Tamil Nadu.

² The method of Marland and Rotty (1984) were used to estimate the amount of CO₂ emitted to the atmosphere from fossil fuel burning. For each type of fuel, the annual CO₂ emissions are the product of three terms: the amount of fuel consumed, the fraction of the fuel that is oxidized, and a factor for the carbon content of the fuel: $CO_2i = (P_i)(FO_i)(C_i)$ where the subscript i represents a particular fuel, P represents the amount of fuel i that is consumed each year, FO is the fraction of P that is oxidized, C is the average carbon content for fuel i, and CO₂i is the resulting CO₂ emissions for fuel i expressed in mass of carbon.

Table 1.4: Estimates of State Level CO₂ Emissions of India

(000 Metric Tons of Carbon)

Year	J&K	HP	Punjab	Haryana	UP	Rajasthan	Delhi
1980	168.3	88.8	2377.1	1258.4	9343.1	1578.6	2791.5
1985	243.0	125.4	5185.4	2788.6	16437.5	2897.5	3772.8
1990	455.5	316.7	6544.9	3307.5	24603.2	4573.6	5090.6
1995	467.8	498.2	8646.7	4068.3	35823.4	7058.5	5691.1
2000	696.5	659.1	10845.7	5460.5	44268.3	8929.3	6033.8
Mean							
Emission	377.4	312.8	6791.9	3614.3	26009.1	4998.0	4813.4
Rank of							
Mean	18	19	10	14	1	12	13
	Bihar	Orissa	WB	Assam	Gujarat	Maharashtra	Goa
1980	16785.8	3787.6	11499.3	589.8	7501.6	10564.2	234.4
1985	18854.4	4284.9	12848.3	856.7	11536.4	16059.6	382.6
1990	20345.3	8424.2	15175.4	1470.4	15081.9	22660.1	442.1
1995	21261.2	12180.4	21432.4	1298.4	17375.5	32216.9	589.4
2000	9012.0	16172.3	23363.7	1097.0	18461.5	35595.4	652.2
Mean							
Emission	20325.8	8539.8	16354.8	1035.3	14463.1	23236.9	459.2
Rank of							
Mean	4	9	6	16	7	3	17
	MP	AP	Karnataka	Kerala	TN	Others	
1980	9890.6	4940.9	1586.2	946.1	4540.1	12345.5	
1985	15065.5	9818.6	2754.5	1546.6	7263.9	11827.1	
1990	25945.0	16117.3	4569.4	1697.1	9808.6	10863.0	
1995	35096.1	27312.3	11423.2	4149.6	12837.5	4424.9	
2000	39279.4	30126.0	9059.6	3034.2	17584.9	43712.6	
Mean							
Emission	24626.0	17590.0	5139.1	2012.6	10290.5	14182.7	
Rank of							
Mean	2	5	11	15	8	..	

Source: Ghoshal and Bhattacharyya (2007).

In terms of per capita CO₂, Madhya Pradesh has the highest emission at 660 metric tonnes followed by 440 metric tonnes for Delhi, Orissa and Goa. Punjab has a per capita CO₂ emission of 450 metric tonnes (Table 1.5). The next in order of importance are Gujarat and Maharashtra at 370 metric tonnes per capita. It may be noted that the high per capita emissions may be due either to the state undertaking production of polluting material like Madhya Pradesh (including Chhattisgarh) or Bihar or it may be due per capita consumption as in Delhi, Goa, Gujarat and Maharashtra.

Table 1.5: Estimates of State Level Per Capita CO₂ Emissions of India

(000 Metric Tons of Carbon)

Year	J&K	HP	Punjab	Haryana	UP	Rajasthan	Delhi
1980	0.03	0.02	0.14	0.10	0.09	0.05	0.46
1985	0.04	0.03	0.28	0.19	0.13	0.07	0.50
1990	0.06	0.06	0.33	0.20	0.18	0.10	0.55
1995	0.05	0.09	0.39	0.22	0.24	0.14	0.50
2000	0.07	0.11	0.45	0.26	0.27	0.16	0.44
Mean Emission	0.05	0.06	0.33	0.21	0.18	0.11	0.51
Rank of Mean	18	17	5	11	12	15	1
	Bihar	Orissa	WB	Assam	Gujarat	Maharashtra	Goa
1980	0.24	0.14	0.21	0.03	0.22	0.17	0.23
1985	0.24	0.15	0.21	0.04	0.31	0.23	0.35
1990	0.24	0.27	0.23	0.07	0.37	0.29	0.38
1995	0.30	0.36	0.29	0.05	0.39	0.37	0.43
2000	0.11	0.44	0.29	0.04	0.37	0.37	0.44
Mean Emission	0.27	0.26	0.24	0.05	0.34	0.29	0.37
Rank of Mean	7	8	10	19	4	6	3
	MP	AP	Karnataka	Kerala	TN	Others	
1980	0.19	0.09	0.04	0.04	0.09	1.19	
1985	0.26	0.17	0.07	0.06	0.14	1.18	
1990	0.40	0.24	0.10	0.06	0.18	0.95	
1995	0.65	0.38	0.24	0.14	0.22	0.07	
2000	0.66	0.40	0.17	0.10	0.28	0.62	
Mean Emission	0.44	0.26	0.11	0.07	0.18	0.77	
Rank of Mean	2	9	14	16	13	..	

Source: Ghoshal and Bhattacharyya (2007).

Ghoshal and Bhattacharyya look at the time series data for per capita emissions and growth in the states as measured by per capita NSDP. Using a panel model, they find the existence of two distinct Environmental Kuznets Curves (EKC). One of the curves is expected to bend back at a substantially higher level of emission as compared to the other. The points on the steeper curve belong to undivided Bihar, Orissa, undivided Madhya Pradesh and Andhra Pradesh. These states have India's major steel plants that consume a lot of coal. This makes their emission levels disproportionately high compared to their incomes. If these states are left out of the panel, the authors are able to estimate a single inverted U curve for the entire panel and estimate the level at which the curve bends back at Rs. 18444. The main states beyond this point are Delhi and Goa.

Table 1.6 indicates the relative contribution of CO₂ emission by source and by states data relate to 2000. The main sources that have been identified as contributing to

Table 1.6: Source Wise Percentage Contribution of CO₂ Estimation by States: 2000

(Percent)

States	LPG	Naphth a	MG	Kerosen e	HSD O	LDO	FO	LSH S	Coal	Total C
J &K	7.81	0.00	8.42	18.03	29.21	0.60	0.84	0.48	34.61	100.0
HP	6.48	0.00	6.10	6.35	37.35	0.64	2.92	2.16	38.01	100.0
Punjab	2.45	0.00	3.23	2.62	16.07	0.28	1.63	4.48	69.26	100.0
Haryana	3.51	0.00	3.45	2.91	33.52	0.95	0.00	5.86	49.80	100.0
UP	1.44	2.40	1.11	2.66	8.76	0.32	0.65	0.48	82.18	100.0
Rajasthan	2.52	6.15	2.53	4.82	23.99	0.53	1.73	0.38	57.35	100.0
Delhi	6.33	0.00	7.88	2.91	16.98	1.08	0.10	0.50	64.21	100.0
Bihar (a)	0.58	0.00	0.56	2.89	5.78	0.29	0.84	0.38	88.68	100.0
Orissa	0.36	0.25	0.58	1.74	4.02	0.08	1.01	0.01	91.96	100.0
WB	1.30	1.56	0.66	2.99	6.82	0.55	1.02	0.00	85.11	100.0
Assam	8.55	2.37	5.27	21.22	28.77	0.23	3.59	1.83	28.18	100.0
Gujarat	1.95	10.38	2.58	3.91	12.21	0.94	2.58	6.10	59.35	100.0
Maharashtr a	2.37	2.35	2.21	3.59	9.56	0.77	2.73 19.2	2.61	73.80	100.0
Goa	4.11	38.38	5.52	3.59	28.63	0.51	6	0.00	0.00	100.0
MP	0.62	0.20	0.65	1.36	4.14	0.12	1.09	0.04	91.79	100.0
AP	1.42	1.14	1.35	1.77	9.20	0.11	1.09	0.37	83.55	100.0
Karnataka	3.38	1.41	4.00	5.01	19.92	0.24	4.09	1.20	60.75	100.0
Kerala	7.59	20.34	9.19	8.44	35.38	0.11	6.60	8.89	3.48	100.0
TN	3.07	3.05	2.78	3.46	16.11	0.23	5.29	2.25	63.77	100.0
Others	1.12	6.92	0.38	1.72	1.95	0.09	2.81	0.11	84.88	100.0
	1.8		1.7			0.3			77.0	100.
All India	1	3.01	1	2.93	9.83	7	1.96	1.30	8	0

Source: Ghoshal and Bhattacharyya (2007).

Notes: LPG: Liquefied Petroleum Gas; MG: Motor Gasoline; HSDO: High Speed Diesel Oil; LDO: Light Diesel Oil; FO: Furnace Oil; LSHS: Low Sulphur Heavy Stock. (a) Estimates of Bihar relate to 1999.

CO₂ emission are: liquefied petroleum gas, motor gasoline, high speed diesel oil, light diesel oil, furnace oil, low sulphur heavy stock, naphtha, kerosene, and coal. Looking at the all India figures, nearly 77 percent of the CO₂ emissions are from coal. The next in order of importance is high speed diesel oil which contributes nearly 9.8 percent of the

CO₂ emission at the all India level. Next in order of importance in naphtha which contributes nearly 3 percent and kerosene contributes about 2.9 percent of the overall CO₂ emissions.

The inter-state profile of the contribution of different sources varies considerably from the all India average figures. It is important therefore to supplement the national level environmental control policies with the state and local level instruments.

b. Inter-state Variations in Environmental Quality

In a recent study, Mukherjee and Kathuria (2006) compare 14 major states in India covering all the general category states except Goa. States' environmental quality or environmental degradation is measured on the basis of number of indicators as summarized in Table 1.7.

Table 1.7: Descriptions of the Environmental Groups

Groups	Group Descriptions	Number of Indicators
AIRPOL	Air Pollution	6
INDOOR	Indoor Air Pollution Potential	6
GHGS	Green House Gases (GHGs) Emissions	4
ENERGY	Pollution from Energy Generation and Consumption	12
FOREST	Depletion and Degradation of Forest Resources	11
WATER	Depletion and Degradation of Water Resources	10
NPSP	Non-point Source Water Pollution Potential	7
LAND	Pressure and Degradation of Land Resources	7
Total		63

On the basis of these indicators, states are ranked according to their environmental quality (EQ), by first ranking the states according to individual criteria and then adding the ranks by the Borda rule³. The exercise was done for two time periods: early nineties (1990-1996) and late nineties (1997-2001). The relative position of states is summarized in Table 1.8.

³ The Borda Rule or Borda rank is the rank order scoring rule for ordinal aggregation. The rule can also be viewed as voting rule, where under each environmental criterion (voter), the states are ranked (voted) from high to low EQ. The rule invariably yields a complete ranking of alternatives.

Table 1.8: Ranks Obtained by States for Different Environment Quality Criteria: 1997-2001

Criteria/ States	AIRPOL	INDOOR	GHGS	ENERGY	FOREST	WATER	NPSP	LAND	EQ Score	EQRANK
Andhra Pradesh	2	9	4	3	5	9	12	10	54	6
Bihar	14	1	2	1	12	3	3	6	42	3
Gujarat	9	13	10	7	8	4	9	4	64	9
Haryana	11	11	14	14	13	11	13	13	100	14
Karnataka	12	7	11	8	4	10	7	9	68	11
Kerala	6	10	12	11	3	5	6	5	58	7
Madhya Pradesh	7	4	3	5	1	1	2	1	24	1
Maharashtra	3	12	7	2	7	6	5	8	50	5
Orissa	8	6	5	4	10	2	1	2	38	2
Punjab	4	14	13	13	14	13	14	14	99	13
Rajasthan	1	3	9	10	11	12	4	12	62	8
Tamil Nadu	5	8	8	12	9	14	10	3	69	12
Uttar Pradesh	10	2	1	6	2	7	11	7	46	4
West Bengal	13	5	6	9	6	8	8	11	66	10

Source: Mukherjee and Kathuria (2006)

Looking at the relationship between economic growth and population levels, the study finds evidence for the existence of an EKC, which says that with the rise in per capita income, environmental quality degrades and the environmental degradation continues up to a certain level of per capita income after which the environmental quality starts to improve as more resources become available for on pollution mitigation and use of leaner production technologies. The study finds an inverse relationship between growth in per capita income and environmental quality qualified by some better performing states in terms of maintaining environmental quality. In particular, Haryana, Tamil Nadu, West Bengal, and Karnataka have higher economic growth during late 1990s at the cost of their environmental degradation, whereas high economic growth of Maharashtra and Gujarat has not resulted in much environmental degradation. States like Orissa, Uttar Pradesh, Bihar, Kerala, Punjab and Andhra Pradesh have low economic growth, but seem to have managed their EQ relatively well. For a set of States like Madhya Pradesh, Maharashtra, Gujarat and Rajasthan, there is a positive relationship between economic growth and environmental degradation.

1.4 Growth and Changes in Structure of Output

The pattern of pollution depends on a number of factors including (a) geographic concentration of industries using highly polluting inputs such as coal, (b) structure of output, and (c) level and pattern of consumption. States that have a high share of

agriculture may have pollution affecting soil and ground water due to over use of chemical fertilizers and pesticides. States with a high share of manufacturing sector may have a larger incidence of air pollution due to emissions from their factories. States with a relatively larger share of services may face pressure on environment due to a high degree of urbanization. Higher per capita incomes would normally be associated with high vehicular density and lead to consumed-induced pollution. However, as the nature of environmental degradation may differ, in terms of the overall impact industrial pollution may have the largest impact.

Clearly, high growth rate and high shares of industrial production and to some extent high share of agriculture, dependent on fertilizers and chemicals, is highly correlated with environmental degradation. Accordingly state level economic instruments have to be designed to combat these features in the Indian states.

Table 1.9: Growth Rates: 1993-94 to 2004-05

(Percent)

States	GSDP	Population	Per Capita GSDP
Andhra Pradesh	11.63	1.089	10.432
Assam	10.00	1.621	8.250
Bihar	9.04	2.475	6.411
Gujarat	10.99	2.016	8.794
Haryana	12.34	2.362	9.746
Karnataka	11.86	1.432	10.282
Kerala	12.14	0.910	11.131
Madhya Pradesh	9.20	2.120	6.932
Maharashtra	10.53	1.860	8.512
Orissa	9.96	1.361	8.486
Punjab	10.08	1.559	8.385
Rajasthan	10.49	2.441	7.861
Tamil Nadu	10.79	0.985	9.714
Uttar Pradesh	9.56	2.269	7.133
West Bengal	7.31	1.425	11.330
15 States	10.84	1.802	8.879

Source (Basic Data): Central Statistical Organisation, New Delhi.

Table 1.9 presents the growth rates of GSDP, population, and per capita GSDP of 15 major states in India covering all the general category states excluding Goa and including Assam from among the special category states. In terms of growth rates, some of the middle income states like Kerala, Karnataka, and Andhra Pradesh appear to be doing very well, rising at real growth rates of close to 12 percent or above. In some

cases relatively high growth rates of population is observed. In particular Bihar, Gujarat, Haryana, Madhya Pradesh, Rajasthan and Uttar Pradesh, show a high rate of growth of population. In all these cases, the population growth rate is more than 2 percent per annum.

Based on information given in Table 1.10, Chart 1.1 shows combinations of levels of per capita GSDP and the growth rate of per capita GSDP. An upward sloping relationship is clearly indicated. The general pattern therefore seems to be of combinations of higher initial per capita income, higher growth rate, and higher levels of environmental degradation. In particular, states with a higher and growing share of the secondary sector are likely to experience higher pressures of environmental degradation.

The degree of urbanization is also widely different across states. Some of the highly urbanised states are Tamil Nadu, Maharashtra and Gujarat. On the other hand, states like Assam, Bihar and Orissa have degrees of urbanisation of population limited to 10-15 percent of their total population. Urbanisation is accompanied by high density of vehicular population and a much larger per capita consumption of electricity, and other resources. State and local level pollution abating instruments need to be developed for coping with pollution problems arising due to the growing urbanisation in the country.

Table 1.10: Per Capita GSDP and Growth Rate of Per Capita GSDP

States	Per Capita GSDP [Growth Rate (1993-05)] (Percent)	Per Capita GSDP [Average 2002-05] (Rs.)	Degree of Urbanisation
Andhra Pradesh	4.8	13050	27.3
Assam	1.6	7513	12.9
Bihar	2.1	4053	10.5
Gujarat	4.1	18735	37.4
Haryana	3.7	18146	28.9
Karnataka	5.4	14491	34.0
Kerala	4.8	14257	26.0
Madhya Pradesh	1.9	8830	26.5
Maharashtra	3.4	19148	42.4
Orissa	3.0	7557	15.0
Punjab	2.8	18438	33.9
Rajasthan	3.2	10388	23.4
Tamil Nadu	3.9	15154	44.0
Uttar Pradesh	1.7	6951	20.8
West Bengal	5.5	12766	28.0
15-state average	3.5	11750	27.3

Source (Basic data): Central Statistical Organisation and Census 2001.

Chart 1.1: Levels of Per Capita GSDP and the Growth Rate of Per Capita GSDP

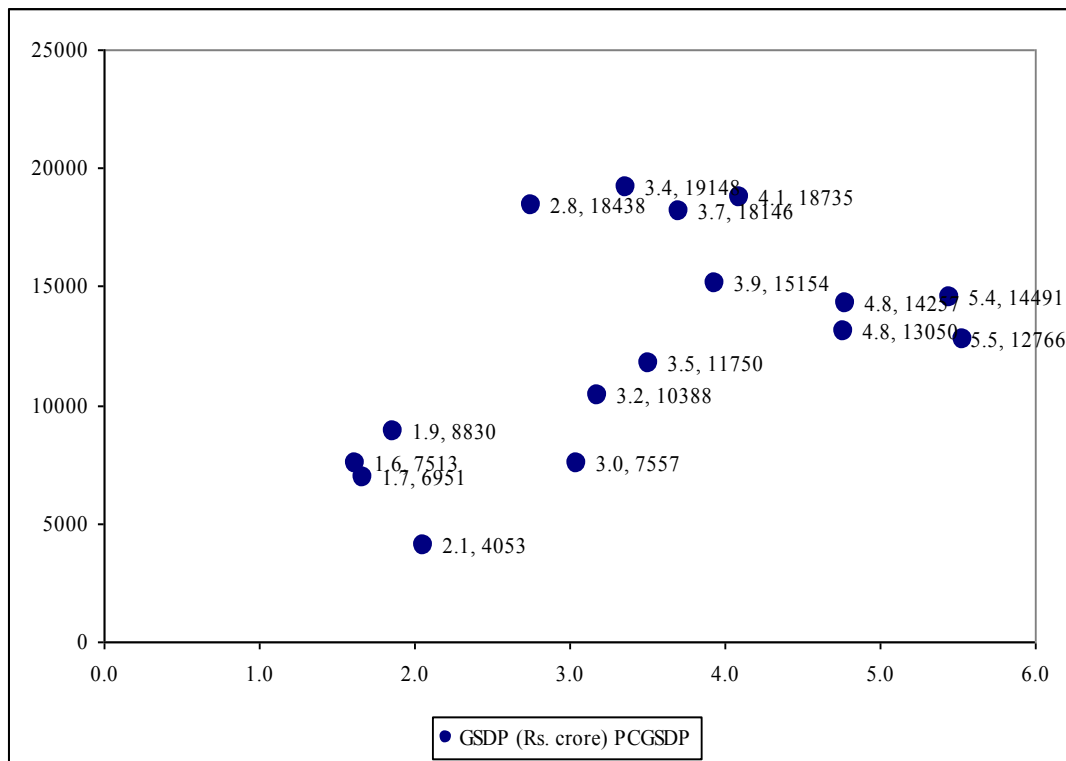


Table 1.11 shows the changes in the structure of GSDP for three selected years during the period from 1993-94 to 2004-05. States where a clear increase in the share of the secondary sector is discernible are Assam, Bihar, Punjab, Orissa, Gujarat, and Haryana. In general, some of the low income states have seen some increase in their industrial sectors. However even after this increase, the share of the industrial sectors is higher in some of the higher income states like Maharashtra and Tamil Nadu. In the group of states where industrial sector has risen include some of the lower income state as well as some of the higher income states. For the states as a whole, the share of agricultural sector has gone down and the share of secondary sector has remained almost stagnant. It is the share of the tertiary sector that has increased. With the increase in the share of tertiary sector, different kinds of environmental problems linked to urbanisation arise.

Table 1.11: Sectoral Shares in Gross State Domestic Product at Current Prices: 1993-94 to 2004-05

(Percent)

State/Sector	1993-94	1999-00	2004-05	State/Sector	1993-94	1999-00	2004-05
Andhra Pradesh				Maharashtra			
Primary	35.73	32.56	28.93	Primary	20.16	16.72	12.13
Secondary	21.92	22.19	22.24	Secondary	32.77	29.89	28.99
Tertiary	42.35	45.26	48.83	Tertiary	47.07	53.39	58.88
Assam				Orissa			
Primary	46.87	46.68	38.36	Primary	44.95	39.48	37.66
Secondary	14.93	14.28	17.85	Secondary	19.78	22.23	21.41
Tertiary	38.20	39.04	43.79	Tertiary	35.27	38.31	40.93
Bihar				Punjab			
Primary	48.78	39.37	36.00	Primary	46.13	41.50	36.47
Secondary	9.93	11.42	11.60	Secondary	21.76	23.20	23.78
Tertiary	41.29	49.21	52.41	Tertiary	32.10	35.31	39.76
Gujarat				Rajasthan			
Primary	25.46	18.77	19.05	Primary	36.27	32.05	26.72
Secondary	35.77	39.39	38.37	Secondary	24.96	28.54	28.70
Tertiary	38.77	41.84	42.58	Tertiary	38.77	39.41	44.57
Haryana				Tamil Nadu			
Primary	42.44	32.88	24.98	Primary	24.79	17.49	13.07
Secondary	26.24	29.56	31.07	Secondary	33.69	31.91	28.53
Tertiary	31.32	37.56	43.95	Tertiary	41.52	52.08	49.95
Karnataka				Uttar Pradesh			
Primary	36.32	29.85	18.22	Primary	39.80	36.90	34.39
Secondary	25.40	25.55	27.28	Secondary	21.45	23.53	21.92
Tertiary	38.27	44.60	54.50	Tertiary	38.75	39.57	43.69
Kerala				West Bengal			
Primary	30.58	24.96	16.33	Primary	33.84	32.89	25.20
Secondary	20.62	21.12	22.97	Secondary	23.02	19.27	20.55
Tertiary	48.80	53.92	60.69	Tertiary	43.14	47.84	54.25
Madhya Pradesh				15 States			
Primary	43.19	37.28	34.84	Primary	33.63	28.80	23.73
Secondary	21.15	25.34	23.93	Secondary	25.65	26.08	25.87
Tertiary	35.66	37.39	41.23	Tertiary	40.71	45.12	50.40

Source (Basic data): Central Statistical Organisation, New Delhi.

1.5 Plan of Study

This study is organized in seven chapters. Chapter 2 looks at the types and characteristics of incentive based environmental instruments in the light of theoretical considerations as well as international practice, focusing on eco-taxes. Chapter 3 looks at

the major environmental and ecological problems of the Indian states in greater detail. Chapter 4 examines the availability of pollution abating fiscal instruments, given the constitutional assignment of taxation powers for the central and the state governments. Chapter 5 provides a review of existing initiatives regarding pollution abatement of the states and examines the scope for intervention through eco-taxes. Chapter 6 looks at a complementary approach to pollution abatement using both the central and the state tax issues in the light of the need for developing an integrated approach to pollution abatement. Chapter 7 provides a summary of findings and conclusions.

Chapter 2

INCENTIVE BASED ENVIRONMENTAL INSTRUMENTS: THEORY AND PRACTICE

Environmental tax or eco-taxes have the potential to induce appropriate environmental decisions through instituting an incentive structure by raising the relative costs of polluting inputs and outputs. Emission trading is another market based instruments for coping with the environmental externalities. In contrast, regulation or command and control regimes are quantity based instruments for pollution control. These are viewed as having a higher cost to society because price-based instrument respond automatically to changes in the market. There has been some debate on the relative merits of *price* versus *quantity* instruments to achieve emission reductions.

- An emission cap and permit trading system is a *quantity* instrument because it fixes the overall emission level (quantity) and allows the price to vary. One problem with the cap and trade system is the uncertainty of the cost of compliance as the price of a permit is not known in advance and will vary over time according to market conditions.
- In contrast, emission taxes are a *price* instrument because it fixes the price while the emission level is allowed to vary according to economic activity. A major drawback of such emission taxes is that the environmental outcome (e.g. the amount of emissions) is not guaranteed.

The best choice depends on the sensitivity of the costs of emission reduction, compared to the sensitivity of the benefits (i.e., climate damages avoided by a reduction) when the level of emission control is varied.

2.1 Eco-taxes: Basic Features

The main form of eco-tax is a Pigouvian tax on polluters. A Pigouvian tax is a tax levied to correct the negative externalities of a market activity. It can be levied on polluting outputs as well as polluting inputs. Levied on output, it is aimed at raising the price of the output, inducing consumers to reduce consumption levels or shift to non-polluting substitutes. Its impact depends on the price-elasticity of the polluting good and availability and relative prices of close substitutes. Levied on inputs, any increase in the prices may be partially or fully passed on to the final goods, depending on the supply and demand elasticities. To the extent that the producers have to bear the burden of the price rise, they will explore the option of using non-polluting inputs should reasonable

substitutes be available. Large taxes may induce technological innovations reducing the use of the polluting inputs and increasing the use of non-polluting substitutes.

a. Forms of Eco-taxes

A carbon tax on the use of fossil fuels is an eco-tax. It is a tax on energy sources, which emit carbon dioxide. A carbon tax aims at reducing emissions of carbon dioxide and thereby slow global warming. It can be implemented by taxing the burning of fossil fuels like coal, petroleum products such as gasoline and aviation fuel, and natural gas, in proportion to their carbon content. Unlike market-based approaches such as carbon cap-and-trade systems, it has the benefit of being easily understood and can be popular with the public if the revenue is earmarked to fund environmental projects.

Effluent charges are also a form of eco-tax, which is levied on effluents, pollution and other hazardous wastes. These are widely used in Western and Eastern Europe countries and are used to control various range of pollutants like carbon monoxide (CO), carbon dioxide (CO₂), sulphur dioxide (SO₂), biological oxygen demand (BOD), Oxides of Nitrogen (NO_x), total suspended solids (TSS), nitrogen (N), phosphate (P), landfill and hazardous waste.

User Charges: These are applied to a range of items at the point of production like fuel taxes, charges for disposing of landfill and hazardous waste, taxes on batteries, beverage containers, batteries, tires, nuclear power, and fertilisers.

Insurance Premium Taxes: These are used in the case of oil and chemical pollution and the amounts raised are used to clean up in cases where the liable party cannot be found or cannot pay the full cost. These are used in Belgium, Finland and the US.

Sales taxes: Sales taxes are very widely used in almost all over the world.

Deposit Refund System: These are used for environment regulation for disposal or recycling hazardous waste.

Severance taxes are levied on the extraction of mineral, energy, and forestry products.

Licence fees are used for fishing and hunting.

Specific taxes on technologies and products, which are associated with substantial environmental negative externalities.

Garbage disposal taxes and refundable fees are used for positive environmental results.

Site value taxes on the unimproved value of land may also be used.

b. Revenue-neutral and Revenue Augmenting Forms of Eco-taxes

In one form, eco-taxes have been proposed as 'green taxes' that are not meant as a revenue-augmenting device. Instead the idea is to change the structure of taxation rather than putting additional burden on the tax payers. In such a case, while eco-taxes are designed, alongside a corresponding reduction in other conventional taxes has also to be planned. In a paper by Ballard and Medema (1992), it is argued that conventional taxes that tax labour and capital income are 'perverse' taxes as they penalise the 'goods', viz., human labour and the successful use of capital rather than taxing the 'bads', viz. the overuse of energy and primary resources that lead to pollution and consumption of exhaustible resources. Weizsacker *et al*/ (2005) argue that ecological tax reforms should be taken up as a 'revenue-neutral, slowly progressing long-term tax shift'.

The object of a green tax shift is often to implement a "full cost accounting" framework, using fiscal policy to internalize market distorting externalities, which would lead to higher efficiency and sustainable wealth creation. To the extent that green taxes correct for externalities such as pollution, they correspond with mainstream economic theory.

Many economists have argued that pollution levies are an efficient instrument for achieving environmental objectives (see Baumol and Oates 1988). Some have gone even further to suggest that environmental taxes may yield benefits over and above a cleaner environment. In particular, governments can use the revenues from pollution taxes to decrease other distortionary taxes. In this way, environmental taxes may yield a "double dividend-not only a cleaner environment, but also a less distortionary tax system. High estimates for the deadweight losses of current tax systems have been used to suggest that environmental taxes may yield important "side benefits" (see e.g., Oates, 1991, Pearce, 1991). Based on work by Bovenberg and de Mooij (1994) and others, it has been argued that a "double dividend"⁴ exists resulting from the introduction of environmental

⁴ The basic idea of the double dividend hypothesis is that using environmental tax revenue to reduce the existing distortionary taxes might be welfare improving regardless of the environmental gain.

taxes. In a full-employment model with mobile firms, Wellisch (1995) shows that direct controls lead to inefficiently low levels of emissions, while taxes continue to produce an efficient outcome. In a similar framework and with a fixed level of emissions, Hoel (1998) argues that taxes are the efficient instrument, and the use of quotas leads to inefficiencies.

Some green tax shift proposals have been criticized as being fiscally regressive (a tax with a marginal rate that decreases as the taxpayer's income increases). Taxing negative externalities usually entails exerting a burden on consumption and since the poor consume more and save or invest less as a share of their income, a shift towards consumption taxes can sometimes be regressive.

The regressivity of a carbon tax could be addressed by allocating the tax revenues to benefit the less affluent. Since richer households use more energy, on average most carbon tax revenues will come from them. This creates a basis for progressive tax-shifting: transferring a portion of the tax burden from regressive taxes such as the payroll tax (in the USA at the federal level) and the sales tax (in the USA at the state level) onto pollution and pollution-generating activities.

Concerns have been raised about carbon leakage which is the tendency for energy-intensive industries to migrate from nations with a carbon tax to those nations without a carbon tax where some of the receiving nations might be less energy-efficient. A possible antidote is for carbon-taxing countries to levy carbon-equivalent fees on imports from non-taxing nations.

There are difficulties in the implementation of Pigouvian tax as it requires complete information of marginal abatement cost and marginal damage functions. In view of these difficulties, Baumol and Oates (1988) have suggested that the standards should set that serve as targets for environmental quality coupled with fiscal measures and other instruments to help in attaining the standards.

Eco-tax may be imposed based on volume and concentrations of pollutants in industrial effluents, solid waste/sewage etc. The indirect economic instruments are (i) taxes/charges on products that are harmful to environment, (ii) taxes/charges on inputs which generate negative externalities, (iii) tax concessions in the form of discounts on excise duty, customs duty and sales tax on pollution control instruments, (iv) subsidies in industrial clusters to adopt clean technologies and common effluent treatment plants,

and (v) cheaper loans for those implanting environmentally friendly investments. Sankar (2002) in their paper have suggested three policy options for prevention and control of pollution (i) introduce pollution charges/taxes based on the volumes of waste and few parameters reflection polluting intensities, (ii) correct distortions in prices of scarce resources like fossil fuels, chemical fertilisers, irrigation water and water for industry, (iii) levy taxes on products and inputs which generate harmful effects. Sankar proposed to include price instruments in the above category at least for publicly provided goods and services. The reason being that any deviation between price and long-run marginal social cost can be interpreted as a tax or subsidy.

Taxes on polluting inputs and outputs have been suggested as a proxy for taxing emissions. These taxes could be levied at the manufacturing stage, consumption stage or disposal stage. In some cases, an eco-cess was recommended, which could be earmarked as special fund. Other policies like accelerated depreciation and capital subsidies were suggested for "green" substitutes.

2.2 Emission Trading

Emissions trading (or cap and trade) is an administrative approach used to control pollution by providing economic incentives for achieving reductions in the emissions of pollutants. In this case a central authority (usually a government or international body) sets a limit or *cap* on the amount of a pollutant that can be emitted. Companies or other groups are issued emission permits and are required to hold an equivalent number of *allowances* (or *credits*) which represent the right to emit a specific amount. The total amount of allowances and credits cannot exceed the cap, limiting total emissions to that level. Companies that need to increase their emissions must buy credits from those who pollute less. The transfer of allowances is referred to as a trade. In effect, the buyer is paying a charge for polluting, while the seller is being rewarded for having reduced emissions by more than was needed. Thus, in theory, those that can easily reduce emissions most cheaply will do so, achieving the pollution reduction at the lowest possible cost to society.

Marginal abatement costs (MACs) refer to the cost spent to reduce an extra unit of pollutant or other emissions. Taking advantage of the difference in MAC's is basic reason behind the international emissions trading markets. Because there is high uncertainty in the compliance costs of firms, some argue that the optimum choice is the price mechanism. However, some scientists have warned of a threshold in atmospheric concentrations of carbon dioxide beyond which a run-away warming effect could take

place, with a large possibility of causing irreversible damages. If this is a conceivable risk then a quantity instrument could be a better choice because the quantity of emissions may be capped with a higher degree of certainty. However, this may not be true if this risk exists but cannot be attached to a known level of green house gases (GHG) concentration or a known emission pathway.

There are active trading programs in several pollutants. For greenhouse gases the largest is the European Union Emission Trading Scheme. In the United States there is a national market to reduce acid rain and several regional markets in nitrous oxide. Markets for other pollutants tend to be smaller and more localized.

Carbon Trading is sometimes seen as a better approach than a direct carbon tax or direct regulation. By solely aiming at the cap it avoids the consequences and compromises that often accompany those other methods. It can be cheaper, and more acceptable to the existing industries because the initial allocation of allowances often has a 'grandfathering provision' where rights are issued in proportion to historical emissions. In addition, most of the money in the system is spent on environmental activities, and the investment directed at sustainable projects while earn credits in the developing world. Critics of emissions trading point to problems of complexity, monitoring, enforcement, and sometimes dispute the initial allocation methods and cap.

The overall goal of an emissions trading plan is to reduce emissions. The cap is usually lowered over time. In other systems, a portion of all traded credits must be retired, causing a net reduction in emissions each time a trade occurs. In many cap and trade systems, organizations which do not pollute may also participate. Environmental groups can purchase and retire allowances or credits and hence drive up the price of the remainder.

Tradable Permits are prevalent in United States for leaded gasoline, water quality, ozone depleting substances, NO_x, SO₂, and other air pollutants. In Canada, European Union and Singapore, tradable permits are use to bring down ozone depletion substances. In USA, the uses of tradable permits have been environmentally successful while in Europe there has been a greater reliance on taxes. The predominant form of environmental regulation is direct control through technology standards. Globally, eco-taxes play an important role in solid waste policies, water management, toxic waste disposal, local air pollution, agricultural run off etc.

2.3 Safety Valve

Another option, known as a *safety valve*, is a hybrid of the price and quantity instruments. The system is essentially an emission cap and tradable permit system but the maximum (or minimum) permit price is capped. Emitters have the choice of either obtaining permits in the marketplace or purchasing them from the government at a specified trigger price (which could be adjusted over time). The system is sometimes recommended as a way of overcoming the fundamental disadvantages of both systems by giving governments the flexibility to adjust the system as new information becomes available. It can be shown that by setting the trigger price high enough, or the number of permits low enough, the safety valve can be used either as a pure quantity or pure price mechanism.

2.4 Information and Labelling Programmes

Information and labelling programmes is a relatively low-cost way to improve consumers' and businesses' responses to energy prices and to simply make them more aware of the value of energy efficiency. These are used in Australia, European Union, US, Canada and Japan to encourage and facilitate energy efficient and positive attitudes to the environment. Compulsory labelling or free provision of information may lead to economic gains, even without levying an eco-tax. In the US, the Toxic Release Inventory forces firms to publicise their levels of use of toxic chemicals and waste production. Similarly, the US 'right to know' legislation allows citizens to find out about the environmental dangers they are exposed to and take legal or political action.

2.5 Effectiveness of Pollution Abating Instruments: Theoretical Studies

a. Impact of Eco-taxes

Most empirical evidence on the incidence of ecological taxes comes from simulation models rather than studies of actual programmes (see Tietenberg, 1985, for a summary of various models). All current models assume that the tax is fully passed through to consumers. Thus they implicitly assume perfectly elastic supply of factors, or equivalently full factor mobility. Some of the important studies are summarised below:

1. Poterba (1990) considers the relative expenditure shares directly devoted to energy across the expenditure distribution. He points out that, for consumers in the lowest expenditure quintiles who are receiving transfers, an automatic partial compensation mechanism exists through the indexation of transfers. This compensation is not captured in measures of regressivity. The indirect effects tend to reduce the

regressivity. Consumer incidence also varies significantly by region within the United States. The Midwest bears the highest costs; the Pacific States bear the lowest.

2. Casler and Rafiqui (1993) use a similar methodology for direct expenditures. They also use an input-output framework to estimate indirect incidence through the purchase of goods produced using energy. They find that rural households are harder hit, and the young less affected. Jorgenson *et al* (1992) find that large households are more affected.
3. Jorgenson, Slesnick and Wilcoxon (1992) use a general equilibrium model to consider the lifetime incidence of carbon taxes through all possible channels. The different models have several consistent qualitative results. All agree that the impact of the tax would be relatively, but not dramatically, regressive. These models do not mention anything about loss of capital income and therefore loss of capital value. To do this, a model needs to identify the elasticity of capital in specific industries and the owners of capital. The models currently can say nothing about the effects of carbon regulation on labour markets. Also the models all assume perfectly competitive pricing, which may not be appropriate in some of the key industries. Goulder *et al* (2000) estimate that existing capital bears around 10 percent of the present value of all future discounted costs from carbon regulation. This analysis looks at the distribution of spending on petrol and hence a significant part of the incidence of a carbon tax on consumers. However, although domestic transport makes up around 80 percent of liquid fuel emissions, they made up only around 25 percent of total CO₂ emissions in 1990⁵. In the long run, consumers will bear all the costs of carbon taxes. Any part that they do not bear directly through higher petrol and other fossil fuel prices, they will bear through the increased costs of goods they purchase.

Symons, Proops and Gay (1994) use a demand system with estimated demand elasticities to study reduction in emissions resulting entirely from consumer demand responses. In this study, they modeled the carbon tax as a set of *ad valorem* taxes on commodity groups. They use input-output data for calculating the consumers' responses to the price changes. They have taken the 14 sector house hold survey commodity grouping and 28 sector input-output classifications for the price changes and the corresponding demand changes. They also investigated the effect of allowing for substitution in production. They observe that the order of magnitude of a carbon tax to

⁵ Greenhouse Gas Emissions, New Zealand Energy Sources 1990 – 1994, Ministry of Commerce.

reduce emissions in Australia by 20 percent (assuming no technological substitution) is high (at A\$414 or US\$306 per tonne of carbon) but it is less than that calculated by Symons, Proops and Gay (1994) for the UK (US\$411). Furthermore, the distributional implications of the tax are also less adverse for Australia.

Bovenberg and Goulder (1996), examine the optimal environmental taxation in the presence of other taxes in a general-equilibrium framework. They examine how optimal environmental tax rates deviate from rates implied by the Pigouvian principle in a second-best setting where other distortionary taxes are present. They link the optimal rate for a newly imposed environmental tax to the marginal excess burden from existing taxes. In a general-equilibrium setting, Sandmo (1975) and Bovenberg and Frederick van der Ploeg (1994) have demonstrated how the well-known "Ramsey" formula for optimal commodity taxes is altered when one of the consumption commodities generates an externality.

Bovenberg and Goulder model indicates that in the presence of distortionary taxes, optimal environmental tax rates are generally below the rates suggested by the Pigouvian principle even when revenues from environmental taxes are used to cut distortionary taxes. The numerical simulations support this analytical result. Under central values for parameters, optimal carbon tax rates from the numerical model (when the tax system is fully optimized) are between 6 and 12 percent below the marginal environmental damages. In addition, the numerical model shows that in the presence of realistic policy constraints, optimal carbon tax rates are far below the marginal environmental damages and may even be negative. Simulations based on the U.S. tax system indicate that if policy makers can only incrementally alter existing distortionary taxes (rather than globally optimize the tax system); the optimal carbon tax may be substantially below the marginal environmental damages.⁶

Nordhaus (1993) considered how recycling carbon-tax revenues through cuts in distortionary taxes affect the optimal carbon tax. When revenues from the carbon tax are returned in lump-sum fashion, the optimal tax rate for the first decade is about \$5 per

⁶ These considerations suggest that estimates of optimal carbon taxes in integrated climate economy models (for example, Nordhaus, 1993, and Peck and Teisberg, 1992) are biased upward. Importantly, that study does not consider how preexisting taxes increase the gross costs of the carbon tax itself (before the revenues are recycled). While the Nordhaus study accounts for the efficiency gains connected with the reduction (through recycling) of initial distortionary taxes, it does not consider the efficiency costs stemming from the interactions between remaining distortionary taxes and the newly imposed carbon tax.

tonne; the optimal rate rises to \$59 per tonne when revenues are devoted to reducing distortionary taxes. Nordhaus (1993) examines the optimal greenhouse gas reductions and the tax policy in the dynamic integrated climate-economy (DICE) model.⁷ This model integrates the economic costs and benefits of other green house gases (GHG) reduction with a simple dynamic representation of the scientific links of emissions, concentrations, and climate change. They examine the alternative approaches to recycling carbon-tax revenues. The model contains two policy variables, conventional investment and reduction of the rate of emissions. The latter represents the fractional reduction of emissions relative to the uncontrolled level. The model determines the optimal control rate along with its dual variable, the derivative of the objective function with respect to emissions, which is the "carbon tax". Two key parts of the model are the climate-damage function and the GHG-reduction cost function. The results suggest that the optimal policy has a global benefit relative to no controls of \$16 billion annually. This policy would have a GHG control rate of slightly less than 10 percent in the first period. The optimal carbon tax would rise steadily over the coming decades, reaching about \$20 per tonne by the end of the next century. The environmentally correct policy of a 20 percent cut would impose significant net global costs of \$762 billion in annualized terms. The control rate in the environmentalist policy is higher than the optimal rate, around 30 percent in the first period, and would require a carbon tax of \$56 per tonne.

Manresa and Sancho (2005) follow the tradition of applied general equilibrium modelling of the Walrasian static variety to study the empirical viability of a double dividend (green, welfare, and employment) in the Spanish economy. They consider a counterfactual scenario in which an eco-tax is levied on the intermediate and final use of energy goods. Under a revenue neutral assumption, they evaluate the real income and employment impact of lowering payroll taxes. They perform simulations under a range of alternative model and policy scenarios to assess the extent the model structure and behavioural assumptions influence the results. They conclude that a double dividend (better environmental quality, as measured by reduced CO₂ emissions and improved levels of employment) may be an achievable goal of economic policy.

⁷ The DICE model assumes that a 3°C warming would lower world output by 1.3 percent and that the impact increases in a quadratic fashion with the temperature increase. Cline (1992) finds quantified impacts for the United States of 1.1 percent of GNP for a 2.5°C warming as opposed to the estimate of 1 percent for 3°C warming by the present author. Fankhauser (1992) estimates total impacts of a doubling of CO₂ would lead to a 1.3 percent cost to the United States, a 1.4 percent cost to the OECD, and a 1.5 percent cost to the world.

b. Impact of Deposit-refund Systems

Deposit-refund systems have significant behavioural effects in terms of assuring careful disposal or recycling where appropriate (Sigman, 1995). Some empirical evidence shows that hazardous waste taxes alter the overall production of hazardous waste as well as altering the method of disposal. Tradable permit programs such as the lead phase down and the Acid Rain program have been associated with dramatic reductions in pollutants (Stavins, 1998 and Hahn and Hester, 1989).

c. Impact of Emission Trading

The economic gains from emissions trading (similar to those that could be achieved through eco-taxes) have been estimated relative to command and control approaches and range from \$250 million annually from lead banking and around \$1 billion per year for the Acid Rain program to around \$5-12 billion from the lifetime of the EPA emissions trading program. Some evidence also supports the theoretical expectation that price signals created through economic instruments such as eco-taxes will lead to increased innovation (Stavins, Newell and Jaffe, 2000) and faster adoption of environmental technology (Kerr and Newell, 2000). Dynamic efficiency, providing efficient incentives for research and development and adoption of new technologies, is also critical (see Fischer, Parry and Pizer, 1998) to protect environment.

In the long run, the effect of a tax or tradable allowance system on R&D and adoption of new technology depends on firms' expectations about the continuity and future stringency of the system. Many people who are unaccustomed to economic approaches are deeply skeptical of the idea that simple price changes with no coercion will lead to significant long-term changes in behaviour. Empirical evidence suggests that responses to price signals are significant but cannot say if they are efficient (see Newell et al., 1999 and Kerr and Newell, 2000).

d. Relative Effectiveness of Eco-Taxes and Other Instruments: Empirical Findings

Hoel (1998) examines the effectiveness of emission taxes versus other environmental policies.⁸ He addresses four arguments, which are often directed against the use of emission taxes. Three arguments relate to information asymmetries and non-convexities.⁹

⁸ For general discussion of environmental taxes versus other policy instruments see Baumol and Oates (1971), Kneese and Schultze (1975), Yohe (1997) and Bohm and Rusell (1985).

⁹ The first two arguments against emissions taxes are related to the possibility of achieving a particular environmental target. It is argued that policymakers give high priority to reaching a quantitative target with a high degree of accuracy,

The other relates to employment effects of different environmental policies in economies with unemployment. He shows that employment is higher with environmental taxes than with non-revenue raising environmental policies.

In the case of greenhouse gas regulation, with no emissions trading (i.e. no regulation in developing countries) Bernstein *et al* (1999) suggest that China's output of energy intensive products will rise 1.94 percent under Kyoto Protocol and South East Asia's by 4.69 percent while Europe's will fall by 0.17 percent, Japan's by 1.06 percent and the US by 7.87 percent. In contrast, with global trading, China's output falls by 0.57 percent, South East Asia's rises by only 0.07 percent and Europe, Japan and the US output rises 0.44 percent, 0.18 percent and falls 0.59 percent, respectively. Global trading of emissions and hence global equalisation of marginal regulatory intensity almost totally removes the effect of the Kyoto Protocol on energy intensive production patterns. The key for maintaining production levels in each country is equalising the marginal effect across countries, not the total cost of the regulation.

Even without regulation in developing countries, the extent of displacement of production is a matter of empirical debate.¹⁰ The extent of displacement will clearly depend on the stringency of the Kyoto Protocol and the resulting rise in marginal cost of energy use. If Kyoto has a small effect on costs, it will have a small displacement effect. Tulpulé *et al* (1999) suggest that leakage/displacement will be low. For example US production is predicted to fall 9.3 percent with leakage and 8.2 percent without. Japanese production is expected to fall 12.5 percent with leakage and 11.6 percent without. These changes have infinitesimal effects on GDP. More generally, empirical evidence seems to suggest that production location decisions are mostly driven by other factors such as the quality of the local labour force, infrastructure, local amenities, and political stability¹¹. Studies generally find no identifiable effect from differences in environmental regulation. If eco-taxes are a more efficient form of regulation for a particular problem they will have even smaller effects on competitiveness than alternative regulatory forms.

even in cases where the exact achievement of a quantitative target is not important from an economic point of view. The third argument relates to the case in which it is costly/difficult/impossible to monitor emissions. Here, it may also be possible to use some type of environmental tax, but it is not obvious that environmental taxes in such cases are superior to appropriate forms of direct regulation. In the fourth he deals with emission taxes and other types of policy instruments in a situation with unemployment. Politicians often argue that emission taxes impose higher costs on producers than various forms of direct regulation, and may therefore be harmful to employment.

¹⁰ These issues are analyzed in detail by Weyant (1999).

¹¹ For a survey see Jaffe, Peterson, Portney, and Stavins (1995).

Kerr (2001) while examining the differences across income groups in the share of income spent on petrol finds that carbon taxes may be mildly regressive in their effect through petrol expenditures but it may be the middle-income people who bear the greatest cost relative to their total current and permanent income¹².

In the US, excise taxes on hazardous chemicals were enacted in 1980 to fund the Environmental Protection Agency's hazardous waste site clean up program. In the aftermath of the Exxon Valdez oil spill, U.S. Congress imposed an additional excise tax on petroleum and petroleum products to fund the Oil Spill Liability Trust Fund in 1989. Congress also imposed an excise tax on the manufacture of ozone-depleting chemicals¹³ in the same year.

2.6 Pollution Abating Instruments in Practice: International Experience

The report by OECD (2007) observes that the number of environmentally related taxes in OECD countries has increased steadily over the years. The OECD and the European Environment Agency (EEA), mentions about 375 environmentally related taxes in OECD countries (excluding measures of 250 environmentally related fees and charges). This includes the energy and transport sectors, and a number of taxes and charges linked to measured or estimated emissions. About 90 percent of the revenues from the environmentally related taxes stems from taxes on motor vehicle fuels and motor vehicles. The environmentally related taxes raise revenues in the order of 2-2.5 percent of gross domestic product (GDP). Taxes and charges can trigger major behavioural changes that cut back on polluting activities, but raise small amounts of revenue because the tax-bases diminish. Fuel use has significantly fallen in recent years in response to higher crude prices and fuel taxes. In a number of countries, using the sulphur content of the fuel as one determinant of the level of fuel tax has led to a strong decrease in sulphur dioxide (SO₂) emissions. A tax on plastic bags in Ireland rapidly had the desired environmental effect of sharply reducing plastic bag usage. Shops stopped giving them

¹² In estimation of the equation many factors that influence household's petrol expenditures such as age, distance to services and employment, occupation, and personal preferences were not included.

¹³ The environmental tax policy, and a more detailed compilation of such tax provisions, begins with Congressional hearings held in March 1990 [see U.S. Congress, Joint Committee on Taxation (1990) and U.S. Congress, Committee on Ways and Means (1990)]. On the issue of global warming, see H.R. 4805, introduced in the 101st Congress by Representative Stark of California. On the issue of recycling (see H.R. 4575 introduced in the 101st Congress by Representative Slaughter of Virginia). This provides information on tax credits to newspaper publishers who use recycled newsprint. For further details see releases from the U.S. Congressional Budget Office on "Carbon Charges as a Response to Global Warming: The Effects of Taxing Fossil Fuels" in August 1990, and "Federal Options for Reducing Waste Disposal" in October 1991. In 1989, Congress enacted the excise tax on ozone-depleting chemicals for reducing the use of chlorofluorocarbons.

away free to customers and the increased price of the bags encouraged customers to return to re-usable shopping bags.

Environmentally related taxes may be efficient, but while implementing them governments need to take into account concerns about any negative impact they might have on the competitiveness of certain sectors, such as energy-intensive or export-oriented industries, and on individuals or households. To meet these concerns, OECD governments often grant exemptions to these taxes. Currently there are more than 1150 such exemptions and several hundred refund mechanisms and other tax provisions. These exemptions generally tend to reduce the environmental effectiveness of the taxes, as well as the economic efficiency with which environmental policy targets are met.

An eco-tax has been enacted in Germany by means of three laws in 1998, 1999 and 2002. The first introduced a tax on electricity and petroleum, at variable rates based on environmental considerations; renewable sources of electricity are not taxed. The second adjusted the taxes to favor efficient conventional power plants. The third increased the tax on petroleum. At the same time, income taxes were reduced proportionally so that the total tax burden remained constant.

The Netherlands, Portugal, and Finland have introduced differentiations into their car registration taxes to encourage car buyers to opt for the cleanest car models. In the Netherlands, the new registration taxes, payable when a car is sold to its first buyer, can earn the owner of a hybrid a discount up to € 6000. Austria has had a registration tax based on fuel consumption for several years.

The European Union has discussed a carbon tax covering its member states to supplement the carbon emissions trading scheme begun in January 2005. The UK has unilaterally introduced a range of carbon taxes and levies to accompany the EU ETS trading regime. However, emissions trading systems do not constitute a Pigovian tax insofar as (a) the payment for emissions is not received by a governmental body, and (b) the price per unit of emissions is not fixed as it is in tax systems, rather it is a market price that fluctuates.

On January 1, 1991, Sweden enacted a carbon tax, placing a tax of 0.25 Swedish Kroner (SEK)/kg (\$100 per tonne) on the use of oil, coal, natural gas, liquefied petroleum gas, petrol, and aviation fuel used in domestic travel. Industrial users paid half the rate (between 1993 and 1997, 25 percent of the rate), and certain high-energy industries

such as commercial horticulture, mining, manufacturing and the pulp and paper industry were fully exempted from these new taxes. In 1997 the rate was raised to 365 SEK/kg (\$150 per tonne) of CO₂ released. In 2007, Sweden will raise taxes on carbon emissions. Finland, the Netherlands, and Norway also introduced carbon taxes in the 1990s.

The United Kingdom Treasury imposed the Fuel Price Escalator, an incrementally-increasing pollution tax, on retail petroleum products from 1993. The increases stopped after politically-damaging fuel protests in 1999, at which time tax and duty represented more than 75 percent of the total pump price. Tax now represents about 2/3rd of the pump price.

In 2005, New Zealand proposed a carbon tax, setting an emissions price of NZ\$15 per tonne of CO₂ equivalent. The planned tax was scheduled to take effect from April 2007, and applied across most economic sectors though with an exemption for methane emissions from farming and provisions for special exemptions from carbon intensive businesses if they adopted world's-best-practice standards of emissions. After the 2005 election, the minor parties supporting the Government opposed the proposed tax, and it was abandoned in December 2005.

A tax on plastic bags was introduced in Ireland in 2002, with a tax rate of EUR 0.15 per bag. The tax has contributed to a reduction in the use of plastic bags by more than 90 percent, leading to a considerable reduction of the litter problem. From an administrative point of view, it was originally thought it would be most efficient to levy the tax on producers and importers of plastic bags, thus limiting the number of collection points. However, domestic producers of plastic bags argued that the proposed tax rate would represent some 1500 percent of the net-of-tax price of the bags, which could make smuggling an issue. From an environmental perspective, it was also argued that levying the tax at the point of sale could provide a stronger signal to consumers to avoid using plastic bags. Based partly on these arguments, the tax is levied at some 5000 points of sale. Each retailer is obliged to pass on the full amount of the levy to their customers, and local authorities ensure that they do so. To limit the administrative costs of such an approach, the Irish Office of the Revenue Commissioners developed a solution where the collection of the tax was integrated into the VAT collection system. This entailed a one-off set-up cost of some EUR 1.2 million and annual administrative costs in the order of EUR 350000. The retailers' extra administrative costs seem to be more than off-set by cost savings, in terms of forgone plastic bag purchases and through additional sales of bin liners.

In the UK, the latest policy changes in 2008 have introduced a significant 'green' shift in the regime of indirect taxes. Taxes have been tilted heavily against alcohol, cigarettes, gas-guzzling cars and, potentially, plastic bags. Much as advocated by the advocates of green shift in taxes, a gradual increase in the tax rates is also planned. These changes are seen to have long run welfare improvement apart from reducing the carbon emissions. Alcohol duties are slated to rise by 6 percent above the rate of inflation, meaning an extra 4 pence for a pint of beer, 13 pence for a bottle of wine and a whopping 55 pence a bottle for spirits such as whisky. The duties will then rise by another 2 percent above inflation in each of the next four years, reversing a trend in previous budgets to keep increases low for most alcohol products. A packet of cigarettes will rise by 11 pence. The first budget under Prime Minister Gordon Brown is also planned to reward environmentally aware voter by imposing higher taxes on heavier polluting cars from 2010. These increases are to be charged at the point of sale and subsequent higher road taxes, gas guzzling vehicles and sports cars will have larger price tags and be more expensive to drive. The government will impose a charge on single-use plastic bags next year, a measure already in place in Ireland. The government stressed that the money raised by a plastic bag levy would go to environmental charities.

2.7 Pollution Abatement: Indian Experience

In India also, the impact on pollution abatement of several policy measures has been studied in a number of studies. Kathuria (2001) examines the common effluent treatment plants (CETP)¹⁴ advocated as a cost effective method for meeting the standards by the small-scale polluting units in industrial estates/clusters. He argues that common effluent treatment plants do not solve the problem as many hazardous persistent organic pollutants and toxic metals remain in the treated water or in the sludge. He is in favour of pollution prevention rather than pollution control.

Kerr (2002) examined watershed development projects initiated in India under various types of organizations and qualitatively analyzes the impact of those projects on the poorest sector of society, based on informal personal interviews. He observes that in the case where public lands are closed to use for re-vegetation, women and the poorest in the villages were hurt the most, although frequently the effort failed and the closing of the commons was not enforced.

¹⁴ This concept was used by Ministry of Environment in 1984 to treat waste-water from a large number of small and medium-scale industries. This was basically to monitor waste discharge by individual industries.

Chatterjee, Dhavala and Murthy (2007) provide estimates of cost of air pollution abatement for road transport in India for two states Andhra Pradesh and Himachal Pradesh for vehicles complying with Euro norms. The pollution abatement cost of each vehicle comprises the cost of upgrading vehicular technology and the cost of improving fuel quality. For passenger cars complying with Euro III norms, it is estimated at Rs. 7190 and Rs. 6624 for Andhra Pradesh and Himachal Pradesh. If all vehicles comply with Euro III norms, total air pollution abatement cost of the road transport sector would be 2.13 percent and 2.16 percent of gross state domestic product for the two states respectively.

Kathuria (2005) investigated whether CNG conversion has really affected all the air pollutants or not¹⁵ using data from June 1999 to September 2003 from the busiest intersections in Delhi. The study finds that there is no improvement in ambient quality as NO_x rose after the conversion while suspended particulate matter and respirable suspended particulate matter showed only a marginal fall. Only carbon monoxide showed a significant decline.

A World Bank (2001) study showed that the poor conversion of some gasoline vehicles to CNG has led to higher emissions, and even accidents. Pundir (2001) found that 20 percent of the in-service vehicles contribute to 60 percent of the total vehicular emissions under Indian road conditions.

Behera and Reddy (2002) study the impact of water pollution on rural communities as a whole and on some specific areas like agricultural production, human health, and live stock in a village under the Patancheru industrial belt of Medak district¹⁶ in Andhra Pradesh. They highlighted the failure of market, as it failed to internalise the externalities, causing extensive damage to the victims. The political intervention and legal bottlenecks hindered the implementation inspite of the Pollution Control Board acquiring powers to close down units causing pollution. The NGO's community action was met with severe action from the authorities leading to militancy.

¹⁵ The major air pollutants are suspended particulate matter, respirable suspended particulate matter, sulphur dioxide, carbon monoxide and Ozone.

¹⁶ It has major chemical and bulk drug manufacturing units which generate hazardous waste, these are dumped at sites which lead to contamination of soil, surface and ground water.

Chapter 3

MAJOR ENVIRONMENTAL/ECOLOGICAL PROBLEMS OF THE STATES

The main forms of pollution are atmospheric pollution, land degradation and soil pollution, water pollution, and noise pollution. The main sources of pollution are industries that pollute both water and atmosphere by emitting harmful gases and discharging effluents. Vehicles constitute an important source of atmospheric and noise pollution. Fertilizers and pesticides as well as mining and industrial activities pollute land and soil. In designing a suitable strategy for state level system of eco-taxes, we need to examine the differential inter-state incidence of the different sources of pollution.

3.1 Atmospheric Pollution

The atmosphere consists of a mixture of gases that completely surround the earth. Major polluting gases/particles are confined to the lowermost layer of atmosphere known as Troposphere that extends between 8 and 16 kilometers above the earth surface.

a. Sources of Atmospheric Pollution

The main sources of atmospheric pollution are: (a) combustion of fuels to produce energy for heating and power generation in the household and industrial sectors; (b) exhaust emissions from the transport vehicles that use petrol, diesel oil, etc., and (c) waste gases, dust and heat from many industrial sites including chemical manufacturers, electrical power generating stations, etc. Three main pollutants of ambient air quality are Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂) and Particulate Matter (PM).

a1. Combustion of Fuels

A considerable amount of air pollution results from the 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. More than 60 percent of Indian households depend on traditional sources of energy like fuel wood, dung and crop residue for meeting their cooking and heating needs. Burning of traditional fuels introduces large quantities of carbon dioxide (CO₂) when the combustion is complete, but if there is incomplete combustion and oxidation then carbon monoxide (CO) is produced, in addition to hydrocarbons (HCs). 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 percent of sulphur which is oxidized to SO₂ during combustion. The consumption of petroleum products in vehicles,

industries and domestic cooking activities results in the emission of pollutants in large quantities.

a2. Industrial Emissions

Air borne emissions emitted from various industries include solid particles (SPM) and gaseous emissions (SO₂, NO_x, CO, etc.). In India, 17 categories of highly polluting industries have been identified. The Ministry of Environment and Forests has 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.

a3. Road Transport

Road vehicles emit CO, HCs, NO_x, SO₂, and other toxic substances such as TSP and lead. Vehicles are one of the major sources of NO₂ in the country. Diesel engines have a conversion efficiency of around 30 percent while petrol engines have 15-20 percent conversion efficiency. Both types of engines have incomplete combustion of fuel, so the major pollutant is CO, amounting to 91 percent by weight of all vehicle emissions. 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. Vehicular pollution has a higher incidence in areas where poor quality of vehicles or lower quality of fuel is used. The incidence is also high in large cities with high concentration of motor vehicles.

The high concentration of particulates in the atmosphere over large urban and industrial areas are harmful. Smoke and fumes can increase the atmospheric turbidity and reduce the amount of solar radiation reaching the ground.

Table 3.1 shows the number of vehicles along with major types of vehicles in the major states in India. By the end of 2002-03, in India, we had 6.7 crore vehicles of which nearly 4.75 crore were two wheelers, 66 lakh cars, and 35 lakh goods vehicles. In terms of the relative share of the major states in the all India total number of vehicles as given in Table 3.2 Maharashtra had the highest share of 12.1 percent, followed by Tamil Nadu, which had a share of 11.9 percent. Gujarat was the next with a share of 9.7 percent, followed by Uttar Pradesh with a share of 8.8 percent. In terms of two wheelers, Tamil Nadu had the highest share of 13.2 percent followed by Maharashtra at 11.8 percent. In terms of cars, Maharashtra had the largest share but in terms of goods vehicles Tamil

Nadu has a higher share whereas Uttar Pradesh had a much lower share. In all the three categories of auto-rickshaws, cars and goods vehicles, Uttar Pradesh had a relatively lower share.

Table 3.1: State-wise Number of Vehicles: Major States: 2002-03

State/UT	Total No. of Vehicles	Of which			
		Two- Wheelers	Auto- Rickshaws	Cars	Goods Vehicles #
Andhra Pradesh	5001623	3985049	245935	312096	182889
Assam	656663	372825	24886	95063	92394
Bihar	1121398	709213	66316	61832	64919
Gujarat	6508370	4702529	275740	504801	362572
Haryana	2278489	1356957	33258	238816	175269
Karnataka	3738401	2527674	187262	405621	183509
Kerala	2552171	1449154	276244	336540	193061
Madhya Pradesh	3458988	2600989	43055	134045	99688
Maharashtra	8133837	5587662	463550	831261	456355
Orissa	1358586	1074873	19667	59296	77692
Punjab	3307604	2414928	34442	239210	105508
Rajasthan	3486679	2429892	59125	179969	166576
Tamil Nadu	8004982	6260093	147087	690271	458290
Uttar Pradesh	5928395	4488426	74692	326604	143296
West Bengal	2366416	1429818	42362	482429	239166
INDIA	67033032	47525161	2114668	6597325	3487538

Source: Transport Research Wing, Ministry of Road Transport and Highways (2003).

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

Additional details covering all States and Union Territories are given in Appendix Table 9.

Table 3.2: State-wise Share in the Total Vehicles in the Country: 2002-03

State/UT	Total No. of Vehicles	Of which			
		Two- Wheelers	Auto- Rickshaws	Cars	Goods Vehicles #
Andhra Pradesh	7.46	8.39	11.63	4.73	5.24
Assam	0.98	0.78	1.18	1.44	2.65
Bihar	1.67	1.49	3.14	0.94	1.86
Gujarat	9.71	9.89	13.04	7.65	10.40
Haryana	3.40	2.86	1.57	3.62	5.03
Karnataka	5.58	5.32	8.86	6.15	5.26
Kerala	3.81	3.05	13.06	5.10	5.54
Madhya Pradesh	5.16	5.47	2.04	2.03	2.86
Maharashtra	12.13	11.76	21.92	12.60	13.09
Orissa	2.03	2.26	0.93	0.90	2.23
Punjab	4.93	5.08	1.63	3.63	3.03
Rajasthan	5.20	5.11	2.80	2.73	4.78
Tamil Nadu	11.94	13.17	6.96	10.46	13.14
Uttar Pradesh	8.84	9.44	3.53	4.95	4.11
West Bengal	3.53	3.01	2.00	7.31	6.86
INDIA	100.00	100.00	100.00	100.00	100.00

Table 3.3 shows the category of pollution load of different types of vehicles in terms of the carbon monoxide (CO) emissions. The largest pollution load emanates from private commercial goods vehicle followed by two-stroke two wheelers (2S/2W) and light commercial vehicles (LCV). For emission of hydrocarbons the two-stroke two wheelers and private commercial goods (PCGs) vehicles had the highest pollution load. In this case of emission of nitrogenous oxides the highest pollution load was for private commercial vehicles followed by truck and light commercial goods vehicles. In terms of the pollution load for the ozone potential, two-stroke two wheelers are the most damaging followed by private commercial goods vehicles and three wheelers.

Table 3.3: Category-wise Pollution Load of Vehicles: 2005

(Thousand Tonnes)

Vehicles	CO	HC	NO_x	PM	Benzene	BUTDN	Ozone Potential
Buses	24.7472	5.527692	76.4352	6.3844	0.026171	0.0048	19.1597
Taxis	2.204345	0.421481	1.020249	0.510331	0.024397	0.007556	1.4609
PCG	595.1925	102.9881	114.5861	5.37958	6.357509	0.93816	357.0164
PCD	2.8754	0.50072	1.431865	0.571527	0.028627	0.008752	1.7357
MUV-G	16.00954	2.242921	3.108215	0.168137	0.167631	0.024967	7.7751
MUV-D	30.15951	1.804338	16.11801	7.291563	0.175473	0.058491	6.25488
3W	63.41416	44.8064	0.968903	1.129543	1.575929	0.069132	155.3234
4S/2W	40.24123	11.3397	4.773367	0.926914	0.669075	0.088262	39.3099
2S/2W	391.206	281.8195	4.46923	6.65697	4.013949	0.435521	1028.249
Trucks	55.25224	11.58194	74.72162	11.86569	0.05888	0.011176	40.1496
LCV	104.6087	3.303424	30.03871	7.829501	0.165171	0.047691	11.4513
Total	1325.91	466.3362	327.6715	48.71416	13.26281	1.694508	1667.886

Source: Transport fuel quality for year 2005. Central Pollution Control Board, Ministry of Environment and Forests, Government of India.

CO: Carbon Monoxide; **CC:** Catalytic Converter; **PM:** Particulate Matter; **HC:** Hydrocarbon; **NO_x:** Oxides of Nitrogen; **LCV:** Light Commercial Vehicles; **MUV:** Multi Utility Vehicles; **3W:** Three Wheeler. **BUTDN:** Butadiene.

Table 3.4 describes the exhaust emission standards for Indian vehicles covering both petrol vehicles and diesel vehicles. While there is considerable improvement since 1990-91 in the emission standards, further improvement in the two wheeler and three wheeler segments are called for given the large number of such vehicles.

The Central Pollution Control Board of the Ministry of Environment and Forests carried out a forward looking exercise upto 2010 indicating the impact of fuel quality and engine technology in terms of the ozone potential showing significant improvement by 2010 if the fuel quality of 2005 and the engine technology of 2005 proposed values are used (case D). The improvement is limited in the case of two-stroke two wheeler vehicles (factor of 34 percent) whereas the improvement in the case of PCG was by a margin of 34 percent. In the case trucks, there was no improvement. There is an Overall improvement by a margin of 33 percent (Table 3.5),

Table 3.4: Phased Tightening of Exhaust Emission Standards for Indian Automobiles

Category	1991	1996	2000 (Euro II)	2005 (Euro III)
Petrol Vehicles : (in grams/km)				
(i) Two wheelers				
(a) CO	12-30	4.5	2.00	-
(b) HC	8-12	-	-	-
(c) (HC+NO _x)	-	3.6	2.00	-
(ii) Three Wheelers				
(a) CO	12-30	6.75	4.00	-
(b) HC	8-12	-	-	-
(c) (HC+NO _x)	-	5.4	2.00	-
(iii) Cars with CC :				
(a) CO	-	4.34-6.20	2.72	2.20
(b) HC	-	-	-	-
(c) (HC+NO _x)	-	1.5-2.18	0.97	0.50
(iv) Cars without CC :				
(a) CO	14.3-27.1	8.68-12.4	2.72	2.20
(b) HC	2.0-2.9	-	-	-
(c) (HC+NO _x)	-	3.00-4.36	0.97	0.50
Diesel Vehicles :				
A : Gross Vehicles Weight > 3.5 ton (Heavy Duty Vehicles)-in grams/kWh				
(a) CO	14.0	11.2	4.50	4.00
(b) HC	3.5	2.4	1.10	1.10
(c) NO _x	18.0	14.4	8.00	7.00
(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	0.08

Source: The Energy Resources Institute.

CO: Carbon Monoxide; **CC:** Catalytic Converter; **PM:** Particulate Matter; **HC:** Hydrocarbon; **NO_x:** Oxides of Nitrogen; **NO_x:** Oxides of Nitrogen: The test cycle is as per 13 mode cycle or a chassis 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.

Table 3.5: Category-wise Ozone Potential of Vehicles under Different Scenarios -2010

(Thousand Tonnes)

Vehicles	Ozone			
	A	B	C	D
Buses	23.6764	23.1911	24.55391	23.9191
LCV	11.4048	9.4288	9.7755	8.1116
MUV-G	7.9503	7.3649	6.1829	5.7438
MUV-D	12.64126	10.26126	10.7966	8.82896
PCG	319.9306	305.8357	248.6682	238.4928
PCD	2.8611	2.2291	2.4401	1.9207
Taxis	0.91	0.67013	0.77	0.17846
Trucks	42.8138	42.0166	44.3762	43.7783
3W	71.8402	54.0951	55.7204	42.0448
4S/2W	48.2657	52.1265	37.6472	40.6654
2S/2W	694.2833	676.4602	540.8494	518.0621
Total	1236.577	1183.679	981.7804	931.746

Source: Transport fuel quality for year 2005. Central Pollution Control Board, Ministry of Environment and Forests, Government of India.

Note: Case 2010A: Fuel quality of 2000 Engine technology of 2000 i.e. there will be no change in 2005 but 2000 norms to be continued.

Case 2010B: Fuel quality of 2000 Engine technology of 2005. The engine technology is updated in 2005 while fuel technology to remain same as in 2000.

Case 2010C: Fuel quality of 2005 Engine technology of 2000. In this case fuel quality is upgraded to 2005 norms while maintaining engine technology of 2000.

Case 2010D: Fuel quality of 2005 Engine technology of 2005. Both fuel quality and engine technology are changed to 2005 proposed values.

a4. Particulate Matter

In most India cities, the annual average concentrations of respirable suspended particulate matter (RSPM) and suspended particulate matter (SPM) reflecting presence of particulate matter exceeded the National Ambient Air Quality Standards. The reasons for high particulate matter levels may be vehicles, engine gensets, small scale industries, biomass incineration, boilers and emission from power plants, resuspension of traffic dust, commercial, and domestic use of fuels.

3.2 Land and Soil Degradation

a. Soil Degradation

Land is degraded when it suffers a loss of its intrinsic qualities, decline in its capabilities or loss in its productive capacity. Land degradation may be due to natural causes or human causes or it may be due to a combination of both. Soil erosion is the major cause

of land degradation. In India, about 130 million hectares of land (45 percent of total geographical area) is affected by serious soil erosion through ravine and gully, shifting cultivation, cultivated wastelands, sandy areas, deserts, and water logging. Soil erosion by rain and river that takes place in hilly areas causes landslides and floods, while cutting trees for firewood, agricultural implements and timber, grazing by a large number of livestock, over and above the carrying capacity of grass lands, traditional agricultural practices, construction of roads, indiscriminate limestone quarrying and other similar activities, have all led to the opening of hill-faces to heavy soil erosion. Wind erosion causes expansion of deserts, dust, storms, whirlwinds and destruction of crops, while moving sand covers the land and makes it sterile. Excessive soil erosion with consequent high rate of sedimentation in the reservoirs and decreased fertility has become serious environmental problems with disastrous economic consequences. Of the 16 rivers of world, which experience severe erosion and carry heavy sediment load, 3 rivers, namely; Ganges, Brahmaputra and Kosy occupy the second, third and twelfth positions, respectively.

Soil erosion results in huge loss of nutrients in suspension or solution, which are removed away from one place to another, thus causing depletion or enrichment of nutrients. Besides the loss of nutrients from the topsoil, there is also degradation through the creation of gullies and ravines, which makes the land unsuitable for agricultural production. A major concern particularly about chlorinated hydrocarbons like DDT is their persistence in soil. Among fertilizers, the conversion of fertilizer-N to gaseous forms-ammonia (NH_3) and various oxides of Nitrogen lead to atmospheric pollution. Escape of fertilizer-N as ammonia gas is called ammonia volatilization. The presence of ammonia and sulphur dioxide may lead to acid rains which ultimately degrade the soil. Atmospheric ammonia contaminates water bodies, impairs visibility and causes corrosion. Nitrous oxide also contributes to global warming.

Table 3.6 gives information on the percent of degraded area for selected districts of various states. The average degradation percentage is 18.8 considering all the districts. Some of the relatively higher percentages compared to the average are Mizoram, Maharashtra, Uttar Pradesh, West Bengal, Madhya Pradesh, Himachal Pradesh and Bihar. The reasons for such degradation can be quite different. In the hilly areas degradation, can be due to erosion of soil and running of water. In the case of states like Bihar and Madhya Pradesh, degradation may be due to the large number of mines.

Table 3.6: State-wise Information on Degraded Land of the Districts

				(Hectare)			
State/District	Total Area	Total Degraded	Percent Degraded Area	State/District	Total Area	Total Degraded	Percent Degraded Area
Andhra Pradesh				Maharashtra			
Kurnool	1761393	309412	17.50	Bhandara	934716	49933	5.35
Nellore	1307600	169808	13.00	Nasik	1527764	647462	42.38
Bihar				Wardha	630900	69308	10.98
Banka	278768	29294	10.51	Meghalaya			
Bhagalpur	255822	32589	12.74	East Garohills	260300	34201	10.37
Gaya	473659	7727	1.63	South Garohills	185700	N/A	--
Munger	634594	144617	22.79	West Garohills	370700	N/A	--
Siwan	221900	22611	10.19	Mizoram			
Goa				Aizawl	357631	109184	30.53
North Goa	175592	24634	14.03	Champhai	318583	184795	58.01
South Goa	194608	19639	10.09	Kolasib	138251	16865	12.20
Gujarat				Mamit	302575	50986	16.85
Bharuch	776430	192841	24.84	Serchhip	142160	70702	49.74
Bhavnagar	1115500	271337	24.33	Rajasthan			
Surat	776161	85469	11.10	Ajmer	842388	398913	47.36
Himachal Pradesh				Jhunjhunu	591681	81478	13.78
Chamba	671500	74238	11.05	Nagaur	1764504	361120	20.47
Kullu	566604	259127	45.73	Tamil Nadu			
Jharkhand				Coimbatore	746128	19566	2.62
Palamau	802291	50363	6.28	Dharmapuri	962247	194532	20.21
Karnataka				Erode	825997	5579	0.68
Chickmagalur	722072	16038	2.26	Thirunelveli	682308	36240	5.31
Bagalkot	658877	135145	20.51	Tuticorin	459054	78213	17.04
Bijapur	1053471	256010	24.30	Uttar Pradesh			
Gulbarga	1610208	313347	19.46	Agra	400369	92650	23.14
Tumkur	1055090	N/A	--	Lalitpur	504149	95450	18.90
Kerala				Mathura	376432	22975	6.10
Palghat	448000	16204	3.60	Sitapur	570633	88717	15.55
Madhya Pradesh				West Bengal			
Balaghat	924500	112941	12.21	Puruliya	625100	198619	31.77
Gwalior	456449			North 24 Pargana	378090	64062	16.94
Jhabua	646912	322601	49.90	South 24 Pargana	966171	263635	27.29
Morena	1168336	373553	27.20	Total	35660062	6703466	18.80
Sidhi	1039194	228736	22.01				

Source: All India Soil and Land Use Survey, Ministry of Agriculture.

b. Use of Pesticides

Both land and water are polluted because of excessive use of pesticides. Table 3.7 gives an inter-state comparison of consumption of pesticides. The consumption figures are in metric tonnes. In 2004-05, the highest amount of pesticides was used in Punjab followed by Uttar Pradesh, and Haryana. Next in order of extent of consumption are West Bengal, Maharashtra and Gujarat. These inter-state differences are the result of both the

intensive use of pesticides and the area over which the pesticides are used.

Table 3.7: State-wise Consumption of Pesticides

(Mts technical grade)

Name of State/ Union Territories	2000-01	2001-02	2002-03	2003-04	2004-05 (P)
Andhra Pradesh	4000	3850	3706	2034	2133
Assam	245	237	181	175	170
Bihar	853	890	1010	860	850
Gujarat	2822	4100	4500	4000	2900
Haryana	5025	5020	5012	4730	4520
Karnataka	2020	2500	2700	1692	2200
Kerala	754	1345	902	326	360
Madhya Pradesh	871	714	1026	662	749
Maharashtra	3239	3135	3725	3385	3030
Orissa	1006	1018	1134	682	692
Punjab	7005	7200	7200	6780	6900
Rajasthan	3040	4628	3200	2303	1628
Tamil Nadu	1668	1576	3346	1434	2466
Uttar Pradesh	7023	6951	6775	6710	6855
West Bengal	3250	3180	3000	3900	4000
All-India	43584	47020	48350	41020	40672

Source: Directorate of Plant Protection Quarantine and Storage, Ministry of Agriculture.

P: Provisional

The national emission standards for pesticides manufacturing industries in India in 2004 are given in Table 3.8.

**Table 3.8: National Emission Standards for Pesticides
Manufacturing Industries in India: 2004**

Pollutant	Standard, mg/m3
HCl	20
Cl ₂ (Carbon 12)	5
H ₂ S (Hydrogen Sulphide)	5
P ₂ O ₅ (as H ₃ PO ₄) [Phosphorus Pentoxide]	10
NH ₃ (Ammonia)	30
Particulate Matter with Pesticide Compounds	20
CH ₃ Cl (Chloramethane)	20
HBr	5

Source: Ministry of Environment and Forests, Govt. of India.

c. Mining

The activity of mining and quarrying covers underground and surface mines, quarries and wells and includes extraction of minerals as also activities such as dressing and benefaction of ores, crushing, screening, washing, cleaning, grading, milling floatation, melting floatation and other preparations carried out at the mine site, which are needed to render the material marketable.

The mining activities in the country are governed by the Mineral Conservation Development Rules (MCDR), 1988. Every license holder of a mining lease is required take all possible precautions for protection of environment and control of pollution while conducting prospecting, mining beneficiation or metallurgical operations in the area. Specific provisions for proper removal and utilization of top soil, storage of over burden and waste rocks, reclamation and rehabilitation of lands, precautions against air pollution, noise and ground vibrations, restoration of flora, discharge of toxic liquid, control of surface subsidence have been provided under the MCDR.

In India coal is the most important energy source but Indian coal contains 30-40 percent ash and moisture content. About 70 percent of the coal in India is consumed in the power sector. Even though the environmental problems in using coal with high moisture content are well documented, adequate incentives for coal washing have not been provided.

3.3 Water Pollution

The Water Act, 1974 established the Pollution Control Boards at the central and state level. The Water Cess Act 1977 provided the Pollution Control Boards with a funding tool, enabling them to charge the water user with a cess designed as a financial support for the activities of the Boards.

Several industries are now subject to the water cess as per the water (Prevention and Control of Pollution) Cess Act, 1977. These industries are: ferrous metallurgical industry, non-ferrous metallurgical industry, mining industry, ore processing industry, petroleum industry, petrochemical industry, chemical industry, ceramic industry, cement industry, textile industry, paper industry, fertiliser industry, coal (including coke) industry, power (thermal and diesel) generating industry, and processing of animal or vegetable products industry. The rates of water-cess are given Table 3.9.

Table 3.9: Rate of Water Cess

Purpose for which water is consumed	Maximum rate (Paisa per kilolitre)	Maximum rate (Paisa per kilolitre) in case of non-compliance of the water user with the environmental standards
Industrial cooling, spraying in mine pits or boiler feeds	1.50	2.25
Domestic purpose	2.00	3.00
Processing whereby water gets polluted and the pollutants are easily biodegradable and are toxic.	4.00	7.50
Processing whereby water gets polluted and the pollutants are not easily biodegradable and are toxic.	5.00	7.00

Source: The Water (Prevention and Control of Pollution) Cess Act, 1977.

The Environment Protection Act 1986 is an umbrella legislation providing a single focus in the country for the protection of environment and seeks to plug the loopholes of earlier legislation relating to environment. It prohibits the pollution of water bodies and requires any potentially polluting activity to get the consent of the local State Pollution Control Board (SPCB) before being started. The ambient standards for primary water quality have been prescribed as given in Table 3.10.

Table 3.10: Primary Water Quality Standards

Criterion	Designated Best Use				
	Class A	Class B	Class C	Class D	Class E
Dissolved Oxygen (mg/l) Maximum	6	5	4	4	-
BOD (mg/l) Maximum	2	3	3	-	-
Total Coliform Count (MPN/100 ml) Maximum	50	500	5000	-	-
pH Acceptable Range	6.5-8.5	6.5-8.5	09-juin	6.5-8.5	6.5-8.5
Free Ammonia (mg/l)	-	-	-	1.2	-
Conductivity	-	-	-	-	2.25
Sodium Absorption Ratio	-	-	-	-	26
Boron (mg/l)	-	-	-	-	2

Source: Central Pollution Control Board.

Note: Class A: Drinking water source without conventional treatment. Class B: Water for outdoor bathing. Class C: Drinking water with conventional treatment. Class D: Water for wildlife and fisheries. Class E: Water for recreation and aesthetics, irrigation and industrial cooling.

a. Minimum Acceptable Discharge Standards

The Central Pollution Control Board (CPCB) has issued a set of norms that have to be enforced by the SPCBs. Those standards are expressed in terms of effluent concentration and are called Minimum Acceptable Standards (MINAS). SPCBs have the choice to adopt more stringent standards. The MINAS are defined for each type of industry and for each type of medium of release. Classical criteria are biological oxygen demand (BOD), chemical oxygen demand (COD), and Total suspended solids (TSS). The MINAS standards concerning these criteria are respectively of 30 mg/l, 250 mg/l, and 100 mg/l.

Various other economic incentives are also provided.

- **Depreciation allowance:** A depreciation of 100 percent is provided on specific equipment installed by manufacturing units to control pollution.
- **Water cess:** If an industry has installed equipment for treatment of sewage or effluent, it can avail of a rebate of 70 percent on the water cess, which is levied on water use.
- **Concessional custom duty:** Equipment and spares for pollution control attract reduced rates of customs duty
- **Excise duty:** Excise duty at reduced rate of 5 percent on manufactured goods that are used for pollution control
- **Soft loans:** Financial institutions can extend soft loan facilities for installation of pollution control equipment
- **Subsidies:** Small scale industries can receive financial assistance and subsidies to set up common effluent treatment facilities

There are also some special schemes like the Common Effluent Treatment Plants Schemes. Pollution from small-size industries (SSIs) creates a severe problem. Forty percent of the wastewater generated by Indian most polluting industries comes from small sized industries. With the adoption of the Water Act, these small size industries have in theory the obligation to treat their effluent in order to reach a pollution concentration respecting the minimum acceptable standards laid down by the SPCBs. Nevertheless, the size of these facilities makes the installation of a standard effluent treatment plant (ETP) unaffordable because of the high fixed cost of an individual ETP. Therefore, public authorities have taken the initiative to promote common effluent treatment plants (CETPs) schemes, allowing small industries to gather in order to treat jointly their effluents. 82 CETPs had been set up around the country by the end of nineties.

It has been shown that compared to individual ETPs, CETPS are more cost effective in reaching the effluent concentration standards. (Pandey and Deb, 1998; Sankar, 1998). However, treating the effluents is not the only way to meet the standards, and process changes induced by regulatory pressure have resulted in good results, and can even enhance the company's competitiveness. In a seminal article published in 1991, Michael Porter formulated what is usually referred to as the "Porter Hypothesis": "Strict environmental regulations do not inevitably hinder competitive advantage against foreign rivals; indeed, they often enhance it" (Porter, 1991). A test of the Porter hypothesis on the Indian manufacturing industry was recently carried out by Murty and Kumar (2001). It is open to question therefore, whether the CETPs are really a viable long term solution, or they would just delay the necessary effort of process adaptation from the concerned industries.

b. The National Drinking Water Mission

The Accelerated Rural Water Supply Programme (ARWSP) was introduced in 1972-73 by the Government of India to assist the States and Union Territories (UTs) to accelerate the pace of coverage of drinking water supply. The entire programme was given a Mission approach with the launch of the Technology Mission of Drinking Water and Related Water Management, also called the National Drinking Water Mission (NDWM), in 1986. It was one of the five Societal Missions launched by the Government of India. The NDWM was renamed as the Rajiv Gandhi National Drinking Water Mission (RGNDWM) in 1991. In addition of the ARWSP, the government launched a similar initiative on sanitation. The centrally Sponsored Rural Sanitation Programme (CRSP) was launched in 1986.

c. Community action and Informal Regulation

In addition to the action of the different administrative agencies, some kind of pollution regulation can be enforced by direct action of affected communities. According to Goldar and Banerjee (2004) the two channels of informal regulation are (1) to report violation of legal standards to the regulatory institutions (where such standards and institutions exist), and (2) to put pressure on regulators (politicians and administrators) to tighten their monitoring and enforcement. Pargal, Mani and Huq (1997), and Murty and Prashad (1999) have carried out field surveys of effluent discharge from small and medium industries in order to study how the characteristics of local communities impact on the environmental behaviour of local industries. Goldar and Banerjee (2002) have performed a similar study taking environmental water quality instead of industry's effluent discharge as a measure of the output of informal regulation.

d. Surface Water Pollution

The CPCB has set up several network or river quality monitoring stations. In 1999, there were 507 such stations, of which 430 were set up under the Monitoring of Indian National Aquatic Resources (MINARS) program, 50 stations under Global Environmental Monitoring Systems (GEMS), and 27 stations under the Yamuna Action Plan (YAP). The water quality was compared with desirable water quality expressed in terms of the quality class defined in table 1 following the best use of water.

Table 3.11 shows some of the most polluted river stretches. The level of unwanted pollution is given by the difference between the desired class and the existing class. It can be seen that the major sources of pollution identified are domestic pollution from large cities, an industrial pollution from industries such as sugar industry, distilleries, tanneries, or fertilisers.

Table 3.11 Programs implemented by the National River Conservation Directorate

Name	Number of Towns Covered	Volume of Sewage Diverted/Treated (MLD)	Cost (Rs. crore)
Ganga Action Plan Phase I	25	873	462.04
National River Conservation Plan	46	1928	737.13
Yamuna Action Plan	20	744	823.57
Gomati Action Plan	3	269	61.11
Damodar Action Plan	12	68	23.58
Ganga Action Plan Phase II (main stem)	29	618	378.00
Ganga Action Plan Phase II (Supreme Court Towns)	30	162	209.90

Source: National River Conservation Directorate.

Water quality problems are not just pollution related but often geogenic. The main quality problems encountered with ground water in India are due to excess fluoride, arsenic, iron, nitrate, and salinity. Nitrate contamination is mainly anthropogenic, due to the use of fertilizers and discharge of fecal material. Salinity may have different sources but the most common is the infiltration of brackish water in fresh aquifers due to the over-exploitation of such aquifers.

It is estimated as summarized in CSO (2006), that ground water meets 80 percent of domestic needs of the in rural areas and 50 percent of the urban areas. India's total replenishable groundwater has been estimated at 431.8 km by the Central Statistical Organisation. The average level of groundwater development in India is 32 percent, although some states have exploited their resources to a much greater extent (94 percent in Punjab, 84 percent in Haryana, 60 percent in Tamil Nadu, 64 percent in Lakshadweep, 51 percent in Rajasthan). 85 percent of ground water extracted is used for irrigation purposes and 15 percent for industrial and domestic purposes. Reciprocally, as much as 70 to 80 percent of India's agricultural output may be groundwater dependent.

A survey carried out by the Rajiv Gandhi National Drinking Water Mission, based on 1 percent random sampling indicated that 217211 habitations had water quality problems.

Table 3.12: State-wise Water Quality Affected Habitations in India

(As on 31.03.2006)

States/UTs	Habitation Affected by						Total as on 31.03.2006
	Fluoride	Salinity	Iron	Arsenic	Nitrate	Multiple	
Andhra Pradesh	1497	1058	0	0	0	0	2555
Assam	660	0	23841	730	0	2950	28181
Bihar	383	0	21540	794	2000	0	24717
Gujarat	2563	1528	0	0	838	0	4929
Haryana	119	72	0	0	0	145	336
Karnataka	5000	0	6633	0	4077	4460	20170
Kerala	34	86	564	0	78	105	867
Madhya Pradesh	3282	279	105	0	33	153	3852
Maharashtra	2748	1424	2491	0	4552	0	11215
Orissa	794	651	26136	0	0	435	28016
Punjab	588	1289	164	0	0	0	2041
Rajasthan	6992	4428	131	0	7693	12639	31883
Tamil Nadu	452	61	68	0	104	735	1420
Uttar Pradesh	2077	612	2375	0	11	1302	6377
West Bengal	665	811	11883	5408	0	0	18767
India	29030	12425	104477	7067	19387	23427	195813

Source: Lok Sabha Unstarred Question No. 555, dated 02.03.2007.

Note: On basis of survey ordered in March 2000 and updated by States in Bharat Nirman Action Plan.

Table 3.12 gives information on habitations affected by different pollutants in the water. The largest number of habitations affected in India was affected by the presence of iron in water. These habitations were located largely in Orissa, Assam, Bihar, and West Bengal. Next in terms of the pollutants affecting water for habitations was fluoride and

the states most affected were Rajasthan, Karnataka, Madhya Pradesh, Gujarat and Uttar Pradesh. The arsenic contamination of water was limited to two states only viz., Bihar and Assam. The presence of nitrate was mostly in Rajasthan, Maharashtra, Karnataka, and Bihar. Salinity was a problem in Rajasthan, Gujarat, Maharashtra and Punjab.

Table 3.13 indicates the number of habitations with serious water quality problems. Excess fluoride, excess salinity, and excess iron seem to be key hazard for the habitations.

Table 3.13: Number of Habitations Affected with Water Quality Problems

Nature of Quality Problem	Number of Affected Habitations
Excess Fluoride	36988
Excess Arsenic	3553
Excess Salinity	32597
Excess Iron	138670
Excess Nitrate	4003
Other reasons	1400
Total	217211

Source: As in Table 3.11.

d1. Fluoride

High fluoride concentration in ground water beyond the permissible limit of 1.5 parts per million (ppm) is one of the most worrying toxicological problems in India. This contamination has geological origins, and dangerous level of Fluoride presence in ground water has been recorded in 17 states. In affected areas, the range of fluoride contamination varies between 1.5 and 29 ppm. Prolonged ingestion of high quantities of fluoride can lead to dental or skeletal fluorosis. According to a survey carried out by the Rajiv Gandhi National Drinking Water Mission (RGNDWM) in 1993, around 25 million people were affected. The population at risk is estimated at 66 million. Fluoride is present in many different geological formations. Department of Drinking Water Supply of the Ministry of Rural Areas and Employment, Government of India, has constituted a Central Task Force for Fluorosis Mitigation and for the control of fluorosis. Control measures include the installation of fluoride removal plants using processes based on Nalgonda technique or activated alumina process. The main methods identified for Fluoride removal are co-precipitation adsorption by activated carbon and activated alumina exchange method by reverse osmosis.

d2. Arsenic

Arsenic contamination of groundwater has an unusually high and dramatic occurrence in the gangetic delta including West Bengal and Bangladesh. Arsenic contamination through drinking water may be responsible for cancer of skin, lungs, urinary bladder, and kidney, as well as other skin affectations. The population at risk is estimated at 5.3 million, with 200000 people actually affected.

Although people agree about the geologic origin of the arsenic in ground water in West Bengal and Bangladesh, there is no consensus about the reason why the arsenic gets diluted at such a high rate. Some scientist explain the high arsenic concentration in groundwater as a result of the exposition of arseno-ferous complex to atmospheric oxygen introduced in the aquifer in response to the lowering of the groundwater level. An alternative explanation puts forward the strongly reducing condition of the aquifer that can be explained by the burial of organic sediment during its geological formation. Another explanation relates this to the action of phosphates from chemical fertilizers that could displace arsenic from the sediment.

WHO standards concerning arsenic concentration in drinking water established in 1993 prescribe an allowable concentration of 0.01 mg/l, bringing down the 1963 limit of 0.05 mg/l. However, the permissible limit in India and Bangladesh is still 0.05 mg/l, and most of the tests done in these areas use this reference.

The problem of arsenic in drinking water is quite urgent. But there is a bigger problem when arsenic enters the surface environment through extracted ground water. Animals drinking contaminated water may accumulate it in their tissues, as well as crops grown in a field irrigated with contaminated groundwater. Irrigation poses an even more serious threat to the environment, through a potential long term contamination of soils, and maybe a subsequent contamination of surface water flows. The Indian Council of Agricultural Research as started a study in 1998 about the impact of contamination in terms of agricultural management. Although the surface water was not found to be heavily contaminated, the study showed this arsenic accumulated in the crops cultivated on the soils irrigated with contaminated water. Moreover, most toxic from of arsenate are present in the crops.

Arsenic contamination can be avoided either by providing an arsenic-free water supply, either by providing an arsenic removal technology. Providing an arsenic-free water supply, can be achieved by using surface water, rainwater harvesting, tapping into

deeper aquifers (100-150 meters), or shallow aquifers (hand-dug wells less deep than 20 meters) which have been found to be arsenic free. Providing an arsenic removal technology which can be used at the level of the household, or at a more central level.

d3. Iron

High concentration of Iron in drinking water is the most widespread quality problem in India. Nevertheless, the health impact of this contamination is smaller than the one caused by arsenic or fluoride contamination. Using iron contaminated water in excess of the permissible limit of 1 ppm can cause constipation accompanied by other physiological disorders. Brackishness may be an initial characteristic of some aquifers, but it can be caused or worsened by infiltration due to overexploitation of the aquifer. This is often the case in coastal areas where aquifers get contaminated with infiltrated sea water. Excess brackishness in drinking water has laxative effects. The permissible limit is set at 1500 ppm of total dissolved solids (TDS).

In principle, Indian cities and towns are accountable for their wastewater discharge. They are supposed to collect and treat all their wastewater and pay a water cess proportional to their water consumption to the local State Pollution Control Board (SPCB). In practice however, these rules often violated. CPCB statistics shows that even the class I cities are treating only a small part of their effluents, while the smaller towns practically do not have any treatment facilities. The incentive for the municipal bodies to enhance the collection and treatment of wastewater comes from the local demand for better quality. Instead of the municipalities fully taking up the responsibilities, a whole new industry of mineral water has come up. This has clear equity implications as the large part of low-income groups cannot pay for these costly bottled water or buy various water-cleaning devices (Table 3.14).

Table 3.14: Status of Wastewater Generation, Collection and Treatment in Class I Cities and Class II Towns

Type	Number of Cities/Towns		Wastewater Generated (MLD)	Wastewater Collected		Wastewater Treated	
				MLD	% (of generated)	MLD	
						% (of collected)	% (of total)
Class I Cities	299	16662.5	11938.2	72	4037.2	33.8	24
Class II Towns	345	1649.6	1090.3	66	61.5	5.6	3.7
Total	644	18312.1	13028.5	71	4098.7	31.5	22.4

Source: CPCB (2000). MLD: Million litres per day

e. Pollution by Industrial effluents

The CPCB has laid down a list of major polluting industries in 1989. Those industries are subject to a special regime of inspection from the SPCBs and are subject to the water Cess. Those industries are: (1) Cement mills (above 200 tonnes per day), (2) sugar, (3) thermal power plants, (4) distilleries, (5) fertilizers, (6) oil refineries, (7) caustic soda production, (8) petrochemicals, (9) zinc smelting, (10) copper smelting, (11) aluminum smelting, (12) sulphuric acid, (13) integrated iron and steel, (14) pulp and paper, (15) tanneries, (16) pharmaceuticals, (17) dye and dye intermediates, and (18) pesticides.

In 1992, the CPCB launched a water pollution control program in order to tackle the problem of industrial pollution. It has identified 1551 large and medium industries, and given a time schedule for compliance with the prescribed standards. Table 3.15 indicates a drastic reduction in the number of non-compliant industries.

Table 3.15: Status of Pollution Control in 17 Categories of Highly Polluting Industries, India, 1995 and 2000

State/ Union Territory	Number of Units Identified	No. of Units not Having Adequate Facilities to Comply with Standards	
		March 1995	December 2000
Andhra Pradesh	173	32	1
Assam	15	5	1
Bihar	62	11	2
Goa	6	0	0
Gujarat	177	8	0
Haryana	43	7	0
Himachal Pradesh	9	0	0
Jammu and Kashmir	8	4	0
Karnataka	85	21	0
Kerala	28	4	0
Madhya Pradesh	78	21	5
Maharashtra	335	28	5
Orissa	23	10	4
Punjab	45	11	0
Rajasthan	49	2	0
Tamil Nadu	119	8	0
Uttar Pradesh	224	40	3
West Bengal	58	27	3
Delhi	5	3	0
Pondicherry	6	4	0
Other states/UT	3	6	0
Total	1551	252	24

Source: Central Pollution Control Board, Annual Report, 1994-95 and 2000-01, reported in Goldar and Banerjee (2002).

Table 3.16 highlights the status of defaulters. The number of defaulters has gone down to 22 in 2000 as compared to 1997.

Table 3.16: Status of Defaulters under the Program of Industrial Pollution Control along the Rivers and Lakes, India, 1997 and 2000

State/Union Territory	Number of Defaulters in August 1997	Closed Subsequently	Acquired Requisite Treatment/ Disposal Facilities	Number of Defaulters in December 2000
Andhra Pradesh	60	17	37	6
Assam	7	5	0	2
Bihar	14	4	10	0
Goa	0	0	0	0
Gujarat	17	3	14	0
Haryana	21	8	12	1
Himachal Pradesh	0	0	0	0
Jammu and Kashmir	0	0	0	0
Karnataka	20	2	17	1
Kerala	36	4	32	0
Madhya Pradesh	2	1	0	1
Maharashtra	6	3	3	0
Orissa	9	1	4	4
Punjab	18	1	16	1
Rajasthan	0	0	0	0
Tamil Nadu	366	118	248	0
Uttar Pradesh	241	59	176	6
West Bengal	30	7	23	0
Pondicherry	4	0	4	0
Total	851	233	596	22

Source: Central Pollution Control Board, reported in Goldar and Banerjee (2002).

f. Pollution by Small Scale Industries

Small scale industries (SSIs) are a major source of industrial pollution. The number of SSIs is estimated to be over 0.32 million units, of which many are highly polluting. The share of the SSIs in term of wastewater generation among several of the major polluting industries was reported to be about 40 percent. Table 3.17 summarises information on sector-wise number of SSIs generating waste water. The main culprits are engineering units, paper and board units, and textile units.

Table 3.17: Wastewater Generation by SSIs in Selected Industrial Sectors

Industry	Wastewater Generation (MLD)
Engineering	2125
Paper and Board Mills	1087
Textile	450
Organic Chemicals	60
Tanneries	50
Pharmaceuticals	40
Dye and Dye Intermediates	32
Soaps, Paints, Varnishes, and Petrochemicals	10
Edible Oil and Vanaspati	7

Source: CPCB, reported in Kathuria and Gundimeda (2001).

g. Estimation of Pollution Intensity in India using the Industrial Pollution Projection System

In order to deal with the lack of global data about industrial pollution in developing countries, the World Bank has developed a method to assess such levels of pollution, using data from developed countries such as the US and converting them by using pollution intensities coefficients (Hettige *et al*, 1994). This method is called Industrial Pollution Projection System (IPPS). The IPPS merges data from US-EPA about pollution emissions and the Longitudinal Research Database (LRD) on industrial activity, in order to calculate pollution intensity for different industrial sectors. The pollution intensity is defined as the level of pollution emission per unit of industrial activity, which is measured either by the value of production, the value added, or the employment. The pollution intensities from the World Bank have been computed for the year 1987. Recently, an attempt has been made to estimate industrial pollution in India using the IPPS (Pandey and Ghosh, 2002) using data from the Annual Survey of Industries (ASI) and from the Central Statistical Organisation (CSO).

Table 3.18 provides the estimated pollution load for the different states.

Table 3.18: Water Pollution Load Using Output Intensity

(Tonnes of BOD)

States	Pollution Load	States	Pollution Load
Bihar	321494	Rajasthan	23530
Madhya Pradesh	243125	Delhi	12387
Maharashtra	234360	Pondicherry	9655
Orissa	204240	Chandigarh	9294
Andhra Pradesh	131536	Assam	7861
West Bengal	130444	Kerala	6549
Uttar Pradesh	103205	Himachal Pradesh	5709
Punjab	96050	Jammu & Kashmir	2378
Tamil Nadu	84384	Goa	118
Gujarat	78354	Daman & Diu	115
Karnataka	58705	Others	78698
Haryana	36939	All India	1879140

Source: Pandey and Ghosh (2002). BOD: Biological Oxygen Demand.

Table 3.19 provides estimations of the pollution loads for the different industries.

Table 3.19: Estimated Water Pollution Load (in tonnes) by Industry

Industry	Estimates using Output Intensities	Ranking	Estimates using Employment Intensities	Ranking
Aluminum	47469	3	0	16
Copper	16035	6	44495	9
Zinc	7737	8	22923	12
Iron and Steel	1639368	1	8093409	1
Cement	5168	11	28000	11
Oil Refinery	4340	12	16805	13
Drugs	5889	10	44736	8
Petrochemicals	1818	13	3805	14
Fertilisers	31480	4	106644	7
Pesticides	7366	9	37927	10
Caustic Soda	836	15	135691	5
Pulp and Paper	86245	2	801764	3
Leather	894	14	5316058	2
Dyes	0	16	1198	15
Distillery	7740	7	110334	6
Sugar	16747	5	217639	4

Source: Pandey and Ghosh (2002).

Table 3.20 provides details of water pollution in Indian states.

Table 3.20: Water Pollution in Indian States

States	BOD (mg/l)			Total Coliform (MPN/100 ml)			Faecal Coliform (MPN/100 ml)		
	<3	3-6	>6	< 500	500-5000	>5000	< 500	500-5000	>5000
Andhra Pradesh	202	56	19	16	25	0	37	0	0
Assam	113	4	9	15	49	23	22	21	0
Bihar	146	3	1	15	48	82	35	106	2
Gujarat	224	82	125	200	63	164	214	90	116
Haryana	28	4	9	0	0	0	0	0	0
Karnataka	247	49	52	94	283	0	113	136	1
Kerala	275	1	0	10	238	24	71	192	12
Madhya Pradesh	345	114	48	373	124	0	209	0	0
Maharashtra	0	326	123	375	73	0	391	0	0
Orissa	22	298	57	234	143	0	299	78	0
Punjab	26	26	20	72	0	0	71	1	0
Rajasthan	71	5	2	36	42	0	78	0	0
Tamil Nadu	260	38	6	168	72	63	219	53	31
Uttar Pradesh	210	165	176	29	123	161	114	123	49
West Bengal	110	24	0	89	0	0	89	0	0
All States	253	122	68	1895	1373	534	2150	840	216
	6	5	1						

Source (Basic Data): Ministry of Environment and Forests, 2001, New Delhi.

h. Pollution by Agricultural Run-offs

Pollution by agricultural run-offs has too main effects on the environment. Pesticides may be responsible for poisoning. They are specially difficult to remove from freshwater, and thus, can be found in municipal or bottled water, even after conventional treatment. A study from the Centre for Science and Environment (2004) drew the alarm about the concentration in pesticides such as organochlorines and organophosphaters that was exceeding the World Health Organisation (WHO) standards in almost all the Indian brands of bottled water.

As for fertilisers, they have an indirect adverse impact on the water resources. Indeed, by increasing the nutritional content of the water courses, fertilisers allow organisms to proliferate. These organisms may be disease vectors, or algae. The proliferation of algae may slower the flow in the water courses, thus increasing again the proliferation of organisms and sedimentation. In spite of these well known adverse effects, and the worrying growth of fertiliser and pesticide use in the India agricultural sector, these products are still subsidised by the government.

The WHO has defined a permissible limit of concentration of Nitrates of 45 mg/l of NO_3 , which is also accepted by the Indian Council of Medical Research (ICMR). Based on a survey carried out in 1986, the relation between N-Fertilisers in several states and the respective concentration of NO_3 in tube wells, indicated that in states such as Haryana, the NO_3 concentration was already exceeding by far the permissible limits in 1986. The increase in fertilisers consumption reported in the right part of the chart leads us to assume that those concentrations are now exceeding the limits in several other states.

This study allowed us to have a general view of the efforts taken in India to understand the economic implication of water pollution. The measurement of pollution in river flows and underground reservoirs developed during the last decades and it is now possible to have an overview of the ambient water quality in the country thanks to a network of around 500 monitoring stations. The information available is expressed using the ambient quality standards defined by the CPCB and does not allow a real analysis of the water pollution problem, nevertheless it shows clearly that pollution is exceeding the standards in many places.

The only attempt at giving a nation-wide cost of water pollution is the study carried out by Brandon and Homman (1995). We saw that the figures provided are only rough estimates. Moreover, the cost provided is only deduced from the overall figures on diarrhea diseases occurrence in the country, and lets aside many other significant costs. Nevertheless, even if underestimated, the figure of 4.53 percent of GDP for the total cost of pollution, with surface water pollution accounting for 59 percent of it has the merit of being clear. India cannot afford not to deal with water pollution. The rough results provided by Brandon and Homman may be enriched with the comparison with similar although more local studies. Three other studies were reviewed in this report, each of them applying a different method in order to put a price on environmental change. The study carried out by Misra (1999) showed results from a survey using the contingent valuation method (CVM) in order to assess the willingness to pay of local population from in the surrounding of an industrial area for an improvement in ambient water quality. CVM was also applied in an attempt at valuing the benefits from the Ganga Action Plan (Markandya and Murty, 2000). A method more similar to the one applied by Brandon and Homman was used in Appasamy *et al* (2002) where several type of costs (health, agriculture and fisheries productivity) were calculated in the case of the Noyyal river basin in Majarashtra.

Table 3.21 provides the summary status of pollution control in grossly polluting industries discharging their effluents into rivers and lakes.

Table 3.21: Summary Status of Pollution Control in Grossly Polluting Industries Discharging their Effluents into Rivers and Lakes

(as on 30.09.2003)

Name of the State/Union Territory	No. of Defaulters Units	No. of Units Closed	No. of Units which have provided requisite Treatment/Disposal Facilities after Issuance of Directions	No. of Defaulting Units
Andhra Pradesh	60	18	42	0
Assam	7	6	1	0
Bihar	14	4	10	0
Gujarat	17	3	14	0
Haryana	21	9	12	0
Karnataka	20	2	18	0
Kerala	36	4	32	0
Madhya Pradesh	2	1	0	1
Maharashtra	6	3	3	0
Orissa	9	3	4	2
Punjab	18	1	16	1
Tamil Nadu	366	118	248	0
Uttar Pradesh	241	59	181	1
West Bengal	30	7	23	0
Total	851	238	608	5

Source: Ministry of Environment and Forests, Annual Report 2003-2004.

3.4 Noise Pollution

Noise has been recognized as a pollutant although until recently, it 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 55 dB (A) and 45 dB(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. Table 3.22 shows that in the major cities of India, noise standards are not met.

Table 3.22: Average Noise Levels in Various Metropolitan Cities

Db (A)

Metropolitan Cities	Day/ Night	Industrial Area	Commercial Area	Residential Area	Silence Area
Kolkata	Day/Night	78/ 67	82/75	79/65	79/65
Mumbai	Day/Night	76/65	75/66	70/62	66/52
Chennai	Day/Night	71/66	78/71	66/48	63/49
Bangalore	Day/Night	78/53	76/57	67/50	67

Source: TERI Energy Data Directory and Yearbook 2002-03. Db: Decibel.

In this chapter, we have highlighted the major source of pollution and the differential incidence of pollution across states.

Chapter 4

STATE TAXES: SOME RECENT REFORMS

India has a federal fiscal structure with taxation powers divided between the central and the state governments. State governments can, under constitutional provisions, assign some of their taxes to the local governments. Due to efficiency considerations relating to collection efficiency as well as arguments of uniform tax rates and common tax jurisdictions, the central government has the larger powers of taxation. On the other hand, states have been assigned the larger responsibilities due to their perceived closeness to the citizens for whom the public services are provided. The resulting vertical imbalance is made up by a system of fiscal transfers from the central to the state governments on the basis of the recommendations of the Finance Commission as also through the Planning Commission and central ministries. This enables the states to spend far larger amounts on the state level services than their own resources.

4.1. Distribution of Taxation Powers: Constitutional Scheme

Taxes have been assigned between the central and state governments as specified in the Union List and State List in Seventh Schedule to the Constitution (details given at Annexure 1)¹⁷. From among the resources assigned to the states, they can assign resources to the local bodies as per the provisions of the 73rd and 74th amendments to the constitution. The main central taxes are: personal income tax, corporation tax, union excise duties, service tax, and customs duties. The main state taxes are state VAT (value added tax) or sales tax, state excise duties, stamp duty and registration fees, motor vehicle tax, and land revenue and agricultural income tax. Land revenue is often assigned to the local governments. In addition, the local governments have property tax, entry tax, tolls and other local level taxes.

Table 4.1 summarizes the constitutional assignment of taxes between the Union and the state governments.

¹⁷ Article 246(1) of Constitution of India states that Parliament has exclusive powers to make laws with respect to any of matters enumerated in List I in the Seventh Schedule to Constitution. (Called 'Union List'). As per Article 246(3), State Government has exclusive powers to make laws for State with respect to any matter enumerated in List II of Seventh Schedule to Constitution. Seventh schedule to Constitution (referred to in Article 246) indicates bifurcation of powers to make laws, between Union Government and State Governments. Parliament has exclusive powers to make laws in respect of matters given in list I of the Seventh Schedule of the Constitution (*called 'Union List'*). List II (*State List*) contains entries under jurisdiction of States. List III (*concurrent list*) contains entries where both Union and State Governments can exercise power. [In case of Union Territories, Union Government can make laws in respect of all the entries in all three lists].

Table 4.1: Assignment of Taxes: Union and State Governments

Union Taxes	State Taxes
1. Taxes on income other than agricultural income 2. Duties of customs including export duties 3. Duties of excise on tobacco and other goods manufactured and produced in India except – 4. Alcoholic liquors for human consumption 5. Opium, Indian hemp and other narcotic drugs and narcotics but including medicinal and toilet preparations containing alcohol or any substance included in sub-paragraph (b) of this entry 6. Corporation tax 7. Taxes on the capital value of the assets, exclusive of agricultural land 8. Duties in respect of succession to property other than agricultural land 9. Terminal taxes on goods and passengers, carried by railway, sea or air, taxes on railway fares and freights 10. Taxes other than stamp duties on transactions in stock exchanges and futures markets 11. Rates of stamp duty in respect of bills of exchange, cheques, promissory notes, bills of lading, letters of credit, policies of insurance, transfer of shares, debentures, proxies and receipts 12. Taxes on the sale and purchase of newspapers and on advertisement published therein 13. Taxes on the sale and purchase of goods other than newspapers, where such sale or purchase takes place in the course of inter-state trade or commerce 14. Taxes on the consignment of goods (whether the consignment is to the person making it or to any other person), where such consignment takes place in the course of the inter-state trade or commerce	1. Land revenue, including the assessment and collection of revenue, the maintenance of land records, survey for revenue purposes and records of rights, and alienation of revenues 2. Taxes on agricultural income 3. Duties in respect of succession to agricultural land 4. Estate duty in respect of agricultural land 5. Taxes on land and buildings 6. Taxes on mineral rights subject to any limitations imposed by Parliament by law relating to mineral development 7. Duties of excise on the following goods manufactured or produced in the State and countervailing duties at the same or lower rates on similar goods manufactured or produced elsewhere in India 8. Alcoholic liquors for human consumption 9. Opium, Indian hemp and other narcotic drugs and narcotics, but not including medicinal and toilet preparations containing alcohol or any substance included in sub-paragraph (b) of this entry 10. Taxes on entry of goods into a local area for consumption, use or sale therein 11. Taxes on the consumption or sale of electricity 12. Taxes on the sale or purchase of goods other than newspapers, subject to the provisions of entry 92 A of List 1 13. Taxes on advertisements other than advertisements published in newspapers and advertisements broadcast by radio or television 14. Taxes on goods and passengers carried by road or inland waterways 15. Taxes on vehicles, whether mechanically propelled or not, suitable for use on roads, including tramcars subject to the provisions of entry 35 of List III 16. Taxes on animals and boats 17. Tolls 18. Taxes on professions, trades, callings and employments 19. Capitation taxes 20. Taxes on luxuries, including taxes on entertainments, amusements, betting and gambling 21. Rates of stamp duty in respect of documents other than those specified in the provisions of List I with regard to rates of stamp duty

The constitution, under articles 268 and 269 makes provision for the assignment of some of the Union taxes to the states for collection and sharing or retaining the amount of revenues raised. In a recent amendment (88th amendment), the service tax has been brought under Article 268 A. Since the early nineties, the system of taxation has undergone extensive reforms both in direct and indirect taxes. In the case of direct taxes, the emphasis has been to introduce a low tax, low exemption regime, which can be revenue productive by minimizing avoidance as well as compliance costs. For indirect taxes, reforms have aimed at bringing about the VAT principle while reducing multiple taxes, and reducing the overall tax-rates.

4.2 State Level Taxes: Basic Features

In this section, we look at the basic features of some of the main state level taxes.

a. Sales Taxes

The constitution empowers the states to levy 'taxes on sale or purchase of goods other than newspapers, subject to provisions of entry 92 A of List I'. This entry provides that the central government is empowered to levy a tax on the sale and purchase of goods other than newspapers where such sale or purchase takes place in the course of inter-state trade or commerce. The central government has levied a central sales tax on inter-state sales, which under article 269, are collected and retained by the states. An attempt is now being made to abolish this tax in an attempt to create a unified all India market.

The structure of sales tax, prior to reforms undertaken in late nineties was characterized by multiplicity of tax rate and exemptions, lack of uniformity across states, large number incentives, and cascading of taxes. During reforms of sales taxes prior to the introduction of state VAT, most states had agreed to phase out the incentive related exemptions, and implement floor rates.

b. Motor Vehicle Tax

In most states a compounded system of motor vehicle tax exists, where a one time levy is paid for the life of the vehicle. This may be useful, particularly if the tax payers are to be saved from the hassle of interacting with the tax department every year. However, compounded levies are neither revenue productive nor do they permit additional taxation when vehicles become less efficient and more polluting. These levies also need to be revised from time to time to reflect the increasing costs of maintaining roads.

c. Stamp Duty and Registration Fees

The stamp duty on the registration of property or other conveyances has the main difficulty of getting the correct method of evaluation. Until recently, the stamp duty rates were excessively high in most states and the procedures for evaluating the conveyances were also complicated. The linkage between stamp duty and registration fees was also not very efficient. In recent years, states have undertaken reforms by reducing the duty rates and streamlining procedures for evaluation of property. Even after the reduction of rates, the general experience has been revenue-augmenting as the effect of rate reduction is overcome higher values of the conveyances.

There has been an attempt to move towards uniform stamp duty rates. While in Punjab it is 6 percent, in Himachal Pradesh, there is a 12 percent duty, Uttar Pradesh 10 percent and Rajasthan 11 percent. The Union finance ministry has asked states to adopt a uniform 5 percent stamp duty. Following this, some states like Maharashtra and Bihar went for a reduction in existing stamp duties, but a 5 percent stamp duty in all the states still seems to be some distance away. In 2002, Delhi cut stamp duty rates from 13 to 8 percent for men registering property and brought it down to 6 percent for women owners. In case of joint ownership by men and women, the duty is 7 percent. In Delhi, stamp duty rates were further reduced for women at 4 percent against 6 percent for men. Recently, Haryana reduced stamp duty for women to 8 percent while that for men in the state is 10 percent.

d. State Excise Duties

The power of states to levy excise duties is limited to alcoholic liquors for human consumption, and opium, Indian hemp and other narcotic drugs excluding those used for medicinal purposes or for toilet preparations. The revenues accrue to the states in the form of licence duties from the vendors as well as the tax, which can be specific or *ad valorem*.

Excise duties in the states have a special position in the armory of taxes since they are applied on consumption of alcohol, which is known to be harmful. Consumption of alcohol and other beverages containing spirit are hazardous and injurious to health. The constitution has provided the state governments with a monopoly to tax the production and sale of alcoholic beverages. The state governments also control the production of these by giving licenses and often specifying the quantity to which the production should be limited. Since demand for alcoholic beverages is generally assessed to be price-inelastic, this tax provides a case for keeping high tax rates for controlling the

level of consumption. In fact high tax rates yield both high revenues and greater control on consumption. Some states have from time to time embarked upon the path of total prohibition. Attempts at full prohibition often lead to illegal production and export of the tax base to the neighboring states. Production of alcoholic beverages involves considerable pollution due to the effluents that are discharged.

e. Electricity Duty

Electricity duty is charged to consumers along with the electricity tariffs or rates. The rates are meant for electricity boards or the providers of electricity, while the electricity duty is meant for the state government. In this sector, there is considerable non-transparency. The state government administers the electricity prices, and often owes to the electricity boards payments on account unpaid but committed subsidies. In actual practice, as state governments is unable to pay the requisite amounts due to electricity boards, the boards in turn collect the electricity duty but do not pass these on to the state government. In most states, electricity prices are now regulated by the Electricity Regulatory Authorities but the state governments have a large say in the determination of these prices.

f. Entertainment Tax

The entertainment tax is a levy on admission to places of amusement or entertainment including cinema, circus, theatrical performances, exhibitions, etc. The entertainment tax is used to be an important source of revenue for the states, but has lost its importance in recent times due to proliferation of means of home-based entertainment, which has also made it difficult to revise tax rates.

g. Profession Tax

The levy of profession tax is subject to a ceiling prescribed in the constitution. Most states either do not tap this source or use it only to a limited extent. At the same time, since the levy eventually falls on the income of the tax payer, it can not be tapped excessively. The ceiling amount has now been raised to Rs. 2500. Revenues from the profession tax are assigned to the local bodies.

4.3 Local Taxes

The resources of the local bodies, i.e., panchayats and municipalities include assignment of land tax, profession tax and surcharge/cess on state taxes in addition to property tax/house tax, octroi/entry tax, and other user charges.

a. Land Taxes: In many States, land revenue has either been abolished or land holdings up to a certain size have been exempted.

b. Property/House Tax: Property tax/house tax is the single most important local tax in a majority of the States. However, it has been beset with a variety of problems that have prevented the local bodies to exploit its full potential. In most States, the tax rates have not been revised periodically and there is no standard mechanism for determination of property tax rates and their revision. One major impediment to the growth of revenue from the property/house tax has been the rent control laws.

c. Octroi/Entry Tax: Besides the property/house tax, octroi has been the major source of revenue for the municipalities and, in some States, even for the panchayats. Many States have, however, abolished octroi with a view to removing impediments to the physical movement of goods, though several other new barriers have been created. Some States have introduced a levy in lieu of octroi, an entry tax, the net proceeds of which are transferred to the local bodies in the form of grant.

d. User Charges: In many States, the operations and maintenance costs of drinking water supply and many other civic services are met by the local bodies. However, the user charges are not revised periodically and a significant percentage of the demand remains in arrears.

4.4 Trends in State Taxes

a. Growth of State Taxes

Table 4.2 gives state-wise growth rates for own tax revenues and four major state level taxes and also for the residual category of other taxes for the major general category states in India excluding Goa but including Assam from among the special category states. For own tax revenues as a whole, some states show a rate of growth which is higher than the corresponding GSDP growth. In these cases, we expect revenue buoyancy higher than one. Some high growth rates in stamp duty and registration are exhibited in the case of Andhra Pradesh, Haryana, Karnataka, Maharashtra, Punjab, Tamil Nadu, and Uttar Pradesh. Growth rates in the states excise duties differ widely across states. Here the better performing states are Andhra Pradesh, Assam, Haryana, Karnataka and Orissa. In the case of sales tax, many states are undertaking reforms and the growth rate seem to be generally in the range of 12 to 14 percent with Assam and Haryana showing significantly higher growth rates and Bihar and West Bengal showing significantly lower growth rates compared to this range.

Table 4.2: State-wise Growth Rates in Tax Revenues: 1993-94 to 2004-05

(Percent)

States	Own Tax Revenue	Stamps and Registration Fees	State Excise	Sales Tax	Taxes on Vehicles	Other Taxes
Andhra Pradesh	15.01	16.56	25.04	15.17	12.33	7.64
Assam	14.73	14.22	21.00	16.96	15.02	4.20
Bihar	6.28	9.47	5.66	4.56	4.23	16.59
Gujarat	10.28	12.35	10.26	9.55	17.19	9.94
Haryana	15.25	15.97	14.68	17.77	10.83	12.15
Karnataka	12.58	15.66	14.87	11.44	11.42	13.23
Kerala	12.11	7.86	7.00	13.49	13.26	7.13
Madhya Pradesh	9.06	11.85	6.66	10.38	6.77	7.72
Maharashtra	12.39	15.36	9.14	12.18	13.20	12.96
Orissa	14.96	12.62	15.66	13.79	12.71	20.76
Punjab	11.24	15.59	6.01	13.79	10.47	7.66
Rajasthan	13.59	14.96	8.54	14.44	15.23	18.38
Tamil Nadu	12.18	12.18	13.25	12.32	10.51	9.99
Uttar Pradesh	12.56	15.07	10.20	13.27	23.87	1.49
West Bengal	10.26	14.32	10.88	9.71	16.25	9.05

Source (Basic Data): State Finance Accounts, various years**Note:** Data from 1993-94 to 2000-01 is for combined Uttar Pradesh and Madhya Pradesh.**Table 4.3: Buoyancy of Own Tax Revenues: 1993-94 to 2004-05**

States	Own Tax Revenue	Stamps and Registration Fees	State Excise	Sales Tax	Taxes on Vehicles	Other Taxes
Andhra Pradesh	1.258	1.379	1.911	1.279	1.064	0.688
Assam	1.427	1.385	2.020	1.624	1.462	0.431
Bihar	0.710	1.006	0.654	0.547	0.474	1.690
Gujarat	0.922	1.122	0.876	0.855	1.488	0.906
Haryana	1.206	1.276	1.082	1.399	0.871	0.978
Karnataka	1.036	1.252	1.183	0.960	0.922	1.091
Kerala	0.992	0.630	0.602	1.101	1.080	0.563
Madhya Pradesh	0.985	1.255	0.766	1.104	0.758	0.858
Maharashtra	1.150	1.421	0.874	1.130	1.252	1.176
Orissa	1.405	1.220	1.435	1.320	1.206	1.840
Punjab	1.080	1.430	0.614	1.310	1.033	0.603
Rajasthan	1.216	1.350	0.833	1.272	1.340	1.553
Tamil Nadu	1.105	1.081	1.253	1.109	0.939	0.918
Uttar Pradesh	1.267	1.480	1.046	1.338	2.260	0.216
West Bengal	0.785	1.073	0.847	0.755	1.203	0.658

Source (Basic Data): State Finance Accounts, various years**Note:** Data from 1993-94 to 2000-01 is for combined Uttar Pradesh and Madhya Pradesh.

Table 4.3 shows corresponding tax buoyancies in the case of own tax revenues of the states. For Andhra Pradesh, tax-buoyancy is higher than one in all major taxes. For Bihar it is lower than one except the category of 'other taxes'. Looking at the buoyancy of stamp duties and registration fees, it would appear that the buoyancies are tangibly higher than one for all but few states. In the case of state excise duties, the inter-state differences are very sharp varying from the low level of buoyancy for Bihar at 0.654 and the highest buoyancy for Assam at 2.02 followed by 1.9 for Andhra Pradesh.

b. Inter State Share of Taxes

Sales taxes account for the largest share in total own tax revenues of the states. However, there are considerable inter-state variations (Table 4.4). In Assam, the contribution of sales tax was the highest among states at 77 percent in 2004-05, followed by Kerala at 74 percent. The lowest was for Madhya Pradesh at 4.4 percent. State excise duties and stamp and registration duties are next in order of importance. The tax on motor vehicles comes next. It contributes about 2 to 8 percent of states own tax revenues.

Table 4.4: State-wise Relative Share of Major Taxes: 1993-94 to 2004-05

(Percent)

States	Stamps and Registration Fees			State Excise			Sales Tax			Taxes on Vehicles		
	199	199	200	199	199	200	199	199	200	199	199	200
	3	9	4	3	9	4	3	9	4	3	9	4
	-94	-00	-05	-94	-00	-05	-94	-00	-05	-94	-00	-05
Andhra Pradesh	5.81	6.57	8.54	19.8	11.5	12.8	60.6	68.5	67.9	7.84	8.14	7.19
Assam	2.62	2.85	2.67	3.76	9.61	5.31	60.1	60.6	77.3	4.77	5.61	4.97
Bihar	11.0	10.5	12.8	8.81	9.01	8.14	67.2	67.0	56.4	7.15	5.79	6.36
Gujarat	0	6	2	0.47	0.39	0.36	70.3	62.9	64.1	4.43	7.37	8.19
Haryana	7.53	8.81	9.77	27.1	21.7	13.6	48.3	55.9	63.9	3.28	2.41	1.89
Karnataka	6.32	7.31	6	11.1	16.7	15.6	59.7	60.4	55.1	6.81	5.80	6.23
Kerala	9.82	5.38	8.65	14.1	11.3		65.3	74.2	74.7	6.44	7.33	6.81
Madhya Pradesh	7.06	8.11	5	18.7	18.5	15.3	45.3	44.0	50.3	7.85	6.94	6.29
Maharashtra	7.96	11.2	13.4	11.7	10.8	7.25	61.6	60.8	61.4	3.51	4.10	3.85

		4	5	4	6		0	7	8			
							59.8	64.9	59.1	10.0		
Orissa	5.58	5.99	4.74	8.86	6.74	7.34	1	9	7	5	9.13	8.10
			13.9	35.6	31.2	21.4	44.7	50.0	54.9			
Punjab	8.08	8.25	1	4	0	1	1	9	5	6.57	8.14	5.82
				23.6	21.2	15.1	54.2	53.5	57.0		10.0	
Rajasthan	7.20	8.32	9.72	4	1	6	6	1	1	9.26	5	9.71
				11.8	16.7	13.1	66.8	64.3	67.1			
Tamil Nadu	7.99	7.49	8.29	5	9	7	6	3	4	6.53	5.29	5.24
	12.8	12.5	17.0	23.1	22.6	17.1	52.0	54.2	56.6			
Uttar Pradesh	7	3	9	6	2	2	1	4	4	2.38	5.45	4.94
			10.1				62.2	67.2	57.6			
West Bengal	6.22	8.07	4	7.50	8.68	6.77	5	2	0	3.04	3.64	5.32

Source (Basic Data): State Finance Accounts, various years

Note: Data from 1993-94 to 2000-01 is for combined Uttar Pradesh and Madhya Pradesh.

Table 4.5 gives the share of states in the tax revenues of the 15 states. Maharashtra had a share of 18 percent in the 15 state total sale tax revenues in 2004-05.

Table 4.5: Tax-wise Share of States in Total (15 States) Tax Revenue

States	Stamps and Registration Fees			State Excise			Sales Tax			Taxes on Vehicles		
	199	199	2004	199	199	200	199	199	200	199	199	200
	3	9	-05	3	9	4	3	9	4	3	9	4
	-94	-00		-94	-00	-05	-94	-00	-05	-94	-00	-05
Andhra Pradesh				11.2		10.7				12.2	12.6	11.8
Assam	6.44	7.17	7.59	0	7.58	3	8.71	1	2	2	2	6
Bihar	0.46	0.42	0.40	0.34	0.86	0.74	1.38	1.26	2.00	1.19	1.18	1.37
	4.57	3.95	2.35	1.87	2.03	1.40	3.62	3.52	1.80	4.17	3.07	2.16
							10.3				10.3	10.7
Gujarat	6.09	6.33	5.26	0.27	0.23	0.24	9	8.74	7.92	7.10	5	7
Haryana	3.46	3.76	3.97	6.37	5.59	5.19	2.88	3.35	4.54	2.12	1.46	1.42
						14.3				10.5		
Karnataka	6.96	6.86	9.62	9.42	8.87	8	8.54	7.97	8.29	6	7.72	9.98
Kerala	6.65	3.39	4.24	4.88	4.32	3.83	5.75	6.56	6.39	6.14	6.55	6.20
Madhya Pradesh	5.46	5.70	4.31	7.39	7.84	6.11	4.55	4.35	3.73	8.54	6.91	4.96
	17.7	23.5		13.3	13.6	11.3	17.7	17.8	17.9	11.0	12.1	11.9
Maharashtra	1	1	22.50	2	9	7	8	9	4	0	8	5
Orissa	1.39	1.24	1.08	1.12	0.84	1.57	1.93	1.89	2.36	3.51	2.67	3.43
				11.3								
Punjab	5.02	3.95	5.28	0	8.99	7.62	3.60	3.37	3.64	5.74	5.53	4.10
Rajasthan	4.06	4.57	4.47	6.80	7.01	6.54	3.97	4.13	4.57	7.34	7.83	8.29
					13.3	13.0	12.0	11.9	12.3	12.7		10.3
Tamil Nadu	9	9.91	8.77	8.39	9	7	4	6	9	5	9.94	0
	15.3	14.2		14.1	15.5	13.7						
Uttar Pradesh	7	7	14.66	1	2	7	8.06	8.68	8.47	4.00	8.81	7.87
West Bengal	5.24	4.99	5.50	3.22	3.23	3.44	6.80	5.84	5.45	3.61	3.19	5.35
15 Major States	100	100	100	100	100	100	100	100	100	100	100	100

Source (Basic Data): State Finance Accounts, various years

Note: Data from 1993-94 to 2000-01 is for combined Uttar Pradesh and Madhya Pradesh.

Maharashtra has the largest or near largest share in all categories. Uttar Pradesh has the largest share in stamps and registration fees.

4.5 Tax Reforms: Implementation of VAT

As part of fiscal reforms, the value added principle has progressively been introduced in the system of indirect taxation in India with CENVAT replacing the union excise duties and in most states. At present all the states have moved to State VAT. State VAT has been introduced replacing the conventional sales taxes. Historically, there has been a larger dependence on indirect taxes, although direct taxes have been catching up fast with reforms. The idea in VAT is to tax the value added at each stage of manufacturing or sale so that eventually the total value of the product is taxed. In this sense, it amounts to a retail sales tax. However, the difference is that in following the principle of taxing at every stage and rebating at every stage, it creates a paper chain of transactions and thereby tax evasion.

a. Basic Design of State VAT

The state-level VAT is a State subject derived from Entry 54 of the State List, for which the States are sovereign in taking decisions. Under the guidance of the Empowered Committee of State Finance Ministers, states have agreed to a broadly common structure of state VAT. With the basic design of the VAT formulated by the Empowered Committee, states can introduce suitable variations consistent with the basic design. The main features of the basic scheme are as follows:

- uniform schedule of rates of VAT for all states, making the system simple and uniform and prevent unhealthy tax competition among states;
- the provision of input tax credit meant for preventing cascading effect of tax;
- the provision of self assessment by dealers aimed at reducing harassment; and
- the zero rating of exports aimed at increasing the competitiveness of Indian exports

Under the basic VAT design, there are only two basic VAT rates of 4 and 12.5 percent. In addition, there is provision for a specific category of tax-exempted goods and a special VAT rate of 1 percent only for gold and silver ornaments. Under the exempted category, a small list of commodities were placed comprising natural and unprocessed products in the un-organized sector, items that are legally barred from taxation and items

which have social implications. Some flexibility to the states has been given to select a set of maximum of 10 commodities for exemption from the list of goods specified by the Empowered Committee, which are of local social importance for the individual States without having any inter-state implications. The rest of the commodities in the list are common for all the States¹⁸.

VAT will not only provide full set-off for input tax as well as tax on previous purchases, but it will also abolish the burden of several of the existing taxes, such as turnover tax, surcharge on sales tax, additional surcharge, special additional tax, etc. In addition, it recommends phasing out of the Central Sales Tax. This will entail that the overall tax burden will be rationalized. VAT will replace the existing system of inspection by a system of built-in self-assessment by traders and manufacturers.

The most important part of the VAT scheme relates to the tax rates. The VAT system covers about 550 goods. Under exempted category, 46 commodities were identified by the Empowered Committee. Under 4 percent VAT rate category, the largest number of goods (about 270) was placed. These consisted of basic necessities such as medicines and drugs, all agricultural and industrial inputs, capital goods and declared goods. The remaining commodities, common for all the States, fell under the general VAT rate of 12.5 percent.

VAT on the Additional Excise Duty (AED) items relating to sugar, textile and tobacco, because of initial organizational difficulties have not been brought under State VAT so far. The highlights of the scheme proposed in the White Paper by the Empowered Committee are captured in the box 4.1.

Box 4.1: Highlights of White Paper on State Level VAT
• Introduction of VAT would help avoid cascading nature of sales tax. • Present multiple rates and taxes can converge into a few rates and a single VAT • Transparency in the system of tax administration through simple self-assessments and departmental audit.

¹⁸ Under exempted category, in the list prepared by the Empowered Committee, there are about 46 commodities comprising of natural and unprocessed products in unorganised sector, items which are legally barred from taxation and items which have social implications. Under 4 percent VAT rate category, there are the largest number of goods (about 270), common for all the States, comprising of items of basic necessities such as medicines and drugs, all agricultural and industrial inputs, capital goods and declared goods. The remaining commodities, common for all the States, will fall under the general VAT rate of 12.5 cent.

- Nationalization of taxes t result in lower tax burden and higher tax revenues.
- To avoid tax competition, the design of state VAT needs to be harmonized even as the distinctive needs of individual states are recognized.
- State VAT to have two basic rates of 4 percent and 12.5 percent and to over 550 commodities.
- About 270 commodities will be under 4 percent rate.
- 46 items, comprising natural and unprocessed products in the unorganized sector, items legally barred and items having social implications are exempt from VAT.
- Gold and silver ornaments subject to a special VAT rate of 1 percent

Source: Economic Survey, 2004-05

b. Progress by States

All states have moved to VAT broadly consistent with the design recommended by the Empowered Committee. The states have initiated, and in many cases also completed, steps for computerization up to the levels of assessing officers and also at the check posts. This process will continue since this is extremely important for document-based verification and integration with Taxation Information Exchange System as well as with information of the Central excise and income tax systems. In order to support the states, and protect them against revenue loss, the in the initial years of transition, the central government has agreed to compensate for 100 percent of the loss in the first year, 75 percent of the loss in the second year and 50 percent of the loss in the third year of introduction of VAT, and the loss would be computed on the basis of an agreed formula.

During 2006-07, five of the remaining states implemented VAT taking the total number of states implementing VAT to 27 (including NCT Delhi) (Table 4.6). Finally, Uttar Pradesh has also decided to implement VAT with effect from January 1, 2008. Earlier, Tamil Nadu had already implemented VAT with effect from January 1, 2007. The states had already taken measures to streamline the procedures, rationalise tax rates and address other issues so as to enable a smooth transition to VAT in their respective states. State governments in general have aimed at expanding the tax payer base, better compliance, rationalisation of tax rates, improving the efficiency of tax administration, simplification of tax laws and introducing a modern and improved tax system. Excepting for a few states which have contemplated to bring in new taxes (tax on lottery tickets in Maharashtra, tax on resale of certified used cars in Goa, 'green tax' on old vehicles in Rajasthan), most state governments have intended to reduce their tax rates on various types of taxes and even abolish certain taxes.

In this context it may be mentioned that two states (Punjab and Maharashtra) have shown inclination to do away with octroi. Kerala, on the other hand, has created a new schedule of goods to be taxed at 20 percent which is higher than the highest level under VAT i.e., 12.5 percent. Punjab has budgeted to raise bonds through Punjab State Industrial Development Corporation. State governments such as Gujarat and West Bengal have brought in amnesty schemes for realising outstanding amounts or arrears in payment. Several state governments have emphasized streamlining and rationalising of stamp duty while making it applicable on more instruments (e.g., power of attorney, deposits of title deeds). Maharashtra, Meghalaya and Mizoram have proposed to enhance water charges. However, several states have proposed to reduce power/electricity rates to various sections of population (Andhra Pradesh, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Punjab and Tamil Nadu).

Table 4.6: Implementation of Value Added Tax by States

States	Month and Year	States	Month and Year
1. Andhra Pradesh	April 2005	16. Manipur	July 2005
2. Arunachal Pradesh	April 2005	17. Meghalaya	April 2006
3. Assam	May 2005	18. Mizoram	April 2005
4. Bihar	April 2005	19. Nagaland	April 2005
5. Chhattisgarh	April 2006	20. Orissa	April 2005
6. Goa	April 2005	21. Punjab	April 2005
7. Gujarat	April 2006	22. Rajasthan	April 2006
8. Haryana	April 2003	23. Sikkim	April 2005
9. Himachal Pradesh	April 2005	24. Tamil Nadu	January 2007
10. Jammu and Kashmir	April 2005	25. Tripura	October 2005
11. Jharkhand	April 2006	26. Uttaranchal	October 2005
12. Karnataka	April 2005	27. Uttar Pradesh	January 2008
13. Kerala	April 2005	28. West Bengal	April 2005
14. Madhya Pradesh	April 2006	29. NCT Delhi	April 2005

Source: RBI, Based on Information received from the State Governments. In Puducherry Value Added Tax was passed in June 2007.

The Empowered Committee emphasizes the phasing out of Central Sales Tax (CST) after introduction of VAT. State were collecting nearly Rs. 15 thousand crore every year from CST when the rule was 4 percent. The central government has reduced the rate first to 3 percent and now to 2 percent and agreed to give the states some compensation. As CST is phased out, there is also a critical need for putting in place a regulatory frame-work in terms of Taxation Information Exchange System to give a comprehensive picture of inter-State trade of all commodities. This process of setting up of Taxation Information Exchange System has already been started by the Empowered Committee.

c. Goods and Services Tax

The long term solution to the problem of fragmentation of the taxation space between goods and services and the fact that cross cascading cannot be fully avoided as long as these are subject to separate taxation regimes. The Task Force (Kelkar Committee) recently appointed by the central government to examine the medium term fiscal restructuring came out with a plan of restructuring central finances that also involved the levy a comprehensive Goods and Services Tax (GST).

The Task Force argued that vide article 268A, the power to tax services has been vested in the central government. Further, the value-added in the case of goods beyond manufacturing is in the nature of trade arising from wholesaling or retailing, which can be considered as a service. The centre, according to the Task Forces is therefore entitled to tax this value added. At the same time, states are not entitled to tax services as the subject is in the Union list. However, under article 268 A the taxation of services can be assigned fully or partially to the states. The Task Force then suggests that a 'grand bargain' can be proposed to the states whereby they may agree to participate in a national Goods and Services Tax (GST), which can be levied at the rate of 20 percent, of which the centre will levy 12 percent and states can levy 8 percent. As per the estimates provided by the Task Force, these changes will have significant revenue implications.

Several problems with the Task Force's recommendation of GST under a 'grand bargain' have been noted. First, the legal status of centre's power to tax value added of

goods interpreting as services is not beyond question. It is a matter that can lead to legal issues, once the actual legislation is made and notified. Secondly, the 12: 8 ratio in favor of the centre, as suggested by the Task Force, can increase the vertical imbalance in the system, particularly because stamp fees, registration duties and sales tax on works contracts will be merged under the GST. The states are also likely to lose the autonomy to fix rates, which is the essence having autonomy over tax bases. Thirdly, aspects of inter-state taxation of services raise additional problems. It has been argued that there is the need for a negative list of taxes that have an inter-state character. The proposal of a clearing house mechanism to address issues of inter-state taxation and settlement of rebate claims and counter claims may run into a variety of practical problems.

Commenting on the proposal for GST, the Twelfth Finance Commission (TFC) observed, "In our view, the proposal of a comprehensive GST is an attractive one, and should be pursued. However, the relevant legal and administrative aspects should be extensively discussed, particularly with the states. The implementation of a state-level VAT would facilitate its introduction in due course. However, even without this radical change, it should be possible to raise the tax-GDP ratio adequately." The central government has, in successive budgets, reiterated that we may move to a National GST from April 1, 2004.

Reforms are continuing and there is a possibility of developing a comprehensive goods and services tax (GST), which may be levied on a concurrent basis by the central and state governments. This will provide a common treatment for goods and services and fully eliminate problems of cascading. Three options are currently being considered: a central GST, a system of concurrent GST, and a system of State GST. All indications are that India will move towards a system of concurrent GST.

4.6 Pollution Control: Regulatory Initiatives by States

States and cities have implemented a number of regulatory measures under various central initiatives as well as on their own. These are detailed in Annexure 1. Most of the important cities have at least introduced Bharat Stage II norms for motor vehicles and Bharat stage III norms have been introduced for tractors. In many cities compressed natural gas (CNG) vehicles have been promoted by facilitating the availability of CNG kit or catalytic converters. A number of emission standards have been notified under the environment (protection) at EPA 1986. Industries have been directed to install necessary pollution control equipment. The details of these measures are given in Annexure 1.

Chapter 5

STATE AND LOCAL LEVEL ECO-TAXES FOR POLLUTION ABATEMENT

Just as in the case of countries, states in India have also considerable differences in consumption levels, growth rates, and the nature and incidence of pollution. Apart from central measures for overcoming environmental concerns, states also have to play a definitive role in the control of pollution, which is often of a state-specific or local nature. The observation of the latest (Fourth) Report of Inter-governmental Panel on Climate change (IPCC) that "The world has a common but differentiated responsibility and we all have an obligation" applies as well to the state governments in India, which must share with the Central government a common but differentiated responsibility of managing the environment. In this Chapter, we look at the available taxation instruments with the states in the light of reforms of indirect taxation, particularly the introduction of State VAT.

As discussed in Chapter 4, Tax reforms in India, undertaken since the early nineties, have taken the system of taxation of goods slowly towards the application of the value added tax separately for the central and the state taxes. Services at present are largely being taxed by the central government. Attempts are now being made to implement a comprehensive Goods and Services tax both at the centre and the states. While it will take some time for the GST to materialize, it is clear that taxation of goods and services on the value added principle with proper harmonization with the states will bring about major reforms in the way goods and services are being taxed in the country. This is also the ideal time to include ecological tax reform as an integral part of the reformed regime of taxation of goods and services. This chapter looks at some of the immediate and medium term options in this context.

5.1 Some Basic Considerations

In undertaking reforms of the taxation of goods and services integrated with ecological tax reforms, it is important to recognize that in a value added tax regime, where input taxes are fully rebated, taxation of polluting inputs will be ineffective as the tax paid on the inputs will be rebated, unless these are made non-vatable or a non-rebatable cess is levied on the inputs. This cannot be done on a large scale as it will make the tax system very complex and defeat the objective of tax reform. In general, eco-tax reforms would require taxing at a higher rates, outputs that are either polluting or use highly polluting inputs.

With a view not to increase the overall burden of taxes due to the 'greening' of the tax-regime, eco-taxes should be designed so as to be revenue-neutral with respect to total revenues. At best, these may lead to a small net revenue augmentation and these additional revenues should be kept in a separate account for supporting changes in technology and processes, which economise on the use of the polluting inputs or encourage the use of non-polluting substitutes. Eco-taxes should be designed in an integrated way for taxation at the central, state and local levels. These should complement each other and should not be at cross purposes. Global sources of pollution or pollution where state boundaries are generally crossed should be taxed at the national level, regional sources at the state level, and pollution with strong local characteristics should be taxed at the local level. There should be inter-state coordination so that as a result of taxation of polluting inputs and outputs, industries do not attempt to relocate in other states where eco-taxes are less stringent.

Eco-taxes are a price-instrument. For an effective use of a price-instrument, it is important that prices are allowed to be determined by the market forces and reflect international prices. It may be noted that for some of the major polluting inputs and outputs like coal, petroleum products, and fertilizers, prices are regulated by the central government. In the case of electricity, prices are regulated by the Tariff Regulatory Authorities of the states but prices reflect state governments' concerns. Increases in taxes that may lead to increases in prices of some of the polluting inputs or outputs are much resisted by the concerned ministries, particularly, if they are also looking at the interest of some public or private sector enterprises. This often gives rise to perverse subsidies. By not allowing the petroleum prices to increase to reflect the international prices and resisting taxation of this polluting input/output on environmental considerations, government ends up subsidizing the petroleum companies through the general tax pool causing a double loss with a perverse subsidy.

Because of this resistance at introducing eco-taxes at the input levels, greater effort should be placed in designing eco-taxes with respect to the end users, provided prices are allowed to reflect the impact of the eco-taxes. This is consistent with the value added principle of taxation. This will also require taxation of the polluting inputs or outputs at the state and local level. There are a number of tax and non-tax instruments at the state/local level, which may be used to achieve environmental goals. These include state VAT (sales taxes), state excises, motor vehicle tax, and stamps duties and

registration fees. At the local level, the major instruments are the property tax and entry taxes.

Non-tax revenue is derived from charges, particularly the power tariff and water charges. States could use either of these instruments to achieve environmental objectives. State Pollution Boards already levy a "water cess" based on the use of the water.

5.2 State VAT: Salient Features

Introduction of State VAT (Value Added Tax) is the most significant tax reform measure at State level. The State VAT has replaced the earlier state sales tax system. The process of reforms in the state level sales tax began with the recommendation of the Chief Ministers for setting up an Empowered Committee (EC) of State Finance Ministers on 17th July 2000. In chapter 4, we discussed the recommendations of the Empowered Committee. The following feature may be highlighted:

1. Input tax credit will be given for both manufacturers and traders for purchase of inputs/supplies meant for both sales within the state as well as to other states, irrespective of when these will be utilized/sold. Even for stock transfer/consignment sale of goods out of the state, input tax paid in excess of 4 percent will be eligible for tax credit.
2. Input tax credit on capital goods may be adjusted over a maximum of 36 equal monthly installments. The states may at their option reduce this number of installments and there maybe a negative list for capital goods that may not be eligible for input tax credit.
3. All exports made out of the country, tax paid within the state are to be refunded in full. Units located in special economic zone (SEZ) and export oriented unit (EOU) will be granted zero-rating status and refund of the input tax paid will be available within three months. It is also provided that the tax paid on inputs procured from other states through inter-state sale and stock transfer will not be eligible for credit.
4. The inter-state sales tax or central sales tax will be phased out.
5. Comprehensive inter-state tax information exchange system will be set up.
6. States have the flexibility to the fix threshold limit for dealers who need to be registered for payment of VAT. Small dealers with annual gross turnover not exceeding Rs. 50 lakh who are otherwise liable to pay VAT, may be given the option for a composition scheme with payment of tax at a small percentage of gross

turnover. The dealers opting for this composition scheme will not be entitled to input tax credit.

7. All goods, including declared goods will be covered and get the benefit of input tax credit. The few goods that will be outside VAT will be liquor, lottery tickets, petrol, diesel, aviation turbine fuel and other motor spirit since their prices are not fully market determined. These will continue to be taxed under the Sales Tax Act or any other State Act or even by making special provisions in the VAT Act itself, and with uniform floor rates decided by the Empowered Committee.

a. VAT Rates and Classification of Commodities

Under the VAT system covering about 550 goods, only two rates are permitted: basic VAT rate of 4 percent and core rate of 12.5 percent, plus a specific category of tax-exempted goods and a special VAT rate of 1 percent only for gold, silver ornaments, and bullion.

Under the exempted category, the Empowered Committee suggested that about 46 commodities comprising natural and unprocessed products in the un-organized sector, items that are legally barred from taxation and items, which have social implications should be included with a flexibility for the states to select a set of maximum of 10 commodities, for exemption for goods of local social importance for the individual states without having any inter-state implications.

Under the 4 percent VAT rate category, items of basic necessities such as medicines and drugs, all agricultural and industrial inputs, capital goods and declared goods are to be included. The remaining commodities, common for all the states, will fall under the general VAT rate of 12.5 percent.

In deciding the rate-classification of goods, there were no explicit 'environmental considerations'. Excepting for a few States, which have contemplated to bring in new taxes (tax on lottery tickets in Maharashtra, tax on resale of certified used cars in Goa, 'green tax' on old vehicles in Rajasthan), most state governments have intended to reduce their tax rates on various types of taxes and even abolish certain taxes. Kerala has created a new schedule of goods to be taxed at 20 percent, which is higher than the highest level under VAT i.e., 12.5 percent. Maharashtra, Meghalaya and Mizoram have proposed to enhance water charges. However, several states have proposed to reduce power/ electricity rates to various sections of population (Andhra Pradesh, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Punjab and Tamil Nadu).

b. Existing VAT Schedules in States: Selected States

Most States have divided the goods taxable at different rates into several schedules. We consider a set of selected states to highlight some of the differences in the way that the goods are being classified in the states. For example, in Tamil Nadu, there are six separate schedules, which contain different parts. In the first schedule, Part A relates to goods which are taxable at the rate of 1 percent. These include bullion, gold, silver and precious stones. Part B of the first schedule lists goods that are taxable at the rate of 4 percent. This list includes 150 items. Part C of the first schedule includes the residual category of goods, which are taxable at the rate of 12.5 percent. The second schedule includes goods where there is no entitlement for input tax credit. These include alcoholic liquors, gasoline, petrol and high speed and diesel oil, kerosene other than those sold through the PDS, molasses, and sugarcane. The rates vary very widely among these goods from 4 to 73 percent. The third schedule provides for compounded rates for hotels, restaurants and sweet stalls. The fourth schedule gives a list of goods exempted from the state VAT under two parts, Part A and Part B. Part A contains 10 goods and Part B contains 81 goods. The fifth and sixth schedules relate to international organizations where sale is zero-rated and where a transit pass is permissible, respectively.

In the case of Andhra Pradesh, there are six schedules. However, these are quite differently organized compared to Tamil Nadu. Schedule 1 provides a list of exempted goods, which are about 47 in number. Schedule 2 provides a list of goods taxed at 'nil' rate. Schedule 3 provides a list of credits that are taxable at 1 percent rate and include bullion, jewellery and precious stones. Schedule 4 provides a list of goods that are taxable at 4 percent. The list contains 90 items. Schedule 5 is the residual category of goods where the rate of 12.5 percent applies. Schedule 6 includes goods subjected to tax at special rates including liquor, petrol, aviation motor spirit, aviation turbine fuel and diesel oil. These are levied at first point sales and range from 22.5 to 70 percent.

In the case of Punjab, VAT schedules have been divided into 8 categories and the schedules range from A to H. Schedule A contains the list of exempted goods. These are 65 in number. Schedule B contains goods taxable at 4 percent and these are 149 in number. Liquor is included in this list. Schedule C contains goods taxable at 1 percent covering bullion etc. Schedule D contains only one item, viz., aviation turbine fuel, taxable at the rate of 20 percent. No input tax credit is provided in respect of purchases of petrol, diesel, aviation turbine fuel, liquefied petroleum gas, and condensed natural gas. This is also applicable for beverages and tobacco products. Schedule E provides a list of goods taxable at special rates. This includes only three items viz., diesel, molasses

and petrol and the tax rates vary from 8.8 percent for diesel to 27.5 percent for petrol. Schedule F is the residual category where goods are taxable at 12.5 percent. Schedule G makes reference to the UN bodies and Schedule H provides a list of good on which VAT is levied on the taxable turnover. These include paddy, wheat, cotton, sugarcane and milk.

For Maharashtra, there are five schedules. Schedule A gives a list of exempted goods. These are 54 in number and include electricity. Schedule B refers to the tax rate of 1 percent applicable on gold, silver and precious metals. Schedule C gives the list of goods that are taxes at 4 percent. In this list, 109 groups of goods are mentioned. These include iron and steel, various metals, lime and lime stone and their products, paper, and plastic granules etc. Schedule D includes goods taxed at 20 percent or above. Foreign and country liquor and molasses and spirit are taxed at 20 percent. For high speed diesel oil, aviation turbine fuel, aviation gasoline and motor spirit, the rates vary between 27 to 34 percent with a specific component added amounting to Re. 1 per litre in most cases. Schedule E is the residual category taxed at 12.5 percent. A distinction is made according to whether the dealer is located in Brihan Mumbai, Navi Mumbai or Thane and a dealer located elsewhere in Maharashtra.

In the case of Delhi, there are 7 schedules. Schedule 1 gives the list of exempted commodities, which includes electricity and energy, rubber and plastic footwear and plastic waste. Schedule 2 is for the 1 percent rate relating to gold, and precious metals. Schedule 3 includes goods that are taxed at 4 percent. This includes 84 items that cover industrial cables and ferrous and non ferrous metals, paper and news print, pipes and plastic footwear, and plastic granules, powder and master batches. It also includes cooper and various other metals and carbon. It also includes insecticides, fungicides and pesticides of technical grade, and various industrial inputs. Schedule 4 provides a list of goods taxed at 20 percent. It includes petroleum products other than liquid petroleum oil, naphtha, aviation turbine fuel, spirit, gasoline, liquor including country liquor and molasses among others. The 5th and 6th schedules give the list of various categories of dealers and organizations that are exempted on paying tax on sale of goods. The 7th schedule provides a list of non-vatable goods. This includes all automobiles including commercial vehicles, and two and three wheelers, fuels in the form of petrol, diesel, LPG, CNG and coal, beverages for human consumption, air conditioners, tobacco etc. The residual category of goods where the tax rate is 12.5 percent is applicable is not separately mentioned. This provision is included in the Act itself, under Chapter 2.

It is clear that while there is some uniformity in the tax rates, which range from exempted goods, zero-rated goods (for exports), goods taxed at 1 percent, goods taxed at 4 percent, and goods taxed at 12.5 percent, there is considerable variation among the states regarding the goods included in different categories. There are also several goods where special rates are applied and these rates vary considerably across states. There is also considerable variation in the list of goods subject to special rates where credit on taxes paid on goods is allowed or not allowed. Many goods that may be considered as polluting inputs and outputs are taxed at different rates in the states. With a view to deriving a broad idea of such differences, we consider the state-wise treatment of a selected list of these goods which may be considered prima-facie as polluting inputs and outputs.

c. Comparison of State VAT Rates for Selected Goods

We consider here, for purposes of comparison of VAT rates of, five states, viz., Andhra Pradesh, Delhi, Maharashtra, Punjab, and Tamil Nadu for a number of goods that cause pollution directly or indirectly. While making these comparisons, we also spell desirable reforms in VAT rate structure. The overall strategy for bringing environmental considerations centre-stage in tax reforms is guided by the following objectives: (a) changes should be revenue-neutral in general, (b) a significant wedge should be created in the tax rates for polluting inputs/outputs and the tax rates for non-polluting substitutes, and (c) changes in tax rates should be reflected in prices, requiring that if centre is administering the price, states may introduce the change and vice versa.

c1. Fertilisers, Insecticides, Pesticides, and Plastics

Plastics and plastic footwear are invariably kept in the concessional category of 4 percent. As far as plastic granules, powder and master batches are concerned, these are put at 4 percent with some exceptions. Plastic footwear is considered to be an item of mass consumption. However, other plastics are used for a variety of consumer goods and used as inputs in various other industrial processes. There is no reason why plastics should not be put under the core category of 12.5 percent.

Table 5.1: VAT Rates in Selected States: Selected Goods

(Percent)

States	Plastic Footwear	Plastic Granules, Powder, and Master Batches	Insecticides, Pesticides, Fungicides etc.	Fertilizers	Dyes
Andhra Pradesh	4	12.5	4	Chemical fertilizers (4 %)	12.5
Delhi	4	4	4	Naphtha (20 %), Others (12.5 %)	4
Maharashtra	4	4	Exempted	Exempted	12.5
Punjab	4	4	Exempted	Naphtha (4 %), others exempted	4
Tamil Nadu	4	4	4	4	4

Source (Basic Data): AP Value Added Tax Act, 2005; Tamil Nadu Value Added Tax Act, 2006; Punjab Value Added Tax Act, 2005; Maharashtra Value Added Tax Act, 2002 and Delhi Value Added Tax Act, 2006.

The VAT rates for pesticides, fungicides, etc. as well as the chemical fertilizers are highly concessional ranging from exemption to 4 percent in most cases as given in Table 5.1. As noted earlier, excess application of these chemicals are highly polluting for both ground water and soil. While detailed recommendations are considered in Chapter 6, it may be noted that for encouraging the use of organic fertilisers, these should be exempted. All other chemical fertilizers and pesticides should be placed in the core rate category of 12.5 percent. This would encourage the use of organic fertilizers and discourage the excess use of chemical fertilizers as well fungicides and pesticides.

c2. Electricity, Coal and Paper

Table 5.2 gives the VAT rates for electricity, coal, and paper. In the case of coal, some of the important states like Andhra Pradesh and Maharashtra had levied the concessional rate of 4 percent whereas in other states coal is part of the residual category. As far as charcoal is considered it is exempted in most states.

Table 5.2: VAT Rates in Selected States: Coal and Plastics

(Percent)

States	Electricity	Paper of All Sorts	Coal (including coke but excluding charcoal)	Charcoal
Andhra Pradesh	Exempted	4	4	Exempted
Delhi	Exempted	4	12.5	Exempted
Maharashtra	Exempted	4	4	Exempted
Punjab	Exempted		12.5	Exempted
Tamil Nadu	Exempted	4	12.5	Exempted

Source: As in Table 5.1.

In the case of states, which produce electricity where the main input is coal, either for consumption within the state or for export outside the state, the citizens of such states have to bear the impact of pollution relatively more. The producing states are often states where coal is available underground and in mining processes also, pollution results. These states are entitled to charge a higher rate of tax on coal so that pollution mitigation measures can be put in place.

c3. Iron and Steel, Metals

Table 5.3 gives a comparative picture of VAT rates for iron and steel and other metals. Iron and steel, and most of other metals, are taxed at the concessional rate of 4 percent in most of the states. This is because most of these are inputs into other products. However, a lot of pollution results in the processing of these metals. As part of overall reforms with environmental concerns in focus, there would be a need to raise the tax rates on metals like iron and steel, particularly in states where pollution occurs because many production units are located in these states. There is a case of raising the tax rate to a higher category particularly when as part of reforms the core rate of State VAT is brought down from 12.5 percent to somewhat lower levels.

Table 5.3: VAT Rates in Selected States: Iron and Steel and other Metals

Andhra Pradesh

The VAT rates for iron and steel, iron and steel scrap, aluminum utensils and enameled utensils, non-ferrous category (including alloy) and non-ferrous scrap had a rate of 4 percent.

Delhi

The VAT rates for iron and steel, non-ferrous category, copper, nickel, cobalt, aluminum, lead, zinc, tin etc ores and concentrates had a rate of 4 percent.

Maharashtra

The VAT rates for iron and steel, iron and steel scrap, ferrous and non-ferrous utensils, non-ferrous and alloys in primary form or in scrap had a rate of 4 percent.

Punjab

The VAT rates for iron and steel, non-ferrous category and non-ferrous scrap had a rate of 4 percent.

Tamil Nadu

The VAT rates for iron and steel scrap, non-ferrous scrap, copper, nickel, cobalt, aluminum, lead, zinc, tin etc ores and concentrates had a rate of 4 percent.

Source: As in Table 5.1.

c4. Taxation of Petroleum Products

Table 5.4 shows the special rates non-vatable for petroleum products for four states.

Table 5.4: VAT Rates for Petroleum, Diesel, High Speed Diesel and Kerosene ¹⁹
(Percent)

States	Petrol	Diesel Oil	High Speed Diesel Oil	Kerosene other than those sold through PDS
Andhra Pradesh	32.55	21.33	21.33	12.50
Delhi	20.00	20.00	20.00	12.50
Maharashtra *	28.00 plus Re. 1 per litre	28.00 plus Re. 1 per litre	a. To a retail trader or person located within municipal corporations of Brihan Mumbai, Thane and Navi Mumbai: 28 b. To a retail trader or person situated outside the above three Municipal Corporations: 31 percent plus Re. 1 per litre.	12.50
Punjab	27.50	8.80		12.50
Tamil Nadu	30.00 (with or without additives)	25.00 (light diesel oil)	23.45	25.00

Source: As in Table 5.1.

Note: * Maharashtra makes a distinction between: a. retail traders located in the geographical limits of the municipal corporation Brihan Mumbai, Thane and Navi Mumbai; and b. retail traders located outside these areas in Maharashtra; **at the first point of sale.

In Andhra Pradesh every dealer has to pay tax on sale price of goods at point of first sale in the state; No input tax credit is allowed in respect of tax paid on the purchase of goods listed in Schedule 6.

Table 5.5 presents the VAT rates for aviation fuels and any other motor spirit.

¹⁹ Airlines mention surcharge and congestion fee under the head of tax in their tickets to passengers. For example, if they charge an airfare of Rs 5,200 for Delhi-Mumbai they mention Rs 3,475 as airfare and Rs 1,725 as 'tax' in the tickets even though the actual tax component in the airfare is just Rs 225 per passenger. The other charges levied as tax are a fuel surcharge of Rs 1,350 and a congestion fee of Rs 150. Both congestion fee and fuel surcharge go to airlines. "If only Rs 225 goes to the government or the airport operator, why should airlines charge other fees which come to them as tax," the official added.

Table 5.5: VAT Rates for Aviation Fuels and any other Motor Spirit

(Percent)

States	Aviation Motor Spirit	Any Other Motor Spirit	Aviation Turbine Fuel	Aviation Gasoline
Andhra Pradesh	32.55	32.55	32.55	32.55
Delhi	20.00	20.00	20.00	20.00 also applies to furnace oil
Maharashtra *	30.00 plus Re.1 per litre	a. to a retail trader or person located within municipal corporations of Brihan Mumbai, Thane and Navi Mumbai: 28.00 plus Re. 1 per litre. b. To a retail trader or person situated outside the above three Municipal Corporations: 27.00 percent plus Re. 1 per litre.	a. duty Paid (25.00), b. Bonded (30.00): to a retail trader located in Brihan Mumbai, Thane and Navi Mumbai a. 5.00 to a retail trader located in Brihan Mumbai, Thane and Navi Mumbai introduced in the 2008-09 budget. Sold to a turbo prop aircraft: 4.00	a. Duty Paid (10.00), b. Bonded (24.00)
Punjab			20.00	
Tamil Nadu			a.29 (includes jet fuel), b. ATF sold to a turbo-prop aircraft 4	29.00**

Source: As in Table 5.1.

Two general considerations are pertinent in devising suitable modifications in the VAT rate structures of the state governments in regard to petroleum. One, the central government regulates the petroleum prices and because of the visibility of the petroleum prices, high levels of international prices, and both equity and growth considerations, the central government is not likely to consider favorably, further eco-tax loads on the petroleum prices at least in the short run. The states have differential impacts of the vehicular pollution depending on the size of the vehicular population and pattern of usage. Their tax rates also vary in a large range.

The states should ensure that VAT rates for petroleum products

- a. Are kept at a reasonable minimum level, i.e., there should be agreement on a floor rate and a ceiling rate.

- b. These are kept at levels much higher than the floor level by states where the incidence of vehicular pollution is relatively higher; such increases should be brought in stages.
- c. In the case of VAT on the petroleum products, taxes paid on inputs should not be made rebatable, which is generally the case.
- d. Higher tax revenues from VAT on the petroleum products should prepare ground for reducing the core VAT rate from 12.5 to 10 percent in the medium term so that it becomes a 'green' shift in taxation and does not hamper growth.

While economizing on the use of petroleum products, the use of bio-fuels needs to be encouraged through suitable tax incentives. States should put bio-fuels under the exempted category of State VAT. The tax at the retail level should reflect the differential tax rates of bio-fuel and petroleum depending on the proportion in which it has been mixed.

c5. Liquor and Alcoholic Beverages

Many states have brought in liquor and all beverages in VAT schedule, although these are subjected to special rates.

Table 5.6 provides a comparison of the tax rates for liquor (including foreign liquor) and alcoholic beverages. In the case of VAT rates on liquor and alcoholic beverages also, there are considerable variations among the states. The rates vary from 12.5 percent to as high as 70 percent. In many cases, the tax paid on inputs is not rebatable also. These are appropriate commodities where special rates may be applied and states may agree to a minimum rate of not less than 30 percent and in states where many manufacturing units are located, a rate higher than the floor may be charged as considerable pollution occurs around the manufacturing units. There should not be any rebate on taxes paid on goods nor should exports be zero rated because consumption may take place in other states but pollution may be more localized in the state where the manufacturing units are located.

Table 5.6: VAT Rates: Liquor and Alcoholic Beverages

Andhra Pradesh	All liquors bottled and packed as per the provisions of the AP Excise Act 1968 including imported liquor but excluding Toddy and Arrack at the point of first sale in the state: a. where cost of such liquor is more than Rs. 700 per case: 90 percent, b. where the cost of such liquor is Rs. 700 or below per case: 70 percent.
Delhi	Liquor (foreign and Indian made foreign liquor and country liquor: 30 percent.
Maharashtra	Foreign liquor as defined in foreign liquor rules 1953: 20 percent; country liquor 20 percent, liquor imported from any place outside India at 20 percent.
Punjab	12.50 percent
Tamil Nadu	Alcoholic liquors for human consumption brought from outside at point of first sale 58 percent. Foreign liquors at the first point of sale 73 percent. Alcoholic liquors for human consumption other than outside state or foreign liquor; a. first point of sale in the state 58 percent, b. second point of sale in the state 38 percent.

Source: As in Table 5.1.

5.3 Motor Vehicle Tax: Environmental Considerations

Vehicle pollution is an important source of air pollution in most cities. It is a non-point source of pollution. Government has taken many measures to improve the quality of automobiles and auto fuel. The Expert Committee on Auto Fuel Policy has laid down a road map regarding vehicle norms and fuel norms.

In most states a compounded system of motor vehicle tax exists where a one time levy is paid for the life of the vehicle. Such a system cannot distinguish between the pollution impact of old vehicles vis-a-vis new vehicles who may also meet more upto date emissions norms. In many states motor vehicles are taxed at 12.5 percent of the purchase value. This covers two and three wheelers as well as cars, trucks and buses. Only in the case of tractors and trailers a concessional rate is applied, which may be of 4 percent.

It is recommended that instead of the one time levy, the motor vehicle tax should be levied every five years and the older cars should be subjected to an increasing level of eco-cess every five years. After 15 years the vehicles should be compulsorily taken out of the road.

States like Tamil Nadu are implementing a "green" motor vehicle tax. These could be introduced in states with high vehicular pollution. In Tamil Nadu, a new tax called 'Green Tax' under Section 3-A of the Tamil Nadu Motor Vehicles Taxation Act was levied in 2003. It amounted to an additional tax in respect of vehicles specified in the Fourth Schedule of the Act. For Motor Cycles of age exceeding 15 years, a sum of Rs 500 is charged and for other vehicles a sum of Rs 1,000 is charged. Section 3-A of the Tamil Nadu Motor Vehicles Taxation Act reads as follows: "Levy of Green Tax:- (1) There shall be levied and collected an additional tax called 'green tax', in addition to the tax levied under Section 3, on the motor vehicles suitable for use on road, as specified in the Fourth Schedule for the purpose of implementation of various measures to control air pollution." This tax has been upheld by the Madras High Court.

5.4 States and the Electricity Sector

Electricity is produced both from polluting inputs like coal, and non-polluting inputs like hydel, nuclear, solar and wind energy sources. It was in the nineties that reforms of the electricity sector began and a new Electricity Act was passed in 2003. This Act provided for various measures to introduce competition in the electricity industry. It delicensed generation and recognized trading as an independent activity. It also provided for open

access in transmission at the outset and in distribution in phases. It recommended unbundling of State Electricity Boards (SEBs) by a stipulated date. Many states have unbundled or restructured their SEBs and State Electricity Regulatory Commissions (SERCs) have been appointed by them. These SERCs recommend electricity tariffs for different categories of consumers. The state governments continue to control these tariffs. However, they have to pay a subsidy if the prices are kept below the recommended prices. In most states, electricity has been put under the exempted category in State VAT.

For bringing about environmental considerations in the electricity sector, it is useful to distinguish between polluting and non-polluting sources of electricity as a first step at the stage of transmission and distribution 'the degree of greenness' of electricity drawn from different sources needs to be labeled and the consumers should be informed as to the degree of 'greenness' of the electricity being distributed in different areas. At a later stage, an eco-cess on electricity should be considered. Electricity that is less 'green' than a threshold level should be considered. For the time being, the eco-cess is best levied at the stage of production of coal itself. This is discussed in Chapter 6.

5.5 Environmental Taxation at the Local Level

a. Congestion Taxes

Many cities in the world impose a congestion tax on certain specified segments of the city area, where there is a heavy density of vehicular traffic. This is implemented through suitable softwares and monitoring mechanisms so that taxes may be collected without any disruption to the traffic. In London, for example, in the central area, an entering vehicle is charged a congestion tax of £ 8, and in case of evasion, a fine of £ 50 is levied. This is applicable from 7 am to 6 pm, every day except Sundays and excepting certain types of vehicles like hospital ambulances. The enforcement system includes database of registered vehicles, a number of cameras guarding the entrance and exits of congestion zones, apart from the inner roads in the zone and Automatic Number Plate Recognition (ANPR) Software. The use of ANPR software is needed for this purpose.

A congestion tax should be complemented by improvement in the public transport system. The congestion tax should also cover the heavy two-wheeler population. Adequate parking spaces should also be provided, near the congestion tax collection points, to serve the commuters who want to opt for cheap public transport. The parking fee may be kept at a nominal level.

The Delhi Government has finalised a new parking policy and imposition of a "congestion tax" for financing parking infrastructure projects and encouraging institutional finance for multi-level parking complex at various places in the Capital. This congestion tax would be area-based and could be levied on vehicles entering specific areas.

It is recommended that a congestion tax is levied, subject to using suitable software and related facilities, in all major cities in India, in specified areas of the cities.

b. Property Tax for 'Green' Rated Buildings

The central government is looking at the possibility of offering tax sops for developers of energy-efficient buildings, including possibility of property tax concessions. Buildings are to be graded for a "greenness" certification ranging from one to five stars. The scope for an incentive scheme involving a set-off mechanism, whereby firms constructing buildings conforming to prescribed standards could take credit for a part of the construction cost against the developer's corporate or personal income-tax liability, is also being examined. A rating mechanism called 'Griha' (Green Rating and Integrated Habitat Assessment) has been developed by the Tata Energy and Resources Institute (TERI) and the Ministry of New and Renewable Energy Sources based on inputs from the Power Ministry's Energy Conservation Building Code. This is in the process of being implemented for new commercial, institutional and large-scale residential buildings.

The system would essentially evaluate the environmental performance of a building over its entire lifecycle by awarding points to new buildings for meeting the design and performance intent of the criteria, with each criterion having points assigned to it. 'Griha' has a 100 point rating scheme with some core points that are mandatory for compliance, while the rest are optional and can be earned by complying with the respective criterion. Different levels of certification are to be awarded based on the number of points earned, with the minimum points required being 50. Buildings scoring 50 to 90 points will get between one and four stars, while those scoring 91 to 100 points would get the maximum rating of five stars, making them eligible for maximum sops under the scheme. The rating of new buildings would be carried out by an evaluation panel comprising professionals. The system could be extended to existing structures in the second phase.

The local governments can also levy property tax on highly rated green buildings at a concessional rate. At first, a start can be made by covering commercial building,

which consumes large amounts of energy. Any incentive of this nature will reduce the consumption of energy in the concerned areas. This will have an overall beneficial impact.

c. Urban Governance: Pollution Reducing Effects

The decentralization of urban governance and management, introduced in the early 1990s, led to the introduction of the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) by the Indian government in 2005. It was meant to generate a reform-based mechanism for States through the implementation of best practices in the development of urban centres and the decentralization of funds to municipal offices by the states. In the assessment mechanism for the allocation of funds, the factors under the category of urban transport should require greater attention to the expansion of road width and augmentation of pedestrian facilities. Any measure that reduces the waiting time at traffic lights also reduces consumption of petrol. Increasing energy efficiency in the management of the city should be rewarded. Many motivating factors for improvement are available from elsewhere, notable among them are the urban greening schemes in Singapore and Malaysia.

d. Facilitating Availability of CNG

Spiralling crude prices coupled with wider availability of alternate fuels, and lower maintenance cost has spurred conscious citizens on a 'green drive'. It is estimated that the number of compressed natural gas (CNG) vehicles in India is now over 3.54 lakh. Mumbai has lesser number of CNG stations compared to Delhi, but has more vehicles running on the alternative fuel. Mumbai with 127 CNG stations has about 183429 vehicles against Delhi that has 153 outlets with 150000 vehicles. The other cities that have CNG stations include Hyderabad, Vijayawada, Vadodara, Agartala, Kanpur, Bareilly and Lucknow. The demand is not only by the mass transport vehicles, but is catching up among passenger cars as well. Within the National Capital Region, the number of private cars that ply on CNG are just a little less than the government mandated CNG autos. Currently, about 70000 autos, 50000 cars, 12000 buses and more than 6000 taxis and light commercial vehicles are operating on CNG. In smaller cities, too, automobiles run on CNG seem to be getting popular, with Vadodara accounting for 3630 vehicles, Kanpur and Bareilly 6801, Agra 5215 and Lucknow 5430. This is a trend that should be emulated by all the important cities and towns in the country.

Chapter 6

CENTRAL AND STATE TAXES: A COORDINATED APPROACH TO ENVIRONMENTAL REFORMS

In this chapter, we consider: (a) coordination issues with central taxes in designing suitable environmental reforms, particularly for some of the critical polluting industries like coal, petroleum, fertilizers, metals, plastics, and pesticides; (b) relevant considerations in integrating environmental concerns in the on-going tax reforms aimed at bringing about a comprehensive regime of taxation of goods and services subsuming both central and state level taxation of goods and services; and (c) the potential of the Clean Development Mechanism for reducing carbon emissions. Other complementary policy intervention environmental reforms relate to the use of subsidies for complementing the effort through eco-taxes to address and achieve environmental objectives without sacrificing growth or other developmental objectives and environmental implications of tax-concessions for the Special Economic Zones (SEZs) and similar other concessions.

6.1 Industry Specific Eco-taxes

Goods bear a variety of taxes including customs duties, central excise duty (CENVAT), and state sales taxes (State VAT), and motor vehicle tax. Customs duties include apart from the basic duty, additional duty of customs, additional duty of customs to countervail state taxes/VAT, special duty, additional duty on light speed diesel oil, additional duty on motor spirit, National Calamity Contingency Duty, Education Cess, and Secondary and Higher Education Cess. In designing eco-taxes, it is important to examine the overall incidence of taxes at all levels, a suitable point of levy for the eco-tax, distribution of the eco-tax components between centre and states, if levied at both levels, and relevance of inter-state differentials in the tax rates. We consider below some important polluting inputs/outputs.

a. Environmental Reforms in Taxation of Coal

Coal is consumed largely by the power sector, steel, and cement sectors, and to some extent by the fertilizer companies. The Expert Committee under the Chairmanship of Shri K.S. Parikh, prepared an integrated energy policy, by examining both efficiency and environmental issues. Its Report, submitted in 2006, made a set of recommendations in relation to pricing and distribution of coal. In respect of the pricing of coal, the Committee recommended that high quality coking and non-coking coals, which are

exportable, may be sold at export parity prices. 20 percent of the total coal produced should be sold through e-auctions. The remaining coal should be sold under long term fuel supply and transport agreements. In these cases, the pit head price of coal should be revised annually by a coal regulator. Further, the practice of grading coal under wide bands of the empirically determined useful heat value (UHV) should be replaced by the international practice of grading coal based on gross calorific value (GCV).

The demand for coal in India for 2006-07 was assessed at 474.18 metric tonnes (MTs) and indigenous coal production was projected at 432.50 MTs. This was divided between coking coal used in steel and coke oven to the extent of 43.7 MTs and non-coking coal to be used by the power, cement and other sectors to the extent of 430.48 MTs. Any gap between demand and supply is met through imports by the concerned sectors. Imports take place also because of quality considerations and consideration of transport costs.

Coal is under the Open General License (OGL) list. India exports coal to Nepal, Bangladesh and Bhutan. Coal can also be freely imported under the OGL by the consumers themselves. Coking coal is being imported by the Steel Authority of India and other steel manufacturing units mainly to augment the quality of domestically available coal. Coast-based power plants, cement plants, captive power plants, sponge-iron plants, industrial consumers, and coal traders are also importing non-coking coal. Total import in 2005-06 was about 39 MTs.

As far as taxation of coal under customs duty and CENVAT is concerned, the following provisions apply. Under the Customs Duty Act, for all varieties of coal except Bituminous coal, the tariff rate is 10 percent. For Bituminous coal, the tariff rate is 55 percent. Under the Central Excise Act, the tariff rate is zero percent for all varieties of coal. Under a special notification, under the Coal Mines (conservation and development) Act, 1974, a Stowing Excise Duty has been levied at rate of Rs. 10 per tonne of coal irrespective of its grade with effect from 26.03.2003. This excise duty is collected by the Coal Controller on all raw coal produced and dispatched from all the collieries in India. It is realized from the consumers alongwith the coal sale bills raised by the coal companies. The net proceeds from the stowing excise duty during the preceding year or years is disbursed to the owners, agents or the managers for execution of stowing and other operations for the safety in coal mines or conservation of coal or any other purpose connected with development of coal mines or transportation, distribution or utilization of

coal. During 2006-07, as per the revised estimates, Rs. 409 crore was collected under this excise duty.

The Expert Committee appointed by the Government of India under the Chairmanship of Shri T.L. Sankar submitted Part I of their Report in December 2005 and Par II Report in 2007. Among other recommendations, they have observed that the environmental issues with respect of coal projects should be taken up on priority consideration by the government. Further, planned imports of coal needs to be encouraged and an increasing proportion of all domestic coal that is not earmarked for the power sector should be brought into e-auction. They also observed that coal price should be regulated in the light of the market realities. There should be a differentiation in the pricing of coal for power generation, which consumes 80 percent of the domestic production and the quality of coal that it consumes is not easily saleable to the steel and cement sectors. E-auction was introduced during the year 2005-06. In 2006-07, 36 MTs of coal were sold through e-marketing. However, e-auction has since been stopped with effect from December 2006 following a judgment of Hon'ble Supreme Court declaring it illegal.

Coal containing high ash content causes serious environmental pollution and health hazards in transportation and handling, industrial applications, and generation of power. For promotion of clean coal technologies, action has been initiated with the cooperation of Indo-US Working Group, Indo-EU Working Group, and Asia Pacific Partnership. The environmental management plans are now scrutinized by an Expert Committee setup by the Ministry of Environment and Forests. Under a jointly funded project by the Global Environment Facility, United Nations Development Programme and the Government of India a "coal bed methane recovery and commercial utilization project" was approved with the objective of harnessing methane to minimize safety risks in mines and to utilize potential energy source and to mitigate damage to the atmosphere. It is also meant to bring to the country a state of art methodology for source assessment and recovery techniques of coal bed methane recovery taking account of the Indian conditions.

A royalty is paid by the coal producers to the concerned states. The coal royalty rates were fixed in 1971 and revised in 1975, 1981, 1991, 1994, and 2002. Table 6.1 shows the royalty rates as applicable from time to time. In fixing the royalty rate, the views of both producing and consuming states as well as the consuming sectors is taken into account. A Committee under the chairmanship of Additional Secretary, Ministry of

Coal has examined the issue of further revision of royalty rates and submitted its report in July 2006.²⁰ The Committee had observed that some of the state governments levy a cess on coal. This, together with the enhanced royalty rates, has a cascading effect on the coal consuming sectors causing differential costs of coal across states. From an environmental viewpoint, however, a coal cess levied by the states, where excessive pollution is caused because of location of coal mines or industries intensively using coal, may be justified.

Table 6.1: Coal Royalty Rates: 1981 to 2002

(Rs. per tonne)

Coal Group	Coal, Royalty Rates w.e.f. 13.02.1981	Coal, Royalty Rates w.e.f. 1.08.1991	Coal, Royalty Rates w.e.f. 11.10.1994	Coal, Royalty Rates w.e.f. 16.08.2002
Group I Coking Coal SG I, II, WG-I	7.00	150.00	195.00	250.00
Group II, Coking Coal WG-II, III; Non-coking AB, Semi Coking Gr-I, Semi Coking Fr II	6.50	120.00	135.00	165.00
Group III, Coking Coal WG-IV, Non-coking C	5.50	75.00	95.00	115.00
Group IV, Non-coking D, E	4.50	45.00	70.00	85.00
Group V, Non-coking F, G	2.50	25.00	50.00	65.00
Group VI, Coal Produced in Andhra Pradesh	5.00	70.00	75.00	90.00

Source: Ministry of Coal India Annual Report, 2005-06.

²⁰ GoI (2007), Annual Report, 2006-07, Ministry of Coal, <http://coal.nic.in>.

Coal beneficiation reduces the ash content in the coal and improves its thermal efficiency and reduces the operation and transport costs of thermal power plants. The MSE (2007) study recommended the levy of an eco-cess to provide suitable incentives for reducing the ash-content by prior treatment²¹. It is also suggested that this should be complemented with reforms in the power sector. Revenues generated from eco-cess may be used to set up a Clean Coal Fund, which could be utilized for setting up infrastructure for coal washing, selective mining and research and development. We recommend a similar but somewhat simplified structure of the eco-cess as given in Table 6.2.

Table 6.2: Rates of Eco-tax on Coal

Type of Coal	Rate (Rs. per tonne)
All varieties of coking coal where ash content is 18 percent or less	nil
All varieties of coking coal where ash content is between 19 to 28 percent	20
All varieties of coking coal where ash content is higher than 28 percent	40
All varieties of non-coking coal where ash content is 28 percent or less	nil
All varieties of coking coal where ash content is higher than 28 percent	50

As discussed earlier, a cess is already being collected by the Coal Commissioner. Since 2003, this cess is levied at the rate of Rs.10 per tonne, without any distinction in respect of the variety of coal, and the cess is fully passed on to users or consumers. It should possible to levy an environmentally rational cess under the same provision, and pass it on the users, while allowing prices to reflect the benefit of prior treatment of coal. It will reduce pollution as well as improve efficiency of production without causing loss either to consumers (who need less in weight of a better quality of coal) or producers of

²¹ The MSE (2005) study recommended the following rates:

Rate of Eco Cess (Rs. per tonne)				Rate of Eco Cess (Rs. per tonne)			Ash Percent
A. Coking Coal				B. Non-coking Coal			
1	S - I	-	<15	A	-		<14
2	S - II	-	15 - 18	B	-		14 - 18
3	W-I	20	18 - 21	C	-		18 - 23
4	W - II	20	21 - 24	D	-		23 - 28
5	W-III	40	24 - 28	E	50		28 - 34
6	W - IV	50	28 - 35	F	70		34 - 41
7	SC - I	-	<19	G	70		41 - 49
8	SC - II	20	19 - 24				

coal since they do not bear the cess. The receipts from the cess must be allocated for setting up facilities for washing and treating coal and related research and development.

There are additional considerations for taxation of coal at the state level. This arises particularly, in the case of producing states where the coal mines are located. They suffer pollution damage both in the atmosphere and on land. They suffer a double damage if the thermal power plants or other coal-using industries are also located in the state. These states do not get any returns from the mining out of the mineral resources, which belong to the centre, coal being a major mineral. The limited royalty that they get is in an inadequate compensation for the massive negative externalities that citizens of these states suffer because of the coal-related pollution damages. Since the consumers of power or other products where coal is an input are located in all the states, particularly, in higher income states where per capita consumption of power may be higher, the counterpart of export of coal to other states is import of pollution in the producing states. The producing states are Bihar, Assam, Orissa, Jharkhand, Madhya Pradesh, and Chhattisgarh. As discussed in Chapters 1 and 3 carbon emissions and surface pollution are high in these states and these states are entitled to levy a higher than floor rate of State VAT or levy a special cess. Further, on export of coal outside the country or to SEZs, the tax should not be zero-rated because although the good is consumed outside the state, considerable pollution remains within the producing state.

b. Environmental Tax Reforms in Respect of Petroleum Products

After a long period administered prices for the petroleum sector, a dismantling of the Administered Pricing Mechanism (APM) was announced and made effective from 1.4.2002. Subsidies for the public distribution system (PDS) kerosene and domestic liquefied petroleum gas (LPG) were continued on the ground that these were fuels of mass consumption. With a sharp and spiraling increase in international oil prices, particularly since late 2003, combined with sharp week-to-week and sometimes day-to-day volatility of petroleum prices, this arrangement has virtually collapsed. The explosive increase in the global crude prices increased the volume of subsidy on PDS kerosene and domestic LPG to unprecedented levels. Government took back control of price setting for petrol and diesel, and restrained the 'pass-through' of the international prices to domestic consumers.

The Rangarajan Committee (2006) had examined these issues keeping in mind the following principles.

- (i) Pricing and taxation of petroleum products should be rationalized to transmit the right price signals so as to minimize if not eliminate distortions and inefficiencies that result in misallocation of resources.
- (ii) Prices of petroleum products should, as far as possible, be aligned with international prices.
- (iii) Across the board subsidies result in inefficiencies and place an undue burden on an already strained fiscal situation. Subsidies should be minimal, targeted and restrained by a monetary ceiling.
- (iv) To the extent the Government decides to extend subsidies, the burden should be borne entirely and transparently in the Union Budget. The oil marketing companies should be freed from the burden of subsidy.
- (v) Custom tariffs on crude and products should be rationalized so as to moderate the effective rate of protection to a level that will offset the disadvantages suffered by the domestic producers without at the same time allowing them any undue cushion. Excise tariffs should be restructured to protect the consumers from excessive volatility in prices.

The Committee had recommended adopting the trade parity principle for pricing petrol and diesel, which would be a weighted average of the import parity and export parity prices in the ratio of 80:20. This principle of trade parity pricing was to be applied for the refinery gate price as well as for determining the retail price. The marketing companies were allowed flexibility to fix the actual retail price subject to the indicative ceiling for introducing an element of competition in consumer interest. The Committee also recommended terminating the principle of freight equalization.

The Committee observed that as there was no customs duty on domestic LPG, PDS kerosene and fertilizers inputs [naphtha and low sulphur heavy stock (LSHS)], these products were under a regime of negative effective protection. With a customs duty on crude oil of 5 percent, and the customs duty on petrol, diesel and other products of 10 percent, there was an effective rate of protection as high as 40 percent for these products.

The Committee recommended that the customs duty on crude may be retained at 5 percent but the customs duty on petrol and diesel should be reduced from the existing rate of 10 percent to 7.5 percent. This will reduce the effective rate of protection for refining these two products from the present high rate of 40 percent to a more reasonable rate of 20 percent.

The Committee observed that excise levy on petrol and diesel was a combination of ad-valorem and specific rates. At that time, the excise duty on petrol was 8 percent plus Rs.13 per litre while the excise duty on diesel was 8 percent plus Rs.3.25 per litre. This included the cess for road construction. There is an education cess of 2 percent on top of this. Now there is additional higher educational cess of one percent. The contribution of the petroleum sector to the total net excise revenues of the Government was of the order of 40 percent. Moreover, taxes (including sales tax/VAT) and duties constitute a significant proportion of the retail prices, about 55 percent and 34 percent of the retail prices of petrol and diesel respectively in Delhi. The Committee recommended that excise levies on petrol and diesel (inclusive of road construction cess) should be made specific. The indicative levies (rounded off appropriately) at the currently prevailing prices in Delhi worked out to Rs.14.75 per litre for petrol and Rs.5.00 per litre for diesel. Education levy, if any, will be on top of this. The rate of specific levy may be reviewed every year as part of the budgetary exercise.

State level taxes are also high for petroleum products. The Committee took note of the fact that tax levels as a percentage of the retail price in India for petrol and diesel were similar to the levels prevailing in the developed countries (with the exception of USA) and were substantially higher than the rates prevailing in the neighbouring countries where the rates of taxes on petrol and diesel are more moderate. Table 6.3 gives the relevant comparison.

Table 6.3: Tax as Percent of Retail Price

(Percent)

Country	Petrol	Diesel
France	65	47
Germany	66	50
Italy	62	43
Spain	54	37
UK	68	60
Japan	45	34
Canada	33	25
USA	17	19
Pakistan	42	20
Nepal	31	22
Bangladesh	24	24
Sri Lanka	37	5

Source: Developed countries as per IEA (Jan'06) and other countries collected from respective websites.

Many state governments in India are also levying non-vatable taxes on crude oil and petroleum products at the local level. In Mumbai, the two refineries of HPCL and BPCL pay an octroi at 3 percent on crude oil entering the municipal limits of Mumbai. Similarly, the state governments of Karnataka, UP, Bihar, Assam and Haryana levy an entry tax on crude oil where the rates are shown in Table 6.4.

Table 6.4: Rate of Entry Tax on Crude Oil

(Percent)

State	Rate of Entry Tax on Crude Oil
Uttar Pradesh	4
Haryana	4
Karnataka, Bihar and Assam	2

As argued in Chapter 5, with the administered prices of various petroleum products, and centre still not being able to follow suitable principles of pricing reflecting the trade parity prices, as recommended by the Rangarajan Committee, it does not seem feasible that the Central Government would be able to impose any additional tax-load on the petroleum products on environmental considerations. In this case, states have a greater flexibility. Not only are they entitled to have special rates on petroleum products, they also often keep the tax paid on inputs in the case petroleum and related products non-rebatable. Since states suffer different levels of pollution, related to vehicular and other uses of petroleum products, they are entitled to use different rates, reflecting their own environmental considerations. In particular, the higher income states, where per capita consumption of petroleum products may be higher, may levy a higher special rate of tax.

As part of the overall tax reforms, we suggest that

- a. In the case of petroleum products, states may levy differential special rates but agree on a floor rate as well as ceiling rate. Within this range, states with higher vehicular intensity or share of industry may levy a rate higher than the floor rate.
- b. Considering the revenue-importance of this tax, in order not to have detrimental effects either on growth or prices, the core (floor) State VAT rate on all other goods may be reduced from 12.5 to 10 percent.

This would also facilitate introducing a comprehensive GST regime where both the core rates of CENVAT and State VAT will need to be reduced from the present levels

of 14 and 12.5 percent respectively. At the same time, a long-term policy for encouraging the use of bio-fuel should be encouraged in a manner that it does not have a detrimental effect on the supply of foodgrains or other important agricultural products.

The rising cost of petroleum internationally as well as tax loads from the centre and the state is bound to further affect the Indian prices. This would make CNG/LPG fuel the cost effective solution.

c. Environmental Reforms and Taxation/Subsidisation of Fertilisers

At present, natural gas based plants account for more than 66 percent of urea capacity, naphtha is used for less than 30 percent of urea production and the balance capacity is based on fuel of oil (FO) and low sulphur heavy stock (LSHS) as feedstock. Natural gas has been the preferred feedstock for the manufacture of urea over other feed stocks viz. naphtha and FO/LSHS. It is a clean and efficient source of energy. Also, it is considerably cheaper and more cost effective in terms of manufacturing costs.

Current policies aim at working out the possibility of using alternative sources like liquefied natural gas, coal gasification, etc., to overcome the constraints in the domestic availability of cheap and clean feedstock, particularly for the production of urea. The pricing policy, announced in January 2004, provides that new urea projects as well as expansion of existing urea units and capacity increases will be allowed or recognized if production comes from using natural gas/LNG as feedstock. A policy for conversion of the existing naphtha/FO/LSHS based urea units to natural gas/LNG as feedstock has also been formulated in January 2004.

Pricing of feedstock is important in this context. The cost of feedstock constitutes about 60 to 75 percent of the total cost of production of urea in respect of gas based units. For naphtha based and FO/LSHS based units, it accounts for about 75 percent of the cost of production. Due to the dwindling supplies of natural gas, gas based units have been facing shortage of natural gas under the New Pricing Scheme for urea units and the Concession Scheme for decontrolled phosphatic and potassic fertilizers. The notified sale price and indicative minimum retail price (MRP) is generally less than the cost of production of the respective manufacturing unit. The difference between the cost of production and the selling price/MRP is paid as subsidy/concession to manufacturers. As the consumer prices of both indigenous and imported fertilizers are fixed uniformly, financial support is also given on imported urea and decontrolled phosphatic and potassic fertilizers.

Until March 2003, the subsidy to urea manufacturers was regulated under Retention Price Scheme (RPS) where, the difference between retention price (cost of production as assessed by the Government plus 12 percent post tax return on net worth) and the statutorily notified sale price was paid as subsidy to each urea unit. Table 6.5 shows the amount of subsidy disbursed on the indigenous and imported urea. The total subsidy on urea has grown from Rs. 6236 crore in 1995-96 to Rs. 14104 crore in 2006-07.

Table 6.5: Expenditure on Urea Subsidy

(Rs. crore)

Period	Amount of Subsidy Disbursed on		Total Subsidy on Urea
	Indigenous Urea	Imported Urea	
1995-96	4300.00	1935.00	6235.00
1996-97	4743.00	1163.08	5906.08
1997-98	6600.00	721.96	7321.96
1998-99	7473.00	124.22	7597.22
1999-00	8670.00	74.07	8744.07
2000-01	9480.00	0.98	9480.98
2001-02	8257.00	47.34	8304.34
2002-03	7790.00	0.00	7790.00
2003-04	8521.00	0.00	8521.00
2004-05	10243.15	493.91	10737.06
2005-06	10460.17	1418.07	11878.24
2006-07 (RE)	11400.37	2703.54	14103.91
2007-08 (BE)	11400.37	2703.54	14103.91

Source: Department of Fertiliser, Annual Report 2006-07.

A New Pricing Scheme (NPS) for urea units was introduced from 1.1.2003. Under NPS, the existing urea units were divided into six groups based on vintage and feedstock for determining the group based concession. These groups were: Pre-1992 gas based units, post-1992 gas based units, pre-1992 naphtha based units, post-1992 naphtha based units, fuel oil/low sulphur heavy stock (FO/LSHS) based units and mixed energy based units. As per the New Pricing Scheme for urea units, it was also envisaged that decontrol of urea distribution/movement will be carried out in a phased manner. During Stage-I, i.e. from 1.4.2003 to 31.3.2004, the allocation of urea under the Essential Commodities Act 1955 (ECA) was restricted up to 75 percent and 50 percent of installed capacity (as reassessed) of each unit in kharif 2003 and rabi 2003-04, respectively.

The Stage-III policy applicable from 1.10.2006 to 31.3.2010 seeks to promote usage of most efficient and comparatively cheaper feed stock viz., Natural Gas/LNG for production of urea in the country. The policy lays down a definite plan for conversion of all non-gas based urea units to gas. At present, there are 9 urea units (MFL, SPIC, ZIL, MCFL, SFC, GNFC, NFL-Nangal, NFL-Bhatinda, NFL-Panipat), which are based on naphtha or FOL/LSHS as feed stock. All these 9 units are required to switch over to Natural Gas/LNG within the next three years.

The Government continues to regulate movement of urea up to 50 percent of production depending upon the exigency of the situation. The State Governments will be required to allocate the entire quantity of planned urea arrivals including both regulated and de-regulated urea in district-wise, month-wise and supplier-wise format.

Subsidies have continued to increase because while cost increased, the selling prices remained unchanged or increased only marginally. The cost of various inputs/utilities, such as coal, gas, naphtha, rock phosphate, sulphur, ammonia, phosphoric acid, electricity, etc., as also the cost of transportation went up significantly during the eighties. The gas-based fertilizer units commissioned during this period also involved higher capital investment per tonne of installed capacity, necessitating constant upward revision in the retention prices. The selling prices of fertilizers to the farmers, however, remained almost at the same level between July, 1981 and July 1991. The Government effected an increase of 30 percent in the issue prices of fertilizers in August, 1991 after a gap of a decade. The selling price of urea, which was reduced by 10 percent in August 1992, was revised upwards by 20 percent in June 1994 followed by another increase by 10 percent with effect from 21.2.97. The prices of urea were again revised in February 2002 by 5 percent and by Rs. 240.

Phosphatic and Potassic fertilizers were decontrolled with effect from 25.8.1992. Consequent upon this, the prices of these fertilizers increased sharply vis-à-vis the price of urea, and also led to imbalance in fertilizer usage in terms nutrient application. In order to cushion the impact of increase in prices of these fertilizers, the Ministry of Agriculture introduced a scheme of concession on sale of decontrolled fertilizers. Under this scheme, base rates of concession are announced annually. The final concession rates, except for SSP, are calculated and announced quarterly after taking into account the average price of raw material and intermediates of the preceding quarter and the average exchange rate of the current quarter. The Country is almost fully dependent on

imported raw material/intermediates (i.e. rock phosphate, sulphur and phosphoric acid) for the production of phosphatic fertilizers in the country. The prices of these commodities, both finished fertilizer and intermediates, have been a rising in the international market. As a result, subsidies on phosphatic and potassic fertilizers have gone up substantially.

As regards SSP, the Department of Fertilizers pays an ad-hoc concession. The MRP of SSP is fixed by State Governments and varies from State to State. This ad-hoc dispensation and the low rates of concession, coupled with the progressive increases in the input cost, not only led to a sharp decrease in SSP consumption, which is often referred to as the "poor farmers' fertilizer," but also had a serious adverse impact on the SSP industry. Keeping this in view, it was decided to increase the ad-hoc concession rate of SSP from Rs. 650 to Rs. 975 PMT w.e.f. 1.9.2005. The State Governments have also been requested to maintain the present MRP of SSP in their States.

A Task Force on the "Balanced use of Fertilizers" constituted by Department of Agriculture and Cooperation submitted its report in 2005-06. The task force recommended a nutrient based subsidy regime. The Task Force also recommended that usage of organic manure, bio-fertilizers and NPK mixture fertilizers to be encouraged alongwith their judicious use with chemical fertilizers. It highlighted the application of nutrients, recognizing this, soil specific and crop/climate specific characteristics.

The production of bio-fertilisers has stagnated at around 700 MT (Fertiliser Association of India, 2003). Animal or vegetable fertilisers are already exempt from excise duty. Promotion of bio-fertilisers would require research and development to improve their quality and improve their shelf life. Government should formulate and implement a fairly comprehensive policy, (a) to improve the quality of bio-fertilisers by providing capital subsidy for investment in R&D to identify more suitable strains, and to develop better production technology and quality control methods, and (b) to encourage the states to undertake extension work in respect of use of bio-fertilisers.

Given the large volume of subsidies being given by the central government, it will not be possible for the central government to impose an eco-tax for reducing the consumption of chemical fertilisers. As far as state governments are concerned, they have different fertiliser tax-rates that vary between exemption to 12.5 percent. In some cases, naphtha is taxed at 20 percent.

Decreasing the subsidy on chemical fertilisers will be more beneficial than imposing an eco-tax as such. There is also a strong case for promoting the use of bio-fertilisers, which should be put in the exempted category in all states.

d. Eco-taxation of Polluting Chemicals, Fungicides, and Pesticides

For these goods we summarise and reiterate the recommendations of MSE (2007) study and add a state level intervention, where necessary.

d1. Chlorine

Chlorine used in pulp and paper and viscose rayon industries results in discharge of organochlorine compounds which are highly toxic. The recommendations are:

Rebate on CENVAT should be withdrawn. These mills could be encouraged to use chlorine substitutes like hydrogen peroxide;

The rebate may be continued for chlorine substitutes (even if they contain small quantities of chlorine) like chlorine dioxide or hypochlorite; and

States should place chlorine in the 12.5 percent rate category and chlorine substitutes in the 4 percent rate category.

d2. Phosphates

Phosphates are used to soften the water in order to improve the cleansing action. But it contributes to an oversupply of nutrients to water bodies, and hence to the eutrophication of lakes and ponds. The three top brands of detergents are found to contain more than 20 percent of sodium tri-poly-phosphate (STPP) by weight while the desirable percentage is five or less. In a few countries phosphates in detergents are banned while in a few others phosphate use is restricted. There are alternatives to phosphates e.g. synthetic detergent zeolites. It is desirable to limit the use of phosphates in detergents. The major input in detergents which contributes to the phosphate content is sodium tri-poly phosphate (STPP). The recommendations are:

The rebate of the CENVAT levied on the phosphate compounds used as inputs (such as STPP) should be discontinued;

It should be placed in the 12.5 rate category for all the states;

Non-phosphate detergents should be promoted by decreasing the excise duty from 14 percent to 8 percent;

For compact detergent and non-phosphatic detergents since these reduce chemical load, packaging and energy consumption; and

CENVAT should be reduced from 14 to 8 percent. In State VAT, there should be

place in the 4 percent rate category.

Detergent-less technologies will result in savings in water and will also decrease the discharge of effluents. These technologies will benefit hotels and other institutions which use large volumes of water.

d3. Eco-tax on Chemical Pesticides

Spraying of chemical pesticides results in residues in drinking water, vegetables, milk, fish, etc. At present, use of chemical pesticides is concentrated on a few crops like cotton, rice and pulses, and fruits and vegetables. At present, the market for bio-pesticides is about one percent of the pesticide market. Neem based pesticides dominate the bio-pesticides market in India. Following the MSE (2007) study and adding the state components, we recommend:

- a. CENVAT rate on bio-pesticides be decreased from 14 percent to 8 percent and in State VAT this should be kept in the exempted category.
- b. Chemical pesticides should be kept at 14 percent in CENVAT and at 12.5 percent in State VAT.
- c. The Central Insecticides Board has designated a color coding based on toxicity (Table 6.6). This code may be used for the levy of an additional eco-cess by the central government the VAT rates are not placed in the highest rate category.

Table 6.6: Colour Coding Based on Toxicity

Toxicity	Colour	(Percent)
		Cess
Extremely Toxic	Bright Red	8
Highly Toxic	Bright Yellow	6
Moderately Toxic	Bright Blue	4
Slightly Toxic	Bright Green	2
	Average	5

Source: Central Insecticides Board and Regulation Committee.

The rate of excise duty on all varieties of pesticides including bio-pesticides is 14 percent. To promote the use of bio-pesticides, the excise duty could be reduced to 8 percent. The revenue implication would be small since the bio-pesticides account for 1-2 percent of the pesticide market.

e. Metals and Environmental Considerations

e1. Lead

Lead is a toxic material with carcinogenic effects. Recycling of scrap lead, primarily in used batteries, and using certified methods is necessary for environmental protection. As a first step, unauthorised recycling of scrap batteries, and re-building/reconditioning of batteries needs to be checked. The enforcement of current legislation, which focuses only on the organised sector manufacturers to organise for the return of used batteries to the authorised smelters will have only a limited impact because the unorganised sector. The recommendations, following the MSE (2007) study, are as follows:

- (a) A reduction in CENVAT on production of secondary lead by organised smelters from 14 to 8 percent,
- (b) Levy of an environmental cess on the scale of scrap batteries in auctions by the bulk consumers. This cess should be allowed to be set off against the levies on production of secondary lead.

f. Plastics and Eco-taxes

Plastics pose considerable environmental problems because of their popular use and chemical properties. Polyethylene, polyvinyl chloride, polystyrene is largely used in the manufacture of plastics. Synthetic polymers have molecular weights ranging from several thousands to 1,50,000. Excessive molecular size is responsible for the resistance of these chemicals to biodegradation and their persistence in soil environment for a long time. The plastic industry in the US alone is estimated to be around \$ 50 billion per year. 20% of solid municipal wastes in US is plastic. Non-degradable plastics accumulate at the rate of 25 million tonnes per year. According to an estimate more than 100 million tonnes of plastic is produced every year all over the world. In India it is only 2 million tonnes. In India use of plastic is 2 kg per person per year while in European countries it is 60 kg per person per year while that in US it is 80 kg per person per year. Now, biotechnological processes are being developed as an alternative to get new biodegradable biopolymers.

In India, plastic products like carry bags, beverage containers and thin sheets are causing significant solid waste problems. There is a concern that recycling may not be environmentally safe. The following strategy, as recommended in MSE (2007) study, may be adopted:

- a. *Biodegradable Plastics*: The CENVAT on biodegradable plastics be completely removed. In State VAT also, these should be exempted.
- b. *Deposit Refused on PET bottles*: A deposit of Re.1 per bottle should be levied on PET

bottles at the time of sale, which can be refunded when the bottle is returned. Manufacturers would have to set up a network of collection centers which will collect the bottles and send them for recycling.

- c. *Incentive to Rag pickers:* Households can be encouraged by their respective municipal authorities to segregate their plastic wastes and hand over the low value wastes to the rag pickers. The plastic industry can provide a matching incentive amount (say Rs.10 per kg of plastic bags) to the rag pickers in addition to the amount that the recycler would pay.
- d. *Recycling:* Municipalities can also set up a central facility/complex with assistance from the industry to recycle low value plastic wastes in an environmentally sound manner. It is recommended that 50 percent reduction in customs duty be given to recyclers who wish to import equipment and machinery for upgradation of recycling technology for a limited period of 10 years.

6.2. Eco-taxes as an Integral Part of the Proposed GST and Related Tax Reforms

As discussed in Chapter 4, there is a concerted move both by the central government and the Empowered Committee of State Finance Ministers to move towards a National Goods and Services Tax by April 1, 2010. This is the ideal time to bring environmental considerations as an integral part of tax reforms.

Promotion of environment in a sustained way can be pursued by an extensive use of economic instruments. Eco-taxes on polluting inputs and outputs provide a highly potent instrument in the hands of the central and the state governments as well as the local governments. These instruments are now being extensively used internationally. India is in the midst of a major reform of taxation of goods and services. At this stage, any piecemeal approach to eco-taxes may not be very effective although there may be a case for some selected taxes on the polluting inputs and outputs in selected industries. In general, eco-taxes should be embedded in an overall scheme of reforms relating to taxation of goods and services. The terms of reference of the Thirteenth Finance Commission include the following reference under Para 6(vi) of the terms of reference: "In making its recommendations, the Commission shall have regard, among other considerations, to - ... the impact of the proposed implementation of Goods and Services Tax with effect from 1st April, 2010, including its impact on the country's foreign trade;". The previous Finance Commissions have encouraged

environmental-protective activities by the state by giving special grants (Annexure 4). For the first time, the 13th Finance Commission has been given a formal reference and a comprehensive view covering both ecotaxes and grants may be taken.

Tax reforms undertaken in India since the early nineties have taken the system of taxation of goods slowly towards the application of the value added tax separately for the central and the state taxes. Services at present are largely being taxed by the central government and the sharing of their revenues with the states is also outside the purview of the Finance Commission as these are placed under article 268 rather than article 270 of the Constitution.

For implementing a comprehensive Goods and Services tax both at the centre and the states, several options are being considered ranging from a completely centralized levy of GST to a system of extensive State GSTs. However, a consensus that seems to be emerging is likely to favour a dual system consisting of a GST with two components: a central GST (CGST) and a system of state GSTs (SGST). Once the reformed system is put in practice, it will subsume the service tax, the central excise duties, state sales taxes, additional excise duties in lieu of sales tax on textiles, tobacco and sugar and a number of other state taxes. The sales tax on inter-state transactions on goods (CST) will also go. While it will be some time for the GST to materialize, it is clear that taxation of goods and services on the value added principle with proper harmonization with the states will bring about major reforms in the way goods and services are being taxed in the country. Some of the issues that will need to be settled relate to determination of the central and state components of the overall GST rates, assessments of relative losses and gains to the centre and the states, if any; and if so, making good those losses through the recommendations of the Finance Commission. As the Finance Commission deliberates on these matters, it should also consider including ecological tax reform as an integral element of the reform regime of taxation of goods and services.

It may be noted that with the recent upsurge in the growth momentum of the economy is also increasing the pollution load. In 2005, India occupied the fifth rank among countries arranged in order of carbon emissions, USA, China, Russia, and Japan. It may be, however, be recognized that per unit of GDP, the pollution load in India still compares favourably with many industrialized and emerging economies. Recent trends indicate that carbon emissions are increasing in India at a fast rate given the explosive growth in the number of vehicles and increasing demand for energy. Pollution patterns have country-wide as well as significant state and local dimensions. So far, pollution

control in India has relied heavily on regulatory and control and command type of regimes. These include considerable administrative and monitoring costs. The use of economic instruments that tend to be self-monitoring are generally considered to more efficient although these have not been used in India except in a small way.

Proponents of eco-taxes argue for a 'green shift' in taxation of goods and services, which implies that the overall tax burden does not increase on the system so that inefficiency costs of excess taxation such as deadweight losses, compliance, costs, and administrative costs do not increase. Some economists consider that in fact such a green shift will yield a double dividend by raising overall efficiency without reducing the overall size of tax revenues. It will also improve inter-generational equity by spreading better among different generation the use of natural resources and fossil fuels as compared to their overexploitation by the present generation. In any case, when the social welfare function is seen in the broader context where various positive externalities of green development and negative externalities of pollution are internalized, any 'green shift' in taxation is likely to be welfare improving without affecting the growth momentum adversely. It is therefore imperative that in the analysis undertaken by the Finance Commission of a comprehensive goods and services tax, a thrust towards the eco-taxes is taken up as the crucial core of tax reforms.

In undertaking reforms of the taxation of goods and services where the environmental tax reforms are an integral part of the overall tax reforms, there are several important considerations. First, in a value added tax regime, input taxes are fully rebated. As such, taxation of polluting inputs will be ineffective as the tax paid on the inputs will be fully rebated, unless a non-rebatable cess is levied on the inputs. This cannot be done on a large scale as it will make the tax system very complex and defeat the objective of tax reform. In VAT, the more appropriate method would be to tax outputs and introduce ecological considerations by taxing at a higher rate, outputs that are either polluting or use highly polluting inputs.

Ecological taxes should not be taken as revenue augmenting measures in general. Any ecological taxes should be accompanied by a rate reduction for the non-polluting outputs/inputs so that the overall tax burden does not increase, the use of non-polluting inputs is encouraged and the development processes are not adversely affected. These should only become more environment-friendly and therefore sustainable over the longer run. If ecological considerations lead to some regressivity, as has been noted in the relevant literatures, as a result of taxation at a higher rate, some polluting but mass-

consumed good, this should be properly neutralized by a well designed subsidy. Weizsacker *et al* (2005) emphasize that eco-taxation should affect the end-user prices such that existing price differences between domestic and commercial uses of the polluting inputs/outputs may be continued if the difference is due to any equity considerations.

Only to a limited extent eco-taxes should be designed to lead to a net revenue augmentation and these revenues should be kept in a separate account for supporting changes in technology and processes, which use less of the polluting inputs. Eco-taxes should be designed in an integrated way for taxation at the central, state and local levels. These should complement each other and should not be at cross purposes. Global sources of pollution or pollution where state boundaries are generally crossed should be taxed at the national level, regional sources at the state level, and pollution with strong local characteristics should be taxed at the local level. Further, the tax rates for eco-taxes should be fixed after taking into account the full extent of negative externalities of the polluting inputs and outputs. This requires major changes in national accounting frameworks.

It is important to ensure that in general revenue-neutral. New eco-taxes should be accompanied by reduction in other taxes. There should be inter-state coordination so that as a result of taxation of polluting inputs and outputs, industries do not attempt to relocate in other states where eco-taxes are less stringent. This may happen if some states pursue more active pollution control while some others are more relaxed and the CST also goes. The Finance Commission should ensure that inter-state coordination takes place in the state level initiatives and at any rate state that are more aggressive in pursuing pollution control do not suffer any revenue loss if industries relocate themselves.

As part of reforms towards GST, the system of additional excise duties in lieu of sales tax for sugar, tobacco, and textiles will also be integrated with GST. The Finance Commission determines the inter-state distribution of revenues under additional excise duties guided by the principle of returning to the states what they would have earned had a sales tax been levied on these commodities. Production processes in all these cases have significant environmental implications. When these commodities are subsumed in the overall GST, care has to be taken that environmental considerations are kept in mind. An additional consideration relates to the special economic zones and export oriented units, which are given inputs including polluting inputs on a zero-rated basis. While their

products may be exported or treated as imports if sold in the domestic economy, much of the pollution that they generate is affecting the geographical area in which they are located. Polluting inputs in their case should not be zero-rated. They should also be subject to all other applicable regulatory measures for pollution control.

Considering some important forthcoming tax reforms in India, it is important also to recognize that the vertical imbalance would be affected depending on the way the goods and services tax (GST) is implemented in India. In Australia, the implementation of GST led to a substantial increase in the vertical imbalance because the states agreed to forego a number of taxes assigned to them in favor of a national GST.

If the vertical imbalance in the system is not to be drastically altered, the concurrent or dual VAT regime seems to be most relevant in the current fiscal conditions of India. One important issue is to determine a suitable GST rate. At present goods are taxed at the core rate of CENVAT at 14 percent and State VAT of 12.5 percent. This together would be very high although it would be less than 28.5 percent as the 14 percent rate applies to value added only upto the manufacturing stage and GST will have a larger base. The service tax rate is 12 percent. The suggestion of the Kelkar Committee to aim at a 20 percent combined GST rate seems to be a suitable target for the medium term as it is consistent with some of the international GST rates at the higher end. The highest GST rates are in Sweden and Denmark at 25 percent. At the lower end, Switzerland, Japan, Thailand and Singapore have GST/VAT rates at 5 percent or marginally above. In the longer run, the overall GST rate will have to be brought down even further.

The overall rate needs to be decomposed into its central and state components making sure that the relative pre-transfer revenue levels are not disturbed. To achieve a 20 percent composite rate, both tiers of governments have to jointly bring down the overall tax rate, which at present amounts to 14 percent and 12.5 percent on the respective tax bases of the CENVAT and State VAT as far as manufacturing and sales of goods are concerned. While the tax rate on goods can come down, that on services, which is at 12 percent may have to be incrementally uplifted to bring it closer to the long term desired norm. The Kelkar Committee had suggested a division of the overall rate of 20 percent into a 12:8 ratio in favour the centre. This may need to be reexamined with current levels of revenues under CENVAT and service taxes and the state VAT and other related taxes that may be subsumed in the GST. Since the taxation of petroleum and liquor and alcoholic beverages subject to special rates in the states and non-rebatable,

revenues from these products should be taken into account for determining the relative shares.

6.3 Benefits from the Clean Development Mechanism

The Clean Development Mechanism (CDM) is an arrangement under the Kyoto Protocol. It allows industrialised countries with a greenhouse gas reduction commitment (called Annex 1 countries)²² to invest in projects that reduce emissions in developing countries. This is seen as an alternative to more expensive emission reductions in their own countries. The incentive is provided by emission reductions credits. The CDM allows net global greenhouse gas emissions to be reduced at a much lower global cost by financing emissions reduction projects in developing countries where costs are lower than in industrialized countries. There is a provision that use of CDM be 'supplemental' to domestic actions to reduce emissions. The CDM gained momentum in 2005 after the entry into force of the Kyoto Protocol. A successful implementation of CDM in India will also have indirect benefits in India as the new technologies and processes developed under the CDM will have wide-ranging applications in the economy. This will help improve the impact of the eco-taxes regime.

The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) is an international environmental treaty produced at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro in 1992. The treaty is aimed at reducing emissions of greenhouse gases in order to combat global warming. One of its first achievements was to establish a national greenhouse gas inventory, as a count of greenhouse gas (GHG) emissions and removals. Accounts must be regularly submitted by signatories of the United Nations Framework Convention on Climate Change.

Annex I countries have agreed to reduce their emissions (particularly carbon dioxide) to target levels below their 1990 emissions levels. If they cannot do so, they must buy emission credits or invest in conservation. Annex II²³ countries that have to

²² Annex I countries (industrialized countries): Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United States of America (40 countries and separately the European Union).

²³ Annex II countries (developed countries which pay for costs of developing countries) Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States of America. (23 countries and separately the European Union; Turkey was removed from the annex II list in 2001 at its request to recognize its economy as a transition one).

provide financial resources for the developing countries, are a sub-group of the annex I countries consisting of the OECD members, without those that were with transition economy in 1992.

Developing countries have no immediate restrictions under the UNFCCC. Developing countries may volunteer to become Annex I countries when they are sufficiently developed. On June 12, 1992, 154 nations signed the UNFCCC that upon ratification committed signatories' governments to a voluntary "non-binding aim" to reduce atmospheric concentrations of greenhouse gases with the goal of "preventing dangerous anthropogenic interference with Earth's climate system." US has signed the UNFCCC but not the Kyoto Protocol.

An industrialised country that wishes to get credits from a CDM project must obtain the consent of the developing country hosting the project that it will contribute to sustainable development. Then, using methodologies approved by the CDM Executive Board (EB), the applicant (the industrialised country) must make the case that the carbon project would not have happened anyway (establishing additionality), and must establish a baseline estimating the future emissions in absence of the registered project. A third party agency, called a Designated Operational Entity (DOE), then validate the case to ensure the project results in real, measurable, and long-term emission reductions. If a project is registered and implemented, the EB issues credits, Certified Emission Reductions (CERs, also commonly known as carbon credits). Each unit is equivalent to the reduction of one metric tonne of CO₂ or its equivalent), to project participants based on the monitored difference between the baseline and the actual emissions, verified by the DOE.

The amount of emission reduction depends on the emissions that would have occurred without the project minus the emissions of the project. The construction of such a hypothetical scenario is known as the baseline of the project. The baseline may be estimated through reference to emissions from similar activities and technologies in the same country or other countries, or to actual emissions prior to project implementation.

The IPCC has projected GDP losses for OECD Europe with full use of CDM and Joint Implementation to between 0.13 and 0.81 percent of GDP versus 0.31 to 1.50 percent with only domestic action. While there would always be some cheap domestic emission reductions available in Europe, the cost of switching from coal to gas could be in the order of €40-50 per tonne CO₂ equivalent. CERs from CDM projects were in 2006

traded on a forward basis for between €5 and € 20 per tonne CO₂ equivalent. The price depends on the distribution of risk between seller and buyer. The seller could get a very good price if it agrees to bear the risk that the project's baseline and monitoring methodology is rejected; that the host country rejects the project; that the CDM Executive Board rejects the project; that the project for some reason produces fewer credits than planned; or that the buyer doesn't get CERs at the agreed time if the international transaction log is not in place by then. These risks, the seller can usually take only if it is a very reliable counterparty rated by international rating agencies. As of 2 November 2007, 828 projects have been registered by the CDM Executive Board as CDM projects. These projects reduce greenhouse gas emissions by an estimated 171 million ton CO₂ equivalent per year. There are about 2600 projects in the pipeline (most of which not yet registered) would until the end of 2012 produce over 2.5 billion tons CO₂ equivalent reductions.

The first commitment period of the Kyoto Protocol excluded forest conservation/avoided deforestation from the CDM for a variety of political, practical and ethical reasons. However, carbon emissions from deforestation represent 18-25 percent of all emissions. There have been growing calls for the inclusion of forests in CDM schemes for the second commitment period from a variety of sectors, under the leadership of the Coalition for Rainforest Nations, and brought together under the Forests Now Declaration, which has been signed by over 300 NGOs, business leaders, and policy makers. This will also be helpful for India, given the large size of its forests.

Chapter 7

SUMMARY AND CONCLUSIONS

The Indian economy has been growing at an average rate of more than eight and a half percent since 2003-04. With economic growth, the rate at which pollution is increasing has also increased. The implications of growth for pollution depend largely on the changing structure of the economy and the inter-state spread of growth. Since the pace of industrialization and economic growth are different across states, the extent of pollution is also different across states.

The present study focuses largely on state taxes and complements an earlier study on eco taxation in India undertaken by the Madras School of Economics (MSE, 2007). In that study, the feasibility of incentive based environment instruments were examined, particularly with respect to the central taxes. Taxation policies in India have not historically been environmentally oriented. As such, these often lead to adverse incentives in relation to pollution and environmental hazards. It is imperative to reform the system of taxation to make it environmentally rational, which does not compromise on growth and is welfare-augmenting. In this study, it is argued that India is currently going through a major reform of indirect taxes aimed at ushering in a comprehensive regime of taxation of goods and services at the level of the centre and that states by April 1, 2010 and this is the appropriate time to make the entire tax regime environmentally rational.

Some notable general points may be noted first:

1. India's contribution to global carbon emissions is much less than major developed countries and China, but the impact of adverse climate change will be disproportionately higher because of our proximity to the Himalayas where already there is evidence that many glaciers have started receding.
2. India has certain long term advantages that will make the cost of adjustment minimal and may actually lead to a 'double dividend' where not only pollution is reduced but growth is strengthened. One major advantage is that the structure of the GDP is more service sector-oriented rather manufacturing oriented. This will imply lower carbon emissions per unit of GDP although the services sector will have its own pollution problems. Secondly, already many new technologies that are environment friendly have been and are being developed across the

world and can be taken off the shelf although these may have to be adopted to suit the local conditions. This is an advantage arising from being a late comer in the group of fast growing countries.

3. The strategy for environmentally oriented tax reforms should cover all the levels of government covering central and state governments as well as the local governments. Interventions at the central level provide a better policy thrust and greater overall impact while interventions at the state and local levels provide better targeting of environmentally detrimental economic activities.
4. The strategy needs to discourage excessive use of polluting inputs and outputs while encouraging the use of non-polluting inputs and outputs and facilitating the development of environmentally friendly technologies suitable for local conditions.
5. India has to take full advantage of the clean development mechanism.
6. Apart from taxation, the regime of subsidies will also have to be reformed; many environmentally perverse subsidies will have to be weeded out and subsidies have to be strengthened for promoting the use of environmentally beneficial inputs and their production.
7. Environmental reforms of tax regimes should aim at revenue-neutral changes so that the overall tax load on the system does not increase on account of the environmental concerns. However, the system should be restructured, differentiating and discouraging environmentally harmful inputs and outputs while encouraging switching to environmentally beneficial inputs, outputs, and technologies.

7.1 Carbon Emissions in India: Pattern and Sources

In recent years, there has been a growing level of concern that anthropogenic (i.e., caused by human activities) emissions of carbon dioxide and other so-called "greenhouse gases" are contributing to "global warming." The relative contributions of different fossil fuels to total energy-related carbon dioxide emissions have changed over time. In 1990, emissions from petroleum and other liquids combustion made up an estimated 42 percent of the world total. In 2004, the petroleum share was 40 percent, and in 2030 its share is projected to be 36 percent, of the world total. Carbon dioxide emissions from

natural gas combustion, which accounted for 19 percent of the total in 1990, increased to 20 percent of the 2004 total. This share is projected to rise to 21 percent in 2030. Coal's share in 2004 was the same as its share in 1990, at 39 percent; however, its share is projected to increase to 43 percent in 2030. Coal is the most carbon- intensive of the fossil fuels, and it is the fastest growing energy source in the International Economic Outlook 2007 reference case projection.

In 1990, China and India combined accounted for 13 percent of world emissions, but by 2004 that share had risen to 22 percent, largely because of a strong increase in coal use in these two countries. This trend is projected to continue; and by 2030, carbon dioxide emissions from China and India combined are projected to account for 31 percent of total world emissions, with China alone responsible for 26 percent of the world total. Effects on India will be disproportionately larger as compared to its contribution to global carbon emissions. According to the Geological Survey of India, it is estimated that nearly 46000 glaciers (one-third of world's glaciers) in the Himalayas between 2000 and 5000 metres altitude have started receding by 10-15 metres every year causing concerns of rivers getting dry in summer.

Historical experience demonstrates that the relationship between economic growth and energy use is strong but not unique. Countries experiencing similar paths of economic expansion may exhibit significant differences in the growth rate of energy use. Moreover, countries with similar levels of economic output per capita vary widely in per capita energy consumption. Additionally, countries with similar levels of energy consumption may have significantly different rates of carbon emissions.

Pollution, of course, has larger ramifications than the carbon emissions. Differences in pollution levels across countries or states within a country with large geographic areas as the case in India depend, among other factors, on the level and structure of demand for goods and services, which may be produced by polluting inputs and processes. Effects of pollution are different for local, regional, and national/global perspectives, as summarized below.

Local Effects: Heavy metals in air, soil, water and plants, e.g. from industrial emissions and discharges, noise, smell, air pollution.

Regional Effects: Eutrophication, contaminants in the soil and water, landscape changes due to mining or agriculture.

Global Effects: Changes in the climate due to ozone depletion and the green house effect.

With a view to designing a suitable strategy for pollution abatement consisting of market-based instruments, one needs to recognize the extent and nature of state level pollution pattern in India and also identify differences in the relative importance of different sources of pollution across states.

State level CO₂ emissions figures for 2000 indicate that Uttar Pradesh has the highest level of pollution followed by Madhya Pradesh, Maharashtra, Andhra Pradesh, West Bengal, Gujarat, and Tamil Nadu. Looking at the 2000 figures for per capita CO₂, Madhya Pradesh has the highest emission at 660 metric tonnes followed by 440 metric tonnes for Delhi, Orissa and Goa. Punjab has a per capita CO₂ emission of 450 metric tonnes. Next in order of importance are Gujarat and Maharashtra at 370 metric tonnes per capita. High per capita emissions may be due either to the state undertaking production of polluting material like Madhya Pradesh, Chhattisgarh, and Bihar or it may be due per capita consumption as in Delhi, Goa, Gujarat and Maharashtra.

States like Bihar, Orissa, Madhya Pradesh, and Andhra Pradesh have India's major steel plants that consume a lot of coal. This makes their emission levels disproportionately high compared to their incomes. The main sources that have been identified as contributing to CO₂ emission are: liquefied petroleum gas, motor gasoline, high speed diesel oil, light diesel oil, furnace oil, low sulphur heavy stock, naphtha, kerosene, and coal. Looking at the all India figures, nearly 77 percent of the CO₂ emissions are from coal. The next in order of importance is high speed diesel oil which contributes nearly 9.8 percent of the CO₂ emission at the all India level. Naphtha contributes nearly 3 percent and kerosene contributes about 2.9 percent of the overall CO₂ emissions.

An inverse relationship between growth in per capita income and environmental quality has been identified in some studies. In particular, Haryana, Tamil Nadu, West Bengal, and Karnataka had higher economic growth during late 1990s at the cost of their environmental degradation. However, there are some exceptions also.

7.2 Role of Incentive Based Environmental Instruments

Environmental taxes or eco-taxes have the potential to induce appropriate environmental decisions through instituting an incentive structure by raising the relative costs of

polluting inputs and outputs. There has been some debate on the relative merits of a price instrument like ecotaxes versus a quantity instrument like a carbon trading mechanism for achieving environmental goals. Choices can be made on the basis of the context, sensitivity of polluters to additional costs, and setting up of goals. The main form of eco-tax is a Pigouvian tax on polluters. A Pigouvian tax is a tax levied to correct the negative externalities of a market activity. It can be levied on polluting outputs as well as polluting inputs. Levied on output, it is aimed at raising the price of the output, inducing consumers to reduce consumption levels or shift to non-polluting substitutes. Its impact depends on the price-elasticity of the polluting good and availability and relative prices of close substitutes. Levied on inputs, any increase in the prices may be partially or fully passed on to the final goods, depending on the supply and demand elasticities.

In one form, ecotaxes have been proposed as 'green taxes' that are not meant as a revenue-augmenting device. Instead, the idea is to change the structure of taxation rather than putting additional burden on the tax payers. In such a case, while eco-taxes are levied or increased, a corresponding reduction in other conventional taxes may also be planned. Many economists have argued that environmental taxes may yield benefits over and above a cleaner environment. In particular, governments can use the revenues from pollution taxes to decrease other distortionary taxes, thereby providing a 'double dividend'.

Internationally, environmental taxes have caught on. The OECD and the European Environment Agency (EEA), mentions about 375 environment-related taxes in OECD countries (excluding measures of 250 environmentally related fees and charges). This includes the energy and transport sectors, and a number of taxes and charges linked to measured or estimated emissions. About 90 percent of the revenues from the environmentally related taxes stems from taxes on motor vehicle fuels and motor vehicles. The environmentally related taxes raise revenues in the order of 2-2.5 percent of gross domestic product (GDP).

Countries having important ecotaxes include the United Kingdom, Ireland, Germany, and Sweden among others. In the U.K., the Treasury imposed the Fuel Price Escalator, an incrementally-increasing pollution tax, on retail petroleum products from 1993. The increases stopped after politically-damaging Fuel protests in 1999, at which time tax and duty represented more than 75 percent of the total pump price. This tax now represents about 2/3rd of the pump price.

7.3 Major Environmental/Ecological Problems of the States

The main forms of pollution are atmospheric pollution, land degradation and soil pollution, water pollution, and noise pollution. The main sources of atmospheric pollution are: (a) combustion of fuels to produce energy for heating and power generation in the household and industrial sectors; (b) exhaust emissions from the transport vehicles that use petrol, diesel oil, etc., and (c) waste gases, dust and heat from many industrial sites including chemical manufacturers, electrical power generating stations, etc. Three main pollutants of ambient air quality are Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂) and Particulate Matter.

Vehicles are a major source of atmospheric pollution. In terms of the relative share of the major states in the all India total number of vehicles, Maharashtra had the highest share of 12.1 percent, followed by Tamil Nadu, which had a share of 11.9 percent. Gujarat was the next with a share of 9.7 percent, followed by Uttar Pradesh with a share of 8.8 percent. In terms of two wheelers, Tami Nadu had the highest share of 13.2 percent followed by Maharashtra at 11.8 percent. In terms of cars, Maharashtra had the largest share but in terms of goods vehicles, Tamil Nadu has a higher share whereas Uttar Pradesh had a much lower share. In all the three categories of auto-rickshaws, cars and goods vehicles, Uttar Pradesh had a relatively lower share.

The largest pollution load emanates from private commercial goods vehicle followed by two-stroke two wheelers and light commercial vehicles. For emission of hydrocarbons, the two-stoke two wheelers and the private commercial goods vehicles had the highest pollution load. In the case of emission of nitrogenous oxides the highest pollution load was for private commercial vehicles followed by truck and light commercial goods vehicles. In terms of the pollution load for the ozone potential, two-stroke two wheelers are the most damaging followed by private commercial goods vehicles and three wheelers.

In India, about 130 million hectares of land (45 percent of total geographical area) is affected by serious soil erosion through ravine and gully, shifting cultivation, cultivated wastelands, sandy areas, deserts, and water logging. Information on the percent of degraded area for selected districts of various states indicates that the average degradation percentage is 18.8 considering all the districts. Some of the relatively higher percentages compared to the average are Mizoram, Maharashtra, Uttar Pradesh, West Bengal, Madhya Pradesh, Himachal Pradesh and Bihar. The reasons for such degradation can be quite different. In the hilly areas, degradation can be due to

erosion of soil and running of water. In the case of states like Bihar and Madhya Pradesh, degradation may be due to the large number of mines.

The activity of mining and quarrying covers underground and surface mines, quarries and wells and includes extraction of minerals as also activities such as dressing and benefaction of ores, crushing, screening, washing, cleaning, grading, milling floatation, melting floatation and other preparations carried out at the mine site, which are needed to render the material marketable. In India, coal is the most important energy source but Indian coal contains 30-40 percent ash and moisture content. About 70 percent of the coal in India is consumed in the power sector.

Water is polluted by the effluents of industries. Some of the important industries in this context are ferrous metallurgical industry, non-ferrous metallurgical industry, mining industry, ore processing industry, petroleum industry, petrochemical industry, chemical industry, ceramic industry, cement industry, textile industry, paper industry, fertiliser industry, coal (including coke) industry, power (thermal and diesel) generating industry, and processing of animal or vegetable products industry. All of these are subjected to a water cess now.

The average level of groundwater development in India is 32 percent, although some states have exploited their resources to a much greater extent (94 percent in Punjab, 84 percent in Haryana, 60 percent in Tamil Nadu, 64 percent in Lakshadweep, 51 percent in Rajasthan). 85 percent of ground water extracted is used for irrigation purposes and 15 percent for industrial and domestic purposes. Reciprocally, as much as 70 to 80 percent of India's agricultural output may be groundwater dependent.

The presence of iron in water has affected the largest number of habitations affected in India was affected by. These habitations were located largely in Orissa, Assam, Bihar, and West Bengal. Next in terms of the pollutants affecting water for habitations was fluoride and the states most affected were Rajasthan, Karnataka, Madhya Pradesh, Gujarat and Uttar Pradesh. The arsenic contamination of water was limited to two states only viz., Bihar and Assam. The presence of nitrate was mostly in Rajasthan, Maharashtra, Karnataka, and Bihar. Salinity was a problem in Rajasthan, Gujarat, Maharashtra and Punjab.

Small scale industries (SSIs) are a major source of industrial pollution. The number of SSIs is estimated to be over 0.32 million units, of which many are highly

polluting. The share of the SSIs in term of wastewater generation among several of the major polluting industries was reported to be about 40 percent.

7.4 State Taxes: Some Recent Reforms

India has a federal fiscal structure with taxation powers divided between central and state governments. State governments can, under constitutional provisions, assign some of their taxes to the local governments. Sales taxes account for the largest share in total own tax revenues of the states. However, there are considerable inter-state variations. In Assam, the contribution of sales tax was the highest among states at 77 percent in 2004-05, followed by Kerala at 74 percent. The lowest was for Madhya Pradesh at 4.4 percent. State excise duties and stamp and registration duties are next in order of importance. The tax on motor vehicles comes next. It contributes about 2 to 8 percent of states own tax revenues.

As part of fiscal reforms, the value added principle has progressively been introduced in the system of indirect taxation in India with CENVAT replacing the union excise duties. At present all the states have moved to State VAT (value added tax), which has replaced the conventional sales taxes.

Under the guidance of the Empowered Committee of State Finance Ministers, states have agreed to a broadly common structure of state VAT. With the basic design of VAT formulated by the Empowered Committee, states can introduce suitable variations consistent with the basic design. The main features of the basic scheme are as follows:

1. uniform schedule of rates of VAT for all states, making the system simple and uniform to prevent unhealthy tax competition among states;
2. the provision of input tax credit meant for preventing cascading effect of tax;
3. the provision of self assessment by dealers aimed at reducing harassment; and
4. the zero rating of exports aimed at increasing the competitiveness of Indian exports

Under the basic VAT design, there are only two basic VAT rates of 4 and 12.5 percent. In addition, there is provision for a specific category of tax-exempted goods and a special VAT rate of 1 percent only for gold and silver ornaments. Under the exempted category, a small list of commodities were placed comprising natural and unprocessed products in the un-organized sector, items that are legally barred from taxation and items which have social implications. Some flexibility to the states has been given to select a set of maximum of 10 commodities for exemption from the list of goods specified by the

Empowered Committee, which are of local social importance for the individual States without having any inter-state implications.

The most important part of the VAT scheme relates to the tax rates. The VAT system covers about 550 goods. Under exempted category, 46 commodities were identified by the Empowered Committee. Under the 4 percent VAT rate category, the largest number of goods (about 270) was placed. These consisted of basic necessities such as medicines and drugs, all agricultural and industrial inputs, capital goods and declared goods. The remaining commodities, common for all the States, fell under the general VAT rate of 12.5 percent.

Reforms are continuing and there is a possibility of developing a comprehensive goods and services tax (GST), which may be levied on a concurrent basis by the central and state governments. This will provide a common treatment for goods and services and fully eliminate problems of cascading. Three options are currently being considered: a central GST, a system of concurrent GST, and a system of State GST. All indications are that India will move towards a system of concurrent GST.

7.5 State Level Eco-Taxes for Pollution Abatement

Just as in the case of countries, states in India have also considerable differences in consumption levels, growth rates, and the nature and incidence of pollution. Apart from central measures for overcoming environmental concerns, states also have to play a definitive role in the control of pollution, which is often of a state-specific or local nature. In undertaking reforms of the taxation of goods and services integrated with ecological tax reforms, it is important to recognize that in a value added tax regime, where input taxes are fully rebated, taxation of polluting inputs will be ineffective as the tax paid on the inputs will be rebated, unless these are made non-Vatable or a non-rebatable cess is levied on the inputs. This cannot be done on a large scale as it will make the tax system very complex and defeat the objective of tax reform. In general, eco-tax reforms would require taxing at a higher rates, outputs that are either polluting or use highly polluting inputs.

With a view not to increase the overall burden of taxes due to the 'greening' of the tax-regime, eco-taxes should be designed so as to be revenue-neutral with respect to total revenues. At best, these may lead to a small net revenue augmentation and these revenues should be kept in a separate account for supporting changes in technology and processes, which promote the use of non-polluting substitutes. Eco-taxes should be

designed in an integrated way for taxation at the central, state and local levels. These should complement each other and should not be at cross purposes. Global sources of pollution or pollution where state boundaries are generally crossed should be taxed at the national level, regional sources at the state level, and pollution with strong local characteristics should be taxed at the local level. There should be inter-state coordination so that as a result of taxation of polluting inputs and outputs, industries do not attempt to relocate in other states where eco-taxes are less stringent.

Eco-taxes are a price-instrument. For an effective use of a price-instrument, it is important that prices are allowed to be determined by the market forces and reflect international prices. It may be noted that for some of the major polluting inputs and outputs like coal, petroleum products, and fertilizers, prices are regulated by the central government. In the case of electricity, prices are regulated by the Tariff Regulatory Authority of the state but prices reflect state government's considerations.

In the context of State VAT, in deciding the rate-classification of goods, there were no explicit 'environmental considerations'. Excepting for a few States which have contemplated to bring in new taxes (tax on lottery tickets in Maharashtra, tax on resale of certified used cars in Goa, 'green tax' on old vehicles in Rajasthan), most State Governments have intended to reduce their tax rates on various types of taxes and even abolish certain taxes. Kerala has created a new schedule of goods to be taxed at 20 percent, which is higher than the highest level under VAT i.e., 12.5 percent. Maharashtra, Meghalaya and Mizoram have proposed to enhance water charges. However, several States have proposed to reduce power/ electricity rates to various sections of population (Andhra Pradesh, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Punjab and Tamil Nadu).

Most States have divided the goods taxable at different rates into several schedules. While there is some uniformity in the tax rates, which range from exempted goods, zero rated goods (for exports), goods taxed at one percent, goods taxed at 4 percent, and goods taxed at 12.5 percent, there is considerable variation among the states regarding the goods included in different categories. There are also several goods where special rates are applied and these rates vary considerably across states. There is also considerable variation in the list of goods subject to special rates where credit on taxes paid on goods is allowed or not allowed. Many goods that may be considered as polluting inputs and outputs are taxed at different, often concessional, rates in the states.

Two general considerations are pertinent in devising suitable modifications in the VAT rate structures of the state governments in regard to petroleum. One, the central government regulates the petroleum prices and because of the visibility of the petroleum prices, high levels of international prices, and both equity and growth considerations, the central government is not likely to consider favorably, further eco-tax loads on the petroleum prices at least in the short run. The states have differential impacts of the vehicular pollution depending on the size of the vehicular population and pattern of usage. Their tax rates also vary in a large range.

The states should ensure that VAT rates for petroleum products

- a. Are kept at a reasonable minimum level, i.e., there should be agreement on a band with a floor and ceiling rates.
- b. These are kept at levels much higher than the floor level by states where the incidence of vehicular pollution is relatively higher; such increases should be brought in stages.
- c. In the case of VAT on the petroleum products, taxes paid on inputs should not be made rebatable, which is generally the case.
- d. Higher tax revenues from VAT on the petroleum products should prepare ground for reducing the core VAT rate in the states from 12.5 to 10 percent in the medium term so that it becomes a 'green' shift in taxation and does not hamper growth.

We consider this and other issues together with the central tax and price regimes.

7.6 Central and State Taxes: A Coordinated Approach to Environmental Reforms

Goods bear a variety of taxes including customs duties, central excise duty (CENVAT), state sales taxes (State VAT), and motor vehicle tax. Customs duties include, apart from the basic duty, additional duty of customs, additional duty of customs to countervail state taxes/VAT, special duty, additional duty on light speed diesel oil, additional duty on motor spirit, National Calamity Contingency Duty, Education Cess, and Secondary and Higher Education Cess. In designing eco-taxes, it is important to examine the overall incidence of taxes at all levels, a suitable point of levy for the eco-tax, distribution of the eco-tax components between centre and states, if levied at both levels, and relevance of inter-state differentials in the tax rates. We consider below some important polluting inputs/outputs.

a. Eco-taxation of Coal and Related Issues

Coal is under the Open General License (OGL) list. India exports coal to Nepal, Bangladesh and Bhutan. Coal can also be freely imported under the OGL by the consumers themselves. Coking coal is being imported by the Steel Authority of India and other steel manufacturing units mainly to improve the quality of domestically available coal. Coast-based power plants, cement plants, captive power plants, sponge-iron plants, industrial consumers and coal traders are also importing non-coking coal. Total import in 2005-06 was about 39 MTs.

As far as taxation of coal under customs duty and CENVAT is concerned the following provisions apply. Under the Customs Duty Act, for all varieties of coal except Bituminous coal, the tariff rate is 10 percent. For Bituminous coal, the tariff rate is 55 percent. Under the Central Excise Act, the tariff rate is zero percent for all varieties of coal. Under a special notification, under the Coal Mines (conservation and development) Act, 1974 a Stowing Excise Duty has been levied at rate of Rs. 10 per tonne of coal irrespective of its grade with effect from 26.03.2003. This excise duty is collected by the Coal Controller on all raw coal produced and dispatched from all the collieries in India. It is realized from the consumers alongwith the coal sale bills raised by the coal companies. The net proceeds from the stowing excise duties during the preceding year or years is disbursed to the owners, agent or the managers for execution of stowing and other operations for the safety in coal mines or conservation of coal or any other purpose connected with development of coal mines or transportation, distribution or utilization of coal.

Coal beneficiation reduces the ash content in the coal and improves its thermal efficiency and reduces the operation and transport costs of thermal power plants. The MSE (2007) study recommended the levy of an eco-cess to provide suitable incentives for reducing the ash-content. We recommend a similar but somewhat simplified structure of the eco-cess as given in Table 7.1.

Table 7.1: Rates of Eco-tax on Coal

Type of Coal	Rate (Rs. per tonne)
All varieties of coking coal where ash content is 18 percent or less	nil
All varieties of coking coal where ash content is between 19 to 28 percent	20
All varieties of coking coal where ash content is higher than 28 percent	40
All varieties of non-coking coal where ash content is 28 percent or less	nil
All varieties of coking coal where ash content is higher than 28 percent	50

As discussed earlier, a cess is already being collected by the Coal Commissioner, since 2003, of an amount of Rs.10 per tonne, without any distinction in respect of the variety of coal, and the cess is fully passed on to users or consumers. It should be possible to levy an environmentally rational cess under the same provision, and pass it on to the users, while allowing prices to reflect the benefit of prior treatment of coal. It will reduce pollution as well as improve efficiency of production without causing loss either to consumers (who need less of a better quality of coal) or producers of coal since they do not bear the cess. The receipts from the cess must be allocated for setting up facilities for washing and treating coal and related research and development.

There are additional considerations for taxation of coal at the state level. This arises, particularly in the case of producing states where the coal mines are located. They suffer pollution damage both in the atmosphere and on land. They suffer a double damage if the thermal power plants or other coal-using industries are also located in the state. These states do not get any returns from the mining out of the mineral resources, which belong to the centre, coal being a major mineral. The limited royalty that they get is a modest compensation for the massive negative externalities that citizens of these states suffer because of the coal-related pollution damages. Since the consumers of power or other products where coal is an input are located in all the states, particularly, in higher income states where per capita consumption of power may be higher, the counterpart of export of coal to other states is import of pollution in the producing states. The producing states like Bihar, Assam, Orissa, Jharkhand, Madhya Pradesh, and Chhattisgarh are therefore entitled to levy a higher than floor rate of State VAT or levy a special cess. Further, on export of coal, the tax should not be zero-rated because although good is consumed outside the state, considerable pollution remains within the producing state. This should also apply to the Special Economic Zones.

b. Environmental Tax Reforms in Respect of Petroleum Products

After a long period administered prices for the petroleum sector, a dismantling of the Administered Pricing Mechanism (APM) was announced and made effective from 1.4.2002. Subsidies for the PDS kerosene and domestic LPG were continued on the ground that these were fuels of mass consumption. With a sharp and spiraling increase in international oil prices, particularly since late 2003, combined with sharp week-to-week and sometimes day-to-day volatility of petroleum prices, this arrangement has virtually collapsed. The explosive increase in the global crude prices increased the volume of subsidy on PDS kerosene and domestic LPG to unprecedented levels. Government took

back control of price setting for petrol and diesel, and restrained the 'pass-through' of the international prices to domestic consumers.

The Central excise levy on petrol and diesel has been a combination of ad-valorem and specific rates. The contribution of the petroleum sector to the total net excise revenues of the Government was of the order of 40 percent. Moreover, taxes (including sales tax/VAT) and duties constitute a significant proportion of the retail prices.

State level taxes are also high for petroleum products. Almost all state governments in India are also levying non-Vatable taxes on crude oil and petroleum products at special rates. With the administered prices of various petroleum products, and centre still not being able to follow suitable principles of pricing reflecting the trade parity prices, as recommended by the Rangarajan Committee, it does not seem feasible that the Central Government would be able to impose any additional tax-load on the petroleum products on environmental considerations. In this case, states have a greater flexibility. Not only are they entitled to have special rates on petroleum products, they also keep the tax non-Vatable. Since states suffer different levels of pollution, related to vehicular and other uses of petroleum products, they are entitled to use different rates, reflecting their own environmental considerations. In particular, the higher income states, where per capita consumption of petroleum products may be higher, may levy a higher special rate of tax.

As part of the overall tax reforms, we suggest that

- a. In the case of petroleum products, states may levy differential special rates but agree on floor and ceiling rates. The existing floor rate may be increased from 20 to 25 percent;
- b. Considering the revenue-importance of this tax, in order not to have detrimental effects either on growth or on prices, the core (floor) State VAT rate on all other goods may be reduced from 12.5 to 10 percent.

This would also facilitate introducing a comprehensive GST regime where both the core rates of CENVAT and State VAT will need to be reduced from the present levels of 14 and 12.5 percent respectively.

c. Environmental Reforms and Taxation/Subsidisation of Fertilisers

At present, natural gas based plants account for more than 66 percent of urea capacity, naphtha is used for less than 30 percent of urea production and the balance capacity is

based on fuel of oil (FO) and low sulphur heavy stock (LSHS) as feedstock. Natural gas has been the preferred feedstock for the manufacture of urea over other feedstocks viz. naphtha and FO/LSHS. It is a clean and efficient source of energy. Also, it is considerably cheaper and more cost effective in terms of manufacturing costs. Given the large volume of subsidies being given by the central government, it does not seem feasible for the central government to impose an eco-tax for reducing the consumption of chemical fertilisers. As far as the state governments are concerned, they have also put fertiliser rates that vary between exemption to 12.5 percent. In some cases, naphtha is rated at 20 percent.

At the present juncture, the following are recommended:

- i. Overall volume of subsidy for chemical fertilizers should be reduced in stages and eventually eliminated.
- ii. Encourage a more balanced use of fertilizers by following a nutrient-based subsidy regime.
- iii. Reduce the overall cost by shifting away from Naphtha as feedstock.
- iv. States should keep chemical fertilizers in the 12.5 percent category and bio-fertilizers in the exempted category.

d. Eco-tax on Chemical Pesticides

Spraying of chemical pesticides results in residues in drinking water, vegetables, milk, fish, etc. At present, use of chemical pesticides is concentrated on a few crops like cotton, rice and pulses, and fruits and vegetables. At the same time, there is a growing organic farming and organic food and the use of bio-fertilisers. At present, the market for bio-pesticides is about one percent of the pesticide market. Neem based pesticides dominate the bio-pesticides market in India. In the context, the recommendations, following the MSE (2007) study are:

- a. Chemical fertilizers should be placed at 14 percent under CENVAT and at 12.5 percent under State VAT.
- b. CENVAT on bio-pesticides be decreased from 16 percent to 8 percent and it should be put under the exempted category in State VAT.

e. Plastics and Eco-taxes

Plastic products like carry bags, beverage containers and thin sheets are causing significant solid waste problems. There is a concern that recycling may not be environmentally safe. We recommend the following:

1. *Biodegradable Plastics*: The 14 percent CENVAT on biodegradable plastics be removed. In State VAT also these should invariably be placed under the exempted category.
2. *Deposit Refused on PET bottles*: A deposit of Re.1 per bottle should be levied on PET bottles at the time of sale which can be refunded when the bottle is returned. Manufacturers would have to set up a network of collection centers which will collect the bottles and send them for recycling.
3. *Incentive to Rag pickers*: Households can be encouraged by their respective municipal authorities to segregate their plastic wastes and hand over the low value wastes to the rag pickers. The plastic industry can provide a matching incentive amount (say Rs.10 per kg of plastic bags) to the rag pickers in addition to the amount that the recycler would pay.
4. *Recycling*: Municipalities can also set up a central facility/complex with assistance from the industry to recycle low value plastic wastes in an environmentally sound manner.
5. 50 percent reduction in customs duty be given to recyclers who wish to import equipment and machinery for upgradation of recycling technology for a limited period of 10 years.

f. Taxation of Alcohol

In the case of State VAT, rates on liquor and alcoholic beverages vary considerably. The rates vary from 12.5 percent to as high as 70 percent. These are part of the special rates although they are often specified in the VAT schedules themselves. In general, the tax is non-vatable. In most cases, the tax paid on inputs is not rebatable also. As part of overall reforms, states may agree to a minimum rate of not less than 30 percent and in states where many manufacturing units are located, a higher rate may be charged as considerable pollution occurs around the manufacturing units. There should not be any rebate on taxes paid on goods nor should exports be zero rated because consumption may take place in other states but pollution may be more localized in the state where the manufacturing units are located.

7.7 Eco-taxes as an Integral Part of the Proposed GST

There is a concerted move both by the central government and the Empowered Committee of State Finance Ministers to move towards a National Goods and Services Tax by April 1, 2010. This is the ideal time to bring environmental considerations as an integral part of tax reforms. The promotion of environment in a sustained way can be pursued by an extensive use of economic instruments. Eco-taxes on polluting inputs

and outputs provide a highly potent instrument in the hands of the central and the state governments as well as the local governments. These instruments are now being extensively used internationally. At this stage, any piecemeal approach to eco-taxes may not be very effective although there may be a case for some selected taxes on the polluting inputs and outputs in selected industries. In general, eco-taxes should be embedded in an overall scheme of reforms relating to taxation of goods and services.

For implementing a comprehensive Goods and Services tax both at the centre and the states, several options are being considered ranging from a completely centralized levy of GST to a system of extensive State GSTs. However, a consensus that seems to be emerging is likely to favour a dual system consisting of a GST with two components: a central GST (CGST) and a system of state GSTs (SGST). Once the reformed system is put in practice, it will subsume the service tax, the central excise duties, state sales taxes, additional excise duties in lieu of sales tax on textiles, tobacco and sugar and a number of other state taxes. The sales tax on inter-state transactions on goods (CST) will also go. While it will be some time for the GST to materialize, it is clear that taxation of goods and services on the value added principle with proper harmonization with the states will bring about major reforms in the way goods and services are being taxed in the country. Some of the issues that will need to be settled relate to determination of the central and state components of the overall GST rates, assessments of relative losses and gains to the centre and the states, if any; and if so, making good those losses through the recommendations of the Finance Commission. As the Finance Commission deliberates on these matters, it should also consider including ecological tax reform as an integral element of the reform regime of taxation of goods and services.

Proponents of eco-taxes have argued for a 'green shift' in taxation of goods and services, which implies that the overall tax burden does not increase on the system so that inefficiency costs of excess taxation such as deadweight losses, compliance, costs, and administrative costs do not increase. Some economists consider that in fact such a green shift will yield a double dividend by raising overall efficiency without reducing the overall size of tax revenues. It will also improve inter-generational equity by spreading better among different generation the use of natural resources and fossil fuels as compared to their overexploitation by the present generation. In any case, when the social welfare function is seen in the broader context where various positive externalities of green development and negative externalities of pollution are internalized, any 'green shift' in taxation is likely to be welfare improving without affecting the growth momentum

adversely. It is therefore imperative that in the analysis undertaken by the 13th Finance Commission of a comprehensive goods and services tax, a thrust towards the eco-taxes is taken up as the crucial core of tax reforms.

In undertaking reforms of the taxation of goods and services where the ecological tax reforms are an integral part of the overall tax reforms, some important considerations are listed below:

1. In a value added tax regime, input taxes are fully rebated. As such, taxation of polluting inputs will be ineffective as the tax paid on the inputs will be fully rebated, unless a non-rebatable cess is levied on the inputs. This cannot be done on a large scale as it will make the tax system very complex and defeat the objective of tax reform.
2. The more appropriate method would be to tax outputs and introduce ecological considerations by taxing at a higher rate, outputs that are either polluting or use highly polluting inputs. In important cases, a non-rebatable tax or cess should be introduced.
3. Ecological taxes should not be taken as revenue augmenting measures in general. Any ecological taxes should be accompanied by a rate reduction for the non-polluting outputs/inputs so that the overall tax burden does not increase, the use of non-polluting inputs is encouraged and the development processes are not adversely affected. These should only become more environment-friendly and therefore sustainable over the longer run.
4. If ecological considerations lead to some regressivity, as has been noted in the relevant literatures, as a result of taxation at a higher rate, some polluting but mass-consumed good, this should be properly neutralized by a well designed subsidy. Weizsacker *et al* (2005) emphasize that eco-taxation should affect the end-user prices such that existing price differences between domestic and commercial uses of the polluting inputs/outputs may be continued if the difference is due to any equity considerations.
5. Only to a limited extent, eco-taxes should be designed to lead to a net revenue augmentation and these revenues should be kept in a separate account for

supporting changes in technology and processes, which use less of the polluting inputs.

6. Eco-taxes should be designed in an integrated way for taxation at the central, state and local levels. These should complement each other and should not be at cross purposes. Global sources of pollution or pollution where state boundaries are generally crossed should be taxed at the national level, regional sources at the state level, and pollution with strong local characteristics should be taxed at the local level.
7. Tax rates for eco-taxes should be fixed after taking into account the full extent of negative externalities of the polluting inputs and outputs. This requires major changes in national accounting frameworks.
8. Any state level taxation should generally be revenue-neutral. New eco-taxes should be accompanied by reduction in other taxes.
9. There should be inter-state coordination so that as result of taxation of polluting inputs and outputs, industries do not attempt to relocate in other states where eco-taxes are less stringent. This may happen if some states pursue more actively pollution control while some others are more relaxed and the CST also goes. The 13th Finance Commission should ensure that inter-state coordination takes place in the state level initiatives and at any rate state that are more aggressive in pursuing pollution control do not suffer any revenue loss if industries relocate themselves.
10. As part of reforms towards GST, the system of additional excise duties in lieu of sales tax for sugar, tobacco, and textiles will also be integrated with GST. The Finance Commission determines the inter-state distribution of revenues under additional excise duties guided by the principle of returning to the states what they would have earned had a sales tax was levied on these commodities. Production processes in all these cases have significant environmental implications. When these commodities are subsumed in the overall GST, care has to be taken that environmental considerations are kept in mind.
11. The Special Economic Zones and Export Oriented Units are given inputs including polluting inputs on a zero-rated basis. While their products may be exported or

treated as imports if sold in the domestic economy, much of the pollution that they generate is affecting the geographical area in which they are located. Polluting inputs in their case should not be zero-rated. They should also be subject to all other applicable regulatory measures for pollution control.

The next one to two years are going to be critical for motivating the central and state governments to bring about environmental reforms as an integral part of their taxation strategies. Public opinion has also to be mobilized for an effective support to the 'green' shift in taxation. The Ministry of Environment and Forests may consider bringing out a White Paper on the subject for presentation in Parliament and organize a meeting with the 13th Finance Commission as well as the Empowered Committee of the State Finance Ministers.

REFERENCES

Air (Prevention and Control of Pollution) Act, 1981.

Appasamy P., *et al*, (2002) "Environmental Impact of Industrial Effluents in Noyyal River Basin" Unpublished report, Madras School of Economics. Also see Appasamy, Paul P. and Prakash Nelliya (2007), Compensating the Loss of Ecosystem Services Due to Pollution in Noyyal River Basin, Tamil Nadu, Madras School of Economics, Working Paper 14.

Association of British Insurers (June 2005) "A Changing Climate for Insurance: A Summary Report for Chief Executives and Policymakers".

Babcock, B.A., Lakshminarayan, P.G., Wu, J., and Zilberman, D. (1997), "Targeting Tools for the Purchase of Environmental Amenities," *Land Economics*, 73(3), 325-339.

Ballard, J.L. and S.G. Medema (1992), The Marginal Efficiency Effects of Taxes and Subsidies in the Presence of Externalities: A Computational General Equilibrium Approach, East Lansing MI, Michigan State University.

Baumol, W.J. and Oates, W.E (1971), "The Use of Standards and Prices for Protection of the Environment", *Swedish Journal of Economics*, 73 (1), pp. 45-52; reprinted in P. Bohm and A. Kneese (eds.), *The Economics of the Environment: Papers from Four Nations*, Macmillan, London and Basingstoke, 1971.

Baumol, W.J. and Oates, W.E (1988), *The Theory of Environmental Policy*, (2nd Edition), Cambridge, Cambridge University Press.

Behera, Bhagirath and V. Ratna Reddy (2002), "Environment and Accountability Impact of Industrial Pollution on Rural Communities", *Economic and Political Weekly*, Vol. 36, No. 3, January 19-25.

Bernstein, Paul M., W. David Montgomery, Thomas F. Rutherford and Gui-Fang Yang (1999), "Effects of Restrictions on International Permit Trading: The MSMRT Model" in John Weyant (ed.), *The Costs of the Kyoto Protocol: A Multi-Model Evaluation*, Special issue of *The Energy Journal*.

Bohm, P. and Russell, C (1985), "Comparative Analysis of Alternative Policy Instruments" in A.V. Kneese and J.L. Sweeney (ed.), *Handbook of Natural Resource and Energy Economics*, North-Holland, Amsterdam.

Bovenberg, A. Lans and R.A. de Mooij (1997), "Environmental Tax Reform and Endogenous Growth," *Journal of Public Economics*, Vol. 63, No. 2, pp. 207-237, January.

- Bovenberg, A. Lans and Lawrence H. Goulder (1996), "Optimal Environmental Taxation in the Presence of Other Taxes: General-Equilibrium analyses", *The American Economic Review*, Vo. 86 (4), September, pp. 985-1000.
- Bovenberg, A. Lans and Ruud A. de Mooij (1994), "Environmental Levies and Distortionary Taxation", *American Economic Review*, 84, 1085-9.
- Bovenberg, Lans and Frederick van der Ploeg (1994), "Consequences of Environmental Tax Reform for Involuntary Unemployment and Welfare," CESifo Working Paper Series.
- Brandon, C. and K. Homman (1995), *The Cost of Inaction: Valuing the Economy-wide Cost of Environmental Degradation in India*, Asia Environmental Division, The World Bank, Washington DC.
- Casler, Stephen D and Aisha Rafiqui (1993), "Evaluating Fuel Tax Equity: Direct and Indirect Distributional Effects", *National Tax Journal* 46(2), 197 – 205.
- Central Pollution Control Board (2000), "Clean Coal Initiatives", *Parivesh Newsletter*, New Delhi.
- Central Pollution Control Board (2000), Status of Water and Wastewater Generation, Collection, Treatment and Disposal in Class-I Cities.
- Central Pollution Control Board (2000), Status of Water and Wastewater Generation, Collection, Treatment and Disposal in Class-II Towns.
- Central Pollution Control Board (2005), *Transport Fuel Quality Report*, Ministry of Environment and Forests, Government of India.
- Central Pollution Control Board, Annual Report, 1994-95, 2000-01 and 2003-04.
- Central Pollution Control Board, Air (Prevention and Control of Pollution) Act, 1981.
- Central Statistical Organisation (1997), "Compendium of Environment Statistics", New Delhi: Department of Statistics, Ministry of Planning and Programme implementation, Government of India.
- Central Statistics Organisation (2006), Compendium of Environment Statistic (2006), New Delhi,
- Centre for Science and Environment (2004), *Poision Vs Nutrition*, New Delhi.
- Chatterjee, Sushmita, Kishore K Dhavala, and M.N.Murty (2007), "Estimating Cost of Air Pollution Abatement for Road Transport in India Case studies of Andhra Pradesh and Himachal Pradesh", *Economic and Political Weekly*, September 8, pp. 3662-3668.

- Chelliah, Raja. J, Paul P.Appasamy, U. Sankar, and Rita Pandey (2007), *Ecotaxes on Polluting Inputs and Outputs*, Academic Foundation, New Delhi. MSE Study (2007).
- Choi, O. and Fisher, A. (2003), "The Impacts of Socioeconomic Development and Climate Change on Severe Weather Catastrophe Losses: Mid-Atlantic Region (MAR) and the U.S." *Climatic Change* 58 (1-2), 149-170.
- Cline, W.R (1992), *The Economics of Global Warming*, Institute for International Economics, Washington, DC.
- Directorate of Plant Protection Quarantine and Storage, Ministry of Agriculture.
- Energy Information Administration (2007), International Energy Outlook 2007.
- Energy Information Administration (2004), US Department of Energy, Report.
- Energy Information Administration (2006), International Energy Annual 2004 (May-July 2006), web site www.eia.doe.gov/iea.
- Energy Information Administration (2007), System for the Analysis of Global Energy Markets, US Department of Energy. Projections for 2010-2030.
- Energy Information Administration (2004), U.S. Department of Energy, Report.
- Fankhauser, Samuel (1992), "The Economic Costs of Global Warming: Some Monetary Estimates", unpublished manuscript presented to the International Workshop on Costs, Impacts, and Possible Benefits of CO₂ Mitigation, Laxenburg, Austria.
- Fischer, Carolyn, Ian W. H. Parry, and William A. Pizer (1998), "Instrument Choice for Environmental Protection When Technological Innovation is Endogenous", *RFF Discussion Paper* 99-04.
- Ghoshal, Tapas and Ranajoy Bhattacharyya (2007), "State Level Carbon Dioxide Emissions of India: 1980-2000", <http://ssrn.com/abstract=999353>.
- GoI (2007), Gazette of India: Notification of the Thirteen Finance Commission, Ministry of Finance, Department of Economic Affairs, New Delhi, November.
- GoI, *Report of the Finance Commissions*, 9, 10, 11, and 12.
- GoI (2007), *Union Budget 2007-08*, Ministry of Finance.
- GoI (2007), *Annual Report 2006-07*, Ministry of Coal India.
- GoI (2007), *Annual Report 2006-07*, Department of Fertiliser.

GoI (2007), *The Expert Committee on Road Map for Coal Sector Reforms*, Report (Part II), Ministry of Coal, October. Chairman: S.L. Sankar.

GoI (2006), *Report of the Committee on Pricing and Taxation of Petroleum Products*, Chairman C. Rangarajan, February.

GoI (2006), *Integrated Energy Policy*, Report of the Expert Committee, Planning Commission, Chairman: Kirit S. Parikh.

GoI (2005), *A White Paper on State-Level Value Added Tax*.

GoI (2005), *The Expert Committee on Road Map for Coal Sector Reforms*, Report (Part I), Ministry of Coal, Delhi, December.

GoI (2005), *Economic Survey 2004-05*, Economic Division, Ministry of Finance.

GoI (2003), Electricity Act, 2003.

GoI (2002), *Report of the Expert Committee on Auto Fuel Policy*, Chairman R.A.Mashelkar, August.

GoI (1997), The Water (Prevention and Control of Pollution) Cess Act, 1997.

GoI (1986), Environment Protection Act, 1986.

GoI (1974), Coal Mines (Conservation and Development) Act, 1974.

GoI, (1974), The Water Act, 1974.

GoI (1955), Essential Commodities Act, 1955.

GoI, *All India Soil and Land Use Survey*, Ministry of Agriculture and Forests.

GoI, Directorate of Plant Protection Quarantine and Storage, Ministry of Agriculture.

GoI, State Finance Accounts, various years.

GoAP (2005), Andhra Pradesh Value Added Tax Act, 2005.

GoTN (2006), Tamil Nadu Value Added Tax Act, 2006.

GoM (2007), Maharashtra Pradesh Value Added Tax Act, 2007.

GoP (2005), Punjab Value Added Tax Act, 2005.

GoD (2006), Delhi Value Added Tax Act, 2006

- Goldar, B. and Banerjee N. (2004), "Impact of Informal Regulation of Pollution on Water Quality in Rivers in India", *Journal of Environment Management*, 73 (2), 117-130.
- Goulder, Lawrence H and Ian W. H. Parry (2000), "Green Tax Reform and the 'Double Dividend'", *Association of Environmental and Resource Economists Newsletter*, 20 (1) May.
- Greenhouse Gas Emissions, New Zealand Energy Sources 1990 – 1994, Ministry of Commerce.
- Hahn, R. W. and Hester, G. L. (1989), "Marketable Permits: Lessons for Theory and Practice", *Ecology Law Quarterly*, 16, 380–391.
- Helfand, G.E., and House, B.W (1995), "Regulating Nonpoint Source Pollution under Heterogeneous Conditions", *American Journal of Agricultural Economics*, 77(4), 1024-1023.
- Hettige M., Martin P., Singh M., and Wheeler D. (1994), "The Industrial Pollution Projection System", Policy Research Department, Policy Research Working Paper 1431, World Bank, <http://web.mit.edu/murcott/www/arsenic>
- Hoel, M., Karp, L (1998), "Taxes Versus Quotas for a Stock Pollutant", *Fondazione Eni Enrico Mattei, Nota di Lavoro* 29-98.
- Jaffe, A., S. Peterson, P. Portney, and R. Stavins (1995), "Environmental Regulation and the Competitiveness of US Manufacturing: What Does the Evidence Tell Us?", *Journal of Economic Literature*, XXXIII (March), pp. 132–63.
- John Weyant, (1999), "The Costs of the Kyoto Protocol, A Multi-Model Evaluation" (ed.), Special Issue, *The Energy Journal*, International Association for Energy Economics.
- Jorgenson, Dale W. and Peter J. Wilcoxon (1991), "Reducing U.S. Carbon Dioxide Emissions: The Cost of Different Goals", in John R. Moroney, Ed., *Energy, Growth and the Environment*, Greenwich, CT: JAI Press, pp. 125-8.
- Jorgenson, Dale W., Daniel T. Slesnick and Peter J. Wilcoxon (1992), "Carbon Taxes and Economic Welfare" *Brookings Papers: Microeconomics*.
- Kathuria V., and Gundimeda H., (2001), "Industrial Pollution Control. Need for Flexibility" in Parikh K., Marikh J., (ed.), *India Development Report 2001*, IGIDR, Bombay.
- Kathuria, Vinish (2001), "Pollution: Prevention vs Control", *Economic and Political Weekly*, July 21, pp. 2745-2748.

- Kathuria, Vinish (2005), "Vehicular Pollution Control in Delhi - Impact of Compressed Natural Gas", *Economic and Political Weekly*, April 30, pp. 1907-1915.
- Kerr, J. (2002), "Watershed Development, Environmental Services, and Poverty Alleviation in India", *World Development*, 30(8), 1387-1400.
- Kerr, Suzi (2001), *Ecological Tax Reform*, MOTU Economic and Public Policy Research, Report prepared for the Ministry of Environment New Zealand, 23 January.
- Kerr, Suzi and Richard Newell (2000), "Policy-Induced Technology Adoption: Evidence from the U.S. Lead Phasedown", Draft Manuscript, *Resources for the Future*.
- Kerr, Suzi, Megan Claridge and Dominic Milichich (1998) "Devolution and the New Zealand Resource Management Act" *Treasury Working Paper* 98/7.
- Kneese, A.V. and Schultze, C.L (1975), *Pollution and Public Policy*, Brookings Institution, Washington, DC.
- Kolstad, Charles D (1992), "Looking vs. Leaping the Timing of CO₂ Control in the Face of Uncertainty and Learning", unpublished manuscript presented to the International Workshop on Costs, Impacts and Possible Benefits of CO₂ Mitigation, IIASA, Laxenburg, Austria, September.
- Manne, Allan S. and Richels, Richard G (1992), *buying Greenhouse Insurance: The Economic Costs of CO₂ Emission Limits*, Cambridge, MA: MIT Press.
- Manresa, Antonio and Sancho, Ferran (2005), "Implementing a double dividend: recycling ecotaxes towards lower labour taxes" , *Energy Policy* ,Volume 33, Issue 12, August 2005, Pages 1577-1585.
- Maria, A. (2003), *The Costs of Water Pollution in India*, CERNA, Ecole Nationale Supérieure des Mines de Paris, Paris, France. Revised Version Paper Presented at the conference on Market Development of Water & Waste Technologies through Environmental Economics, 30th-31st October 2003, Delhi.
- Markandya A., and M.N. Murty (2000), *Cleaning up the Ganga: A Cost-Benefit Analysis of the Ganga Action Plan*, Oxford University Press, New Delhi.
- Marland, G., and R. M. Rotty (1984), "Carbon Dioxide Emissions from Fossil Fuels: A procedure for Estimation and Results for 1950-1982", *Tellus*, 36(B), pp.232-61.
- Ministry of Environment and Forests, Annual Report 2001 and 2004 New Delhi, <http://www.moef.gov.in>; <http://envfor.nic.in>.

- Misra S. (1999), "Accounting for Costs of Water Pollution Abatement: A Case Study of the Nandesari Industrial Area", in Murty, James and Misra (eds.), *Economics of Water Pollution*, OUP.
- Mooij, Ruud A. de (1998), "The Double Dividend of an Environmental Tax Reform", in *Hand Book of Resource and Environmental Economics*, Jeroen C.J.M. Van den Bergh (ed.), Edward Elgar Publication, Chapter 20, pp.293-306.
- Mukherjee, Sacchidananda and Prakesh Nelliya (2006), "Ground Water Pollution and Emerging Environmental Challenges of Industrial Effluent Irrigation: A Case Study of Mettupalayam Taluk, Tamil Nadu", Madras School of Economics, Working Paper No. 7.
- Mukherjee, Sacchidananda and Vinish Kathuria (2006), "Is Economic Growth Sustainable? Environmental Quality of Indian States Post 1991", Madras School of Economics, Working Paper No. 6.
- Munich Re and Swiss Re (2002) in UNEP (2002) "Key findings of UNEP's Finance Initiatives study" *CEO briefing*.
- Murty M.N., and S. Kumar (2001), "Environmental and Economic Accounting for India Industry", Institute of Economic Growth, Working Paper E/212/2001, Delhi.
- Murty M.N., and S. Kumar (2001), "Methodology for Estimating the Cost of Pollution Abatement: A Review of the Literature", Institute of Economic Growth, Working Paper E/217/2001, Delhi.
- Murty M.N., Prashad U.R., (1999), "Emissions Reduction and Influence of Local Communities in India" in Murty, James and Misra (eds.), *Economics of Water Pollution*, OUP.
- Newell, R.G., A.B. Jaffe and R.N. Stavins (1999), "The Induced Innovation Hypothesis and Energy-Saving Technological Change", *Quarterly Journal of Economics*, 114 (3), 941–975.
- Nordhaus, W.D (1993), "Rolling the DICE: an optimal transition path for controlling greenhouse gases, resource", *Resource and Energy Economics*, 15 (1993), pp.27–50.
- Nordhaus, William D. (1993), "Optimal Greenhouse-Gas Reductions and Tax Policy in the "DICE" Model", *The American Economic Review*, Vol. 83, No. 2, Papers and Proceedings of the Hundred and Fifth Annual Meeting of the American Economic Association, May, pp. 313-317.
- Oates, Wallace E (1991), "Pollution Charges as a Source of Public Revenues", discussion Paper NO. QE92-05, Resources for the Future, Washington, DC.

- Oates, Wallace E (1994), "Taxation and the Environment: A Case Study of United States", in Organization for Economic Co-operation and Development (OECD), *Taxation and Environment for Case Studies*.
- OECD (2001), *Environmentally Related Taxes in OECD Countries: Issues and Strategies*, Paris.
- OECD (2007), *The Political Economy of Environmentally Related Taxes*, Paris, www.oecd.org/env/politicaconomy.
- Panda, Ramesh Chandra (2003), Rajiv Gandhi National "Drinking Water Mission, Drinking Water Quality and Related Health Impact in Rural India" Presented in the 3rd World Water Forum, Kyoto, 2003.
- Pandey R., and S. Deb (1998), "CETPs and Pollution abatement in SSIs", National Institute of Public Finance and Policy, New Delhi.
- Pandey R., and S. Ghosh (2002), "Estimating Industrial Pollution in India: Implications for an Effluent Charge", National Institute of Public Finance and Policy, New Delhi.
- Pargal S., M. Mani, and M. Huq (1997), "Inspections and Emissions in India. Puzzling Survey Evidence on Industrial Pollution", Policy Research Department Working Paper No 1810, World Bank.
- Parry, Ian W. H., Robertson C. Williams, and Lawrence H. Goulder (1998), "When Can Carbon Abatement Policies Increase Welfare? The Fundamental Role of Distorted Factor Markets", *Journal of Environmental Economics and Management*, forthcoming.
- Pearce, D (1991), "The Role of Carbon Taxes in Adjusting to Global Warming", *Economic Journal*, Vol.101, pp. 938-48.
- Peck, Stephen C and Thomas J. Teisberg (1992), "CETA: A Model for Carbon Emissions Trajectory Assessment", *Energy Journal*, Vol. 13 (1), pp. 55-77.
- Porter M.E., (1991), "America's Green Strategy" *Scientific American*.
- Poterba, James (1990), "Is the Gasoline Tax Regressive?", *MIT Working Paper* 586, Nov.
- Pundir, B.P. (2001), "Vehicular Air Pollution in India: Recent Control Measures and Related Issues", in *India Infrastructure Report 2001*, Oxford University Press, Delhi.
- Queen Elizabeth II National Trust (2000) Contact: Charlie Palmer, Queen Elizabeth II National Trust, PO Box 3341, Wellington.

Registrar General of India, Census, 2001.

Sandmo, Agnar (1975), "Optimal Taxation in the Presence of Externalities", *The Swedish Journal of Economics*, Vol. 77 (1), Public Finance: Allocation and Distribution, pp. 86-98.

Sandmo, Agnar (2003), "Bridging the Tax-Expenditure Gap: Green Taxes and the Marginal Cost of Funds", in Sijbren Cnossen and Hans-Werner Sinn (ed.), *Public Finance and Public Policy in the New Century*, The CESifo Seminar Series, MIT Press, Cambridge.

Sankar, U (2002), "On the Design and Enforcement of Fiscal Instruments for Pollution Control in India", in M. Govinda Rao (ed.), *Development, Poverty and Public Policy*, Oxford University Press.

Sankar, U and O.P. Mathur (1998), *Economic Instruments for Environment Sustainability*, National Institute of Public Finance and Policy and Madras School of Economics.

Sankar, U (1998), "Laws and Institutions Relating to Environmental Protection in India, Madras School of Economics, Occasional Paper No. 2, Chennai

Schoeb, R. (2003), "Double Dividend Hypothesis of Environment Taxes: A Survey", Public Finance, May.

Sigman, H. A (1995), "A Comparison of Public Policies for Lead Recycling", *RAND Journal of Economics* 26(3): 425-478.

Stavins, Robert; Jaffe, Adam and Newell, Richard (2000), "Technological Change and the Environment", Discussion Papers, dp-00-47, Resources for the Future, revised. Also in NBER Working Paper Series, No. 7970.

Stavins, R. N (1998), "What Have We Learned from the Grand Policy-Experiment? Positive and Normative Lessons from SO₂ Allowance Trading", *Journal of Economic Perspectives*, 12 (3), 69-88.

Stern, Nicholas (2006), *Stern Review*, World Bank.

Symons, E., Proops, J. and Gay, P. (1994), "Carbon Taxes, consumer Demand and Carbon Dioxide Emissions: A Simulation Analysis for the UK", *Fiscal Studies*, Vol. 15 (2), pp. 19-43.

Tata Energy Research Institute (TERI), Energy Data Directory and Yearbook 2002-03, New Delhi.

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

Tietenberg, T.H (1985), *Marketable Emission Permits: Reforming Pollution Policy*, Resources for the Future, Washington DC.

Transport Research Wing, Ministry of Road Transport and Highways (2003).

Tulpulé, Vivek, Stephen Brown, Jaekyu Lim, Cain Polidano, Hom Pant and Brian S. Fisher. (1999), "The Kyoto Protocol: An Economic Analysis Using GTEM", in John Weyant (ed.), *The Costs of the Kyoto Protocol: A Multi-Model Evaluation*, Special issue of *The Energy Journal*.

UNEP (2007), *Report of Inter-Governmental Panel on Climate Change*, April.

U.S. Congress (1990), *Committee on Ways and Means, Hearings*, Serial 101-98, March 6,7 and 14.

U.S. Congress (1990), Congressional Budget Office, on "Carbon Charges as a Response to Global Warming: The Effects of Taxing Fossil Fuels" in August.

U.S. Congress (1990), *Joint Committee on Taxation*, Present Law and Background Relating to Federal Environmental Tax Policy (JCS-6-90), March 1.

U.S. Congress (1991), Congressional Budget Office, on "Federal Options for Reducing Waste Disposal" in October.

US. H.R. 4575 introduced in the 101st Congress by Representative Slaughter of Virginia.

US. H.R. 4805, introduced in the 101st Congress by Representative Stark of California.

Weizsacker, Ernstvon, Amory B. Lovins, and L. Hunter Lovins (2005), *Factor Four: Doubling Wealth, Halving Resource Use*, Earthscan Publisher, Replika Press Pvt., India.

Wellisch, D (1995), "Locational Choices of Firms and Decentralized Environmental Policy with Various Instruments", *Journal of Urban Economics*, 37, 290-310.

Weyant, John (1999), "The Costs of the Kyoto Protocol, A Multi-Model Evaluation" (ed.), Special Issue, *The Energy Journal*, International Association for Energy Economics.

World Bank (2001) *International experience with CNG vehicles*, South Asian Urban Air Quality Management Briefing Note No. 1, ESMAP, World Bank.

World Bank, Ministry of Environment and Forests and Confederation of Indian Industry (2002), *International Workshop on Economic Instruments for Industrial Pollution Prevention and control in India, Proceedings*, New Delhi.

Yohe, G.W (1997), "Comparisons of Price and Quantity Controls: A Survey", *Journal of Comparative Economics*, 1, 213-233.

APPENDIX TABLES

Table A1: Carbon Dioxide Intensity by Region and Country, 1980-2030

(Metric Tonnes per Million 2000 U.S. Dollars of Gross Domestic Product)

Region	History			Projections					Average Annual Percent Change	
	1980	1990	2004	2010	2015	2020	2025	2030	1990-2004	2004-2030
OECD	731	565	470	419	385	353	328	306	1.30%	1.60%
United States	917	701	553	486	448	407	378	353	-1.70%	-1.70%
Canada	867	693	581	545	490	465	437	410	-1.30%	-1.30%
Mexico	395	441	379	380	353	329	300	273	-1.10%	-1.30%
Europe	672	507	394	349	316	284	258	235	-1.80%	-2.00%
Japan	483	355	375	336	319	307	299	292	0.40%	-1.00%
South Korea	883	719	694	543	488	451	418	392	-0.30%	-2.20%
Australia/New Zealand	693	678	621	590	529	480	443	400	-0.60%	-1.70%
Non-OECD	687	701	516	434	383	338	298	263	2.20%	2.60%
Europe/Eurasia	1,018	1,164	846	643	562	504	446	392	-2.30%	-2.90%
Russia	882	1,042	883	689	606	548	494	441	-1.20%	-2.60%
Other	1,242	1,366	796	587	511	454	396	344	-3.80%	-3.20%
Asia	738	605	468	393	346	305	269	238	-1.80%	-2.60%
China	1,766	1,120	610	500	425	367	321	284	-4.20%	-2.90%
India	305	340	298	227	202	178	158	138	-0.90%	-2.90%
Other	400	352	363	319	302	276	248	220	0.20%	-1.90%
Middle East	454	860	887	821	743	677	609	545	0.20%	-1.90%
Africa	398	448	425	388	344	301	261	223	-0.40%	-2.40%
Central and South America	314	307	311	288	273	252	230	209	0.10%	-1.50%
Brazil	214	215	231	227	216	201	186	174	0.50%	-1.10%
Other	393	388	374	332	313	285	259	230	-0.30%	-1.80%
Total World	713	621	492	427	384	344	309	278	1.60%	2.10%

Sources: 1980-2004: Energy Information Administration (EIA), International Energy Annual 2004 (May-July 2006), web site www.eia.doe.gov/iea. 2010-2030: EIA, System for the Analysis of Global Energy Markets (2007).

Note: GDP is expressed in terms of purchasing power parity.

(lakh M.T.)

Year	Consumption				Production				Imports			
	N	P	K	Total	N	P	K	Total	N	P	K	Total
1981-82		13.2					0.0		10.5			
1982-83	40.69	2	6.73	60.64	31.44	9.49	0	40.93	4	3.43	6.44	20.41
1983-84	42.24	7	7.27	63.88	34.24	9.80	0	44.04	4.25	0.63	6.44	11.32
1984-85	52.86	7	7.99	77.92	34.85	8	0	45.33	6.56	1.43	5.56	13.55
1985-86	54.87	6	8.38	82.11	39.17	4	0	51.81	8	7.45	8.71	36.24
1986-87	56.61	5	8.08	84.74	43.28	8	0	57.56	0	8.16	9.03	33.99
1987-88	57.16	9	8.50	86.45	54.10	0	0	70.70	3	2.55	9.52	23.10
1988-89	57.17	7	8.80	87.84	54.66	5	0	71.31	1.75	0.00	8.09	9.84
1989-90	72.51	1	8	0	67.12	2	0	89.64	2.19	4.07	9.82	16.08
1990-91	73.86	4	8	8	67.47	6	0	85.43	5.23	1	0	31.14
1991-92	79.97	1	8	6	69.93	2	0	90.45	4.14	6	8	27.58
1992-93	80.46	1	1	8	73.01	2	0	98.63	5.66	9.67	6	27.69
1993-94	84.27	4	8.84	5	74.30	6	0	97.36	7	6.89	2	29.08
1994-95	87.89	9	9.08	6	72.31	6	0	90.47	8	7.22	8.57	31.67
1995-96	95.07	1	5	3	79.45	3	0	104.38	6	3.80	9	29.65
1996-97	98.23	8	6	7	87.77	8	0	113.35	3	6.47	5	39.55
1997-98	103.0	29.7	10.3	143.0	85.99	6	0	111.55	7	2.46	6.13	20.26
1998-99	109.0	39.1	13.7	161.8	100.8	29.7	0.0		13.6		11.4	
1999-00	1	4	3	8	6	6	0	130.62	2	6.72	0	31.74
2000-01	113.5	41.1	13.3	167.9	104.8	31.4	0.0				15.4	
2001-02	4	2	2	8	0	1	0	136.21	6.35	9.68	2	31.45
2002-03	115.9	47.9	16.7	180.6	108.9	33.9	0.0		15.0	17.3		
2003-04	2	9	8	9	0	9	0	142.89	8.33	3	9	40.75
2004-05	109.2	42.1	15.6	167.0	109.6	37.4	0.0				15.4	
	0	5	7	2	1	3	0	147.04	1.54	3.96	1	20.91
2001-02	113.1	43.8	16.6	173.5	107.6	38.6	0.0				17.0	
2002-03	0	2	7	9	8	0	0	146.28	2.69	4.29	1	23.99
2003-04	104.7	40.1	16.0	160.9	105.6	39.1	0.0				14.3	
2004-05	4	9	1	4	4	0	0	144.74	0.66	1.70	8	16.74
2005-06	110.7	41.2	15.9	167.9	106.3	36.3	0.0				15.4	
2006-07	6	4	8	8	4	2	0	142.66	1.32	3.38	8	20.18
2007-08	117.1	46.2	20.6	183.9	113.3	40.6	0.0				20.4	
2008-09	4	4	1	9	8	7	0	154.05	4.09	2.96	5	27.50

2005-	127.2	52.0	24.1	203.4	113.5	42.2	0.0		13.8	11.2	27.4	
06	3	4	3	0	4	1	0	155.75	5	1	7	52.53
2006-					114.5	45.0	0.0	159.61	24.8	12.7	17.7	55.20*
07	N.A.	N.A.	N.A.	N.A.	2	9	0	*	0	0	0	*

Source: Department of Fertiliser, Annual Report 2006-07.

Note: * Production figures for the year 2006-07 are estimated.

** Import figures for the year 2006-07 are reported up to 31.01.2007. N: Nitrogen; P: Phosphate; K: Potassium

Table A3: Estimates of State Level CO₂ Emissions of India

(000 Metric tons of Carbon)

Year	J&K	HP	Punjab	Haryana	UP	Rajasthan	Delhi	Bihar	Orissa	WB
1980	168.29	88.75	2377.12	1258.36	9343.07	1578.61	2791.54	16785.77	3787.62	11499.33
1981	183.15	93.77	3114.93	1651.86	10338.96	1696.24	3113.24	18632.27	3789.09	12501.49
1982	177.70	107.79	3332.82	2009.99	10824.98	2020.46	3673.14	19639.46	3568.06	12753.50
1983	190.05	109.47	3694.72	2207.57	12455.89	2734.82	3657.65	18779.63	4049.46	12313.33
1984	221.24	118.68	4026.68	2817.07	14090.17	3131.88	3890.40	16956.36	4461.80	11663.23
1985	243.01	125.38	5185.40	2788.61	16437.54	2897.46	3772.78	18854.36	4284.94	12848.32
1986	342.01	153.42	5638.13	2860.82	17317.68	3039.37	4559.56	18429.89	4107.03	12742.42
1987	344.31	177.50	6109.50	3229.41	20510.24	3322.36	4696.66	18757.25	5516.50	13307.97
1988	277.55	222.71	5370.01	3192.99	23014.18	3758.98	4881.27	20135.12	6380.52	14190.19
1989	443.32	228.78	6225.66	3698.06	24423.24	4770.77	4727.44	20552.89	7677.80	14268.27
1990	455.46	316.68	6544.86	3307.49	24603.24	4573.60	5090.58	20345.27	8424.19	15175.41
1991	453.78	301.62	6830.78	3983.13	26963.81	5746.56	5500.19	20383.78	9122.22	17909.15
1992	373.20	343.48	7629.28	4625.08	29599.19	5830.91	5696.11	22025.59	9527.44	17197.93
1993	365.88	331.76	8572.63	3786.60	31449.68	6251.62	6101.74	20414.13	9557.16	18439.54
1994	381.16	422.39	8235.86	4262.36	31961.24	6427.45	6288.66	20313.46	10442.74	20435.90
1995	467.81	498.16	8646.74	4068.34	35823.36	7058.52	5691.09	21261.20	12180.41	21432.42
1996	474.93	547.55	9408.62	4901.59	38313.29	7903.29	5625.17	22867.63	12606.97	20984.92
1997	506.74	549.65	10434.64	5007.92	40284.56	7763.89	6143.62	18291.14	14175.73	19212.73
1998	569.95	488.22	9392.09	5532.66	40046.38	7960.23	4018.43	29905.87	13546.24	17753.24
1999	588.90	682.98	11012.55	5250.84	44122.21	7562.35	5129.22	23184.21	15957.24	23457.05
2000	696.69	659.59	10845.54	5460.44	44268.33	8929.33	6033.60	9011.99	16172.23	23363.33

	48	12	72	6	30		84	7	30	71
	377.	312.	6791.8	3614.3	26009.		4813.	20325.	8539.7	16354.
Mean	38	75	5	4	11	4998.03	44	76	8	76
Emission										
Rank of	18	19	10	14	1	12	13	4	9	6
Mean										

J&K: Jammu & Kashmir; HP: Himachal Pradesh; UP: Uttar Pradesh; Raj: Rajasthan; Wb: West Bengal;

Table A3 (contd.): Estimates of State Level CO₂ Emissions of India

(000 Metric tons of Carbon)

Year	Assam	Gujarat	Mah	Goa	MP	AP	Kar	Kerala	TN	Others
1980	589.84	7501.63	10564.23	234.43	9890.58	4940.93	1586.15	946.09	4540.14	12345.52
1981	682.14	8875.51	11166.82	317.32	10501.97	6626.26	1859.93	1011.18	4913.12	11498.67
1982	657.02	9894.43	11534.16	316.48	11656.09	7006.99	1844.65	991.93	5384.90	13708.95
1983	622.91	10570.49	12544.69	338.25	12753.70	8051.43	2208.01	1052.42	5577.67	13480.59
1984	668.75	10705.50	13382.98	335.74	14390.89	8367.49	2376.71	1227.19	6321.76	13590.70
1985	856.71	11536.44	16059.59	382.62	15065.49	9818.61	2754.51	1546.59	7263.85	11827.08
1986	956.76	12442.96	17613.07	406.07	17388.37	11027.98	3508.02	1425.41	7915.64	12888.26
1987	1043.83	13644.80	19243.15	398.53	18206.35	10830.40	3794.35	1539.90	8253.88	12988.62
1988	1252.72	13893.88	19564.25	391.00	21916.93	12329.67	4392.34	1719.70	9424.96	11787.20
1989	1257.11	14355.40	21449.69	409.42	24574.08	13797.34	4265.30	1828.33	9329.52	11095.76
1990	1470.40	15081.90	22660.12	442.07	25945.04	16117.29	4569.42	1697.10	9808.62	10863.01
1991	1329.33	15776.39	24651.46	499.00	27238.76	19429.14	4708.82	2059.20	10550.83	9531.41
1992	1245.81	15840.44	25387.39	503.19	27406.21	20335.24	5104.21	2328.37	12409.68	8079.03
1993	1093.23	16255.28	28229.36	512.40	31345.35	23159.41	5767.29	2344.91	11802.27	8078.20
1994	1134.67	16214.27	29056.75	545.05	33412.05	24102.55	6232.59	2208.24	12298.76	12362.49
1995	1298.35	17375.52	32216.88	589.42	35096.14	27312.28	11423.18	4149.56	12837.53	4424.89
1996	1277.21	17786.82	34255.33	578.54	33988.91	28383.31	7941.59	2628.74	13765.18	13332.01
1997	1078.78	18932.99	34626.23	617.05	35698.32	29787.55	7808.47	2925.33	15663.17	18621.88
1998	923.27	18511.16	33120.79	532.49	33601.08	28364.70	8211.81	2710.80	15384.18	27415.73
1999	1205.10	20066.85	35051.86	642.17	37790.15	29475.08	8504.22	2889.45	15069.19	16203.07
2000	1097.00	18461.46	35595.43	652.22	39279.35	30126.02	9059.61	3034.19	17584.85	43712.56
Mean Emission	1035.28	14463.05	23236.87	459.21	24625.99	17589.98	5139.10	2012.60	10290.46	14182.65
Rank of Mean	16	7	3	17	2	5	11	15	8	..

Mah: Maharashtra; MP: Madhya Pradesh; AP: Andhra Pradesh; Kar: Karnataka; TN: Tamil Nadu.

Source: Ghoshal and Bhattacharyya (2007).

Table A4: Estimated CO₂ Emission of India

('000 metric ton of Carbon)

Year	ORNL Estimates	Alternate Estimates	Index on ORNL Estimates [Base 1980=100]	Index on Alternate Estimates [Base 1980=100]
1980	92060.0	102818.0	100.0	100.0
1981	98167.0	112568.0	106.6	109.5
1982	104246.0	121103.0	113.2	117.8
1983	112913.0	127393.0	122.7	123.9
1984	116208.0	132745.0	126.2	129.1
1985	127151.0	144549.0	138.1	140.6
1986	136776.0	154763.0	148.6	150.5
1987	144873.0	165916.0	157.4	161.4
1988	155917.0	178096.0	169.4	173.2
1989	168741.0	189378.0	183.3	184.2
1990	174918.0	197492.0	190.0	192.1
1991	188203.0	212969.0	204.4	207.1
1992	202114.0	221488.0	219.6	215.4
1993	210579.0	233858.0	228.7	227.5
1994	225921.0	246739.0	245.4	240.0
1995	238450.0	263852.0	259.0	256.6
1996	262786.0	277572.0	285.5	270.0
1997	268128.0	288130.0	291.3	280.2
1998	276821.0	297989.0	300.7	289.8
1999	280853.0	303845.0	305.1	295.5
2000	278432.0	324044.0	302.5	315.2
CAGR [1980- 2000]	5.69	5.91		

Source: Ghoshal and Bhattacharyya (2007).**Note:** CAGR is the compounded annual growth rate.

Table A5: Source-wise Percentage Contribution of CO₂ Estimation by States

States		LPG	Naphtha	MG	Kerosene	HSDO	LDO	FO	LSHS	Coal	Total C
Jammu & Kashmir	1980	0.995	0.000	6.468	13.433	40.796	2.488	0.995	0.000	34.825	100.000
	2000	7.814	0.000	8.415	18.032	29.211	0.601	0.841	0.481	34.605	100.000
Himachal Pradesh	1980	0.943	0.000	4.717	15.094	41.510	0.943	3.774	0.000	33.018	100.000
	2000	6.478	0.000	6.097	6.351	37.346	0.635	2.922	2.159	38.011	100.000
Punjab	1980	0.247	0.000	2.923	5.424	21.027	1.198	7.291	6.727	55.163	100.000
	2000	2.447	0.000	3.227	2.617	16.065	0.278	1.629	4.477	69.260	100.000
Haryana	1980	0.532	0.000	2.196	4.724	20.692	2.329	0.000	1.996	67.531	100.000
	2000	3.511	0.000	3.450	2.913	33.518	0.951	0.000	5.857	49.800	100.000
Uttar Pradesh	1980	0.260	2.536	1.022	3.531	9.956	0.905	2.599	0.000	79.192	100.000
	2000	1.441	2.400	1.106	2.663	8.761	0.320	0.653	0.480	82.176	100.000
Rajasthan	1980	0.265	6.099	2.493	6.789	29.330	2.440	3.394	0.000	49.190	100.000
	2000	2.522	6.151	2.532	4.819	23.994	0.534	1.725	0.375	57.347	100.000
Delhi	1980	1.410	0.000	3.989	3.659	11.307	0.840	3.479	0.000	75.316	100.000
	2000	6.327	0.000	7.882	2.914	16.984	1.082	0.097	0.500	64.214	100.000
Bihar ^a	1980	0.060	0.439	0.304	1.127	2.619	0.339	1.566	0.195	93.351	100.000
	2000	0.575	0.003	0.562	2.889	5.781	0.293	0.844	0.376	88.677	100.000
Orissa	1980	0.066	1.348	0.486	1.636	3.979	0.088	3.272	0.155	88.970	100.000
	2000	0.357	0.248	0.580	1.739	4.023	0.083	1.010	0.005	91.955	100.000
West Bengal	1980	0.138	0.641	0.743	2.920	5.468	0.815	2.716	0.175	86.385	100.000
	2000	1.297	1.559	0.656	2.992	6.819	0.548	1.018	0.000	85.110	100.000
Assam	1980	0.284	0.000	4.258	14.620	22.569	3.123	9.085	3.833	42.228	100.000
	2000	8.548	2.366	5.266	21.218	28.773	0.229	3.587	1.832	28.181	100.000
Gujarat	1980	0.368	5.078	1.362	4.397	7.723	3.281	6.172	11.462	60.156	100.000
	2000	1.950	10.381	2.580	3.914	12.213	0.939	2.576	6.100	59.347	100.000
Maharashtra	1980	1.070	2.988	2.172	6.515	10.889	1.894	8.520	5.207	60.746	100.000
	2000	2.371	2.350	2.209	3.592	9.564	0.774	2.728	2.613	73.800	100.000
Goa	1980	0.357	21.786	3.214	5.000	26.786	1.071	41.786	0.000	0.000	100.000
	2000	4.108	38.383	5.520	3.594	28.626	0.513	19.255	0.000	0.000	100.000
Madhya Pradesh	1980	0.102	0.110	0.457	1.608	4.842	0.068	1.414	0.000	91.399	100.000
	2000	0.616	0.198	0.652	1.358	4.139	0.117	1.089	0.040	91.789	100.000
Andhra Pradesh	1980	0.491	1.169	1.271	5.304	15.115	0.593	3.999	0.000	72.057	100.000
	2000	1.417	1.142	1.348	1.773	9.202	0.106	1.092	0.367	83.553	100.000
Karnataka	1980	0.845	5.384	5.384	12.352	28.293	0.792	9.079	0.000	37.872	100.000
	2000	3.382	1.405	4.002	5.009	19.916	0.240	4.094	1.201	60.751	100.000
Kerala	1980	0.619	16.903	7.788	11.504	31.150	0.973	19.204	5.664	6.195	100.000
	2000	7.588	20.337	9.189	8.444	35.375	0.110	6.595	8.885	3.477	100.000
Tamil Nadu	1980	0.590	8.483	2.158	6.639	18.976	0.959	18.773	0.018	43.404	100.000
	2000	3.066	3.047	2.781	3.461	16.112	0.229	5.285	2.247	63.772	100.000
Others	1980	0.034	-0.258	0.258	0.373	0.902	0.061	0.061	0.007	98.562	100.000
	2000	1.124	6.922	0.383	1.718	1.954	0.094	2.812	0.113	84.880	100.000
All India	1980	0.330	1.893	1.239	3.443	8.424	0.914	4.190	1.684	77.883	100.000
	2000	1.809	3.014	1.706	2.929	9.834	0.370	1.962	1.301	77.076	100.000

Source: Ghoshal and Bhattacharyya (2007). **Note:** LPG: Liquefied Petroleum Gas; MG: Motor Gasoline; HSDO: High Speed Diesel Oil; LDO: Light Diesel Oil; FO: Furnace Oil; LSHS: Low Sulphur Heavy Stock; a: Estimates of Bihar relate to 1999.

Table A6: Estimates of State Level Per Capita CO₂ Emissions of India

(000 Metric Tons of Carbon)

Year	Jammu & Kashmir	Himachal Pradesh	Pun jab	Haryana	Uttar Pradesh	Raja- sthan	Delhi	Bihar	Orissa	West Bengal
1980	0.03	0.02	0.14	0.10	0.09	0.05	0.46	0.24	0.14	0.21
1981	0.03	0.02	0.18	0.13	0.09	0.05	0.49	0.26	0.14	0.23
1982	0.03	0.02	0.19	0.15	0.09	0.06	0.55	0.27	0.13	0.23
1983	0.03	0.02	0.21	0.16	0.11	0.07	0.53	0.25	0.15	0.21
1984	0.03	0.03	0.22	0.20	0.12	0.08	0.54	0.22	0.16	0.20
1985	0.04	0.03	0.28	0.19	0.13	0.07	0.50	0.24	0.15	0.21
1986	0.05	0.03	0.30	0.19	0.14	0.08	0.58	0.23	0.14	0.21
1987	0.05	0.04	0.32	0.21	0.16	0.08	0.57	0.23	0.19	0.21
1988	0.04	0.05	0.28	0.21	0.17	0.09	0.57	0.24	0.21	0.22
1989	0.06	0.05	0.32	0.23	0.18	0.11	0.53	0.24	0.25	0.22
1990	0.06	0.06	0.33	0.20	0.18	0.10	0.55	0.24	0.27	0.23
1991	0.06	0.06	0.33	0.24	0.20	0.13	0.57	0.31	0.28	0.26
1992	0.05	0.06	0.37	0.27	0.22	0.13	0.57	0.33	0.29	0.24
1993	0.04	0.06	0.40	0.22	0.22	0.13	0.58	0.30	0.29	0.26
1994	0.04	0.08	0.38	0.24	0.22	0.13	0.58	0.29	0.31	0.28
1995	0.05	0.09	0.39	0.22	0.24	0.14	0.50	0.30	0.36	0.29
1996	0.05	0.10	0.42	0.26	0.26	0.16	0.48	0.31	0.36	0.28
1997	0.05	0.10	0.46	0.26	0.26	0.15	0.50	0.24	0.40	0.25
1998	0.06	0.08	0.40	0.28	0.25	0.15	0.32	0.39	0.38	0.23
1999	0.06	0.11	0.47	0.26	0.27	0.14	0.39	0.29	0.44	0.30
2000	0.07	0.11	0.45	0.26	0.27	0.16	0.44	0.11	0.44	0.29
Mean	0.05	0.06	0.33	0.21	0.18	0.11	0.51	0.27	0.26	0.24
Rank of Mean	18	17	5	11	12	15	1	7	8	10

Table A6 (contd.): Estimates of State Level Per Capita CO₂ Emissions of India

(000 Metric Tons of Carbon)

Year	Assam	Gujarat	Maha rashtra	Goa	Madhya Pradesh	Andhra Pradesh	Karnataka	Kerala	TM	Others
1980	0.03	0.22	0.17	0.23	0.19	0.09	0.04	0.04	0.09	1.19
1981	0.04	0.26	0.18	0.31	0.20	0.12	0.05	0.04	0.10	1.33
1982	0.04	0.28	0.18	0.30	0.22	0.13	0.05	0.04	0.11	1.52
1983	0.03	0.29	0.19	0.32	0.23	0.14	0.06	0.04	0.11	1.45
1984	0.03	0.29	0.20	0.31	0.25	0.14	0.06	0.05	0.12	1.42
1985	0.04	0.31	0.23	0.35	0.26	0.17	0.07	0.06	0.14	1.18
1986	0.05	0.32	0.25	0.37	0.29	0.18	0.08	0.05	0.15	1.31
1987	0.05	0.35	0.26	0.35	0.30	0.18	0.09	0.05	0.15	1.32
1988	0.06	0.35	0.26	0.34	0.35	0.20	0.10	0.06	0.17	1.08
1989	0.06	0.36	0.28	0.36	0.38	0.21	0.10	0.06	0.17	1.00
1990	0.07	0.37	0.29	0.38	0.40	0.24	0.10	0.06	0.18	0.95
1991	0.06	0.38	0.31	0.39	0.55	0.30	0.10	0.07	0.19	0.15
1992	0.05	0.37	0.31	0.39	0.54	0.30	0.11	0.08	0.22	0.13
1993	0.05	0.37	0.34	0.39	0.61	0.33	0.12	0.08	0.20	0.13
1994	0.05	0.37	0.34	0.41	0.63	0.34	0.13	0.07	0.21	0.20
1995	0.05	0.39	0.37	0.43	0.65	0.38	0.24	0.14	0.22	0.07
1996	0.05	0.39	0.39	0.42	0.62	0.39	0.16	0.09	0.23	0.20
1997	0.04	0.40	0.38	0.44	0.63	0.40	0.16	0.09	0.26	0.28
1998	0.04	0.39	0.36	0.37	0.58	0.38	0.16	0.09	0.25	0.40
1999	0.05	0.41	0.37	0.44	0.64	0.39	0.16	0.09	0.25	0.23
2000	0.04	0.37	0.37	0.44	0.66	0.40	0.17	0.10	0.28	0.62
Mean	0.05	0.34	0.29	0.37	0.44	0.26	0.11	0.07	0.18	0.77
Rank of Mean	19	4	6	3	2	9	14	16	13	..

Source: Ghoshal and Bhattacharyya (2007).

Table A7: Percentage Contribution of CO₂ Emission by Major States of India

Year	Jammu & Kashmir	Himachal Pradesh	Punjab	Haryana	Uttar Pradesh	Rajasthan	Delhi	Bihar	Orissa	West Bengal
1980	0.16	0.09	2.31	1.22	9.09	1.54	2.72	16.33	3.68	11.18
1981	0.16	0.08	2.77	1.47	9.18	1.51	2.77	16.55	3.37	11.11
1982	0.15	0.09	2.75	1.66	8.94	1.67	3.03	16.22	2.95	10.53
1983	0.15	0.09	2.90	1.73	9.78	2.15	2.87	14.74	3.18	9.67
1984	0.17	0.09	3.03	2.12	10.61	2.36	2.93	12.77	3.36	8.79
1985	0.17	0.09	3.59	1.93	11.37	2.00	2.61	13.04	2.96	8.89
1986	0.22	0.10	3.64	1.85	11.19	1.96	2.95	11.91	2.65	8.23
1987	0.21	0.11	3.68	1.95	12.36	2.00	2.83	11.31	3.32	8.02
1988	0.16	0.13	3.02	1.79	12.92	2.11	2.74	11.31	3.58	7.97
1989	0.23	0.12	3.29	1.95	12.90	2.52	2.50	10.85	4.05	7.53
1990	0.23	0.16	3.31	1.67	12.46	2.32	2.58	10.30	4.27	7.68
1991	0.21	0.14	3.21	1.87	12.66	2.70	2.58	9.57	4.28	8.41
1992	0.17	0.16	3.44	2.09	13.36	2.63	2.57	9.94	4.30	7.76
1993	0.16	0.14	3.67	1.62	13.45	2.67	2.61	8.73	4.09	7.88
1994	0.15	0.17	3.34	1.73	12.95	2.60	2.55	8.23	4.23	8.28
1995	0.18	0.19	3.28	1.54	13.58	2.68	2.16	8.06	4.62	8.12
1996	0.17	0.20	3.39	1.77	13.80	2.85	2.03	8.24	4.54	7.56
1997	0.18	0.19	3.62	1.74	13.98	2.69	2.13	6.35	4.92	6.67
1998	0.19	0.16	3.15	1.86	13.44	2.67	1.35	10.0	4.55	5.96

8								4		
199										
9	0.19	0.22	3.62	1.73	14.52	2.49	1.69	7.63	5.25	7.72
200										
0	0.21	0.20	3.35	1.69	13.66	2.76	1.86	2.78	4.99	7.21

Table A7 (Contd.): Percentage Contribution of CO₂ Emission by Major States of India

Year	Assam	Gujarat	Maha rashtra	Goa	Madhya Pradesh	Andhra Pradesh	Karna taka	Kerala	Tamil Nadu	Others	Total
1980	0.57	7.30	10.27	0.23	9.62	4.81	1.54	0.92	4.42	12.01	100.00
1981	0.61	7.88	9.92	0.28	9.33	5.89	1.65	0.90	4.36	10.21	100.00
1982	0.54	8.17	9.52	0.26	9.62	5.79	1.52	0.82	4.45	11.32	100.00
1983	0.49	8.30	9.85	0.27	10.01	6.32	1.73	0.83	4.38	10.58	100.00
1984	0.50	8.06	10.08	0.25	10.84	6.30	1.79	0.92	4.76	10.24	100.00
1985	0.59	7.98	11.11	0.26	10.42	6.79	1.91	1.07	5.03	8.18	100.00
1986	0.62	8.04	11.38	0.26	11.24	7.13	2.27	0.92	5.11	8.33	100.00
1987	0.63	8.22	11.60	0.24	10.97	6.53	2.29	0.93	4.97	7.83	100.00
1988	0.70	7.80	10.99	0.22	12.31	6.92	2.47	0.97	5.29	6.62	100.00
1989	0.66	7.58	11.33	0.22	12.98	7.29	2.25	0.97	4.93	5.86	100.00
1990	0.74	7.64	11.47	0.22	13.14	8.16	2.31	0.86	4.97	5.50	100.00
1991	0.62	7.41	11.58	0.23	12.79	9.12	2.21	0.97	4.95	4.48	100.00
1992	0.56	7.15	11.46	0.23	12.37	9.18	2.30	1.05	5.60	3.65	100.00
1993	0.47	6.95	12.07	0.22	13.40	9.90	2.47	1.00	5.05	3.45	100.00
1994	0.46	6.57	11.78	0.22	13.54	9.77	2.53	0.89	4.98	5.01	100.00
1995	0.49	6.59	12.21	0.22	13.30	10.35	4.33	1.57	4.87	1.68	100.00
1996	0.46	6.41	12.34	0.21	12.25	10.23	2.86	0.95	4.96	4.80	100.00
1997	0.37	6.57	12.02	0.21	12.39	10.34	2.71	1.02	5.44	6.46	100.00
1998	0.31	6.21	11.11	0.18	11.28	9.52	2.76	0.91	5.16	9.20	100.00
1999	0.40	6.60	11.54	0.21	12.44	9.70	2.80	0.95	4.96	5.33	100.00
2000	0.34	5.70	10.98	0.20	12.12	9.30	2.80	0.94	5.43	13.49	100.00

Source: Ghoshal and Bhattacharyya (2007).

Table A8: National Ambient Air Quality Standards

Pollutant	Sulphur Dioxide(SO ₂)		Oxides of Nitrogen (NO ₂)		Suspended Particulate Matter (SPM)			
Time Weighted Average	Annual * Average (µg/m ³)	24 hours* * Average (µg/m ³)	Annual * Average (µg/m ³)	24 hours* * Average (µg/m ³)	Annual * Average (µg/m ³)	24 hours* * Average (µg/m ³)		
Industrial Area	80	120	80	120	360	500		
Residential, Rural and Other Area	60	80	60	80	140	200		
Sensitive Area	15	30	15	30	70	100		
Methods of Measurement	1. Improved West & Gaeke Method. 2. Ultraviolet Fluorescence		1. Jacob & Hochheiser Modified (Na-arsenic) Method 2. Gas Phase Chemiluminiscence		High Volume sampling (Average flow rate not less than 1.1 m ³ /minute)			
	Respirable Particular Matter (RPM) (size less than 10 µm)	Lead	Carbon Monoxide (CO)		Ammonia #			
Time Weighted Average	Annual * Average (µg/m ³)	24 hours* * Average (µg/m ³)	Annual * Average (µg/m ³)	24 hours* * Average (µg/m ³)	8 hours* * Average (µg/m ³)	1 hours Average (µg/m ³)	Annual * Average (µg/m ³)	24 hours* * Average (µg/m ³)
Industrial Area	120	150	1.00	1.50	5.00	10.00	0.10	0.40
Residential, Rural and Other Area	60	100	0.75	1.00	2.00	4.00	0.10	0.40
Sensitive Area	50	75	0.50	0.75	1.00	2.00	0.10	0.40
Methods of Measurement	Respirable particulate matter Sampler		AAS Method after sampling using EPM 2000 or equivalent filter paper		Non-dispersive infra-red Spectroscopy			

Source: Central Pollution Control Board.

*: Annual Arithmetic 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 percent of the time in a year. However 2

percent 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. µm: Micrometer

- 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 H₂s and CS₂ have been notified separately vide GSR No. 7, dated December 22, 1998 under Rayon Industry.

Table A9: Number of Motor Vehicles Registered in India (Taxed and Tax-exempted): 2002-03

Year/ State/UT	Two- Wheelers	Auto- Ricksha ws	Jeeps	Cars	Taxis	Buses	Goods Vehicle s #	Miscell aneous #	Total No. of Vehicles
Andhra Pradesh	3985049	245935	54631	312096	66200	46524	182889	108299	5001623
Arunachal Pradesh	10605	1430	2260	2340	299	665	2878	667	21144
Assam	372825	24886	13861	95063	9646	9702	92394	38286	656663
Bihar	709213	66316	@	61832	21149	15493	64919	182476	1121398
Chhattisgarh	881248	6593	7127	34365	18979	1900	51511	74328	1076051
Goa	280787	8975	@	64735	7720	4504	26586	4139	397446
Gujarat	4702529	275740	104263	504801	36917	45519	362572	476029	6508370
Haryana	1356957	33258	69692	238816	12752	8091	175269	383654	2278489
Himachal Pradesh	149286	2611	8777	34472	13909	5213	38175	15902	268345
Jammu & Kashmir	230577	13808	10579	64307	8918	19253	39338	11702	398482
Jharkhand	844973	33261	21756	82907	20256	9098	60601	28264	1101116
Karnataka	2527674	187262	40944	405621	36939	65692	183509	290760	3738401
Kerala	1449154	276244	70864	336540	108503	88868	193061	28937	2552171
Madhya Pradesh	2600989	43055	35111	134045	54949	23895	99688	467256	3458988
Maharashtra	5587662	463550	244025	831261	94920	64384	456355	391680	8133837
Manipur	68975	2395	7474	6560	357	2808	6829	1948	97346
Meghalaya	21050	2934	9401	14595	5030	2827	14028	3517	73382
Mizoram	16941	858	6622	4146	3343	794	3948	552	37204
Nagaland	44401	11279	35831	36328	3316	4855	45510	15213	196733
Orissa	1074873	19667	28986	59296	14870	15939	77692	67263	1358586
Punjab	2414928	34442	29791	239210	11180	17601	105508	454944	3307604
Rajasthan	2429892	59125	120685	179969	27989	53036	166576	449407	3486679
Sikkim	4441	..	2473	1176	4064	287	1714	4	14159
Tamil Nadu	6260093	147087	53142	690271	110080	91068	458290	194951	8004982
Tripura	32634	7901	1344	4954	1375	1985	5775	1460	57428
Uttaranchal	346784	6222	6238	34877	12486	4653	12976	33218	457454
Uttar Pradesh	4488426	74692	86035	326604	29522	40994	143296	738826	5928395
West Bengal	1429818	42362	@	482429	63390	35226	239166	74025	2366416
Union Territory									
A & N Islands	21743	784	1033	1693	436	459	1519	789	28456
Chandigarh	399797	..	..	148959	1173	1309	10503	34	561775
Dadra & Nagar Haveli	15435	470	410	8356	102	144	6288	49	31254
Daman & Diu	28031	782	156	11356	42	328	3410	280	44385
Delhi	2517788	15567	118545	1096148	23145	39593	145781	14303	3970870
Lakshadweep	3656	402	83	17	..	5	224	537	4924
Pondicherry	215927	4775	3919	47180	1682	4397	8760	5836	292476

INDIA	4752516	2114668	119605	659732	82563	72710	348753	455953	6703303
	1		8	5	8	9	8	5	2

Source: Transport Research Wing, Ministry of Road Transport and Highways (2003).

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

Table A10: Summary Status of Pollution Control in 17 Categories of Industries

(As on 31-03-2004)

Sl. No.	Category	Total No. of Units	Status (No. of Units)		
			Closed	Comply #	Defaulter
1	Aluminium	7	1	6	0
2	Caustic	33	0	33	0
3	Cement	205	17	182	6
4	Copper	4	0	4	0
5	Distillery	209	39	167	3
6	Dyes & Dying Industries	102	10	90	2
7	Fertilizer	124	13	109	2
8	Iron and Steel	19	1	14	4
9	Leather	94	15	75	4
10	Pesticide	111	8	102	1
11	Petrochemicals	75	0	74	1
12	Pharmaceuticals	401	41	350	10
13	Pulp & Paper	136	26	108	2
14	Refinery	16	0	16	0
15	Sugar	462	50	409	3
16	TPP	151	3	133	15
17	Zinc	6	1	5	0
Total		2155	225	1877	53

Source: Ministry of Environment and Forests, Annual Report 2003-2004.

: Having adequate facilities to comply with the standards.

Table A11: State-wise Consumption of Pesticides

(Mts Technical Grade)

S. N.	Name of State/ U.Ts	2000-01	2001-02	2002-03	2003-04	2004-05 (P)
1	Andhra Pradesh	4000	3850	3706	2034	2133
2	Arunachal Pradesh	13	17	15	147	17
3	Assam	245	237	181	175	170
4	Bihar	853	890	1010	860	850
5	Chhattisgarh	NA	NA	NA	332	486
6	Goa	6	5	5	5	5
7	Gujarat	2822	4100	4500	4000	2900
8	Haryana	5025	5020	5012	4730	4520
9	Himachal Pradesh	302	311	380	360	310
10	Jammu & Kashmir	1	4	98	9	12
11	Jharkhand	150	36	40	56	69
12	Karnataka	2020	2500	2700	1692	2200
13	Kerala	754	1345	902	326	360
14	Madhya Pradesh	871	714	1026	662	749
15	Maharashtra	3239	3135	3725	3385	3030
16	Manipur	20	14	19	25	26
17	Meghalaya	6	6	6	6	8
18	Mizoram	8	26	15	15	25
19	Nagaland	8	7	7	7	5
20	Orissa	1006	1018	1134	682	692
21	Punjab	7005	7200	7200	6780	6900
22	Rajasthan	3040	4628	3200	2303	1628
23	Sikkim	4	2	3	3	-
24	Tamil Nadu	1668	1576	3346	1434	2466
25	Tripura	11	16	88	118	17
26	Uttar Pradesh	7023	6951	6775	6710	6855
27	Uttaranchal	99	105	129	147	132
28	West Bengal	3250	3180	3000	3900	4000
29	Andaman & Nicobar Islands	3	2	3	6	3
30	Chandigarh	2	1	1	1	1
31	Delhi	55	58	60	56	53
32	Dadra & Nagar Haveli	6	4	5	5	5
33	Daman and Diu	2	2	1	1	1
34	Lakshadweep	2	2	2	2	2
35	Pondicherry	65	58	57	46	42
All-India		43584	47020	48350	41020	40672

Source: Directorate of Plant Protection Quarantine & Storage, Ministry of Agriculture.

P: Provisional

Table A12: Centre's Gross Tax Revenues: 1993-94 to 2006-07

(Rs. crore)

Taxes	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00
Gross tax revenue	75743	92294	111224	128762	139221	143797	171752
Corporation tax	10060	13822	16487	18567	20016	24529	30692
Income tax	9123	12025	15592	18231	17097	20240	25654
Customs	22193	26789	35757	42851	40193	40668	48420
Union excise duties	31697	37347	40187	45008	47962	53246	61902
Service tax	0	407	862	1059	1586	1957	2128
Other taxes	2670	1904	2339	3046	12367	3157	2956
Taxes	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Gross tax revenue	188603	187060	216266	254348	304958	366152	467848
Corporation tax	35696	36609	46172	63562	82680	101277	146497
Income tax	31764	32004	36866	41387	49268	63629	82510
Customs	47542	40268	44852	48629	57611	65067	81800
Union excise duties	68526	72555	82310	90774	99125	111226	117266
Service tax	2613	3302	4122	7891	14200	23055	38169
Other taxes	2462	2322	1944	2105	2074	1898	1606

Source (Basic Data): Union Budget 2007-08 and various issues.

**Table A13: Sectoral Shares in Gross State Domestic Product at
Current Prices: 1993-94 to 2005-06**

Sectors	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Andhra Pradesh												
Primary	35.73	35.09	34.89	34.96	31.44	34.37	32.56	33.27	31.88	29.10	30.08	28.93
Secondary	21.92	22.97	22.80	22.34	23.74	22.29	22.19	20.98	21.15	22.52	21.87	22.24
Tertiary	42.35	41.94	42.31	42.70	44.82	43.34	45.26	45.75	46.97	48.38	48.05	48.83
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Assam												
Primary	46.87	47.64	46.28	43.17	45.50	45.41	46.68	42.06	40.76	40.66	39.42	38.36
Secondary	14.93	15.45	15.15	15.88	16.59	16.32	14.28	15.89	14.06	14.94	16.42	17.85
Tertiary	38.20	36.91	38.57	40.95	37.90	38.28	39.04	42.05	45.19	44.40	44.16	43.79
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Bihar												
Primary	48.78	49.17	44.27	48.03	42.19	44.71	39.37	39.68	38.28	39.28	36.04	36.00
Secondary	9.93	8.72	10.02	8.71	11.40	8.97	11.42	10.55	9.95	10.43	11.72	11.60
Tertiary	41.29	42.11	45.71	43.27	46.41	46.32	49.21	49.77	51.78	50.29	52.24	52.41
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Gujarat												
Primary	25.46	28.79	22.97	26.58	24.96	24.82	18.77	17.60	19.09	17.85	21.93	19.05
Secondary	35.77	35.34	39.49	38.31	37.17	37.30	39.39	37.91	36.94	38.88	37.18	38.37
Tertiary	38.77	35.87	37.54	35.11	37.88	37.88	41.84	44.49	43.98	43.27	40.89	42.58
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Haryana												
Primary	42.44	41.31	36.91	37.95	35.08	34.81	32.88	31.10	28.59	26.85	26.72	24.98
Secondary	26.24	27.83	31.44	29.77	30.90	29.85	29.56	29.15	30.20	30.87	30.74	31.07
Tertiary	31.32	30.85	31.65	32.27	34.02	35.33	37.56	39.75	41.22	42.28	42.54	43.95
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Karnataka												
Primary	36.32	34.54	33.50	33.14	30.15	29.89	29.85	28.97	23.86	21.59	17.78	18.22
Secondary	25.40	26.36	26.26	25.68	26.88	27.62	25.55	24.56	26.47	27.44	28.63	27.28
Tertiary	38.27	39.10	40.24	41.17	42.97	42.49	44.60	46.47	49.67	50.97	53.59	54.50
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Kerala												
Primary	30.58	30.76	30.65	29.91	27.01	25.02	24.96	21.32	18.96	18.88	17.75	16.33
Secondary	20.62	21.07	21.54	21.26	21.84	22.86	21.12	22.16	21.90	22.49	23.05	22.97
Tertiary	48.80	48.18	47.81	48.83	51.16	52.12	53.92	56.52	59.14	58.63	59.20	60.69
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Madhya Pradesh												
Primary	43.19	40.27	38.92	39.64	38.50	38.63	37.28	31.23	34.79	31.73	36.81	34.84
Secondary	21.15	23.88	24.41	23.31	23.69	23.34	25.34	27.91	25.24	24.93	22.82	23.93
Tertiary	35.66	35.85	36.67	37.05	37.81	38.03	37.39	40.86	39.97	43.34	40.37	41.23
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Maharashtra												
Primary	20.16	19.72	18.18	21.46	17.16	17.04	16.72	16.25	15.95	14.26	12.96	12.13
Secondary	32.77	32.50	33.69	32.59	34.75	31.57	29.89	27.70	26.83	26.79	28.35	28.99
Tertiary	47.07	47.77	48.14	45.95	48.09	51.38	53.39	56.05	57.21	58.94	58.69	58.88
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

**Table A13 (contd.): Sectoral Shares in Gross State Domestic Product at
Current Prices: 1993-94 to 2005-06**

Sectors	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Orissa												
Primary	44.95	43.91	46.27	43.36	45.78	43.76	39.48	37.20	38.68	38.35	39.81	37.66
Secondary	19.78	21.07	19.82	19.01	17.91	19.32	22.23	21.06	19.54	17.57	20.06	21.41
Tertiary	35.27	35.02	33.91	37.63	36.31	36.92	38.31	41.74	41.78	44.08	40.13	40.93
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Punjab												
Primary	46.13	45.01	43.12	44.05	42.08	40.32	41.50	40.96	39.73	37.12	36.85	36.47
Secondary	21.76	22.57	24.11	22.68	23.25	24.91	23.20	23.62	23.38	24.01	23.82	23.78
Tertiary	32.10	32.42	32.77	33.27	34.67	34.77	35.31	35.42	36.89	38.87	39.33	39.76
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Rajasthan												
Primary	36.27	37.12	35.87	38.69	36.27	35.90	32.05	28.36	29.74	22.40	30.22	26.72
Secondary	24.96	26.30	27.18	24.86	26.40	25.74	28.54	28.09	27.03	30.26	26.46	28.70
Tertiary	38.77	36.58	36.95	36.45	37.33	38.36	39.41	43.55	43.23	47.33	43.32	44.57
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Tamil Nadu												
Primary	24.79	23.22	20.02	19.87	20.44	20.16	17.49	16.89	16.79	13.09	12.46	13.07
Secondary	33.69	34.84	35.57	33.87	31.11	30.62	31.91	31.70	29.04	30.37	28.90	28.53
Tertiary	41.52	41.94	44.40	46.26	48.44	50.37	52.08	52.60	55.15	57.41	59.50	49.95
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Uttar Pradesh												
Primary	39.80	38.77	37.34	37.52	35.83	36.33	36.90	36.20	35.32	35.24	35.23	34.39
Secondary	21.45	23.19	23.72	23.96	23.95	24.24	23.53	21.70	21.31	21.78	21.94	21.92
Tertiary	38.75	38.04	38.94	38.52	40.22	39.43	39.57	42.10	43.37	42.98	42.83	43.69
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
West Bengal												
Primary	33.84	34.85	34.12	34.92	36.03	35.09	32.89	30.92	30.38	27.84	27.09	25.20
Secondary	23.02	21.74	22.48	21.31	20.37	19.90	19.27	19.63	19.48	19.41	20.15	20.55
Tertiary	43.14	43.41	43.41	43.76	43.60	45.01	47.84	49.45	50.15	52.75	52.76	54.25
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
15 States												
Primary	33.63	33.21	31.19	32.35	30.35	30.48	28.80	27.56	26.92	24.70	25.06	23.73
Secondary	25.65	26.36	27.46	26.53	26.91	26.17	26.08	25.22	24.65	25.40	25.45	25.87
Tertiary	40.71	40.43	41.34	41.12	42.74	43.35	45.12	47.21	48.43	49.90	49.48	50.40
GSDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table A14: Inter-state Share of Taxes

(Percent)

State/Taxes	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Andhra Pradesh												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	5.8	7.4	7.9	8.9	6.3	6.2	6.6	6.4	7.0	7.9	8.1	8.5
State excise	19.8	10.5	1.9	1.3	12.5	11.6	11.5	11.8	14.3	14.7	13.9	12.9
Sales tax	60.6	66.9	71.7	72.2	66.5	66.0	68.5	69.2	67.0	66.0	66.5	67.9
Taxes on vehicles	7.8	8.4	11.2	11.3	8.9	8.7	8.1	7.9	8.1	7.4	7.7	7.2
Other taxes	5.9	6.8	7.3	6.2	5.8	7.5	5.3	4.7	3.6	4.0	3.8	3.5
Arunachal Pradesh												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	2.4	1.3	4.2	4.4	4.3	4.4	3.2	1.2	0.9	5.6	0.7	0.9
State excise	39.9	57.1	58.5	57.4	56.5	67.1	72.6	43.7	34.1	38.3	35.3	35.5
Sales tax	19.2	8.8	4.4	4.7	3.2	2.5	2.5	39.7	54.3	47.3	49.8	56.4
Taxes on vehicles	18.3	14.5	12.9	12.8	9.9	9.0	8.1	5.4	5.2	4.7	4.6	4.4
Other taxes	20.3	18.4	20.0	20.8	26.1	17.0	13.6	9.9	5.5	4.1	9.6	2.8
Assam												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	2.6	2.9	3.0	2.9	2.8	3.0	2.9	2.7	2.7	2.6	3.0	2.7
State excise	3.8	4.2	4.1	3.8	8.8	10.2	9.6	9.8	9.7	6.3	6.2	5.3
Sales tax	60.2	64.5	66.1	67.5	57.6	56.0	60.6	65.1	68.9	74.5	74.9	77.3
Taxes on vehicles	4.8	6.0	5.7	6.8	4.9	4.2	5.6	5.2	6.0	6.0	6.0	5.0
Other taxes	28.7	22.4	21.1	19.0	25.9	26.6	21.3	17.2	12.7	10.6	9.9	9.7
Bihar												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	11.0	9.2	10.5	10.1	10.5	10.4	10.6	10.7	13.1	12.6	14.4	12.8
State excise	8.8	8.7	9.3	9.7	9.4	8.9	9.0	8.6	10.3	8.8	8.3	8.1
Sales tax	67.2	67.1	66.6	66.5	65.3	67.9	67.0	64.8	60.9	59.7	56.7	56.5
Taxes on vehicles	7.2	9.2	8.0	7.1	7.3	6.2	5.8	8.0	6.1	6.4	7.3	6.4
Other taxes	5.8	5.8	5.7	6.6	7.4	6.6	7.6	7.8	9.5	12.5	13.3	16.2
Goa												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	5.0	5.8	6.6	5.6	4.5	4.6	4.0	4.3	4.6	4.4	4.1	4.2
State excise	11.2	11.5	9.9	8.8	8.8	9.8	7.9	7.6	8.1	7.8	7.5	6.5
Sales tax	72.2	70.5	71.2	72.8	70.7	71.2	75.9	75.3	70.5	72.9	70.7	66.2
Taxes on vehicles	4.5	4.6	4.6	5.0	8.5	6.8	6.2	5.8	5.8	6.1	7.1	6.9
Other taxes	7.1	7.6	7.7	7.8	7.5	7.5	6.1	7.0	11.0	8.8	10.5	16.3
Gujarat												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	5.3	5.7	6.7	6.6	6.2	6.6	6.4	5.9	5.8	6.8	7.4	7.4
State excise	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.4
Sales tax	70.3	67.2	67.5	66.4	66.8	63.0	62.9	65.7	63.4	65.7	64.2	64.1
Taxes on vehicles	4.4	4.4	5.7	5.5	6.0	6.0	7.4	6.9	7.3	8.5	8.4	8.2
Other taxes	19.5	22.3	19.7	21.1	20.6	24.0	22.9	21.0	22.9	18.5	19.7	19.9

Chapter 1

INTRODUCTION

The Indian economy has been growing at an average rate of more than eight and a half percent since 2003-04. With economic growth, the rate at which pollution is increasing has also increased. The implications of growth for pollution depend largely on the changing structure of the economy and the inter-state spread of growth. Since the pace of industrialization and economic growth are different across states, the extent of pollution is also different across states. Until now pollution control measures in India have largely been regulatory in nature. Given the rapid pace of industrialization as also the international practices, regulatory measures need to be complemented by market based instruments, particularly environmental or eco-taxes. Given India's federal structure and the heterogeneous pattern of pollution in the states, it would be ideal to design interventions based on central taxes as well as state taxes.

The present study focuses largely on state taxes and complements an earlier study on eco-taxation in India undertaken by the Madras School of Economics (MSE, 2007). In that study, the feasibility of incentive based environment instruments were examined, particularly with respect to the central taxes. The following industries were studied in detail: coal, automobiles, chlorine used in pulp and paper and viscose rayon industries, phosphate based detergents, chemical pesticides and bio-pesticides, fertilisers, lead acid batteries, and plastics. However, since in India's federal system taxation powers have been divided between the central and the state governments, a more comprehensive approach to eco- taxation requires a study of state taxes also.

1.1 Global Pollution Trends and Position of India

In recent years, there has been a growing level of concern that anthropogenic (i.e., caused by human activities) emissions of carbon dioxide and other so-called "greenhouse gases" are contributing to "global warming." (Greenhouse gases also include: methane; nitrous oxide; chlorofluorocarbons and related compounds; non-methane volatile organic compounds; and water vapor). As a result of this concern, interest has risen regarding possible cost-effective options to help reduce greenhouse gas emissions without compromising the growth impulses of a developing economy like India. Interest has focused primarily on limiting the burning of fossil fuels, which releases carbon (mainly in the form of carbon dioxide) into the atmosphere.

Table A14 (contd.): Inter-state Share of Taxes

(Percent)

State/Taxes	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Haryana												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	7.5	8.7	11.3	12.7	12.7	9.4	8.8	9.7	9.8	9.8	11.0	9.8
State excise	27.2	28.0	25.5	3.0	2.1	24.8	21.8	19.5	17.6	15.8	14.5	13.6
Sales tax	48.4	47.1	48.7	64.4	65.6	51.3	55.9	59.7	59.2	60.1	60.5	64.0
Taxes on vehicles	3.3	2.4	2.4	2.9	2.8	2.3	2.4	2.0	2.1	2.1	2.1	1.9
Other taxes	13.6	13.7	12.1	17.0	16.8	12.2	11.1	9.1	11.3	12.2	12.0	10.7
Himachal Pradesh												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	4.0	4.0	4.0	3.7	3.9	3.8	4.0	4.0	3.7	4.2	5.3	6.0
State excise	32.7	31.6	30.9	32.1	33.5	32.4	32.0	28.7	25.8	30.8	28.5	24.0
Sales tax	36.7	35.8	36.0	35.5	35.9	34.4	37.6	41.5	38.8	43.2	44.4	43.3
Taxes on vehicles	4.5	3.7	3.6	3.5	3.3	3.1	4.6	8.4	14.5	9.2	8.0	8.6
Other taxes	22.1	24.9	25.5	25.1	23.3	26.4	21.8	17.4	17.2	12.6	13.9	18.1
Jammu and Kashmir												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	3.1	2.4	2.1	2.9	3.1	2.8	2.6	2.8	3.1	2.5	2.9	2.9
State excise	50.9	50.9	50.1	46.0	44.0	47.2	47.6	40.1	19.3	21.4	17.5	20.2
Sales tax	38.6	38.5	38.5	40.6	39.3	41.3	40.9	47.9	47.7	51.6	57.4	59.5
Taxes on vehicles	3.2	3.7	4.2	4.0	4.0	4.2	3.8	3.1	3.3	3.2	3.3	3.1
Other taxes	4.3	4.4	5.2	6.6	9.6	4.6	5.1	6.0	26.6	21.3	19.0	14.3
Karnataka												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	6.3	8.7	10.2	8.5	9.5	7.9	7.3	7.1	8.7	10.7	10.8	11.2
State excise	16.8	16.6	15.6	14.6	13.5	14.5	15.7	16.8	20.1	20.1	18.6	17.8
Sales tax	59.8	58.4	56.0	60.9	59.7	61.4	60.5	59.6	53.5	52.4	52.9	55.2
Taxes on vehicles	6.8	6.8	8.6	5.6	6.9	5.6	5.8	5.5	7.2	6.5	6.4	6.2
Other taxes	10.4	9.5	9.6	10.4	10.4	10.6	10.7	11.0	10.5	10.4	11.4	9.6
Kerala												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	9.8	10.6	10.5	9.2	7.4	6.5	5.4	5.8	6.7	6.7	6.8	8.6
State excise	14.1	12.6	13.3	10.7	12.1	11.4	11.4	11.7	9.1	9.1	8.1	8.3
Sales tax	65.4	66.6	67.6	71.1	68.5	72.4	74.2	74.0	75.0	73.2	74.1	74.8
Taxes on vehicles	6.4	6.6	6.6	6.4	6.7	7.0	7.3	6.7	7.6	7.0	7.2	6.8
Other taxes	4.2	3.6	2.1	2.6	5.3	2.8	1.7	1.7	1.6	4.1	3.8	1.5
Madhya Pradesh												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	7.1	7.9	7.8	7.8	7.9	7.8	8.1	8.5	9.5	8.7	9.1	10.1
State excise	18.7	19.3	17.5	18.1	18.5	18.9	18.5	17.3	15.1	14.4	16.0	15.3
Sales tax	45.3	45.6	43.2	42.2	45.0	45.0	44.1	49.1	50.5	47.1	48.5	50.3
Taxes on vehicles	7.8	8.1	8.8	8.2	8.1	7.5	6.9	7.2	8.4	7.0	6.7	6.3
Other taxes	21.0	19.1	22.7	23.7	20.4	20.8	22.3	18.0	16.6	22.8	19.7	17.9

Table A14 (contd.): Inter-state Share of Taxes

(Percent)

State/Taxes	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Maharashtra												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	8.0	11.8	11.3	10.9	12.3	11.3	11.2	11.2	11.5	12.4	13.3	13.5
State excise	11.7	10.0	9.8	9.1	12.0	12.3	10.9	9.0	8.4	8.5	9.2	7.2
Sales tax	61.6	60.9	62.6	62.2	57.0	56.8	60.9	61.8	57.0	59.2	60.9	61.5
Taxes on vehicles	3.5	3.6	3.9	5.2	5.5	4.5	4.1	4.0	4.5	4.1	4.8	3.8
Other taxes	15.2	13.7	12.4	12.5	13.1	15.1	12.9	14.0	18.7	15.8	11.7	14.0
Manipur												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	4.5	4.1	4.1	4.5	4.0	4.0	3.7	3.7	2.9	2.9	3.4	2.7
State excise	4.4	3.9	5.7	5.8	5.2	5.9	3.5	2.5	2.9	3.5	4.3	3.7
Sales tax	57.1	59.1	63.2	61.9	67.1	63.2	57.3	63.8	57.9	66.3	67.6	67.2
Taxes on vehicles	7.0	10.6	4.8	4.3	3.9	3.6	5.8	5.7	5.4	5.3	5.0	4.1
Other taxes	27.0	22.2	22.2	23.6	19.8	23.3	29.8	24.3	30.9	22.0	19.7	22.2
Meghalaya												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	2.0	1.7	2.1	1.5	2.8	2.6	2.6	2.5	2.6	2.0	1.9	2.2
State excise	43.3	36.6	39.5	40.4	38.2	37.0	38.4	34.6	30.7	31.0	29.7	30.2
Sales tax	41.1	48.3	44.4	40.6	50.1	52.0	52.0	54.6	59.5	60.2	62.0	60.7
Taxes on vehicles	5.2	4.4	4.7	3.8	4.0	3.3	3.7	3.9	3.5	3.2	3.1	3.6
Other taxes	8.4	9.0	9.3	13.7	4.8	5.2	3.4	4.3	3.8	3.6	3.3	3.3
Mizoram												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	0.6	1.7	0.7	0.4	0.8	1.0	0.7	0.5	0.4	0.3	0.4	0.3
State excise	16.7	10.7	14.3	13.3	11.6	9.8	8.7	6.7	7.1	4.6	4.0	3.5
Sales tax	30.5	27.0	27.6	29.8	31.9	31.2	33.6	42.0	51.5	65.1	68.9	71.0
Taxes on vehicles	12.1	13.7	13.6	13.9	16.9	16.6	17.1	14.0	11.0	9.2	10.0	9.6
Other taxes	40.2	46.8	43.7	42.6	38.8	41.4	39.9	36.9	30.0	20.9	16.7	15.6
Nagaland												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	1.1	1.1	7.5	17.7	11.6	6.3	4.7	3.8	1.7	0.9	1.0	0.9
State excise	5.6	6.3	6.8	6.1	6.7	6.2	4.4	3.8	3.4	3.2	2.9	2.6
Sales tax	60.9	56.8	52.9	49.6	52.3	52.7	58.3	59.0	62.9	66.4	66.6	67.8
Taxes on vehicles	15.3	13.2	12.5	11.9	12.2	14.3	11.6	11.4	9.8	7.6	8.7	9.3
Other taxes	17.2	22.6	20.3	14.7	17.2	20.5	21.0	21.9	22.2	21.9	20.8	19.3
Orissa												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	5.6	5.8	5.6	5.1	5.4	5.9	6.0	5.0	4.4	4.7	4.6	4.7
State excise	8.9	6.4	6.5	6.8	7.4	7.4	6.7	6.2	8.0	8.6	7.8	7.3
Sales tax	59.8	62.7	63.5	66.6	65.1	65.3	65.0	61.5	56.8	55.9	56.5	59.2
Taxes on vehicles	10.1	10.3	9.5	9.6	10.0	9.6	9.1	8.2	8.8	9.0	8.5	8.1
Other taxes	15.7	14.8	14.8	12.0	12.1	11.8	13.2	19.2	21.9	21.8	22.7	20.7

Table A14 (contd.): Inter-state Share of Taxes

(Percent)

State/Taxes	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Punjab												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	8.1	9.4	8.6	6.7	7.7	7.9	8.2	8.7	9.2	9.8	11.9	13.9
State excise	35.6	34.0	35.6	36.6	37.6	36.9	31.2	27.1	28.0	25.0	23.8	21.4
Sales tax	44.7	46.0	44.6	46.2	46.0	45.7	50.1	54.0	55.7	53.8	53.8	55.0
Taxes on vehicles	6.6	6.9	7.2	7.1	7.1	8.2	8.1	6.9	6.6	7.8	6.3	5.8
Other taxes	5.0	3.7	4.0	3.4	1.7	1.3	2.3	3.3	0.5	3.6	4.2	3.9
Rajasthan												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	7.2	7.9	8.4	8.8	8.6	8.7	8.3	8.2	8.4	8.2	8.4	9.7
State excise	23.6	24.2	25.8	25.1	25.6	25.1	21.2	21.1	19.6	18.3	16.1	15.2
Sales tax	54.3	51.3	51.3	51.2	50.6	52.3	53.5	53.2	54.1	55.0	55.0	57.0
Taxes on vehicles	9.3	10.1	9.0	8.9	9.6	9.2	10.1	9.6	10.0	10.3	12.5	9.7
Other taxes	5.6	6.5	5.5	6.0	5.6	4.6	6.9	7.8	7.9	8.2	8.0	8.4
Sikkim												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	1.6	1.7	1.6	1.9	1.3	1.8	2.0	1.1	2.2	4.7	1.4	1.6
State excise	50.6	50.1	51.3	48.6	39.4	41.7	42.9	38.2	30.1	30.8	31.1	37.2
Sales tax	35.6	37.2	35.7	37.9	46.3	45.9	43.7	53.1	59.9	56.8	60.2	54.8
Taxes on vehicles	3.6	4.5	6.0	5.6	5.6	5.3	5.4	3.3	3.4	3.2	3.4	3.7
Other taxes	8.6	6.5	5.3	6.0	7.3	5.2	6.0	4.2	4.3	4.4	4.0	2.6
Tamil Nadu												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	8.0	8.7	8.6	7.4	7.3	7.0	7.5	7.4	8.7	7.5	8.3	8.3
State excise	11.8	10.5	13.1	13.3	15.0	17.8	16.8	15.2	15.8	14.7	10.4	13.2
Sales tax	66.9	67.1	65.6	66.9	64.5	63.5	64.3	66.7	64.5	66.9	69.0	67.1
Taxes on vehicles	6.5	6.4	5.5	5.3	5.4	5.4	5.3	4.8	5.0	5.2	5.9	5.2
Other taxes	6.8	7.3	7.3	7.1	7.8	6.4	6.1	5.8	6.0	5.7	6.5	6.2
Tripura												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	7.6	6.7	6.7	6.0	5.5	5.7	5.0	4.7	6.1	4.3	5.0	5.0
State excise	20.2	19.0	19.1	20.5	20.9	20.2	19.8	15.8	13.9	15.4	14.2	13.5
Sales tax	52.3	53.5	57.0	59.0	59.2	56.7	56.8	64.6	66.7	69.4	67.4	67.1
Taxes on vehicles	3.4	3.6	2.8	2.3	2.5	4.2	3.5	3.4	3.3	2.9	3.6	4.4
Other taxes	16.6	17.3	14.3	12.2	11.9	13.2	14.9	11.6	10.0	8.0	9.8	9.9
Uttar Pradesh												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	12.9	12.9	13.4	13.9	13.7	13.0	12.5	11.6	13.8	16.3	16.9	17.1
State excise	23.2	22.6	21.2	21.0	20.1	20.6	22.6	20.4	19.0	20.0	18.2	17.1
Sales tax	52.0	53.4	55.6	55.1	56.2	56.4	54.2	55.7	59.7	55.8	56.5	56.6
Taxes on vehicles	2.4	2.2	2.3	2.2	2.4	2.7	5.4	4.9	4.9	4.8	5.0	4.9
Other taxes	9.6	8.8	7.5	7.9	7.7	7.3	5.2	7.4	2.6	3.1	3.5	4.2
West Bengal												
Own tax revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Stamps and registration fees	6.2	7.6	7.4	7.3	7.4	7.8	8.1	8.0	8.5	10.2	9.1	10.1
State excise	7.5	6.2	6.5	7.7	7.9	8.4	8.7	7.8	7.8	8.0	7.1	6.8
Sales tax	62.2	56.1	59.2	63.5	63.0	65.3	67.2	61.8	58.2	59.5	55.1	57.6
Taxes on vehicles	3.0	3.0	2.9	3.2	3.3	3.3	3.6	4.8	3.2	3.5	6.1	5.3
Other taxes	21.0	27.1	24.1	18.4	18.4	15.2	12.4	17.7	22.3	18.7	22.7	20.2

Source (Basic Data): Finance Account of States, various years.

Table A15: Share of Each State in Total Collections of 15 Major States

(Percent)

State/Taxes	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Andhra Pradesh												
Own tax revenue	8.6	8.0	6.8	7.2	9.3	9.4	9.3	9.6	10.1	9.9	9.6	9.5
Stamps and registration fees	6.4	6.5	5.7	7.1	6.4	6.8	7.2	7.3	7.7	7.9	7.5	7.6
State excise	11.2	6.2	1.0	0.8	8.5	7.5	7.6	8.5	10.9	11.1	11.1	10.7
Sales tax	8.7	9.0	8.1	8.5	10.3	10.5	10.5	10.7	11.3	10.8	10.5	10.5
Taxes on vehicles	12.2	12.0	12.8	13.9	13.6	14.4	12.6	13.1	13.6	12.1	11.6	11.9
Other taxes	4.2	4.5	4.3	4.0	4.7	6.2	4.7	4.3	3.2	3.7	3.5	3.2
Assam												
Own tax revenue	1.4	1.2	1.2	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.4	1.6
Stamps and registration fees	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
State excise	0.3	0.4	0.4	0.4	0.7	0.8	0.9	0.9	1.0	0.7	0.7	0.7
Sales tax	1.4	1.3	1.3	1.2	1.1	1.1	1.3	1.3	1.6	1.9	1.8	2.0
Taxes on vehicles	1.2	1.3	1.1	1.3	0.9	0.8	1.2	1.2	1.4	1.5	1.3	1.4
Other taxes	3.3	2.2	2.1	1.9	2.6	2.7	2.6	2.1	1.5	1.5	1.3	1.5
Bihar												
Own tax revenue	3.2	3.1	3.2	3.3	3.1	3.2	3.2	2.6	2.0	2.2	2.0	2.0
Stamps and registration fees	4.6	3.2	3.6	3.7	3.6	3.9	3.9	3.3	2.9	2.8	2.8	2.3
State excise	1.9	2.0	2.3	2.7	2.2	1.9	2.0	1.7	1.6	1.4	1.4	1.4
Sales tax	3.6	3.6	3.6	3.6	3.4	3.6	3.5	2.7	2.1	2.1	1.9	1.8
Taxes on vehicles	4.2	5.2	4.4	4.0	3.7	3.4	3.1	3.5	2.0	2.3	2.3	2.2
Other taxes	1.6	1.5	1.6	1.9	2.1	1.8	2.3	1.9	1.7	2.5	2.5	3.1
Gujarat												
Own tax revenue	8.8	9.0	8.8	9.0	8.6	9.0	8.4	8.2	8.1	7.4	7.8	7.6
Stamps and registration fees	6.1	5.6	6.2	6.5	5.9	7.0	6.3	5.8	5.2	5.1	5.5	5.3
State excise	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.2
Sales tax	10.4	10.1	9.9	9.7	9.6	9.5	8.7	8.7	8.5	8.1	8.2	7.9
Taxes on vehicles	7.1	7.1	8.5	8.4	8.5	9.5	10.3	9.8	9.8	10.5	10.1	10.8
Other taxes	14.3	16.4	15.0	16.7	15.6	19.0	18.5	16.2	16.4	12.8	14.5	14.5
Haryana												
Own tax revenue	3.6	3.6	3.6	3.2	3.1	3.7	3.6	3.9	4.4	4.3	4.4	4.4
Stamps and registration fees	3.5	3.4	4.3	4.5	4.3	4.1	3.8	4.5	4.7	4.3	4.7	4.0
State excise	6.4	7.4	7.0	0.8	0.5	6.3	5.6	5.8	5.8	5.2	5.3	5.2
Sales tax	2.9	2.8	2.9	3.3	3.4	3.2	3.3	3.8	4.3	4.3	4.4	4.5
Taxes on vehicles	2.1	1.5	1.5	1.5	1.4	1.5	1.5	1.3	1.5	1.5	1.4	1.4
Other taxes	4.0	4.0	3.8	4.8	4.6	3.9	3.9	3.4	4.3	4.9	5.0	4.5
Karnataka												
Own tax revenue	8.5	8.1	8.7	8.6	8.3	8.2	8.0	8.2	8.6	8.2	8.7	9.3
Stamps and registration fees	7.0	7.7	9.4	8.0	8.7	7.6	6.9	6.9	8.2	8.8	9.1	9.6
State excise	9.4	9.9	10.4	10.5	8.3	8.1	8.9	10.4	13.0	12.5	13.5	14.4
Sales tax	8.5	8.0	8.1	8.5	8.3	8.5	8.0	7.9	7.7	7.1	7.6	8.3
Taxes on vehicles	10.6	9.9	12.6	8.2	9.5	8.0	7.7	7.9	10.3	8.8	8.7	10.0
Other taxes	7.3	6.3	7.3	7.8	7.7	7.7	8.2	8.5	8.0	7.9	9.4	8.6

Table A15 (contd.): Share of Each State in Total Collections of 15 Major States

(Percent)

State/Taxes	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Kerala												
Own tax revenue	5.2	5.3	5.6	5.8	5.9	5.5	5.4	5.3	5.2	5.7	5.6	5.3
Stamps and registration fees	6.7	6.1	6.2	5.9	4.7	4.2	3.4	3.7	3.8	3.8	3.7	4.2
State excise	4.9	4.9	5.7	5.2	5.2	4.3	4.3	4.7	3.6	4.0	3.8	3.8
Sales tax	5.7	5.9	6.3	6.7	6.7	6.7	6.6	6.4	6.5	6.9	6.9	6.4
Taxes on vehicles	6.1	6.2	6.2	6.2	6.5	6.7	6.5	6.2	6.5	6.7	6.3	6.2
Other taxes	1.8	1.6	1.0	1.3	2.8	1.3	0.9	0.9	0.7	2.2	2.0	0.7
Madhya Pradesh												
Own tax revenue	6.0	5.4	5.8	6.1	5.9	6.1	6.0	5.1	4.1	4.8	4.7	4.6
Stamps and registration fees	5.5	4.7	4.8	5.2	5.2	5.5	5.7	5.2	4.2	4.2	4.1	4.3
State excise	7.4	7.7	7.8	9.2	8.1	7.8	7.8	6.7	4.6	5.3	6.3	6.1
Sales tax	4.6	4.2	4.2	4.2	4.5	4.6	4.3	4.1	3.4	3.8	3.8	3.7
Taxes on vehicles	8.5	7.9	8.6	8.5	7.9	7.9	6.9	6.4	5.7	5.6	4.9	5.0
Other taxes	10.5	8.5	11.5	12.7	10.7	11.0	12.8	8.7	6.0	10.2	8.8	7.8
Maharashtra												
Own tax revenue	17.2	17.9	18.0	17.4	17.9	16.9	17.9	17.9	18.6	17.8	17.5	18.0
Stamps and registration fees	17.7	23.1	21.6	20.9	24.2	22.2	23.5	23.8	23.3	22.3	22.5	22.5
State excise	13.3	13.1	13.6	13.3	15.9	14.1	13.7	12.2	11.8	11.6	13.4	11.4
Sales tax	17.8	18.3	18.8	17.6	17.0	16.1	17.9	17.9	17.6	17.5	17.6	17.9
Taxes on vehicles	11.0	11.7	11.7	15.4	16.1	13.2	12.2	12.3	13.7	12.3	13.1	11.9
Other taxes	21.7	20.1	19.5	19.1	20.7	22.2	22.1	23.6	30.8	26.2	19.4	24.1
Orissa												
Own tax revenue	1.9	1.7	1.9	2.0	1.9	1.8	1.8	2.0	2.2	2.2	2.3	2.5
Stamps and registration fees	1.4	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.0	1.1	1.0	1.1
State excise	1.1	0.8	0.9	1.1	1.0	0.9	0.8	0.9	1.3	1.5	1.5	1.6
Sales tax	1.9	1.8	2.0	2.2	2.0	1.9	1.9	2.0	2.0	2.1	2.1	2.4
Taxes on vehicles	3.5	3.2	3.0	3.2	3.0	3.0	2.7	2.8	3.1	3.4	3.0	3.4
Other taxes	2.5	2.1	2.4	2.1	2.0	1.8	2.2	3.6	4.2	4.6	4.9	4.9
Punjab												
Own tax revenue	4.8	4.9	4.4	4.1	4.0	3.9	4.1	4.5	4.2	4.5	4.3	4.1
Stamps and registration fees	5.0	5.1	4.0	3.0	3.4	3.6	3.9	4.6	4.2	4.4	4.9	5.3
State excise	11.3	12.3	11.9	12.4	11.0	9.7	9.0	9.1	8.9	8.5	8.5	7.6
Sales tax	3.6	3.8	3.2	3.0	3.0	3.0	3.4	3.9	3.9	4.0	3.8	3.6
Taxes on vehicles	5.7	6.0	5.3	4.9	4.6	5.5	5.5	5.3	4.6	5.8	4.2	4.1
Other taxes	2.0	1.5	1.5	1.2	0.6	0.5	0.9	1.4	0.2	1.5	1.7	1.5
Rajasthan												
Own tax revenue	4.4	4.4	4.5	4.6	4.7	4.7	4.7	4.8	5.0	4.9	5.0	4.9
Stamps and registration fees	4.1	3.8	4.0	4.5	4.5	4.8	4.6	4.7	4.6	4.1	4.1	4.5
State excise	6.8	7.8	8.9	9.7	8.9	8.0	7.0	7.7	7.3	6.8	6.7	6.5
Sales tax	4.0	3.8	3.8	3.9	4.0	4.1	4.1	4.1	4.5	4.5	4.6	4.6
Taxes on vehicles	7.3	7.9	6.8	6.9	7.4	7.6	7.8	8.0	8.2	8.4	9.8	8.3
Other taxes	2.0	2.3	2.2	2.4	2.3	1.9	3.1	3.5	3.5	3.7	3.8	4.0

Table A15 (contd.): Share of Each State in Total Collections of 15 Major States
(Percent)

State/Taxes	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Tamil Nadu												
Own tax revenue	10.7	11.0	11.8	11.9	11.3	11.4	11.3	11.2	11.4	11.2	11.1	11.4
Stamps and registration fees	11.1	10.5	10.7	9.7	9.0	9.3	9.9	9.8	10.9	8.5	8.8	8.8
State excise	8.4	8.6	11.8	13.2	12.5	13.8	13.4	12.8	13.6	12.6	9.6	13.1
Sales tax	12.0	12.5	12.9	12.9	12.2	12.2	12.0	12.0	12.2	12.4	12.6	12.4
Taxes on vehicles	12.8	12.6	10.9	10.7	10.0	10.7	9.9	9.3	9.4	9.7	10.1	10.3
Other taxes	6.0	6.6	7.5	7.3	7.8	6.4	6.6	6.1	6.0	5.9	6.8	6.7
Uttar Pradesh												
Own tax revenue	9.2	9.2	9.0	9.4	9.1	9.4	9.7	10.0	9.0	10.0	9.5	9.2
Stamps and registration fees	15.4	13.1	12.8	14.3	13.7	14.3	14.3	13.7	13.6	16.4	15.4	14.7
State excise	14.1	15.4	14.7	16.4	13.5	13.2	15.5	15.3	12.9	15.2	14.3	13.8
Sales tax	8.1	8.3	8.3	8.4	8.5	8.9	8.7	9.0	9.0	9.2	8.8	8.5
Taxes on vehicles	4.0	3.7	3.5	3.5	3.6	4.4	8.8	8.5	7.3	8.1	7.3	7.9
Other taxes	7.4	6.7	5.9	6.5	6.2	6.0	4.8	6.9	2.1	2.8	3.1	3.7
West Bengal												
Own tax revenue	6.5	7.1	6.8	6.3	5.9	5.7	5.3	5.4	5.7	5.5	6.1	5.8
Stamps and registration fees	5.2	5.8	5.3	5.1	4.8	5.1	5.0	5.1	5.3	5.7	5.3	5.5
State excise	3.2	3.2	3.4	4.1	3.4	3.2	3.2	3.2	3.4	3.4	3.6	3.4
Sales tax	6.8	6.7	6.7	6.5	6.2	6.2	5.8	5.4	5.5	5.4	5.5	5.4
Taxes on vehicles	3.6	3.8	3.3	3.4	3.2	3.3	3.2	4.4	3.0	3.3	5.8	5.4
Other taxes	11.4	15.7	14.3	10.2	9.6	7.5	6.3	9.0	11.3	9.6	13.1	11.3

Source (Basic Data): Finance Account of States, various years.

Annexure 1: Measures Taken for Control of Air Pollution from Vehicles

A. Vehicular Emission Norms

The vehicle emission norms in India are detailed below.

- a) During 1990-91 India for the first time notified mass emission norms for the vehicles at the manufacturing stage as well as for in-use vehicles. These norms were notified under EPA, more vehicles rules and Air Act.
- b) The emission norms introduced in 1996 have been crucial in controlling vehicular pollution because of stringency of emission norms along with specifications on fuel quality in 1996. For the first time crankcase emission norms and evaporative emission norms were introduced.
- c) From April 1995 passenger cars were allowed to register only if they are fitted with a catalytic converter in four metros-Delhi, Mumbai, Kolkata and Chennai. Emission norms for such vehicles were stricter by 50 percent compared to 1996 norms.
- d) The testing method for passenger car norms were changed from hot start to cold start, which is also a stringent measure, compared to the earlier one.
- e) More stringent norms were introduced for the year 2000. These norms were notified under Motor Vehicle Rules during 1997. Automobile manufacturers have to undergo major modification to meet these norms.
- f) As per Hon'ble Supreme Court's directions only private vehicles conforming to at least EURO-1 norms are being registered. In Mumbai Euro-II norms for private vehicles (4 wheelers) was applicable from 2001. In Kolkata, India-2000 norms (Euro-I) have been made applicable from November 1999.
- g) From 1st October 1999, emission norms for agricultural tractors were introduced throughout the country. Bharat Stage-II and Bharat Stage-III emission norms for tractors have been scheduled to be implemented from 2003 and 2005 respectively.
- h) The Bharat Stage-II norms for new 4wheeler private non-commercial vehicle were introduced in Mumbai from January 2001 and in Kolkata and Chennai from July 2001 to 24th October, 2001.
- i) Only those taxis are being registered in Delhi, which are meeting Bharat Stage-II norms.
- j) Bharat Stage-II norms for Diesel 4 wheeler transport vehicles were introduced in NCT from 24th October, 2001, in Greater Mumbai, Kolkata & Chennai from 31.10.2001.
- k) The expert committee on Auto Oil Policy was constituted during September 2001. The interim report of the committee was submitted to Govt. on 1.1.2000, recommending Bharat Stage-III emission norms for all category of 4-whellers in 7 mega cities from

2005 and rest of the country by 2010. Final report of the committee has been submitted in September 2002 which includes road map for control of vehicular pollution up to 2010.

- I) Final report of the inter-Ministerial Task Force constituted by Ministry of Petroleum & Natural Gases at the instance of the Committee of Secretaries to evolve a long term policy for vehicular emission and auto fuel policy has been submitted which recommended introduction of Bharat Stage-II norms for 4wheelers and next stage emission norms for 2/3 wheelers throughout the country from 2005 and introduction of Bharat stage III norms for four wheelers in 7-mega cities from 2005.

B. Fuel Quality Specifications

For the first time diesel and gasoline fuel quality with respect to environment related parameters has been notified under EPA during April 1996.

C. Lubricants Quality

Specifications of 2T oil for two stroke engine with respect to smoke has been notified under EPA during September 1998 for implementation from 1.4.1999 throughout the country. Pre-mix 2T oil dispenser has been installed at all petrol filling stations in Delhi so that excessive oil is not being used by the vehicle owners. Sale of loose 2T oil has been banned from December 1998 in Delhi.

D. Alternate Fuels

- a) All Govt. vehicles were required to compulsorily fit CNG kit or catalytic converter by December 1996.
- b) Custom duty on CNG kit has been accepted for promotion of CNG vehicles.
- c) Emission norms for CNG vehicles have been notified under Motor Vehicles Rule Vide GSR 853 (E) dated 19.11.2001.
- d) LPG is now being used as alternate fuel for motor vehicles after making amendments in CMVR. Emission norms for LPG vehicles have been notified vide GSR 284 (E) dated 24.4.2001.
- e) Battery driven vehicles have been introduced in few corridors in Delhi.

E. Restriction of Grossly Polluting Vehicles

- a) Registration of new auto rickshaws with conventional engine has been banned from May 1996 from May 1996 and registration of Defense Service and Govt. auctioned vehicles has been banned from April 1994 in Delhi.
- b) 20 years old commercial vehicles were phased out from October 1998, 17 year old

commercial vehicles has been phased out from November 1998 and 15 year old commercial vehicle from December 1998 in Delhi.

- c) Registration on alternation of vehicles by replacing petrol engine with diesel has been banned from 1.4.1998 in Delhi.

F. Traffic Management

- a) Restriction has been imposed on goods vehicles during day time from August 1999 in Delhi.
- b) Left lane has been made exclusive to buses and other HMV in Delhi.
- c) Time clocks have been installed in important red lights to enable the drivers to switch off their vehicles depending on the time left in the time clocks.
- d) More fly over and subways have been constructed and T-Junctions have been closed for better traffic flow.

G. Public Transport Systems

- a) Number of buses has been increased to discourage use of individual vehicles by allowing private sectors for operation.
- b) Metro Rail Project for Shahdara – Tri Nagar has been commissioned.

H. Technology

- a. Fitment of catalytic converter for new petrol passenger cars has been made compulsory from 1.4.1995 in four metros and 45 cities from 1.9.1998.
- b. Two wheeler scooters with four stroke engine are being introduced in the market from October 1998.
- c. Registration of only rear engine auto rickshaws is being allowed from May 1996 onwards.
- d. More four stroke two wheelers are being registered in Delhi.

I. Mass Awareness

- a. Messages/articles related to vehicular emissions are disseminated through newsletters, pamphlets, newspapers, magazines, Television, Radio, internet,
- b. Workshops and Summer Exhibitions. Display of ambient air quality data through display system near ITO, Newspapers, daily news and internet.
- c. NGOs working on vehicular pollution control are being encouraged for mass awareness companies.

Measures Taken for Controlling Air Pollution from Industries

The measures taken for controlling air pollution from industries are as follows:

- a. Emission standards have been notified under the Environment (Protection) Act, 1986 to check pollution.
- b. Industries have been directed to install necessary pollution control equipment in a time bound manner and legal action has been initiated against the defaulting units.
- c. 24 critically polluted areas have been identified. Action Plan has been formulated for restoration of environmental quality in these areas.
- d. Environmental guidelines have evolved for setting of industries.
- e. Environmental clearance is made compulsory for 29 categories of development projects involving public hearing/NGO participation as an important component of Environmental Impact Assessment process.
- f. Environmental audit in the form of environmental statement has been made mandatory for all polluting industries.
- g. Preparation of zoning Atlas for setting of industries based on environmental considerations in various districts of the country has been taken up.
- h. Power plants (coal based) located beyond 1000 kilometres from the pit-head are required to use low ash content coal (not exceeding 34 percent) with effect from 1.6.2002. Power plants located in the sensitive areas are also required to use low ash coal irrespective of their distance from the pit head.

Up-coming Initiatives

- a. Monitoring using automatic analysers is being initiated in 16 polluted cities identified by Hon'ble Supreme Court.
- b. Action Plan are being formulated and implemented by the Central/States Pollution Control Boards in 16 cities identified by Hon'ble Supreme Court as polluted cities.
- c. Road map given by Auto fuel policy for vehicular pollution control is being implemented.

Corporate Responsibility for Environmental protection (CREP) is being implemented by industries for controlling industrial pollution. Source apportionment studies have been initiated and it is planned to carry out such studies initially in six cities. Monitoring of hazardous air pollutants such as benzene, polycyclic aromatic hydrocarbons etc., has been initiated and it is proposed to carry out there monitoring in other cities also.

Annexure 2: Quantities and Emission Relations

- A barrel of oil has 42 US gallons or 158.9873 litres.
- A metric ton is 1.1023 short (American) tons.
- To convert a quantity of CO₂ to a quantity of carbon, multiply by $12/44 = .273$; to convert a quantity of carbon to a quantity of CO₂, multiply by $44/12 = 3.6667$ [3].
- The previous calculations are reversed if you're converting *tax rates* because the relevant units are in the denominator, not the numerator. To convert a tax on CO₂ to a tax on carbon, multiply by $44/12 = 3.6667$, so that a \$100 tax per ton of CO₂ is equal to a tax of about \$ 367 per ton of carbon. To convert a tax on carbon into a tax on CO₂, multiply by $12/44 = 0.273$, so that \$100 tax per ton of carbon is equal to a tax of about \$ 27 per ton of CO₂.
- A ton is 2000 pounds, so (for example) a tax of \$100 per ton of CO₂ is equal to a tax of \$ 0.05 per pound of CO₂.

Petroleum (Motor Gasoline, Diesel, Jet Fuel)

Emissions total about 20 pounds of CO₂ per gallon, so a tax of \$100 per ton of CO₂ would translate to a tax of about \$1.00 per gallon. (To be precise: motor gasoline emits 19.564 pounds of CO₂ per gallon, diesel emits 22.384 pounds of CO₂ per gallon, and jet fuel emits 21.095 pounds of CO₂ per gallon. So a tax of \$100 per ton of CO₂ translates to a tax of \$0.978 per gallon of gasoline, \$1.119 per gallon of diesel, and \$1.055 per gallon of jet fuel.) At a price of between \$2.5 and \$5 per gallon, a tax of \$100 per ton of CO₂ would raise gas prices by 40-20 percent.

For the purpose of looking at electricity generation: emissions total about 155 pounds of CO₂ per million (British Thermal Units (BTUs), so a tax of \$100 per ton of CO₂ translates to a tax of about \$ 7.75 per million BTUs. (To be precise: motor gasoline emits 156.425 pounds of CO₂ per million BTUs, diesel emits 161.386 pounds of CO₂ per million BTUs, and jet fuel emits 156.258 pounds of CO₂ per million BTUs. So a tax of \$100 per ton of CO₂ translates to a tax of \$ 7 .82 per million BTUs of gasoline, \$8.07 per million BTUs of diesel, and \$7.81 per million BTUs of jet fuel.)

Natural Gas

Emissions total 120.6 pounds of CO₂ per thousand cubic feet, i.e., 60.3 tons per million cubic feet, so a tax of \$100 per ton of CO₂ translates to a tax of \$6.03 per thousand cubic feet of natural gas. At a price of between \$4 and \$10 per thousand cubic feet, a tax of \$100 per ton of CO₂ would raise natural gas prices by 60-150 percent. For the purpose

of looking at electricity generation: emissions total 117.08 pounds of CO₂ per million BTUs, so a tax of \$100 per ton of CO₂ translates to a tax of \$5.854 per million BTUs.

Coal

Emissions per ton of coal range from 1.40 tons of CO₂ to 2.84 tons of CO₂, depending on the type of coal (1.40 for lignite, 1.86 for sub-bituminous, 2.47 for bituminous, and 2.84 for anthracite, to be precise), so a tax of \$100 per ton of CO₂ translates to a tax of between \$140 and \$284 per ton of coal, depending on the type (\$140 for lignite, \$186 for sub-bituminous, \$247 for bituminous, and \$284 for anthracite). The price of coal delivered to electric utilities nationwide averaged \$27.34 per ton in 2004"; for that price, a tax of \$100 per ton of CO₂ means a price increase of 500-1000% depending on the type (512 percent for lignite, 680 percent for sub-bituminous, 903 percent for bituminous, and 1039 percent for anthracite).

Because of the differences in the carbon content of different types of coal, it is easier to do the calculations in terms of BTUs rather than tons of coal. So: Emissions per million BTUs range from 205 to 227 pounds of CO₂ per million BTUs (215.4 for lignite, 212.7 for sub-bituminous, 205.3 for bituminous, and 227.4 for anthracite, to be precise, so a tax of \$100 per ton of CO₂ translates to a tax of about \$10 per million BTUs, depending on the type of coal (\$10.77 for lignite, \$10.635 for sub-bituminous, \$10.265 for bituminous, and \$11.37 for anthracite).

Electricity

The impact of a carbon tax on electricity prices depends on the amount of CO₂ generated along with the electricity, and that depends on the type of fuel used and the efficiency ("heat rate") of the generator. 3413 British thermal unit (BTU) = 1 kWh.

In terms of fuel use, note from above that CO₂ emissions per million BTUs (293 kWh) range from 117.08 pounds of CO₂ for natural gas and about 155 pounds of CO₂ for petroleum to between 205 and 227 pounds of CO₂ for coal, and that a tax of \$100 per ton of CO₂ therefore translates into a tax per million BTUs that ranges from \$5.854 per million BTUs for natural gas and about \$7.75 per million BTUs for petroleum to between \$10.27 and \$11.37 per million BTUs for coal. For comparison purposes: in 2005, fuel prices to electricity generators per million BTU were \$7.70 for oil, \$8.18 for natural gas, \$1.53 for coal, and \$0.48 for nuclear. Current electricity prices are in the neighborhood of \$0.08 per kWh.

Old-style generators have a heat rate in the ballpark of 10,000 BTUs per KWh. At that heat rate, a tax of \$100 per ton of CO₂ translates into a tax of \$0.05854 per KWh for natural gas, about \$0.0775 per KWh for petroleum, and between \$0.1027 and \$0.1137 per KWh for coal. As noted above, current electricity prices are in the neighborhood of \$0.08 per KWh.

New-style combined-cycle gas turbines currently (2005) use 6,572 BTUs per KWh (51.93 percent efficient), a number that is expected to decline to 6,333 by 2015. At these heat rates, a tax of \$100 per ton of CO₂ translates into a tax of \$0.0385 per KWh for natural gas using 2005 technology and a tax of \$0.0371 per KWh for natural gas using 2015 technology and considering only emissions at the generator.

New-style combined-cycle coal gasification units currently (2005) use 8,309 BTUs per KWh (41.08 percent efficient), a number that is expected to decline to 7,200 by 2015. At these heat rates, a tax of \$100 per ton of CO₂ translates into a tax of between \$0.0853 and \$0.0945 per KWh for coal using 2005 technology and a tax of between \$0.0739 and \$0.0819 per KWh for coal using 2015 technology and considering only emissions at the generator. Life cycle emissions from coal power tend to be concentrated at the generator, whereas with gas plants, upstream emissions can be more significant, depending on the source of the gas.

Annexure 3: Major Environmental Initiative by Important Cities in India

Delhi: Vehicular Pollution Control

- a. Public transport (buses, auto, and taxis) in Delhi has been converted to CNG mode.
- b. Sulphur content in diesel has been reduced in a phased manner.
- c. The lead content in petrol has been progressively reduced to make it unleaded.
- d. Bharat Stage-III norms have been implemented in Delhi.
- e. Pre-mix 2T oil dispensers have been installed at all petrol filling stations.
- f. Grossly polluting old commercial vehicles have been phased out.
- g. Restriction has been made on plying of goods commercial vehicles during day time.

1986 have been issued on April 1996 and July 1996 to all the three power plants located in Delhi for completing the following in a time bound manner.

- a. Comply with emission and liquid effluent standard.
- b. Submission of action plan for switching over the beneficiated coal with an ash content of not more than 34 percent.
- c. Submission of action plan to achieve 20 percent utilization of fly-ash by Dec. 1997.
- d. Installation of opacity meter in all units to ensure compliance with the standards.
- e. Coverage of abandoned ash ponds with top soil.
- f. All stone crushers have been closed down in Delhi and shifted to Pali in Rajasthan.
- g. All the hot mix plants have been closed down and shifted to other states.
- h. As per the directions of Hon'ble Supreme Court, 168 hazardous industries have been closed down in Delhi.

Mumbai

- a. Bharat Stage-III norms have been implemented in Mumbai.
- b. Unleaded gasoline and low sulphur diesel are being supplied in Mumbai.
- c. Visits are made to petrol pump as per guidelines prescribed to check/inspect adulteration/malpractices in diesel and petrol under Central Govt. vide order The Motor Spirit and High Diesel (Regulation of Supply and Distribution and Prevention of Malpractices), 1998. Defaulter petrol pumps are legally prosecuted under Essential Commodities Act, 1955.
- d. Licence and 'End Use Certificate' is made compulsory to persons who store Naphtha and Solvents which are also used as adulterants in petrol and diesel.
- e. Pollution under Control certificate has been made mandatory for every vehicle owner.
- f. Implementation of rigorous inspection and maintenance measures periodically for all types of vehicles, involving vehicle manufacturers.

- g. From 15.10.99 'No Pollution Under Certificate-No Petrol' scheme is launched in Mumbai Metropolitan Region (MMR)
- h. Buses, taxis, autos are on CNG mode.
- i. Mass awareness Programme are being organized for creating awareness in public.
- j. The Transport Commissioner's Office has increased vigilance in checking polluting vehicles in Mumbai by increasing number of exhaust monitors for petrol and diesel driven vehicles.
- k. Auto exhaust checking are also done at entry points to Maharashtra State to check compliance to norms fixed under Central Motor Vehicles Act, 1989.

Ahmedabad

The measures include following

- a. Banning of old buses of more than 15 years old
- b. Bharat Stage-III norms have been introduced in Ahmedabad.
- c. Banning of diesel run rickshaw within city limits.
- d. Diversion of heavy vehicles such as trucks/luxury buses/trailers/tankers/tractors/lorries, etc. away from the city.
- e. Improvement of road condition and making the roads pucca upto the footpath not leaving any uncovered space on either side of the roads.
- f. Strict enforcement of smoke test/vehicle test protocol
- g. Surveillance of vehicles with higher black smoke emission
- h. Third party audits of PUC centres including calibration audits
- i. To launch a drive to stop usage of kerosene in vehicles particularly three wheelers and commercial vehicles.

(b) Industrial Pollution Control

The measures include following

- a. Intensifying monitoring by special vigilance squad under the Air Act, 1981.
- b. Determining efficacy of APC system & taking remedial action(s) including upgradation of existing Air Pollution Control Measures wherever needed.
- c. Implementation of CREP Action Plan for highly pollution industries as decided by MOEF.

Vehicular Pollution Control

Ban on burning of off specification materials/wastes by scrap traders.

Bangalore

To reduce traffic congestion, 108 roads have been converted to one way, 5 flyovers completed, 3 railway under pass on outer ring road (ORR) limit completed, 2 railway over bridges completed and 206 Km of road has been asphalted.

Low sulphur diesel (Green Diesel) and Green Petrol (Sulphur 0.05 percent) is being supplied in Bangalore ORR area from 1.4.2003.

Bharat Stage – III norms have been introduced in Bangalore.

Out of 70,131 (as on 31.07.2003) auto rickshaws registered in Bangalore city, 35000 auto rickshaws are running on LPG 6 Auto LPG dispensing stations (ALDS) are operating.

Transport department has approved Bajaj 4 stroke (rear engine) LPG auto rickshaw in Bi- fuel mode 5 percent ethanol blended petrol is being supplied in all districts from 01.10.2003.

Regular check on adulteration of fuel is being conducted by Food and Civil Supplies Department.

Goods vehicles carrying construction materials are allowed within ORR only during 10 PM to 6AM for unloading.

Modernization of Emission testing Centers for issue of "Pollution Under Control" Certificate bearing photograph of the tested vehicle using web camera by the Transport Department.

Karnataka State Pollution Control Board to take action to promote use of cleaner fuels used by major industries in Generator sets and boilers.

Major City Specific Action Plan in Chennai

- a. Bharat Stage – III norms have been introduced in Chennai.
- b. Unleaded gasoline and low sulphur diesel are being supplied in Chennai.
- c. Pollution Under Control Certificate has been made mandatory.
- d. Pre mixed 2T oil dispensers have been installed in most of the retail outlets in Chennai City.
- e. The Motor Spirit and High Speed Diesel (Regulation & Supply and Distribution and Prevention of malpractices) order 1998 has been republished by the Government of Tamil Nadu with the intention to curb malpractices such as adulteration, pilferation etc.
- f. LPG supply is being implemented by oil companies, Oil companies have promised to setup 28 Auto ALP dispensing station (ALDS). Presently five ALDS are functioning.

- g. Mass Rapid Transit System (MRTS) and electric trains are operated by Southern Railways.
- h. Power plants have been insisted to provide scrubber for the control of emissions
- i. For all the process emission sources and boiler of higher capacity air pollution control measures such as dust collectors and wet scrubbers are insisted by Tamil Nadu Pollution Control Board.
- j. The industrial units are also insisted to switch over to cleaner fuels such as LSHS, LDO etc., to control the SO₂ emission.

Major City Specific Action Plan in Kolkata

Vehicular Pollution Control

- a. Bharat State –III norms have been introduced in Kolkata
- b. Supply, Distribution and Selling of Loose 2T oil in Kolkata Metropolitan Area (KMA) has been banned from 01.10.2001 and Selling of Premixed Fuel oil made Mandatory within KMA from 15.11.2001.
- c. Unleaded Petrol and Low Sulphur Petrol and Diesel made available within Kolkata and Howrah and adjoining agglomeration.
- d. Availability of Cleaner Automotive Fuel like LPG ensured in Kolkata.
- e. Introduced Upgraded Auto Emission Testing Centre (PUC Centre)

Industrial Pollution Control

- a. Stricter Locational Policy for New Industrial Units
- b. Ensuring Regulatory Compliance by Grossly Polluting Industries
- c. Introduction of Stricter Emission Standard for Boilers, Ceramic, Kilns, Foundries and Rolling Mills operating within Kolkata Metropolitan Areas.
- d. Mandatory Use of Cleaner Fuel in Small Boilers, Ceramic Kilns and Rolling Mills operating within Kolkata Metropolitan Area.
- e. Discontinuance of Coal Supply to the industries which have been ordered to discontinue the use of coal.
- f. Environmental compliance by Cluster of Small Scale Industries is also ensured

Annexure 4: Specific Grants for Protection of Ecology and Environment

Apart from the reforms related to integrating eco-taxes in the GST, the Thirteenth Finance Commission may also give specific grants to support states that have special ecological and environmental problems. It may be noted that even though a specific mention about ecological and environmental concerns was not included as part of the Terms of Reference (ToR) of the earlier Finance Commissions, some special grants were given for this purpose by some of the earlier Finance Commissions, particularly Ninth Commission onwards. In the case of the Twelfth Finance Commission, considerable amounts of grants were recommended that had a clear bearing on ecological and environmental problems of the states. Some of these grants given by Twelfth, Eleventh, Tenth, and Ninth Finance Commissions are summarized below. In the light of these, some suggestions are made for the consideration of the Thirteenth Finance Commission.

a. Twelfth Finance Commission

a1. Maintenance of Forests

The Twelfth Finance Commission (TFC) gave for the first time a specific grant for maintenance of forests amounting to Rs.1000 crore spread over the period 2005-10. The TFC observed that 'forests are a national wealth, and the country as a whole has a responsibility in preserving it'. This grant was given as additionality over and above what the states have been spending through their forest department. State-wise amounts were determined in proportion of their forest area in the total all-state forest area. Table 1 gives the recommended grants for the maintenance of forest and its year-wise distribution.

Annexures Table 1: Maintenance of Forests; State-wise Grants Recommended by the Twelfth Finance Commission

(Rs. crore)

States	2005-06	2006-07	2007-08	2008-09	2009-10	Total
Andhra Pradesh	13.00	13.00	13.00	13.00	13.00	65
Arunachal Pradesh	20.00	20.00	20.00	20.00	20.00	100
Assam	8.00	8.00	8.00	8.00	8.00	40
Bihar	1.00	1.00	1.00	1.00	1.00	5
Chhattisgarh	17.00	17.00	17.00	17.00	17.00	85
Goa	0.60	0.60	0.60	0.60	0.60	3
Gujarat	4.00	4.00	4.00	4.00	4.00	20
Haryana	0.40	0.40	0.40	0.40	0.40	2
Himachal Pradesh	4.00	4.00	4.00	4.00	4.00	20
Jammu and Kashmir	6.00	6.00	6.00	6.00	6.00	30
Jharkhand	6.00	6.00	6.00	6.00	6.00	30
Karnataka	11.00	11.00	11.00	11.00	11.00	55
Kerala	5.00	5.00	5.00	5.00	5.00	25
Madhya Pradesh	23.00	23.00	23.00	23.00	23.00	115
Maharashtra	14.00	14.00	14.00	14.00	14.00	70
Manipur	6.00	6.00	6.00	6.00	6.00	30
Meghalaya	6.00	6.00	6.00	6.00	6.00	30
Mizoram	5.00	5.00	5.00	5.00	5.00	25
Nagaland	5.00	5.00	5.00	5.00	5.00	25
Orissa	15.00	15.00	15.00	15.00	15.00	75
Punjab	0.40	0.40	0.40	0.40	0.40	2
Rajasthan	5.00	5.00	5.00	5.00	5.00	25
Sikkim	1.60	1.60	1.60	1.60	1.60	8
Tamil Nadu	6.00	6.00	6.00	6.00	6.00	30
Tripura	3.00	3.00	3.00	3.00	3.00	15
Uttar Pradesh	4.00	4.00	4.00	4.00	4.00	20
Uttaranchal	7.00	7.00	7.00	7.00	7.00	35
West Bengal	3.00	3.00	3.00	3.00	3.00	15
Total	200	200	200	200	200	1000

Source: Report of the Twelfth Finance Commission, 2004.

a2. Grants for State Specific Needs for Ecology and Environment

In addition, under grants meant for state-specific needs, some ecology and environment related grants were given by the TFC. These are indicated below:

Andhra Pradesh

Drinking water supply to fluoride affected areas

For installation of de-fluorination plants in Nalgonda and neighbouring districts to supply safe drinking water by complete removal of fluorosis, Rs.325 crore were provided.

Assam

Development of urban areas

For the construction of road side drains and for clearing storm water drains in Guwahati city, an assistance of Rs.121 crore was provided as seed money.

Bihar

Improvement of urban water supply and drainage

For augmentation of water supply, sewerage and drainage facilities in major towns, Rs.180 crore were provided.

Gujarat

Salinity ingress:

For tackling the salinity ingress problem, particularly in the Saurashtra coastal area, Rs.200 crore was provided.

Haryana

Water logging/salinity and declining water table

In Haryana, large scale introduction of canal irrigation has resulted in higher water table with brackish water underneath. Water logging and salinity have become major problems. Further, due to over-drawal in sweet water zone, there is considerable decline in the ground water table in such zones. For addressing these problems, Rs. 100 crore was provided.

Kerala

Inland waterways and canals

For the improvement of main canal and feeder canals for inland water transport, Rs.225 crore was provided.

Coastal zone management

Kerala coast is subject to severe erosion, which undermines the valuable coastal eco-system and affects the lives of millions of people. Nearly 100 kilometres of coastal zone is prone to severe sea erosion. Rs.175 crore was provided for this purpose.

Development of urban are

A grant of Rs. 25 crore was provided for improvement of the existing water supply system, construction/widening of road network and improvement of drainage facilities in Dewas.

Coastal and eco-tourism

For integrated tourism development in coastal areas a grant of Rs.250 crore was provided.

Meghalaya

Loktak lake: For improving the water management at the lake, the state was provided assistance of Rs.11.50 crore.

Zoological park: For protecting endangered species, an assistance of Rs.30 crore has been provided.

Botanical garden: In order to conserve flora, a provision of Rs.5 crore for establishment of a botanical garden was made.

Mizoram

Bamboo flowering

The state was given assistance of Rs.30 crore to meet its project cost for tackling the problem of rodents arising out of impending bamboo flowering, which leads to large scale losses in agriculture and forestry.

Orissa

Consolidation and strengthening eco-restoration work in the Chilika Lake

The Eleventh Finance Commission had provided Rs.30 crore for undertaking consolidation measures for eco-restoration works in the Chilika lagoon. An additional support of Rs.30 crore was given by the Twelfth Finance Commission for consolidating and further expanding the scope of eco-restoration works.

Sewerage system for Bhubaneswar

For providing a comprehensive sewerage system with necessary branch sewers, trunk sewers and treatment units in the capital city of Bhubaneswar, the TFC provided Rs.140 crore.

Rajasthan

Indira Gandhi Nahar Pariyojana

For completing the Indira Gandhi Nahar Pariyojana, which involves transfer of surplus water of Ravi and Beas rivers to desert and border districts of the state with a view to eliminating drought, irrigating desert areas and providing drinking water, an amount of Rs. 300 crore was provided.

Meeting drinking water scarcity in border and desert districts

Rajasthan is amongst the most water deficient states in the country. The problem is particularly acute in the desert and border districts. Additional funds amounting to Rs.150 crore were provided for augmentation of water from existing sources and setting-up of fluoride and salinity treatment plants in the border and desert districts.

Tamil Nadu

Sea erosion and coastal area protection work

For tackling the problem of sea erosion in various parts of the state, TFC provided Rs. 50 crore for this purpose.

West Bengal

Arsenic contamination of ground water

Arsenic contamination of ground water is a serious problem affecting certain areas in West Bengal. To provide arsenic free water to about 77.76 lakh population in 4747 habitations, Rs. 600 crore were provided.

Problems relating to erosion by Ganga-Padma river in Malda and Murshidabad districts

There is a severe bank erosion of the river Ganga-Padma in Malda and Murshidabad districts. The Eleventh Finance Commission had provided Rs. 60 crore for tackling this problem. The TFC has given an additional sum of Rs. 190 crore for this purpose.

Development of Sundarbans Region

Sundarbans is a predominantly riverine area. This region needs focused attention for development of agriculture, strengthening of embankments, and development of communication, Rs.100 crore were provided for this purpose.

b. Eleventh Finance Commission

In the case of earlier Finance Commission also there were grants for special problems and some of those related to ecological and environmental concerns. In the case of the Eleventh Finance Commission there was an upgradation grant for augmentation of traditional water sources amounting Rs. 500 crore. This was meant for protecting and augmenting traditional water sources that have been the main stay of water supply particularly in the rural areas. It was observed that most of such water sources were gradually silted and these need to be rejuvenated and augmented in a systematic way.

Under the special grants recommended by the Eleventh Finance Commission there were some grants that had a significant bearing on ecological and environmental problems of the states. For example a grant of Rs. 50 crore was given to Bihar for upgradation of water supply and drainage systems of Patna and Ranchi districts. In the case of Haryana also Rs. 50 crore were provided for upgradation of civic infrastructure for solid waste management, drainage/sewerage, and water supply. For Himachal Pradesh Rs. 30 crore was provided for sewerage/drainage systems for three large towns. For Kerala in order to check erosion of the coast line a grant of Rs. 50 crore was given to construct 86 kilometers of new sea wall and to reform 37 kms of the existing sea walls. For Madhya Pradesh to promote tourism including eco-tourism a grant of Rs. 45 crore was provided. For Orissa Rs. 15 crore were provided for the establishment of a communication net work for linking cyclone relief centers through satellite. In addition Rs. 10 crore were provided for the restoration of Nandan Kanan, Chandaka-dampara eco-zoological complex. In addition Rs. 5 crore were provided for the upgradation of plant genetic resource centre, Bhubaneswar. For the eco restoration works in the Chilika lake lagoon the EFC provide Rs. 30 crore as a special grant. For Meghalay Rs. 10 crore was provided for forest conservation/protection measures. In the case of Rajasthan, Rs. 40 crore were provided for slum improvements including drainage/sewerage and water supply facilities. For Tamil Nadu Rs. 49 crore for slum improvement works in Chennai, Madurai and Coimbatore. For Uttar Pradesh Rs. 10 crore was provided for rejuvenation of lakes other than Nainital Lake in the Kumaon region. For West Bengal Rs. 60 crore were provided for checking the severe erosion of Ganga-Padma river system in the districts of Malda and Murshidabad.

c. Tenth Finance Commission

Similar special problem grants were also given by the Tenth Finance Commission. Some of the grants recommended by the Tenth Finance Commission grants relate to ecological and environmental problems. It was noted that inundation of lakhs of hectares of agricultural lands over long periods is the special vane of Bihar particularly the Tal and Diara lands. For development of these lands Rs. 31 crore where given. For Gujarat in order to cope with the problem of excessive fluoride in drinking water Rs. 50 crore where given for villages of Mehsana district. For Himachal Pradesh Rs. 40 crore was given for reorginasation and augmentation of existing water supply system and an extension of sewerage system of Shimla. For Madhya Pradesh for preserving and regenerating forest Rs. 60 crore where given. For Maharashtra Rs. 100 crore where given for the development of urban water supply and sewerage systems. For Manipur for the maintenance and preservation of Loktak lake Rs. 30 crore where given. For Orissa for the preservation of Chilika lake and the restoration of eco system Rs. 27 crore where given. For Tamil Nadu Rs. 60 crore where given for improvement of slum areas in Chennai. For Uttar Pradesh Rs. 8 crore where given for regenerating lake areas in the Kumaon region. For West Bengal towards the improvement of slum areas Rs. 50 crore where given. In addition Rs. 35 crore for the development of Sunderbans and Rs. 20 crore for tackling the problem of erosion and the related narrowing of the critical gap between the Bhagirathi and Ganga-Padma river systems where given.

d. Ninth Finance Commission

In the case of the Ninth Finance Commsision some of the special problem grants related to urban decay in Mumbai and Kolkata, clean-up of the Dal Lake to arrest environmental degradation in Srinagar.

f. Suggestions for the Thirteenth Finance Commission

The Thirteenth Finance Commission may consider specific grants for preservation of ecology and promotion of environment both under a general head and for meeting state specific needs in a more systematic and comprehensive way given the specific reference in the ToR of the Commission. The following are some specific suggestions:

1. A special questionnaire can be issued asking the states for giving information with a view to making an assessment about the utilization and impact of the special grants on the ecological and environmental problems of the state by the Twelfth Finance Commission.

2. States may be asked to submit details of any specific subsidies or expenditures that they have been undertaking on a regular basis for providing incentives for the use of more green technologies.
3. Grants for support for protection of natural forests may be continued, The Thirteenth Finance Commission can take up other similar issues.
4. Many ecological problems are very state-specific. Taking advantage of the specific mention of ecological concerns in the ToR, it is possible to take up a more systematic approach to protection of ecology by considering a new head under which grants may be given such as 'Grants for Protection of Ecology and Environment'. The emphasis should still be on the state-specific nature of these problems and grants should be designed accordingly.

III. Expenditure Assessment

In determining the needs of the states, the Finance Commission makes an assessment of the expenditures of the state governments and used various prescriptive and normative considerations for modifying the state estimates of expenditures in respect of both the base year and for the projection period. In order to promote ecological and environmental initiatives by the states, the Commission can make an explicit 100 percent allowance without any modification for any expenditure undertaken for this purpose by the states. The commission can also recommend certain initiatives for promotion of ecology and environment to be undertaken by all the states and make due provision for this in the expenditure assessment in the projection period even if there is no past history of such expenditures.

IV. Linking Grants to Local Bodies with Environment Related Initiatives

Environmental concerns have a significant local dimension. In particular, vehicular pollution of atmosphere as well as noise pollution specially arises in urban areas with high density of population, including the population of vehicles. Many polluting industries are also located in or close to urban areas. A major problem in municipal areas is that of management of waste particularly solid waste. The Thirteenth Finance Commission may consider initiatives to link some of the grants year marked for local bodies with environment related issues of the local bodies.

In the case of the urban local bodies, the TFC stressed the importance of public-private partnership to enhance the service delivery in respect of solid waste management. The municipalities should concentrate on collection, segregation and transportation of solid waste. State governments may require the municipalities of towns

with population of over 100,000 by 2001 census to prepare a comprehensive scheme including composting and waste to energy programmes to be undertaken in the private sector for appropriate funding from the grants-in-aid recommended by TFC. Grants-in-aid shall, however, be available to support the cost of collection, segregation and transportation only, as the activities to be taken up by the private sector should be commercially viable once the municipality is able to discharge its role effectively. The TFC recommended that at least 50 percent of the grants provided to each state for the urban local bodies should be earmarked for these schemes. The six mega cities of Delhi, Mumbai, Kolkata, Chennai, Bangalore and Hyderabad may be excluded for the purpose of grants-in-aid, as it should be possible for them to generate their own resources for this important service.

In this regard the TFC took into account the need of urban local bodies for undertaking initiatives in regard to solid waste management. The Department of Drinking Water Supply had represented that panchayats do not get any financial assistance under the total sanitation campaign (TCS) for disposal of solid waste, cleaning of drains etc., until there is basic sanitation coverage. Once they achieve basic sanitation coverage, they qualify for the Nirmal Gram Puraskar ranging from Rs. 2 lakh to Rs. 4 lakh depending on their population. Till such time as they qualify they could be provided assistance to maintain environmental sanitation for a hand holding period of five years. Against this background, the TFC recommend that the grants-in-aid allocated for the Panchayati Raj Institutions in each state, priority should be given to expenditure on the O&M costs of water supply and sanitation.

MSE Working Papers

Recent Issues

- * Working Paper 47/2009
Ecology, Environment and Sustainable Development in Indian Fiscal Federalism
U.Sankar
- * Working Paper 48/2009
Revenue-Expenditure Nexus for Southern States: Some Policy Oriented Econometric Observations
Kausik Chaudhuri and Bodhisattva Sengupta
- * Working Paper 49/2009
MNEs and Export Spillovers: An Analysis of Indian Manufacturing Industries
Chiara Franco and Subash Sasidharan
- * Working Paper 50/2010
Reforming Indirect Taxes in India: Role of Environmental Taxes
D K Srivastava and C Bhujanga Rao
- * Working Paper 51/2010
The Value of Improved Public Services: An Application of the Choice Experiment Method to Estimate the Value of Improved Wastewater Treatment Infrastructure in India
Ekin Birol and Sukanya Das
- * Working Paper 52/2010
Measuring Accuracy of Projections of Central Taxes by the Finance Commission
D K Srivastava and C Bhujanga Rao
- * Working Paper 53/2010
Heterogeneous MNC Subsidiaries and Technological Spillovers: Explaining Positive and Negative Effects in India
Anabel Marin and Subash Sasidharan
- * Working Paper 54/2010
Climate Variability and Agricultural Productivity: Case Study of Rice Yields in Northern India
Ishwarya Balasubramanian and K.S. Kavi Kumar
- * Working Paper 55/2010
Valuing the Environment in Developing Countries: Modeling the Impact of Distrust in Public Authorities' Ability to Deliver on the Citizens' Willingness to Pay for Improved Environmental Quality
Ekin Birol and Sukanya Das
- * Working Paper 56/2010
India's Low Carbon Inclusive Growth Strategy
U. Sankar

* Working papers are downloadable from MSE website <http://www.mse.ac.in>

\$ Restricted circulation

MSE Monographs

- * Monograph 1/2006
A Tract on Reform of Federal Fiscal Relations in India
Raja J. Chelliah
- * Monograph 2/2006
Employment and Growth
C. Rangarajan
- * Monograph 3/2006
The Importance of Being Earnest about Fiscal Responsibility
C. Rangarajan and Duvvuri Subbarao
- * Monograph 4/2007
The Reserve Bank and The State Governments: Partners in Progress
Y.V.Reddy
- * Monograph 5/2008
India's Dilemmas: The Political Economy of Policy -Making in a Globalized World
Kaushik Basu
- * Monograph 6/2010
MDGS-Based Poverty Reduction Strategy for Tamil Nadu
D.K.Srivastava, K.R. Shanmugam and C.Bhujanga Rao
- * Monograph 7/2010
Urban Poverty Alleviation Strategy: A Study of Six Cities
D.K.Srivastava, C.Bhujanga Rao, Swarna S. Vepa and Brinda Viswanathan
- * Monograph 8/2010
Review of Trends in Fiscal Transfers in India
D K Srivastava and C Bhujanga Rao